KAP

Elam CONSTRUCTION, INC.
556 Struthers Avenue
Grand Junction, CO 81501-3826
(970) 242-5370 Fax (970) 245-7716
www.elamconstruction.com

January 9, 2014

RECEIVED
JAN 16 2014
DIVISION OF RECLAMATION
MINING AND SAFETY

Colorado Division of Reclamation, Mining and Safety
1313 Sherman St.
Room 215
Denver, CO 80203

RE: Dillon Ranch Pit, Permit M-1987-064; Request for Technical Revision 04

Staff,

Under Rule 1.9.1, I am submitting this request for a Technical Revision to the Dillon Ranch Pit, Permit M-1987-064. With this request the following revisions are requested:

> The current mining plan allows for extraction of sand and gravel to an approximate depth of 35 feet. Dewatering of the pit was not proposed as part of the approved mining plan. With this TR, Elam Construction, Inc. dba Sandco Inc., is requesting to dewater the pit to a depth of 35 feet during times of extracting the sand and gravel. Mining is currently allowed during winter months of November through March. Therefore, dewatering will occur during this time frame. Documentation to support our request is provided in the attached Groundwater Hydrology Report, prepared by Western Water & Land, inc., dated September 17, 2013. This report discusses the impact of dewatering to wells within close proximity to the Dillon Ranch Pit and vegetation, in particular cottonwood trees along the river bank. Groundwater from the pit will be discharged to the Animas River. A Stormwater/Process water Discharge permit will be applied for from CDPHE - WQCD that will allow for dewatering.

Please let me know if there are any questions regarding this request. I can be reached at (970) 242-5370 or gayle.lyman@elamconstruction.com .

Sincerely

Gayle L Lyman

Gayle Lyman
Compliance Director

AF & Report
No Violations

Xc: Kate Pickford, DRMS, Durango Field Office (email)

Groundwater Hydrology Report
Dillon Ranch Pit
La Plata County, Colorado

Prepared for:

Elam Construction, Inc. dba Sandco, Inc.

September 17, 2013

Western Water & Land, Inc.
743 Horizon Ct. - Suite 330
Grand Junction, CO 81506

CONTENTS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

The Dillon Ranch Pit (formerly known as the Sandco Gravel Pit) is an active sand and gravel pit recently acquired by Elam Construction Inc. dba Sandco, Inc. (Elam) that is located in La Plata County in the Animas River Valley approximately 7 miles north of Durango, Colorado (Figure 1-1). The Dillon Ranch Pit (Pit) is permitted under Colorado Division of Reclamation, Mining, & Safety (DRMS) Permit No. M-1987-064. The permit allows Elam to mine a 43.33- acre site adjacent to the Animas River to a depth of 35 feet, below ground surface (bgs). Despite groundwater occurring at the site at a depth of between 8 to 14 feet bgs, dewatering of the gravel pit is not currently permitted and wet mining must be performed below the water table. Mining operations are permitted to take place from November through mid-April.

The mining plan indicates the gravel reserve extends to a depth of 75 feet bgs. Elam is evaluating the feasibility of mining to a depth greater than 35 feet bgs. To improve mining conditions below 35 feet bgs, Elam would like to dewater the pit to the base of the existing permitted mining depth of 35 feet. Because groundwater has been documented to occur between depths of 8 to 14 feet at the site, the pit would need to be dewatered to a depth about 25 feet below the existing water table. Elam is considering actively dewatering for a time period of two months during the permitted active mine period of November to mid-April.

Western Water & Land, Inc. (WWL) has prepared this report on behalf of Elam to document the findings of a hydrologic evaluation conducted to assess the potential impacts associated with dewatering at the Pit. The proposed dewatering operations have the potential to impact existing groundwater wells in the vicinity of the Pit, cottonwood trees that inhabit the riparian area along the Animas River, and the flows in the Animas River. The evaluation was completed by first assessing local geologic and hydrogeologic conditions using published geologic maps, well information data obtained from the Colorado Division of Water Resources (DWR), and previous hydrologic and subsurface studies completed for the Pit. The dewatering impacts were then evaluated using a site-specific numerical groundwater model. This report outlines local site conditions, describes construction and execution of the site-specific numerical groundwater model, and addresses the potential impacts to permitted wells within a ¼ mile radius of the Pit, the surrounding cottonwood trees, and flows in the Animas River.

2.0 SITE DESCRIPTION

This section provides general descriptions of the site, mine plan, and local geologic and hydrogeologic conditions. The descriptions are based on existing data and literature; no new data were collected for this study.

The Pit is an active sand and gravel mine located approximately seven miles north of the City of Durango in the Animas River Valley. The Pit is situated adjacent to the Animas River in the NW ¼ of the NW ¼ of Section 14, Township 36 North, Range 9 West of the New Mexico Principal Meridian in La Plata County, Colorado (Figure 2-1). The site is situated on a flood plain, at an elevation of about 6,576 feet (NAVD 88).

The Pit, when completed, will be approximately 43.33 acres in size and have a minimum buffer of 300 feet between the edge of the Pit and the Animas River. Mining will be confined to the area shown in Figure 2-1. The slopes of the Pit will be made no steeper than 1:1.5 during mining and reduced to 1:3 following the completion of mining operations. Each year, mining operations are permitted to occur from November through mid-April. The Pit will be progressively mined from the south to the north.

A well permit (Permit No. 64853-F) has been issued for the Pit. The permit allows groundwater encountered in the Pit to be used for irrigation and industrial use. A conditional water right (originally decreed in Case No. 04CW59) is associated with the Pit. According to the permit and conditional decree, the maximum pumping rate will not exceed 350 gallons per minute (gpm) and annual diversions will not exceed 123 acre-feet during mining and 101.5 acre-feet after mining operations are completed.

2.1 Geologic Conditions

The Animas River Valley is a large U-shaped valley carved by glaciers during the Pleistocene. The valley has been subsequently filled by sediments over tens of thousands of years. According to the geologic map of the Hermosa Quadrangle, La Plata County, Colorado (Gonzales et al., 2003), the Animas River Valley north of Durango is filled with alluvial, glacial and colluvial deposits with the majority of the valley fill mapped as alluvial deposits by Gonzales et al. (2003) and Blair and Yager (2002).

Geologic deposits beneath the pit consist of alluvial sand and gravels characterized as stream-channel, floodplain, and low terrace deposits. These deposits overlie bedrock formations that include the Hermosa Group, Leadville Limestone, Ouray Limestone, and the Elbert Formation. The sand and gravel deposits serve as an unconfined aquifer that is bound to the east and west by the Hermosa Group. The depth to bedrock in the Animas River Valley north of Durango is said to extend to as much as 900 feet bgs (Gonzales et al.,2003); however, a well log located just under a mile from the south end of the Dillon Ranch Pit (well permit no. 241349) encountered bedrock at a depth of 200 feet bgs. According to well logs, bedrock was not encountered in any of the other wells in the vicinity of the Pit.

Soil conditions and depth to water were evaluated in over forty well logs in the vicinity of the Pit. The majority of these wells ranged in depth from 12 feet to 260 feet bgs, with the majority of soil textures consisting of sand and gravel. Based on the evaluated well logs, the alluvial deposits appear to be continuous and extend beneath the site.

2.2 Hydrologic Conditions

Depths to water vary with ground surface elevation and fluctuations of the Animas River stage and other varying sources of recharge. The main sources of recharge to the alluvial aquifer beneath the Pit are from upgradient subsurface flow from the north and other small tributary canyons carrying subsurface flow (Hermosa Creek Canyon), leakage from the Animas River, leakage from irrigation ditches and deep percolation return flows from irrigation, and infiltration of precipitation. According to a 2004 hydrology study report prepared by Southwest Hydro-Logic, the depth to water at the Pit varies between 8 to 12 feet bgs. Information included in the well permit file (Well Permit No. 64853-F) indicates the exposed water table in the pit was surveyed at 14 feet bgs on March 4, 2005.

The Animas River borders the Pit to the west. The river is typical of a mountain stream as peak and springtime flows are dominated by snowmelt runoff. Peak flows typically occur between the middle of May to the middle of June, cresting at around 3,000 cfs. Flows in July through September are augmented by precipitation. The lowest flows of the Animas River are in the winter, and typically extend from November to early March. On average, the flows during this time of year are approximately 200 cfs. A hydrograph of the Animas River (USGS Station No. 9361500 the Animas River at Durango, Colorado) of mean daily flow from 1964 through 2012 is shown in Figure 2-2.

3.0 GROUNDWATER FLOW MODEL

A simplified numerical groundwater model was used to assess the impacts from dewatering at the Pit. Numerical groundwater models are a valuable tool in determining the spatial and temporal drawdown effects as well as estimating stream depletion. The site-specific model uses complex horizontal geometry of the aquifer and river, coupled with less complex vertical geometry and homogeneous aquifer properties. These simplifying assumptions are part of the analytical solutions used to solve groundwater problems. Some general aspects of the modeling approach are as follows:

- The bedrock that bounds the valley fill material represents no-flow areas.
- The Animas River is the only modeled surface water feature. River surface elevations were determined from a United States Geological Survey (USGS) digital elevation model (DEM) with a 10 meter resolution.
- Aquifer properties are homogeneous and were based on 1) soil types identified onsite and in drillers' logs for nearby wells and 2) literature based values. No aquifer testing data could be found for wells in the vicinity of the Pit.
- The groundwater gradient in the alluvial aquifer is based on the slope of the land surface. A groundwater gradient was introduced into the model because the gradient does have an influence on the shape of the drawdown cone of depression, however, the gradient does not influence stream depletion evaluations.
- Stream depletions and drawdowns are estimated assuming a 2-month dewatering period that extends from December 15 through February 15 for a period of 5 years.

The modeling approach consisted of first developing a "Base Model" to evaluate potential drawdown impacts. The base model reflects site conditions based on existing, available data. The base model was run under steady-state conditions without dewatering to provide the initial conditions for the transient dewatering simulations. Dewatering operations were simulated by making time-variable changes to the model during transient runs. External time-variable recharge and discharge sources were not considered. Assigned aquifer properties and model boundaries were varied as part of a sensitivity analysis to evaluate the alternative model configurations and to determine the properties and boundaries to which the model results are most sensitive. Using the base model and alternate configurations with the sensitivity analysis helps provide a possible range of observed spatial and temporal drawdown effects.

3.1 MODEL SETUP

The numerical model was developed by using Groundwater Vistas Version 4 graphical user interface to the USGS program MODFLOW (McDonald and Harbaugh, 1988). The model domain is 12,000 feet wide by 17,700 feet long. The domain is discretized into 100 feet by 100 feet cells and further subdivided into 2 layers. Layer 1 was assigned as an unconfined layer and Layer 2 was assigned as a confined layer to increase model stability (Anderson and Woessner, 1992). The model grid was oriented in a north-easterly/south-westerly direction. The model setup is shown on Figure 3-1.

3.1.1 Model Boundaries

The bedrock that bounds the Animas River valley to the east and west were established as no-flow boundaries. The base of the model was established at a depth of 200 feet bgs based on the depth to bedrock reported for a nearby well. The slope of the bedrock base was consistent with the slope of the land-surface elevation data from the USGS DEM with 10 meter resolution. The bottom of Layer 1 was established 100 feet above the bottom of Layer 2.

The groundwater flow field was established by assigning general head boundaries to the north and south model-domain boundaries. The general head boundaries represent a line of equal head potential. The general head boundaries were established far enough away from the Pit to minimize potential influences on the model results. The boundary to the north was established to exclude Hermosa Creek flowing into the Animas River Valley from the northwest. Water level elevations assigned to the general head boundaries were extrapolated from elevations of the USGS DEM where the boundary intersects the river elevation and the slope of the land surface. The general head boundary conductance was established at a conservative value (2,000 ft^2/day) to allow groundwater to flow into and out of the model with little resistance.

