Bill Hutchison *has more than 20 years of experience as a hydrogeologist and is licensed as a Professional Geoscientist in Texas. He has been with El Paso Water Utilities for about three years. Bill has a B.S. degree from University of California at Davis and an M.S. degree from the University of Arizona. Bill has worked on several water resource management issues throughout the western U.S., including Owens Valley and Mono Basin in eastern California.*

EL PASO'S DESALINATION EFFORTS

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Thank you for the introduction. Today, I would first like to give you an overview of El Paso's water supply. Then more specifically, I will talk about the Hueco Bolson, which is where a lot of our water comes from. I will describe how we are managing groundwater in the basin, mainly in the context of the groundwater budget and what that budget tells us about how we are managing the basin and how we used that information to design the desalination plant. It represents a very unique opportunity in groundwater management.

As many of you probably know, we get our water from three sources: the Rio Grande; the Hueco Bolson, which is on the east side of the Franklin Mountains; and the Mesilla Bolson, located on the west side of the Franklin Mountains. El Paso has two surface water plants: the Canal Plant in downtown El Paso and the Jonathon Rogers Plant in the southeastern part of town.

Figure 1 shows the Hueco Bolson, east of the Franklin Mountains, which on this map is the greenish/reddish area. The small red dots represent wells in the area, of which there are several. We started pumping water in the Hueco in 1903. On the west side of the Franklins in the Canutillo area, we have a few wells in the Mesilla Basin, represented by the yellow dots.

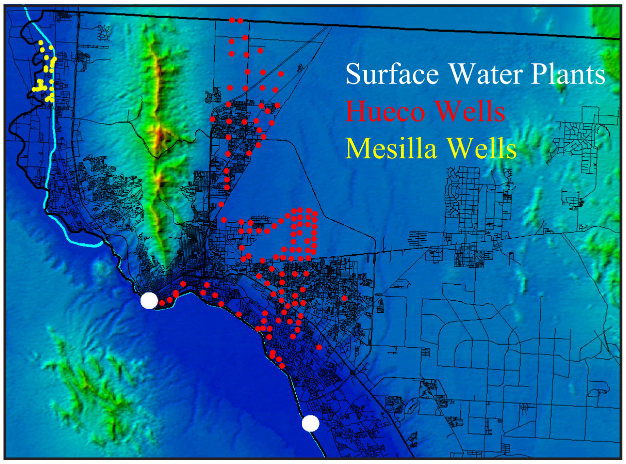

Figure 1.

Figure 2 provides the amount of water we have taken out of these three sources since 1967. Note a couple of things here. Red represents the Hueco and notice in 1989 we had peak pumping at about 80,000 acre-feet/year. Since then, the pumping in the Hueco has dropped over time to where it hit a low of a little less than 40,000 acre-feet/year in 2002. Also note that during that period, surface water diversions increased. Note that the overall demand had been flat or declining somewhat. The year 2003 is a bit of a unique situation because of the drought. Since 1989, our demand has been flat at about 120,000 acre-feet/year. But during that time, our per capita demand has dropped from over 200 gallons per person per day to less than 150. That is largely a result of a new rate structure and conservation programs that have been put in place as well as our increased use of reclaimed water.

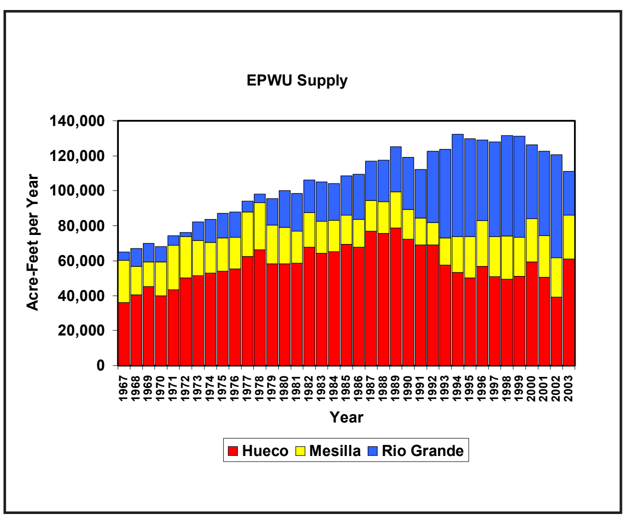

Figure 2.

