

TECHNICAL MEMORANDUM

DATE: April 22, 2024 Project No.: 941-80-22-26

TO: Ground-Level Monitoring Committee

FROM: West Yost Associates

REVIEWED BY: Andy Malone, PG

SUBJECT: Recommended Scope of Work and Budget for the Ground-Level Monitoring Program for Fiscal Year 2024/25 **(FINAL)**

BACKGROUND AND PURPOSE

Pursuant to the Optimum Basin Management Program Implementation Plan and the Peace Agreement, the Chino Basin Watermaster (Watermaster) implements a Subsidence Management Plan (SMP) for the Chino Basin to minimize or stop the occurrence of land subsidence and ground fissuring. The Court approved the SMP and ordered its implementation in November 2007 (2007 SMP). The 2007 SMP was updated in 2015 (2015 SMP) and can be downloaded from the Watermaster [website](#). The SMP outlines a program of monitoring, data analysis, and annual reporting. A key element of the SMP is its adaptive nature—Watermaster can adjust the SMP as warranted by the data.

The Watermaster Engineer, with the guidance of the Ground-Level Monitoring Committee (GLMC), prepares annual reports which include: the results of the monitoring program; interpretations of the data; recommendations for the Ground-Level Monitoring Program (GLMP) for the following fiscal year (FY); and recommendations for adjustments to the SMP, if any.

This Technical Memorandum (TM) describes the Watermaster Engineer's recommended activities for the GLMP for FY 2024/25 in the form of a proposed scope of services and budget.

Members of the GLMC were asked to:

- Review the draft TM prior to March 7, 2024.
- Attend a meeting of the GLMC at 10:00 am on March 7, 2024 to discuss the proposed scope of services and budget for FY 2024/25.
- Submit comments and suggested revisions on the proposed scope of services and budget for FY 2024/25 to the Watermaster by April 4, 2024.

This final scope of services and budget that addresses the comments and suggested revisions of the GLMC will be included in the Watermaster's proposed budget for FY 2024/25. The final scope of services, budget, and schedule for FY 2024/25 will be included in Section 4 of the *2023/24 Annual Report for the GLMP*.

RECOMMENDED SCOPE OF SERVICES AND BUDGET – FY 2024/25

A proposed scope of services for the GLMP for FY 2024/25 is shown in Table 1 as a line-item cost estimate. The proposed scope of services is summarized below.

Task 1. Setup and Maintenance of the Monitoring Network

The Chino Basin extensometer facilities are key monitoring facilities for the GLMP. They require regular and as-needed maintenance and calibration to remain in good working order and to ensure the recording of accurate measurements.

Task 1.1. Maintain Extensometer Facilities

This subtask includes performing monthly visits to the Ayala Park, Chino Creek, and Pomona extensometer (PX) facilities to ensure functionality and calibration of the monitoring equipment and data loggers. Two staff members are required for these visits due to safety concerns.

Non-routine efforts to be performed during FY 2024/25 under this subtask include:

- Monthly adjustments to the PX extensometers to improve the accuracy of the measurements of aquifer-system deformation.
- Purchase and install two metal covers for Ayala Park PA vault and PX 2 vault.
- Construct French drains around the PA vault to convey surface-water runoff away from the vault.

Task 1.2. Annual Lease Fees for the Chino Creek Extensometer Site

The County of San Bernardino (County) owns the land the Chino Creek extensometer facility is located on. As such, the Watermaster entered into a lease agreement with the County in 2012 and pays the County an annual rental payment of \$1,596.

Task 2. Aquifer-System Monitoring and Testing

This task involves the collection, compilation, and checking of hydraulic head and aquifer-system deformation data from the Ayala Park, Chino Creek, and PX extensometer facilities.

Task 2.1. Conduct Quarterly Monitoring at Extensometer Facilities

This subtask involves the routine quarterly collection, processing, and checking of data from the three extensometer facilities in the Chino Basin. Quarterly data collection is necessary to ensure that the monitoring equipment is in good working order and to minimize the risk of losing data because of equipment malfunction. For this subtask, the complete extensometer and piezometer records from the Ayala Park, Chino Creek, and PX facilities are loaded to HydroDaVESM (Hydrologic Database and Visual Explanations), the annual report figures are updated, and all the new data are checked for accuracy. If the data indicated malfunctioning equipment or inaccurate measurements, then any necessary adjustments to the monitoring equipment are made. Two staff members are required for these visits due to safety concerns.

Task 3. Basin-Wide Ground-Level Monitoring Program (InSAR)

This task involves the annual collection and analysis of Synthetic Aperture Radar (SAR) scenes to estimate the vertical ground motion across the western portion of Chino Basin from March 2024 to March 2025.¹

In this subtask, five SAR scenes that are acquired by the TerraSAR-X satellite from March 2024 to March 2025 are purchased from the German Aerospace Center. West Yost will use the SAR scenes to prepare 12 interferograms (InSAR) that describe the incremental and cumulative vertical ground motion that occurred from March 2024 to March 2025 and since 2011. The associated costs to task, acquire, purchase, and process the InSAR data is as follows:

- Task TerraSAR-X for five SAR acquisitions for the western Chino Basin (\$1,000)
- Purchase TerraSAR-X data (\$10,000)
- Prepare and check InSAR results, including the interferograms and GIS-generated rasters (\$62,000)

In addition, West Yost purchased and maintains the GAMMA software that is necessary to process the SAR data and prepare the InSAR estimates of vertical ground motion. The one-time initial cost for the software was \$44,000. Since the Watermaster is the only West Yost client that utilizes InSAR services, the Watermaster is paying for the GAMMA software over a three-year period (\$11,000 in FY 2023/24, \$22,000 in FY 2024/25, and \$11,000 in FY 2025/26). The annual maintenance cost is \$6,600. Therefore, in FY 2024/25 the Watermaster's costs for the GAMMA software is: $\$22,000 + \$6,600 = \$28,000$.