The Animas River was simulated using the River Package of MODFLOW. The river was assigned elevations by dividing the reach into three segments. The first river segment extended from the northern general head boundary down to immediately north of the Pit. The second river segment extended from the end of segment 1 down to immediately south of the Pit. The third river segment extended from the end of segment 2 to the southern general head boundary. River stage was assigned to the beginning and end of each segment based from elevations generated from the USGS DEM. The elevations between the beginning and end of each segment were extrapolated between the end points. The bottom of the river cell was set 5 feet below the river stage, and the river bed thickness was set at 3 feet. The dimensions of the boundary were set to be the same as the cells, and the hydraulic conductivity of the boundary was set at 100 ft/day. The overall river conductance was 33,333 ft^2/day. A large river bed conductance value was used to ensure the river was hydraulically well connected to the aquifer.

The influence of the extrapolated elevations and assigned conductance values of the general head boundaries and river boundaries as well as elevations of the bedrock boundary on model results were evaluated as part of the sensitivity analysis.

3.1.2 Aquifer Parameters

Each model cell was assigned hydraulic conductivity values and aquifer storage values for model simulations. A single hydraulic conductivity value of 280 ft/day (1×10^{-1} cm/sec) was assigned to represent the valley-fill sand and gravel deposits based on literature values for sand and gravel (Freeze and Cherry, 1979). A specific yield and storage value of 0.2 was assigned to Layer 1 and Layer 2 to represent the storage properties of the aquifer deposits. Model simulations were run to evaluate the sensitivity of the timing and magnitude of drawdown to a range of aquifer parameters.

3.1.3 Representation of Dewatering System and Transient Model Setup

Conventional dewatering systems typically involve implementation of some type of pumping well or system to draw down water levels below the target level. Dewatering systems, especially in unconfined aquifers, initially pump at higher rates compared to steady state pumping rates required to maintain target drawdown water levels. The need for higher initial pumping rate is attributed to storage properties of the aquifer. It is assumed that the gravel pit will be dewatered using a sump pump system at the bottom of the pit. As water will flow into the pit it will be channeled to one or more high volume sump pumps and discharged to the Animas River.

In the model, drain cells were used to draw down water levels in the area of the pit. Drain cells remove water based on the hydraulic conductivity and the difference between the water level in the aquifer and the assigned drain elevation. The use of drain cells for simulating dewatering systems allows the model to simulate time varying discharge associated with aquifer storage properties. Each model cell located in the footprint of the bottom of pit at full build-out was assigned as a drain cell boundary. The footprint of the dewatered pit assumes the pit would have 1.5:1 side slopes during construction. During the simulated dewatering period from December 15 to February 15, drain cells were activated; the cells were not activated for the 10 months of the year when dewatering would not occur. The drain cells were assigned varying elevations so that the pit would be approximately dewatered to a depth of 25 feet below the static water level. Assigned elevations of the drains in the north side of the pit were typically higher than the drain cells in the south side of the pit due to the assumed aquifer gradient. A conservative drawdown amount (25 feet) was used for the simulations, which assumes a static depth to water of 10feet at the Pit[1].

3.2 Base Model Dewatering Results

The Base Model was used to evaluate the temporal and spatial distribution of potential drawdown and stream depletion as a result of dewatering the Pit. Drawdown was observed over time at three established monitoring points in the model; the spatial distribution of drawdown was observed by plotting the cone of depression at the end of the dewatering period in the 5th year. Stream depletion was evaluated based on the percent of flow reduction to the stream based on the extraction rate. It should be noted that the results are for the maximum drawdown that would occur when the pit is at full build-out. It is likely the pit would only have a dewatered footprint of this size for the last few years of mining.

Three monitoring points were used in the model to look at how drawdown occurs over time. One monitoring point was located ¼ mile to the north of the north edge of the Pit (referred to as the north monitoring point), one monitoring point was located ¼ mile to the south of the south edge of the Pit (referred to as the south monitoring point), and one monitoring point was located in the approximate middle of the cottonwood trees directly west of the Pit (referred to as the cottonwood monitoring point). The monitoring points are shown on Figure 3-1.

3.2.1 Potential Drawdown

At full build-out, the simulated areal extent of the potential cone of depression after two months of dewatering is shown on Figure 3-2. Two feet of drawdown was observed to extend approximately 4,000 feet north of the pit and about 2,800 feet to the south of the pit. Drawdown is observed to have the

[1] The actual surveyed water level was determined to be 14 feet during low water conditions which equates to a drawdown of 21 feet as opposed to 25 feet below static water level. The less drawdown that occurs in the pit, the less drawdown will occur at a given distance from the pit.

potential to be greater along the edges of the valley closer to the Animas River. No drawdown was observed on the opposite side of the Animas River.

Drawdown observed at the three monitoring points is shown on the charts on Figures 3-3. Maximum simulated potential drawdown observed at the north and south monitoring points was approximately 5.5 feet. Drawdown at the cottonwood monitoring point is approximately 10 feet; however, a drawdown of over 20 feet was simulated at cottonwoods located in closer proximity to the pit. The charts show that drawdown observed at the monitoring points reaches near steady state during the two- month active dewatering period.

Drawdown at the monitoring point north of the pit recovers to less than 0.5 feet of drawdown in approximately 47 days, whereas drawdown at the monitoring point south of the pit recovers to less than 0.5 feet of drawdown in about 35 days. Drawdown at the monitoring point used to monitor transient drawdown near the cottonwoods adjacent to the pit recovers to less than 0.5 feet of drawdown within about 22 days.

3.2.2 River Depletions

Depletions to the Animas River were evaluated on the basis of percent of the average extraction rate. The simulated percent depletions are shown on Figure 3-4 for the first year and fifth year of dewatering. As shown, the depletions do not significantly change between year 1 and year 5. Upon dewatering, due to the high transmissivity of sand and gravel deposits at the site and close proximity of the pit to the river, depletions reach the river almost immediately and are projected to be about 98.6% of the average pumping rate by the end of the first two months. When dewatering stops on February 15, depletions to the river have reduced to 3.5% by the end of March and to about 0.5% by the end of April.

3.2.3 Sensitivity Analysis

A sensitivity analysis was conducted to identify the boundaries and assigned aquifer parameters to which the results are most sensitive. Assigned aquifer properties and model boundaries were varied within reason and drawdown at the monitoring points and depletions were monitored. Using the base model and alternate configurations with the sensitivity analysis helps provide a possible range of observed spatial and temporal drawdown effects. The additional model runs (referred to as sensitivity runs) included the following:

- Sensitivity Run 1: Increased hydraulic conductivity by a factor of 10
- Sensitivity Run 2: Decreased hydraulic conductivity by a factor of 10
- Sensitivity Run 3: Decreased hydraulic conductivity of layer 2 only by a factor of 10
- Sensitivity Run 4: Increased storage values to 0.3
- Sensitivity Run 5: Decreased storage values to 0.1
- Sensitivity Run 6: Increase river stage 2 feet
- Sensitivity Run 7: Decreased river stage and bottom 2 feet
- Sensitivity Run 8: Increased river conductance by a factor of 10
- Sensitivity Run 9: Decreased river conductance by a factor of 10
- Sensitivity Run 10: Decreased bedrock elevation 100 feet
- Sensitivity Run 11: Increased bedrock elevation 50 feet
- Sensitivity Run 12: Decreased general head boundary conductance by a factor of 100
- Sensitivity Run 13: Increased general head boundary conductance by a factor of 100
- Sensitivity Run 14: Increased general head boundary elevation by 2 feet
- Sensitivity Run 15: Decreased general head boundary elevation by 2 feet
- Sensitivity Run 16: Added aerial recharge to the model of 10% of the average monthly rainfall

Overall, drawdown was most sensitive to hydraulic conductivity and river conductance (which cannot be measured). Sensitivity Run 1 and Sensitivity Run 9 both increased drawdown at the monitoring points by about 0.5 ft. All other sensitivity runs changed the drawdown results by less than 0.5 feet with the exception of Sensitivity Run 2 which drastically reduced the drawdown at the north and south monitoring points. However, the slower response which resulted from reducing the hydraulic conductivity also prevented the north and south monitoring points from recovering to less than 0.5 to 0.7 feet during the non-dewatering period. Sensitivity to the low hydraulic conductivity shows how potential heterogeneities or lower permeable zones could influence drawdown and timing of drawdown.

The sensitivity runs also showed there was relatively little impact on the stream depletion results by changing the majority of the boundary conditions and aquifer parameters. Except for Sensitivity Run 2, the model runs indicated that by the end of the two months of active dewatering, the river will be depleted by at least 97.6% or greater of the extraction rate and will reduce to less than 1% to 0% of the extraction rate by early June; the depletion rate reduced to 1.9% by early June in Sensitivity Run 3. Sensitivity Run 2 showed that the maximum depletions felt by the river will be 77.6% of the extraction rate after the fifth year of pumping, and the depletions to the river will only reduce to 20.7% of the extraction rate by early June and to about 7% of the extraction rate by the time pumping begins later in the year. The results of the sensitivity analysis are included as Appendix A.

4.0 DEWATERING IMPACTS

Dewatering operations inherently cause impacts to local groundwater systems by removal of water from the aquifer. Dewatering impacts can also involve changes to surface water environments (depletions). In general, reducing the time and magnitude of the dewatering operation will reduce overall impacts.

Local Wells

Wells within the 5-feet drawdown contour are identified in Table 4-1 and shown in Figure 4-1. The well locations shown in Figure 4-1 are based on the permitted locations as reported in the DWR well-permit database. Several of the wells are located more than ¼ mile from the Pit. The modeled results indicate that five wells may experience 10 to 24 feet of drawdown and 10 wells could experience 5 to 10 feet of drawdown. All of the wells are for domestic use only with the exception of the well with Permit No. 13987-F, which is used for commercial use. The wells that may be impacted the most based on well depth, reported static water level, and potential drawdown are well permit nos. 103589, 244426-A, 144732, and 46320. It should be noted that well locations, depths, and static water levels of these wells are as reported in the permit records and have not been verified. Wells that may experience less than 5 feet of drawdown are not included in the Table 4-1 but are shown in Figure 4-1.

Cottonwoods

The projected drawdown within the cottonwood trees area ranges from 1 foot to more than 20 feet. Cottonwoods located further from the Pit will experience less of a drawdown with a slower drawdown response than will cottonwoods located closer to the pit. The active growing season for Cottonwoods is April through October. If dewatering operations are completed by February 15, drawdowns will have recovered by mid-March to approximately 1 foot in areas further from the Pit and to less than 1 foot in areas closer to the Pit. Moreover, as the Animas River stage begins to rise from snowmelt runoff in mid-March, recharge rates to the aquifer from the stream are likely to increase causing additional recharge to the aquifer and further reducing the drawdown effects. If it is later determined that drawdown impacts at the cottonwood areas are detrimental to the trees, the impacts could be reduced by irrigating the trees with water pumped from the Pit during dewatering and water pumped from the river under free river conditions after dewatering operations have been suspended; watering would be conducted when not otherwise prevented by snow cover or frozen ground conditions.

