Reclaimed Water Reuse Study

Final Report - February 2016

CITY OF KINGMAN
FOUNDED 1882

SUNRISE
ENGINEERING

RECLAIMED WATER REUSE STUDY

FOR

FEBRUARY 2016

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ABBREVIATIONS LIST

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
APP	Aquifer Protection Permit
ARS	Arizona Revised Statues
DIP	Ductile iron pipe
ft	foot or feet
gal	gallon
GPM	gallons per minute
GPD	gallons per day
LF	linear feet
Max	Maximum
MGD	million gallons per day
O&M	Operations and Maintenance
TCE	Temporary Construction Easement
psi	pounds per square inch
PVC	Polyvinyl chloride
WWTF	Wastewater Treatment Facility

EXECUTIVE SUMMARY

The City of Kingman owns and operates their Hilltop Wastewater Treatment Facility (WWTF) north of the City of Kingman located at 5925 E Highway 66 in Kingman, Arizona. This facility has the capacity and is permitted through the Arizona Department of Environmental Quality (ADEQ) to treat and redistribute up to 1 MGD of Class A+ reclaimed water. Currently, however, the WWTF only treats the wastewater to a Class B+ condition and then discharges the effluent to the Mohave Wash and to wetlands northwest of the facility.

Per ADEQ, Class A+ reclaimed water is wastewater that has been treated to a high standard of cleanliness and is cleared for human contact. Class B+ reclaimed water is also wastewater that has been treated, but to a lesser standard of cleanliness although it is still safe for human contact.

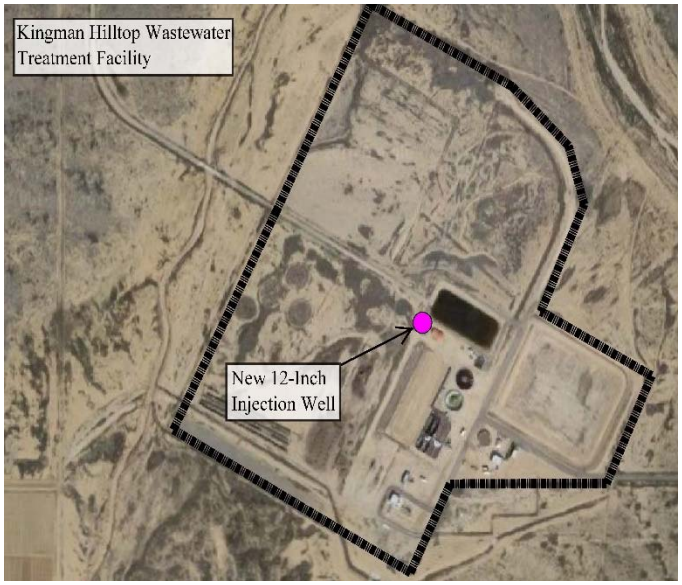
The City of Kingman would like to produce and utilize Class A+ reclaimed water and has contracted with Sunrise Engineering to perform a study of Options that would best serve Kingman's interests. These options include the following:

- Injection of the reclaimed water back into the Hualapai Valley Basin aquifer
- Distribution of the reclaimed water to the Kingman Airport Industrial Park
- Distribution of the reclaimed water to the Cerbat Cliffs Golf Course, Kingman schools and Kingman parks.

In order to determine which of the three above mentioned Options would best serve the City of Kingman, an analysis of these options was performed and is listed below.

Option 1 – Groundwater Injection:

This Option analyzed the benefits of injecting 1 MGD of Class A+ reclaimed water back into the Hualapai Valley Basin aquifer. An analysis of the Basin aquifer was performed and it was noted that groundwater levels in the Kingman and surrounding areas have been declining over time. Injection of Class A+ reclaimed water into the Basin aquifer would help to stabilize and/or raise groundwater levels.



Option 1 – Groundwater Injection

Injection Conceptual Design:
In order to achieve this injection a few options were considered. The City owns and operates a few drinking water wells within a three mile radius of the WWTF and these wells were analyzed to determine their injection capacities. It was determined that City Well #6 has enough capacity to inject the desired 1 MGD of reclaimed water and that City Well #1 only has the capacity to inject 264K GPD of reclaimed water. In order to reduce initial capital of installing a distribution

system to these wells, a third option for groundwater injection was analyzed and ultimately decided upon. This option includes drilling a new injection well at the WWTF and allowing the 1 MGD of reclaimed water to gravity flow into this new well.

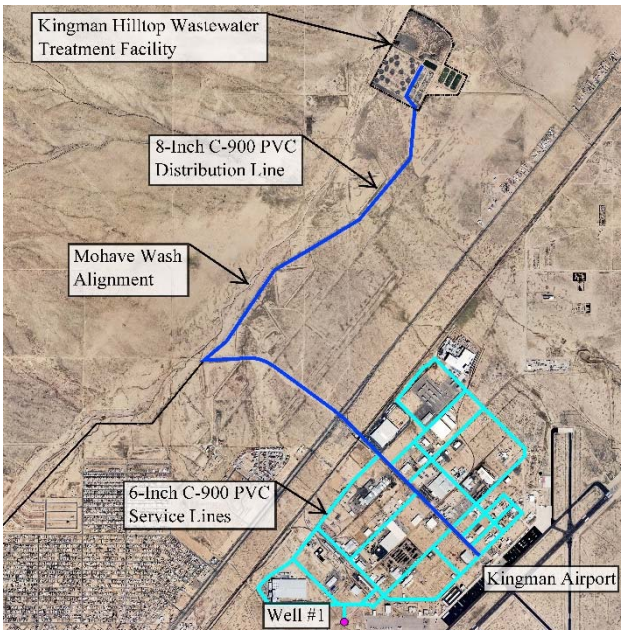
Permitting:
Permitting for Option 1 – Groundwater Injection would require that the City amend their current ADEQ Aquifer Protection Permit (APP) no. P-100611 to include groundwater injection as a form of discharge.

Capital and Long Term O&M Costs:
With the injection well being installed onsite, projected capital costs are approximately $1 Million and has minimal long term operations and maintenance (O&M) costs as there are no pumps, storage tanks or distribution line to maintain.

Option 2 – Airport Industrial Park Reuse:

This Option analyzed the feasibility of distributing Class A+ reclaimed water from the Hilltop Wastewater Treatment Facility to the property and business owners of the Kingman Municipal Airport Industrial Park.

Water Usage Study:
Current and historic water usage was analyzed to help project future reclaimed water usage demands for the next 20-years at the Airpark with an assumed 6% growth rate. Surprisingly, the projected reclaimed water peak demand was under 350K GPD with the average reclaimed water demand even lower.



Option 2 – Airport Industrial Park Reuse

Distribution Conceptual Design:
The design to distribute reclaimed water to the Airpark would include a booster station to pump reclaimed water from the City's tertiary treatment facility to a new steel water storage tank onsite, a pump station to pump the stored reclaimed water to the Airpark and an 8-inch C-900 PVC distribution line from the WWTF to the Airpark with 6-inch C-900 PVC service lines from the distribution line to the tenants at the Airpark.

This distribution line would follow the City's existing sewer easement along the Mohave Wash alignment north to the Grace Neal Parkway alignment and then run east boring under AZ Highway 66 and on to the Airpark. Option 2 would also include the option to recharge groundwater at the City's Well #1 near the Airpark. As mentioned above, this well has the capacity to inject up to 264K GPD.

Permitting:
The ADEQ permitting required for this Option would include a Type III user's permit which would allow for the City to act as the agent for the reuse of reclaimed water. This would allow the City to determine who could reuse reclaimed water and it would be the responsibility of the City to guarantee that the reclaimed water is being used appropriately and that end users are in compliance with all Arizona Administrative Code (AAC) requirements and regulations. Also, the City would need to amend their APP permit no. P-100611 to allow for reclaimed water to be discharged into the Basin aquifer.

Capital and Long Term O&M Costs:
Projected capital costs for this Option are the highest of all three Options coming in at just over $10.7 Million. Long term O&M costs are also high as there are pump stations, a storage tank and several miles of distribution lines to operate and maintain.

Rate Analysis:
A rate analysis was performed on this Option to determine by how much the reclaimed water base rates at the Airpark would need to be adjusted to in order to fund this project. Low water demand spread over a limited amount of users equated to a reclaimed water base rate increase of approximately $1,057 higher than the City's current water base rate.

Capital Savings:
Option 2 does, however, provide approximately $1.9 Million of capital savings by reducing the demands on the City's water system thereby freeing up water infrastructure.

Survey:
A survey for this Option was prepared and sent to the tenants of the Airpark to gauge interest in a reclaimed water system. To date, most of the responses have not been in favor of this system.

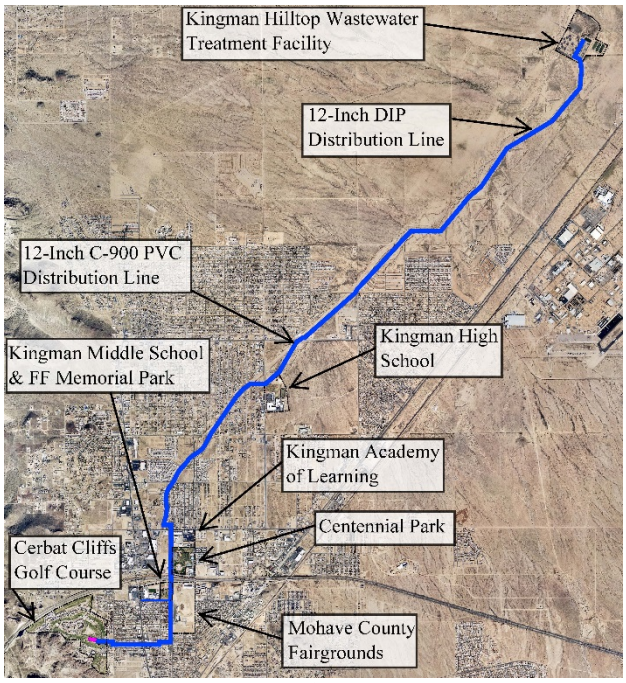
Option 3 – Golf Course, Schools and Parks Reuse:

This Option analyzed the feasibility of distributing Class A+ effluent from the Hilltop Wastewater Treatment Facility to Cerbat Cliffs Golf Course in Kingman with the possibility to have connections to the Kingman High School, Kingman Middle School, Kingman Academy of Learning, Firefighter's Memorial Park, Centennial Park and the Mohave County Fairgrounds.

Water Usage Study:
Historic irrigation water usage at the golf course, schools, parks and fairgrounds were analyzed to determine which entity had the highest demand. It was immediately determined that the golf course's irrigation water demand was almost 1 MGD in the summer months with the next highest water demand being the Kingman High School with a peak 2011 summer usage of approximately 292K GPD. Since the golf course's irrigation demands are three times higher than the next entity's irrigation water demands, it was decided that the conceptual design for Option 3 should include a distribution line from the WWTF to the golf course.

Distribution Conceptual Design:

A route was selected for this distribution line that follows the City's existing sewer easement along the Mohave Wash alignment from the WWTF into town, briefly exiting the Mohave Wash alignment to pass by the Kingman High School and then return to the Wash. At Airway Avenue, the distribution line would again exit the Mohave Wash alignment and head east to N Burbank Street. The distribution line would then turn south passing by the Kingman Academy of Learning, Centennial Park, boring under Interstate 40, and passing by Firefighter's Memorial Park, Kingman Middle School and the Mohave County Fairgrounds.



Option 3 – Golf Course, Schools and Parks Reuse

The distribution line would be a combination of 12-inch DIP for the higher pressured section near the WWTF and C-900 PVC for the lower pressured section near the golf course. This distribution line would be sized for future growth. Also, as part of the conceptual design for Option 3 there would be a booster station at the WWTF to pump the reclaimed water to the golf course.

The reclaimed water would then be stored at an available pond at the golf course with another booster station to pressurize the reclaimed water into their irrigation system. Possible service lines to the schools, parks and fairgrounds could be provided, however, all these entities except the Kingman High School would need to add additional booster stations onsite to pressurize their irrigation systems.

Permitting:

As with Option 2, this Option would only require a Type III user's permit which would allow for the City to act as the agent for the reuse of reclaimed water.

Capital and Long Term O&M Costs:

Projected capital costs for this Option were significantly higher than Option 1 but were not as high as Option 2. Projected capital costs for Option 3 came in just over $8.2 million. Long term O&M costs are also high as there are multiple pump stations to power and maintain and a long distribution line to maintain.

Rate Analysis:

To determine how much the City's current water rates would need to be adjusted to in order to fund this Option, a rate analysis was performed. Water base rates Citywide would need to increase approximately $3.16 to fund this Option.

Capital Savings:
This Option does however provide approximately $3.6 Million of capital savings by reducing the demands on the City's water system thereby freeing up water infrastructure.

Benefits Analysis:

A benefits analysis of all three Options was performed to weigh the pros and cons and help determine which of these Options best serves the City's interests. To equally compare all three Options, a list of unbiased selection criteria with assigned points possible was prepared. Criteria with a higher level of importance, such as capital costs and long term O&M were given higher points possible. A total of 200 points was possible for scoring.

Option 1 – Groundwater Injection:
This Option was the least costly of all three Options and therefore scored the highest in the capital cost criteria. It did not, however, provide any capital savings or provide any connections for future developments and therefore scored low in these criteria. This Option scored 120 points out of a possible 200 points and was ranked second of the three Options.

Option 2 – Airport Industrial Park Reuse:
This Option provides a high probability for positive community economic impact and is available for green funding and therefore scored high in these criteria. This Option was, however, the most expensive project in the study, had the highest long term O&M costs and would increase user rates the highest, therefore scoring low in these criteria. This Option scored 95 points out of a possible 200 points and was ranked last of the three Options.

Option 3 – Golf Course, Schools and Parks Reuse:
This Option provided the highest capital savings, provided a high probability for positive community economic impact and was eligible for green funding and therefore scored high in these criteria. It did not, however provide any groundwater recharging and although its capital costs and long term O&M costs were not as high as Option 2, they were significantly higher than Option 1's costs and therefore this Option scored low in these criteria. This Option scored 129 points out of a possible 200 points and was ranked first of the three Options.

Recommendations:

Option 1 Recommendation
If the City of Kingman would prefer a project with low capital costs, low long term O&M costs and an Option that provides groundwater recharging, Option 1 – Groundwater Injection is recommended.

This Option only provides groundwater injection and will be the easiest to construct. It also is the least expensive Option in this study and has the lowest O&M costs.

Option 3 Recommendation
If the City of Kingman would like to service multiple entities with reclaimed water, free up existing water infrastructure and has options for funding, Option 3 – Golf Course, Schools and Parks Reuse is recommended.

This option would use approximately 1 MGD of reclaimed water as irrigation water for the Cerbat Cliffs Golf Course with possible connections to the schools, parks and the fairgrounds. Its capital and O&M costs are higher than Option 1, but it will qualify for WIFA funding and will provide capital savings by reducing the demands on the City's water system thereby freeing up water infrastructure. Also, water base rates Citywide would only need to rise slightly in order to fully fund this Option.

Option 3 is the most flexible/scalable Option in the study. It would pass near the Airpark (approximately one mile away), multiple schools and parks, the fairgrounds and City wells that could be retrofitted for groundwater injection.

This Option would also positively impact the community economy as it has the possibility to attract new "green" businesses that want to use reclaimed water.

1.0 INTRODUCTION

1.1 Purpose and Scope of Work

The purpose of this report is to present to the City of Kingman the feasibility of three different options to reuse their reclaimed water that is produced at their Hilltop Wastewater Treatment Facility. These three options include the following:

- Groundwater Injection
- Airport Industrial Reuse
- Golf Course, Schools and Parks Reuse

This study will provide the City of Kingman with current water usage analysis, conceptual designs, capital cost estimates, long term O&M cost estimates, rate and capital savings analysis and benefits analysis. Projections for systems sizings of conceptual designs, long term O&M costs and rate and capital savings analysis will be based on a 20-year period with a 3% inflation rate, a 6% growth rate at the Airpark and a 3% growth rate for the City of Kingman. Each option will be compared to determine the pros and cons, helping the City of Kingman to determine which option or combination of options is best suited for their needs and budget.

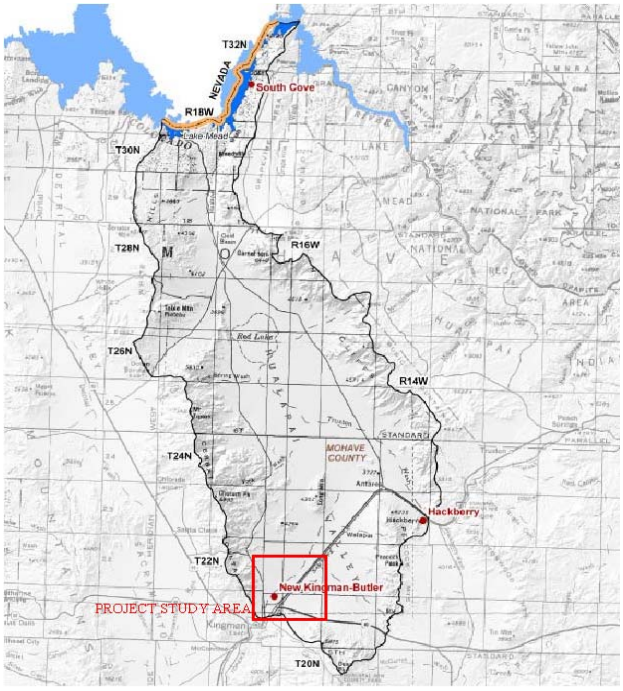


Figure 1.2 - Project Study Area

1.2 Project Study Area

The project study area focuses on the City of Kingman area within the southwestern portion of the Hualapai Valley Basin in Mohave County, Arizona as shown in Figure 1.2 – Project Study Area

1.3 Background Information

Kingman Hilltop Wastewater Treatment Facility

The City of Kingman owns and operates the Hilltop Wastewater Treatment Facility located at 5925 E Highway 66 in Kingman, Arizona (see Figure 1.3 - Kingman Wastewater Treatment Facility). From July 2014 to July 2015, the daily average sewage inflow was 1.58 million gallons per day (MGD) with a maximum inflow of 1.67 MGD. The daily average effluent flow was 1.55 million gallons with a maximum flow of 1.69 MGD (see Appendix A - Hilltop WWTF Inflow/Effluent Flows).

Once effluent has passed through secondary treatment, it goes to a chlorine contact pond. Here the effluent reaches Class B+ status and it is then discharged to the Mohave Wash on the north side of the plant. The facility is permitted with ADEQ to discharge a maximum of 5.1 MGD of Class B+ reclaimed water down the Mohave Wash and to existing wetlands located to the northwest of the facility.

The facility also has the capacity to further treat effluent. Prior to the chlorine contact tank, effluent may be diverted to a tertiary treatment facility that can treat a maximum of 1 MGD (694 GPM), resulting in Class A+ reclaimed water. The Hilltop WWTF is permitted with the ADEQ to discharge a maximum of 1 MGD of Class A+ reclaimed water for beneficial reuse under a valid reclaimed water permit. Beneficial reuse is defined by ADEQ as "direct reuse of reclaimed water".

Figure 1.3 - Kingman Hilltop Wastewater Treatment Facility

Per ADEQ, Class A+ reclaimed water is wastewater that has been treated to a high standard of cleanliness and is cleared for human contact. Access to areas that use Class A+ reclaimed water do not need to be controlled. Class A+ reclaimed water is allowed for use as irrigation for food crops, recreational areas and open access irrigation, toilet flushing, fire protection systems, industrial purposes etc. It cannot, however, be used in production for human consumption.

Class B+ reclaimed water is also wastewater that has been treated, but to a lesser standard of cleanliness. It is still safe for human contact, though. Access to areas that use Class B+ reclaimed water must be controlled. Class B+ reclaimed water is allowed for use as golf course irrigation, dust control, concrete mixing, livestock watering and irrigation to restricted access areas to name a few.

Kingman currently does not use its tertiary treatment capabilities but in the past, the tertiary treatment has been used to provide minimal amounts of Class A+ reclaimed water for a local contractor to be used for dust control measures.

ADEQ Permits

The Hilltop Wastewater Treatment Facility currently has three permits in place with ADEQ to operate and discharge (see Appendix B – Current Permits). These permits are as follows:

- **Aquifer Protection Permit (APP) no. P-100611** – This ADEQ permit authorizes the City of Kingman, Arizona to operate their Hilltop Wastewater Treatment Facility over groundwater of the Hualapai Valley basin. This permit became effective June 3, 2014 and is valid for the life of the treatment facility. This permit also allows for the

City to discharge a maximum of 5.1 MGD of Class B+ effluent to the Mohave Wash and wetlands under a valid Arizona Pollution Discharge Elimination System (AZPDES) permit or to be beneficially reused under a valid reclaimed water permit.

- **Aquifer Protection Permit (APP) no. P-106051** – This ADEQ permit authorizes the City of Kingman, Arizona to operate their Hilltop Tertiary Wastewater Treatment Facility over groundwater of the Hualapai Valley basin. This permit became effective June 25th, 2010 and is valid for the life of the treatment facility. Tertiary treatment of effluent shall be obtained through use of tertiary filters and chlorine disinfection. This permit also allows for the City to produce a maximum of 1 MGD of Class A+ effluent which may be reused for beneficial use under a valid reclaimed water permit. Any Class A+ effluent not delivered for beneficial reuse shall be discharged to the Hilltop WWTF equalization basin for discharge under APP P-100611.

- **Arizona Pollutant Discharge Elimination System (AZPDES) no. AZ0025844**– This ADEQ permit authorizes the City of Kingman, Arizona to discharge treated domestic wastewater from their Hilltop Wastewater Treatment Facility into the Mohave Wash in accordance with effluent limitations, monitoring requirements and other conditions set forth within the Standard AZPDES Permit Conditions. This permit became effective March 1, 2011 and will expire February 29, 2016.

Reuse Rules and Regulations

The City of Kingman currently has reclaimed rules and regulations in place for effluent reuse. These rules and regulations can be found in their Utility Regulations and include policies, requirements and permitting. In addition, ADEQ has a comprehensive regulatory framework of rules, standards and permits which foster reuse while protecting water quality and human health.

The Arizona Administrative Code (AAC) outlines rules for reuse of reclaimed water. The following are the AAC rules pertaining to reuse:

- **(AAC) Title 18 Chapter 9** (R18-9-601 through R18-9-603). These set of codes outline the conveyance of reclaimed water including definitions, pipeline conveyance and open water conveyance of reclaimed water.

- **(AAC) Title 18 Chapter 9** (R18-9-701 through R18-9-720). These set of codes outline the direct reuse of reclaimed water from definitions and general requirements to required permits, enforcement and penalties.

- **(AAC) Title 18 Chapter 11** (R18-11-301 through R18-11-309). These set of codes outline the Reclaimed Water Quality standards and include definitions, applicability and requirements.

2.0 OPTION 1 – GROUNDWATER INJECTION

2.1 Introduction

Option 1 of this study is groundwater injection. Currently, the majority of all water consumed by the City of Kingman and surrounding areas is provided by groundwater derived from the Hualapai Valley Basin aquifer. Option 1 would determine the benefits of injecting 1 MGD of Class A+ effluent back into the Hualapai Valley Basin aquifer. This analysis will include the following:

- An analysis of the geologic and available groundwater studies of the Hualapai Valley Basin aquifer to determine feasibility of groundwater injection.
- A conceptual design of a system that can inject the A+ effluent from the Hilltop WWTF into the aquifer.
- A capital cost estimate based on the conceptual design.
- Long term Operations and Maintenance (O&M) costs to permit, own and operate such a system.
- A benefits analysis of pros and cons of this Option to compare against other Options in this study.

2.2 Hualapai Valley Basin Groundwater Conditions

The Hualapai Valley is a basin that trends south-north and is approximately 60 miles long (See Figure 2.2. – Hualapai Valley Basin Groundwater Conditions). The Basin is relatively deep with its sediments divided into three units; young basin fill, intermediate basin fill and older basin fill. The younger basin fill consists of streambed deposits, the intermediate basin fill consists of course grained sands, silts and clays and the older basin fill consists of clastic sedimentary, limestone and basaltic flows. The older basin fill is the primary water supply in the Hualapai Valley Basin with depths of up to 1,200 feet (Ref-1).

The Hualapai Valley basin has between 5 million to 5.3 million acre-feet of stored water within the aquifer with an annual recharge of approximately 2,000 acre-feet to 3,000 acre-feet per year (Ref-1).

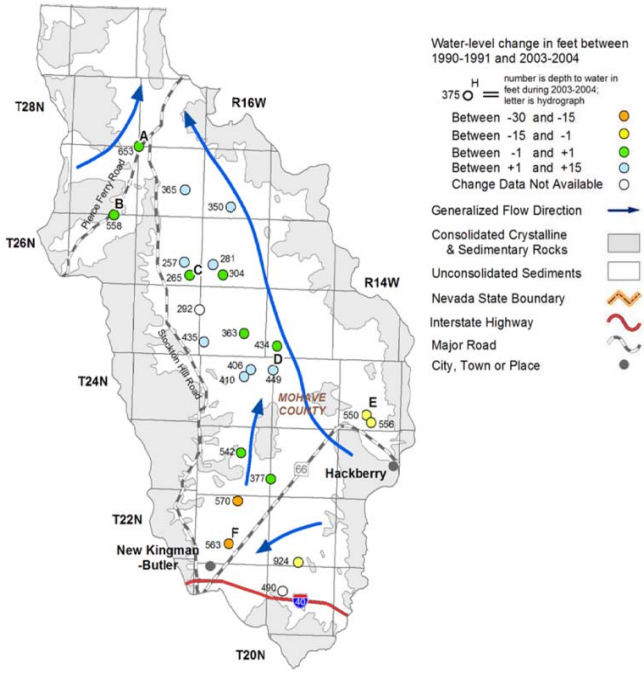


Figure 2.2 - Hualapai Valley Basin Groundwater Conditions

Usage of the Hualapai Valley Basin water is primarily derived from large volumes of municipal well pumpage by the City of Kingman. Median reported well yields are at approximately 900 GPM. Currently, there are no Active Management Areas (AMA) in the Kingman area that manage the groundwater resources. As a result, usage of the Hualapai Valley Basin aquifer is almost three times

more than that of recharge. Water levels in the southern portions of the Hualapai Valley Basin near Kingman have been declining and water levels in the central and northern parts of the Basin have been relatively stable or rising.

With no AMA present in the area, the City would receive no official credits for groundwater recharge. However, injection of Class A+ reclaimed water into the Basin aquifer would help to stabilize and/or raise groundwater levels and prove beneficial to the Kingman Area.

2.3 Conceptual Design

The City of Kingman's Hilltop Wastewater Treatment Plant has the capability to produce 1 MGD of Class A+ effluent. For the groundwater injection option, as much of that effluent as possible would be injected into the Hualapai Valley Basin aquifer by means of an injection well. ADEQ defines an injection well as "a well that receives a discharge through pressure or gravity flow." For the conceptual design of Option 1, all options of injections wells were considered to be gravity flow injection wells.

There were three options to review for injection well locations prior to designing the remainder of the injection system. The three different options of injection well locations are as followed:

- Retrofitting the City of Kingman's Well #1 into a gravity flow injection well.
- Retrofitting the City of Kingman's Well #6 into a gravity flow injection well.
- Drilling and installing a new gravity flow injection well onsite.

City Well #1

Well # 1 is a drinking water supply well owned by the City of Kingman. It is registered as Well no. 612667 with the Arizona Department of Water Resources (ADWR). The well is located in the southeast ¼ of the southeast ¼ of the southeast ¼ of Section 27, Township 22 North, Range 16 West, and is adjacent to the Kingman Airport.

Figure 2.3.1 – City of Kingman Well #1

Well #1 was completed in March 1968 with a static water level recorded at 590-feet. It has a 14-inch diameter casing drilled to a depth of 1,015-feet and has the capacity to pump 700 GPM. Currently, Well #1 is not operational. The last recorded static water level taken in June, 2006 was at 663.5-feet, providing a decline in the static groundwater level of 73.5-feet over 38 years.

Information about Well #1 is limited. ADWR records and City records have no data concerning the duration of the pumping tests performed at the time of install as well as bore hole data and perforation depths. With this information not available, it was assumed that Well #1's injection

capacity would be equal to a percentage of its pumping capacity in comparison to Well #6's pumping and injection capacities.

Well #1's data is shown in Table 2.3.1 below and Appendix D – Existing Well Data.

Table 2.3.1 – Well #1 Data

Casing Diameter (in)	Well Depth (ft)	Static Water Level (ft)	Pumping Capacity (GPM)
14	1,015	663.5	700

Well #6

Well # 6 is a drinking water supply well owned by the City of Kingman. It is registered as Well no. 529815 with ADWR. The well is located in the southeast ¼ of the southeast ¼ of the southeast ¼ of Section 17, Township 22 North, Range 16 West, approximately 2.5 miles southwest of the Hilltop Wastewater Treatment Plant.

The well was completed in September 1994 with a static water level recorded at 650-feet. It has an 18-inch diameter casing drilled to a depth of 1,200-feet and has the capacity to pump 1,600 GPM.

Figure 2.3.2 – City of Kingman Well #6

The driller's logs were very conclusive for Well #6. The casing was perforated at the following intervals: 640-820 feet, 840-1,020 feet, and 1,040 to 1,200 feet below grade with a total perforation of 520 feet. Materials encountered during drilling were primarily decomposed granite. A 49-hour constant rate pumping test was conducted in July 1991 at a pumping rate of 2,713 GPM. Subsequent 21-hour recovery data was also collected. Analysis of the drawdown versus time data yielded a transmissivity value of approximately 14,080 feet2/day.

Well #6 data is shown below in Table 2.3.2 and Appendix D – Existing Well Data.

Table 2.3.2 – Well #6 Data

Casing Diameter (in)	Well Depth (ft)	Static Water Level (ft)	Pumping Capacity (GPM)
18	1,200	650	1,600

New Onsite Injection Well

This study also included analyzing an option to drill a new injection well onsite at the Hilltop Wastewater Treatment Facility. Per ADEQ, there are no restrictions to drilling an injection well within close proximity to a WWTF or existing monitoring well. Discussions with ADEQ yielded only one potential issue which was to verify that the introduction of reclaimed water into the aquifer would not negatively affect the surrounding buildings.

To help determine groundwater conditions onsite, the closest well to the Hilltop Wastewater Treatment Facility was analyzed. This well is a monitoring well onsite registered with the Arizona Department of Water Resources (ADWR), registry no. 529463. It is a 16-inch diameter well that was drilled to a depth of 650-feet. This well currently indicates groundwater at a depth of 423-feet deep. With groundwater at that depth, 1 MGD of injection would not affect the surrounding buildings (see Figure 2.3.3 – Water Level vs Distance).

By having an injection well that recharges the groundwater onsite at the WWTF, nitrates in the aquifer in the immediate area could potentially be cleared up through dilution much quicker than without the injection.

In analyzing the onsite monitoring well data, however, it was realized that the geological data for the well was insufficient to determine injection rates for varying well sizes (See Appendix D – Existing Well Data). In order to design a functioning injection well capable of injecting 1 MGD at the Hilltop Wastewater Treatment Facility, geological and groundwater data from Well #6 was assumed. See Table 2.3.5 – Onsite Injection Wells for injection well sizes and perforation intervals. For future design, a full geotechnical report on the underlying strata is recommended.

Injection Well Capacity Analysis

The maximum allowable injection rate can be estimated using the following equation developed by Mathews and Russell (Ref 2):

$$Q = \frac{\Delta p\, kb}{162.6\mu} \frac{1}{\log \frac{kt}{\emptyset \mu C r^2} - 3.23}$$

Where

Q	=	injection rate in barrels/day;
k	=	permeability in millidarcies;
b	=	thickness of aquifer in feet;
t	=	injection time in hours;
r	=	distance from center of well in feet;
Δp	=	pressure at well in feet;
μ	=	viscosity of injected water in centipoises;
$\emptyset$	=	aquifer porosity in fraction; and
C	=	water compressibility in psi^{-1}.

For Well #6, the following values were used in the injection capacity analysis:

Table 2.3.3 – Well #6 Injection Capacity Parameters

Parameter	Value	Unit	Comment
k	301	millidarcies	
b	520	feet	perforation intervals
t	175,200	hours	20 years
r	0.75	feet	18 inches in diameter
Δp	649	feet	static water level minus well loss (<1 foot)
μ	0.98	centipoises	assumes 70°F
Ø	0.20	fraction	
C	3.08×10^{-6}	psi^{-1}	

Using the parameter values in Table 2.3.3 – Well #6 Injection Capacity Parameters above, the maximum allowable injection rate was estimated to be approximately 1,058,520 GDP (see Appendix D – Existing Well Data). Well #6 has enough injection capacity for the proposed 1 MGD reclaimed water. Assuming the water level in the aquifer does not change, injection of 1 MGD of reclaimed water into the aquifer would raise the water table in surrounding areas over a period of 20-years. See Figure 2.3.3 – Water Level vs Distance.

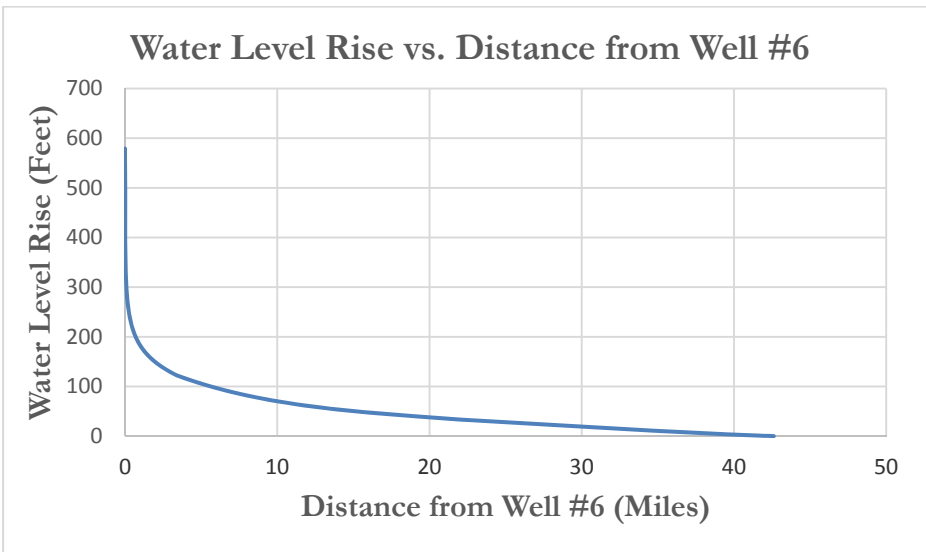


Figure 2.3.3 – Water Level vs Distance

For Well #1, an accurate estimate for the maximum allowable injection rate could not be provided since there is no detailed well construction information available. Nonetheless, the maximum allowable injection rate for Well #1 should be about ¼ of that for Well #6 based on the pumping capacity for the two wells and is shown in Table 2.3.4.

Table 2.3.4 – City Injection Wells

Well #	Casing Diameter (in)	Well Depth (ft)	Perforation Intervals (ft)	Injection Capacity (GPD)
1	14	1,015	Unknown	264,630
6	18	1,200	520	1,058,520

Since there was insufficient well information for the monitoring well onsite, well data from Well #6 was assumed for the design of a new injection well onsite. With the assumed geological and groundwater data from Well #6, three different injection well sizes with perforations were analyzed and are listed in Table 2.3.5. This analysis determined the minimal amount of perforation intervals necessary to achieve a 1 MGD injection capacity.

Table 2.3.5 – Onsite Injection Wells

Casing Diameter (in)	Well Depth (ft)	Perforation Intervals (ft)	Injection Capacity (GPD)
12	1,200	520	1,004,576
18	1,200	500	1,017,888
24	1,200	480	1,001,169

With a 12-inch well casing diameter and 520-ft perforation interval injection capacity was slightly more than a 24-inch well with a 480-ft perforation interval. Additional injection capacity could be attained by increasing the perforation interval or by installing multiple injection wells.

Injection Well Conceptual Design

In order to utilize Well #1 or Well #6 the existing water productions well would need to be retrofitted for injection. The pump, column pipe, well shaft, yard piping and appurtenances would need to be removed. The column pipe would then need to be re-inserted and the reclaimed water distribution line would need to be tapped into the column pipe.

For a new injection well onsite, a new well would need to be drilled and installed per ADEQ Bulletin 10, Chapter 3 (Ref 3). This well would include the casings with perforations, an empty column pipe for injection flow and appurtenances. Geological and groundwater data from the nearby monitoring well onsite did not have sufficient data to determine injection rates, therefore data from Well #6 was assumed. In moving forward with a design utilizing any onsite injection wells, a full hydrogeological report on the underlying strata is recommended.

In discussions with local drilling companies, a 12-inch injection well would cost significantly less to construct than an 18-in or 24-inch injection well. And since the 12-inch injection well has the capacity for a minimum of 1 MGD of injection, it was selected as the diameter for an onsite well.

The estimated costs associated with retrofitting or installing a new gravity flow injection well are listed below in Table 2.3.6 – Injection Well Cost Estimate.

Table 2.3.6 –Injection Well Cost Estimate

Injection Well	Well Diameter (in)	Well Depth (ft)	Perforation Intervals (ft)	Injection Capacity (GPD)	Estimated Cost
Well #1	14	1,015	Unknown	264,630	$200,000
Well #6	18	1,200	520	1,058,520	$200,000
Onsite	12	1,200	520	1,004,576	$650,000

Distribution Conceptual Design

Well #6 and all the new injection well options installed onsite have more injection capacity than the required 1 MGD whereas Well #1 injection does not. Therefore the idea of routing reclaimed water to Well #1 as part of this Option was not considered.

For the conceptual design of Option 1 – Groundwater Injection, reclaimed water from the Hilltop Wastewater Treatment Facility will be delivered to a new 12-inch diameter gravity flow injection well with 520-feet of perforations in the casing. This injection well has the capacity to inject 1,004,576 MGD of reclaimed water.

The well would be drilled within close proximity to the tertiary treatment facility onsite. A new 10-inch C-900 PVC line would tie into the existing 10-inch pipe that currently drains the tertiary chlorine contact tank and would allow for gravity flow from the tertiary to the column pipe in the injection well. A new 10-inch check valve and flowmeter would be installed inside a concrete vault below grade along the distribution line (See Exhibit 2.3.3 – Option 1 – Groundwater Injection). The concrete vault would be sized large enough for current design and future expansion of another injection well. For a list of all the required items needed for the Option 1 conceptual design and associated costs see Table 2.5 – Option 1 Conceptual Design Capital Cost.

2.4 Permitting

The permits which the City of Kingman currently operate under for their Hilltop Wastewater Treatment Facility allow for the disposal of effluent to the Mohave Wash (See Section 1.3 – Background Information). The City's current ADEQ Aquifer Protection Permit (AAP) P-100611 allows for the beneficial reuse of the effluent generated at the WWTF. According to ADEQ, groundwater injection is not classified as direct reuse or beneficial reuse. Therefore, for the City to adopt Option 1 – Groundwater Injection, APP permit no. P-100611 would need to be amended to allow for up to 1 MGD of Class A+ reclaimed water to be discharged into the Hualapai Valley Basin aquifer. The cost to amend this permit is shown in Table 2.4. Once the amendment has been made, the permit is valid for the life of the WWTF as long as no other changes are made.

Table 2.4 – Groundwater Injection Permit Costs

Permit Action	Initial Cost	Add'n Review
Amend AAP P-100611	$2,000	$122.00/hr

2.5 Capital Costs

Option 1 – Groundwater Injection is the least expensive option for reclaimed water in this study. The Engineer's estimated capital costs to design and construct Option 1 – Groundwater injection as described in Section 2.3 –Conceptual Design are listed below in Table 2.5 and in Appendix E – Engineer's Opinion of Probable Cost.

Table 2.5– Option 1 – Conceptual Design Capital Cost Estimate

Item Description	Total
Site Work (includes clearing and grubbing, grading & backfill)	$8,000
10" C-900 PVC Distribution Piping (includes valves, bends, tees, appurtenances, trenching & backfill)	$6,000
New 12-inch diameter injection well (includes, drilling, casings, column pipe, perforations and appurtenances)	$650,000
Concrete Vault	$16,000
Flowmeter	$6,000
Backflow Preventer	$15,000
Site Electrical	$25,000
25% Contingency	$182,000
Professional Engineering Services	$88,000
Construction Administration	$59,000
TOTAL	**$1,055,000**

2.6 Long-Term Operations and Maintenance

Operations and maintenance (O&M) for Option 1 – Groundwater Injection is significantly less than the other Options in this study. Many factors were assumed in determining the O&M expenses. Some of these expenses are listed below. For a list of all the O&M expenses and associated costs see Appendix F – Operations & Maintenance Expenses.

- Employee Salaries –
- Equipment Supplies and System Maintenance
- Sub consultant Engineering
- Travel/Education Expenses
- Administrative Services and Office Supplies
- ADEQ Permitting
- Power Consumption

Some assumptions were taken in determining long term O&M costs. Employee salaries were determined based on the assumption that the City would be able to operate and maintain the injection system with their current staff working a few additional hours a month. Costs for equipment supplies, maintenance, sub-consultant engineering and travel/education expenses were determined and then spread out over a 20-year period. An analysis of the power consumption/costs of four well sites was done to determine an average power cost. And although ADEQ permitting costs as shown in Table 2.4 are only $2, 000 with $122/hour for review, it was assumed the final cost would be $8,000. An

As outlined in Section 1.1 – Purpose and Scope of Work, the project analysis was based on a 20-year period with a 3% inflation rate and a 3% City growth rate. Costs for the above mentioned expenses, adjusted for inflation over a 20-year period were calculated and added to a debt service amount for the total amount of Option 1 with a 3% interest rate. The annual O&M, debt service payment, total annual net expenses and cumulative net expenses for a 1, 5, 10, 15 and 20 year period for Option 1 – Groundwater Injection are shown in Table 2.6.

Table 2.6 – Option 1 Long Term O&M and Debt Service Expenses

Item Description	Year 1	Year 5	Year 10	Year 15	Year 20
Annual O&M Expenses (adjusted for inflation)	$19,377	$12,795	$14,834	$17,196	$19,935
Debt Service Payment	$70,913	$70,913	$70,913	$70,913	$70,913
Annual Net Expense	($90,290)	($83,707)	($85,746)	($88,109)	($90,847)
Cumulative Expense	($90,290)	($422,928)	($847,459)	($1,283,135)	($1,731,730)

The reason for the higher O&M costs in the first year are for the ADEQ permitting as explained in Section 2.4 – Permitting. Once ADEQ permitting has been paid for the first year, no further ADEQ permitting would be required for the life of the WWTF.

2.7 Benefits Analysis

To help analyze the pros and cons in each Option of this study, a list of selection criteria was developed to help evaluate the pros and cons of all three Options. This selection criteria was weighted and each one of the criteria was assigned a point value depending upon the level of importance that the Option provided for the City (see Appendix K – Benefits Analysis).

Then each Option's pros and cons were analyzed and the Option was assigned a point value to each selection criteria. The assigned points for each Option's selection criteria were then summed to help determine which Option was to be recommended as part of this study.

Prior to assigning a score to each selection criteria for Option 1, the pros and cons for this Option were analyzed and are listed below in Table 2.7.1.

Table 2.7.1 – Option 1 Pros vs. Cons

Pros	Cons
Least expensive Option	Only recharges to groundwater
Lowest O&M costs	Provides no connections for future developments
Provides groundwater injection @ WWTF	Provides no capital savings for City's water system
Utilizes 1 MGD immediately	No credits for recharge (No AMA)
Has simple ADEQ permitting	
Potential to reduce nitrates at the WWTF	

Assigned points for the selection criteria for Option 1 are shown in Table 2.7.2 below.

Table 2.7.2 – Option 1 Selection Criteria Score

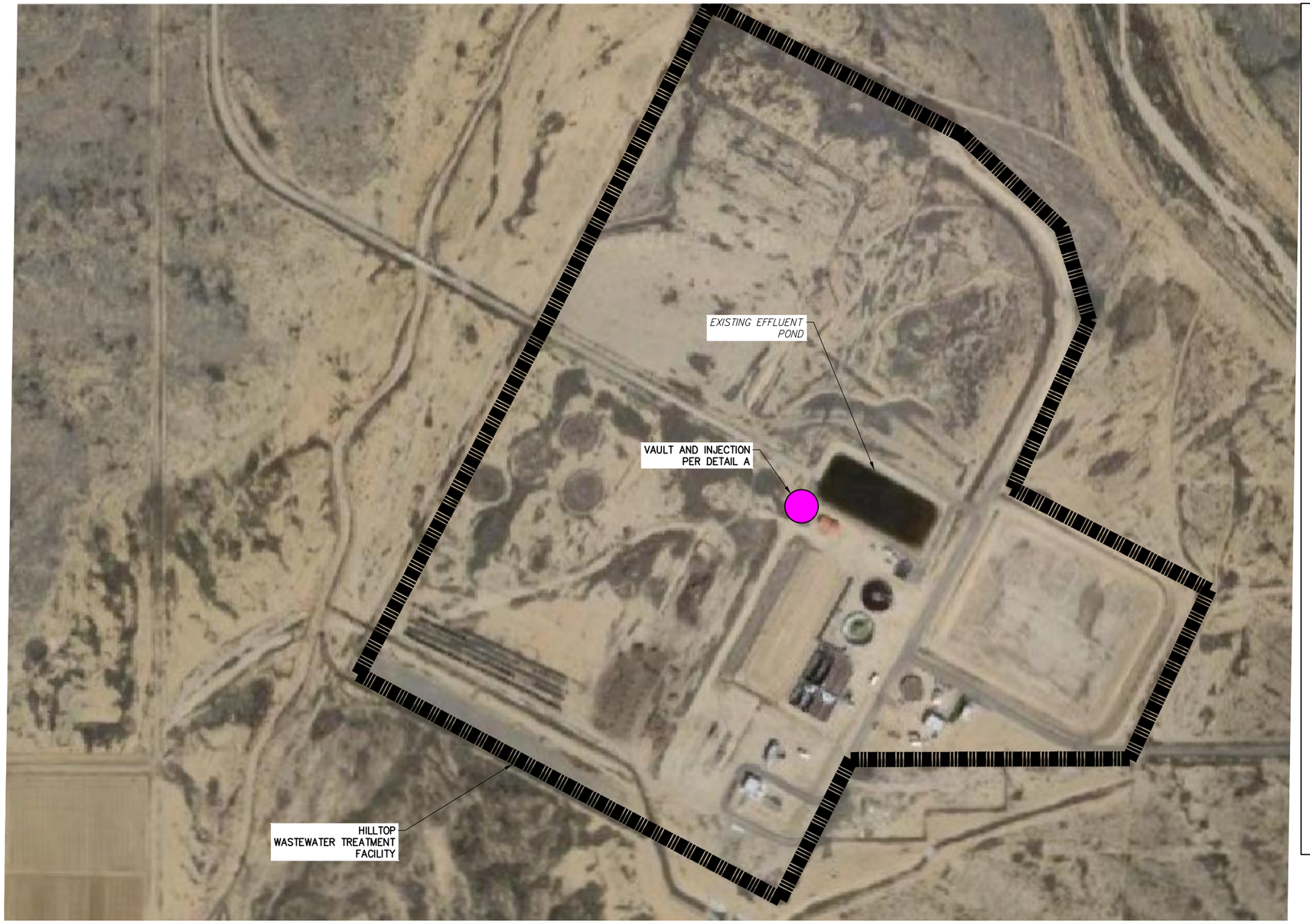
Selection Criteria	Points Possible	Option 1 Score
Capital Cost	30	30
Long Term O&M	30	30
Reduces Drinking Water System Requirements	30	0
Community Economic Impact	30	0
Flexible/Scalable	25	5
Eligible for Green Funding	20	20
Negatively Affects Water User Base Rates	15	15
Recharges Groundwater	10	10
Ease/Cost of Permitting	5	5
Ease of Constructability	5	5
Total	**200**	**120**

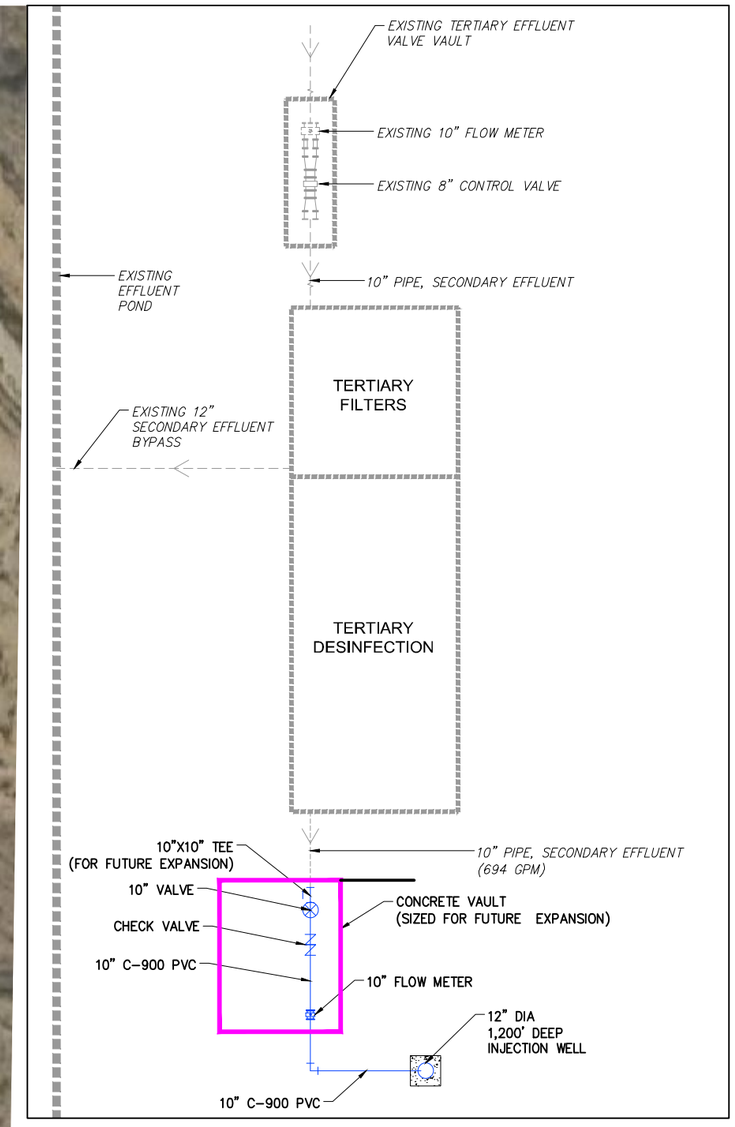
After the pros and cons for this Option were analyzed and points assigned for selection criteria, it was determined that Option 1 – Groundwater Injection scored 120 points of 200 total.

Section 2 Exhibits

Exhibit 2.3.3 – Option 1 – Groundwater Injection Conceptual Design

EXHIBIT 2.3.3





A ~ DETAIL - VAULT AND INJECTION
NOT TO SCALE

SCALE
0 200' 400'
HORIZ: 1" = 200'

EXHIBIT 2.3.3 - OPTION 1 - GROUNDWATER INJECTION CONCEPTUAL DESIGN

SUNRISE ENGINEERING
2152 SOUTH VINEYARD, SUITE 123
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3.0 OPTION 2 – AIRPORT INDUSTRIAL PARK REUSE

3.1 Introduction

Option 2 of this study analyzes the feasibility of distributing Class A+ reclaimed water from the Hilltop Wastewater Treatment Facility to the business/property owners of the Kingman Municipal Industrial Park. This analysis will include the following:

- A conceptual design of a system that can distribute the A+ reclaimed water from the Hilltop WWTF to the Kingman Airport Industrial Park and Well #1.
- A capital cost estimate based on the conceptual design.
- Long term Operation and Maintenance (O&M) costs to permit, own and operate such a system.
- A rate/capital savings analysis to determine water usage revenue vs expenditures for the Airpark and how to financially pay for this option.
- A survey to the Airpark tenants to gauge interest in using a reclaimed water system.
- A benefits analysis of pros and cons of this Option to compare against other Options in this study.

The Kingman Municipal Airport and the Airport Industrial Park are located approximately two miles southeast of the Hilltop Wastewater Treatment Facility. Historically there has been 70 business/property owners that have operated at the Airpark, however currently there are approximately 64 that operate within the Airpark. From 2010 to 2014, the average daily water usage from these tenants was 64,181 GPD with a peak usage of 125,863 GPD in July of 2010.

Figure 3.1.1 – City of Kingman Airport Industrial Park

Historically, more water was used in the summer months than the winter months. This leads to show that there is a large amount of water that is used for either irrigation purposes, evaporative coolers or that some of the business/property owners at the Airpark are seasonal. Water usage at the Airpark from 2010 to 2015 is shown in Figure 3.1.2.

