FREEPORT-MCMORAN
COPPER & GOLD

Sierrita Operations
Environment, Land & Water Department
6200 West Duval Mine Road
PO Box 527
Green Valley, Arizona 85622-0527

January 29, 2010

Via Certified Mail # 7008 2810 0000 0983 6437
Return Receipt Requested

Ms. Cynthia S. Campbell
Arizona Department of Environmental Quality
Water Quality Compliance Section
1110 West Washington Street
Phoenix, Arizona 85007-2935

Re: Mitigation Order on Consent Docket No. P-50-06
Final Conceptual Wellfield Design

Dear Ms. Campbell:

As per the Mitigation Plan submitted to ADEQ on May 8, 2009, Freeport-McMoRan Sierrita Inc. (Sierrita) is hereby submitting the Final Conceptual Wellfield Design for the recommended, and ADEQ approved, alternative 5 of the Feasibility Study.

Please do not hesitate to contact me at (520) 393-4435 if you have any question regarding this submittal.

Sincerely,

Martha G. Mottley
Chief Environmental Engineer
Freeport-McMoRan Sierrita Inc.

MGM:ms
Attachment

xc: Henry Darwin, Arizona Department of Environmental Quality
John Broderick, Sierrita
Chad Fretz, Sierrita
Ned Hall, Freeport-McMoRan Copper & Gold
Stuart Brown, Bridgewater Group, Inc.
Jim Norris, Clear Creek Associates

FINAL WELLFIELD CONCEPTUAL DESIGN
MITIGATION ORDER ON CONSENT DOCKET NO. P-50-06

Prepared for:

FREEPORT-MCMORAN SIERRITA INC.
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Green Valley, Arizona 85614

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January 29, 2010

HYDRO GEO CHEM, INC.

Environmental Science & Technology

FINAL WELLFIELD CONCEPTUAL DESIGN
MITIGATION ORDER ON CONSENT DOCKET NO. P-50-06

Prepared for:

FREEPORT-MCMORAN SIERRITA INC.
6200 West Duval Mine Road
Green Valley, Arizona 85614

Prepared and Approved by:

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January 29, 2010

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

1.1 Background

This report provides a final conceptual wellfield design for groundwater pumping facilities to be developed and operated as mitigation measures to address a groundwater sulfate plume with respect to drinking water supplies in the vicinity of the Freeport-McMoRan Sierrita Inc. (Sierrita) Tailing Impoundment (STI) south of Tucson, Arizona (Figures 1 and 2). The wellfield design was developed in accordance with the requirements of Mitigation Order on Consent Docket No. P-50-06 (Mitigation Order) between Sierrita and Arizona Department of Environmental Quality (ADEQ) and is subject to the terms of the Mitigation Order.

Under the Mitigation Order, the sulfate plume is defined as consisting of groundwater with sulfate concentrations greater than 250 milligrams per liter (mg/L) due to the STI. Figure 3 shows the location of the plume based on groundwater monitoring data for the second quarter of 2009.

Mitigation measures were identified by a Feasibility Study (FS) (Hydro Geo Chem, Inc [HGC], 2008) and approved by ADEQ (ADEQ, 2009). The mitigation measures consist of groundwater pumping and water use to control seepage from the STI to the regional aquifer, stabilize the northern and eastern edges of the sulfate plume, and, to the extent practicable, remove sulfate from within the plume to reduce its extent. The FS identified, and ADEQ approved (ADEQ, 2009), Alternative 5 as the recommended mitigation measures. Alternative 5 calls for Sierrita to install groundwater pumping wells and conveyances needed to relocate a significant portion of its groundwater pumping from an unimpacted part of the aquifer to locations within the plume where pumping will control the migration of the plume and reduce its areal extent over time.

Sierrita submitted a Mitigation Plan (HGC, 2009b) to ADEQ in May 2009 which describes the process and schedule for implementing the mitigation measures. Sierrita is proceeding to implement the Mitigation Plan, although ADEQ is deferring its approval of the plan until contingencies associated with Alternative 5 are resolved. Section 1.3.5 discusses the Mitigation Plan schedule.

1.2 Preliminary Conceptual Wellfield Design

Figure 4 shows the preliminary conceptual wellfield design for Alternative 5 as reported in the FS. The preliminary wellfield design was based on hydraulic capture zone modeling with a numerical model of groundwater flow and sulfate transport. The modeling results were used to estimate groundwater capture areas and pumping rates needed to accomplish the objectives of Alternative 5. The numerical model is described in the FS and discussed further in Section 1.4.

The preliminary conceptual design in the FS identified groundwater pumping at four groups of wells: interceptor wells (IW), focused feasibility study wells (FFS), source control wells (SC), plume stabilization wells (PS), and mass capture wells (MC). The IW wells are existing wells. The FFS, SC, PS, and MC wells would be new wells.

Groundwater pumping at the well groups would accomplish different objectives. The IW, FFS, and SC wells would be pumped for source control to prevent seepage from the STI from migrating to the regional aquifer. The PS wells at the northern edge of the plume would be pumped for plume stabilization to prevent additional downgradient movement of the plume. The MC and FFS wells would be pumped to reduce sulfate mass within the downgradient plume. The FFS wells have a dual role of source control and mass removal because they would be pumped at rates greater than those needed to accomplish source control alone. Under Alternative 5 the sulfate plume is not predicted to migrate into unaffected portions of the aquifer, the plume extent is predicted to decrease over time, and existing drinking water supplies are expected to be protected from impact by the sulfate plume.

The approach and objectives of Alternative 5 were retained for development of the final conceptual wellfield design. The final conceptual wellfield design varies from the preliminary design in the FS because it accounts for new information developed since the FS was prepared. Considerations included in the final conceptual wellfield design are described in Section 1.3. Also, the four SC wells identified in the FS (Figure 4) were renamed IW-25 through IW-28 in the final conceptual wellfield design. The SC wells were renamed because they are near the existing IW wellfield and have the same function of capturing seepage from the STI.

1.3 Considerations for the Final Conceptual Wellfield Design

The purpose of the final conceptual wellfield design is to specify the well locations, pumping rates, performance goals, and well designs for implementation by Sierrita. The well locations and pumping specifications form the basis for development of engineering designs for wellfield infrastructure such as pipeline conveyances, pumping stations, and electrical systems. The engineering designs provide the plans for bid solicitation and construction. The well locations also impact the land access and permitting requirements of the project.

The final wellfield design accounts for several developments that occurred since the FS. The developments include the contingency of acquiring state land east of the STI for the location of the FFS wells, mine operational changes, and land access constraints for some wells. Additionally, the numerical model used to develop the wellfield design for the FS was updated to account for actual groundwater pumping rates in 2007 and 2008 and the Mitigation Plan schedule. Lastly, the hydraulic conductivity specifications in the numerical model were evaluated with respect to the results of a large-scale aquifer test conducted in February 2009. The developments considered for the final design are discussed in Sections 1.3.1 to 1.3.6. The numerical model used to develop the final design is described in Section 1.4.

1.3.1 State Land Acquisition

The Mitigation Plan identified Sierrita's potential acquisition of Arizona State Land Department (ASLD) property east of the STI (Figure 4) as a contingency that could modify Alternative 5. Sierrita submitted an application to purchase the ASLD property in July 2009. Sierrita would locate the FFS wells on the ASLD property instead of the locations described in the FS if it is successful in acquiring the property (hereafter called the State Land Option). Otherwise, Sierrita would locate the FFS wells off of state land as described in the FS (the Non-State Land Option). ASLD's decision on the sale of the ASLD property is not expected until July 2011. To meet the Mitigation Plan schedule, Sierrita developed final conceptual wellfield designs for both the State Land Option and the Non-State Land Option. Engineering designs will be developed for each option so that construction can begin without delay once the outcome of the state land purchase is known. The final conceptual wellfield designs for both the state land and non-state land options are presented in Section 2.

1.3.2 Mine Operations Changes

The preliminary conceptual wellfield design in the FS assumed an increase in mine production in 2010 based on the mine plan at the time of the FS. The increase in production would have increased tailing water deposition and seepage from the STI. The increase in seepage due to the assumed production increase was explicitly included in the tailing seepage term of the numerical model used to develop the preliminary conceptual wellfield design.

Since the FS was prepared, Sierrita decided not to increase mine production. Therefore, the seepage term in the numerical model had to be modified to reflect seepage from the STI based on the current mining rate. The change reduced the amount of seepage assumed in the model compared to the FS model because of the lower assumed tailing water delivery rate. Appendix A discusses the estimation of future STI seepage and the specifications used for the current numerical model.

1.3.3 Land Access Constraints

The development of land access and right-of-way permits is a significant challenge for wells located on both public and private property. Sierrita owns the land on which wells IW-25 through IW-28 would be located, but needs to develop access to all other locations. Sierrita's land access efforts have identified the need to modify the positions of several wells from those identified in the conceptual design. The wells with access issues were generally moved less than 1,000 feet from the locations identified in the FS to locations with better accessibility due to logistics or ownership. The well locations identified in the final conceptual wellfield design (Section 2) represent the best land access information available at this time based on discussions with property owners and Pima County. The revised well locations were incorporated into the numerical model and used for wellfield design.

1.3.4 Groundwater Pumping in 2007 and 2008

The numerical model used for the FS was calibrated to groundwater pumping records through 2006. Estimates of future pumping for predictive simulations in the FS were based on a compilation and analysis of future water use by the Upper Santa Cruz Providers and Users Group (PUG) (Hedden, et al., 2008) and records of groundwater pumping obtained from Arizona Department of Water Resources (ADWR). ADWR provided data on the 2007 and 2008 total groundwater pumping at wells in the area covered by the numerical model (Figure 5). The well pumping files in the numerical model used for the final design were updated with the total annual groundwater pumping for 2007 and 2008. Simulation of future conditions (after 2008) at non-Sierrita wells retained the pumping estimates of PUG (Hedden, et al., 2008). The pumping assumptions for the State Land and Non-State Land Options are described in Section 2

1.3.5 Mitigation Plan Schedule

The Mitigation Plan provides a schedule for implementation of the mitigation measures. The schedule has been further refined by Sierrita since the Mitigation Plan was submitted. The IW-25 through IW-28 wells will be constructed and commissioned first because their locations do not depend on the state land purchase and their production can be conveyed to Sierrita by the existing IW pipeline. The expected startup of pumping at IW-25 through IW-28 is January 2012. The startup of pumping at the FFS, PS, and MC wells is expected to be in the second half of

2013 because installation of the FFS and some MC wells and associated pipelines cannot be started until ASLD decides on the sale of the state land and the locations of the FFS and MC wells can be finalized. The numerical model was modified to specify pumping at wells IW-25 through IW-28 starting in January 2012 and pumping at the FFS, PS, and MC wells in January 2014. Pumping at the FFS, PS, and MC wells was specified for January 2014 instead of late 2013 because the model uses year-long stress periods in which pumping rates are constant. The simulated delay in startup of the FFS, PS, and MC wells should not have a substantive effect on the long-term predictions of the model.

1.3.6 Results of the February 2009 Large-Scale Aquifer Test

A large-scale aquifer test was conducted in February 2009 to measure field-scale hydraulic conductivity in the vicinity of future wellfields (HGC, 2009c). The magnitude of pumping necessary to achieve the capture required to control sulfate migration is directly proportional to the estimate of hydraulic conductivity of the aquifer. The groundwater extraction rates specified in the final conceptual design directly affect the sizing of wells, pumps, and piping; electrical specifications; and, hence, costs. The large-scale aquifer test was conducted to verify the hydraulic properties specified in the numerical model used to simulate pumping and groundwater capture for the final design.

The large-scale aquifer test was conducted within the west central portion of the model domain (Figure 5). The test consisted of pumping wells ESP-1 and ESP-3 (Figure 3) at a combined rate of approximately 1,700 gallons per minute (gpm) for approximately 7 days. Drawdown and recovery were monitored in 22 observation wells. HGC's interpretation of the large-scale aquifer test results indicated hydraulic conductivities for basin fill ranging from 6 feet per day (ft/day) to 41 ft/day, although the results considered the most reliable ranged from 6 ft/day to 15 ft/day. The aquifer test results yielded storage coefficients ranging from 7.0×10^{-5} to 6.1×10^{-4} and specific yields ranging from 0.07 to 0.25.

The numerical model was constructed using hydraulic conductivities ranging from approximately 6 ft/day to 88 ft/day within the test area, although most of the pumping and observation wells for the test were within areas of the model with hydraulic conductivities ranging from approximately 6 ft/day to 39 ft/day. The highest model hydraulic conductivities, ranging from approximately 39 ft/day to 88 ft/day, are within a limited zone centered approximately on the MH-26 well nest (Figure 3). The specific yields used in the model in the area of the test vary from approximately 0.125 to 0.2, and storage coefficient is constant at 0.0001.

Overall, the range of hydraulic conductivities derived from the aquifer test data is similar to the range used in the model, particularly if the high model conductivities at MH-26 are excluded. The range of hydraulic conductivities estimated by the aquifer test narrows to approximately 6 ft/day to 15 ft/day if the estimates HGC considered to be of low reliability are excluded. Thus, the aquifer test results indicate hydraulic conductivities at the lower end of the conductivity range used in the numerical model. The specific yield and storage coefficients derived by the aquifer test are similar to those used in the numerical model.

The results of the large-scale aquifer test indicate that the aquifer properties used in the model are reasonable and do not require modification. Because the model conductivities are on average higher than those derived from the aquifer test, use of the model to predict capture should be conservative in that capture effectiveness is more likely to be under-predicted rather than over-predicted.

1.4 Numerical Modeling for the Final Conceptual Wellfield Design

Well locations and pumping rates for the final conceptual design were evaluated using the numerical model constructed for the FS as modified to accommodate the changes described in Section 1.3. The numerical model was constructed using MODFLOW-SURFACT version 2.2 (HydroGeoLogic, Inc., 1996) to simulate groundwater flow and transport in the vicinity of the STI from 1940 to the present (HGC, 2009a). MODFLOW-SURFACT is based on the widely used United States Geological Survey modeling program MODFLOW (McDonald and Harbaugh, 1988).

The numerical model represents the hydrogeologic conditions of the basin-fill aquifer in the vicinity of the STI. Hydrogeologic processes represented in the numerical model include groundwater recharge sources (e.g., river, agricultural, mountain front, tailing seepage, and artificial recharge) and withdrawal sources (e.g., pumping wells). The model was calibrated to measured water levels and spatial and temporal trends in sulfate concentration in the vicinity of the STI, including a 66-year record of groundwater pumping (1940 through 2006) and a 47-year record of tailing emplacement (HGC, 2009a). The calibrated model was used for predictive simulations from 2007 to 2060. Predictive simulations were conducted to evaluate mitigation alternatives for the FS (HGC, 2008). Additional predictive simulations were conducted for the final conceptual wellfield design.

Predictive simulations for the final conceptual wellfield design used the initial conditions for head and sulfate concentration distribution provided by the calibrated MODFLOW-SURFACT model and used for the FS. The numerical model was updated for the final wellfield conceptual design to reflect new information and changes in conditions since the FS (Sections 1.3.1 to 1.3.6). The predictive simulations were run from 2007 to 2060 to evaluate 50 years of mitigation pumping.

1.4.1 Revision of the Numerical Model for the Final Wellfield Conceptual Design

The numerical model used for the FS was updated for development of the final conceptual wellfield design. Changes to the model assumptions consisted of the following.

- Reducing the seepage term from the STI corresponding to the current tailing deposition rate (Appendix A)
- Specifying actual groundwater pumping rates to area wells for 2007 and 2008 based on ADWR records (Section 1.3.4)
- Modifying the start of pumping for the mitigation measures to start the proposed IW25 through IW-28 wells in 2012 and the FFS, MC, and PS wells in 2014 consistent with the Mitigation Plan schedule (Section 1.3.5)
- Calculating groundwater withdrawal from the Canoa Ranch wellfield (S-1, S-2, S-3, S-4, S-5, and S-6) to furnish the projected operational water demand not provided by mitigation pumping (IW-25 through IW-28, FFS, MC, and PS wells)

Modeling for the final wellfield conceptual design used the same estimates of future pumping at non-Sierrita wells and recharge from non-Sierrita sources as were used for the FS. Estimates of future pumping at non-Sierrita wells in the model domain were obtained from PUG (Hedden, et al., 2008), which provides estimated future pumping for existing mining, agricultural, and water supplies and users. PUG (Hedden, et al., 2008) also estimates pumping for potential major users that are expected in the future but are not yet active. The potential major users are included in the model to account for the projected growth in water usage at new developments. Estimates of recharge from non-Sierrita sources were unchanged from those assumed for the FS.

Sierrita's groundwater use is estimated to be approximately 16,550 gpm based on the current mine plan. FS Alternative 5 assumes that the volume of groundwater pumped at the IW-25 through IW-28, FFS, MC, and PS wells for sulfate mitigation would be offset by a one-to-one reduction of Sierrita's water supply pumping at the Canoa Ranch wellfield. The offset of mitigation pumping means that during mining operations there would be no net change in the amount of groundwater pumping by Sierrita for mining use over what is expected to be pumped (during mine operations) under current mine planning assumptions. Instead, Sierrita's groundwater would be partially relocated from Canoa Ranch to the sulfate plume. The relocation of pumping would have the beneficial effect of increasing the volume of unimpacted groundwater in the aquifer upgradient of Green Valley, while allowing control of the plume by the mitigation measures. Modeling for the final conceptual wellfield design maintained the assumptions of Alternative 5 regarding offsetting mitigation pumping by a reduction in Canoa Ranch pumping. The Canoa Ranch extraction rate was distributed among the six wells in the wellfield based on their respective percentages of total Canoa Ranch pumping in the recent past. However, mine plans are periodically reevaluated and the assumptions on Sierrita's future water use, including the required pumping from the Canoa Ranch wellfield, are subject to change depending on mine operations.

Future changes to STI seepage and recharge were estimated for input to the numerical model as described in Appendix A. The draindown of pore water stored in the STI will commence at termination of tailing deposition. The rate of draindown continuously declines over time such that most of the draindown occurs in the first 25 years after tailing deposition ends, after which draindown rates are relatively slow. The numerical simulations for the final design retained the FS Alternative 5 assumption that draindown at the STI would begin in 2016 with the startup of a new tailing impoundment.

The final wellfield conceptual design was based on the best available water extraction and recharge projections for the area. Nonetheless, quantifying long-term, future projections of the location, timing, and magnitude of future pumping and recharge in a developing area such as Green Valley is difficult and subject to considerable uncertainty. Significant differences between the actual future pumping and recharge and the assumptions in the model can result in differences between the model predictions and actual conditions.

1.4.2 Evaluation of Final Wellfield Conceptual Design Configurations

The effectiveness of the wellfield design was evaluated using the numerical model to simulate groundwater flow and sulfate transport. The goals by which the effectiveness was evaluated were establishment of source control by capture of seepage from the STI, prevention of downgradient migration of the sulfate plume, the removal of sulfate mass from the aquifer to reduce the footprint of the 250 mg/L sulfate plume, and minimization of groundwater extraction rates, especially following the projected mine life. The effectiveness of a mitigation wellfield pumping scheme in addressing these goals was assessed primarily by changes in the simulated configuration of the 250 mg/L sulfate plume. These results are posted on maps showing the sulfate plume extent over time. Plume extent maps were created by contouring the maximum sulfate concentration present in all three layers. Displaying the sulfate plume using the maximum concentrations in each of the three layers is expected to be a conservative (i.e. maximum) estimate of the sulfate plume extent compared to the plume extent estimated from water quality sampling of regional wells because the sampling results represent a composite of sulfate concentrations at various depths.

The ability of the wellfield design to meet its mitigation objectives was also evaluated by the results of the particle tracking simulations, although the transport simulations were used as the primary measure of effectiveness. MODPATH code was used to track the movement of hypothetical particles in model Layers 2 and 3, based on cell-by-cell files from the groundwater flow simulation. MODPATH results are the depicted pathways of predicted particles from their point of origin to the end of the simulation. Groundwater within the zone of hydraulic capture will either be removed or hydraulically isolated from the down gradient aquifer by pumping at the mitigation wells. Hydraulic capture zones were simulated by the evaluation of the flow paths of virtual particles released at selected locations. Depending on the purpose of the particle tracking simulation, the selected release locations included a line (i.e., linear array) of particles placed along the edge of the 2008 sulfate plume, particles at the outer edges of the STI, particles at locations between the IW wellfield and the FFS wells, and particles between the FFS and PS wells.

2. FINAL WELLFIELD CONCEPTUAL DESIGN

The final wellfield conceptual design provides well locations and pumping rates for implementation. Designs are provided for both the State Land and Non-State Land Options. The wellfield designs were developed using an iterative process of numerical simulation of the well locations and pumping rates needed to match the performance of Alternative 5 in the FS. The conceptual designs do not address pipelines between wells, pumps, or other system components needed to convey water from the proposed wells. Sierrita will develop detailed engineering designs for conveyances based on the well locations and pumping rate targets identified for the final conceptual wellfield designs. The engineering design will begin following submittal of the final conceptual wellfield design report.

The groundwater extraction objectives for Alternative 5 are to establish source control, prevent plume expansion (plume stabilization), reduce the extent of the plume, and prevent impacts to drinking water supply wells. Performance goals were also identified for the final wellfield conceptual design. As described in the Mitigation Plan, performance goals are estimates of the minimum pumping needed to achieve the groundwater extraction objectives of source control and plume stabilization.

2.1 State Land Option

Figure 6 shows the locations of wells to be installed for the State Land Option. Table 1 lists Universal Transverse Mercator (UTM) coordinates, the estimated bedrock elevation, and the initial and maximum pumping rate targets for the wells. Table 2 summarizes pumping at Sierrita wells from 2012 to 2060. Groundwater pumping from the existing IW wells and the proposed IW-25 through IW-28 (formally called SC wells) are accounted for separately on Table 2 to provide the detail on the proposed mitigation measures. The year-by-year groundwater pumping rate specifications assumed for all wells in the numerical model for 2007 through 2060 are provided in Appendix B.

The wellfield design for the State Land Option was based on the preliminary conceptual design for Alternative 5, but with the FFS wells located on the ASLD property east of the STI and the inclusion of two additional MC wells. The additional MC wells were needed to compensate for the movement of the FFS wells to the west and south in comparison to Alternative 5 and because the FFS wells are expected to pump at lower rates than the in the Non-State Land Option due to a decreased saturated thickness on the state land. Figure 7 shows the simulated 250 mg/L sulfate contours for 2020, 2030, 2040, 2050, and 2060 for the State Land Option. Appendix B contains maps of predicted sulfate concentration and groundwater elevation by decade from 2020 through 2060. The results of particle tracking simulations for the State Land Option are also shown in Appendix B.

The pumping rate specifications of the State Land Option (Table 2) are similar to but lower than those of FS Alternative 5 except after 2043, although the two designs are not exactly comparable due to changes in well locations. The differences in pumping between the State Land Option and Alternative 5 are due to the different assumed locations of the FFS and MC wells, the inclusion of two additional MC wells needed to meet the objectives of Alternative 5, and the updates made to the numerical model (Section 1.3). The total mitigation pumping for the State Land Option ranges from a high of 14,410 gpm in 2014 at the start of the complete mitigation measures system to a low of 2,955 gpm in 2051. The total mitigation pumping for the State Land Option is approximately 2 percent to 13 percent less than the simulated pumping for Alternative 5 from 2014 through 2042. The State Land Option pumping is approximately 16 percent to 23 percent higher than Alternative 5 after 2043 (i.e., 2,555 gpm for Alternative 5 versus 2,955 gpm to 3,155 gpm for the State Land Option). The higher long-term pumping rate is needed to maintain plume stabilization. Compared to Alternative 5, the State Land Option would pump less from the existing IW wells due to well efficiency issues, pump less from the FFS wells due to a smaller saturated thickness resulting from moving the wells to the west, pump more from the MC wells due to the addition of two more MC wells, and pump more from the PS wells for plume stabilization. There is no pumping assumed from the MC and PS wells after 2043.

The numerical simulation results for the State Land Option indicate no significant expansion of the plume during the simulation period. The extent of the plume is largely reduced to the vicinity of the IW and FFS wells by 2040. The simulation results indicate the State Land Option performs as well as Alternative 5 in the FS with respect to source control, prevention of plume expansion, and protection of unimpacted drinking water supply wells. Existing drinking water supply wells are not predicted to be impacted by the plume because groundwater extraction reduces the footprint of the plume over time and prevents the plume from expanding to the north, south, and east.

The State Land Option reduces the extent of sulfate to a greater degree than Alternative 5 because the sulfate plume would be mainly within the boundary of the state land after 2040. Alternative 5 simulated the plume as being located 2,000 feet to the east of the state land boundary.

Simulation results show a residual zone of sulfate remaining after 2060 in the vicinity of the PS wells north of Duval Mine Road. Simulation of the State Land Option was conducted for a

100-year time period to examine the fate of the residual zone of sulfate (Appendix B). Although the results for a 100-year simulation are considered preliminary due to uncertainty in future conditions, the simulation results indicate that the residual zone of sulfate persists over time, migrates northward approximately 2,500 feet and decreases in size and concentration. There are no drinking water supply wells along the predicted path of the residual zone of sulfate. A similar residual zone of sulfate was reported in the FS for the predicted results of Alternative 5. In summary, the final wellfield design for the State Land Option meets the groundwater extraction objectives for FS Alternative 5.

2.2 Non-State Land Option

Figure 8 shows the locations of wells to be installed for the Non-State Land Option. Table 3 lists Universal Transverse Mercator (UTM) coordinates, the estimated bedrock elevation, and the initial and maximum pumping rate targets for the wells. Table 4 summarizes pumping at Sierrita wells from 2012 to 2060. Groundwater pumping from the existing IW wells and the proposed IW-25 through IW-28 (formally called SC wells) are accounted for separately on Table 4 to provide detail on the proposed mitigation measures. The year-by-year groundwater pumping rate specifications assumed for all wells in the numerical model for 2007 through 2060 are provided in Appendix C.

The wellfield design for the Non-State Land Option is similar to the preliminary conceptual design for Alternative 5 presented in the FS. Some well locations were shifted due to access constraints (Section 1.3.3). Figure 9 shows the simulated 250 mg/L sulfate contours for 2020, 2030, 2040, 2050, and 2060 for the Non-State Land Option. Appendix C contains maps of predicted sulfate concentration and groundwater elevation by decade from 2020 through 2060. The results of particle tracking simulations for the Non-State Land Option are also shown in Appendix C.

The pumping rate specifications of the Non-State Land Option (Table 4) are similar to those of FS Alternative 5, although the there are minor differences due to revisions to the model (Section 1.3) and the ability to optimize pumping from the preliminary conceptual design. The total mitigation pumping for the Non-State Land Option ranges from a high of 15,110 gpm in 2014 at the start of the complete mitigation measures system to a low of 3,045 gpm in 2043. The total mitigation pumping for the Non-State Land Option is approximately 1 percent to 4 percent less than the simulated pumping for Alternative 5 except from years 2031 to 2036 when it is 11 percent higher and years 2043 to 2060 when it is 19 percent higher (i.e., 2,555 gpm for Alternative 5 versus 3,045 gpm for the Non-State Land Option). The higher long-term pumping rate is needed to maintain plume stabilization. Compared to Alternative 5, the Non-State Land

Option would pump less from the existing IW wells due to well efficiency issues related to water table declines and pump more water from IW-25 through IW-28 and the FFS wells to compensate for reductions at the existing IW wells. There is no pumping assumed from the MC and PS wells after 2043.

The numerical simulation results for the Non-State Land Option indicate that there is no significant expansion of the plume over time and that the extent of the plume is largely reduced to the locations of the IW and FFS wells by 2040. The simulation results indicate the Non-State Land Option would perform like Alternative 5 in the FS with respect to source control, prevention of plume expansion, and protection of unimpacted drinking water supply wells.

Existing drinking water supply wells are not predicted to be impacted by the plume because groundwater extraction reduces the footprint of the plume over time and prevents the plume from expanding to the north, south, and east. The State Land Option would reduce the extent of sulfate to the boundary of the state land after 2040.

Simulation results show a residual zone of sulfate remaining after 2060 in the vicinity of the PS wells north of Duval Mine Road. Simulation of the State Land Option was conducted for a 100-year time period to examine the fate of the residual sulfate zone (Appendix C). Although the results of a 100-year simulation are considered preliminary due to uncertainty in future conditions, the simulation results indicate that the residual zone of sulfate persists, migrates northward approximately 3,000 feet, and decreases in size and concentration. There are no drinking water supply wells along the predicted path of the residual zone of sulfate. A similar residual zone of sulfate was reported in the FS for the predicted results of Alternative 5. In summary, the final wellfield design for the Non-State Land Option meets the groundwater extraction objectives for FS Alternative 5.

2.3 Performance Goals

Performance goals for the State Land and Non-State Land Options were developed to identify the minimum pumping necessary to maintain the source control and plume stabilization objectives of Alternative 5 if mass capture pumping were reduced or eliminated. Appendix D describes the results of numerical simulations used to develop pumping rate specifications for performance goals. The results of sulfate transport and particle tracking simulations presented in Appendix D indicate that source control and plume stabilization are accomplished under the performance goal pumping rates and model assumptions.

3. EXTRACTION WELL DESIGN

This section provides a design for extraction wells to be installed as mitigation measures. As described in Section 2, the State Land Option calls for installation of 18 extraction wells (Table 1) and the Non-State Land option requires installation of 16 extraction wells (Table 3). The wells will be installed over a large area and will tap different parts of the basin fill aquifer. The geologic and hydrologic properties of basin fill at each well site are expected to differ due to spatial variability in the basin fill. The magnitude and range of pumping rates also will vary over time across the wellfield. The ability of individual wells to meet the target pumping rates in Tables 2 and 4 depends in large part on the hydraulic properties of the basin fill and the saturated thickness at each well site. The saturated thickness in the wellfield will vary over time because of projected water level declines due to pumping in the wellfield and at non-Sierrita wells throughout the region. The numerical model includes spatial variability in hydraulic properties and predicts water levels over time based on the best available data. However, the natural variability of site-specific hydraulic properties, and the precision of predictive model simulations in comparison to actual future water level conditions remain to be determined by experience. Therefore, the design for extraction wells should be flexible to adapt to site-specific conditions determined during well installation and wellfield operation.

3.1 Design Objectives

Design objectives for the extraction wells are longevity, productivity, strength and durability, and ease of access for operations or maintenance. The design objectives need to be balanced against factors such as cost and uncertainty in hydrogeologic variables to develop an effective well design for the mitigation measures.

3.1.1 Longevity

The extraction wells installed as mitigation measures will be pumped for three to five decades, and it is likely that some wells will be pumped for longer (Tables 2 and 4). Therefore, the longevity of the extraction wells is a key design objective so that the cost and potential disruption of pumping associated with the installation of replacement wells is minimized. An effective service life of 30 to 50 years is used as a design goal for the extraction wells. Factors that influence the longevity of wells are the type and thickness of casing and screen materials. However, the service life of a well is difficult to predict in that it depends to some degree on site-specific and operational conditions such as the chemical and biochemical aggressiveness of the water, the expected range of water levels, and maintenance.

3.1.2 Productivity

The maximum modeled production rate of individual extraction wells ranges from 400 gpm to 1,100 gpm for both the State Land and Non-State Land Options (Tables 1 and 3). The extraction well design should be consistent with design basis pumping rates, although the actual productivity of individual wells will be primarily dependent on the basin fill transmissivity over time at the well location. Design factors that impact well productivity include the screen length, screen open area, well diameter, and filter pack. The inflow rate to a well is directly proportional to the screen length if other factors are constant. Therefore, the screen should be long enough to allow the design production rates to be maintained. The well screen open area and slot size should be appropriate to hold back the filter pack while allowing groundwater inflow at the design production rates without excessive entrance velocities, well losses, or sand entrainment. The well diameter should be adequate to allow installation of pumping equipment sized for the design basis production rates. The filter pack should allow good hydraulic connection to the basin fill upon development so that head losses associated with groundwater withdrawal from the well are minimized.

The productivity of the existing IW wells has been observed to decline over time due to mineral precipitation and biological growth that clog screens and pumping equipment, which leads to reduced inflow and additional head losses. A proactive well rehabilitation program is needed to maintain the productivity of wells to the extent practicable. Another problem in some of the existing IW wells is cascading water in dewatered portions of the screen. The cascading water causes air entrainment that affects the efficiency of pumps and conveyances, and may also exacerbate mineral precipitation and biofouling problems. Ideally, the top of the well screen could be kept below the water table at all times to limit air introduction. However, it is not always possible to set the top of the screen deeper than the deepest potential water level, because that may reduce the screen length and, hence, the productivity of the well. This is particularly true at sites expected to have large declines in water levels over time. Additionally, the deeper portions of the saturated basin fill tend to have a lower hydraulic conductivity than more shallow portions in the vicinity of the STI (HGC, 2009a). In that case, deepening the screen may reduce the effective transmissivity of a well by eliminating inflow from the more permeable upper portions of the basin fill aquifer. Productivity, screen length, and minimizing air entrainment are trade-offs in a setting such as the STI where water levels are expected to decline over time and permeability decreases with depth.