In terms of the Hueco and the groundwater management programs with which we are dealing, we are facing two major issues: declining groundwater levels and brackish water intrusion. Figure 3 shows the Hueco Bolson extending up into New Mexico and down into Mexico. In Texas, the Hueco includes most of El Paso County and extends a bit into Hudspeth County.

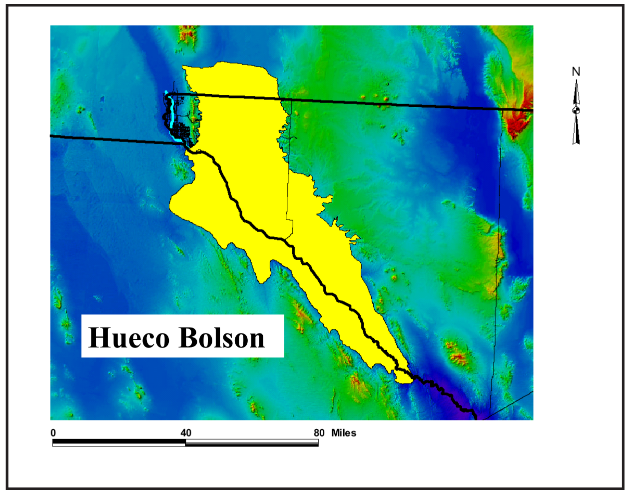

Figure 3.

In the cross-section on Figure 4, we see that the Hueco Bolson is a very deep basin bounded by the Franklin Mountains on the west and the Hueco Mountains on the east. Note that in the upper zone, there is a fairly thin lens of fresh water that seems to be the deepest at around 1200 feet thick. We have not touched the bottom of the fresh water in some places but it is thought to be about 1200 feet thick at its deepest; below that is brackish water. To the east is brackish water.

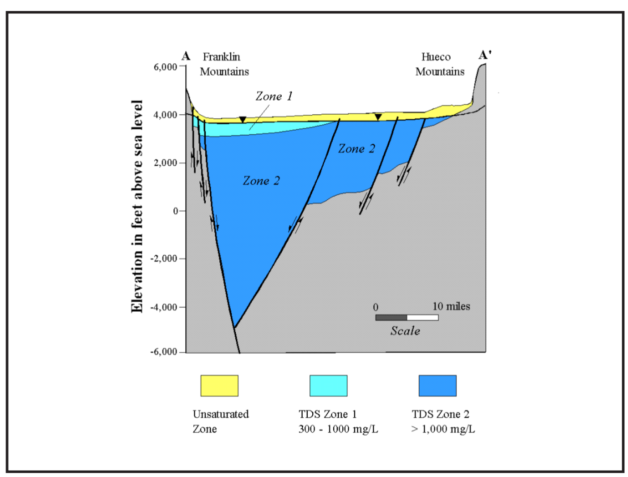

Figure 4.

Over time, a lot of pumping has been done in the Hueco since we started pumping in 1903. The result has been a decline in the water level. Along the airport area, we have had a decline of over 60 feet since 1960. But in that area, since 1990, the water levels have been relatively flat. That coincides with the period when we reduced our pumping in the Hueco. Many wells in the area have exhibited similar stabilization of water levels since the reduction of pumping started in 1989.

Historically, we can look at the drawdown in the Hueco in terms of the water level between any particular year and 1903. The map on Figure 5 shows four classes of drawdowns. Prior to World War I, little pumping took place. Then suddenly we started seeing between 10-15 feet of drawdown in El Paso as the city developed. As we get into the World War II, Juarez begins to put wells in and water levels begin to decline. By that point, we see the 50-ft contour starting to extend outward and we start seeing 50 to 100 feet declines, which are now 100 to 150 feet drawdowns. Juarez is now pumping quite a bit of water and has considerable drawdown. In 2002, Juarez had between 150 and 200 feet of draw-down in comparison to 1903 water levels, although a good chunk of El Paso declines have been in excess of 100 feet based on 1903 levels.