By utilizing reclaimed water at the Airpark to meet the demands of irrigation and industrial purposes, clean drinking water infrastructure could be freed up for future growth and expansion. In addition, by having a reclaimed system in place, it could possibly bring in new "green" businesses that are willing to utilize this system, thus having a positive community economic impact.

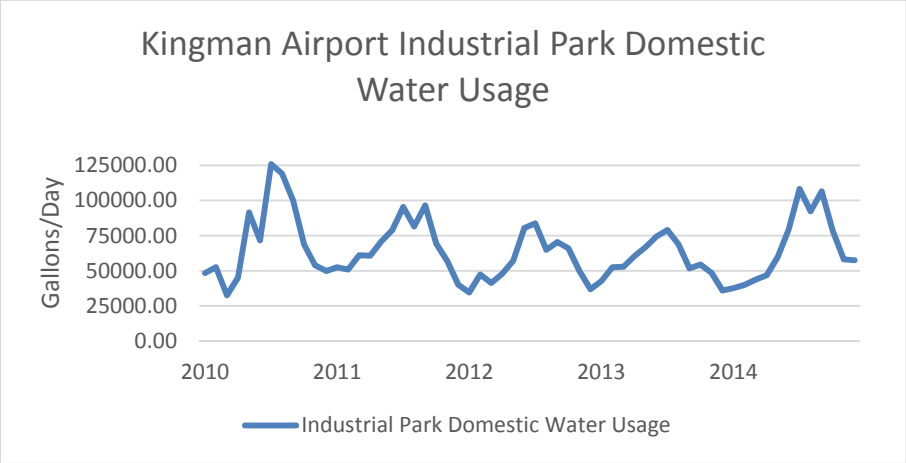


Figure 3.1.2 – 2010 – 2015 Kingman Airpark Water Usage

3.2 Conceptual Design

Future Use Study

Prior to the design of a system capable of delivering reclaimed water to the Airpark, future water demands needed to be accounted for. Using the historical water usage data and some assumptions as listed below, the water usage for the next 20 years at the Airpark was calculated. Below is a list of the assumptions used to calculate the reclaimed water demand for the next 20 years:

- 80% of the Airport Industrial Park's water usage from 2010 to 2015 was used for industrial purposes.
- 20% of the Airport Industrial Park's water usage from 2010 to 2015 was used for domestic usage (i.e. human consumption).
- If a the primary business is food related, 100% of the water usage from 2010 to 2015 was used for domestic usage (i.e. human consumption).
- The Airport Industrial Park will see a 6% growth rate over the next 20 years
- This system will not be designed to provide fire flow.

Contact was made with the Kingman Airport Authority to determine an estimated growth rate. They provided a growth anticipation in terms of development and employee growth which does not necessarily translate into water usage growth. Therefore it was determined that a 6% growth rate would be applied to the water usage at the Airpark.

This calculated reclaimed water usage after the 80/20 split helped to determine the required reclaimed water storage necessary, the pump sizing and the distribution line sizes necessary for the next 20 years and is shown in Table 3.2.1 and in Appendix C – Industrial Park Flows and Calculations.

Table 3.2.1 – Kingman Airpark Projected Water Usage

Item Description	Year 1	Year 5	Year 10	Year 15	Year 20
Average Water Usage (GPD)	80,219	101,275	135,529	181,369	242,712
Peak Water Usage (GPD)	128,867	162,692	217,718	291,356	389,900
Average Reclaimed Usage (GPD)	64,176	81,020	108,423	145,095	194,170
Peak Reclaimed Usage (GPD)	103,094	130,153	174,175	233,085	311,920

Table 3.2.1 shows the maximum calculated reclaimed water demand in 20 years for the Airpark would not exceed the tertiary treatment facility's capability to produce 1 MGD.

For an overview of the Option 2 conceptual design, see Exhibit 3.2.3 – Option 2 – Airport Industrial Park Reuse Conceptual Design. For a summary list of the required items needed for the Option 2 conceptual design and associated costs see Table 3.4 – Option 2 Conceptual Design Capital Cost.

Storage Conceptual Design

In order to provide reclaimed water to the Airpark, there needs to be a storage system for the reclaimed water exiting the tertiary treatment facility. To save on costs, this system would need to be able to store more than the average demand but not more than the peak demand. The tertiary treatment is capable of treating up to 1 MGD, which is significantly higher than the 20-year peak demand. If the average demand storage becomes depleted, flows exiting the tertiary treatment facility would be able to meet the peak demands. It would be expected that the tertiary treatment facility would constantly be running at an average 694 GPM.

In speaking with local tank manufactures and contractors, a wider, shallower tank is financially more beneficial than a higher, slimmer tank. This is due to the engineering and design required to withstand wind loads. Also, an above grade tank costs significantly less to construct than a below grade tank. Therefore it is recommended that an above grade 288,000 gallon reclaimed water storage tank be used. This tank's dimensions would be 24-feet tall by 48-feet in diameter.

Because the tertiary treatment facility is gravity flow, a booster station would need to be installed prior to a storage tank in order to fill the tank. This would include two 750 GPM horizontal split case pumps capable of overcoming 35-feet of head (15 psi). One of these pumps would be on standby. The pumps and appurtenances would be installed in a below grade concrete vault to intercept gravity flows from the tertiary. There would need to be a high-level sensor installed in the tank and it would need to be able to communicate with the pumps so that when the tank is full, the pumps could shut off and the reclaimed water from the tertiary would be diverted to the existing effluent pond to the north through a 12-inch overflow installed at the tertiary.

Distribution Conceptual Design

The Airpark is located approximately 2 miles southeast of the Hilltop Wastewater Treatment Facility. The Airpark is approximately 3,390-feet above sea level with the WWTF being approximately 3,240-feet above sea level. In order to convey the reclaimed water to the Airpark another onsite booster station is needed. This booster station would include two 300 GPM horizontal split case pumps capable of overcoming 270-feet of head (116 psi). One of these pumps would be on standby. This pump size would be sufficient to overcome elevation difference, head losses in the 8-inch distribution line and still provide the highest point in elevation at the Airpark

with a minimum of 92-feet of head (40 psi). No pressure calculations were performed for the 6-inch service lines.

There would also need to be a low-level sensor installed in the tank and it would need to be able to communicate with the distribution pumps so that when the tank is empty, the pumps could shut off. These pumps would be installed on a concrete pad above grade. In addition a backflow preventer immediately after the booster station and then a flow meter downstream of the backflow preventer is required prior to the distribution line returning to below grade and onto the Airpark.

The distribution line from the WWTF to the Airpark would be an 8-inch C-900 PVC pipe and include various valves and fittings. Valves were spaced every 1,000 feet for conservative cost estimating purposes. An 8-inch line size would allow for a conveyance of the calculated 20-year peak demand of 311,920 GPD (217 GPM) with a velocity that would not exceed 5 feet per second. See Appendix J – Distribution Line Size Analysis for line size calculations.

This distribution line would be installed 4-feet minimum below grade within the existing 30-foot wide sewer easement from Kingman to the WWTF, following the Mohave Wash alignment. The line would be installed a minimum of two feet from the northwestern edge of the easement (See Exhibit 3.2.3 – Option 2 – Airport Industrial Park Re-use Conceptual Design). A temporary construction easement (TCE) on the north-west side of the easement may be necessary. However, having the reclaimed distribution line run so close to the edge of the easement would allow for easier construction of a future sewer outfall line. The distribution line would exit this easement at the Grace Neal Parkway alignment and run east in the Grace Neal Parkway right-of way, bore under AZ Highway 66 and BNSF Railroad and then follow on through to the Airpark.

6-inch service lines would tee off from the 8-inch distribution line and loop throughout the Airpark with commercial meters installed at each property that would be receiving reclaimed water. It would then be the responsibility of each of the business/property owners to plumb their buildings accordingly for use of reclaimed water and to tie into the reclaim service lines at the meter.

Well #1 Injection Conceptual Design

There is also an option to route reclaimed water to Well #1 for injection as part of the Option 2 – Airport Industrial Park Reuse option. As mentioned in Section 2.3 – Conceptual Design, Well #1 is located adjacent to the Kingman Airport. The distribution line throughout the Airpark would include a service line to Well #1. Injection capacities for Well #1 is shown in Table 2.3.6.

In order to utilize Well #1 the existing water production well would need to be retrofitted for injection. The pump, column pipe, well shaft, yard piping and appurtenances would need to be removed. The column pipe would then need to be re-inserted and the reclaimed water distribution line would need to be tapped into the column pipe.

3.3 Permitting

There are two different kinds of permits issued by ADEQ for the beneficial reuse of reclaimed water and are listed below and in Table 3.3:

- **Type II Permit** – This ADEQ issued permit allows for the end user to act as their own agent and directly reuse reclaimed water per AAC R18-9-708. It would be the responsibility of the end user to comply with all the requirements and regulations of AAC R18-9-708. It would also be the responsibility of the end user to pay for and maintain the permit as long as reclaimed water is being used. Per AAC R18-14-110, there is a $600 application fee. The permit is valid for five years per AAC R18-9-709 with a renewal fee of $450 per AAC R18-14-110.

- **Type III Permit** – This ADEQ issued permit would allow for the City to act as the agent for the reuse reclaimed water per AAC R18-9-708. This would allow the City to determine who can reuse reclaimed water. It would be the responsibility of the City to maintain contracts with the designated end users to guarantee the reclaimed water is being used appropriately and that the end users are in compliance with all the requirements and regulations of AAC R18-9-708. It is also the responsibility of the City to pay for and maintain the permit as long as reclaimed water is being used. Per AAC R18-14-110, there is a $1,500 application fee. The permit is valid for five years per AAC R18-9-709 with a renewal fee of $1,250 per AAC R18-14-110.

ADEQ indicates that most municipalities use a Type III permit for the reuse of reclaimed water.

Table 3.3 –ADEQ Reclaimed Water Reuse Permit Costs

ADEQ Permit Type	Agent/Responsibility	Application Cost	Duration of Permit	Renewal Cost
Type II	End User	$600/EA	5-years	$450/EA
Type III	City	$1,500	5-years	$1,250

As mentioned in Section 2.4 – Permitting, in order to utilize Well #1 for groundwater injection, the Hilltop Wastewater Treatment Facility's current ADEQ Aquifer Protection Permit (APP) no. P-100611 would need to be amended to allow for up to 1 MGD of Class A+ reclaimed water to be discharged into the Hualapai Valley Basin aquifer. See Table 2.4 – Groundwater Injection Permit Costs for initial costs and review fees.

3.4 Capital Costs

Option 2 – Airport Industrial Park Reuse is the most expensive option for reclaimed water in this study. The Engineer's estimated capital costs to design and construct Option 2 – Airport Industrial Park Reuse as described is Section 3.2 – Conceptual Design are listed below in Table 3 and in Appendix E – Engineer's Opinion of Probable Cost.

Table 3.4– Option 2 – Conceptual Design Capital Cost Estimate

Item Description	Total
Site Work (includes clearing and grubbing, grading & backfill)	$15,000
8" C-900 PVC Distribution Piping (includes valves, bends, tees, appurtenances, trenching & backfill)	$1,500,000
6" C-900 PVC Service Lines (includes valves, bends, tees, appurtenances, trenching & backfill)	$3,000,000
Jack and Bore Reuse Line Under AZ Highway 66	$300,000
Jack and Bore Reuse Line Under BNSF Railroad	$150,000
Pump Station to Fill Storage Tank (includes two 750 GPM pumps, valves, bends, appurtenances and vault)	$150,000
Booster Station (includes two 300 GPM pumps, valves, bends, appurtenances and concrete pad)	$150,000
Flow Meter @ WWTF	$6,000
Water Meter For Industrial Park	$75,000
Backflow Preventer @ WWTF	$30,000
288,000 Gallon Steel Water Storage Tank, coating (interior/exterior) & Foundation	$300,000
Remove and Replace Existing Asphalt, Concrete, Curb and Gutter	$1,240,000
Electrical & SCADA	$300,000
Retrofit Well #1 (includes all demo items, re-installation and connection)	$200,000
25% Contingency	$1,854,000
Engineering Design Services	$890,000
Construction Administration	$594,000
TOTAL	**$10,754,000**

3.5 Long-Term Operations and Maintenance

Long term O&M for Option 2 – Airport Industrial Park Reuse is higher than the other Options in this study. Many factors were assumed in determining the O&M expenses. Some of these expenses are listed below. For a list of all the O&M expenses and associated costs see Appendix F – Operations & Maintenance Expenses.

- Employee Salaries and Benefits
- Equipment Supplies and System Maintenance
- Sub consultant Engineering
- Vehicle and Travel/Education Expenses
- Administrative Services and Office Supplies
- ADEQ Permitting
- Power Consumption

Some assumptions were taken in determining long term O&M costs. Employee salaries were determined based on the assumption that the City would need to hire additional staff to be able to operate and maintain the distribution system. Costs for vehicle expenses, equipment supplies, maintenance, sub-consultant engineering, travel/education expenses and ADEQ permitting were

determined and then spread out over a 20-year period. An analysis of the power consumption/costs of four well sites was done to determine an average power cost.

As outlined in Section 1.1 – Purpose and Scope of Work, the project analysis was based on a 20-year period with a 3% inflation rate and a 6% water usage growth rate at the Airpark. Costs for the above mentioned expenses, adjusted for inflation over a 20-year period were calculated and added to a debt service amount for the total amount of the project with a 3% interest rate. The annual O&M, debt service payment, total annual net expenses and cumulative net expenses for a 1, 5, 10, 15 and 20 year period for Option 2 – Airport Industrial Park Reuse is shown in Table 3.5.

Table 3.5 – Option 2 Long Term O&M and Debt Service Expenses

Item Description	Year 1	Year 5	Year 10	Year 15	Year 20
Annual O&M Expenses (adjusted for inflation)	$164,200	$183,449	$212,667	$246,539	$285,807
Debt Service Payment	$722,838	$722,838	$722,838	$722,838	$722,838
Annual Net Expense	($887,038)	($906,286)	($935,504)	($969,377)	($1,008,644)
Cumulative Expense	($887,038)	($4,480,740)	($9,098,098)	($13,875,235)	($18,837,600)

3.6 Rate Analysis and Capital Savings

At the Airpark, there are approximately 70 business/property owners connected to Kingman's domestic water system. As mentioned in Section 3.2 – Conceptual Design, it was assumed that 80% of the historic water usage was used for industrial purposes and that the remaining 20% was used for domestic purposes.

An average monthly water usage for all users was determined and applied to the current City of Kingman non-residential, outside City limits water rates. These rates are shown in Table 3.6.

Table 3.6.1 – City of Kingman Water Rates

Water Usage	Cost
Base Service Charge Fee	$9.64
Capital Renewal Fee	$3.75
All usage per 1,000 gallons	$2.95

In order to make the connection from domestic water to reclaimed water attractive to the Airpark tenants, it was assumed that the reclaimed water rates would not exceed the current water rates. The estimated revenue of water users over the course of a 20-year period using the current water rates and adjusted for a 6% water usage growth rate at the Airpark is shown in Table 3.6.2.

Table 3.6.2– Option 2 Projected Revenue at Current Water Rates

Item Description	Year 1	Year 5	Year 10	Year 15	Year 20
Reclaimed Water Revenue	$77,348	$210,803	$471,382	$884,115	$1,522,116
Domestic Water Revenue	$27,773	$35,063	$46,922	$62,791	$84,029
Total Revenue	$105,121	$245,866	$518,304	$946,906	$1,606,145

Table 3.5 shows the revenue that needs to be earned over a 20-year period is significantly higher than the projected revenue earned after 20-years, utilizing the current water base rates as shown in Table 3.6.2– Option 2 Projected Revenue at Current Water Rates.

After discussions with the City of Kingman, it was determined that this Option should be self-funded and the cost of it should not be borne by the all the City's water users as this Option only services a small amount of users. Also, the City stated that an increase to sewer rates would not be considered. Therefore, in order to balance Option 2, the base rate for reclaimed water was analyzed and determined that it would need to increase significantly to balance this Option. Only the base rate was adjusted since the amount of water used per connection may vary and is susceptible to change. Rate analysis for Option 2 – Airport Industrial Park Reuse is shown in Appendix G – Rate Analysis.

Aside from raising reclaimed water rates, there are other available options to provide funding for this Option or to reduce the initial capital. The City could apply for WIFA funding, water smart grants, or re-direct City water funds to help pay for this Option.

Another item to take into consideration when deciding upon this Option is the capital savings this Option will provide. Table 3.2.1 – Kingman Airpark Projected Water Usage, the 20-year analysis shows a projected average reclaimed water usage of 194,170 GPD with a peak reclaimed usage of 311,920 GPD by the tenants at the Airpark. By meeting this demand with reclaimed water, clean drinking water and infrastructure could be freed up for future growth and expansion. The estimated value associated with that freed up infrastructure for 311,920 GPD is seen in Table 3.6.3 – Option 2 Projected Capital Savings and in Appendix H – Capital Savings Analysis.

Table 3.6.3 – Option 2 Projected Capital Savings

Item Description	Total
220 GPM Well (includes well, pump, motor, control valves, chlorination and yard piping)	$850,000
220 GPM Booster Station (includes two pumps, valves, backflow preventer, flowmeter, fittings, appurtenances and concrete pad)	$80,000
100,000 Gallon Steel Water Storage Tank, coating (interior & exterior) and foundation	$150,000
Electrical	$250,000
25% Contingency	$333,000
Professional Engineering Services	$160,000
Construction Administration	$107,000
TOTAL	**$1,930,000**

After analysis of capital costs, rate analysis and capital savings, Option 2 – Airport Industrial Park Reuse does not appear to be a very financially feasible project and is not recommended.

3.7 Water Reuse Survey

In order to gauge the interest of using reclaimed water at the Airpark, a survey was prepared and sent to the 64 business/property owners of the Airpark that are currently using domestic water. The survey contained ten questions which were aimed to determine their thoughts about using reclaimed water at their facility and knowledge about reclaimed water. To see the complete survey that was sent to the tenants of the Airpark and result to the survey, see Appendix I – Reuse Water Survey and Results.

Table 3.7 shows four questions from the survey and actual results that best helped to determine the business/property owner's willingness to use reclaimed water at their facility. These results were last updated at the time of final preparation of this report.

Table 3.7 – Water Reuse Survey and Results

Survey Question	Yes	No	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Do you have processes at your facility that could use Class A+ reclaimed water in lieu of drinking water	3	15	-	-	-	-	-
I would support using Class A+ reclaimed water at my facility because it is an environmentally friendly alternative	-	-	4	1	4	6	3
I would support using Class A+ reclaimed water at my facility if it were cheaper than using drinking water	-	-	3		6	5	4
If the City of Kingman were to provide Class A+ reclaimed water to my facility, I would connect to and use this service	-	-	3	3	7	2	3

Table 3.7 shows results from business/property owner's are contradictory. A strong majority of tenants stated that they do not have processes that would use reclaimed water, yet a small majority of tenants stated that they support using reclaimed at their facility. A large majority of tenants stated, however, that they are either neutral or won't connect to a reclaimed service if provided by the City.

From the results of the survey, it appears that most water users at the Airport would be somewhat reluctant to use reclaimed water provided by the City at their facility.

3.8 Benefits Analysis

For Option 2, the pros and cons were analyzed and are listed below in Table 3.8.1.

Table 3.8.1 – Option 2 Pros vs. Cons

Pros	Cons
Uses 300K+ of reclaimed water	Is the most expensive Option
Provides for some recharge into the groundwater	Highest O&M costs
Expandable	Received negative community input
Positive economic impact	Requires service changeover for Airpark business/property owners
Adds capacity to the City's drinking water system	High user base rates
	Limited users benefited
	Has a high construction/community impact
	Requires City involvement to enforce ADEQ codes

Assigned points for the selection criteria for Option 2 is shown in Table 3.8.2 – Option 2 Selection Criteria Score.

Table 3.8.2 – Option 2 Selection Criteria Score

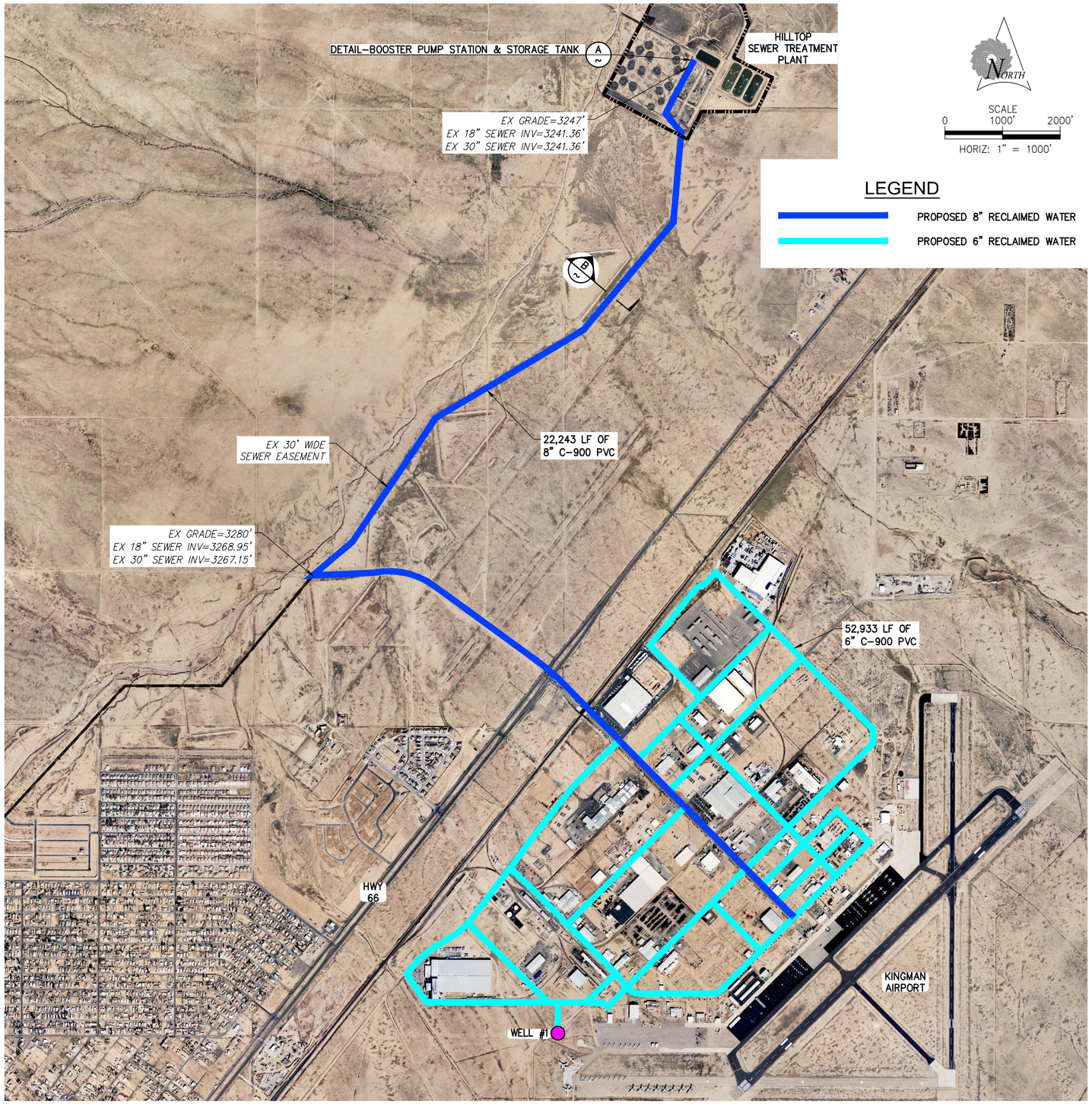
Selection Criteria	Points Possible	Option 2 Score
Capital Cost	30	5
Long Term O&M	30	5
Reduces Drinking Water System Requirements	30	15
Community Economic Impact	30	30
Flexible/Scalable	25	13
Eligible for Green Funding	20	20
Negatively Affects Water User Base Rates	15	0
Recharges Groundwater	10	4
Ease/Cost of Permitting	5	2
Ease of Constructability	5	1
Total	**200**	**95**

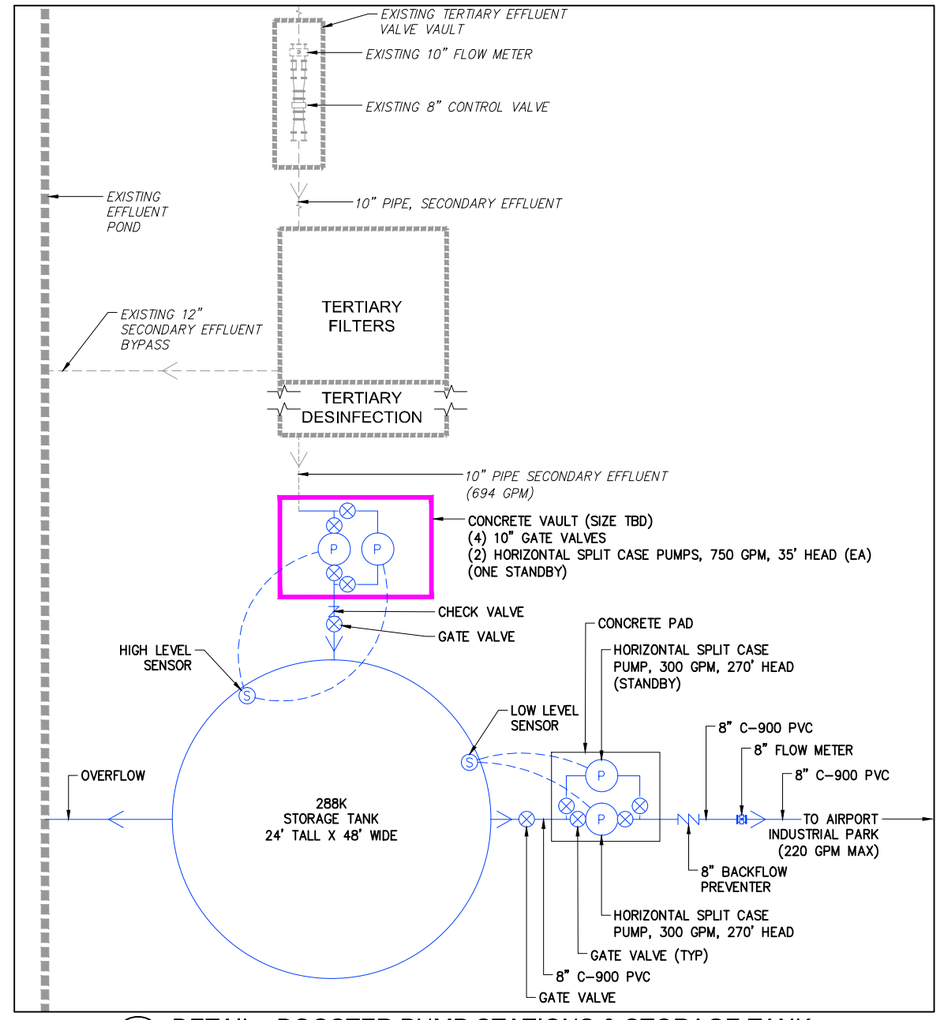
After the pros and cons for this Option were analyzed and points assigned for selection criteria, it was determined that Option 2 – Airport Industrial Park Reuse scored 95 points of 200 total.

Section 3 Exhibits

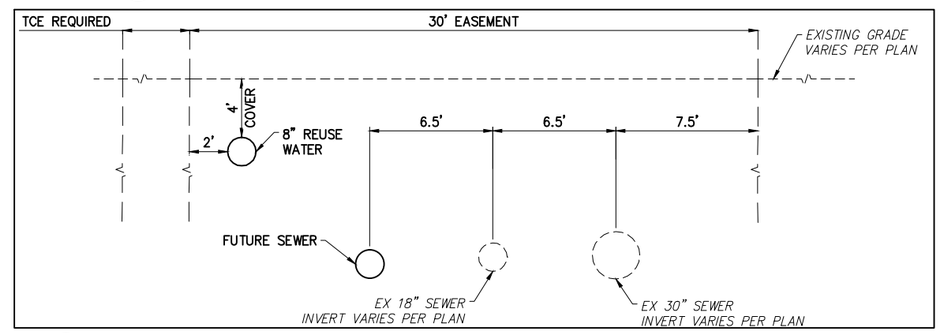
Exhibit 3.2.3 – Option 2 – Airport Industrial Park Re-use Conceptual Design

EXHIBIT 3.2.3





A ~ DETAIL - BOOSTER PUMP STATIONS & STORAGE TANK
NOT TO SCALE



B ~ SECTION - SEWER EASMENT UTILITIES
NOT TO SCALE

EXHIBIT 3.2.3 - OPTION 2 - AIRPORT INDUSTRIAL PARK REUSE CONCEPTUAL DESIGN

SUNRISE ENGINEERING
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4.0 OPTION 3 – GOLF COURSE, SCHOOLS AND PARKS REUSE

4.1 Introduction

Option 3 of this study will determine the feasibility of distributing Class A+ effluent from the Hilltop Wastewater Treatment Facility to the Cerbat Cliffs Golf Course in Kingman with the possibility to have connections to the Kingman High School, Kingman Middle School, Kingman Academy of Learning, Firefighter's Memorial Park, Centennial Park and the Mohave County Fairgrounds. This analysis will include the following:

- A conceptual design of a system that can distribute the A+ effluent from the Hilltop WWTF to the Cerbat Cliffs Golf Course with possible services to schools, parks and the Mohave County Fairgrounds.
- A capital cost estimate based on the conceptual design.
- Long term Operations and Maintenance (O&M) costs to permit, own and operate such a system.
- A rate/capital savings analysis to determine water usage revenue vs expenditures, capital saved in infrastructure for future growth as a result of a reduction in drinking water usage and how to financially afford this option.
- A benefits analysis of pros and cons of this Option to compare against other Options in this study.

Figure 4.1.1 - Cerbat Cliffs Golf Course

As shown in Figures 4.1.2, 4.1.3 and 4.1.4 below, the Cerbat Cliffs Golf Course historically has used more water for irrigation purposes than the schools and fairgrounds combined. From 2010 to 2014, the average daily irrigation water usage for the golf course was 456K GPD with a peak usage of 969K GPD in July of 2011. The average daily irrigation water usage from 2010 to 2014 for the schools and parks was approximately 140K GPD with a maximum usage of 501K GPD. Data for park irrigation usage was only included starting 2014 to 2015, hence the reason for the increase in Figure 4.1 for those years. The average daily water usage at the Mohave County Fairgrounds was approximately 8.5K GPD with a maximum usage of 28K GPD (see Appendix L – Golf Course, Schools and Parks Flows and Calculations). As a result, it was determined to route the reclaimed water from the WWTF to the Cerbat Cliffs Golf Course.

The golf course is the furthest destination from the WWTF, being approximately eight miles southwest of the WWTF. In order to maximize the amount of locations that could connect to a reclaimed water line, the distribution line to the golf course was aligned such that it would pass directly by the Kingman High School, Kingman Middle School, Kingman Academy of Learning, Firefighter's Memorial Park, Centennial Park and the Mohave County Fairgrounds. Any excess reclaimed water not used by the golf course could be used by these entities. See Exhibit 4.1.5 – Option 3 – Golf Course, School and Parks Reuse Conceptual Design.

Pressures in the distribution line from the WWTF to the golf course for the current design range from 142 psi to atmosphere (0 psi). Pressures at the Kingman Middle School, Firefighter's Memorial Park, Mohave County Fairgrounds, Kingman Academy for Learning and the Centennial Park are anticipated to be less than 40 psi, therefore these entities would need to supply additional booster pumps to obtain pressures sufficient for their irrigation systems. Pressure in the distribution line at the Kingman High School are anticipated to be around 60 psi and should be sufficient for their irrigation system.

Water usage for the Cerbat Cliffs Golf Course from 2010 to 2015 is shown in Figure 4.1A. Water usage for the Kingman Schools from 2010 to 2015 is shown in Figure 4.1B and water usage for the Mohave County Fairgrounds is shown in Figure 4.1C.

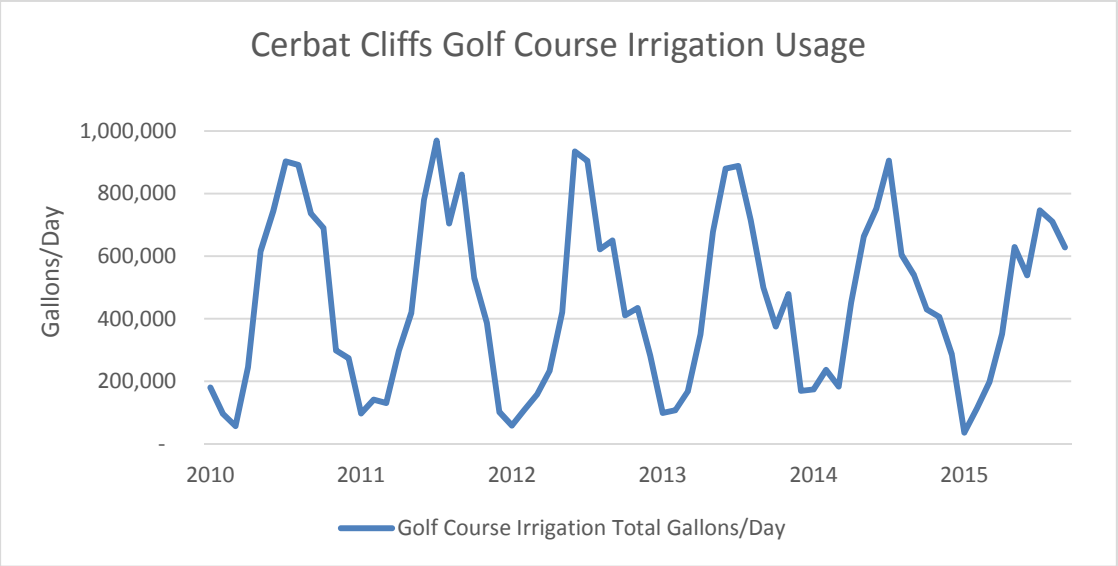


Figure 4.1.2 – 2010 – 2015 Cerbat Cliffs Golf Course Irrigation Water Usage

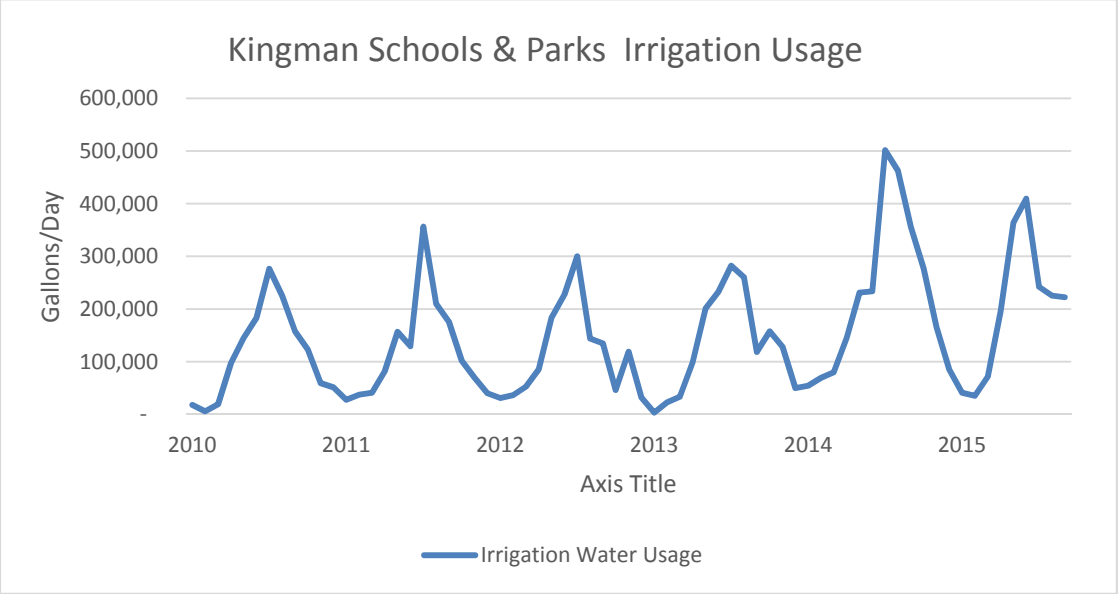


Figure 4.1.3 – 2010 – 2015 Kingman Schools & Parks Irrigation Water Usage

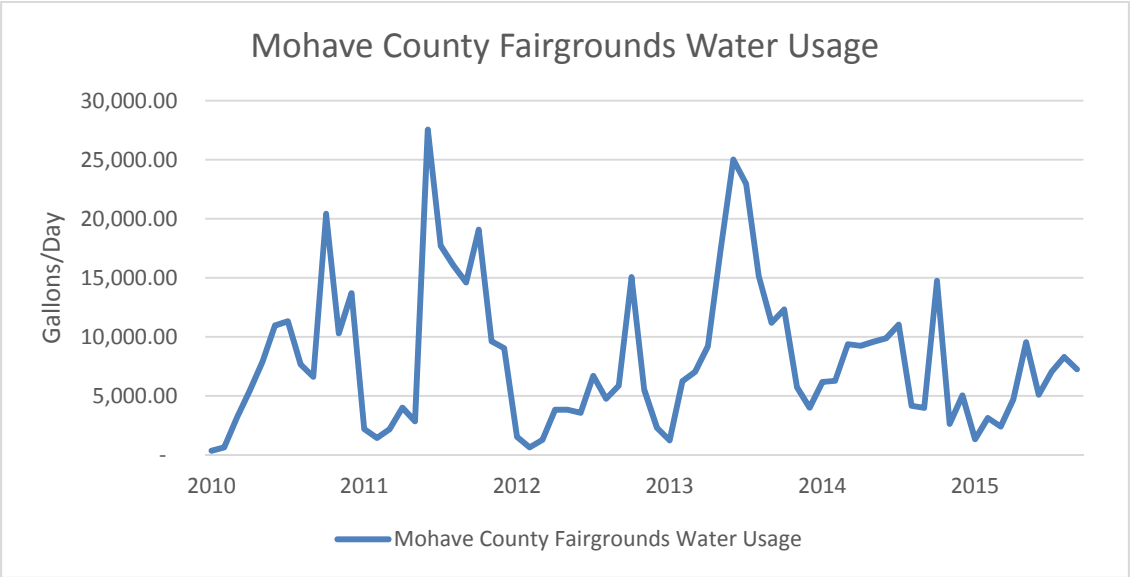


Figure 4.1.4 – 2010 – 2015 Mohave County Fairgrounds Water Usage

By utilizing reclaimed water at the golf course to meet the demands of irrigation purposes, clean drinking water infrastructure could be freed up for future growth and expansion. In addition, by having a reclaimed system that is sized for future growth in place, new "green" businesses could possibly be attracted, creating a positive community economic impact. In order for these new businesses to tie into the system, however, the tertiary outflow would need to be increased as the majority of the reclaimed water in the summer months will be used up by the golf course.

Option 3 is the most flexible/scalable Option in the study. It would pass the Airpark, multiple schools and parks, the fairgrounds and City wells that could be retrofitted for groundwater injection.

4.2 Conceptual Design

Distribution Conceptual Design

The conceptual design for Option 3 – Golf Course, Schools and Parks will consist of a distribution line from the Hilltop Wastewater Treatment Facility to the Cerbat Cliffs Golf Course, passing by the Kingman High School, the Kingman Academy of Learning, Kingman Middle School, Firefighter's Memorial Park, Centennial Park and the Mohave County Fairgrounds.

Currently the WWTF produces more effluent flows than what is permitted to be reused as Class A+ reclaimed water. And with future growth expected, the City could amend their current APP no. P-106051 and upgrade their tertiary treatment facility to increase the maximum amount of Class A+ effluent that could be reused for beneficial use.

In order to determine the proper size for the distribution line with accounting for future growth an analysis of 8-inch, 10-inch, 12-inch and 16-inch line sizes was performed (see Appendix I – Distribution Line Size Analysis). This analysis determined the maximum capacity of the line without exceeding a maximum velocity of 5 feet/second and without exceeding 315 psi (90% of the working pressure rating for DIP).

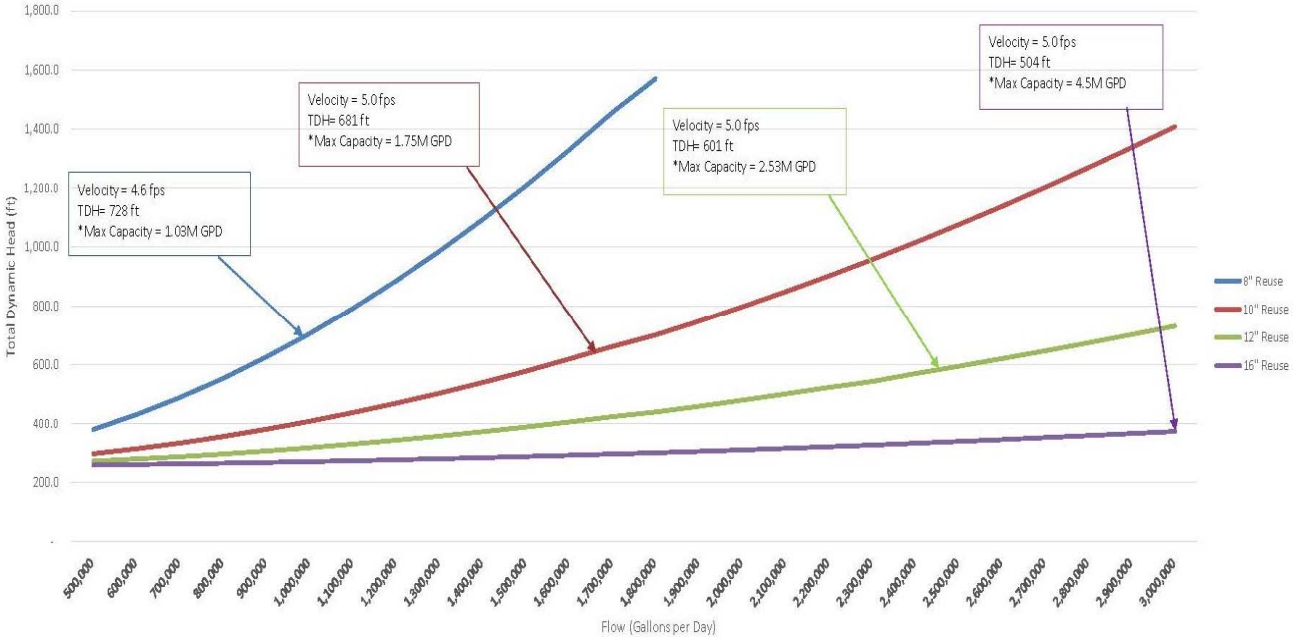


Figure 4.2 – Option 3 Distribution Line Size Analysis

Figure 4.2 shows that the 12-inch (green) line has a maximum capacity of 2.53 MGD with a maximum velocity of 5 feet per second and a pressure of 601 total dynamic head (253 psi). The capacity of this line would allow for more than double the amount of reuse flow than what is currently permitted therefore the Option 3 conceptual design included a 12-inch pipe (see Appendix J – Distribution Line Size Analysis).

The distribution line from the WWTF to the golf course would be a combination of 12-inch ductile iron pipe and 12-inch C-900 PVC pipe with valves and fittings. Valves were spaced every 1,000 feet for conservative cost estimating purposes. Pressures in the lower section of the distribution line near the WWTF were expected to much higher than the pressures experienced in the upper section of the line near the golf course. Also, with future growth expected, the anticipated pressure coming out of the pumps at the WWTF would be closely approaching the max working pressure ratings of C-900 PVC. Therefore, to be conservative, the lower section of the distribution line was selected to be ductile iron pipe with a working pressure of 350 psi. The upper section of the distribution line was selected to be C-900 PVC. A line with less thickness is required as the line moves up towards Kingman.

This distribution line would be installed 4-feet minimum below grade within the existing 30-foot wide sewer easement from Kingman to the WWTF, following the Mohave Wash alignment. A temporary construction easement (TCE) on the north-west side of the easement may be necessary. However, having the reclaimed distribution line run so close to the edge of the easement would allow for easier construction of a future sewer outfall line. The distribution line would briefly exit the Mohave Wash alignment to pass by the Kingman High School and then return to the Wash. At Airway Avenue, the distribution line would again exit the Mohave Wash alignment and head east to N Burbank Street. The distribution line would then turn south passing by the Kingman Academy of Learning, Centennial Park, Firefighter's Memorial Park, Kingman Middle School and the Mohave County Fairgrounds.

The golf course is located approximately eight miles southwest of the Hilltop Wastewater Treatment Facility. The golf course is approximately 3,490-feet above sea level and the WWTF is approximately 3,240-feet above sea level. In order to convey the reclaimed water to the golf course an onsite booster station is needed. This booster station would include two 680 GPM horizontal split case pumps capable of overcoming 330-feet of head (142 psi) and two 320 GPM horizontal split case pumps capable of overcoming 330-feet of head (142 psi). One of each of these pumps would be on standby. These pumps would be installed on a concrete pad above grade. There would need to be installed a backflow preventer immediately after the booster station and then a flow meter downstream of the backflow preventer prior to the distribution line returning to below grade and onto the golf course. See Exhibit 4.1.5 – Option 3 – Golf Course, School and Parks Reuse Conceptual Design.

Figures 4.1.2, 4.1.3 and 4.1.4 above show the golf course, schools, parks and fairgrounds have historically used more water in the summer months than the winter months. Also, according to the City of Kingman, the golf course typically uses the majority of their water for irrigation in the nighttime hours. For this reason there are two sets of booster pumps at the WWTF. During the summer months and during the nighttime hours, when the demand for water is high, the 680 GPM pump would be used, suppling the required reclaimed water. During the winter months and daytime hours when the demand is low, the 380 GPM pump would be used for supply.

Golf Course Storage and Irrigation Conceptual Design

There are two available water storage ponds at the Cerbat Cliffs Golf Course (see Exhibit 4.1.5 – Option 3 – Golf Course, School and Parks Reuse Conceptual Design). One is a 1.5 million gallon storage pond and the other is a 3.74 million gallon storage pond. The reclaimed water for the golf course's demands would be pumped up to the larger storage pond. This would allow for ample storage for the approximately 1 MGD of reclaimed water required in the summer months and for future growth.

Water losses due to seepage and evaporation were taken into account when deciding upon the use of the pond for storage. After speaking with the Director at the golf course, seepage does not seem to be an issue. The ponds stay full for quite some time after filling and the golf course believes there is a natural bedrock below the ponds. The average evaporation rate in the Kingman area is approximately 115 inches/year. Calculations to determine the amount of water loss due to evaporation is shown in Table 4.2 below and in Appendix M – Evaporation Calculations.

Table 4.2 – Option 3 Evaporation Losses

Surface Area of Pond (sf)	Evaporation Rate (in/yr)	Evaporation Rate (ft/day)	Water Losses (cf/day)	Water losses (gal/day)
136,204	115	0.0263	3,576	26,749

The storage ponds at the golf course are located at a lower elevation than most of the rest of the golf course. Therefore, in order to convey the reclaimed water from the storage pond to the golf course's irrigation system an onsite pump station is needed. This pump station would include two 700 GPM horizontal split case pumps capable of overcoming 100-feet (43 psi) of head. One of these pumps would be on standby. These pumps would be installed in a concrete vault below grade for aesthetics. There would need to be installed a backflow preventer immediately after the booster station. See Exhibit 4.1.5 – Option 3 – Golf Course, School and Parks Reuse Conceptual Design.

4.3 Permitting

Option 3 – Golf Course, Schools and Parks Reuse would require ADEQ permitting. As described in Section 3.3 – Permitting, ADEQ offers two types of permitting:

- **Type II Permit –** This ADEQ issued permit allows for the end user to act as their own agent and directly reuse reclaimed water per AAC R18-9-708.

- **Type III Permit** – This ADEQ issued permit would allow for the City to act as the agent for the reuse reclaimed water per AAC R18-9-708.

According to ADEQ, most municipalities use a Type III permit for the reuse of reclaimed water. Also, the golf course and parks that would receive reclaimed water as part of this Option are City owned. Therefore a Type III permit is recommended for this Option. The cost of this permit is shown in Table 3.3.

4.4 Capital Costs

Option 3 – Golf Course, Schools and Parks Reuse is more expensive than Option 1 of this study, yet it is not as expensive as Option 2. The Engineer's estimated capital costs to design and construct Option 3 – Golf Course, Schools and Parks Reuse as described is Section 4.2 –Conceptual Design are listed below in Table 4.4 and in Appendix E – Engineer's Opinion of Probable Cost.

Table 4.4– Option 3 – Conceptual Design Capital Cost Estimate

Item Description	Total
Site Work (includes clearing and grubbing, grading & backfill)	$10,000
12" C-900 (DR 14) PVC Waterline (includes waterline, valves, bends, tees, appurtenances, trenching and backfill)	$1,900,000
12" DIP Waterline (includes waterline, valves, bends, tees, appurtenances, trenching and backfill)	$2,250,000
Jack and Bore Reuse Line Under Stockton Hill Rd	$120,000
Jack and Bore Reuse Line Under Interstate 40	$360,000
Booster Station (includes two 320 GPM pumps, two 680 GPM pumps valves, bends, appurtenances and concrete pad)	$190,000
Flow Meter @ WWTF	$6,000
Backflow Preventer (@WWTF, Golf Course, 3 Schools, 2 Parks and Fairgrounds)	$105,000
Pump Station @ Golf Course (includes two 700 GPM pumps, backflow preventer, valves, bends, appurtenances and concrete pad)	$160,000
Remove and Replace Existing Asphalt, Concrete, Curb and Gutter	$320,000
Electrical	$275,000
25% Contingency	$1,424,000
Professional Engineering Services	$684,000
Construction Administration	$456,000
TOTAL	**$8,260,000**

4.5 Long-Term Operations and Maintenance

Long term O&M for Option 3 – Golf Course, Schools and Parks Reuse is higher than Option 1 in this study but less than Option 2. Many factors were assumed in determining the O&M expenses. Some of these expenses are listed below. For a list of all the O&M expenses and associated costs see Appendix F – Operations & Maintenance Expenses.

- Employee Salaries and Benefits
- Equipment Supplies and System Maintenance
- Sub consultant Engineering
- Vehicle and Travel/Education Expenses
- Administrative Services and Office Supplies
- ADEQ Permitting
- Power Consumption

Some assumptions were taken in determining long term O&M costs. Employee salaries were determined based on the assumption that the City would need to hire additional staff to be able to operate and maintain the distribution system. Costs for vehicle expenses, equipment supplies, maintenance, sub-consultant engineering, travel/education expenses and ADEQ permitting were determined and then spread out over a 20-year period. An analysis of the power consumption/costs of four well sites was done to determine an average power cost.

As outlined in Section 1.1 – Purpose and Scope of Work, the project analysis was based on a 20-year period with a 3% inflation rate and a 3% growth rate Citywide. Costs for the above mentioned expenses, adjusted for inflation over a 20-year period were calculated and added to a debt service amount for the total amount of the project with an assumed 3% interest rate. The annual O&M, debt service payment, total annual net expenses and cumulative net expenses for a 1, 5, 10, 15 and 20 year period for Option 3 – Golf Course, Schools and Parks Reuse is shown in Table 4.5.

Table 4.5 – Option 3 Long Term O&M and Debt Service Expenses

Item Description	Year 1	Year 5	Year 10	Year 15	Year 20
Annual O&M Expenses (adjusted for inflation)	$157,753	$176,192	$204,255	$236,788	$274,502
Debt Service Payment	$555,202	$555,202	$555,202	$555,202	$555,202
Annual Net Expense	($712,955)	($731,394)	($759,457)	($791,898)	($829,704)
Cumulative Expense	($712,955)	($3,608,333)	($7,347,831)	($11,240,789)	($15,311,647)

4.6 Rate Analysis and Capital Savings

Option 3 of this study includes a reclaimed water distribution line from the Hilltop Wastewater Treatment Facility to the Cerbat Cliffs Golf Course with the possibility to have connections to the Kingman High School, Kingman Middle School, Kingman Academy of Learning, Firefighter's Memorial Park, Centennial Park and the Mohave County Fairgrounds.

The irrigation water currently being used by the golf course and parks is provided free of charge by the City and the City has stated that there is no desire to begin to charge the golf course or themselves for the use of reclaimed water as irrigation water at these locations.

Table 4.5 shows the revenue that needs to be earned over a 20-year period to pay for this Option is high. After discussions with the City, it was determined that this Option should be self-funded and the cost of it could be borne by the all the City's water users. With that in mind, an analysis was performed based on the estimated number of connections to the City's water system, the average water use per connection and the City's residential, in-town water base rates. Only the base rate was adjusted since the amount of water used per connection may vary and is susceptible to change.

Assuming a 3% growth rate for the City over the next 20-years with a WIFA loan for the full amount of the Option at 3% interest rate a slight increase to the water base rates Citywide would provide enough capital to fully fund this project. See Appendix G – Rate Analysis for the base rate analysis. To keep the increased to base rates even lower, the City could re-direct City water funds.