3.1.3 Strength and Durability

The strength and durability of the extraction well materials should be sufficient to manage the expected stresses of well installation, well development, and repeated well rehabilitation over time. Groundwater pumped from the extraction wells will have elevated concentrations of sulfate that can lead to mineral precipitation and encrustation of the well screen. Aerobic and anaerobic microbial growth in wells can lead to a biofilm that can clog screens and pumping equipment. Therefore, well cleaning by physical and chemical means should be conducted periodically to mitigate the impact of mineral encrustation and biological growth should they occur. Resistance to corrosion should be accounted for in the design because the high total dissolved solids of sulfate-impacted groundwater and the chemicals used for well rehabilitation can be corrosive. Design factors that influence well strength and durability are the type and thickness of casing and screen materials.

3.1.4 Access for Operations and Maintenance

Wells can be designed with access tubes for water level measurement, evaluation of well condition, and rehabilitation activities. Design elements that can be incorporated in wells to provide access include tubes for water level measurement, downhole camera access, chemical feed for rehabilitation, and gravel feed to the filter pack. Depending on their intended use, access tubes can be installed within the well casing and screen, or in the annulus outside the well casing and screen. Either means of access tube installation has benefits and disadvantages. The need for access ports was determined based on discussion with Sierrita personnel. Sierrita identified the need for a sounding tube in the annulus for periodic water level monitoring and a sounding tube in the well for a pressure transducer in the event that a variable frequency drive pump is used. The former is incorporated into the well design. The latter will be included in the engineering design of the well surface completion.

3.2 Extraction Well Design

Two extraction well designs were developed based on the design objectives and discussion with Sierrita. The first design would be applicable at proposed well sites where cascading water and entrained air are not expected to occur. The second design would be applicable at proposed well sites where cascading water and air entrainment are expected to occur. The key difference between the two designs is the type of casing used above the water table of the well. The design for sites with potential for cascading water and air entrainment would use materials suitable for future modifications (casing liner installation) to exclude sections of dewatered screen through which cascading occurs. The potential for cascading water would be evaluated based on proximity to wells that have cascading water, extrapolation of geologic and pumping data for existing wells, and conditions encountered during drilling.

Schematic diagrams are provided for the two designs. The schematic diagrams identify the materials and basic elements recommended for extraction wells. Schematic diagrams are provided because the actual design of each well depends on the site-specific conditions of current static water elevation, basin fill stratigraphy and bedrock depth as determined by drilling, the expected lowest future water level, and in some cases, hydraulic conductivity and water quality conditions known from data for nearby existing wells. The construction of individual wells will be based on the estimated depth of bedrock, the current static water level, and the predicted future water level at each well site as discussed in Sections 3.2.1 and 3.2.2. Estimates of depth of bedrock, the current static water level, and the predicted future water level for individual wells are provided in Tables 5 and 6 for the State Land and Non-State Land Options, respectively. The well design recommendations should be modified as needed based on both anticipated and unanticipated site-specific conditions determined during well installation.

The extraction well designs are based on available information and should be modified, as needed to accommodate site-specific conditions encountered in the field. The sizing of the louvered screen slots and filter pack sand is based on experience with high capacity water wells in basin fill of the Tucson basin. The open area of the screen and filter pack are specified based on prior experience to allow sufficient inflow with a minimal head losses, prevent sand invasion, and allow well development to produce a good hydraulic connection with the formation.

The extraction wells should be installed to fully penetrate the basin fill aquifer unless information on basin fill permeability or water quality is available that supports the concept that exclusion of a portion of the basin fill would be advantageous. The wells will have a range of depths based on the estimated depth of bedrock, the current static water level, and the predicted future water level at each location (Tables 5 and 6). A fundamental concept of the well design is to have the screen and filter pack extend over the entire current saturated thickness of the basin fill. This will allow the entire saturated thickness of the aquifer to contribute inflow to the well and provide the best opportunity for meeting pumping rate targets during initiation of the mitigation measures. This concept is based on prioritizing the groundwater productivity above the avoidance of air entrainment that may result from dewatering the upper portions of the screen as water level declines occur. Two extraction well designs were developed to address air entrainment so that a different construction can be used at wells with potential for air entrainment. The extraction well designs should be reevaluated periodically, as experience is gained with the hydrogeology and operation of the wellfield. The effects of air entrainment can also be mitigated by setting pumps at greater depths below the dynamic water level, or using a tail pipe to extend the depth of the pump intake.

Wells FFS-3 and FFS-4 in the State Land Option (Table 5) have low minimum predicted water levels and small predicted minimum saturated thicknesses (between 75 and 95 feet). The small predicted minimum saturated thickness could limit the productivity of those wells if it occurs. The model predicts that the low saturated thicknesses occur between years 2040 and 2043, or approximately 26 to 29 years after the start of the mitigation measures. The saturated thickness at FFS-3 and FFS-4 is predicted to increase after 2043 when pumping is reduced at the end of mine life. The predicted low water elevations and their significance to the mitigation measures need to be assessed after installation of the FFS wells when bedrock elevations and site-specific hydraulic properties are determined. Additional information with which to evaluate predicted future water levels will be obtained after the first several years of wellfield operation.

3.2.1 Design for Well Not Expected to Encounter Cascading Water

Figure 10 is a schematic diagram for an extraction well not expected to encounter significant cascading water. The extraction well design for a well without cascading water uses both low carbon steel (LCS) and stainless steel for well casing.

3.2.1.1 Casing and Screen

The surface casing should be a 40-foot-long, 30-inch diameter, LCS casing cemented in a 34-inch borehole. A 24-inch diameter borehole is recommended for the well screen and blank casing below a depth of 40 feet. Boreholes for the extraction wells should be drilled approximately 50 feet into the bedrock or the lowermost geologic unit to accommodate potential fill during well construction and for installation of a 40-foot casing sump, subject to site-specific conditions and the limitations of low penetration rates.

Blank casing in the portion of the well above the estimated current static water table is recommended to be LCS with an outside diameter of 16.625 inches and a 0.375-inch wall thickness from the land surface to approximately 15 feet above the top of the current static water level. LCS is recommended above the water table because it has adequate strength and durability, and is less expensive than stainless or high strength low alloy steel.

Grade 304 stainless steel blank casing and screen with an outside diameter of 16.625 inches and a 0.312-inch wall thickness are recommended below the water table for longevity, strength and durability, and chemical resistance. Full flow louvered screen with 0.050-inch slots is recommended to provide appropriate open area to prevent excessive entrance velocities, and to be consistent with an 8-12 mesh filter pack. This screen design results in approximately 14.4 square inches of open area per foot of screen and has a maximum flow capacity of approximately 69 gpm per lineal foot of screen at the American Water Works Association (AWWA) recommended maximum entrance flow velocity of 1.5 feet per second. Casing and screen materials are specified with a 16.625-inch outer diameter to enable pumping equipment of sufficient size to be installed to achieve the target pumping rates.

The top of the screen should be placed 40 feet below the estimated current static water level to allow for some drawdown without aerating the top of the screen, and to avoid significantly reducing the length of screen in the upper portion of the basin fill. The bottom of the screen should be placed at the contact between basin fill and bedrock.

Two 40-foot-long pump galleries of stainless steel blank casing are recommended to reduce screen entrance velocities at the pump. The depth of the upper pump gallery will be determined in the field based on geology and the predicted rate of water level decline over time. The depth of the lower pump gallery will be approximately 100 feet below the deepest predicted water level, if possible. If the bottom of the well is less than 100 feet below the deepest predicted water level, the decision of where and whether to install a pump gallery will be made based on site-specific data and discussion with Sierrita.

Grade 304 stainless steel blank casing should extend from the top of the screen to the LCS casing. The stainless steel and LCS casing should be joined by a dissimilar metal connector (Figure 11). A 40-foot-long sump of stainless steel blank casing with a stainless steel bottom plate is recommended below the bottom of the screen.

Based on discussion with Sierrita, a sounding tube will be installed in the annulus of the well for long-term water level monitoring. The sounding tube would consist of 1.25-inch outside diameter blank LCS tubing with a 0.154-inch wall thickness from the surface to approximately 15 feet above the current static water level. Grade 304 stainless steel with a 1.25-inch outside diameter and a 0.154-inch wall thickness is recommended for blank and slotted tubing below the LCS blank. The LCS and stainless steel blank tubing should be joined with a dissimilar metal connector (Figure 11). The stainless steel sounding tube should have 0.050-inch factory slots and a stainless steel bottom cap. The slots should extend from approximately 40 feet below the estimated current static water level to the bottom of the well screen, except for sections adjacent to a pump gallery. Blank tubing should be installed adjacent to a pump gallery.

3.2.1.1 Annular Materials

A filter pack of 8-12 mesh silica sand is recommended for the extraction well annulus from the bottom of the borehole to the estimated current static water level. Pure silica sand with a minimal lithic content is recommended for chemical resistance. A 10-foot-thick bentonite seal should be placed in the annulus at the midpoint of each pump gallery to allow the option of segregating flow above and below the pump gallery. A 30-foot bentonite annular seal is recommended above the filter pack. Formation stabilizer consisting of pea gravel with 5-foot thick bentonite seals placed at 100-foot intervals is recommended from the top of the bentonite seal to 39 feet below land surface. Formation stabilizer is recommended rather than cement grout or a pure bentonite seal, because it is less expensive than cement or bentonite, and there are no perched aquifers to be sealed off in the basin fill. A sand cement grout seal would extend from 39 feet below land surface to land surface. Sand cement is recommended rather than neat cement or pozzolan cement due to its lower cost and adequate sealing characteristics.

3.2.2 Design for Well Expected to Encounter Cascading Water

Figure 12 is a schematic diagram for an extraction well expected to encounter significant cascading water. The extraction well design for a well with cascading water uses stainless steel well casing and screen exclusively in anticipation of the need to modify the well in the future by installation of a casing liner to exclude intervals of cascading water. A single casing material is needed to prevent the galvanic corrosion that would occur if the well casing and casing liner were dissimilar metals.

3.2.2.1 Casing and Screen

The surface casing should be a 40-foot-long, 30-inch diameter, LCS casing cemented in a 34-inch borehole. A 24-inch diameter borehole is recommended for the well screen and blank casing below a depth of 40 feet. Boreholes for the extraction wells should be drilled approximately 50 feet into the bedrock or the lowermost geologic unit to accommodate potential fill during well construction and for installation of a 40-foot casing sump, subject to site-specific conditions and the limitations of low penetration rates.

Grade 304 stainless steel blank casing and screen with an outside diameter of 16.625 inches and a 0.312-inch wall thickness are recommended throughout the well for longevity, strength and durability, chemical resistance, and the ability for future modification to exclude dewatered screen by the installation of a stainless steel casing liner. Full flow louvered screen with

0.050-inch slots is recommended to provide appropriate open area to prevent excessive entrance velocities, and to be consistent with an 8-12 mesh filter pack. This screen design results in approximately 14.4 square inches of open area per foot of screen and has a maximum flow capacity of approximately 69 gpm per lineal foot of screen at the AWWA recommended maximum entrance flow velocity of 1.5 feet per second. Casing and screen materials are specified with a 16.625-inch outer diameter to enable pumping equipment of sufficient size to be installed to achieve the target pumping rates.

The top of the screen should be placed 40 feet below the estimated current static water level to allow for some drawdown without aerating the top of the screen, and to avoid significantly reducing the length of screen in the upper portion of the basin fill. The bottom of the screen should be placed at the contact between basin fill and bedrock.

Two 40-foot-long pump galleries of stainless steel blank casing are recommended to reduce screen entrance velocities at the pump. The depth of the upper pump gallery will be determined in the field based on geology and the predicted rate of water level decline over time. The depth of the lower pump gallery will be approximately 100 feet below the deepest predicted water level, if possible. If the bottom of the well is less than 100 feet below the deepest predicted water level, the decision of where and whether to install a pump gallery will be made based on site-specific data and discussion with Sierrita. A 40-foot-long sump of blank casing with a stainless steel bottom plate is recommended below the bottom of the screen.

Based on discussion with Sierrita, a sounding tube will be installed in the annulus of the well for long-term water level monitoring. The sounding tube would consist of Grade 304 stainless steel blank and slotted tubing with a 1.25-inch outside diameter and a 0.154-inch wall thickness unless it is determined that Schedule 80 polyvinyl chloride pipe can be used for the portion of the tube above the water table. The stainless steel sounding tube should have 0.050-inch factory slots and a stainless steel bottom cap. The slots should extend from approximately 40 feet below the estimated current static water level to the bottom of the well screen, except for sections adjacent to a pump gallery. Blank tubing should be installed adjacent to a pump gallery.

3.2.2.2 Annular Materials

A filter pack of 8-12 mesh silica sand is recommended for the extraction well annulus from the bottom of the borehole to the estimated current static water level. Pure silica sand with a minimal lithic content is recommended for chemical resistance. A 10-foot-thick bentonite seal should be placed in the annulus at the midpoint of each pump gallery to allow the option of segregating flow above and below the pump gallery. A 30-foot bentonite annular seal is recommended above the filter pack. Formation stabilizer consisting of pea gravel with 5-foot thick bentonite seals placed at 100-foot intervals is recommended from the top of the bentonite seal to 39 feet below land surface. Formation stabilizer is recommended rather than cement grout or a pure bentonite seal, because it is less expensive than cement or bentonite, and there are no perched aquifers to be sealed off in the basin fill. A sand cement grout seal would extend from 39 feet below land surface to land surface. Sand cement is recommended rather than neat cement or pozzolan cement due to its lower cost and adequate sealing characteristics.

3.3 Extraction Well Installation

The extraction wells should be installed in a borehole with minimal deviation from the vertical (per AWWA Standard A-100). A 17.5-inch pilot borehole should be drilled to allow efficient installation of vertical borehole, lithologic logging, geophysical logging, and, if elected, formation solids sampling and sieve analysis for filter pack and screen specification. The pilot hole should be reamed to final diameter of 24 inches. Selection of drilling method will be determined based on drill bid specifications to be developed, but would likely include the flooded reverse rotary method. Drill bid specifications should provide guidelines for drilling methods, surface casing installation, pilot boring drilling, extraction well installation, well development, plumbness and alignment requirements, borehole geophysical survey (optional), video survey of the completed well, a welded or locking temporary surface cap, and record keeping and reporting requirements. The engineering design will prepare drawings for a final surface completion that includes a pump, the pump riser pipe, internal sounding tube, and electrical service.

4. REFERENCES

Arizona Department of Environmental Quality (ADEQ). 2009. Correspondence from Cynthia S. Campbell, Water Quality Compliance Section, to E.L. (Ned) Hall, Sierrita, Re: Mitigation Order on Consent, Docket No. P-50-06 ADEQ's Response to Freeport's Feasibility Report. March 6, 2009.

Hedden, R., Metz, H., Miller, T., Taylor, K., and Thompson, F. 2008. Estimated Water Usage for USC/PUG Geographical Area, Years: 2006 – 2030. April 7, 2008.

Hydro Geo Chem, Inc. (HGC). 2008. Feasibility Study Report for Sulfate with Respect to Drinking Water Supplies in the Vicinity of the Freeport-McMoRan Sierrita Inc. Tailing Impoundment, Mitigation Order on Consent Docket No. P-50-06. October 22, 2008.

HGC. 2009a. Revision 1 Aquifer Characterization Report, Task 5 of Aquifer Characterization Plan, Mitigation Order on Consent Docket No. P-50-06. January 30, 2009.

HGC. 2009b. Mitigation Plan for Sulfate with Respect to Drinking Water Supplies in the Vicinity of the Freeport-McMoRan Sierrita Inc. Tailing Impoundment, Mitigation Order on Consent Docket No. P-50-06. May 8, 2009.

HGC. 2009c. Aquifer Testing Results Associated with Feasibility Studies, Sierrita Tailing Impoundment, Mitigation Order on Consent Docket No. P-50-06. September 3, 2009.

HydroGeoLogic, Inc. 1996. MODFLOW-SURFACT Software (Version 2.2).

McDonald, M.G. and A.W. Harbaugh. 1998. A Modular Three-Dimensional Finite Difference Groundwater Flow Model. U.S. Geological Survey Techniques of Water Resources Investigations, Book 6, Chapter A-1.

TABLES

TABLE 1
Well List for State Land Option

Well Name	NAD83 UTM Coordinates		Estimated Bedrock	Initial Pumping	Maximum Pumping
	East (meters)	North (meters)	Elevation (ft amsl)	Rate (gpm)	Rate (gpm)
FFS-1	498327	3524076	2284	700	700
FFS-2	498316	3524590	2389	600	600
FFS-3	498357	3525295	2326	400	400
FFS-4	498356	3525930	2320	500	500
FFS-5	498346	3526693	2352	900	900
FFS-6	498330	3527287	2369	600	600
MC-1	499448	3525189	1903	700	700
MC-2	499171	3526077	1877	700	900
MC-3	499249	3526870	2008	600	900
MC-4	498597	3527872	2297	600	600
PS-1	499148	3529128	2090	600	750
PS-2	499318	3529357	2024	600	600
PS-3	499570	3529350	1936	600	600
PS-4	499153	3528830	2083	750	1100
IW-25	497643	3521741	2090	400	400
IW-26	497644	3522160	2165	400	400
IW-27	497647	3522578	2215	400	400
IW-28	497652	3523177	2392	400	400

ft amsl = feet above mean sea level
gpm = gallons per minute

TABLE 2
Pumping Wells and Rates for State Land Option Simulation

Well Name	UTM Coordinates NAD83 meters		Pumping Rate in gallons per minute							
	Easting	Northing	2012 to 2013	2014 to 2020	2021 to 2025	2026 to 2030	2031 to 2035	2036 to 2042	2043 to 2050	2051 to 2060
Focused Feasibility Study Wells										
FFS-1	498327	3524076	0	700	700	500	500	200	200	200
FFS-2	498316	3524590	0	600	400	400	400	100	200	200
FFS-3	498357	3525295	0	400	400	400	400	400	200	200
FFS-4	498356	3525930	0	500	500	300	300	300	400	400
FFS-5	498346	3526693	0	900	900	900	900	900	500	300
FFS-6	498330	3527287	0	600	600	600	400	400	200	200
		Totals	**0**	**3,700**	**3,500**	**3,100**	**2,900**	**2,300**	**1,700**	**1,500**
New Interceptor Wells (formerly called Source Control Wells)										
IW-25	497643	3521741	400	400	300	300	300	300	0	0
IW-26	497644	3522160	400	400	400	400	400	400	0	0
IW-27	497647	3522578	400	400	400	300	300	300	300	300
IW-28	497652	3523177	400	400	400	200	200	200	150	150
		Totals	**1,600**	**1,600**	**1,500**	**1,200**	**1,200**	**1,200**	**450**	**450**
Plume Stabilization Wells										
PS-1	499148	3529128	0	600	600	600	750	750	0	0
PS-2	499318	3529357	0	600	450	450	450	450	0	0
PS-3	499570	3529350	0	600	450	450	0	0	0	0
PS-4	499153	3528830	0	750	750	800	1100	1100	0	0
		Totals	**0**	**2,550**	**2,250**	**2,300**	**2,300**	**2,300**	**0**	**0**
Mass Capture Wells										
MC-1	499448	3525189	0	700	700	700	700	700	0	0
MC-2	499171	3526077	0	700	700	700	900	900	0	0
MC-3	499249	3526870	0	600	600	600	900	900	0	0
MC-4	498597	3527872	0	600	600	600	600	0	0	0
		Totals	**0**	**2,600**	**2,600**	**2,600**	**3,100**	**2,500**	**0**	**0**
Existing Interceptor Wells										
IW1	496906	3521278	250	250	250	250	250	188	80	80
IW10	497370	3523122	325	325	325	325	250	250	100	100
IW11	497371	3523429	325	325	325	325	250	150	100	100
IW12	497365	3523970	150	150	150	150	75	75	50	50
IW13	497364	3524167	0	0	0	0	0	0	0	0
IW14	497367	3524373	75	75	75	75	75	50	0	0
IW15	497373	3524567	50	50	50	50	50	40	0	0
IW16	497371	3524783	0	0	0	0	0	0	0	0
IW17	497374	3525003	0	0	0	0	0	0	0	0
IW18	497374	3525170	0	0	0	0	0	0	0	0
IW19	497374	3525343	200	200	200	200	100	40	40	40
IW20	497365	3525569	0	0	0	0	0	0	0	0
IW21	497375	3525773	150	150	150	150	75	50	0	0
IW22	497370	3523274	325	325	325	40	40	40	40	40
IW23	497369	3522971	150	150	150	150	150	125	50	50
IW24	497372	3522634	100	100	100	100	100	75	40	40
IW2A	497469	3521338	425	425	425	425	425	325	125	125
IW3A	497366	3521723	500	500	500	500	500	400	150	150
IW4	497372	3522466	80	80	80	80	80	60	0	0
IW5	497370	3522815	90	90	90	90	90	70	0	0
IW6A	497381	3523709	90	90	90	90	50	0	0	0
IW8	497368	3522021	425	425	425	425	425	325	150	150
IW9	497370	3522208	250	250	250	250	250	188	80	80
		Totals	**3,960**	**3,960**	**3,960**	**3,675**	**3,235**	**2,450**	**1,005**	**1,005**
Total Mitigation Pumping			5,560	14,410	13,810	12,875	12,735	10,750	3,155	2,955
Total Canoa Ranch Pumping			10,990	2,140	2,740	3,675	3,815	5,800	0	0
Total Sierrita Pumping			16,550	16,550	16,550	16,550	16,550	16,550	3,155	2,955

TABLE 3
Well List for Non-State Land Option

Well Name	NAD83 UTM Coordinates		Estimated Bedrock	Initial Pumping	Maximum Pumping
	East (meters)	North (meters)	Elevation (ft amsl)	Rate (gpm)	Rate (gpm)
FFS-1	498941	3524778	2142	900	900
FFS-2	499000	3525189	2133	900	900
FFS-3	498969	3525722	2149	900	900
FFS-4	498919	3526560	2110	850	850
FFS-5	498907	3527336	2188	900	1100
FFS-6	498597	3527872	2297	1000	1000
MC-1	499448	3525189	1903	900	900
MC-2	499171	3526077	1877	900	900
PS-1	499148	3529128	2090	600	750
PS-2	499318	3529357	2024	600	600
PS-3	499570	3529350	1936	600	600
PS-4	499153	3528830	2083	500	950
IW-25	497643	3521741	2090	400	400
IW-26	497644	3522160	2165	400	400
IW-27	497647	3522578	2215	400	400
IW-28	497652	3523177	2392	400	400

ft amsl = feet above mean sea level
gpm = gallons per minute

TABLE 4
Pumping Wells and Rates for Non-State Land Option Simulation

Well Name	UTM Coordinates NAD83 meters		Pumping Rate in gallons per minute							
	Easting	Northing	2012 to 2013	2014 to 2020	2021 to 2025	2026 to 2030	2031 to 2035	2036	2037 to 2042	2043 to 2060
Focused Feasibility Study Wells										
FFS-1	498941	3524778	0	900	900	900	900	900	900	0
FFS-2	499000	3525189	0	900	900	900	900	900	900	200
FFS-3	498969	3525722	0	900	900	900	900	900	900	0
FFS-4	498919	3526560	0	850	850	850	850	850	850	200
FFS-5	498907	3527336	0	900	900	900	900	900	1,100	900
FFS-6	498597	3527872	0	1,000	1,000	1,000	1,000	1,000	400	400
		Totals	**0**	**5,450**	**5,450**	**5,450**	**5,450**	**5,450**	**5,050**	**1,700**
New Interceptor Wells (formerly called Source Control Wells)										
IW-25	497643	3521741	400	400	300	300	300	300	300	0
IW-26	497644	3522160	400	400	400	400	400	400	400	0
IW-27	497647	3522578	400	400	400	300	300	300	300	100
IW-28	497652	3523177	400	400	400	200	200	200	200	200
		Totals	**1,600**	**1,600**	**1,500**	**1,200**	**1,200**	**1,200**	**1,200**	**300**
Plume Stabilization Wells										
PS-1	499148	3529128	0	600	600	600	750	750	750	0
PS-2	499318	3529357	0	600	450	450	450	450	400	0
PS-3	499570	3529350	0	600	450	450	0	0	0	0
PS-4	499153	3528830	0	500	500	800	950	950	950	0
		Totals	**0**	**2,300**	**2,000**	**2,300**	**2,150**	**2,150**	**2,100**	**0**
Mass Capture Wells										
MC-1	499448	3525189	0	900	900	900	0	0	0	0
MC-2	499171	3526077	0	900	900	900	0	0	0	0
		Totals	**0**	**1,800**	**1,800**	**1,800**	**0**	**0**	**0**	**0**
Existing Interceptor Wells										
IW1	496906	3521278	250	250	250	250	250	188	188	80
IW10	497370	3523122	325	325	325	325	250	250	250	100
IW11	497371	3523429	325	325	325	325	250	250	250	100
IW12	497365	3523970	150	150	150	150	75	75	75	50
IW13	497364	3524167	0	0	0	0	0	0	0	0
IW14	497367	3524373	75	75	75	75	75	50	50	0
IW15	497373	3524567	50	50	50	50	50	40	40	0
IW16	497371	3524783	0	0	0	0	0	0	0	0
IW17	497374	3525003	0	0	0	0	0	0	0	0
IW18	497374	3525170	0	0	0	0	0	0	0	0
IW19	497374	3525343	200	200	200	200	100	100	100	40
IW20	497365	3525569	0	0	0	0	0	0	0	0
IW21	497375	3525773	150	150	150	150	75	75	75	40
IW22	497370	3523274	325	325	325	40	40	40	40	40
IW23	497369	3522971	150	150	150	150	150	125	125	50
IW24	497372	3522634	100	100	100	100	100	75	75	40
IW2A	497469	3521338	425	425	425	425	425	325	325	125
IW3A	497366	3521723	500	500	500	500	500	400	400	150
IW4	497372	3522466	80	80	80	80	80	60	60	0
IW5	497370	3522815	90	90	90	90	90	70	70	0
IW6A	497381	3523709	90	90	90	90	50	0	0	0
IW8	497368	3522021	425	425	425	425	425	325	325	150
IW9	497370	3522208	250	250	250	250	250	188	188	80
		Totals	**3,960**	**3,960**	**3,960**	**3,675**	**3,235**	**2,635**	**2,635**	**1,045**
Total Mitigation Pumping			5,560	15,110	14,710	14,425	12,035	11,435	10,985	3,045
Total Canoa Ranch Pumping			10,990	1,440	1,840	2,125	4,515	5,115	5,565	0
Total Sierrita Pumping			16,550	16,550	16,550	16,550	16,550	16,550	16,550	3,045

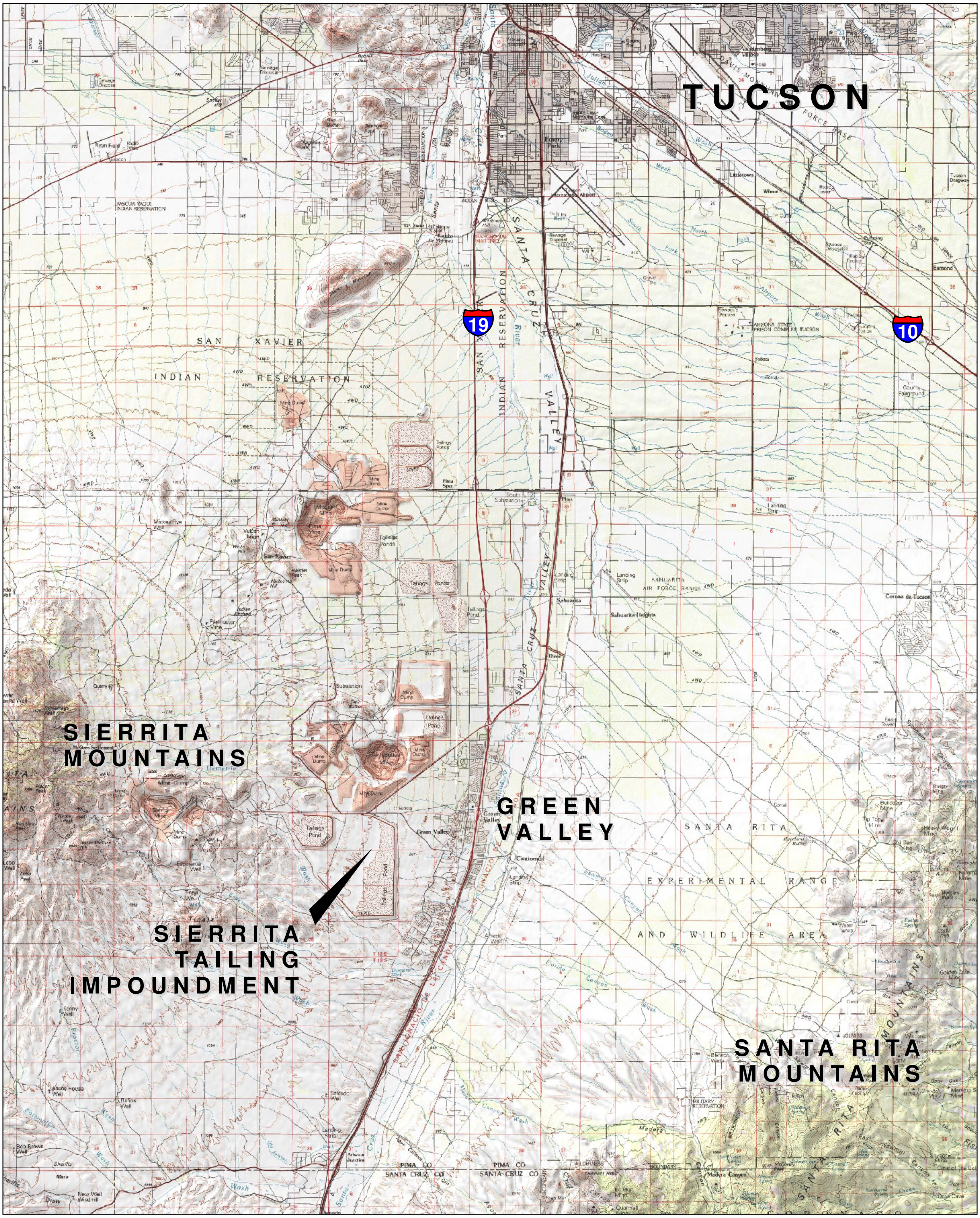
TABLE 5
Estimated Bedrock and Water Level Information for State Land Wells

Well Name	Estimated Land Surface	Model Estimated Bedrock Elevation	Estimated Depth to Bedrock	Estimated Current Static Water Level (2009)	Depth to Estimated Current Static Water Level	Lowest Predicted Future Water Level	Difference Between Current Static and Lowest Predicted Water Levels	Modeled Minimum Saturated Thickness
	(ft amsl)	(ft amsl)	(ft amsl)	(ft amsl)	(ft)	(ft amsl)	(ft)	(ft)
FFS-1	3040	2284	756	2720	320	2575	145	291
FFS-2	3075	2389	686	2775	300	2497	278	108
FFS-3	3080	2326	754	2680	400	2421	259	95
FFS-4	3100	2320	780	2650	450	2395	255	75
FFS-5	3100	2352	748	2625	475	2471	154	119
FFS-6	3120	2369	751	2575	545	2477	98	108
IW-25	3100	2090	1010	2740	360	2648	92	558
IW-26	3075	2165	910	2750	325	2627	123	462
IW-27	3100	2215	885	2760	340	2616	144	401
IW-28	3100	2392	708	2720	380	2591	129	199
MC-1	3000	1903	1097	2620	380	2543	77	640
MC-2	3060	1877	1183	2610	450	2472	138	595
MC-3	3025	2008	1017	2600	425	2485	115	477
MC-4	3100	2297	803	2575	525	2478	97	181
PS-1	3040	2090	950	2540	500	2478	62	388
PS-2	3040	2024	1016	2535	505	2481	54	457
PS-3	3020	1936	1084	2535	485	2484	51	548
PS-4	3050	2083	967	2550	500	2480	70	397

TABLE 6
Estimated Bedrock and Water Level Information for Non-State Land Wells

Well Name	Estimated Land Surface	Modeled Bedrock Elevation	Estimated Depth to Bedrock	Estimated Current Static Water Level (2009)	Depth to Estimated Current Static Water Level	Lowest Predicted Future Water Level	Difference Between Current Static and Lowest Predicted Water Levels	Modeled Minimum Saturated Thickness
	(ft amsl)	(ft amsl)	(ft amsl)	(ft amsl)	(ft)	(ft amsl)	(ft)	(ft)
FFS-1	3040	2142	898	2640	400	2514	126	372
FFS-2	3040	2133	907	2630	410	2493	137	360
FFS-3	3040	2149	891	2620	420	2459	161	310
FFS-4	3040	2110	930	2600	440	2485	115	376
FFS-5	3040	2188	852	2580	460	2483	97	295
FFS-6	3100	2297	803	2575	525	2483	92	186
IW-25	3100	2090	1010	2740	360	2648	92	558
IW-26	3075	2165	910	2750	325	2625	125	460
IW-27	3100	2215	885	2760	340	2614	146	399
IW-28	3100	2392	708	2720	380	2583	137	191
MC-1	3000	1903	1097	2620	380	2528	92	625
MC-2	3060	1877	1183	2610	450	2482	128	606
PS-1	3040	2090	950	2540	500	2480	60	390
PS-2	3040	2024	1016	2535	505	2482	53	458
PS-3	3020	1936	1084	2535	485	2485	50	549
PS-4	3050	2083	967	2550	500	2482	68	399