Stream Depletion

Depletions to the Animas River will occur in response to dewatering operations at the Pit. However, the high transmissive nature of the deposits beneath the site allows depletions to occur and diminish rapidly. Modeled depletions to the Animas River would be greater than 98% of the pumping rate at the end of the two- month pumping period; however, the river will not actually experience the modeled depletions during active dewatering because the water generated will be discharged directly to the river. During active dewatering and discharge to the river, actual flows in the river will increase as the pumping/discharge rate will exceed the depletion rate. Upon completion of dewatering operations, the river will experience delayed depletions attributed to dewatering. If dewatering occurs from December 15 through February 15 (as simulated), the river will experience the greatest impact immediately after the pumps are turned off but the impact will diminish to about 3.5 percent of the pumping rate by the mid-March. As shown on the hydrograph in Figure 2-1, river flows generally begin to increase each year beginning in mid-March.

According to the DWR (Water Division 7), the Animas River is not over-appropriated, and therefore augmentation of depletions is not currently required for water right on the river. However, the City of Durango recently filed for a recreational in-channel right on the Animas River and may be in a position to place a call on the river above Durango in the near future. Such a call by the City of Durango would likely occur in late summer or fall when no depletions would be expected to the Animas River in response to dewatering operations at the Pit.

4.1 Limitations

The findings and conclusions presented herein are based on projections made from numerical modeling results. As with all model simulations, projected results are highly dependent on the hydrologic and geologic information available at the time the model is constructed. For this study, the hydrologic and geologic inputs to the model were based on existing, available information in the vicinity of the Pit, no new field investigations were performed to confirm the existing data or to obtain the additional data necessary to refine the model predictions. As a result, some variations in geologic and hydrologic groundwater conditions in the vicinity of the Pit may not be represented in the evaluation conducted for this report. Accordingly, unanticipated impacts could occur in response to these variations.

5.0 REFERENCES

Anderson, M.P. and Woessner, W.W., 1992. Applied Groundwater Modeling, Simulation of Flow and Advective Transport. Academic Press, 382 p.

Blair, Robert W. and D.B. Yager. 2002. Surficial Geology Along the Animas River in the Hermosa Quadrangle, Animas River Watershed, La Plata County, Colorado. United States Geological Survey Digital Data Series DDS 71.

Environmental Simulation, Inc., 2004. Guide to Using Groundwater Vistas, Version 4.

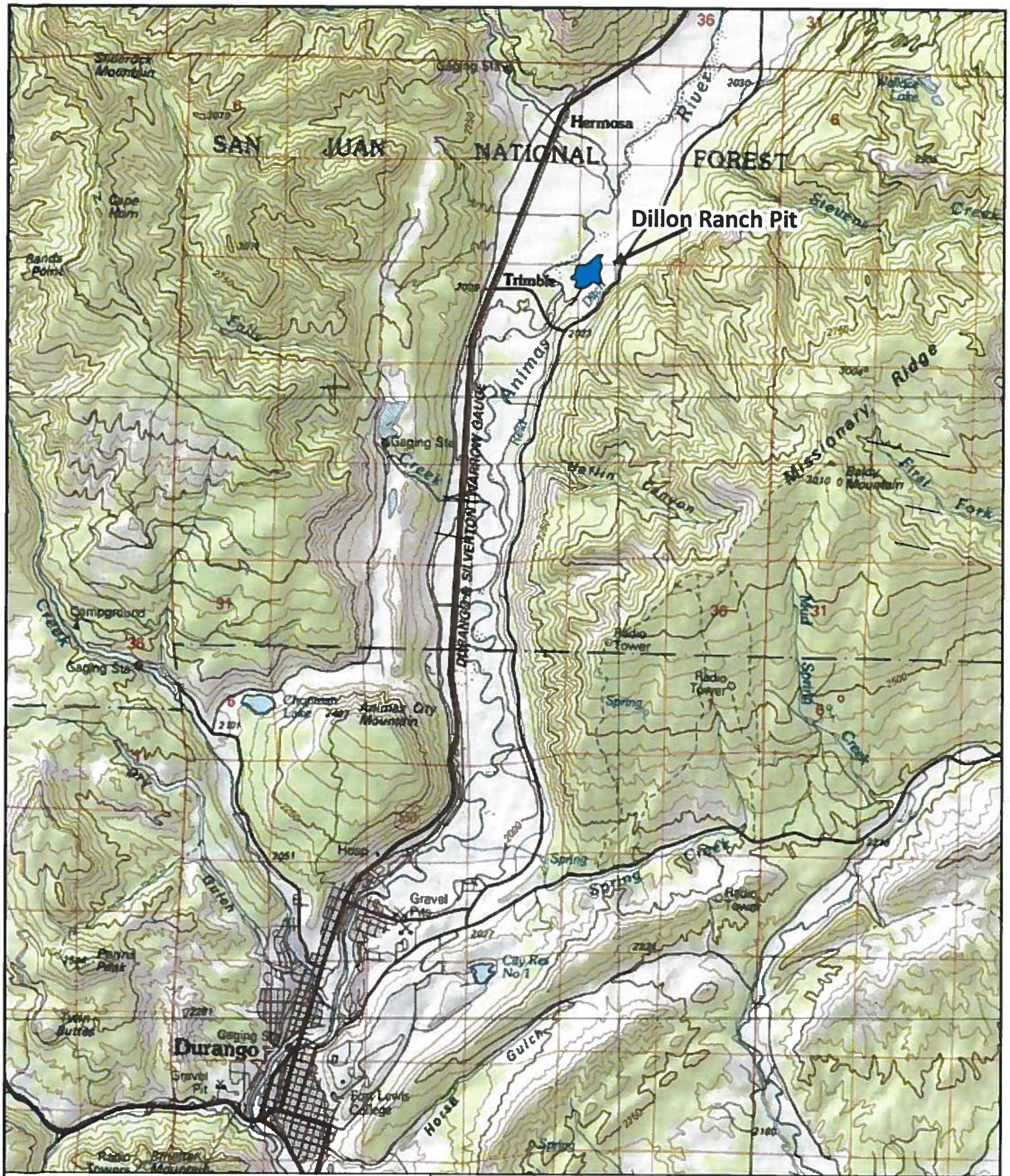
Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice-Hall, Inc. Englewood Cliffs, NJ. 604 p.

Gonzales, David A., D.W. Stahr III, and R.M. Kirkham. 2003. Geologic Map of the Hermosa Quadrangle, La Plata County, Colorado. Colorado Geological Survey Open-File Report 02-1.

McDonald, M.G. and Harbaugh, A.W., 1984. A modular three-dimensional finite difference ground-water flow model. U.S. Geological Survey Open-File Report 83-875, 528 pp.

McDonald, M.G. and A.W. Harbaugh. 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model. Techniques of Water-Resources Investigations of the United State Geological Survey. Book 6 Chapter A1. This book supersedes U.S. Geological Survey Open-File Report 83-875.

FIGURES



Miles

1 0.5 0 1

N

Basemap Source: USGS Topo and Esri ArcGIS Online

Figure 1-1 Location Map

La Plata County, Colorado

Western Water & Land, Inc.
Applications in Earth Science

Miles

0.25 0.125 0 0.25

N

Basemap Source: Esri ArcGIS Online

Figure 2-1: Dillon Ranch Pit - Site Map

La Plata County, Colorado

Western Water & Land, Inc.
Applications in Earth Science

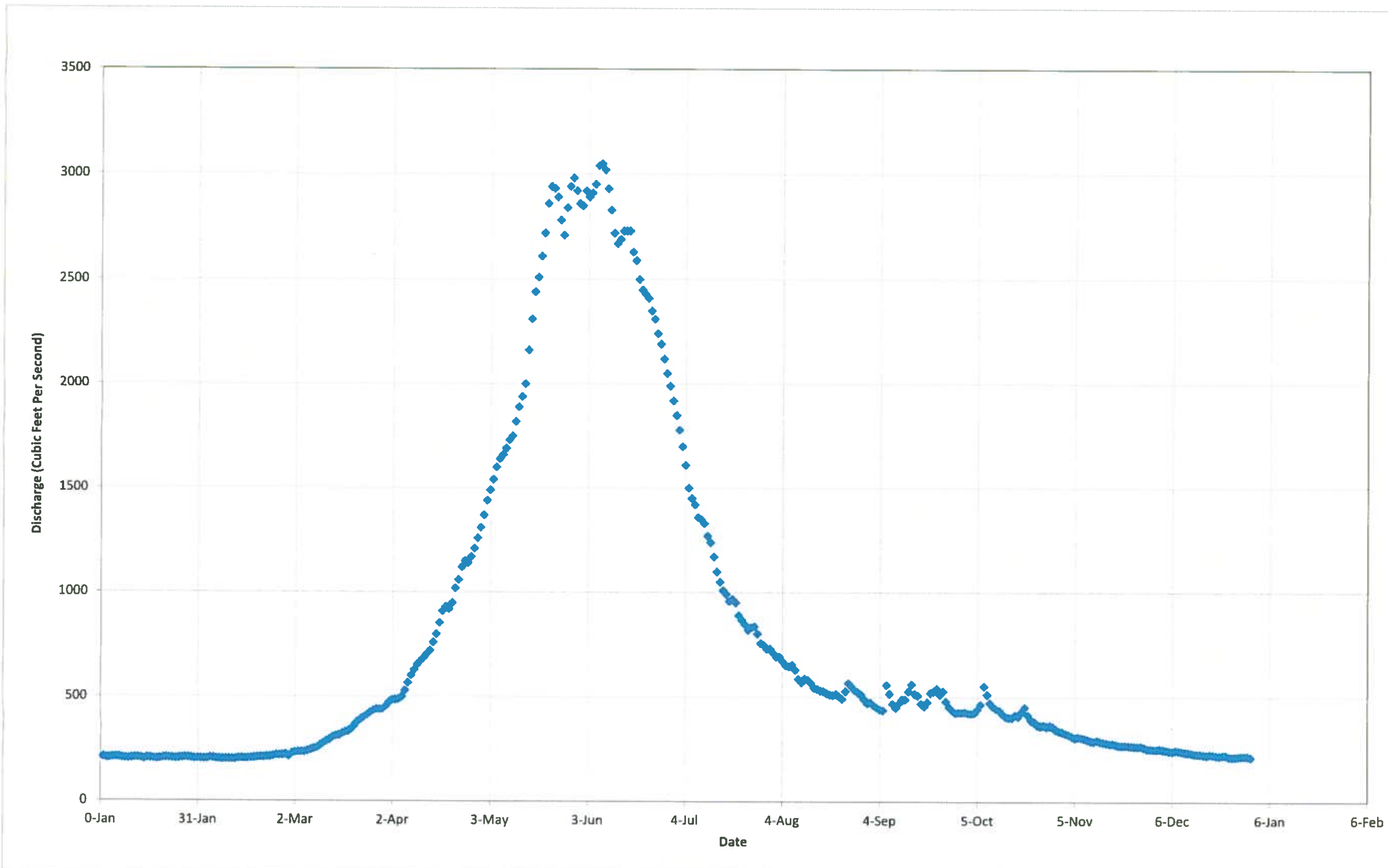


Figure 2-2: Mean Daily Discharge (1964-2012) USGS Station 9361500 Animas River At Durango, Colorado

Western Water & Land, Inc.