Another item to take into consideration when deciding upon this Option is the capital savings this Option will provide. If the golf course, schools, parks and fairgrounds mentioned received approximately 1 MGD of reclaimed water for irrigation purposes, this would free up 1 MGD of drinking water and infrastructure for future growth. The estimated value associated with that freed up infrastructure for 1 MGD is seen in Table 4.6 – Option 3 Capital Savings and in Appendix H – Capital Savings Analysis

Table 4.6 – Option 3 Capital Savings Estimate

Item Description	Total
700 GPM Well (includes well, pump, motor, control valves, chlorination and yard piping)	$1,500,000
700GPM Booster Station (includes two pumps, valves, backflow preventer, flowmeter, fittings, appurtenances and concrete pad)	$150,000
500,000 Gallon Steel Water Storage Tank, coating (interior & exterior) and foundation	$560,000
Electrical	$275,000
25% Contingency	$622,000
Professional Engineering Services	$299,000
Construction Administration	$199,000
TOTAL	**$3,605,000**

4.7 Benefits Analysis

For Option 3, the pros and cons were analyzed and are listed below in Table 4.7.1.

Table 4.7.1 – Option 3 Pros vs. Cons

Pros	Cons
Adds the highest capacity to the City's drinking water system	Change over for most water users requires additional booster station
Benefits multiple high-water users	Initial capital cost is high
Expandable	High O&M costs
Simpler ADEQ permitting than Option 2	No groundwater recharge
Positive economic impact	

Assigned points for the selection criteria for Option 3 is shown in Table 4.7.3

Table 4.7.3 – Option 3 Selection Criteria Score

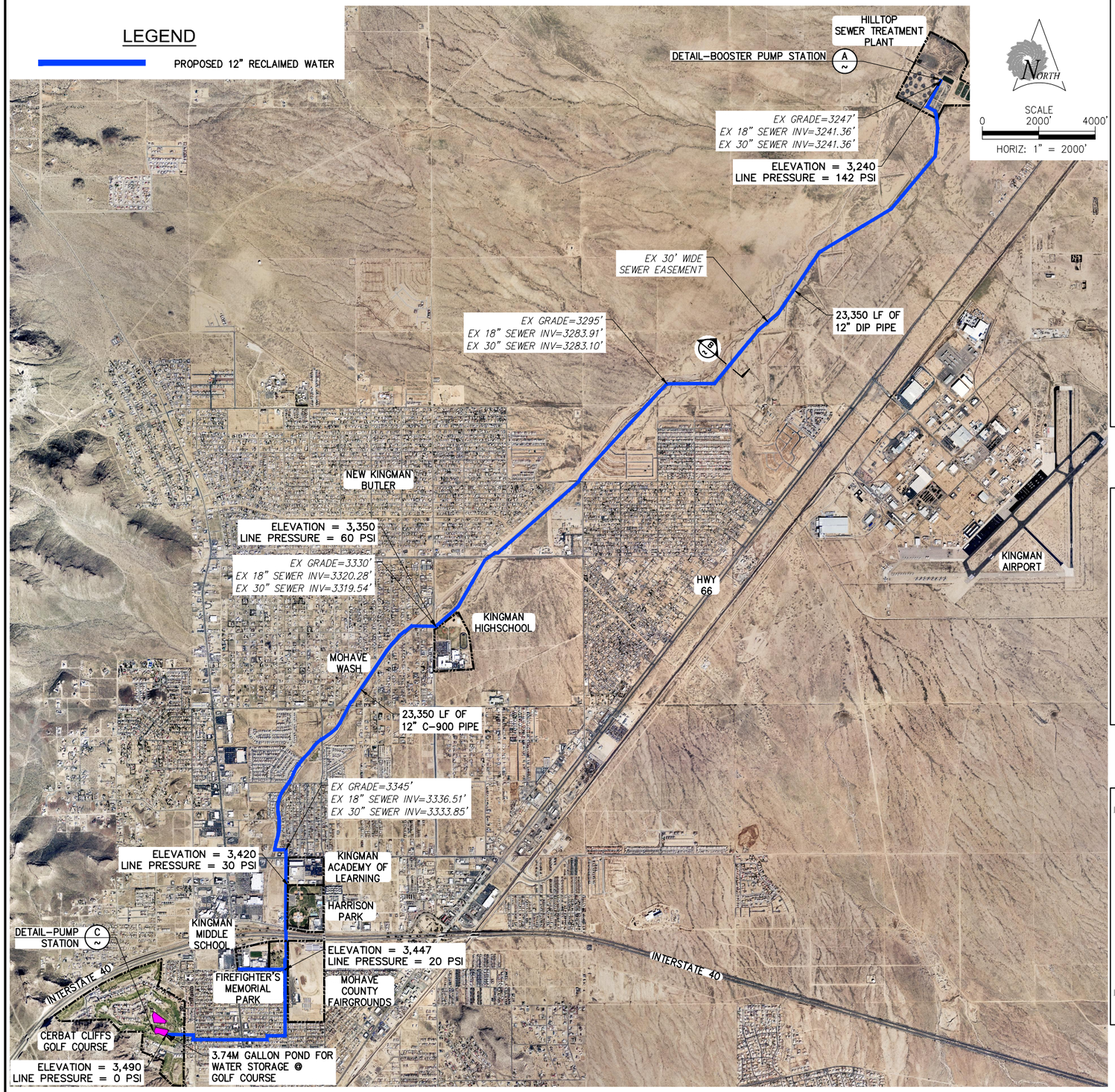
Selection Criteria	Points Possible	Option 3 Score
Capital Cost	30	10
Long Term O&M	30	5
Option Reduces Drinking Water System Requirements	30	30
Option has Community Economic Impact	30	20
Option is Flexible/Scalable	25	20
Option is Eligible for Green Funding	20	20
Option Negatively Affects Water User Base Rates	15	10
Option Recharges Groundwater	10	0
Ease/Cost of Permitting	5	2
Ease of Constructability	5	2
Total	**200**	**129**

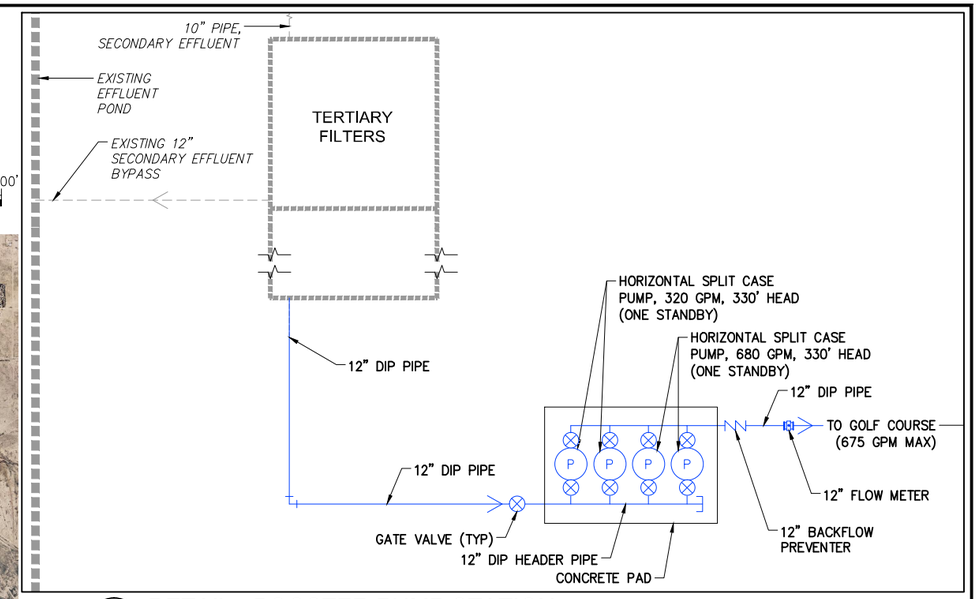
After the pros and cons for this Option were analyzed and points assigned for selection criteria, it was determined that Option 3 – Golf Course, Schools and Parks Reuse scored 129 points of 200 total.

Section 4 Exhibits

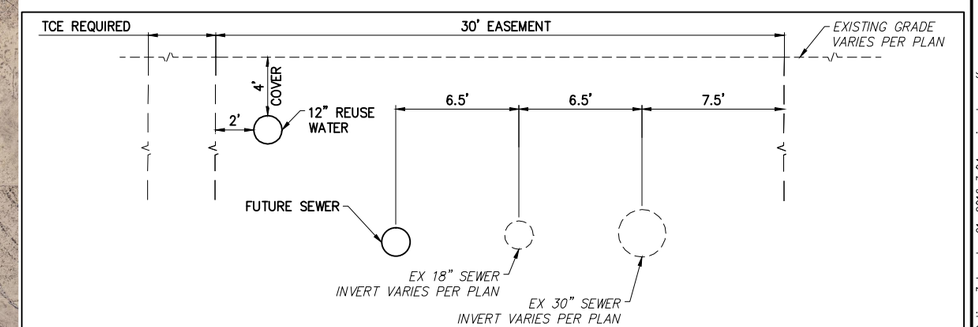
Exhibit 4.1.5 – Option 3 – Golf Course, School and Parks Reuse Conceptual Design

EXHIBIT 4.1.5

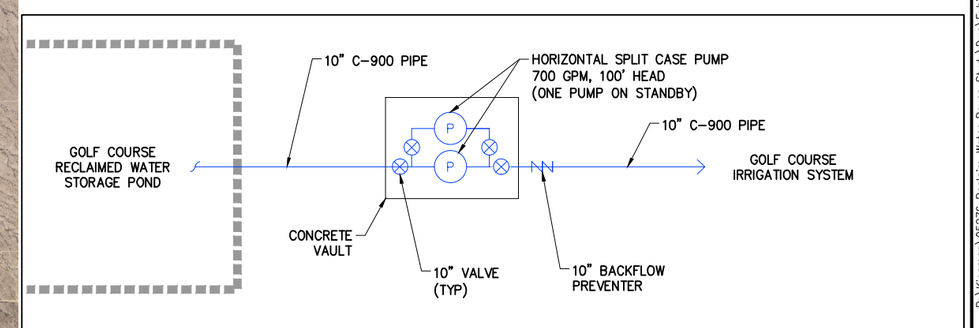




A DETAIL - BOOSTER PUMP STATION
NOT TO SCALE



B DETAIL - SEWER EASTMENT UTILITIES
NOT TO SCALE



C DETAIL - PUMP STATION
NOT TO SCALE

EXHIBIT 4.1.5 - OPTION 3 - GOLF COURSE, SCHOOLS AND FAIRGROUNDS REUSE CONCEPTUAL DESIGN

SUNRISE ENGINEERING
2152 SOUTH VINEYARD, SUITE 123
MESA, ARIZONA 85210
TEL 480.768.8600 · FAX 480.768.8609
www.sunrise-eng.com

P:\Kingman\05276 Reclaim Water Reuse Study\Dwg\Exhibits\KRP – Option 3.dwg Jan 21, 2016 3:04pm jvandegraaff

5.0 CONCLUSION

5.1 Closing Summary

The City of Kingman's Hilltop Wastewater Treatment Facility has the capacity and is permitted to treat and reuse up to 1 MGD of Class A+ reclaimed water. However, currently the WWTF only treats the effluent to Class B+ standards and such effluent is discharged to the Mohave Wash and to wetlands to the northwest.

The City would like to utilize this reclaimed water and this study has analyzed the following three possible Options:

- Groundwater Injection
- Airport Industrial Park Reuse
- Golf Course, Schools and Parks Reuse

In order to determine which Option is best suited for the City, an analysis of each of the Options was performed. A brief summary of each of the Options and results of the analysis are as follows:

Table 5.1 – Summarized Comparison of Options

Item Description	Option 1	Option 2	Option 3
Project Type	Groundwater injection	Distribution line and groundwater injection	Distribution line
Areas Serviced	Basin aquifer	Airpark and Basin aquifer	Golf course, schools, parks and fairgrounds
Conceptual Design	Injection well onsite	Distribution line to Airpark with injection at Well #1	Distribution line to Golf Course
Capital Cost	$1,055,000	$10,754,000	$8,260,000
First Yr O&M Costs	$19,377	$164,200	$157,753
Rate Analysis	N/A	Increase non-residential reclaimed water rates by $1,056 for Airpark business/property owners only	Increase to in-town residential water base rates by $3.16 Citywide
Capital Savings	N/A	$1,930,000	$3,605,000
Benefits Analysis Score	120	95	129

5.2 Recommendations

A benefits analysis of all three Options was performed to weigh the pros and cons of each Option and help determine which of these would best serve the City's interests. A summary of all three options and their scores based upon their pros and cons is shown in Table 5.2 below.

Table 5.2 – Summarized Selection Criteria Scores

Selection Criteria	Points Possible	Option 1 Score	Option 2 Score	Option 3 Score
Capital Cost	30	30	5	10
Long Term O&M	30	30	5	5
Option Reduces Drinking Water System Requirements	30	0	8	30
Option has Community Economic Impact	30	0	30	20
Option is Flexible/Scalable	25	5	13	20
Option is Eligible for Green Funding	20	20	20	20
Option Negatively Affects Water User Base Rates	15	15	0	10
Option Recharges Groundwater	10	10	4	0
Ease/Cost of Permitting	5	5	2	2
Ease of Constructability	5	5	1	2
Total	**200**	**120**	**95**	**129**

In closing, this study has provided enough information to make an engineered recommendation to the City of Kingman as to which Option they should use to utilize their reclaimed water.

Option 1 Recommendation

If the City of Kingman would prefer a project with low capital costs, low long term O&M costs and provides groundwater recharging, Option 1 – Groundwater Injection is recommended.

This Option only provides groundwater injection and will be the easiest to construct. It also is the least expensive Option in this study and has the lowest O&M costs.

Option 3 Recommendation

If the City of Kingman would like to service multiple entities with reclaimed water, free up existing water infrastructure and has options for funding, Option 3 – Golf Course, Schools and Parks Reuse is recommended.

This option would use approximately 1 MGD of reclaimed water as irrigation water for the Cerbat Cliffs Golf Course with possible connections to the schools, parks and the Fairgrounds. Its capital and O&M costs are higher than Option 1, but it will qualify for WIFA funding and will provide capital savings by reducing the demands on the City's water system thereby freeing up water infrastructure. Also, water base rates Citywide would only need to rise slightly in order to fully fund this Option.

Option 3 is the most flexible/scalable Option in the study. It would pass the Airpark, multiple schools and parks, the fairgrounds and City wells that could be retrofitted for groundwater injection.

This Option could also positively impact the community economy as it has the possibility to attract new "green" businesses.

6.0 REFERENCES

1. Arizona Department of Water Resources (ADWR), 2009, Arizona Water Atlas, Volume 4, Upper Colorado River Planning Area

2. Matthews, C.S. and Russell, D.G.. 1967. Pressure Buildup and Flow Tests in Wells.

3. Arizona Department of Environmental Quality, Guidelines for the Construction of Water System, Engineering Bulletin No. 10, May 1978

4. City of Kingman Utility Regulations, March1, 2015

APPENDICES

Appendix A – Hilltop WWTF Inflow/Effluent Flows

Appendix B - Current Permits

Appendix C – Industrial Park Flows and Calculations

Appendix D – Existing Well Data

Appendix E – Engineer's Opinion of Probable Cost

Appendix F – Operations & Maintenance Expenses

Appendix G – Rate Analysis

Appendix H – Capital Savings Analysis

Appendix I – Reuse Water Survey and Results

Appendix J – Distribution Line Size Analysis

Appendix K – Benefits Analysis

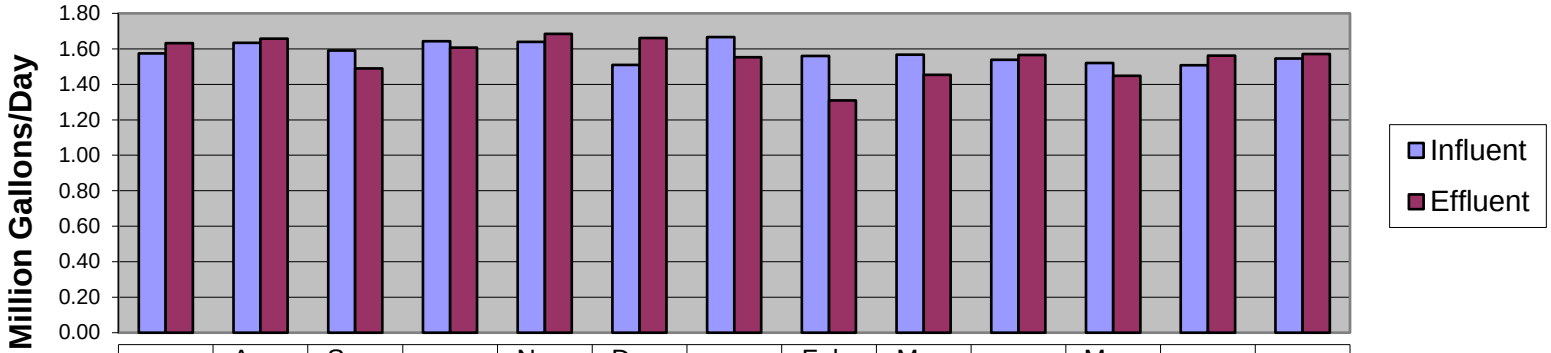
Appendix L – Golf Course, Schools and Parks Flows and Calculations

Appendix M – Evaporation Calculations

APPENDIX A

Hilltop WWTF Inflow/Effluent Flows

Hilltop WWTF



	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15
Influent	1.57	1.63	1.59	1.64	1.64	1.51	1.67	1.56	1.57	1.54	1.52	1.51	1.55
Effluent	1.63	1.66	1.49	1.61	1.69	1.66	1.55	1.31	1.45	1.57	1.45	1.56	1.57

City of Kingman
Hilltop Wastewater Treatment Plant
Inflow/Effluent Flows
(in million gallons)

	Monthly Influent Total	Daily Average	Monthly Effluent Total	Monthly Average
Jul-14	48.784	1.57	50.571	1.63
Aug-14	47.388	1.63	44.761	1.66
Sep-14	47.708	1.59	44.690	1.49
Oct-14	50.911	1.64	49.818	1.61
Nov-14	49.182	1.64	50.556	1.69
Dec-14	46.813	1.51	51.495	1.66
Jan-15	51.649	1.67	48.143	1.55
Feb-15	43.655	1.56	36.66	1.31
Mar-15	48.574	1.57	45.047	1.45
Apr-15	44.634	1.54	45.418	1.57
May-15	47.139	1.52	44.885	1.45
Jun-15	45.203	1.51	46.848	1.56
Jul-15	47.913	1.55	48.677	1.57
	Average	Average	Average	Average
	47.63	1.58	46.43	1.55
	Maximum	Maximum	Maximum	Maximum
	51.65	1.67	51.50	1.69

APPENDIX B

Current Permits

STATE OF ARIZONA
AQUIFER PROTECTION PERMIT NO. P-100611
PLACE ID 987, LTF 58694
OTHER AMENDMENT

1.0 AUTHORIZATION

In compliance with the provisions of Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2, Articles 1, 2, and 3, Arizona Administrative Code (A.A.C.) Title 18, Chapter 9, Articles 1 and 2, A.A.C. Title 18, Chapter 11, Article 4 and amendments thereto, and the conditions set forth in this permit, the Arizona Department of Environmental Quality (ADEQ) hereby authorizes City of Kingman to operate the City of Kingman Hilltop Wastewater Treatment Plant located at 5925 E. Highway 66, in Kingman, Arizona, in Mohave County, over groundwater of the Hualapai Valley basin, in Township 22 N, Range 16 W, Sections 2, 11 and 14 of the Gila and Salt River Baseline and Meridian.

This permit becomes effective on the date of the Water Quality Division Director's signature and shall be valid for the life of the facility (operational, closure, and post-closure periods) unless suspended or revoked pursuant to A.A.C. R18-9-A213. The permittee shall construct, operate and maintain the permitted facilities:

1. Following all the conditions of this permit including the design and operational information documented or referenced below, and
2. Such that Aquifer Water Quality Standards (AWQS) are not violated at the applicable point(s) of compliance (POC) set forth below or if an AWQS for a pollutant has been exceeded in an aquifer at the time of permit issuance, that no additional degradation of the aquifer relative to that pollutant and as determined at the applicable POC occurs as a result of the discharge from the facility.

1.1 PERMITTEE INFORMATION

Facility Name:	City of Kingman Hilltop Wastewater Treatment Plant
Facility Address:	5925 E. Highway 66 Kingman, Arizona 86401
County:	Mohave
Permittee:	City of Kingman
Permittee Address:	3700 E. Andy Devine Avenue Kingman, Arizona 86401
Facility Contact:	Rob Owen, Public Works Director
Emergency Phone No.:	(928) 692-3101
Latitude/Longitude:	35° 18' 00" N/ 113° 57' 00" W
Legal Description:	Township 22 N, Range 16 W, Sections 2, 11 and 14 of the Gila and Salt River Baseline and Meridian

1.2 AUTHORIZING SIGNATURE

Michael A. Fulton, Director
Water Quality Division
Arizona Department of Environmental Quality

Signed this 3rd day of June, 2014

THIS AMENDED PERMIT SUPERCEDES ALL PREVIOUS PERMITS

2.0 SPECIFIC CONDITIONS [A.R.S. §§ 49-203(4), 49-241(A)]

2.1 Facility / Site Description [A.R.S. § 49-243(K)(8)]

The City of Kingman is authorized to operate the Hilltop Wastewater Treatment Plant (WWTP) with a maximum average monthly flow of 5.1 million gallons per day (mgd). The WWTP process consists of an influent pump station, headworks with screening and a grit chamber, two (2) oxidation ditches, two (2) secondary clarifiers, an equalization basin, a gas chlorination system, a de-chlorination system using sulfur dioxide, a sludge holding tank, and a belt filter press. After clarification, up to 1.0 mgd of effluent may be diverted to the City of Kingman Hilltop Tertiary WWTP (a separately permitted facility, see APP #P-106051) for additional treatment resulting in Class A+ reclaimed water. The remaining effluent may be discharged to Mohave Wash under a valid Arizona Pollution Discharge Elimination System (AZPDES) permit (#AZ0025844) and/or beneficially reused under a valid reclaimed water permit. In addition, effluent may be discharged to the constructed wetlands to keep the wetland vegetation alive. Effluent from this facility may be discharged to Rapid Infiltration Basins (RIBs) on an emergency basis only. The sludge, including screenings, grit, and scum, shall be treated and dewatered on-site, then hauled off-site to a landfill for disposal in accordance with state and federal regulations.

Depth to groundwater at the WWTP site ranges from approximately 415 to 490 feet below ground surface. The direction of groundwater flow at the WWTP site is believed to be to the south-southwest. The WWTP is designed and constructed according to plans approved by the Arizona Department of Environmental Quality (ADEQ).

The WWTP will produce reclaimed water meeting Class B+ reclaimed water standards (A.A.C. R18-11, Article 3) that may be delivered for beneficial use under a valid reclaimed water permit under A.A.C. R18-9, Article 7.

All industrial hookups and other non-residential hookups to the treatment system shall be authorized according to the applicable federal, state or local regulations.

The purpose of this amendment is to established Alert Level (AL) and Aquifer Quality Limits (AQLs) for nitrogen species at point of compliance (POC) wells #1 and #2.

The site includes the following permitted discharging facilities:

Facility	Latitude	Longitude
Hilltop WWTP	35° 18' 00" N	113° 57' 00" W
Constructed Wetland Cells	35° 18' 51" N	113° 57' 30" W
22 Rapid Infiltration Basins (RIBs)	35° 19' 15" N	113° 57' 00" W

Annual Registration Fee [A.R.S. § 49-242 and A.A.C. R18-14-104]

The Annual Registration Fee for this permit is established by A.R.S. § 49-242 and is payable to the Arizona Department of Environmental Quality (ADEQ) each year. The design flow is 5.1 million gallons per day. The permittee shall notify ADEQ of any change in the facility contact information according to Section 2.7.7.

Financial Capability [A.R.S. § 49-243(N) and A.A.C. R18-9-A203]

The permittee has demonstrated financial capability under A.R.S. § 49-243(N) and A.A.C. R18-9-A203. The permittee shall maintain financial capability throughout the life of the facility. The estimated dollar amount demonstrated for financial capability is $10,062,000.00. The financial capability was demonstrated through A.A.C. R18-9-A203(B)(1) and (2).

STATE OF ARIZONA
AQUIFER PROTECTION PERMIT NO. P-106051
PLACE ID 987, LTF 48583

1.0 AUTHORIZATION

In compliance with the provisions of Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2, Articles 1, 2 and 3, Arizona Administrative Code (A.A.C.) Title 18, Chapter 9, Articles 1 and 2, A.A.C. Title 18, Chapter 11, Article 4 and amendments thereto, and the conditions set forth in this permit, the City of Kingman is hereby authorized to operate the Hilltop Tertiary Wastewater Treatment Plant, located at 5925 East Highway 66 in Kingman, Arizona, in Mohave County, over groundwater of the Hualapai Valley groundwater basin, in Township 22 N, Range 16 W, Sections 11 and 14 of the Gila and Salt River Baseline and Meridian.

This permit becomes effective on the date of the Water Quality Division Director's signature and shall be valid for the life of the facility (operational, closure, and post-closure periods) unless suspended or revoked pursuant to A.A.C. R18-9-A213. The permittee shall construct, operate and maintain the permitted facilities:

1. Following all the conditions of this permit including the design and operational information documented or referenced below, and
2. Such that Aquifer Water Quality Standards (AWQS) are not violated at the applicable point(s) of compliance (POC) set forth below or if an AWQS for a pollutant has been exceeded in an aquifer at the time of permit issuance, that no additional degradation of the aquifer relative to that pollutant and as determined at the applicable POC occurs as a result of the discharge from the facility.

1.1 PERMITTEE INFORMATION

Facility Name:	Hilltop Tertiary Wastewater Treatment Plant
Facility Address:	5925 East Highway 66 Kingman, Arizona 86401
County:	Mohave
Permittee:	City of Kingman
Permittee Address:	3700 East Andy Devine Avenue Kingman, Arizona 86401
Facility Contact:	Jeff Corwin, Wastewater Superintendent
Emergency Phone No.:	(928) 692-3125
Latitude/Longitude:	35° 17' 58.4" N/ 113°57' 0.4" W
Legal Description:	Township 22 N, Range 16 W, Sections 11 and 14 of the Gila and Salt River Baseline and Meridian

1.2 AUTHORIZING SIGNATURE

Michael A. Fulton, Director
Water Quality Division
Arizona Department of Environmental Quality

Signed this 25th day of June, 2010

2.0 SPECIFIC CONDITIONS [A.R.S. §§ 49-203(4), 49-241(A)]

2.1 Facility / Site Description [A.R.S. § 49-243(K)(8)]

The City of Kingman is authorized to operate Hilltop Tertiary Wastewater Treatment Plant (WWTP), a 1.0 million gallons per day (mgd) facility. This facility shall apply tertiary treatment to a portion of the secondary treated effluent produced by Hilltop WWTP, which operates under APP No. P-100611. The Hilltop Tertiary WWTP treatment process shall use tertiary filters, chlorine disinfection, and an effluent pump station.

Hilltop Tertiary WWTP effluent shall be beneficially reused under a valid reclaimed water permit. Any effluent not delivered for beneficial reuse shall be discharged to the Hilltop WWTP equalization basin for discharge under APP No. P-100611.

Hilltop Tertiary WWTP shall produce reclaimed water meeting Class A+ Reclaimed Water Standards (A.A.C. R18-11, Article 3) which may be delivered for beneficial use under a valid reclaimed water permit under A.A.C. R18-9, Article 7. Reclaimed water delivered for beneficial reuse shall be disinfected by chlorination.

The depth to groundwater is approximately 415 to 490 feet below the ground surface, and the direction of groundwater flow is to the south-southwest.

Hilltop Tertiary WWTP is designed and constructed according to plans approved by the ADEQ APP and Reuse Unit.

All industrial hookups and other non-residential hookups to the treatment system shall be authorized according to the applicable federal, state or local regulations.

The site includes the following permitted discharging facility:

Facility	Latitude	Longitude
Hilltop Tertiary WWTP	35° 17' 58.4" N	113° 57' 0.4" W

Annual Registration Fee [A.R.S. § 49-242]

The Annual Registration Fee for this permit is established by A.R.S. § 49-242(E) and is payable to the Arizona Department of Environmental Quality (ADEQ) each year. The design flow is 1.0 million gallons per day (mgd).

Financial Capability [A.R.S. § 49-243(N) and A.A.C. R18-9-A203]

The permittee has demonstrated financial capability under A.R.S. § 49-243(N) and A.A.C. R18-9-A203(1) and (2). The permittee shall maintain financial capability throughout the life of the facility. The estimated dollar amount demonstrated for financial capability is $414,600.00.

2.2 Best Available Demonstrated Control Technology [A.R.S. § 49-243(B) and A.A.C. R18-9-A202(A)(5)]

Hilltop Tertiary WWTP shall be designed, constructed, operated, and maintained to meet the treatment performance criteria for new facilities as specified in Arizona Administrative Code R18-9-B204.

The facility shall meet the requirements for pretreatment by conducting monitoring as per R18-9-B204(B)(6)(b)(i).

ADEQ Inventory No. 100611
LTF No. 49696

Permit No. AZ0025844

AUTHORIZATION TO DISCHARGE UNDER THE ARIZONA POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2, Article 3.1; the Federal Water Pollution Control Act, (33 USC §1251 et. seq., as amended), and Arizona Administrative Code (A.A.C.) Title 18, Chapter 9, Articles 9 and 10, and amendments thereto,

City of Kingman
Hilltop Wastewater Treatment Plant
3700 East Andy Devine Avenue
Kingman, Arizona 86409

is authorized to discharge treated domestic wastewater from the wastewater treatment plant located at 5925 East Highway 66, Kingman in Mohave, Arizona to Mohave Wash in the Colorado Lower Gila Watershed at:

Outfall No.	Latitude	Longitude	Legal
001	35° 18' 09" N	113° 56' 48" W	Township 22 N, Range 16 W, Section 11

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein, and in the attached "Standard AZPDES Permit Conditions."

This permit shall become effective on March 1, 2011.

This permit and the authorization to discharge shall expire at midnight, **February 29, 2016.**

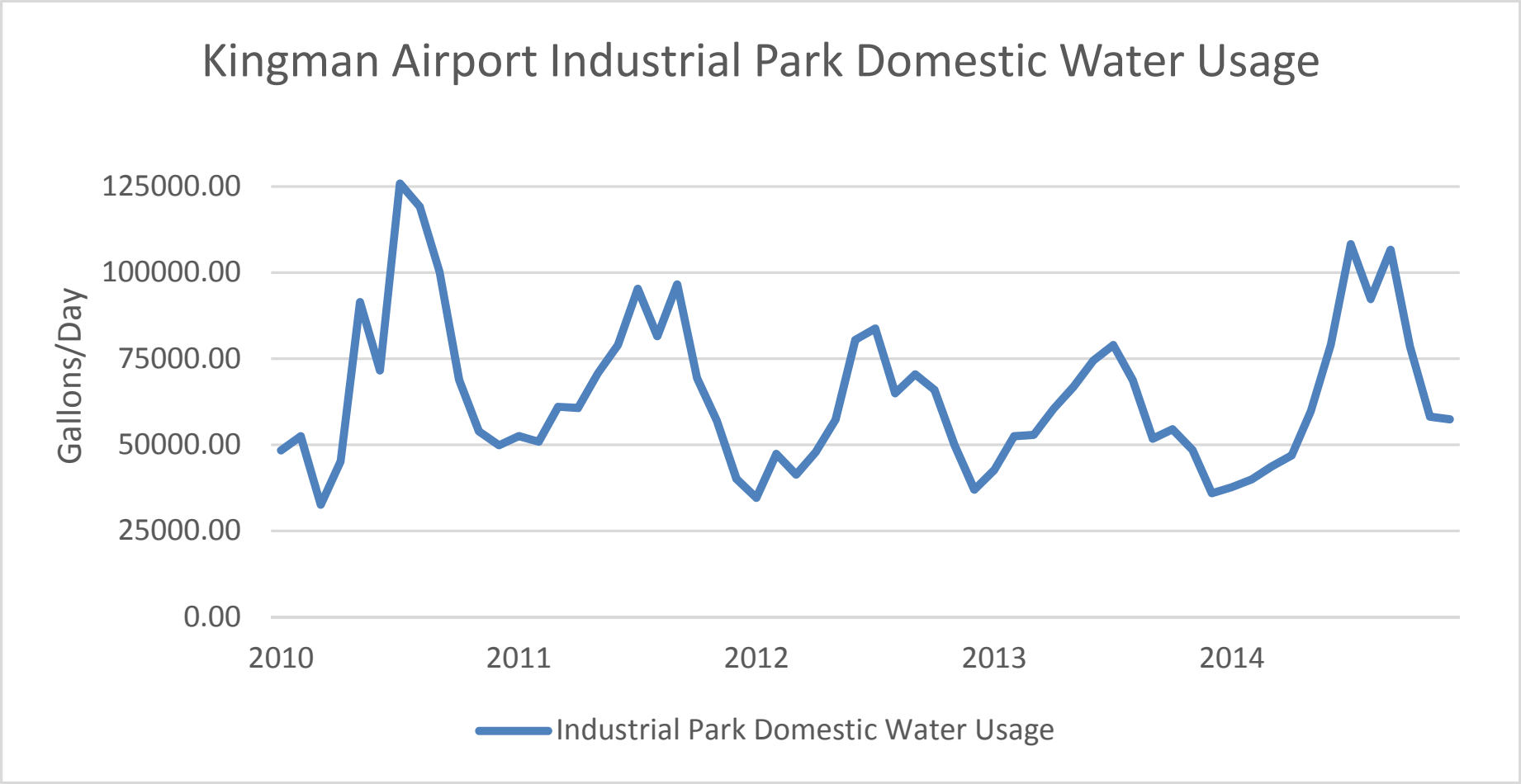
/S/ December 18, 2009
Henry R. Darwin, Acting Director
Water Quality Division
Department of Environmental Quality

Minor modification signed this 19th day of April, 2014

Michael A. Fulton, Director
Water Quality Division
Department of Environmental Quality

APPENDIX C

Industrial Park Flows and Calculations


Kingman Airport Industrial Park Domestic Water Usage
Gallons/Day
125000.00
100000.00
75000.00
50000.00
25000.00
0.00
2010
2011
2012
2013
2014
Industrial Park Domestic Water Usage

City of Kingman
Airport Industrial Park
Water Usage
(in thousands of gallons)

					Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
											2010						
BUSINESS	**SERVICE ADDRESS**	**CUSTOMER**	**LOCATION 1**	**LOCATION 2**	**LOCATION 3**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**
Aero-Flite, Inc.	4800 Flightline Dr	33956	11237	31807		2	6	11.8	17.3	15	3.7	24.7	6.3	22	12	39	3.5
Honeywell	4805 Mohave Airport Dr	27962	24833			21	22	11	17	24	48	88	92	40	66	63	78
Air'Zona Aircraft Services	7100 Flightline Dr	WA 9082	WA 10307			18	14	9	19	25	35	88	63	57	50	22	20
Air'Zona Aircraft Services	7100 Flightline Dr	IRR 9082	IRR 10307														
Air Treads/Goodyear	4105 Mohave Airport Dr	8506	11223			26.5	26.9	30.9	26.4	60.3	67.6	215.2	180.9	107.6	71.1	35.9	35.7
American Woodmark	4475 Mohave Airport Dr	8614	11165			360.9	383.1	303.5	355.1	354.9	354.2	638.5	571.3	557.5	364.8	285.4	281.1
Aquarium Décor, Inc.	4730 Finance Way	8820	11255			0	1	0	1	2	1	1	1	2	1	1	1
Arizona Hydraulics Engineering	9450 Commerce Dr	84810	40599			0.87	0.97	1.46	0.98	1.11	17.71	3.24	3.56	3.17	2.18	0.99	1.03
BLM	9990 Flightline Dr	34852	28321			2	15	1	2	1	1	2	3	1	1	1	1
Brackett Aircraft	7045 Flightline Dr	8542	11029			5	6	7	6	7	12	29	27	19	26	29	11
Cantex, Inc.	4045 Bonanza Dr	WA 77548	WA 40197			23	29	36	46	45	126	838	1022	538	448	343	364.8
Cantex, Inc.	4045 Bonanza Dr	IRR 77548	IRR 40197			0.15	0.47	0.15	0.03	0	0	0	116.02	32.34	22.18	26.16	31.08
Cascades Tissue Group	4625 Interstate Way	90486	11137	40429						0	20.4	42.9	37.2	37.5	32.1	40	42.1
Composite Solutions	4510 Flighline Dr	82816	40301			6	4	1	2	1	1	0	1	1	1	1	1
Custom Aluminum Radiators	4925 Finance Way	56746	10991														
Desert Diamond Distillers	4875 Olympic Way	86710	40765			3.15	1	7.11	6.89	11.61	12.39	13.99	18.16	15.47	12.18	11.92	8.97
Dillon Transportation	4445 Interstate Way	100860	31683														
Guardian Air	7010 Flightline Dr	44434	29455			4	4	4	5	4	5	4	4	4	4	4	4
Hav-a-Lube Inc	9350 Shipping Lane	80996	40181			11.52	3.23	3.8	3.4	3.54	3.26	5.3	1.41	1.13	5.17	6.14	5.97
Hi-Desert Delivery	5005 1/2 Interstate Way	76536	11341			1	1	1	1	1	1	3	1	2	1	1	1
I-Corp Arizona, Inc.	4155 Finance Way	38988	27759			2.84	2.61	2.96	11.41	3.31	5.39	25.61	22.85	17.37	13.07	6.25	2.97
Import Corner	9000 Government Way	54954	10261			2	1	1	5	7	15	20	8	5	8	2	4
Insteel Wire Products	4750 Olympic Dr	92772	27067														
Interstate Group	4400 Interstate Way	56440	31745			7	14	12	19	24	17	23	35	3	11	13	12
ISCO Industries	4725 Flightline Dr	92130	41003													0	10.85

						2010											
BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Jasper Engines & Transmissions	9400 Commerce Dr	83184	40451			1.26	1.54	1.65	2.08	2.56	3.58	6.51	5.95	6.22	4.1	3.25	2.15
Jim Straube's Aircraft Service	4890 Flightline Dr	25482	10703			6	45	7	9	10	10	6	4	9	4	12	13
J-M Manufacturing	4620 Olympic Dr	61118	11125			48	39	24	30	33	38	44	41	35	32	28	35
Karnak Chemical	4585 Interstate Way	90616	39365								0	0.02	0.34	0.3	0.25	0.63	1.03
Kingman Airport Café		9086	10679			12	15	25	86	57	49	68	63	66	58	59	47
Kingman Army Airfield Museum	4540 Flightline Dr	48506	23547			0	1	1	0	1	3	4	2	3	3	3	2
Kingman Property LLC	4625 Interstate Way	54676	33281			3.9	3.8	2.7	2.5	2.2	1.8	2.5	2.2	2	2	2.5	4.2
Knauf Insulation	4200 Industrial Blvd	WA 109200	WA 29433														
Knauf Insulation	4200 Industrial Blvd	IRR109200	IRR 29433														
Lander Industries	9000 Transport Way	105776	29751														
Laron Incorporated	4545 Interstate Way	8526	11193	25065	32517	7	4	13	12	6	45	62	60	53	42	30	65
Lomanco West	4450 Airport Dr	8606	11151			5	4	6	6	7	7	9	8	8	6	5	7
Luseaux Laboratories, Inc	4625 Sante Fe Dr	28662	24667			75.4	66.9	67.8	88.2	83.5	70.2	70.6	61.2	65.7	67.8	51.7	58
Mohave Materials	8055 Flightline Dr	8564	11063			2	1	2	4	3	5	16	12	4	3	2	3
MC2	9300 Commerce Dr	83162	39339			13.5	7.9	7.5	4.8	4.4	23.5	34.4	50.8	31.5	18.6	6.6	6.5
Monsey Products/Henry Company	4685 Finance Way	8522	10977			180.1	216.9	188.8	260.4	282	224.7	392.1	336.9	270.7	262.7	222.5	129.2
Musket Corporation	4400 Industrial Blvd	57132	31981			2	1	0	1	1	0	1	0	1	0	1	1
Pepsi-Cola Company	7100 Commerce Dr	11688	26741			2	3	2	2	5	4	9	6	6	5	5	6
Performance Specialists, Inc.	4906 Olympic Dr	68588	36485			2.87	3.56	3.11	3.89	3.67	3.3	4.8	3.37	3.2	3.1	2.95	3.45
Plastic Express	7300 Commerce Dr L-1	99790	40199														
Potters Industries, Inc.	4665 Finance Way	8512	10969			9	6	8	8	11	9	25	27	26	20	11	5
Schwan Food Company	5055 Interstate Way	8772	11241			2	1	2	2	1	2	2	2	2	2	1	2
Scot Industries	4550 Mohave Airport Dr	101548	11181														
Southwest Alarm Services	4855 Finance Way	8548	11039			3	3	2	3	3	3	4	5	6	3	3	4
Southwire	4900 Industrial Blvd	54002	11207			229.6	159.3	0.04	0	689	254	310	121	242	26	3	31
Solution Dispersion Inc/Chromascape	4430 Sante Fe	WA 43534	WA 11293			4	6	5	6	7	5	6	7	7	8	7	9

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	2010 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Solution Dispersion Inc/Chromascape	4430 Sante Fe	IRR 43534	IRR 11293			33.9	28.6	37.4	61.7	68.7	78.4	82.7	97.4	82.6	84.4	41.3	39.7
StarRfoam Manufacturing, Inc.	4555 Olympic Dr	75342	38863			69	103.4	94.1	144.4	197	190.9	153	218.6	202	198.5	103.1	45.8
Sun State Components	4505 Mohave Airport Dr	30596	25793			12	10	14	7	7	8	30	20	20	13	10	10
Support Source Inc	5005 Olympic Dr	106260	38595														
Telling Industries	4425 Windrose Lane	86868	40677			3.88	3.4	3.99	4.75	4.74	4.31	8.76	4.69	5.37	4.09	4.83	4.98
Tri-State Care Flight	5880 Flightline Dr	89316	40909			N/A	0	0	3.37	5.8	5.34	5.91	5.19	5.94	5.44	5.31	6.21
True Value	4005 Mohave Airport Dr	9134	10809			19	18	21	29	23	21	21	18	25	27	22	22
Ultimate Systems Limited	4550 Interstate Way	8840	11259			0	0	0	0	0	0	0.01	0	0	0	0	0
UPS	4745 Finance Way	8752	11233			5	3	4	4	5	6	12	10	7	6	6	5
West Coast Netting	5070 Flightline Dr	22608	23887			17	16	17	18	26	42	87	68	51	33	21	20
Viking Freight System/FedEx Freight	4955 Interstate Way	8872	11307			2	2	1	2	2	1	2	2	2	2	2	2
Inactive Accounts																	
Acton Welding	4765 Interstate Way	8758	11235														
Irby Construction Co	5005 Interstate Way	24894	10733														
Skyview Construction	4655 Mohave Airport Dr	71416	30809														
Allied Signal	4790 Olympic Dr	24262	11077			3	3	4	5	4	30	47	97	48	11	5	4
Southwire	4900 Industrial Blvd	54002	11207			229.6	159.3	0.04	0	689	254	310	121	242	26	3	31
Mracek, Beverly	7045 Government Way	9118	10781														
Vacant-2	4910 Industrial Blvd	22030	11239														
Action Delivery	4985 A Interstate Way	11263	4905														
					Total Thousand Gallons/Month	1499.94	1470.88	1009.81	1354.60	2835.34	2148.68	3901.75	3695.34	3004.61	2132.76	1615.43	1546.29
					Total Thousand Gallons /Day	**48.39**	**52.53**	**32.57**	**45.15**	**91.46**	**71.62**	**125.86**	**119.20**	**100.15**	**68.80**	**53.85**	**49.88**
					Total Gallons/Day	48385.16	52531.43	32574.52	45153.33	91462.58	71622.67	125862.90	119204.52	100153.67	68798.71	53847.67	49880.32

2010 Average Usage	71,826
2010 Peak Usage	100,154
2010 Minimum Usage	91,463
2010 - 2014 Average Usage	62,320
2010 - 2014 Peak Usage	108,199
2010 - 2014 Minimum Usage	34,565

City of Kingman
Airport Industrial Park
Water Usage
(in thousands of gallons)

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
					Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
						2011											
Aero-Flite, Inc.	4800 Flightline Dr	33956	11237	31807		7.1	20.6	7.4	11.1	6.3	9.5	8.3	10.1	5.3	12.6	76.5	7.6
Honeywell	4805 Mohave Airport Dr	27962	24833			33	12	12	10	12	33	63	66	69	34	19	11
Air'Zona Aircraft Services	7100 Flightline Dr	WA 9082	WA 10307			18	17	16	17	33	66	36	57	51	32	15	12
Air'Zona Aircraft Services	7100 Flightline Dr	IRR 9082	IRR 10307														
Air Treads/Goodyear	4105 Mohave Airport Dr	8506	11223			26.2	34.5	32.3	31.9	33.2	74	140.4	154.9	223.1	102.1	67.4	80.2
American Woodmark	4475 Mohave Airport Dr	8614	11165			240.7	245.5	297.8	277.8	318.6	377.4	568.5	573.1	670.5	402.7	356.5	232
Aquarium Décor, Inc.	4730 Finance Way	8820	11255			2	1	1	0	1	1	2	1	0	1	1	0
Arizona Hydraulics Engineering	9450 Commerce Dr	84810	40599			0.73	0.92	0.96	1.5	1.25	1.34	3.54	3.2	3.19	2.17	1.03	1.11
BLM	9990 Flightline Dr	34852	28321			31	0	0	20	1	2	5	2	3.67	0.97	0.76	0.87
Brackett Aircraft	7045 Flightline Dr	8542	11029			4	7	5	5	4	11	23	23	16	12	6	5
Cantex, Inc.	4045 Bonanza Dr	WA 77548	WA 40197			272.9	288	322	412	510	211	9	8	8	9	7	10
Cantex, Inc.	4045 Bonanza Dr	IRR 77548	IRR 40197			22.21	22.35	15.38	28.05	38.43	370.84	522.7	81.07	137.37	274.38	78.16	103.47
Cascades Tissue Group	4625 Interstate Way	90486	11137	40429		84.9	96.6	37.6	36.9	38.6	38.1	35.5	36	52.5	46.4	48.1	46.2
Composite Solutions	4510 Flighline Dr	82816	40301			1	1	1	1	0	1	2	1	0	1	0	1
Custom Aluminum Radiators	4925 Finance Way	56746	10991														
Desert Diamond Distillers	4875 Olympic Way	86710	40765			6.35	10.85	14.16	20.75	14.4	12.8	13.8	6.86	13.24	9.12	13.67	10.36
Dillon Transportation	4445 Interstate Way	100860	31683														
Guardian Air	7010 Flightline Dr	44434	29455			4	4	4	5	4	4	4	5	5	3	4	6
Hav-a-Lube Inc	9350 Shipping Lane	80996	40181			4.88	1.67	0.72	3.02	1.88	1.52	5.25	1.03	0.95	1.66	2.44	2.14
Hi-Desert Delivery	5005 1/2 Interstate Way	76536	11341			1	1	1	1	1	2	1	0	2	0	1	0
I-Corp Arizona, Inc.	4155 Finance Way	38988	27759			2.51	2.93	3.13	3.15	3.46	13.35	24.44	27.14	24.36	7.6	3.37	2.87
Import Corner	9000 Government Way	54954	10261			1	2	4	5	7	13	15	14	14	6	5	3
Insteel Wire Products	4750 Olympic Dr	92772	27067			0	51.2	47.6	85.8	285.1	146.6	186.3	217.8	293.3	170	108.9	67.7
Interstate Group	4400 Interstate Way	56440	31745			11	11	18	16	19	15	15	10	10	8	8	8
ISCO Industries	4725 Flightline Dr	92130	41003			7.93	8.14	11.13	26.01	17.94	29.32	46.07	49.64	52.32	20.56	6.91	3.08

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	2011 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Jasper Engines & Transmissions	9400 Commerce Dr	83184	40451			1.63	2.01	1.84	1.56	1.26	1.99	3.44	3.57	3.79	3.96	3.32	2.16
Jim Straube's Aircraft Service	4890 Flightline Dr	25482	10703			47	29	9	9	11	5	6	7	7	9	7	10
J-M Manufacturing	4620 Olympic Dr	61118	11125			31	31	34	68	67	65	79	62	85	64	78	67
Karnak Chemical	4585 Interstate Way	90616	39365			0.42	0.81	0.69	0.55	0.56	5.56	16.17	20.43	11.34	5.88	2.89	1.48
Kingman Airport Café		9086	10679			31	33	34	47	75	51	51	62	70	62	57	11
Kingman Army Airfield Museum	4540 Flightline Dr	48506	23547			2	1	0	1	1	1	1	0	1	7	0	1
Kingman Property LLC	4625 Interstate Way	54676	33281			3.1	3.1	3.9	6.6	5.7	5	4.7	4.8	5	4.7	6.1	2.8
Knauf Insulation	4200 Industrial Blvd	WA 109200	WA 29433														
Knauf Insulation	4200 Industrial Blvd	IRR109200	IRR 29433														
Lander Industries	9000 Transport Way	105776	29751														
Laron Incorporated	4545 Interstate Way	8526	11193	25065	32517	17	7	9	4	11	15	49	32	20	4	4	5
Lomanco West	4450 Airport Dr	8606	11151			6	9	8	9	10	12	10	12	12	10	10	9
Luseaux Laboratories, Inc	4625 Sante Fe Dr	28662	24667			59	55.5	65.9	61.7	75.6	77.2	62.8	55.4	66.9	54.4	74.6	46.9
Mohave Materials	8055 Flightline Dr	8564	11063			2	3	4	3	4	4	7	4	15	3	2	6
MC2	9300 Commerce Dr	83162	39339			17.5	6.6	17.4	16.3	11.7	7	38.2	44.5	34.8	17.3	4.3	5.5
Monsey Products/Henry Company	4685 Finance Way	8522	10977			118.2	164.4	165.6	240.6	228.1	300.3	358.8	348.8	285.3	293.5	274.8	187.6
Musket Corporation	4400 Industrial Blvd	57132	31981			0	0	1	0	1	0	0	1	0	0	0	0
Pepsi-Cola Company	7100 Commerce Dr	11688	26741			6	5	6	5	6	6	6	6	7	7	5	6
Performance Specialists, Inc.	4906 Olympic Dr	68588	36485			2.89	2.97	3.73	3.64	4.02	3.63	3.65	3.36	4.23	3.57	3.56	3.65
Plastic Express	7300 Commerce Dr L-1	99790	40199														
Potters Industries, Inc.	4665 Finance Way	8512	10969			35	4	4	5	5	7	16	17	24	14	12	7
Schwan Food Company	5055 Interstate Way	8772	11241			1	2	2	2	2	2	2	2	1	2	1	2
Scot Industries	4550 Mohave Airport Dr	101548	11181														
Southwest Alarm Services	4855 Finance Way	8548	11039			3	3	4	4	3	4	5	5	4	4	4	3
Southwire	4900 Industrial Blvd	54002	11207			143	24	238	59	35	0	28	16	25	19	0	24
Solution Dispersion Inc/Chromascape	4430 Sante Fe	WA 43534	WA 11293			8	8	9	9	10	11	12	11	12	12	16	23