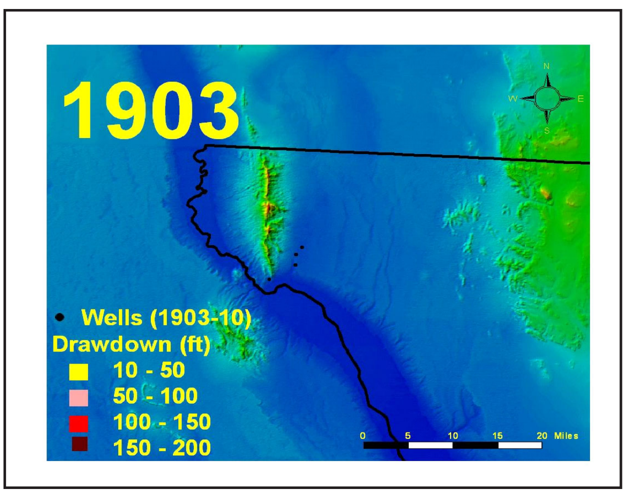

Figure 5.

What has happened as a result of this draw-down? Brackish water surrounds the fresh water as we saw in the cross-section on Figure 4. When water levels are lowered, water is drawn into it causing brackish water to seep into wells that had historically pumped fresh water (Figure 6).

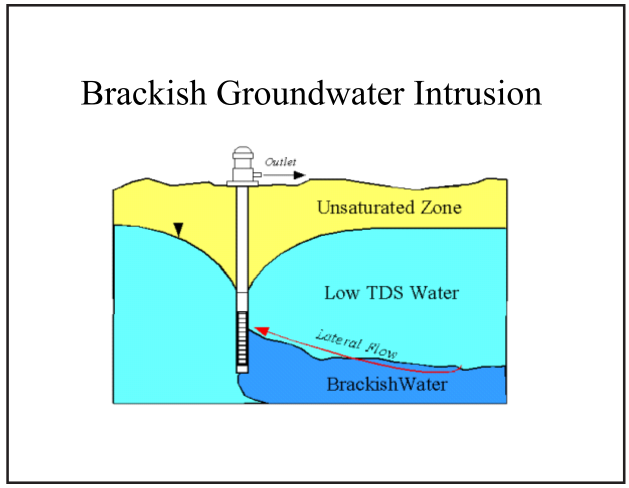

Figure 6.

For example, wells in the airport area have become brackish over time. Figure 7 indicates wells (in red) that have not been in operation over the last five years as a result of brackish water intrusion. The wells in yellow still operate, primarily in the northeast as well as some at the airport. Brackish water intrusion continues to be a challenge and a problem.

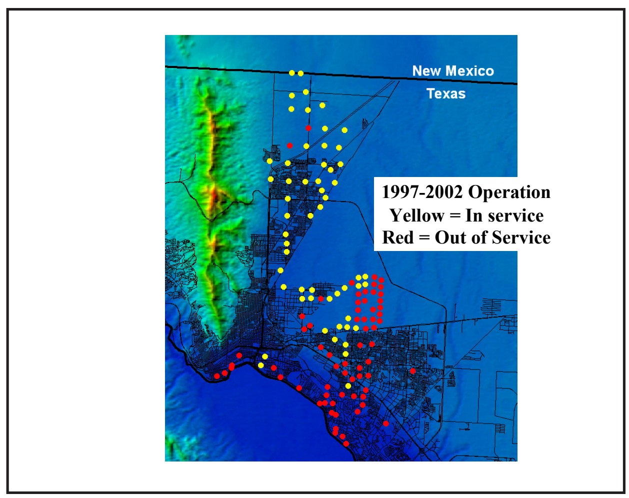

Figure 7.

Also, chloride concentrations have increased over the years. For example, Well 39, which is located near Fort Bliss and the airport, had chloride concentrations between 50 and 100 back in the 60s and 70s but since that time, the concentrations have increased steadily. If you use a scientifically appropriate approach and drop a straight line on a trend like that of Well 39, you get a sense of when the chloride concentrations will hit the 250 mg/L mark and that turns out to be around 2020. In other words, if we do nothing, Well 39 is going to go brackish in about 20 years.

In terms of our overall groundwater management efforts, we have taken many steps to stabilize groundwater levels in a lot of areas but brackish water intrusion remains an issue. Our groundwater budget is a result of developing a groundwater model of the area to help us understand what opportunities exist for additional groundwater management. A groundwater budget is an accounting of all the in-flows, out-flows, and storage changes in a system.