Legend
General Head Boundary
River Boundary
Monitoring Points
No-Flow Boundary

Feet
2,000 1,000 0

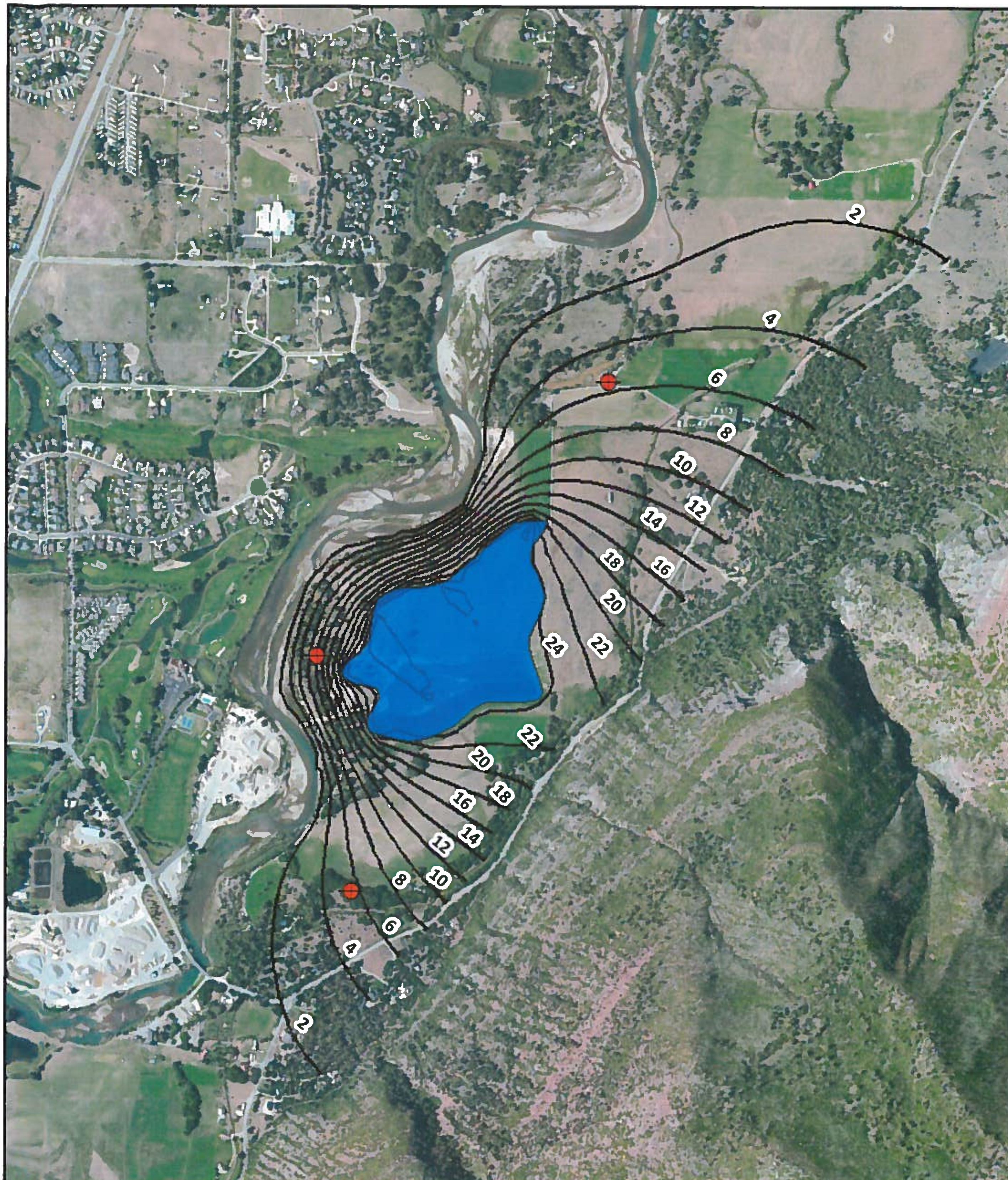
N

Basemap Source: Esri ArcGIS Online

Figure 3-1: Groundwater Model Setup

La Plata County, Colorado

Western Water & Land, Inc.
Applications in Earth Science



Legend

Drawdown Contour (2 ft)

Monitoring Points

Feet

975 487.5 0

N

Basemap Source: Esri ArcGIS Online

Figure 3-2: Maximum Simulated Potential Drawdown (Assumes a 2-month Dewatering Period)

La Plata County, Colorado

Western Water & Land, Inc.
Applications in Earth Science

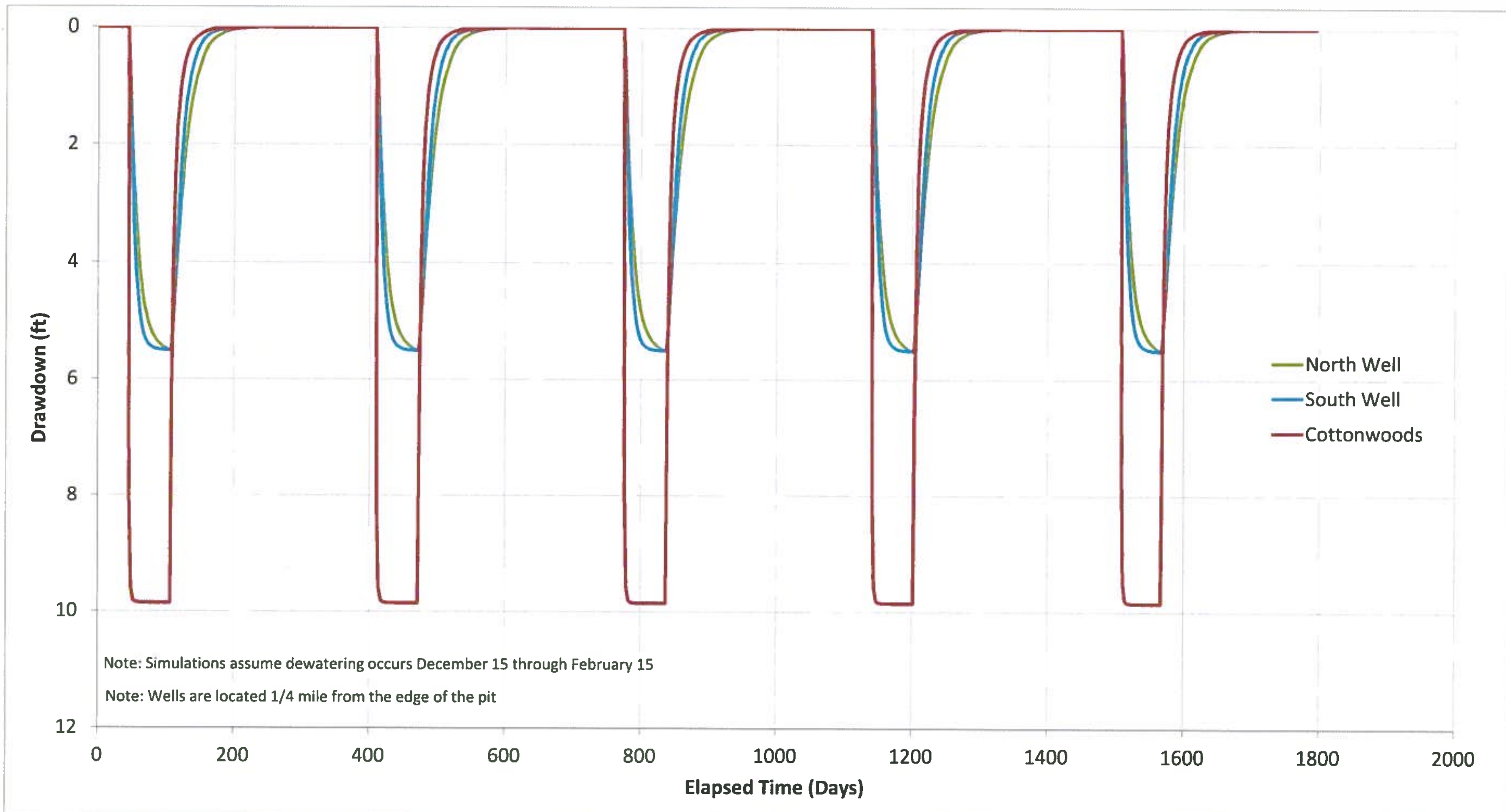


Figure 3-3: Simulated Drawdown at Designated Monitoring Points
(25 Feet of Drawdown in the Pit)
Dillon Ranch Pit, La Plata County, Colorado

Western Water & Land, Inc.

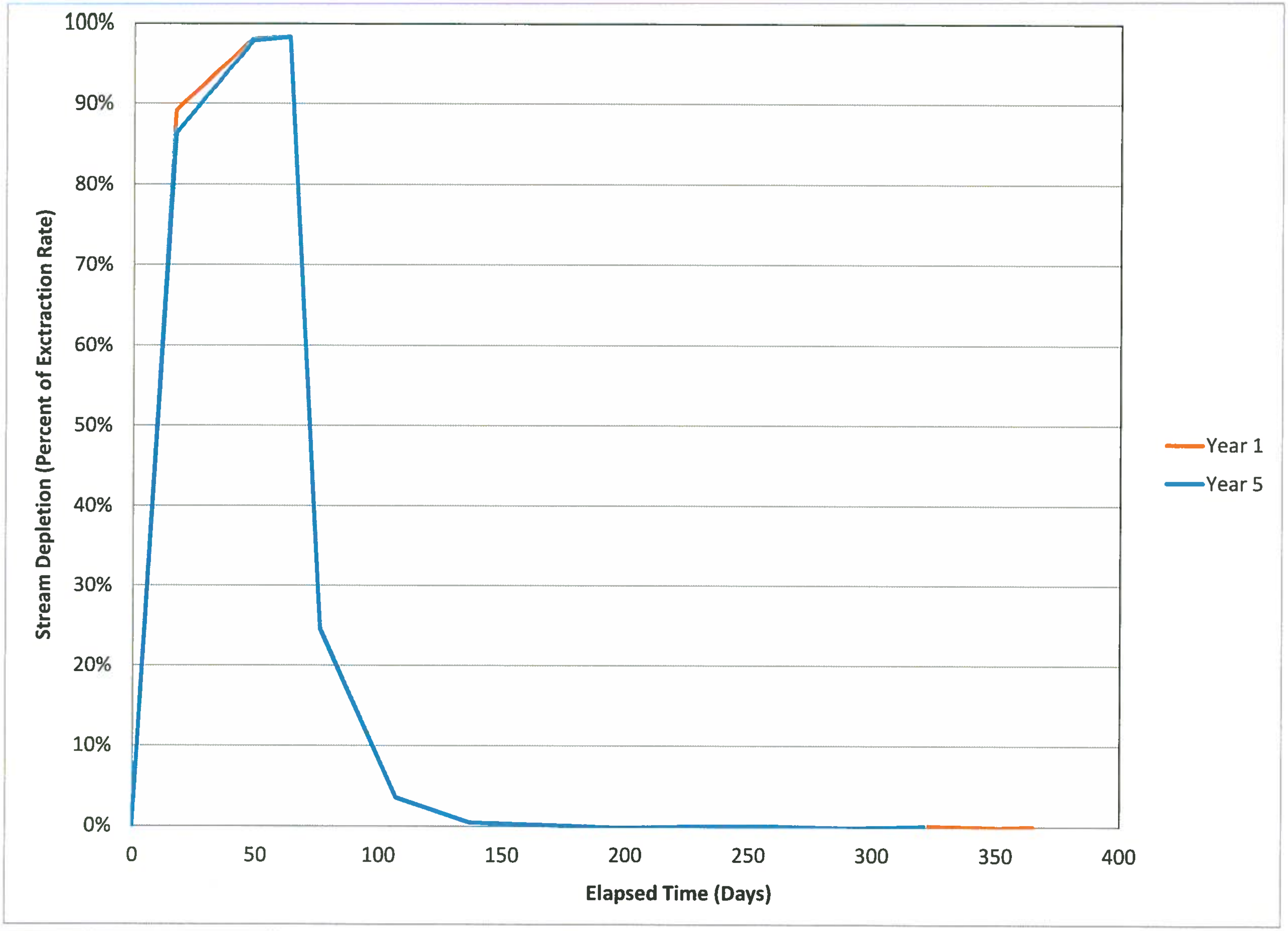


Figure 3-4: Simulated Stream Depletion on the Animas River – Years 1 and 5 of Active Dewatering
Dillon Ranch Pit, La Plata County, Colorado

Western Water & Land, Inc.