FIGURES



0 10,000 20,000 Feet

PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

REGIONAL LOCATION MAP

Approved	Date	Author	Date	File Name	Figure
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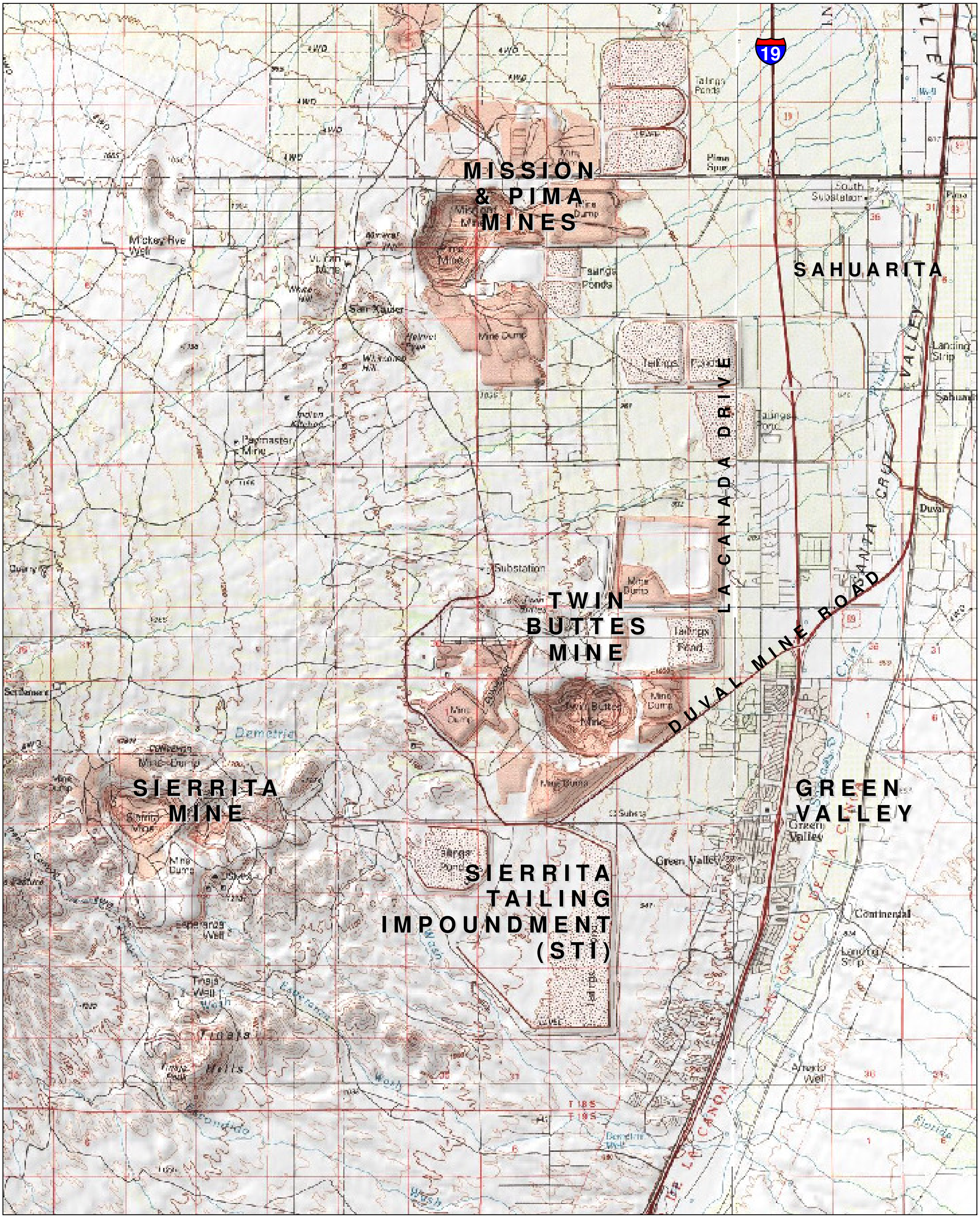
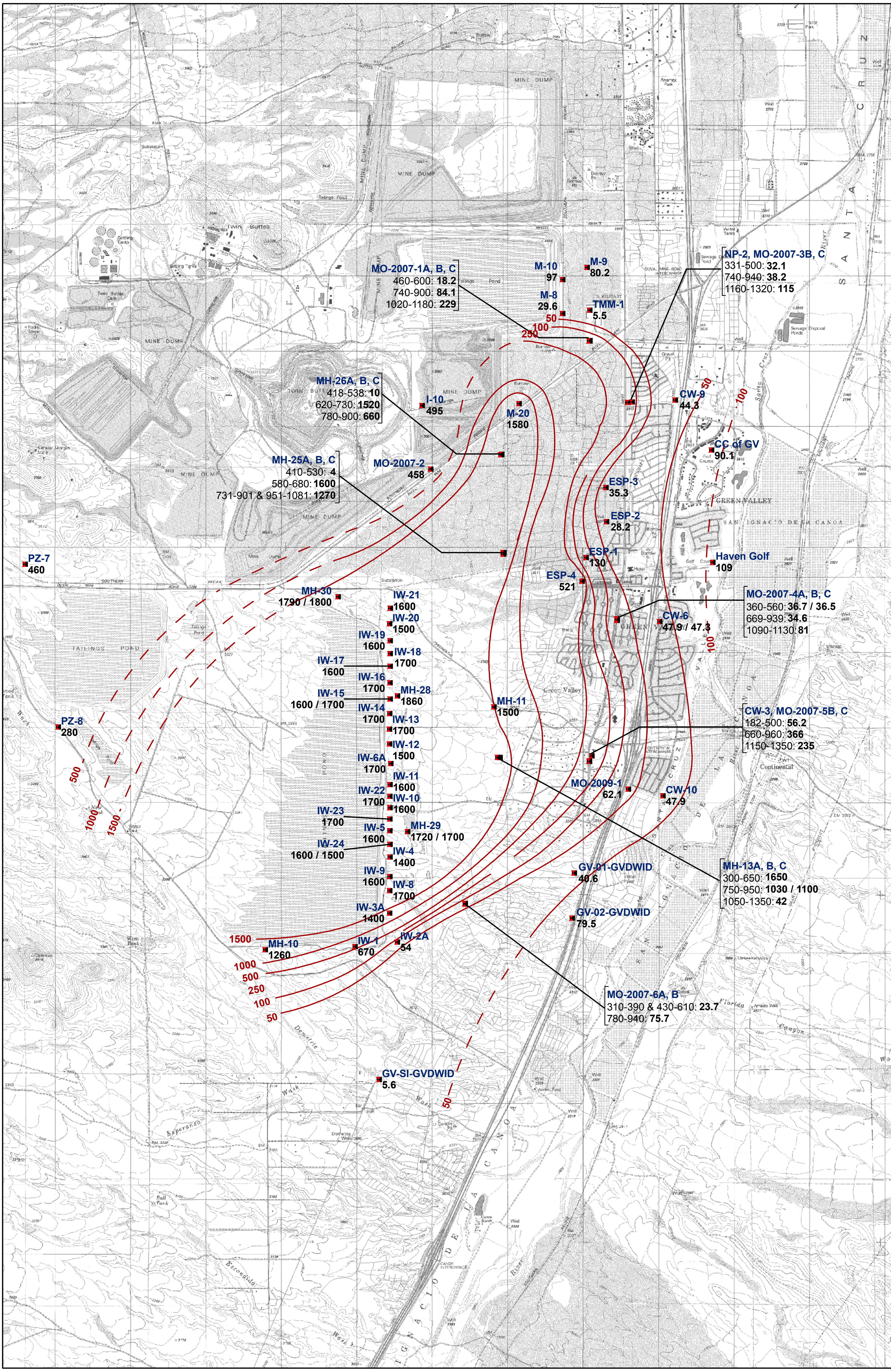


PROJECTION: UTM Zone12N NAD83

HYDRO GEO CHEM, INC.

VICINITY MAP FOR STI AND GREEN VALLEY

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200056G	2



Legend

- ESP-1 — Well Identification
- 130 — Sulfate Concentration (mg/L)
- Sulfate Isoconcentration Contour (mg/L) (dashed where inferred)

Co-located Wells

Screen (ft bgs): Sulfate Concentration (mg/L)

0 2000 4000 6000 Feet

PROJECTION:
UTM Zone 12 NAD83

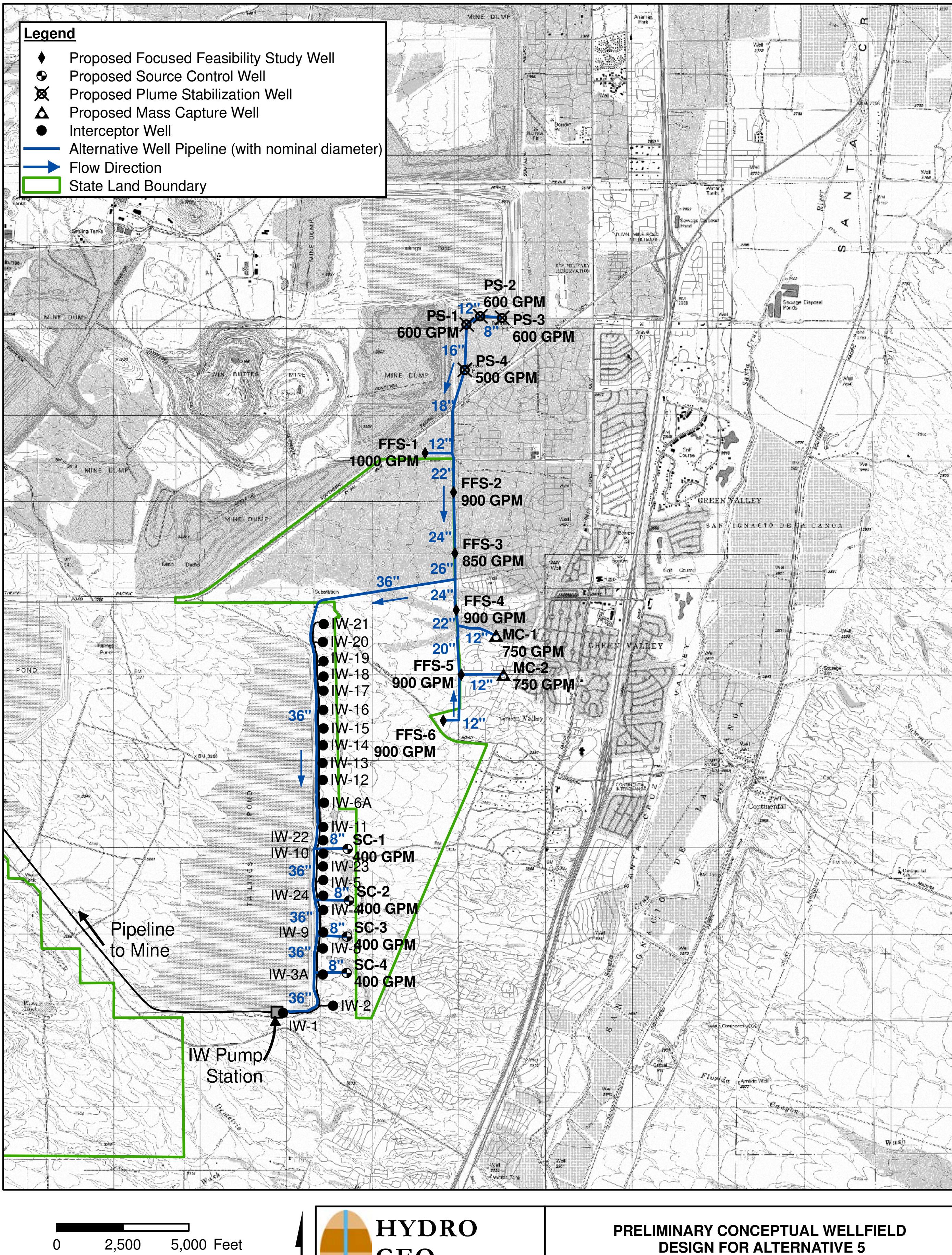
(Duplicate results seperated by "/")

N

HYDRO GEO CHEM, INC.

SULFATE CONCENTRATIONS IN GROUNDWATER SECOND QUARTER 2009

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200058G	3



HYDRO GEO CHEM, INC.

PRELIMINARY CONCEPTUAL WELLFIELD DESIGN FOR ALTERNATIVE 5

Approved	Date	Author	Date	File Name	Figure
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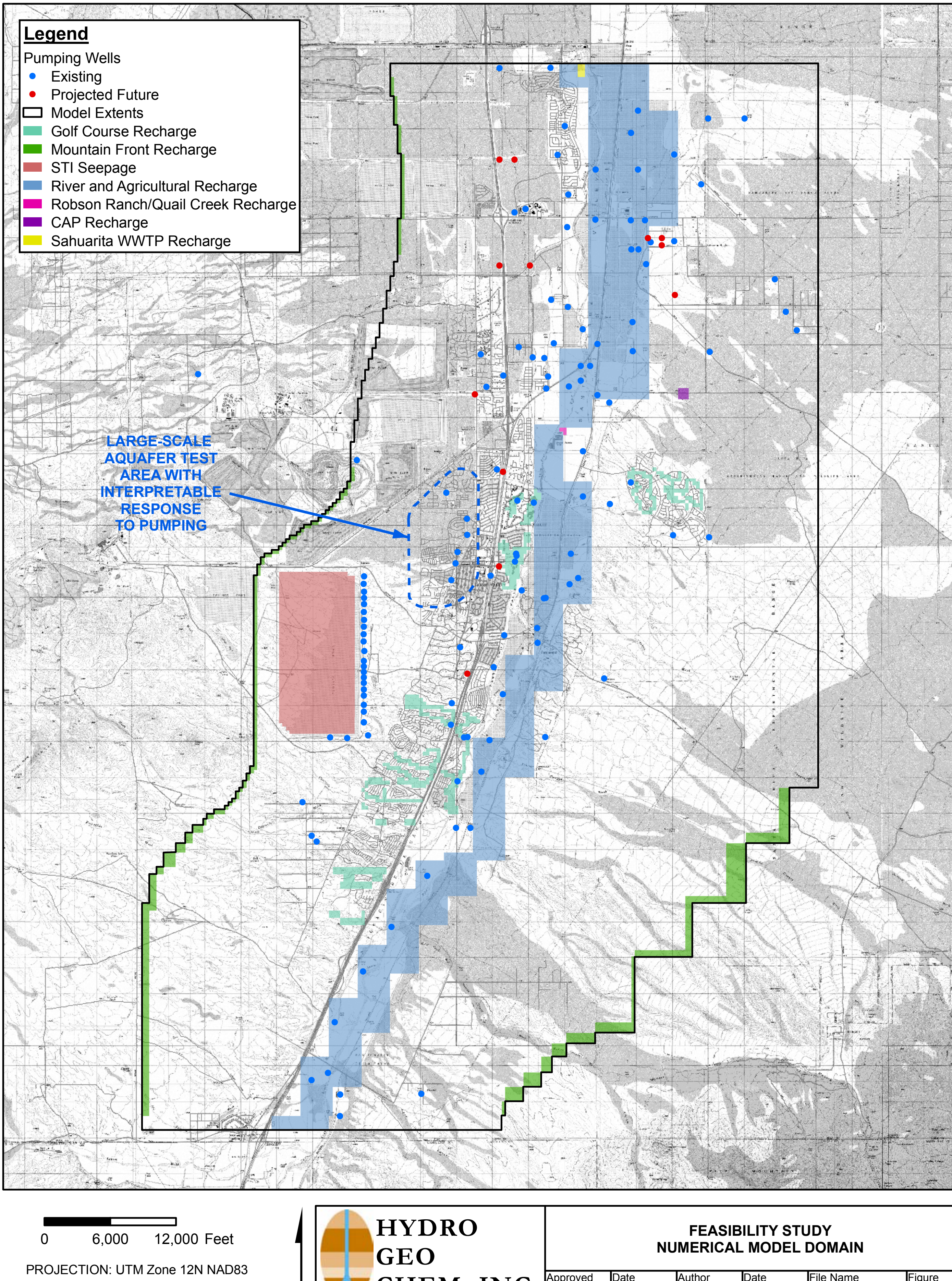

HYDRO GEO CHEM, INC.

FEASIBILITY STUDY
NUMERICAL MODEL DOMAIN

Approved	Date	Author	Date	File Name	Figure
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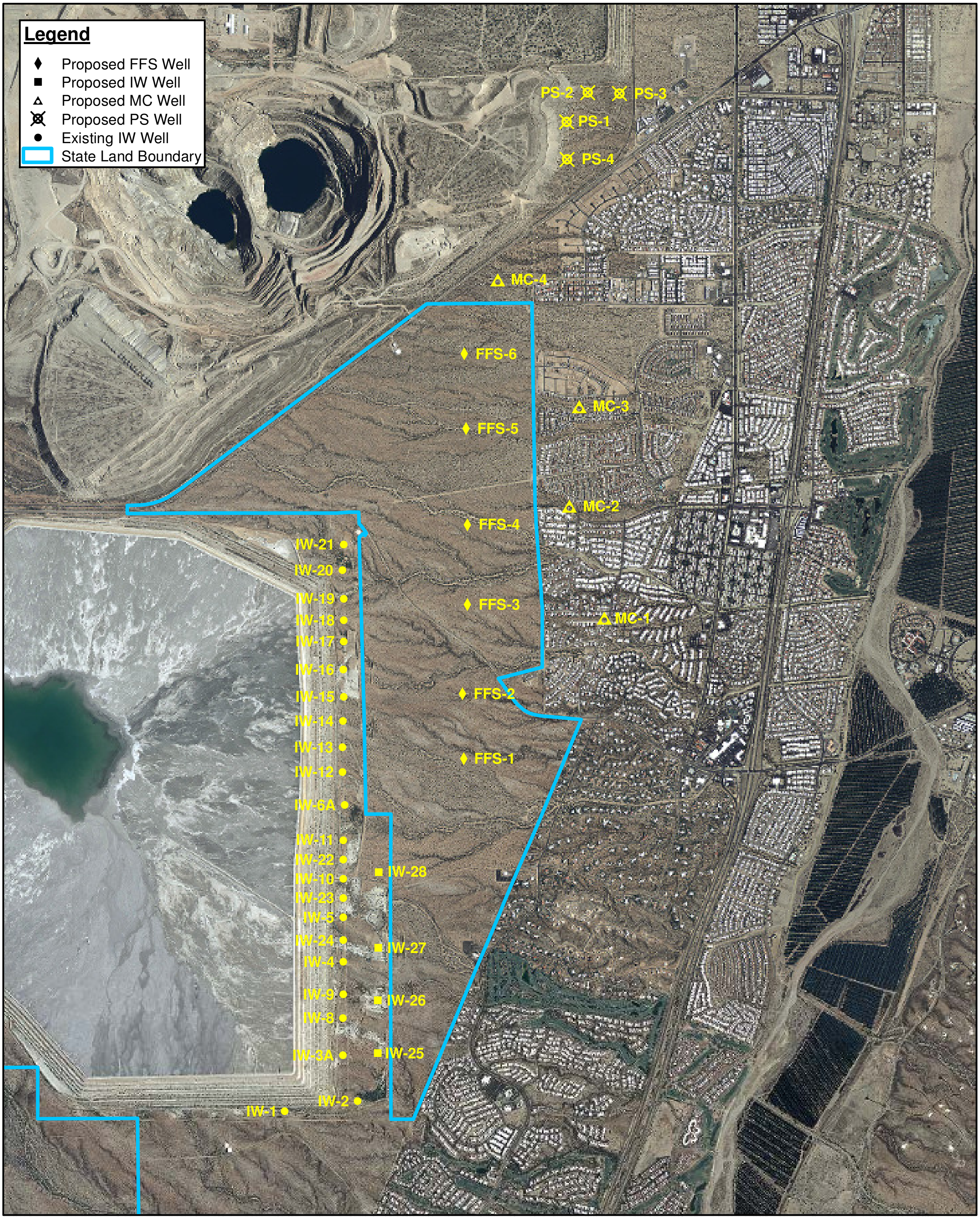

0 1,750 3,500 Feet

PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

WELL LOCATIONS FOR STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
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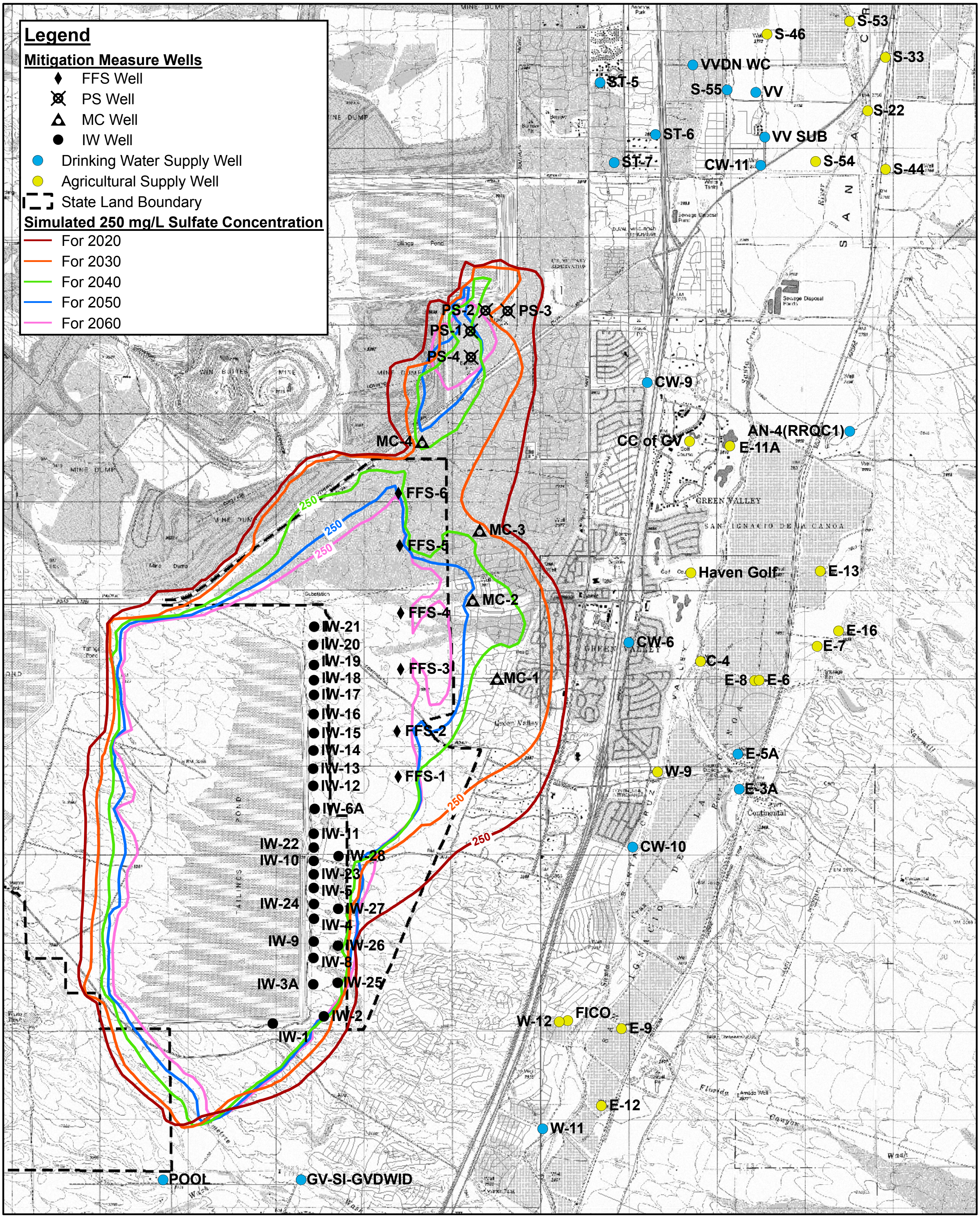

HYDRO GEO CHEM, INC.

SIMULATED EXTENT OF SULFATE PLUME FROM 2020 TO 2060 FOR STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200037G	7

HYDRO GEO CHEM, INC.

WELL LOCATIONS FOR NON-STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
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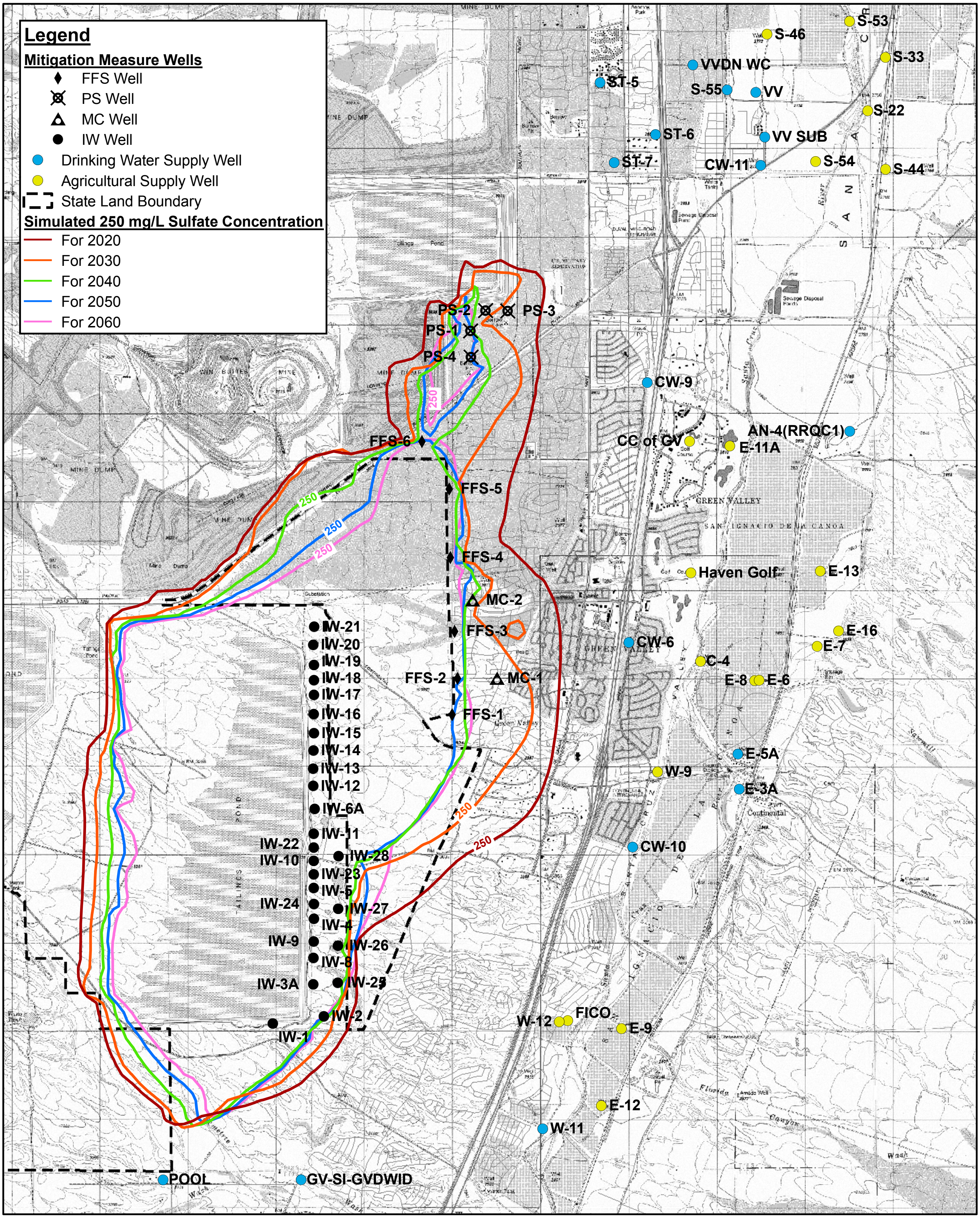


0 2500 5000 Feet

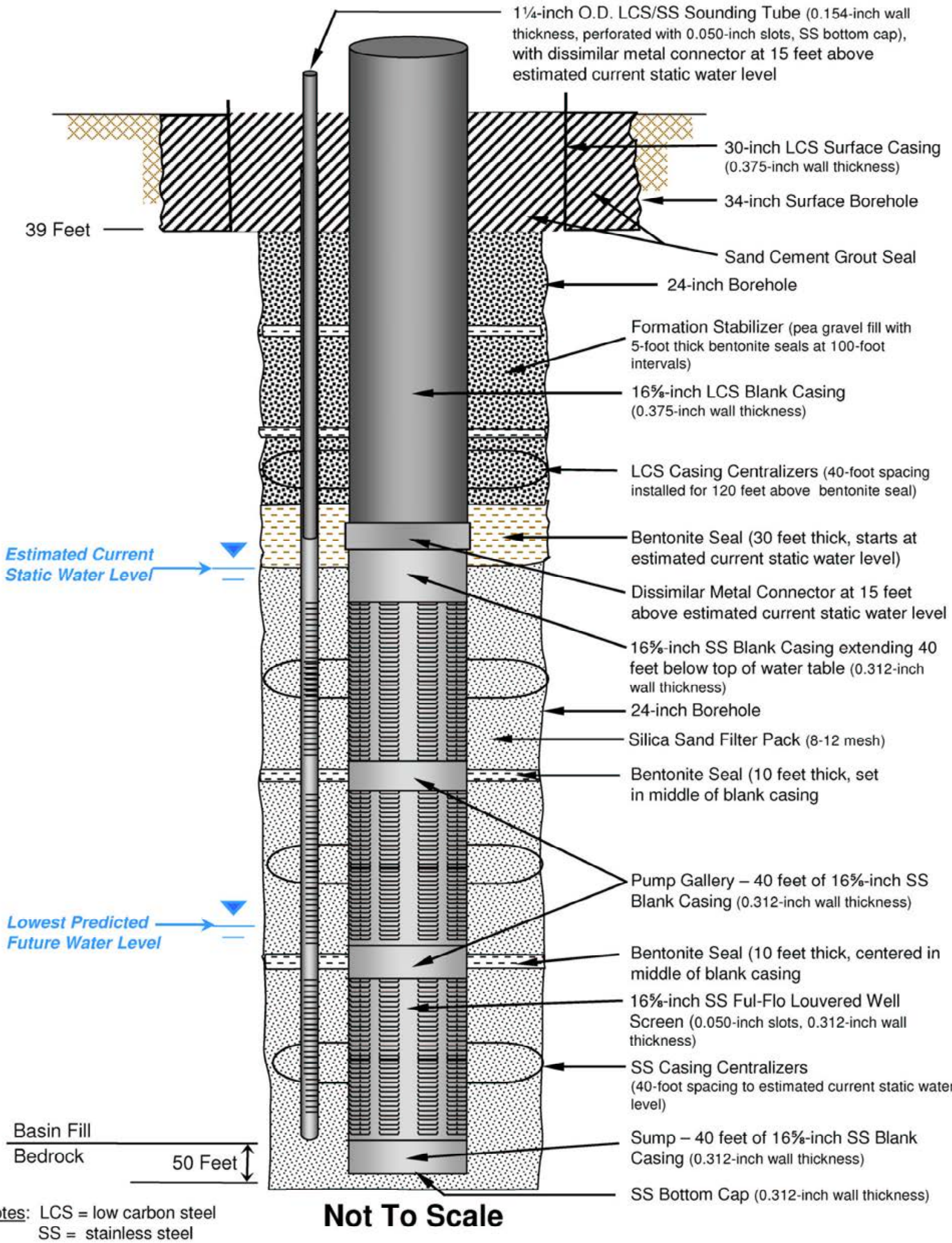
PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SIMULATED EXTENT OF SULFATE PLUME FROM 2020 TO 2060 FOR NON-STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200026G	9



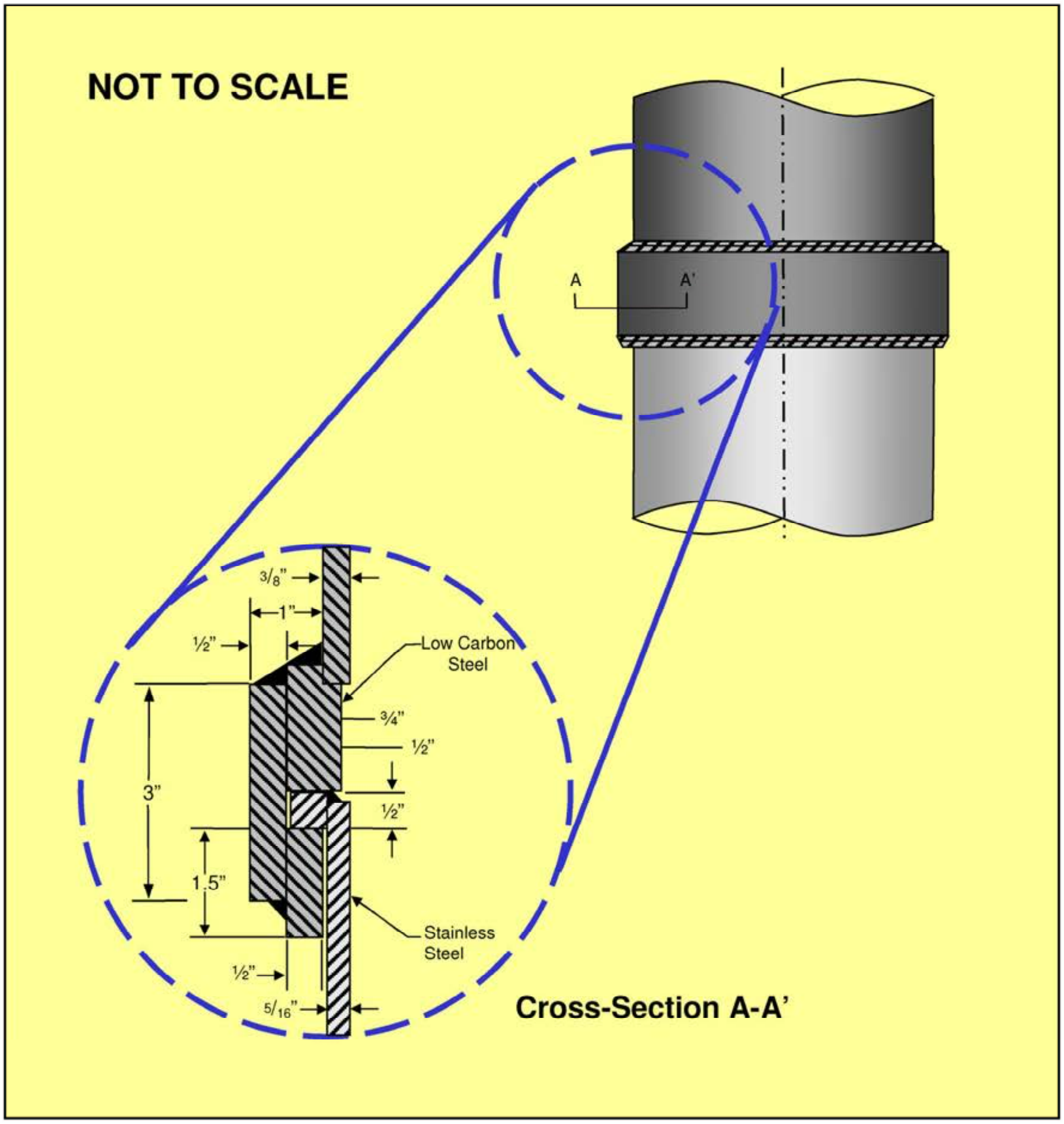
Notes: LCS = low carbon steel
SS = stainless steel
O.D. = outside diameter
See Tables 5 and 6 for estimated water table and bedrock depths
All diameters are O.D. except the sounding tube and well screen, which are nominal.