Task 4. Perform Ground-Level Surveys

This task involves conducting elevation surveys at benchmark monuments across defined areas of western Chino Basin to estimate the vertical ground motion that occurred since the prior survey. Figure 1 shows the location of the benchmark monuments surveyed across the western Chino Basin. Electronic distance measurements (EDM surveys) are also performed periodically between monuments to estimate horizontal ground motion in areas where ground fissuring due to differential land subsidence is a concern. Table 2 documents the areas surveyed over the last six years as part of the GLMP.

¹ West Yost is now performing this task internally instead of subcontracting the work, as was done in the past. This was made possible by West Yost hiring the InSAR subconsultant directly and purchasing/maintaining the necessary hardware and software.

Ground-Level Survey Area	Ground-Level Survey Completed (Y/N)?						
	2018	2019	2020	2021	2022	2023	2024 ^(b)
Managed Area	Y	N	N	N	N	N	Y
Fissure Zone Area ^(a)	Y	N	N	N	N	N	N
Central Area	N	N	N	N	N	N	N
Northwest Area	Y	Y	Y	Y	Y	Y	Y
San Jose Fault Zone Area ^(a)	Y	Y	Y	Y	Y	N	N
Southeast Area	Y	N	N	N	Y	N	N
Northeast Area	Y	Y	Y	N	N	N	N

(a) Denotes EDM survey area (measurements of horizontal strain).
 (b) The 2024 ground-level surveys are scheduled to begin in March 2024.

The ground-level surveys recommended for FY 2024/25 include the following:

Task 4.1. Conduct Spring-2025 Elevation surveys in Northwest MZ-1

In this subtask, the surveyor conducts elevation and EDM surveys at the established benchmarks in Northwest MZ-1 in Spring 2025. The elevation survey will begin at the Pomona Extensometer Facility and includes benchmarks across Northwest MZ-1. The elevation survey will be referenced to the Ayala Park elevation datum at the Ayala Park Extensometer via a GPS survey performed at both Ayala Park and the Pomona Extensometers.

*The vertical elevation survey is recommended in Spring 2025 because of the recent subsidence that has occurred in Northwest MZ-1 and because the survey will support the development of a subsidence management plan in Northwest MZ-1. The EDM survey is **not** recommended to be performed across the San Jose fault zone because past surveys (2013-2021) have demonstrated that the horizontal strain measured between benchmark pairs appears to behave elastically. The EDM surveys should be conducted less frequently than annual (e.g., once every five years).*

Ground-Level Surveys Not Recommended for Spring 2025

Ground-level surveys are **not** recommended for Spring 2025 in the other Areas of Subsidence Concern (i.e., Managed, Central, Southeast, and Northeast Areas). This recommendation is justified because:

- InSAR is proving to be an accurate, more efficient, higher-resolution method to monitor vertical ground motion across the western Chino Basin.
- Hydraulic heads and vertical ground motion in some of these areas are stable or increasing.

Ground-level surveys should be conducted in these areas less frequently than annual (e.g., once every five years).

Task 4.5. Replace Destroyed Benchmarks (if needed)

In this subtask, the surveyor replaces benchmark monuments that have been destroyed since the last survey, if any.

Task 4.6. Process, Check, and Update Database

In this subtask, the Watermaster Engineer receives and catalogs the survey results provided by the surveyor, prepares the data for display as a GIS layer, and performs checks against InSAR and extensometer data for reasonableness and accuracy.

Task 5. Data Analysis and Reporting

Task 5.1. Prepare Draft 2023/24 Annual Report for the Ground-Level Monitoring Program

Prepare the text, tables, and figures for a draft *2023/24 Annual Report for the GLMP* and submit the report to the GLMC by September 20, 2024 for review and comment.

Task 5.2. Prepare Final 2023/24 Annual Report for the Ground-Level Monitoring Program

Update the text, tables, and figures based on the comments received from the GLMC and prepare a final *2023/24 Annual Report for the GLMP* by November 1, 2024. Responses to GLMC comments will be included as an appendix to the final report. The report will be included in the agenda packet for the November 2024 Watermaster meetings for approval.

Task 5.3. Compile and Analyze Data from the 2024/25 Ground-Level Monitoring Program

In this subtask, monitoring data generated from the GLMP during 2024/25 is checked, mapped, charted, and analyzed as the first step in the preparation of the subsequent annual report. Some of the maps, charts, and tables are shared with the GLMC at its meetings in early 2025 during the development of a recommended scope of services and budget for FY 2025/26.

Task 5.4. Conduct Whispering Lakes Subsidence Investigation of the Northeast Area

In the Northeast Area, the long-term and short-term InSAR estimates indicate that persistent downward ground motion has occurred in a concentrated area south of the Ontario International Airport between Vineyard Avenue and Archibald Avenue in the vicinity of Whispering Lakes Golf Course. The western edge of this subsiding area exhibits a steep subsidence gradient or “differential subsidence.”

In FY 2021/22, the Watermaster Engineer conducted a Reconnaissance-Level Investigation that included the review and analysis of readily-available borehole and lithologic data, historical air photos, pumping and recharge data, hydraulic head data, and InSAR estimates of vertical ground motion. Figures and charts were prepared and analyzed to derive interpretations and recommendations for future investigations and monitoring. The investigation and recommendations were included in the FY 2021/22 Annual Report of the GLMC. Plausible mechanisms for this subsidence feature include pumping-induced aquitard drainage and shallow soil consolidation associated with historical land uses. The investigation identified data gaps in available site-specific hydrogeologic data.

Potential next steps presented to the GLMC at its December 13, 2022 meeting included:

- Aquifer-system monitoring (*e.g.*, collecting existing hydrogeologic data; installing transducers at wells in the study area; constructing an aquifer-system monitoring facility within the subsidence feature)

- Further investigation of the historical land use practices in the vicinity of the Whispering Lakes Golf Course (e.g., agricultural disturbance and augmentation of soils; historical sewage disposal and spreading of solids; golf course construction and maintenance activities)
- Perform field studies of shallow soil consolidation (i.e., develop a dataset of site-specific shallow soil compaction that could be compared to the rates of subsidence estimated by InSAR).

