Fall 2016

WOLFFORTH PROJECT

OPTIMIZATION OF EXISTING INFRASTRUCTURE FOR MUNICIPAL WELLS

CE 5366: Water Resources Management

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Outline of the Study

- The purpose of this report was to minimize the total energy used to pump and transport water to the water treatment facility.
- The total energy was determined by considering the energy required to produce enough water to meet the demand set by the city for summer and winter for a population of 4400.
- 5 scenarios, based on using 13 wells, were considered to meet these demands.
- Factors considered in each scenario were water quality, yield from each well and well distance from the ground storage tank.
- The best scenario was chosen by comparing the results of the 5 scenarios.

Background of Study Area

- Wolfforth is a city in Lubbock County, Texas, United States.
- Its population was 3,670 at the 2010 census and 4,104 in 2014.
- Wolfforth was established in 1916.

Background of Study Area

- The first visit to the city of Wolfforth's groundwater treatment facility was made on October 4, 2016.
- There are 17 wells in the city, but only 16 are producing; from those 16, only 13 are active.
- Two ground water storage tanks and three water storage towers are being used by the city.
- The new ground water storage tank with a capacity of 1.5 million gallons is being used to store all the pumped water from wells.

Constraints and Considerations:

- There is a limit on the maximum yield from each well
- Maximum and minimum storage capacity of the groundwater storage tank puts a constraint on the total flow produced by the system
- Drawdown at each well needs to be noted while pumping.
- City's demands are required to be met by the chosen scenario.
- Energy costs of EDR operations is also a constraining factor.

Data Reference

- The majority of used data (e.g. location of municipal wells and storage tank, diameter of pipelines, etc.) was pulled from the city of Wolfforth's website (www.wolfforthtx.us)
- Aquifer related data was obtained from the United States Geological Survey (USGS)
- Concentration data was downloaded from Texas Commission on Environmental Quality's website (www.tceq.texas.gov)

Methodology

- The pipe infrastructure system was created in AutoCAD by using the required data from city's website.
- Saturated thickness raster was calculated in ESRI's ArcGIS using the aquifer data from USGS. These values were later used in Theis solution for estimation of drawdown.
- Energy for pumping water was calculated then considering the required energy for pumping water to the surface, driving it through the pipeline network and also for compensating the drawdown effect over time.
- Concentration records for each well was obtained and organized.
- The energy to transport water to the storage tank consisted of three different types: Kinetic energy, potential energy, and the energy lost to friction.
- The Hazen-Williams method was used to calculate the head loss.
- Calculations of the net total energy was performed using "R"

Results and Discussion

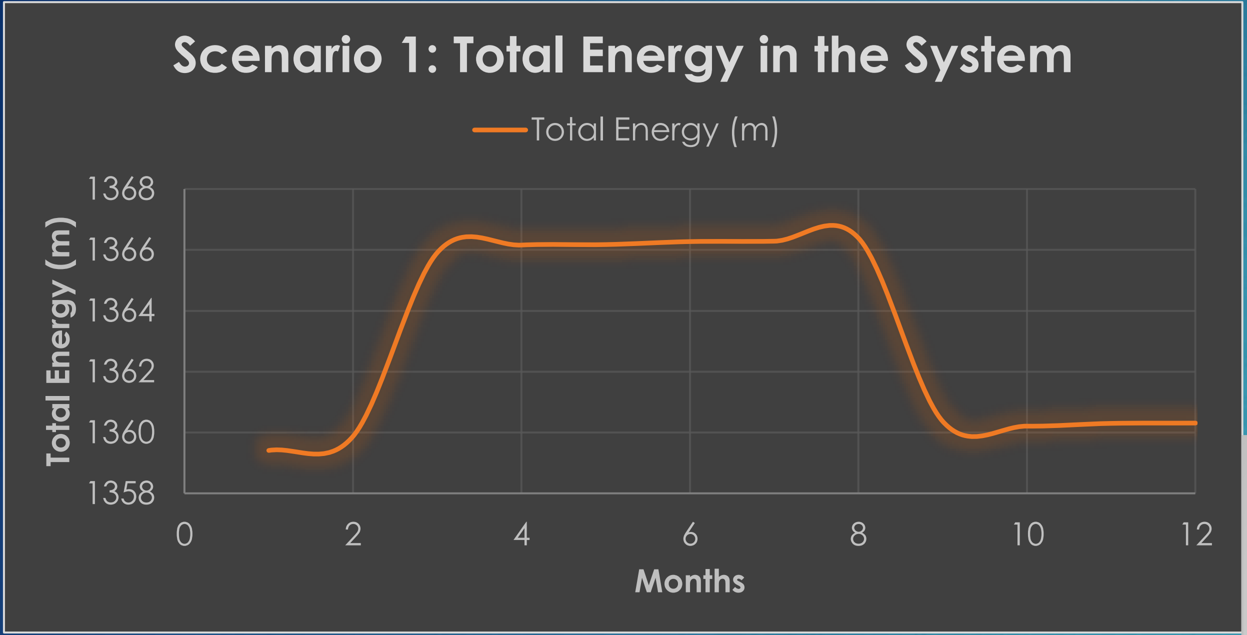
Five scenarios were created to minimize energy for this project. They were as follows:

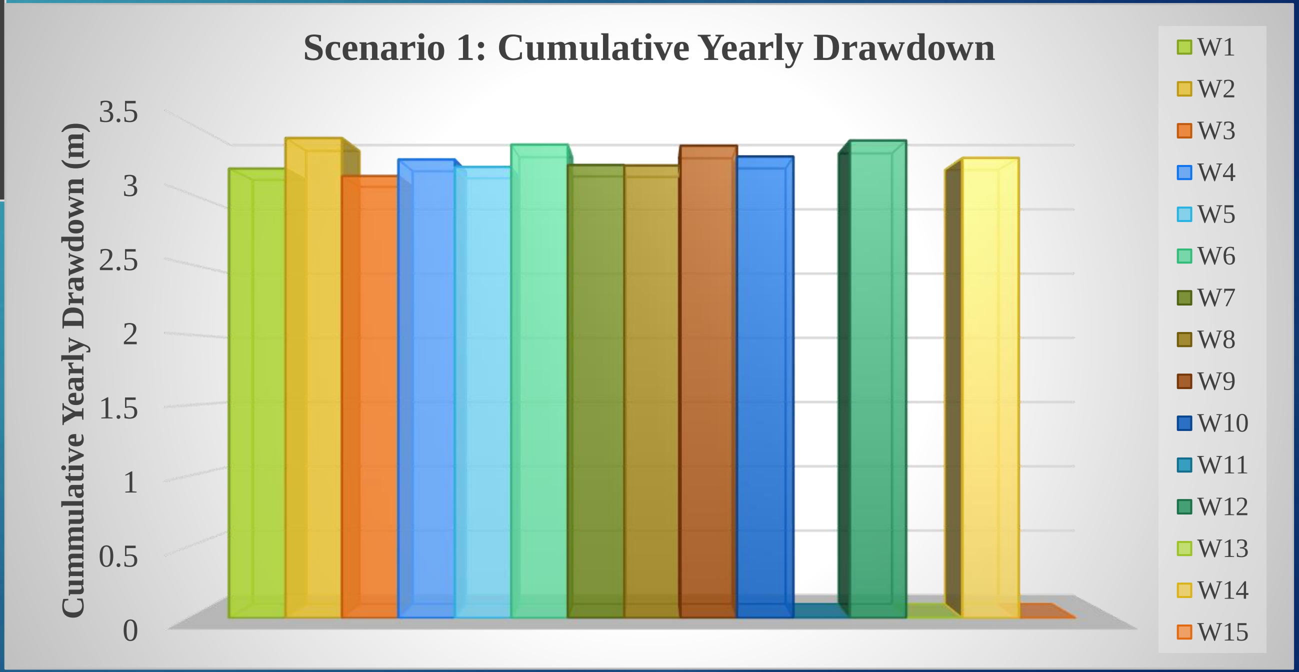
- Equal Flow for All Wells
- Maximum Flow from Clean Wells and Minimum Flows from Dirty Wells
- Using Wells Closer to the Groundwater Tank Storage
- Using the Least Possible Number of Wells
- Maximum Flow from all the Wells

Results and Discussion - **Scenario 1: Equal Flow for All Wells**

- 12 Wells are pumping at 50 GPM
- The whole network will be in use, which will minimize pipeline corrosion and bacterial growth in stagnant pipe water
- Drawdown was significantly low because all of the wells were producing at less than maximum; the yearly cumulative drawdowns were within a range of 3-3.5 meters for all wells
- The energy required for pumping was significantly higher since all the wells were in production
- Concentration values remained under the maximum concentration needed for industry production standards

Results and Discussion - **Scenario 1: Equal Flow for All Wells**





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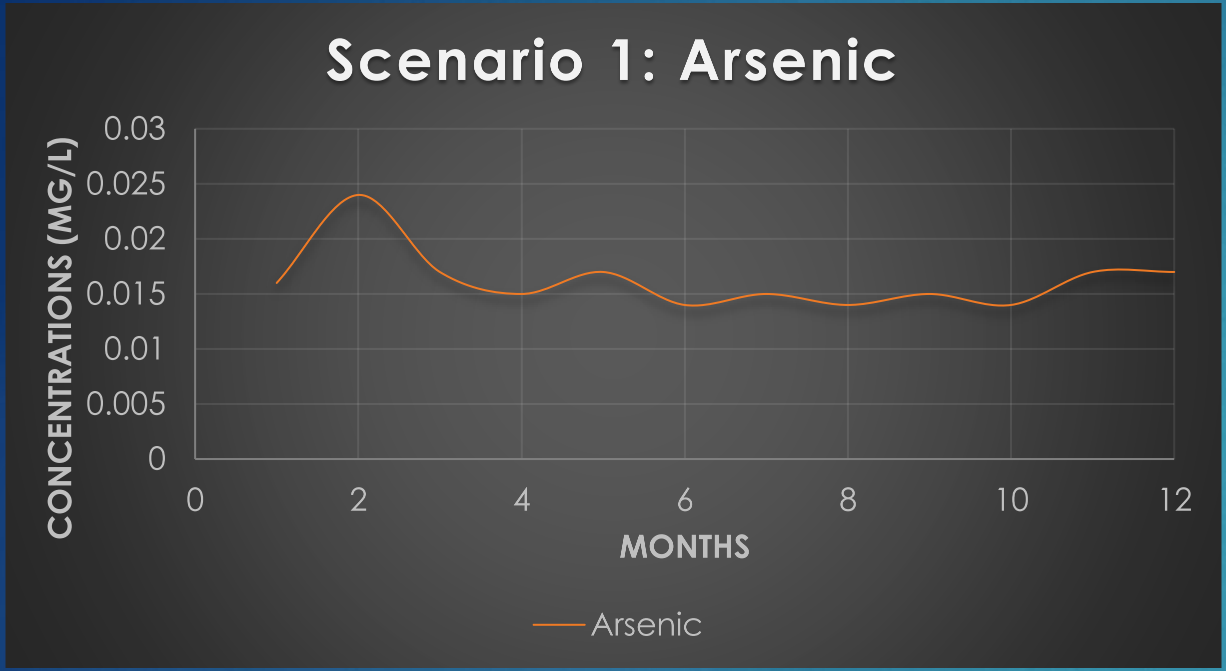
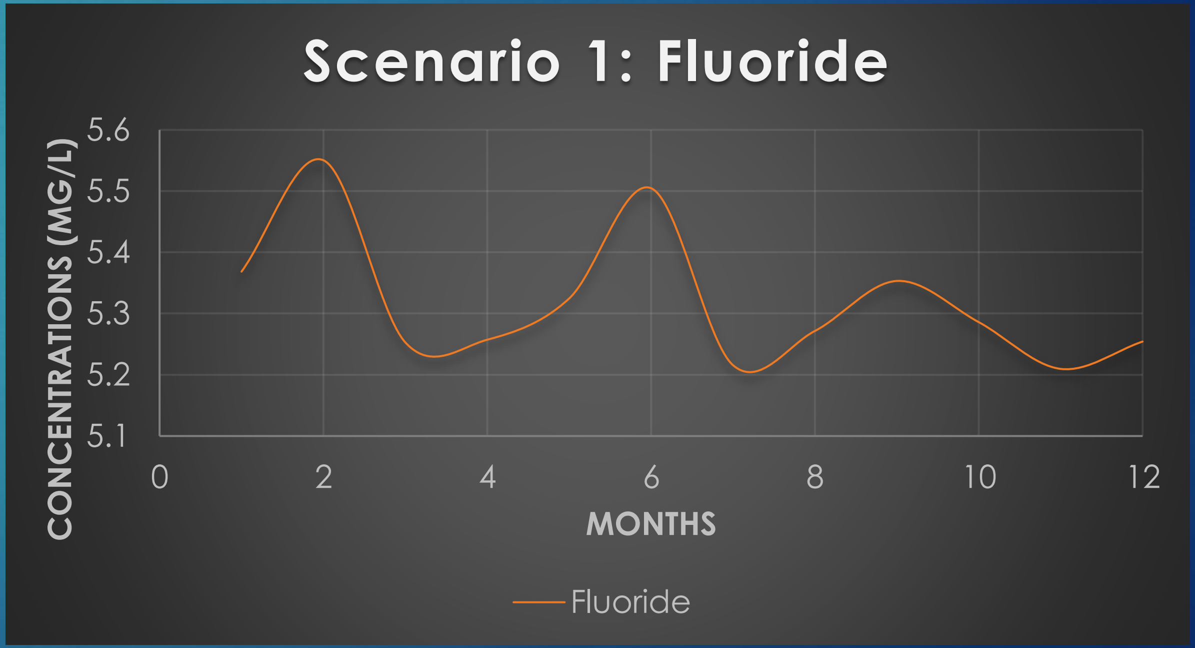
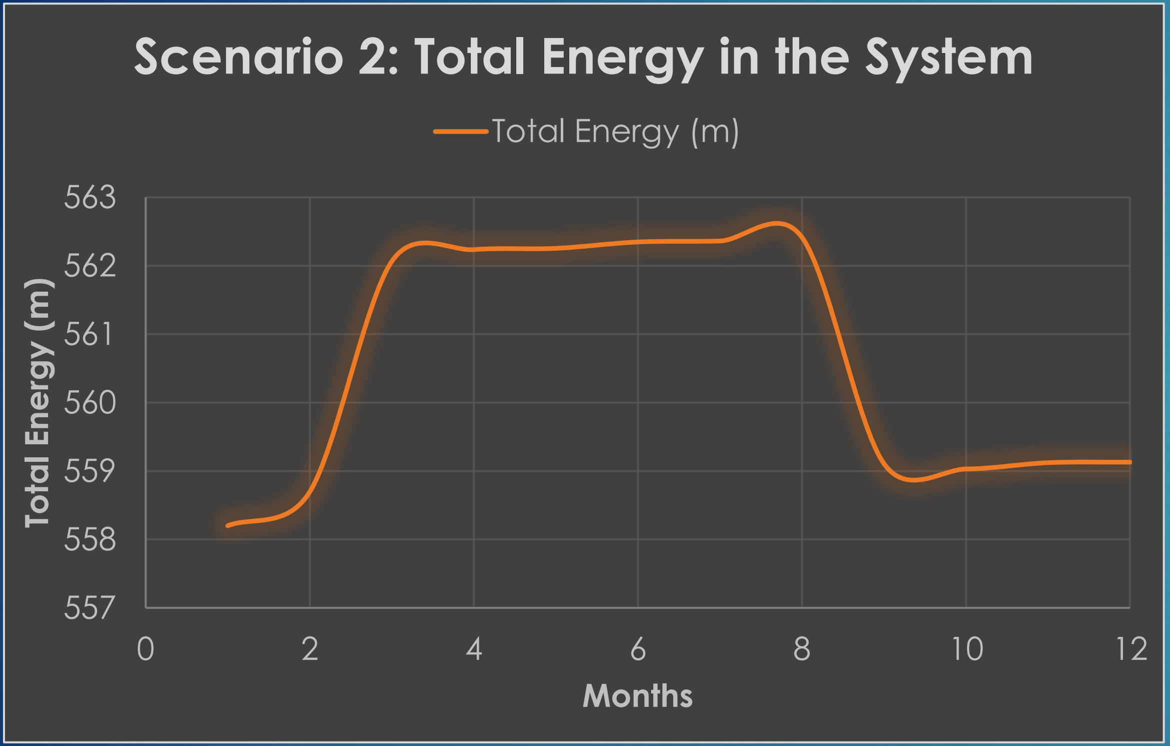


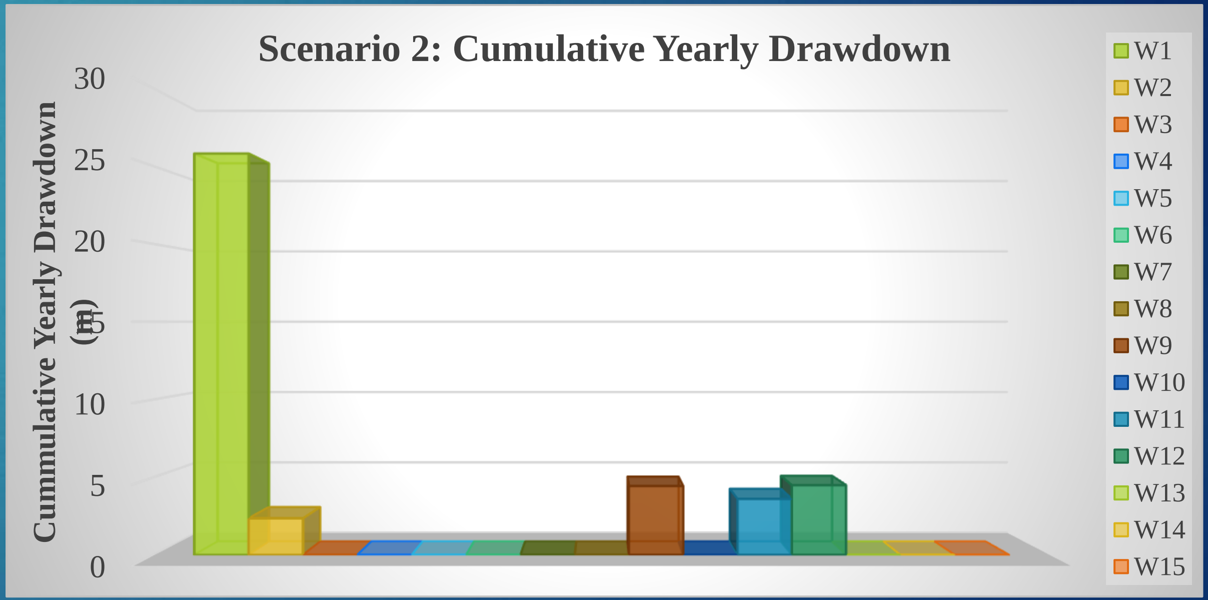


Results and Discussion - **Scenario 2: Maximum Flow From Clean Wells and Minimum Flows From Dirty Wells**

- Fluoride is more critical.
- Wells 9, 11, 12, 1 and 2 have the lowest fluoride concentration, so these wells were chosen for production.
- This scenario’s objective of having a reduced amount of fluoride was reached in the outcome.
- Since we were using well 1 at its maximum yield, the drawdown is going to have a high value, 25.81 m, in comparison to the other wells, which fluctuate from 3 to 4.5 m.

Results and Discussion - **Scenario 2: Maximum Flow From Clean Wells and Minimum Flows From Dirty Wells**





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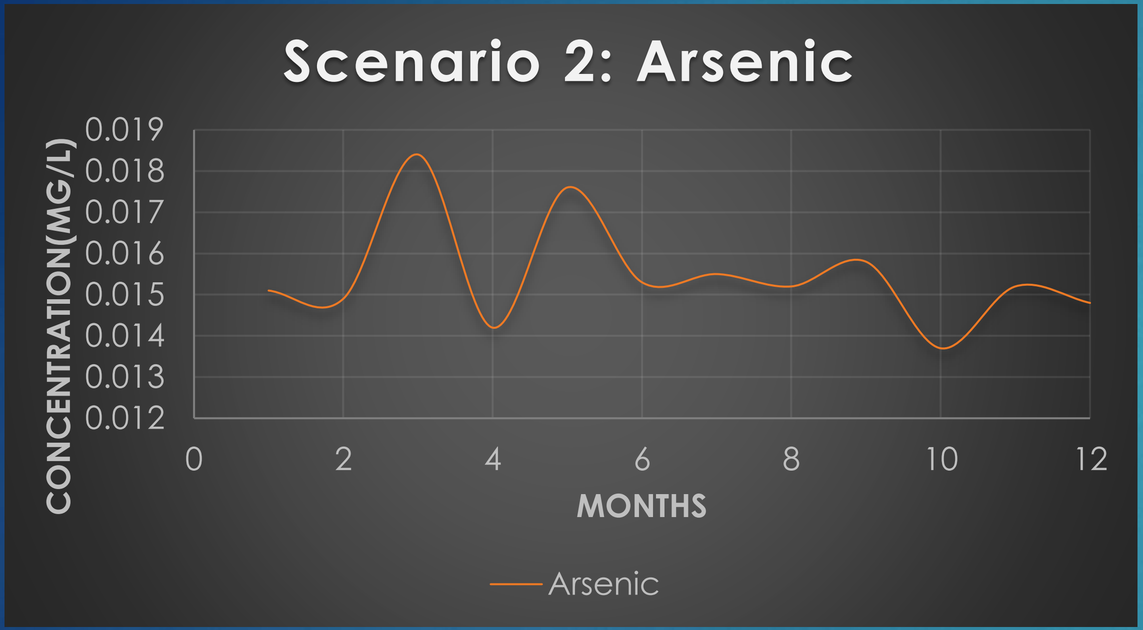
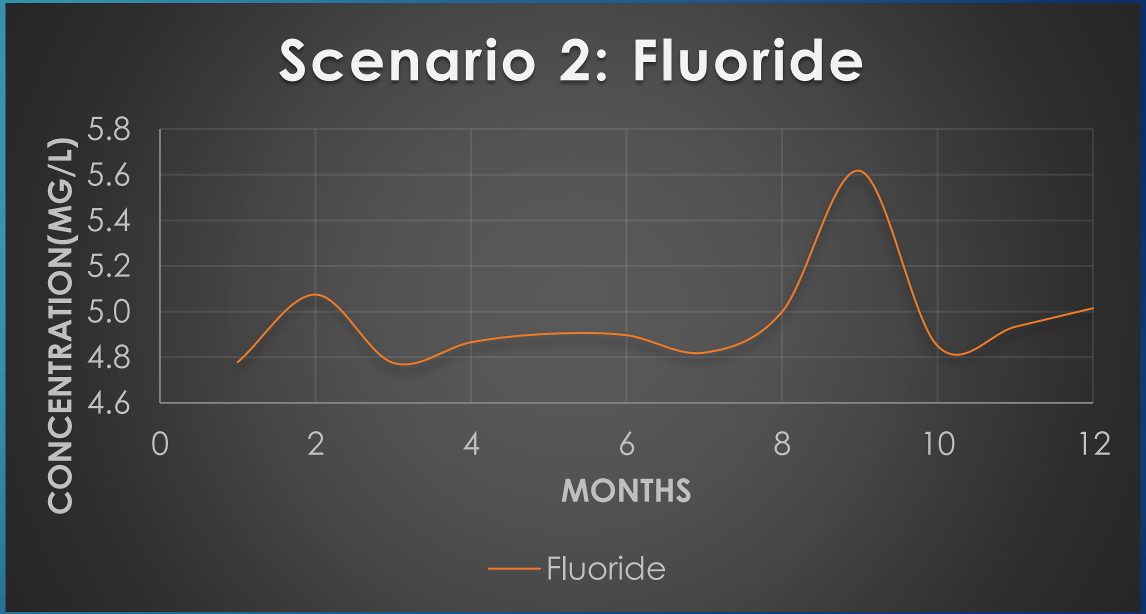
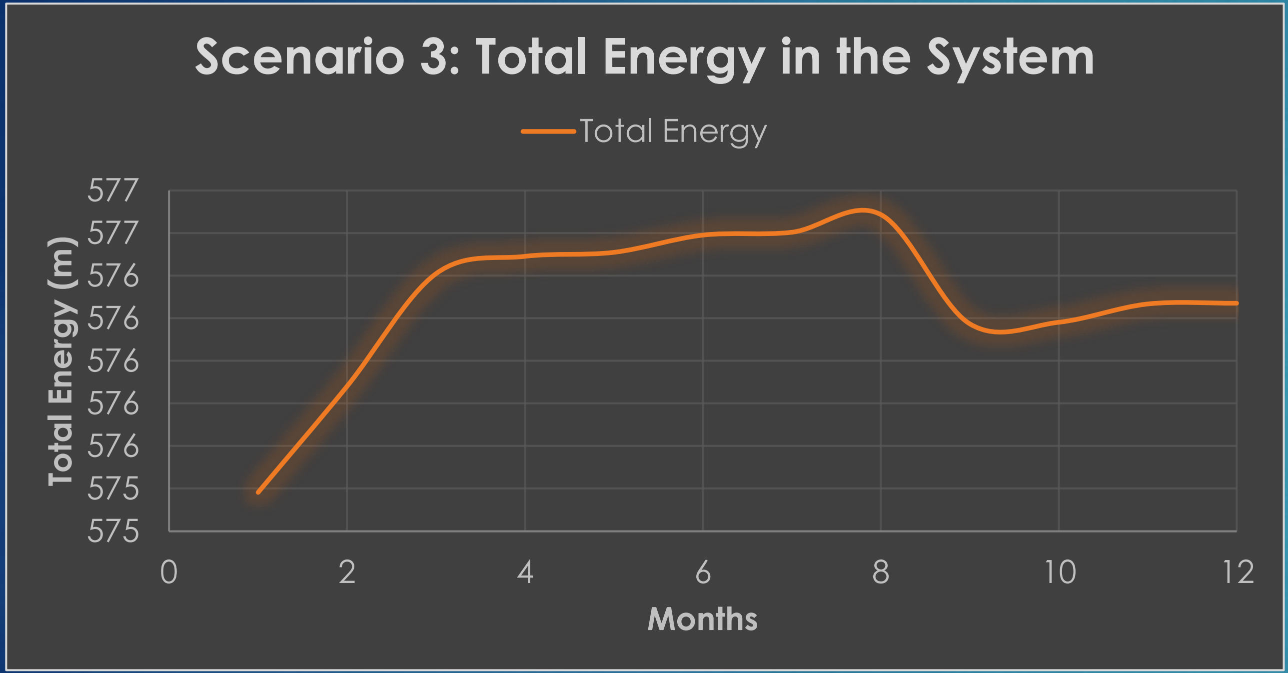


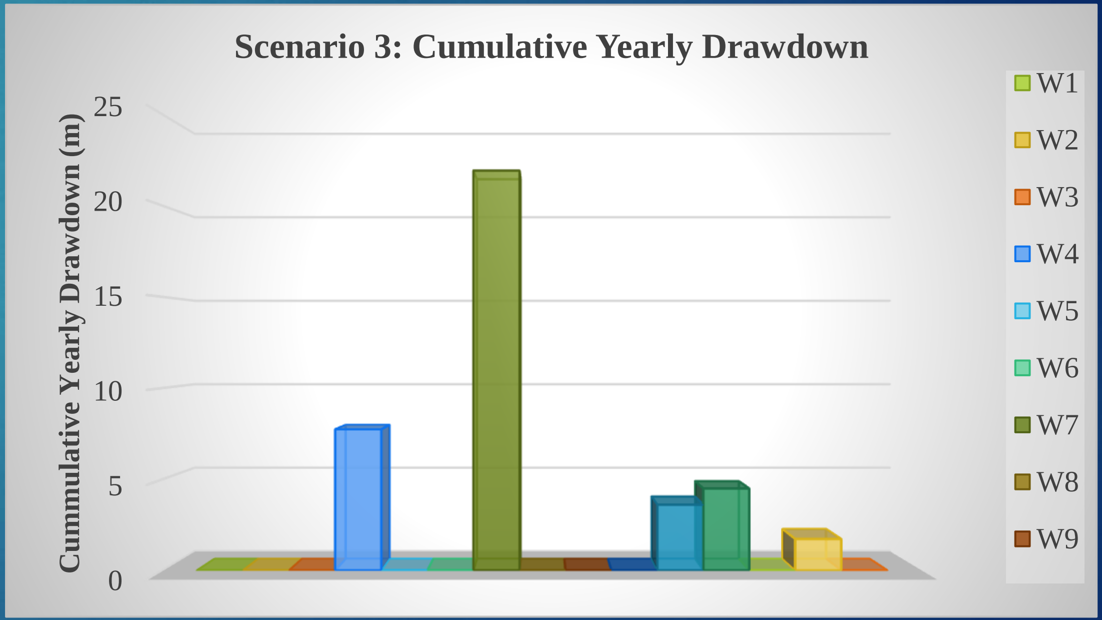


Results and Discussion - **Scenario 3: Using the Closest Wells to the Groundwater Storage Tank**

- It would be beneficial to produce water from wells within close proximity to the groundwater storage tank in order to minimize the total energy
- Wells considered in this scenario, were within a 5,000 foot radius from the storage tank: wells 12, 11, 4, 7 and 14
- The reduction of total energy and cost of transportation less head losses for the pipes
- For the summer season, wells 12, 11, 4 & 7 were pumping at full capacity. For well 14, it was adjusted to pump at 109.02 m^3/day. But for the winter season, wells 12, 11, & 4 were pumping at full capacity.
- Both Arsenic and Fluoride meet the limit of the required criteria.
- Since well 7 was at its maximum yield, the drawdown had a high value of 21.926 m when compared to the other wells.