CLEAR CREEK ASSOCIATES

HYDRO GEO CHEM, INC.

SCHEMATIC DIAGRAM FOR EXTRACTION WELL NOT EXPECTED TO ENCOUNTER CASCADING WATER

Approved	Date	Author	Date	File Name	Figure
JRN	01/29/10	JRN	01/29/10	7830183A	10



CLEAR CREEK ASSOCIATES

HYDRO GEO CHEM, INC.

DISSIMILAR METAL CONNECTOR DETAIL

Approved	Date	Author	Date	File Name	Figure
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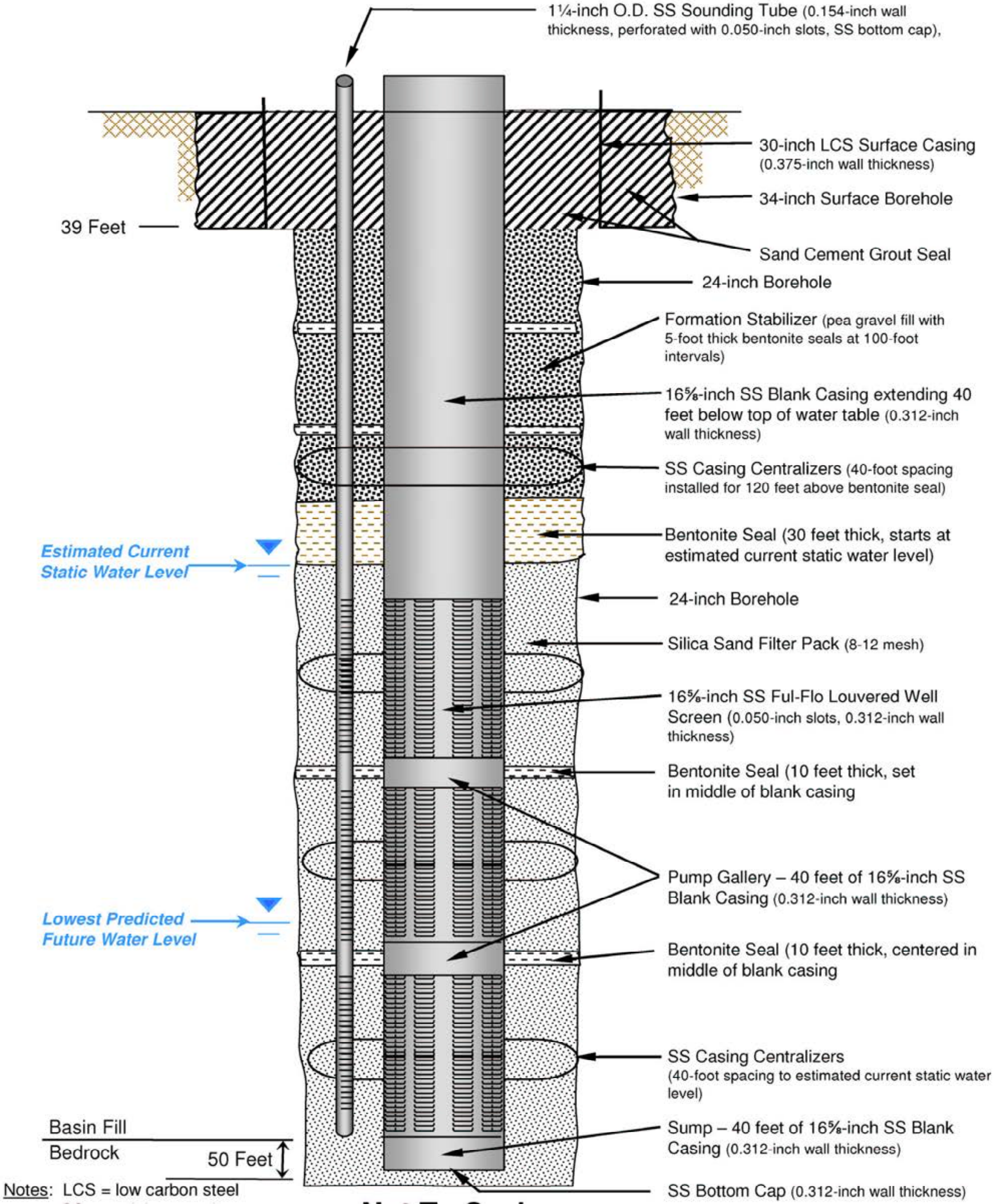

Not To Scale

Notes: LCS = low carbon steel
SS = stainless steel
O.D. = outside diameter
See Tables 5 and 6 for estimated water table and bedrock depths

All diameters are O.D. except the sounding tube and well screen, which are nominal.

CLEAR CREEK ASSOCIATES

HYDRO GEO CHEM, INC.

SCHEMATIC DIAGRAM FOR EXTRACTION WELL EXPECTED TO ENCOUNTER CASCADING WATER

Approved	Date	Author	Date	File Name	Figure
JRN	01/29/10	JRN	01/29/10	7830185A	12

APPENDIX A

ESTIMATION OF FUTURE STI SEEPAGE

APPENDIX A

ESTIMATION OF FUTURE STI SEEPAGE

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January 29, 2010

TABLE OF CONTENTS

TABLES

FIGURES

1. INTRODUCTION

Hydro Geo Chem (HGC) developed a numerical groundwater flow and sulfate transport model to evaluate potential alternatives for sulfate mitigation being considered in the vicinity of the Freeport McMoRan Sierrita (Sierrita) Tailing Impoundment (STI) (HGC, 2007; 2008). The numerical model was constructed to represent the hydrogeologic conditions of the basin-fill aquifer in the vicinity of the STI and includes groundwater pumping and natural and artificial recharge. The numerical model was calibrated to groundwater levels and measured sulfate concentrations to approximate the development of the sulfate plume originating from the STI (HGC, 2007). The model of the historical conditions (1940 - 2006) was then used to simulate future conditions (2007 and forward), particularly with respect to sulfate plume mitigation under various mitigation alternatives (HGC, 2008).

2. METHOD OF ESTIMATION

An important component for the model of future conditions (predictive model) was the projection of future seepage rates from the STI. Since the original development of the predictive model in 2008, Sierrita forecasts of mining activity have been modified. The change in mining forecast necessitates a change in the projection of seepage from the STI. This report documents how the new STI seepage projections were computed.

Estimation of future seepage for the STI was conducted in a four step process.

1. Estimation of water available for seepage under future conditions
2. Construction and calibration of a one-dimensional numerical model of the STI
3. Estimation of seepage below the STI between 2008 and the end of tailing slurry application to the STI
4. Estimation of yearly decreases in seepage (draindown) resulting from the termination of tailing slurry application.

Two scenarios are considered for the end of slurry application to the STI (i.e., the start of draindown). The first scenario assumes draindown begins after 2016 because the STI is closed and tailing slurry is sent to a new tailing impoundment. The second scenario assumed draindown begins after 2042, which is the currently forecast end of mine life.

2.1 Estimation of Future Water Available for Seepage and Future Tailing Height

The estimation of water available for seepage in the STI under future conditions uses the water balance approach described in Errol L. Montgomery and Associates (M&A) (2007) for estimation of the historical seepage in the STI. This approach computes annual seepage as the difference for the STI between the sum of all water inputs and the sum of outflows and water retained. Water inputs include water delivered to the STI, precipitation, and surface water discharges to the STI. Water outflows include tailing water reclaimed from the STI, evaporation, and water retained in the tailing material.

Table A.1 gives the average value used for each component in the water balance. With the exception of water deliveries to and water reclaimed from the STI, estimates of each of the water balance components are based on the 10-year average (1997 through 2006) of each component using the information compiled in M&A (2007). Water delivered to and reclaimed from the STI is estimated by accounting for current mine operations and projected ore milling rates. For 2007, the annual volumes of water delivered and reclaimed are estimated as the average of the 2005 and 2006 volumes. The volumes of water delivered and reclaimed for 2008 are taken from values reported by Sierrita, and the volumes of water delivered and reclaimed in 2009 through the end of tailing slurry application to the STI (2016 or 2042), are estimated from projected ore milling rates (Mottley, 2009). The water delivery is assumed to be zero starting the year after the end of tailing slurry application to the STI.

The average thicknesses of the STI for the years 2016 and 2042 are estimated by determining the average thickness of the STI in 2007, computing the total volume of tailing expected to be applied by the target date (2016 or 2042), and relating the estimate tailing application volume to a future average STI thickness.

The thickness of the STI in 2007 is estimated by dividing the volume of the STI in 2007 by the surface area of the STI in 2007. The volume between the surface of the STI in 2007 and the pre-mining ground surface is computed using the Civil 3D package in AutoCAD (Autodesk, Inc.). The 2007 surface was based on contour maps from aerial photos taken in 2007. The pre-mining ground surface is estimated from digitized contours of pre-mining topographic maps prepared by Duval Sierrita Corporation in 1978. Using this approach, the 2007 average thickness of the STI in 2007 is computed to range from 20 feet to 301 feet and average 170 feet.

The total mass of tailing applied to the STI is estimated assuming ore milling rates of 39.1 million tons in 2007, 40.88 million tons per year from 2008 through 2011, and 42.0 million tons per year from 2012 through the end of mine life (Mottley, 2009). The tailing fraction used to convert ore milled to tailing applied is 0.98745 (M&A, 2007). Under these assumptions, the mass of new tailing applied to the STI is computed to be 407 millions tons by 2016 and 1,486 million tons by the year 2042. Using a tailing dry density of 100 pounds per cubic foot (URS Corporation [URS], 2007) the volume of new tailing added is estimated as 302 million cubic yards (2016) and 1,101 million cubic yards (2042). From the estimated tailing volume added to the STI, the future average thickness of the STI is projected using the mass-volume-elevation relationship developed for the STI by URS (2007). The estimation procedure gives future STI thicknesses of 230 feet (2016) and 400 feet (2042).

2.2 Construction of Numerical Model of the Sierrita Tailing Impoundment

A one dimensional numerical model of the STI was constructed for MODFLOW-SURFACT, a numerical model capable of simulating water movement and retention in variably saturated media (Hydrogeologic, Inc., 1996). Details of model domain, parameters, and initial and boundary conditions are provided below.

2.2.1 Model Domain

In the numerical model the STI is represented as a one-dimensional vertical column. The total height of the column represents the average thickness of the STI plus the thickness of the underlying native basin fill between the bottom of the STI and the groundwater table. The thickness of the underlying basin fill was assumed to be 50 feet. (Seepage estimates were taken from model result for the grid cell at the bottom of the STI, and the thickness of the basin fill is not important in the estimation of tailing drainage.) Three model domains were constructed: one for the current average STI thickness, one for the estimated average thickness in 2016, and one for the future average thickness in 2042. The vertical grid cell spacings for the model domains are 2 feet for current average STI thickness (170 feet), 3 feet for the 2016 average thickness (230 feet), and 4 feet for the 2042 average thickness (400 feet).

2.2.2 Model Parameters

The STI model requires five parameters: saturated hydraulic conductivity (*Ks*), initial tailing saturation (Sw_i), residual tailing saturation (Sw_r), and van Genuchten (1980) moisture retention parameters α and *n*. The tailing saturation parameters are defined as $Sw_i = \theta_i / \theta_s$ and $Sw_r = \theta_r / \theta_s$; where θ_i, θ_r, and θ_s are the initial, residual (irreducible), and saturated water contents of the tailing material, respectively. The potential ranges of parameter values were taken from measurements of samples collected from the STI. Over 90 STI material samples were collected by M&A in 2007. The samples were taken from depths ranging from three to 180 feet in boring locations ranging from the interior STI to the STI face. GeoSytems Analysis, Inc. (GSA) conducted soil properties measurements on the tailing samples. Measured properties included *Ks* (30 samples), θ_s (27 samples), and water content (91 samples). GSA also conducted moisture retention tests on 27 tailing material samples using seven suction values from 0.1 centimeters (cm) to 1,000 cm (1 bar). Values of α and *n* were estimated by fitting the van Genuchten (1980) suction-saturation equation to moisture retention test conducted on the samples.

An uncertainty in the curve fitting was the value of Sw_r (or θ_r). The curve fitting was conducted twice using different assumptions for the value of θ_r. The values of θ_r for the first fitting (Estimate A in Table A.2) were estimated from using the Rosetta neural network database model (Schaap, 1999). The θ_r values from this database model were low, between 0.02 and 0.05, and suggest a highly drainable material, which is not expected of the tailing material. A second curve fitting (Estimate B in Table A.2) was conducted by assuming θ_r to be equal to the tailing water content at the 1 bar suction measurement, which is commonly assumed as the wilting point suction. Values of θ_r at 1 bar were between 0.06 and 0.22). Curve fitting exercises using the different values for θ_r yielded slightly different averages for the α and n values (Table A.2).

After the ranges of parameters were established the parameters used in the STI were determined by calibration of a steady-state model of the current average thickness of the STI (170 feet). The calibration goal was to match the current seepage rate of approximately 7,500 acre-feet per year when the one dimensional model was scaled up assuming an infiltration surface area of 4.7 square miles, which is the approximate top area of the STI .

The steady-state model calibration was conducted by varying *Ks*, α , and *n* within the range of measured and estimated values until a good match to the steady-state seepage rate was obtained. The calibrated values of *Ks* and *n* were on the high end of the range of measured and estimated values, implying that the coarser-grained fraction of tailing dominates the drainage response. The steady-state model is insensitive to the value of α ; therefore, a rigorous calibration of this parameter could not be performed. The value of α does, however, affect the transient (draindown) simulations. The value of α was selected after conducted preliminary draindown simulations using different values from the range of possible values. The value of α selected for use in the predictive model is 0.01 cm^{-1}. This value is reasonably conservative in that it produces a longer draindown period that most other values within the range of estimates for α .

Although draindown of the STI also will be influenced by the Sw_i and Sw_r, these parameters were not adjusted during model calibration to reduce the calibration degrees of freedom. The value of Sw_i was specified to be 80 percent (θ_i = 0.29) and θ_r was specified as 25 percent (θ_r = 0.09). The value of Sw_i that was chosen is the average saturation measured by GSA for the tailing samples (although saturation values varied over a wide range). The value of Sw_r was derived by assuming θ_s=0.36 and θ_r = 0.09, which are that average values from the two curve fitting approaches (Table A.2).

2.2.3 Model Initial and Boundary Conditions

Constant head boundary conditions were used to control the pressure and water saturations in the model domain. A constant head of zero was specified on the lowermost grid cell to represent the water table. Steady-state simulations were first conducted to establish initial conditions. For the steady-state simulations, a constant head or constant flux was specified for the uppermost cell. The value of the constant head or flux was set to produce a water saturation of 80 percent within that portion of the draindown model domain corresponding to the STI. A saturation of 80 percent is equivalent to the approximate average tailing saturation measured in STI soil core samples (M&A, 2007). The transient simulations used a specified flux top boundary to represent periods of active tailing application or a zero flux top boundary to represent post-tailing application periods (draindown).

3. SEEPAGE MODELING RESULTS

The one-dimensional model for STI seepage was used to estimate seepage rates for three scenarios. The first estimated seepage between 2008 and the end of active tailing deposition. The second models the period of draindown after the impoundment is no longer active. The third combines the two to provide seepage rates for the predictive flow and transport numerical model used to evaluate mitigation alternatives.

3.1 Estimation of Seepage between 2008 and the Start of Draindown

Seepage rates between 2008 and the start of draindown were estimated using the one-dimensional draindown model developed for the current average tailing thickness (170 feet). Initial conditions for the simulation were established by specifying a constant flux boundary condition for the top model cell. The constant flux was set to establish a uniform saturation within the STI of 80 percent at steady state. After steady-state conditions were established within the model domain, the specified flux through the upper boundary was increased to correspond to the projected yearly changes in net infiltration within the STI for years 2008 and 2012. The simulations predict a lag time of about four years before the seepage through the bottom of the STI is equivalent to the increased seepage input.

3.2 Estimation of Draindown After the End of Tailing Slurry Application

Transient simulations were run to predict the annual seepage from the STI assuming cessation of tailing deposition in 2016 or 2042. The initial condition for the draindown simulations was the uniform tailing saturation of 80 percent that was established in the steady-state simulations. Drainage from the bottom of the STI was then simulated under a zero flux top boundary condition. The zero flux condition assumes that that STI has been capped and graded so that the infiltration is negligible. Figure A.1 shows simulated relative seepage fluxes for the 2016 and 2042 scenarios. The seepage rate initially decreases rapidly with time and the rate of decrease slows as the tailing desaturates. Times to achieve the same degree of draindown increase for the greater STI thicknesses as a result of the greater amount of water in storage and the longer drainage lengths. The draindown simulation for a tailing thickness of 230 feet predicts that seepage will decrease to 50 percent of its original rate in 8 years after the start of draindown and that it will decrease to 10 percent of its starting rate in 32 years. The draindown simulation for a tailing thickness of 400 feet takes 12 years to decrease to 50 percent and 48 years to decrease to 10 percent of the starting rate.

3.3 Modeled Seepage For Predictive Simulations

Figure A.2 and Table A.3 provide the seepage rates applied in the predictive model. The one-dimensional numerical model simulations gave seepage rates relative to a baseline seepage rate (e.g., see Figure A.1 for relative draindown seepage rates). The actual yearly seepage rates were then computed by multiplying the baseline seepage rate by the relative seepage rate for each year. The baseline seepage rate for the period between 2008 and the end of slurry application was the seepage rate specified for 2007 (7,838 acre-feet per year[1]), which is the average of the 2005 and 2006 seepage rates from the historical model. The seepage rate applied in the predictive model increase from 7,838 to 8,705 acre-feet per year by the year 2015. This maximum rate was specified as the baseline seepage rate for the period of draindown after the end of slurry application, and the relative draindown curve (Figure A.1) was multiplied by this baseline rate to give the actual draindown curve. The predicted seepage rates were lagged by one year to account for the travel time from the bottom of the STI to the groundwater table, which is consistent with the lag times used for other recharge sources in the predictive model (HGC, 2008).

[1] This value is greater than estimated in the water budget reported by M&A (2007). Rates specified in the historical model were increase from those reported in M&A (2007) to improved calibration of the numerical model (Appendix I of HGC, 2007).

4. REFERENCES

Errol L. Montgomery and Associates (M&A). 2007. Evaluation of the Current Effectiveness of the Sierrita Interceptor Wellfield, Phelps Dodge Sierrita Mine. Prepared for Phelps Dodge Sierrita, Inc., November 14, 2007.

Hydro Geo Chem (HGC). 2007. Aquifer Characterization Report: Task 5 of Aquifer Characterization Plan, Mitigation Order in Consent Docket No. P-50-06, Pima County, Arizona. December 28, 2007.

HGC. 2008. Feasibility Study for Sulfate with Respect to Drinking Water Supplies in the Vicinity of the Freeport-McMoRan Sierrita Inc. Tailing Impoundment Mitigation Order on Consent Docket No. P-50-06.

Hydrogeologic, Inc., 1996. MODFLOW-SURFACT Software (Version 2.2). Herndon, Virginia.

Mottley, Martha. 2009. E-mail communication with Jim Norris. July, 16, 2009.

Schaap, Marcel G. 1999. Rosetta Model, version 1.0. United Stated Department of Agriculture, Agricultural Research Service, Salinity Laboratory; Riverside, California.

URS Corporation (URS). 2007. Sierrita Tailing Facility, Pima County Arizona, Revision 1.0. Prepared for Phelps Dodge Sierrita, Inc. February, 2007.

van Genuchten, M. T. 1980. A Closed-Form Equation for Predicting The Hydraulic Conductivity of Unsaturated Soils. Soil. Sci. Soc. Am. J. 44:892-898.

TABLES

TABLE A.1
Water Budget Components for Seepage Estimation

Year(s)	Ore Milled (million tons/year)	Water Delivered to Impoundment (ac-ft/yr)	Reclaimed Water[1] (ac-ft/yr)	Surface Water Discharge[2] (ac-ft/yr)	Precipitation[2] (ac-ft/yr)	Evaporation[2] (ac-ft/yr)	Retained in Impoundment[2] (ac-ft/yr)	Available Seepage Water[3] (ac-ft/yr)
2007	39.06	26,196	6,222	296	3,507	12,156	5,364	5,947
2008	40.88	27,417	6,512	296	3,507	12,156	5,614	6,347
2009 - 2011	40.88	27,417	6,512	296	3,507	12,156	5,614	6,347
2012 - EOM	42.00	28,168	6,690	296	3,507	12,156	5,767	6,592
EOM - future	0	0	0	na	na	na	na	0

Notes:

1. *Value for 2007 based on average value for 2005 and 2006 (M&A, 2007)*
2. *Values based on average value for 1997 - 2006 (M&A, 2007)*
3. *Derived from water budget*

EOM = end of mine life
ac-ft/yr = acre-feet per year
na = not applicable

TABLE A.2
Summary of Parameter Estimates

Summary	Ks[1] (cm/s)	Unsaturated Parameters[2]			
		θ_s	θ_r	α (cm^{-1})	*n*
		Estimate A[5]			
Average[3]	7.70E-06	0.36	0.030	0.087	1.350
Median	5.90E-06	0.36	0.029	0.016	1.284
Min	1.50E-06	0.29	0.022	0.002	1.054
Max	1.20E-03	0.44	0.054	0.575	2.570
Std Dev[4]	4.76	0.043	0.007	0.153	0.325
		Estimate B[6]			
Average[3]	7.70E-06	0.37	0.16	0.061	1.59
Median	5.90E-06	0.37	0.18	0.026	1.60
Min	1.50E-06	0.28	0.061	0.003	1.09
Max	1.20E-03	0.45	0.22	0.380	2.51
Std Dev[4]	4.76	0.044	0.059	0.083	0.35
		Calibrated Model			
	2.30E-05	0.36	0.09	0.01	2.03

Notes:
1. *Measured by Geosystems Analysis, Inc.*
2. *Estimated via curve fitting using unsaturated measurements made by Geosystems Analysis, Inc.*
3. *Average for Ks is geometric average. All others averages are arithmetic averages*
4. *Standard deviation for Ks is reverse transform of the standard deviation of the natural log transformed data*
5. *Parameters estimated by using database values for θ_r (Schaap, 1999)*
6. *Parameters estimated by using θ_r equal to θ at 1 bar (1000 cm) suction*

Ks = Saturated hydraulic conductivity
θ_s = saturated water content (porosity)
θ_r = residual water content
α, n = van Genuchten (1980) equation constants

TABLE A.3
Seepage Rates Applied in Predictive Simulations

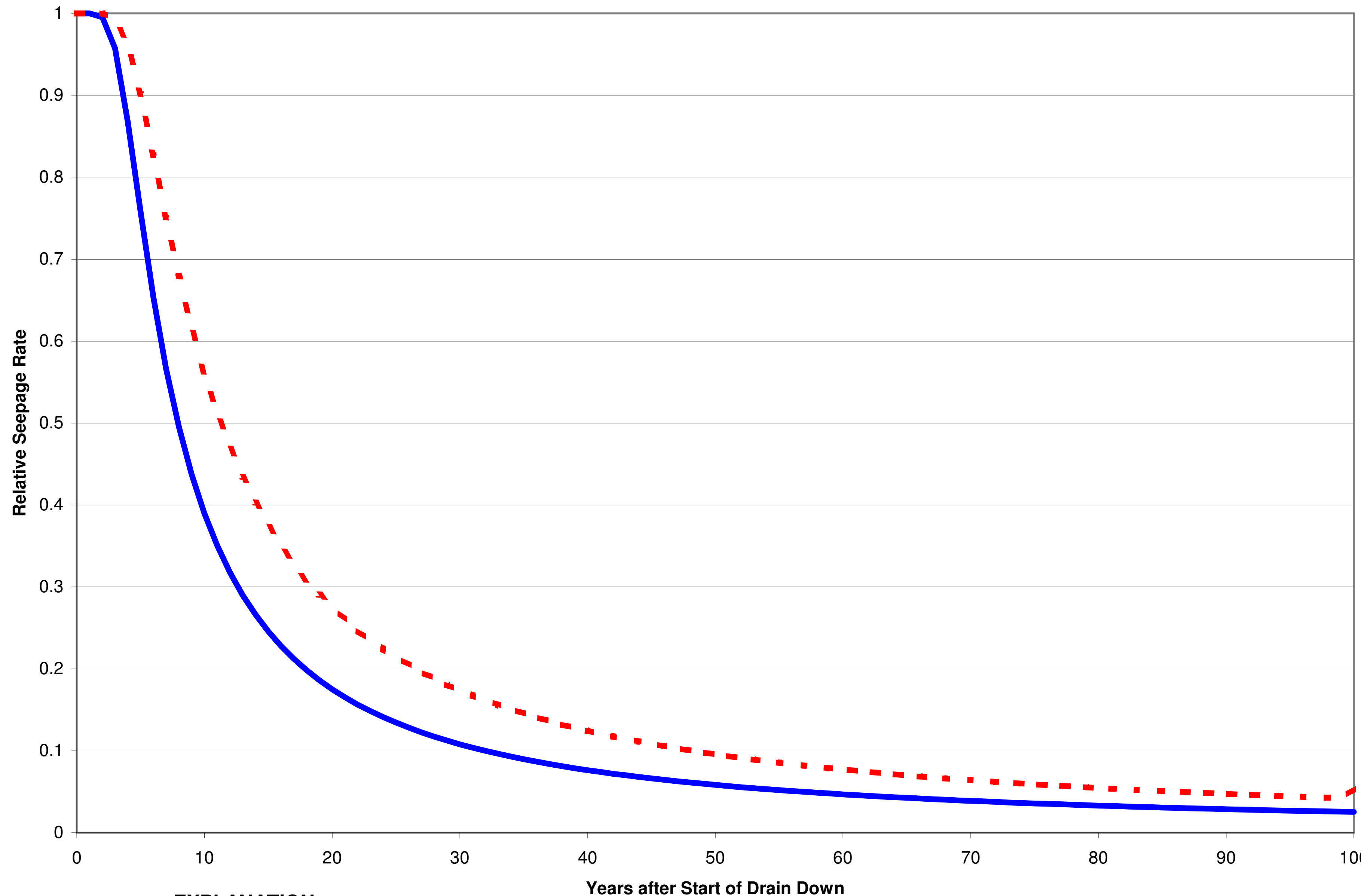
Year	2016 Scenario[1] (ac-ft/yr)	2042 Scenario[2] (ac-ft/yr)
2007	7,843	7,843
2008	7,853	7,853
2009	7,986	7,986
2010	8,379	8,379
2011	8,379	8,379
2012	8,379	8,379
2013	8,389	8,389
2014	8,531	8,531
2015	8,705	8,705
2016	8,705	8,705
2017	8,703	8,705
2018	8,665	8,705
2019	8,334	8,705
2020	7,556	8,705
2021	6,592	8,705
2022	5,689	8,705
2023	4,929	8,705
2024	4,309	8,705
2025	3,805	8,705
2026	3,392	8,705
2027	3,051	8,705
2028	2,765	8,705
2029	2,524	8,705
2030	2,317	8,705
2031	2,139	8,705
2032	1,983	8,705
2033	1,847	8,705
2034	1,727	8,705
2035	1,620	8,705
2036	1,525	8,705
2037	1,439	8,705
2038	1,362	8,705
2039	1,292	8,705
2040	1,228	8,705
2041	1,169	8,705
2042	1,116	8,705
2043	1,066	8,705
2044	1,021	8,705
2045	979	8,658
2046	940	8,366
2047	904	7,847
2048	870	7,199
2049	838	6,534
2050	809	5,913
2051	781	5,361
2052	755	4,879
2053	730	4,460
2054	707	4,097

TABLE A.3
Seepage Rates Applied in Predictive Simulations

Year	2016 Scenario[1] (ac-ft/yr)	2042 Scenario[2] (ac-ft/yr)
2055	685	3,781
2056	665	3,504
2057	645	3,261
2058	627	3,046
2059	609	2,854
2060	593	2,683
2061	577	2,529
2062	562	2,390
2063	547	2,265
2064	534	2,150
2065	521	2,046
2066	508	1,950
2067	496	1,862
2068	485	1,781
2069	474	1,706
2070	463	1,637
2071	453	1,573
2072	443	1,513

Note:
ac-ft/yr = acre-feet per year
[1] Tailing impoundment drain down begins in the year 2016
[2] Tailing impoundment drain down begins in the year 2042

FIGURES



EXPLANATION

230 ft (2016 Scenario)

400 ft (2042 Scenario)

HYDRO GEO CHEM, INC.