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	2011 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Solution Dispersion Inc/Chromascape	4430 Sante Fe	IRR 43534	IRR 11293			26.2	23.2	31.9	60	79.3	91.1	100.2	101.7	112.7	75.1	56.2	37.2
StarRfoam Manufacturing, Inc.	4555 Olympic Dr	75342	38863			53.1	58.3	68.5	47.6	48.7	113.8	104.6	124.9	189.3	168.2	185.7	68.5
Sun State Components	4505 Mohave Airport Dr	30596	25793			16	10	5	4	5	10	8	7	9	15	6	5
Support Source Inc	5005 Olympic Dr	106260	38595														
Telling Industries	4425 Windrose Lane	86868	40677			9.07	8.74	10.91	10.45	9.99	9.96	9.66	8.48	10.04	13.55	8.88	8.06
Tri-State Care Flight	5880 Flightline Dr	89316	40909			5.24	5.6	5.78	5.86	5.47	5.61	5.53	5.08	6.09	4.98	4.32	5.08
True Value	4005 Mohave Airport Dr	9134	10809			26	18	26	23	26	26	24	38	26	24	20	23
Ultimate Systems Limited	4550 Interstate Way	8840	11259			0	0	0	0	0	0	0.01	0.01	0.01	0	0	0
UPS	4745 Finance Way	8752	11233			7	4	4	8	6	8	11	9	9	9	6	4
West Coast Netting	5070 Flightline Dr	22608	23887			17	19	20	22	51	59	94	87	84	45	21	25
Viking Freight System/FedEx Freight	4955 Interstate Way	8872	11307			5	2	2	2	1	2	2	2	1	2	2	2
Inactive Accounts																	
Acton Welding	4765 Interstate Way	8758	11235														
Irby Construction Co	5005 Interstate Way	24894	10733														
Skyview Construction	4655 Mohave Airport Dr	71416	30809														
Allied Signal	4790 Olympic Dr	24262	11077			3	17	5	4	9	25	79	61	75	18	2	4
Southwire	4900 Industrial Blvd	54002	11207			143	24	238	59	35	0	28	16	25	19	0	24
Mracek, Beverly	7045 Government Way	9118	10781														
Vacant-2	4910 Industrial Blvd	22030	11239														
Action Delivery	4985 A Interstate Way	11263	4905														
					Total Thousand Gallons/Month	1627.76	1423.49	1890.33	1819.84	2195.56	2367.92	2955.56	2525.87	2896.30	2150.40	1707.41	1243.53
					Total Thousand Gallons /Day	**52.51**	**50.84**	**60.98**	**60.66**	**70.82**	**78.93**	**95.34**	**81.48**	**96.54**	**69.37**	**56.91**	**40.11**
					Total Gallons/Day	52508.39	50838.93	60978.39	60661.33	70824.52	78930.67	95340.65	81479.68	96543.33	69367.74	56913.67	40113.87

2011 Average Usage	67,875
2011 Peak Usage	96,543
2011 Minimum Usage	40,114

City of Kingman
Airport Industrial Park
Water Usage
(in thousands of gallons)

					Days in Month	31	29	31	30	31	30	31	31	30	31	30	31
											2012						
BUSINESS	**SERVICE ADDRESS**	**CUSTOMER**	**LOCATION 1**	**LOCATION 2**	**LOCATION 3**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**
Aero-Flite, Inc.	4800 Flightline Dr	33956	11237	31807		6.4	15.4	7.1	21.27	30.57	20.18	15.3	6.78	5.37	4.02	30.19	5.76
Honeywell	4805 Mohave Airport Dr	27962	24833			8	9	10	12	17	32	43	31	26	21	15	12
Air'Zona Aircraft Services	7100 Flightline Dr	WA 9082	WA 10307			15	16	19	21	30	43	54	44	42	47	31	24
Air'Zona Aircraft Services	7100 Flightline Dr	IRR 9082	IRR 10307														0
Air Treads/Goodyear	4105 Mohave Airport Dr	8506	11223			148.1	97.4	34.9	42.3	62.9	126.5	155.3	108.7	105	104.3	78.9	27.9
American Woodmark	4475 Mohave Airport Dr	8614	11165			221.7	365	257.3	317.2	402	502.6	571.3	412.2	410.9	420.8	293.5	259.3
Aquarium Décor, Inc.	4730 Finance Way	8820	11255			1	0	0	1	0	1	1	1	1	0	1	1
Arizona Hydraulics Engineering	9450 Commerce Dr	84810	40599			0.97	1.31	1.21	1.83	2.28	3.82	3.74	2.85	2.64	2.6	1.38	1.03
BLM	9990 Flightline Dr	34852	28321			0	0	0	0	1.1	0.9	2.49	5.08	3.92	1.11	0.97	0
Brackett Aircraft	7045 Flightline Dr	8542	11029			4	6	6	7	12	23	26	23	17	14	7	4
Cantex, Inc.	4045 Bonanza Dr	WA 77548	WA 40197			7	10	12	12	9	8	10	9	12	11	11	6
Cantex, Inc.	4045 Bonanza Dr	IRR 77548	IRR 40197			51.52	26.61	63.04	30.86	21.58	19.28	70.2	29.41	31.03	39.86	32.57	20.52
Cascades Tissue Group	4625 Interstate Way	90486	11137	40429		35.2	41.4	42.8	48.6	42.6	42.5	44.8	47.2	45.5	36.2	20.4	21.3
Composite Solutions	4510 Flighline Dr	82816	40301			1	0	4	6	12	12	7	1	0	1	1	0
Custom Aluminum Radiators	4925 Finance Way	56746	10991						0	1	8	9	6	5	3	1	0
Desert Diamond Distillers	4875 Olympic Way	86710	40765			10.56	11.12	11.71	16.56	10.23	13.71	11.22	9.73	6.89	12.83	14.37	10.57
Dillon Transportation	4445 Interstate Way	100860	31683														
Guardian Air	7010 Flightline Dr	44434	29455			4	5	4	9	4	5	6	6	8	9	6	7
Hav-a-Lube Inc	9350 Shipping Lane	80996	40181			1.66	1.24	1.64	1.4	1.17	4.04	4.23	2.73	2.14	1.22	0.74	0.7
Hi-Desert Delivery	5005 1/2 Interstate Way	76536	11341			1	1	1	1	0	1	2	1	0	N/A	1	1
I-Corp Arizona, Inc.	4155 Finance Way	38988	27759			3.15	3.32	2.67	3.41	5.17	19.14	19.7	12.5	18.48	24.43	3.34	2.69
Import Corner	9000 Government Way	54954	10261			1	1	2	5	8	17	12	2	2	5	6	5
Insteel Wire Products	4750 Olympic Dr	92772	27067			40.2	54.6	50.7	63	87.1	110.3	127.5	99.7	117.4	169.1	102.6	86.5
Interstate Group	4400 Interstate Way	56440	31745			6	10	11.1	12.4	8.5	8.5	7.3	8	8.3	7.1	6.3	5.7
ISCO Industries	4725 Flightline Dr	92130	41003			3.14	21.29	3.52	3.22	7.33	45.11	49.87	33.23	27.67	26.02	6.87	6.75

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	2012 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Jasper Engines & Transmissions	9400 Commerce Dr	83184	40451			1.81	2.21	2.11	2.64	2.41	5.92	5.14	4.87	3.12	3.01	1.6	1.88
Jim Straube's Aircraft Service	4890 Flightline Dr	25482	10703			12	12	14	6	13	8	5	7	9	9	7	9
J-M Manufacturing	4620 Olympic Dr	61118	11125			61	50	57	54	40	58	78	68	72	58	40	45
Karnak Chemical	4585 Interstate Way	90616	39365			1.23	1.02	1.02	4.03	10.56	14.17	18.86	30.08	6.07	6.11	3.5	1.72
Kingman Airport Café		9086	10679			27	31	25	41	88	87	101	89	52	13	14	11
Kingman Army Airfield Museum	4540 Flightline Dr	48506	23547			0	0	1	0	1	0	0	1	0	1	0	0
Kingman Property LLC	4625 Interstate Way	54676	33281			6.1	7	2.1	4	10.4	7.6	12.3	3.8	4.6	4.5	4.6	5.1
Knauf Insulation	4200 Industrial Blvd	WA 109200	WA 29433														
Knauf Insulation	4200 Industrial Blvd	IRR109200	IRR 29433														
Lander Industries	9000 Transport Way	105776	29751														
Laron Incorporated	4545 Interstate Way	8526	11193	25065	32517	8	4	4	5	3	41	42	33	33	10	6	3
Lomanco West	4450 Airport Dr	8606	11151			10	9	5	5	8	7	13	10	14	12	9	18
Luseaux Laboratories, Inc	4625 Sante Fe Dr	28662	24667			43.1	65.6	56.7	71.6	89.4	71.4	64	64.9	76	61.4	53.7	51.4
Mohave Materials	8055 Flightline Dr	8564	11063			4	2	2.66	1.82	6.07	8.61	5.37	3.22	6.54	2	4.6	12.88
MC2	9300 Commerce Dr	83162	39339			6.4	5	4.3	7.1	6.6	17.6	37.4	25	75.1	54.4	5.6	4.9
Monsey Products/Henry Company	4685 Finance Way	8522	10977			161.9	211.9	172.2	284.6	248.4	336.3	351	366.2	372.7	375.6	349	169.4
Musket Corporation	4400 Industrial Blvd	57132	31981			0	0	0.31	0.4	0.3	0.28	0.35	0.39	0.48	0.6	0.38	0.27
Pepsi-Cola Company	7100 Commerce Dr	11688	26741			6	6	5	6	26	5	8	6	7	7	6	4
Performance Specialists, Inc.	4906 Olympic Dr	68588	36485			3.57	3.98	3.91	4.14	4.46	4.22	5.44	3.43	3.47	3.86	3.06	3.18
Plastic Express	7300 Commerce Dr L-1	99790	40199														
Potters Industries, Inc.	4665 Finance Way	8512	10969			6	7	6	10	16	15	22	23	15	12	19	25
Schwan Food Company	5055 Interstate Way	8772	11241			1	1	1	1	2	2	1	2	1	2	1	2
Scot Industries	4550 Mohave Airport Dr	101548	11181														
Southwest Alarm Services	4855 Finance Way	8548	11039			4	3	4	4	5	7	8	4	2	5	3	3
Southwire	4900 Industrial Blvd	54002	11207			N/A	16	89	21	75	101	45	10	60	31	18	21
Solution Dispersion Inc/Chromascape	4430 Sante Fe	WA 43534	WA 11293			16	18	16	14	5	12	11	6	4	6	4	4

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	2012 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Solution Dispersion Inc/Chromascape	4430 Sante Fe	IRR 43534	IRR 11293			31.1	38	27.5	58.4	67.9	142.7	123.4	82.3	94.1	79.6	61.8	27.5
StarRfoam Manufacturing, Inc.	4555 Olympic Dr	75342	38863			27.3	89	76.7	95.7	86.1	94.9	101.4	93.5	93.8	159.2	90.2	129.5
Sun State Components	4505 Mohave Airport Dr	30596	25793			6	5	5	5	7	7	32	9	7	10	23	1
Support Source Inc	5005 Olympic Dr	106260	38595														
Telling Industries	4425 Windrose Lane	86868	40677			7.13	7.81	7.39	6.92	5.63	5.97	6.27	6.46	7.76	8.01	6.74	7.09
Tri-State Care Flight	5880 Flightline Dr	89316	40909			4.28	4.26	3.83	4.44	3.85	3.81	4.46	3.77	4.11	4.73	3.6	3.9
True Value	4005 Mohave Airport Dr	9134	10809			20	26	23	26	26	31	25	21	23	26	29	23
Ultimate Systems Limited	4550 Interstate Way	8840	11259			0	2	2	2	4	9	7	4	4	2	1	1
UPS	4745 Finance Way	8752	11233			4	4	4	5	5	10	14	9	9	10	7	5
West Coast Netting	5070 Flightline Dr	22608	23887			18	21	18	22	41	70	87	68	64	59	22	18
Viking Freight System/FedEx Freight	4955 Interstate Way	8872	11307			2	2	3.18	2.34	1.65	1.75	1.66	1.59	1.63	1.69	1.39	1.18
Inactive Accounts																	
Acton Welding	4765 Interstate Way	8758	11235														
Irby Construction Co	5005 Interstate Way	24894	10733														
Skyview Construction	4655 Mohave Airport Dr	71416	30809														
Allied Signal	4790 Olympic Dr	24262	11077			2	5	2	6	14	62	62	40	31	16	5	2
Southwire	4900 Industrial Blvd	54002	11207			N/A	16	89	21	75	101	45	10	60	31	18	21
Mracek, Beverly	7045 Government Way	9118	10781														
Vacant-2	4910 Industrial Blvd	22030	11239														
Action Delivery	4985 A Interstate Way	11263	4905														
					Total Thousand Gallons/Month	1071.52	1372.47	1279.60	1438.18	1773.26	2414.81	2596.00	2011.62	2114.72	2045.30	1493.90	1144.62
					Total Thousand Gallons /Day	**34.57**	**47.33**	**41.28**	**47.94**	**57.20**	**80.49**	**83.74**	**64.89**	**70.49**	**65.98**	**49.80**	**36.92**
					Total Gallons/Day	34565.16	47326.55	41277.42	47939.33	57201.94	80493.67	83741.94	64890.97	70490.67	65977.42	49796.67	36923.23

2012 Average Usage	56,719
2012 Peak Usage	83,742
2012 Minimum Usage	34,565

City of Kingman
Airport Industrial Park
Water Usage
(in thousands of gallons)

					Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
											2013						
BUSINESS	**SERVICE ADDRESS**	**CUSTOMER**	**LOCATION 1**	**LOCATION 2**	**LOCATION 3**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**
Aero-Flite, Inc.	4800 Flightline Dr	33956	11237	31807		3.5	5.61	9.33	15.92	5.53	13.8	11.75	14.32	8.21	2.7	13.96	3.72
Honeywell	4805 Mohave Airport Dr	27962	24833			11	11	10	12	13	26	33	19	11	12	9	8
Air'Zona Aircraft Services	7100 Flightline Dr	WA 9082	WA 10307			15	7	8	10	11	20	27	23	16	8	6	6
Air'Zona Aircraft Services	7100 Flightline Dr	IRR 9082	IRR 10307			2.3	13.42	6.72	7.2	36.66	27.22	46.75	30.63	21.84	11.01	7.69	3.15
Air Treads/Goodyear	4105 Mohave Airport Dr	8506	11223			27.2	29.3	30.1	24.6	59.1	148	162.5	100.1	81.5	68	44.7	31.9
American Woodmark	4475 Mohave Airport Dr	8614	11165			225.2	318.7	645.8	481.9	303.7	444.5	464.6	385.6	294.5	331.2	289.4	205.9
Aquarium Décor, Inc.	4730 Finance Way	8820	11255			0	0	1	0	1	1	1	1	1	0	0	1
Arizona Hydraulics Engineering	9450 Commerce Dr	84810	40599			1.07	1.27	1.4	1.43	1.72	3.93	4.23	4.02	2.31	1.66	1.16	1.43
BLM	9990 Flightline Dr	34852	28321			0	0	0	0.33	0.71	0.56	9.57	1.17	1.47	0.83	0.1	0
Brackett Aircraft	7045 Flightline Dr	8542	11029			6	7	7	6	11	20	58	24	15	11	7	5
Cantex, Inc.	4045 Bonanza Dr	WA 77548	WA 40197			8	12	11	10.1	11	25	10	10	10	11	10	11
Cantex, Inc.	4045 Bonanza Dr	IRR 77548	IRR 40197			25.25	37.92	19.44	12.28	23.44	44.29	65.84	44.81	41.9	39.33	51.49	37.34
Cascades Tissue Group	4625 Interstate Way	90486	11137	40429		23.8	24.3	21.7	53.9	30.6	17.2	16.9	18.8	18	38.2	30.2	25.7
Composite Solutions	4510 Flighline Dr	82816	40301			0	6	0	0	4	8	3	0	1	0	0	1
Custom Aluminum Radiators	4925 Finance Way	56746	10991			1	0	0	0	1	4	6	4	3	1	0	0
Desert Diamond Distillers	4875 Olympic Way	86710	40765			11.49	8.36	10.69	10.88	16.52	14.38	4.35	14.76	8.64	10.15	11.99	7.05
Dillon Transportation	4445 Interstate Way	100860	31683						0	0.02	0.13	1.53	1.39	0.42	0.99	1.03	9.4
Guardian Air	7010 Flightline Dr	44434	29455			9	5	5	6	11	3	5	4	4	3	4	4
Hav-a-Lube Inc	9350 Shipping Lane	80996	40181			1.06	1.03	1.01	0.8	1.15	3.28	3.61	3.98	1.97	1.24	0.82	1.06
Hi-Desert Delivery	5005 1/2 Interstate Way	76536	11341			1	0	1	1	1	2	2	1	1	3	2	1
I-Corp Arizona, Inc.	4155 Finance Way	38988	27759			2.67	3.06	3.29	2.47	3.68	16.99	23.92	24.21	18	5.95	2.88	2.61
Import Corner	9000 Government Way	54954	10261			2	4	2	10	14.2	16.52	24.71	9.05	1.87	5.7	4.13	2.25
Insteel Wire Products	4750 Olympic Dr	92772	27067			98	74.3	88.6	135.8	228.9	297.1	337.3	138.9	96.3	86.3	68.6	49.5
Interstate Group	4400 Interstate Way	56440	31745			4.7	5.5	6.6	6.6	7.4	9.2	8.6	8.7	7.7	7	7	6.2
ISCO Industries	4725 Flightline Dr	92130	41003			6.98	16.46	6.5	6.2	10.07	51.16	41.13	30	23.19	10.76	6.31	5.61

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	2013 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Jasper Engines & Transmissions	9400 Commerce Dr	83184	40451			1.63	1.87	1.95	2.23	2.22	5.47	6.21	4.88	4.79	3.69	3.17	2.56
Jim Straube's Aircraft Service	4890 Flightline Dr	25482	10703			10	5	14	8	8	10	6	10	7	7	12	6
J-M Manufacturing	4620 Olympic Dr	61118	11125			81	47	24	40	33	50	92	46	63	40	66	69
Karnak Chemical	4585 Interstate Way	90616	39365			17.21	2.35	2.91	5.58	7.6	12.3	23.28	20.65	23.01	16.57	3	3.23
Kingman Airport Café		9086	10679			12	11	13	122	120	116	84	82	74	92	84	62
Kingman Army Airfield Museum	4540 Flightline Dr	48506	23547			1	9	1	1	0	0	1	0	1	1	0	1
Kingman Property LLC	4625 Interstate Way	54676	33281			5.6	4.7	4.2	3.5	3.8	4.3	5.8	7.6	4.1	6.3	6.6	4.8
Knauf Insulation	4200 Industrial Blvd	WA 109200	WA 29433														
Knauf Insulation	4200 Industrial Blvd	IRR109200	IRR 29433														
Lander Industries	9000 Transport Way	105776	29751														
Laron Incorporated	4545 Interstate Way	8526	11193	25065	32517	6	4	6	4	9	18	57	12	16	7	6	5
Lomanco West	4450 Airport Dr	8606	11151			4	3	3	4	6	5	13	7	5	6	4	3
Luseaux Laboratories, Inc	4625 Sante Fe Dr	28662	24667			43.2	76.2	76	65.6	80.1	72.6	63.6	97.6	100.7	72.8	57.2	52.8
Mohave Materials	8055 Flightline Dr	8564	11063			51.25	81.88	2.05	4.14	4.02	9.96	11.26	6.88	4.75	3.8	2.97	1.6
MC2	9300 Commerce Dr	83162	39339			7.7	5.7	6	8.7	6.5	33.8	54.9	47.7	23.5	11.1	4.6	6
Monsey Products/Henry Company	4685 Finance Way	8522	10977			183.2	196.5	190.1	288.6	265.5	227.9	5.7	355	96	376	301	188
Musket Corporation	4400 Industrial Blvd	57132	31981			0.4	0.32	0.24	0.33	0.46	0.27	0.44	0.32	0.31	0.48	1.11	0.87
Pepsi-Cola Company	7100 Commerce Dr	11688	26741			3	3	3	3	3	6	6	4	6	13	5	2
Performance Specialists, Inc.	4906 Olympic Dr	68588	36485			3.81	3.13	3.47	3.29	3.68	3.1	3.68	3.42	2.68	3.65	3.44	3.25
Plastic Express	7300 Commerce Dr L-1	99790	40199			0.1	47.1	0.3	0.3	1.5	1.4	89.5	1.2	1.1	0.9	1	0.9
Potters Industries, Inc.	4665 Finance Way	8512	10969			13	15	15	17	20	21	28	21	15	12	12	13
Schwan Food Company	5055 Interstate Way	8772	11241			1	1	1	1	1	1	1	1	0	1	1	1
Scot Industries	4550 Mohave Airport Dr	101548	11181								0	4	4	3	4	4	2
Southwest Alarm Services	4855 Finance Way	8548	11039			2	2	2	3	3	5	8	5	3	5	3	2
Southwire	4900 Industrial Blvd	54002	11207			84	38	39	27	23	1	1	1	0	1	2	1
Solution Dispersion Inc/Chromascape	4430 Sante Fe	WA 43534	WA 11293			5	5	7	5	6	5	5	6	6	5	6	8

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	2013 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Solution Dispersion Inc/Chromascape	4430 Sante Fe	IRR 43534	IRR 11293			29.8	24.2	27.4	74.3	70.6	83.5	101.7	115.5	82.4	55.5	40	24.4
StarRfoam Manufacturing, Inc.	4555 Olympic Dr	75342	38863			124	173.5	195.5	209.1	465.5	119.3	135.9	147.8	148.4	142.8	157.2	142.6
Sun State Components	4505 Mohave Airport Dr	30596	25793			0	7	1	0	14	7	16	9	20	19	6	4
Support Source Inc	5005 Olympic Dr	106260	38595														
Telling Industries	4425 Windrose Lane	86868	40677			7.22	6.42	8.25	6.43	10.12	16.11	19.53	10.87	6.45	6.12	5.65	6.73
Tri-State Care Flight	5880 Flightline Dr	89316	40909			5.24	3.87	3.69	3.85	3.54	4.06	4.2	3.87	3.94	4.08	3.99	3.96
True Value	4005 Mohave Airport Dr	9134	10809			28	19	18	17	23	20	39	25	34	40	39	34
Ultimate Systems Limited	4550 Interstate Way	8840	11259			0	0	1	1	1	2	5	3	3	0	1	1
UPS	4745 Finance Way	8752	11233			6	5	6	6	5	10	11	10	8	10	9	6
West Coast Netting	5070 Flightline Dr	22608	23887			12	12	20	25	21	64	94	75	44	29	9	6
Viking Freight System/FedEx Freight	4955 Interstate Way	8872	11307			1.62	1.2	1.45	1.33	1.53	1.49	1.24	1.37	1.41	1.4	1.26	2.21
Inactive Accounts																	
Acton Welding	4765 Interstate Way	8758	11235														
Irby Construction Co	5005 Interstate Way	24894	10733														
Skyview Construction	4655 Mohave Airport Dr	71416	30809														
Allied Signal	4790 Olympic Dr	24262	11077			3	26	5	9	17	79	76	71	49	20	11	13
Southwire	4900 Industrial Blvd	54002	11207			84	38	39	27	23	1	1	1	0	1	2	1
Mracek, Beverly	7045 Government Way	9118	10781														
Vacant-2	4910 Industrial Blvd	22030	11239														
Action Delivery	4985 A Interstate Way	11263	4905														
					Total Thousand Gallons/Month	1323.20	1470.17	1637.69	1812.69	2070.07	2233.82	2447.23	2134.10	1550.36	1688.21	1453.65	1113.73
					Total Thousand Gallons /Day	**42.68**	**52.51**	**52.83**	**60.42**	**66.78**	**74.46**	**78.94**	**68.84**	**51.68**	**54.46**	**48.46**	**35.93**
					Total Gallons/Day	42683.87	52506.07	52828.71	60423.00	66776.45	74460.67	78942.90	68841.94	51678.67	54458.39	48455.00	35926.77

2013 Average Usage	57,332
2013 Peak Usage	78,943
2013 Minimum Usage	35,927

City of Kingman
Airport Industrial Park
Water Usage
(in thousands of gallons)

					Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
						2014											
BUSINESS	**SERVICE ADDRESS**	**CUSTOMER**	**LOCATION 1**	**LOCATION 2**	**LOCATION 3**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**
Aero-Flite, Inc.	4800 Flightline Dr	33956	11237	31807		4.56	5.73	10.84	31.47	4.26	9.36	6.49	3.37	2.14	7.02	4.09	7.23
Honeywell	4805 Mohave Airport Dr	27962	24833			11	12	11	12	16	23	23	47	43	67	13	9
Air'Zona Aircraft Services	7100 Flightline Dr	WA 9082	WA 10307			8	5	7	6	10	8	30	20	26	16	13	5
Air'Zona Aircraft Services	7100 Flightline Dr	IRR 9082	IRR 10307			9.93	8.01	22.87	22.28	30.11	47.22	38.43	27.88	29.94	25.05	17.72	17.49
Air Treads/Goodyear	4105 Mohave Airport Dr	8506	11223			22.8	26.8	26	26.6	53.3	98.1	140.2	95.7	150.3	51.2	38.9	34.6
American Woodmark	4475 Mohave Airport Dr	8614	11165			284.2	265	281.1	247.8	473.5	391.5	457.9	377.2	394.8	305.1	256.8	210.1
Aquarium Décor, Inc.	4730 Finance Way	8820	11255			20	8	1	0	0	0	1	1	0	1	0	0
Arizona Hydraulics Engineering	9450 Commerce Dr	84810	40599			1.44	1.28	1.37	1.79	2.24	3.45	4.39	3.25	2.84	2.03	1.32	1.31
BLM	9990 Flightline Dr	34852	28321			0	0	0	0.14	1	1.11	2.11	0.91	1.22	0.77	0.81	0.04
Brackett Aircraft	7045 Flightline Dr	8542	11029			9	7	5	7	17	41	39	27	23	18	11	9
Cantex, Inc.	4045 Bonanza Dr	WA 77548	WA 40197			10	11	10	10	0	20	10	4	31	18	18	8
Cantex, Inc.	4045 Bonanza Dr	IRR 77548	IRR 40197			27.98	23.82	14.9	21.21	57.75	390.01	584.54	492.42	700.21	470.32	243.06	434.95
Cascades Tissue Group	4625 Interstate Way	90486	11137	40429		21.9	19.6	31.8	27.7	26.36	19.9	25.13	20.24	27.37	27.29	29.9	42.15
Composite Solutions	4510 Flighline Dr	82816	40301			1	0	1	1	1	2	1	0	0	2	0	1
Custom Aluminum Radiators	4925 Finance Way	56746	10991			1	1	0	1	0	4	5	5	4	2	1	0
Desert Diamond Distillers	4875 Olympic Way	86710	40765			6.45	8.35	7.19	10.61	11.94	7.7	3.01	2.04	13.19	8.74	4.96	5.18
Dillon Transportation	4445 Interstate Way	100860	31683			3.74	1.44	1.59	3.18	4.36	7.44	9.91	10.95	11.09	4.8	7.42	5.59
Guardian Air	7010 Flightline Dr	44434	29455			3	3	3	3	4	2	3	5	2	4	4	4
Hav-a-Lube Inc	9350 Shipping Lane	80996	40181			1.16	1.04	1.29	1.74	1.75	1.74	5.79	4.54	2.39	1.63	1.04	1
Hi-Desert Delivery	5005 1/2 Interstate Way	76536	11341			1	1	2	1	1	1	1	1	0	1	1	0
I-Corp Arizona, Inc.	4155 Finance Way	38988	27759			2.79	3.26	3.67	2.86	3.49	17.26	20.71	12.57	6.51	5.63	3.52	3.13
Import Corner	9000 Government Way	54954	10261			2.45	1.99	4.78	6.44	15.15	12.01	12.9	8.71	4.8	5.4	5.42	2.01
Insteel Wire Products	4750 Olympic Dr	92772	27067			54.7	51.3	142.9	119.1	113	154.6	217	177.4	191.4	130.4	97.7	74.1
Interstate Group	4400 Interstate Way	56440	31745			6.7	6.2	8.7	8.2	9.7	8.9	10	40.6	9.4	7	7.6	6.1

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	2014 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
ISCO Industries	4725 Flightline Dr	92130	41003			6.7	5.75	6.74	6.26	13.59	30.74	48.8	36.94	32.96	17.6	10.16	8.34
Jasper Engines & Transmissions	9400 Commerce Dr	83184	40451			2.53	2.51	2.73	3.46	4.69	6.5	7.79	6.33	5.87	3.53	2.54	2.43
Jim Straube's Aircraft Service	4890 Flightline Dr	25482	10703			9	7	11	8	14	6	6	7	8	17	7	8
J-M Manufacturing	4620 Olympic Dr	61118	11125			32	56	52	74	46	46	57	62	74	28	48	71
Karnak Chemical	4585 Interstate Way	90616	39365			2.68	3.29	3.48	6.33	14.06	10.11	17.81	12.2	12.04	10.15	7.44	6.2
Kingman Airport Café		9086	10679			14	10	11	39	68	59	67	56	69	64	64	34
Kingman Army Airfield Museum	4540 Flightline Dr	48506	23547			1	1	0	1	0	1	0	0	1	0	0	1
Kingman Property LLC	4625 Interstate Way	54676	33281			2.2	3.4	10.9	4.4	4.2	3.8	3.2	3.5	4	2.5	4.8	3
Knauf Insulation	4200 Industrial Blvd	WA 109200	WA 29433									NA	NA	NA	NA	NA	NA
Knauf Insulation	4200 Industrial Blvd	IRR109200	IRR 29433									NA	NA	NA	NA	NA	NA
Lander Industries	9000 Transport Way	105776	29751									Started Service	17	37	9	5	4
Laron Incorporated	4545 Interstate Way	8526	11193	25065	32517	3	3	5	10	3	69	111	143	112	36	30	27
Lomanco West	4450 Airport Dr	8606	11151			4	2	6	7	23	9	12	10	8	5	5	4
Luseaux Laboratories, Inc	4625 Sante Fe Dr	28662	24667			64.7	76.8	56.3	53.6	68.7	50.6	80.6	49.4	56.7	73.8	54.3	49.5
Mohave Materials	8055 Flightline Dr	8564	11063			2.67	2.56	2.44	0.28	0.27	3.85	3.65	2.83	4.08	5.49	4.06	1.57
MC2	9300 Commerce Dr	83162	39339			15.2	6.1	7.8	6.8	7.6	31	60.5	63.3	47.7	24.7	5.9	7.4
Monsey Products/Henry Company	4685 Finance Way	8522	10977			201	195	269	333	366	342	568	429	411	403	354	216
Musket Corporation	4400 Industrial Blvd	57132	31981			0.32	0.39	0.24	0.62	0	27.74	96.64	197.33	156.96	204.17	54.21	207.21
Pepsi-Cola Company	7100 Commerce Dr	11688	26741			3	3	3	3	8	22	52	39	36	21	10	3
Performance Specialists, Inc.	4906 Olympic Dr	68588	36485			3.31	2.94	2.86	3.86	4.04	2.85	3.18	2.63	3.16	2.57	2.71	2.99
Plastic Express	7300 Commerce Dr L-1	99790	40199			1.1	0.7	1.1	0.8	1.3	1.1	0.8	2.2	2	1.2	0.7	0.6
Potters Industries, Inc.	4665 Finance Way	8512	10969			11	19	13	10	18	18	34	21	21	12	18	21
Schwan Food Company	5055 Interstate Way	8772	11241			1	1	1	1	1	1	1	1	1	0	1	1
Scot Industries	4550 Mohave Airport Dr	101548	11181			2	4	5	5	6	5	6	4	8	3	5	5
Southwest Alarm Services	4855 Finance Way	8548	11039			3	3	2	2	4	5	5	4	3	4	3	2
Southwire	4900 Industrial Blvd	54002	11207			2	1	1	2	1	0	48	1	1	47	0	0

BUSINESS	SERVICE ADDRESS	CUSTOMER	LOCATION 1	LOCATION 2	LOCATION 3	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
						2014											
Solution Dispersion Inc/Chromascape	4430 Sante Fe	WA 43534	WA 11293			8	3	6	4	4	3	7	4	5	3	5	4
Solution Dispersion Inc/Chromascape	4430 Sante Fe	IRR 43534	IRR 11293			30.2	29.1	28	51.3	77	81.4	90.4	73	97	44.7	58.2	33.4
StarRfoam Manufacturing, Inc.	4555 Olympic Dr	75342	38863			164.4	151.4	178.9	146.2	147.7	170.8	177.8	132.9	180.3	139.4	141.9	125.2
Sun State Components	4505 Mohave Airport Dr	30596	25793			1	9	13	2	5	4	7	4	12	4	3	2
Support Source Inc	5005 Olympic Dr	106260	38595			0	0	0	0	0	0	NA	Started Service	1.03	0.14	0.56	0.17
Telling Industries	4425 Windrose Lane	86868	40677			5.43	4.94	4.79	5.62	6.96	6.3	9.27	6.56	7.25	7.26	6.87	6.55
Tri-State Care Flight	5880 Flightline Dr	89316	40909			4.49	3.88	3.79	3.84	4.57	3.56	4.82	3.75	5.02	3.6	4.49	3.94
True Value	4005 Mohave Airport Dr	9134	10809			22	18	25	20	35	21	26	18	23	20	20	18
Ultimate Systems Limited	4550 Interstate Way	8840	11259			0	1	0	1	1	2	5	4	2	0	1	1
UPS	4745 Finance Way	8752	11233			7	4	6	4	5	7	9	6	10	7	9	5
West Coast Netting	5070 Flightline Dr	22608	23887			7	8	14	9	31	51	75	51	61	28	14	13
Viking Freight System/FedEx Freight	4955 Interstate Way	8872	11307			1.16	1.25	1.31	1.32	1.45	1.15	1.41	1.11	1.5	1.52	1.66	1.43
Inactive Accounts																	
Acton Welding	4765 Interstate Way	8758	11235														
Irby Construction Co	5005 Interstate Way	24894	10733														
Skyview Construction	4655 Mohave Airport Dr	71416	30809														
Allied Signal	4790 Olympic Dr	24262	11077			13	2	1									
Southwire	4900 Industrial Blvd	54002	11207			2	1	1	2	1	0						
Mracek, Beverly	7045 Government Way	9118	10781														
Vacant-2	4910 Industrial Blvd	22030	11239														
Action Delivery	4985 A Interstate Way	11263	4905														
					Total Thousand Gallons/Month	1167.89	1117.83	1355.38	1403.81	1853.04	2373.80	3354.18	2862.76	3197.17	2434.71	1743.76	1780.91
					Total Thousand Gallons /Day	**37.67**	**39.92**	**43.72**	**46.79**	**59.78**	**79.13**	**108.20**	**92.35**	**106.57**	**78.54**	**58.13**	**57.45**
					Total Gallons/Day	37673.87	39922.50	43721.94	46793.67	59775.48	79126.67	108199.35	92347.10	106572.33	78539.03	58125.33	57448.71

2014 Average Usage	67,354
2014 Peak Usage	108,199
2014 Minimum Usage	37,674

APPENDIX D

Existing Well Data

Well #1 Data

Run Date: 11/27/2013

AZ DEPARTMENT OF WATER RESOURCES

WELL REGISTRY REPORT - WELLS55

Location B 22.0 16.0 27 D D D

Well Reg.No 55 - 612667

AMA NOT WITHIN ANY AMA OR INA

Registered Name KINGMAN, CITY OF,
310 N 4TH ST

KINGMAN AZ 86401

File Type REGISTERED WELL
Application/Issue Date 06/04/1982

Owner OWNER
Driller No. 150
Driller Name MIKE WININGER DRILLING COMPANY
Driller Phone
County MOHAVE
Parcel No. 310-21-014
Intended Capacity GPM 0.00

Well Type NON-EXEMPT
SubBasin HUALAPAI VALLEY
Watershed COLORADO RIVER
Registered Water Uses MUNICIPAL USES
Registered Well Uses WATER PRODUCTION
Discharge Method METER
Power ELECTRIC MOTOR > 100 HP

Well Depth	1,015.00	**Case Diam**	14.00	**Tested Cap**	700.00
Pump Cap.	700.00	**Case Depth**	1,015.00	**CRT**	X
Draw Down	44.00	**Water Level**	663.00	**Log**	
		Acres Irrig	0.00	**Finish**	STEEL - PERFORATED OR SLOTTED CASING

Contamination Site: NO - NOT IN ANY WQARF SITE

Tribe: Not in a tribal zone

Comments City of Kingman Well #1. Well is located adjacent to the Kingman Airport. As of 2/17/05, the Public Water System (PWS) sign that is posted on the fence surrounding the wellsite indicated that Well #1 is registered as 55-612671. A check of the wells registered with ADWR in B(22-16)27 lists City of Kingman well 55-612667. The well that is assigned 55-612671 is a 2-inch diameter, 32 foot in depth stock well that is located in the area of Yuma, AZ. Will attempt to contact the city engineer in order to correct this obvious mistake. File update conducted 3/7/05. From 1986 through 6/4/06, this well was equipped with an ADWR installed Quarterly Recorder (Sounder) which provided water level measurements to ADWR's Basic Data Section. The last recorded water level was at 663.5 feet. It should be noted that the Registration of Existing Well form that was filed by the City of Kingman on 6/4/82 reflects that the depth of the well is at 1015-feet. On the other hand, Basic Data reports that the depth of this well is at 970-feet. As a copy of the 1968 well file is missing, there appears to be some confusion between the City of Kingman and Basic Data over the true depth of this well. File update conducted 6/3/09. mib

Current Action

6/3/2009 856 CHANGE OF BOOK/MAP/PARCEL DATA
Action Comment: mib

Action History

6/2/2009 880 CHANGE IN REMEDIAL ACTION SITE CODE
Action Comment: OLD WQARF code: null

6/6/1997 805 PUMP INSTALLATION COMPLETION REPORT RECEIVED
Action Comment: mib

3/28/1968 755 WELL CONSTRUCTION COMPLETED
Action Comment:

Michael I. Ball

From: Michael I. Ball
Sent: Friday, November 29, 2013 4:27 PM
To: 'Paul Gaines'
Cc: Stella A. Murillo
Subject: RE: Quick question about my local well station
Attachments: DOC (1000).pdf; DOC (088).pdf

Mr. Gaines,

It appears that the last time the Department took a close look at this well was in 2006. At that time the well was equipped with a 200-hp electric turbine pump which was capable of producing 534-gpm. According to a pump report that was filed by the City of Kingman in 1997, the well produced 700-gpm. If you really need the current production details for this well, you should contact the City of Kingman's Water Department. I have attached a number of documents that pertain to this well.

Mike Ball
Compliance Enforcement Officer

From: Paul Gaines [mailto:alpha-zulu@outlook.com]
Sent: Tuesday, November 26, 2013 10:44 AM
To: Michael I. Ball
Subject: Quick question about my local well station

Mr. Michael Ball;
I was told you could help me out. I had a question about a well station near my business. The registry ID # is 55-612667. I was just wondering if this pump is still operational? Also, I understand this pump was recently under investigation, and I would like to know more about this matter. If you could please return my e-mail as soon as possible I would really appreciate it.

Thank you!

Arizona Department of Water Resources GWSI Well Report

Well Site ID 351514113572801 **Local ID** B-22-16 27DDD **Quad Name** KINGMAN AIRPORT

Meridian	Site Type	Reliability	Topo Setting	Source	Map Scale	Latitude	Longitude	Accuracy	Lat DD	Long DD
G	W	C	V	USGS	24000	35 15 14.5	113 57 28.2	5	35.254028	-113.957833

ADWR File 55- Num	Altitude	Altitude Method	Altitude Accuracy	USGS Basin	Sub Basin	ADWR Basin	State	County	Site Uses	Water Uses	Hole Depth	Well Depth
612667	3373.6	L	0.1	HUA	HUA	HUA	AZ	15	W	P	970	970

Geo Unit	Date Created	Complete?	Current Index Book
	8/8/1980		

Well Completion

Date Completed	Complete?	Drill Method	Finish	Source	Driller Name
3/5/1968		H	P	*	MIKE WINNINGER

Casing

Top	Bottom	Diameter	Material
0	0	14	S

No Bore Hole Data Found

No Perforation Data Found

Well Lifts

Date Visited	Complete?	Lift	Power	Meter Number	Pwr Co	Hp	Account Number	Divider	Source	Method
3/19/1980		T	E			0		0		
1/16/1986		N				0		0		
7/9/1999		T	E	61266	CIT	200		1256	A	P
6/14/2006		T	E	74552	CIT	200		1548	A	P

Well Log

Log Type	Log Start	Log End	Source
D	0	970	D

Owner Site Names

Other ID	Assigner
CITY NO 1	CITY OF KINGMAN
YW	FORMER ADWR RECORDER

Well Owners

Date Entered	Complete?	Last Name	First Name	MI
3/19/1980		KINGMAN	CITY OF	

Report genenerated on 11/29/2013

Arizona Department of Water Resources GWSI Well Report

Well Site ID 351514113572801 **Local ID** B-22-16 27DDD **Quad Name** KINGMAN AIRPORT

Pumping Discharges	Date Measured	Complete?	Discharge Rate	Method	Source	Production Water Level	Static Water Level	Static Method	Static Source	Pumping Period	Specific Capaciity	Well Drawdowns
	3/19/1980		700	M	A	0	0			0	0	0
	5/24/1983		700	M	A	0	0			0	0	0
	7/9/1999		679	S	A	0	0			0	0	0
	6/14/2006		534	S	A	663.5	628.7	V	A	30	15.3	34.8

Remarks	Date Entered	Complete?	Remark
	6/23/1988		ADWR QUARTERLY RECORDER SITE

Site Inventories	Date Inventoried	Complete?	Inventoried By
	3/19/1980		REMICK

Water Levels	Date Measured	Complete?	Depth to Water	Method	Source	Water Level Elevation	Remark
	1/13/1986		601.4	V	A	2772.2	
	5/18/1988		603.6	V	A	2770	
	8/12/1988		604.1	V	A	2769.5	
	10/27/1988		604.2	V	A	2769.4	
	1/26/1989		604.4	V	A	2769.2	
	4/19/1989		604.8	V	A	2768.8	
	7/25/1989		605.1	V	A	2768.5	
	11/2/1989		605.8	V	A	2767.8	
	2/28/1990		605.7	V	A	2767.9	
	5/30/1990		606.2	V	A	2767.4	
	8/29/1990		606.4	V	A	2767.2	
	11/12/1990		606.8	V	A	2766.8	
	2/11/1991		606.7	V	A	2766.9	
	5/7/1991		607	V	A	2766.6	
	8/7/1991		607.4	V	A	2766.2	
	11/11/1991		607.6	V	A	2766	
	2/11/1992		607.9	V	A	2765.7	

Arizona Department of Water Resources GWSI Well Report

Well Site ID 351514113572801 **Local ID** B-22-16 27DDD **Quad Name** KINGMAN AIRPORT

Water Levels

Date Measured	Complete?	Depth to Water	Method	Source	Water Level Elevation	Remark
5/13/1992		608.2	V	A	2765.4	
8/13/1992		608.75	V	A	2764.85	
11/10/1992		608.6	V	A	2765	
2/10/1993		609	V	A	2764.6	
5/12/1993		609.2	V	A	2764.4	
8/17/1993		609.5	V	A	2764.1	
11/17/1993		610.1	V	A	2763.5	
2/15/1994		610.1	V	A	2763.5	
5/17/1994		610.3	V	A	2763.3	
8/16/1994		610.4	V	A	2763.2	
11/16/1994		610.65	V	A	2762.95	
2/14/1995		610.6	V	A	2763	
5/16/1995		611.05	V	A	2762.55	
8/16/1995		611.3	V	A	2762.3	
11/15/1995		612.3	V	A	2761.3	
1/12/2006		628.7	V	A	2744.9	
6/14/2006		663.5	V	A	2710.1	P

Measuring Points

Date Established	Complete?	Msmt Point Height	Description
1/13/1986		1	HTCA
5/18/1988		1	HOLE IN TABLE TOP
1/10/2006		1.5	AIRL,HBOP,N

Water Quality

Date Collected	Complete?	Specific Conductance	Fluoride	Deg C	Ph	Alkilinity	Disolved Oxygen	Disolved Solids
9/20/1982		345	2.5	28	0	0	0	0
5/24/1983		345	2.5	29	7.8	0	0	0
7/9/1999		340	0	30	7.3	0	0	0
6/14/2006		0	0	28	7.9	0	0	0

DEPARTMENT OF WATER RESOURCES
99 EAST VIRGINIA AVENUE
PHOENIX, ARIZONA 85004

RECEIVED JUN 4 1982 DEPT. OF WATER RESOURCES

REGISTRATION OF EXISTING WELLS

READ INSTRUCTIONS ON BACK OF THIS FORM BEFORE COMPLETING
PRINT OR TYPE — FILE IN DUPLICATE

02

FOR OFFICE USE ONLY	
REGISTRATION NO. 55-	612667
FILE NO.	B(22-16)27 ddd
FILED (DATE)	6-4-82
AT (TIME)	3 pm
INA	✓
AMA	✓

REGISTRATION FEE (CHECK ONE)	
EXEMPT WELL (NO CHARGE)	☐
NON-EXEMPT WELL — $10.00	☒

1. Name of Registrant:
CITY OF KINGMAN City Well #1
310 North Fourth Street, Kingman, AZ 86401
(Address) (City) (State) (Zip)

2. File and/or Control Number under previous groundwater law:
(B-22-16) 27-1 (File Number) 35- (Control Number)

3. a. The well is located within the SE ¼ SE ¼ SE ¼, Section 27, of Township 22N N/S, Range 16W E/W, G & SRB & M, in the County of MOHAVE.

b. If in a subdivision: Name of subdivision N/A, Lot No. _____, Address _____.

4. The principal use(s) of water (Examples: irrigation - stockwater - domestic - municipal - industrial)
Municipal.

5. If for irrigation use, number of acres irrigated from well _____.

6. Owner of land on which well is located. If same as Item 1, check this box ☐XX
(Address) (City) (State) (Zip)

7. Well data (If data not available, write N/A)
a. Depth of Well 1015' feet
b. Diameter of casing 14" inches
c. Depth of casing 1015' feet
d. Type of casing Steel.
e. Maximum pump capacity 700 gpm gallons per minute.
f. Depth to water 590' feet below land surface.
g. Date well completed Mar (Month) 28 (Day) 1968 (Year).

8. The place(s) of use of water. If same as Item 3, check this box ☐.
____¼ ____¼ ____¼, Section ____ Township ____ Range ____
____¼ ____¼ ____¼, Section ____ Township ____ Range ____
KINGMAN MUNICIPAL WATER SYSTEM SERVICE AREA
Attach additional sheet if necessary.

9. DATE 6/2/82 SIGNATURE OF REGISTRANT Louis G. Foreman

CITY OF KINGMAN
310 N FOURTH ST
KINGMAN AZ 86401

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
WATER RIGHTS ADMINISTRATION
99 EAST VIRGINIA
PHOENIX, ARIZONA 85004

RECEIPT

KIND ENTRY	FILE REFERENCE NO.
55	612653
	THRU
55	612667

(15)

FUND SOURCE	ACCOUNT NO. AGENCY	CHAPTER	DIV.	INT. ACCT.	ITEM DESCRIPTION	RATE	$ AMOUNT
					Filing fee for Registration of	10.00	150.00
					Existing Wells		
						WAITER	PAYMENT
						QUESTS	15
						CHK NO	3267
						152	10.00
						55-I	150.00
						TAX	0.00
						TOTL	150.00
						GEN.CHEK	150.00

55-612653 B(21-17)15bcc 55-612661 B(21-17)24cdb
55-612654 B(21-17)3 cda 55-612662 B(21-17)24cdd
55-612655 B(22-17)34dcd 55-612663 B(21-17)24cbc
55-612656 B(22-17)34bda 55-612664 B(22-16)34 cbc
55-612657 B(22-16)15ccc 55-612665 B(22-16)33cdc
55-612658 B(22-16)19baa 55-612666 B(22-16)33bcd
55-612659 B(22-16)28bad 55-612667 B(22-16)27ddd
55-612660 B(21-17)1 cbc

Check No. 3267

7/13/82 jc

TOTAL $ # 308 A 12:37- 150.00

STATE OF ARIZONA
ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470

RECEIVED
JUN - 6 1997
RECORDS MGT

COMPLETION REPORT
(Pump Installation Report)

1. Per A.R.S. § 45-600, the Completion Report is to be filed with the Department within 30 days after installation of pump equipment by the registered well owner.

2. Drawdown of the water level for a non-flowing well should be measured in feet after not less than 4 hours of continuous operation. For a flowing well the shut-in pressure should be measured in feet above the land or in pounds per square inch at the land surface.

3. The static groundwater level should be measured in feet from the land surface immediately prior to the well capacity test.

4. The tested pumping capacity of the well in gallons per minute for a non-flowing well should be determined by measuring the discharge of the pump after continuous operation for at least 4 hours and for a flowing well by measuring the natural flow at the land surface.

REGISTRATION NO: 55- 612667 **FILE NO:** B(22-16)27DDD

ENTERED JUN 6 1997

LOCATION OF THE WELL:

22N N/S (Township) 16W E/W (Range) 27 (Section) ¼ SE (10-acre) ¼ SE (40-acre) ¼ SE (160-acre)

EQUIPMENT INSTALLED:

Kind of pump Turbine (Turbine, submersible, centrifugal, etc.) Kind of power Electric (Electric, natural gas, gasoline, etc.)

H.P. Rating of Motor 200 Pumping Capacity 700 GPM Date Pump Installed 8-10-96

WELL TEST:

Test pumping capacity 700 (Gallons per minute) Date Well Tested: 10-23-96

Method of Discharge Measurement McCrometer Flow Meter (Weir, orifice, current meter, etc.)

Static Groundwater Level 610 ft. Drawdown 44 ft.

Total Pumping Lift 654 ft. Drawdown _____ lbs. (Flowing Well)

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

Print Well Owner's Name	Address	City	State	Zip
City of Kingman	310 N. Fourth St	Kingman	AZ	86401

Signature of Well Owner	Phone Number	Date
Peter R Johnson, City Engr.	520-753-8122	06-04-97

DWR 55-56 (Rev 10/95)

City of Kingman
310 NORTH FOURTH STREET • KINGMAN • ARIZONA • 86401 • 520 • 753-5561

June 4, 1997

RECEIVED
JUN - 6 1997
RECORDS MGT

Arizona Department of Water Resources
Groundwater Management Support Section
500 North Third Street
Phoenix, Arizona 85004

Re: Kingman City Well No. 1, ADWR No. 55-612667

Enclosed is a copy of a Pump Installation Report for the City of Kingman's City Well No. 1. The pump installation was completed in October 1996. The completion report was not submitted at that time because of questions about its applicability since it was not the first time a pump had been installed in this well.

City Well No. 1 was used by the City of Kingman for a number of years and then taken out of service in the early 1980's. It is being reactivated now to increase the system supply capabilities.

Please let me know if you have questions or need additional information.

