WATER SUPPLY PLANNING COMMITTEE REPORT

The “Water Supply Planning Committee,” consisting of George Bailey, Marty Davis, Dave Otter and Francis West has met to evaluate La Mesa Water Cooperative water supply alternatives for the next decade or so. The situation at this time is that Well #1 may have some problems indicative of a very short life, Well #2 has a rather low capacity (~25 gpm), Well #3 has a high Arsenic content, requiring treatment, Well #4 was never completed and currently has a stuck tool and likely a damaged screen, and Well #5 seems capable of producing about 100 gpm – adequate for wintertime, but not for the summer months. This report is the summary of our deliberations.

DISCUSSION OF ALTERNATIVES

Cleaning Well #1

In the closing months of 2006, we noticed that water from Well #1 had a larger than normal amount of granular material. Some of the material was sand, but most of it was magnetic, meaning that it was predominantly iron. The iron granules are most likely from the well casing, and the implication is that the casing is being eroded or corroded. The presence of the sand could mean that the “screen” section of the casing is not functioning as well as it once did. The screen section of the casing in this well simply has long, vertical slits cut in it. If the casing is being eroded or corroded, it is reasonable to consider that the openings have become a little wider. Ordinarily, the openings tend to become smaller as the well ages because of the buildup of deposits in the slits. However, as the slits become norrower, the water velocity increases and erosion is possible. The casing is made of “ordinary” steel, rather than the more expensive stainless steel, so accumulation of rust and its erosion are quite possible. Although it is difficult to project well life, a reasonable prediction is that Well #1 will be productive for only about an additional year if nothing is done.

The treatment normally prescribed for an aging well (Well #1 is about 15 years old) is some kind of cleaning. There are three possibilities: 1) brushing, which simply brushes away much of the deposits and thereby opens up the slits in the screen; 2) Chemical (generally acid) flushing in which the chemical is forced out through the screen section where it dissolves the deposits, requiring a period of pumping to waste to clear the well of the chemicals; and 3) a new (and untried, in this environment) technology in which repeated bursts of air are directed at the screen to force the water, at high pressure, through the screen to dislodge the deposits. Because of our uncertainty as to the actual condition of the screen, we are reluctant to recommend either the air burst of chemical cleaning technologies. Brushing seems to pose the least threat to the existing casing and, if the well is to be cleaned, it is the recommended approach.

One possibility and, we believe, a very good one, is that the well is filling up with granular matter and that it is being entrained in the pump inlet. Two things can be done to correct this: 1) pull the pump up so it sits farther away from the bottom of the well; and 2) clean the material from the bottom of the well. The material can be removed by a process called “air-lifting” in which air is introduced into the water where the material is located. The turbulence created entrains the material in the water and the air helps push the water out of the well before the entrained material can settle out. If the well is to be brushed, air-lifting should be used to remove the deposits brushed away from the screen. This will take care of the material at the bottom, as well.

Lifting the pump also seems to be a good option, but it has its own problems. The output of a pump depends on the pressure at which the water is delivered. The water supply at Well #1 will support a pumping rate of about 50 gallons per minute. The capability of the pump is greater than that, so we have “throttled it back” to produce that flow. If we lift the pump up, the static head above it will decrease, causing it to deliver more water and thereby exceeding the capability of the well to maintain flow. On the other hand, we have throttled the pump back about as far as we can without putting undue stress on the pump and being wasteful of the energy consumed simply pumping against a static

Well #1 Corrective Actions	
Action	**Cost**
Setup (remove pipe, pump, etc.)	$1,200
Video	$1,200
Brush & Airlift	$2,240
New Pump	$12,000
Well House Modifications	$4,000
Total	$20,640
Contingency	$4,130
Total incl. Contingency	**$24,770**

head. The solution is a smaller pump. If these changes were to be done, there would also be some changes to the well house to improve operations there.

