



Technical Memorandum

To:	Ground-Level Monitoring Committee
From:	Watermaster Engineer – Wildermuth Environmental Inc. (WEI)
Date:	March 6, 2017
Subject:	Recommended Scope and Budget of the Ground-Level Monitoring Committee for FY 2017-18 (draft)

Background and Purpose

Pursuant to the Optimum Basin Management Program (OBMP) Implementation Plan and the Peace Agreement, the Chino Basin Watermaster (Watermaster) implements a Subsidence Management Plan (SMP) for the Chino Basin to minimize or abate the occurrence of land subsidence and ground fissuring. 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.¹

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

This memorandum describes the Watermaster Engineer’s recommended activities for the Ground-Level Monitoring Program (GLMP) for FY 2017-18 in the form of a proposed scope-of-work and budget.

Members of the GLMC are asked to:

1. Review this memorandum by March 23, 2017.
2. Attend a meeting of the GLMC at 8:30am on March 23, 2017 at Watermaster to discuss the proposed scope-of-work and budget for FY 2017-18.
3. Submit comments and suggested revisions to scope-of-work and budget for FY 2017-18 to the Watermaster Engineer by March 31, 2017.

A second round of review and a meeting discussion is scheduled in April 11, 2017, if necessary.

The final scope-of-work, schedule, and budget that is recommended by the GLMC will run through Watermaster’s budgeting process for revisions, if needed, and approval. The final scope-

¹ The Court approved the SMP and ordered its implementation in November, 2007. The SMP was updated in 2015.

of-work, schedule, and budget for FY 2017-18 will be included in Section 4 of the *2016 Annual Report of the Ground-Level Monitoring Committee*.

Recommended Scope of Work and Budget – FY 2017-18

A proposed scope-of-work for the GLMP for FY 2017-18 is shown in Table 1 as a line-item cost estimate:

Task 1—Setup and Maintenance of the Monitoring Network. The extensometers are the key monitoring facilities for the GLMP. They require regular and as-needed maintenance and recalibration to remain in good working order. Task 1.1 includes conducting monthly visits to the Ayala Park and Chino Creek Extensometer Facilities to ensure functionality and calibration of the monitoring equipment and data loggers.

Task 1.3 is work to site a new horizontal extensometer facility in the Managed Area to replace the Daniels Horizontal Extensometer, perform CEQA, and to procure permits and easements. This work was originally budgeted for FY 2016-17, but is not anticipated to be completed by the end of FY 2016-17. Watermaster Engineer is currently reviewing all of the historical horizontal data that has been collected in the Fissure Zone Area (see Figure 1) to assist in siting the new horizontal extensometer. The results of this analysis will be documented in the *2016 Annual Report of the GLMC* along with recommendations for potential sites. Based on these results, and if the GLMC recommends installation of a new horizontal extensometer facility, Watermaster Engineer will perform Task 1.3 in FY 2017-18. These costs are shown as carry-over budget under Task 1.3.

Task 2—Aquifer-System Monitoring and Testing. This task involves quarterly collection of piezometric levels and aquifer-system deformation data at the Ayala Park, Chino Creek, and Pomona Extensometer Facilities. Collection of piezometric levels and aquifer-system deformation at the new Pomona Extensometer Facility are anticipated for the final two quarters of FY 2017-18. Quarterly collection and checking of data is necessary to (1) ensure that the monitoring equipment is in good working order, and (2) minimize the risk of losing data because of equipment malfunction.

Task 3—Basin Wide Ground-Level Monitoring Program. This task involves the annual data collection and analysis of InSAR data during 2017. The data for InSAR is collected by the TerraSAR-X satellite operated by the German Aerospace Center. Five interferograms will be prepared that will describe the vertical ground motion across the western portion of Chino Basin during 2017. Correlation between InSAR data and ground-level survey data (Task 4) will be evaluated in Task 5 to validate the reliability of the InSAR data.