Sincerely,

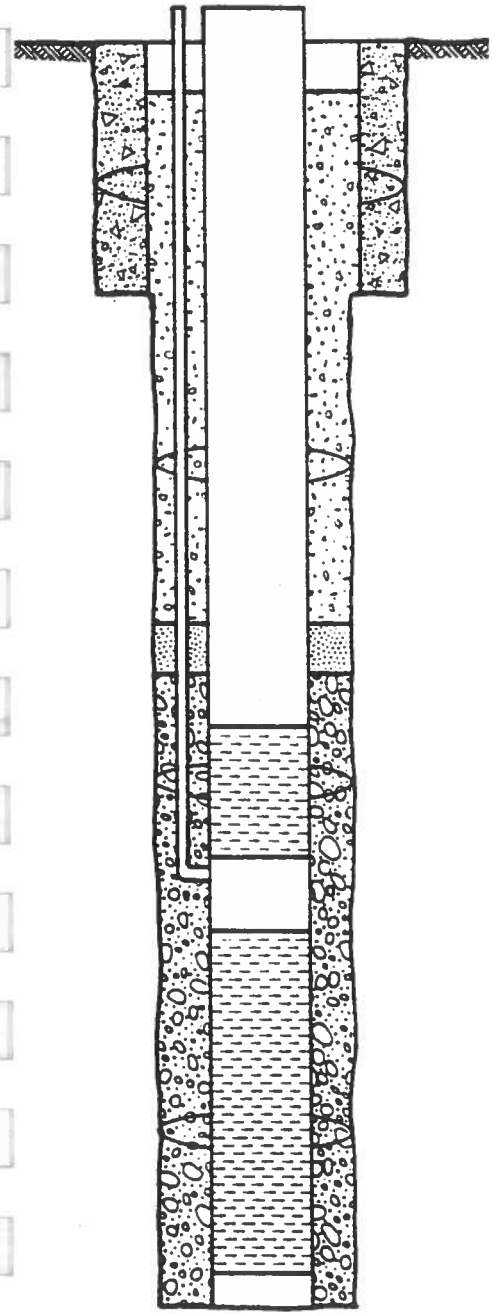
Peter R. Johnson

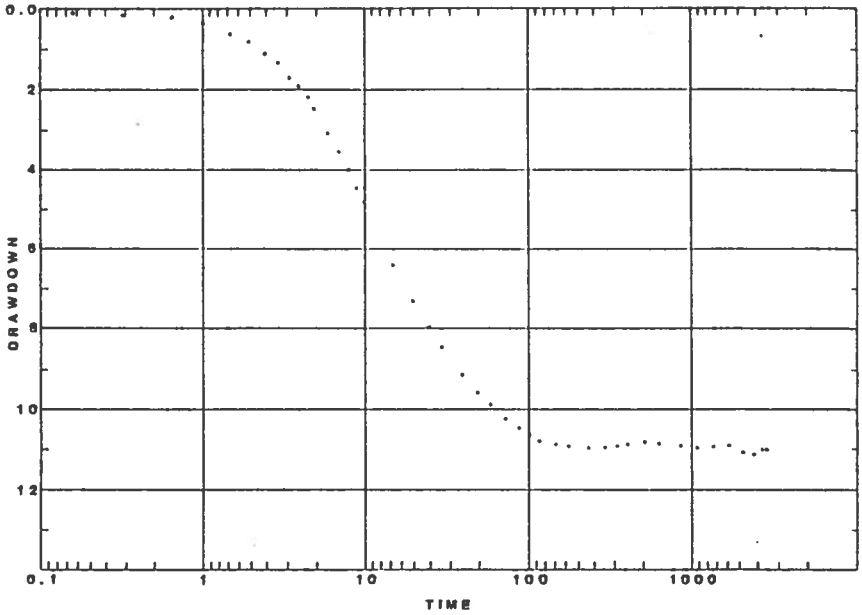
Peter R. Johnson, P.E.
City Engineer

c: Scott Yocum, Utilities Superintendent
City Well No. 6 file

Well #6 Data

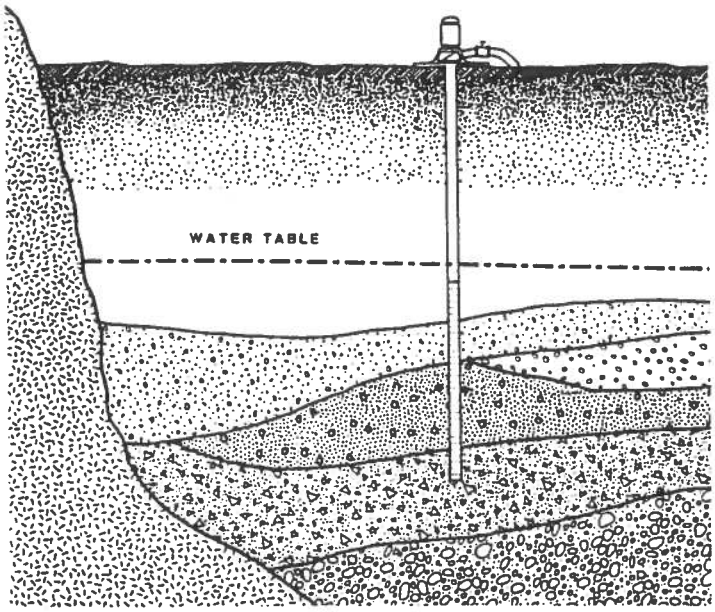
City of Kingman





CITY WELL NO. 6

DESIGN, CONSTRUCTION, AND TESTING COMPLETION REPORT



CELLA BARR ASSOCIATES

KINGMAN CITY WELL NO. 6
WELL CONSTRUCTION
AND
TESTING RESULTS
October 14, 1991

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Appendix VIII: Water Quality Sampling City Well No. 6

LIST OF GEOPHYSICAL LOGS

Caliper

Differential Temperature

Sonic VDL

Electric

Spinner Observation Well (Static Run)

Spinner Observation Well (Non-Pumping Log)

Spinner Long Mountain No. 2

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1.0 INTRODUCTION

Over the last ten years, the City of Kingman has grown steadily to a population of almost 13,000 according to the 1990 census (DES, 1991 and DES, 1990). The City Water Department, however, serves over 27,000 people. Because of continued growth, a greater demand has been placed upon the municipal water system especially during the peak summer months when water use is generally at its highest level. Though the City wells can meet the current demand, some have been removed from service due to high chromium levels stemming from natural sources. In recognition of these factors, the City expanded their existing system by constructing a new large diameter well. In the following paragraphs, a brief chronology of the major events are given for construction City Well No. 6.

On August 24, 1990, the City of Kingman hired Cella Barr Associates (CBA) to prepare the contract documents and bid specifications for City Well No. 6. According to the work plan developed by the City and CBA, an observation well would be constructed to 1,200 feet in order to provide an evaluation of the suitability of the proposed well site (Figure 1) for the installation of a sand-free, gravel-enveloped water well capable of a minimum continuous yield of 1,500 gallons per minute (gpm). When completed, the well would be equipped with a test pump and both a step test and a continuous discharge test performed. In mid October 1990, the city assumed the responsibility of bidding the project and selecting the driller. Four firms responded including: All American Water Supply Inc., Beylik Drilling Inc., Campbell's Drilling, and Layne Western Co. Inc. Of these, Campbell's Drilling was awarded the contract on the basis of the bid price and qualifications to perform the work. Notice to proceed was issued on December 10, 1990 with a specified project completion of 75 days on March 15, 1991.

Actual construction of the observation well commenced sometime shortly after January 1, 1991. The well was drilled to a total depth of 1,200 feet, having a six inch diameter. Welenco of Bakersfield, California, performed the downhole geophysical surveys. After logging, four inch schedule 80 PVC casing was set, perforated at the following intervals: 600 to 780, 800 to 980, and 1,000 to 1,180. The hole was then cleaned by alternating

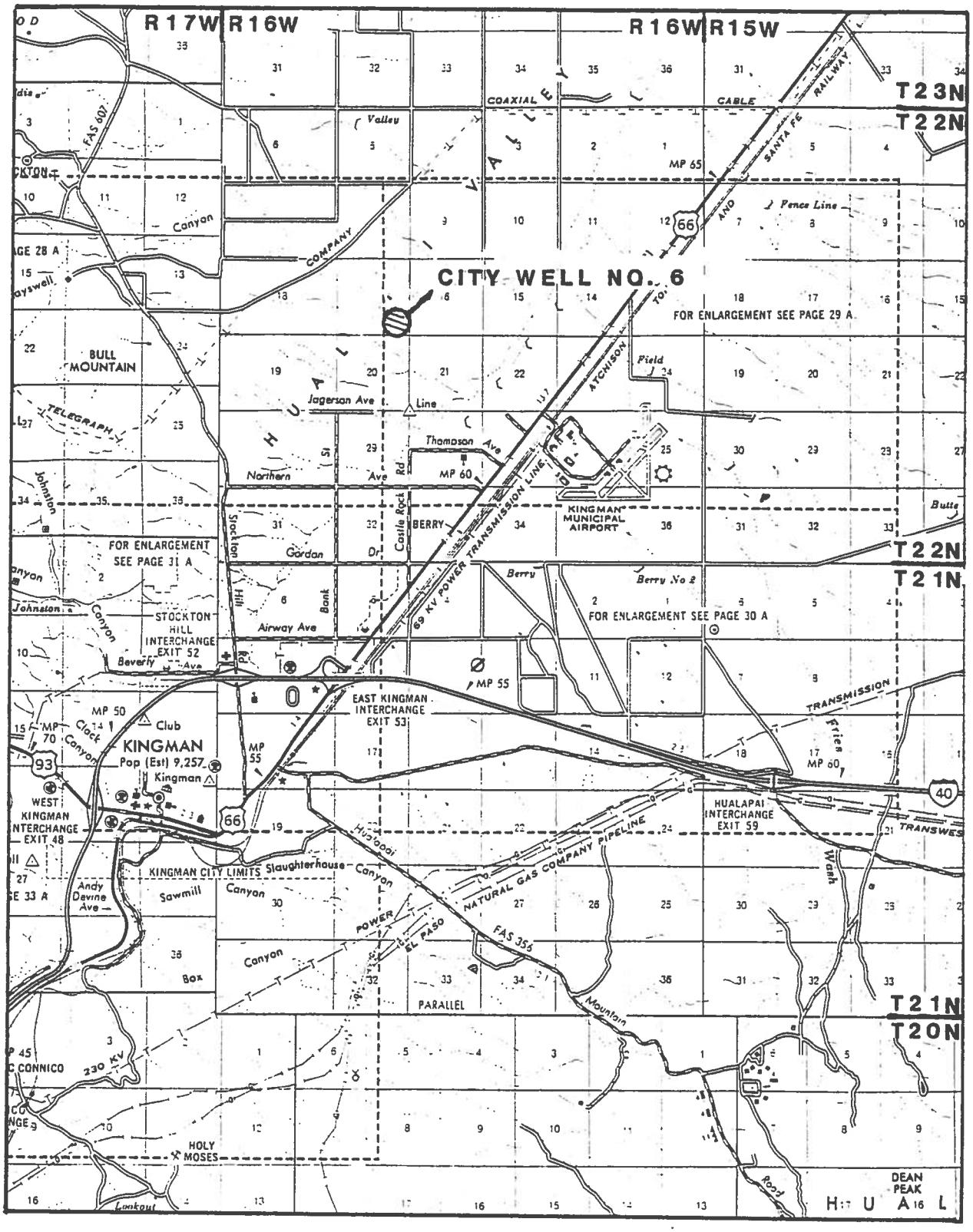

FIGURE 1:
KINGMAN CITY WELL NO. 6

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between water and air lifting. At varying intervals CBA collected water samples during air lifting and also under static conditions. Completion of the well and surveys was on February 4, 1991.

Between February 4 and March 5, 1991, additional data were collected relative to the design of the production well. Some water testing left questions regarding chromium levels in the host aquifer and time was needed to process additional water samples and check the results. A downhole spinner log was run at two sites to determine the direction and velocity of groundwater flow. Cutting samples from the observation well were analyzed by CBA, Drilling Equipment and Supply, and Johnson Filtration Systems for size and location of the well screen.

The City issued Campbell's Drilling a contract extension of 55 days from March 5, 1991 to April 29, 1991 because of the delay caused by additional testing. A special agent was hired by the City to monitor construction of the production well. Construction commenced April 3, 1991 with the emplacement of surface casing, and was completed on June 26, 1991 with well development services provided by the driller. The finished well had a 26-inch diameter bore housing an 18-inch diameter casing with a total depth of 1,040 feet.

On July 12, 1991 Gilbert Pump Company performed a step test followed, on July 15, 1991, by a constant rate test lasting 49 hours. During both pumping periods, water level measurements were recorded from both the pumping and observation wells; and, water samples were collected for quality analysis.

A combination of low specific capacity values and elevated chromium levels, led to questions about full development of the well by the Driller and indicated that additional well development might increase flow. For this reason, over a 13 day period from July 18 to July 31, 1991 the well was further developed by alternate pumping and surging. It should be noted that there were several off times during this 13 day period due to equipment repairs and schedules. During the surging process water samples were collected with some checked in the field for hexavalent chromium using a Hach water

test kit. When surging and supplemental testing were complete, all pumping equipment was removed and the well capped.

With the preceding paragraphs as an overview for construction of City Well No. 6, the remainder of this document details the results from the initial observation well logging, aquifer pump testing, development, water quality analysis, and recommendations. In addition, a complete set of appendices is included with pertinent test data and analytical results as noted in the text.

2.0 OBSERVATION WELL CONSTRUCTION AND LOGGING

Construction of the observation well, B(22-16)17ddd, commenced shortly after January 1, 1991. The well penetrated three alluvial units reaching a finished depth of 1,200 feet. Methods employed to construct the well consisted of a combination of air percussion and mud rotary. The hole was air drilled from the land surface down to 950 feet. At this point the driller added foam due to an increase in hydraulic resistance and subsequent loss of bit pressure. At 1,100 feet it was necessary to switch over to mud rotary drilling. With completion of the drilling operation, the observation well was logged and four inch, schedule 80 PVC casing set. Finish construction is shown on Figure 2.

2.1 Sample Collection

In the process of constructing the observation well, sediment samples, weighing approximately three pounds each, were collected at ten foot intervals. When the drill bit reached the bottom portion of the sampling point, cuttings were allowed to circulate to the surface for collection at the end of the discharge pipe. Cuttings were then placed in cotton sample bags labeled with the well location, sample depth, date and time, and stored in a nearby City facility for analysis. Once the samples were logged, a set was given to the City Engineer, and another set kept on file with CBA. The remainder of the samples will be filed with Arizona Geological Survey in Tucson, Arizona for incorporation to the State's geologic archives.

2.2 Sample Analysis

Samples collected from the observation well were initially logged by CBA, where the major alluvial units could be identified. The samples were then run through a series of sieves for particle sizing.

2.2.1 Lithologic Analysis

Sediments from the observation well revealed three main units consisting of older, intermediate, and younger alluvium. The younger alluvial (Qs) deposits, of Quaternary age, ran from land surface to 10 feet deep in the form of a sandy loam soil. Directly underlying the younger alluvium is the intermediate alluvium (QTs) of Quaternary and Tertiary age, extending from 10 feet to 520 feet below the land surface. This unit is

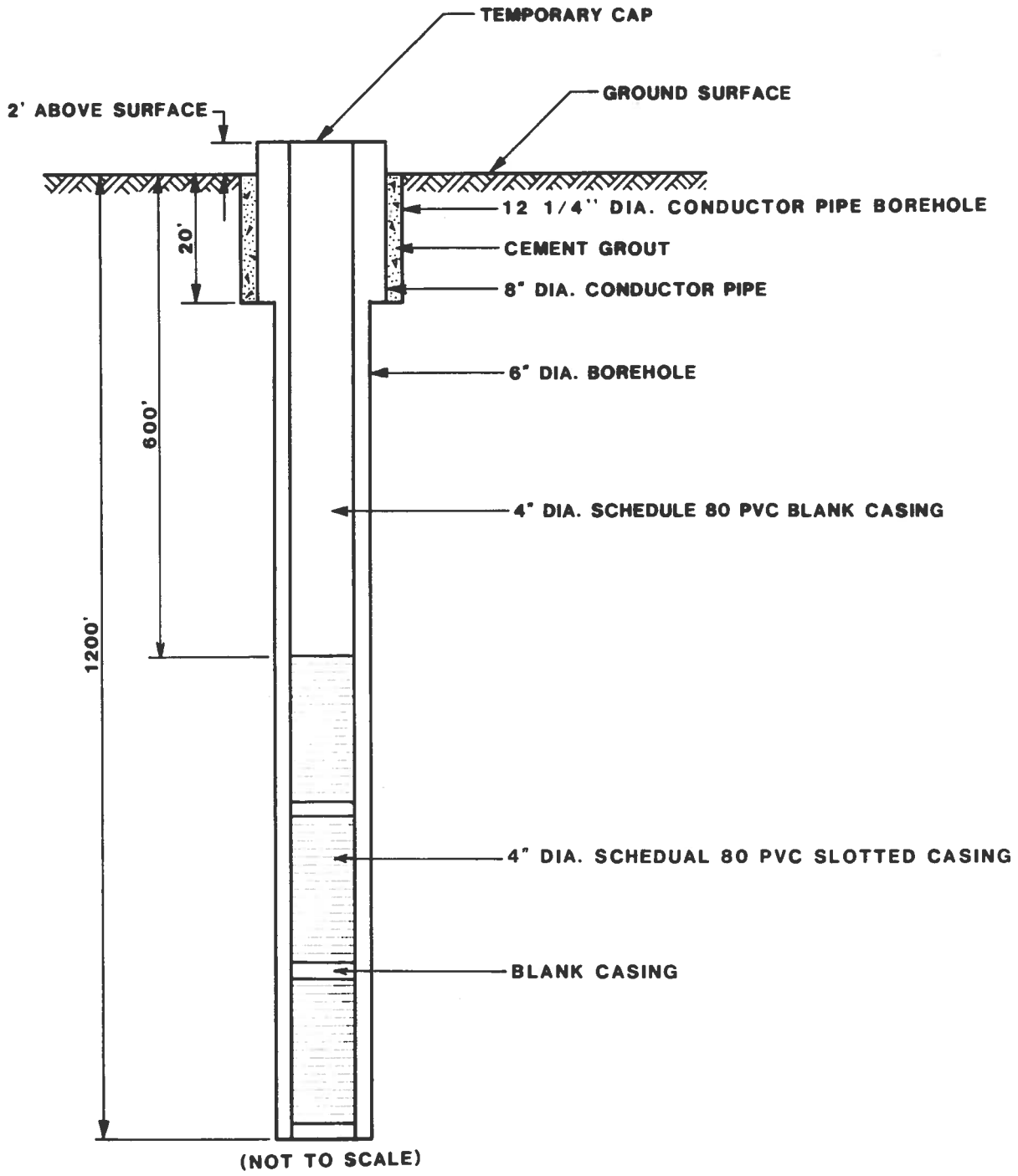

FIGURE 2:
OBSERVATION WELL

CELLA BARR ASSOCIATES

composed predominantly of weakly consolidated fragments of granite, schist, gneiss, and volcanic rocks, having a grain size of fine gravel, sand and silt. From 520 feet to 1,200 feet, the older alluvium (Ts) of Tertiary age was penetrated. This is the principal aquifer of the Hualapai Valley consisting of moderately consolidated fragments of granite, schist, gneiss and volcanic rocks in a brownish-gray silty clay or sand matrix containing some weakly consolidated tuff and agglomerate. CBA's detailed lithological log is supplied in Appendix I.

2.2.2 Sieve Analysis

In order to adequately size the openings for the well screen, the Driller delivered the samples to Drilling Equipment and Supply, in Phoenix, Arizona, for sieve analysis. The interval targeted for water production ran from 730 to 1,020 feet. The sieve results were sent to Johnson Filtration Systems, of St. Paul, Minnesota, who made recommendations for screen placement, slot size and adjustments in the artificial filter pack. Appendix II provides the details of this analysis.

2.3 Geophysical Logs

At the conclusion of drilling the observation well, Welenco, of Bakersfield, California, performed a series of downhole geophysical surveys. The suite of logs included: Caliper, differential temperature, sonic and electric logs. These surveys allowed a correlation of geologic units and sediment characteristics in the observation well. About 30 days later, spinner logs were run in the observation well and at Long Mountain #2 to check direction and flow velocity components regarding water quality testing. The results of the spinner logs, as checked by CBA and Welenco, showed virtually no movement. Copies of the geophysical logs follow the appendices.

2.4 Summary

Construction and logging of the observation well enabled CBA to determine the final design for City Well No. 6. According to the data, groundwater would be received from the older alluvium having a static water level of 585 feet below the topographic land surface. The total depth of the production well was planned at 1,040 feet and the screened intervals would lie between 740 and 1,020 feet. Complete construction details are provided in the following section.

3.0 PRODUCTION WELL CONSTRUCTION

Construction of Kingman City Well No. 6 began with drilling and setting of the conductor pipe casing on April 3, 1991. Over the course of this operation, the City hired a special agent to monitor construction activities. Because of the 26-inch diameter borehole, mud rotary was the selected drilling method. On June 6, 1991 the Driller reached the planned depth of 1,040 feet, and on June 7, 1991 Welenco performed the required directional surveys. Copies of the survey can be found in Appendix III.

Finished construction of City Well No. 6 is shown on Figure 3. An additional detailed drawing depicting the water production intervals below the static water level is illustrated on Figure 4. Considering this design, Gilbert Pump and Equipment, of Phoenix, Arizona, set an overhead line shaft driven turbine test pump with the intake located in the blank 40 foot interval between 800 and 840 feet. This is also the planned setting for the permanent water production pump.

Development of City Well No. 6 occurred in two phases. These will be discussed following the constant rate test section.

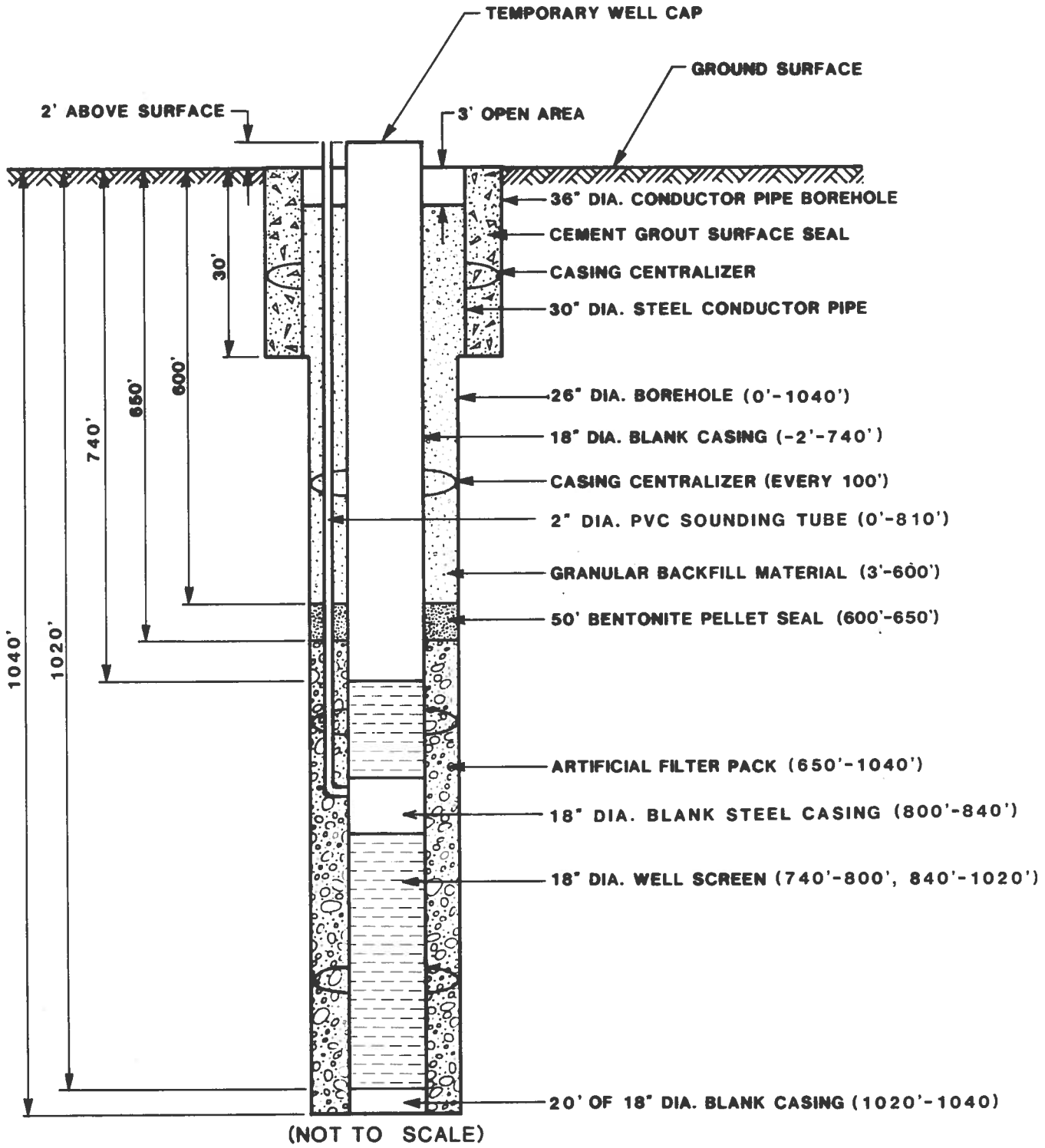

FIGURE 3:
KINGMAN CITY WELL NO. 6

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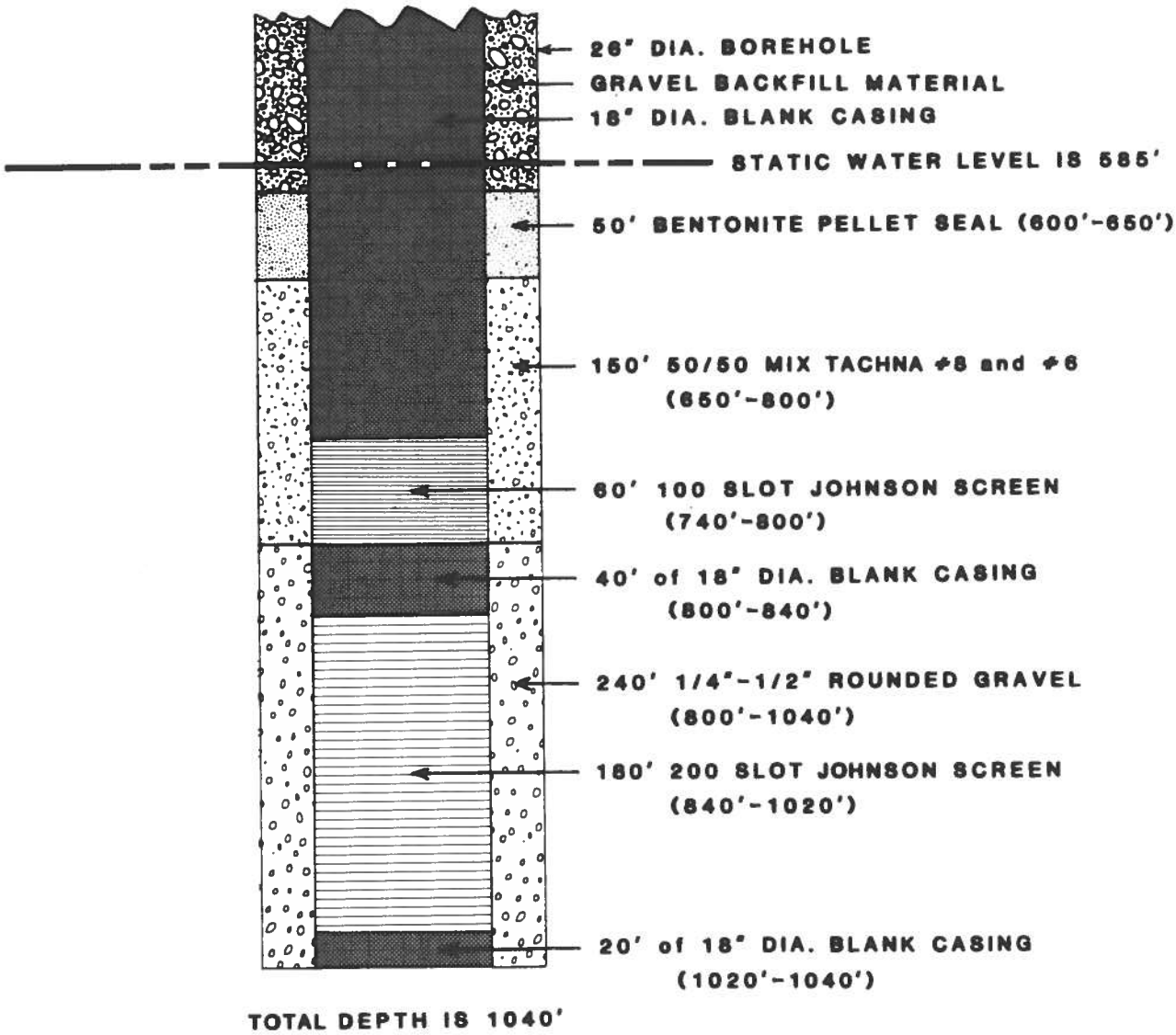

SCALE: 1"=100'

FIGURE 4:

CITY WELL NO. 6 PLACEMENT OF ARTIFICIAL FILTER PACK AND WELL SCREEN

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4.0 STEP TEST

Gilbert Pump and Equipment provided all equipment necessary to test pump City Well No. 6. The test pump consisted of an overhead line shaft turbine pump powered by a Caterpillar 3412-TA diesel engine capable of delivering 2,100 RPM at 700 HP. Two air lines provided points to measure water levels; one for reading pressure and the other for electric soundings. Discharge rates were recorded from readings near the 10-inch orifice plate (USBR, 1984 and 1977). Discharge for three steps ran from 2,000 to 2,435, ending at 2,850 gpm.

The step test began on July 11, 1991 at 1526. For performance calculations, the first step of 2,000 gpm started at 1625 and ended at 1830. Because of the late start time, the pump was shut down until morning. On July 12, 1991, step testing commenced again having discharge rates of 2,435 and 2,850 gpm. At the close of the test, concern was raised regarding the validity of measured water levels in the pumping well. The air line readings appeared high, and the electric sounder could not duplicate the pumping level measurements. Since the observation well would be used to monitor water levels for the constant rate test, it was decided to continue with the aquifer testing program.

At this point it would be helpful to mention the problems encountered while trying to measure water levels in the pumping well. In the process of the constant rate test, there were problems with the air gauges. Most of the measurements could not be duplicated. Also, the air line for the electric sounder would not allow passage of the line cord to monitor pumping levels at the higher discharge rates. Though a sounding tube was installed during well construction, it became clogged at some time when the Driller developed the well. Attempts to clear the tube proved unsuccessful. In addition, during the constant rate test three sounding wires got stuck in various accesses to the well. When the decision was made to conduct a supplemental step test, after development by pump surging, a PVC line was hung free and allowed reliable electric sounder readings.

The supplemental step test started at 0750 on July 31, 1991 having discharges of 1,200, 1,810 and 2,232 gpm. It should be noted that because of excessive wear on the pump bowls during development, the last step of the test could not go beyond 2,232 gpm at full throttle. The data plot for each successive step is shown on Figure 5. Specific capacity vs. discharge is illustrated on Figure 6. Appendix IV lists water level measurements collected during the test from the pumping well.

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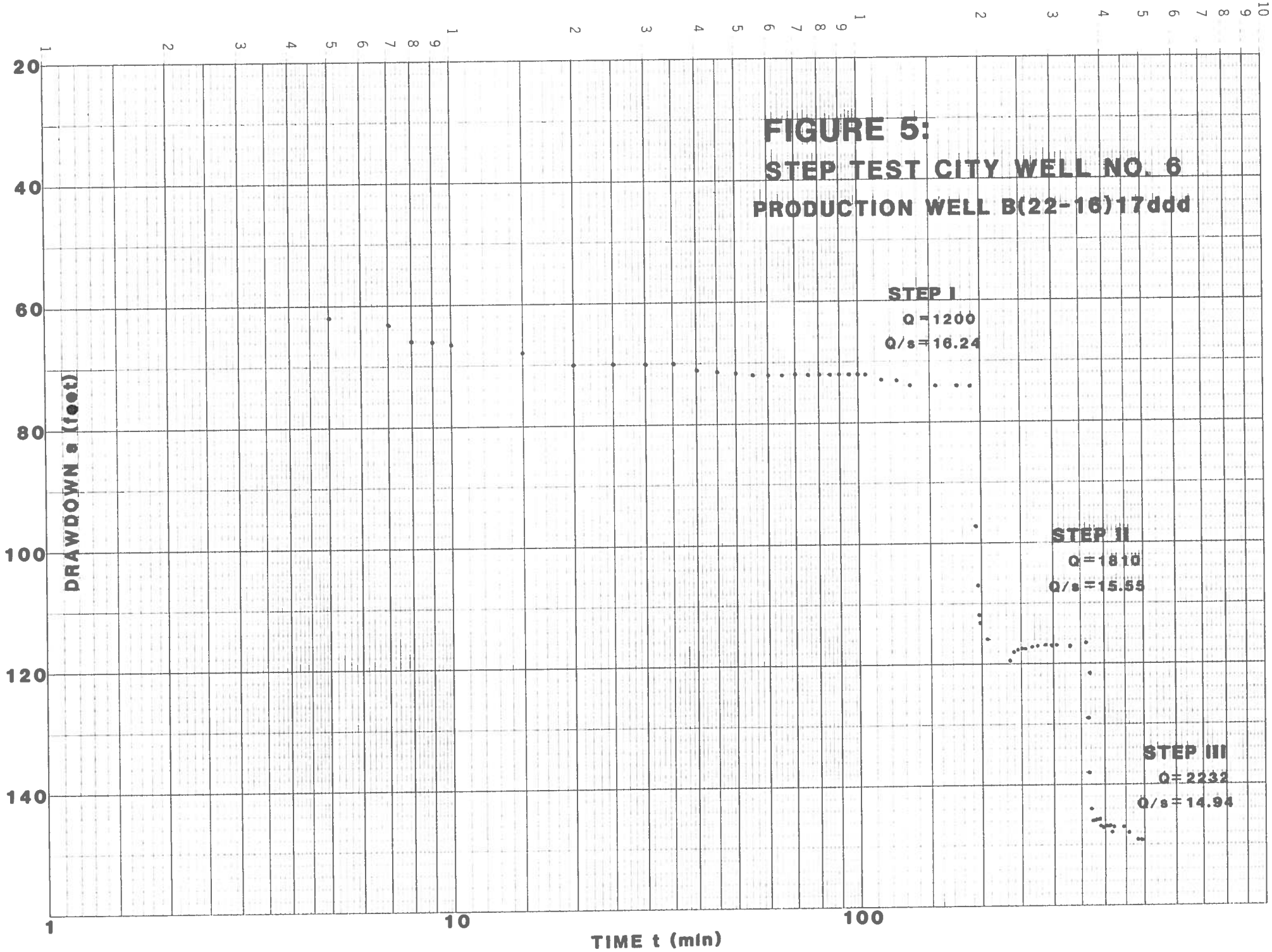

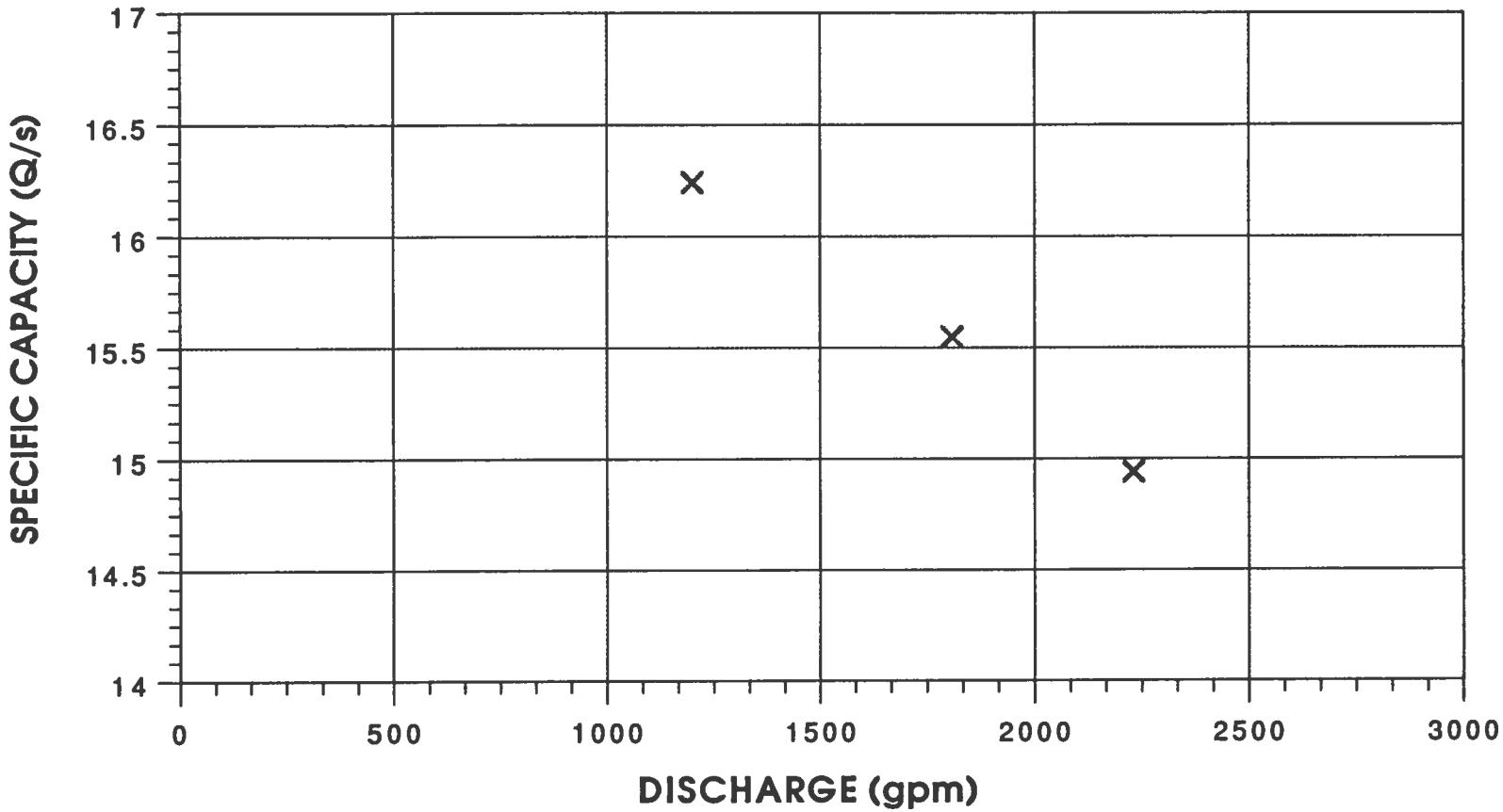

FIGURE 6:
SPECIFIC CAPACITY vs. DISCHARGE

2-41503-02-0302/LPO00554.MAC/Kingman Well

5.0 CONSTANT RATE TEST

The aquifer test at City Well No. 6 commenced at 1020 on July 15, 1991. An observation well, 105 feet west of Well No. 6, provided a point from which to monitor water levels during the course of the test. The pumping rate over the 49 hour time frame averaged 2,713 gallons per minute (gpm) as monitored from an orifice plate. Figures included in this analysis are data plots reflecting changes in the observation well. On the graphs, drawdown "s" is along the scale of the ordinate and time "t" along the scale of the abscissa. The actual field data is listed in Appendix V.

During the initial 60 minutes of the test, water levels in the observation well fell rapidly, then gradually leveled off for the remainder of the test. From this, two things could be postulated. First, it is possible that the host aquifer is capable of delivering more water to the well than could be discharged with the test pump. Secondly, and probably more likely, the effects of delayed yield from storage, or gravity response had not taken place. For the purpose of this analysis the later is assumed.

In selecting an appropriate method of analysis, CBA viewed the data in light of similar testing, performed in two other Arizona alluvial filled basins. In these tests, drawdown in attendant observation wells fell rapidly at the start of testing, leveled off for approximately six days, then continued to drop until the tests were completed several months later. From these tests it was noticed that aquifer transmissivity remained relatively the same during the early and late time segments. The storage coefficient, however, changed from artisan or confined conditions early in the test to unconfined water table conditions after the effects of delayed yield from storage had taken place. With this in mind, data collected at the Kingman test site was analyzed using early time data by mathematical techniques devised by Jacob-Cooper, Chow, and Theis.

5.1 Jacob-Cooper Analysis

The Jacob-Cooper approximation method is a straight line graphical approach directly applicable to confined conditions and is suitable for use, with limitations, in unconfined aquifers. These limitations are analogous to the percentage of drawdown in observation wells as related to the total aquifer saturated thickness. If the drawdown is less than 25 percent of the saturated thickness, the transient flow equations may be used. Furthermore, if the percentage is less than 10, little error is introduced (USBR, 1977). The total drawdown measured in observation well B(22-16)17ddd over the a 49 hour pumping period amounted to 11.07 feet. Based upon a penetrated well depth of 1200 feet and depth to water of 585 feet, the saturated thickness is about 615 feet. This represents less than 2 percent of the total saturated thickness of the aquifer. For this reason the Jacob-Cooper is one method that has been selected to determine the aquifer transmissivity and storage based upon data collected during the aquifer test. Using the semilogarithmic data plot (Figure 7), the change in drawdown is determined over one log cycle and amounts to about 7.2 feet.

Transmissivity can be calculated by applying the Jacob-Cooper equation that takes the form:

$$T = 2.303\ Q/4\pi\Delta s$$

Where: T = Transmissivity, gpd/ft
Q = Discharge, gpm
Δs = Drawdown over one log cycle, ft

The storage coefficient is determined by the Jacob-Cooper method from the following equation:

$$S = 2.25Tt_o/r^2$$

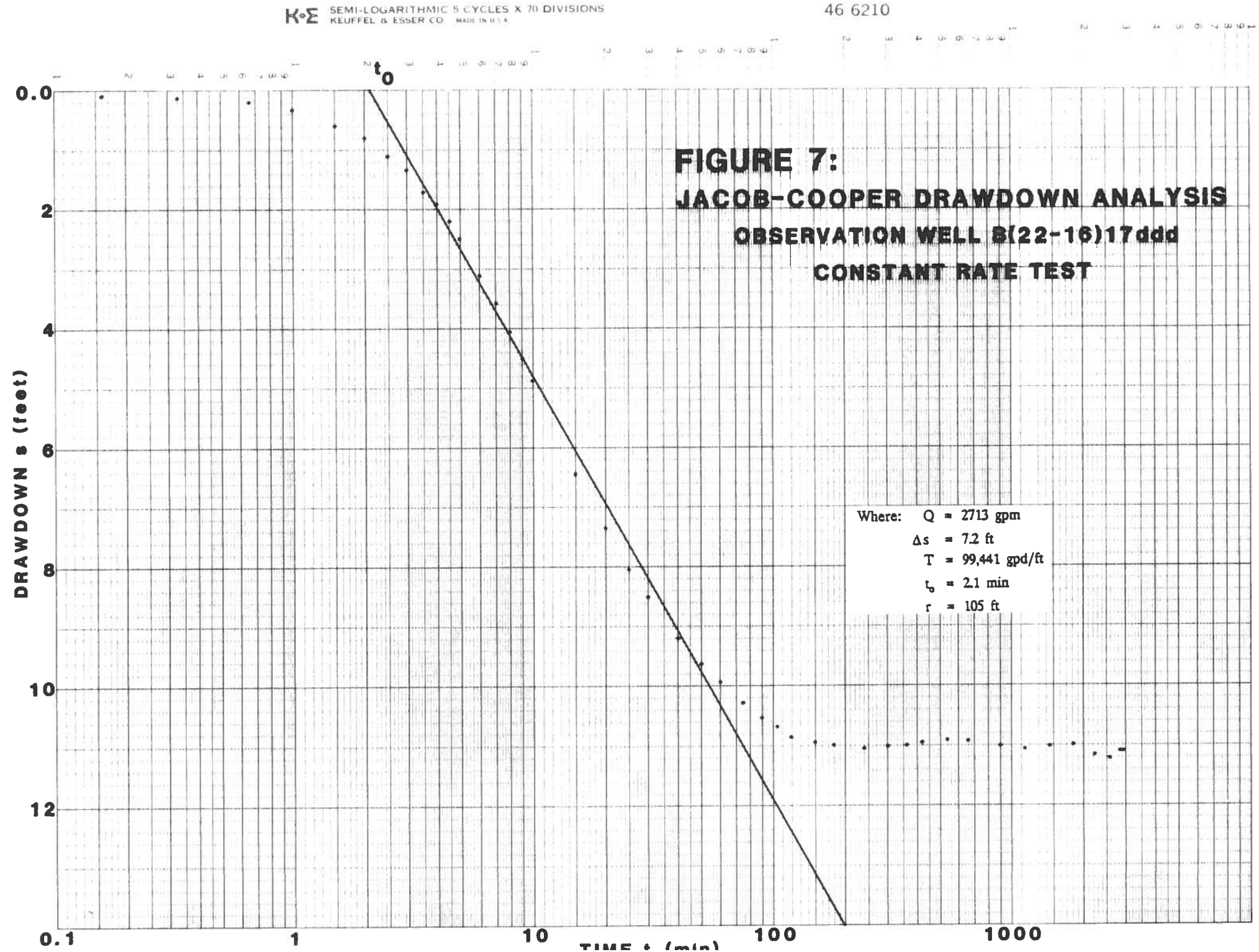
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FIGURE 7:
JACOB-COOPER DRAWDOWN ANALYSIS
OBSERVATION WELL S(22-16)17ddd
CONSTANT RATE TEST
Where: Q = 2713 gpm
Δs = 7.2 ft
T = 99,441 gpd/ft
t0 = 2.1 min
r = 105 ft
t0
DRAWDOWN s (feet)
0.0
2
4
6
8
10
12
0.1
1
10
100
1000
TIME t (min)

Where: S = Storage coefficient

T = Transmissivity, gpd/ft

t_o = Time, min

r = Radius, ft

Substituting information into the Jacob-Cooper equation, transmissivity is calculated as shown below:

Where: Q = 2713 gpm

Δs = 7.2 ft

Transmissivity (T)

$$T = 2.303 \times Q/4\pi\Delta s$$
$$= 2.303 \times 2713 \text{ gpm} \times 1440 \text{ min}/4 \times 3.14 \times 7.2 \text{ ft}$$
$$= \underline{\underline{99{,}441 \text{ gpd/ft}}}$$

The storage coefficient is then calculated by:

Where: T = 99,441 gpd/ft

t_o = 2.1 min

r = 105 ft

Storage (S)

$$S = 2.25\ Tt_o/r^2$$
$$= 2.25 \times 99{,}441 \text{ gpd/ft } (2.1 \text{ min}/1440 \text{ min})/7.48 \text{ gal } (105 \text{ ft})^2$$
$$= \underline{\underline{3.96 \times 10^{-3}}}$$

5.2 Chow's Method of Analysis

The Chow technique offers another straight-line solution that avoids type curve fitting and is not restricted in its application as some other graphical methods (Bouwer, 1978, Kruseman, 1976, and Todd, 1976). As with the Jacob-Cooper approximation analysis, the data plot on Figure 8 is used to evaluate aquifer parameters. Once the slope of the of the time-drawdown plot is established, an arbitrary point is selected with the "s" and

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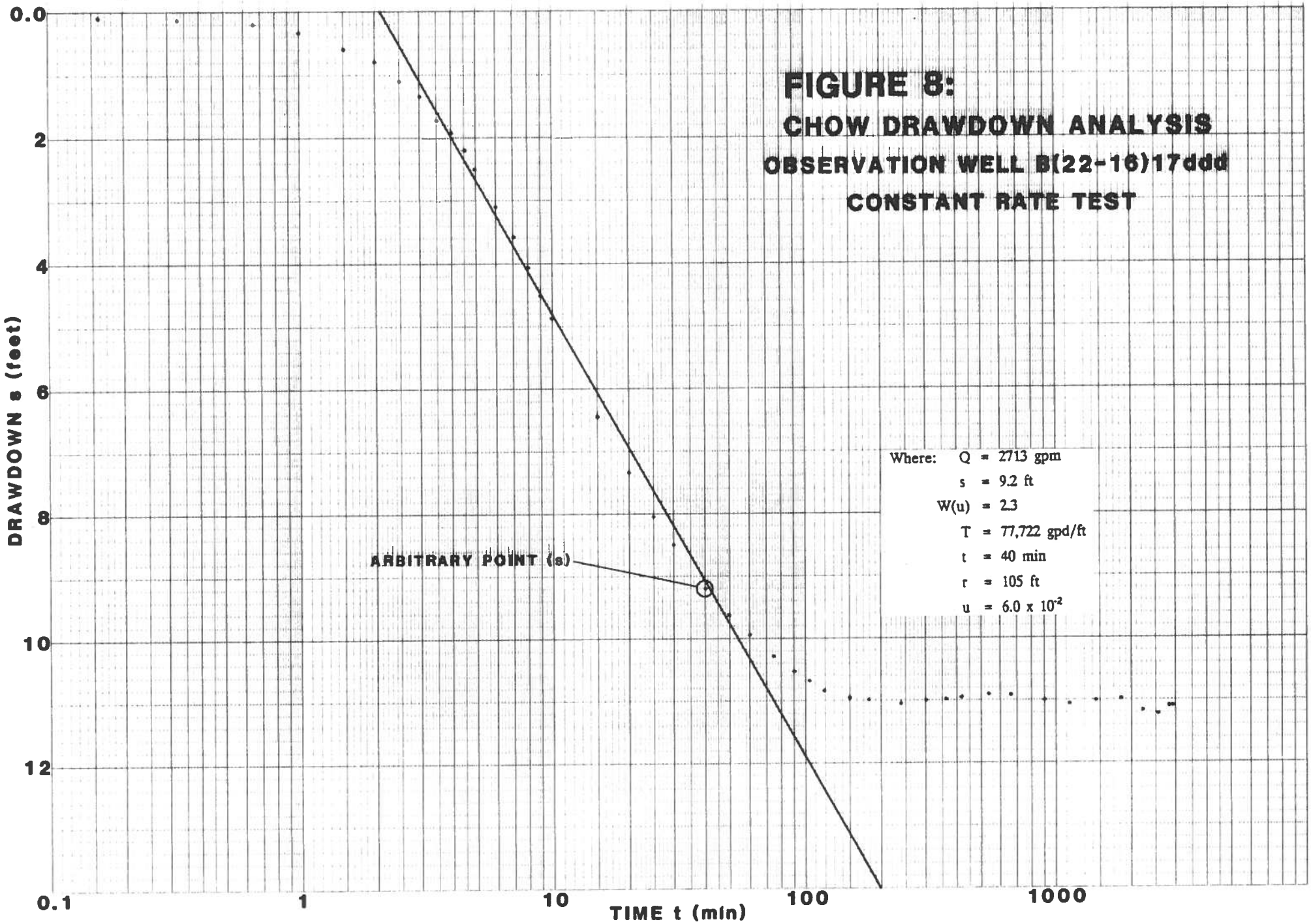

FIGURE 8:
CHOW DRAWDOWN ANALYSIS
OBSERVATION WELL B(22-16)17ddd
CONSTANT RATE TEST

"t" coordinates noted. Next, a line is drawn tangent with the data at the chosen point and the change in drawdown (Δs) over one log cycle is noted. Using this information, the function F(u) is computed from:

$$F(u) = s/\Delta s$$

Where: F(u) = Function of $s/\Delta s$
s = Arbitrary point, ft.
Δs = Drawdown over one log cycle, ft

The arbitrary point along the drawdown curve has been selected at 9.2 feet. The change in drawdown over one log cycle amounted to 7.2 feet. F(u) can now be calculated as shown below:

$$\begin{aligned} F(u) &= s/\Delta s \\ &= 9.2/7.2 \\ &= 1.28 \end{aligned}$$

Because the value of F(u) is greater than 2.0, W(u) is calculated from the formula:

$$\begin{aligned} W(u) &= 2.3 \times F(u) \\ &= 2.3 \times 2.3 \\ &= 5.29 \end{aligned}$$

Since F(u) is equal to 1.28, a nomogram is used to relate this value to W(u) and u. From the nomogram, W(u) is 2.3 and the corresponding value of u is 6.0×10^{-2} as determined by comparing the functions (Bouwer, 1978). With this information, transmissivity and storage can be determined by use of the Theis equation. Transmissivity is calculated by:

$$T = Q/4\pi\ s \times W(u)$$

Where: T = Transmissivity, gpd/ft
Q = Discharge, gpm
s = Drawdown, ft
$W(u)$ = Well function of u, dimensionless

Storage is calculated from the Theis equation by:

$$S = 4Tt/r^2 \times u$$

Where: S = Storage Coefficient
T = Transmissivity, gpd/ft
t = Time, min
r = Radius, ft
u = Lower limit of integration, dimensionless

Substituting the information into the Theis equation transmissivity is calculated as shown below:

Where: Q = 2713 gpm
s = 9.2 ft
$W(u)$ = 2.3

Transmissivity (T)

$$T = Q/4\pi s \times W(u)$$
$$= (2713 \text{ gpm} \times 1440 \text{ min}/4 \times 3.14 \times 9.2 \text{ ft}) \times 2.3$$
$$= \underline{\underline{77{,}722 \text{ gpd/ft}}}$$

The storage coefficient is calculated below:

Where: T = 77,722 gpd/ft
t = 40 min
r = 105 ft
u = 6.0×10^{-2}

Storage (S)

$$S = (4Tt/r^2) \times u$$
$$= [4 \times 77{,}722 \text{ gpd/ft } (40 \text{ min}/1440 \text{ min})/7.48 \text{ gal } (105 \text{ ft})^2] \times 6.0 \times 10^{-2}$$
$$= \underline{\underline{6.28 \times 10^{-3}}}$$

5.3 Theis Recovery Method

At the close of the test, recovery measurements were initiated immediately and continued at the test well for a total of 4,180 minutes. Recovery measurements are listed at the end of Appendix V.

Recovery analysis of the constant rate test was accomplished by using a corollary to the nonequilibrium formula devised by Theis for the recovery of a pumped well (Todd, 1980). In theory, if a well is allowed to discharge for a known period of time, and then shut down, the drawdown observed thereafter is the same as if the discharge had been continued and a recharge well with the same flow were superimposed on the discharging well at the instant the discharging well is shut down. From this principle, the recovery equation is written in the form:

$$T = 2.303 \quad Q/4\pi s \; [\log (t/t')]$$

Where:
- T = Transmissivity, in gpd/ft
- Q = Discharge, in gpd
- s = Change in water level, in ft
- t = Time since pumping started, in min.
- t' = Time since pumping ceased, in min.