The costs for these actions are as in the table at the left. We are not sure how useful a video of the well would be and we are still considering whether that should be done. These actions would presumably add 10 years to the life of well #1. Assuming the well would produce 50 gpm and run half of the time for 10 years, its total production would be 131 million gallons and the cost would be about 19¢ per thousand gallons.

Our previous planning has assumed replacement of Well #1 in 5-10 years. These actions could delay that somewhat and would not preclude locating the replacement well adjacent to the existing well.

Replace Well #1

Instead of waiting 5-10 years to replace Well #1, we could do it now. The well would cost about $200,000, including the pump and associated equipment. We could use the existing well house, but would have to install the piping from the well to the well house and inside the well house (about $5,000) and seal up the current well (another $5,000). It is likely we would have to extend our easement there so that the new well could be at least 50 feet from the existing well – that would likely cost about $2,000. The total cost would then be about $213,000. The life of the well would likely be about 30 years. Obtaining a replacement permit for the new well should be very easy.

Replace Well #2

Well #2 is only capable of producing about 25 gpm. When higher pumping rates have been tried, air has been entrained in the water and we assume that is because we are over-pumping the aquifer (meaning that the aquifer is incapable of replacing more than about 25 gpm). We now believe that a deeper well would produce more water. Well #2 is 720 feet deep. It apparently stops short of the zones of higher permeability (higher water flow) encountered at Well #5 and at the North Ranchos de Placitas well at the end of Calle Montoya. We discussed with the well driller (Rodgers & Company) the possibility of deepening the well. Their answer was that it was possible, but not something they would recommend.

One could drill (or mill if the well bottom is metal) out the bottom of the well with a bit less than the 6.437 inch I.D. of the casing, maybe something like a 5 inch bit. Then to prevent the sand filter behind the casing from washing out, a collar would be made by setting a short cement plug in the ~ 8 inch hole from the bottom of the casing at 708' to 720' and then drilling through it with a ~ 5 inch bit, continuing on to the zones of higher water flow. The casing would probably be around 4 inch O.D. below the existing casing.

An alternate method would be to pull the existing casing in Well 2 and the deepen with an 8 inch hole and set a 6 5/8 inch casing to the bottom. Pulling the existing casing would disrupt the sand filter behind the casing, so the entire well would have to be re-cased and a new "gravel pack" placed around the casing.

Yet another alternative is step over and just drill a new hole. This is the approach the drillers would much prefer. If the existing infrastructure is retained, the cost would be around $208,000 and the flow would be 40-60 gpm. Flow is limited primarily by the fact that the electrical supply is single phase. Such a well would have a lifetime of around 30 years.

Considering the difficulties and cost associated with making the existing well deeper, the Committee believes that approach should be rejected in favor of a new well adjacent to Well #2.

Well #3

The Arsenic content of the water from Well #3 exceeds 20 ppb and the new standard is 10 ppb. Effective in January 2006. We have looked into an arsenic treatment system. Such systems typically are based on a filtration process. In some cases one or more chemicals are added to the water before filtering, but in most, the needed reactions take place in the filter bed. We actually ran some tests using a sample filtration medium. Phil Carter, our Water System Operator, contacted a media supplier and operated a small experimental arsenic removal system at Well #3. We expect a facility using the Dow Company media to be effective.

Remove Arsenic from Well #3 Water	
Capital Cost	
Equipment (per Dow)	$18,000
pH and degas system (per Dow)	$21,000
Building (12' x 20' w/ foundation)	$30,000
Piping & Mechanical + Labor	$10,000

If, in fact, we were to treat water from Well #3, the flow rate would probably be reduced from 65 gpm to 50 gpm because of the added pressure drop through the filter media. Based on our tests and the information we have received from Dow Chemical, the table above is a reasonable estimate. In this case, we need a "capital" cost estimate for acquiring and installing the facility, and an Operations & Maintenance (O&M) cost estimate for the annual costs of using such a facility. The cost estimate is based on use of Well #3 about 60% of the time. At 50 gpm, that is about 15.75 million gallons per year. Consequently, the operating cost is about $1.62 per thousand gallons.

