BGC ENGINEERING USA INC.
AN APPLIED EARTH SCIENCES COMPANY
701 12th Street – Suite 211, Golden, CO USA 80401
Telephone (720) 598-5982

Project Memorandum

To:	**SWCA Environmental Consultants**	**Doc. No.:**	**N/A**
Attention:	**Chris Garrett**	**cc:**	
From:	**Gabriele Walser**	**Date:**	**August 3, 2020**
Subject:	**Review of ADWR Salt River Valley Groundwater Model Application for Resolution's Desert Wellfield - FINAL**		
Project No.:	**1704007-06**		

This technical memorandum summarizes and evaluates Montgomery & Associates' (M&A's) use of the ADWR Salt River Valley model for pumping from the Desert Wellfield. The evaluation was performed for the Resolution Copper Project Environmental Impact Statement (EIS) Water Working Group.

1.0 INTRODUCTION

On behalf of the Secretary of Agriculture, the Tonto National Forest is preparing an Environmental Impact Statement (EIS) for the mining operations proposed by Resolution Copper Mining, LLC. (Resolution Copper). The proposed mining operations will require additional water beyond that created by mine dewatering. The largest consumptive water use will be for the tailings storage facility. Thus, included in the proposed action is the pumping of groundwater, including banked water credits. Pumping for the proposed Resolution Copper mine is proposed to occur at the Desert Wellfield, located in the east Salt River Valley.

The Arizona Department of Water Resources (ADWR) Modeling Section develops regional models to simulate Arizona's water supply and the future demands it may encounter. One of those regional models is the Salt River Valley model, which encompasses the Desert Wellfield. M&A (2020a) utilized the ADWR Salt River Valley model to simulate Resolution Copper groundwater pumping to satisfy water demands under Alternative 1 ("no action") and Alternative 2 (maximum groundwater withdrawal) in support of the Resolution Copper Environmental Impact Statement (Tonto National Forest, 2019). After reviewing the initial report by M&A (2020a), BGC and the EIS Water Workgroup requested additional information. In response, M&A (2020b) provided additional figures.

This technical memorandum summarizes the existing ADWR Salt River Valley model, and reviews the modifications M&A (2020a) made to the model in order to apply the model to the Desert Wellfield. It examines the applicability and limits of the ADWR Salt River Valley model to simulate the Desert Wellfield pumping for the proposed Resolution Copper mine. The scope of this work includes an examination of the setup and calibration of the ADWR Salt River Valley model to understand the applicability of the model for modeling of the Desert Wellfield. However, beyond reviewing the applicability of the ADWR Salt River Valley model to modeling the Desert

Wellfield, the original ADWR model is not subject to review here, since it was created and reviewed by the ADWR.

2.0 ADWR SALT RIVER VALLEY MODEL

2.1. Historic Development of the ADWR Salt River Valley Model

In 1978, concerns about future groundwater supplies led to creation of the "Salt River Valley Cooperative Study" as a cooperative effort between the ADWR and several other agencies and water users (ADWR, 1982). The purpose of the study was to establish a groundwater database and develop a numerical groundwater flow model that could be used for groundwater planning and management. A database including water levels, specific yield and transmissivity values, pumped volumes, and recharge rates was completed for available data from 1964 through 1977. The data were used in the calibration of the groundwater model.

In 1987, development started on a new groundwater flow model for the Salt River Valley, a three-dimensional model utilizing MODFLOW (McDonald and Harbaugh, 1988). By 1987 the trend of groundwater depletion had become apparent, and a goal of avoiding long-term water declines by 2025 was established. The groundwater model was created to aid the Phoenix Active Management Area (AMA) in water management planning as a quantitative tool to test various groundwater management scenarios. The model area includes the cities of Phoenix, Tempe, Scottsdale, Mesa, Glendale, Chandler, Peoria and many smaller cities. The groundwater model was finished in 1994 and ADWR used it to run predictive analyses through 2025 (ADWR, 1993; ADWR, 1994; ADWR, 1996).

In 2004, the model was revised and updated (ADWR, 2004 a and 2004b). The model was recalibrated using water levels, recharge rates estimated from irrigation and precipitation, and pumping data through 2002. Additionally, the model was converted to MODFLOW-2000 (Harbaugh et al., 2000), which allowed the re-wetting of cells which had previously been simulated as becoming dry (and remained permanently dry in previous MODFLOW versions). The calibrated model was used to simulate future scenarios for groundwater use in the East Salt River Valley through the year 2100 (ADWR, 2007).

2.2. Current ADWR Salt River Valley Model

The current ADWR Salt River Valley Model was last updated in 2009. It was calibrated to conditions from 1983 through 2006 (ADWR, 2009). The model domain of the Salt River Valley Model covers approximately 2,505 square miles and, with Phoenix, contains the area with Arizona's greatest population density (see Figure 1). The model domain includes the two largest groundwater sub-basins of the Phoenix AMA: The East Salt River Valley and the West Salt River Valley, which are together referred to as the Salt River Valley. These groundwater sub-basins are defined as lying completely within the alluvial basin (see Figure 2).

The historic groundwater flow (prior to large scale groundwater pumping and irrigation) follows an east to west gradient along the Salt River and then Gila Rivers (see Figure 3); however, pumping and irrigation recharge have introduced differing flow directions and vertical gradients over time. The original geologic conceptual design divided the Salt River Valley model's alluvial basin-fill deposits into three separate layers, based on well logs (ADWR, 1993). The three layers are the upper alluvial unit (UAU), middle alluvial unit (MAU), and the lower alluvial unit (LAU). The UAU is defined by gravel, sand, and silt. The MAU is defined by clay, silt, mudstone, and gypsiferous mudstone. The LAU is defined by conglomerate and gravel near the basin margins, transitioning into mudstone, gypsiferous and anhydritic mudstone, and anhydrite in the basin centers (ADWR, 2009). The LAU overlies the bedrock unit, which is composed predominantly of crystalline rocks of Precambrian to middle Tertiary age and extrusive rocks of middle Tertiary to Quaternary age (ADWR 1993). The thicknesses of the three units differ depending on bedrock elevation throughout the basin.