In order to apply the Theis recovery formula, a plot of the residual drawdown must be made. The residual drawdown at any time during the recovery period is defined as the difference between the observed water level and the static water level prior to the aquifer test. Recovery measurements are then plotted on semi-log paper with residual drawdown, s, along the arithmetic scale of the ordinate and the ratio "t/t'" on the logarithmic scale of the abscissa (Figure 9). The relationship between t and t' spans the entire aquifer test from the time pumping started up to and including the time since

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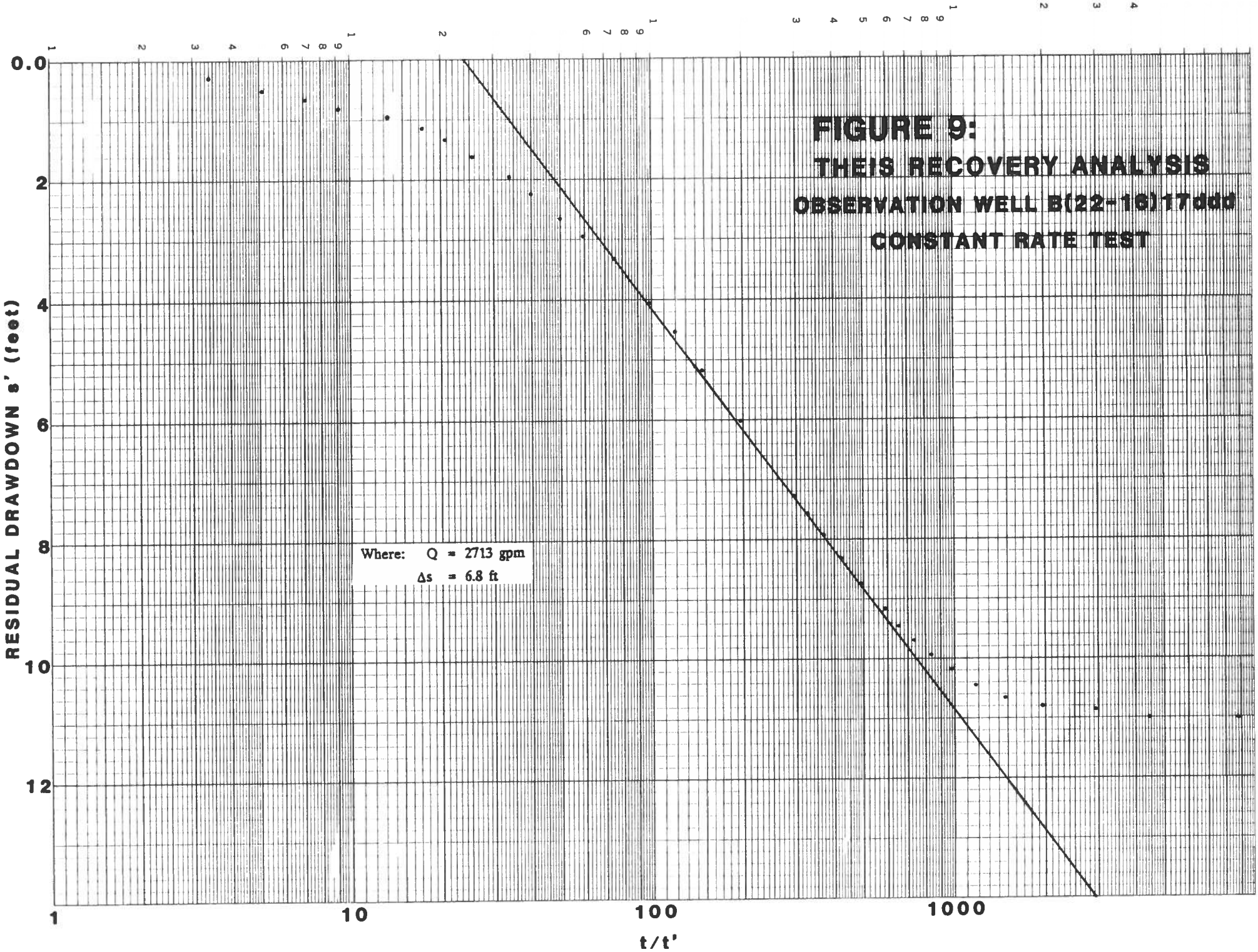

pumping ceased. A line of best fit is then drawn through the later data points, extrapolated over one log cycle, to determine the drawdown s from t/t' values. Once this value is established it is possible to calculate the transmissivity from the reduced form of the Theis equation:

$$T = 2.303 \quad Q/4\pi\Delta s$$

Substituting the data into the equation we find:

Where: $Q = 2713$ gpm

$\Delta s = 6.8$ ft

Transmissivity (T)

$$T = 2.303 \times Q/4\pi\Delta s$$
$$= 2.303 \times 2713 \text{ gpm} \times 1440 \text{ min}/4 \times 3.14 \times 6.8 \text{ ft}$$
$$= \underline{\underline{105{,}290 \text{ gpd/ft}}}$$

5.4 Jacob Recovery Analysis

When measurements are recorded in an observation well, the Jacob recovery analysis allows for calculation of transmissive and storage parameters. In order to use this method, a time-recovery data plot must be made on semi-log paper as shown on Figure 10. It should be noted, however, that the Jacob analysis differs from the Theis technique in that t'_o, as needed for storage, cannot be determined from the unitless ratio t/t' on Figure 9 (Driscoll, 1986). For this reason, Figure 10 provides the necessary data arrangement and units required for characterization of the aquifer.

Using the later portion of the data plot, a line of best fit is drawn through the points and projected to the x-axis at the top of the graph. From this, t'_o is 2.75 minutes and the change in recovery over one log cycle is 6.8 feet. Transmissivity and storage can then be calculated by the same equation used for the Jacob-Cooper drawdown analysis.

Where: $Q = 2713$ gpm

$\Delta s = 6.8$ ft

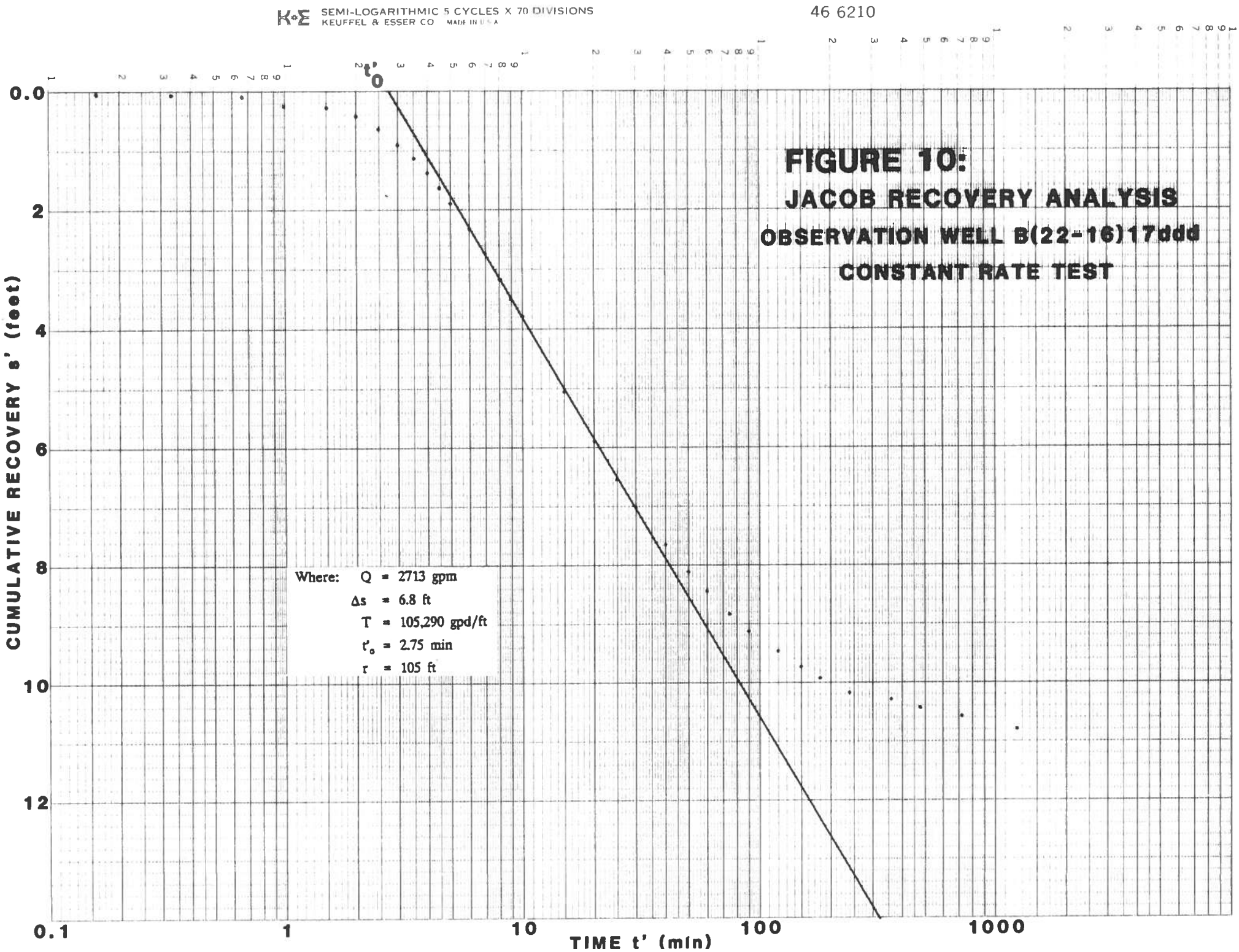
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FIGURE 10:
JACOB RECOVERY ANALYSIS
OBSERVATION WELL B(22-16)17ddd
CONSTANT RATE TEST
Where: Q = 2713 gpm
Δs = 6.8 ft
T = 105,290 gpd/ft
t'o = 2.75 min
r = 105 ft
t'o
CUMULATIVE RECOVERY s' (feet)
0.0
2
4
6
8
10
12
0.1
1
10
100
1000
TIME t' (min)

Transmissivity (T)

$$T = 2.303 \times Q/4\pi\Delta s$$
$$= 2.303 \times 2713 \text{ gpm} \times 1440 \text{ min}/4 \times 3.14 \times 6.8 \text{ ft}$$
$$= \underline{105{,}290 \text{ gpd/ft}}$$

Substituting information into the Jacob-Cooper equation, storage is calculated at:

Where: $T = 105{,}290$ gpd/ft

$t'_o = 2.75$ min

$r = 105$ ft

Storage (S)

$$S = 2.25\ Tt_o/r^2$$
$$= 2.25 \times 105{,}290 \text{ gpd/ft } (2.75 \text{ min}/1440 \text{ min})/7.48 \text{ gal } (105 \text{ ft})^2$$
$$= \underline{5.49 \times 10^{-3}}$$

5.5 Summary of Analysis

The aquifer test at City Well No. 6 consisted of a pumping period lasting 49 hours, and recovery time of almost 21 hours. Using a simplified graphic straight-line analysis and early time data, transmissivity averaged 91,500 gpd/ft; and, disregarding high and low outliers, storage is in the artesian range at about 5.50×10^{-3}. The results are listed below.

Method of Analysis	Condition	Transmissivity	Storage
Jacob-Cooper	Drawdown	77,722	3.96×10^{-3}
Chow	Drawdown	77,722	6.28×10^{-3}
Theis	Recovery (t/t')	105,290	Not applicable
Jacob	Recovery	105,290	5.49×10^{-3}

In 1990, CBA prepared a report for the City of Kingman entitled "Geohydrologic Study for the Kingman Red Lake Sub-Area of the Hualapai Basin. In this study, limited aquifer test data from the USGS showed the following transmissive properties for Area I (Area I encompassed the City of Kingman) at the listed well sites:

Well Location	Discharge (gpm)	Transmissivity gpd/ft
B(22-16)26bac	660	44,000
B(23-13)20ccd	580	22,000

In comparison, testing at City Well No. 6 showed transmissivity averaging about 91,500 gpd/ft. When combining the earlier USGS results, testing at City Well No. 6 shows almost a three-fold increase. This could be due to any number of factors including; testing location, availability of observation wells, or the length of the test to name a few.

Storage properties were noted by other authors to lay in the artesian range (10^{-3} to 10^{-5}). This agrees with testing at City Well No. 6 in lieu of extended aquifer testing where the effects of delayed yield from storage or gravity response begin to take effect.

6.0 WELL DEVELOPMENT

With construction completed at City Well No. 6, development took place, as monitored by CBA, in accordance with Item 5.2 of the well specifications as noted below (CBA, October, 1990):

> Development shall be by alternating high velocity, horizontal jetting and airlift pumping. A booster compressor with a capacity of not less than 600 cfm at 250 psi shall be available for the air lift operation.
>
> The minimum exit velocity of the jetting fluid at the jet nozzle shall be 150 ft./sec. The tool shall be rotated at a speed less than one rpm. It shall be positioned at one level for not less than two minutes and then shall be moved to the next level approximately 6 inches vertically from the preceding jetting level. After jetting approximately a 30 foot interval, the same interval shall be airlifted. Alternate jetting and pumping shall proceed from the bottom of the screen to the top. All water used for jetting shall be potable water from an approved source and shall contain less than 1 ppm suspended solids.

In order to meet the required 150 ft./sec. jetting velocity, the Driller fabricated a tool approved by the City Engineer and CBA. Actual well development began on June 18, 1991 and ended June 26, 1991 with some down-time between these dates. For development, the Driller used source water made available from a two inch metered City waterline delivering approximately 120 gpm to the drilling rig. Clear water was jetted, commencing at the lower portion of the well, and allowed to rise to the surface. Attempts at air lifting proved unsuccessful in reaches of the well below 800 feet. Because of this the City Engineer and CBA approved the use of foam to assist with sediment removal. It is possible if more cubic feet per minute (cfm) were employed, the well could of been air lifted without using foam. Even though an additional compressor was on site, to boost the cfm from 900 to 1,900, the costs to deliver the additional air by the Driller would have been prohibitive to the City. Therefore, development was completed for the contracted time. After this the Driller moved his equipment off of the well. Other details regarding development by the Driller are supplied from CBA notes in Appendix VI.

In the process of aquifer testing, low specific capacity values and water quality results led to questions regarding full development of the well. Because of this, the well was surged with the test pump over several days with the addition of Hexametaphosphate to breakdown drilling fluids in the formation. In the course of surging and pumping the well clear, at varying discharge rates, substantial amounts of drilling fluid were removed. Specific capacity increased slightly along with water quality.

7.0 WATER QUALITY

Prior to implementation of the City's drilling program, there was some concern over chromium levels in the underlaying aquifer. For many years the City has been faced with a natural source chromium problem in their water with levels in some wells near or above the current limit of 0.05 mg/l. Approximately 1.5 miles west of the project site lies Long Mountain #4 where total chromium has been relatively low at 0.024 mg/l (3/30/90). However, one mile east of the site, Long Mountain #6 has been removed from service because total chromium levels reached 0.061 mg/l (4/25/84). With this in mind, the drilling program was approached on the basis of favorable geologic conditions and acceptable water quality. While constructing the observation well and City Well No. 6, several samples were collected and checked by two certified state labs. At one point in the sampling program the testing labs were checked by a control lab using a known chromium standard. Both labs passed the test. The sampling program for both wells are given below.

7.1 Observation Well Sampling

While constructing the observation well, water samples were collected at three progressively deeper intervals air lifting water to the surface. Because drilling was in progress, the samples contained a considerable amount of sediment. Test results for total chromium ranged from 0.028 to 0.74 mg/l. Based upon this, additional samples were collected while the observation well was being cleaned and developed by air lifting. Again, drilling fluids and formation sediments could not be separated in the field for a clean set of samples. Lab results showed total chromium levels from 0.057 to 0.26 mg/l. It should be mentioned that at the 1,000 foot level, the total chromium value for an unfiltered sample was 0.260 mg/l. When filtered, this value dropped to 0.150 mg/l. Because of this a round of stratigraphic samples were collected and checked for total chromium and dissolved chromium. Since the dissolved chromium levels were substantially lower, it was decided to drill the production well at the same project site. It was possible that sediment in the water samples was producing much higher total chromium levels than were actually represented in this portion of the aquifer. A complete list of testing dates and results are given in Appendix VII.

7.2 City Well No. 6

During the first step test, CBA collected water samples for primary and secondary drinking water analysis at discharge rates of 2,000, 2,435 and 2,850 gpm. Prior to sampling, pumping levels stabilized at each rate increase and water was clear and free from sediment. Lab results showed a commensurate rise in total chromium with each increase in pumping rate. Values ranged from 0.071 to 0.092 mg/l.

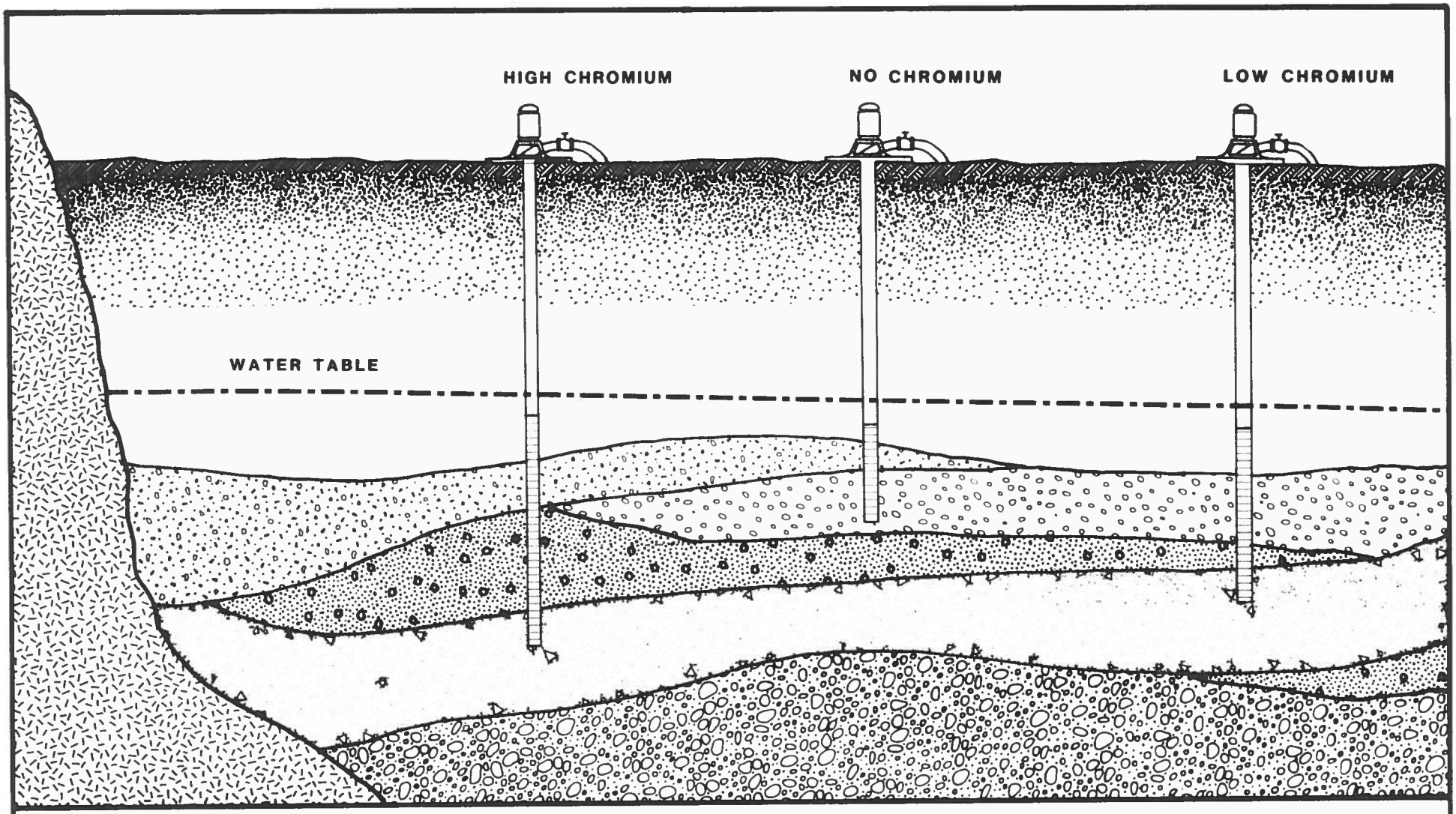
After the step test, additional water samples were gathered in the process of the constant rate test. Primary and secondary samples were taken about five hours into the test and radio chemistry, EPA method 502.2, 608, 615 and turbidity analysis samples were collected at 49 hours, prior to shut-down of the pump. The pumping rate was maintained at 2,713 gpm, and total chromium amounted to 0.110 mg/l.

The well was surged and pumped for several days and then pumped clear at 2,461 gpm. Total chromium testing at this time showed 0.130 mg/l.

A supplemental step test was conducted and samples collected at 1,200, 1,810 and 2,232 gpm. Total chromium values were 0.092, 0.100, and 0.099, respectively. The analytical testing results and field measurements can be found in Appendix VIII.

7.3 Summary

From data collected during the City Well No. 6 drilling program, it is evident that elevated levels of chromium found in this portion of the Hualapai Basin originate from natural geologic sources. Chromium levels are dependent upon location and subsurface lithology where one well may receive water from high source chromium sediments, while another well taps sediments with significantly lower values, even though both wells have similar perforated intervals. Figure 11 illustrates this concept. The problem, however, is identifying intervals where undesirable water is coming from. When the source area is detected, there are various methods of sealing this portion of the well off, allowing higher quality water to be received. Equipment to locate these intervals is in the process of being developed.



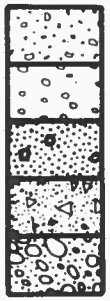


FIGURE 11:
CONCEPTUAL AQUIFER CROSS-SECTION SHOWING SEDIMENTARY SEQUENCE AND SOURCE AREAS FOR CHROMIUM

CELLA BARR ASSOCIATES

8.0 RECOMMENDATIONS

After reviewing the geologic and water quality information collected during the construction of City Well No. 6, CBA offers the following recommendations for future water development at this site.

1. Though chromium levels at this site were higher than expected, they are not high enough to require total abandonment of the well. Since total chromium levels appear to be less concentrated at lower discharge rates, the well could be equipped with a pump in the range of 1,500 to 2,000 gpm. This should provide water with chromium levels low enough to make blending a feasible option. In addition, the results of the pumping tests and well development indicate that, as further development occurs, chromium levels may drop. In any event, by July, 1992, the U.S. Environmental Protection Agency intends to adopt a higher standard for total chromium in drinking water (0.1 mg/l); and, the Arizona Department of Environmental Quality (ADEQ) will follow their lead (Ohnmeiss, 1991). We believe that City Well No. 6 could meet this standard without blending. Given the time necessary to specify, select, order, receive and install a new pump in the system, the well would probably not be ready until the spring anyway and would not need to be brought on line until it became necessary to meet peak summer demands.

2. To speed the adoption process for these new standards, the City should contact Dale Ohnmeiss at ADEQ and offer to assist with the public hearing program. This will probably be implemented sometime after the first of the year.

3. Since sediment samples are available from construction of the observation well, it would be advantageous to the City to have the samples analyzed by a testing lab. The interval targeted for analysis should cover 760 to 1020 feet. This corresponds to the water production portion of City Well No. 6. The total number of samples would be 26. After contact with Laboratory Consultants, of Tempe and a few other reliable sources, the following analysis plan is offered.

a. First, analyze all sediment samples for chromium by EPA method 3050. This method will determine all hexavalent and most trivalent chromium present in the sediment. Digestion by EPA method 3050 and analysis of digest for chromium would be about $32.00 per sample.

b. Second, analyze samples identified by EPA method 3050 above that contain "high" chromium for extractable chromium. This method would involve equilibrating 1 part sediment with 5 parts deionized water for 5 days at room temperature. Such a test would approximate aquifer conditions and provide an estimate of the relative amount of chromium that will dissolve into the groundwater. Select "low" chromium samples could be analyzed by this method for relative comparison purposes. This test is not EPA approved but should indicate zones of chromium contamination in the well. Aqueous extraction and analysis for total, hexavalent and trivalent chromium would amount to $42.00 per sample.

c. If it becomes necessary to determine total chromium in sediments a more rigorous digestion involving nitric and perchloric acid would be utilized. As with the extractable chromium test, this method is not EPA approved. Aqueous extraction and analysis for total chromium is $32.00 per sample.

4. As a follow-up to point Number 3, this well could still provide valuable insight into the local chromium problem. Since it is located in an area where chromium levels have historically been lower and an observation well is in place, it's relationship to these other wells should be explored along with a more detailed assessment of how chromium levels change, with time, during pumping.

5. Finally, if the decision is made to abandon this well, a new well site could be located in a chromium free area. This well, however, would probably be some distance from the existing service lines making interconnection with the existing system difficult and costly.

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APPENDIX E

Engineer's Opinion of Probable Cost

SUNRISE ENGINEERING, INC.
2152 S. Vineyard, Suite 123
Mesa, Arizona 85210
Tel: (480) 768-8600 Fax: (480) 768-8609

Engineer's Opinion of Probable Cost *

Project: Reclaimed Water Re-Use Study
Option 1 - Onsite Groundwater Injection
Owner: City of Kingman
Prepared By: JV

No.	Item Description - Construction	QTY	Unit	Unit Price	Total
	New 18-inch Diameter Injection Well Conceptual Design				
1	Site Work (Includes all clearing and grubbing, grading and backfilling)	1	LS	$8,000	$8,000
2	10" C900 PVC Waterline (includes waterline, valves, bends, tees, appurtenances, trenching and backfill)	40	LF	$150	$6,000
3	New 12-inch Injection Well (includes drilling, casing, perforations, column pipe and appurtenances)	1	LS	$650,000	$650,000
4	Concrete Vault	1	LS	$16,000	$16,000
5	Flow Meter @ WWTP	1	EA	$6,000	$6,000
6	Backflow Preventer @ WWTP	1	EA	$15,000	$15,000
7	Electrical	1	LS	$25,000	$25,000
				Sub-Total A	**$726,000**
				25% Contingency	$182,000
				Professional Engineering Services	$88,000
				Construction Administration	$59,000
				GRAND TOTAL A	**$1,055,000**

*In providing opinions of probable construction cost the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer makes no warranty, expressed or implied, as the accuracy if such opinions compared to bid or actual costs.

SUNRISE ENGINEERING, INC.
2152 S. Vineyard, Suite 123
Mesa, Arizona 85210
Tel: (480) 768-8600 Fax: (480) 768-8609

Engineer's Opinion of Probable Cost *

Project: Reclaimed Water Re-Use Study
Option 2 - Airport Industrial Park Reuse
Owner: City of Kingman
Prepared By: JV

No.	Item Description - Construction	QTY	Unit	Unit Price	Total
	Airport Industrial Park Distribution				
1	Site Work (Includes all clearing and grubbing, grading and backfilling)	1	LS	$15,000	$15,000
2	8" C900 PVC Waterline (includes waterline, valves, bends, tees, appurtenances, trenching and backfill)	22,636	LF	$65	$1,500,000
3	6" C900 PVC Service Lines (includes waterline, valves, bends, tees, appurtenances, trenching and	53,120	LF	$55	$3,000,000
4	Jack and Bore Reuse Line Under Highway 66	1	LS	$300,000	$300,000
5	Jack and Bore Reuse Line Under BNSF Railroad	1	LS	$150,000	$150,000
6	Pump Station to Fill Storage Tank (includes two 750 GPM pumps, valves, bends, appurtenances and	1	LS	$150,000	$150,000
7	Booster Station (includes two 300 GPM pumps, valves, bends, appurtenances and concrete pad)	1	LS	$150,000	$150,000
8	Flow Meter @ WWTP	1	EA	$6,000	$6,000
9	Water Meter For Industrial Park	63	EA	$1,190	$75,000
10	Backflow Preventer @ WWTP	2	EA	$15,000	$30,000
11	288,000 Gallon Steel Water Storage Tank, coating (interior/exterior) & Foundation	1	LS	$300,000	$300,000
12	Remove and Replace Existing Asphalt, Concrete, Curb and Gutter	1	LS	$1,240,000	$1,240,000
13	Electrical & SCADA	1	LS	$300,000	$300,000
				Sub-Total A	**$7,216,000**
				15% Contingency	$1,804,000
				Professional Engineering Services	$866,000
				Construction Administration	$578,000
				GRAND TOTAL A	**$10,464,000**
	Well #1 Injection				
14	Retrofit Well #1 (includes all demo items, re-installation and connection)	1	LS	$200,000	$200,000
				Sub-Total B	**$200,000**
				15% Contingency	$50,000
				Engineering Design Services	$24,000
				Construction Administration	$16,000
				GRAND TOTAL B	**$290,000**
				GRAND TOTAL A+B	**$10,754,000**

*In providing opinions of probable construction cost the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer makes no warranty, expressed or implied, as the accuracy if such opinions compared to bid or actual costs.

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2152 S. Vineyard, Suite 123
Mesa, Arizona 85210
Tel: (480) 768-8600 Fax: (480) 768-8609

Engineer's Opinion of Probable Cost *

Project: Reclaimed Water Re-Use Study
Option 3 - Golf Course Reuse
Owner: City of Kingman
Prepared By: JV

No.	Item Description - Construction	QTY	Unit	Unit Price	Total
	Golf Course Distribution				
1	Site Work (Includes all clearing and grubbing, grading and backfilling)	1	LS	$10,000	$10,000
2	12" C-900 (DR 14) PVC Waterline (includes waterline, valves, bends, tees, appurtenances, trenching and backfill)	23,350	LF	$80	$1,900,000
3	12" DIP Waterline (includes waterline, valves, bends, tees, appurtenances, trenching and backfill)	25,000	LF	$90	$2,250,000
4	Jack and Bore Reuse Line Under Stockton Pass Rd	1	LS	$120,000	$120,000
5	Jack and Bore Reuse Line Under Interstate 40	1	LS	$360,000	$360,000
6	Booster Station (includes two 320 GPM pumps, two 680 GPM pumps valves, bends, appurtenances and concrete pad)	1	LS	$190,000	$190,000
7	Flow Meter @ WWTP	1	EA	$6,000	$6,000
8	Backflow Preventer (@WWTP, Golf Course, 3 Schools, 2 Parks and Fairgrounds)	7	EA	$15,000	$105,000
9	Pump Station @ Golf Course (includes two 700 GPM pumps, backflow preventer, valves, bends, appurtenances and concrete pad)	1	LS	$160,000	$160,000
10	Remove and Replace Existing Asphalt, Concrete, Curb and Gutter	1	LS	$320,000	$320,000
11	Electrical & SCADA	1	LS	$275,000	$275,000
				Sub-Total A	**$5,696,000**
				25% Contingency	$1,424,000
				Professional Engineering Services	$684,000
				Construction Administration Services	$456,000
				GRAND TOTAL	**$8,260,000**

*In providing opinions of probable construction cost the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer makes no warranty, expressed or implied, as the accuracy if such opinions compared to bid or actual costs.

APPENDIX F

Operations & Maintenance Expenses

City of Kingman
Option 2 - Airport Industrial Park Reuse
CASHFLOW SPREAD SHEET

Existing Number of Connections (Dec 2014)		70
Average Water Use per Connection - (1,000 gal/mo)		33.34
Annual Inflation Rate		3%
Annual Growth Rate - Kingman, Arizona		6%
Outside (Non-Residential) City Limits Rates		
Base Service Charge Fee	$	9.64
Capital Renewal Fee	$	3.75
All usage gallons, per 1,000 gallons	$	2.95

Year	1	2	3	4	5	6	7	8	9	10
YEAR	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Number of Connections	70	74	79	83	88	94	99	105	112	118
Average Reuse Use per Connection (80%) - (gal/mo)	27	27	27	27	27	27	27	27	27	27
Average Water Use per Connection (20%) - (gal/mo)	7	7	7	7	7	7	7	7	7	7
Reuse Base Rate Per Month + Capital Renewal Fee	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39
Reuse Rate per 1,000 gallons	$ 2.95	$ 3.95	$ 4.95	$ 5.95	$ 6.95	$ 7.95	$ 8.95	$ 9.95	$ 10.95	$ 11.95
Water Use Base Rate Per Month + Capital Renewal Fee	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39
Water Use Rate per 1,000 gallons	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95
Monthly Reuse Fee per Connection	$ 92.08	$ 118.76	$ 145.43	$ 172.11	$ 198.78	$ 225.46	$ 252.13	$ 278.81	$ 305.48	$ 332.15
Yearly Reuse Fee per Connection	$ 1,104.97	$ 1,425.07	$ 1,745.17	$ 2,065.27	$ 2,385.37	$ 2,705.46	$ 3,025.56	$ 3,345.66	$ 3,665.76	$ 3,985.86
Monthly Water Use Fee per Connection	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06
Yearly Water Use Fee per Connection	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75
REVENUES:										
Yearly Reuse Income:	$ 77,347.96	$ 105,740.15	$ 137,260.95	$ 172,183.59	$ 210,802.80	$ 253,436.45	$ 300,427.26	$ 352,144.59	$ 408,986.46	$ 471,381.63
Water Use Income:	$ 27,772.69	$ 29,439.05	$ 31,205.39	$ 33,077.72	$ 35,062.38	$ 37,166.12	$ 39,396.09	$ 41,759.86	$ 44,265.45	$ 46,921.37
Total Revenues:	$ 105,120.65	$ 135,179.20	$ 168,466.35	$ 205,261.30	$ 245,865.18	$ 290,602.58	$ 339,823.35	$ 393,904.44	$ 453,251.90	$ 518,303.00
OPERATION & MAINTENANCE EXPENSES:										
Employee Salaries	$ 30,000.00	$ 30,900.00	$ 31,827.00	$ 32,781.81	$ 33,765.26	$ 34,778.22	$ 35,821.57	$ 36,896.22	$ 38,003.10	$ 39,143.20
Employee Benefits	$ 11,250.00	$ 11,587.50	$ 11,935.13	$ 12,293.18	$ 12,661.97	$ 13,041.83	$ 13,433.09	$ 13,836.08	$ 14,251.16	$ 14,678.70
Equipment Supplies	$ 2,700.00	$ 2,781.00	$ 2,864.43	$ 2,950.36	$ 3,038.87	$ 3,130.04	$ 3,223.94	$ 3,320.66	$ 3,420.28	$ 3,522.89
System Maintenance	$ 20,000.00	$ 20,600.00	$ 21,218.00	$ 21,854.54	$ 22,510.18	$ 23,185.48	$ 23,881.05	$ 24,597.48	$ 25,335.40	$ 26,095.46
Office Supplies	$ 300.00	$ 300.00	$ 309.00	$ 318.27	$ 327.82	$ 337.65	$ 347.78	$ 358.22	$ 368.96	$ 380.03
Subconsultant Engineering	$ 3,850.00	$ 3,965.50	$ 4,084.47	$ 4,207.00	$ 4,333.21	$ 4,463.21	$ 4,597.10	$ 4,735.01	$ 4,877.06	$ 5,023.38
Travel & Education	$ 1,100.00	$ 1,133.00	$ 1,166.99	$ 1,202.00	$ 1,238.06	$ 1,275.20	$ 1,313.46	$ 1,352.86	$ 1,393.45	$ 1,435.25
Vehicle Lease/Finance	$ 3,600.00	$ 3,708.00	$ 3,819.24	$ 3,933.82	$ 4,051.83	$ 4,173.39	$ 4,298.59	$ 4,427.55	$ 4,560.37	$ 4,697.18
Administrative Services	$ 3,600.00	$ 3,708.00	$ 3,819.24	$ 3,933.82	$ 4,051.83	$ 4,173.39	$ 4,298.59	$ 4,427.55	$ 4,560.37	$ 4,697.18
ADEQ Permitting	$1,500	$ 309.00	$ 318.27	$ 327.82	$ 337.65	$ 347.78	$ 358.22	$ 368.96	$ 380.03	$ 391.43
Power Consumption	$86,300	$ 88,889.00	$ 91,555.67	$ 94,302.34	$ 97,131.41	$ 100,045.35	$ 103,046.71	$ 106,138.11	$ 109,322.26	$ 112,601.93
Operation & Maintenance Expenses:	$ 164,200.00	$ 167,881.00	$ 172,917.43	$ 178,104.95	$ 183,448.10	$ 188,951.54	$ 194,620.09	$ 200,458.69	$ 206,472.45	$ 212,666.63
City Expenditures	$ 105,120.65	$ 135,179.20	$ 168,466.35	$ 205,261.30	$ 245,865.18	$ 290,602.58	$ 339,823.35	$ 393,904.44	$ 453,251.90	$ 518,303.00
Net Revenue Less Expense:	$ (164,200.00)	$ (167,881.00)	$ (172,917.43)	$ (178,104.95)	$ (183,448.10)	$ (188,951.54)	$ (194,620.09)	$ (200,458.69)	$ (206,472.45)	$ (212,666.63)
DEBT SERVICE EXPENSE:										
WIFA Loan ($8,232,500, 20years @ 3%):	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72
Debt Service Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Debt Service Payment	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72
NET REVENUE LESS EXPENSES	$ (887,037.72)	$ (890,718.72)	$ (895,755.15)	$ (900,942.67)	$ (906,285.82)	$ (911,789.26)	$ (917,457.81)	$ (923,296.41)	$ (929,310.17)	$ (935,504.35)
CUMULATIVE REVENUE LESS EXPEN	$ (887,037.72)	$ (1,777,756.44)	$ (2,673,511.59)	$ (3,574,454.26)	$ (4,480,740.08)	$ (5,392,529.35)	$ (6,309,987.16)	$ (7,233,283.57)	$ (8,162,593.74)	$ (9,098,098.09)

City of Kingman
Option 2 - Airport Industrial Park Reuse
CASHFLOW SPREAD SHEET

Existing Number of Connections (Dec 2014)		70
Average Water Use per Connection - (1,000 gal/mo)		33.34
Annual Inflation Rate		3%
Annual Growth Rate - Kingman, Arizona		6%
Outside (Non-Residential) City Limits Rates		
Base Service Charge Fee	$	9.64
Capital Renewal Fee	$	3.75
All usage gallons, per 1,000 gallons	$	2.95

Year	11	12	13	14	15	16	17	18	19	20
YEAR	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Number of Connections	125	133	141	149	158	168	178	188	200	212
Average Reuse Use per Connection (80%) - (gal/mo)	27	27	27	27	27	27	27	27	27	27
Average Water Use per Connection (20%) - (gal/mo)	7	7	7	7	7	7	7	7	7	7
Reuse Base Rate Per Month + Capital Renewal Fee	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39
Reuse Rate per 1,000 gallons	$ 12.95	$ 13.95	$ 14.95	$ 15.95	$ 16.95	$ 17.95	$ 18.95	$ 19.95	$ 20.95	$ 21.95
Water Use Base Rate Per Month + Capital Renewal Fee	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39
Water Use Rate per 1,000 gallons	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95
Monthly Reuse Fee per Connection	$ 358.83	$ 385.50	$ 412.18	$ 438.85	$ 465.53	$ 492.20	$ 518.88	$ 545.55	$ 572.23	$ 598.90
Yearly Reuse Fee per Connection	$ 4,305.96	$ 4,626.06	$ 4,946.15	$ 5,266.25	$ 5,586.35	$ 5,906.45	$ 6,226.55	$ 6,546.65	$ 6,866.75	$ 7,186.84
Monthly Water Use Fee per Connection	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06
Yearly Water Use Fee per Connection	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75
REVENUES:										
Yearly Reuse Income:	$ 539,791.87	$ 614,714.37	$ 696,684.32	$ 786,277.69	$ 884,114.21	$ 990,860.50	$ 1,107,233.54	$ 1,234,004.24	$ 1,372,001.39	$ 1,522,115.78
Water Use Income:	$ 49,736.66	$ 52,720.86	$ 55,884.11	$ 59,237.15	$ 62,791.38	$ 66,558.87	$ 70,552.40	$ 74,785.54	$ 79,272.67	$ 84,029.03
Total Revenues:	$ 589,528.53	$ 667,435.23	$ 752,568.43	$ 845,514.85	$ 946,905.59	$ 1,057,419.37	$ 1,177,785.94	$ 1,308,789.78	$ 1,451,274.06	$ 1,606,144.82
OPERATION & MAINTENANCE EXPENSI										
Employee Salaries	$ 40,317.49	$ 41,527.02	$ 42,772.83	$ 44,056.01	$ 45,377.69	$ 46,739.02	$ 48,141.19	$ 49,585.43	$ 51,072.99	$ 52,605.18
Employee Benefits	$ 15,119.06	$ 15,572.63	$ 16,039.81	$ 16,521.00	$ 17,016.63	$ 17,527.13	$ 18,052.95	$ 18,594.54	$ 19,152.37	$ 19,726.94
Equipment Supplies	$ 3,628.57	$ 3,737.43	$ 3,849.55	$ 3,965.04	$ 4,083.99	$ 4,206.51	$ 4,332.71	$ 4,462.69	$ 4,596.57	$ 4,734.47
System Maintenance	$ 26,878.33	$ 27,684.68	$ 28,515.22	$ 29,370.67	$ 30,251.79	$ 31,159.35	$ 32,094.13	$ 33,056.95	$ 34,048.66	$ 35,070.12
Office Supplies	$ 391.43	$ 403.17	$ 415.27	$ 427.73	$ 440.56	$ 453.78	$ 467.39	$ 481.41	$ 495.85	$ 510.73
Subconsultant Engineering	$ 5,174.08	$ 5,329.30	$ 5,489.18	$ 5,653.85	$ 5,823.47	$ 5,998.17	$ 6,178.12	$ 6,363.46	$ 6,554.37	$ 6,751.00
Travel & Education	$ 1,478.31	$ 1,522.66	$ 1,568.34	$ 1,615.39	$ 1,663.85	$ 1,713.76	$ 1,765.18	$ 1,818.13	$ 1,872.68	$ 1,928.86
Vehicle Lease/Finance	$ 4,838.10	$ 4,983.24	$ 5,132.74	$ 5,286.72	$ 5,445.32	$ 5,608.68	$ 5,776.94	$ 5,950.25	$ 6,128.76	$ 6,312.62
Administrative Services	$ 4,838.10	$ 4,983.24	$ 5,132.74	$ 5,286.72	$ 5,445.32	$ 5,608.68	$ 5,776.94	$ 5,950.25	$ 6,128.76	$ 6,312.62
ADEQ Permitting	$ 403.17	$ 415.27	$ 427.73	$ 440.56	$ 453.78	$ 467.39	$ 481.41	$ 495.85	$ 510.73	$ 526.05
Power Consumption	$ 115,979.98	$ 119,459.38	$ 123,043.16	$ 126,734.46	$ 130,536.49	$ 134,452.59	$ 138,486.17	$ 142,640.75	$ 146,919.97	$ 151,327.57
Operation & Maintenance Expenses:	$ 219,046.63	$ 225,618.03	$ 232,386.57	$ 239,358.16	$ 246,538.91	$ 253,935.08	$ 261,553.13	$ 269,399.72	$ 277,481.71	$ 285,806.16
City Expenditures	$ 589,528.53	$ 667,435.23	$ 752,568.43	$ 845,514.85	$ 946,905.59	$ 1,057,419.37	$ 1,177,785.94	$ 1,308,789.78	$ 1,451,274.06	$ 1,606,144.82
Net Revenue Less Expense:	$ (219,046.63)	$ (225,618.03)	$ (232,386.57)	$ (239,358.16)	$ (246,538.91)	$ (253,935.08)	$ (261,553.13)	$ (269,399.72)	$ (277,481.71)	$ (285,806.16)
DEBT SERVICE EXPENSE:										
WIFA Loan ($8,232,500, 20years @ 3%):	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72
Debt Service Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Debt Service Payment	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72
NET REVENUE LESS EXPENSES	$ (941,884.35)	$ (948,455.75)	$ (955,224.29)	$ (962,195.88)	$ (969,376.63)	$ (976,772.80)	$ (984,390.85)	$ (992,237.44)	$ (1,000,319.43)	$ (1,008,643.88)
CUMULATIVE REVENUE LESS EXPEN	$ (10,039,982.44)	$ (10,988,438.18)	$ (11,943,662.47)	$ (12,905,858.35)	$ (13,875,234.98)	$ (14,852,007.77)	$ (15,836,398.62)	$ (16,828,636.06)	$ (17,828,955.50)	$ (18,837,599.38)

City of Kingman
Option 3 - Golf Course, Schools and Parks Reuse
CASHFLOW SPREAD SHEET

Existing Population (July 1, 2014)[1]	28,549
Persons per Household (2010-2014)[1]	2.54
Estimated Number of Connections[2]	18,846
Total Possible Number of Connections	70
Average Water Use per Capita (gal/day)[3]	200
Average Water Use per Connection (gal/day)	508
Average Water Use per Connection (gal/mo)	15,240
Annual Inflation Rate	3%
Annual Growth Rate - Kingman, Arizona	3%

Inside (Residential) City Limits Rates		
Base Service Charge Fee	$	7.21
Capital Renewal Fee	$	3.75
0-10,000 gallons, per 1,000 gallons	$	1.93
10,001-45,000 gallons, per 1,000 gallons	$	2.42
Over 45,000 gallons, per 1,000 gallons	$	3.64

Year		1		2		3		4		5		6		7		8		9		10
YEAR		**2017**		**2018**		**2019**		**2020**		**2021**		**2022**		**2023**		**2024**		**2025**		**2026**
Estimated Number of Connections		18,846		19411		19994		20594		21211		21848		22503		23178		23874		24590
Average Water Use per Connection (gal/mo)		15,240		15,240		15,240		15,240		15,240		15,240		15,240		15,240		15,240		15,240
Water Use Base Rate Per Month + Capital Renewal Fee	$	10.96	$	10.96	$	10.96	$	10.96	$	10.96	$	10.96	$	10.96	$	10.96	$	10.96	$	10.96
Water Use Rate (10,001-45,000 gallons)	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42
Monthly Water Use Fee per Connection	$	43.00	$	43.00	$	43.00	$	43.00	$	43.00	$	43.00	$	43.00	$	43.00	$	43.00	$	43.00
Yearly Water Use Fee per Connection	$	516.01	$	516.01	$	516.01	$	516.01	$	516.01	$	516.01	$	516.01	$	516.01	$	516.01	$	516.01
REVENUES:																				
Water Use Income:	$	9,724,716.92	$	10,016,458.43	$	10,316,952.18	$	10,626,460.75	$	10,945,254.57	$	11,273,612.21	$	11,611,820.57	$	11,960,175.19	$	12,318,980.45	$	12,688,549.86
Total Revenues:	$	9,724,716.92	$	10,016,458.43	$	10,316,952.18	$	10,626,460.75	$	10,945,254.57	$	11,273,612.21	$	11,611,820.57	$	11,960,175.19	$	12,318,980.45	$	12,688,549.86
OPERATION & MAINTENANCE EXPENSES:																				
Employee Salaries	$	30,000.00	$	30,900.00	$	31,827.00	$	32,781.81	$	33,765.26	$	34,778.22	$	35,821.57	$	36,896.22	$	38,003.10	$	39,143.20
Employee Benefits	$	11,250.00	$	11,587.50	$	11,935.13	$	12,293.18	$	12,661.97	$	13,041.83	$	13,433.09	$	13,836.08	$	14,251.16	$	14,678.70
Equipment Supplies	$	3,200.00	$	3,296.00	$	3,394.88	$	3,496.73	$	3,601.63	$	3,709.68	$	3,820.97	$	3,935.60	$	4,053.66	$	4,175.27
System Maintenance	$	12,000.00	$	12,360.00	$	12,730.80	$	13,112.72	$	13,506.11	$	13,911.29	$	14,328.63	$	14,758.49	$	15,201.24	$	15,657.28
Office Supplies	$	300.00	$	300.00	$	309.00	$	318.27	$	327.82	$	337.65	$	347.78	$	358.22	$	368.96	$	380.03
Subconsultant Engineering	$	3,500.00	$	3,605.00	$	3,713.15	$	3,824.54	$	3,939.28	$	4,057.46	$	4,179.18	$	4,304.56	$	4,433.70	$	4,566.71
Travel & Education	$	2,500.00	$	2,575.00	$	2,652.25	$	2,731.82	$	2,813.77	$	2,898.19	$	2,985.13	$	3,074.68	$	3,166.93	$	3,261.93
Vehicle Lease/Finance	$	3,600.00	$	3,708.00	$	3,819.24	$	3,933.82	$	4,051.83	$	4,173.39	$	4,298.59	$	4,427.55	$	4,560.37	$	4,697.18
Administrative Services	$	3,600.00	$	3,708.00	$	3,819.24	$	3,933.82	$	4,051.83	$	4,173.39	$	4,298.59	$	4,427.55	$	4,560.37	$	4,697.18
ADEQ Permitting		$1,500	$	309.00	$	318.27	$	327.82	$	337.65	$	347.78	$	358.22	$	368.96	$	380.03	$	391.43
Power Consumption		$86,303	$	88,892.09	$	91,558.85	$	94,305.62	$	97,134.79	$	100,048.83	$	103,050.30	$	106,141.80	$	109,326.06	$	112,605.84
Operation & Maintenance Expenses:	$	157,753.00	$	161,240.59	$	166,077.81	$	171,060.14	$	176,191.95	$	181,477.70	$	186,922.04	$	192,529.70	$	198,305.59	$	204,254.76
City Expenditures	$	9,724,716.92	$	10,016,458.43	$	10,316,952.18	$	10,626,460.75	$	10,945,254.57	$	11,273,612.21	$	11,611,820.57	$	11,960,175.19	$	12,318,980.45	$	12,688,549.86
Net Revenue Less Expense:	$	(157,753.00)	$	(161,240.59)	$	(166,077.81)	$	(171,060.14)	$	(176,191.95)	$	(181,477.70)	$	(186,922.04)	$	(192,529.70)	$	(198,305.59)	$	(204,254.76)
DEBT SERVICE EXPENSE:																				
WIFA Loan ($8,232,500, 20years @ 3%):	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74
Debt Service Reserve	$	-	$	-	$	-	$	-	$	-	$	-	$	-	$	-	$	-	$	-
Total Debt Service Payment	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74
NET REVENUE LESS EXPENSES	$	(712,954.74)	$	(716,442.33)	$	(721,279.55)	$	(726,261.89)	$	(731,393.69)	$	(736,679.45)	$	(742,123.78)	$	(747,731.44)	$	(753,507.33)	$	(759,456.50)
CUMULATIVE REVENUE LESS EXPENSES	$	(712,954.74)	$	(1,429,397.08)	$	(2,150,676.63)	$	(2,876,938.52)	$	(3,608,332.21)	$	(4,345,011.66)	$	(5,087,135.44)	$	(5,834,866.88)	$	(6,588,374.21)	$	(7,347,830.71)

[1] From US Census Bureau website:
http://quickfacts.census.gov/qfd/states/04/0437620.html
[2] Estimated number of connections provided from The City of Kingman Financial Servises Department
[3] From The City of Kingman Water System Master Plan by C5 Engineering, Inc. (May 25, 2005)

City of Kingman
Option 3 - Golf Course, Schools and Parks Reuse
CASHFLOW SPREAD SHEET

Existing Population (July 1, 2014)[1]		28,549
Persons per Household (2010-2014)[1]		3
Estimated Number of Connections[2]		18,846
Total Possible Number of Connections		70
Average Water Use per Capita (gal/day)[3]		200
Average Water Use per Connection (gal/day)		508
Average Water Use per Connection (gal/mo)		15,240
Annual Inflation Rate		3%
Annual Growth Rate - Kingman, Arizona		3%
Inside (Residential) City Limits Rates		
Base Service Charge Fee	$	7.21
Capital Renewal Fee	$	3.75
0-10,000 gallons, per 1,000 gallons	$	1.93
10,001-45,000 gallons, per 1,000 gallons	$	2.42
Over 45,000 gallons, per 1,000 gallons	$	3.64

	Year	11	12	13	14	15	16	17	18	19	20
	YEAR	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Estimated Number of Connections		25327	26087	26870	27676	28506	29361	30242	31150	32084	33047
Average Water Use per Connection (gal/mo)		15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240
Water Use Base Rate Per Month + Capital Renewal Fee	$	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96
Water Use Rate (10,001-45,000 gallons)	$	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42
Monthly Water Use Fee per Connection	$	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Yearly Water Use Fee per Connection	$	516.01	516.01	516.01	516.01	516.01	516.01	516.01	516.01	516.01	516.01
REVENUES:											
Water Use Income:	$	13,069,206.36	13,461,282.55	13,865,121.02	14,281,074.65	14,709,506.89	15,150,792.10	15,605,315.86	16,073,475.34	16,555,679.60	17,052,349.99
Total Revenues:	$	13,069,206.36	13,461,282.55	13,865,121.02	14,281,074.65	14,709,506.89	15,150,792.10	15,605,315.86	16,073,475.34	16,555,679.60	17,052,349.99
OPERATION & MAINTENANCE EXPENSES:											
Employee Salaries	$	40,317.49	41,527.02	42,772.83	44,056.01	45,377.69	46,739.02	48,141.19	49,585.43	51,072.99	52,605.18
Employee Benefits	$	15,119.06	15,572.63	16,039.81	16,521.00	17,016.63	17,527.13	18,052.95	18,594.54	19,152.37	19,726.94
Equipment Supplies	$	4,300.53	4,429.55	4,562.43	4,699.31	4,840.29	4,985.50	5,135.06	5,289.11	5,447.79	5,611.22
System Maintenance	$	16,127.00	16,610.81	17,109.13	17,622.40	18,151.08	18,695.61	19,256.48	19,834.17	20,429.20	21,042.07
Office Supplies	$	391.43	403.17	415.27	427.73	440.56	453.78	467.39	481.41	495.85	510.73
Subconsultant Engineering	$	4,703.71	4,844.82	4,990.16	5,139.87	5,294.06	5,452.89	5,616.47	5,784.97	5,958.52	6,137.27
Travel & Education	$	3,359.79	3,460.58	3,564.40	3,671.33	3,781.47	3,894.92	4,011.77	4,132.12	4,256.08	4,383.77
Vehicle Lease/Finance	$	4,838.10	4,983.24	5,132.74	5,286.72	5,445.32	5,608.68	5,776.94	5,950.25	6,128.76	6,312.62
Administrative Services	$	4,838.10	4,983.24	5,132.74	5,286.72	5,445.32	5,608.68	5,776.94	5,950.25	6,128.76	6,312.62
ADEQ Permitting	$	403.17	415.27	427.73	440.56	453.78	467.39	481.41	495.85	510.73	526.05
Power Consumption	$	115,984.02	119,463.54	123,047.44	126,738.87	130,541.03	134,457.26	138,490.98	142,645.71	146,925.08	151,332.83
Operation & Maintenance Expenses:	$	210,382.40	216,693.87	223,194.69	229,890.53	236,787.24	243,890.86	251,207.59	258,743.81	266,506.13	274,501.31
City Expenditures	$	13,069,206.36	13,461,282.55	13,865,121.02	14,281,074.65	14,709,506.89	15,150,792.10	15,605,315.86	16,073,475.34	16,555,679.60	17,052,349.99
Net Revenue Less Expense:	$	(210,382.40)	(216,693.87)	(223,194.69)	(229,890.53)	(236,787.24)	(243,890.86)	(251,207.59)	(258,743.81)	(266,506.13)	(274,501.31)
DEBT SERVICE EXPENSE:											
WIFA Loan ($8,232,500, 20years @ 3%):	$	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74
Debt Service Reserve	$	-	-	-	-	-	-	-	-	-	-
Total Debt Service Payment	$	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74	555,201.74
NET REVENUE LESS EXPENSES	$	(765,584.14)	(771,895.61)	(778,396.43)	(785,092.27)	(791,988.99)	(799,092.60)	(806,409.33)	(813,945.56)	(821,707.87)	(829,703.06)
CUMULATIVE REVENUE LESS EXPENSES	$	(8,113,414.86)	(8,885,310.47)	(9,663,706.90)	(10,448,799.17)	(11,240,788.16)	(12,039,880.76)	(12,846,290.09)	(13,660,235.65)	(14,481,943.52)	(15,311,646.58)

[1] From US Census Bureau website:
http://quickfacts.census.gov/qfd/states/04/0437620.html
[2] Estimated number of connections provided from The City of Kingman Financial Servises Department
[3] From The City of Kingman Water System Master Plan by C5 Engineering, Inc. (May 25, 2005)

CASHFLOW SPREAD SHEET
City of Kingman
Sunrise Engineering, Inc.