The GLMC has recommended a stepwise, process-of-elimination approach to identify the subsidence mechanism(s). The GLMC approved a \$10,000 budget for FY 2023/24 to implement the recommendations derived from the Reconnaissance-Level Investigation. This budget is being used to collect and evaluate existing data (e.g., hydrogeologic data, well information, reports, historical land use data) and install transducers at nearby pumping wells. The results of these efforts will be documented in the GLMC Annual Report for 2023/24 along with recommendations for follow-on work.

The GLMC should consider dedicating contingency budget for FY 2024/25 (\$10,000) to continue the implementation of the recommendations derived Reconnaissance-Level Investigation and future recommendations based on results of work performed in 2023/24.

Task 6. Develop a Subsidence-Management Plan for Northwest MZ-1

The 2007 SMP called for ongoing monitoring and data analysis of the Managed Area; including annual reporting and adjustments to the SMP, as warranted by the data. The 2007 SMP also called for expanded monitoring of the aquifer-system and land subsidence in other areas of subsidence and ground fissuring concern. Figure 1 shows the location of these so-called Areas of Subsidence Concern: Central MZ-1, Northwest MZ-1, Northeast Area, and Southeast Area. The expanded monitoring efforts outside of the Managed Area are consistent with the requirements of OBMP Program Element 1 and its implementation plan contained in the Peace Agreement.²

The 2007 SMP stated that if data from existing monitoring efforts in the Areas of Subsidence Concern indicate the potential for adverse impacts due to subsidence, the Watermaster would revise the SMP to avoid those adverse impacts. The 2014 Annual Report of the GLMC recommended that the 2007 SMP be updated to better describe the Watermaster's land subsidence efforts and obligations, including areas outside of MZ-1. As such, the update included a name change to the 2015 Chino Basin Subsidence Management Plan (2015 SMP) and a recommendation to develop a subsidence management plan for Northwest MZ 1.

The Watermaster had been monitoring vertical ground motion in Northwest MZ-1 via InSAR during the development of the 2007 SMP. Land subsidence in Northwest MZ-1 was first identified as a concern in 2006 in the MZ-1 Summary Report and again in 2007 in the 2007 SMP. Of particular concern was the occurrence of concentrated differential subsidence across the San Jose Fault in Northwest MZ-1—the same spatial pattern of differential subsidence that occurred in the Managed Area during the time of ground fissuring. Ground fissuring is the main subsidence-related threat to infrastructure. The issue of differential subsidence, and the potential for ground fissuring in Northwest MZ-1, has been discussed at prior GLMC meetings, and the subsidence has been documented and described as a concern in the Watermaster's State of the Basin Reports, the annual reports of the GLMC, and in the *Initial Hydrologic*

² http://www.cbwm.org/docs/legaldocs/Peace_Agreement.pdf

Conceptual Model and Monitoring and Testing Program for the Northwest MZ-1 Area (WEI, 2017). The Watermaster increased monitoring efforts in Northwest MZ-1 beginning in FY 2012/13 to include ground elevation surveys and electronic distance measurements (EDM) to monitor ground motion and the potential for fissuring.

In 2015, the Watermaster’s Engineer developed the *Work Plan to Develop a Subsidence Management Plan for the Northwest MZ-1 Area* (Work Plan; WEI 2015b).³ The Work Plan is characterized as an ongoing Watermaster effort and includes a description of a multi-year scope-of-work, a cost estimate, and an implementation schedule. The Work Plan was included in the 2015 SMP as Appendix B. Implementation of the Work Plan began in July 2015. On an annual basis, the GLMC analyzes the data and information generated by the implementation of the Work Plan. The results and interpretations generated from the analysis are documented in the annual report for the GLMP and used to prepare recommendations for future activities.

Progress to Implement Work Plan through FY 2023/24

The progress that has been made to implement the Work Plan through FY 2023/24 is described below:

- An initial hydrogeologic conceptual model of the Northwest MZ-1 Area was developed, and a report was published in 2017.⁴ This report described the hydrogeology of the area, speculated on the causes of the observed land subsidence, and included a recommended monitoring program.
- A preliminary one-dimensional (1D) compaction model, based on hydrogeologic information from the MVWD-28 well site, was constructed, calibrated and used to explore the future occurrence of subsidence in Northwest MZ-1 under various basin-operation scenarios of groundwater production and artificial recharge and to identify potential subsidence mitigation strategies. A report⁵ was published to document the results and interpretations of the modeling, which were: ***the deep aquifer system is most susceptible to future compaction and associated land subsidence, and hence, heads will need to increase in the deep aquifer system to minimize or abate future subsidence in Northwest MZ-1.*** The report also included a recommendation to construct the Pomona Extensometer.
- The initial monitoring program was implemented to closely track groundwater-levels, groundwater production, recharge, and ground motion across Northwest MZ-1. This monitoring program included the construction of the Pomona Extensometer to measure and record depth-specific heads and aquifer-system deformation. Implementation of the monitoring program is ongoing.
- A new 1D model was constructed and calibrated using the hydrogeologic information collected at the Pomona Extensometer. The 1D model at MVWD-28 was also updated and recalibrated using current information. The objectives of this exercise were to: (i) describe the subsidence mechanisms and the pre-consolidation head by aquifer-system layer in Northwest MZ-1 and (ii)

³ [Work Plan to Develop a Subsidence-Management Plan for Northwest MZ-1](#)

⁴ https://www.cbwm.org/docs/engdocs/GLMC/nwmz1/Final_NWMZ1_Task1_Report.pdf

⁵ <https://www.cbwm.org/docs/engdocs/GLMC/nwmz1/20171220%20Final%20NWMZ1%20Task3-4%20Tech%20Memo.pdf>

develop modeling tools that can be used to explore the future occurrence of subsidence in Northwest MZ-1 under various basin-operation scenarios of groundwater production and artificial recharge and to identify potential subsidence mitigation strategies. This work was reviewed by the GLMC, and additional model calibration refinements and sensitivity analyses were performed based on GLMC input. In November 2022, the Watermaster Engineer published a final report⁶ on the 1D Model calibrations and sensitivity analyses (with review by the GLMC) and deemed the 1D Models sufficient to simulation future land subsidence under prospective plans for pumping and recharge.