The water balance for the model considers inflows from groundwater underflow, natural recharge, and human-caused recharge. Groundwater underflow is groundwater flow that enters or leaves the alluvial basin from adjacent basins outside the model area, generally along with and in the same direction as surface water flow. Inflow from groundwater underflow occurs where the Aqua Fria River and the New River enter the Salt Valley River model domain, where the Gila River enters the model domain, and also from the Hassayampa sub-basin (Figure 4). Groundwater underflow volumes into the system were originally derived by ADWR (1993) from examining water level gradients, developing a flow net analysis using predevelopment conditions, and applying the results of previous transient modeling (see Section 2.1 above). Natural recharge includes precipitation and runoff on mountain ranges outside of the model area, which is distributed at the margins of the alluvial basin. Other natural recharge includes infiltration through stream beds of ephemeral streams including Queens Creek. Recharge from flood flows was added for years and locations when and where flood flows occurred (ADWR 2009).

Human-caused recharge is responsible for nearly 85% of the total estimated recharge for the Salt River Valley, and of that the largest portion comes from irrigated agricultural lands. Additional recharge derives from turf irrigation in parks and golf courses, from golf course ponds and other artificial lakes, from irrigation canal seepage, and treated wastewater discharge seepage. Another source of recharge occurs at permitted underground storage facilities (USF), where injected freshwater is stored in the aquifer for potential future use. Artificial recharge has progressively increased since 1989.

Water outflows from the basin occur as groundwater underflow, through groundwater pumping, and evapotranspiration. Groundwater outflow through underflow occurs along the Gila River, where groundwater along the Gila River leaves the Salt River Valley model domain, and groundwater outflow occurs to the south, where, due to increased pumping in the Pinal AMA, groundwater leaves the Phoenix AMA and flows into the Pinal AMA.

The numerical model was created using MODFLOW 2000 (Harbaugh et al., 2000). ADWR (2009) describes the model: The model cell size is 0.5 by 0.5 miles throughout. The model was calibrated for transient flow conditions from 1983 to 2006. The transient period was divided into 24 annual stress periods between 1983 and 2006. Calibration targets were the observed water level data, and the conceptual water budget (i.e., groundwater inflows to and outflows from the model domain). Streamflow and groundwater/surface water interactions in the major stream beds were simulated using the MODFLOW stream package.

During calibration, most adjustments were made to recharge from agriculture. The final calibration met predetermined measures: The total head change across the SRV model is approximately 1,020 feet. All weighted model residuals were less than or equal to 10 percent of the total head change, or less than 102 feet. The root mean squared error (RMSE) of the residuals was below 2% of the total head change, or 20 feet. The conceptual versus simulated net water budget (Inflow – Outflow) varied in total volume; however, the trend between the two budgets was very similar. The difference between conceptual and modeled outflows was less than 10% for most calibration years, with a maximum of 23% difference. The difference between conceptual and modeled inflows was less than 5% for most years, with a maximum difference of 18% (ADWR, 2009, Appendix B). Evaluation of long-term hydrographs and residual error during the three years when groundwater levels were measured basin-wide, confirms the model's ability to reproduce historic water level changes.

In 2010, the model was used to simulate different development scenarios (ADWR, 2010a). Later the same year, a refined geology framework was developed for the model area (ADWR, 2010b), however, this framework has not been incorporated in the numerical model.

By 2014, the same model was upgraded to Version 3.0, which used MODFLOW-2005 (Harbaugh, 2005), and run within the Groundwater Vistas (ESI, 2017) interface (ADWR, 2014). The recharge was updated to more accurately reflect the distribution of Irrigation Grandfathered Rights in the model domain, but no other changes were made to the model. ADWR (2020) confirms that this is the most recent version of the Salt River Valley model.

3.0 APPLICATION OF THE ADWR SALT RIVER VALLEY MODEL TO THE DESERT WELLFIELD

M&A (2020a) utilized the ADWR Salt River Valley model to simulate Resolution Copper groundwater pumping to satisfy water demands under Alternative 1 ("no action") and Alternative 2 (maximum groundwater withdrawal) in support of the Resolution Copper Environmental Impact Statement (Tonto National Forest, 2019). The pumping is planned to occur at the proposed Desert Wellfield, located in the east Salt River Valley within the Phoenix Active Management Area (AMA), approximately 3.5 miles southwest from the junction of Superstition Freeway (US-60) and AZ-79 along the Magma Arizona Railroad Company (MARRCO) corridor (Figure 5). The MARRCO corridor is an approximately 28-mile long right-of-way, generally 200 feet wide, for the old Magma Arizona Railroad. Currently, several utilities are present within the MARRCO Corridor, including Arizona Water Company facilities and a water pipeline partially buried in the railbed. This 18-inch pipeline was installed by Resolution Copper to deliver treated water from the existing water treatment plant at the Plant site to the New Magma Irrigation and Drainage District.

3.1. Changes to the ADWR Model

The model used to simulate the Desert Wellfield is a modified version of the model described in ADWR (2009), Version 3.0, as updated in 2014. Grid spacing, layering, and aquifer hydraulic parameters are not changed from the original 2009 Salt River Valley model. As in the ADWR (2009) model, grid spacing is uniformly 0.5 by 0.5 miles throughout the model, and the model domain encompasses the alluvial basin-fill deposits which are divided into three layers with variable thicknesses reflecting the regional hydrogeology.