Results and Discussion - **Scenario 3: Using the Closest Wells to the Groundwater Storage Tank**





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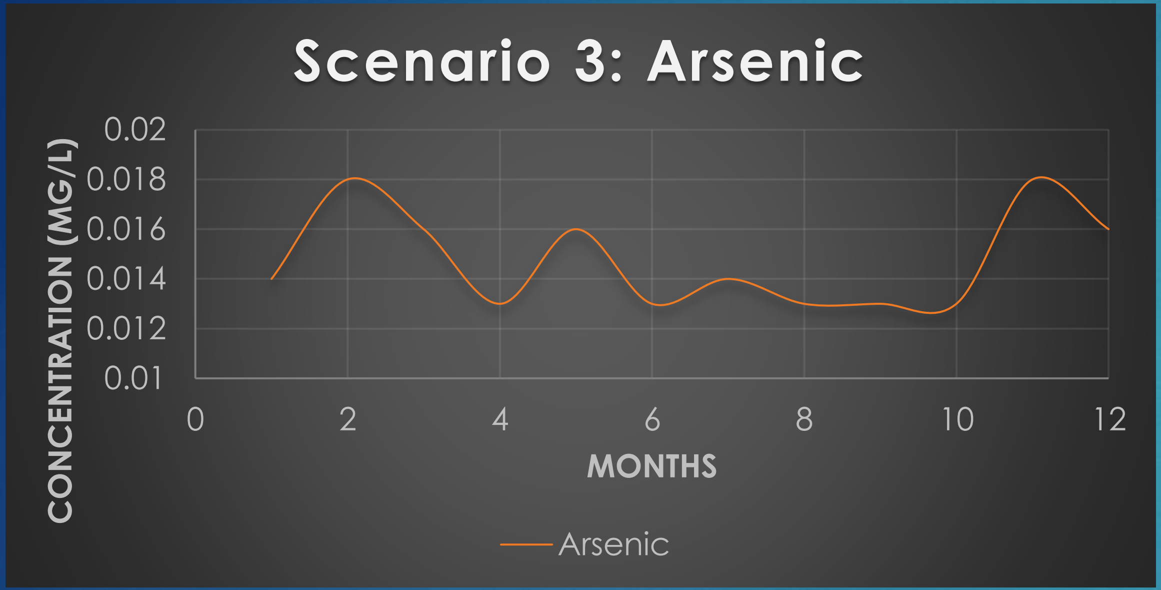
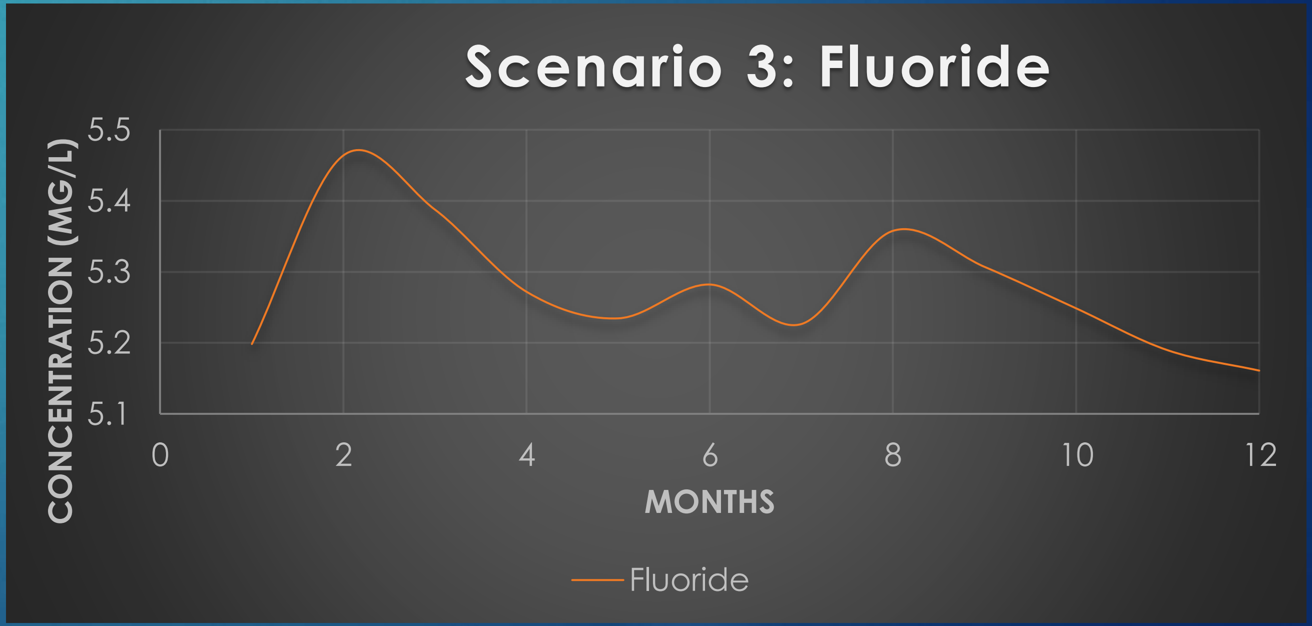




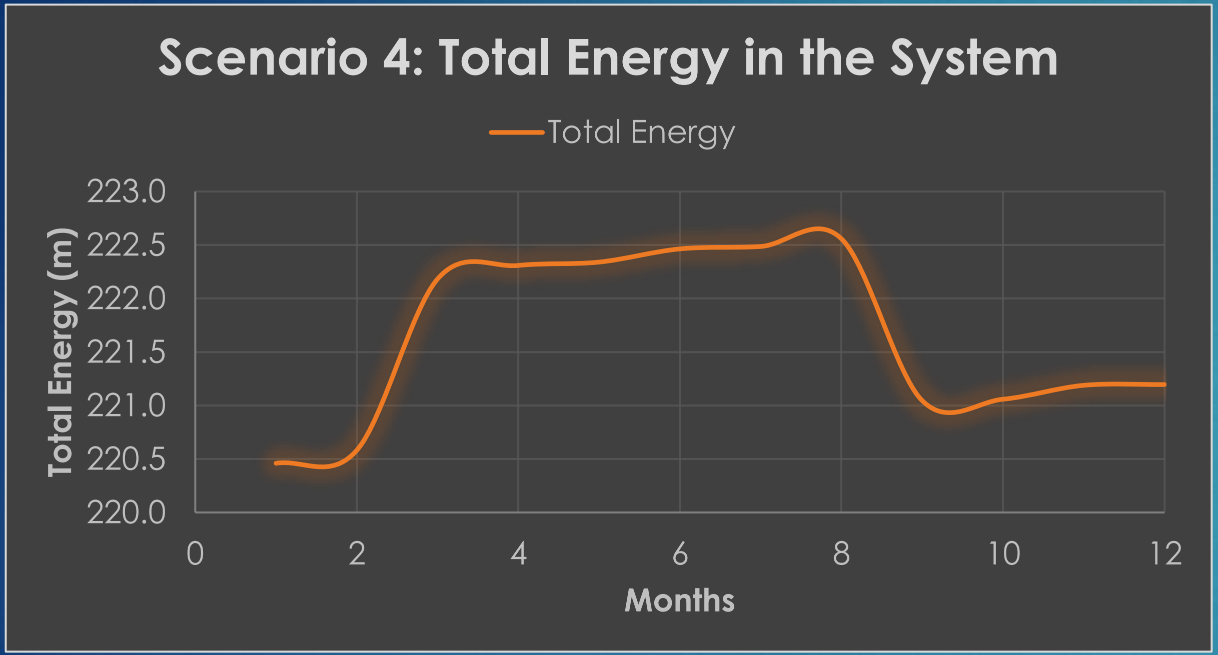
Results and Discussion - **Scenario 4: Using the Least Possible Number of Wells**

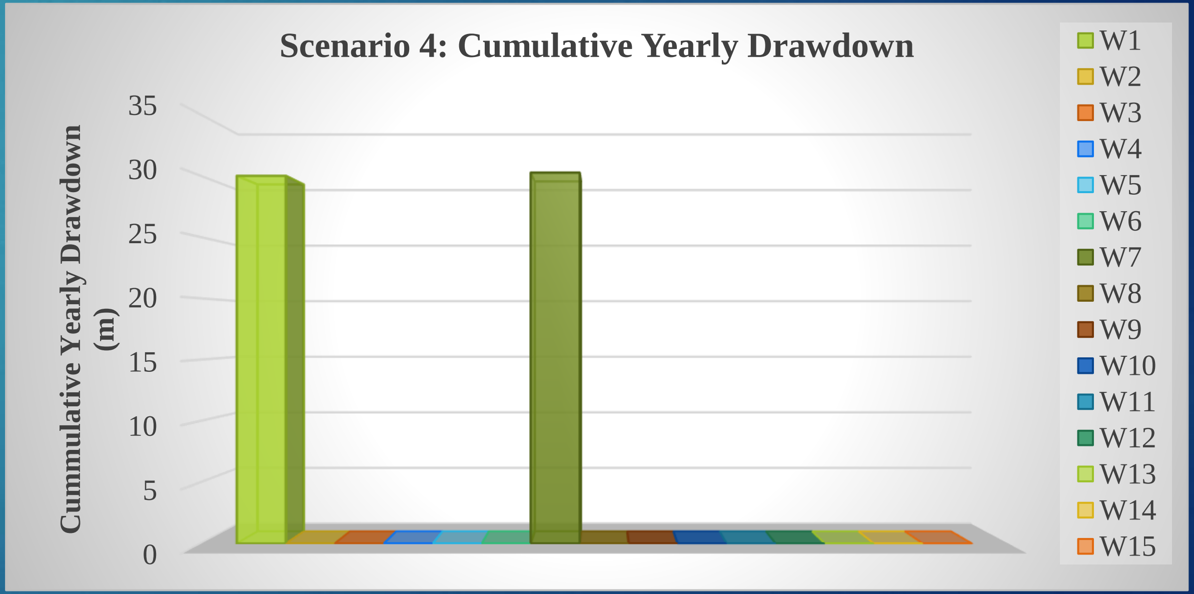
- The main criteria for selecting the wells in this scenario were well yields: Well 1 & 7 were chosen.
- By using wells 1 and 7 at 80% of their maximum yield during summer, each well would produce a total of 1526.28 m^3/day. The sum of the two wells would be equal to 3052.56 m^3/day.
- During winter, at 70% of maximum yield, the total supply of the two wells would be 2670.98 m^3/day.
- The flowrates in each of these seasons would be sufficient in meeting the demands with a safety surplus of 1%.

Results and Discussion - **Scenario 4: Using the Least Possible Number of Wells**

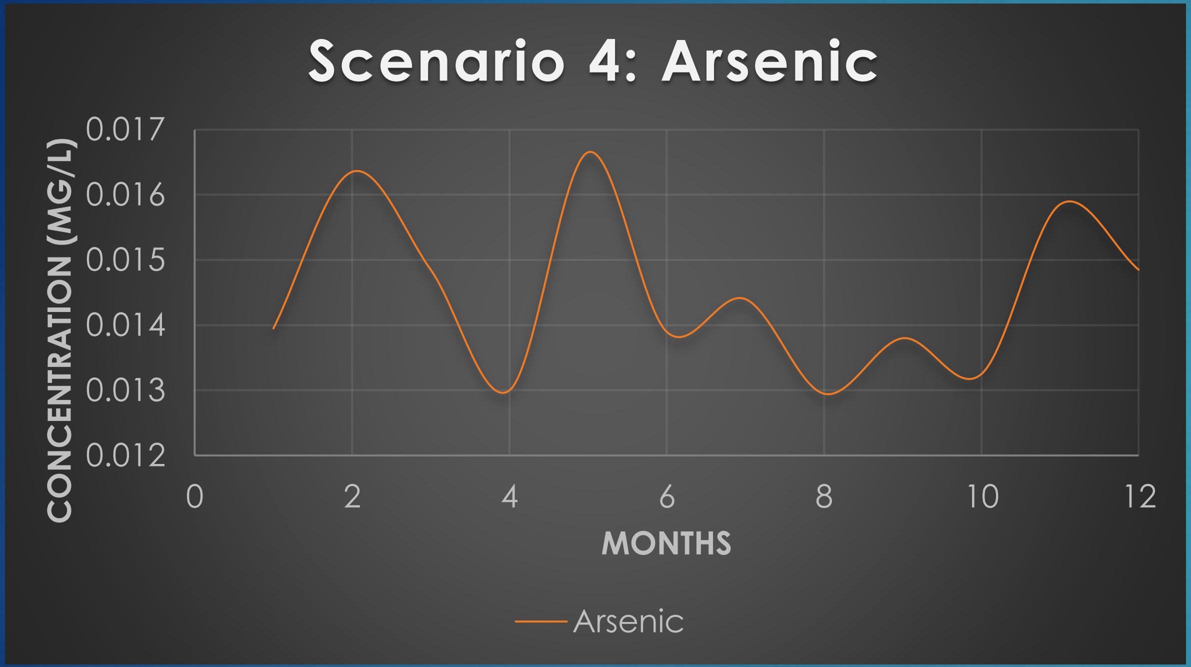
- The energy observed through the pipeline segments was relative low compared to the previous scenarios due to the fewer amount of wells used.
- When only two wells were being pumped, a considerate amount of energy was saved.
- Under this scenario, the demands were met while reducing energy.
- Both Arsenic and Fluoride meet the limit of the required criteria even though the numbers were slightly high.
- Since in this scenario only had two wells in use, the drawdown for each well had a high value, 30m.

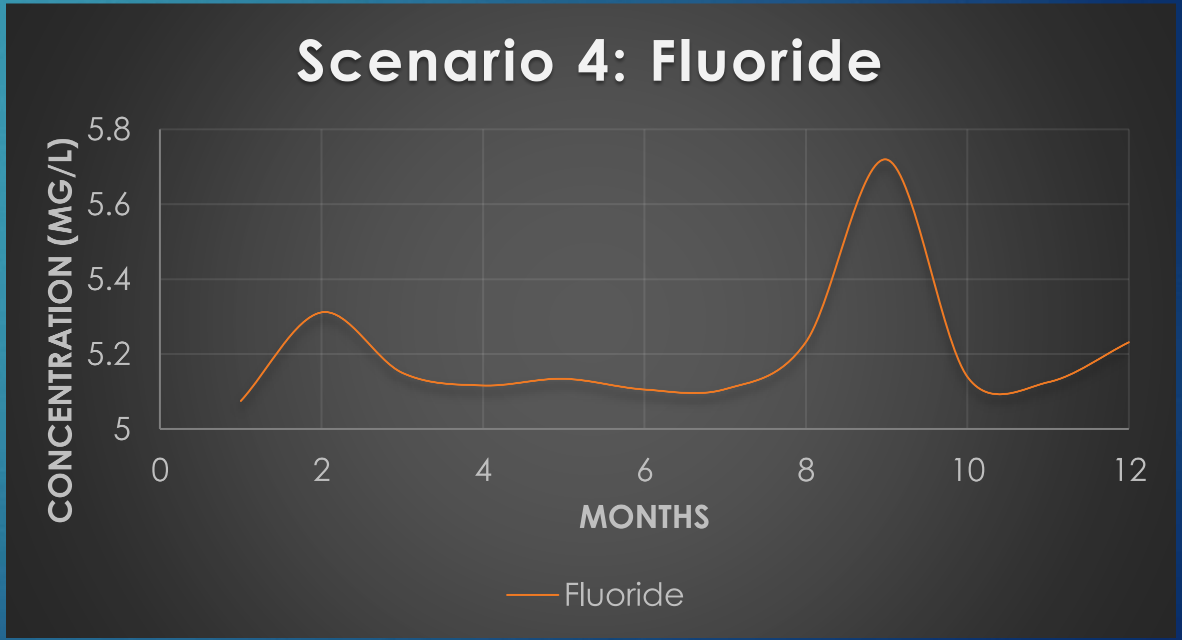
Results and Discussion - **Scenario 4: Using the Least Possible Number of Wells**





Results and Discussion - **Scenario 4: Using the Least Possible Number of Wells**





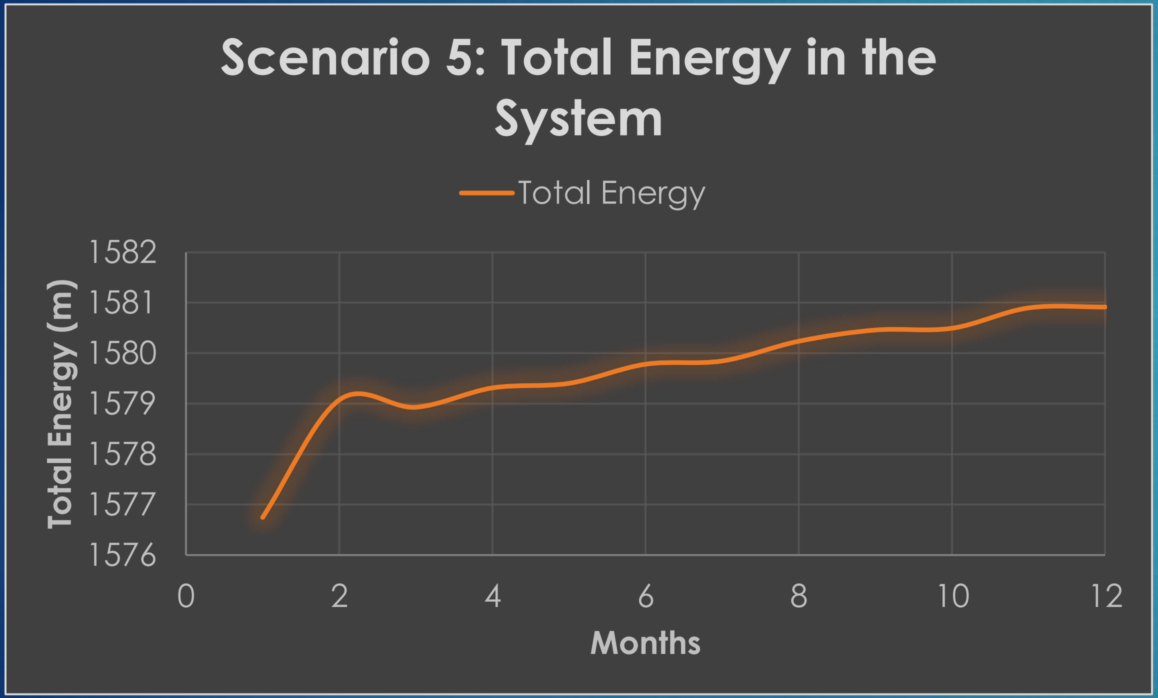
Results and Discussion - **Scenario 5: Maximum Flow from All the Wells**

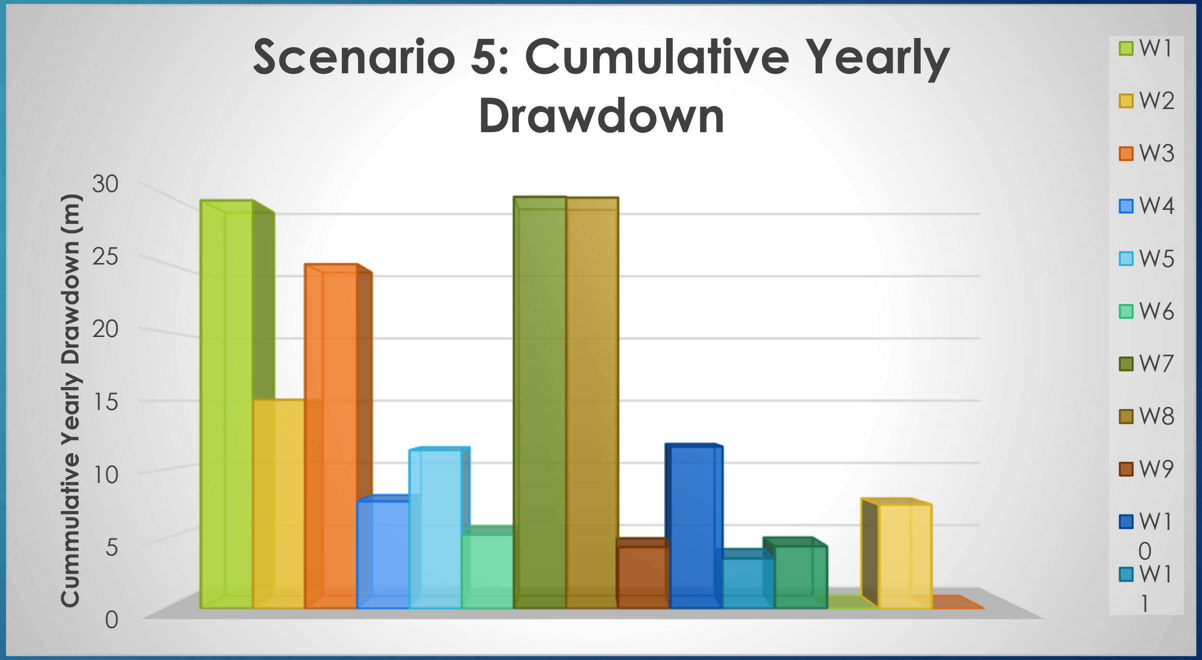
- This scenario was meant to determine the full capacity of the entire system and to foresee how far it could meet the future demands.
- The results indicated a water production value that was four times larger than the current demand.
- The energy required for pumping was significantly high since all the wells were pumping water at its maximum yield.

Results and Discussion - **Scenario 5: Maximum Flow from All the Wells**

- This energy was higher than the other scenarios since not only the wells are pumping at maximum yield but also there are small pipe diameters through the pipe network that require more energy.
- Both Arsenic and Fluoride have the highest values with an Arsenic violation in the month of February.
- Since this scenario uses all the wells at maximum yield, the drawdown was going to vary. The difference between the wells was significant since some wells have a maximum yield of 350 GPM while others have a maximum of 40 GPM

Results and Discussion - **Scenario 5: Maximum Flow from All the Wells**





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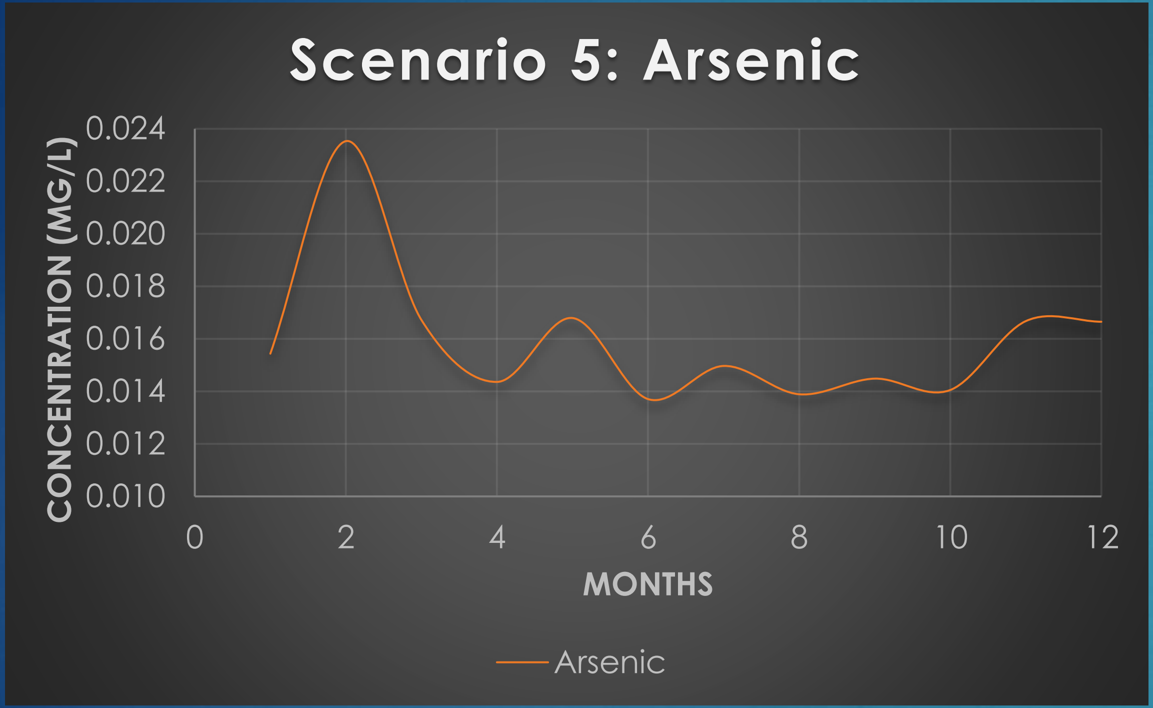
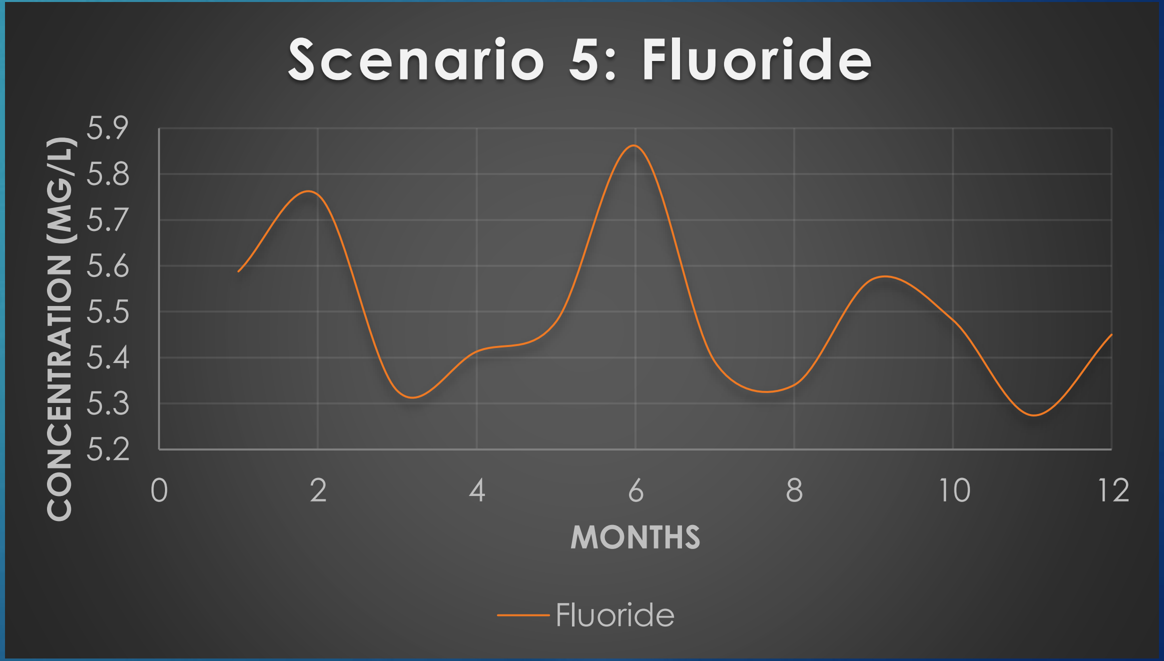




Conclusion – **Comparison of Scenarios**

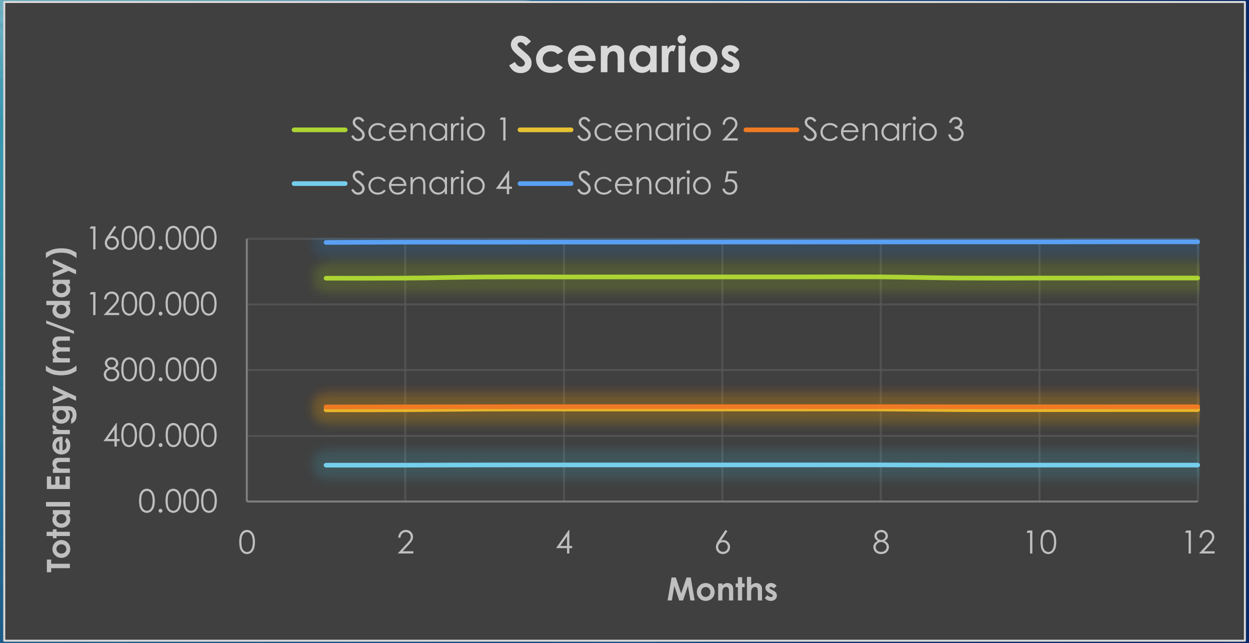
		Wells Producing												
Scenario	**Description**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**14**
1	Equal Flow All Wells	X	X	X	X	X	X	X	X	X	X		X	X
2	Maximum Flow Clean Wells / Minimum Flow Dirty Wells	X								X		X	X	
3	Wells Closer to Tank Storage				X			X				X	X	
4	Fewest Number of Wells	X						X						
5	All Wells with Maximum Flow	X	X	X	X	X	X	X	X	X	X	X	X	X

	Scenarios		
Rank	Total Energy	Concentration of Fluoride	Drawdown
1	4	2	1
2	2	4	3
3	3	3	2

Conclusion – **Comparison of Scenarios**

Total Energy (m/day)

Scenario	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
1	1359.413	1359.876	1365.914	1366.164	1366.180	1366.278	1366.291	1366.393	1360.368	1360.212	1360.303	1360.313
2	558.202	558.698	562.065	562.237	562.256	562.349	562.363	562.417	559.109	559.032	559.124	559.132
3	575.382	575.881	576.409	576.491	576.510	576.591	576.604	576.687	576.174	576.181	576.267	576.271
4	220.460	220.582	222.183	222.309	222.340	222.463	222.486	222.558	221.046	221.058	221.189	221.196
5	1576.748	1579.074	1578.931	1579.314	1579.404	1579.783	1579.847	1580.238	1580.460	1580.495	1580.898	1580.916



thank you!

Texas Tech University

Department of Civil Engineering

Water Resources

WOLFFORTH PROJECT

Optimization of Existing Infrastructure for Municipal Wells

Water Resources Management

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12/10/16

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Executive Summary

The Purpose of this report was to minimize the total energy used by the city of Wolfforth to pump and transport water to its water treatment facility. The total energy was determined by considering the energy required to produce 792,000 gallons of water per day in the summer and 660,000 gallons of water per day in the winter for a population of 4400. 5 scenarios, which used 13 wells, were considered to meet these demands. Factors considered in each scenario were water quality, yield from each well, and well distance from the ground storage tank. Based on these factors, the optimal scenario for meeting the summer and winter daily water demands had a minimum net total energy of 223 meters. The project model considered the following constraints and considerations:

- Capacity of wells
- Maximum and minimum storage capacity of the groundwater storage tank
- Drawdown at each pump
- Demands
- Energy costs of EDR operations

Background of Study Area

The first visit to the city of Wolfforth's water treatment facility was made on October 4, 2016. During this visit, the city's current water conditions were explained and their future expectations were detailed. It was decided that the current water system could be optimized to reduce the total cost needed to produce water from the wells and distributed for residential use. During this time, valuable information was obtained to complete our project and information. The group was informed that there were 17 wells in the city, but only 16 were producing; from those 16, only 13 were active. It was also stated that there were two groundwater ground storage tanks and three water storage towers. Of the two groundwater storage tanks, one was new, and built by the company Caldwell Tanks, and had a capacity of 1.5 million gallons.