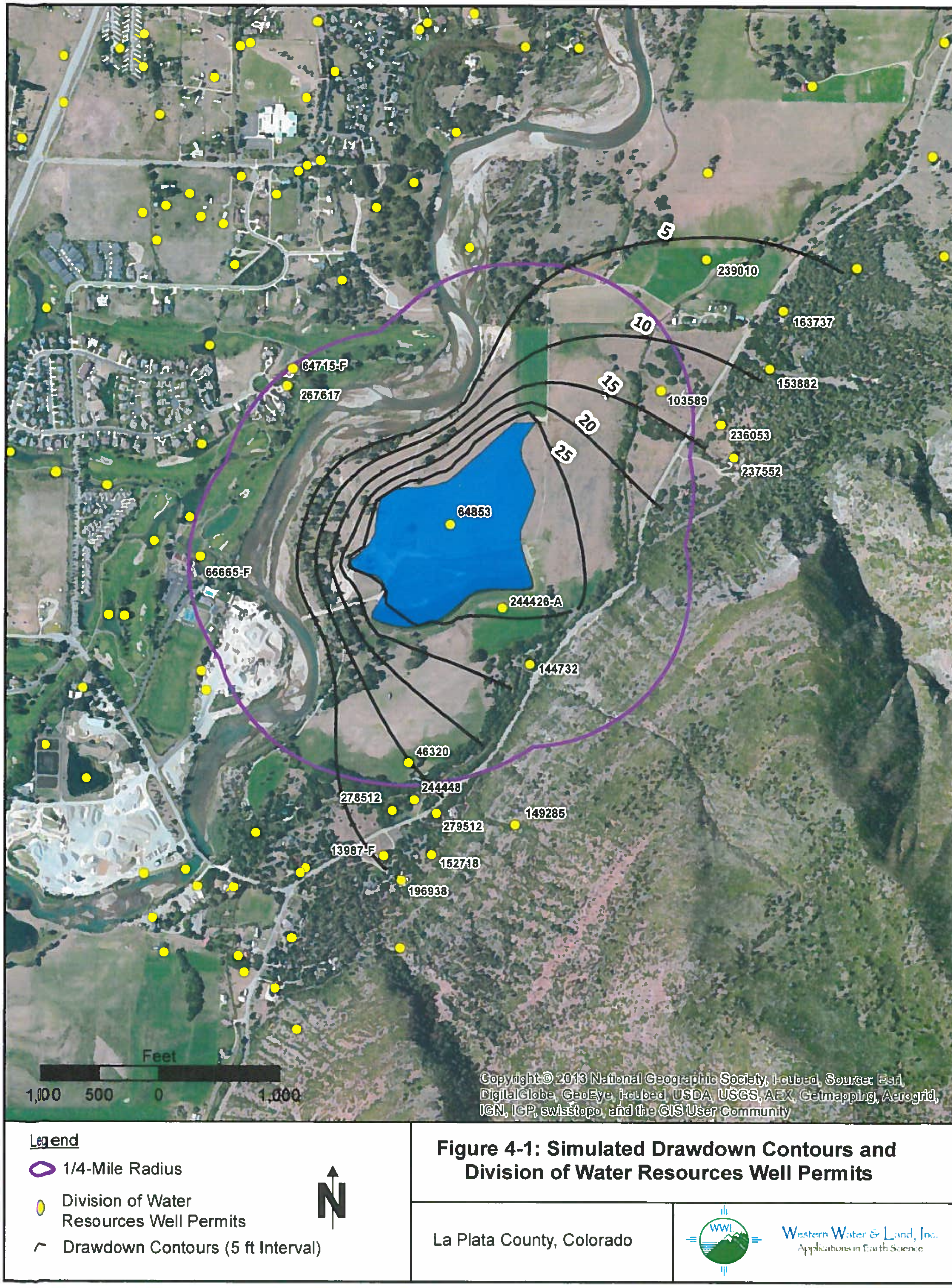


Figure 4-1: Simulated Drawdown Contours and Division of Water Resources Well Permits

La Plata County, Colorado

Western Water & Land, Inc.
Applications in Earth Science

TABLES

Table 4-1: Permitted Wells with Potential Drawdowns of Five Feet or Greater
Dillon Ranch Pit - La Plata County, Colorado

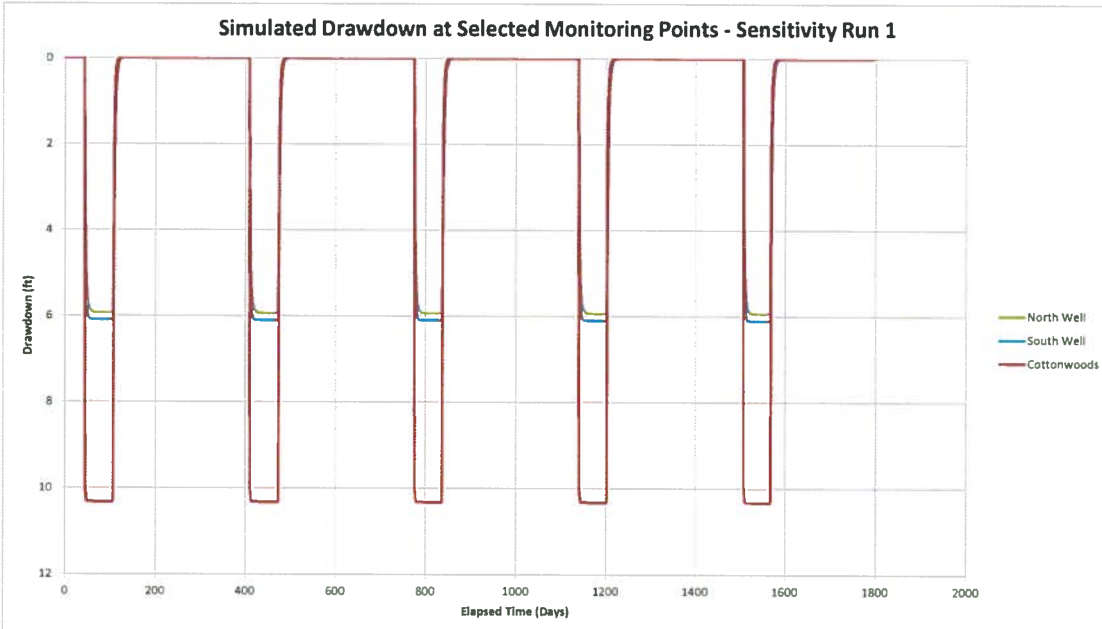
Well Permit No.	Well Depth (Ft.)	Depth to Static Water Level (Ft.)	Pump Set Depth (Ft.)	Use(s)	Approximate Distance to Edge of Pit (Ft.)	Maximum Potential Drawdown (Ft.)	Type
North							
64715-F*	60	10	45	Irrigation	1320	0	Well
267617*	14	11	13.5	Domestic, Irrigation	1220	0	Well
239010	80	15	N/A	Domestic	1974	5.0	Well
163737	103	60	N/A	Domestic	2269	6.0	Well
153882	135	78	N/A	Domestic	2012	8	Well
103589	105	63	N/A	Domestic	1092	11.3	Well
236053	180	118	N/A	Domestic	1550	11.5	Well
237552	220	100	N/A	Domestic	1672	12.5	Well
South							
66665-F*	15	12	15	Other, Irrigation	1230	0	Pond
149285#	102	80	N/A	Domestic	~1630	~8-10	Well
196938	153	100	106	Domestic	2110	5	Well
13987-F	156	142	N/A	Commercial	1913	5.7	Well
152718	133	110	N/A	Domestic	1906	6.5	Well
278512	86	Unknown	N/A	Domestic	1531	6.9	Well
244448	140	62	125	Domestic	1440	8.3	Well
279512	140	60	N/A	Domestic	1566	8.5	Well
46320	14	12	N/A	Domestic	1139	9.6	Well
144732	74	10	N/A	Domestic	635	21	Well
244426-A	40	12	N/A	Domestic	144	24	Well

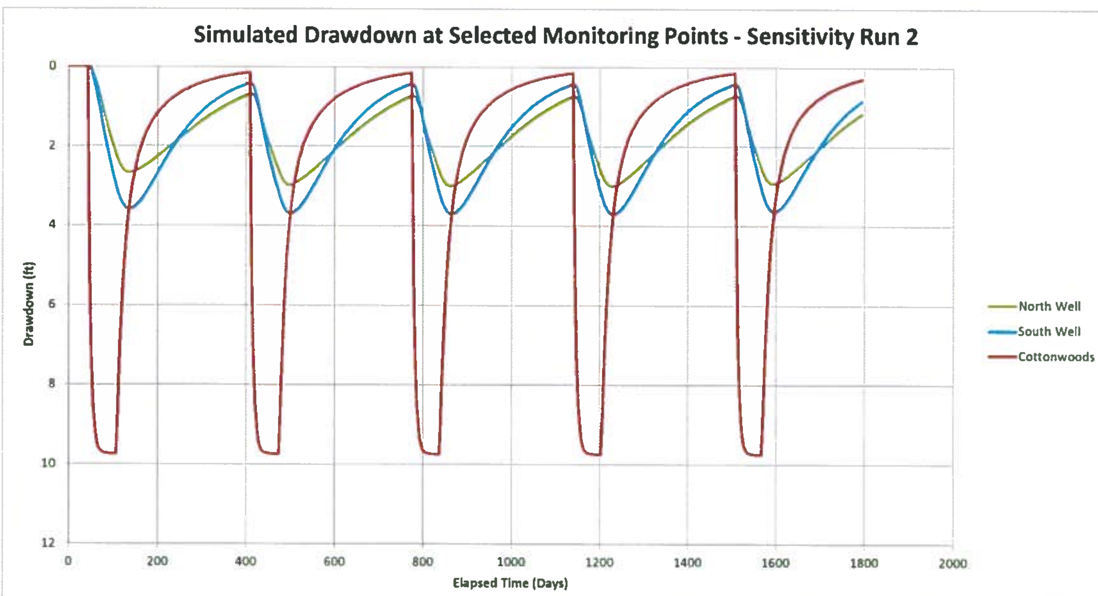
* Well located west of the Animas River

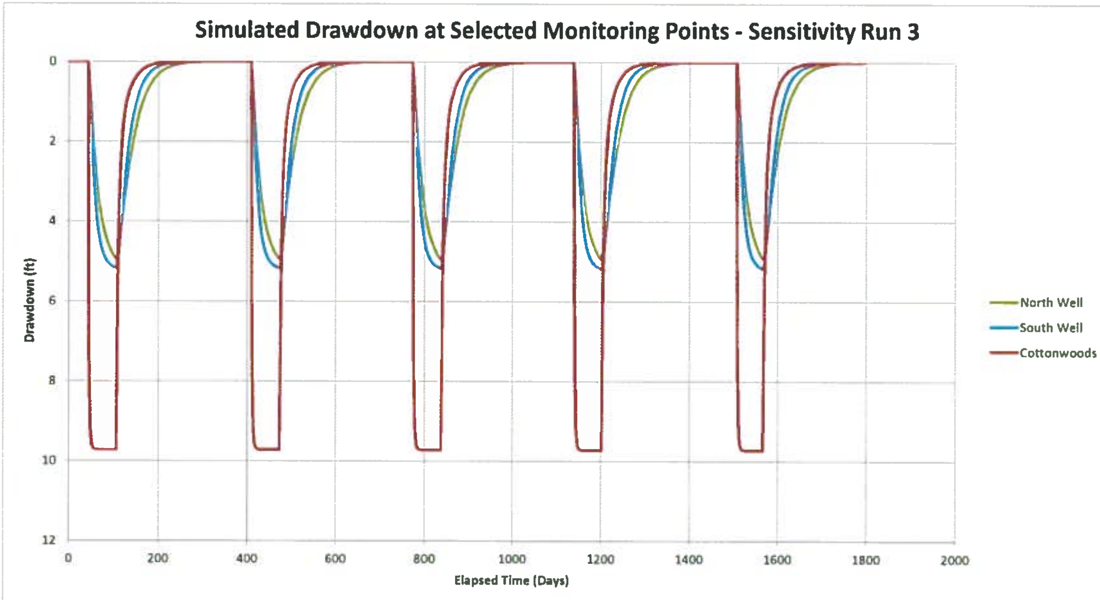
Well drawdown and distance estimates are based on location of related parcel