RELATIVE SEEPAGE RATE ESTIMATES FOR FUTURE TAILING THICKNESSES

Approved	Date	Author	Date	File Name	Figure
NWH	7/17/09	NWH	7/17/09	F1 QREL	A.1

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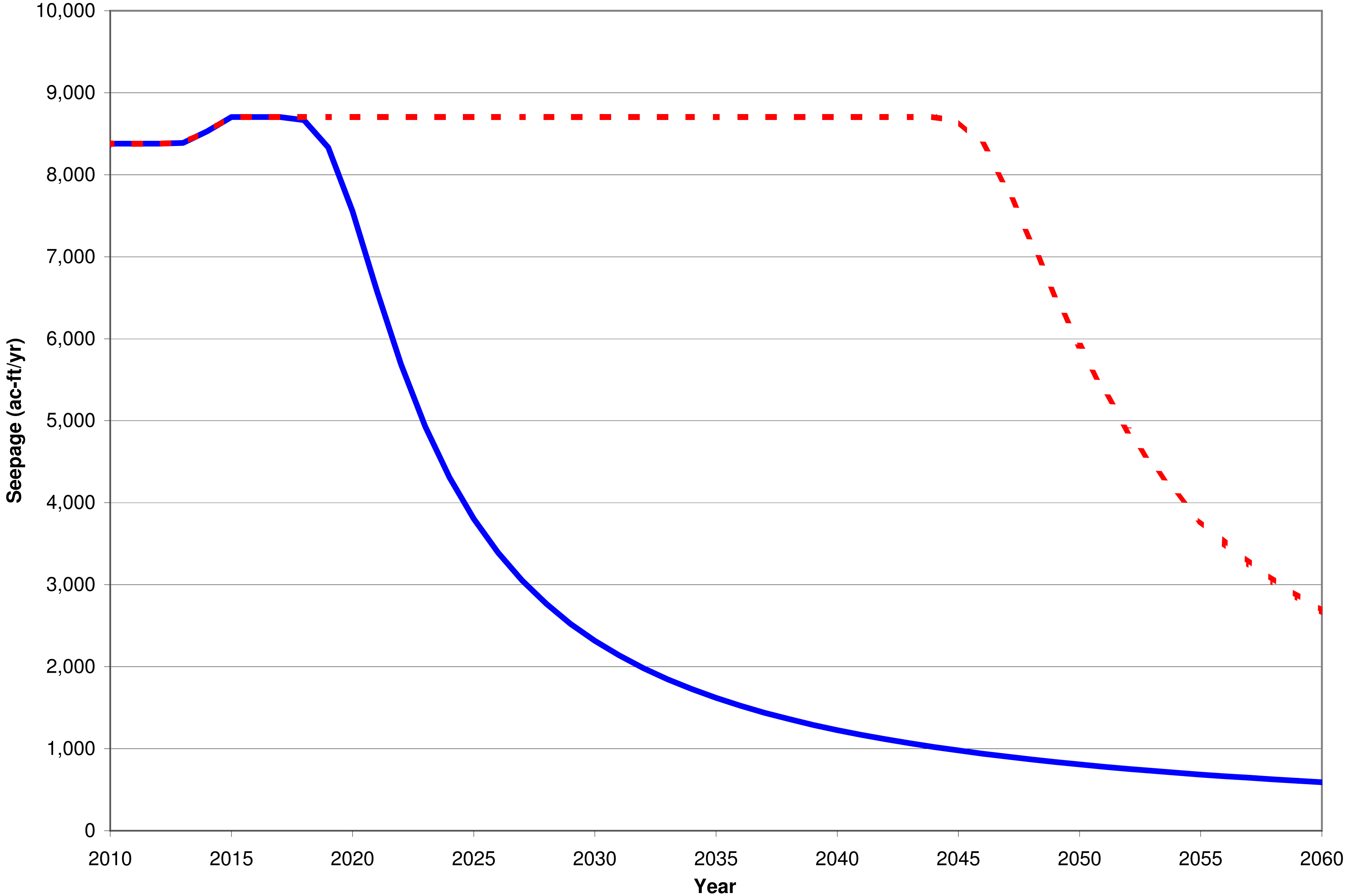

EXPLANATION

2016 Scenario

2042 Scenario

HYDRO GEO CHEM, INC.

SEEPAGE RATES FOR PREDICTIVE SIMULATIONS

Approved	Date	Author	Date	File Name	Figure
NWH	7/17/09	NWH	7/17/09	F2 seepage	A.2

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APPENDIX B

WELLFIELD SIMULATION RESULTS FOR STATE LAND OPTION

TABLE OF CONTENTS

TABLE

FIGURES

TABLE

TABLE B.1
Pumping Wells and Rates for
Predictive Simulation of State Land Option

Well NAME	ADWR Well Registration (55-)	UTM83E(m)	UTM83N(m)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
FREEPORT-MCMORAN SIERRITA INC. (Annual Average Pumping in Gallons Per Minute)																													
FFS-1	Future	498327	3524076	0	0	0	0	0	0	0	700	700	700	700	700	700	700	700	700	700	700	700	500	500	500	500	500	500	500
FFS-2	Future	498316	3524590	0	0	0	0	0	0	0	600	600	600	600	600	600	600	400	400	400	400	400	400	400	400	400	400	400	400
FFS-3	Future	498357	3525295	0	0	0	0	0	0	0	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
FFS-4	Future	498356	3525930	0	0	0	0	0	0	0	500	500	500	500	500	500	500	500	500	500	500	500	300	300	300	300	300	300	300
FFS-5	Future	498346	3526693	0	0	0	0	0	0	0	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
FFS-6	Future	498330	3527287	0	0	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	400	400
IW1	623129	496906	3521278	327	298	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
IW10	508237	497370	3523122	353	350	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	250	250
IW11	508235	497371	3523429	377	363	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	250	250
IW12	545555	497365	3523970	166	154	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	75	75
IW13	545556	497364	3524167	26	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW14	545557	497367	3524373	89	81	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
IW15	545558	497373	3524567	46	49	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
IW16	545559	497371	3524783	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW17	545560	497374	3525003	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW18	545561	497374	3525170	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW19	545562	497374	3525343	154	206	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	100	100
IW20	545563	497365	3525569	44	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW21	545564	497375	3525773	159	148	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	75	75
IW22	200554	497370	3523274	337	352	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	40	40	40	40	40	40	40
IW23	200555	497369	3522971	193	164	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
IW24	200556	497372	3522634	77	142	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IW-25	Future	497643	3521741	0	0	0	0	0	400	400	400	400	400	400	400	400	400	300	300	300	300	300	300	300	300	300	300	300	300
IW-26	Future	497644	3522160	0	0	0	0	0	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
IW-27	Future	497647	3522578	0	0	0	0	0	400	400	400	400	400	400	400	400	400	400	400	400	400	400	300	300	300	300	300	300	300
IW-28	Future	497652	3523177	0	0	0	0	0	400	400	400	400	400	400	400	400	400	400	400	400	400	400	200	200	200	200	200	200	200
IW2A	216464	497469	3521338	473	409	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
IW3A	201732	497366	3521723	722	650	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
IW4	623132	497372	3522466	210	122	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
IW5	623133	497370	3522815	103	93	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
IW6A	545565	497381	3523709	133	95	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	50	50
IW8	508238	497368	3522021	440	423	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
IW9	508236	497370	3522208	214	266	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
MC-1	Future	499448	3525189	0	0	0	0	0	0	0	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700
MC-2	Future	499171	3526077	0	0	0	0	0	0	0	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	900	900
MC-3	Future	499249	3526870	0	0	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	900	900
MC-4	Future	498597	3527872	0	0	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
PS-1	Future	499148	3529128	0	0	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	750	750
PS-2	Future	499318	3529357	0	0	0	0	0	0	0	600	600	600	600	600	600	600	450	450	450	450	450	450	450	450	450	450	450	450
PS-3	Future	499570	3529350	0	0	0	0	0	0	0	600	600	600	600	600	600	600	450	450	450	450	450	450	450	450	450	450	0	0
PS-4	Future	499153	3528830	0	0	0	0	0	0	0	750	750	750	750	750	750	750	750	750	750	750	750	800	800	800	800	800	1100	1100
S1	623111	499931	3518793	1431	1867	1447	1675	1675	1462	1462	192	192	192	192	192	192	192	245	245	245	245	245	283	283	283	283	283	601	601
S2	623112	499133	3517459	1515	1609	1344	1675	1675	1462	1462	192	192	192	192	192	192	192	245	245	245	245	245	283	283	283	283	283	601	601
S3	623113	498136	3516037	1804	1853	1722	1675	1675	1462	1462	192	192	192	192	192	192	192	245	245	245	245	245	283	283	283	283	283	601	601
S4	623114	497344	3514807	2067	2451	2245	2518	2518	2198	2198	288	288	288	288	288	288	288	368	368	368	368	368	425	425	425	425	425	903	903
S5	623115	496561	3513401	2633	2482	2737	2531	2531	2209	2209	290	290	290	290	290	290	290	370	370	370	370	370	427	427	427	427	427	908	908
S6	623116	496371	3511992	2370	2133	2482	2518	2518	2198	2198	288	288	288	288	288	288	288	368	368	368	368	368	425	425	425	425	425	903	903

TABLE B.1
Pumping Wells and Rates for
Predictive Simulation of State Land Option

Well NAME	ADWR Well Registration (55-)	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
FREEPORT-MCMORAN SIERRITA INC. (Annual Average Pumping in Gallons Per Minute)																													
FFS-1	Future	500	500	500	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
FFS-2	Future	400	400	400	100	100	100	100	100	100	100	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
FFS-3	Future	400	400	400	400	400	400	400	400	400	400	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
FFS-4	Future	300	300	300	300	300	300	300	300	300	300	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
FFS-5	Future	900	900	900	900	900	900	900	900	900	900	500	500	500	500	500	500	500	500	300	300	300	300	300	300	300	300	300	300
FFS-6	Future	400	400	400	400	400	400	400	400	400	400	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
IW1	623129	250	250	250	188	188	188	188	188	188	188	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
IW10	508237	250	250	250	250	250	250	250	250	250	250	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IW11	508235	250	250	250	250	250	250	250	250	250	250	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IW12	545555	75	75	75	75	75	75	75	75	75	75	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
IW13	545556	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW14	545557	75	75	75	50	50	50	50	50	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW15	545558	50	50	50	40	40	40	40	40	40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW16	545559	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW17	545560	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW18	545561	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW19	545562	100	100	100	100	100	100	100	100	100	100	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
IW20	545563	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW21	545564	75	75	75	75	75	75	75	75	75	75	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
IW22	200554	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
IW23	200555	150	150	150	125	125	125	125	125	125	125	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
IW24	200556	100	100	100	75	75	75	75	75	75	75	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
IW-25	Future	300	300	300	300	300	300	300	300	300	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW-26	Future	400	400	400	400	400	400	400	400	400	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW-27	Future	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
IW-28	Future	200	200	200	200	200	200	200	200	200	200	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
IW2A	216464	425	425	425	325	325	325	325	325	325	325	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
IW3A	201732	500	500	500	400	400	400	400	400	400	400	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
IW4	623132	80	80	80	60	60	60	60	60	60	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW5	623133	90	90	90	70	70	70	70	70	70	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW6A	545565	50	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW8	508238	425	425	425	325	325	325	325	325	325	325	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
IW9	508236	250	250	250	188	188	188	188	188	188	188	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
MC-1	Future	700	700	700	700	700	700	700	700	700	700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MC-2	Future	900	900	900	900	900	900	900	900	900	900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MC-3	Future	900	900	900	900	900	900	900	900	900	900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MC-4	Future	600	600	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS-1	Future	750	750	750	750	750	750	750	750	750	750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS-2	Future	450	450	450	450	450	450	450	450	450	450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS-3	Future	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS-4	Future	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S1	623111	601	601	601	680	740	740	740	740	740	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S2	623112	601	601	601	680	740	740	740	740	740	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S3	623113	601	601	601	680	740	740	740	740	740	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S4	623114	903	903	903	1023	1113	1113	1113	1113	1113	1113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S5	623115	908	908	908	1028	1119	1119	1119	1119	1119	1119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S6	623116	903	903	903	1023	1113	1113	1113	1113	1113	1113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B.1
Pumping Wells and Rates for
Predictive Simulation of State Land Option

Well NAME	ADWR Well Registration (55-)	UTM83E(m)	UTM83N(m)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
				ALL OTHER WELLS (Annual Average Pumping in Gallons Per Minute)																									
201058	201058	506980	3532009	3	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Amado	623888	495913	3511786	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
AN-4(RRQC1)	608521	503457	3527990	458	358	408	319	327	335	343	350	358	366	374	382	390	398	408	418	427	437	447	457	467	477	486	496	496	496
C4	624010	501760	3525384	1125	1090	1107	1066	1059	1052	1045	1038	1031	1024	1017	1010	1003	996	977	958	939	921	902	883	864	845	826	808	808	808
CCofGV	501760	501635	3527876	121	81	101	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
CCofGV(CW-5)	627484	501234	3522497	301	340	321	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330
ContSD39	601769	504049	3522942	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cox	604432	508795	3534015	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CW10	207982	500975	3523255	767	564	765	920	935	951	967	983	999	1010	1021	1033	1044	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055
CW11	608518	502442	3530984	0	669	765	920	935	951	967	983	999	1010	1021	1033	1044	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055
CW12	Future	500249	3523080	0	0	0	0	43	86	130	173	216	259	302	346	389	432	437	442	448	453	458	463	468	474	479	484	484	484
CW6	627485	500891	3525794	155	204	385	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW6r	Future	501123	3526046	0	0	0	484	490	495	501	507	513	519	525	531	537	543	549	556	562	569	575	582	588	595	601	608	608	608
CW8	543600	499799	3525661	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW9	588121	501072	3528741	352	227	550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW9r	Future	501233	3528673	0	0	0	484	490	495	501	507	513	519	525	531	537	543	549	556	562	569	575	582	588	595	601	608	608	608
Davis	621257	506996	3533678	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Duckett	800365	508809	3533012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E10A	86931	502452	3523995	0	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
E11A	624018	502092	3527822	515	504	509	490	487	484	480	477	474	471	468	464	461	458	449	441	432	423	415	406	397	389	380	371	371	371
E12	624019	500635	3520347	38	0	19	18	18	18	18	18	18	18	18	17	17	17	17	17	16	16	16	15	15	15	14	14	14	14
E13	624020	503122	3526403	80	156	118	114	113	112	111	111	110	109	109	108	107	106	104	102	100	98	96	94	92	90	88	86	86	86
E15	624022	500333	3518794	739	789	764	735	730	726	721	716	711	706	702	697	692	687	674	661	648	635	622	609	596	583	570	557	557	557
E16	624023	503328	3525727	539	566	553	532	529	525	522	518	515	511	508	504	501	497	488	478	469	460	450	441	431	422	413	403	403	403
E3A	624011	502198	3523933	551	566	558	537	534	530	527	523	520	516	513	509	506	502	493	483	474	464	455	445	436	426	417	407	407	407
E5A	624012	502184	3524332	187	145	166	160	159	158	157	156	155	154	152	151	150	149	147	144	141	138	135	132	130	127	124	121	121	121
E6	624013	502425	3525169	497	484	491	472	469	466	463	460	457	454	451	448	444	441	433	425	416	408	400	391	383	375	366	358	358	358
E7	624014	503086	3525553	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E8	624015	502374	3525166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E9	624016	500862	3521222	86	0	43	42	41	41	41	40	40	40	40	39	39	39	38	37	37	36	35	34	34	33	32	32	32	32
ESP1	623102	499970	3526449	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP2	623103	500242	3526925	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP3	623104	500234	3527377	96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP4	623105	499917	3526133	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FICO543409	543409	500252	3521313	0	331	165	159	158	157	156	155	154	153	152	151	150	149	146	143	140	138	135	132	129	126	123	121	121	121
Grant	801401	496059	3518416	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GV1	603428	499813	3522254	687	641	664	695	700	704	709	713	718	722	727	731	736	740	743	745	747	750	752	754	757	759	761	764	764	764
GV2	603429	499786	3521654	312	301	307	328	331	333	335	337	339	341	343	345	347	350	351	352	353	354	355	356	357	358	359	361	361	361
GVDWID-Canoa	586729	497325	3516610	303	320	311	328	331	333	335	337	339	341	343	345	347	350	351	352	353	354	355	356	357	358	359	361	361	361
GVDWID-SI	208825	497227	3519510	553	556	555	580	583	587	591	595	598	602	606	609	613	617	619	622	624	626	628	631	633	635	638	640	640	640
GVINV_625711	625711	501568	3526181	363	340	352	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328
GVINV_625712	625712	501600	3526400	140	161	150	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141
Hoogerwerk_RL	601910	509871	3532610	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I10	608525	497798	3528469	30	10	20	19	19	19	19	19	19	19	18	18	18	18	18	17	17	17	16	16	16	15	15	15	15	15
Kiewit	583888	504190	3530600	181	115	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
Lamb	628534	505340	3535044	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lawyers	608599	504207	3527782	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LosArboles	524178	502573	3533448	37	7	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
NP2	624028	500929	3519541	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
OcotilloCommunity	801309	498963	3511412	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Olivas	801154	503396	3531213	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PimaCoCanoaRanch	623128	498467	3517655	0	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pollux1	213787	504871	3514658	6	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Poole	801975	495659	3519508	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
QCWC_No11	608597	505964	3526918	99	92	96	78	80	82	84	86	88	90	92	94	96	98	100	102	105	107	110	112	115	117	119	122	122	122

TABLE B.1
Pumping Wells and Rates for
Predictive Simulation of State Land Option

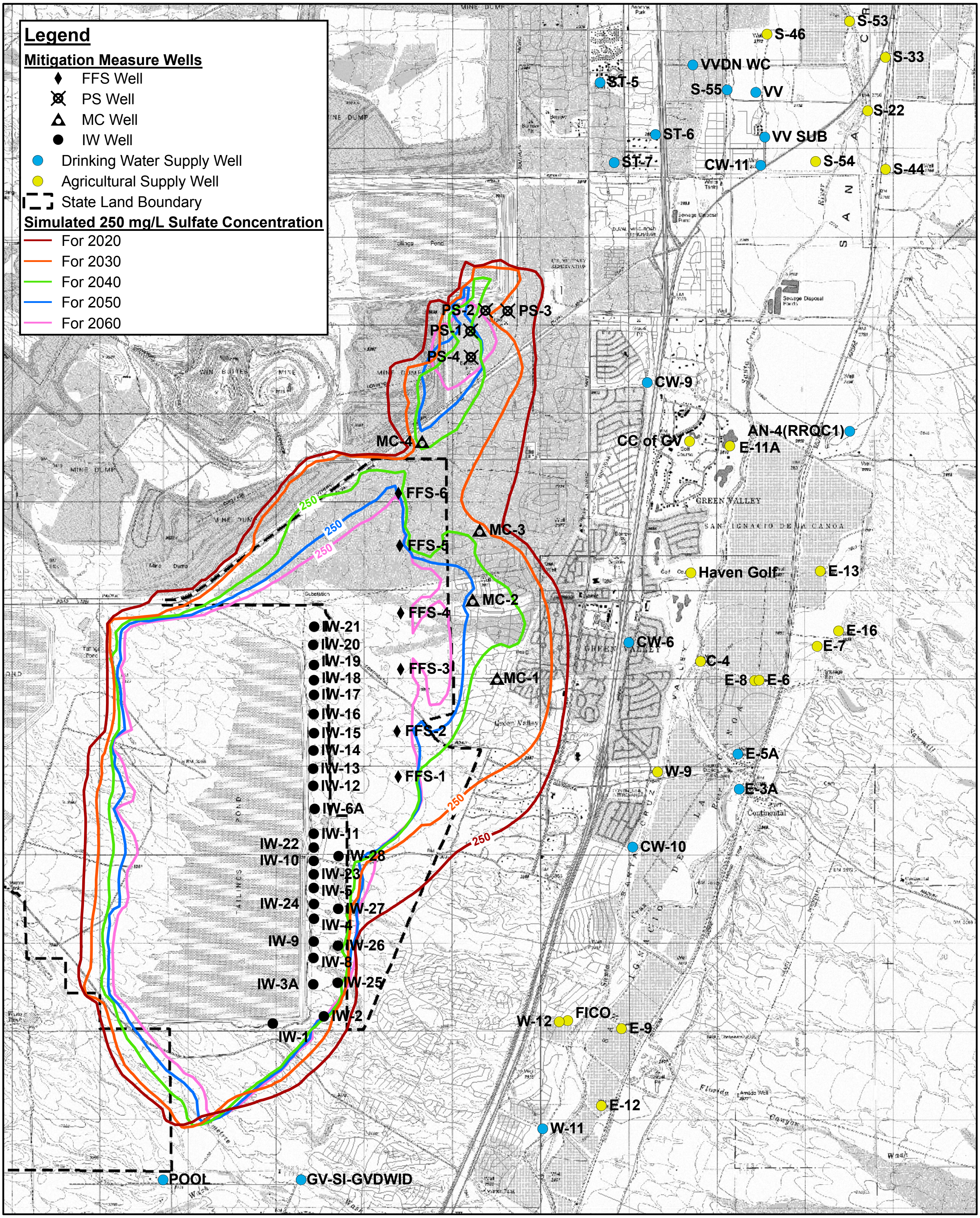
Well NAME	ADWR Well Registration (55-)	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
		ALL OTHER WELLS (Annual Average Pumping in Gallons Per Minute)																											
201058	201058	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Amado	623888	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
AN-4(RRQC1)	608521	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496
C4	624010	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808
CCofGV	501760	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
CCofGV(CW-5)	627484	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330
ContSD39	601769	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cox	604432	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CW10	207982	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055
CW11	608518	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055
CW12	Future	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484
CW6	627485	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW6r	Future	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608
CW8	543600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW9	588121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW9r	Future	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608
Davis	621257	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Duckett	800365	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E10A	86931	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E11A	624018	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371
E12	624019	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
E13	624020	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86
E15	624022	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557
E16	624023	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403
E3A	624011	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407
E5A	624012	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
E6	624013	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358
E7	624014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E8	624015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E9	624016	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
ESP1	623102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP2	623103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP3	623104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP4	623105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FICO543409	543409	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
Grant	801401	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GV1	603428	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764
GV2	603429	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361
GVDWID-Canoa	586729	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361
GVDWID-SI	208825	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640
GVINV_625711	625711	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328
GVINV_625712	625712	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141
Hoogerwerk_RL	601910	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I10	608525	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Kiewit	583888	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
Lamb	628534	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lawyers	608599	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LosArboles	524178	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
NP2	624028	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
OcotilloCommunity	801309	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Olivas	801154	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PimaCoCanoaRanch	623128	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pollux1	213787	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Poole	801975	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
QCWC_No11	608597	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122

Well NAME	ADWR Well Registration (55-)	UTM83E(m)	UTM83N(m)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
																	ALL OTHER WELLS (Annual Average Pumping in Gallons Per Minute)												
QCWC_No13	608522	504788	3528380	218	312	265	205	210	215	220	225	230	235	240	245	250	255	262	268	274	280	287	293	299	306	312	318	318	318
QCWC_No16	608598	506962	3526858	0	8	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
RanchoSonado	507495	496705	3510791	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
Rosemont1	214277	505997	3535073	1	0	0	0	0	0	0	0	0	0	0	0	0	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont2	216391	508421	3533513	4	0	0	0	0	0	0	0	0	0	0	0	0	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont3	Future	505653	3535164	0	0	0	0	0	0	0	0	0	0	0	0	0	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont4	Future	505648	3534962	0	0	0	0	0	0	0	0	0	0	0	0	0	929	929	929	929	929	929	929	929	929	929	929	929	929
RT1	504946	499811	3530971	43	75	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
S12	623981	505183	3535660	927	835	881	848	842	837	831	826	820	814	809	803	798	792	777	762	747	732	717	702	687	672	657	642	642	642
S19	623982	504841	3532023	876	846	861	829	823	818	812	807	802	796	791	785	780	774	760	745	731	716	701	687	672	657	643	628	628	628
S22	623983	503660	3531621	424	326	375	361	358	356	354	351	349	347	344	342	340	337	331	324	318	312	305	299	293	286	280	273	273	273
S25	623985	503037	3533248	1004	881	942	907	901	895	889	883	877	871	865	859	853	847	831	815	799	783	767	751	735	719	703	687	687	687
S29	623986	503806	3535671	455	434	444	427	425	422	419	416	414	411	408	405	402	400	392	384	377	369	362	354	347	339	332	324	324	324
S31	623987	505995	3537476	108	183	146	140	139	138	137	136	136	135	134	133	132	131	129	126	124	121	119	116	114	111	109	106	106	106
S33	623988	503859	3532226	432	403	418	402	399	397	394	391	389	386	384	381	378	376	369	362	354	347	340	333	326	319	312	305	305	305
S40	623991	505004	3534851	712	668	690	664	659	655	651	646	642	638	633	629	625	620	609	597	585	574	562	550	538	527	515	503	503	503
S43	623993	503813	3537068	560	491	526	506	502	499	496	493	489	486	483	479	476	473	464	455	446	437	428	419	410	401	392	383	383	383
S44	623994	503859	3530811	1045	1041	1043	1003	997	990	984	977	971	964	957	951	944	938	920	902	885	867	849	831	814	796	778	760	760	760
S45	623995	504834	3532831	1149	1258	1204	1158	1151	1143	1136	1128	1120	1113	1105	1098	1090	1083	1062	1042	1021	1001	980	960	939	919	898	878	878	878
S46	623996	502647	3532239	748	628	688	662	658	654	649	645	641	636	632	628	623	619	607	596	584	572	560	549	537	525	514	502	502	502
S48	623997	504987	3537067	486	403	444	427	425	422	419	416	413	411	408	405	402	399	392	384	377	369	362	354	347	339	331	324	324	324
S49	623998	504793	3538083	305	336	320	308	306	304	302	300	298	296	294	292	290	288	283	277	272	266	261	255	250	245	239	234	234	234
S50	623999	504991	3538695	163	152	157	152	151	150	149	148	147	146	145	144	143	142	139	136	134	131	128	126	123	120	118	115	115	115
S51	624000	503017	3535471	927	901	914	879	874	868	862	856	851	845	839	833	828	822	806	791	775	760	744	729	713	698	682	666	666	666
S52	624001	504790	3535663	246	302	274	263	262	260	258	257	255	253	251	250	248	246	242	237	232	228	223	218	214	209	204	200	200	200
S52A	534992	504806	3534853	36	33	34	33	33	33	32	32	32	32	32	31	31	31	30	30	29	29	28	27	27	26	26	25	25	25
S53	624002	503453	3532635	1175	1154	1164	1120	1113	1106	1098	1091	1084	1076	1069	1062	1054	1047	1027	1007	988	968	948	928	908	889	869	849	849	849
S54	624003	503069	3531047	1109	984	1046	1007	1000	994	987	981	974	967	961	954	948	941	923	906	888	870	852	834	817	799	781	763	763	763
S55	624004	502062	3531858	1169	1117	1143	1100	1093	1085	1078	1071	1064	1057	1050	1042	1035	1028	1009	989	970	950	931	911	892	872	853	834	834	834
S56	624005	505213	3534443	296	302	299	287	285	284	282	280	278	276	274	272	270	269	264	258	253	248	243	238	233	228	223	218	218	218
SAH-2B	211809	500959	3534907	0	8	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sahuarita	611142	506745	3536662	16	21	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Sahuarita2	534039	502953	3538272	235	247	275	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
SahVal_WC	607626	503052	3536369	19	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
SC23A	619897	506943	3538481	397	119	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258
SC24A	619898	507953	3538486	438	267	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352
ST5	608531	500619	3531941	8	43	25	30	31	31	31	32	32	32	33	33	34	34	34	34	34	34	34	34	34	34	34	34	34	34
ST6	608530	501248	3531353	12	19	16	15	15	16	16	16	16	16	16	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
ST7	566940	500778	3531036	315	259	287	333	337	341	345	349	353	357	361	366	370	374	374	374	374	374	374	374	374	374	374	374	374	374
StateLand	Future	506015	3533579	0	0	0	0	31	62	93	124	155	186	217	248	279	310	361	412	463	514	565	617	668	719	770	821	821	821
SUS	605344	501863	3535970	75	79	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77
SWC_1	611144	502752	3537471	667	670	1369	1369	1392	1416	1439	1462	1485	1508	1531	1554	1577	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
SWC_3	Future	501134	3537343	0	0	31	31	128	225	322	419	516	613	709	806	903	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SWC_4	Future	501983	3534401	0	0	0	0	71	142	213	284	354	425	496	567	638	709	735	762	788	815	841	868	894	920	947	973	973	973
SWC_5	Future	501134	3534401	0	0	0	0	71	142	213	284	354	425	496	567	638	709	735	762	788	815	841	868	894	920	947	973	973	973
SWC_6	Future	501558	3537343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97	195	292	389	487	584	681	779	876	973	973	973
TorresBlancas	543409	502409	3521313	0	331	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347
TwinButtes	Future	500455	3530824	0	0	0	104	124	145	166	186	207	227	248	269	289	310	372	434	496	558	620	682	744	806	868	929	929	929
Underdown	626063	496709	3511387	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
ValVerde	803064	502386	3531830	19	4	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
VVDN_WC	602019	501674	3532142	38	41	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
W11	624025	499969	3520085	169	177	173	166	165	164	163	162	161	160	159	158	157	156	153	150	147	144	141	138	135	132	129	126	126	126
W12	624026	500156	3521299	731	710	721	694	689	685	680	676	671	666	662	657	653	648	636	624	612	599	587	575	563	550	538	526	526	526
W9	624024	501271	3524132	566	573	569	548	544	541	537	533	530	526	523	519	516	512	502	493	483	473	464	454	444	435	425	415	415	415

TABLE B.1
Pumping Wells and Rates for
Predictive Simulation of State Land Option

Well NAME	ADWR Well Registration (55-)	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
ALL OTHER WELLS (Annual Average Pumping in Gallons Per Minute)																													
QCWC_No13	608522	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318
QCWC_No16	608598	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
RanchoSonado	507495	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
Rosemont1	214277	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont2	216391	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont3	Future	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont4	Future	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
RT1	504946	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
S12	623981	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642
S19	623982	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628
S22	623983	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273
S25	623985	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687
S29	623986	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324
S31	623987	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106
S33	623988	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305
S40	623991	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503
S43	623993	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
S44	623994	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760
S45	623995	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878
S46	623996	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502
S48	623997	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324
S49	623998	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234
S50	623999	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
S51	624000	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666
S52	624001	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
S52A	534992	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
S53	624002	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849
S54	624003	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763
S55	624004	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834
S56	624005	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218
SAH-2B	211809	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sahuarita	611142	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Sahuarita2	534039	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
SahVal_WC	607626	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
SC23A	619897	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258
SC24A	619898	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352
ST5	608531	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
ST6	608530	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
ST7	566940	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374
StateLand	Future	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821
SUS	605344	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77
SWC_1	611144	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
SWC_3	Future	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SWC_4	Future	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973
SWC_5	Future	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973
SWC_6	Future	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973
TorresBlancas	543409	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347
TwinButtes	Future	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
Underdown	626063	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
ValVerde	803064	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
VVDN_WC	602019	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
W11	624025	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126
W12	624026	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526
W9	624024	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415

FIGURES



0 2500 5000 Feet

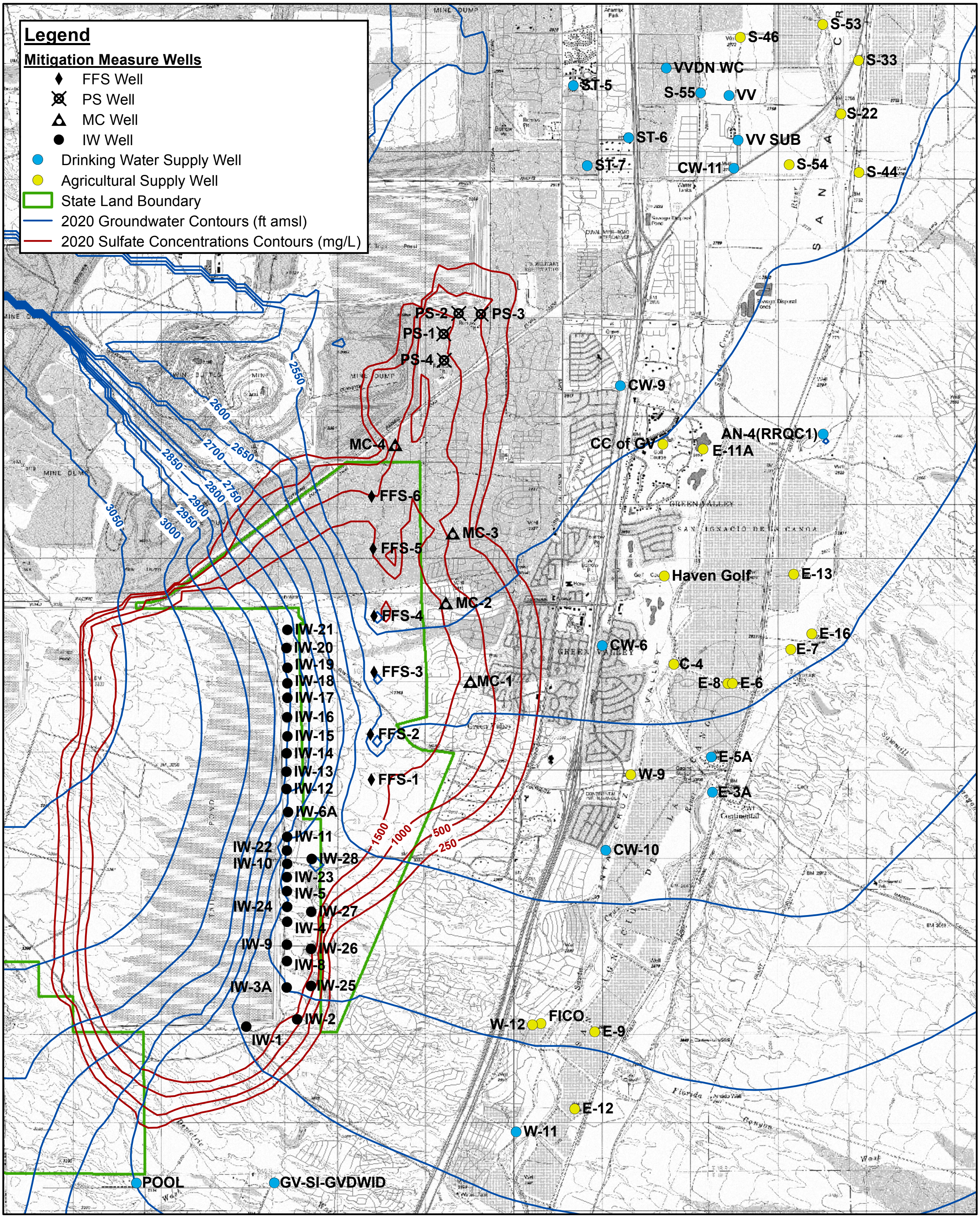
PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SIMULATED EXTENT OF SULFATE PLUME FROM 2020 TO 2060 FOR STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200037G	B.1