M&A extended the 2009 Salt River Valley model to include the years 2007 through 2018 using updated groundwater pumping and recharge volumes provided by ADWR (2020). The model was further extended to include a 100-year predictive period through 2118. Model boundary conditions for evapotranspiration, specified-head, and stream flow were kept from the original model and extended, unchanged through 2118.

Recharge, except for recharge from USFs and agriculture was copied from the original 2009 Salt River Valley model for the year 2006 and kept constant. Recharge from USFs and agriculture was updated for the years 2007 to 2017 based on ADWR reported rates. Recharge from Underground Storage Facilities and agriculture for the future was updated on best available information in consultation with ADWR (2020), based on projections for water use in Arizona (M&A 2020a).

A similar approach was taken for pumping: all pumping from 1983 to 2006 is unchanged from the 2009 ADWR model. All Pumping 2007 to 2017 is updated to ADWR reported rates. Pumping for the future was updated on best available information in consultation with ADWR (2020)., based on projections for water use in Arizona (M&A 2020a).

No calibration was performed after updating the ADWR model.

3.2. Applicability of the ADWR Model to the Desert Wellfield

The following issues were considered in the review of the ADWR model simulation of the Desert Wellfield.

3.2.1. Updates to ADWR Model

M&A (2020a) performed the updates in pumping and recharge to the ADWR Salt River Valley model in consultation with the ADWR (2020), these updates are not evaluated here.

3.2.2. Model Area and Grid

The ADWR Salt River Valley model is a regional model. The model area of the ADWR Salt River Valley model is large in comparison to the proposed Desert Wellfield (M&A, 2020a, Figure 11). Pumping at the Desert Wellfield impacts only the eastern-most part of the Salt River Valley model. The model grid cells are 0.5 miles by 0.5 miles, and thus do not allow the actual modeling of individual wells.

3.2.3. Initial Conditions and Boundaries

The ADWR Salt River Valley model has a specified flux boundary at the southern-most boundary of the model area near the Desert Wellfield, and no-flow boundaries on all other sides (Figure 4). Mountain front recharge is applied along the eastern no-flow boundaries. Measured head contours for baseline conditions in 2017 (no pumping in the Desert Wellfield), shown in M&A (2020b) Figure 1, indicate that the natural groundwater flow direction is from the mountains in the east towards the Desert Wellfield and then north towards the center of the Salt River Valley, in response to the mountain front recharge. This agrees with the conceptual flow direction established in ADWR (2009) and supports the use of the ADWR model for modeling the Desert Wellfield.

The lateral boundary conditions in the model (no-flow boundaries on all sides except the southernmost boundary, where a specified flux boundary is prescribed) are such that the head would change at the boundary if drawdown were to extend to the boundary. The drawdown contours shown in M&A (2020a, Figure 4) indicate that under maximum drawdown conditions, the drawdown does not extend to the boundary, and thus simulated drawdown at the Desert Wellfield is not significantly impacted by the model boundaries or domain size.

3.2.4. Model Validation

The ADWR Salt River Valley model was last calibrated to 2006 conditions. Multiple changes in actual groundwater recharge and withdrawal rates have occurred since 2006. For instance, Resolution Copper started injecting water in USF in the New Magma Irrigation and Drainage District in 2006. The New Magma Irrigation and Drainage District is located just south and east of the proposed Desert Wellfield (M&A, 2020a, Figure 1). These changes were incorporated into the modified ADWR model by M&A (2020a).

M&A (2020a, Figure 6) shows measured depth to water for 2017. M&A (2020b, Figure 2) compares measured and simulated groundwater elevations in 2017. The general flow direction is simulated appropriately in the ADWR Salt River Valley model as applied by M&A (2020b), but simulated heads are 50 to 100 feet higher than observed in the vicinity of the Desert Wellfield. Absolute heads do not match well, as might be expected for a regional model that was not recalibrated to recent observations; however, relative drawdowns can be estimated and are useful for evaluating differences between scenarios, which in this case are predicted drawdowns with and without pumping of the Desert Wellfield.

3.2.5. Model Results

Predicted drawdown contours are shown for the years 2058 (M&A, 2020a, Figure 4) and 2118 (M&A, 2020a, Figure 5). Drawdown is at a maximum of 212 feet in 2058 at the center of the wellfield (M&A, 2020a, Figure 3). As requested by BGC and the EIS Water Workgroup M&A (2020b) provided additional figures, showing drawdown over time for various locations. M&A (2020b, Figure 3) shows the location for the graphs of drawdown over time. The actual graphs of drawdown over time are given in M&A (2020b, Figure 4). Drawdowns in M&A (2020b, Figure 4) are for Alternative 1 (no Desert Wellfield pumping), and Alternative 2, (maximum project water demand, and thus maximum Desert Wellfield pumping). Drawdown two miles outside the wellfield reaches a maximum of approximately 100 feet in the year 2060 (M&A, 2020b, Figure 4). Projected drawdowns from Desert Wellfield pumping five and 10 miles distant from the wellfield continue to be about 20 to 40 feet greater than projected drawdowns without pumping for at least 50 years after pumping ends (M&A, 2020b, Figure 4).

4.0 CONCLUSIONS

The ADWR Salt River Valley model was used appropriately to compare drawdowns for two pumping scenarios (no pumping and maximum pumping) for Resolution's Desert Wellfield.