Originally, we had considered using Well #3 just to supplement the other wells. The capital cost estimate considers year-round use. If we were to use it for just a few months in the summer, we might mount the equipment on a trailer and just move the trailer and equipment into the well site during the time it is actually being used. Storage space for the trailer would probably run $70-100 per month and the cost of the trailer would likely be in the $5,000-$10,000 range.

Also, our other wells require periodic inspection and maintenance and electricity. While operating this facility would likely be more costly than the other wells, the analysis later in this report considers only the $20,300 ($1.28 per 1000 gallons) for acquiring and replacing the filter media.

Well #4

At Well #4, we know there is a substantial supply of good water. However, there is a tool stuck in the bottom 20-30 feet of the well, the screen is damaged, and we still do not know the source of the sand. We could put a concrete plug over the tool to create a new "bottom" to the well, and we could put in a screen with smaller openings to eliminate the sand. The new screen would have to be smaller than the current casing and the pump would also have to be smaller. We estimate production to be around 40 gpm. We would need a well house and all the equipment – at a cost approaching $100,000. When the cost of refurbishing the well is taken into account and the relatively meager production is considered, Well #4 seems not to be a worthwhile investment. Accordingly, it has been removed from our list of alternatives.

Electrical + Labor	$10,000
Total Capital	**$89,000**
Oper. & Maint. Cost (each year)	
Filter Media (per Dow)	$18,300
Electricity, CO_2, etc.	$3,000
Oper. Labor (1 hr/wk @ $40)	$2,100
Replace & Dispose Media	$2,000
Total O & M	**$25,400**

New Well

A new well is a possibility. It would require a new permit from the Office of the State Engineer. It would cost about $280,000 if it were within 200 feet of the existing 6" distribution system. It is presumed to last for 30 years, although it would likely need to be cleaned every 10 years. We can assume the flow would be 100 gpm.

Spare Parts

The most likely failure that would cause us to lose a well is failure of the converter. This piece of equipment, if it failed, would have to be sent back to the manufacturer, who would determine whether to replace or repair. The entire process could easily take six weeks. In the past, our planning has assumed that we could lose the largest well, and so our plans included sufficient capacity to permit us to survive a summer without that well. Now, our biggest well is bigger and providing the spare capacity is more difficult – and more costly. But stockpiling spare parts would permit us to recover a well within a week, thereby significantly reducing the pressure for extra capacity. Based on expense and lead times, it appears the only piece of equipment for which we need a spare is the converter. That would cost about $6,000.

Buying Water from North Ranchos de Placitas

We could, at least in theory, buy water from our neighboring water system, North Ranchos de Placitas. Their wells are at the end of Calle Montoya and a connection would be very easy. We have previously connected to their system to provide them with an emergency supply of water and water can certainly flow both ways through such a connection. They have agreed that, in an emergency, they would sell us water. No price has been set but their rates were recently about $3 per thousand gallons plus $15 per month. A customer using about 100,000 gal/yr would be paying about $4 per 1000 gallons. We would likely be looking for around 1.5 million gallons per month. It's not at all clear that they would (or could) do that. It is questionable that they would give up around 4-5 acre-feet of water rights to meet our needs and it seems unlikely that they would guarantee to do so. Accordingly, we removed this from the list of water supply options.

Evaluation of Alternatives

Comparison of the alternatives is difficult because the costs involve a combination of capital cost and operating costs and because the benefits are quite different. For example, stockpiling long lead time spare parts will not add to our pumping capacity and will not increase water deliveries unless we lose production from a well because of the failure of such a part. Treating water from Well #3 to reduce the arsenic content has a relatively low initial cost, but relatively high operating costs that will continue over its lifetime. To look at how these alternatives compare, we need to first look at how our system operates.

Here are some thoughts about our system:

- The "baseline" seems to be Well #5 at 100 gpm, and Well #2 at 25 gpm. Well #3 is not counted because of high Arsenic, and Well #1 is not counted because it appears to have a very limited lifetime.
- Using Wells #2 & #5, with a combined capacity of 125 gpm, provides adequate capacity during "normal" years (peak use is 109 gpm at full build-out) but not during a once-in-ten-years June when use could peak at 131 gpm.