0 2500 5000 Feet

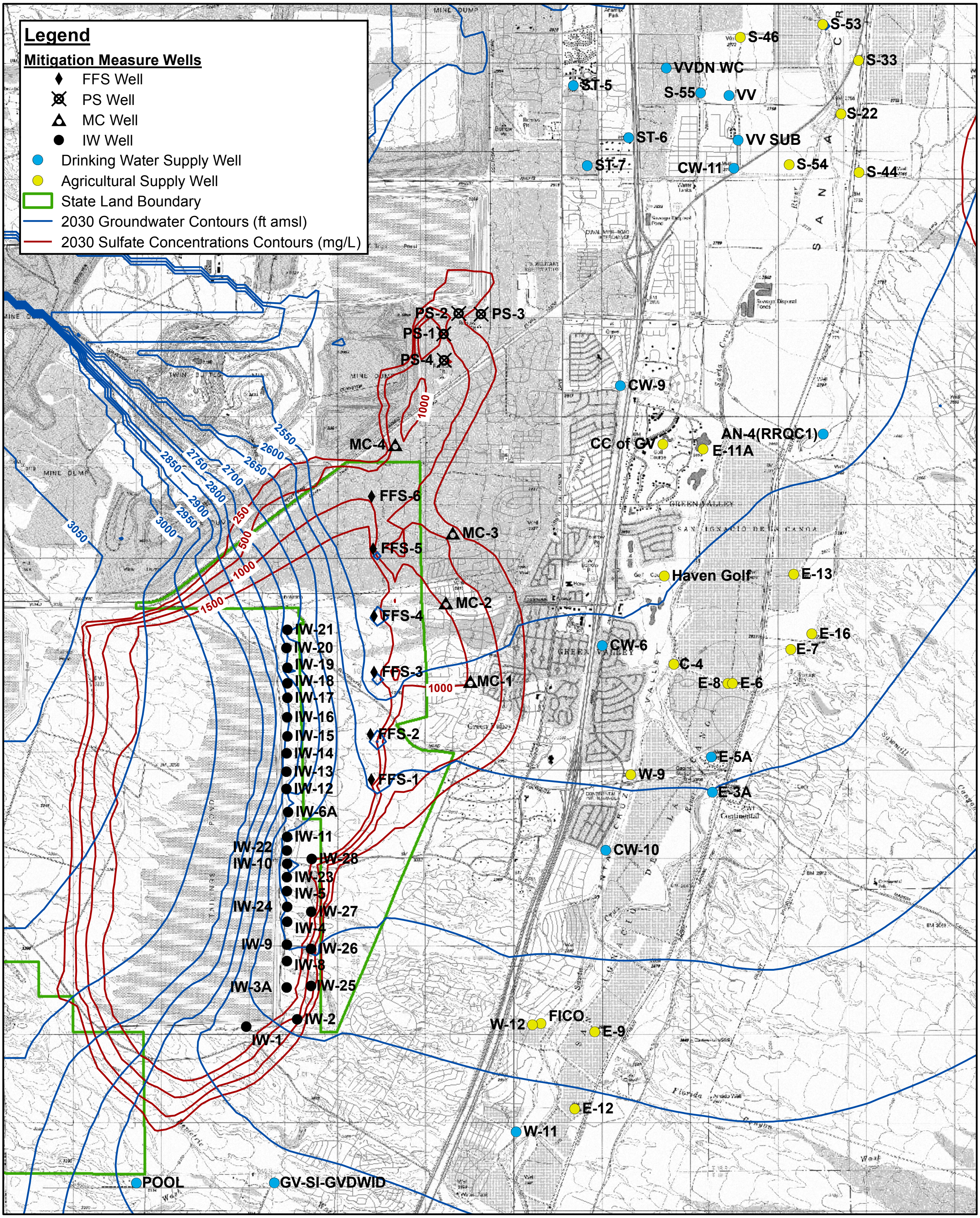
PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2020 FOR STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200032G	B.2



0 2500 5000 Feet

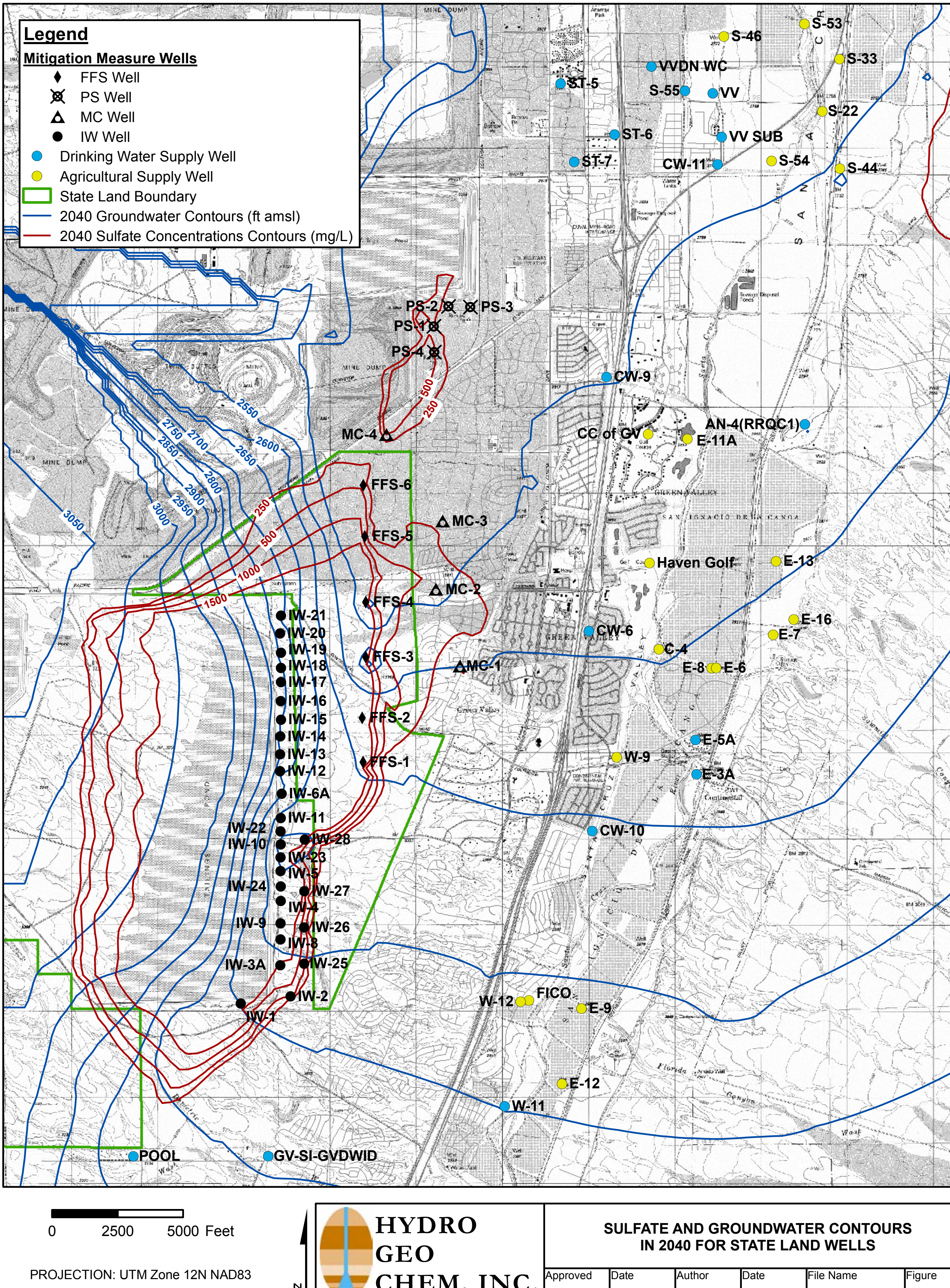
PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2030 FOR STATE LAND WELLS

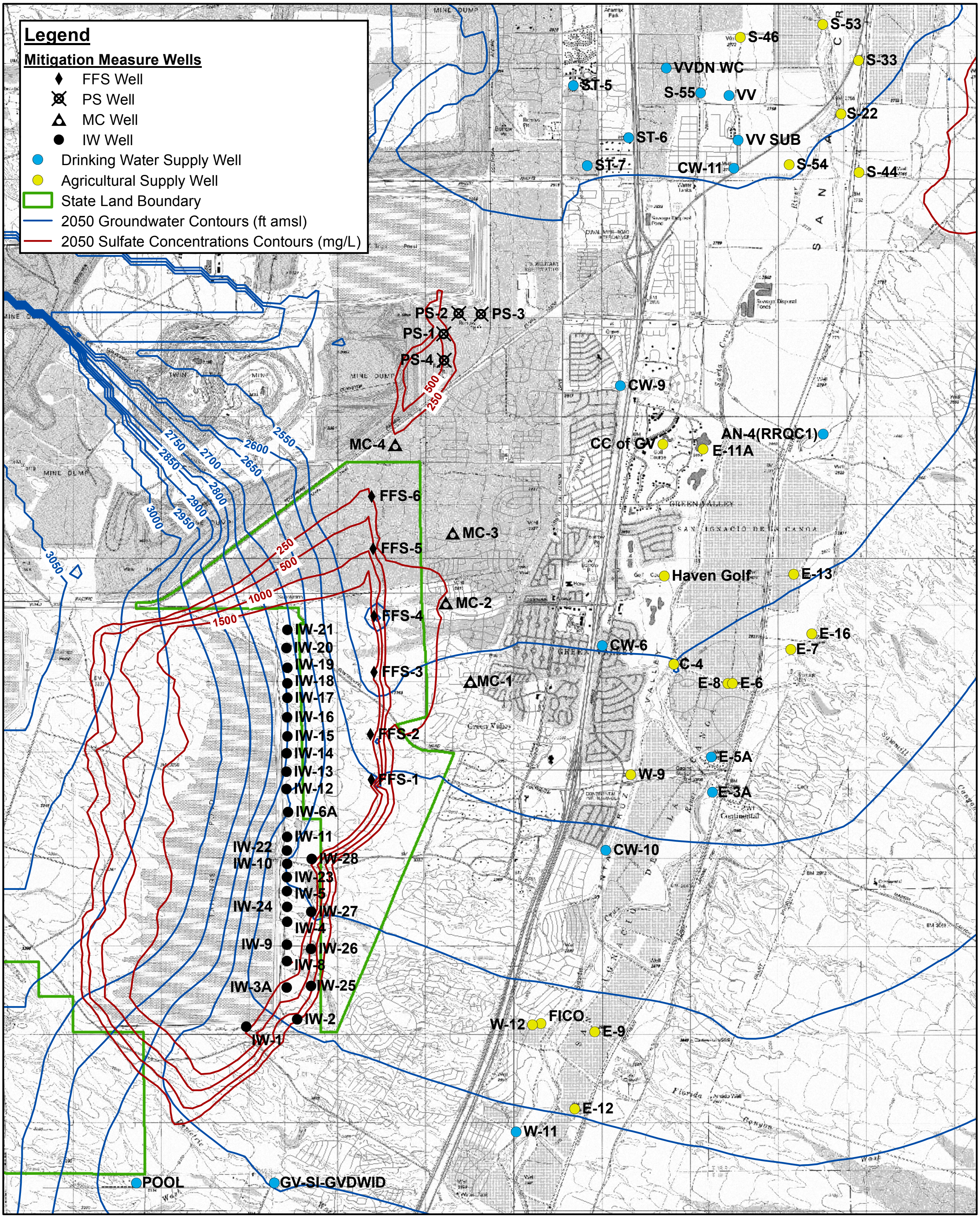
Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200033G	B 3



HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2040 FOR STATE LAND WELLS

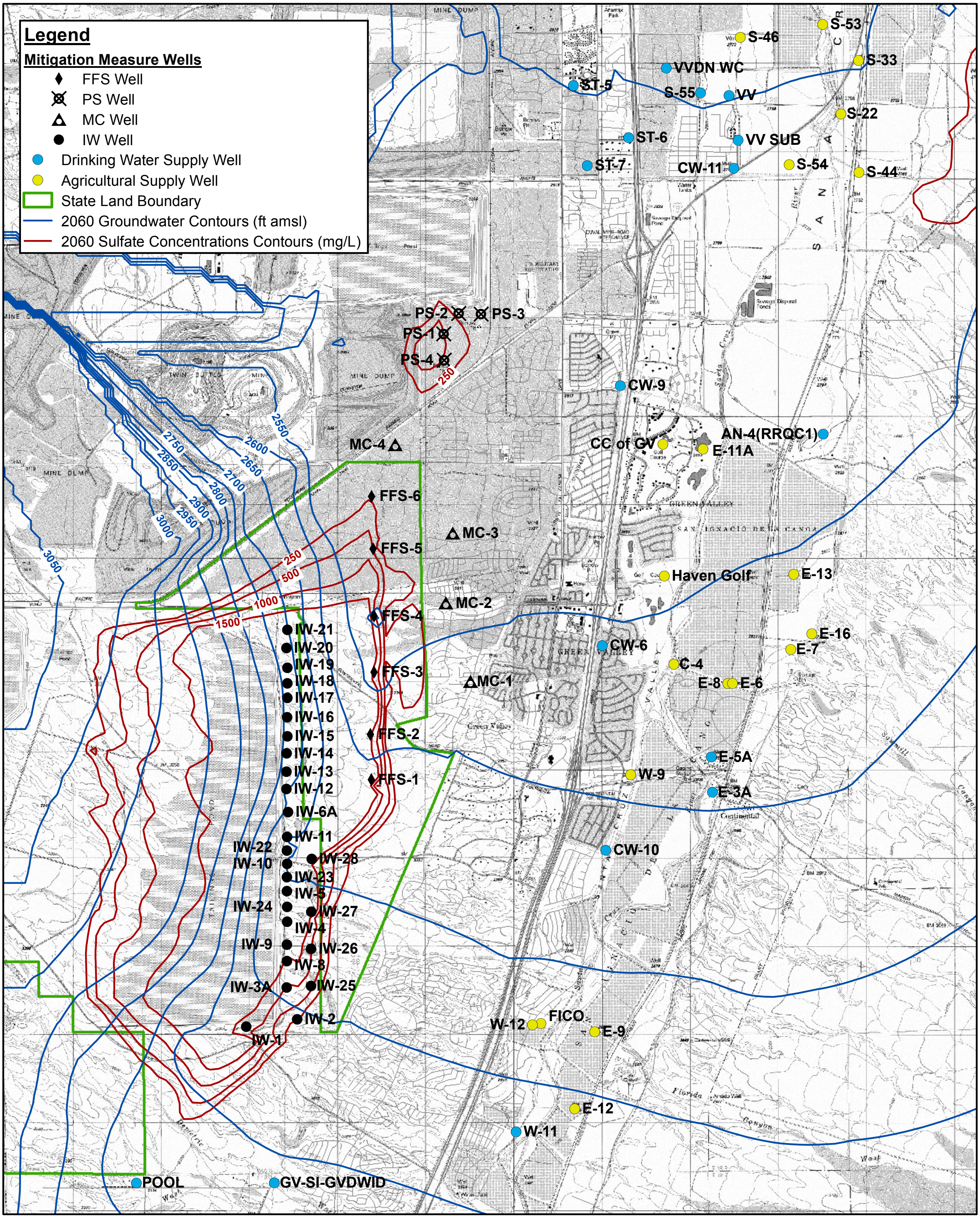
Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200034G	B 4



HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2050 FOR STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200035G	B.5



0 2500 5000 Feet

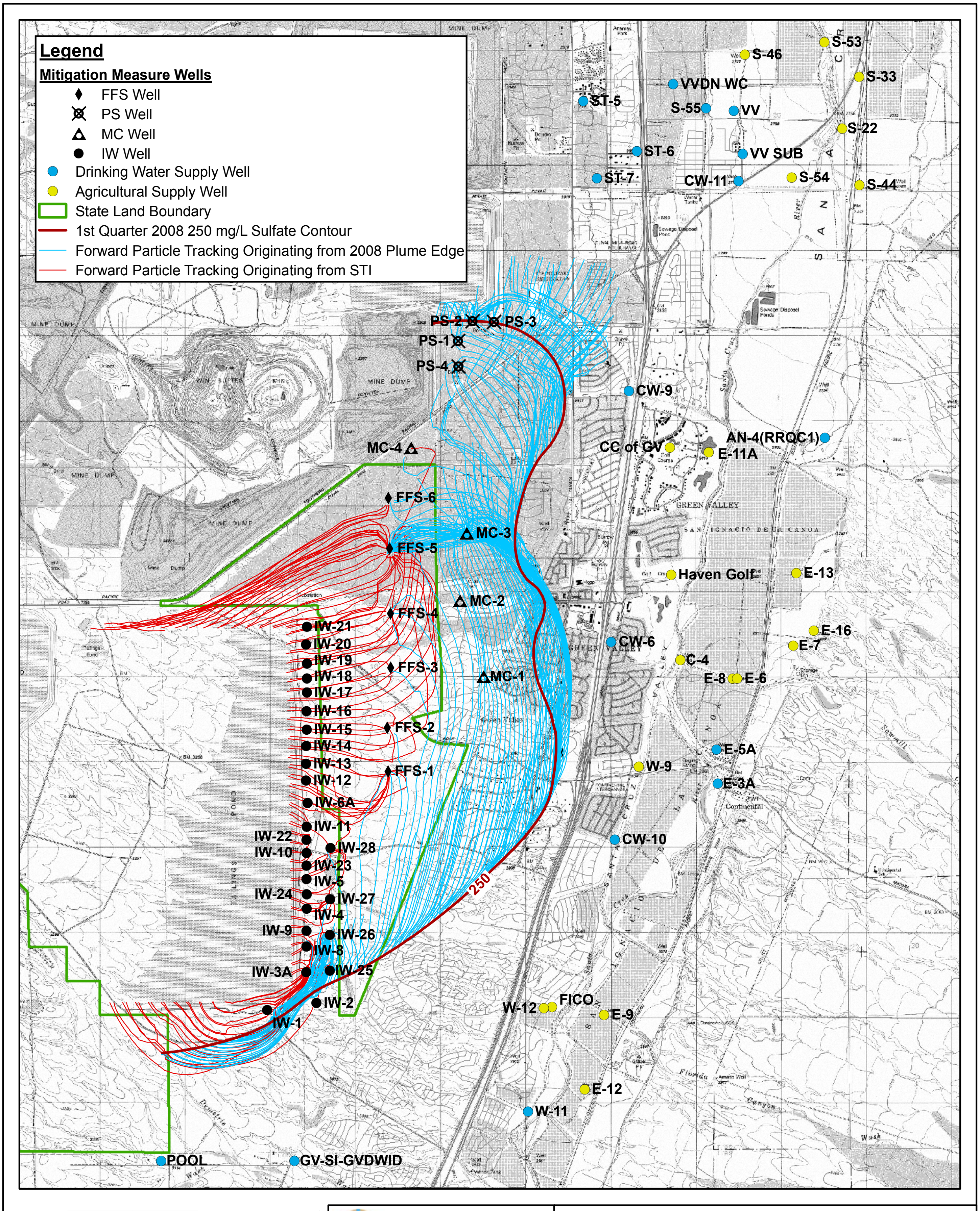
PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2060 FOR STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200036G	B 6

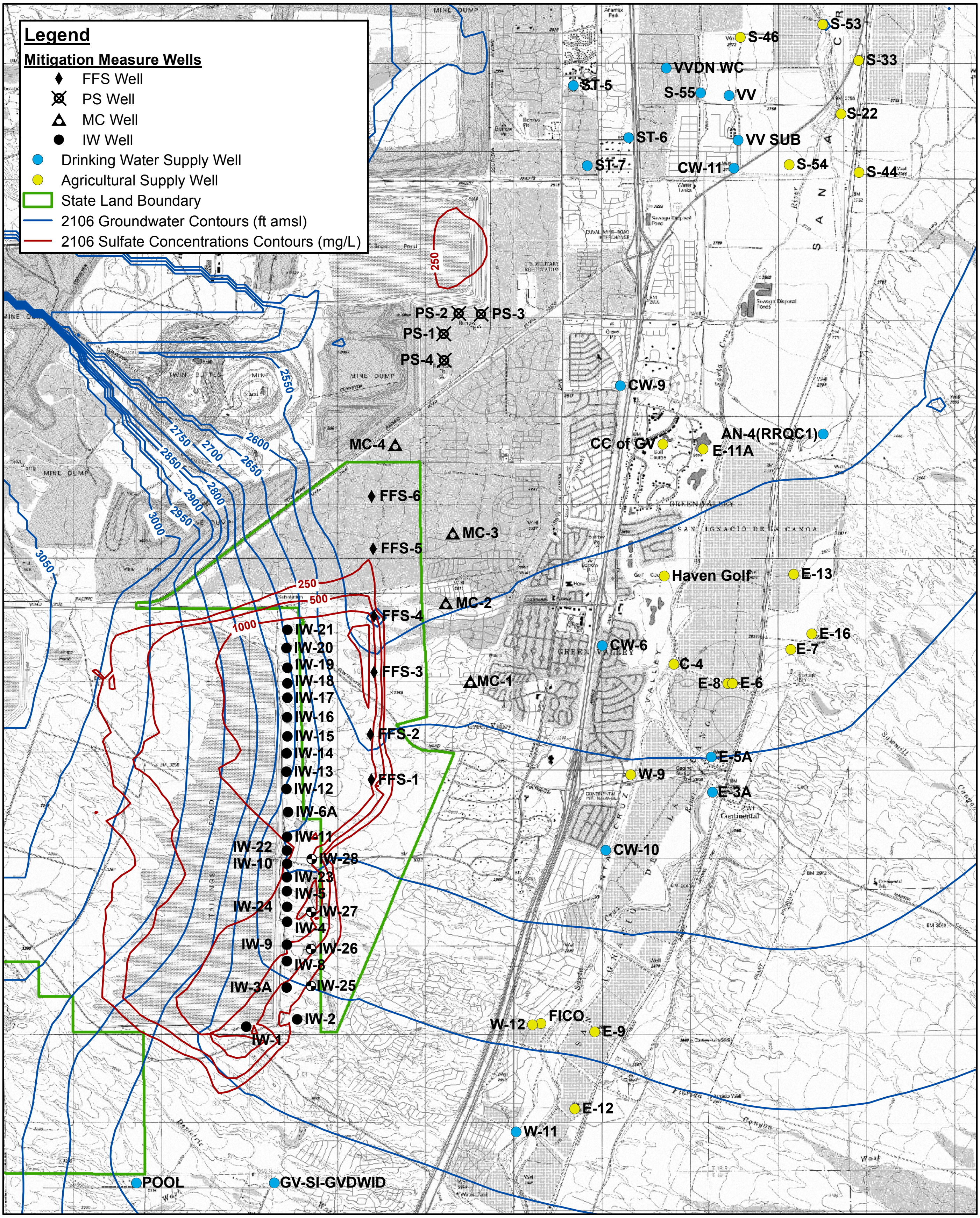


PROJECTION: UTM Zone 12N NAD83

HYDRO GEO CHEM, INC.

PARTICLE TRACKS FROM STI AND 2008 PLUME EXTENT, 2008 TO 2060 STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200039G	B.7



0 2500 5000 Feet

PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2106 FOR STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200038G	B.8

APPENDIX C

WELLFIELD SIMULATION RESULTS FOR NON-STATE LAND OPTION

TABLE OF CONTENTS

TABLE

FIGURES

TABLE

TABLE C.1
Pumping Wells and Rates for Predictive Simulation of Non-State Land Option

Well NAME	ADWR Well Registration (55-)	UTM83E(m)	UTM83N(m)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
														FREEPORT-MCMORAN SIERRITA INC. (Annual Average Pumping in Gallons Per Minute)															
FFS-1	Future	498941	3524778	0	0	0	0	0	0	0	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
FFS-2	Future	499000	3525189	0	0	0	0	0	0	0	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
FFS-3	Future	498969	3525722	0	0	0	0	0	0	0	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
FFS-4	Future	498919	3526560	0	0	0	0	0	0	0	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850
FFS-5	Future	498907	3527336	0	0	0	0	0	0	0	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
FFS-6	Future	498597	3527872	0	0	0	0	0	0	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
IW1	623129	496906	3521278	327	298	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
IW10	508237	497370	3523122	353	350	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	250	250
IW11	508235	497371	3523429	377	363	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	250	250
IW12	545555	497365	3523970	166	154	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	75	75
IW13	545556	497364	3524167	26	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW14	545557	497367	3524373	89	81	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
IW15	545558	497373	3524567	46	49	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
IW16	545559	497371	3524783	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW17	545560	497374	3525003	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW18	545561	497374	3525170	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW19	545562	497374	3525343	154	206	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	100	100
IW20	545563	497365	3525569	44	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW21	545564	497375	3525773	159	148	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	75	75
IW22	200554	497370	3523274	337	352	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	40	40	40	40	40	40	40
IW23	200555	497369	3522971	193	164	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
IW24	200556	497372	3522634	77	142	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IW-25	Future	497643	3521741	0	0	0	0	0	400	400	400	400	400	400	400	400	400	300	300	300	300	300	300	300	300	300	300	300	300
IW-26	Future	497644	3522160	0	0	0	0	0	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
IW-27	Future	497647	3522578	0	0	0	0	0	400	400	400	400	400	400	400	400	400	400	400	400	400	400	300	300	300	300	300	300	300
IW-28	Future	497652	3523177	0	0	0	0	0	400	400	400	400	400	400	400	400	400	400	400	400	400	400	200	200	200	200	200	200	200
IW2A	216464	497469	3521338	473	409	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
IW3A	201732	497366	3521723	722	650	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
IW4	623132	497372	3522466	210	122	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
IW5	623133	497370	3522815	103	93	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
IW6A	545565	497381	3523709	133	95	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	50	50
IW8	508238	497368	3522021	440	423	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
IW9	508236	497370	3522208	214	266	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
MC-1	Future	499448	3525189	0	0	0	0	0	0	0	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	0	0
MC-2	Future	499171	3526077	0	0	0	0	0	0	0	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	0	0
PS-1	Future	499148	3529128	0	0	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	750	750
PS-2	Future	499318	3529357	0	0	0	0	0	0	0	600	600	600	600	600	600	600	450	450	450	450	450	450	450	450	450	450	450	450
PS-3	Future	499570	3529350	0	0	0	0	0	0	0	600	600	600	600	600	600	600	450	450	450	450	450	450	450	450	450	450	0	0
PS-4	Future	499153	3528830	0	0	0	0	0	0	0	500	500	500	500	500	500	500	500	500	500	500	500	800	800	800	800	800	950	950
S1	623111	499931	3518793	1431	1867	1447	1675	1675	1462	1462	192	192	192	192	192	192	192	245	245	245	245	245	283	283	283	283	283	601	601
S2	623112	499133	3517459	1515	1609	1344	1675	1675	1462	1462	192	192	192	192	192	192	192	245	245	245	245	245	283	283	283	283	283	601	601
S3	623113	498136	3516037	1804	1853	1722	1675	1675	1462	1462	192	192	192	192	192	192	192	245	245	245	245	245	283	283	283	283	283	601	601
S4	623114	497344	3514807	2067	2451	2245	2518	2518	2198	2198	288	288	288	288	288	288	288	368	368	368	368	368	425	425	425	425	425	903	903
S5	623115	496561	3513401	2633	2482	2737	2531	2531	2209	2209	290	290	290	290	290	290	290	370	370	370	370	370	427	427	427	427	427	908	908
S6	623116	496371	3511992	2370	2133	2482	2518	2518	2198	2198	288	288	288	288	288	288	288	368	368	368	368	368	425	425	425	425	425	903	903

TABLE C.1
Pumping Wells and Rates for Predictive Simulation of Non-State Land Option

Well ID	Reg. No.	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
												FREEPORT-MCMORAN SIERRITA INC. (Annual Average Pumping in Gallons Per Minute)																	
FFS-1	Future	900	900	900	900	900	900	900	900	900	900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FFS-2	Future	900	900	900	900	900	900	900	900	900	900	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
FFS-3	Future	900	900	900	900	900	900	900	900	900	900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FFS-4	Future	850	850	850	850	850	850	850	850	850	850	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
FFS-5	Future	900	900	900	900	1100	1100	1100	1100	1100	1100	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
FFS-6	Future	1000	1000	1000	1000	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
IW1	623129	250	250	250	188	188	188	188	188	188	188	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
IW10	508237	250	250	250	250	250	250	250	250	250	250	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IW11	508235	250	250	250	250	250	250	250	250	250	250	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IW12	545555	75	75	75	75	75	75	75	75	75	75	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
IW13	545556	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW14	545557	75	75	75	50	50	50	50	50	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW15	545558	50	50	50	40	40	40	40	40	40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW16	545559	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW17	545560	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW18	545561	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW19	545562	100	100	100	100	100	100	100	100	100	100	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
IW20	545563	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW21	545564	75	75	75	75	75	75	75	75	75	75	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
IW22	200554	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
IW23	200555	150	150	150	125	125	125	125	125	125	125	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
IW24	200556	100	100	100	75	75	75	75	75	75	75	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
IW-25	Future	300	300	300	300	300	300	300	300	300	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW-26	Future	400	400	400	400	400	400	400	400	400	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW-27	Future	300	300	300	300	300	300	300	300	300	300	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
IW-28	Future	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
IW2A	216464	425	425	425	325	325	325	325	325	325	325	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
IW3A	201732	500	500	500	400	400	400	400	400	400	400	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
IW4	623132	80	80	80	60	60	60	60	60	60	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW5	623133	90	90	90	70	70	70	70	70	70	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW6A	545565	50	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IW8	508238	425	425	425	325	325	325	325	325	325	325	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
IW9	508236	250	250	250	188	188	188	188	188	188	188	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
MC-1	Future	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MC-2	Future	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS-1	Future	750	750	750	750	750	750	750	750	750	750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS-2	Future	450	450	450	450	400	400	400	400	400	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS-3	Future	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS-4	Future	950	950	950	950	950	950	950	950	950	950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S1	623111	601	601	601	680	740	740	740	740	740	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S2	623112	601	601	601	680	740	740	740	740	740	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S3	623113	601	601	601	680	740	740	740	740	740	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S4	623114	903	903	903	1023	1113	1113	1113	1113	1113	1113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S5	623115	908	908	908	1028	1119	1119	1119	1119	1119	1119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S6	623116	903	903	903	1023	1113	1113	1113	1113	1113	1113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE C.1
Pumping Wells and Rates for Predictive
Simulation of Non-State Land Option