The ADWR Salt River Valley model is a large-scale regional model which includes the Desert Wellfield in its southeastern most area. Due to its regional extent and large grid size (i.e., 0.5 miles by 0.5 miles), prediction of groundwater elevations at individual wells is not possible, however, it can be used to compare likely drawdowns with and without Desert Wellfield pumping in the region around the Desert Wellfield. This type of prediction of regional drawdown from future groundwater development scenarios is consistent with the original intent and use of the Salt River Valley model. This is consistent with the analysis approach taken by the Tonto National Forest EIS, as described in Newell and Garrett (2018) (see "Inability to Analyze Individual Wells", p. 9-10).

M&A (2020a) updated the model to 2017 conditions but did not recalibrate to recent field observations. Although the general flow direction is simulated appropriately, simulated heads are 50 to 100 feet higher than measured heads. Consequently, the model could not be used to evaluate model impacts on other water resources based on modeled water levels, however, the modeled relative drawdowns are appropriate for comparing scenarios. Relative drawdowns from the model illustrate the expected differences between scenarios with either pumping or not pumping the Desert Wellfield. With pumping of the Desert Wellfield, maximum drawdown is predicted to be 212 feet in 2058 at the center of the wellfield. Drawdown two miles outside the wellfield is predicted to reach a maximum of approximately 100 feet in the year 2060. For the same time and location, predicted drawdown attributed to other projected uses (i.e., without Desert Wellfield pumping) is approximately 10 feet. Projected drawdowns five and ten miles distant from the edges of the wellfield continue to be approximately 20 to 40 feet greater than projected drawdowns without pumping for at least 50 years after pumping ends.

5.0 CLOSURE

BGC Engineering USA Inc. (BGC) completed this evaluation for SWCA Environmental Consultants (SWCA) and the Tonto National Forest as part of our scope of services under Subcontractor Master Services Agreement, dated September 13, 2016, and Work Authorization 10, dated April 7, 2020. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of document preparation. Any use which a third party makes of this document or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

As a mutual protection to our client, the public, and ourselves all documents and drawings are submitted for the confidential information of our client for a specific project. Authorization for any use and/or publication of this document or any data, statements, conclusions or abstracts from or regarding our documents and drawings, through any form of print or electronic media, including without limitation, posting or reproduction of same on any website, is reserved pending BGC’s written approval. A record copy of this document is on file at BGC. That copy takes precedence over any other copy or reproduction of this document.

Yours sincerely,

BGC ENGINEERING USA INC.
per:

Gabriele Walser, Ph.D.
Senior Environmental Engineer

Reviewed by:

Carl Mendoza, Ph.D., P.Eng. (B.C.)
Principal Hydrogeological Engineer

NE/CAM/cr/syt

Attachment(s): Figure 1. Salt River Valley
Figure 2. Model domain and aquifer thickness
Figure 3. Water table elevation circa 1900
Figure 4. Model boundaries
Figure 5. Proposed Desert Wellfield

REFERENCES

ADWR. (1982). Long, M.R., Niccoli, M.A., Hollander, R., & Watts, J.L. A comprehensive Study of Groundwater Conditions of the Salt River Valley Aquifer System and Description of Digital Groundwater Modeling Efforts by the ADWR. Prepared by the Arizona Department of Water Resources in Cooperation with the Municipal Water Users Association and Irrigation Districts in the Salt River Valley. June 1982.

ADWR. (1993). Corkhill, E.F., Corell, S.W., Hill, B.M., & Carr, D.A. Arizona Department of Water Resources, A Regional Groundwater Flow Model of the Salt River Valley – Phase I. Phoenix Active Management Area, Hydrogeologic Framework and Basic Data Report. Hydrology Division – Groundwater Modeling Section, Modeling Report No. 6. April 1993.

ADWR. (1994). Corell, S.W., and Corkhill, E.F. Arizona Department of Water Resources, A Regional Groundwater Flow Model of the Salt River Valley – Phase II. Phoenix Active Management Area, Numerical Model, Calibration, and Recommendations. Hydrology Division – Groundwater Modeling Section, Modeling Report No. 8. March 1994.

ADWR. (1996). Hipke, W., Putman, F., Holway, J.M., & Ferrell, M. An Application of the Regional Groundwater Flow Model of the Salt River Valley, Arizona. Analysis of Future Water Use and Supply Conditions: Current Trends Alternative 1989 – 2025. Hydrology Division, Modeling Report No. 11. October 1996.

ADWR. (2004a). Mason, D., Bota, L., & Jahnke, P. Arizona Department of Water Resources Hydrology Division, Memorandum to Salt River Valley Model File, SRV Model Calibration Update 1983-2002, December 2004.

ADWR. (2004b). Corkhill, E.F., Bota, L., Jahnke, P., Mason, D., & Hipke, W. Arizona Department of Water Resources, Hydrology Division, Revised Groundwater Modeling Results for the East Valley Water Forum Regional Water Planning Study. December 2004.

ADWR. (2007). Hipke, W. Arizona Department of Water Resources, Hydrology Division, East Valley Water Forum Scenarios for the East Salt River Valley Sub-basin an Application of the Regional Groundwater Flow Model of the Salt River Valley, Arizona, Modeling Report No. 17. April 2007.

ADWR. (2009). Freihoefer, A., Mason, D., Jahnke, P., Dubas, L., & Hutchinson, K. Arizona Department of Water Resources, Hydrology Division, Regional Groundwater Flow Model of the Salt River Valley Phoenix Active Management Area, Model Update and Calibration, Arizona, Modeling Report No. 19. April 2009.