I want to present a brief summary of the El Paso portion of the Hueco (Fig. 8). We receive inflows from across the state line, coming in from the east along with a little bit of recharge from the Franklin Mountains. Outflows go to Juarez. Thus, to the east, during pre-development times from 1903 through the 1950s, water was actually moving out toward the eastern boundary. But as pumping increased, water levels were drawn down, the flow reversed, and flow was drawn in to the point where now, about 8,000 acre-feet of water is being drawn.

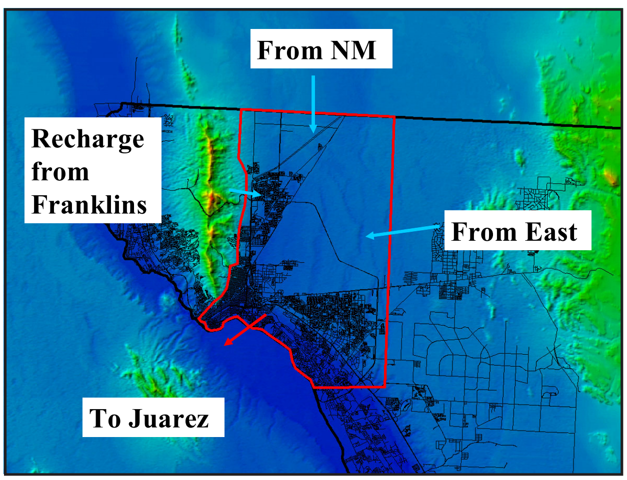

Figure 8.

What are the implications? Figure 9 contains a map of freshwater with dark blue representing chloride under 250. You can see where the water is being drawn in, the source of the brackish water intrusion. That represents the groundwater management challenge that we face.

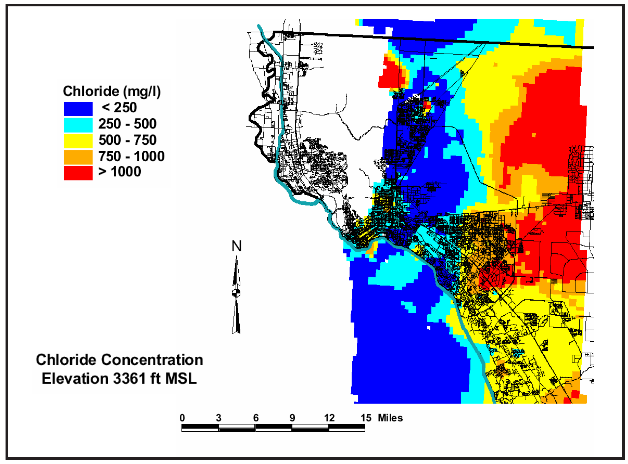

Figure 9.

In terms of storage decline, very slight declines occurred through the 40s and 50s. A spike occurred to about 50,000 acre-feet/year of storage decline up until about 1989. In more recent years, we have backed off that decline so that storage declines have become less of an issue. The inflow increase from the east is the source of the brackish water intrusion.

Storage declines have been reduced and now we have to deal with the question of what we are going to do with the brackish water. We do not want to increase pumping; we have that under control. But how do we deal with the brackish water?

Enter the joint desalination facility with Fort Bliss. At one time, El Paso looked at building a 20 mgd plant and Fort Bliss was contemplating a 7.5 mgd plant. People started talking and decided it might be a good idea for us to build a 27.5 mgd plant together. The plant is currently in design and will be located along with some of the wells at Fort Bliss. The concentrate disposal method, described earlier by Tony Tarquin, will be used in which the concentrate will either go through an injection well or be evaporated.

Figure 10 shows the area where the facility will be located. Note the source wells (in yellow) that will be used to supply the plant. The water from those wells (about 18 mgd) will go through the plant with the permeate blended with water from wells along Route 375 on Fort Bliss (indicated as blue dots on the map). The plant is located at the bottom of the figure. Blended water will go to the distribution system with the concentrate either going to a very large 700-acre evaporation pond or will follow a route to an injection well site. As I mentioned earlier, 15 feed water wells will generate about 18.5 mgd. The 16 blend wells located on Fort Bliss will blend with the permeate of about 12 mgd. The yield will be about 27.5 mgd of water to the distribution system and about 3 mgd of concentrate.