- In 2023, the Watermaster Engineer, with review and input from the GLMC, developed an initial “Subsidence Management Alternative” for Northwest MZ-1 called SMA-1. SMA-1 is equivalent to the planning scenario that was simulated with the 2020 Chino Valley Model (CVM) to support the 2020 Safe Yield Recalculation (2020 SYR). The 2020 SYR was intended to represent and simulate the Parties’ projected pumping, recharge, and use of storage through 2050. The results of the 2020 SYR (*i.e.*, projected hydraulic heads by CVM layer) were used as input data for the 1D Model simulations to predict the potential future occurrence of subsidence through 2050. In September 2023, the Watermaster Engineer published a draft TM titled *1D Model Simulation of Subsidence in Northwest MZ-1—Subsidence Management Alternative #1*. The Watermaster’s recommendations from this work were the following:
 - a. Establish a preliminary “Northwest MZ-1 Guidance Level” of 630 ft-amsl for hydraulic heads in Layers 3 and 5 at the PX location. The preliminary Guidance Level is an aspirational Watermaster recommendation that, if achieved, would likely slow or stop aquitard compaction and land subsidence in Northwest MZ-1.
 - b. Compliance with the Guidance Level should be measured at the PX-2/3 piezometer, which is generally representative of heads in Layers 3 and 5.
 - c. The methods to achieve the Guidance Level could include but are not limited to: voluntary modification of pumping patterns; in-lieu recharge; wet-water recharge via spreading and/or injection; or a combination of methods. These methods might necessitate: voluntary modification of water-supply plans of the purveyors in the Chino Basin; modification of Watermaster practices for recharge and replenishment; and/or the implementation of regional-scale storage or conjunctive-use programs.
 - d. Additional SMAs should be developed and evaluated with the 1D Models to generate the necessary information to finalize the Guidance Level and the *Subsidence Management Plan for Northwest MZ-1*. The additional SMAs could be developed during Watermaster’s groundwater modeling efforts associated with the 2025 Safe Yield Reevaluation and the development of the Storage and Recovery Master Plan. The GLMC should participate in the scenario building exercises associated with these Watermaster efforts to develop the SMAs, so that the scenarios include various methods to achieve the Guidance Level. Then, the 1D Models should be used to evaluate the potential future subsidence in Northwest MZ-1 under the SMAs. These model results and evaluations will support the establishment

⁶ <https://www.cbwm.org/docs/engdocs/GLMC/nwmz1/TM%20-%20941%20-%201D%20Model%20-%20Final.pdf>

of a Guidance Level in the *Subsidence Management Plan for Northwest MZ-1*. It should be noted that future monitoring and analyses always hold the potential for revisions to the Guidance Level, consistent with the adaptive management approach called for in the Chino Basin Subsidence Management Plan.

Based on the expected progress through FY 2023/24, the following work is recommended for FY 2024/25 to develop the *Subsidence Management Plan for Northwest MZ-1*:

Task 6.1. Aquifer-System Monitoring

The established monitoring program of piezometric levels and pumping at wells in Northwest MZ-1 will continue through various techniques, including: (i) SCADA-based monitoring by the Monte Vista Water District; (ii) monitoring of piezometric levels via sonar⁷; (iii) monitoring of piezometric levels via pressure transducers at City of Pomona production wells; and (iv) manual measurements of piezometric levels. These data, along with data collected from the PX in Task 2.1, will improve the understanding of the hydrogeology in Northwest MZ-1, will be used to develop the *Subsidence Management Plan for Northwest MZ-1*, and in the future, will be used to adapt the Chino Basin Subsidence Management Plan, as appropriate.

In this subtask, all data is collected, compiled, checked, and analyzed every three months. Charts and data graphics of pumping, piezometric levels, and aquifer-system deformation will be updated to support the data collection and analysis. The PX extensometer data is charted and analyzed monthly in the ongoing effort to improve the reliability and accuracy of the extensometers.

Task 6.5. Provide Advice in the Development of the 2025 SYR Scenarios

The ongoing 2025 SYR involves the development of multiple projection scenarios of future hydrology, pumping, managed recharge, and use of managed storage in the Chino Basin. These projection scenarios will be simulated with an updated CVM. The CVM results will be used to determine a tentative Safe Yield, which will be evaluated for MPI and then used to evaluate the current Safe Yield of the Chino Basin. The evaluation of MPI associated with land subsidence will be performed using the 1D Models in Northwest MZ-1 and in other Areas of Subsidence Concern (see Task 7 below). In FY 2024/25, the GLMC can provide the Watermaster with valuable advice on the following:

- The development of the 2025 SYR scenarios to ensure a plausible range of future conditions are simulated.
- Interpretation of the 1D Model results re: potential subsidence-related MPI associated with the Safe Yield estimates.
- How the model results can be used to evaluate the minimum recharge quantity of supplemental water in MZ-1 as required by the Peace II Agreement.

⁷ The use of sonar technology to measure piezometric levels in wells in currently being used in Monte Vista Water District wells 28 and 31.

Providing GLMC advice should be conducted in conjunction with the 2025 SYR and can be discussed at regularly scheduled GLMC meetings at no additional cost.⁸

Task 7. Construct and Calibrate Additional 1D Models Across Western Chino Basin

As described above in Task 6, the Watermaster has constructed, calibrated, and used 1D Models at the PX and MVWD-28 locations to evaluate the potential future subsidence in Northwest MZ-1 through 2040. The Watermaster used the information derived from the 1D Models to develop a preliminary “Guidance Level” to avoid future subsidence in Northwest MZ-1.

In Task 7, three additional 1D Models are constructed and calibrated across other Areas of Subsidence Concern in western Chino Basin, so that Watermaster can use all of the 1D Models during the 2025 SYR process to:

- Evaluate for subsidence-related MPI during the 2025 SYR.
- Refine the preliminary “Guidance Level” in Northwest MZ-1 and the Managed Area.
- Evaluate for the minimum recharge quantity of supplemental water in MZ-1 as required by the Peace II Agreement.

