WATER SUPPLY/DEMAND ANALYSIS – 2010

Introduction & Background

About three years ago, the LMWC Board considered several alternatives for future water supply and commissioned a study to explore the feasibility and cost of each. The alternatives fell into two general categories: 1) wells producing 50-100 gpm of compliant water and 2) treatment to remove arsenic from existing or new non-compliant wells. The Board approved a plan to explore the feasibility and cost of treating the water from Well #3. Toward that end, requests for proposals were sent to several prospective vendors and bids received from several of them. Over the course of the last year the proposals have been evaluated and some vendors eliminated as being overly expensive.

The LMWC is now approaching a point where a decision must be made. Also, at this time, the LMWC is undertaking its annual review of its rates. Because treatment to remove arsenic is expensive, updated analyses are required. This report is intended to supply the needed updated analysis. The analysis is intended to address the following questions:

- When is a new well needed?
- In treating the water from Well #3 to reduce arsenic, should we acquire a system that will treat 50 gpm, or one that treats 75 gpm?
- How much water will we have to treat each year?

Summary and Conclusions

<u>When is a new well needed?</u> In the absence of treatment to remove arsenic, a new well is needed now. We normally plan for a water demand that would be exceeded only once in ten years. We cannot meet that goal at this time and after 2012, we may not be able to meet the average demand if our pessimistic projections of well life are realized. If Well #3 water is treated a new well is needed the year Well #3 stops operating.

<u>In treating the water from Well #3 to reduce arsenic, should we acquire a system that will treat 50 gpm, or one that treats 75 gpm?</u> Provided the added cost is not excessive, the larger system is better because it allows more time until a new well is required. It pushes the need for a new well out from 2013-15 to 2019 and beyond.

<u>How much water will we have to treat each year?</u> Over the next 5 years, we would need to treat 2-5 millions gallons annually to meet the higher demand (exceeded only once in ten years) and 0-2.5 million gallons to meet the average demand. Note that the analysis cannot exactly simulate the control system, so these are probably minimum estimates.

Assumptions

Assumptions for each well are as follows:

Well	Capacity	Lifetime	Capacity Loss
#1	34 gpm	10-15 years from 2008	2% per year
#2	20 gpm	2-5 years from 2010	2% per year
#3a	50 gpm	10 years from 2010	1% per year
#3b	75 gpm	10 years from 2010	1% per year
#5	106 gpm	30 years from 2008	2% per year

Note that two capacities are given for Well #3 to account for the 50 gpm option and the 75 gpm option.

An attempt will be made to minimize the amount of water from Well #3 to minimize treatment costs. However, the analysis cannot accurately simulate the LMWC control system. For the analysis, it was assumed generally that the compliant pumps operated 60% of the time and that Well #3 provided enough additional water to meet demand. In those situations in which Well #3 had to operate more that 60% of the time to meet demand, all wells were assumed to operate together. The actual control system uses the water level in the tanks to start and stop the pumps. It could be configured so that at 10.5 feet (12 feet is full) the compliant pumps are started. Then, if the level continued to fall, Well #3 would be started at some lower level – say 10 feet. Alternatively, the pumps could all be started at one time (say, 10 feet) and Well #3 shut off at one level (say, 11 feet) and the rest when the tank is full. Or a combination of these schemes could be used. It is likely that the system would need "tweaking" to get it "right."

Year	Houses	Demand, gpm	
		Average	1 in 10
2010	321	87.1	106.5
2011	326	88.4	108.1
2012	331	89.9	109.8
2013	336	91.1	111.4
2014	341	92.5	113.1
2015	346	93.8	114.8
2016	350	94.9	116.1
2017	353	95.7	117.1
2018	356	96.6	118.1
2019	358	97.1	118.7
2020	360	97.6	119.4
2021	362	98.2	120.1
2022	364	98.7	120.7
2023	366	99.3	121.4
2024	368	99.8	122.1

Prior analyses of water demand per household remain valid, as do the "average", "1 year in 10" and "Maximum" demands for the three summer months. For this analysis, the usage per household averaged over the three summer months is used. The average demand is 390.6 gal/day/household, and the "one year in 10" demand is 477.6 gal/day/household. The "highest ever" is not used in this study. It was assumed that 5 households per year would be added over the next 5 years, with the addition rate declining in later years. Actual numbers of houses is given in the table to the left. The demand, based on that number of houses is also given in the table. In the past, our projections have not seriously considered the average demand, because the goal was to provide sufficient resources to meet demand most of the time. However, this year, we must estimate the cost to treat the water, and it may be more appropriate to consider the average, realizing that the cost over several years will more nearly approach an average of higher and lower costs.

We consider "maximum" usage of the wells to occur when their pumps operate 60% of the time. The water resource for this area was estimated using pump/well test data and assumed that the pumps operated 60% of the time. By acting to stay under (or near) this condition, we achieve the greatest likelihood that the resource will continue to be available for the estimated duration (originally 40 years, but now 100 years). To the best of our knowledge, the 60% point does not represent some sort of "cliff" and exceeding it periodically does not foretell a sudden decline in the resource. Accordingly, we use this as a "figure of merit" to guide our decisions on acquisition of additional resources.