Figure 1: New Groundwater Storage Tank

Once the visit was concluded, the city of Wolfforth website was used to retrieve further information on their water system and water quality. According to the website, the city population for 2010 was approximately 3,672 people, which was an increase of 43% compared to the population in 2000. From this data, it was concluded that future growth would continue at this rate. . From this website, under the Annual Drinking Water Quality Report, the following information was obtained:

Table 1 – Wolfforth Contaminant Detection in 2015

Contaminant	**Highest Level Detected**	**Range of Levels Detected**	**Maximum Contaminant Level Allowed**	**Causes for Contamination**
Arsenic	14 ppb	8.48 – 14.1 ppb	10 ppb	Erosion of natural deposits, runoff from orchards, glass and electronics production wastes
Fluoride	5.2 ppm	4.78 – 5.38 ppm	4 ppm	Erosion of natural deposits, addition to water to promote strong teeth, discharge from fertilizer and aluminum factories

According to the United States Environmental Protection Agency, the current enforceable drinking water standard for fluoride is 4 mg/L, 4 ppm, and 0.010 mg/L, 10 ppb, for arsenic. These standards match the maximum contaminant level allowed by the City of Wolfforth.

Once groundwater is extracted and stored at the groundwater storage tank, it remains there until it is cleaned and ready to use. The treatment facility uses the EDR membrane method to filter water and get it to the required EPA standards. The GE EDR product features state that this system targets Arsenic, Fluoride, Radium and Nitrate removal. The EDR can be set to have a desirable water quality standard by adjusting the amount of electricity applied to the membrane stack. According to the GE fact sheet, the EDR works by an electrodialysis process that forces direct current to transfer and remove ionic species from the source water. The source water is passed through a cation and anion transfer membrane creating a more dilute stream. The EDR uses electrode polarity reversal to automatically clean membrane surfaces. The polarity is reversed 2 – 4 times per hour.

Figure 2: EDR Membrane Filtering

The main task assigned by the city of Wolfforth was to find a solution for optimizing their water production and treatment. Optimization will be done to find which wells should be produced to get as close to the EPA required quality needed, while meeting the city water demands and minimizing the energy costs.

Methodology

The following methods were used to calculate the total energy in the system. First the pipe infrastructure system needed to be created. This included the location and size of all the municipal well collection pipes, the location of the 13 producing wells, and the location of the 1.5 million gallon ground storage tank. This was created in AutoCAD from the information obtained from the city of Wolfforth website (http://www.wolfforthtx.us/). Once the infrastructure system was created, the energy needed to produce water and transport it to the ground storage tank could be determined. The energy needed to produce the water was determined first, but in order for this to occur, some basic aquifer properties were obtained from the United States

Geologic Survey for the High Plains Aquifer in Texas. These properties were needed to calculate the drawdown in the system as well as the depth to the water table. Once the energy to produce the water was calculated, the energy to transport the water to the ground storage was then determined. Concentration was also considered from the producing wells, and was determined for each well using data acquired from the TCEQ website (https://www.tceq.texas.gov/). The methodology for creating the system infrastructure will now be covered in greater detail

The system infrastructure was created using AutoCAD. The data inputted into AutoCAD was acquired mainly from the city of Wolfforth website (http://www.wolfforthtx.us/). The parameters needed were the location of the wells, the length of the pipes, the diameters of the pipes, and the location of the ground storage tank. A scaled model was then created in AutoCAD, which can be viewed in the appendix. A table which documents the length of each segment along with the corresponding diameter of the segments can also be viewed there. The concentrations of Arsenic and Fluoride were also considered in each well.

The concentrations for Arsenic and Fluoride were obtained from the TCEQ Water Watch database. The data gathered for each contaminate was over a range of 15 years. Each well had concentrations taken at a random time during each month. Some wells had a high number of concentrations measured for each month, while other wells only had a few concentrations measured for some months. The average of each month for a particular well was recorded for the concentration for both Arsenic and Fluoride. For the wells that did not have a concentration for a month, the average of the season (summer or winter months) for the particular well was recorded. Wells 13, 14 and 15 did not have any data recorded except for one month. The assumption was to take the average of all the wells for that particular month and record it for each well. Some concentrations are high due to a lack of samples taken for the well for that month. A table with monthly concentrations for each well can be found in the appendix. Once the concentrations for each well were determined, the next step was determine the properties of the High Plains Aquifer in Texas. This was done using data acquired from the USGS website

The properties of the High Plains Aquifer were needed to calculate the depth to the water table and the drawdown resulting from producing water from each well. These parameters were necessary for calculating the energy needed to lift water to the surface. The properties obtained and inputted into GIS were as follows: Hydraulic conductivity, specific yield, depth to water table, bottom of the well and land surface elevation. The depth to the water table and the land surface elevation are with respect to mean sea level. From this data, the saturated thickness was calculated. The saturated thickness assumes that the bottom of the aquifer corresponds to the bottom of the drilled well. It was also assumed that for any saturated thickness less than 30 meters, water could not be pumped. A raster was then created for the 13 producing wells in the city of Wolfforth. From this raster, the properties needed to apply the Theis solution were obtained.

The Theis solution was needed to calculate the net drawdown for a one year period for each producing well. This solution accounts for super positional effects each producing well has on the aquifer. The drawdown was necessary to calculate the energy to lift water because it affects the depth to the water table. It was also necessary to account for the storage capacity of the city's water supply. The energy to lift water can then be then be defined simply as the amount of energy it takes to lift water from the water table to the surface. The energy to transport water to the ground storage tank, was calculated next.

The energy to transport water to the storage tank consisted of three different types: Kinetic energy, potential energy, and the energy lost to friction. The following equation was used.

$$\frac{P_1}{\gamma} + Z_1 + \frac{V_1^2}{2g} + h_m = \frac{P_2}{\gamma} + Z_2 + \frac{V_2^2}{2g} + h_L$$

Where: $\frac{P_1}{\gamma}$ = 0, assuming that is open to the atmosphere

$\frac{P_2}{\gamma}$ = 0, assuming that is open to the atmosphere

Z: elevation at each point

V = $\frac{Q}{A}$: flow, cfs

h_m: machine head

h_L: head loss using Hazen-William formula

The Hazen-Williams method was used because of its ease of use and because its friction coefficient "C" is not a function of velocity or pipe diameter. The value of C in our scenarios was 150, which corresponds to a value used for PVC pipes. The machine head parameter was assumed to be zero in our model because we were only considered with the net total energy for each section of our system. The following equation represents the Hazen-Williams head loss:

$$h_f = \left[\frac{10.67Q^{1.852}}{C^{1.852}d^{4.8704}}\right] * L$$

Where: Q: well flow rate, m^3/day

C: Hazen-Williams roughness

L: length of the pipe, m

d: inner diameter, m

Calculations of the net total energy were performed using R. The code used in R makes use of the previously mentioned methods. The code calculates the net total energy in the system. Negative values in the code were assumed to be energy needed to move water up gradient. Tables with the concentration of Arsenic and Fluoride, energy of the segments, energy to lift water, and total energy for each scenario can be found in the appendix along with the code executed.

Results and Discussion

Five scenarios were created to minimize energy for this project. They were as follows:

1. Equal flow for all wells
2. Maximum flow from clean wells and minimum flows from dirty wells
3. Using wells closer to the groundwater tank storage
4. Maximum flow from all the wells
5. Using the least possible amount of wells to meet the demands

The total energy associated was based on the calculation of energy required to transport water to the storage tank, as well as the energy associated with pumping water from the wells. The energy required for transmission considered kinetic energy, potential energy, and frictional energy loss. The energy required to pump water considered the distance in meters to lift water from the water table. The drawdown resulting from water production in each well was considered in these calculations The following equations were used:

- Kinetic, Potential and Head loss: $E = \frac{V^2}{2g} + z + HF$
- Hazen Williams: $HF = \frac{10.67 * Q^{1.852}}{C^{1.852} D^{4.8704}} * L$
    - Units:
        - Q = $\frac{m^3}{s}$,   D = m,   L = m,   C = constant = 150,   V = $\frac{m}{s}$,g = 9.81m/s^2
- Capacity of the storage tank: 1.5 MGD
- Final concentrations going into the tank:
    - Arsenic: $(\sum_{i=1}^{n} C_i * Q_i) \ / \ Q_{total} \leq 0.02 \frac{mg}{l}$
    - Fluoride: $(\sum_{i=1}^{n} C_i * Q_i) \ / \ Q_{total} \leq 10 \ \frac{mg}{l}$
- Demands for a population of 4,400
    - Summer: 792,000 GPD = 2,998.05 m^3/day
    - Winter: 660,000 GPD = 2,498.37 m^3/day

Concerning concentration, there were some values in both Arsenic and Fluoride that were outliers which caused the values to fluctuate. This was due to fewer data entries by the TCEQ for certain wells.

Scenario 1: Equal flow for all wells

The City of Wolfforth has a water network that contains 15 municipal wells, and 13 of those wells were connected to the ground storage tank. The first scenario involved having 12 wells producing an equal flowrate. The city's summer and winter demand was 2998 and 2498 m^3/day, respectively, and in order to fulfill this demand, the 13 wells have to produce at a rate of 231 m^3/day in the summer and 192 m^3/day in the winter. Having all the wells produce at this rate was not possible since well 11 could not produce higher than 218 m^3/day. Instead, well 11 was excluded and 12 wells were used. The remaining wells have a maximum flowrate of 273 m^3/s, which meets the requirement of having the 12 wells producing at 250 m^3/day in the summer and 208 m^3/day in the winter. For this scenario, the constraints that were taken under consideration were the demand previously mentioned and the concentrations using the following equation formats:

- Concentration:
  - Arsenic: $(\sum_{i=1}^{12} C_i * Q_i) / Q_{total} \leq 0.02 \frac{mg}{l}$
  - Fluoride: $(\sum_{i=1}^{12} C_i * Q_i) / Q_{total} \leq 10 \frac{mg}{l}$

One of the benefits of this scenario was that the whole well network will be in use, which will minimize pipeline corrosion and bacterial growth in stagnant pipe water. A second benefit was less drawdown. Drawdown was less because all of the wells were producing at less than maximum. Less drawdown equates to less energy needed to lift water, and longer life of the well in production.

In the outcome of this scenario, the energy observed through the pipe line segments remained the same for each month during the summer season. The value was 16.380 m. The energy in the Winer months was 10.471, and remained the same for each month. The energy required for pumping was significantly higher since all the wells were in production. The total energy consumption in the winter was less than in the summer by an average range of 5-7 meters. This can be observed in Table 2 and Figure 3:

Table 2 – Energy and Concentration Results for Scenario 1

Month	Total Energy System (m)	Total Energy Segments (m)	Total Energy to Pump (m)	Concentration Arsenic (mg/l)	Concentration Fluoride (mg/l)
Jan	1359.413	10.471	1348.942	0.016	5.369
Feb	1359.876	10.471	1349.405	0.024	5.550
Mar	1365.914	16.380	1349.534	0.017	5.253
Apr	1366.164	16.380	1349.784	0.015	5.257
May	1366.180	16.380	1349.800	0.017	5.325
June	1366.278	16.380	1349.898	0.014	5.505
July	1366.291	16.380	1349.911	0.015	5.216
Aug	1366.393	16.380	1350.013	0.014	5.272
Sep	1360.368	10.417	1349.897	0.015	5.353
Oct	1360.212	10.471	1349.740	0.014	5.286
Nov	1360.303	10.471	1349.832	0.017	5.210
Dec	1360.313	10.471	1349.842	0.017	5.254

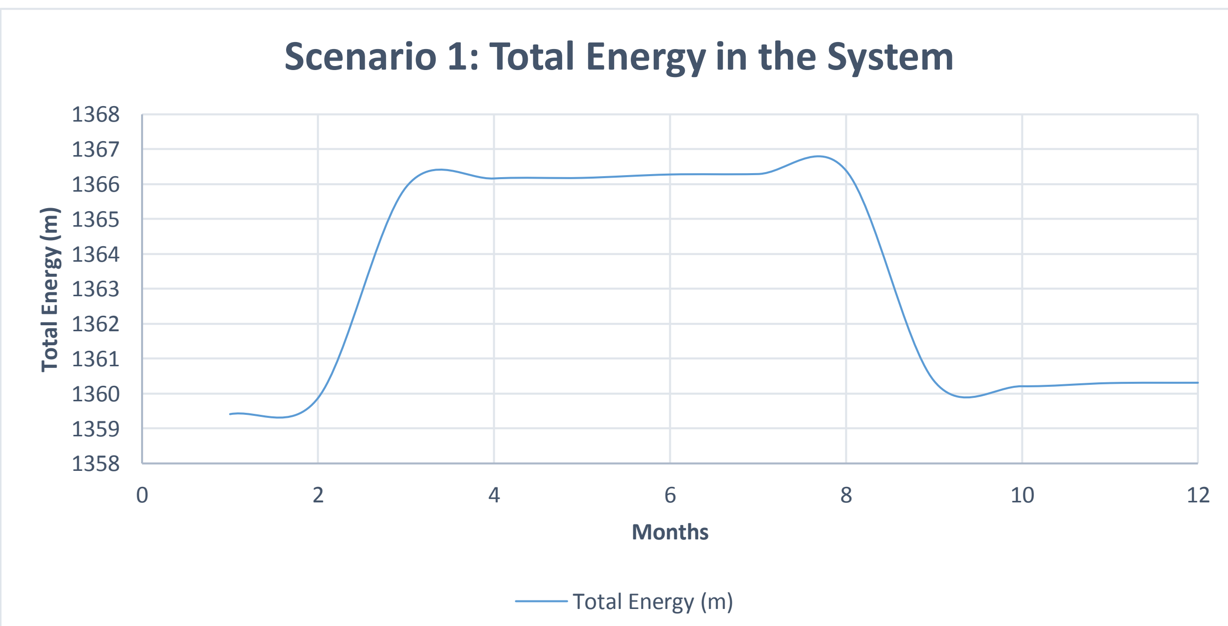


Figure 3 – Total Energy in the System for Scenario 1

Concerning concentration, for the month of February the concentration for arsenic had a value of 0.024 mg/l. This was due to the scarce amount of sample data available at the Texas Commission on Environmental

Quality (TxCEQ). Meanwhile for fluoride, consistent values were obtained with exception to February's high outlier value. Although there was an outlier, the values remained under the maximum concentration needed for industry production standards. This is observed in Figures 4 and 5:

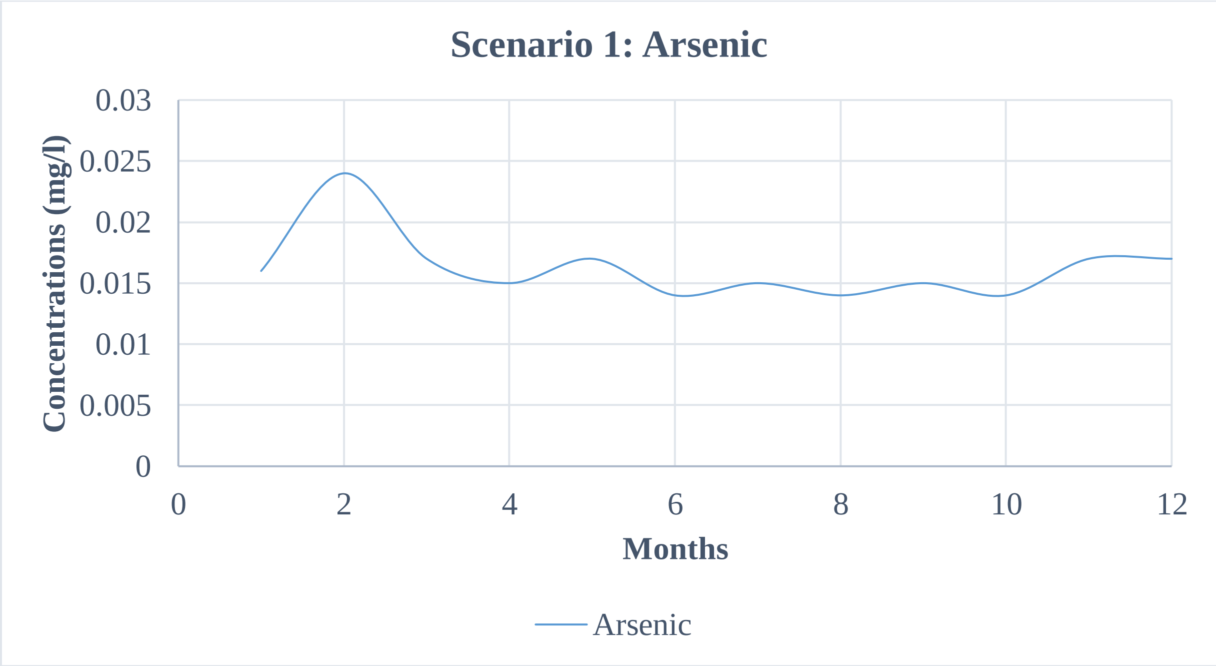


Figure 4 – Arsenic Concentration for Scenario 1

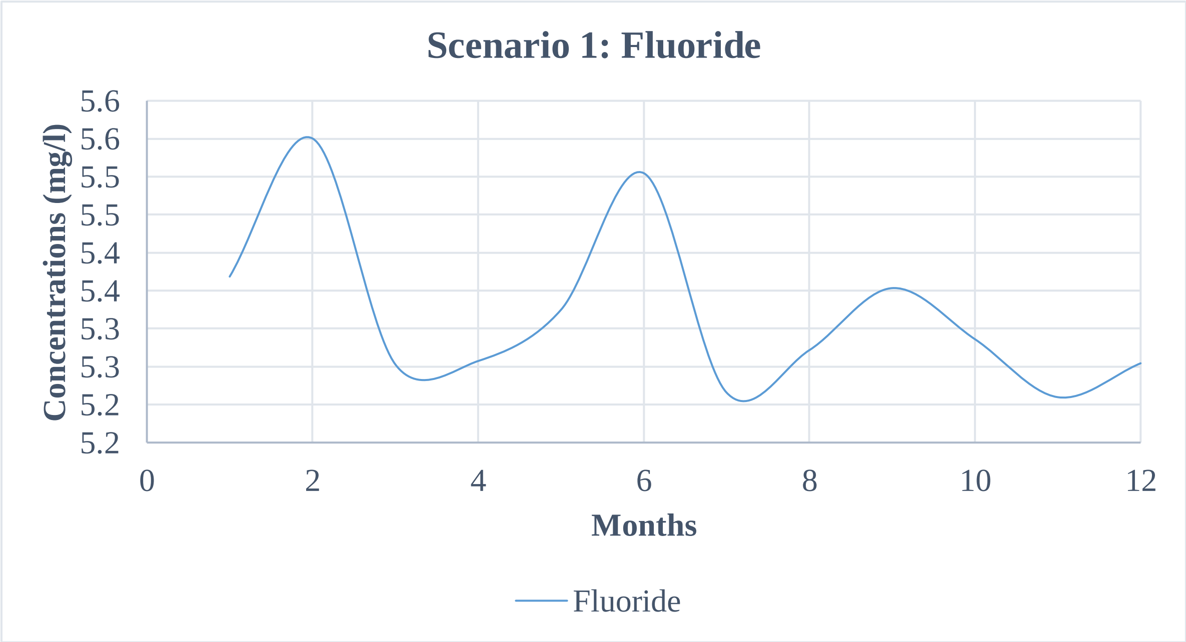


Figure 5 – Fluoride Concentration for Scenario 1

For all the wells, the yearly cumulative drawdowns were within a range of 3-3.5 meters. Following the trend for this scenario, for the following ten years, 30-35 meters of drawdown would be expected. The cumulative yearly drawdown is observed in the Figure 6:

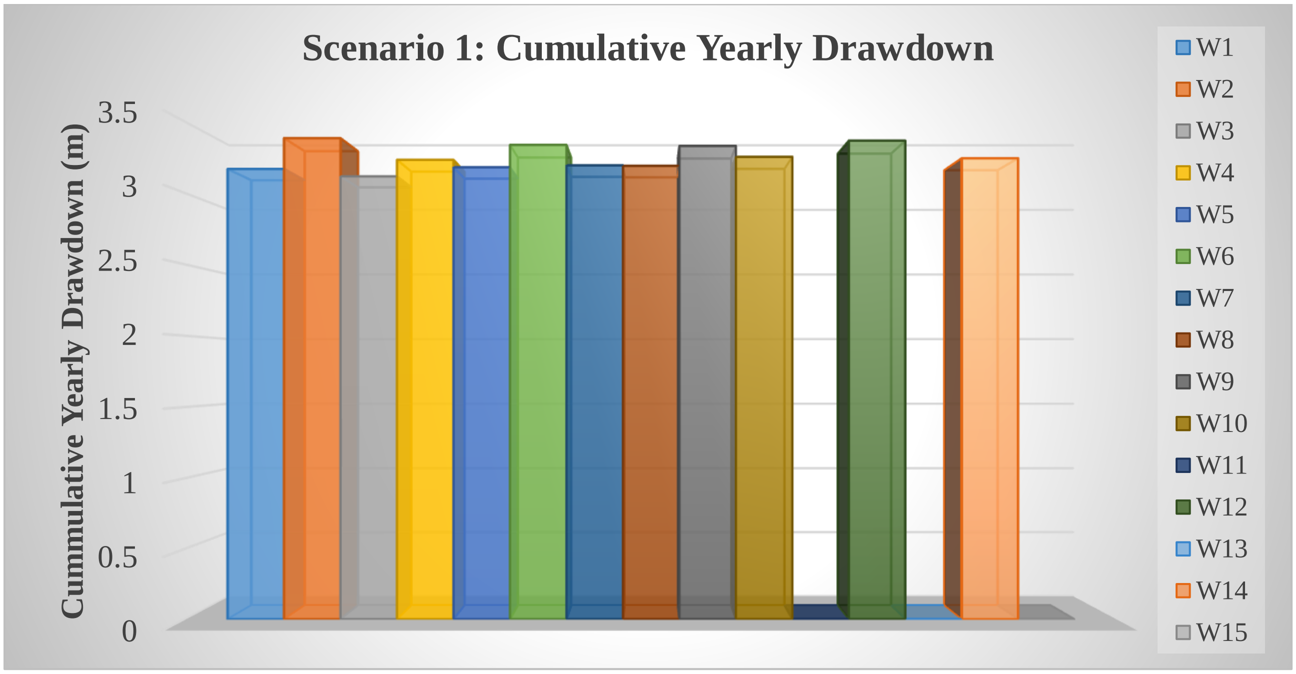


Figure 6 – Cumulative Yearly Drawdown for Scenario 1

Although producing from all the wells in this scenario had benefits, it does not consider the well contaminant concentration. Concentration must be considered if the cost of treating water is to be minimized. A way to minimize water treatment cost would be to produce more from cleaner wells.

Scenario 2: Maximum flow from clean wells and minimum flows from dirty wells

Within Wolfforth's city well network, there were different contaminant concentrations being produced from each well. The water treatment facilities would save cost if the concentration of fluoride in the groundwater was low enough to directly give to the population, so it would be beneficial to produce water from wells with lower contaminant levels and have less production from higher contaminated wells. Wells 9, 11, 12, 1 and 2 have the lowest fluoride concentration, so these wells were chosen for production.

Historically the city of Wolfforth has had difficulties treating groundwater to have acceptable contaminant concentrations. According to the city's website, during 2015, there were 4 violations throughout several months. To reduce the frequency of the violations, it would be beneficial to decrease the contaminant concentration that is being produced. For this scenario, the constraints that were considered were the demands and concentrations previously mentioned. This was done by using the following equation formats:

- Concentration of Arsenic
  - Clean wells: $(\sum_{i=1}^{n} C_i * Q_i)\ Q_{total} \leq 0.02 \frac{mg}{l}$
  - Dirty wells: $(\sum_{i=1}^{n} C_i * Q_i)\ Q_{total} \geq 0.02 \frac{mg}{l}$
  - Maximum: $(\sum_{i=1}^{n} C_i clean * Q_i clean + C_i dirty * Q_i dirty)\ Q_{total} \leq 0.02 \frac{mg}{l}$
- Concentration of Fluoride
  - Clean wells: $(\sum_{i=1}^{n} C_i * Q_i)\ /\ Q_{total} \leq 10 \frac{mg}{l}$
  - Dirty wells: $(\sum_{i=1}^{n} C_i * Q_i)\ /\ Q_{total} \geq 10 \frac{mg}{l}$
  - Maximum: $(\sum_{i=1}^{n} C_i clean * Q_i clean + C_i dirty * Q_i dirty)\ /\ Q_{total} \leq 10 \frac{mg}{l}$

In the outcome of this scenario, the energy observed through the pipe line segments remained the same during the summer season. The value was 15.123 m. The energy remained the same during the winter as well. The value was 11.809 m. The energy required for pumping remained approximately constant through the year. The total energy consumption in the winter was less than in the summer by an average range of approximately 4 meters. This can be observed in Table 3 and Figure 7:

Table 3 – Energy and Concentration Results for Scenario 2

Month	**Total Energy System (m)**	**Total Energy Segments (m)**	**Total Energy to Pump (m)**	**Concentration Arsenic (mg/l)**	**Concentration Fluoride (mg/l)**
Jan	558.202	11.809	546.394	0.015	4.777
Feb	558.698	11.809	546.890	0.015	5.074
Mar	562.065	15.123	546.942	0.018	4.775
Apr	562.237	15.123	547.114	0.014	4.865
May	562.256	15.123	547.133	0.018	4.902
June	562.349	15.123	547.226	0.015	4.896
July	562.363	15.123	547.240	0.016	4.819
Aug	562.417	15.123	547.293	0.015	4.998
Sep	559.109	11.809	547.300	0.016	5.617
Oct	559.032	11.809	547.223	0.014	4.849
Nov	559.124	11.809	547.316	0.015	4.933
Dec	559.132	11.809	547.323	0.015	5.014

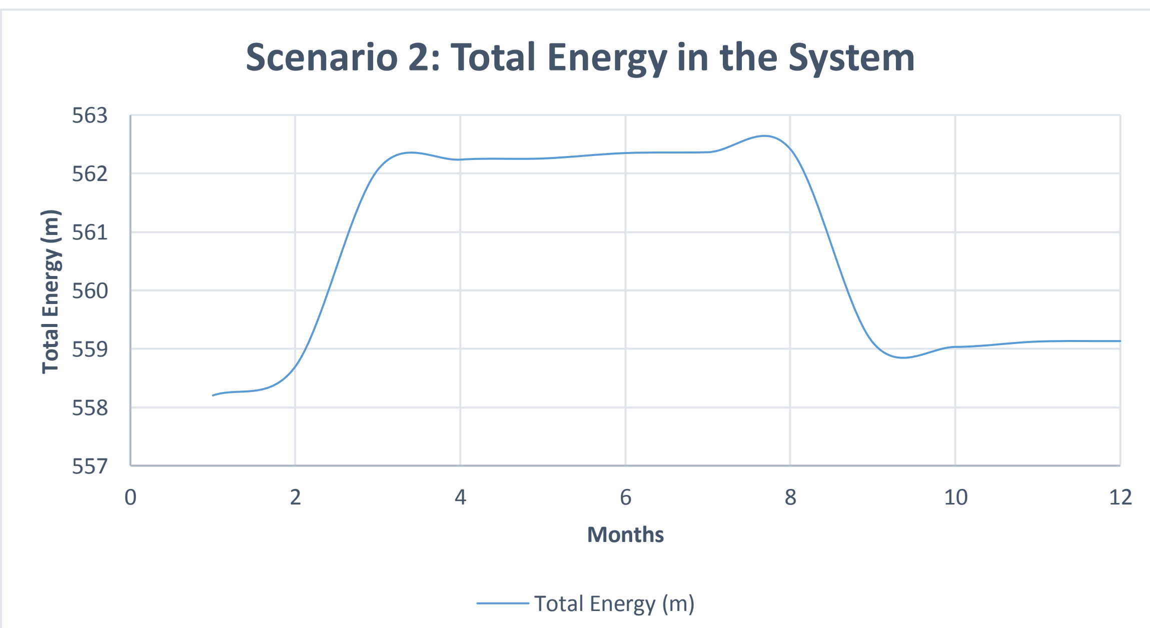


Figure 7 – Total Energy in the System for Scenario 2

Concerning concentration, this scenario's objective of having a reduced amount of fluoride was reached. The concentrations for arsenic and fluoride can be observed in Figures 8 and 9:

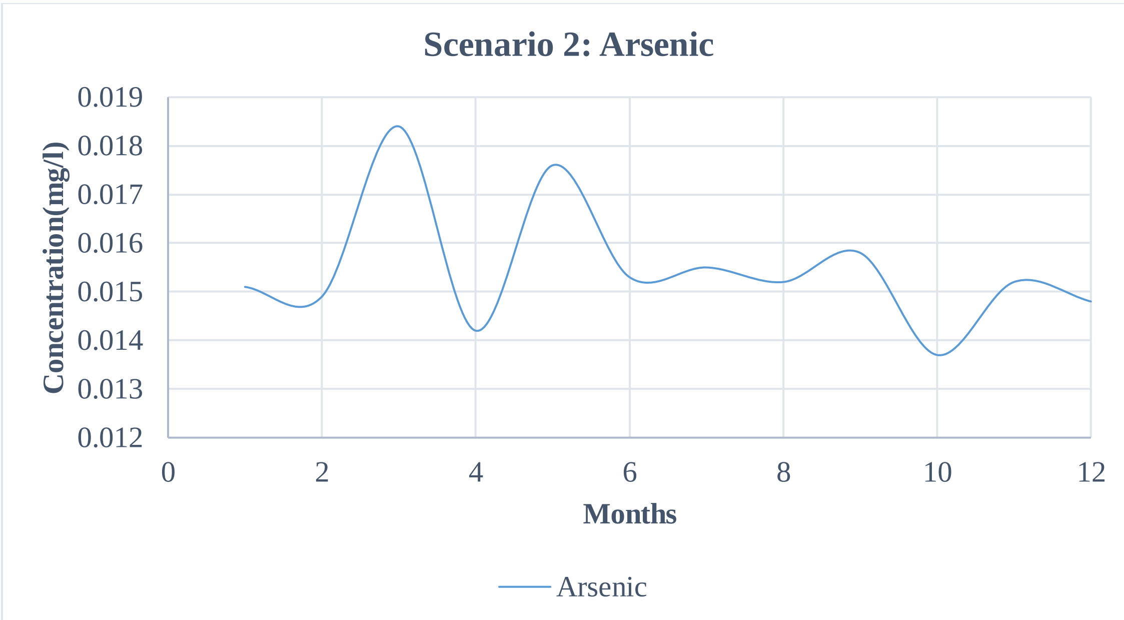


Figure 8 – Arsenic Concentration for Scenario 2

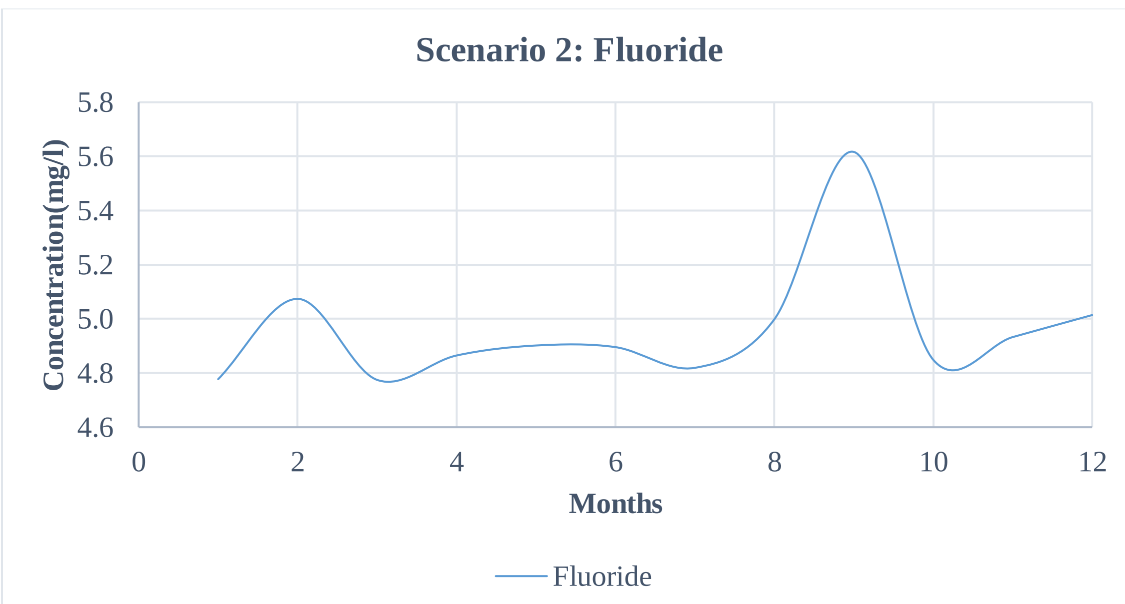


Figure 9 – Fluoride Concentration for Scenario 2

Since we were using well 1 at its maximum yield, the drawdown is going to have a high value, 25.81 m, in comparison to the other wells, which fluctuate from 3 to 4.5 m. The cumulative yearly drawdown can be observed in Figure 10:

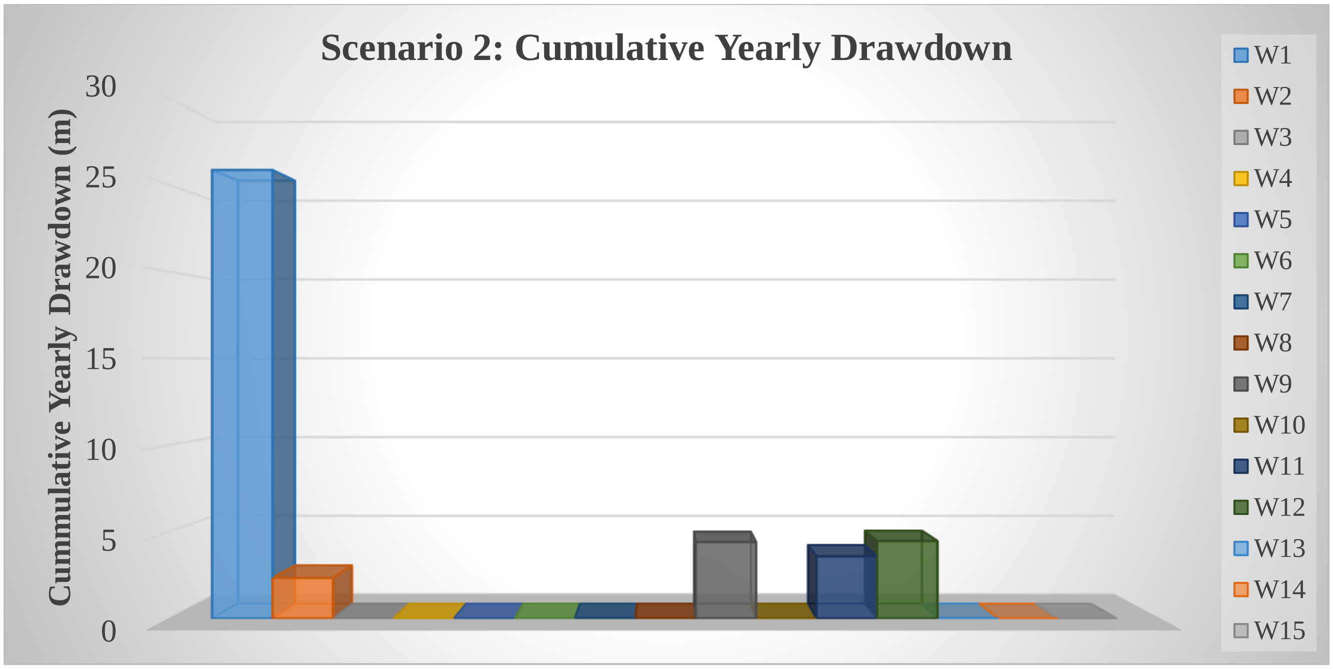


Figure 10 – Cumulative Yearly Drawdown for Scenario 2

If the main objective was to minimize cost, another factor that needs to be taken into consideration should be the distance the well is from the ground storage tank. In this scenario, the well distance was not taken into consideration, so there was a possibility that the cost of transportation was high. Another method to minimize the cost of water treatment and prevent contamination violations is to use newer treatment technology that would increase the ability to remove the water's impurities.

Scenario 3: Using wells closer to groundwater tank storage

Within the well network, there were different variations of well distances. It would be beneficial to produce water from wells within close proximity to the groundwater storage tank in order to minimize the total energy. Therefore, Wells considered in this scenario, were within a 5,000 feet radius from the storage tank. The benefits for this scenario include not only the minimization of distance to the storage tank, but also the reduction of total energy and cost of transportation. Another benefit was shorter distances to the storage tank equates to less head losses for the pipes. For this scenario, the constraints taken into consideration were the demands previously mentioned and the concentrations using the following equation formats:

- Radius from storage tank: 5,000 ft
- Concentration:
  - Arsenic: $(\sum_{i=1}^{5} C_i * Q_i) / Q_{total} \leq 0.02 \frac{mg}{l}$
  - Fluoride: $(\sum_{i=1}^{5} C_i * Q_i) / Q_{total} \leq 10 \frac{mg}{l}$

The wells chosen for this scenario were 12, 11, 4, 7 and 14 because they were within the range given by the constraints of this scenario. Although Well 2 was closer to the storage tank, it was not chosen because it had a high level of contaminants.

For the summer season, wells 12, 11, 4 & 7 were pumping at full capacity. For well 14, it was adjusted to pump at 109.02 m^3/day. Bur for the winter season, wells 12, 11, & 4 were pumping at full capacity. For well 7, it was adjusted to pump at 1408.17 m^3/day and for well 14 it was adjusted to pump at 109.02 m^3/day. Well 12 and 11 were the cleanest, while wells 4 and 7 experience a concentration higher than 5 mg/l (ppm).

In the outcome of this scenario, the energy observed through the pipe line segments remains the same during the summer season and winter season since the wells chosen were the closet to the storage tank. The energy required for pumping remains relatively constant throughout the year. The total energy consumption in the winter was less than in the summer by an average range of 1 meter. This can be observed in Table 4 and Figure 11:

Table 4 – Energy and Concentration Results for Scenario 3

Month	**Total Energy System (m)**	**Total Energy Segments (m)**	**Total Energy to Pump (m)**	**Concentration Arsenic (mg/l)**	**Concentration Fluoride (mg/l)**
Jan	575.382	24.989	550.393	0.014	5.198
Feb	575.881	24.989	550.891	0.018	5.464
Mar	576.409	25.549	550.860	0.016	5.388
Apr	576.491	25.549	550.941	0.013	5.272
May	576.510	25.549	550.960	0.016	5.235
June	576.591	25.549	551.041	0.013	5.282
July	576.604	25.549	551.054	0.014	5.227
Aug	576.687	25.549	551.138	0.013	5.358
Sep	576.174	24.989	551.185	0.013	5.307
Oct	576.181	24.989	551.192	0.013	5.249
Nov	576.267	24.989	551.278	0.018	5.190
Dec	576.271	24.989	551.281	0.016	5.161

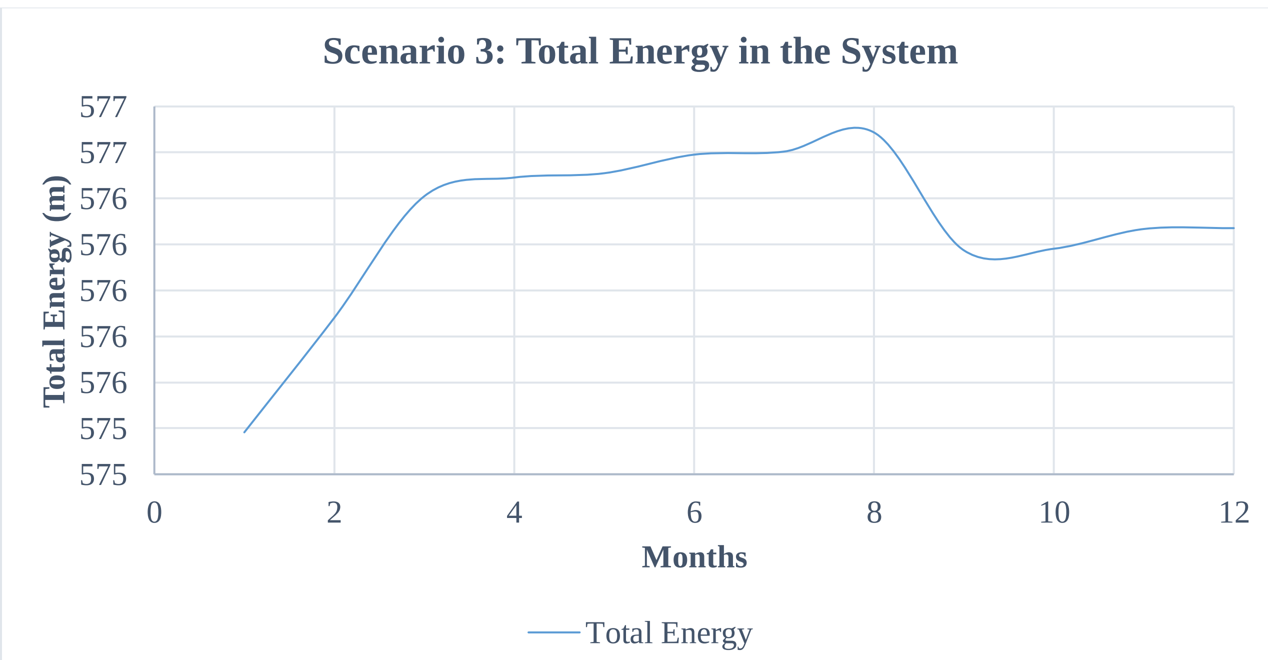


Figure 11 – Total Energy in the System for Scenario 3

Concerning concentration, both Arsenic and Fluoride meet the limit of the required criteria. The concentration for Arsenic and Fluoride can be observed in Figures 12 and 13:

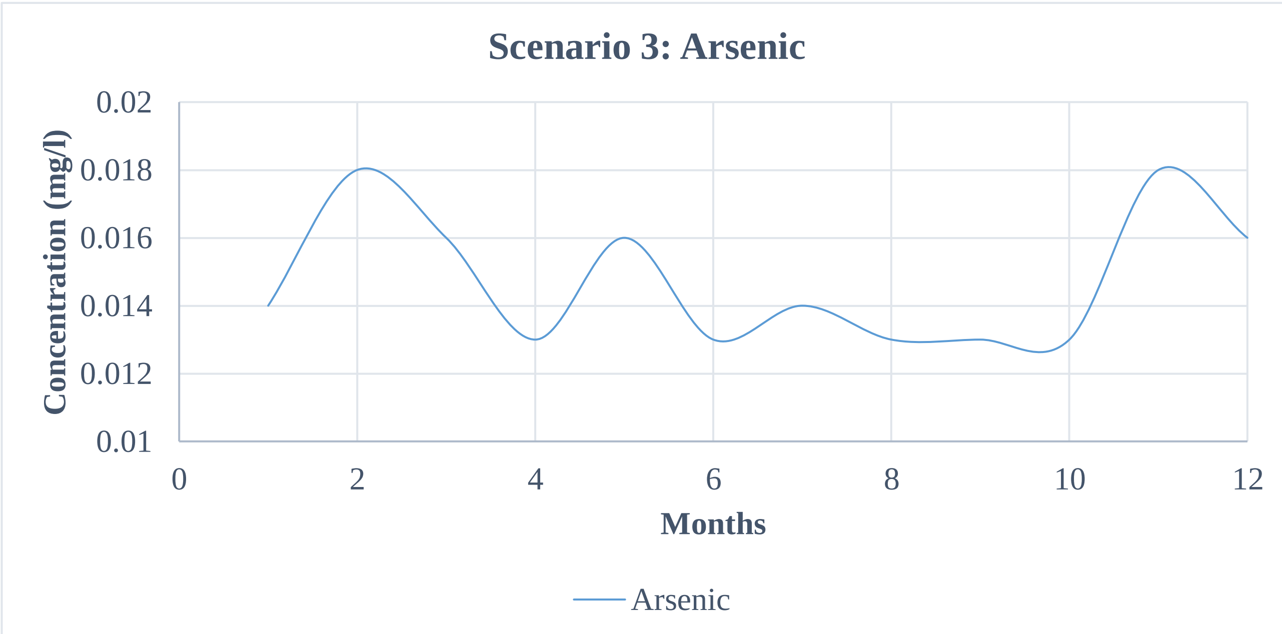


Figure 12 – Arsenic Concentration for Scenario 3

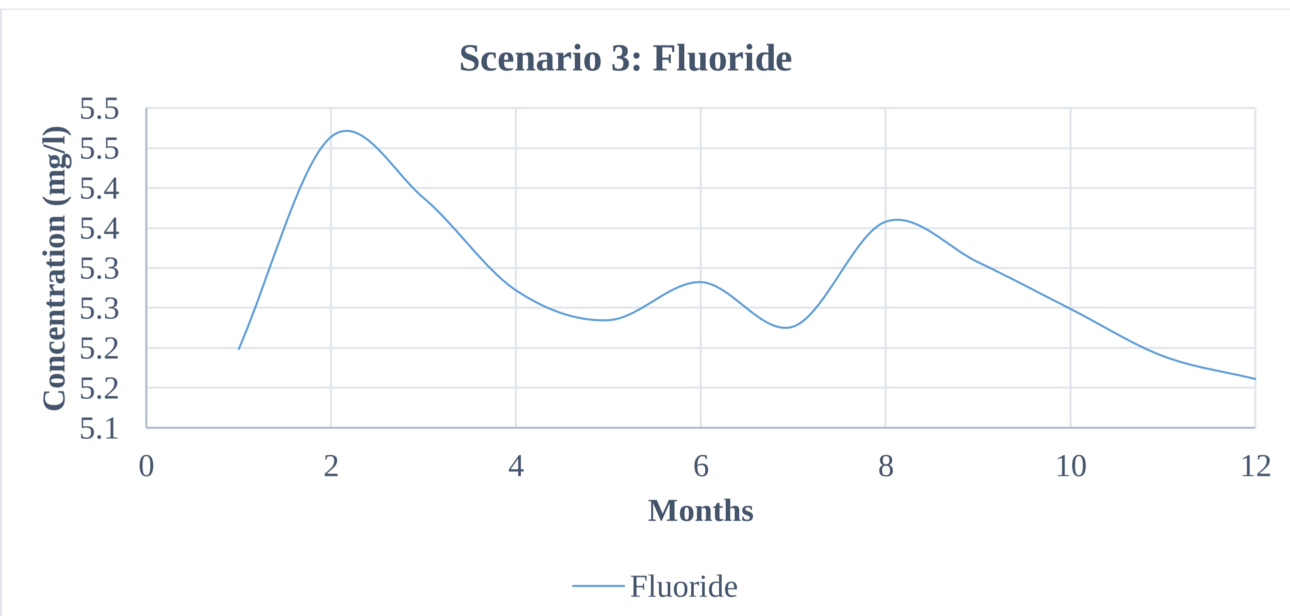


Figure 13 – Fluoride Concentration for Scenario 3

Since well 7 was at its maximum yield, the drawdown had a high value of 21.926 m when compared to the other wells. The cumulative yearly drawdown can be observed in Figure 14:

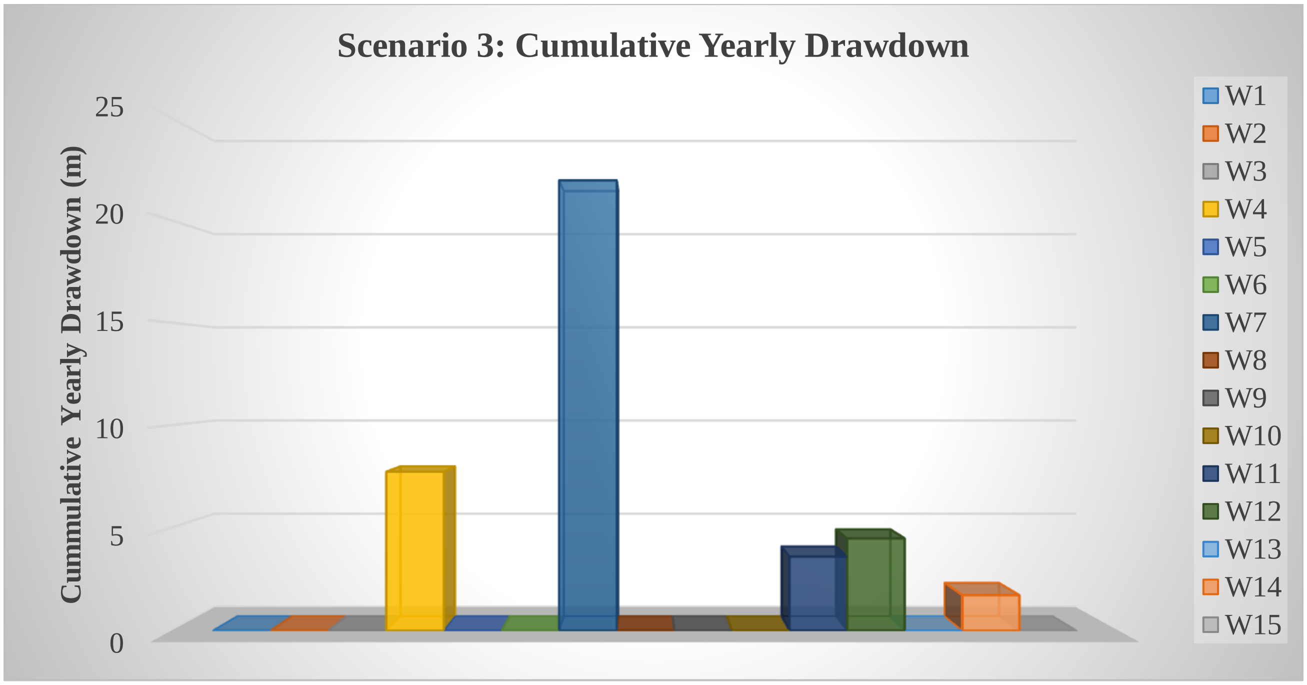


Figure 14 – Cumulative Yearly Drawdown for Scenario 3

In this scenario, the well distance was taken into consideration to minimize the cost of transporting water to the storage tank. Since concentration was also considered another benefit would be lower treatment costs.

A recommendation for this scenario would be to consider the minimum amount of close, clean wells to meet the demand criteria.

Scenario 4: Using the least possible number of wells to meet the demands.

The main criteria for selecting the wells in this scenario were well yields. Wells 1 and 7 were chosen because they produce clean water at high levels within a relatively close distance to the storage tank. Each well had a discharge value of 1907.87 m^3/day. As summer demand was higher than winter demand, pumping for each of the wells was set at 80% of their maximum yield in summer and 70 % in winter.

By using wells 1 and 7 at 80% of their maximum yield, each well would produce a total of 1526.28 m^3/day. The sum of the two wells would be equal to 3052.56 m^3/day. During winter, at 70% of maximum yield, the total supply of the two wells would be 2670.98 m^3/day. The flowrates in each of these seasons would be sufficient in meeting the demands with a safety surplus of 1%.

Our main target of the project lies on minimizing the total energy associated with the water system network. This scenario was expected to be one of the best possible scenarios for meeting the main objectives.

If there was a smaller number of wells in the system, it was expected that less energy would be expended on producing the water and transporting it to the ground storage tank. This was anticipated because the water might be required to flow through a relatively shorter network.

In the outcome of this scenario, the energy observed through the pipeline segments was relative low compared to the previous scenarios due to the fewer amount of wells used. The energy required for pumping remains relatively constant throughout the year. The total energy consumption in the winter was less than in the summer however by an average range of 1 meter. This can be observed in Table 5 and Figure 15.

Table 5 – Energy and Concentration Results for Scenario 4

Month	Total Energy System (m)	Total Energy Segments (m)	Total Energy to Pump (m)	Concentration Arsenic (mg/l)	Concentration Fluoride (mg/l)
Jan	220.460	3.831	216.629	0.014	5.075
Feb	220.582	3.831	216.751	0.016	5.312
Mar	222.183	5.469	216.713	0.015	5.150
Apr	222.309	5.469	216.839	0.013	5.116
May	222.340	5.469	216.871	0.017	5.134
June	222.463	5.469	216.994	0.014	5.105
July	222.486	5.469	217.016	0.014	5.107
Aug	222.558	5.469	217.088	0.013	5.232
Sep	221.046	3.831	217.215	0.014	5.720
Oct	221.058	3.831	217.228	0.013	5.139
Nov	221.189	3.831	217.358	0.016	5.125
Dec	221.196	3.831	217.365	0.015	5.232

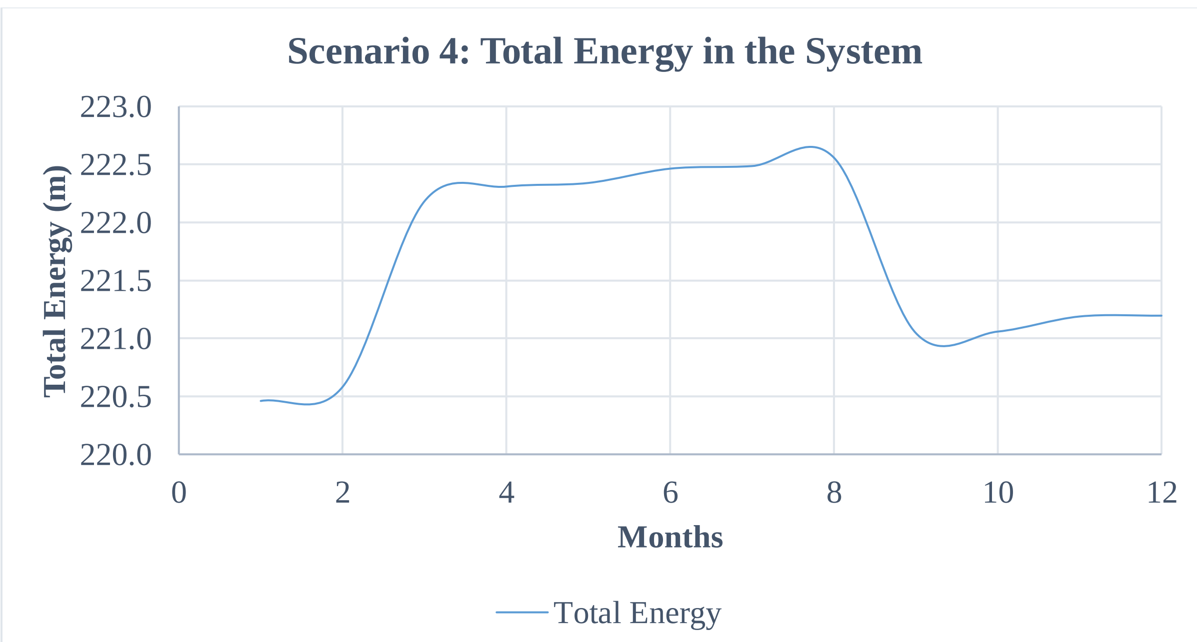


Figure 15 – Total Energy in the System for Scenario 4

Based on the results, it can be inferred that a major value in the total energy equation was the energy for pumping water. When only two wells were being pumped, a considerate amount of energy was saved. Also, when water flows through a limited network of pipes, the frictional energy loss associated would be reduced. Hence, under this scenario, the demands were met while reducing energy.

Concerning concentration, both Arsenic and Fluoride meet the limit of the required criteria even though the numbers were slightly high. The concentration for Arsenic and Fluoride can be observed in Figures 16 and 17:

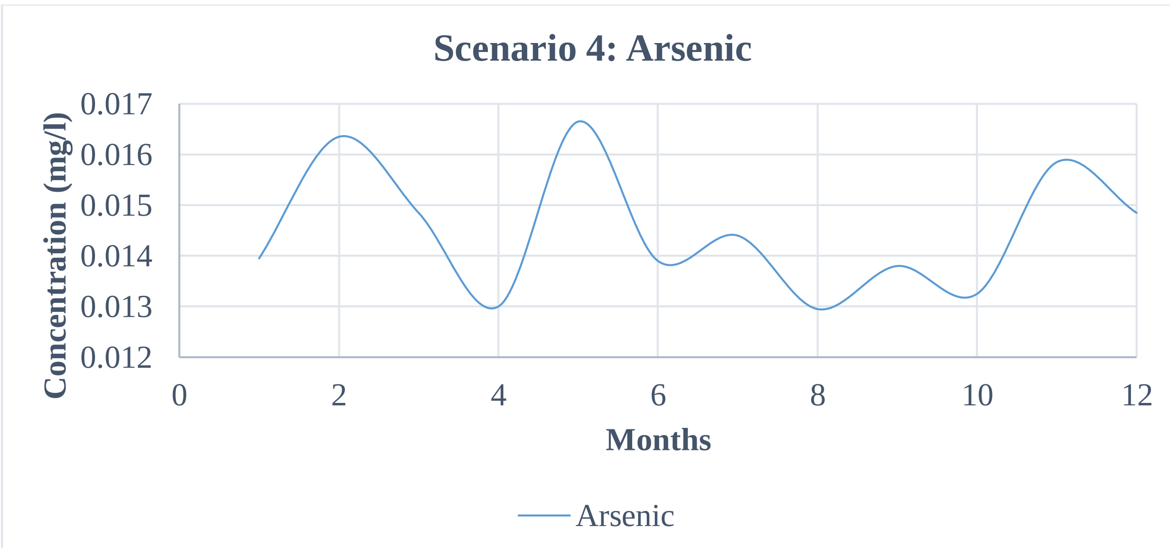


Figure 16 – Arsenic Concentration for Scenario 4

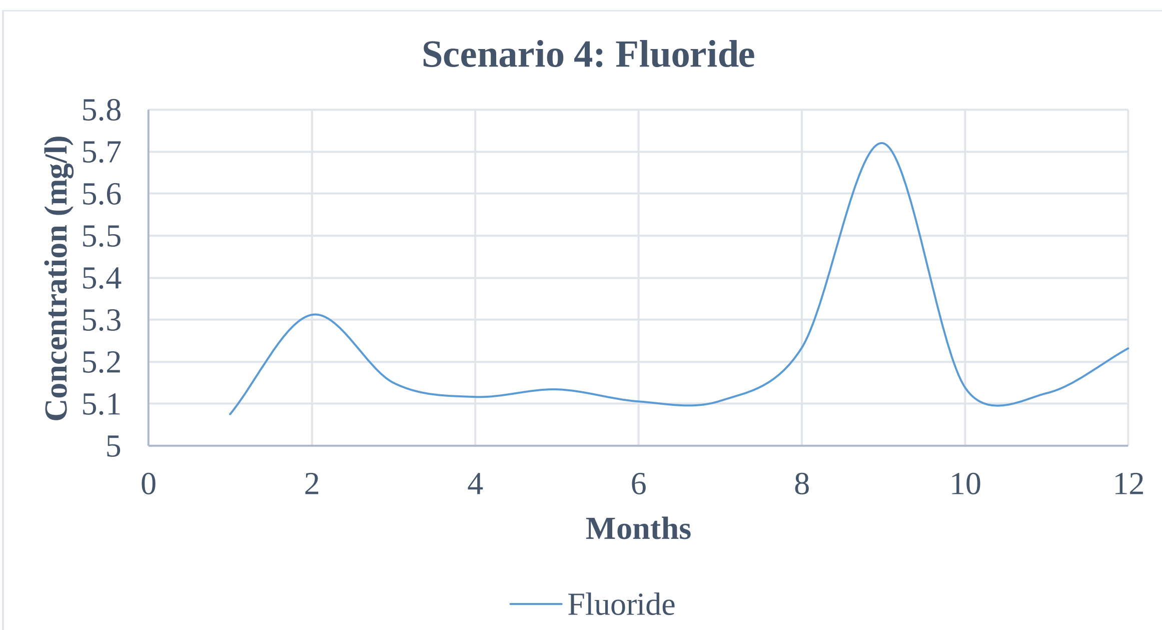


Figure 17 – Fluoride Concentration for Scenario 4

Since in this scenario only had two wells in use, the drawdown for each well had a high value, 30m. For long-term, this is not viable; we suggest alternating production with other high yielding wells in the system. The wells in the system should be turned off periodically so the aquifer can recover. The cumulative yearly drawdown is observed in Figure 18:

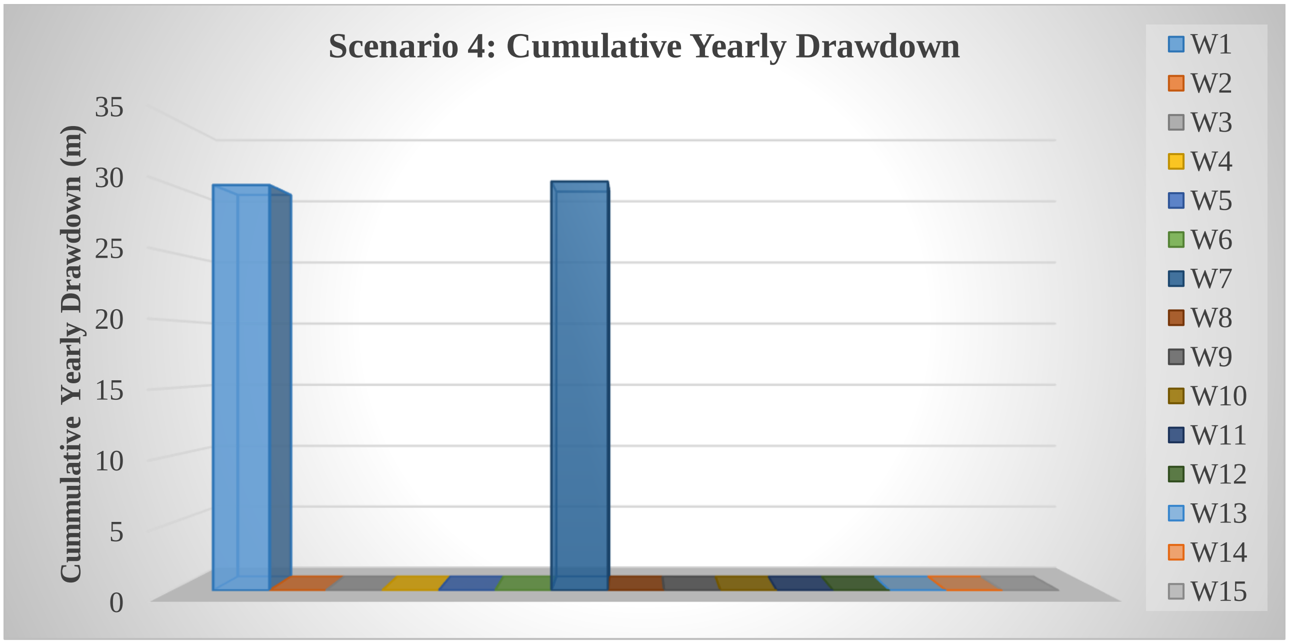


Figure 18 – Cumulative Yearly Drawdown for Scenario 4

Several limitations were observed in scenario 4. The first limitation was the creation of a large drawdown that affects the active wells and surrounding areas. The second limitation was the risk of wear down due to prolonged use. A third limitation would be corrosion in inactive pipes. Another limiting factor for this scenario would be the inability to meet larger future demands; only the demand of a 25% increase in population can be met while producing at a maximum flowrate for both wells. The final limitation would be the need for additional booster pumps to push water through the segments.