Task 4—Ground-Level Surveys. This task involves conducting elevation surveys at benchmark monuments across defined areas of western Chino Basin. Electronic distance measurements (EDM) are performed between benchmark monuments to monitor for horizontal deformation of the ground surface in areas where ground fissuring due to differential land subsidence is a concern. The surveys proposed for FY 2017-18 include:

- **Southeast Area.** Conduct an elevation survey at benchmarks in the Southeast Area in early 2018. The ground-level survey will begin at the Ayala Park extensometer, and will include benchmarks throughout the Southeast Area (Figure 1). The elevation survey data will be referenced to the Ayala Park elevation datum. The elevation survey in the Southeast Area is recommended because InSAR data is largely incoherent across most of the area, and because two additional Chino Creek Desalter wells (I-20 and I-21) commenced production in February 2016.
- **Northwest MZ-1 Area.** Conduct an elevation survey and an EDM survey at benchmarks in the Northwest MZ-1 Area during early 2018. The elevation survey will begin at the Ayala Park extensometer and include the benchmarks along Monte Vista Avenue and along San Bernardino Avenue and along Orchard Street/Lincoln Avenue/Alvarado Street (Figure 1). The elevation survey data will be referenced to the Ayala Park elevation datum. The surveys are recommended to verify the InSAR data and to measure horizontal deformation across the San Jose Fault where differential land subsidence is occurring.
- **Managed Area.** Conduct an elevation survey and EDM survey in the Managed Area during spring 2018. The elevation survey will begin at the Ayala Park extensometer and include benchmarks within the Managed Area and Fissure Zone Area (Figure 1). The elevation survey data will be referenced to the Ayala Park elevation datum. The elevation survey in the Managed Area is recommended because the InSAR data is partly incoherent in the southern portions of the area; because the InSAR data have indicated over 0.1 feet of subsidence in the northern portions of the area; and because the last elevation survey conducted in the Managed Area occurred in March 2015. The EDM survey is recommended to measure horizontal deformation across the historical fissure zone where differential land subsidence is occurring.

Task 5—Data Analysis and Reporting. This task involves the analysis of that data generated by the GLMP through 2017. The results and interpretations generated from the data analysis will be documented in the *2017 Annual Report of the GLMC*.

Task 6—Develop a Subsidence-Management Plan for the Northwest MZ-1 Area. The development of the subsidence management plan for the Northwest MZ-1 Area is a multi-year

effort. The conceptual framework for this effort is described in the *Work Plan to Develop a Subsidence-Management Plan for the Northwest MZ-1 Area*.² Several tasks outlined in the Work Plan are recommended for implementation in FY 2017-18:

- *Finalize implementation of the Initial Monitoring Program.* The initial monitoring program will continue to be implemented. This subtask includes initiation of SCADA-based monitoring of piezometric levels and production at Monte Vista Water District and City of Pomona wells; continuation of monitoring of piezometric levels and production from wells owned by the cities of Chino, Pomona, and Upland, Monte Vista Water District, and the Golden State Water Company; analysis of the data generated from the initial monitoring program; and preparation of a Task Memorandum that will document the improved understanding of the aquifer system in the Northwest MZ-1 Area and provide recommendations for designing short-term controlled pumping tests, if necessary.
- *Install the Pomona Extensometer Facility.* By the start of FY 2017-18, an extensometer facility site, CEQA compliance, and all appropriate easements will have been secured. Within the first quarter of FY 2017-18, the bid package and contractor selection process to construct the Pomona Extensometer piezometers will be completed. It is anticipated that the drilling, construction, and installation of the Pomona Extensometer Facility piezometers will be completed at the end of second quarter for FY 2017-18.
- *Install monitoring equipment for the Pomona Extensometer Facility.* Immediately following the completion of the Pomona Extensometer piezometers, each piezometer will be equipped with a cable extensometer, data loggers, and pressure transducers. It is anticipated the Pomona Extensometer Facility will be online early in third quarter for FY 2017-18.
- *Completion Report for the Pomona Extensometer Facility.* A well completion summary report will be prepared to document drilling and construction activities for the piezometers and installation of the extensometers and monitoring equipment for the Pomona Extensometer Facility by the end of FY 2017-18.

Task 7—Meetings and Administration. Four meetings of the GLMC are planned to oversee the GLMP: August 2017 – kickoff for the GLMP for 2017-18; January 2018 – review of the Technical Memorandum documenting the initial monitoring program for the Northwest MZ-1; March 2018 – review of the data collected from the monitoring program through calendar year 2017 and a recommended scope and budget for FY 2018-19; April 2018 – finalize the recommended scope