Total Power Used

Sites	Kilowatts/Yr	Total Cost/Yr	Average Cost/Kw
Rattlesnake	39,520	$ 4,745.13	$ 0.12
Roosevelt	1,666,160	$ 129,447.64	$ 0.08
Castlerock	1,800,480	$ 210,541.29	$ 0.12
Hualapai	2,609	$ 476.77	$ 0.18
Yearly Average	877,192	$ 86,302.71	$ 0.124

Avg $/Month	**$**	**7,192**
High $/Month	**$**	**17,545**
Low $/Month	**$**	**40**

APPENDIX G

Rate Analysis

City of Kingman
Option 2 - Airport Industrial Park Reuse
CASHFLOW SPREAD SHEET

Existing Number of Connections (Dec 2014)		70
Average Water Use per Connection - (gal/mo) (thousand gallons)		33.34
Annual Inflation Rate		3%
Annual Growth Rate - Kingman, Arizona		6%
Outside (Non-Residential) City Limits Rates (Reuse ONLY)		
Base Service Charge Fee	$	1,066.00
Capital Renewal Fee	$	3.75
All usage gallons, per 1,000 gallons	$	2.95
Outside (Non-Residential) City Limits Rates (Water ONLY)		
Base Service Charge Fee	$	9.64
Capital Renewal Fee	$	3.75
All usage gallons, per 1,000 gallons	$	2.95

Reuse Base Rate Increase		
$	1,056.36	11058%

Year	1	2	3	4	5	6	7	8	9	10
YEAR	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Number of Connections	70	74	79	83	88	94	99	105	112	118
Average Reuse Use per Connection (80%) - (gal/mo)	27	27	27	27	27	27	27	27	27	27
Average Water Use per Connection (20%) - (gal/mo)	7	7	7	7	7	7	7	7	7	7
Reuse Base Rate Per Month + Capital Renewal Fee	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75
Reuse Rate per 1,000 gallons	$ 2.95	$ 3.95	$ 4.95	$ 5.95	$ 6.95	$ 7.95	$ 8.95	$ 9.95	$ 10.95	$ 11.95
Water Use Base Rate Per Month + Capital Renewal Fee	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39
Water Use Rate per 1,000 gallons	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95
Monthly Reuse Fee per Connection	$ 1,148.44	$ 1,175.12	$ 1,201.79	$ 1,228.47	$ 1,255.14	$ 1,281.82	$ 1,308.49	$ 1,335.17	$ 1,361.84	$ 1,388.51
Yearly Reuse Fee per Connection	$ 13,781.29	$ 14,101.39	$ 14,421.49	$ 14,741.59	$ 15,061.69	$ 15,381.78	$ 15,701.88	$ 16,021.98	$ 16,342.08	$ 16,662.18
Monthly Water Use Fee per Connection	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06
Yearly Water Use Fee per Connection	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75
REVENUES:										
Yearly Reuse Income:	$ 964,690.36	$ 1,046,323.09	$ 1,134,278.87	$ 1,229,022.58	$ 1,331,052.13	$ 1,440,900.75	$ 1,559,139.41	$ 1,686,379.47	$ 1,823,275.43	$ 1,970,527.94
Water Use Income:	$ 27,772.69	$ 29,439.05	$ 31,205.39	$ 33,077.72	$ 35,062.38	$ 37,166.12	$ 39,396.09	$ 41,759.86	$ 44,265.45	$ 46,921.37
Total Revenues:	$ 992,463.05	$ 1,075,762.14	$ 1,165,484.27	$ 1,262,100.30	$ 1,366,114.51	$ 1,478,066.87	$ 1,598,535.50	$ 1,728,139.32	$ 1,867,540.88	$ 2,017,449.32
OPERATION & MAINTENANCE EXPENSES:										
Employee Salaries	$ 30,000.00	$ 30,900.00	$ 31,827.00	$ 32,781.81	$ 33,765.26	$ 34,778.22	$ 35,821.57	$ 36,896.22	$ 38,003.10	$ 39,143.20
Employee Benefits	$ 11,250.00	$ 11,587.50	$ 11,935.13	$ 12,293.18	$ 12,661.97	$ 13,041.83	$ 13,433.09	$ 13,836.08	$ 14,251.16	$ 14,678.70
Equipment Supplies	$ 2,700.00	$ 2,781.00	$ 2,864.43	$ 2,950.36	$ 3,038.87	$ 3,130.04	$ 3,223.94	$ 3,320.66	$ 3,420.28	$ 3,522.89
System Maintenance	$ 20,000.00	$ 20,600.00	$ 21,218.00	$ 21,854.54	$ 22,510.18	$ 23,185.48	$ 23,881.05	$ 24,597.48	$ 25,335.40	$ 26,095.46
Office Supplies	$ 300.00	$ 300.00	$ 309.00	$ 318.27	$ 327.82	$ 337.65	$ 347.78	$ 358.22	$ 368.96	$ 380.03
Subconsultant Engineering	$ 3,850.00	$ 3,965.50	$ 4,084.47	$ 4,207.00	$ 4,333.21	$ 4,463.21	$ 4,597.10	$ 4,735.01	$ 4,877.06	$ 5,023.38
Travel & Education	$ 1,100.00	$ 1,133.00	$ 1,166.99	$ 1,202.00	$ 1,238.06	$ 1,275.20	$ 1,313.46	$ 1,352.86	$ 1,393.45	$ 1,435.25
Vehicle Lease/Finance	$ 3,600.00	$ 3,708.00	$ 3,819.24	$ 3,933.82	$ 4,051.83	$ 4,173.39	$ 4,298.59	$ 4,427.55	$ 4,560.37	$ 4,697.18
Administrative Services	$ 3,600.00	$ 3,708.00	$ 3,819.24	$ 3,933.82	$ 4,051.83	$ 4,173.39	$ 4,298.59	$ 4,427.55	$ 4,560.37	$ 4,697.18
ADEQ Permitting	$1,500	$ 309.00	$ 318.27	$ 327.82	$ 337.65	$ 347.78	$ 358.22	$ 368.96	$ 380.03	$ 391.43
Power Consumption	$86,300	$ 88,889.00	$ 91,555.67	$ 94,302.34	$ 97,131.41	$ 100,045.35	$ 103,046.71	$ 106,138.11	$ 109,322.26	$ 112,601.93
Operation & Maintenance Expenses:	$ 164,200.00	$ 167,881.00	$ 172,917.43	$ 178,104.95	$ 183,448.10	$ 188,951.54	$ 194,620.09	$ 200,458.69	$ 206,472.45	$ 212,666.63
City Expenditures	$ 105,120.65	$ 135,179.20	$ 168,466.35	$ 205,261.30	$ 245,865.18	$ 290,602.58	$ 339,823.35	$ 393,904.44	$ 453,251.90	$ 518,303.00
Net Revenue Less Expense:	$ 723,142.40	$ 772,701.94	$ 824,100.49	$ 878,734.04	$ 936,801.23	$ 998,512.75	$ 1,064,092.06	$ 1,133,776.19	$ 1,207,816.52	$ 1,286,479.69
DEBT SERVICE EXPENSE:										
WIFA Loan ($8,232,500, 20years @ 3%):	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72
Debt Service Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Debt Service Payment	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72
NET REVENUE LESS EXPENSES	$ 304.68	$ 49,864.22	$ 101,262.77	$ 155,896.32	$ 213,963.51	$ 275,675.03	$ 341,254.34	$ 410,938.47	$ 484,978.80	$ 563,641.97
CUMULATIVE REVENUE LESS EXPENSES	$ 304.68	$ 50,168.91	$ 151,431.68	$ 307,328.00	$ 521,291.51	$ 796,966.55	$ 1,138,220.89	$ 1,549,159.36	$ 2,034,138.16	$ 2,597,780.13

City of Kingman
Option 2 - Airport Industrial Park Reuse
CASHFLOW SPREAD SHEET

Existing Number of Connections (Dec 2014)		70
Average Water Use per Connection - (gal/mo) (thousand gallons)		33.34
Annual Inflation Rate		3%
Annual Growth Rate - Kingman, Arizona		6%
Outside (Non-Residential) City Limits Rates (Reuse ONLY)		
Base Service Charge Fee	$	1,066.00
Capital Renewal Fee	$	3.75
All usage gallons, per 1,000 gallons	$	2.95
Outside (Non-Residential) City Limits Rates (Water ONLY)		
Base Service Charge Fee	$	9.64
Capital Renewal Fee	$	3.75
All usage gallons, per 1,000 gallons	$	2.95

Reuse Base Rate Increase		
$	1,056.36	11058%

Year	11	12	13	14	15	16	17	18	19	20
YEAR	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Number of Connections	125	133	141	149	158	168	178	188	200	212
Average Reuse Use per Connection (80%) - (gal/mo)	27	27	27	27	27	27	27	27	27	27
Average Water Use per Connection (20%) - (gal/mo)	7	7	7	7	7	7	7	7	7	7
Reuse Base Rate Per Month + Capital Renewal Fee	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75	$ 1,069.75
Reuse Rate per 1,000 gallons	$ 12.95	$ 13.95	$ 14.95	$ 15.95	$ 16.95	$ 17.95	$ 18.95	$ 19.95	$ 20.95	$ 21.95
Water Use Base Rate Per Month + Capital Renewal Fee	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39	$ 13.39
Water Use Rate per 1,000 gallons	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95	$ 2.95
Monthly Reuse Fee per Connection	$ 1,415.19	$ 1,441.86	$ 1,468.54	$ 1,495.21	$ 1,521.89	$ 1,548.56	$ 1,575.24	$ 1,601.91	$ 1,628.59	$ 1,655.26
Yearly Reuse Fee per Connection	$ 16,982.28	$ 17,302.38	$ 17,622.47	$ 17,942.57	$ 18,262.67	$ 18,582.77	$ 18,902.87	$ 19,222.97	$ 19,543.07	$ 19,863.16
Monthly Water Use Fee per Connection	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06	$ 33.06
Yearly Water Use Fee per Connection	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75	$ 396.75
REVENUES:										
Yearly Reuse Income:	$ 2,128,886.97	$ 2,299,155.17	$ 2,482,191.57	$ 2,678,915.38	$ 2,890,310.15	$ 3,117,428.20	$ 3,361,395.30	$ 3,623,415.71	$ 3,904,777.54	$ 4,206,858.50
Water Use Income:	$ 49,736.66	$ 52,720.86	$ 55,884.11	$ 59,237.15	$ 62,791.38	$ 66,558.87	$ 70,552.40	$ 74,785.54	$ 79,272.67	$ 84,029.03
Total Revenues:	$ 2,178,623.62	$ 2,351,876.03	$ 2,538,075.68	$ 2,738,152.53	$ 2,953,101.53	$ 3,183,987.06	$ 3,431,947.70	$ 3,698,201.25	$ 3,984,050.22	$ 4,290,887.54
OPERATION & MAINTENANCE EXPENSES:										
Employee Salaries	$ 40,317.49	$ 41,527.02	$ 42,772.83	$ 44,056.01	$ 45,377.69	$ 46,739.02	$ 48,141.19	$ 49,585.43	$ 51,072.99	$ 52,605.18
Employee Benefits	$ 15,119.06	$ 15,572.63	$ 16,039.81	$ 16,521.00	$ 17,016.63	$ 17,527.13	$ 18,052.95	$ 18,594.54	$ 19,152.37	$ 19,726.94
Equipment Supplies	$ 3,628.57	$ 3,737.43	$ 3,849.55	$ 3,965.04	$ 4,083.99	$ 4,206.51	$ 4,332.71	$ 4,462.69	$ 4,596.57	$ 4,734.47
System Maintenance	$ 26,878.33	$ 27,684.68	$ 28,515.22	$ 29,370.67	$ 30,251.79	$ 31,159.35	$ 32,094.13	$ 33,056.95	$ 34,048.66	$ 35,070.12
Office Supplies	$ 391.43	$ 403.17	$ 415.27	$ 427.73	$ 440.56	$ 453.78	$ 467.39	$ 481.41	$ 495.85	$ 510.73
Subconsultant Engineering	$ 5,174.08	$ 5,329.30	$ 5,489.18	$ 5,653.85	$ 5,823.47	$ 5,998.17	$ 6,178.12	$ 6,363.46	$ 6,554.37	$ 6,751.00
Travel & Education	$ 1,478.31	$ 1,522.66	$ 1,568.34	$ 1,615.39	$ 1,663.85	$ 1,713.76	$ 1,765.18	$ 1,818.13	$ 1,872.68	$ 1,928.86
Vehicle Lease/Finance	$ 4,838.10	$ 4,983.24	$ 5,132.74	$ 5,286.72	$ 5,445.32	$ 5,608.68	$ 5,776.94	$ 5,950.25	$ 6,128.76	$ 6,312.62
Administrative Services	$ 4,838.10	$ 4,983.24	$ 5,132.74	$ 5,286.72	$ 5,445.32	$ 5,608.68	$ 5,776.94	$ 5,950.25	$ 6,128.76	$ 6,312.62
ADEQ Permitting	$ 403.17	$ 415.27	$ 427.73	$ 440.56	$ 453.78	$ 467.39	$ 481.41	$ 495.85	$ 510.73	$ 526.05
Power Consumption	$ 115,979.98	$ 119,459.38	$ 123,043.16	$ 126,734.46	$ 130,536.49	$ 134,452.59	$ 138,486.17	$ 142,640.75	$ 146,919.97	$ 151,327.57
Operation & Maintenance Expenses:	$ 219,046.63	$ 225,618.03	$ 232,386.57	$ 239,358.16	$ 246,538.91	$ 253,935.08	$ 261,553.13	$ 269,399.72	$ 277,481.71	$ 285,806.16
City Expenditures	$ 589,528.53	$ 667,435.23	$ 752,568.43	$ 845,514.85	$ 946,905.59	$ 1,057,419.37	$ 1,177,785.94	$ 1,308,789.78	$ 1,451,274.06	$ 1,606,144.82
Net Revenue Less Expense:	$ 1,370,048.47	$ 1,458,822.77	$ 1,553,120.68	$ 1,653,279.52	$ 1,759,657.03	$ 1,872,632.62	$ 1,992,608.63	$ 2,120,011.74	$ 2,255,294.44	$ 2,398,936.56
DEBT SERVICE EXPENSE:										
WIFA Loan ($8,232,500, 20years @ 3%):	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72
Debt Service Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Debt Service Payment	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72	$ 722,837.72
NET REVENUE LESS EXPENSES	$ 647,210.75	$ 735,985.05	$ 830,282.96	$ 930,441.80	$ 1,036,819.31	$ 1,149,794.90	$ 1,269,770.91	$ 1,397,174.03	$ 1,532,456.72	$ 1,676,098.84
CUMULATIVE REVENUE LESS EXPENSES	$ 3,244,990.87	$ 3,980,975.93	$ 4,811,258.89	$ 5,741,700.69	$ 6,778,520.00	$ 7,928,314.90	$ 9,198,085.82	$ 10,595,259.84	$ 12,127,716.56	$ 13,803,815.40

City of Kingman
Option 3 - Golf Course, Schools and Parks Reuse
CASHFLOW SPREAD SHEET

Existing Population (July 1, 2014)[1]	28,549
Persons per Household (2010-2014)[1]	2.54
Estimated Number of Connections[2]	18,846
Total Possible Number of Connections	70
Average Water Use per Capita (gal/day)[3]	200
Average Water Use per Connection (gal/day)	508
Average Water Use per Connection (gal/mo)	15,240
Annual Inflation Rate	3%
Annual Growth Rate - Kingman, Arizona	3%

Inside (Residential) City Limits Rates		
Base Service Charge Fee	$	10.37
Capital Renewal Fee	$	3.75
0-10,000 gallons, per 1,000 gallons	$	1.93
10,001-45,000 gallons, per 1,000 gallons	$	2.42
Over 45,000 gallons, per 1,000 gallons	$	3.64

Base Rate Increase	
$	3.16

Year		1		2		3		4		5		6		7		8		9		10
YEAR		**2017**		**2018**		**2019**		**2020**		**2021**		**2022**		**2023**		**2024**		**2025**		**2026**
Estimated Number of Connections		18,846		19411		19994		20594		21211		21848		22503		23178		23874		24590
Average Water Use per Connection (gal/mo)		15,240		15,240		15,240		15,240		15,240		15,240		15,240		15,240		15,240		15,240
Water Use Base Rate Per Month + Capital Renewal Fee	$	14.12	$	14.12	$	14.12	$	14.12	$	14.12	$	14.12	$	14.12	$	14.12	$	14.12	$	14.12
Water Use Rate (10,001-45,000 gallons)	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42	$	2.42
Monthly Water Use Fee per Connection	$	46.16	$	46.16	$	46.16	$	46.16	$	46.16	$	46.16	$	46.16	$	46.16	$	46.16	$	46.16
Yearly Water Use Fee per Connection	$	553.93	$	553.93	$	553.93	$	553.93	$	553.93	$	553.93	$	553.93	$	553.93	$	553.93	$	553.93
Base vs Adjusted Monthly Increase Per Connection	$	3.16	$	3.16	$	3.16	$	3.16	$	3.16	$	3.16	$	3.16	$	3.16	$	3.16	$	3.16
Base vs Adjusted Annual Increase Per Connection	$	37.92	$	37.92	$	37.92	$	37.92	$	37.92	$	37.92	$	37.92	$	37.92	$	37.92	$	37.92
REVENUES:																				
Water Use Income:	$	10,439,357.24	$	10,752,537.96	$	11,075,114.10	$	11,407,367.52	$	11,749,588.55	$	12,102,076.20	$	12,465,138.49	$	12,839,092.64	$	13,224,265.42	$	13,620,993.39
Total Revenues:	$	10,439,357.24	$	10,752,537.96	$	11,075,114.10	$	11,407,367.52	$	11,749,588.55	$	12,102,076.20	$	12,465,138.49	$	12,839,092.64	$	13,224,265.42	$	13,620,993.39
OPERATION & MAINTENANCE EXPENSES:																				
Employee Salaries	$	30,000.00	$	30,900.00	$	31,827.00	$	32,781.81	$	33,765.26	$	34,778.22	$	35,821.57	$	36,896.22	$	38,003.10	$	39,143.20
Employee Benefits	$	11,250.00	$	11,587.50	$	11,935.13	$	12,293.18	$	12,661.97	$	13,041.83	$	13,433.09	$	13,836.08	$	14,251.16	$	14,678.70
Equipment Supplies	$	3,200.00	$	3,296.00	$	3,394.88	$	3,496.73	$	3,601.63	$	3,709.68	$	3,820.97	$	3,935.60	$	4,053.66	$	4,175.27
System Maintenance	$	12,000.00	$	12,360.00	$	12,730.80	$	13,112.72	$	13,506.11	$	13,911.29	$	14,328.63	$	14,758.49	$	15,201.24	$	15,657.28
Office Supplies	$	300.00	$	300.00	$	309.00	$	318.27	$	327.82	$	337.65	$	347.78	$	358.22	$	368.96	$	380.03
Subconsultant Engineering	$	3,500.00	$	3,605.00	$	3,713.15	$	3,824.54	$	3,939.28	$	4,057.46	$	4,179.18	$	4,304.56	$	4,433.70	$	4,566.71
Travel & Education	$	2,500.00	$	2,575.00	$	2,652.25	$	2,731.82	$	2,813.77	$	2,898.19	$	2,985.13	$	3,074.68	$	3,166.93	$	3,261.93
Vehicle Lease/Finance	$	3,600.00	$	3,708.00	$	3,819.24	$	3,933.82	$	4,051.83	$	4,173.39	$	4,298.59	$	4,427.55	$	4,560.37	$	4,697.18
Administrative Services	$	3,600.00	$	3,708.00	$	3,819.24	$	3,933.82	$	4,051.83	$	4,173.39	$	4,298.59	$	4,427.55	$	4,560.37	$	4,697.18
ADEQ Permitting		$1,500	$	309.00	$	318.27	$	327.82	$	337.65	$	347.78	$	358.22	$	368.96	$	380.03	$	391.43
Power Consumption		$86,303	$	88,892.09	$	91,558.85	$	94,305.62	$	97,134.79	$	100,048.83	$	103,050.30	$	106,141.80	$	109,326.06	$	112,605.84
Operation & Maintenance Expenses:	$	157,753.00	$	161,240.59	$	166,077.81	$	171,060.14	$	176,191.95	$	181,477.70	$	186,922.04	$	192,529.70	$	198,305.59	$	204,254.76
City Expenditures	$	9,724,716.92	$	10,016,458.43	$	10,316,952.18	$	10,626,460.75	$	10,945,254.57	$	11,273,612.21	$	11,611,820.57	$	11,960,175.19	$	12,318,980.45	$	12,688,549.86
Net Revenue Less Expense:	$	556,887.32	$	574,838.94	$	592,084.11	$	609,846.63	$	628,142.03	$	646,986.29	$	666,395.88	$	686,387.76	$	706,979.39	$	728,188.77
DEBT SERVICE EXPENSE:																				
WIFA Loan ($8,232,500, 20years @ 3%):	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74
Debt Service Reserve	$	-	$	-	$	-	$	-	$	-	$	-	$	-	$	-	$	-	$	-
Total Debt Service Payment	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74	$	555,201.74
NET REVENUE LESS EXPENSES	$	1,685.58	$	19,637.19	$	36,882.36	$	54,644.89	$	72,940.29	$	91,784.55	$	111,194.13	$	131,186.01	$	151,777.64	$	172,987.03
CUMULATIVE REVENUE LESS EXPENSES	$	1,685.58	$	21,322.77	$	58,205.13	$	112,850.02	$	185,790.30	$	277,574.85	$	388,768.99	$	519,955.00	$	671,732.64	$	844,719.67

[1] From US Census Bureau website:
http://quickfacts.census.gov/qfd/states/04/0437620.html
[2] Estimated number of connections provided from The City of Kingman
Financial Servises Department
[3] From The City of Kingman Water System Master Plan by C5
Engineering, Inc. (May 25, 2005)

City of Kingman
Option 3 - Golf Course, Schools and Parks Reuse
CASHFLOW SPREAD SHEET

Existing Population (July 1, 2014)[1]	28,549
Persons per Household (2010-2014)[1]	3
Estimated Number of Connections[2]	18,846
Total Possible Number of Connections	70
Average Water Use per Capita (gal/day)[3]	200
Average Water Use per Connection (gal/day)	508
Average Water Use per Connection (gal/mo)	15,240
Annual Inflation Rate	3%
Annual Growth Rate - Kingman, Arizona	3%

Inside (Residential) City Limits Rates		
Base Service Charge Fee	$	10.37
Capital Renewal Fee	$	3.75
0-10,000 gallons, per 1,000 gallons	$	1.93
10,001-45,000 gallons, per 1,000 gallons	$	2.42
Over 45,000 gallons, per 1,000 gallons	$	3.64

Year		11	12	13	14	15	16	17	18	19	20
YEAR		**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Estimated Number of Connections		25327	26087	26870	27676	28506	29361	30242	31150	32084	33047
Average Water Use per Connection (gal/mo)		15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240
Water Use Base Rate Per Month + Capital Renewal Fee	$	14.12	$ 14.12	$ 14.12	$ 14.12	$ 14.12	$ 14.12	$ 14.12	$ 14.12	$ 14.12	$ 14.12
Water Use Rate (10,001-45,000 gallons)	$	2.42	$ 2.42	$ 2.42	$ 2.42	$ 2.42	$ 2.42	$ 2.42	$ 2.42	$ 2.42	$ 2.42
Monthly Water Use Fee per Connection	$	46.16	$ 46.16	$ 46.16	$ 46.16	$ 46.16	$ 46.16	$ 46.16	$ 46.16	$ 46.16	$ 46.16
Yearly Water Use Fee per Connection	$	553.93	$ 553.93	$ 553.93	$ 553.93	$ 553.93	$ 553.93	$ 553.93	$ 553.93	$ 553.93	$ 553.93
Base vs Adjusted Monthly Increase Per Connection	$	3.16	$ 3.16	$ 3.16	$ 3.16	$ 3.16	$ 3.16	$ 3.16	$ 3.16	$ 3.16	$ 3.16
Base vs Adjusted Annual Increase Per Connection	$	37.92	$ 37.92	$ 37.92	$ 37.92	$ 37.92	$ 37.92	$ 37.92	$ 37.92	$ 37.92	$ 37.92
REVENUES:											
Water Use Income:	$	14,029,623.19	$ 14,450,511.88	$ 14,884,027.24	$ 15,330,548.06	$ 15,790,464.50	$ 16,264,178.43	$ 16,752,103.79	$ 17,254,666.90	$ 17,772,306.91	$ 18,305,476.11
Total Revenues:	$	14,029,623.19	$ 14,450,511.88	$ 14,884,027.24	$ 15,330,548.06	$ 15,790,464.50	$ 16,264,178.43	$ 16,752,103.79	$ 17,254,666.90	$ 17,772,306.91	$ 18,305,476.11
OPERATION & MAINTENANCE EXPENSES:											
Employee Salaries	$	40,317.49	$ 41,527.02	$ 42,772.83	$ 44,056.01	$ 45,377.69	$ 46,739.02	$ 48,141.19	$ 49,585.43	$ 51,072.99	$ 52,605.18
Employee Benefits	$	15,119.06	$ 15,572.63	$ 16,039.81	$ 16,521.00	$ 17,016.63	$ 17,527.13	$ 18,052.95	$ 18,594.54	$ 19,152.37	$ 19,726.94
Equipment Supplies	$	4,300.53	$ 4,429.55	$ 4,562.43	$ 4,699.31	$ 4,840.29	$ 4,985.50	$ 5,135.06	$ 5,289.11	$ 5,447.79	$ 5,611.22
System Maintenance	$	16,127.00	$ 16,610.81	$ 17,109.13	$ 17,622.40	$ 18,151.08	$ 18,695.61	$ 19,256.48	$ 19,834.17	$ 20,429.20	$ 21,042.07
Office Supplies	$	391.43	$ 403.17	$ 415.27	$ 427.73	$ 440.56	$ 453.78	$ 467.39	$ 481.41	$ 495.85	$ 510.73
Subconsultant Engineering	$	4,703.71	$ 4,844.82	$ 4,990.16	$ 5,139.87	$ 5,294.06	$ 5,452.89	$ 5,616.47	$ 5,784.97	$ 5,958.52	$ 6,137.27
Travel & Education	$	3,359.79	$ 3,460.58	$ 3,564.40	$ 3,671.33	$ 3,781.47	$ 3,894.92	$ 4,011.77	$ 4,132.12	$ 4,256.08	$ 4,383.77
Vehicle Lease/Finance	$	4,838.10	$ 4,983.24	$ 5,132.74	$ 5,286.72	$ 5,445.32	$ 5,608.68	$ 5,776.94	$ 5,950.25	$ 6,128.76	$ 6,312.62
Administrative Services	$	4,838.10	$ 4,983.24	$ 5,132.74	$ 5,286.72	$ 5,445.32	$ 5,608.68	$ 5,776.94	$ 5,950.25	$ 6,128.76	$ 6,312.62
ADEQ Permitting	$	403.17	$ 415.27	$ 427.73	$ 440.56	$ 453.78	$ 467.39	$ 481.41	$ 495.85	$ 510.73	$ 526.05
Power Consumption	$	115,984.02	$ 119,463.54	$ 123,047.44	$ 126,738.87	$ 130,541.03	$ 134,457.26	$ 138,490.98	$ 142,645.71	$ 146,925.08	$ 151,332.83
Operation & Maintenance Expenses:	$	210,382.40	$ 216,693.87	$ 223,194.69	$ 229,890.53	$ 236,787.24	$ 243,890.86	$ 251,207.59	$ 258,743.81	$ 266,506.13	$ 274,501.31
City Expenditures	$	13,069,206.36	$ 13,461,282.55	$ 13,865,121.02	$ 14,281,074.65	$ 14,709,506.89	$ 15,150,792.10	$ 15,605,315.86	$ 16,073,475.34	$ 16,555,679.60	$ 17,052,349.99
Net Revenue Less Expense:	$	750,034.43	$ 772,535.47	$ 795,711.53	$ 819,582.88	$ 844,170.36	$ 869,495.47	$ 895,580.34	$ 922,447.75	$ 950,121.18	$ 978,624.82
DEBT SERVICE EXPENSE:											
WIFA Loan ($8,232,500, 20years @ 3%):	$	555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74
Debt Service Reserve	$	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Debt Service Payment	$	555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74	$ 555,201.74
NET REVENUE LESS EXPENSES	$	194,832.69	$ 217,333.72	$ 240,509.79	$ 264,381.13	$ 288,968.62	$ 314,293.73	$ 340,378.59	$ 367,246.00	$ 394,919.44	$ 423,423.07
CUMULATIVE REVENUE LESS EXPENSES	$	1,039,552.35	$ 1,256,886.08	$ 1,497,395.86	$ 1,761,776.99	$ 2,050,745.61	$ 2,365,039.34	$ 2,705,417.93	$ 3,072,663.94	$ 3,467,583.37	$ 3,891,006.44

[1] From US Census Bureau website:
http://quickfacts.census.gov/qfd/states/04/0437620.html
[2] Estimated number of connections provided from The City of Kingman
Financial Servises Department
[3] From The City of Kingman Water System Master Plan by C5
Engineering, Inc. (May 25, 2005)

APPENDIX H

Capital Savings Analysis

SUNRISE ENGINEERING, INC.
2152 S. Vineyard, Suite 123
Mesa, Arizona 85210
Tel: (480) 768-8600 Fax: (480) 768-8609

Engineer's Opinion of Probable Cost *

Project: Reclaimed Water Re-Use Study
Option 2 - Airport Industrial Park Reuse Capital Savings
Owner: City of Kingman
Prepared By: JV

No.	Item Description - Construction	QTY	Unit	Unit Price	Total
	Option 2 Capital Savings				
1	220 GPM Well (includes well, pump, motor, control valves, chlorination and yard piping)	1	LS	$850,000	$850,000
2	220 GPM Booster Station (includes two pumps, valves, backflow preventer, flowmeter, fittings, appurtenances and concrete pad)	1	LS	$80,000	$80,000
3	100,000 Gallon Steel Water Storage Tank, coating (interior/exterior) & Foundation	1	LS	$150,000	$150,000
4	Electrical & SCADA	1	LS	$250,000	$250,000
				Sub-Total A	**$1,330,000**
				25% Contingency	$333,000
				Professional Engineering Services	$160,000
				Construction Administration	$107,000
				GRAND TOTAL A	**$1,930,000**

*In providing opinions of probable construction cost the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer makes no warranty, expressed or implied, as the accuracy if such opinions compared to bid or actual costs.

SUNRISE ENGINEERING, INC.
2152 S. Vineyard, Suite 123
Mesa, Arizona 85210
Tel: (480) 768-8600 Fax: (480) 768-8609

Engineer's Opinion of Probable Cost *

Project: Reclaimed Water Re-Use Study
Option 3 - Golf Course Reuse Capital Savings
Owner: City of Kingman
Prepared By: JV

No.	Item Description - Construction	QTY	Unit	Unit Price	Total
	Option 3 Capital Savings				
1	700 GPM Well (includes well, pump, motor, control valves, chlorination and yard piping)	1	LS	$1,500,000	$1,500,000
2	700 GPM Booster Station (includes two pumps, valves, backflow preventer, flowmeter, fittings, appurtenances and concrete pad)	1	LS	$150,000	$150,000
3	500,000 Gallon Steel Water Storage Tank, coating (interior/exterior) & Foundation	1	LS	$560,000	$560,000
11	Electrical & SCADA	1	LS	$275,000	$275,000
				Sub-Total A	**$2,485,000**
				25% Contingency	$622,000
				Professional Engineering Services	$299,000
				Construction Administration Services	$199,000
				GRAND TOTAL	**$3,605,000**

APPENDIX I

Reuse Water Survey and Results

SUNRISE ENGINEERING

Date: December 16, 2015

To: Name
Company
Address 1
Address 2
Phone (000) 000-0000

Subject: **Kingman Water Reuse Survey – SEI Project No. 05726**

Dear Recipient,

On behalf of the City of Kingman, Sunrise Engineering requests your participation in a brief online survey that may affect how water is supplied to your facility. Please complete the enclosed survey at your earliest convenience and use the provided envelope to return it to Sunrise Engineering at no cost to you. If you prefer, the survey may also be completed online at the following web address:

https://www.surveymonkey.com/r/8LH5WFD

If you would like to receive future correspondence via email or if you have trouble completing the survey, please contact me at jvandegraaff@sunrise-eng.com. We value your input and thank you for your participation.

Sincerely,
SUNRISE ENGINEERING, INC.

Justin Van De Graaff, P.E.
Project Engineer

City of Kingman
Reuse Water Survey

In general, how important do you feel it is to reuse/recycle water in Kingman?

Unimportant Somewhat Important Important Very Important

How knowledgeable are you regarding water quality standards in Arizona?

Not at all Somewhat Knowledgeable Knowledgeable Very Knowledgeable

Approximately what percentage of water used at your facility comes in contact with food or beverages or is otherwise used for human consumption?

0% Less than 25% 25-50% 50-75% Greater than 75%

Do you have processes at your facility that could use A+ reclaimed water in lieu of drinking water?

Yes No

Does all of the water used at your facility need to be potable (drinkable)?

Yes No Unsure

Please indicate how much you agree with the following statements:

I would support using A+ reclaimed water at my facility because it is an environmentally friendly alternative.

Strongly disagree Disagree Neutral Agree Strongly Agree

I would support using A+ reclaimed water at my facility if it were cheaper than using drinking water.

Strongly disagree Disagree Neutral Agree Strongly Agree

I would support using A+ reclaimed water at other facilities in my area, but not mine.

Strongly disagree Disagree Neutral Agree Strongly Agree

I am opposed to the use of A+ reclaimed water in general.

Strongly disagree Disagree Neutral Agree Strongly Agree

If the City of Kingman were to provide A+ reclaimed water to my facility, I would connect to and use this new service.

Strongly disagree Disagree Neutral Agree Strongly Agree

SUNRISE ENGINEERING

City of Kingman- Water Reuse Survey Results

In general, how important do you feel it is to reuse/recycle water in Kingman?	Unimportant	Somewhat Important	Important	Very Important
	2	5	7	4

How knowledgeable are you regarding water quality standards in Arizona?	Not at All	Somewhat Knowledgeable	Knowledgeable	Very Knowledgeable
	7	7	3	1

Approximately what percentage of water used at your facility comes in contact with food or beverage or is otherwise used for human consumption?	0%	Less than 25%	25-50%	50-75%	Greater than 75%
	2	10	3	1	2

Do you have processes at your facility that could use A+ reclaimed water in lieu of drinking water?	Yes	No
	3	15

Does all of the water used at your facility need to be potable(drinkable)?	Yes	No	Unsure
	6	12	

I would support using A+ reclaimed water at my facility because it is an environmentally friendly alternative.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	4	1	4	6	3

I would support using A + reclaimed water at my facility if it were cheaper than using drinking water.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	3		**6**	**5**	**4**

I would support using A+ reclaimed water at other facilities in my area, but not mine.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	3	1	11	2	1

I am opposed to the use of A+ reclaimed water in general.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	6	9	2		1

If the city of Kingman were to provide A+ reclaimed water to my facility, I would connect to and use this new service.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	3	3	7	2	3

APPENDIX J

Distribution Line Size Analysis

City of Kingman
Option 1 - Onsite Well Injection
Line Sizing Analysis

FLOW

Average Flow	**675**	**gpm**
Max Flow	**675**	**gpm**

Water Elevation	
Point A	3240
Point B	3235
Difference	5

HEAD LOSS CALCULATIONS

Minor Loss Formula	$h_l = K_l*(V^2/(2g))$

Head Loss Formula	$hf = 10.44(L_{ft})(Q_{gpm})^{1.85}/C^{1.85}/dia_{in}^{4.8655}$

Enter the following information:

Pipe ID	10	in			Flow	694	gpm
Area of pipe	0.545	ft^2	Velocity	2.8	fps	1.55	cfs
Hazen-Williams coefficient	130				Length of Pipe	40	ft

FITTING	QTY	Coeff K_l	Total	Equiv. Length (ft)
VALVES				
Gate valve (fully open)	1	0.2	0.2	7.91
(3/4 open)		1	0	
(1/2 open)		5.6	0	
(1/4 open)		17	0	
Globe valve (fully open)		10	0	
Angle valve (fully open)		5	0	
Butterfly valve (fully open)		0.4	0	
Swing check valve (fully open)	1	2.5	2.5	98.92
Lift check valve (fully open)		12	0	
Ball check valve (fully open)		70	0	
Foot valve (fully open)		15	0	
Plug valve (fully open)		0.98	0	
MISCELLANEOUS				
Tee (Branch)		1	0	
Tee (Through)		0.2	0	
Flow meter		1	0	
Enlargement - estimate		1	0	
Reducer - estimate		0.06	0	
ENTRANCE				
Rounded	1	0.25	0.25	9.89
Square		0.5	0	
Reentrant		0.4	0	

FITTING	QTY	Coeff K_l	Total	Equiv. Length (ft)
BENDS				
90°				
bend rad / pipe dia				
1		0.5	0	
2		0.3	0	
4		0.25	0	
6		0.15	0	
8	1	0.15	0.15	5.94
45°				
bend rad / pipe dia				
1		0.37	0	
2		0.22	0	
4		0.19	0	
6		0.11	0	
8		0.11	0	
22.5°				
bend rad / pipe dia				
1		0.25	0	
2		0.15	0	
4		0.12	0	
6		0.08	0	
8		0.08	0	
Exit				
Exit	1	1	1	39.57

TOTAL MINOR LOSS COEFFICIENT **4.1**

Head loss due to minor losses	0.512	ft	Head loss due to pipe	0.13 ft
Equivalent length of minor losses	162.23	ft	**Total Combined Head Loss (Elevation, minor and pipe)**	**5.64 ft**
			Line Velocity	**2.84 fps**

City of Kingman
Option 2 - Airport Industrial Park Reuse
Line Sizing Analysis

FLOW

Average Flow	**135**	**gpm**
Max Flow	**217**	**gpm**

Water Elevation	
Point A	3390
Point B	3240
Difference	150
Minimum Required Pressure (ft)	92.4

HEAD LOSS CALCULATIONS

Minor Loss Formula $h_l = K_l*(V^2/(2g))$

Head Loss Formula $hf = 10.44(L_{ft})(Q_{gpm})^{1.85}/C^{1.85}/dia_{in}^{4.8655}$

Enter the following information:

Pipe ID 8 in

Area of pipe 0.349 ft^2

Velocity 1.4 fps

Flow 217 gpm

0.48 cfs

Hazen-Williams coefficient 130

Length of Pipe 22243 ft

FITTING	QTY	Coeff K_l	Total	Equiv. Length (ft)
VALVES				
Gate valve (fully open)	4	0.2	0.8	21.92
(3/4 open)		1	0	
(1/2 open)		5.6	0	
(1/4 open)		17	0	
Globe valve (fully open)		10	0	
Angle valve (fully open)		5	0	
Butterfly valve (fully open)		0.4	0	
Swing check valve (fully open)	2	2.5	5	137.00
Lift check valve (fully open)		12	0	
Ball check valve (fully open)		70	0	
Foot valve (fully open)		15	0	
Plug valve (fully open)		0.98	0	
MISCELLANEOUS				
Tee (Branch)		1	0	
Tee (Through)	1	0.2	0.2	5.48
Flow meter	1	1	1	27.40
Enlargement - estimate		1	0	
Reducer - estimate		0.06	0	
ENTRANCE				
Rounded	1	0.25	0.25	6.85
Square		0.5	0	
Reentrant		0.4	0	

FITTING	QTY	Coeff K_l	Total	Equiv. Length (ft)
BENDS				
90°				
bend rad / pipe dia				
1		0.5	0	
2		0.3	0	
4		0.25	0	
6		0.15	0	
8	5	0.15	0.75	20.55
45°				
bend rad / pipe dia				
1		0.37	0	
2		0.22	0	
4		0.19	0	
6		0.11	0	
8	2	0.11	0.22	6.03
22.5°				
bend rad / pipe dia				
1		0.25	0	
2		0.15	0	
4		0.12	0	
6		0.08	0	
8		0.08	0	
Exit				
Exit	1	1	1	27.40

TOTAL MINOR LOSS COEFFICIENT **9.22**

Head loss due to minor losses 0.275 ft

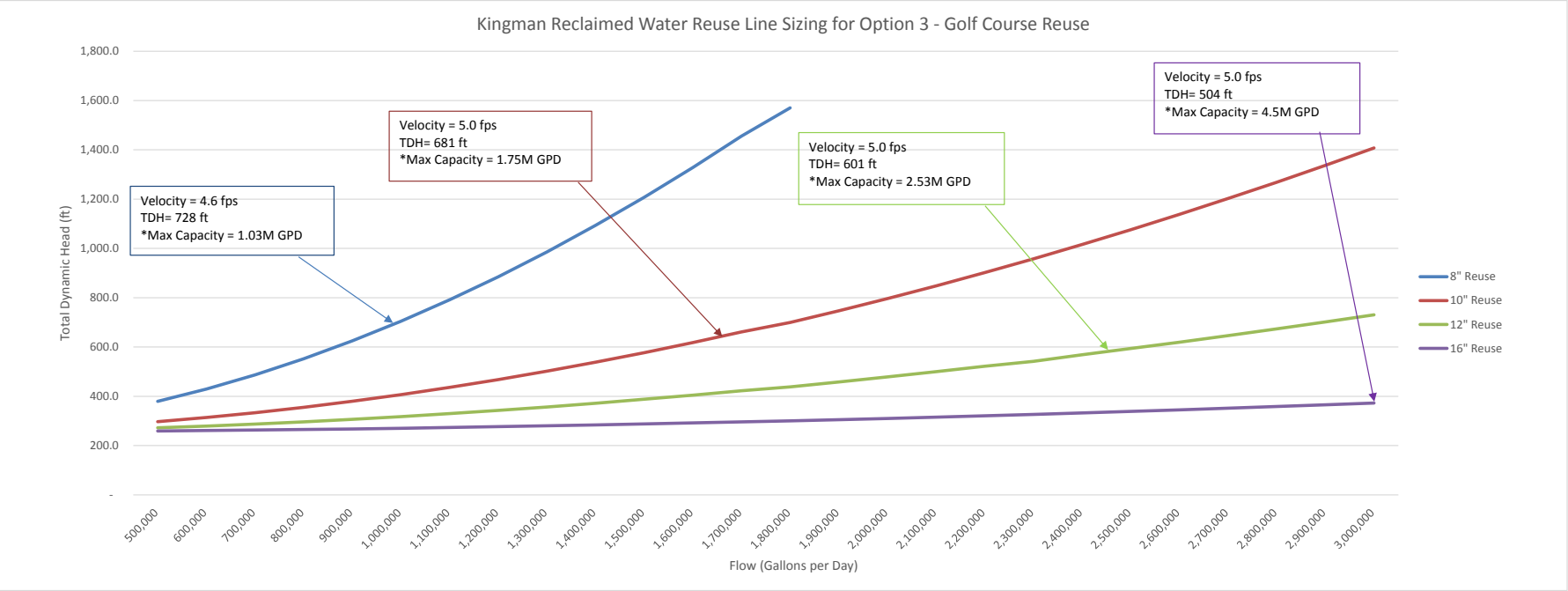
Equivalent length of minor losses 252.62 ft

Head loss due to pipe 24.19 ft

Total Combined Head Loss (Elevation, Minor and Pipe) **266.86 ft**

Line Velocity **1.39 fps**

The City of Kingman Reclaimed Water Reuse Study
Option 3 - Golf Course, Schools and Parks Reuse
Line Sizing vs Capacity vs Costs



*Max Capacity is based on a max velocity of approximatley 5ft/sec in the line and a max pressure of 90% of 350 psi = 315 psi (728 ft head).

Reuse Line Size and Type	Max Capacity (GPD)	Max Capacity (GPM)	**$/LF	LF	***Total Cost
8" Reuse Line	910,000	632	$ 65	46,700	$ 3,035,500
10" Reuse Line	1,650,000	1,146	$ 75	46,700	$ 3,502,500
12" Reuse Line	2,525,000	1,753	$ 80	46,700	$ 3,736,000
16" Reuse Line	4,000,000	2,778	$ 95	46,700	$ 4,436,500

**$/LF is an average between the costs of DIP and C-900, assuming the lower 1/2 of the line will be DIP and the upper 1/2 will be C-900. This assumption has been made due to the higher pressures that will be experienced in the lower 1/2 the reuse line.

***Total cost are the Engineer's estimate made on the basis of the Engineer's qualifications and experienceand are not actual construction costs. The Engineer makes no warranty, expressed or implied, as the accuracy if such opinions compared to bid or actual costs.