We recommend the following: occasional use of other wells to avoid the rapid depletion of the aquifer, a multiple valve system to ensure flow through the whole network to avoid pipe corrosion, and the utilization of more wells when population growth exceeds 20%.

Scenario 5: Maximum flow from all the wells

This scenario was meant to determine the full capacity of the entire system and to foresee how far it could meet the future demands. The City of Wolfforth can be expected to keep growing, so it was important to analyze the capacity of the current system for future development. By analyzing the system, the steps needed to ensure water security for the future residents can be established.

With the current storage infrastructure, the system can meet the demands of twice the current population, where as if more storage is built to hold the maximum yield of the wells, it can support the demands of 4 times the current population. This estimation was calculated by considering the total yield of the wells and dividing by the per capita demand of the summer. The results indicated a water production value that was four times larger than the current demand. This means that with maximum flow from all wells, four times the current population can be sustained.

In the outcome of this scenario, the energy observed through the pipe line segments remains constant during the summer and winter season. The energy required for pumping was significantly high since all the wells were pumping water at its maximum yield. The total energy consumption in the winter was less than in the summer by an average range of 4-5 meters. This energy was higher than the other scenarios since not only the wells are pumping at maximum yield but also there are small pipe diameters through the pipe network that require more energy. This can be observed in Table 6 and Figure 19:

Table 6 – Energy and Concentration Results for Scenario 5

Month	**Total Energy System (m)**	**Total Energy Segments (m)**	**Total Energy to Pump (m)**	**Concentration Arsenic (mg/l)**	**Concentration Fluoride (mg/l)**
Jan	1576.748	117.039	1459.709	0.015	5.588
Feb	1579.074	117.039	1462.035	0.024	5.755
Mar	1578.931	117.039	1461.892	0.017	5.328
Apr	1579.314	117.039	1462.275	0.014	5.413
May	1579.404	117.039	1462.364	0.017	5.478
June	1579.783	117.039	1462.744	0.014	5.862
July	1579.847	117.039	1462.808	0.015	5.391
Aug	1580.238	117.039	1463.199	0.014	5.340
Sep	1580.460	117.039	1463.420	0.014	5.572
Oct	1580.495	117.039	1463.455	0.014	5.482
Nov	1580.898	117.039	1463.859	0.017	5.274
Dec	1580.916	117.039	1463.877	0.017	5.450

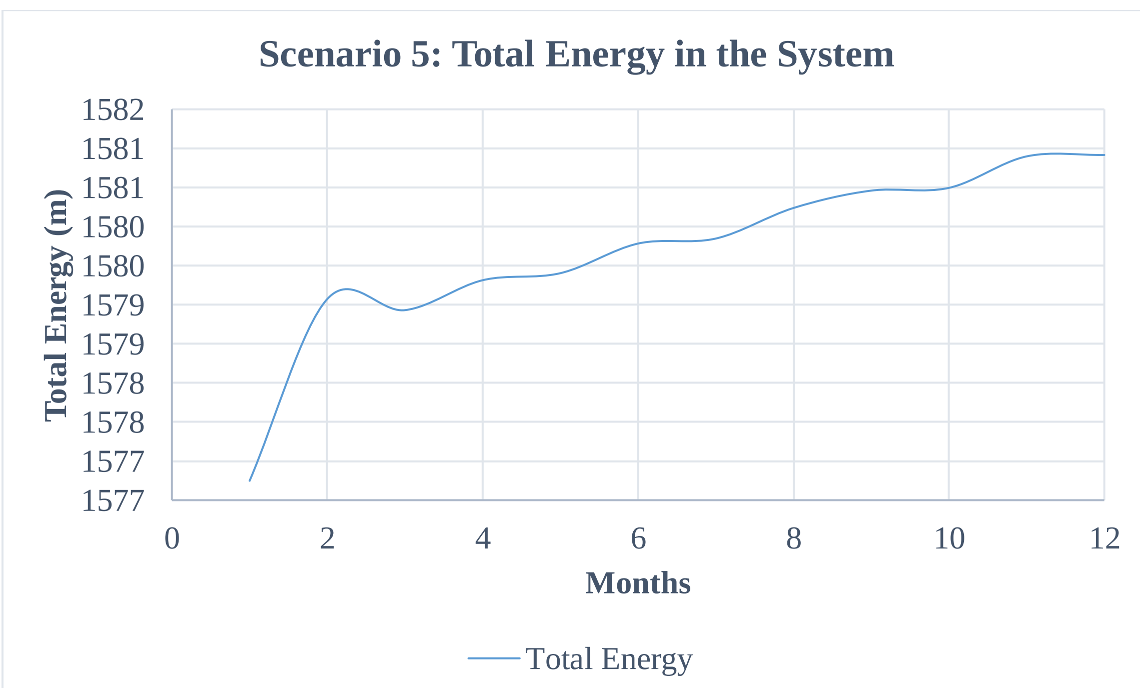


Figure 19 – Total Energy in the System for Scenario 5

Concerning concentration, both Arsenic and Fluoride have the highest values with an Arsenic violation in the month of February. The concentration for arsenic and fluoride can be observed in Figures 20 and 21:

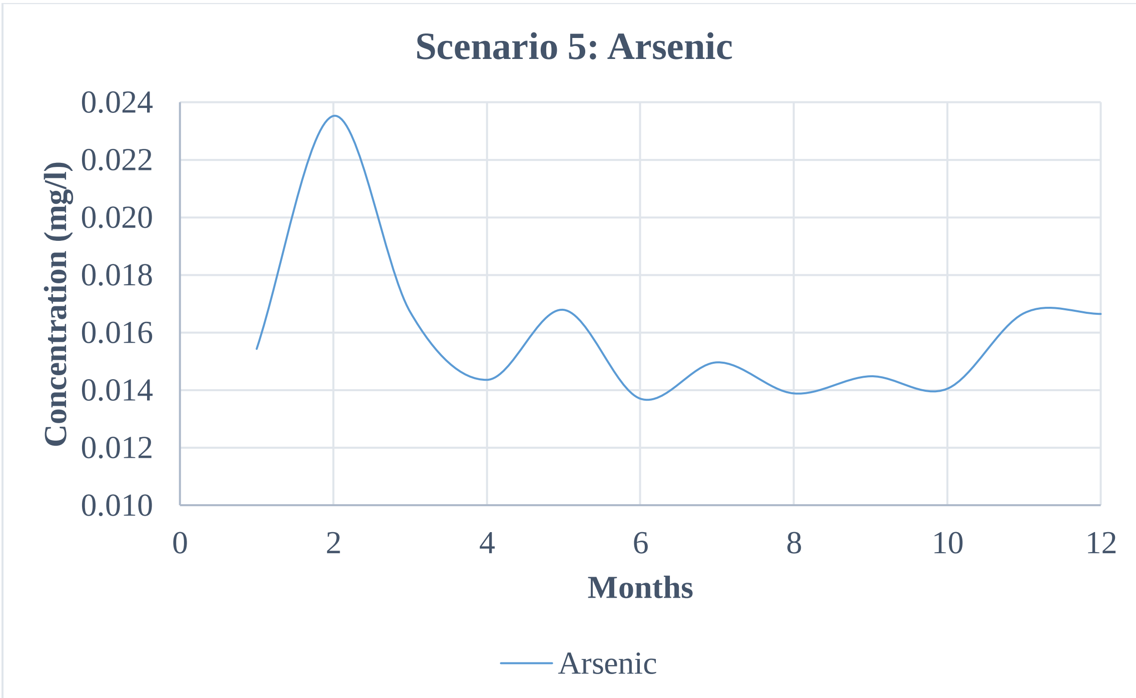


Figure 20 – Arsenic Concentration for Scenario 5

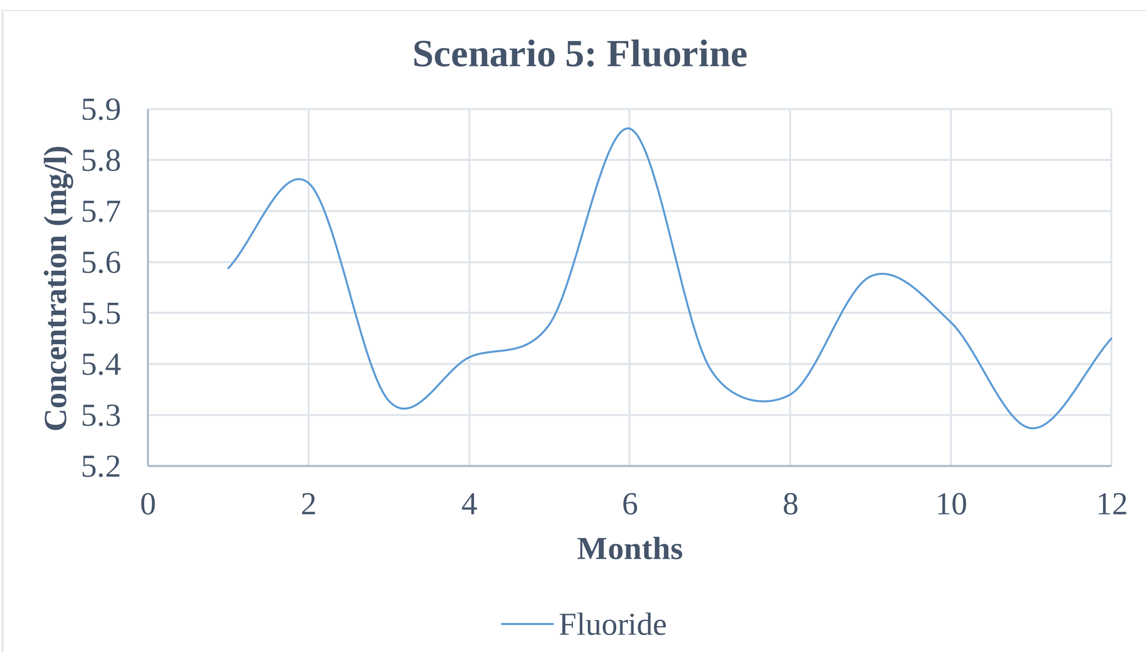


Figure 21 – Fluoride Concentration for Scenario 5

Since this scenario uses all the wells at maximum yield, the drawdown was going to vary. The difference between the wells was significant since some wells have a maximum yield of 350 GPM while others have a maximum of 40 GPM. The cumulative yearly drawdown is observed in Figure 22:

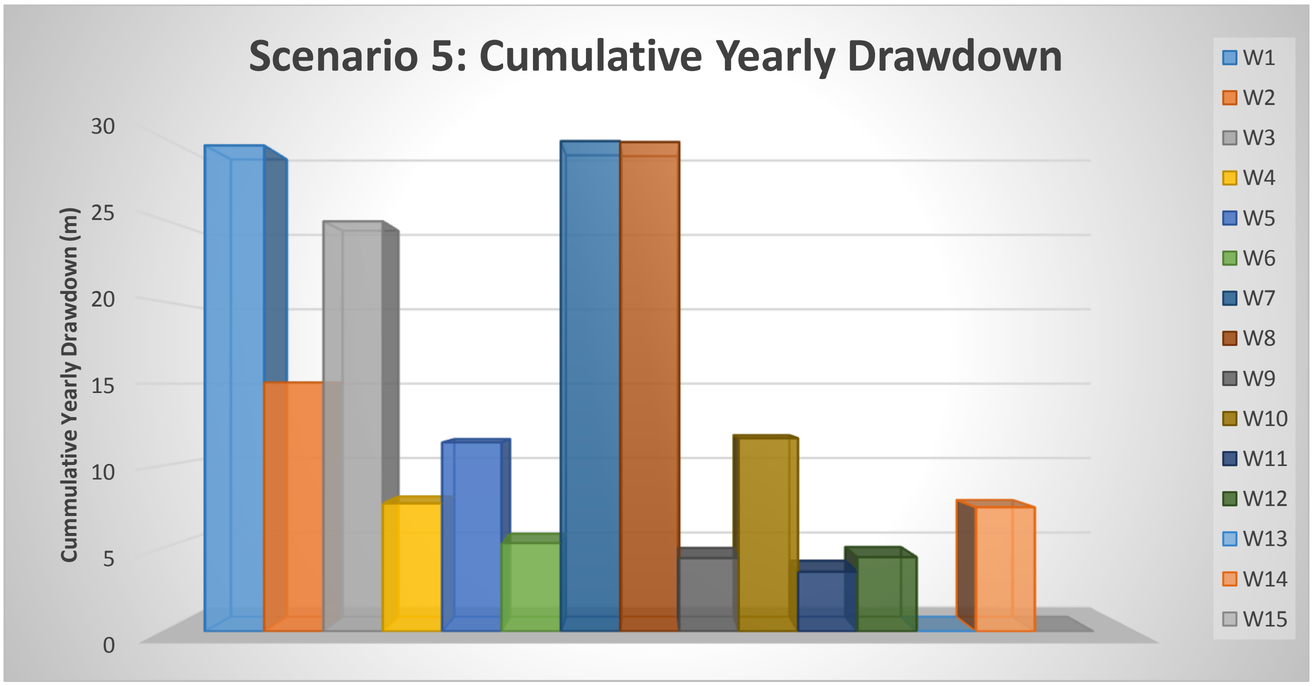


Figure 22 – Cumulative Yearly Drawdown for Scenario 5

The first limitation for this scenario was the storage tank capacity. If wells flow at their maximum rate, there would not be enough space to retain the produced water. The second limitation was the high energy required to operate the system at maximum yield, which leads higher operation costs. It may also create a need for more infrastructure, such as extra booster pumps, larger diameter pipes, and advanced valve controls.

In order to improve this scenario, an additional storage tank may be added. Larger diameter pipes may also be installed to reduce the energy associated with the transmission of water to the storage. The last recommended improvement was to limit the yield of wells with high concentrations of contaminants to meet the demands for water cleanliness. To compensate for the lower yield of the dirtier wells, the equipment for the cleaner wells may be enhanced to meet a larger flowrate. Table 7 summarizes the wells used in each scenario. It can be noted that the most commonly used wells were wells 1, 7 and 12.

Table 7 – Wells and Descriptions for Each Scenario

		Wells Producing												
Scenario	**Description**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**14**
1	Equal Flow All Wells	x	X	X	X	X	X	X	X	X	X		X	X
2	Maximum Flow Clean Wells / Minimum Flow Dirty Wells	X								X		X	X	
3	Wells Closer to Tank Storage				X			X				X	X	
4	Fewest Amount of Wells	X						X						
5	All Wells with Maximum Flow	X	X	X	X	X	X	X	X	X	X	X	X	X

To compare the scenarios and identity which situation conserved the most energy, Table 8 was created. It contains the following information:

Table 8 – Monthly Total Energy Use per Scenario

	Total Energy (m/day)											
Scenario	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	1359.413	1359.876	1365.914	1366.164	1366.180	1366.278	1366.291	1366.393	1360.368	1360.212	1360.303	1360.313
2	558.202	558.698	562.065	562.237	562.256	562.349	562.363	562.417	559.109	559.032	559.124	559.132
3	575.382	575.881	576.409	576.491	576.510	576.591	576.604	576.687	576.174	576.181	576.267	576.271
4	220.460	220.582	222.183	222.309	222.340	222.463	222.486	222.558	221.046	221.058	221.189	221.196
5	1576.748	1579.074	1578.931	1579.314	1579.404	1579.783	1579.847	1580.238	1580.460	1580.495	1580.898	1580.916

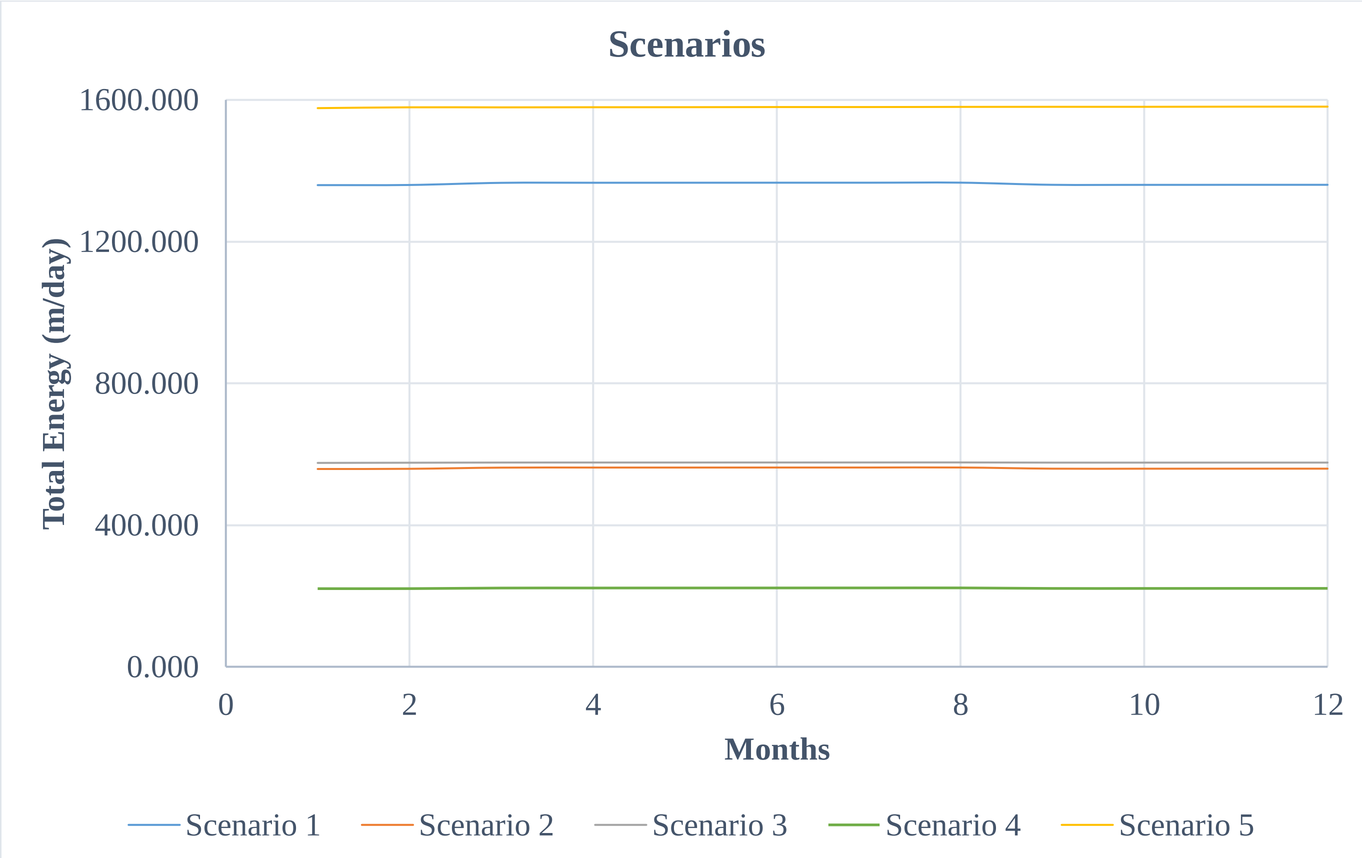


Figure 23 – Total Energy Use for 5 Scenarios

As observed in Figure 23 and Table 8, the best option for minimizing energy was scenario 4, and the second best was scenario 2. In these scenarios, the main concern was the effect long term drawdown. Large drawdowns would eventually have negative effects on the other wells preventing economical production. A large drawdown would also lower the aquifer depth, causing a depletion of water for the surrounding area. This must be kept in mind for the future scenario selection.

Table 9 ranks which scenarios meet the constraints closer to their desired objective. The best scenarios in order of rank, 1 being the best.

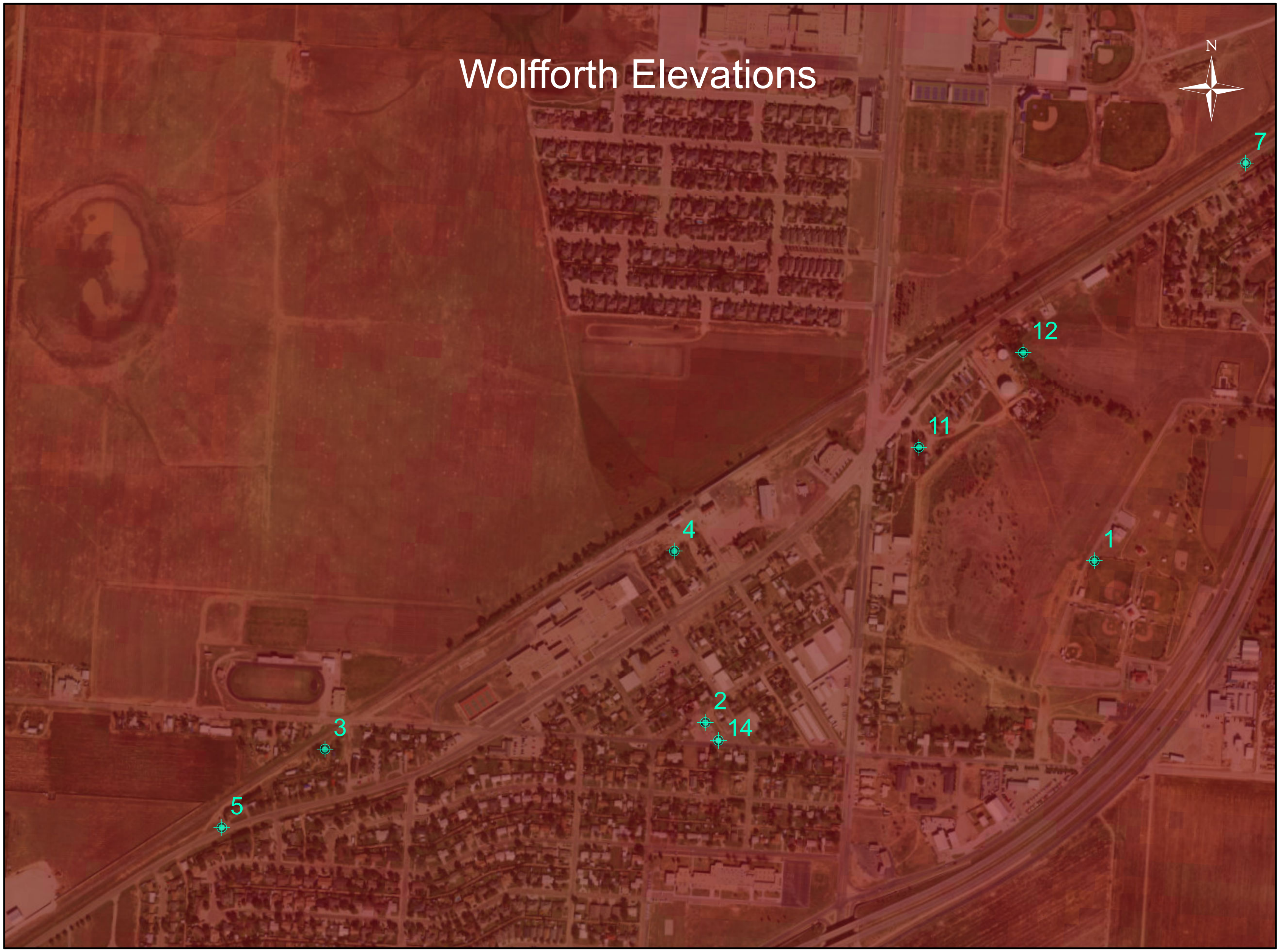
Table 9 – Scenario Results Ranking

	Scenarios		
Rank	Total Energy	Fluoride of Concentration	Drawdown
1	4	2	1
2	2	4	3
3	3	3	2

References

- " Annual Drinking Water Quality Report." Water Quality Report. City of Wolfforth, n.d. Web. Oct. 2016.
- "Chemical Contaminant Rules." EPA. Environmental Protection Agency, n.d. Web. Oct. 2016.
- Electrodialysis Reversal Water Treatment. GE Power Water & Process Technologies, n.d. Web. Oct. 2016.
- "Interactive Maps." High Plains Water District. N.p., n.d. Web. 23 Nov. 2016.
  Drilling logs
- K.F. Dennehy, P.B. McMahon, D.W. Litke, B.W. Bruce, and S.L. Qi. "High Plains Regional Groundwater Study - GIS Data." High Plains Regional Groundwater Study - GIS Data. USGS, n.d. Web. 23 Nov. 2016.
  Aquifer bottom, SY, HC
- "Maps." Maps. City of Wolfforth, n.d. Web. 23 Nov. 2016.
  City of wolfforth interactive map
- "Texas Drinking Water Watch - City of Wolfforth." Texas Drinking Water Watch. N.p., n.d. Web. 23 Nov. 2016.