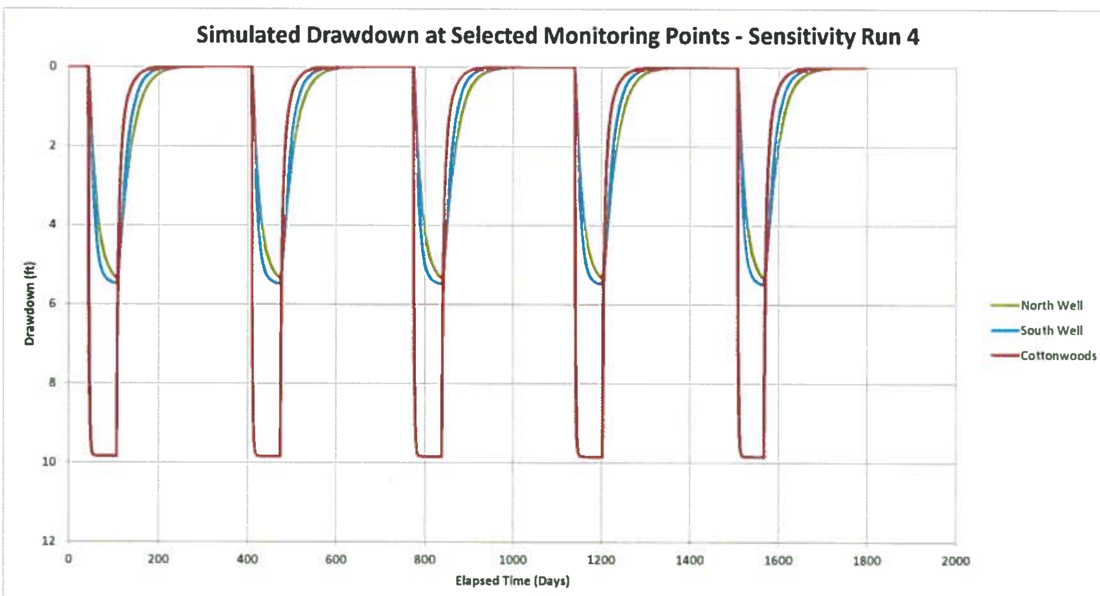
Appendix A

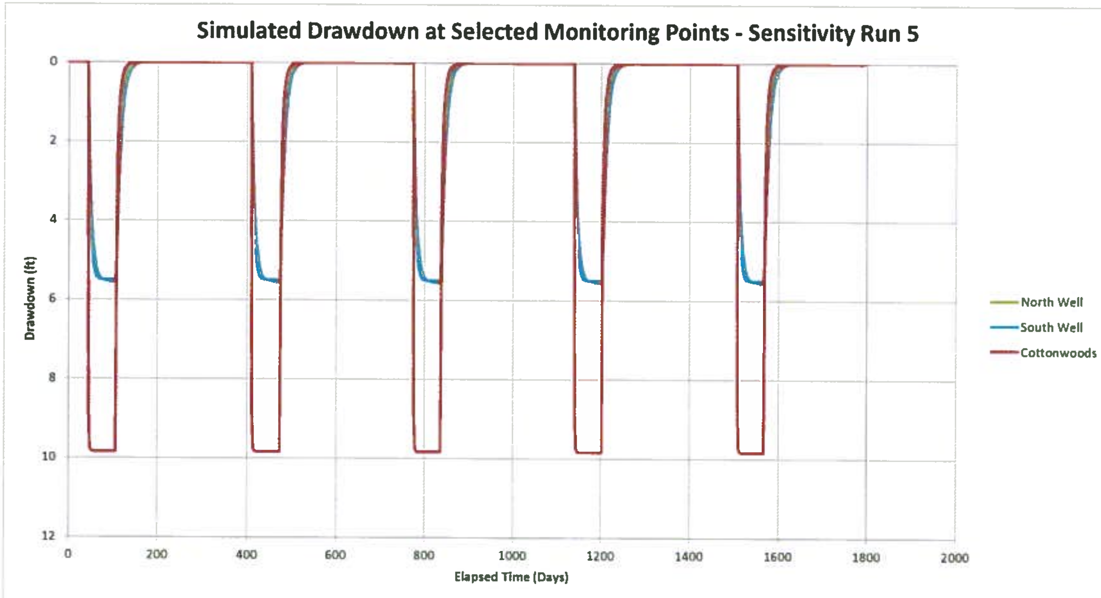
Drawdown and Stream Depletion Sensitivity Analysis Results

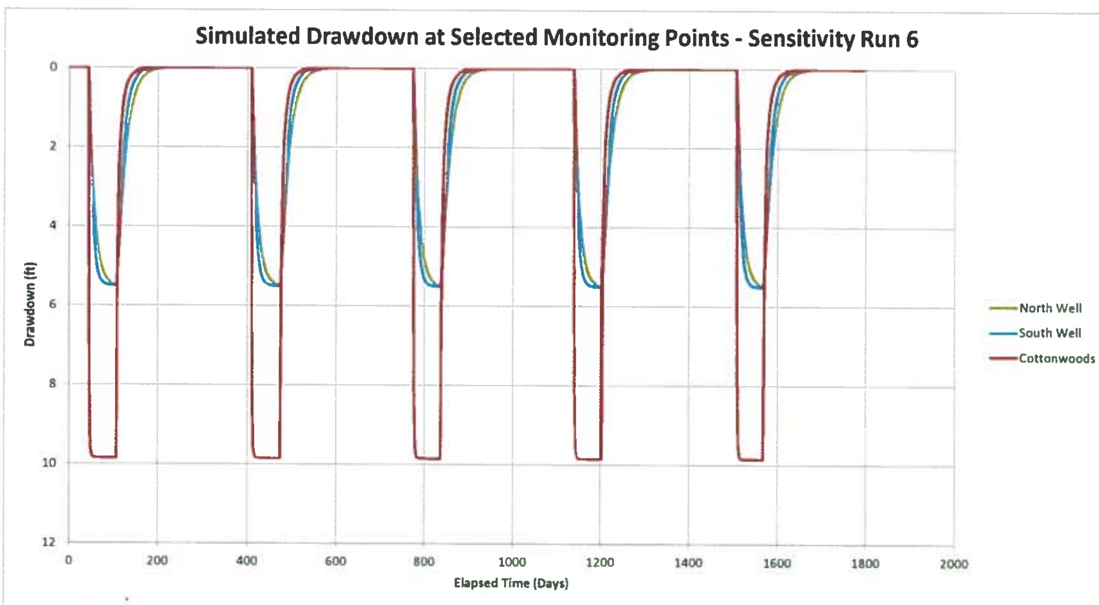

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 1
Drawdown (ft)
0
2
4
6
8
10
12
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Elapsed Time (Days)
North Well
South Well
Cottonwoods

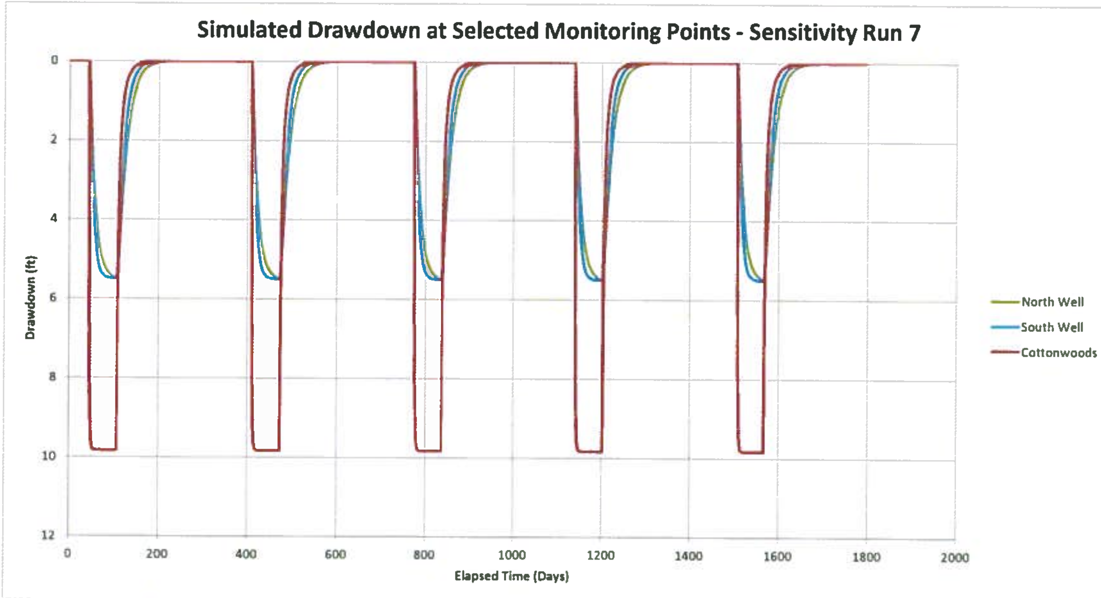

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 2
Drawdown (ft)
0
2
4
6
8
10
12
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Elapsed Time (Days)
North Well
South Well
Cottonwoods

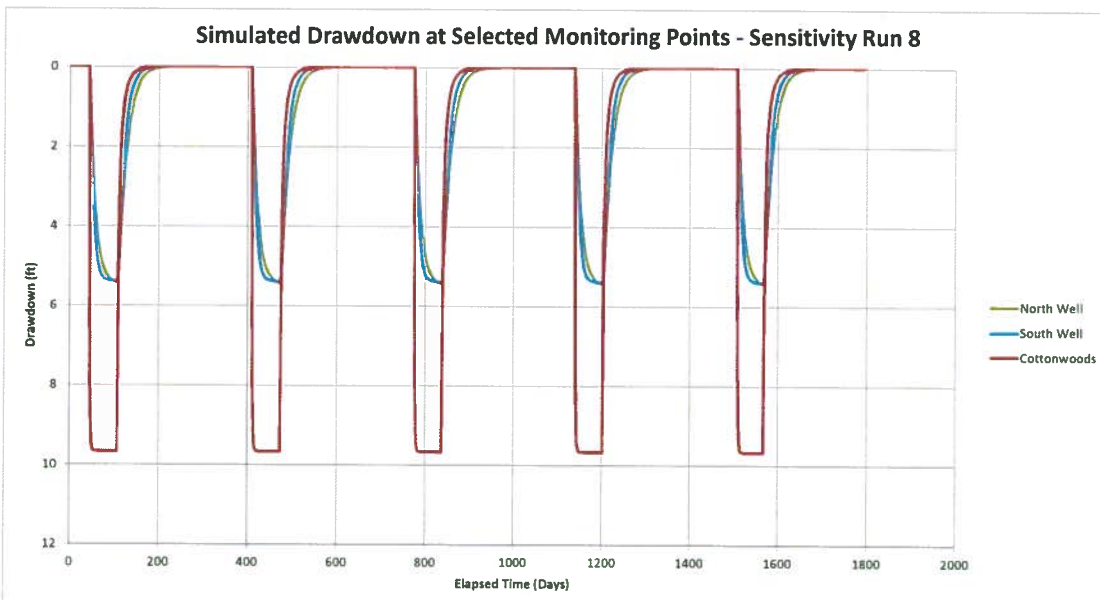

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 3
Drawdown (ft)
0
2
4
6
8
10
12
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Elapsed Time (Days)
North Well
South Well
Cottonwoods