ADWR. (2010a). Hipke, W., Arizona Department of Water Resources, Hydrology Division, A Salt River Valley Groundwater Flow Model Application. 100-Year Predictive Scenarios Used for The Determination of Physical Availability in the Phoenix Active Management Area, Modeling Report No. 22. July 2010.

ADWR. (2010b). Dubas, L.A., Arizona Department of Water Resources, Hydrology Division, Geological Update for the Combined SRV and Lower Hassayampa Regional Groundwater Flow Model Areas in the Phoenix Active Management Area, Modeling Report No. 23. December 2010

ADWR. (2014). Arizona Department of Water Resources, Hydrology Division Modeling Unit, SRV 1983-2006 Model Update Information File - Version 3.0, 03/25/2014. Readme.txt file. March 2014

ADWR. (2020). Buschatzke, T., Director, Arizona Department of Water Resources. Response to letter dated April 2, 2020 - Resolution Copper Project, Modeling of Groundwater Impacts in East Salt River Valley

Environmental Simulations, Inc. (ESI). (2017). Guide to Using Groundwater Vistas.

Harbaugh, A.W. (2005). MODFLOW-2005, The U.S. Geological Survey Modular Ground-Water Model—the Ground-Water Flow Process, U.S. Geological Survey Techniques and Methods 6-A16

Harbaugh, A.W., Banta, E., Hill, M., & McDonald, M. (2000). MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Flow Model – User Guide to the Observation, Sensitivity, and Parameter-Estimation Process and Three PostProcessing Programs: U.S. Geological Survey Open-File Report 00-184.

McDonald, M.G., and Harbaugh A.W., 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model, Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Modeling Techniques.

Montgomery & Associates. (2020a). Technical Memorandum, Desert Wellfield Pumping 100-Year Drawdown Analysis for ADWR Evaluation in Support of the Resolution Copper EIS, Project #: 605.7506. January 23, 2020.

Montgomery & Associates. (2020b). Additional Figures in support of Desert Wellfield Pumping 100-Year Drawdown Analysis for ADWR Evaluation in Support of the Resolution Copper EIS, Project #: 605.7506. June 2020.

Newell E., and Garrett C. (2018). Process Memorandum to File, Water Resource Analysis: Assumptions, Methodology Used, Relevant, Regulations, Laws, and Guidance, and Key Documents. Resolution Copper Project and Land Exchange, Environmental Impact Statement. August 6, 2018.

Tonto National Forest, USDA Forest Service. (2019). Resolution Copper Project and Land Exchange Environmental Impact Statement, Tonto National Forest; Pinal County, AZ, Document Number: 2016-05781. August 9, 2019.