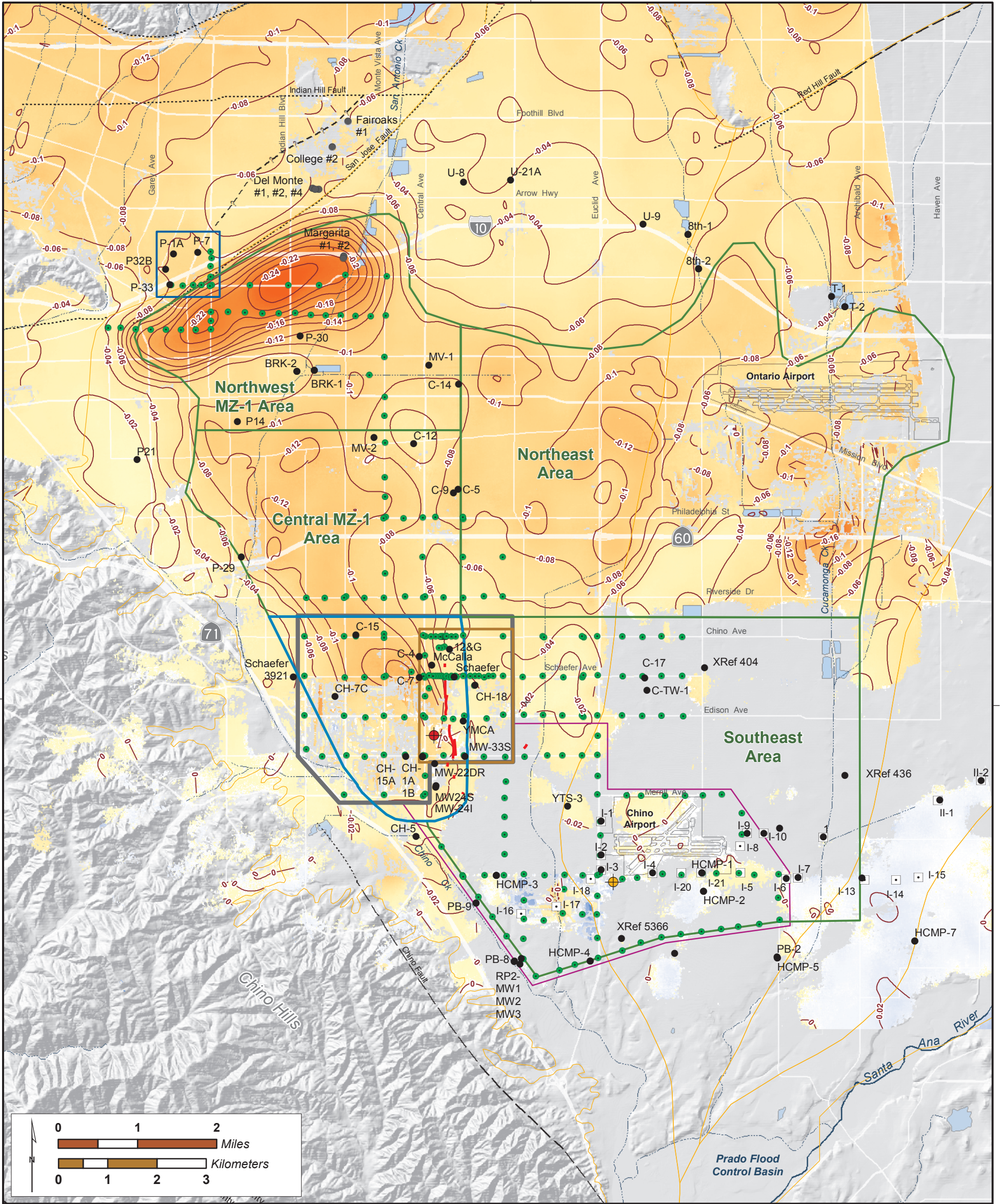
² http://www.cbwm.org/docs/engdocs/Land%20Subsidence/20150724%20-%20Chino%20Basin%20Subsidence%20Management%20Plan%202015/FINAL_CBSMP_Appendix_B.pdf

and budget for FY 2018-19. Also included in Task 7 is project administration, including staffing, and financial/schedule reporting.

Table 1
Work Breakdown Structure and Cost Estimates
Ground-Level Monitoring Program -- FY 2017-18