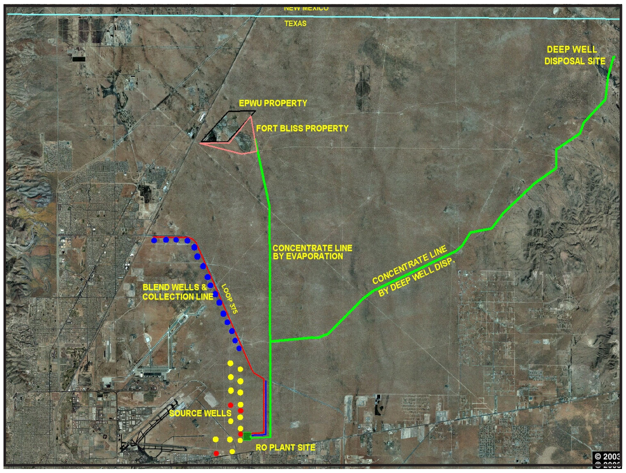

Figure 10.

We looked at two basic scenarios when planning for desalination development. What happens if we do nothing? What happens if we put in a joint desalination facility with blend wells at the Fort Bliss location, in terms of the groundwater flow patterns? Figure 11 shows the flow pattern in the base case, if we basically continue to do what we are doing now. The black dots represent our current wells. Note where the state line is and we can see that water is still going to be drawn toward these wells from basically all directions. The blue area represents fresh water with the lighter blue area still representing basically fresh water but now getting more brackish. The brackish water will continue to move in this direction (darker blue area) and continue to cause salinity increases in those wells. If we take the same amount of pumping of about 40,000 acre-feet/year and instead of spreading it over all these wells, we concentrate about 75 percent of it into the wells associated with the Joint Desalination Facility, notice that the water from the outskirts will still be drawn in (Fig. 12). However, on the back side, we now have a situation where the wells in the airport area will be fed from the north, which is fresh water. Essentially, we create a trough that intercepts the brackish water, treats it, and uses it in the system thereby saving the wells. The groundwater in this area will then be available for future contingency use and droughts.

The question then becomes, what do we do with the concentrate? The cost estimates (even with Tarquin's concentrate) of evaporation are quite expensive. If you could find a suitable geologic

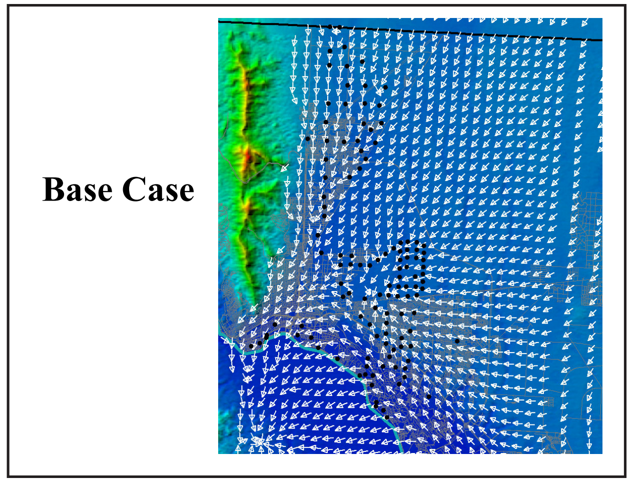

Figure 11.

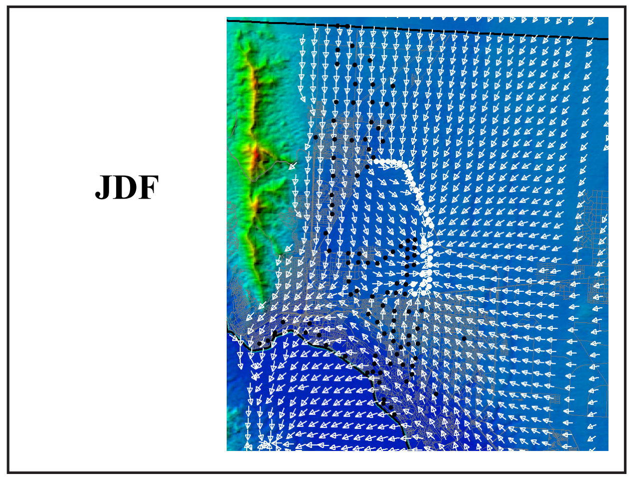

Figure 12.