FIGURES

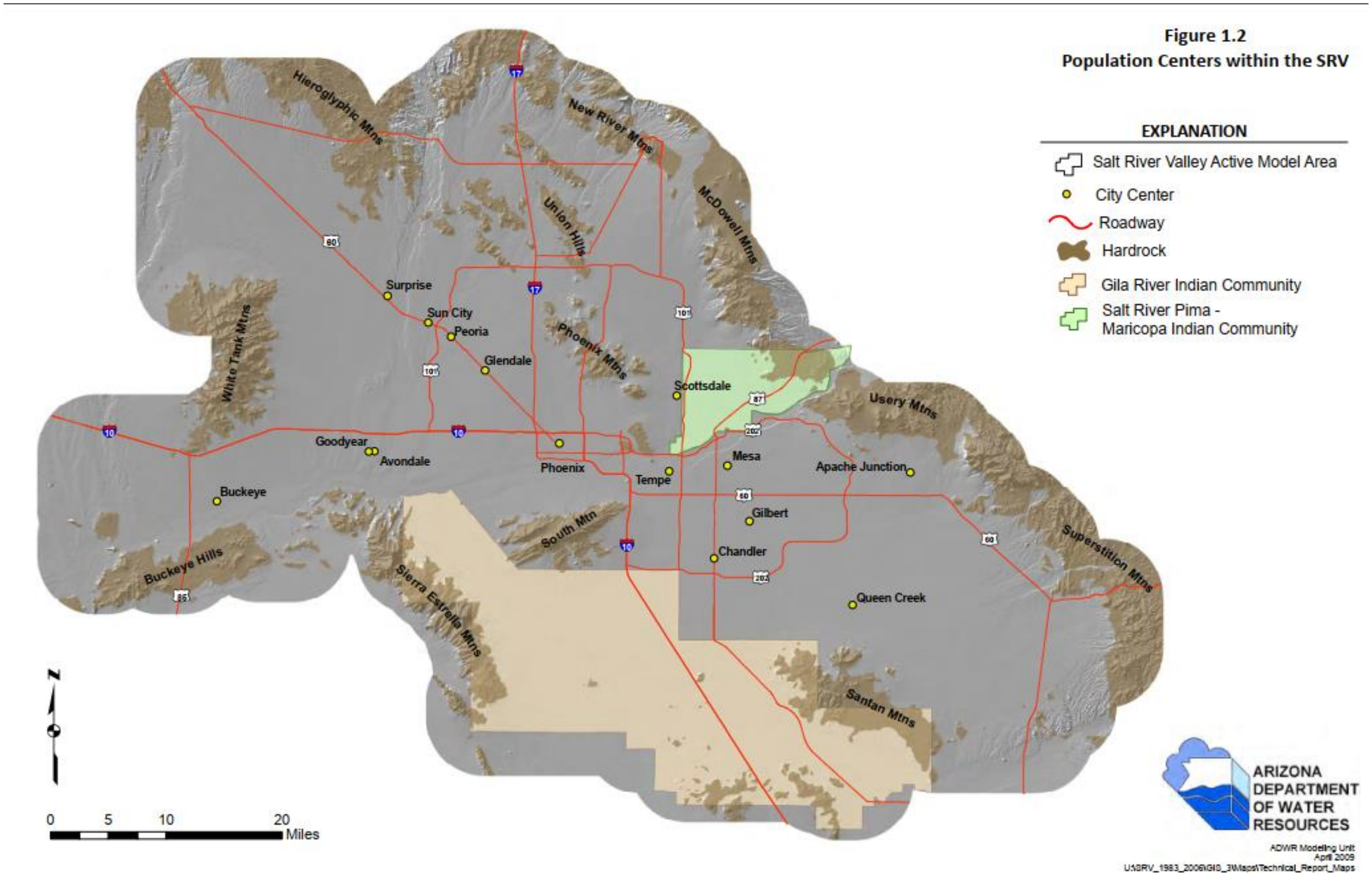

Figure 1. Salt River Valley.

Source: ADWR 2009

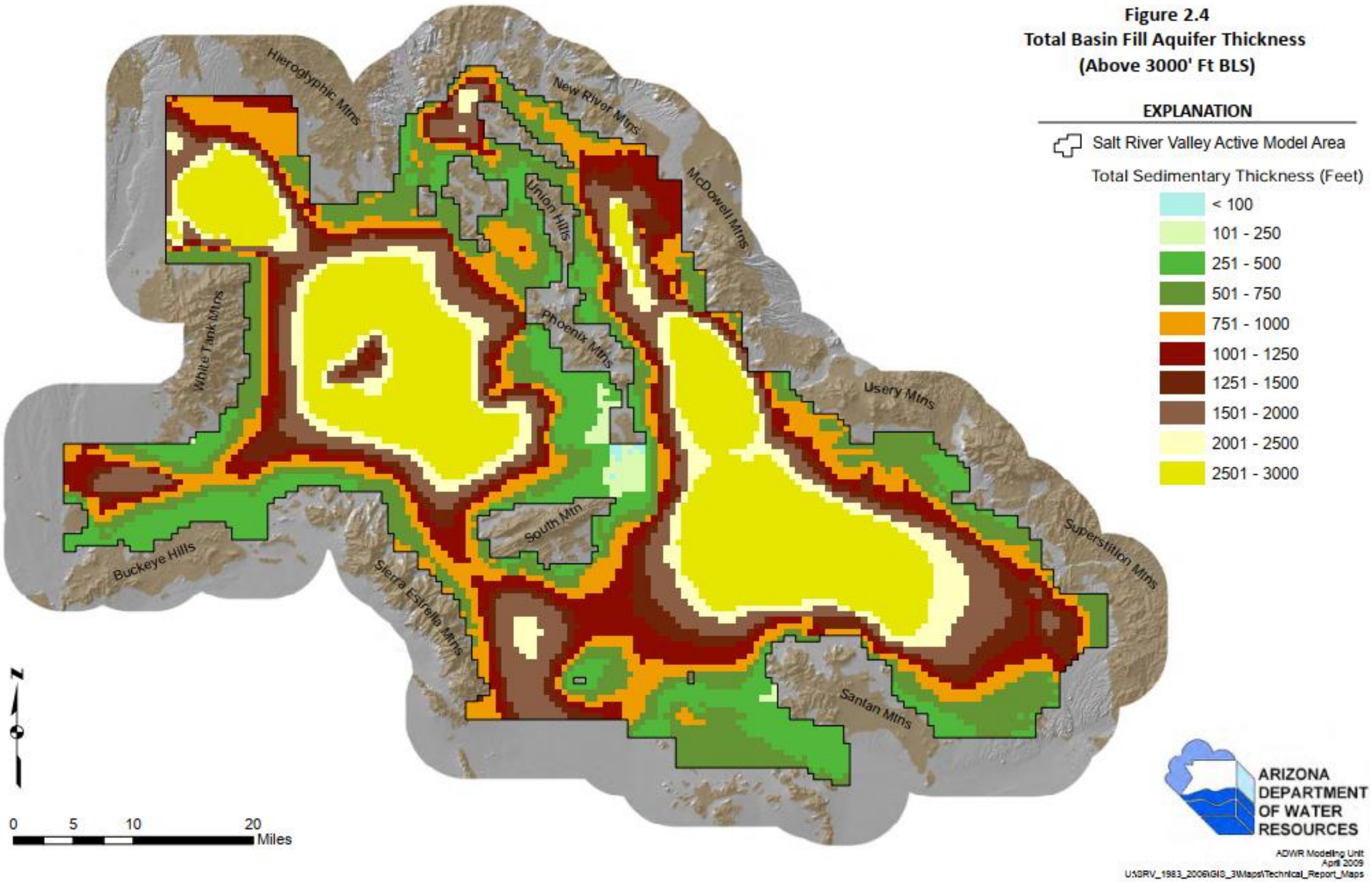

Figure 2. Model domain and aquifer thickness.