In FY 2023/24, the three additional 1D Models are being constructed and calibrated in the following areas: Northeast Area (at Ontario Well 33 location), in the Southeast Area near the CDA well field (at the CCX location), and in the Managed Area (at the Ayala Park Extensometer location).

The deliverables of this task are the following:

- A draft TM to describe the background/objectives of the task and the methods that will be used to complete the task. The methods include a description of the proposed locations for the additional 1D Models and the data that will be used to construct and calibrate the models.
- A draft TM that summarizes the construction and calibration of the additional 1D Models.

This task was budgeted and scheduled for completion in FY 2023/24, but the final work will likely spill over into FY 2024/25. If necessary, unspent budget from FY 2023/24 will be carried over to FY 2024/25 to complete this task. **No additional budget in FY 2024/25 is necessary to complete this task.**

Task 8. Meetings and Administration

Task 8.1. Prepare for and Conduct Four Meetings of the Ground-Level Monitoring Committee

This subtask includes preparing for and conducting four meetings of the GLMC:

- August 2024 – Review and discuss GLMP for FY 2024/25. Review and discuss the draft TM on Task 7 – *Construction/Calibration of Additional 1D Models*.

⁸ This is because most of these discussions will be occurring in the 2025 SYR peer review process with the same technical consultants that participate on the GLMC.

- September 2024 – Review the draft 2023/24 Annual Report for the GLMP
- March 2025 – Review the draft recommended scope and budget for FY 2025/26
- April 2025 – Review the final recommended scope and budget for FY 2025/26 (if needed)

Task 8.2. Prepare for and Conduct One As-Requested Ad-Hoc Meeting

This subtask includes preparing for and conducting one ad-hoc meeting of the GLMC, as requested by the GLMC or Watermaster staff.

Task 8.3. Perform Monthly Project Management

This subtask includes monthly project administration and management, including staffing, financial and schedule reporting to Watermaster and subcontractor coordination.

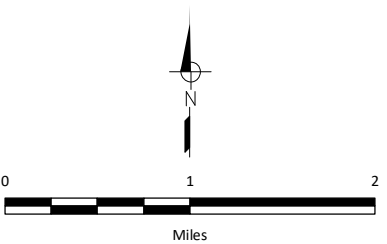
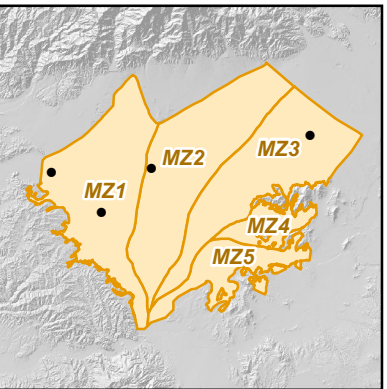
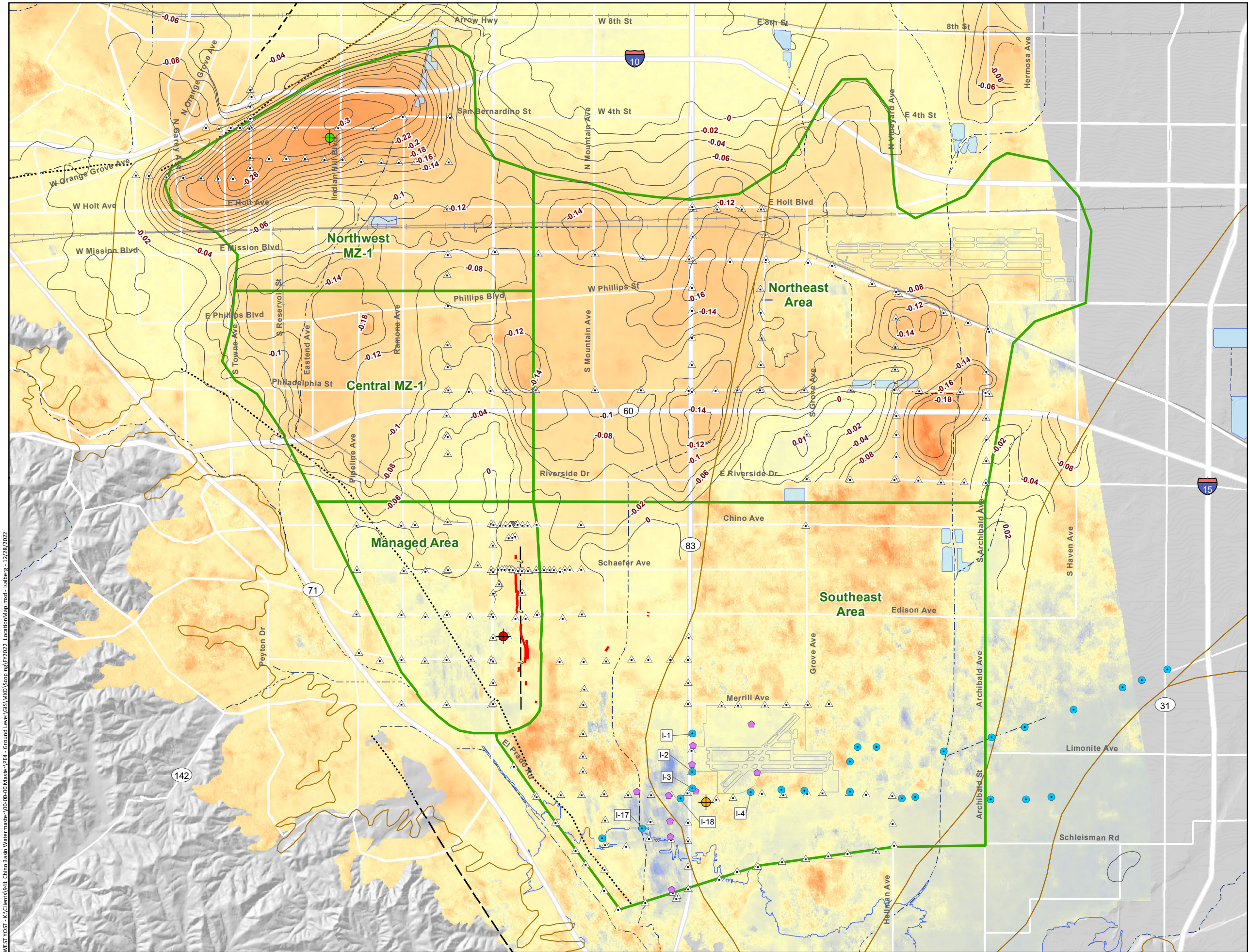
Task 8.4. Prepare a Recommended Scope and Budget for the GLMC for FY 2025/26