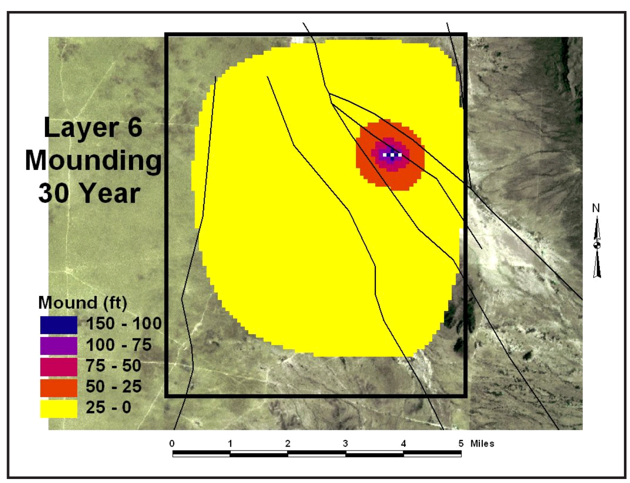

Figure 13.

formation, assuming you could obtain a permit, it is a much more economically viable option for disposal. We have focused our efforts on an area by the state line and completed a pilot well in the area last month. The well was located based on test hole drilling that was done in 2003 under a contract with the Army. We completed the well to 3,770 feet within dolomite limestone in the Fusselman Formation, which is of Silurian age. The perforated casing is a liner between 2,300 and 3,770 feet.

We obtained some nice pieces of the dolomite that we carry around and show people. They often say, "Well, this is nice but where does the water go?" The dolomite samples were fairly non-representative. Most of what we found was busted-up rubble as this is a pretty nicely fractured formation. Our testing indicated that it was quite permeable and took the water quite well. Our preliminary results encouraged us to use the testing results that we did in the well to simulate full injection of the operation on a preliminary basis. We are still in discussion with TCEQ about getting a permit. Based on test results, it looks like we can take care of all the concentrate in three wells in this area. We assume an injection rate of 4.5 mgd instead of the 3 mgd that the plant is supposed to have. A lot of that has to do with the potential need to dilute. A variety of reasons exist for us to be conservative but we decided to run the simulation at 4.5 mgd. The simulation consisted of putting in wells in an area of 5x6 miles. The geology that has been worked out shows these fault block structures at depth.

After 30 years we are seeing something on the order of less than 150 feet of build-up and the static water level is 500 feet below the surface (Fig. 13). We see about a 150 foot rise after 30 years and basically less than 25 feet of rise through a good part of this area.

We have already written the Environmental Impact Statement (EIS) for this project. Because this is a joint project, the Army will grant us easements to build the plant and run pipelines. This project is considered a federal action so the Army is preparing an EIS. The EIS is currently out on the street with the comment period ending on the 27th of this month. We hope to get a Record of Decision turned around by early 2005 and to get a TCEQ permit for the injection well sometime in the spring of next year. Once the Record of Decision is issued, we can start on the construction of the plant, pipelines, wells, and so on. We hope to get the plant started up in the fall of 2006.

Question: What do you have left to do to get the Class I permit from TCEQ? At one time there was an option to go through the Railroad Commission. Do you wish you had done that at the time?
Answer: The decision on Class I or Class V permit has not been formally made. We found that in the receiving formation, the Fusselman Formation, the TDS is about 8,700 ppm, which is below the magic number of 10,000, which means it is an underground source of drinking water making it eligible for a Class V permit. The Class V permit process is a lot less cumbersome in terms of the hearing reviews. Another bit of good news associated with a formation of 8,700 ppm: since our concentrate going in right now is at about 6,800 ppm, we would actually be improving an underground source of drinking water. We hope TCEQ agrees with us on that score. As far as the Railroad Commission question, if we can get a Class V permit through TCEQ, we would be thrilled.

Question: This question is for both you and Tony Tarquin. Tony mentioned costs per 1000 gallons for taking the concentrate and further working it down….. How do the costs of evaporation ponds and injections wells compare to the additional treatment Tony mentioned? What was it $1.50 per 1000 gallons?
Answer: I have not broken it down in terms of dollars per 1000 gallons. What I can tell you is that right now, we are looking at the potential for something on the order of $8 million for the wells. I think Tony's evaporation process is on the order of $17 and I think the actual full-scale evaporation is closer to $20. On a capital basis, this is by far the best way to go.