Appendix



High : 1258

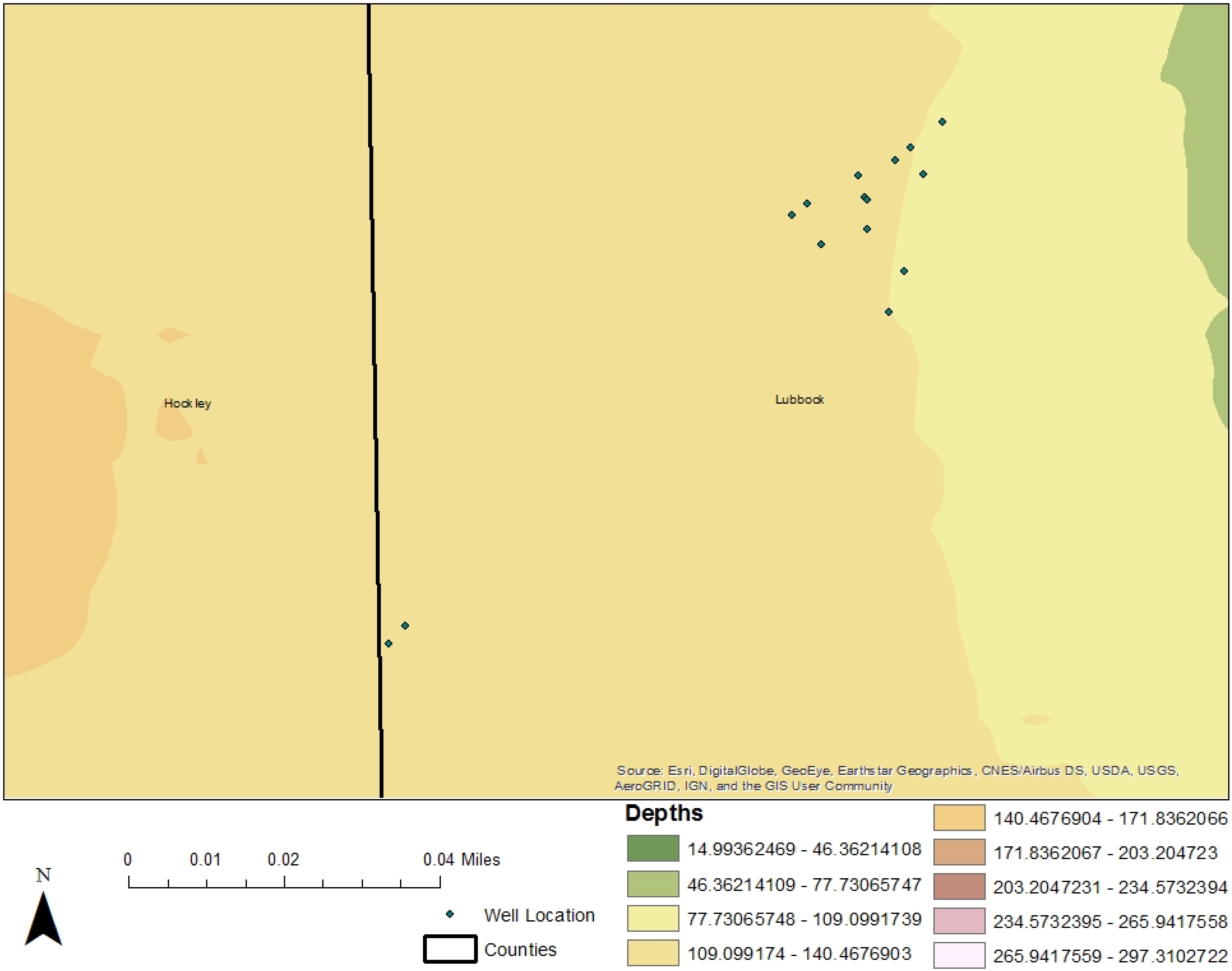
Low : 609

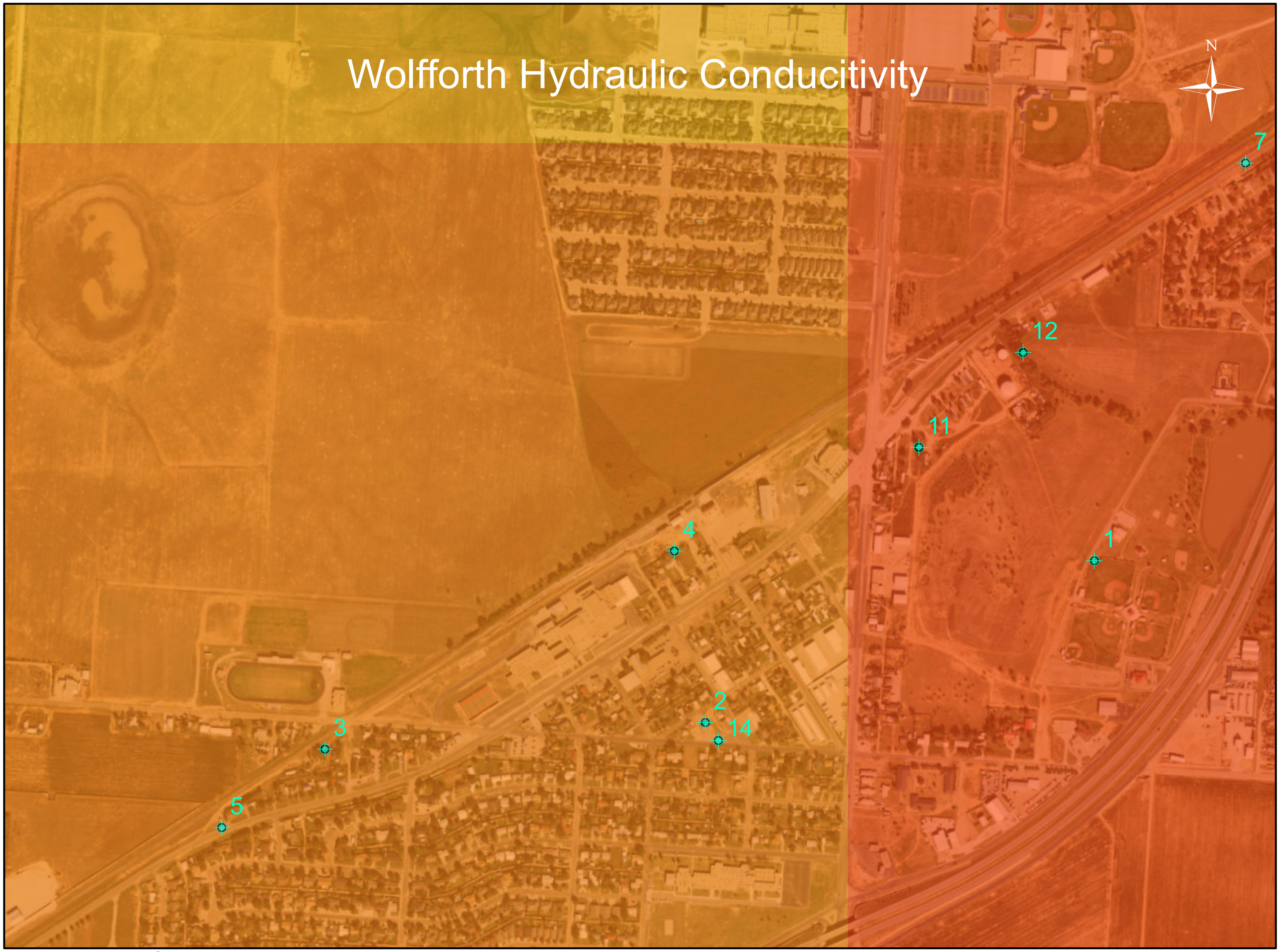
Wells

0 0.125 0.25 0.5 Miles

CE 5366-001
Fall 2016
Wolfforth Project

Depth to Water Table





Hydraulic Conductivity

High : 1048.37

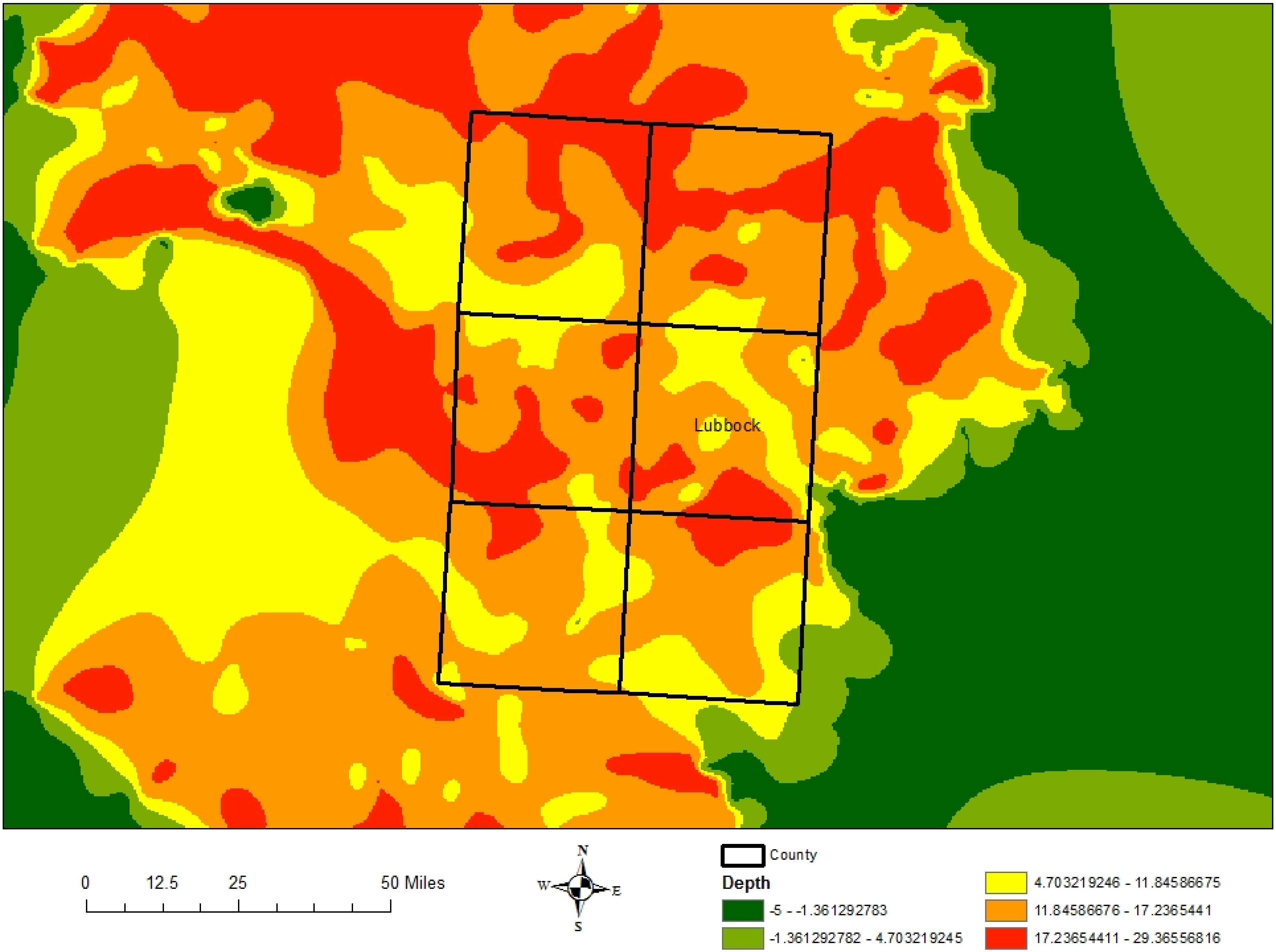
Low : 923.287

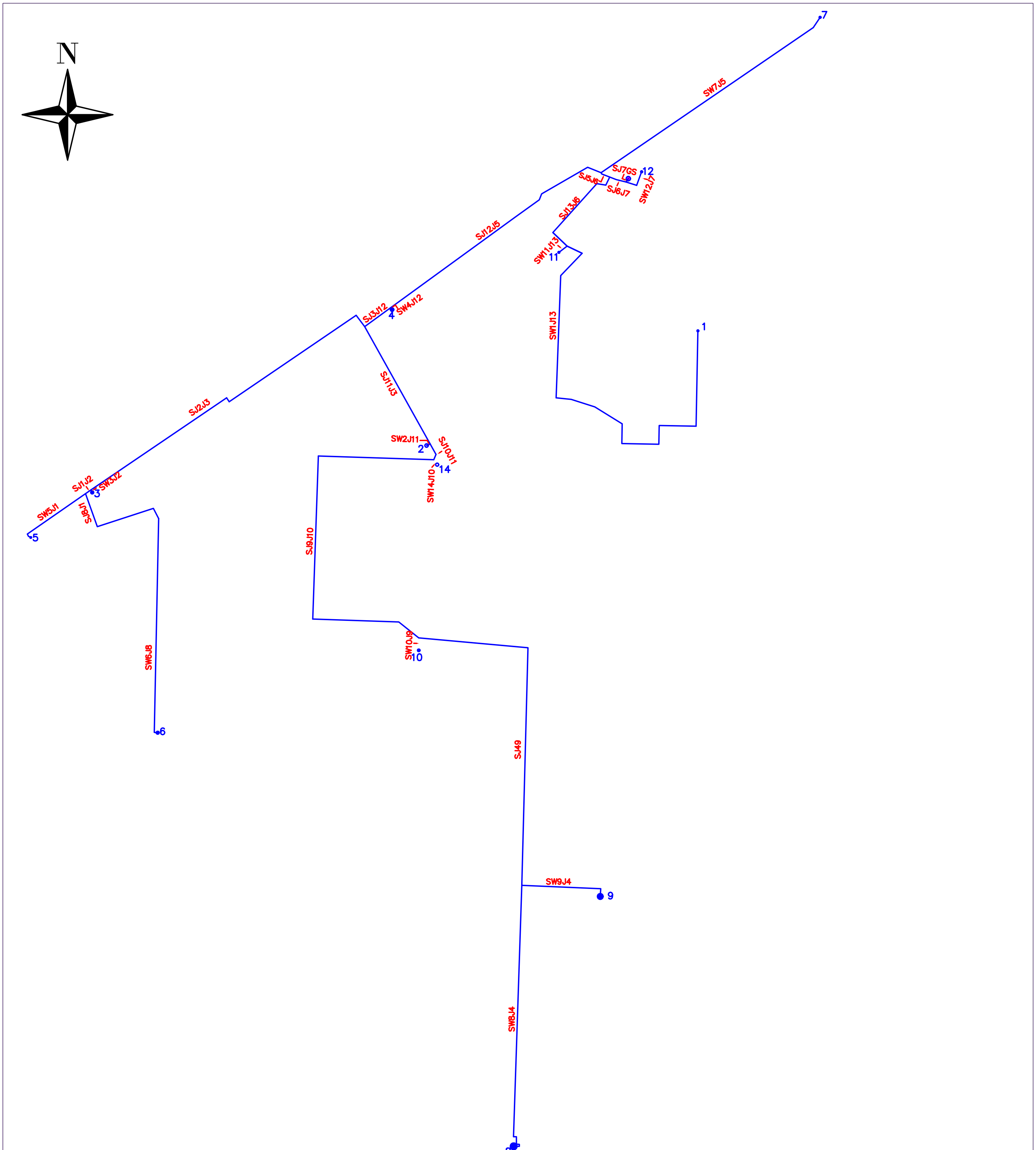
Wells

0 0.125 0.25 0.5 Miles

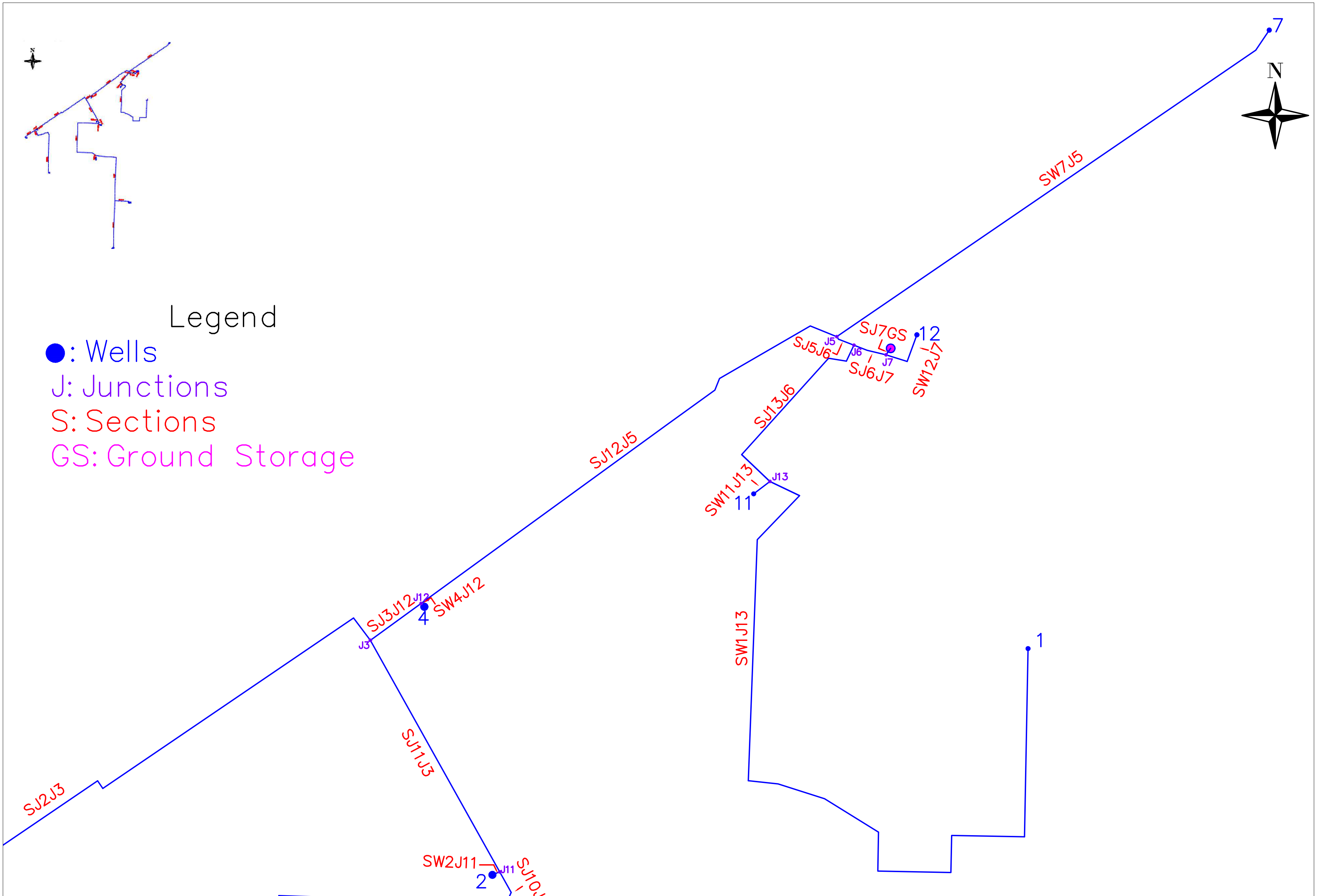
CE 5366-001
Fall 2016
Wolfforth Project

Specific Yield - Lubbock County





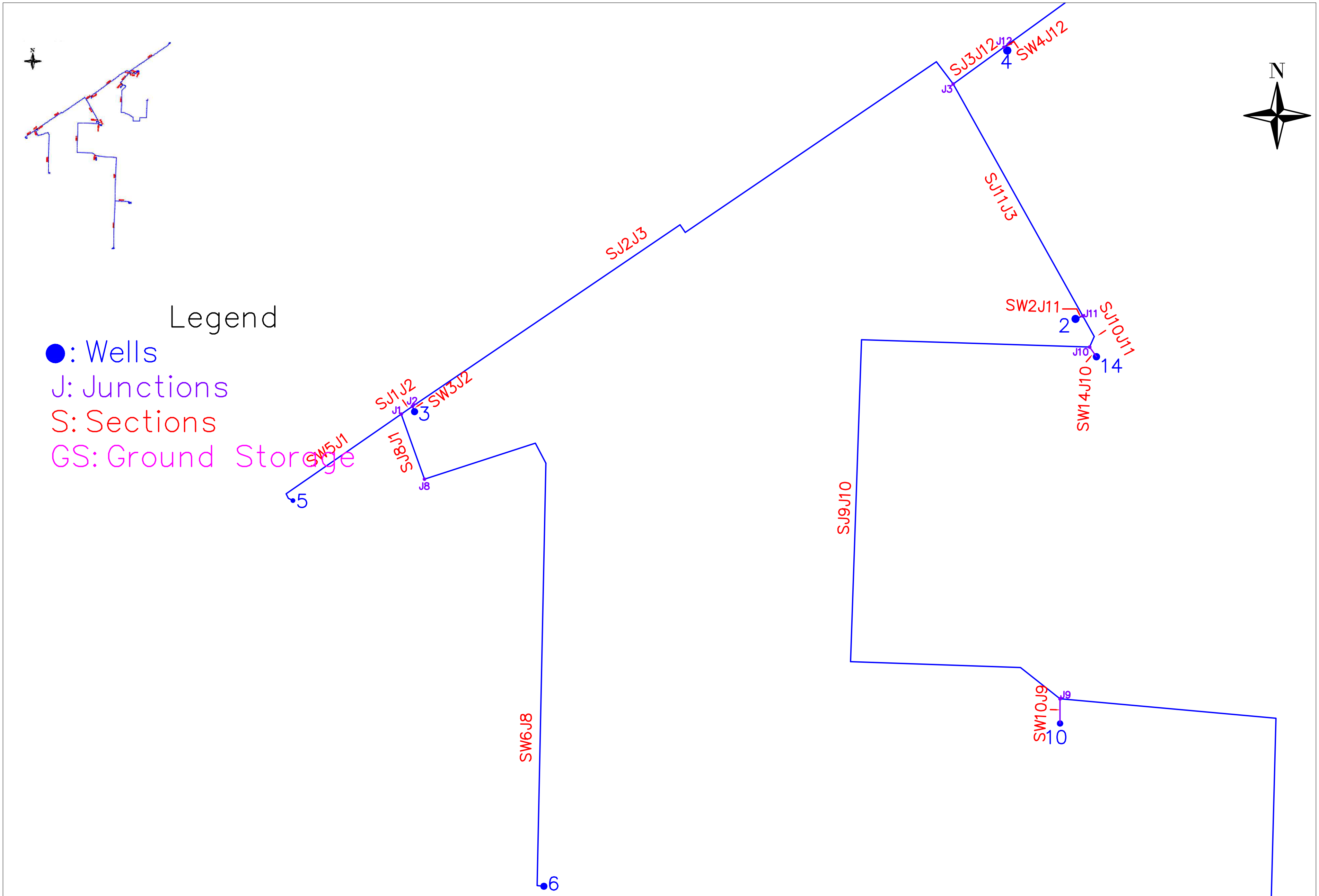
INCI 5366-001 FALL 2016	PIPE STRUCTURE WOLFFORTH	1"=40' 12/10/16



INCI 5366-001
FALL 2016

PIPE STRUCTURE
WOLFFORTH

1"=20'
12/10/16



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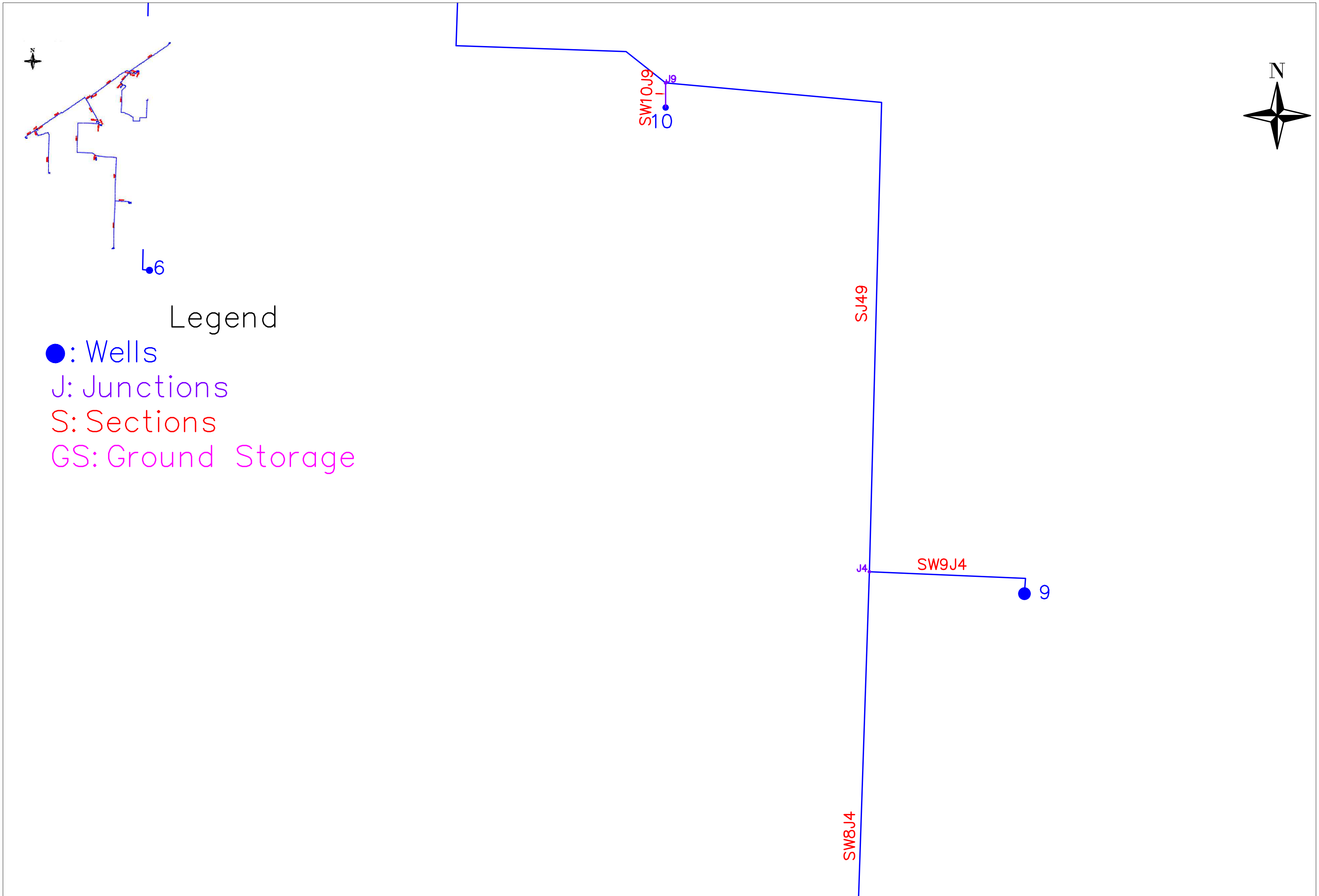
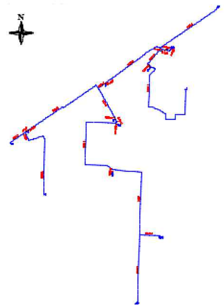
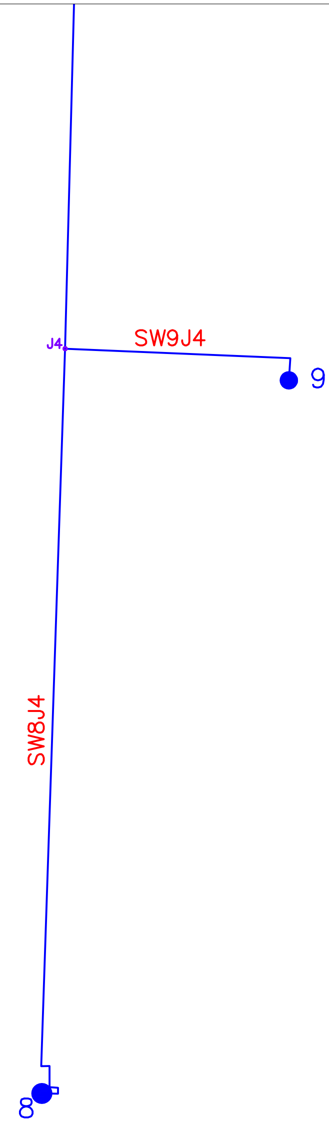


INCI 5366-001 FALL 2016	PIPE STRUCTURE WOLFFORTH	1”=20’ 12/10/16





Legend

●: Wells
J: Junctions
S: Sections
GS: Ground Storage

INCI 5366-001 FALL 2016	PIPE STRUCTURE WOLFFORTH	1"=20' 12/10/16

Data from Municipal Wells

Well Number	Well ID	Latitude	Longitude	Elevation (m)
1	2432911	33.50861111	-102.004444	1011
2	2432901	33.50555556	-102.011944	1021
3	2432904	33.50472222	-102.019444	1031
4	2432905	33.50833333	-102.012778	1023
5	2432906	33.50333333	-102.021389	1021
6	2440307	33.49944444	-102.0175	1015
7	2432907	33.51527778	-102.001944	1020
8	2440308	33.49083333	-102.008889	1009
9	2440309	33.49611111	-102.006944	1014
10	2432908	33.50138889	-102.011667	1016
11	2432909	33.51027778	-102.008056	1015
12	2432910	33.51194444	-102.006111	1021
13	2440502	33.44805556	-102.073333	1016
14	2432902	33.50527778	-102.011667	1022
15	2440503	33.45027778	-102.071111	1024

Data obtain from GIS and AutoCAD Civil 3D

Segment	Pipe Length(ft)	Zup(m)	Zdown(m)
W5J1	573.44	1021	1028
W6J8	2146.39	1015	1024
J8J1	263.8	1024	1028
J1J2	51.9	1028	1025
W3J2	21.541	1031	1025
J2J3	2537.18	1025	1020
W8J4	2025.333	1009	1020
W10J9	94	1016	1007
W9J4	655.161	1014	1020
J4J9	2622.375	1020	1016
W14J10	45	1021	1020
J9J10	2944.622	1016	1022
J10J11	134.1	1022	1021
W2J11	30	1021	1021
J11J3	1014.94	1021	1020
J3J12	239.94	1020	1023
W4J12	18	1023	1023
WJ12J5	1947.16	1023	1011
W7J5	1947.16	1020	1011
J5J6	75.15	1011	1015
W1J13	3395.56	1011	1015
W11J13	79	1015	1015
J13J6	781.99	1015	1015
J6J7	128.36	1015	1011
W12J7	193.4	1021	1011
J7GS	31	1011	1018

Parameters used for RCode

Segment	Pipe Length (ft)	Diameter (in)	Out Dia (in)	Min Thickness (in)	In Dia (in)	Zup (m)	Zdown (m)	C (Hazen coefficient)
W5J1	573.44	12	12.75	0.406	11.938	1021	1028	150
W6J8	2146.39	8	8.625	0.322	7.981	1015	1024	150
J8J1	263.8	6	6.625	0.28	6.065	1024	1028	150
J1J2	51.9	12	12.75	0.406	11.938	1028	1025	150
W3J2	21.541	12	12.75	0.406	11.938	1031	1025	150
J2J3	2537.18	12	12.75	0.406	11.938	1025	1020	150
W8J4	2025.333	8	8.625	0.322	7.981	1009	1020	150
W10J9	94	4	4.5	0.237	4.026	1016	1007	150
W9J4	655.161	4	4.5	0.237	4.026	1014	1020	150
J4J9	2622.375	8	8.625	0.322	7.981	1020	1016	150
W14J10	45	4	4.5	0.237	4.026	1021	1020	150
J9J10	2944.622	8	8.625	0.322	7.981	1016	1022	150
J10J11	134.1	4	4.5	0.237	4.026	1022	1021	150
W2J11	30	4	4.5	0.237	4.026	1021	1021	150
J11J3	1014.94	4	4.5	0.237	4.026	1021	1020	150
J3J12	239.94	12	12.75	0.406	11.938	1020	1023	150
W4J12	18	4	4.5	0.237	4.026	1023	1023	150
WJ12J5	1947.16	2	2.375	0.154	2.067	1023	1011	150
W7J5	1947.16	8	8.625	0.322	7.981	1020	1011	150
J5J6	75.15	12	12.75	0.406	11.938	1011	1015	150
W1J13	3395.56	6	6.625	0.28	6.065	1011	1015	150
W11J13	79	4	4.5	0.237	4.026	1015	1015	150
J13J6	781.99	6	6.625	0.28	6.065	1015	1015	150
J6J7	128.36	12	12.75	0.406	11.938	1015	1011	150
W12J7	193.4	6	6.625	0.28	6.065	1021	1011	150
J7GS	31	12	12.75	0.406	11.938	1011	1018	150

Well Number	Diam. (in)	Hydraulic Conductivity, K	Specific Yield	Depth to Water Table (m)	STTHK	Flow Q (gpm)
W1	6	984.9591	0.175	107.509	174.8164	350
W2	2	979.4019	0.175	111.1771	176.22	167
W3	5	979.4019	0.175	120.4202	181.0036 I4	300
W4	4	979.4019	0.175	111.6515	176.8244	90
W5	4	979.4019	0.125	121.7551	181.7759	135
W6	2	979.4019	0.175	117.8534	178.7662	60
W7	5	984.9591	0.175	107.9826	175.4626	350
W8	6	979.4019	0.175	110.2917	174.5553	350
W9	3	984.9591	0.175	108.1278	173.7095	50
W10	4	979.4019	0.175	110.7696	175.6493	135
W11	2	984.9591	0.175	109.3282	175.5043	40
W12	2	984.9591	0.175	109.8682	176.1776	50
W13	4	984.6516	0.175	132.0057	185.7033	167
W14	4	979.4019	0.175	111.1771	176.22	87
W15	6	985.0404	0.225	134.0376	186.9366	-

Data Obtain for RCode

Scenario 1

Concentrations through the segments mg/l:

Fluoride

Segment	Jan (mg/l)	Feb (mg/l)	Mar (mg/l)	Apr (mg/l)	May (mg/l)	June (mg/l)	July (mg/l)	Aug (mg/l)	Sep (mg/l)	Oct (mg/l)	Nov (mg/l)	Dec (mg/l)
W5J1	5.440	5.370	5.300	5.225	5.150	4.925	4.700	4.850	4.925	5.000	5.110	5.220
W6J8	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J8J1	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J1J2	5.419	5.445	5.453	5.180	5.340	5.202	5.064	5.185	5.201	5.216	5.295	5.329
W3J2	5.160	5.267	5.200	5.080	5.040	5.213	5.088	5.250	5.200	5.051	5.060	5.280
J2J3	5.333	5.386	5.368	5.147	5.240	5.206	5.072	5.207	5.200	5.161	5.217	5.313
W8J4	7.933	8.007	6.100	6.968	7.214	9.700	7.073	5.940	6.656	7.371	5.980	6.956
W10J9	5.621	5.450	5.535	5.478	5.584	5.010	5.531	5.663	5.290	5.538	5.453	4.870
W9J4	4.647	5.153	4.527	4.577	4.808	4.890	4.619	4.833	4.830	4.723	4.643	4.810
J4J9	6.290	6.580	5.313	5.772	6.011	7.295	5.846	5.387	5.743	6.047	5.312	5.883
W14J10	5.327	5.530	5.217	5.230	5.288	5.474	5.186	5.248	5.323	5.261	5.184	5.223
J9J10	6.067	6.203	5.387	5.674	5.869	6.533	5.741	5.479	5.592	5.877	5.359	5.545
J10J11	5.882	6.035	5.345	5.563	5.723	6.269	5.602	5.421	5.525	5.723	5.315	5.465
W2J11	4.887	5.265	5.100	4.924	5.085	5.052	4.913	5.190	5.050	5.019	5.207	5.076
J11J3	5.683	5.881	5.296	5.435	5.596	6.025	5.464	5.375	5.430	5.582	5.293	5.387
J3J12	5.552	5.695	5.323	5.327	5.462	5.718	5.317	5.312	5.344	5.424	5.265	5.359
W4J12	4.990	5.285	5.000	5.070	5.060	5.200	4.906	5.250	5.185	5.079	5.120	5.055
WJ12J5	5.489	5.650	5.287	5.298	5.418	5.660	5.271	5.305	5.326	5.386	5.249	5.325
W7J5	5.381	5.613	5.600	5.384	5.373	5.366	5.399	5.480	5.440	5.406	5.295	5.338
J5J6	5.478	5.646	5.318	5.307	5.413	5.631	5.284	5.323	5.338	5.388	5.253	5.327
W1J13	4.769	5.010	4.700	4.849	4.895	4.844	4.814	4.985	6.000	4.873	4.955	5.125
W11J13	4.833	5.280	4.780	4.895	4.843	5.110	4.828	4.970	4.964	4.958	4.870	4.852
J13J6	4.769	5.010	4.700	4.849	4.895	4.844	4.814	4.985	6.000	4.873	4.955	5.125
J6J7	5.414	5.588	5.262	5.265	5.366	5.560	5.241	5.292	5.398	5.341	5.226	5.308
W12J7	4.870	5.135	5.153	5.170	4.870	4.902	4.933	5.050	4.865	4.680	5.030	4.660
J7GS	5.369	5.550	5.253	5.257	5.325	5.505	5.216	5.272	5.353	5.286	5.210	5.254