This subtask includes preparing a draft and final recommended scope of services and budget for FY 2025/26 for the GLMP to support the Watermaster’s budgeting process.

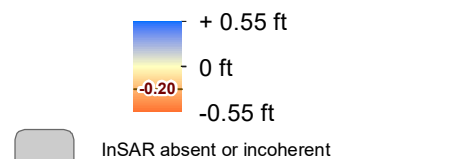
Table 1. Work Breakdown Structure and Cost Estimates for the Ground-Level Monitoring Program: FY 2024/25

Task Description	Notes	Labor (days)		Other Direct Costs						Totals			
		Person Days	Total	Travel	New Equip.	Equip. Rental	Outside Pro	Misc.	Total	Totals by Task	Recommended Budget 2024/25	Approved Budget 2023/24	Net Change from 2023/24
											a	b	a - b
Task 1. Setup and Maintenance of the Monitoring Network			\$40,221						\$8,018	\$48,239	\$48,239	\$47,789	\$450
1.1 Maintain Extensometer Facilities													
1.1.1 Routine maintenance of Ayala Park, Chino Creek, and Pomona extensometer facilities		21	\$29,437	\$649	\$250	\$350			\$1,249	\$30,685	\$30,685	\$33,707	-\$3,022
1.1.2 Replacement/repair of equipment at extensometer facilities		6	\$10,784	\$173	\$2,500		\$2,500		\$5,173	\$15,957	\$15,957	\$12,485	\$3,472
1.2 Annual Lease Fees for the Chino Creek extensometer facility		0	\$0					\$1,596	\$1,596	\$1,596	\$1,596	\$1,596	\$0
Task 2. MZ-1: Aquifer-System Monitoring and Testing			\$32,724						\$784	\$33,508	\$33,508	\$31,456	\$2,052
2.1 Conduct Quarterly Monitoring at Extensometers Facilities													
2.1.1 Download data from the Ayala Park Extensometer facility		4	\$5,436	\$332		\$40			\$372	\$5,808	\$5,808	\$3,032	\$2,776
2.1.2 Download data from the Chino Creek Extensometer facility		4	\$5,436			\$40			\$40	\$5,476	\$5,476	\$2,700	\$2,776
2.1.3 Download data from Pomona Extensometer facility		4	\$5,436	\$332		\$40			\$372	\$5,808	\$5,808	\$10,492	-\$4,684
2.1.4 Process, check, and upload data to database		10	\$16,416						\$0	\$16,416	\$16,416	\$15,232	\$1,184
Task 3. Basin Wide Ground-Level Monitoring Program (InSAR)			\$64,880						\$39,600	\$104,480	\$104,480	\$96,560	\$7,920
3.1 Satellite tasking and data selection with Airbus for 2024/25		0.5	\$1,144					\$1,000	\$1,000	\$2,144	\$2,144		
3.2 Assess SAR baselines for 2024/25 and select/purchase TerraSAR-X frames from Airbus		0.5	\$1,144					\$10,000	\$10,000	\$11,144	\$11,144	\$96,560	\$7,920
3.3 Prepare and check interferograms for 2024/25		28	\$62,592						\$0	\$62,592	\$62,592		
3.4 GAMMA software for InSAR processing (initial purchase + annual maintenance)		0	\$0					\$28,600	\$28,600	\$28,600	\$28,600		
Task 4. Perform Ground-Level Surveys			\$7,144						\$38,600	\$45,744	\$45,744	\$84,280	-\$38,536
4.1 Conduct Spring-2024 Elevation surveys in Northwest MZ-1		0.5	\$1,288					\$28,600	\$28,600	\$29,888	\$29,888	\$28,360	\$1,528
4.2 Conduct Spring-2024 Elevation Survey in the Northeast Area		0	\$0					\$53,416	\$0	\$0	\$0	\$0	\$0
4.3 Conduct Spring-2024 Elevation Survey in the Southeast Area		0	\$0					\$56,584	\$0	\$0	\$0	\$0	\$0
4.4 Conduct Spring-2024 Elevation and EDM Surveys in the Managed Area/Fissure Zone		0	\$0					\$46,800	\$0	\$0	\$0	\$31,248	-\$31,248
4.5 Replace Destroyed Benchmarks (if needed)		0	\$0					\$10,000	\$10,000	\$10,000	\$10,000	\$19,280	-\$9,280
4.6 Process, Check, and Update Database		3	\$5,856						\$0	\$5,856	\$5,856	\$5,392	\$464
Task 5. Data Analysis and Reporting			\$87,084						\$0	\$87,084	\$87,084	\$85,412	\$1,672
5.1 Prepare Draft 2023/24 Annual Report of the Ground-Level Monitoring Committee		19	\$36,744						\$0	\$36,744	\$36,744	\$36,136	\$608
5.2 Prepare Final 2023/24 Annual Report of the Ground-Level Monitoring Committee		8.5	\$16,820						\$0	\$16,820	\$16,820	\$15,732	\$1,088
5.3 Compile and Analyze Data from the 2024/25 Ground-Level Monitoring Program		14	\$23,520						\$0	\$23,520	\$23,520	\$23,544	-\$24
5.4 Continue Whispering Lakes Subsidence Investigation		0	\$10,000						\$0	\$10,000	\$10,000	\$10,000	\$0
Task 6. Develop a Subsidence-Management Plan for Northwest MZ-1			\$16,656						\$0	\$16,656	\$16,656	\$15,536	\$1,120
6.1 Aquifer-System Monitoring													
6.1.1 Collect pumping and piezometric data from agencies every three months; check and upload data to HDX		6	\$8,448						\$0	\$8,448	\$8,448	\$10,560	-\$2,112
6.1.2 Prepare and analyze charts and data graphics of pumping and recharge (Northwest MZ-1), piezometric levels, and aquifer-system deformation from PX		5	\$8,208						\$0	\$8,208	\$8,208	\$4,976	\$3,232
Task 7. Construct and Calibrate Additional 1D Models Across Western Chino Basin			\$0						\$0	\$0	\$0	\$192,511	-\$192,511
7.1 Prepare a draft TM summarizing the background, objectives, and methods; distribute to the GLMC		0	\$0						\$0	\$0	\$0	\$12,760	-\$12,760
7.2 Prepare for and conduct a GLMC meeting to receive feedback and comments on the draft TM		0	\$0						\$0	\$0	\$0	\$5,110	-\$5,110
7.3 Verify and/or recalibrate the 1D Model at Ayala Park Extensometer location		0	\$0						\$0	\$0	\$0	\$22,736	-\$22,736
7.4 Construct two additional 1D Models in the Southeast Area and Northeast Area		0	\$0						\$0	\$0	\$0	\$62,368	-\$62,368
7.5 Calibrate new 1D Models to derive properties of aquifers/aquitards and estimate the pre-consolidation stress(es)		0	\$0						\$0	\$0	\$0	\$45,472	-\$45,472
7.6 Prepare a draft TM summarizing the construction/calibration of additional 1D Models; distribute to the GLMC		0	\$0						\$0	\$0	\$0	\$37,024	-\$37,024
7.7 Prepare for and conduct a GLMC meeting to receive feedback and comments on the draft TM		0	\$0						\$0	\$0	\$0	\$5,110	-\$5,110
7.8 Incorporate the GLMC comments and prepare a final technical memorandum		0	\$0						\$0	\$0	\$0	\$1,932	-\$1,932
Task 8. Meetings and Administration			\$57,562						\$375	\$57,937	\$57,937	\$59,228	-\$1,292
8.1 Prepare for and Conduct Four Meetings of the Ground-Level Monitoring Committee	a	14	\$31,744	\$291					\$291	\$32,035	\$32,035	\$32,636	-\$602
8.2 Prepare for and Conduct One As-Requested Ad-Hoc Meeting	a	3	\$6,792	\$84					\$84	\$6,876	\$6,876	\$5,470	\$1,406
8.3 Perform Monthly Project Management		3	\$7,728						\$0	\$7,728	\$7,728	\$11,592	-\$3,864
8.4 Prepare a Recommended Scope and Budget for the GLMC for FY 2023/24		5.25	\$11,298						\$0	\$11,298	\$11,298	\$9,530	\$1,768
Totals			\$306,271						\$87,376		\$393,647	\$612,772	-\$219,125