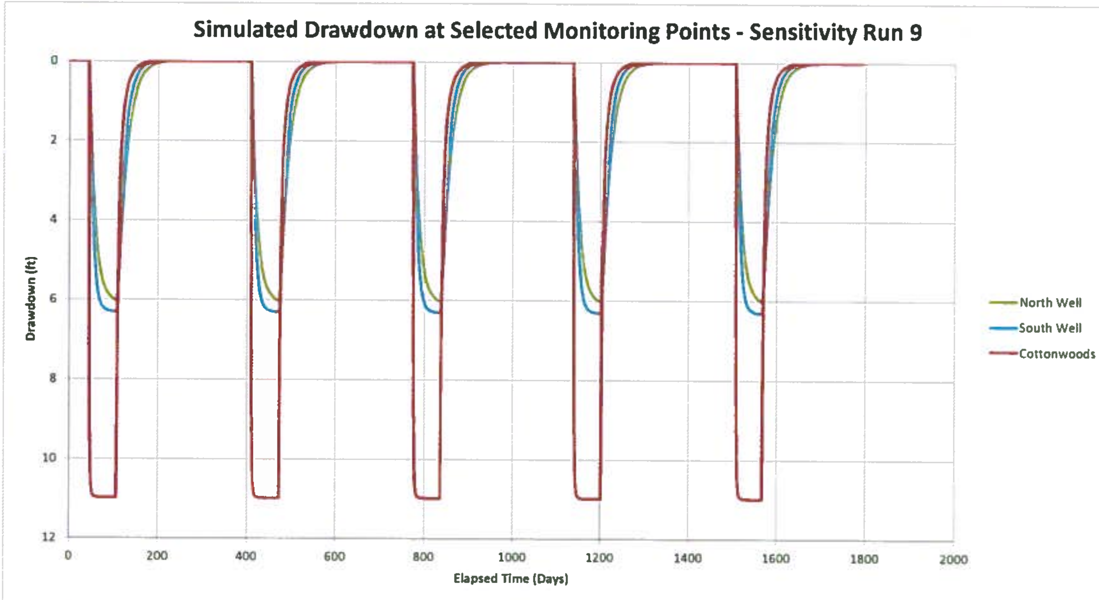

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 4
Drawdown (ft)
0
2
4
6
8
10
12
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Elapsed Time (Days)
North Well
South Well
Cottonwoods

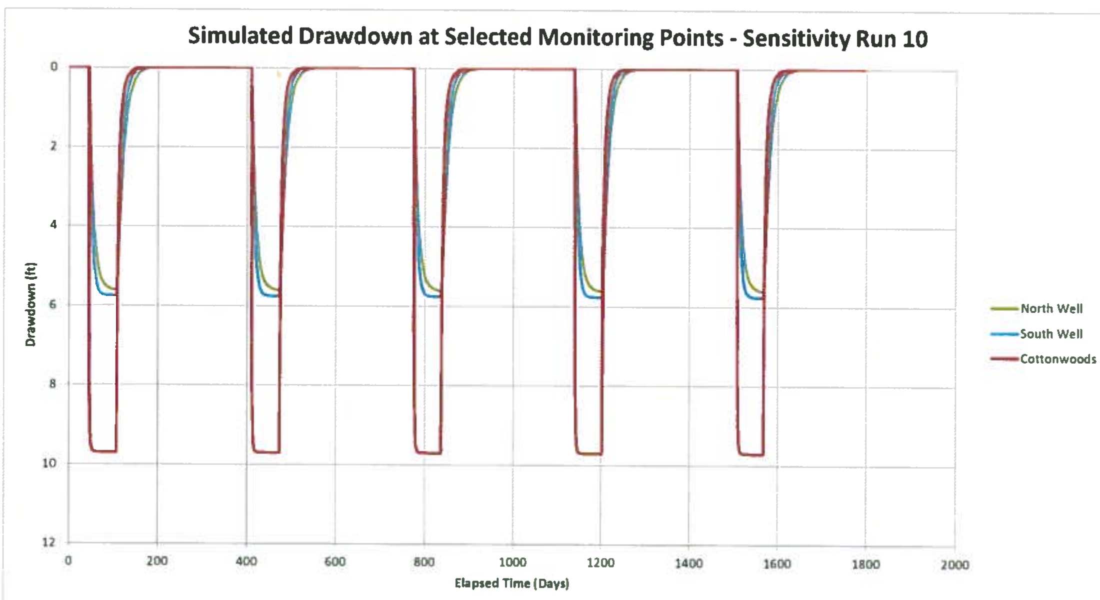

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 5
Drawdown (ft)
Elapsed Time (Days)
North Well
South Well
Cottonwoods

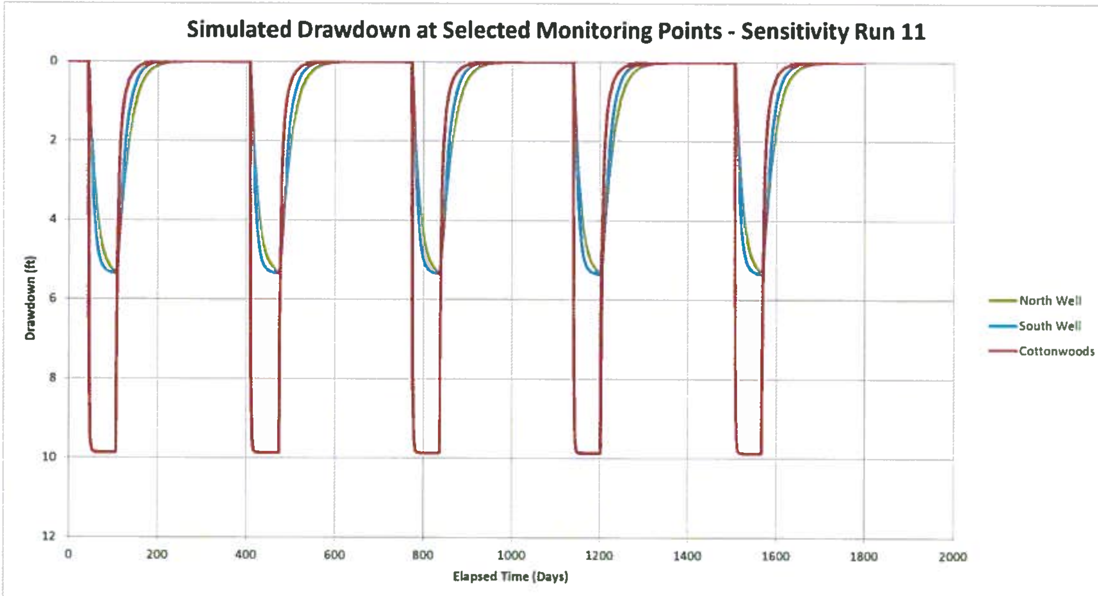

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 6
Drawdown (ft)
Elapsed Time (Days)
North Well
South Well
Cottonwoods

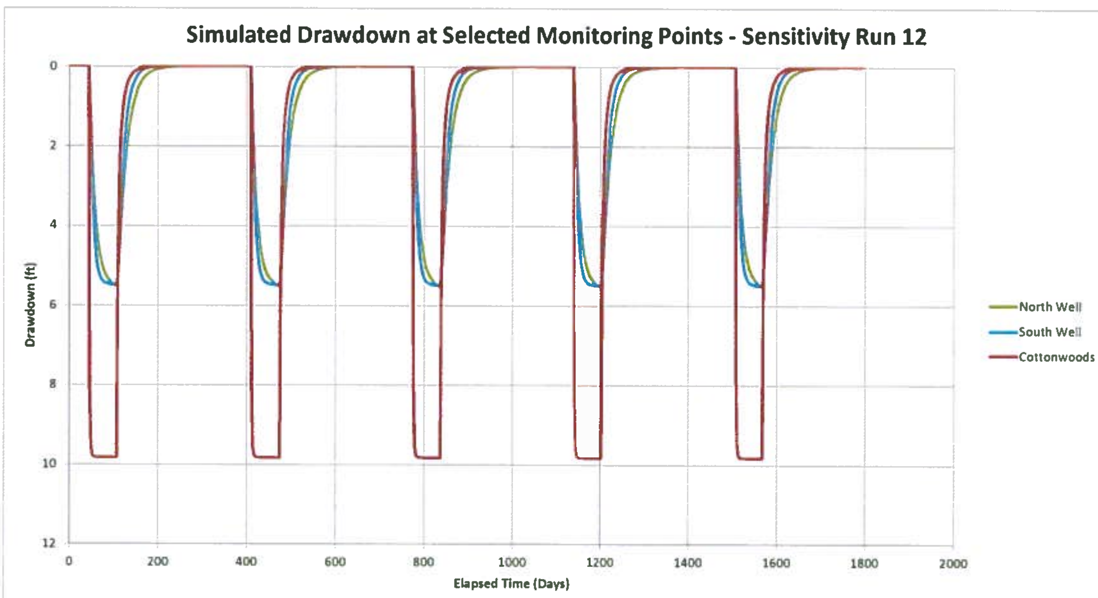

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 7
Drawdown (ft)
Elapsed Time (Days)
0
2
4
6
8
10
12
200
400
600
800
1000
1200
1400
1600
1800
2000
North Well
South Well
Cottonwoods

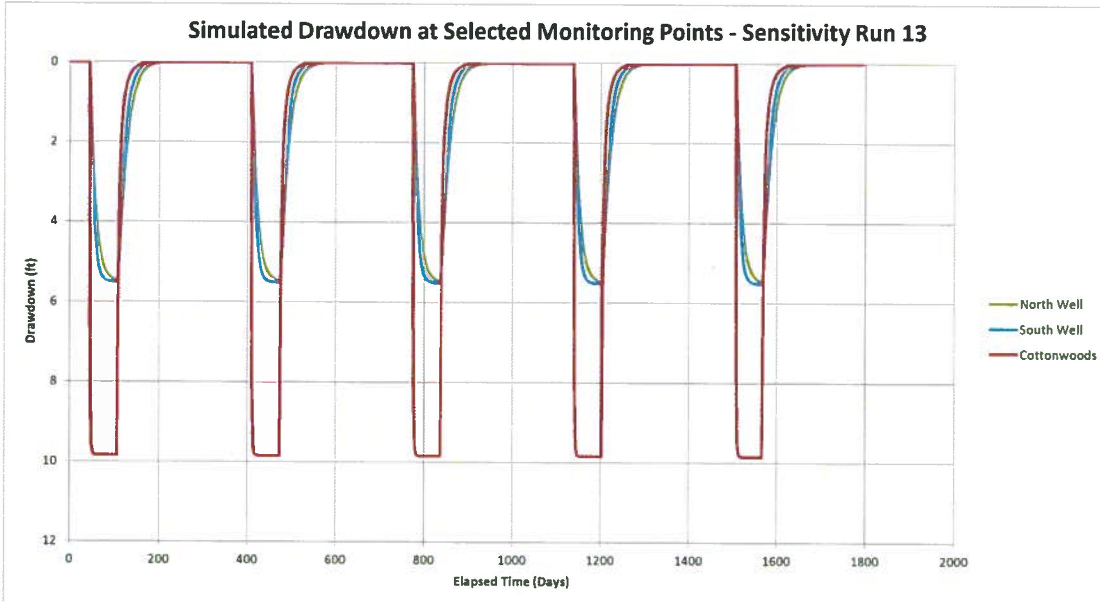

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 8
Drawdown (ft)
Elapsed Time (Days)
0
2
4
6
8
10
12
200
400
600
800
1000
1200
1400
1600
1800
2000
North Well
South Well
Cottonwoods