- Options that produce water (cleaning #1, new or replacement wells) generally produce at least 50 gpm. Adding this to the capacity provided by Wells #2 & #5 will provide sufficient capacity to survive a long, hot Summer.
- With a total capacity of 175 gpm, loss of Well #1 would leave us with only 75 gpm of capacity. In an average year, we would drain the tanks in about 5 days (assuming 250,000 gal in storage), and in about 2.5 days in a once-in-ten-years June. This would seem to argue that we need at least 175 gpm of capacity.
- Surviving on 175 gpm is contingent upon being able to fix the problem in a few days. This would argue for having the spare parts available. The alternative would be to buy water from North Ranchos de Placitas. However, it is unlikely that they could make up 65 gpm for an extended period of time. They could probably provide 25 gpm fairly easily, and maybe 35 gpm. The cost would likely be $3 to $5 per thousand gallons. At 35 gpm that would be $150-$250 per day. The $6,000 estimated cost for spare parts would buy 24-40 days of water. We have no assurance that they can provide this amount of water (1.2 to 2.0 million gallons over about a month) nor that they would consider this a prudent use of their water rights (4-6 acre-feet). This leads to **Recommendation #1: Acquire and maintain on-hand spare parts to recover from a "well failure" within a week.**
- At full build-out our system will be supplying about 35 million gallons per year, on average. That works out to about 67 gpm. If our pumping capacity is 175 gpm, then we will be running our pumps about 40% of the time, on average.

The following table summarizes what we know about the remaining options. The "Water Produced" line assumes the pumps run 40% of the time. The cost to add capacity (Cost/gpm) does not include the operating costs for treating water from Well #3. The values for Well #2 are questionable because its life is not immediately threatened. Consequently, the capacity addition is really only 25 gpm and the water produced is really only half of what is shown. The 30-year life for a new well is different than replacements for Wells #1 & #2. If a more conservative 20-year life is assumed, the cost for water will go up to $0.66/Kgal, comparable to replacing Well #1.

	Clean Well #1	Replace Well #1	Replace Well #2	Treat Well #3	New Well
Capital Cost	$25,400	$213,000	$208,000	$89,000	$280,000
Oper. Cost				$1.3/Kgal	
Capacity Added	50 gpm	70 gpm	50 gpm	50 gpm	100 gpm
Cost/gpm	**$508**	**$3,043**	**$4,160**	**$1,780**	**$2,800**
Life	10 years	30 years	30 years	20 years	30 years
Water Produced	105 Mgal	441 Mgal	315 Mgal	210 Mgal	631 Mgal
Cost/Kgal	**$0.24**	**$0.48**	**$0.99**	**$2.27**	**$0.44**

Based on the above, a reasonable priority would be: 1) clean Well #1; 2) either replace Well #1 or drill a new well at a new location. If cleaning Well #1 does not solve the problems there, replacing it would still be a better option than replacing Well #2. Because cleaning Well #1 has a fairly low "up-front" cost, it allows us to repay our indebtedness for Well #5 before incurring the cost of another well, whether replacement or new. Hence **Recommendation #2: Clean Well #1.**

If cleaning Well #1 does not solve the problems there and our debt level is too high to consider another well, treating water from Well #3 using a system mounted on a trailer, rather than placed in a building, would seem like a reasonable choice. Assuming a trailer mounting could save about $25,000, that would reduce the capital cost to about $65,000 ($1,300/gpm). Once the decision is made to acquire the treatment system, decisions regarding its use might be very different than presented here. Overall system cost is minimized by minimizing use of the treatment facility, because every 1000 gallons of water treated adds about $1.30 to the cost of operating the system. Thus, the operating priority would likely be Well #5 first, Well #2 second, and Well #3 last. At this time, we do not have a third recommendation.