Notes:
a Assumes in-person meetings.



Relative Change in Land Surface Altitude as Estimated by InSAR (March 2011 to March 2022)



- Areas of Subsidence Concern
- Pomona Extensometer Facility
- Chino Creek Extensometer Facility
- Ayala Park Extensometer Facility
- Chino Desalter Authority Well
- SB County Proposed Extraction Well
- ▲ Ground-Level Survey Benchmark
- Ground Fissures
- - - Approximate Location of the Riley Barrier



Figure 1
Ground-Level Monitoring Program
Fiscal Year 2022/23
 Chino Basin Watermaster
 Ground-Level Monitoring Committee

WEST YOST - K:\Clients\941 Chino Basin Watermaster\00-00-00 Master\PEA - Ground Level\GIS\WKD\Scoping\FY2022_LocationMap.mxd - kalberg - 1/28/2022

Attachment A – Responses to Comments

The comments received from the GLMC as of April 4, 2024 on the “Recommended Scope of Services and Budget of the Ground-Level Monitoring Committee for Fiscal Year 2024/25 (Draft)” and the Watermaster Engineer’s response to comments are documented below.

Comments from the City of Chino (Hye Jin Lee)

Comment 1 – Task 1. Setup and Maintenance of the Monitoring Network.

Task 1.1. The City understands settling of the vault structure located at the Ayala Park Extensometer facility has occurred over time which allows water to enter the vault and potentially flow into the monitoring wells. Watermaster proposes to address this field condition by installing French drains around the vault. The City is concerned the construction of French drains may not be the most suitable means to address the field condition. Any contemplated construction activity at the park must be approved by the City of Chino and coordinated with the City of Chino’s Community Services for any planned activities in the area. Prior to taking any steps towards implementing the French drains the Watermaster is advised to contact the City.

Response:

Watermaster staff and engineer will work closely with the City on any modifications at Ayala Park to prevent flooding of the piezometer vault.

Comments from the State of California (Rick Rees)

Comment 1 – Task 3. Basin-Wide Ground-Level Monitoring Program (InSAR)

The InSAR-based monitoring proposed in the 2024/2025 budget is only for the western portion of the Chino Basin. Therefore, it is not “basin-wide” as the task description implies (text and Table 1). The committee has discussed conducting occasional InSAR monitoring of the eastern part of the Chino Basin. This should be considered for the next budget. One option that would reduce cost is to provide InSAR results published by the Department of Water Resources (DWR) to cover the entire basin. Although the DWR InSAR data are not the same level of resolution and not directly comparable with the data that West Yost will process for the western part of the basin, it should be easy to generate true basin-wide InSAR results. This should be continued less frequently than annual (e.g., every five years) to verify that there are no subsidence issues outside of the western part of the Chino Basin where ground levels are well documented every year.