Source: ADWR 2009
Note: BLS – Below Land Surface

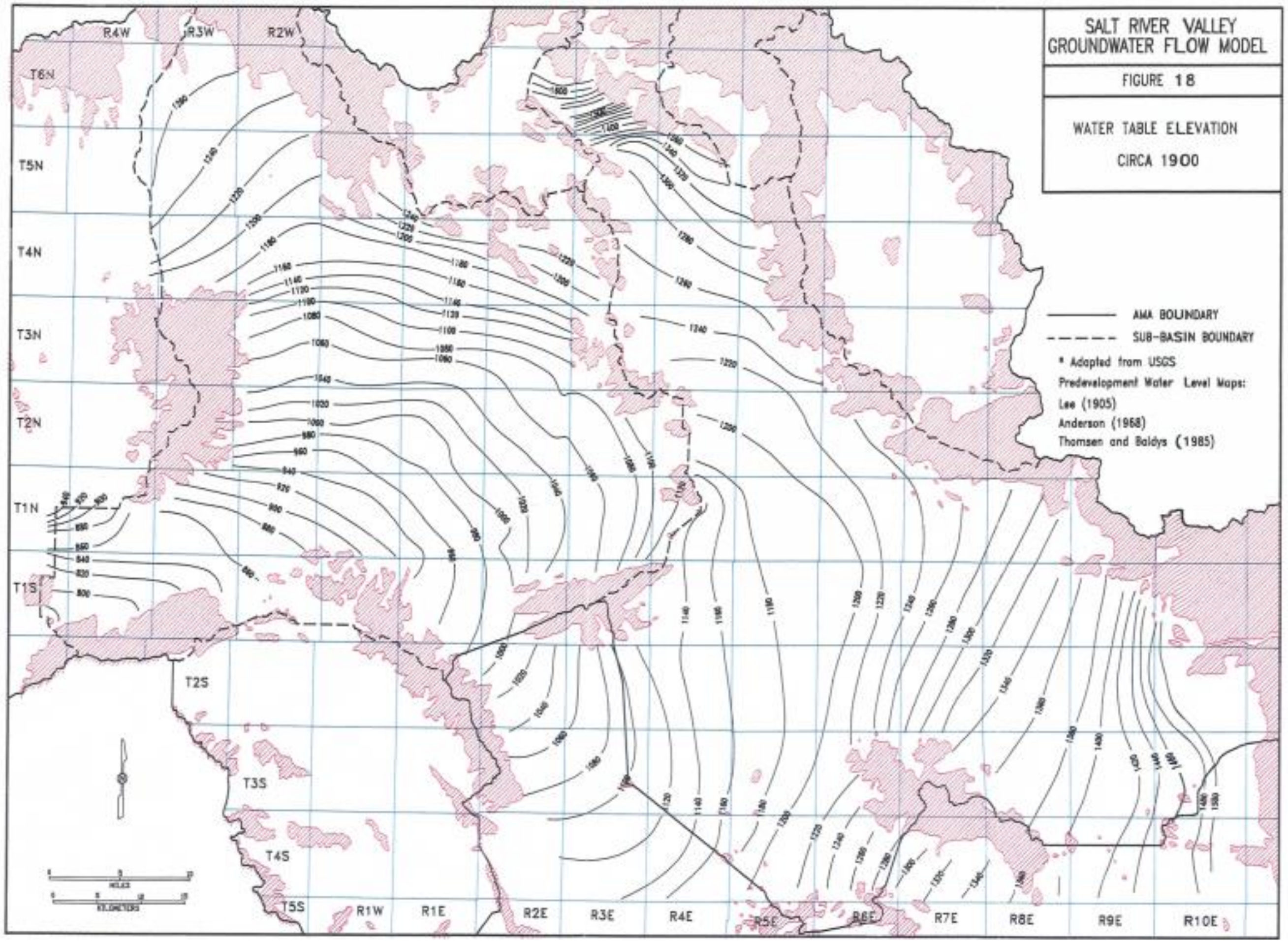

Figure 3. Water table elevation circa 1900.