Arsenic

Segment	Jan (mg/l)	Feb (mg/l)	Mar (mg/l)	Apr (mg/l)	May (mg/l)	June (mg/l)	July (mg/l)	Aug (mg/l)	Sep (mg/l)	Oct (mg/l)	Nov (mg/l)	Dec (mg/l)
W5J1	0.013	0.013	0.013	0.011	0.011	0.011	0.011	0.011	0.011	0.013	0.013	0.013
W6J8	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J8J1	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J1J2	0.016	0.017	0.016	0.015	0.016	0.015	0.015	0.014	0.015	0.016	0.016	0.016
W3J2	0.017	0.022	0.015	0.018	0.019	0.015	0.016	0.017	0.017	0.016	0.015	0.015
J2J3	0.016	0.019	0.015	0.016	0.017	0.015	0.016	0.015	0.016	0.016	0.015	0.016
W8J4	0.012	0.013	0.012	0.013	0.016	0.011	0.014	0.012	0.013	0.012	0.011	0.012
W10J9	0.018	0.016	0.012	0.017	0.018	0.014	0.016	0.015	0.014	0.018	0.017	0.014
W9J4	0.011	0.009	0.011	0.011	0.011	0.010	0.012	0.011	0.014	0.010	0.010	0.010
J4J9	0.012	0.011	0.012	0.012	0.013	0.011	0.013	0.011	0.013	0.011	0.011	0.011
W14J10	0.016	0.024	0.015	0.015	0.017	0.013	0.015	0.015	0.014	0.014	0.018	0.013
J9J10	0.014	0.013	0.012	0.013	0.015	0.012	0.014	0.013	0.014	0.013	0.013	0.012
J10J11	0.014	0.016	0.013	0.014	0.016	0.012	0.014	0.013	0.014	0.013	0.014	0.012
W2J11	0.024	0.102	0.044	0.016	0.018	0.016	0.018	0.014	0.016	0.014	0.036	0.044
J11J3	0.016	0.033	0.019	0.014	0.016	0.013	0.015	0.013	0.014	0.014	0.018	0.019
J3J12	0.016	0.028	0.018	0.015	0.017	0.014	0.015	0.014	0.015	0.015	0.017	0.018
W4J12	0.019	0.022	0.019	0.017	0.017	0.016	0.015	0.016	0.016	0.016	0.017	0.019
WJ12J5	0.017	0.027	0.018	0.015	0.017	0.014	0.015	0.014	0.015	0.015	0.017	0.018
W7J5	0.012	0.017	0.015	0.011	0.015	0.012	0.013	0.011	0.012	0.012	0.017	0.015
J5J6	0.016	0.026	0.017	0.015	0.016	0.014	0.015	0.014	0.015	0.014	0.017	0.017
W1J13	0.016	0.016	0.015	0.015	0.019	0.016	0.016	0.015	0.016	0.015	0.015	0.015
W11J13	0.013	0.013	0.019	0.013	0.015	0.012	0.014	0.021	0.015	0.012	0.021	0.016
J13J6	0.016	0.016	0.015	0.015	0.018	0.016	0.016	0.015	0.016	0.014	0.015	0.015
J6J7	0.016	0.025	0.017	0.015	0.017	0.014	0.015	0.014	0.015	0.014	0.017	0.017
W12J7	0.015	0.018	0.016	0.014	0.019	0.016	0.015	0.017	0.016	0.013	0.019	0.016
J7GS	0.016	0.024	0.017	0.015	0.017	0.014	0.015	0.014	0.015	0.014	0.017	0.017

Total energy required to move water through the segments in meters

Segment	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
W5J1	-6.999	-6.999	-6.999	-6.999	-6.999	-6.999	-6.999	-6.999	-6.999	-6.999	-6.999	-6.999
W6J8	-8.981	-8.981	-8.963	-8.963	-8.963	-8.963	-8.963	-8.963	-8.981	-8.981	-8.981	-8.981
J8J1	-3.990	-3.990	-3.982	-3.982	-3.982	-3.982	-3.982	-3.982	-3.990	-3.990	-3.990	-3.990
J1J2	3.000	3.000	3.001	3.001	3.001	3.001	3.001	3.001	3.000	3.000	3.000	3.000
W3J2	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
J2J3	5.024	5.024	5.047	5.047	5.047	5.047	5.047	5.047	5.024	5.024	5.024	5.024
W8J4	-10.982	-10.982	-10.965	-10.965	-10.965	-10.965	-10.965	-10.965	-10.982	-10.982	-10.982	-10.982
W10J9	9.027	9.027	9.052	9.052	9.052	9.052	9.052	9.052	9.027	9.027	9.027	9.027
W9J4	-5.835	-5.835	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.835	-5.835	-5.835	-5.835
J4J9	4.084	4.084	4.161	4.161	4.161	4.161	4.161	4.161	4.084	4.084	4.084	4.084
W14J10	1.015	1.015	1.029	1.029	1.029	1.029	1.029	1.029	1.015	1.015	1.015	1.015
J9J10	-5.799	-5.799	-5.617	-5.617	-5.617	-5.617	-5.617	-5.617	-5.799	-5.799	-5.799	-5.799
J10J11	1.491	1.491	1.944	1.944	1.944	1.944	1.944	1.944	1.491	1.491	1.491	1.491
W2J11	0.011	0.011	0.022	0.022	0.022	0.022	0.022	0.022	0.011	0.011	0.011	0.011
J11J3	6.027	6.027	10.610	10.610	10.610	10.610	10.610	10.610	6.027	6.027	6.027	6.027
J3J12	-2.983	-2.983	-2.967	-2.967	-2.967	-2.967	-2.967	-2.967	-2.983	-2.983	-2.983	-2.983
W4J12	0.008	0.008	0.016	0.016	0.016	0.016	0.016	0.016	0.008	0.008	0.008	0.008
WJ12J5	12.145	12.145	12.277	12.277	12.277	12.277	12.277	12.277	12.145	12.145	12.145	12.145
W7J5	9.017	9.017	9.033	9.033	9.033	9.033	9.033	9.033	9.017	9.017	9.017	9.017
J5J6	-3.989	-3.989	-3.978	-3.978	-3.978	-3.978	-3.978	-3.978	-3.989	-3.989	-3.989	-3.989
W1J13	-3.885	-3.885	-3.781	-3.781	-3.781	-3.781	-3.781	-3.781	-3.885	-3.885	-3.885	-3.885
W11J13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J13J6	0.027	0.027	0.052	0.052	0.052	0.052	0.052	0.052	0.027	0.027	0.027	0.027
J6J7	4.019	4.019	4.038	4.038	4.038	4.038	4.038	4.038	4.019	4.019	4.019	4.019
W12J7	10.007	10.007	10.014	10.014	10.014	10.014	10.014	10.014	10.007	10.007	10.007	10.007
J7GS	-6.989	-6.989	-6.979	-6.979	-6.979	-6.979	-6.979	-6.979	-6.989	-6.989	-6.989	-6.989
Total	**10.471**	**10.471**	**16.380**	**16.380**	**16.380**	**16.380**	**16.380**	**16.380**	**10.471**	**10.471**	**10.471**	**10.471**

Drawdown energy for well per day in month

Well	DWT (m)	Jan/ per day	Feb/ per day	Mar/ per day	Apr/ per day	May/ per day	June/ per day	July/ per day	Aug/ per day	Sep/ per day	Oct/ per day	Nov/ per day	Dec/ per day
W1	107.509	0.028	0.065	0.076	0.096	0.097	0.105	0.107	0.115	0.106	0.094	0.101	0.102
W2	111.177	0.032	0.073	0.084	0.106	0.107	0.116	0.117	0.125	0.115	0.101	0.109	0.109
W3	120.420	0.028	0.065	0.075	0.095	0.096	0.104	0.105	0.114	0.105	0.092	0.100	0.101
W4	111.651	0.030	0.068	0.079	0.099	0.101	0.109	0.110	0.118	0.109	0.096	0.103	0.104
W5	121.755	0.029	0.067	0.078	0.098	0.099	0.107	0.108	0.117	0.107	0.094	0.102	0.103
W6	117.853	0.032	0.072	0.083	0.105	0.106	0.114	0.115	0.124	0.113	0.099	0.107	0.108
W7	107.983	0.029	0.066	0.077	0.097	0.099	0.107	0.108	0.116	0.107	0.095	0.102	0.103
W8	110.292	0.029	0.066	0.076	0.096	0.098	0.106	0.107	0.116	0.107	0.094	0.102	0.103
W9	108.128	0.031	0.071	0.082	0.103	0.104	0.113	0.114	0.122	0.112	0.099	0.107	0.107
W10	110.770	0.030	0.068	0.079	0.100	0.101	0.109	0.111	0.119	0.109	0.096	0.104	0.105
W11	109.328	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W12	109.868	0.032	0.073	0.084	0.106	0.107	0.115	0.116	0.125	0.114	0.100	0.108	0.109
W13	132.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W14	111.177	0.030	0.068	0.079	0.099	0.101	0.109	0.110	0.119	0.109	0.096	0.104	0.105
W15	134.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Energy for pumping in each well

Well	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
W1	107.537	107.574	107.585	107.605	107.606	107.614	107.616	107.624	107.615	107.603	107.610	107.611
W2	111.209	111.250	111.261	111.283	111.284	111.293	111.294	111.302	111.292	111.278	111.286	111.286
W3	120.448	120.485	120.495	120.515	120.516	120.524	120.526	120.534	120.525	120.512	120.520	120.521
W4	111.681	111.719	111.730	111.751	111.752	111.760	111.761	111.770	111.760	111.747	111.755	111.756
W5	121.784	121.822	121.833	121.853	121.855	121.863	121.864	121.872	121.862	121.849	121.857	121.858
W6	117.885	117.926	117.937	117.958	117.959	117.968	117.968	117.977	117.967	117.953	117.960	117.961
W7	108.011	108.049	108.060	108.080	108.081	108.089	108.091	108.099	108.090	108.077	108.085	108.086
W8	110.320	110.357	110.368	110.388	110.390	110.398	110.399	110.408	110.398	110.386	110.394	110.395
W9	108.159	108.198	108.209	108.231	108.232	108.241	108.242	108.250	108.240	108.227	108.234	108.235
W10	110.799	110.838	110.849	110.869	110.871	110.879	110.880	110.889	110.879	110.866	110.874	110.875
W11												
W12	109.900	109.941	109.952	109.974	109.975	109.983	109.984	109.993	109.982	109.968	109.976	109.977
W13												
W14	111.207	111.245	111.256	111.277	111.278	111.286	111.287	111.296	111.286	111.273	111.281	111.282
W15												
Total	**1348.942**	**1349.405**	**1349.534**	**1349.784**	**1349.800**	**1349.898**	**1349.911**	**1350.013**	**1349.897**	**1349.740**	**1349.832**	**1349.842**

Total energy (m/day/month)

Total Energy	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
To Move Water	10.471	10.471	16.380	16.380	16.380	16.380	16.380	16.380	10.471	10.471	10.471	10.471
To Pump Water	1348.942	1349.405	1349.534	1349.784	1349.8	1349.898	1349.911	1350.013	1349.897	1349.74	1349.832	1349.842
Total Energy (m/day/month)	**1359.413**	**1359.876**	**1365.914**	**1366.164**	**1366.18**	**1366.278**	**1366.291**	**1366.393**	**1360.368**	**1360.212**	**1360.303**	**1360.313**

Scenario 2

Concentrations through the segments mg/l:

Fluoride

Segment	Jan (mg/l)	Feb (mg/l)	Mar (mg/l)	Apr (mg/l)	May (mg/l)	June (mg/l)	July (mg/l)	Aug (mg/l)	Sep (mg/l)	Oct (mg/l)	Nov (mg/l)	Dec (mg/l)
W5J1	5.440	5.370	5.300	5.225	5.150	4.925	4.700	4.850	4.925	5.000	5.110	5.220
W6J8	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J8J1	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J1J2	5.419	5.445	5.453	5.180	5.340	5.202	5.064	5.185	5.201	5.216	5.295	5.329
W3J2	5.160	5.267	5.200	5.080	5.040	5.213	5.088	5.250	5.200	5.051	5.060	5.280
J2J3	5.333	5.386	5.368	5.147	5.240	5.206	5.072	5.207	5.200	5.161	5.217	5.313
W8J4	7.933	8.007	6.100	6.968	7.214	9.700	7.073	5.940	6.656	7.371	5.980	6.956
W10J9	5.621	5.450	5.535	5.478	5.584	5.010	5.531	5.663	5.290	5.538	5.453	4.870
W9J4	4.647	5.153	4.527	4.577	4.808	4.890	4.619	4.833	4.830	4.723	4.643	4.810
J4J9	4.647	5.153	4.527	4.577	4.808	4.890	4.619	4.833	4.830	4.723	4.643	4.810
W14J10	5.327	5.530	5.217	5.230	5.288	5.474	5.186	5.248	5.323	5.261	5.184	5.223
J9J10	4.647	5.153	4.527	4.577	4.808	4.890	4.619	4.833	4.830	4.723	4.643	4.810
J10J11	4.647	5.153	4.527	4.577	4.808	4.890	4.619	4.833	4.830	4.723	4.643	4.810
W2J11	4.887	5.265	5.100	4.924	5.085	5.052	4.913	5.190	5.050	5.019	5.207	5.076
J11J3	4.716	5.185	4.839	4.766	4.959	4.978	4.779	5.028	4.893	4.807	4.804	4.886
J3J12	4.716	5.185	4.839	4.766	4.959	4.978	4.779	5.028	4.893	4.807	4.804	4.886
W4J12	4.990	5.285	5.000	5.070	5.060	5.200	4.906	5.250	5.185	5.079	5.120	5.055
WJ12J5	4.716	5.185	4.839	4.766	4.959	4.978	4.779	5.028	4.893	4.807	4.804	4.886
W7J5	5.381	5.613	5.600	5.384	5.373	5.366	5.399	5.480	5.440	5.406	5.295	5.338
J5J6	4.716	5.185	4.839	4.766	4.959	4.978	4.779	5.028	4.893	4.807	4.804	4.886
W1J13	4.769	5.010	4.700	4.849	4.895	4.844	4.814	4.985	6.000	4.873	4.955	5.125
W11J13	4.833	5.280	4.780	4.895	4.843	5.110	4.828	4.970	4.964	4.958	4.870	4.852
J13J6	4.776	5.042	4.708	4.853	4.890	4.872	4.816	4.983	5.878	4.883	4.945	5.093
J6J7	4.766	5.066	4.737	4.834	4.905	4.895	4.808	4.993	5.709	4.870	4.921	5.058
W12J7	4.870	5.135	5.153	5.170	4.870	4.902	4.933	5.050	4.865	4.680	5.030	4.660
J7GS	4.777	5.074	4.775	4.865	4.902	4.896	4.819	4.998	5.617	4.849	4.933	5.014

Arsenic

Segment	Jan (mg/l)	Feb (mg/l)	Mar (mg/l)	Apr (mg/l)	May (mg/l)	June (mg/l)	July (mg/l)	Aug (mg/l)	Sep (mg/l)	Oct (mg/l)	Nov (mg/l)	Dec (mg/l)
W5J1	0.013	0.013	0.013	0.011	0.011	0.011	0.011	0.011	0.011	0.013	0.013	0.013
W6J8	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J8J1	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J1J2	0.016	0.017	0.016	0.015	0.016	0.015	0.015	0.014	0.015	0.016	0.016	0.016
W3J2	0.017	0.022	0.015	0.018	0.019	0.015	0.016	0.017	0.017	0.016	0.015	0.015
J2J3	0.016	0.019	0.015	0.016	0.017	0.015	0.016	0.015	0.016	0.016	0.015	0.016
W8J4	0.012	0.013	0.012	0.013	0.016	0.011	0.014	0.012	0.013	0.012	0.011	0.012
W10J9	0.018	0.016	0.012	0.017	0.018	0.014	0.016	0.015	0.014	0.018	0.017	0.014
W9J4	0.011	0.009	0.011	0.011	0.011	0.010	0.012	0.011	0.014	0.010	0.010	0.010
J4J9	0.011	0.009	0.011	0.011	0.011	0.010	0.012	0.011	0.014	0.010	0.010	0.010
W14J10	0.016	0.024	0.015	0.015	0.017	0.013	0.015	0.015	0.014	0.014	0.018	0.013
J9J10	0.011	0.009	0.011	0.011	0.011	0.010	0.012	0.011	0.014	0.010	0.010	0.010
J10J11	0.011	0.009	0.011	0.011	0.011	0.010	0.012	0.011	0.014	0.010	0.010	0.010
W2J11	0.024	0.102	0.044	0.016	0.018	0.016	0.018	0.014	0.016	0.014	0.036	0.044
J11J3	0.011	0.009	0.029	0.013	0.015	0.014	0.015	0.013	0.014	0.010	0.010	0.010
J3J12	0.011	0.009	0.029	0.013	0.015	0.014	0.015	0.013	0.014	0.010	0.010	0.010
W4J12	0.019	0.022	0.019	0.017	0.017	0.016	0.015	0.016	0.016	0.016	0.017	0.019
WJ12J5	0.011	0.009	0.029	0.013	0.015	0.014	0.015	0.013	0.014	0.010	0.010	0.010
W7J5	0.012	0.017	0.015	0.011	0.015	0.012	0.013	0.011	0.012	0.012	0.017	0.015
J5J6	0.011	0.009	0.029	0.013	0.015	0.014	0.015	0.013	0.014	0.010	0.010	0.010
W1J13	0.016	0.016	0.015	0.015	0.019	0.016	0.016	0.015	0.016	0.015	0.015	0.015
W11J13	0.013	0.013	0.019	0.013	0.015	0.012	0.014	0.021	0.015	0.012	0.021	0.016
J13J6	0.016	0.015	0.016	0.014	0.018	0.016	0.016	0.016	0.016	0.014	0.015	0.015
J6J7	0.015	0.015	0.019	0.014	0.018	0.015	0.016	0.015	0.016	0.014	0.015	0.015
W12J7	0.015	0.018	0.016	0.014	0.019	0.016	0.015	0.017	0.016	0.013	0.019	0.016
J7GS	0.015	0.015	0.018	0.014	0.018	0.015	0.015	0.015	0.016	0.014	0.015	0.015

Total energy required to move water through the segments in meters

Segments	**Jan (m)**	**Feb (m)**	**Mar (m)**	**Apr (m)**	**May (m)**	**June (m)**	**July (m)**	**Aug (m)**	**Sep (m)**	**Oct (m)**	**Nov (m)**	**Dec (m)**
W5J1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W6J8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J8J1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J1J2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W3J2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J2J3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W8J4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W10J9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W9J4	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684
J4J9	4.045	4.045	4.045	4.045	4.045	4.045	4.045	4.045	4.045	4.045	4.045	4.045
W14J10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J9J10	-5.950	-5.950	-5.950	-5.950	-5.950	-5.950	-5.950	-5.950	-5.950	-5.950	-5.950	-5.950
J10J11	1.071	1.071	1.071	1.071	1.071	1.071	1.071	1.071	1.071	1.071	1.071	1.071
W2J11	0.000	0.000	0.031	0.031	0.031	0.031	0.031	0.031	0.000	0.000	0.000	0.000
J11J3	1.486	1.486	3.096	3.096	3.096	3.096	3.096	3.096	1.486	1.486	1.486	1.486
J3J12	-2.999	-2.999	-2.997	-2.997	-2.997	-2.997	-2.997	-2.997	-2.999	-2.999	-2.999	-2.999
W4J12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WJ12J5	12.005	12.005	12.020	12.020	12.020	12.020	12.020	12.020	12.005	12.005	12.005	12.005
W7J5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J5J6	-4.000	-4.000	-3.999	-3.999	-3.999	-3.999	-3.999	-3.999	-4.000	-4.000	-4.000	-4.000
W1J13	2.762	2.762	4.061	4.061	4.061	4.061	4.061	4.061	2.762	2.762	2.762	2.762
W11J13	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029
J13J6	1.997	1.997	2.337	2.337	2.337	2.337	2.337	2.337	1.997	1.997	1.997	1.997
J6J7	4.021	4.021	4.031	4.031	4.031	4.031	4.031	4.031	4.021	4.021	4.021	4.021
W12J7	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014
J7GS	-6.987	-6.987	-6.982	-6.982	-6.982	-6.982	-6.982	-6.982	-6.987	-6.987	-6.987	-6.987
Total	**11.809**	**11.809**	**15.123**	**15.123**	**15.123**	**15.123**	**15.123**	**15.123**	**11.809**	**11.809**	**11.809**	**11.809**

Drawdown energy for well per day in month

Well	DWT (m)	Jan/ per day	Feb/ per day	Mar/ per day	Apr/ per day	May/ per day	June/ per day	July/ per day	Aug/ per day	Sep/ per day	Oct/ per day	Nov/ per day	Dec/ per day
W1	107.509	0.240	0.552	0.578	0.679	0.692	0.751	0.761	0.796	0.808	0.769	0.827	0.833
W2	111.177	0.018	0.041	0.078	0.124	0.124	0.133	0.134	0.139	0.107	0.068	0.074	0.076
W3	120.420	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W4	111.651	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W5	121.755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W6	117.853	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W7	107.983	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W8	110.292	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W9	108.128	0.044	0.100	0.097	0.106	0.108	0.117	0.118	0.123	0.132	0.133	0.143	0.143
W10	110.770	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W11	109.328	0.036	0.083	0.080	0.087	0.088	0.095	0.096	0.101	0.108	0.108	0.116	0.116
W12	109.868	0.045	0.103	0.099	0.108	0.110	0.119	0.120	0.125	0.135	0.135	0.145	0.145
W13	132.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W14	111.177	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W15	134.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Energy for pumping in each well

Well	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
W1	107.749	108.061	108.087	108.188	108.201	108.260	108.270	108.305	108.317	108.277	108.336	108.342
W2	111.195	111.219	111.255	111.301	111.301	111.310	111.311	111.316	111.284	111.245	111.251	111.253
W3												
W4												
W5												
W6												
W7												
W8												
W9	108.172	108.228	108.224	108.233	108.235	108.244	108.246	108.251	108.260	108.261	108.270	108.271
W10												
W11	109.364	109.411	109.408	109.415	109.416	109.424	109.425	109.429	109.436	109.437	109.444	109.444
W12	109.913	109.971	109.967	109.976	109.978	109.987	109.988	109.993	110.003	110.003	110.013	110.013
W13												
W14												
W15												
Total	**546.394**	**546.890**	**546.942**	**547.114**	**547.133**	**547.226**	**547.240**	**547.293**	**547.300**	**547.223**	**547.316**	**547.323**

Total Energy (m/day/month)

Total Energy	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
To Move Water	11.809	11.809	15.123	15.123	15.123	15.123	15.123	15.123	11.809	11.809	11.809	11.809
To Pump Water	546.394	546.890	546.942	547.114	547.133	547.226	547.240	547.293	547.300	547.223	547.316	547.323
Total Energy (m/day/month)	**558.202**	**558.698**	**562.065**	**562.237**	**562.256**	**562.349**	**562.363**	**562.417**	**559.109**	**559.032**	**559.124**	**559.132**

Scenario 3

Concentrations through the segments mg/l:

Fluoride

Segment	Jan (mg/l)	Feb (mg/l)	Mar (mg/l)	Apr (mg/l)	May (mg/l)	June (mg/l)	July (mg/l)	Aug (mg/l)	Sep (mg/l)	Oct (mg/l)	Nov (mg/l)	Dec (mg/l)
W5J1	5.440	5.370	5.300	5.225	5.150	4.925	4.700	4.850	4.925	5.000	5.110	5.220
W6J8	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J8J1	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J1J2	5.419	5.445	5.453	5.180	5.340	5.202	5.064	5.185	5.201	5.216	5.295	5.329
W3J2	5.160	5.267	5.200	5.080	5.040	5.213	5.088	5.250	5.200	5.051	5.060	5.280
J2J3	5.333	5.386	5.368	5.147	5.240	5.206	5.072	5.207	5.200	5.161	5.217	5.313
W8J4	7.933	8.007	6.100	6.968	7.214	9.700	7.073	5.940	6.656	7.371	5.980	6.956
W10J9	5.621	5.450	5.535	5.478	5.584	5.010	5.531	5.663	5.290	5.538	5.453	4.870
W9J4	4.647	5.153	4.527	4.577	4.808	4.890	4.619	4.833	4.830	4.723	4.643	4.810
J4J9	6.290	6.580	5.313	5.772	6.011	7.295	5.846	5.387	5.743	6.047	5.312	5.883
W14J10	5.327	5.530	5.217	5.230	5.288	5.474	5.186	5.248	5.323	5.261	5.184	5.223
J9J10	6.067	6.203	5.387	5.674	5.869	6.533	5.741	5.479	5.592	5.877	5.359	5.545
J10J11	5.327	5.530	5.217	5.230	5.288	5.474	5.186	5.248	5.323	5.261	5.184	5.223
W2J11	4.887	5.265	5.100	4.924	5.085	5.052	4.913	5.190	5.050	5.019	5.207	5.076
J11J3	5.327	5.530	5.217	5.230	5.288	5.474	5.186	5.248	5.323	5.261	5.184	5.223
J3J12	5.327	5.530	5.217	5.230	5.288	5.474	5.186	5.248	5.323	5.261	5.184	5.223
W4J12	4.990	5.285	5.000	5.070	5.060	5.200	4.906	5.250	5.185	5.079	5.120	5.055
WJ12J5	5.051	5.329	5.039	5.099	5.101	5.250	4.957	5.250	5.210	5.112	5.132	5.086
W7J5	5.381	5.613	5.600	5.384	5.373	5.366	5.399	5.480	5.440	5.406	5.295	5.338
J5J6	5.283	5.529	5.466	5.316	5.308	5.339	5.293	5.425	5.385	5.336	5.246	5.263
W1J13	4.769	5.010	4.700	4.849	4.895	4.844	4.814	4.985	6.000	4.873	4.955	5.125
W11J13	4.833	5.280	4.780	4.895	4.843	5.110	4.828	4.970	4.964	4.958	4.870	4.852
J13J6	4.833	5.280	4.780	4.895	4.843	5.110	4.828	4.970	4.964	4.958	4.870	4.852
J6J7	5.239	5.504	5.411	5.282	5.271	5.320	5.256	5.389	5.351	5.306	5.209	5.222
W12J7	4.870	5.135	5.153	5.170	4.870	4.902	4.933	5.050	4.865	4.680	5.030	4.660
J7GS	5.198	5.464	5.388	5.272	5.235	5.282	5.227	5.358	5.307	5.249	5.190	5.161

Arsenic

Segment	**Jan (mg/l)**	**Feb (mg/l)**	**Mar (mg/l)**	**Apr (mg/l)**	**May (mg/l)**	**June (mg/l)**	**July (mg/l)**	**Aug (mg/l)**	**Sep (mg/l)**	**Oct (mg/l)**	**Nov (mg/l)**	**Dec (mg/l)**
W5J1	0.013	0.013	0.013	0.011	0.011	0.011	0.011	0.011	0.011	0.013	0.013	0.013
W6J8	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J8J1	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J1J2	0.016	0.017	0.016	0.015	0.016	0.015	0.015	0.014	0.015	0.016	0.016	0.016
W3J2	0.017	0.022	0.015	0.018	0.019	0.015	0.016	0.017	0.017	0.016	0.015	0.015
J2J3	0.016	0.019	0.015	0.016	0.017	0.015	0.016	0.015	0.016	0.016	0.015	0.016
W8J4	0.012	0.013	0.012	0.013	0.016	0.011	0.014	0.012	0.013	0.012	0.011	0.012
W10J9	0.018	0.016	0.012	0.017	0.018	0.014	0.016	0.015	0.014	0.018	0.017	0.014
W9J4	0.011	0.009	0.011	0.011	0.011	0.010	0.012	0.011	0.014	0.010	0.010	0.010
J4J9	0.012	0.011	0.012	0.012	0.013	0.011	0.013	0.011	0.013	0.011	0.011	0.011
W14J10	0.016	0.024	0.015	0.015	0.017	0.013	0.015	0.015	0.014	0.014	0.018	0.013
J9J10	0.014	0.013	0.012	0.013	0.015	0.012	0.014	0.013	0.014	0.013	0.013	0.012
J10J11	0.014	0.016	0.015	0.015	0.017	0.013	0.015	0.015	0.014	0.013	0.014	0.012
W2J11	0.024	0.102	0.044	0.016	0.018	0.016	0.018	0.014	0.016	0.014	0.036	0.044
J11J3	0.016	0.033	0.015	0.015	0.017	0.013	0.015	0.015	0.014	0.014	0.018	0.019
J3J12	0.016	0.028	0.015	0.015	0.017	0.013	0.015	0.015	0.015	0.015	0.017	0.018
W4J12	0.019	0.022	0.019	0.017	0.017	0.016	0.015	0.016	0.016	0.016	0.017	0.019
WJ12J5	0.019	0.022	0.018	0.016	0.017	0.015	0.015	0.015	0.016	0.016	0.017	0.019
W7J5	0.012	0.017	0.015	0.011	0.015	0.012	0.013	0.011	0.012	0.012	0.017	0.015
J5J6	0.014	0.018	0.015	0.013	0.015	0.013	0.013	0.012	0.013	0.013	0.017	0.016
W1J13	0.016	0.016	0.015	0.015	0.019	0.016	0.016	0.015	0.016	0.015	0.015	0.015
W11J13	0.013	0.013	0.019	0.013	0.015	0.012	0.014	0.021	0.015	0.012	0.021	0.016
J13J6	0.013	0.013	0.019	0.013	0.015	0.012	0.014	0.021	0.015	0.012	0.021	0.016
J6J7	0.014	0.018	0.016	0.013	0.015	0.013	0.013	0.013	0.013	0.013	0.017	0.016
W12J7	0.015	0.018	0.016	0.014	0.019	0.016	0.015	0.017	0.016	0.013	0.019	0.016
J7GS	0.014	0.018	0.016	0.013	0.016	0.013	0.014	0.013	0.013	0.013	0.018	0.016