Response:

We concur. The effort to conduct InSAR monitoring of the eastern part of the Chino Basin using InSAR results published by the Department of Water Resources (DWR) will be described and budgeted for the proposed scope and budget for the GLMP for 2025/26.

Comments from Monte Vista Water District (Justin Scott-Coe)

Comment 1 – Task 1.1 Maintain Extensometer Facilities

“Non-routine efforts to be performed during FY 2024/25 under this subtask include... Monthly adjustments to the PX extensometers to improve the accuracy of the measurements of aquifer system deformation.”

Watermaster has recognized the importance of the extensometer data in monitoring current conditions and understanding hydrogeologic conditions. As stated in the Technical Memorandum “Construction and Calibration of 1D Compaction Models in Northwest MZ 1 (September 23, 2022), “Continued monitoring and enhanced understanding of hydrogeologic conditions is crucial to minimizing model error and uncertainty, especially the monitoring of the PX in Northwest MZ-1.” The District recommends providing a briefing and the currently available extensometer data to the Ground Level Monitoring Committee (GLMC) for review.

Key questions regarding the PX include:

- How is Watermaster assessing the reliability/accuracy of the extensometer data?
- What adjustments have been made and are proposed to be made to the PX in the upcoming year and what is the anticipated result of those changes?
- What does the extensometer data currently indicate regarding ground-level motion in Northwest MZ-1?

Response:

We concur with the recommendation to brief the GLMC re: the currently available extensometer data and answer the questions listed above. This topic will be included on the GLMC meeting agenda for August 1, 2024.

Comment 2 – Basin-Wide Ground-Level Monitoring Program (InSAR)

A significant cost identified under this task is \$62,000 for “preparation and checking” of InSAR data. What is the basis for this cost, and are there opportunities for more efficiency by workflow automation in the data processing (e.g. save money over time)?

Response:

The basis for this cost is about 28 days of staff time multiplied by the various daily rates by staff position.

The Watermaster Engineer has recently hired Sean Yarborough to perform this task directly. Mr. Yarborough previously worked for the long-time InSAR subconsultant that worked for the Watermaster. The engineer expects the level of effort for this task to decrease in subsequent years as automated coding of processes are developed and implemented and as junior staff are trained to perform portions of this task.

Comment 3 – Develop a Subsidence-Management Plan for Northwest MZ-1

“...the same pattern of differential subsidence that occurred in the Managed Area during the time of ground fissuring.”

The District suggests removing this clause from the sentence or revising to indicate that the differential subsidence conditions in the two areas are not identical. Groundwater levels in Northwest MZ-1 have

stabilized since the late 1970s and no ground fissuring has been reported in Northwest MZ-1 to date. Ground fissuring in the Managed Area was reported to occur as early as the early 1970s and accelerated in the early 1990s.

Response:

The phrase has been revised to read “*spatial* pattern of differential subsidence” to distinguish it from rates and magnitudes of subsidence.

Comment 4 – Progress to Implement Work Plan through FY 2023/24

“a. Establish a preliminary ‘Northwest MZ-1 Guidance Level’ of 630 ft-amsl for hydraulic heads in Layers 3 and 5 at the PX location. The preliminary Guidance Level is an aspirational Watermaster recommendation that, if achieved, would likely slow or stop aquitard compaction and land subsidence in Northwest MZ-1.”

The District recommends removing language from this progress summary suggesting that the aspirational Watermaster recommendation would “likely slow or stop aquitard compaction and land subsidence in Northwest MZ-1.” It is the District’s understanding that modeling to support this statement has neither been conducted nor provided to the GLMC for review; as such, this statement is not supported by relevant technical analyses.

“d. Additional SMAs should be developed and evaluated with the 1D Models... The GLMC should participate in the scenario building exercises associated with these Watermaster efforts to develop the SMAs, so that the scenarios include various methods to achieve the Guidance Level.”

Because the “Guidance Level” cited here has not yet been evaluated, scenario-building to meet this or any other proposed guidance level is premature. Any proposed guidance level should be simulated versus a no-action alternative to evaluate the effectiveness of the guidance level at reducing projected land subsidence versus a no-action alternative. The simulation results should then be presented to the GLMC for review prior to initiating any scenario-building to meet the proposed guidance level.

Response:

For (a), the statement suggesting that the aspirational Watermaster recommendation would “likely slow or stop aquitard compaction and land subsidence in Northwest MZ-1” is based on the physics of aquitard drainage—not on modeling. In other words, any increases in hydraulic heads within the deep aquifer system would have the result of slowing or stopping aquitard drainage.

For (d), the ongoing process to re-evaluate the Safe Yield will include a “no action” scenario(s) and will include 1D compaction modeling in Northwest MZ-1 for review by the GLMC.

Comment 5 – Construct and Calibrate Additional 1D Models Across Western Chino Basin

Regarding Additional Expenditure on 1-D Models

The District continues to have concerns regarding the use of 1-D Models as management tools in Northwest MZ-1 and other Areas of Subsidence Concern. Given the size and heterogeneity of the alluvial sediments across the Areas of Subsidence Concern, the limitations and appropriateness of 1-D models should be re-evaluated before additional budget expenditures. (See above comments on Proposed Locations and Data for Construction/Calibration of Additional 1D Models.)

“The Watermaster used the information derived from the 1D Models to develop a preliminary ‘Guidance Level’ to avoid future subsidence in Northwest MZ-1.”

The District’s understanding is that the “preliminary ‘Guidance Level’” cited here for the deep aquifer was based on water levels in the shallow aquifer and not on “information derived from the 1D Models.” If this is the case, this language does not reflect how the preliminary “Guidance Level” was developed. The preliminary “Guidance Level” was not based on an analysis of 1D Models with the guidance level implemented or evaluated compared to a no-action alternative. Whether the currently proposed guidance level will avoid future subsidence is also unknown. The District recommends that this sentence be removed or modified to reflect the approach taken and the uncertainty regarding the effectiveness of the preliminary “Guidance Level.”

Response:

As stated in this memorandum, this task was budgeted and scheduled for completion in FY 2023/24. No additional budget in FY 2024/25 is necessary to complete this task.