Source: ADWR 1993

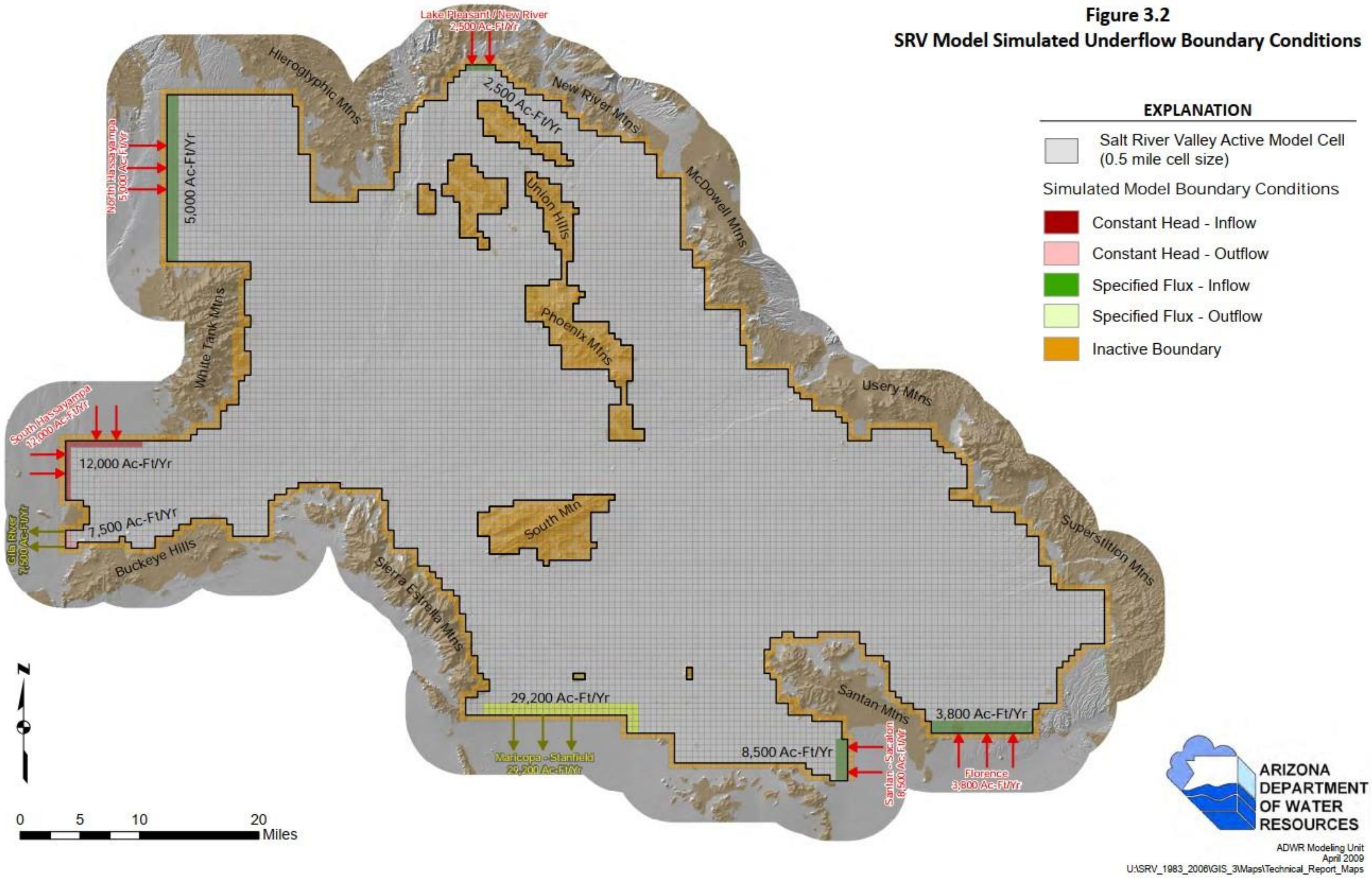

Figure 4. Model boundaries.

Source: ADWR 2009

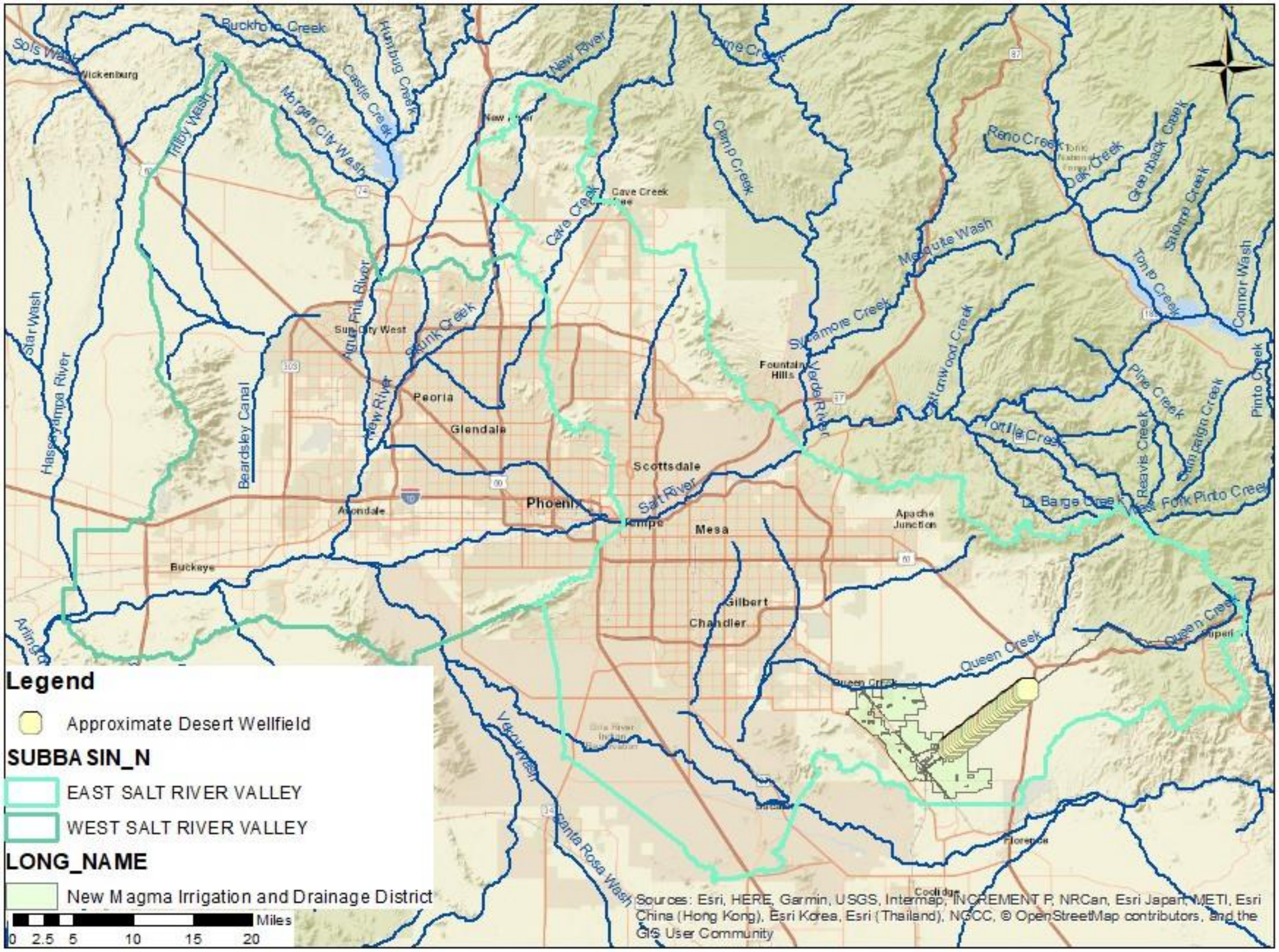

Figure 5. Proposed Desert Wellfield.