Total energy required to move water through the segments in meters

Segments	**Jan (m)**	**Feb (m)**	**Mar (m)**	**Apr (m)**	**May (m)**	**June (m)**	**July (m)**	**Aug (m)**	**Sep (m)**	**Oct (m)**	**Nov (m)**	**Dec (m)**
W5J1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W6J8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J8J1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J1J2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W3J2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J2J3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W8J4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W10J9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W9J4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J4J9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W14J10	0.000	0.000	1.005	1.005	1.005	1.005	1.005	1.005	0.000	0.000	0.000	0.000
J9J10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J10J11	0.000	0.000	1.013	1.013	1.013	1.013	1.013	1.013	0.000	0.000	0.000	0.000
W2J11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J11J3	0.000	0.000	1.089	1.089	1.089	1.089	1.089	1.089	0.000	0.000	0.000	0.000
J3J12	0.000	0.000	-3.000	-3.000	-3.000	-3.000	-3.000	-3.000	0.000	0.000	0.000	0.000
W4J12	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
WJ12J5	12.014	12.014	12.020	12.020	12.020	12.020	12.020	12.020	12.014	12.014	12.014	12.014
W7J5	9.802	9.802	10.227	10.227	10.227	10.227	10.227	10.227	9.802	9.802	9.802	9.802
J5J6	-3.988	-3.988	-3.981	-3.981	-3.981	-3.981	-3.981	-3.981	-3.988	-3.988	-3.988	-3.988
W1J13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W11J13	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029
J13J6	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
J6J7	4.021	4.021	4.031	4.031	4.031	4.031	4.031	4.031	4.021	4.021	4.021	4.021
W12J7	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014
J7GS	-6.987	-6.987	-6.982	-6.982	-6.982	-6.982	-6.982	-6.982	-6.987	-6.987	-6.987	-6.987
Total	**24.989**	**24.989**	**25.549**	**25.549**	**25.549**	**25.549**	**25.549**	**25.549**	**24.989**	**24.989**	**24.989**	**24.989**

Drawdown energy for well per day in month

Well	DWT (m)	Jan/ per day	Feb/ per day	Mar/ per day	Apr/ per day	May/ per day	June/ per day	July/ per day	Aug/ per day	Sep/ per day	Oct/ per day	Nov/ per day	Dec/ per day
W1	107.509	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W2	111.177	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W3	120.420	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W4	111.651	0.075	0.173	0.167	0.183	0.187	0.203	0.205	0.221	0.231	0.232	0.249	0.250
W5	121.755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W6	117.853	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W7	107.983	0.212	0.486	0.470	0.515	0.526	0.571	0.579	0.626	0.652	0.657	0.705	0.707
W8	110.292	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W9	108.128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W10	110.770	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W11	109.328	0.036	0.083	0.080	0.087	0.088	0.095	0.096	0.104	0.108	0.108	0.116	0.116
W12	109.868	0.045	0.103	0.099	0.108	0.110	0.119	0.120	0.129	0.135	0.135	0.145	0.145
W13	132.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W14	111.177	0.017	0.039	0.037	0.041	0.042	0.045	0.046	0.049	0.051	0.052	0.055	0.056
W15	134.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Energy for pumping in each well

Well	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
W1												
W2												
W3												
W4	111.727	111.825	111.818	111.834	111.838	111.854	111.857	111.873	111.882	111.884	111.900	111.901
W5												
W6												
W7	108.194	108.469	108.452	108.498	108.509	108.554	108.562	108.608	108.635	108.639	108.687	108.690
W8												
W9												
W10												
W11	109.364	109.411	109.408	109.415	109.416	109.424	109.425	109.432	109.436	109.437	109.444	109.444
W12	109.913	109.971	109.967	109.976	109.978	109.987	109.988	109.998	110.003	110.003	110.013	110.013
W13												
W14	111.194	111.216	111.214	111.218	111.219	111.222	111.223	111.226	111.229	111.229	111.233	111.233
W15												
Total	**550.393**	**550.891**	**550.860**	**550.941**	**550.960**	**551.041**	**551.054**	**551.138**	**551.185**	**551.192**	**551.278**	**551.281**

Total Energy (m/day/month)

Total Energy	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
To Move Water	24.989	24.989	25.549	25.549	25.549	25.549	25.549	25.549	24.989	24.989	24.989	24.989
To Pump Water	550.393	550.891	550.860	550.941	550.960	551.041	551.054	551.138	551.185	551.192	551.278	551.281
Total Energy (m/day/month)	**575.382**	**575.881**	**576.409**	**576.491**	**576.510**	**576.591**	**576.604**	**576.687**	**576.174**	**576.181**	**576.267**	**576.271**

Scenario 4

Concentrations through the segments mg/l:

Fluoride

Segment	Jan (mg/l)	Feb (mg/l)	Mar (mg/l)	Apr (mg/l)	May (mg/l)	June (mg/l)	July (mg/l)	Aug (mg/l)	Sep (mg/l)	Oct (mg/l)	Nov (mg/l)	Dec (mg/l)
W5J1	5.440	5.370	5.300	5.225	5.150	4.925	4.700	4.850	4.925	5.000	5.110	5.220
W6J8	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J8J1	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J1J2	5.419	5.445	5.453	5.180	5.340	5.202	5.064	5.185	5.201	5.216	5.295	5.329
W3J2	5.160	5.267	5.200	5.080	5.040	5.213	5.088	5.250	5.200	5.051	5.060	5.280
J2J3	5.333	5.386	5.368	5.147	5.240	5.206	5.072	5.207	5.200	5.161	5.217	5.313
W8J4	7.933	8.007	6.100	6.968	7.214	9.700	7.073	5.940	6.656	7.371	5.980	6.956
W10J9	5.621	5.450	5.535	5.478	5.584	5.010	5.531	5.663	5.290	5.538	5.453	4.870
W9J4	4.647	5.153	4.527	4.577	4.808	4.890	4.619	4.833	4.830	4.723	4.643	4.810
J4J9	6.290	6.580	5.313	5.772	6.011	7.295	5.846	5.387	5.743	6.047	5.312	5.883
W14J10	5.327	5.530	5.217	5.230	5.288	5.474	5.186	5.248	5.323	5.261	5.184	5.223
J9J10	6.067	6.203	5.387	5.674	5.869	6.533	5.741	5.479	5.592	5.877	5.359	5.545
J10J11	5.882	6.035	5.345	5.563	5.723	6.269	5.602	5.421	5.525	5.723	5.315	5.465
W2J11	4.887	5.265	5.100	4.924	5.085	5.052	4.913	5.190	5.050	5.019	5.207	5.076
J11J3	5.683	5.881	5.296	5.435	5.596	6.025	5.464	5.375	5.430	5.582	5.293	5.387
J3J12	5.552	5.695	5.323	5.327	5.462	5.718	5.317	5.312	5.344	5.424	5.265	5.359
W4J12	4.990	5.285	5.000	5.070	5.060	5.200	4.906	5.250	5.185	5.079	5.120	5.055
WJ12J5	5.489	5.650	5.287	5.298	5.418	5.660	5.271	5.305	5.326	5.386	5.249	5.325
W7J5	5.381	5.613	5.600	5.384	5.373	5.366	5.399	5.480	5.440	5.406	5.295	5.338
J5J6	5.381	5.613	5.600	5.384	5.373	5.366	5.399	5.480	5.440	5.406	5.295	5.338
W1J13	4.769	5.010	4.700	4.849	4.895	4.844	4.814	4.985	6.000	4.873	4.955	5.125
W11J13	4.833	5.280	4.780	4.895	4.843	5.110	4.828	4.970	4.964	4.958	4.870	4.852
J13J6	4.769	5.010	4.700	4.849	4.895	4.844	4.814	4.985	6.000	4.873	4.955	5.125
J6J7	5.075	5.312	5.150	5.116	5.134	5.105	5.107	5.233	5.720	5.139	5.125	5.232
W12J7	4.870	5.135	5.153	5.170	4.870	4.902	4.933	5.050	4.865	4.680	5.030	4.660
J7GS	5.075	5.312	5.150	5.116	5.134	5.105	5.107	5.233	5.720	5.139	5.125	5.232

Arsenic

Segment	Jan (mg/l)	Feb (mg/l)	Mar (mg/l)	Apr (mg/l)	May (mg/l)	June (mg/l)	July (mg/l)	Aug (mg/l)	Sep (mg/l)	Oct (mg/l)	Nov (mg/l)	Dec (mg/l)
W5J1	0.013	0.013	0.013	0.011	0.011	0.011	0.011	0.011	0.011	0.013	0.013	0.013
W6J8	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J8J1	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J1J2	0.016	0.017	0.016	0.015	0.016	0.015	0.015	0.014	0.015	0.016	0.016	0.016
W3J2	0.017	0.022	0.015	0.018	0.019	0.015	0.016	0.017	0.017	0.016	0.015	0.015
J2J3	0.016	0.019	0.015	0.016	0.017	0.015	0.016	0.015	0.016	0.016	0.015	0.016
W8J4	0.012	0.013	0.012	0.013	0.016	0.011	0.014	0.012	0.013	0.012	0.011	0.012
W10J9	0.018	0.016	0.012	0.017	0.018	0.014	0.016	0.015	0.014	0.018	0.017	0.014
W9J4	0.011	0.009	0.011	0.011	0.011	0.010	0.012	0.011	0.014	0.010	0.010	0.010
J4J9	0.012	0.011	0.012	0.012	0.013	0.011	0.013	0.011	0.013	0.011	0.011	0.011
W14J10	0.016	0.024	0.015	0.015	0.017	0.013	0.015	0.015	0.014	0.014	0.018	0.013
J9J10	0.014	0.013	0.012	0.013	0.015	0.012	0.014	0.013	0.014	0.013	0.013	0.012
J10J11	0.014	0.016	0.013	0.014	0.016	0.012	0.014	0.013	0.014	0.013	0.014	0.012
W2J11	0.024	0.102	0.044	0.016	0.018	0.016	0.018	0.014	0.016	0.014	0.036	0.044
J11J3	0.016	0.033	0.019	0.014	0.016	0.013	0.015	0.013	0.014	0.014	0.018	0.019
J3J12	0.016	0.028	0.018	0.015	0.017	0.014	0.015	0.014	0.015	0.015	0.017	0.018
W4J12	0.019	0.022	0.019	0.017	0.017	0.016	0.015	0.016	0.016	0.016	0.017	0.019
WJ12J5	0.017	0.027	0.018	0.015	0.017	0.014	0.015	0.014	0.015	0.015	0.017	0.018
W7J5	0.012	0.017	0.015	0.011	0.015	0.012	0.013	0.011	0.012	0.012	0.017	0.015
J5J6	0.012	0.017	0.015	0.011	0.015	0.012	0.013	0.011	0.012	0.012	0.017	0.015
W1J13	0.016	0.016	0.015	0.015	0.019	0.016	0.016	0.015	0.016	0.015	0.015	0.015
W11J13	0.013	0.013	0.019	0.013	0.015	0.012	0.014	0.021	0.015	0.012	0.021	0.016
J13J6	0.016	0.016	0.015	0.015	0.018	0.016	0.016	0.015	0.016	0.014	0.015	0.015
J6J7	0.014	0.016	0.015	0.013	0.017	0.014	0.014	0.013	0.014	0.013	0.016	0.015
W12J7	0.015	0.018	0.016	0.014	0.019	0.016	0.015	0.017	0.016	0.013	0.019	0.016
J7GS	0.014	0.016	0.015	0.013	0.017	0.014	0.014	0.013	0.014	0.013	0.016	0.015

Total energy required to move water through the segments in meters

Segments	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
W5J1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W6J8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J8J1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J1J2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W3J2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J2J3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W8J4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W10J9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W9J4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J4J9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W14J10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J9J10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J10J11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W2J11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J11J3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J3J12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W4J12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WJ12J5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W7J5	9.633	9.633	9.811	9.811	9.811	9.811	9.811	9.811	9.633	9.633	9.633	9.633
J5J6	-3.994	-3.994	-3.993	-3.993	-3.993	-3.993	-3.993	-3.993	-3.994	-3.994	-3.994	-3.994
W1J13	0.162	0.162	1.331	1.331	1.331	1.331	1.331	1.331	0.162	0.162	0.162	0.162
W11J13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J13J6	0.985	0.985	1.263	1.263	1.263	1.263	1.263	1.263	0.985	0.985	0.985	0.985
J6J7	4.030	4.030	4.039	4.039	4.039	4.039	4.039	4.039	4.030	4.030	4.030	4.030
W12J7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
J7GS	-6.986	-6.986	-6.981	-6.981	-6.981	-6.981	-6.981	-6.981	-6.986	-6.986	-6.986	-6.986
Total	**3.831**	**3.831**	**5.469**	**5.469**	**5.469**	**5.469**	**5.469**	**5.469**	**3.831**	**3.831**	**3.831**	**3.831**

Drawdown energy for well per day in month

Well	**DWT (m)**	**Jan/ per day**	**Feb/ per day**	**Mar/ per day**	**Apr/ per day**	**May/ per day**	**June/ per day**	**July/ per day**	**Aug/ per day**	**Sep/ per day**	**Oct/ per day**	**Nov/ per day**	**Dec/ per day**
W1	107.509	0.564	0.624	0.606	0.669	0.685	0.746	0.758	0.794	0.857	0.864	0.929	0.932
W2	111.177	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W3	120.420	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W4	111.651	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W5	121.755	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W6	117.853	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W7	107.983	0.574	0.635	0.616	0.679	0.694	0.756	0.767	0.803	0.866	0.872	0.938	0.941
W8	110.292	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W9	108.128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W10	110.770	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W11	109.328	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W12	109.868	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W13	132.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W14	111.177	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W15	134.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Energy for pumping in each well

Well	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
W1	108.073	108.133	108.115	108.178	108.194	108.255	108.267	108.303	108.366	108.373	108.438	108.441
W2												
W3												
W4												
W5												
W6												
W7	108.556	108.618	108.598	108.661	108.677	108.739	108.749	108.785	108.849	108.855	108.920	108.924
W8												
W9												
W10												
W11												
W12												
W13												
W14												
W15												
Total	**216.629**	**216.751**	**216.713**	216.839	**216.871**	**216.994**	**217.016**	**217.088**	**217.215**	**217.228**	**217.358**	**217.365**

Total Energy (m/day/month)

Total Energy	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
To Move Water	3.831	3.831	5.469	5.469	5.469	5.469	5.469	5.469	3.831	3.831	3.831	3.831
To Pump Water	216.629	216.751	216.713	216.839	216.871	216.994	217.016	217.088	217.215	217.228	217.358	217.365
Total Energy (m/day/month)	**220.460**	**220.582**	**222.183**	**222.309**	**222.340**	**222.463**	**222.486**	**222.558**	**221.046**	**221.058**	**221.189**	**221.196**

Scenario 5

Concentrations through the segments mg/l:

Fluoride

Segment	Jan (mg/l)	Feb (mg/l)	Mar (mg/l)	Apr (mg/l)	May (mg/l)	June (mg/l)	July (mg/l)	Aug (mg/l)	Sep (mg/l)	Oct (mg/l)	Nov (mg/l)	Dec (mg/l)
W5J1	5.440	5.370	5.300	5.225	5.150	4.925	4.700	4.850	4.925	5.000	5.110	5.220
W6J8	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J8J1	5.398	5.520	5.605	5.135	5.530	5.479	5.428	5.520	5.476	5.432	5.480	5.439
J1J2	5.427	5.416	5.394	5.197	5.267	5.096	4.924	5.056	5.095	5.133	5.224	5.287
W3J2	5.160	5.267	5.200	5.080	5.040	5.213	5.088	5.250	5.200	5.051	5.060	5.280
J2J3	5.265	5.326	5.276	5.126	5.129	5.167	5.023	5.174	5.158	5.084	5.125	5.283
W8J4	7.933	8.007	6.100	6.968	7.214	9.700	7.073	5.940	6.656	7.371	5.980	6.956
W10J9	5.621	5.450	5.535	5.478	5.584	5.010	5.531	5.663	5.290	5.538	5.453	4.870
W9J4	4.647	5.153	4.527	4.577	4.808	4.890	4.619	4.833	4.830	4.723	4.643	4.810
J4J9	7.522	7.650	5.903	6.669	6.913	9.099	6.766	5.802	6.428	7.040	5.813	6.688
W14J10	5.327	5.530	5.217	5.230	5.288	5.474	5.186	5.248	5.323	5.261	5.184	5.223
J9J10	7.042	7.095	5.810	6.368	6.578	8.067	6.454	5.767	6.140	6.661	5.722	6.229
J10J11	6.802	6.876	5.727	6.209	6.397	7.704	6.277	5.694	6.026	6.465	5.647	6.089
W2J11	4.887	5.265	5.100	4.924	5.085	5.052	4.913	5.190	5.050	5.019	5.207	5.076
J11J3	6.397	6.535	5.595	5.937	6.120	7.143	5.988	5.588	5.820	6.159	5.554	5.874
J3J12	5.961	6.069	5.472	5.624	5.738	6.381	5.616	5.428	5.565	5.744	5.388	5.646
W4J12	4.990	5.285	5.000	5.070	5.060	5.200	4.906	5.250	5.185	5.079	5.120	5.055
WJ12J5	5.897	6.017	5.441	5.588	5.693	6.304	5.570	5.416	5.540	5.701	5.371	5.607
W7J5	5.381	5.613	5.600	5.384	5.373	5.366	5.399	5.480	5.440	5.406	5.295	5.338
J5J6	5.792	5.935	5.473	5.547	5.628	6.114	5.535	5.429	5.520	5.641	5.355	5.553
W1J13	4.769	5.010	4.700	4.849	4.895	4.844	4.814	4.985	6.000	4.873	4.955	5.125
W11J13	4.833	5.280	4.780	4.895	4.843	5.110	4.828	4.970	4.964	4.958	4.870	4.852
J13J6	4.775	5.038	4.708	4.853	4.890	4.872	4.816	4.983	5.894	4.881	4.946	5.097
J6J7	5.605	5.770	5.332	5.419	5.492	5.884	5.402	5.347	5.589	5.501	5.280	5.469
W12J7	4.870	5.135	5.153	5.170	4.870	4.902	4.933	5.050	4.865	4.680	5.030	4.660
J7GS	5.588	5.755	5.328	5.413	5.478	5.862	5.391	5.340	5.572	5.482	5.274	5.450

Arsenic

Segment	**Jan (mg/l)**	**Feb (mg/l)**	**Mar (mg/l)**	**Apr (mg/l)**	**May (mg/l)**	**June (mg/l)**	**July (mg/l)**	**Aug (mg/l)**	**Sep (mg/l)**	**Oct (mg/l)**	**Nov (mg/l)**	**Dec (mg/l)**
W5J1	0.013	0.013	0.013	0.011	0.011	0.011	0.011	0.011	0.011	0.013	0.013	0.013
W6J8	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J8J1	0.019	0.021	0.018	0.020	0.022	0.020	0.020	0.017	0.020	0.019	0.018	0.019
J1J2	0.015	0.016	0.015	0.014	0.014	0.014	0.014	0.013	0.014	0.015	0.015	0.015
W3J2	0.017	0.022	0.015	0.018	0.019	0.015	0.016	0.017	0.017	0.016	0.015	0.015
J2J3	0.016	0.019	0.015	0.016	0.017	0.015	0.015	0.015	0.016	0.016	0.015	0.015
W8J4	0.012	0.013	0.012	0.013	0.016	0.011	0.014	0.012	0.013	0.012	0.011	0.012
W10J9	0.018	0.016	0.012	0.017	0.018	0.014	0.016	0.015	0.014	0.018	0.017	0.014
W9J4	0.011	0.009	0.011	0.011	0.011	0.010	0.012	0.011	0.014	0.010	0.010	0.010
J4J9	0.012	0.013	0.012	0.012	0.015	0.011	0.014	0.011	0.013	0.012	0.011	0.012
W14J10	0.016	0.024	0.015	0.015	0.017	0.013	0.015	0.015	0.014	0.014	0.018	0.013
J9J10	0.013	0.014	0.012	0.013	0.016	0.011	0.015	0.012	0.013	0.013	0.012	0.012
J10J11	0.014	0.015	0.012	0.014	0.016	0.012	0.015	0.013	0.013	0.013	0.013	0.012
W2J11	0.024	0.102	0.044	0.016	0.018	0.016	0.018	0.014	0.016	0.014	0.036	0.044
J11J3	0.016	0.034	0.019	0.014	0.017	0.013	0.015	0.013	0.014	0.014	0.018	0.019
J3J12	0.016	0.028	0.018	0.015	0.017	0.013	0.015	0.014	0.015	0.014	0.017	0.018
W4J12	0.019	0.022	0.019	0.017	0.017	0.016	0.015	0.016	0.016	0.016	0.017	0.019
WJ12J5	0.016	0.028	0.018	0.015	0.017	0.014	0.015	0.014	0.015	0.015	0.017	0.018
W7J5	0.012	0.017	0.015	0.011	0.015	0.012	0.013	0.011	0.012	0.012	0.017	0.015
J5J6	0.015	0.026	0.017	0.014	0.016	0.013	0.015	0.013	0.014	0.014	0.017	0.017
W1J13	0.016	0.016	0.015	0.015	0.019	0.016	0.016	0.015	0.016	0.015	0.015	0.015
W11J13	0.013	0.013	0.019	0.013	0.015	0.012	0.014	0.021	0.015	0.012	0.021	0.016
J13J6	0.016	0.015	0.016	0.014	0.018	0.016	0.016	0.016	0.016	0.014	0.015	0.015
J6J7	0.015	0.024	0.017	0.014	0.017	0.014	0.015	0.014	0.014	0.014	0.017	0.017
W12J7	0.015	0.018	0.016	0.014	0.019	0.016	0.015	0.017	0.016	0.013	0.019	0.016
J7GS	0.015	0.024	0.017	0.014	0.017	0.014	0.015	0.014	0.014	0.014	0.017	0.017

Total energy required to move water through the segments in meters

Segments	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
W5J1	-6.991	-6.991	-6.991	-6.991	-6.991	-6.991	-6.991	-6.991	-6.991	-6.991	-6.991	-6.991
W6J8	-8.949	-8.949	-8.949	-8.949	-8.949	-8.949	-8.949	-8.949	-8.949	-8.949	-8.949	-8.949
J8J1	-3.974	-3.974	-3.974	-3.974	-3.974	-3.974	-3.974	-3.974	-3.974	-3.974	-3.974	-3.974
J1J2	3.003	3.003	3.003	3.003	3.003	3.003	3.003	3.003	3.003	3.003	3.003	3.003
W3J2	6.005	6.005	6.005	6.005	6.005	6.005	6.005	6.005	6.005	6.005	6.005	6.005
J2J3	5.429	5.429	5.429	5.429	5.429	5.429	5.429	5.429	5.429	5.429	5.429	5.429
W8J4	-9.725	-9.725	-9.725	-9.725	-9.725	-9.725	-9.725	-9.725	-9.725	-9.725	-9.725	-9.725
W10J9	9.334	9.334	9.334	9.334	9.334	9.334	9.334	9.334	9.334	9.334	9.334	9.334
W9J4	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684	-5.684
J4J9	6.106	6.106	6.106	6.106	6.106	6.106	6.106	6.106	6.106	6.106	6.106	6.106
W14J10	1.082	1.082	1.082	1.082	1.082	1.082	1.082	1.082	1.082	1.082	1.082	1.082
J9J10	-1.952	-1.952	-1.952	-1.952	-1.952	-1.952	-1.952	-1.952	-1.952	-1.952	-1.952	-1.952
J10J11	8.897	8.897	8.897	8.897	8.897	8.897	8.897	8.897	8.897	8.897	8.897	8.897
W2J11	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216
J11J3	82.037	82.037	82.037	82.037	82.037	82.037	82.037	82.037	82.037	82.037	82.037	82.037
J3J12	-2.704	-2.704	-2.704	-2.704	-2.704	-2.704	-2.704	-2.704	-2.704	-2.704	-2.704	-2.704
W4J12	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
WJ12J5	14.204	14.204	14.204	14.204	14.204	14.204	14.204	14.204	14.204	14.204	14.204	14.204
W7J5	10.227	10.227	10.227	10.227	10.227	10.227	10.227	10.227	10.227	10.227	10.227	10.227
J5J6	-3.759	-3.759	-3.759	-3.759	-3.759	-3.759	-3.759	-3.759	-3.759	-3.759	-3.759	-3.759
W1J13	4.061	4.061	4.061	4.061	4.061	4.061	4.061	4.061	4.061	4.061	4.061	4.061
W11J13	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029
J13J6	2.337	2.337	2.337	2.337	2.337	2.337	2.337	2.337	2.337	2.337	2.337	2.337
J6J7	4.486	4.486	4.486	4.486	4.486	4.486	4.486	4.486	4.486	4.486	4.486	4.486
W12J7	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014	10.014
J7GS	-6.739	-6.739	-6.739	-6.739	-6.739	-6.739	-6.739	-6.739	-6.739	-6.739	-6.739	-6.739
Total	**117.039**	**117.039**	**117.039**	**117.039**	**117.039**	**117.039**	**117.039**	**117.039**	**117.039**	**117.039**	**117.039**	**117.039**

Drawdown energy for well per day in month

Well	**DWT (m)**	**Jan/ per day**	**Feb/ per day**	**Mar/ per day**	**Apr/ per day**	**May/ per day**	**June/ per day**	**July/ per day**	**Aug/ per day**	**Sep/ per day**	**Oct/ per day**	**Nov/ per day**	**Dec/ per day**
W1	107.509	0.282	0.648	0.627	0.688	0.704	0.765	0.776	0.839	0.875	0.881	0.946	0.950
W2	111.177	0.151	0.346	0.332	0.363	0.369	0.399	0.403	0.435	0.452	0.454	0.486	0.486
W3	120.420	0.240	0.551	0.532	0.584	0.596	0.648	0.657	0.709	0.739	0.744	0.799	0.801
W4	111.651	0.075	0.173	0.167	0.183	0.187	0.203	0.205	0.221	0.231	0.232	0.249	0.250
W5	121.755	0.112	0.257	0.248	0.272	0.277	0.300	0.304	0.328	0.341	0.343	0.368	0.369
W6	117.853	0.054	0.123	0.118	0.129	0.131	0.141	0.143	0.154	0.160	0.161	0.172	0.172
W7	107.983	0.287	0.658	0.636	0.698	0.713	0.774	0.785	0.848	0.884	0.890	0.955	0.958
W8	110.292	0.284	0.652	0.631	0.693	0.708	0.770	0.781	0.844	0.881	0.887	0.953	0.956
W9	108.128	0.044	0.100	0.097	0.106	0.108	0.117	0.118	0.127	0.132	0.133	0.143	0.143
W10	110.770	0.114	0.261	0.252	0.276	0.282	0.306	0.310	0.334	0.348	0.350	0.376	0.377
W11	109.328	0.036	0.083	0.080	0.087	0.088	0.095	0.096	0.104	0.108	0.108	0.116	0.116
W12	109.868	0.045	0.103	0.099	0.108	0.110	0.119	0.120	0.129	0.135	0.135	0.145	0.145
W13	132.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W14	111.177	0.073	0.168	0.162	0.177	0.181	0.196	0.199	0.215	0.224	0.225	0.241	0.242
W15	134.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Energy for pumping in each well

Well	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
W1	107.791	108.157	108.136	108.197	108.212	108.274	108.285	108.348	108.384	108.390	108.455	108.459
W2	111.328	111.523	111.509	111.540	111.546	111.576	111.581	111.612	111.629	111.631	111.663	111.663
W3	120.660	120.971	120.953	121.004	121.017	121.068	121.077	121.129	121.159	121.164	121.219	121.222
W4	111.727	111.825	111.818	111.834	111.838	111.854	111.857	111.873	111.882	111.884	111.900	111.901
W5	121.867	122.013	122.003	122.027	122.032	122.055	122.059	122.083	122.096	122.098	122.123	122.124
W6	117.907	117.976	117.971	117.982	117.984	117.995	117.996	118.007	118.013	118.014	118.026	118.026
W7	108.270	108.641	108.619	108.681	108.695	108.757	108.767	108.831	108.866	108.872	108.938	108.941
W8	110.576	110.944	110.923	110.985	111.000	111.062	111.073	111.136	111.172	111.179	111.244	111.248
W9	108.172	108.228	108.224	108.233	108.235	108.244	108.246	108.255	108.260	108.261	108.270	108.271
W10	110.884	111.031	111.022	111.046	111.051	111.075	111.079	111.104	111.118	111.120	111.145	111.147
W11	109.364	109.411	109.408	109.415	109.416	109.424	109.425	109.432	109.436	109.437	109.444	109.444
W12	109.913	109.971	109.967	109.976	109.978	109.987	109.988	109.998	110.003	110.003	110.013	110.013
W13												
W14	111.250	111.345	111.339	111.355	111.358	111.373	111.376	111.392	111.401	111.402	111.418	111.419
W15												
Total	**1459.709**	**1462.035**	**1461.892**	**1462.275**	**1462.364**	**1462.744**	**1462.808**	**1463.199**	**1463.420**	**1463.455**	**1463.859**	**1463.877**

Total Energy (m/day/month)

Total Energy	Jan (m)	Feb (m)	Mar (m)	Apr (m)	May (m)	June (m)	July (m)	Aug (m)	Sep (m)	Oct (m)	Nov (m)	Dec (m)
To Move Water	117.039	117.039	117.039	117.039	117.039	117.039	117.039	117.039	117.039	117.039	117.039	117.039
To Pump Water	1459.709	1462.035	1461.892	1462.275	1462.364	1462.744	1462.808	1463.199	1463.420	1463.455	1463.859	1463.877
Total Energy (m/day/month)	**1576.748**	**1579.074**	**1578.931**	**1579.314**	**1579.404**	**1579.783**	**1579.847**	**1580.238**	**1580.460**	**1580.495**	**1580.898**	**1580.916**

All Scenarios

Total Energy (m/day)

Scenario	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
1	1359.413	1359.876	1365.914	1366.164	1366.180	1366.278	1366.291	1366.393	1360.368	1360.212	1360.303	1360.313
2	558.202	558.698	562.065	562.237	562.256	562.349	562.363	562.417	559.109	559.032	559.124	559.132
3	575.382	575.881	576.409	576.491	576.510	576.591	576.604	576.687	576.174	576.181	576.267	576.271
4	220.460	220.582	222.183	222.309	222.340	222.463	222.486	222.558	221.046	221.058	221.189	221.196
5	1576.748	1579.074	1578.931	1579.314	1579.404	1579.783	1579.847	1580.238	1580.460	1580.495	1580.898	1580.916