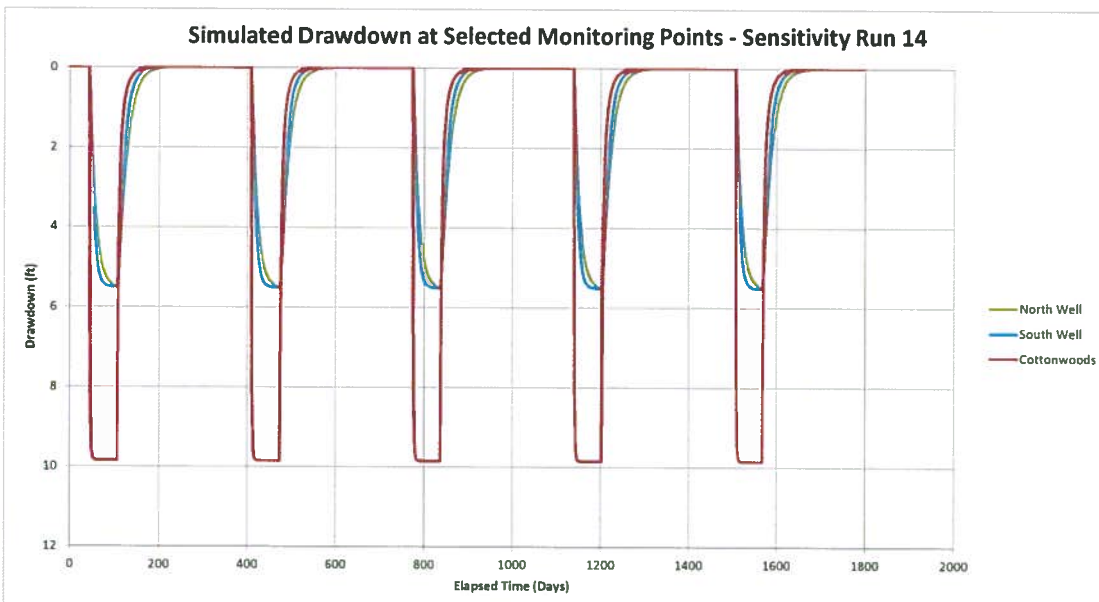

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 9
Drawdown (ft)
0
2
4
6
8
10
12
Elapsed Time (Days)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
North Well
South Well
Cottonwoods

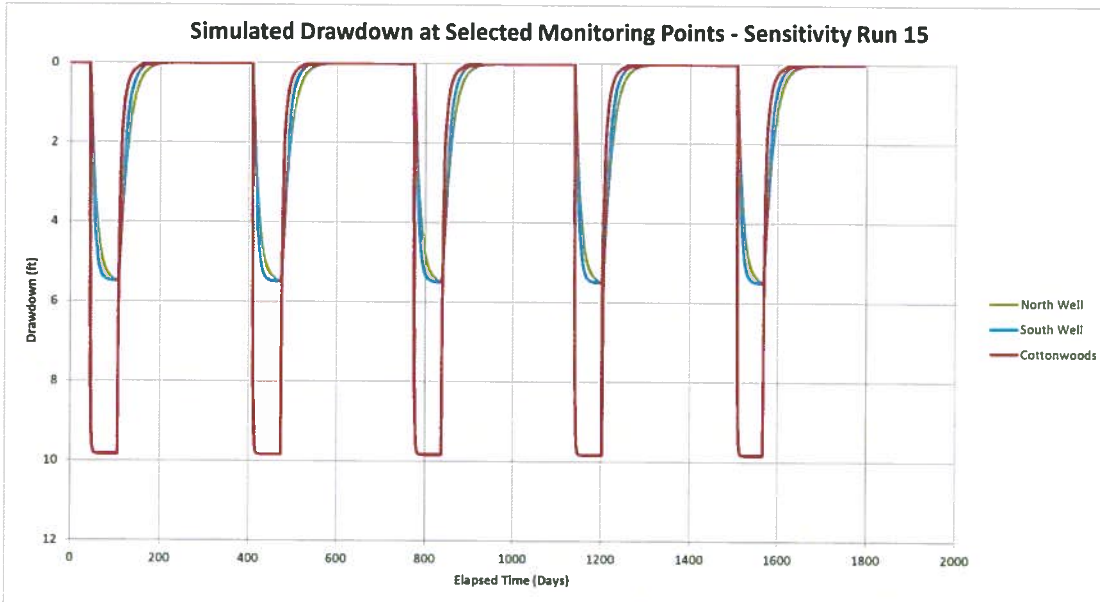

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 10
Drawdown (ft)
0
2
4
6
8
10
12
Elapsed Time (Days)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
North Well
South Well
Cottonwoods


Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 11
Drawdown (ft)
Elapsed Time (Days)
North Well
South Well
Cottonwoods


Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 12
Drawdown (ft)
Elapsed Time (Days)
North Well
South Well
Cottonwoods


Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 13
Drawdown (ft)
0
2
4
6
8
10
12
0 200 400 600 800 1000 1200 1400 1600 1800 2000
Elapsed Time (Days)
North Well
South Well
Cottonwoods


Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 14
Drawdown (ft)
0
2
4
6
8
10
12
0 200 400 600 800 1000 1200 1400 1600 1800 2000
Elapsed Time (Days)
North Well
South Well
Cottonwoods


Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 15
Drawdown (ft)
0
2
4
6
8
10
12
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Elapsed Time (Days)
North Well
South Well
Cottonwoods

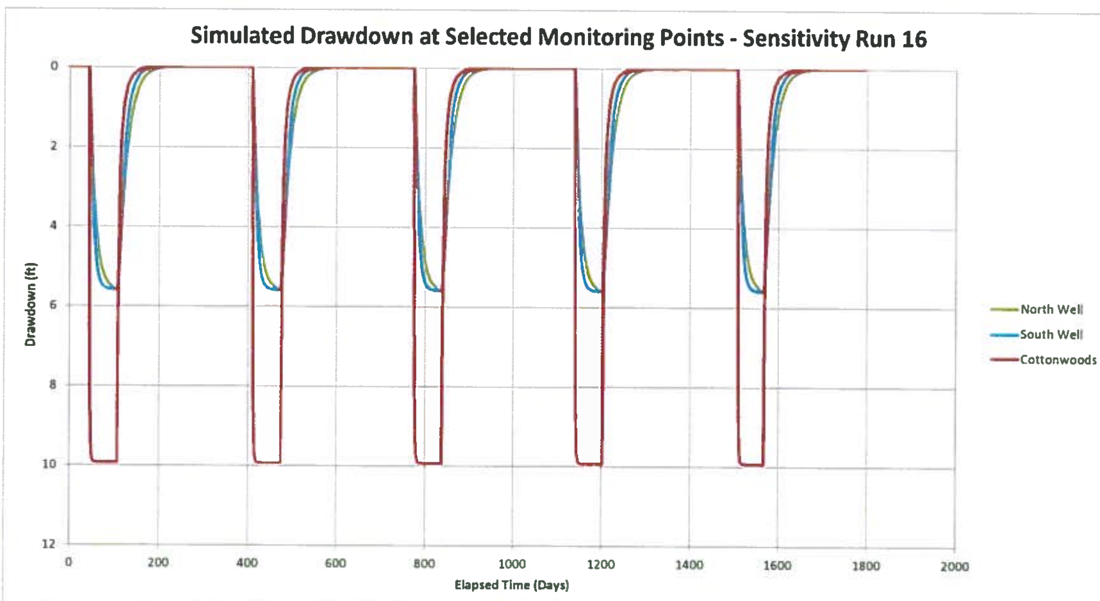

Simulated Drawdown at Selected Monitoring Points - Sensitivity Run 16
Drawdown (ft)
0
2
4
6
8
10
12
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Elapsed Time (Days)
North Well
South Well
Cottonwoods

Table A-1: Summary of Stream Depletion Results from the Sensitivyt Analysis
Dillon Ranch Pit, La Plata County, Colorado

	Base Model	Sensitivity 1	Sensitivity 2	Sensitivity 3	Sensitivity 4
Feb 15 -yr 1	98.7%	99.6%	76.6%	97.4%	97.8%
Early June -yr 1	0.5%	0.0%	20.7%	1.9%	0.8%
Dec 14 -yr 1	0.3%	0.0%	6.8%	0.6%	0.5%
Feb 15 -yr 5	98.6%	99.6%	77.6%	97.2%	97.6%
Early June -yr 1	0.5%	0.0%	21.3%	1.9%	0.8%
Oct 31 -yr 5	0.4%	0.0%	9.5%	0.9%	0.2%
	Sensitivity 5	Sensitivity 6	Sensitivity 7	Sensitivity 8	Sensitivity 9
Feb 15 -yr 1	99.0%	98.7%	98.6%	98.9%	97.5%
Early June -yr 1	0.3%	0.5%	0.6%	1.9%	0.2%
Dec 14 -yr 1	0.1%	0.3%	0.3%	*2.4%	0.0%
Feb 15 -yr 5	99.0%	98.7%	98.6%	98.7%	97.4%
Early June -yr 1	0.3%	0.5%	0.6%	1.9%	0.3%
Oct 31 -yr 5	0.3%	0.5%	0.5%	*2.3%	0.0%
	Sensitivity 10	Sensitivity 11	Sensitivity 12	Sensitivity 13	Sensitivity 14
Feb 15 -yr 1	98.6%	98.4%	99.3%	98.2%	98.7%
Early June -yr 1	0.4%	0.9%	0.7%	0.5%	0.5%
Dec 14 -yr 1	0.3%	0.5%	0.3%	0.4%	0.3%
Feb 15 -yr 5	98.6%	98.2%	99.2%	98.2%	98.6%
Early June -yr 1	0.4%	0.9%	0.7%	0.5%	0.6%
Oct 31 -yr 5	0.3%	0.6%	0.5%	0.5%	0.4%
	Sensitivity 15	Sensitivity 16			
Feb 15 -yr 1	98.7%	98.8%			
Early June -yr 1	0.6%	0.6%			
Dec 14 -yr 1	0.4%	0.4%			
Feb 15 -yr 5	98.6%	98.7%			
Early June -yr 1	0.6%	0.6%			
Oct 31 -yr 5	0.5%	0.5%			

Note:
Stream depletion results are reported as percent of the dewatering rate.
*Values with an asterisk are inaccurate due to high errors in the water balance due to trouble with model convergance

7013 1710 0001 6953 5306

UNITED STATES POSTAGE
PITNEY BOWES
$ 007.77⁰
02 1P
0003124332 JAN 13 2014
MAILED FROM ZIP CODE 81501

Elam CONSTRUCTION, INC.
556 Struthers Avenue
Grand Junction, Colorado 81501-3826

Colo Division of Reclamation, Mining and Safety
1313 Sherman St.
Room 215
Denver, CO 80203

Division of Reclamation, Mining, and Safety

Fee Receipt for M1987064

Elam Construction, Inc. dba Sandco, Inc.

000000000

Receipt #: 16689
Date: 01/16/2014
Permit: M1987064

Payment Method	Revenue Code	Fee Description/Notes	Amount
16042 msr	4300-11	Minerals Technical Revision M1987-064	$216.00
		Receipt Total:	**$216.00**