A. Ductile Iron Pipe has a working pressure rating of 350 psi (All sizes)
B. C-900 (DR-14) has a working pressure rating of 305 psi and comes in sizes 4" through 12"
C. C-909 (DR-18) has a working pressure of 235 psi and comes in sizes 14" to 24"

City of Kingman

Option 3 - Golf Course, Schools and Parks Reuse

CURRENT Line Sizing Analysis

The pipe will be completely submerged, therefore the the Hazen Williams method will be used

FLOW

Average Flow	**700**	**gpm**
Max Flow	**700**	**gpm**

Water Elevation	
Point A	3490
Point B	3240
Difference	250

HEAD LOSS CALCULATIONS

Minor Loss Formula	$h_l = K_l*(V^2/(2g))$

Head Loss Formula	$hf = 10.44(L_{ft})(Q_{gpm})^{1.85}/C^{1.85}/dia_{in}^{4.8655}$

Enter the following information:

Pipe ID	12	in			Flow	700	gpm
Area of pipe	0.785	ft^2	Velocity	1.99	fps	1.56	cfs
Hazen-Williams coefficient	130				Length of Pipe	47000	ft

FITTING	QTY	Coeff K_l	Total	Equiv. Length (ft)	FITTING	QTY	Coeff K_l	Total	Equiv. Length (ft)
VALVES					**BENDS**				
Gate valve (fully open)	8	0.2	1.6	74.23	90°				
(3/4 open)		1	0		bend rad / pipe dia				
(1/2 open)		5.6	0		1		0.5	0	
(1/4 open)		17	0		2		0.3	0	
Globe valve (fully open)		10	0		4		0.25	0	
Angle valve (fully open)		5	0		6		0.15	0	
Butterfly valve (fully open)		0.4	0		8	15	0.15	2.25	104.38
Swing check valve (fully open)	2	2.5	5	231.96	45°				
Lift check valve (fully open)		12	0		bend rad / pipe dia				
Ball check valve (fully open)		70	0		1		0.37	0	
Foot valve (fully open)		15	0		2		0.22	0	
Plug valve (fully open)		0.98	0		4		0.19	0	
					6		0.11	0	
MISCELLANEOUS					8	2	0.11	0.22	10.21
Tee (Branch)		1	0		22.5°				
Tee (Through)	1	0.2	0.2	9.28	bend rad / pipe dia				
Flow meter	1	1	1	46.39	1		0.25	0	
Enlargement - estimate		1	0		2		0.15	0	
Reducer - estimate		0.06	0		4		0.12	0	
					6		0.08	0	
ENTRANCE					8		0.08	0	
Rounded	1	0.25	0.25	11.60					
Square		0.5	0		**Exit**				
Reentrant		0.4	0		Exit	1	1	1	46.39

TOTAL MINOR LOSS COEFFICIENT **11.52**

Head loss due to minor losses	0.705	ft	Head loss due to pipe	62.04	ft
Equivalent length of minor losses	534.44	ft	**Total Combined Head Loss**	**312.75**	**ft**
			Line Velocity	**1.99**	**fps**

City of Kingman

Option 3 - Golf Course, Schools and Parks Reuse

FUTURE Line Sizing Analysis

The pipe will be completely submerged, therefore the the Hazen Williams method will be used

FLOW

Average Flow	**1,760**	**gpm**
Max Flow	**1,760**	**gpm**

Water Elevation	
Point A	3490
Point B	3240
Difference	250

HEAD LOSS CALCULATIONS

Minor Loss Formula	$h_l = K_l*(V^2/(2g))$

Head Loss Formula	$hf = 10.44(L_{ft})(Q_{gpm})^{1.85}/C^{1.85}/dia_{in}^{4.8655}$

Enter the following information:

Pipe ID	12	in			Flow	1,760	gpm
Area of pipe	0.785	ft^2	Velocity	4.99	fps	3.92	cfs
Hazen-Williams coefficient	130				Length of Pipe	47000	ft

FITTING	QTY	Coeff K_l	Total	Equiv. Length (ft)	FITTING	QTY	Coeff K_l	Total	Equiv. Length (ft)
VALVES					**BENDS**				
Gate valve (fully open)	8	0.2	1.6	85.24	90°				
(3/4 open)		1	0		bend rad / pipe dia				
(1/2 open)		5.6	0		1		0.5	0	
(1/4 open)		17	0		2		0.3	0	
Globe valve (fully open)		10	0		4		0.25	0	
Angle valve (fully open)		5	0		6		0.15	0	
Butterfly valve (fully open)		0.4	0		8	15	0.15	2.25	119.86
Swing check valve (fully open)	2	2.5	5	266.37	45°				
Lift check valve (fully open)		12	0		bend rad / pipe dia				
Ball check valve (fully open)		70	0		1		0.37	0	
Foot valve (fully open)		15	0		2		0.22	0	
Plug valve (fully open)		0.98	0		4		0.19	0	
					6		0.11	0	
MISCELLANEOUS					8	2	0.11	0.22	11.72
Tee (Branch)		1	0		22.5°				
Tee (Through)	1	0.2	0.2	10.65	bend rad / pipe dia				
Flow meter	1	1	1	53.27	1		0.25	0	
Enlargement - estimate		1	0		2		0.15	0	
Reducer - estimate		0.06	0		4		0.12	0	
					6		0.08	0	
ENTRANCE					8		0.08	0	
Rounded	1	0.25	0.25	13.32					
Square		0.5	0		**Exit**				
Reentrant		0.4	0		Exit	1	1	1	53.27

TOTAL MINOR LOSS COEFFICIENT **11.52**

Head loss due to minor losses	4.460	ft	Head loss due to pipe	341.54	ft
Equivalent length of minor losses	613.71	ft	**Total Combined Head Loss**	**596.00**	**ft**
			Line Velocity	**4.99**	**fps**

APPENDIX K

Benefits Analysis

City of Kingman
Reclaimed Water Reuse Study Option 1, 2 & 3 Summary
Benefits Analysis

	Selection Criteria	Possible Points	Selection Criteria Description	Option 1 Score	Option 2 Score	Option 3 Score
1	Capital Cost	**30**	Option scores higher if it has a lower capital cost	**30**	**5**	**10**
2	Long Term O&M	**30**	Option scores higher if it has a lower long term O&M cost	**30**	**5**	**15**
3	Option Reduces Drinking Water System Requirements	**30**	Option scores higher if it provides for future drinking water infrastructure savings	**0**	**15**	**30**
4	Option has Community Economic Impact	**30**	Option scores higher if it offers positive impact for current/future Community Economy and provides for future development connection	**0**	**30**	**20**
5	Option is Flexibility/Scalable	**25**	Option scores higher for it's ease of flexibility with other Options or if it is scalable for future growth	**5**	**13**	**20**
6	Option is Eligible for Green Funding	**20**	Option scores higher if it is eligible for green funding through WIFA	**20**	**20**	**20**
7	Option Negatively Affects User Base Rates	**15**	Option scores lower if the user base rates must be adjusted to fund the Option	**15**	**0**	**10**
8	Option Recharges Groundwater	**10**	Option scores higher for the more amount of groundwater it recharges	**10**	**4**	**0**
9	Ease/Cost of Permitting	**5**	Option scores higher if the ADEQ permitting costs and maintenance are low	**5**	**2**	**2**
10	Ease of Constructability	**5**	Option scores higher if the project is easier to contruct and less of the community is impacted during construction	5	1	2
	Total Possible Points	**200**		**120**	**95**	**129**

City of Kingman
Reclaimed Water Reuse Study Option 1 - Groundwater Injection
Benefits Analysis

	Selection Criteria	Possible Points	Selection Criteria Description	Option 1 Score	Scoring Comments
1	Capital Cost	**30**	Option scores higher if it has a lower capital cost	**30**	Option 1 has the lowest capital cost
2	Long Term O&M	**30**	Option scores higher if it has a lower long term O&M cost	**30**	Option 1 has the lowest long term O&M costs
3	Option Reduces Drinking Water System Requirements	**30**	Option scores higher if it provides for future drinking water infrastructure savings	**0**	Option 1 offers no savings to the City's drinking water infrastructure
4	Option has Community Economic Impact	**30**	Option scores higher if it offers positive impact for current/future Community Economy and provides for future development connection	**0**	Option 1 offers no positive impact to the community economy as there are no connections for future developments
5	Option is Flexibility/Scalable	**25**	Option scores higher for it's ease of flexibility with other Options or if it is scalable for future growth	**5**	Option is scalable, but incorporating the other Options would add significant costs to this Option
6	Option is Eligible for Green Funding	**20**	Option scores higher if it is eligible for green funding through WIFA	**20**	Option qualifies for WIFA funding
7	Option Negatively Affects User Base Rates	**15**	Option scores lower if the user base rates must be adjusted to fund the Option	**15**	User base rates for Option 1 woould increse the least, if at all
8	Option Recharges Groundwater	**10**	Option scores higher for the more amount of groundwater it recharges	**10**	Option 1 offers the most groundwater recharge
9	Ease/Cost of Permitting	**5**	Option scores higher if the ADEQ permitting costs and maintenance are low	**5**	Although Option 1 ADEQ permit fees are initially high, the permit is valid for the life of the WWTF
10	Ease of Constructability	**5**	Option scores higher if the project is easier to construct and less of the community is impacted during construction	**5**	Option 1 is the easiest to construct and has no negative impact to the community during construction
	Total Possible Points	**200**		**120**	

City of Kingman
Reclaimed Water Reuse Study Option 2 - Airport Industrial Park Reuse
Benefits Analysis

	Selection Criteria	Possible Points	Selection Criteria Description	Option 2 Score	Scoring Comments
1	Capital Cost	**30**	Option scores higher if it has a lower capital cost	**5**	Option 2 has the highest capital cost
2	Long Term O&M	**30**	Option scores higher if it has a lower long term O&M cost	**5**	Option 2 has the highest long term O&M cost
3	Option Reduces Drinking Water System Requirements	**30**	Option scores higher if it provides for future drinking water infrastructure savings	**15**	Option 2 provides less than 400K GPD (after 20-years) of water system infrastructure savings
4	Option has Community Economic Impact	**30**	Option scores higher if it offers positive impact for current/future Community Economy and provides for future development connection	**30**	Option 2 offers a positie impact to the current and future community economy
5	Option is Flexibility/Scalable	**25**	Option scores higher for it's ease of flexibility with other Options or if it is scalable for future growth	**13**	Option 2 is flexible with the other 2 Options and is scalable
6	Option is Eligible for Green Funding	**20**	Option scores higher if it is eligible for green funding through WIFA	**20**	Option qualifies for WIFA funding
7	Option Negatively Affects User Base Rates	**15**	Option scores lower if the user base rates must be adjusted to fund the Option	**0**	Raised user base rates would only affect the Airpark tenants and would raise significantly higher than any other Option
8	Option Recharges Groundwater	**10**	Option scores higher for the more amount of groundwater it recharges	**4**	Option 2 provides for less than 300K GPD of groundwater recharge
9	Ease/Cost of Permitting	**5**	Option scores higher if the ADEQ permitting costs and maintenance are low	**2**	Although initial ADEQ permitting costs are low, the permitting would need to be renewed every five years. Also, the City would have the responsibilty to enforce ADEQ requirements at all facilities that use reclaimed water
10	Ease of Constructability	**5**	Option scores higher if the project is easier to construct and less of the community is impacted during construction	**1**	Option 2 would require construction phasing, crossings at multiple streets and would impact the Airport and the industrial Park
	Total Possible Points	**200**		**95**	

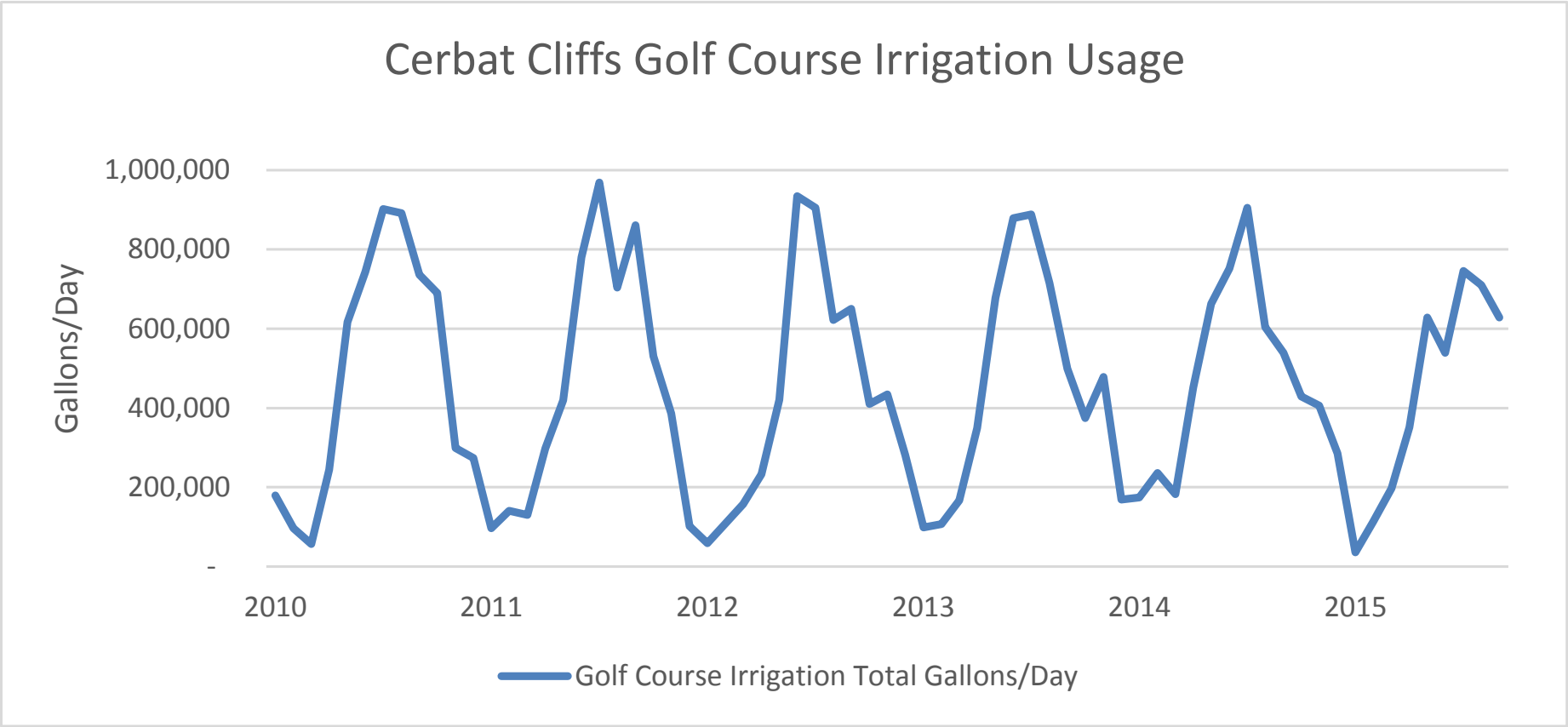
City of Kingman
Reclaimed Water Reuse Study
Benefits Analysis

Option 3 - Golf Course, School and Parks Reuse

	Selection Criteria	Possible Points	Selection Criteria Description	Option 3 Score	Scoring Comments
1	Capital Cost	**30**	Option scores higher if it has a lower capital cost	**10**	Option 3 capital costs are significantly higher than Option 1 but less than Option 2
2	Long Term O&M	**30**	Option scores higher if it has a lower long term O&M cost	**15**	Option 3 long term O&M costs are more than Option 1 but less than Option 2
3	Option Reduces Drinking Water System Requirements	**30**	Option scores higher if it provides for future drinking water infrastructure savings	**30**	Option 3 provides approximatley 1 million GPD of water system infrastructure savings immediatley
6	Option has Community Economic Impact	**30**	Option scores higher if it offers positive impact for current/future Community Economy and provides for future development connection	**20**	Option 3 offers a positie impact to the current and future community economy
5	Option is Flexibility/Scalable	**25**	Option scores higher for it's ease of flexibility with other Options or if it is scalable for future growth	**20**	Option 3 has the most flexibility with the other Options and is scalable
4	Option is Eligible for Green Funding	**20**	Option scores higher if it is eligible for green funding through WIFA	**20**	All of Option 3 is eligible for WIFA funding
7	Option Negatively Affects User Base Rates	**15**	Option scores lower if the user base rates must be adjusted to fund the Option	**10**	Raised user base rates would affect the the entire City and would slightly need to be raised
8	Option Recharges Groundwater	**10**	Option scores higher for the more amount of groundwater it recharges	**0**	Option 3 offers no groundwater recharge
9	Ease/Cost of Permitting	**5**	Option scores higher if the ADEQ permitting costs and maintenance are low	**2**	Although initial ADEQ permitting costs are low, the permitting would need to be renewed every five years. Also, the City would have the responsibilty to enforce ADEQ requirements at all facilities that use reclaimed water
10	Ease of Constructability	**5**	Option scores higher if the project is easier to construct and less of the community is impacted during construction	**2**	The majority of Option 3 follows the Mohave Wash alignment and has less community impact during construction than Option 2.
	Total Possible Points	**200**		**129**	

APPENDIX L

Golf Course, Schools and Parks Flows and Calculations


Cerbat Cliffs Golf Course Irrigation Usage
Gallons/Day
1,000,000
800,000
600,000
400,000
200,000
-
2010
2011
2012
2013
2014
2015
Golf Course Irrigation Total Gallons/Day

City of Kingman
Cerbat Cliffs Golf Course
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2010											
Name	**Service Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golf Course Irrigation	Gates Avenue	6	23757	97.42	44.82	26.29	106.17	265.48	298.00	375.65	369.52	312.00	293.87	132.67	124.52
Golf Course Irrigation	1003 Gates Ave	6	25049	24.35	13.00	9.19	35.40	96.39	117.90	133.48	136.68	97.77	108.19	48.77	38.84
Golf Course Irrigation	1005 Gates Ave	6	25051	24.06	15.25	8.68	41.63	98.97	126.13	159.52	153.58	131.27	106.81	49.50	40.87
Golf Course Irrigation	1007 Gates Ave	6	25053	21.19	13.75	7.74	36.50	89.65	118.07	144.65	140.61	120.10	108.32	37.67	42.19
Golf Course Irrigation	1009 Gates Ave	6	25055	11.90	8.93	4.55	24.90	64.52	82.10	87.68	89.84	74.10	71.26	28.13	26.68
Golf Course Irrigation	1013 Gates Ave	6	28703	1.04	0.47	0.00	0.11	1.46	1.75	1.57	1.41	0.98	1.36	1.88	0.47
Golf Course Irrigation	Total Gallons/Day			179,971	96,221	56,452	244,707	616,455	743,953	902,542	891,636	736,216	689,808	298,615	273,569

2010 Avg Usage	477,512
2010 Peak Usage	902,542
2010 Min Usage	56,452
2010-2014 Avg Usage	456,625
2010-2014 Peak Usage	968,936
2010-2014 Min Usage	56,452

City of Kingman
Cerbat Cliffs Golf Course
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2011											
Name	**Service Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golf Course Irrigation	Gates Avenue	6	23757	55.81	80.71	69.68	147.33	174.19	328.33	408.39	296.77	370.33	225.16	187.17	52.90
Golf Course Irrigation	1003 Gates Ave	6	25049	9.71	2.96	3.61	23.03	72.39	117.90	157.13	107.19	127.77	81.10	54.83	17.16
Golf Course Irrigation	1005 Gates Ave	6	25051	11.68	22.04	22.32	49.60	65.87	135.00	158.90	121.90	141.30	87.42	56.53	10.55
Golf Course Irrigation	1007 Gates Ave	6	25053	11.39	20.57	20.45	44.83	60.90	120.57	147.84	107.77	130.00	81.68	54.00	13.19
Golf Course Irrigation	1009 Gates Ave	6	25055	8.03	14.04	14.29	32.37	45.32	77.43	95.90	69.71	90.27	54.65	33.47	7.13
Golf Course Irrigation	1013 Gates Ave	6	28703	0.51	0.54	0.09	0.38	0.59	0.81	0.77	0.81	1.07	0.51	0.52	0.50
Golf Course Irrigation	Total Gallons/Day			97,124	140,860	130,449	297,547	419,267	780,047	968,936	704,163	860,734	530,512	386,518	101,437

2011 Avg Usage	451,466
2011 Peak Usage	968,936
2011 Min Usage	97,124

City of Kingman
Cerbat Cliffs Golf Course
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	29	31	30	31	30	31	31	30	31	30	31
				2012											
Name	**Service Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golf Course Irrigation	Gates Avenue	6	23757	27.10	47.07	73.55	104.00	176.77	382.00	378.39	270.97	284.00	175.32	187.83	120.97
Golf Course Irrigation	1003 Gates Ave	6	25049	12.77	27.28	33.10	38.87	81.90	151.90	142.35	92.97	104.67	63.45	67.87	46.26
Golf Course Irrigation	1005 Gates Ave	6	25051	7.23	13.97	22.10	35.30	66.71	165.97	162.16	103.10	106.97	70.39	74.03	48.06
Golf Course Irrigation	1007 Gates Ave	6	25053	7.26	11.59	14.26	32.80	56.48	140.93	135.29	98.48	94.10	60.97	64.37	41.81
Golf Course Irrigation	1009 Gates Ave	6	25055	4.06	8.10	14.32	21.53	38.19	92.37	85.87	55.55	59.37	39.94	39.60	24.19
Golf Course Irrigation	1013 Gates Ave	6	28703	0.00	0.51	0.58	0.37	0.66	1.07	0.68	0.65	0.77	0.47	0.46	0.28
Golf Course Irrigation	Total Gallons/Day			58,422	108,510	157,906	232,872	420,726	934,236	904,746	621,715	649,873	410,530	434,159	281,569

2012 Avg Usage	434,605
2012 Peak Usage	934,236
2012 Min Usage	58,422

City of Kingman
Cerbat Cliffs Golf Course
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2013											
Name	**Service Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golf Course Irrigation	Gates Avenue	6	23757	40.00	53.21	65.32	118.83	295.81	376.67	379.68	305.32	214.17	163.23	204.67	78.71
Golf Course Irrigation	1003 Gates Ave	6	25049	19.26	11.68	30.13	85.10	105.97	129.03	128.61	103.06	72.13	53.19	75.57	25.94
Golf Course Irrigation	1005 Gates Ave	6	25051	17.00	17.29	29.45	59.73	114.94	150.17	159.23	125.48	87.77	64.77	79.30	26.06
Golf Course Irrigation	1007 Gates Ave	6	25053	12.39	15.36	26.42	51.67	100.81	138.20	133.29	109.42	75.33	56.06	72.83	23.19
Golf Course Irrigation	1009 Gates Ave	6	25055	10.00	9.89	16.10	34.20	59.97	85.10	86.90	71.35	49.87	37.19	45.70	14.42
Golf Course Irrigation	1013 Gates Ave	6	28703	0.02	0.02	0.00	0.18	0.20	0.27	0.63	0.51	0.55	0.49	0.60	0.76
Golf Course Irrigation	Total Gallons/Day			98,666	107,446	167,419	349,708	677,688	879,439	888,343	715,159	499,816	374,937	478,662	169,082

2013 Avg Usage	450,530
2013 Peak Usage	888,343
2013 Min Usage	98,666

City of Kingman
Cerbat Cliffs Golf Course
Irrigation Meter Readings
(in thousand gallons)

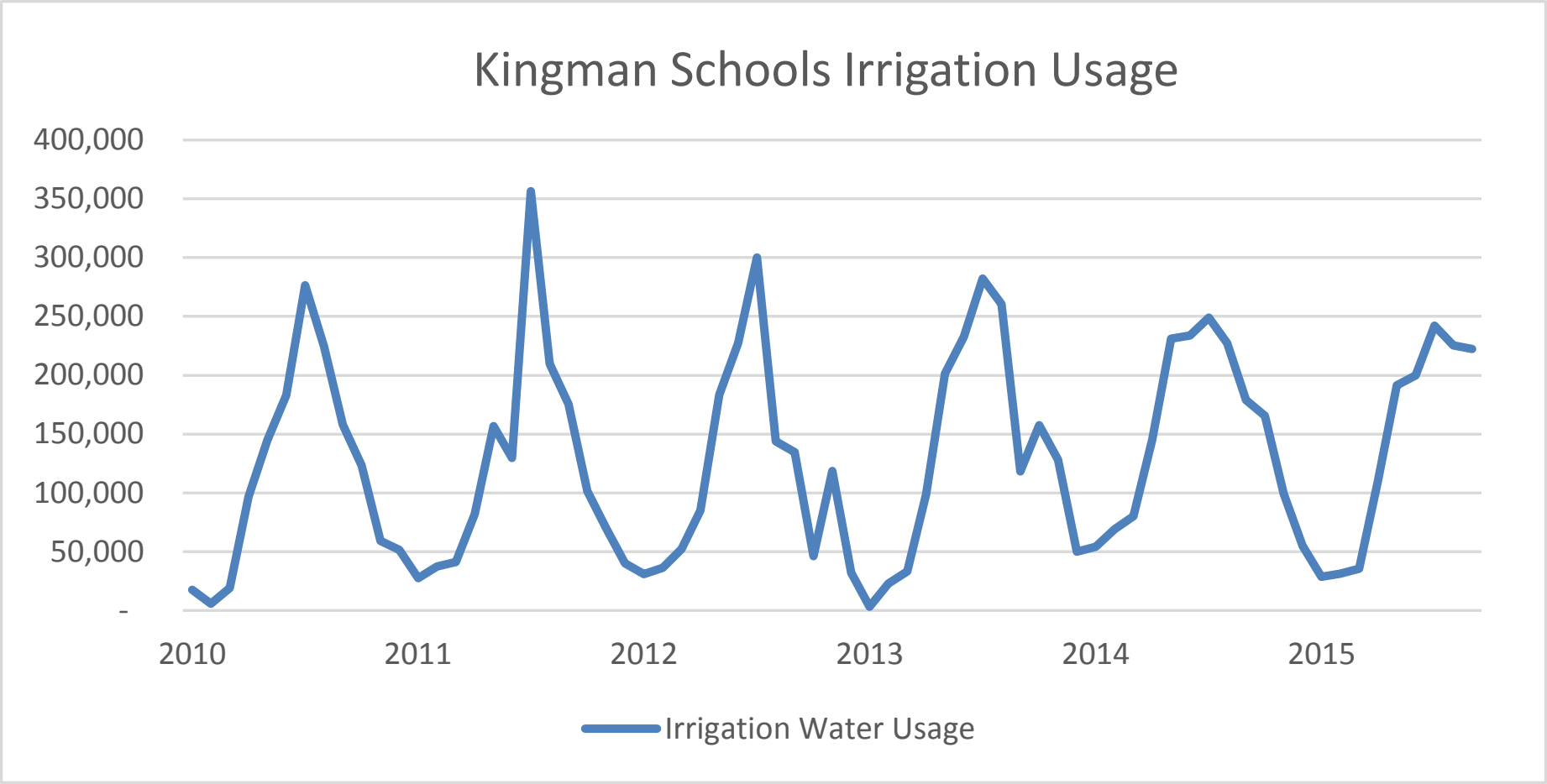
			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2014											
Name	**Service Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golf Course Irrigation	Gates Avenue	6	23757	79.35	106.07	83.39	192.50	294.35	324.83	398.39	262.58	222.00	186.13	181.17	122.10
Golf Course Irrigation	1003 Gates Ave	6	25049	25.48	35.18	24.68	63.37	93.68	101.90	117.23	85.13	73.30	56.65	56.23	41.52
Golf Course Irrigation	1005 Gates Ave	6	25051	28.61	38.71	32.71	82.00	116.35	131.93	160.87	105.71	100.40	74.81	65.10	49.84
Golf Course Irrigation	1007 Gates Ave	6	25053	24.94	33.79	25.58	69.90	99.00	111.87	137.55	90.81	83.57	68.03	65.93	45.45
Golf Course Irrigation	1009 Gates Ave	6	25055	15.35	22.32	16.71	43.63	58.65	80.60	90.87	59.06	59.33	43.48	37.23	26.23
Golf Course Irrigation	1013 Gates Ave	6	28703	0.25	0.00	0.00	0.42	0.49	0.44	0.39	0.49	0.44	0.41	0.48	0.21
Golf Course Irrigation	Total Gallons/Day			173,988	236,071	183,065	451,823	662,518	751,569	905,290	603,777	539,044	429,506	406,145	285,334

2014 Avg Usage	469,011
2014 Peak Usage	905,290
2014 Min Usage	173,988

City of Kingman
Cerbat Cliffs Golf Course
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2015											
Name	**Service Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golf Course Irrigation	Gates Avenue	6	23757	19.68	60.36	98.06	153.67	273.39	236.50	253.06	387.26	240.00	0.00	0.00	0.00
Golf Course Irrigation	1003 Gates Ave	6	25049	5.48	15.93	29.81	47.50	87.77	74.13	158.35	44.68	116.10	0.00	0.00	0.00
Golf Course Irrigation	1005 Gates Ave	6	25051	4.55	17.93	29.42	57.47	112.45	89.00	142.97	107.84	109.10	0.00	0.00	0.00
Golf Course Irrigation	1007 Gates Ave	6	25053	5.48	16.29	29.97	55.47	98.39	85.23	108.35	105.81	90.47	0.00	0.00	0.00
Golf Course Irrigation	1009 Gates Ave	6	25055	0.65	2.93	9.45	36.87	56.35	53.43	82.87	64.26	71.70	0.00	0.00	0.00
Golf Course Irrigation	1013 Gates Ave	6	28703	0.00	0.18	0.41	0.44	0.43	0.43	0.43	0.60	0.44	0.00	0.00	0.00
Golf Course Irrigation	Total Gallons/Day			35,839	113,609	197,118	351,403	628,787	538,731	746,044	710,444	627,805	-	-	-

2015 Avg Usage	329,148
2015 Peak Usage	746,044
2015 Min Usage	35,839


Kingman Schools Irrigation Usage
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-
2010
2011
2012
2013
2014
2015
Irrigation Water Usage

City of Kingman
City of Kingman Schools
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2010											
School	**Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Kingman High School	4182 Bank St	IRR16027	11597	-	-	1	4	5	10	16	15	10	9	1	0
Kingman High School	4182 Bank St	IRR16028	11597	10	1	15	70	118	146	208	161	103	67	32	22
		Total Gallons/Day		9,516	500	15,677	74,663	123,632	155,533	223,929	176,861	112,840	76,323	33,077	22,032
Kingman Middle School	1969 Detroit St	WA5896	23725	7	5	3	22	21	27	52	47	44	46	26	29
		Total Gallons/Day		6,526	5,232	3,303	21,773	21,077	27,367	52,074	47,232	44,223	46,332	25,790	29,019
Kingman Academy Middle School	3400 Burbank	IRR37868	40067	2	0	0	0	0	0	0	1	1	0	0	0
Kingman Academy Middle School	3269 Harrison	IRR37868	28979	-	-	-	-	-	-	-	-	0	-	-	-
		Total Gallons/Day		1,673	45	7	267	234	179	344	564	674	474	287	315
		Total Gallons/Day		17,715	5,778	18,988	96,704	144,943	183,079	276,347	224,657	157,737	123,129	59,153	51,367

2010 Avg Usage	113,300
2010 Max Usage	276,347
2010 Min Usage	5,778
2010-2014 Avg Usage	125,902
2010-2014 Max Usage	356,486
2010-2014 Min Usage	3,176

City of Kingman
City of Kingman Schools
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2011											
School	**Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Kingman High School	4182 Bank St	IRR16027	11597	1	4	5	13	12	16	12	13	14	6	5	2
Kingman High School	4182 Bank St	IRR16028	11597	12	31	28	59	133	70	279	145	111	61	38	19
		Total Gallons/Day		13,223	34,464	33,203	71,293	145,113	85,417	291,758	157,377	125,110	66,503	42,377	21,265
Kingman Middle School	1969 Detroit St	WA5896	23725	14	3	8	11	11	44	65	52	50	35	27	19
		Total Gallons/Day		14,265	2,764	7,742	10,540	11,326	43,873	64,542	52,287	50,243	34,935	27,267	18,658
Kingman Academy Middle School	3400 Burbank	IRR37868	40067	0	0	0	0	0	0	0	0	0	0	-	-
Kingman Academy Middle School	3269 Harrison	IRR37868	28979	-	-	-	-	-	-	-	-	-	-	-	-
		Total Gallons/Day		173	132	114	150	168	209	186	210	192	161	-	-
		Total Gallons/Day		27,660	37,360	41,059	81,983	156,607	129,499	356,486	209,875	175,546	101,599	69,643	39,923

2011 Avg Usage	118,937
2011 Max Usage	356,486
2011 Min Usage	27,660

City of Kingman
City of Kingman Schools
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	29	31	30	31	30	31	31	30	31	30	31
				2012											
School	**Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Kingman High School	4182 Bank St	IRR16027	11597	3	3	3	5	8	10	14	15	12	3	6	2
Kingman High School	4182 Bank St	IRR16028	11597	20	24	29	51	141	160	239	81	72	10	64	19
		Total Gallons/Day		22,703	27,400	31,726	56,270	149,487	170,343	252,584	96,277	83,533	13,161	70,500	21,355
Kingman Middle School	1969 Detroit St	WA5896	23725	8	9	21	29	34	57	47	48	51	33	48	10
		Total Gallons/Day		8,129	8,971	20,639	28,940	33,790	56,927	47,458	47,519	51,087	33,003	48,077	10,406
Kingman Academy Middle School	3400 Burbank	IRR37868	40067	0	-	0	-	0	0	0	0	0	-	0	0
Kingman Academy Middle School	3269 Harrison	IRR37868	28979	-	-	-	-	-	-	-	-	-	-	-	-
		Total Gallons/Day		1	-	1	-	93	160	170	145	125	-	107	132
		Total Gallons/Day		30,834	36,371	52,365	85,210	183,370	227,430	300,212	143,942	134,745	46,165	118,684	31,893

2012 Avg Usage	115,935
2012 Max Usage	300,212
2012 Min Usage	30,834

City of Kingman
City of Kingman Schools
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2013											
School	**Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Kingman High School	4182 Bank St	IRR16027	11597	0	2	2	3	11	13	16	23	17	12	8	0
Kingman High School	4182 Bank St	IRR16028	11597	0	17	26	80	158	158	206	161	47	113	65	7
		Total Gallons/Day		258	19,643	28,290	83,167	168,774	170,933	221,452	184,194	64,433	124,645	72,667	7,032
Kingman Middle School	1969 Detroit St	WA5896	23725	3	3	5	15	32	62	61	76	53	33	55	43
		Total Gallons/Day		2,771	2,929	4,790	15,480	32,268	61,547	60,613	75,739	53,477	32,784	55,190	42,713
Kingman Academy Middle School	3400 Burbank	IRR37868	40067	0	0	0	0	0	0	0	0	0	0	0	0
Kingman Academy Middle School	3269 Harrison	IRR37868	28979	0	0	-	-	-	-	-	-	-	-	-	-
		Total Gallons/Day		147	154	127	130	141	159	246	353	447	260	155	135
		Total Gallons/Day		3,176	22,725	33,208	98,777	201,183	232,639	282,311	260,285	118,357	157,689	128,012	49,880

2013 Avg Usage	132,354
2013 Max Usage	282,311
2013 Min Usage	3,176

City of Kingman
City of Kingman Schools
Irrigation Meter Readings
(in thousand gallons)

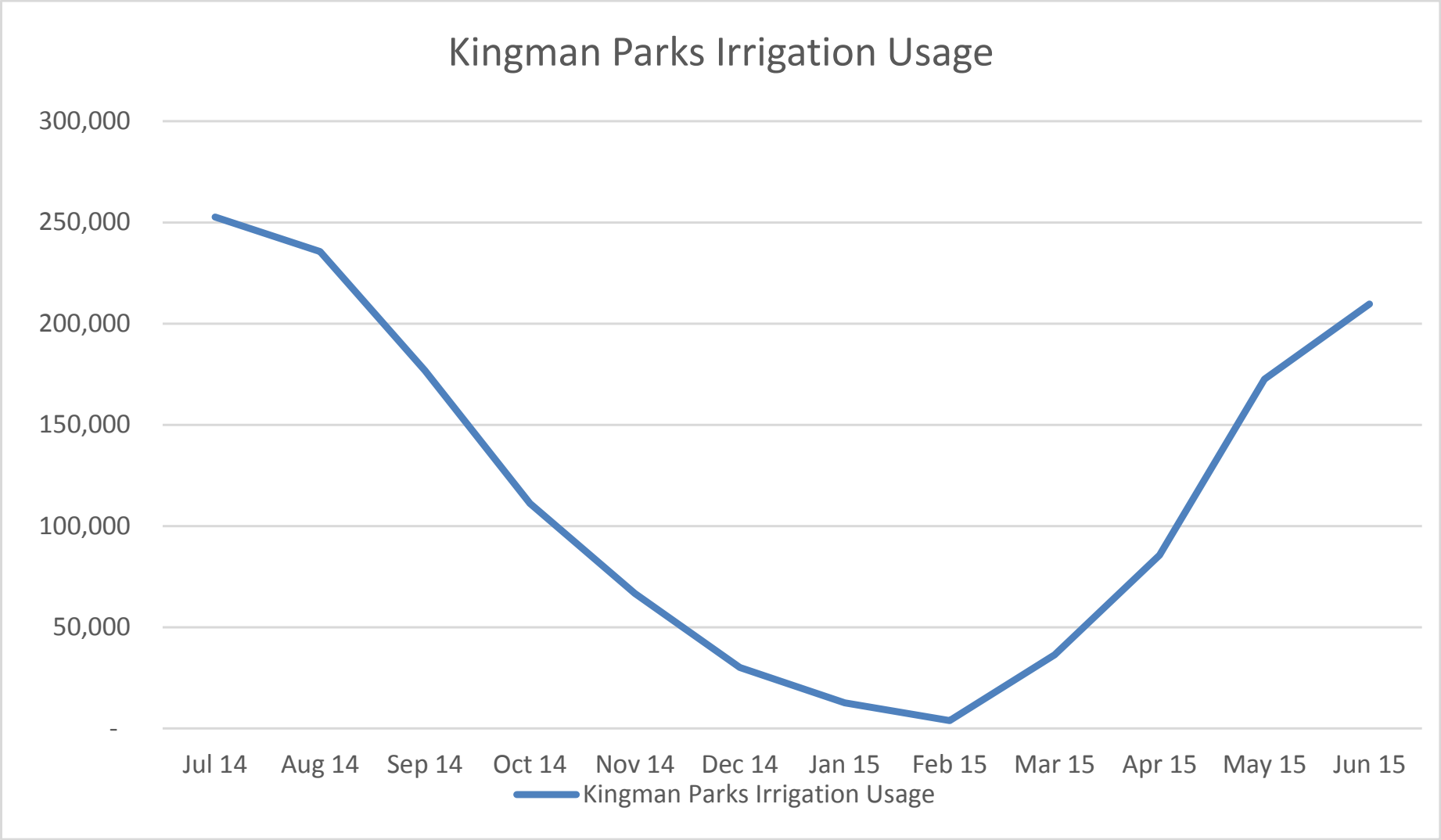
			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2014											
School	**Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Kingman High School	4182 Bank St	IRR16027	11597	0	0	5	14	16	16	19	16	13	13	5	1
Kingman High School	4182 Bank St	IRR16028	11597	33	37	46	99	168	155	164	131	102	96	37	14
		Total Gallons/Day		33,194	36,536	51,032	113,333	183,968	170,800	183,226	147,161	114,667	108,871	42,567	15,613
Kingman Middle School	1969 Detroit St	WA5896	23725	21	32	29	32	47	63	65	80	64	56	56	39
		Total Gallons/Day		20,942	32,464	28,781	31,633	46,974	62,620	65,400	79,942	63,977	56,361	56,480	38,974
Kingman Academy Middle School	3400 Burbank	IRR37868	40067	0	0	0	0	0	0	0	0	0	0	0	0
Kingman Academy Middle School	3269 Harrison	IRR37868	28979	-	-	-	-	-	-	-	-	-	0	-	-
		Total Gallons/Day		162	149	144	159	186	191	222	189	243	259	182	209
		Total Gallons/Day		54,298	69,149	79,957	145,126	231,128	233,611	248,847	227,293	178,886	165,492	99,229	54,796

2014 Avg Usage	148,984
2014 Max Usage	248,847
2014 Min Usage	54,298

City of Kingman
City of Kingman Schools
Irrigation Meter Readings
(in thousand gallons)

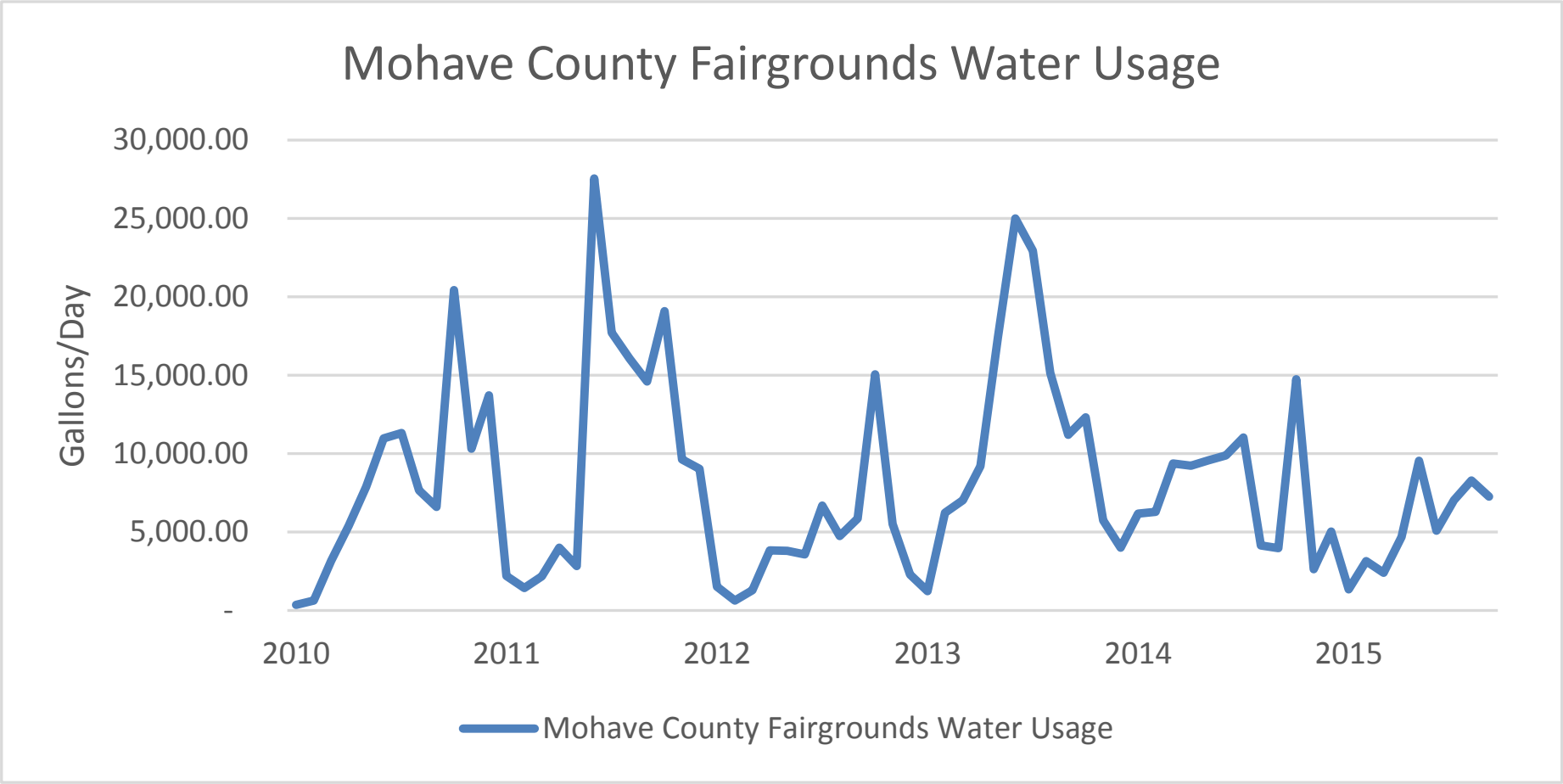
			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2015											
School	**Address**	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Kingman High School	4182 Bank St	IRR16027	11597	-	1	1	3	9	10	9	11	8	-	-	-
Kingman High School	4182 Bank St	IRR16028	11597	0	10	14	71	139	137	166	132	145	-	-	-
		Total Gallons/Day		452	11,536	14,935	74,000	148,484	146,833	175,032	143,774	153,267	-	-	-
Kingman Middle School	1969 Detroit St	WA5896	23725	28	20	20	36	43	53	67	81	69	-	-	-
		Total Gallons/Day		27,852	19,668	20,148	35,797	42,629	52,857	66,816	81,448	68,810	-	-	-
Kingman Academy Middle School	3400 Burbank	IRR37868	40067	0	0	0	0	0	0	0	0	0	-	-	-
Kingman Academy Middle School	3269 Harrison	IRR37868	28979	-	-	-	-	-	-	-	-	-	-	-	-
		Total Gallons/Day		199	254	215	255	234	233	232	205	222	-	-	-
		Total Gallons/Day		28,502	31,458	35,299	110,052	191,347	199,923	242,081	225,427	222,299	-	-	-

2015 Avg Usage	107,199
2015 Max Usage	242,081
2015 Min Usage	-


Kingman Parks Irrigation Usage
300,000
250,000
200,000
150,000
100,000
50,000
-
Jul 14
Aug 14
Sep 14
Oct 14
Nov 14
Dec 14
Jan 15
Feb 15
Mar 15
Apr 15
May 15
Jun 15
Kingman Parks Irrigation Usage

City of Kingman
City of Kingman Parks
Irrigation Meter Readings
(in thousand gallons)

Park	Address	Customer	Location	Jul 14	Aug 14	Sep 14	Oct 14	Nov 14	Dec 14	Jan 15	Feb 15	Mar 15	Apr 15	May 15	Jun 15
Parks & Irrigation	3333 Harrison St.	6	8045	106.19	82.83	62.31	38.93	18.50	12.06	3.12	1.89	14.43	25.90	52.99	57.97
Parks & Irrigation	Firefighters Memorial Park	6	23721	61.39	75.68	53.37	36.77	33.70	7.97	4.81	0.07	5.84	20.47	49.94	79.33
Parks & Irrigation	1 Burbank St./Centennial Park	6	27927	85.06	77.00	61.03	35.45	14.43	10.13	4.61	1.90	16.06	39.23	69.61	72.43
		Total Gallons/Day		252,645	235,504	176,710	111,155	66,630	30,162	12,543	3,854	36,337	85,600	172,542	209,732


Mohave County Fairgrounds Water Usage
30,000.00
25,000.00
20,000.00
15,000.00
10,000.00
5,000.00
-
Gallons/Day
2010
2011
2012
2013
2014
2015
Mohave County Fairgrounds Water Usage

City of Kingman
Mohave County Fairgrounds
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2010											
	Address	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Desert 66 BMX Racetrack	2600 Fairgrounds	103654	41663	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fairgrounds Front Inside	2600 Fairgrounds	18646	23715	0.33	0.61	3.15	5.22	7.45	10.89	11.12	7.58	6.25	7.62	2.79	2.75
Fairgrounds Racetrack 1	2600 Fairgrounds	18646	23717	0.00	0.00	0.00	0.15	0.39	0.05	0.06	0.03	0.15	1.34	0.02	0.27
Fairgrounds Racetrack 2	2600 Fairgrounds	18646	23719	0.03	0.02	0.02	0.04	0.05	0.03	0.14	0.05	0.21	11.46	7.50	10.69
			Total Gallons/Day	358.06	632.14	3,174.19	5,417.33	7,876.13	10,970.00	11,317.74	7,656.13	6,616.00	20,420.97	10,306.00	13,706.45

2010 Avg Usage	8,204
2010 Max Usage	20,421
2010 Min Usage	358
2010-2014 Avg Usage	8,488
2010-2014 Max Usage	27,553
2010-2014 Min Usage	358

City of Kingman
Mohave County Fairgrounds
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2011											
	Address	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Desert 66 BMX Racetrack	2600 Fairgrounds	103654	41663	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fairgrounds Front Inside	2600 Fairgrounds	18646	23715	1.88	1.40	0.70	2.21	2.04	6.18	3.16	8.51	14.11	11.46	9.57	9.04
Fairgrounds Racetrack 1	2600 Fairgrounds	18646	23717	0.02	0.02	0.08	0.23	0.35	0.19	0.15	0.11	0.00	1.14	0.05	0.00
Fairgrounds Racetrack 2	2600 Fairgrounds	18646	23719	0.29	0.03	1.40	1.56	0.45	21.19	14.41	7.45	0.49	6.48	0.01	0.01
			Total Gallons/Day	2,202.26	1,443.93	2,187.74	3,997.00	2,845.48	27,553.00	17,727.74	16,059.03	14,603.67	19,083.55	9,628.00	9,044.84

2011 Avg Usage	10,531
2011 Max Usage	27,553
2011 Min Usage	1,444

City of Kingman
Mohave County Fairgrounds
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2012											
	Address	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Desert 66 BMX Racetrack	2600 Fairgrounds	103654	41663	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fairgrounds Front Inside	2600 Fairgrounds	18646	23715	1.51	0.63	1.27	3.20	3.11	3.11	6.20	4.53	5.67	9.48	2.86	1.65
Fairgrounds Racetrack 1	2600 Fairgrounds	18646	23717	0.00	0.00	0.00	0.25	0.63	0.31	0.13	0.02	0.15	1.02	0.05	0.01
Fairgrounds Racetrack 2	2600 Fairgrounds	18646	23719	0.01	0.01	0.01	0.38	0.08	0.14	0.37	0.20	0.04	4.55	2.62	0.64
			Total Gallons/Day	1,526.13	641.38	1,277.42	3,822.00	3,817.74	3,562.33	6,701.29	4,755.81	5,867.67	15,051.61	5,528.33	2,295.48

2012 Avg Usage	4,571
2012 Max Usage	15,052
2012 Min Usage	641

City of Kingman
Mohave County Fairgrounds
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2013											
	Address	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Desert 66 BMX Racetrack	2600 Fairgrounds	103654	41663	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fairgrounds Front Inside	2600 Fairgrounds	18646	23715	1.04	2.70	1.98	2.57	10.85	16.76	13.92	10.53	7.24	4.88	2.27	1.87
Fairgrounds Racetrack 1	2600 Fairgrounds	18646	23717	0.00	0.98	1.22	0.68	1.03	0.48	0.36	0.91	1.53	2.10	0.75	0.05
Fairgrounds Racetrack 2	2600 Fairgrounds	18646	23719	0.19	2.56	3.85	5.95	5.52	7.78	8.67	3.69	2.42	5.34	2.71	2.07
			Total Gallons/Day	1,229.03	6,243.57	7,039.03	9,205.67	17,395.48	25,015.33	22,955.48	15,136.13	11,194.67	12,320.97	5,735.00	3,994.52

2013 Avg Usage	11,455
2013 Max Usage	25,015
2013 Min Usage	1,229

City of Kingman
Mohave County Fairgrounds
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2014											
	Address	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Desert 66 BMX Racetrack	2600 Fairgrounds	103654	41663	0.00	0.16	0.28	0.45	0.61	1.34	0.94	0.63	0.54	0.35	0.42	0.33
Fairgrounds Front Inside	2600 Fairgrounds	18646	23715	2.69	2.10	2.44	2.02	3.88	2.19	3.54	1.90	1.21	5.05	1.20	1.26
Fairgrounds Racetrack 1	2600 Fairgrounds	18646	23717	0.17	0.14	5.01	0.66	0.94	0.73	0.36	0.05	0.07	1.65	0.19	0.14
Fairgrounds Racetrack 2	2600 Fairgrounds	18646	23719	3.33	3.88	1.66	6.11	4.14	5.62	6.19	1.58	2.16	7.70	0.83	3.31
			Total Gallons/Day	6,186.77	6,280.71	9,381.94	9,239.67	9,575.81	9,878.33	11,032.58	4,154.84	3,979.00	14,750.00	2,632.67	5,040.65

2014 Avg Usage	7,678
2014 Max Usage	14,750
2014 Min Usage	2,633

City of Kingman
Mohave County Fairgrounds
Irrigation Meter Readings
(in thousand gallons)

			Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
				2015											
	Address	**Customer**	**Location**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Desert 66 BMX Racetrack	2600 Fairgrounds	103654	41663	0.11	0.14	0.16	0.43	0.80	0.86	0.56	0.71	0.61	0.00	0.00	0.00
Fairgrounds Front Inside	2600 Fairgrounds	18646	23715	0.98	1.01	0.61	1.69	2.11	2.08	3.25	3.85	2.76	0.00	0.00	0.00
Fairgrounds Racetrack 1	2600 Fairgrounds	18646	23717	0.00	0.10	0.00	0.00	3.24	0.04	0.06	0.03	0.04	0.00	0.00	0.00
Fairgrounds Racetrack 2	2600 Fairgrounds	18646	23719	0.24	1.89	1.62	2.58	3.38	2.11	3.16	3.71	3.84	0.00	0.00	0.00
			Total Gallons/Day	1,332.58	3,135.36	2,395.16	4,699.67	9,539.03	5,090.33	7,038.06	8,300.97	7,255.33	-	-	-

2015 Avg Usage	4,066
2015 Max Usage	9,539
2015 Min Usage	-

APPENDIX M

Evaporation Calculations

City of Kingman
Option 3 - Golf Course, Schools and Parks Reuse
Evaporation Calculations

Surface Area of Pond (sf)	Evaporation Rate (in/yr)	Evaporation Rate (ft/day)	Water Losses (cf/day)	Water Losses (gal/day)
136,204	115	0.0263	3,576	26,749

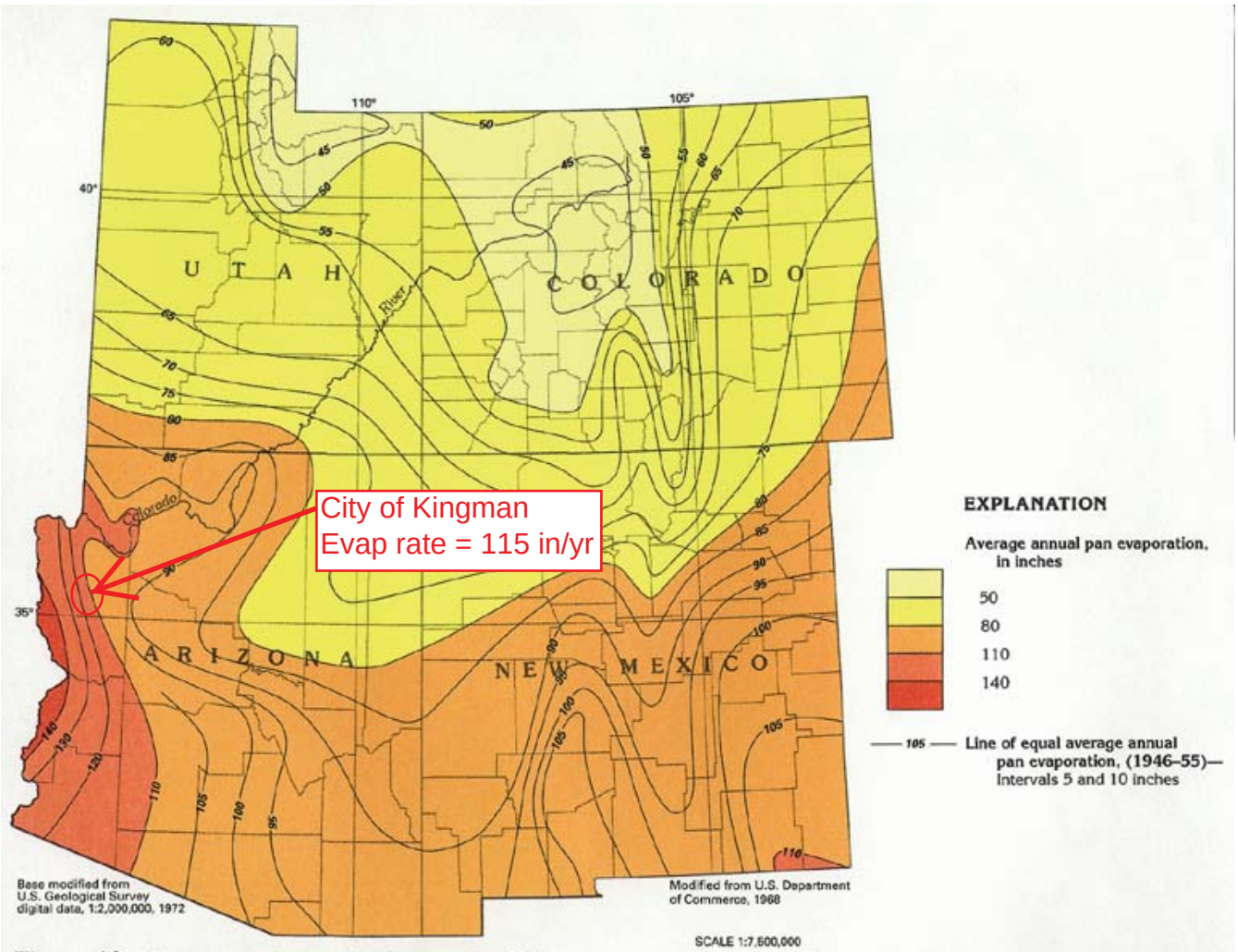


Figure 10. *Average annual evaporation is as much as 140 inches in western Arizona and is in excess of annual precipitation in almost all of Segment 2.*

KINGMAN EVAPORATION @ GOLF COURSE.

MAX AREA of POND = 136,204 sf ≈ 3.12 ac-ft

KINGMAN'S AVG ANNUAL EVAP RATE = 115 in/yr
= 0.315 in/day
= 0.0262 ft/day

$0.0262 \frac{ft}{day} (136{,}204 sf) = 3{,}568.55$ cf/day

$3{,}568.55 \text{ cf/day} \left(\frac{7.48 \text{ gal}}{1 \text{ cf}}\right) = \boxed{26{,}692.72 \text{ gal/day}}$

MAX GOLF COURSE USAGE (2010-2014) = 968,936 gal/day

Option 3 provides 1M gal/day

1,000,000 gal/day
− 968,936
31,064 gal/day Left over in POND.

After Evaporation: 31,064 gal
− 26,692 gal
4,372 gal