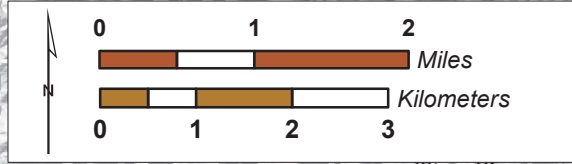
Task Description	Labor		Other Direct Costs								Totals					
	Person Days	Total	Travel	New Equip.	Equip. Rental	Outside Pro	Lab	Repro	Misc.	Total	Totals by Task	Recommended Budget 2017-18	Budget 2016-17	Net Change 2016-17 to 2017-18	Potential Carry-Over 2017-18	Budget with Carry-Over 2017-18
												a	b	a - b	c	a - c
Task 1 -- Setup and Maintenance of the Monitoring Network		\$36,092								\$30,182	\$66,274	\$66,274	\$64,714	\$1,560	\$41,268	\$25,006
1.1 Equipment maintenance																
Routine maintenance of Ayala Park and CCX extensometer facilities	9	\$11,208	\$583	\$500	\$152					\$1,235	\$12,443	\$12,443	\$12,227	\$216	\$0	\$12,443
Replacement/repair of equipment at extensometer facilities	4	\$5,616	\$73	\$3,000	\$38	\$2,000				\$5,111	\$10,727	\$10,727	\$10,407	\$320	\$0	\$10,727
1.2 Annual lease fees for CCX extensometer site	0	\$0							\$1,596	\$1,596	\$1,596	\$1,596	\$1,596	\$0	\$0	\$1,596
1.3 Identify a site and install a horizontal extensometer in the Managed Area																
Coordinate with the City of Chino	7	\$10,760	\$194							\$194	\$10,954	\$10,954	\$10,298	\$656	\$10,760	\$194
Prepare for and attend a meeting of the GLMC to discuss and approve potential sites	2	\$3,536	\$46							\$46	\$3,582	\$3,582	\$3,398	\$184	\$3,536	\$46
Perform CEQA for the potential new sites and procure permits and easements	4	\$4,972				\$22,000				\$22,000	\$26,972	\$26,972	\$26,788	\$184	\$26,972	\$0
Task 2 -- MZ-1: Aquifer-System Monitoring and Testing		\$21,770								\$1,004	\$22,774	\$22,774	\$16,294	\$6,480	\$0	\$22,774
2.1 Groundwater-level and extensometer data collection and processing																
Download data from the Ayala Park facility	1.5	\$2,004	\$259		\$76					\$335	\$2,339	\$2,339	\$2,255	\$84	\$0	\$2,339
Download data from the CCX facility	0.5	\$804	\$259		\$76					\$335	\$1,139	\$1,139	\$1,063	\$76	\$0	\$1,139
Download data from PX facility	0.8	\$1,002	\$144	\$190						\$334	\$1,336	\$1,336	\$0	\$1,336	\$0	\$1,336
Process, check, and upload data to database	13	\$17,960								\$0	\$17,960	\$17,960	\$12,976	\$4,984	\$0	\$17,960
Task 3 -- Basin Wide: InSAR		\$4,292								\$85,000	\$89,292	\$89,292	\$89,082	\$210	\$0	\$89,292
3.1 InSAR data collection	1	\$1,608				\$85,000				\$85,000	\$86,608	\$86,608	\$86,456	\$152	\$0	\$86,608
3.2 Process, check, and upload data to database/GIS	2	\$2,684								\$0	\$2,684	\$2,684	\$2,626	\$58	\$0	\$2,684
Task 4 -- Ground-Level Surveys		\$5,690								\$96,315	\$102,005	\$101,705	\$71,147	\$30,558	\$0	\$101,705
4.1 Conduct fall 2017 ground-level survey in Southeast Area	0.25	\$300				\$29,563				\$29,563	\$29,863	\$29,863	\$29,435	\$428	\$0	\$29,863
4.2 Conduct fall 2017 ground-level and EDM survey in Northwest MZ-1 Area	0.5	\$600				\$21,902				\$21,902	\$22,502	\$22,502	\$15,441	\$7,061	\$0	\$22,502
4.3 Install additional benchmarks and conduct fall 2017 ground-level and EDM survey in the NW MZ-1 Area	0	\$0								\$0	\$0	\$0	\$16,456	-\$16,456	\$0	\$0
4.4 Conduct ground-level and EDM survey in Managed Area	0.25	\$300				\$32,479				\$32,479	\$32,779	\$32,479	\$0	\$32,479	\$0	\$32,479
4.5 Replace destroyed benchmarks (if needed)	0	\$0				\$5,961				\$5,961	\$5,961	\$5,961	\$5,501	\$460	\$0	\$5,961
4.6 Process, check, and update database	3.25	\$4,490				\$6,409				\$6,409	\$10,899	\$10,899	\$4,314	\$6,585	\$0	\$10,899
Task 5 -- Data Analysis and Reports		\$59,644								\$20,000	\$79,644	\$79,644	\$105,398	-\$25,754	\$0	\$79,644