Well NAME	ADWR Well Registration (55-)	UTM83E(m)	UTM83N(m)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
				ALL OTHER WELLS (Annual Average Pumping in Gallons Per Minute)																									
201058	201058	506980	3532009	3	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Amado	623888	495913	3511786	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
AN-4(RRQC1)	608521	503457	3527990	458	358	408	319	327	335	343	350	358	366	374	382	390	398	408	418	427	437	447	457	467	477	486	496	496	496
C4	624010	501760	3525384	1125	1090	1107	1066	1059	1052	1045	1038	1031	1024	1017	1010	1003	996	977	958	939	921	902	883	864	845	826	808	808	808
CCofGV	501760	501635	3527876	121	81	101	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
CCofGV(CW-5)	627484	501234	3522497	301	340	321	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330
ContSD39	601769	504049	3522942	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cox	604432	508795	3534015	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CW10	207982	500975	3523255	767	564	765	920	935	951	967	983	999	1010	1021	1033	1044	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055
CW11	608518	502442	3530984	0	669	765	920	935	951	967	983	999	1010	1021	1033	1044	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055
CW12	Future	500249	3523080	0	0	0	0	43	86	130	173	216	259	302	346	389	432	437	442	448	453	458	463	468	474	479	484	484	484
CW6	627485	500891	3525794	155	204	385	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW6r	Future	501123	3526046	0	0	0	484	490	495	501	507	513	519	525	531	537	543	549	556	562	569	575	582	588	595	601	608	608	608
CW8	543600	499799	3525661	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW9	588121	501072	3528741	352	227	550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW9r	Future	501233	3528673	0	0	0	484	490	495	501	507	513	519	525	531	537	543	549	556	562	569	575	582	588	595	601	608	608	608
Davis	621257	506996	3533678	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Duckett	800365	508809	3533012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E10A	86931	502452	3523995	0	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
E11A	624018	502092	3527822	515	504	509	490	487	484	480	477	474	471	468	464	461	458	449	441	432	423	415	406	397	389	380	371	371	371
E12	624019	500635	3520347	38	0	19	18	18	18	18	18	18	18	18	17	17	17	17	17	16	16	16	15	15	15	14	14	14	14
E13	624020	503122	3526403	80	156	118	114	113	112	111	111	110	109	109	108	107	106	104	102	100	98	96	94	92	90	88	86	86	86
E15	624022	500333	3518794	739	789	764	735	730	726	721	716	711	706	702	697	692	687	674	661	648	635	622	609	596	583	570	557	557	557
E16	624023	503328	3525727	539	566	553	532	529	525	522	518	515	511	508	504	501	497	488	478	469	460	450	441	431	422	413	403	403	403
E3A	624011	502198	3523933	551	566	558	537	534	530	527	523	520	516	513	509	506	502	493	483	474	464	455	445	436	426	417	407	407	407
E5A	624012	502184	3524332	187	145	166	160	159	158	157	156	155	154	152	151	150	149	147	144	141	138	135	132	130	127	124	121	121	121
E6	624013	502425	3525169	497	484	491	472	469	466	463	460	457	454	451	448	444	441	433	425	416	408	400	391	383	375	366	358	358	358
E7	624014	503086	3525553	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E8	624015	502374	3525166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E9	624016	500862	3521222	86	0	43	42	41	41	41	40	40	40	40	39	39	39	38	37	37	36	35	34	34	33	32	32	32	32
ESP1	623102	499970	3526449	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP2	623103	500242	3526925	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP3	623104	500234	3527377	96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP4	623105	499917	3526133	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FICO543409	543409	500252	3521313	0	331	165	159	158	157	156	155	154	153	152	151	150	149	146	143	140	138	135	132	129	126	123	121	121	121
Grant	801401	496059	3518416	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GV1	603428	499813	3522254	687	641	664	695	700	704	709	713	718	722	727	731	736	740	743	745	747	750	752	754	757	759	761	764	764	764
GV2	603429	499786	3521654	312	301	307	328	331	333	335	337	339	341	343	345	347	350	351	352	353	354	355	356	357	358	359	361	361	361
GVDWID-Canoa	586729	497325	3516610	303	320	311	328	331	333	335	337	339	341	343	345	347	350	351	352	353	354	355	356	357	358	359	361	361	361
GVDWID-SI	208825	497227	3519510	553	556	555	580	583	587	591	595	598	602	606	609	613	617	619	622	624	626	628	631	633	635	638	640	640	640
GVINV_625711	625711	501568	3526181	363	340	352	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328
GVINV_625712	625712	501600	3526400	140	161	150	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141
Hoogerwerk_RL	601910	509871	3532610	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I10	608525	497798	3528469	30	10	20	19	19	19	19	19	19	19	18	18	18	18	18	17	17	17	16	16	16	15	15	15	15	15
Kiewit	583888	504190	3530600	181	115	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
Lamb	628534	505340	3535044	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lawyers	608599	504207	3527782	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LosArboles	524178	502573	3533448	37	7	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
NP2	624028	500929	3519541	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
OcotilloCommunity	801309	498963	3511412	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Olivas	801154	503396	3531213	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PimaCoCanoaRanch	623128	498467	3517655	0	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pollux1	213787	504871	3514658	6	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Poole	801975	495659	3519508	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
QCWC_No11	608597	505964	3526918	99	92	96	78	80	82	84	86	88	90	92	94	96	98	100	102	105	107	110	112	115	117	119	122	122	122

TABLE C.1
Pumping Wells and Rates for Predictive
Simulation of Non-State Land Option

ALL OTHER WELLS
(Annual Average Pumping in Gallons Per Minute)

Well ID	Reg. No.	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
201058	201058	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Amado	623888	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
AN-4(RRQC1)	608521	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496	496
C4	624010	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808	808
CCofGV	501760	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
CCofGV(CW-5)	627484	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330
ContSD39	601769	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cox	604432	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CW10	207982	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055
CW11	608518	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055	1055
CW12	Future	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484
CW6	627485	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW6r	Future	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608
CW8	543600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW9	588121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CW9r	Future	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608	608
Davis	621257	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Duckett	800365	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E10A	86931	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E11A	624018	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371
E12	624019	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
E13	624020	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86
E15	624022	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557	557
E16	624023	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403	403
E3A	624011	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407
E5A	624012	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
E6	624013	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358	358
E7	624014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E8	624015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E9	624016	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
ESP1	623102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP2	623103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP3	623104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESP4	623105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FICO543409	543409	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
Grant	801401	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GV1	603428	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764
GV2	603429	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361
GVDWID-Canoa	586729	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361
GVDWID-SI	208825	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640
GVINV_625711	625711	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328
GVINV_625712	625712	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141
Hoogerwerk_RL	601910	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I10	608525	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Kiewit	583888	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
Lamb	628534	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lawyers	608599	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LosArboles	524178	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
NP2	624028	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
OcotilloCommunity	801309	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Olivas	801154	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PimaCoCanoaRanch	623128	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pollux1	213787	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Poole	801975	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
QCWC_No11	608597	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122

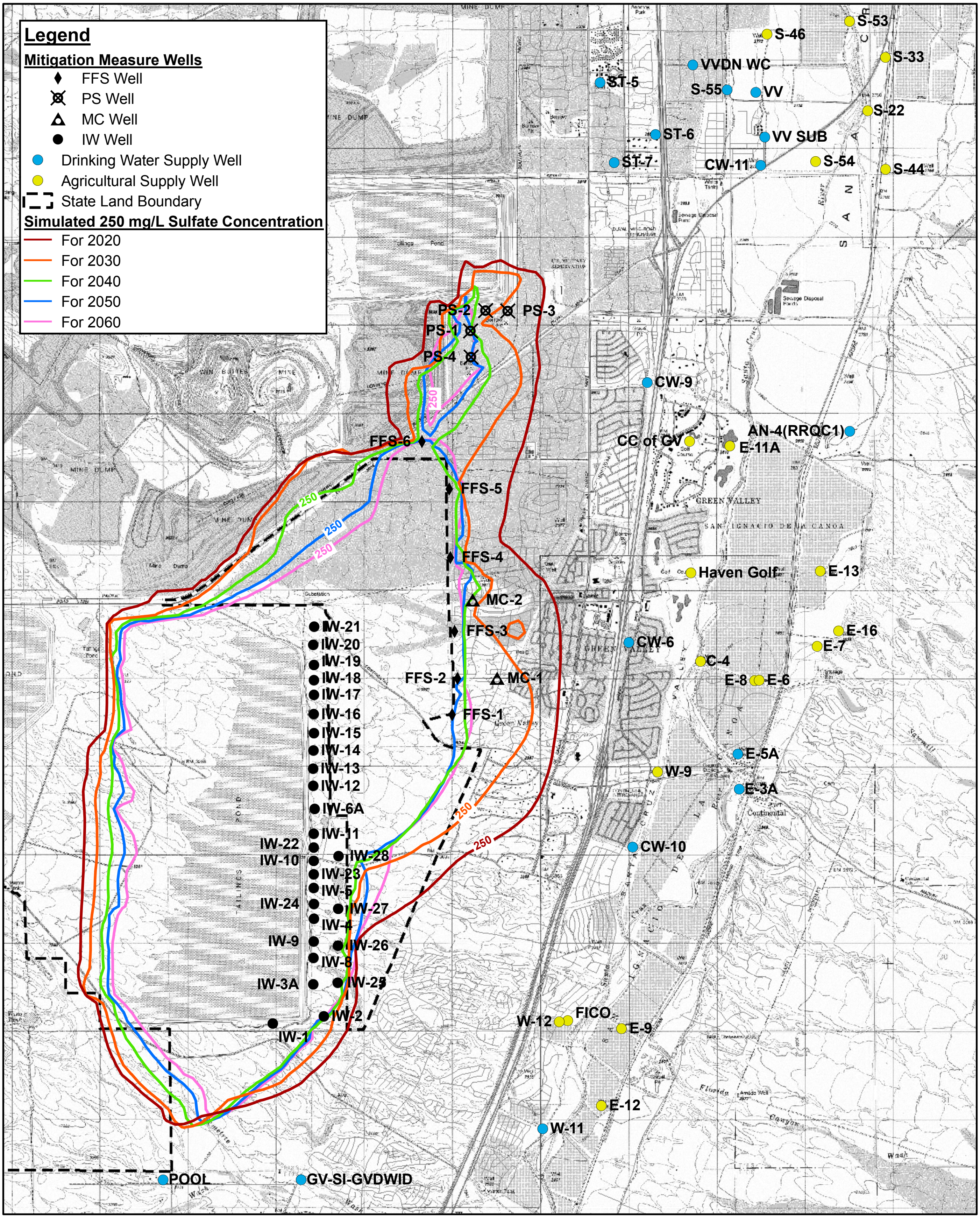
TABLE C.1
Pumping Wells and Rates for Predictive Simulation of Non-State Land Option

Well NAME	ADWR Well Registration (55-)	UTM83E(m)	UTM83N(m)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
ALL OTHER WELLS (Annual Average Pumping in Gallons Per Minute)																													
QCWC_No13	608522	504788	3528380	218	312	265	205	210	215	220	225	230	235	240	245	250	255	262	268	274	280	287	293	299	306	312	318	318	318
QCWC_No16	608598	506962	3526858	0	8	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
RanchoSonado	507495	496705	3510791	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
Rosemont1	214277	505997	3535073	1	0	0	0	0	0	0	0	0	0	0	0	0	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont2	216391	508421	3533513	4	0	0	0	0	0	0	0	0	0	0	0	0	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont3	Future	505653	3535164	0	0	0	0	0	0	0	0	0	0	0	0	0	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont4	Future	505648	3534962	0	0	0	0	0	0	0	0	0	0	0	0	0	929	929	929	929	929	929	929	929	929	929	929	929	929
RT1	504946	499811	3530971	43	75	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
S12	623981	505183	3535660	927	835	881	848	842	837	831	826	820	814	809	803	798	792	777	762	747	732	717	702	687	672	657	642	642	642
S19	623982	504841	3532023	876	846	861	829	823	818	812	807	802	796	791	785	780	774	760	745	731	716	701	687	672	657	643	628	628	628
S22	623983	503660	3531621	424	326	375	361	358	356	354	351	349	347	344	342	340	337	331	324	318	312	305	299	293	286	280	273	273	273
S25	623985	503037	3533248	1004	881	942	907	901	895	889	883	877	871	865	859	853	847	831	815	799	783	767	751	735	719	703	687	687	687
S29	623986	503806	3535671	455	434	444	427	425	422	419	416	414	411	408	405	402	400	392	384	377	369	362	354	347	339	332	324	324	324
S31	623987	505995	3537476	108	183	146	140	139	138	137	136	136	135	134	133	132	131	129	126	124	121	119	116	114	111	109	106	106	106
S33	623988	503859	3532226	432	403	418	402	399	397	394	391	389	386	384	381	378	376	369	362	354	347	340	333	326	319	312	305	305	305
S40	623991	505004	3534851	712	668	690	664	659	655	651	646	642	638	633	629	625	620	609	597	585	574	562	550	538	527	515	503	503	503
S43	623993	503813	3537068	560	491	526	506	502	499	496	493	489	486	483	479	476	473	464	455	446	437	428	419	410	401	392	383	383	383
S44	623994	503859	3530811	1045	1041	1043	1003	997	990	984	977	971	964	957	951	944	938	920	902	885	867	849	831	814	796	778	760	760	760
S45	623995	504834	3532831	1149	1258	1204	1158	1151	1143	1136	1128	1120	1113	1105	1098	1090	1083	1062	1042	1021	1001	980	960	939	919	898	878	878	878
S46	623996	502647	3532239	748	628	688	662	658	654	649	645	641	636	632	628	623	619	607	596	584	572	560	549	537	525	514	502	502	502
S48	623997	504987	3537067	486	403	444	427	425	422	419	416	413	411	408	405	402	399	392	384	377	369	362	354	347	339	331	324	324	324
S49	623998	504793	3538083	305	336	320	308	306	304	302	300	298	296	294	292	290	288	283	277	272	266	261	255	250	245	239	234	234	234
S50	623999	504991	3538695	163	152	157	152	151	150	149	148	147	146	145	144	143	142	139	136	134	131	128	126	123	120	118	115	115	115
S51	624000	503017	3535471	927	901	914	879	874	868	862	856	851	845	839	833	828	822	806	791	775	760	744	729	713	698	682	666	666	666
S52	624001	504790	3535663	246	302	274	263	262	260	258	257	255	253	251	250	248	246	242	237	232	228	223	218	214	209	204	200	200	200
S52A	534992	504806	3534853	36	33	34	33	33	33	32	32	32	32	32	31	31	31	30	30	29	29	28	27	27	26	26	25	25	25
S53	624002	503453	3532635	1175	1154	1164	1120	1113	1106	1098	1091	1084	1076	1069	1062	1054	1047	1027	1007	988	968	948	928	908	889	869	849	849	849
S54	624003	503069	3531047	1109	984	1046	1007	1000	994	987	981	974	967	961	954	948	941	923	906	888	870	852	834	817	799	781	763	763	763
S55	624004	502062	3531858	1169	1117	1143	1100	1093	1085	1078	1071	1064	1057	1050	1042	1035	1028	1009	989	970	950	931	911	892	872	853	834	834	834
S56	624005	505213	3534443	296	302	299	287	285	284	282	280	278	276	274	272	270	269	264	258	253	248	243	238	233	228	223	218	218	218
SAH-2B	211809	500959	3534907	0	8	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sahuarita	611142	506745	3536662	16	21	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Sahuarita2	534039	502953	3538272	235	247	275	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
SahVal_WC	607626	503052	3536369	19	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
SC23A	619897	506943	3538481	397	119	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258
SC24A	619898	507953	3538486	438	267	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352
ST5	608531	500619	3531941	8	43	25	30	31	31	31	32	32	32	33	33	34	34	34	34	34	34	34	34	34	34	34	34	34	34
ST6	608530	501248	3531353	12	19	16	15	15	16	16	16	16	16	16	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
ST7	566940	500778	3531036	315	259	287	333	337	341	345	349	353	357	361	366	370	374	374	374	374	374	374	374	374	374	374	374	374	374
StateLand	Future	506015	3533579	0	0	0	0	31	62	93	124	155	186	217	248	279	310	361	412	463	514	565	617	668	719	770	821	821	821
SUS	605344	501863	3535970	75	79	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77
SWC_1	611144	502752	3537471	667	670	1369	1369	1392	1416	1439	1462	1485	1508	1531	1554	1577	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
SWC_3	Future	501134	3537343	0	0	31	31	128	225	322	419	516	613	709	806	903	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SWC_4	Future	501983	3534401	0	0	0	0	71	142	213	284	354	425	496	567	638	709	735	762	788	815	841	868	894	920	947	973	973	973
SWC_5	Future	501134	3534401	0	0	0	0	71	142	213	284	354	425	496	567	638	709	735	762	788	815	841	868	894	920	947	973	973	973
SWC_6	Future	501558	3537343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97	195	292	389	487	584	681	779	876	973	973	973
TorresBlancas	543409	502409	3521313	0	331	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347
TwinButtes	Future	500455	3530824	0	0	0	104	124	145	166	186	207	227	248	269	289	310	372	434	496	558	620	682	744	806	868	929	929	929
Underdown	626063	496709	3511387	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
ValVerde	803064	502386	3531830	19	4	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
VVDN_WC	602019	501674	3532142	38	41	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
W11	624025	499969	3520085	169	177	173	166	165	164	163	162	161	160	159	158	157	156	153	150	147	144	141	138	135	132	129	126	126	126
W12	624026	500156	3521299	731	710	721	694	689	685	680	676	671	666	662	657	653	648	636	624	612	599	587	575	563	550	538	526	526	526
W9	624024	501271	3524132	566	573	569	548	544	541	537	533	530	526	523	519	516	512	502	493	483	473	464	454	444	435	425	415	415	415

TABLE C.1
Pumping Wells and Rates for Predictive Simulation of Non-State Land Option

Well ID	Reg. No.	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
ALL OTHER WELLS (Annual Average Pumping in Gallons Per Minute)																													
QCWC_No13	608522	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318
QCWC_No16	608598	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
RanchoSonado	507495	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
Rosemont1	214277	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont2	216391	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont3	Future	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
Rosemont4	Future	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
RT1	504946	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
S12	623981	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642	642
S19	623982	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628	628
S22	623983	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273
S25	623985	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687
S29	623986	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324
S31	623987	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106
S33	623988	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305
S40	623991	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503
S43	623993	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383	383
S44	623994	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760
S45	623995	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878	878
S46	623996	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502	502
S48	623997	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324
S49	623998	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234
S50	623999	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
S51	624000	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666
S52	624001	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
S52A	534992	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
S53	624002	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849	849
S54	624003	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763	763
S55	624004	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834	834
S56	624005	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218
SAH-2B	211809	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sahuarita	611142	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Sahuarita2	534039	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
SahVal_WC	607626	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
SC23A	619897	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258
SC24A	619898	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352
ST5	608531	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
ST6	608530	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
ST7	566940	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374	374
StateLand	Future	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821	821
SUS	605344	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77
SWC_1	611144	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
SWC_3	Future	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SWC_4	Future	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973
SWC_5	Future	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973
SWC_6	Future	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973	973
TorresBlancas	543409	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347	347
TwinButtes	Future	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929	929
Underdown	626063	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
ValVerde	803064	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
VVDN_WC	602019	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
W11	624025	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126
W12	624026	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526	526
W9	624024	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415	415

FIGURES



0 2500 5000 Feet

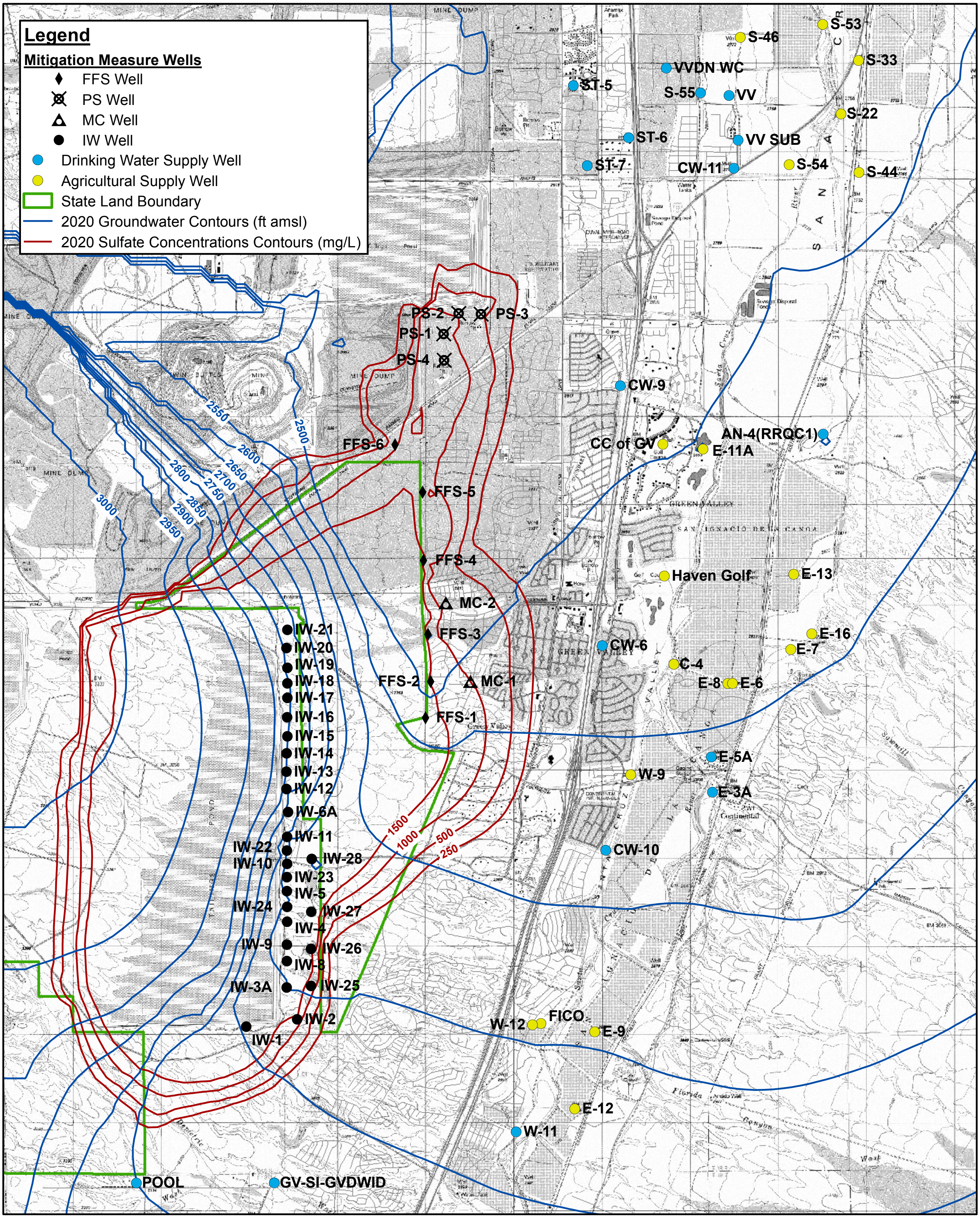
PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SIMULATED EXTENT OF SULFATE PLUME FROM 2020 TO 2060 FOR NON-STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200026G	C.1



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PROJECTION: UTM Zone 12N NAD83

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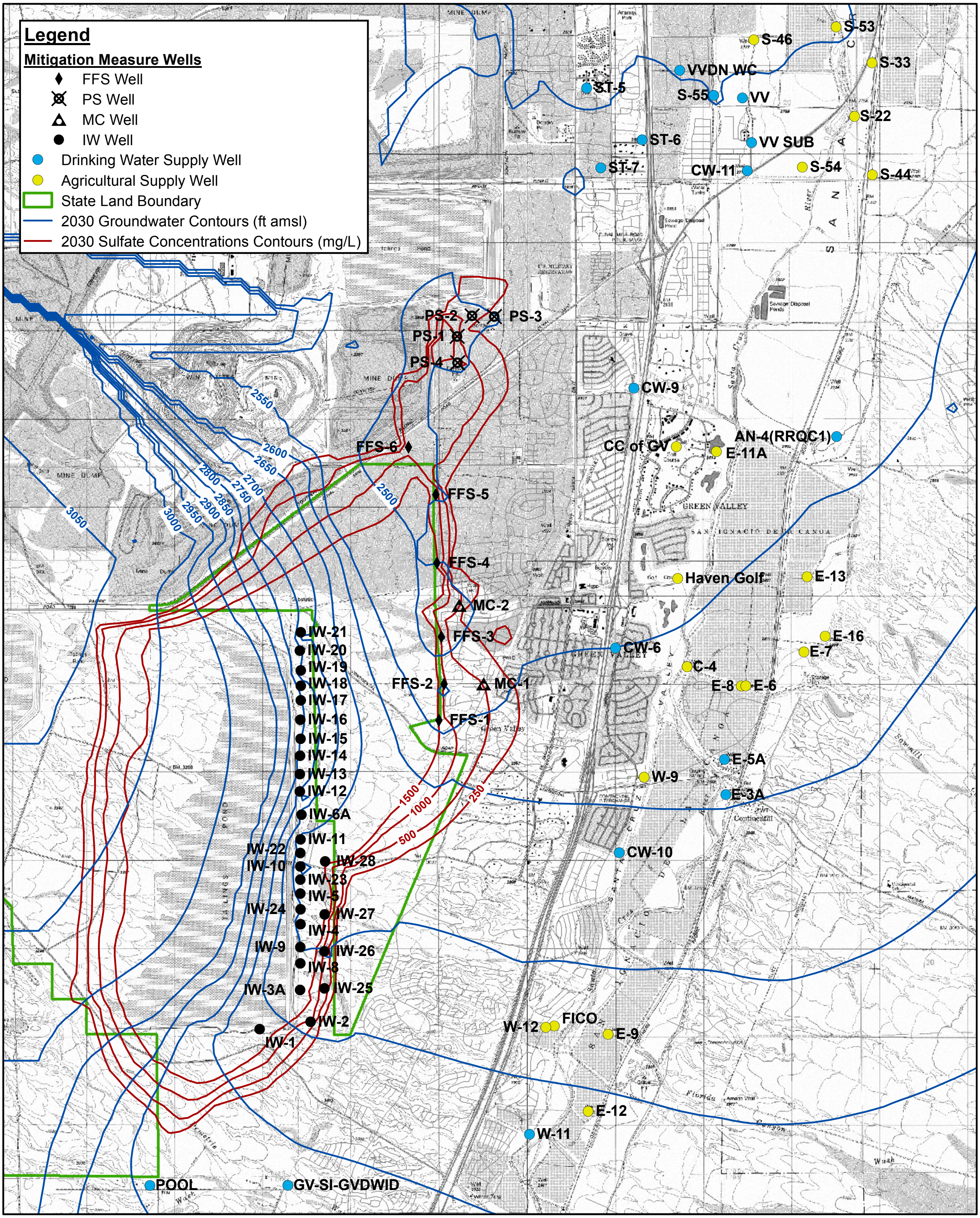
HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2020 FOR NON-STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200021G	C.2



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PROJECTION: UTM Zone 12N NAD83

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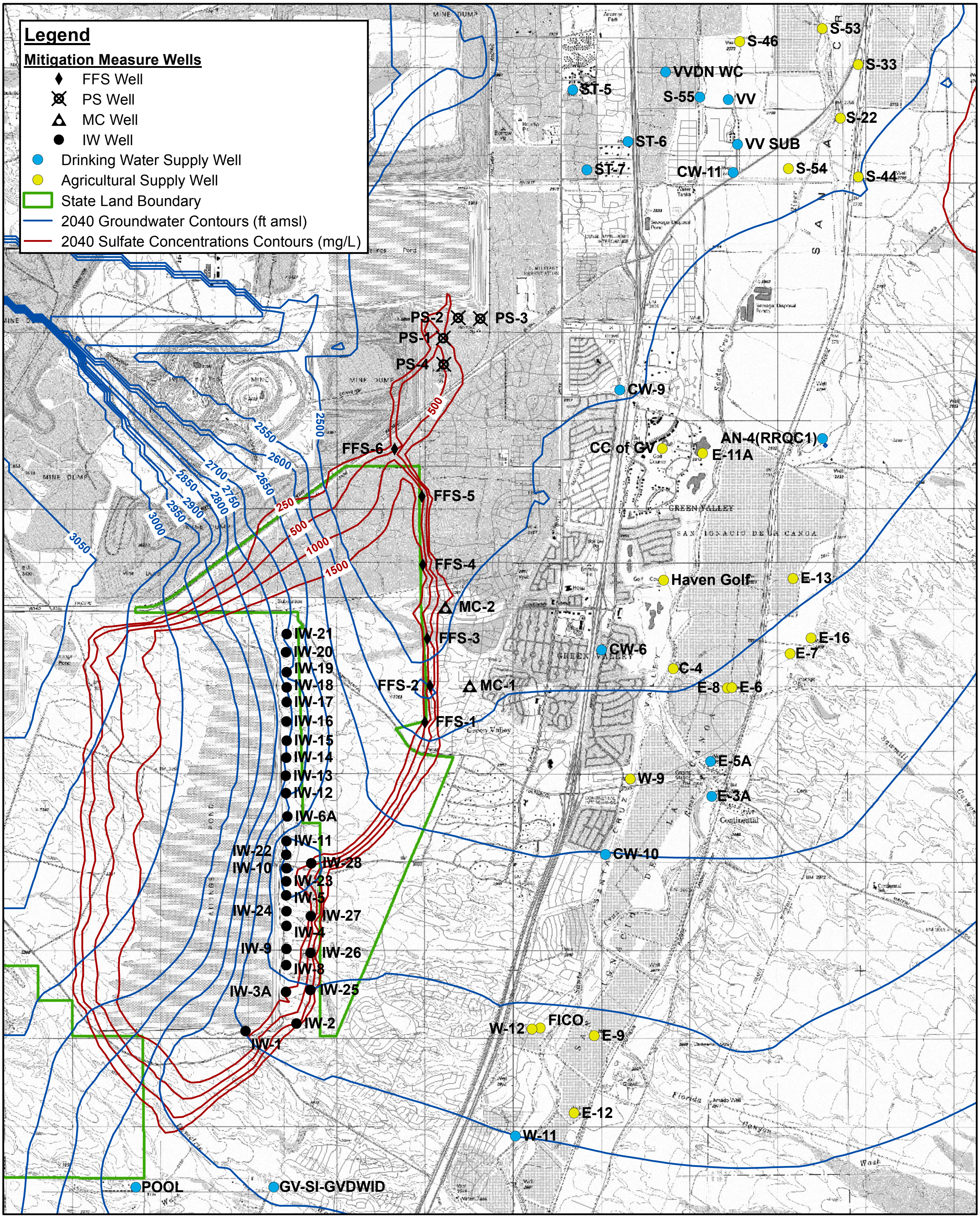
HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2030 FOR NON-STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200022G	C 3



PROJECTION: UTM Zone 12N NAD83

HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2040 FOR NON-STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
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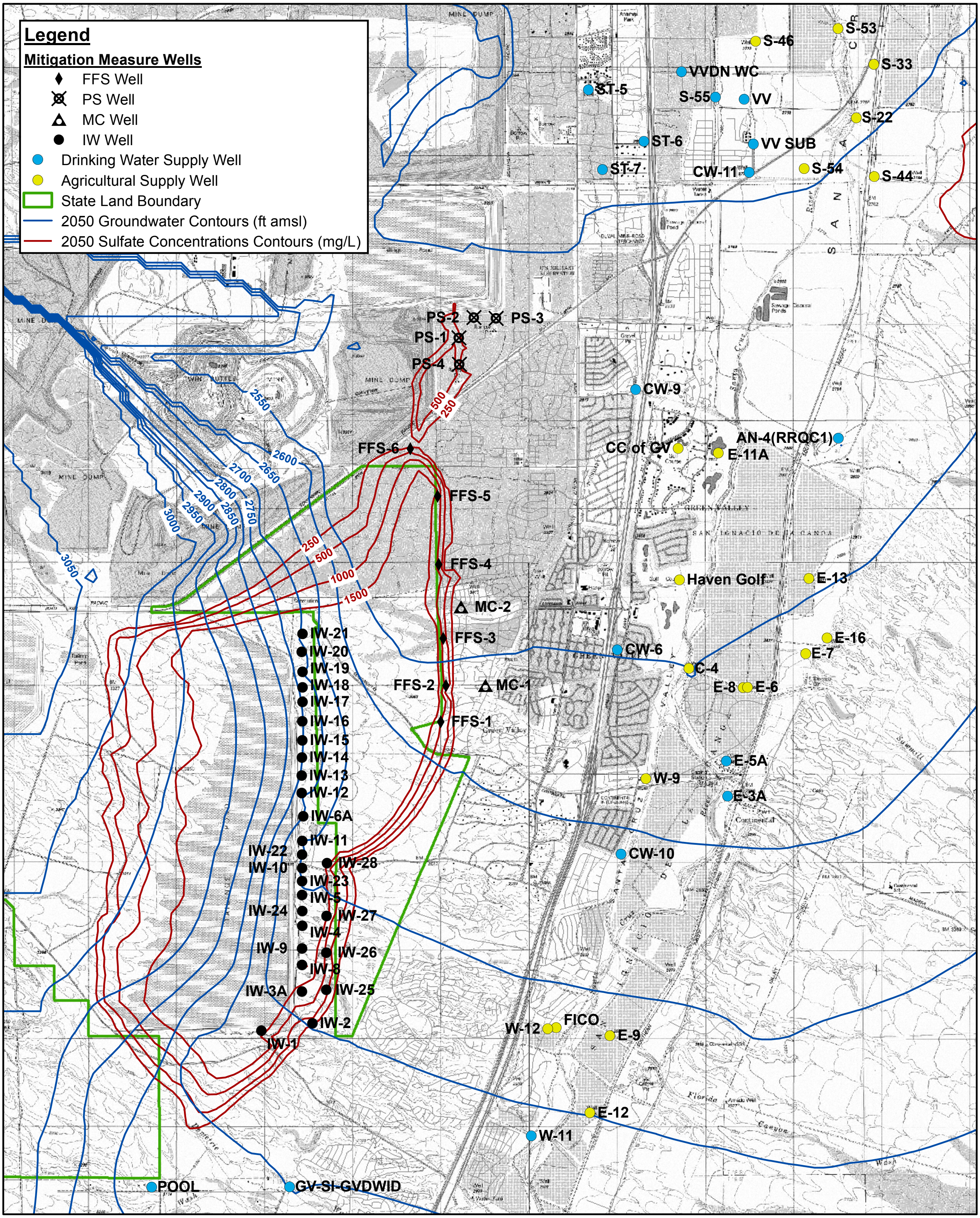

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PROJECTION: UTM Zone 12N NAD83

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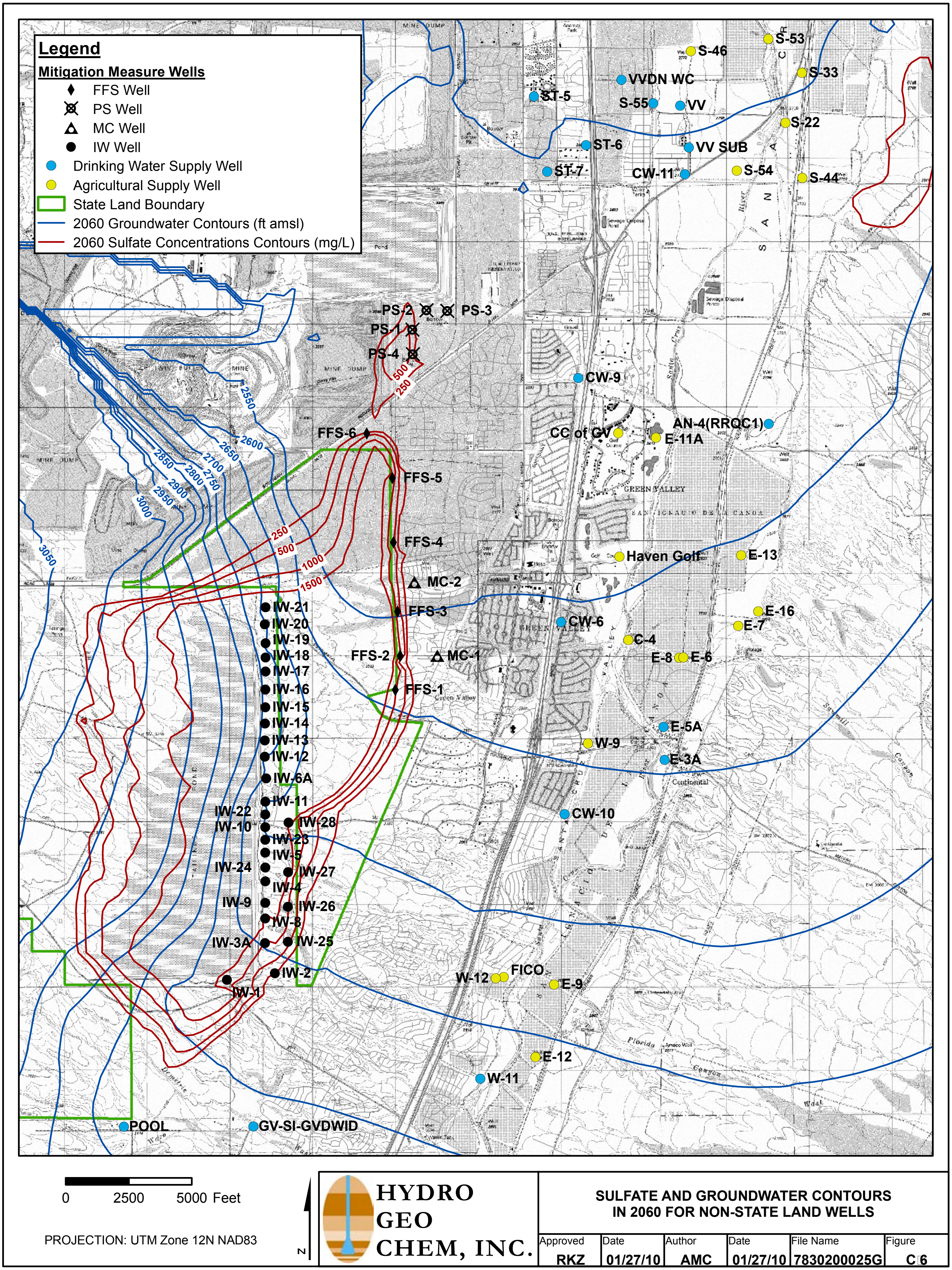
HYDRO GEO CHEM, INC.

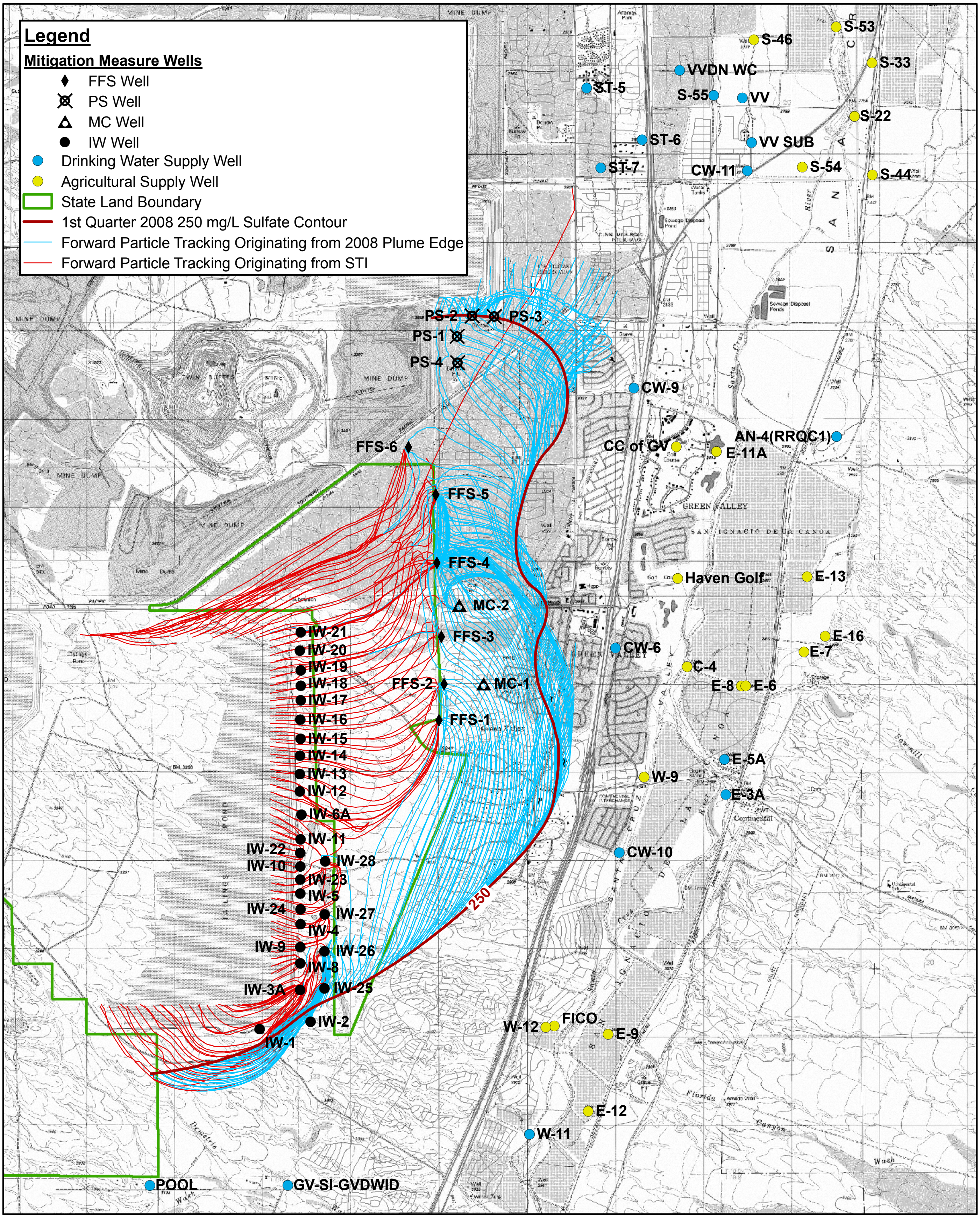
SULFATE AND GROUNDWATER CONTOURS IN 2050 FOR NON-STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200024G	C.5



SULFATE AND GROUNDWATER CONTOURS IN 2060 FOR NON-STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200025G	C 6



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PROJECTION: UTM Zone 12N NAD83

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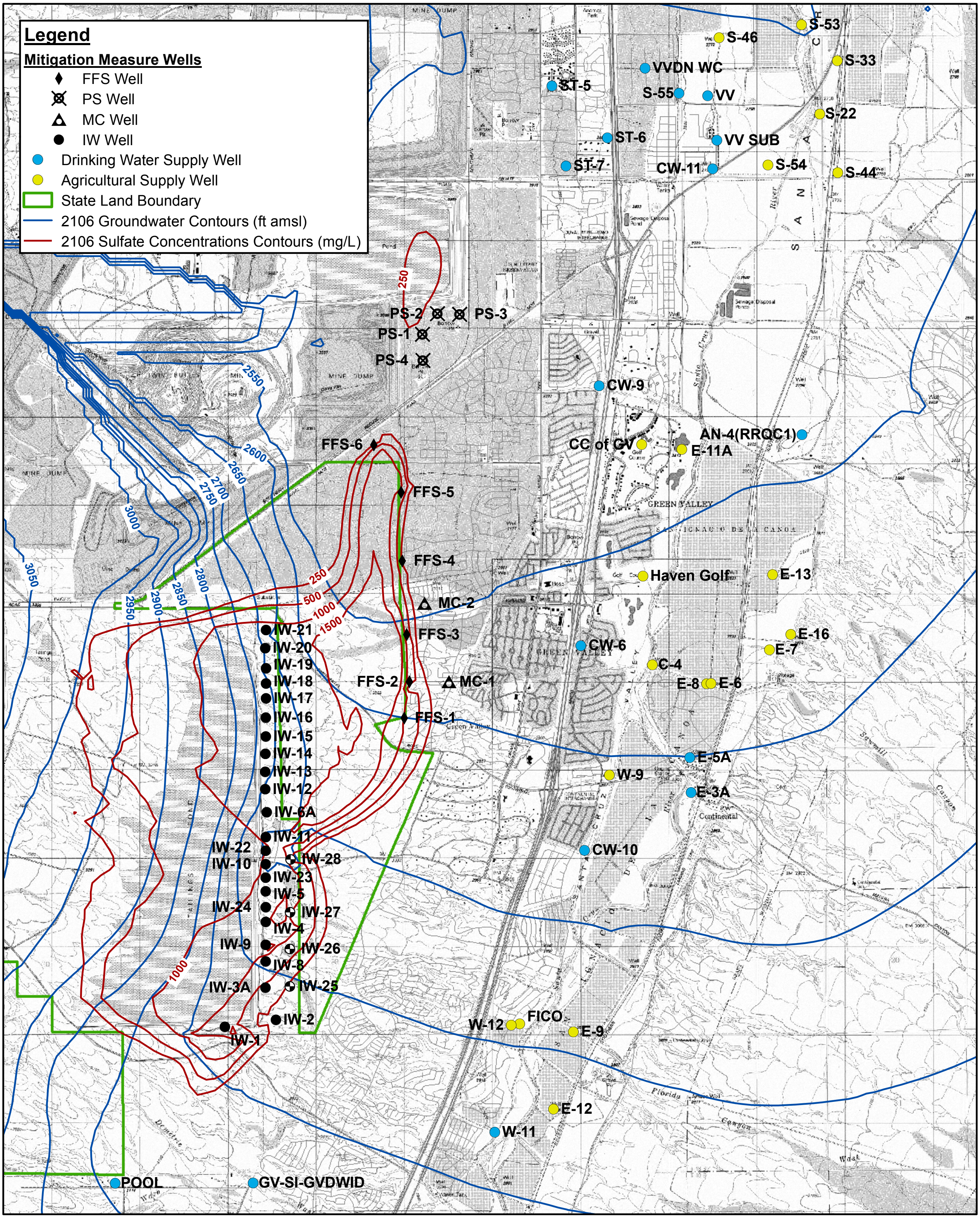
HYDRO GEO CHEM, INC.

PARTICLE TRACKS FROM STI AND 2008 PLUME EDGE–2008 TO 2060 NON-STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200028G	C.7



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PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SULFATE AND GROUNDWATER CONTOURS IN 2106 FOR NON-STATE LAND WELLS

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200029G	C 8

APPENDIX D

PERFORMANCE GOAL SIMULATION RESULTS

TABLE OF CONTENTS

TABLES

FIGURES

1. PERFORMANCE GOALS

Performance goals were identified for the final wellfield conceptual designs for the State Land and Non-State Land Options. As described in the Mitigation Plan, performance goals are estimates of the minimum pumping needed to achieve the groundwater extraction objectives of source control and plume stabilization in the event that the mass removal pumping is reduced.

The performance goals were developed by conducting numerical simulations in which mass capture groundwater pumping at the MC wells was eliminated. Iterative numerical simulations were used to develop the performance goals. First, the minimum pumping needed to accomplish source control was determined. Second, the minimum pumping needed for plume stabilization in addition to source control was determined. Pumping at the performance goal rates is predicted to be adequate to maintain the source control and plume stabilization groundwater extraction objectives. The performance goals are meant as planning tools for the short-term (next 10 to 15 years) in the event that mass capture pumping is reduced. The goals should not be relied on as long-term operating specifications because the assumptions used in their development are expected to change over time and may not be appropriate for future conditions. A reduction of mass capture pumping should be fully evaluated prior to implementation as to its potential impact on plume migration.

1.1 State Land Option

Table D.1 lists performance goal pumping rates for source control and plume stabilization for the State Land Option. Figure D.1 shows the predicted sulfate plume in 2013, 2020, 2030, and 2040 based on pumping at the performance goal rates. Figure D.2 shows the results of particle tracking simulations to evaluate wellfield capture zones under the performance goal pumping rates. The results of sulfate transport and particle tracking simulations indicate that source control and plume stabilization are accomplished under the performance goal pumping rates and model assumptions.

1.2 Non-State Land Option

Table D.2 lists performance goal pumping rates for source control and plume stabilization for the Non-State Land Option. Figure D.3 shows the predicted sulfate plume in 2013, 2020, 2030, and 2040 based on pumping at the performance goal rates. Figure D.4 shows the results of particle tracking simulations to evaluate wellfield capture zones under the performance goal pumping rates. The results of sulfate transport and particle tracking simulations indicate that source control and plume stabilization are accomplished under the performance goal pumping rates and model assumptions.

TABLES

TABLE D.1

Performance Measures Pumping Rates for State Land Option

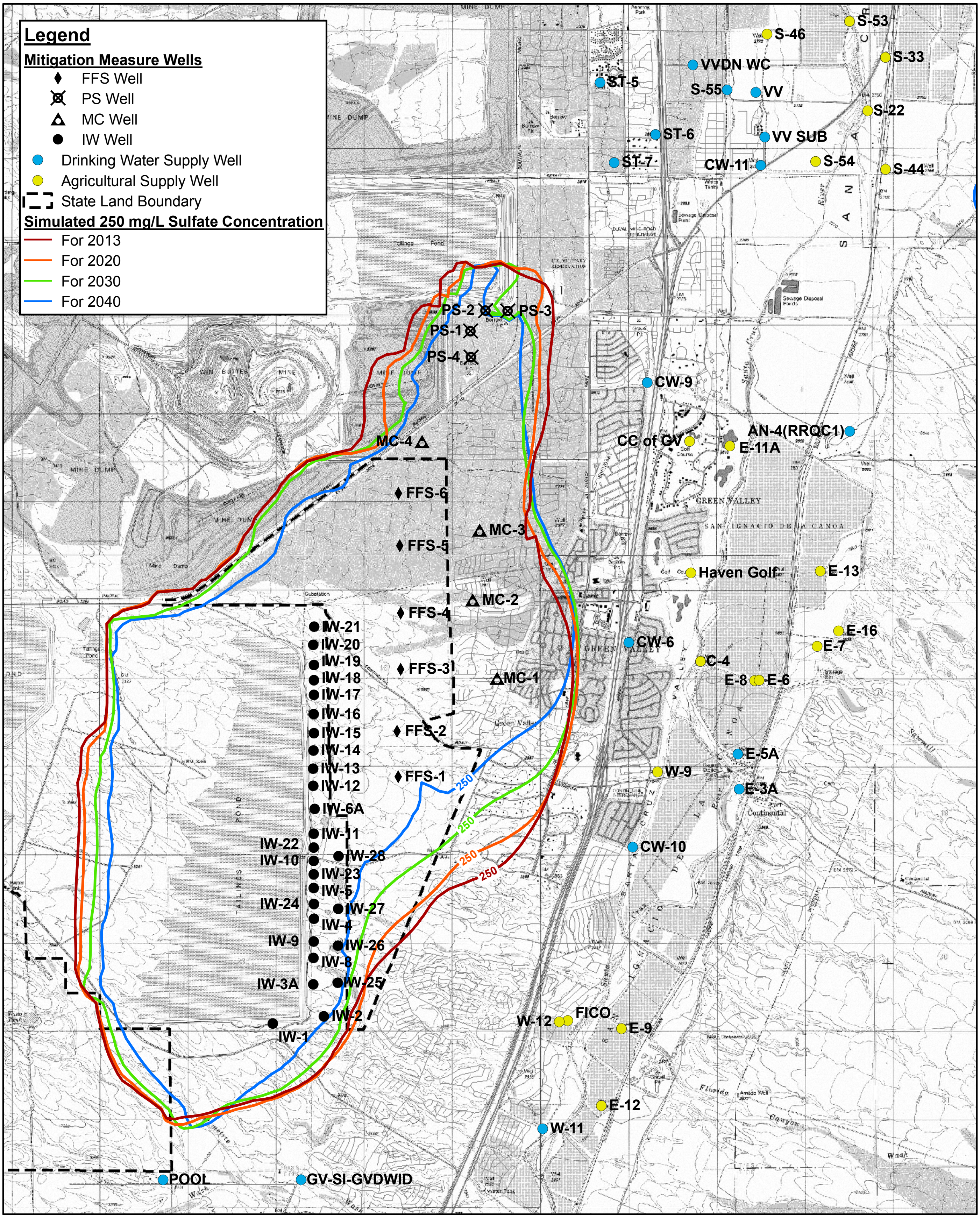
Well Name	UTM Coordinates NAD 83 meters									
	Easting	Northing	2012 to 2014	2014 to 2020	2020 to 2024	2024 to 2025	2025 to 2031	2031 to 2036	2036 to 2043	2043 to 2060
FFS-1	498327	3524076	0	400	400	400	400	400	400	100
FFS-2	498316	3524590	0	500	500	350	350	350	350	100
FFS-3	498357	3525295	0	450	450	350	350	350	350	100
FFS-4	498356	3525930	0	500	500	300	300	300	300	100
FFS-5	498346	3526693	0	550	550	250	250	250	250	100
FFS-6	498330	3527287	0	500	500	300	300	300	300	100
PS-1	499148	3529128	0	750	750	750	1,000	1,000	1,000	200
PS-2	499318	3529357	0	1,000	1,000	1,000	750	750	750	200
PS-3	499570	3529350	0	1,000	750	750	250	250	250	0
PS-4	499153	3528830	0	1,000	1,000	1,000	1,000	1,000	1,000	200
IW-28	497652	3523177	300	300	300	250	250	250	100	100
IW-25	497643	3521741	200	200	200	200	200	0	0	0
IW-26	497644	3522160	200	200	200	200	200	250	150	0
IW-27	497647	3522578	300	300	300	300	300	250	150	0
MC-1	499448	3525189	0	0	0	0	0	0	0	0
MC-2	499171	3526077	0	0	0	0	0	0	0	0
MC-3	499249	3526870	0	0	0	0	0	0	0	0
MC-4	498597	3527872	0	0	0	0	0	0	0	0

TABLE D.2

Performance Measures Pumping Rates for Non-State Land Option

Well Name	UTM Coordinates NAD 83 meters									
	Easting	Northing	2012 to 2014	2014 to 2020	2020 to 2024	2024 to 2025	2025 to 2031	2031 to 2036	2036 to 2043	2043 to 2060
FFS-1	498941	3524778	0	200	200	200	200	200	200	0
FFS-2	499000	3525189	0	200	200	200	200	200	200	0
FFS-3	498969	3525722	0	200	200	200	200	200	200	100
FFS-4	498919	3526560	0	500	500	500	500	500	500	100
FFS-5	498907	3527336	0	700	700	700	700	700	700	300
FFS-6	498597	3527872	0	550	550	550	550	550	550	400
PS-1	499148	3529128	0	750	750	750	1,000	1,000	1,000	200
PS-2	499318	3529357	0	1,000	1,000	1,000	750	750	750	200
PS-3	499570	3529350	0	1,000	750	750	250	250	250	0
PS-4	499153	3528830	0	250	500	500	1,000	1,000	1,000	200
IW-28	497652	3523177	300	300	300	250	250	250	100	100
IW-25	497643	3521741	200	200	200	200	200	0	0	0
IW-26	497644	3522160	200	200	200	200	200	250	150	0
IW-27	497647	3522578	300	300	300	300	300	250	150	0
MC-1	499448	3525189	0	0	0	0	0	0	0	0
MC-2	499171	3526077	0	0	0	0	0	0	0	0

FIGURES



HYDRO GEO CHEM, INC.

SIMULATED SULFATE PLUME WITH PERFORMANCE GOAL PUMPING ONLY STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
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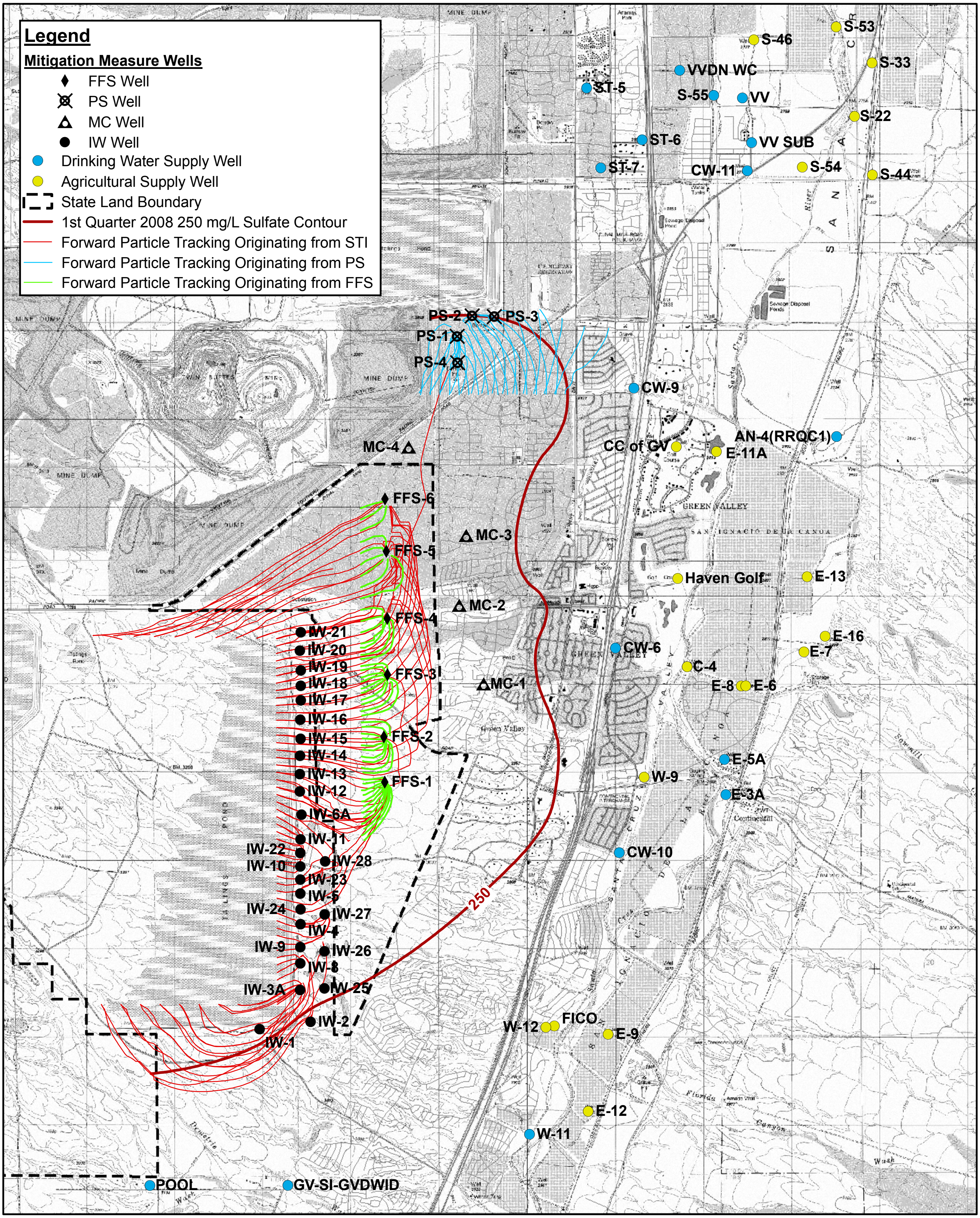

0 2500 5000 Feet

PROJECTION: UTM Zone 12N NAD83

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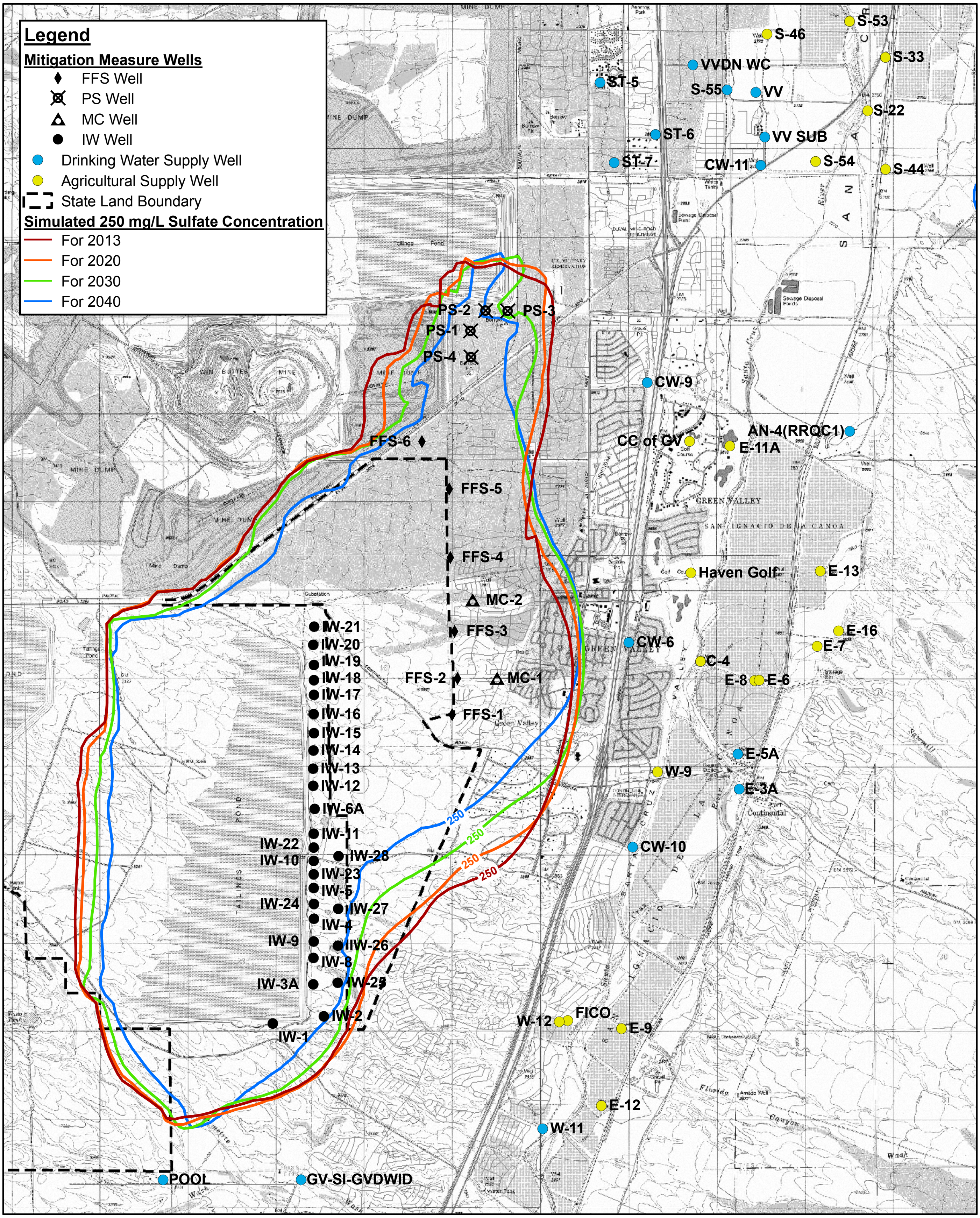
HYDRO GEO CHEM, INC.

PARTICLE TRACKS WITH PERFORMANCE GOAL PUMPING STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200062G	D.2



0 2500 5000 Feet

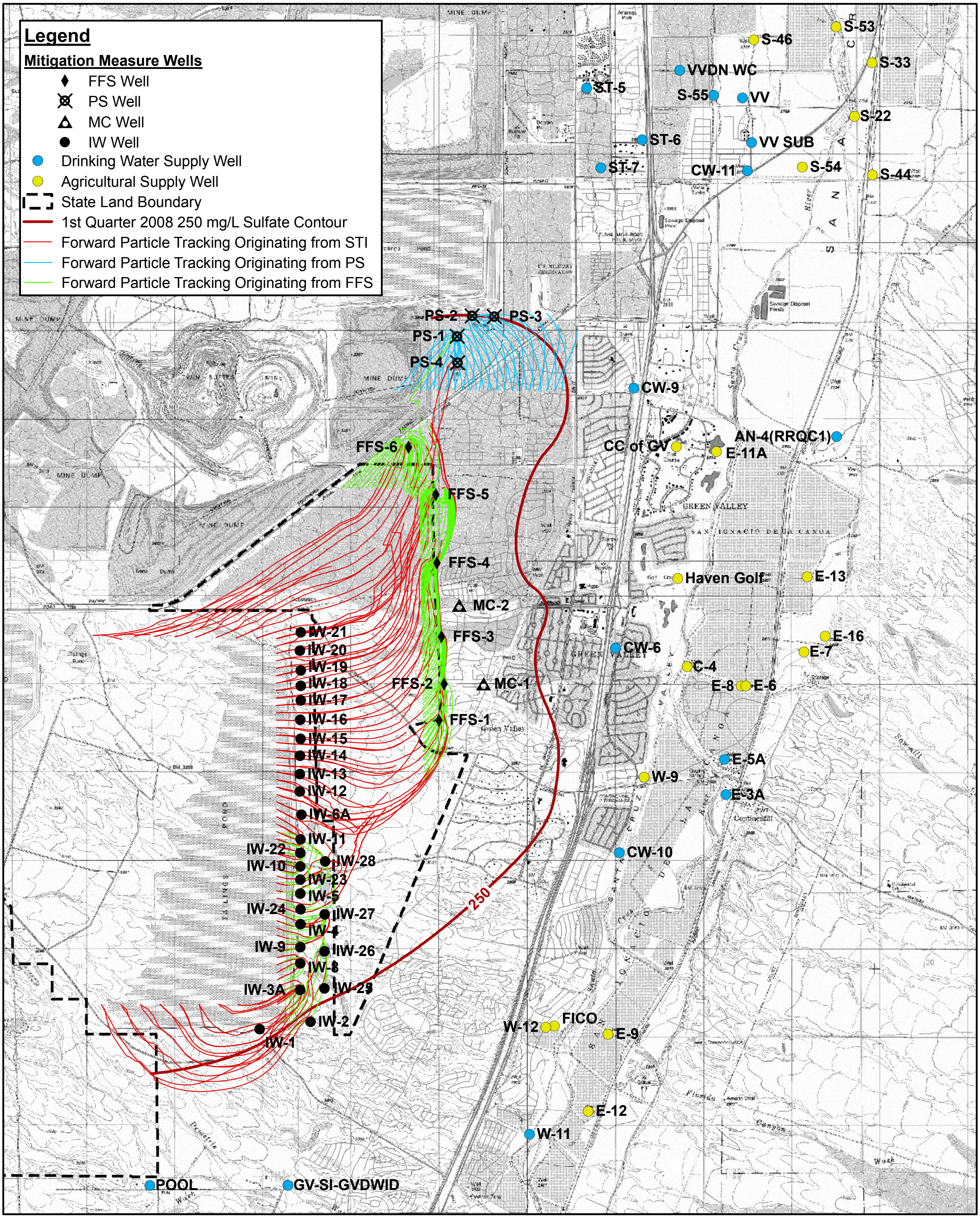
PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

SIMULATED SULFATE PLUME WITH PERFORMANCE GOAL PUMPING ONLY NON-STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
RKZ	01/27/10	AMC	01/27/10	7830200047G	D.3



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PROJECTION: UTM Zone 12N NAD83

N

HYDRO GEO CHEM, INC.

PARTICLE TRACKS WITH PERFORMANCE GOAL PUMPING NON-STATE LAND OPTION

Approved	Date	Author	Date	File Name	Figure
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