5.1 Analysis of data from the areas of subsidence concern																
Production/recharge/piezometric/extensometer	4	\$5,208				\$20,000				\$20,000	\$25,208	\$25,208	\$25,032	\$176	\$0	\$25,208
Ground-level survey and Northwest MZ-1 Area EDM data	4	\$5,572								\$0	\$5,572	\$5,572	\$5,384	\$188	\$0	\$5,572
Perform analysis of EDM and elevations surveys in the Fissure Zone	0	\$0								\$0	\$0	\$0	\$28,352	-\$28,352	\$0	\$0
InSAR data	4	\$5,208								\$0	\$5,208	\$5,208	\$5,032	\$176	\$0	\$5,208
Tectonic data	0.25	\$300								\$0	\$300	\$300	\$298	\$2	\$0	\$300
Recycled water reuse data	2	\$2,400								\$0	\$2,400	\$2,400	\$2,384	\$16	\$0	\$2,400
5.2 Prepare 2017 Annual Report of the Ground-Level Monitoring Committee																
Prepare draft annual report	23	\$32,920								\$0	\$32,920	\$32,920	\$31,240	\$1,680	\$0	\$32,920
Prepare final annual report	5.5	\$8,036								\$0	\$8,036	\$8,036	\$7,676	\$360	\$0	\$8,036
Task 6 -- Work Plan to Develop a Subsidence-Management Plan for the Northwest MZ-1 Area		\$286,834								\$1,013,850	\$1,300,684	\$1,300,684	\$275,945	\$1,024,739	\$75,000	\$1,225,684
6.1 Finalize implementation of the initial monitoring program	77	\$98,408	\$1,300						\$50	\$1,350	\$99,758	\$99,758	\$84,645	\$15,113	\$75,000	\$24,758
6.2 Develop and evaluate the Initial Subsidence-Management Alternative (ISMA)	0	\$0								\$0	\$0	\$0	\$112,014	-\$112,014	\$0	\$0
6.3 Install the Pomona Extensometer Facility	93.75	\$188,426	\$12,500			\$1,000,000				\$1,012,500	\$1,200,926	\$1,200,926	\$60,944	\$1,139,982	\$0	\$1,200,926
6.4 Install monitoring equipment (transducers, data loggers, telemetry) in the Pomona Extensometer and test	48	\$62,312	\$1,920		\$16,000	\$24,000				\$41,920	\$104,232	\$104,232	\$0	\$104,232	\$0	\$104,232
6.5 Prepare task memorandum - completion report for the Pomona Extensometer Facility	20	\$30,088	\$62						\$50	\$112	\$30,200	\$30,200	\$0	\$30,200	\$0	\$30,200
6.6 Meetings and administration	0	\$0								\$0	\$0	\$0	\$18,342	-\$18,342	\$0	\$0
Task 7 -- Meetings and Administration		\$43,404								\$242	\$43,646	\$43,646	\$35,814	\$7,832	\$0	\$43,646
7.1 Prepare for and attend three Ground-Level Monitoring Committee meetings	12	\$20,576	\$194							\$194	\$20,770	\$20,770	\$14,569	\$6,200	\$0	\$20,770
7.2 Ad hoc meetings	3	\$5,144	\$48							\$48	\$5,192	\$5,192	\$4,856	\$336	\$0	\$5,192
7.3 Project administration and financial reporting	7.5	\$12,540								\$0	\$12,540	\$12,540	\$11,580	\$960	\$0	\$12,540
7.4 Scope and budget for FY2018/19	3	\$5,144								\$0	\$5,144	\$5,144	\$4,808	\$336	\$0	\$5,144
Totals											\$1,704,320	\$1,704,020	\$658,394	\$1,045,626	\$116,268	\$1,587,752





34°00'0"N

34°00'0"N



+ 0.25 ft
 0
 -0.1
 -0.25
 Relative Change in Land Surface Altitude as Measured by InSAR Mar-2011 to Jan-2016

InSAR data incoherent

Survey Areas

- Southeast Area
- Fissure Zone
- Managed Area
- San Jose Fault Zone

Survey Benchmarks

- Existing Monument

Wells and Extensometers

- Desalter Well
- Ayala Park Extensometer
- Chino Creek Extensometer
- Well Monitored by Pressure Transducer as of Dec-2015

- Managed Area
- Areas of Subsidence Concern
- Ground Fissures
- Flood Control & Conservation Basins
- Chino Basin Management Zones



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Ground-Level Monitoring Committee
 2015 Annual Report

Ground-Level Monitoring Program
 Fiscal Year 2017-18

Figure 1