Results

All of these assumptions can be put together to create a preliminary view of how the LMWC system would operate during future years. The result is shown in Figure 1, on the following page. The red line is the "Once in 10 Years" demand and its trajectory is a reflection of the assumption about the number of houses. The pinkish line provides the same information for "Average" demand. The dashed black line shows our ability to supply compliant water, assuming the pumps operate 60% of the time and pessimistic assumptions are made about their lives (Well #2 does not operate after 2012 and Well #1 does not operate after 2018). The little "bump" in 2018 reflects a well cleaning that could be done that year. This part of the figure reveals that we are currently unable to meet the "1 in 10" demand and will be unable to meet average demand after 2012 –

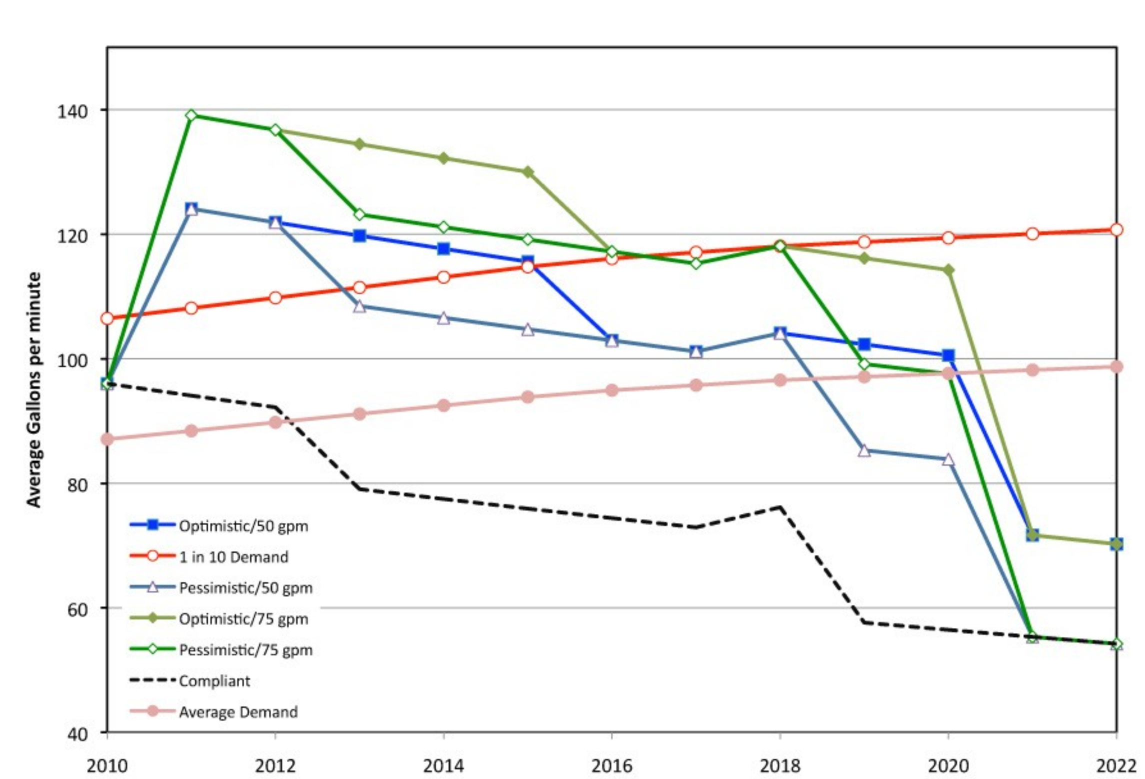

Figure 1. Supply and Demand with Pumps Operating 60% of the Time

assuming pump operation at 60%.

The blue lines depict the total water supply if Well #3 can pump 50 gpm, and the green, 75 gpm. Lines with solid markers are for optimistic assumptions about compliant well lifetimes and those with open markers are for pessimistic assumptions. Note that the 75 gpm option allows demand to be met at least through 2018 for even pessimistic assumptions.

Note also that the situation deteriorates dramatically when Well #3 is shut down. It seems clear that another water source must available when Well #3 is no longer operating. Also, the 75 gpm option extends the time until a new is required by 3-5 years more than the 50 gpm option. This would seem to argue in favor of the 75 gpm option.

Another way to look at this is to see how often Well #3 would have to operate, rather than just assume all pumps operate 60% of the time. This is shown in Figure 2 on the next page. There are a lot of lines on that chart, so the following "key" will help interpret it:

- Red lines are used for pessimistic assumptions about compliant well lifetimes, blue lines are for optimistic assumptions.
- Solid lines are for "Average" demand, dashed lines for "1 year in 10" demand
- Solid markers are for the 50 gpm option, open ones denote 75 gpm

We can expand the 60% guideline to indicate an "Alert" situation at 60% with "Concern" deferred until the pumps run 70% of the time. The 75 gpm option barely breaches he "Alert" threshold and only exceeds the "Concern" threshold when Well #1 is shut down in 2018 under pessimistic assumptions. The 50 gpm option hovers hear the "Concern" threshold after Well #2 is shut down

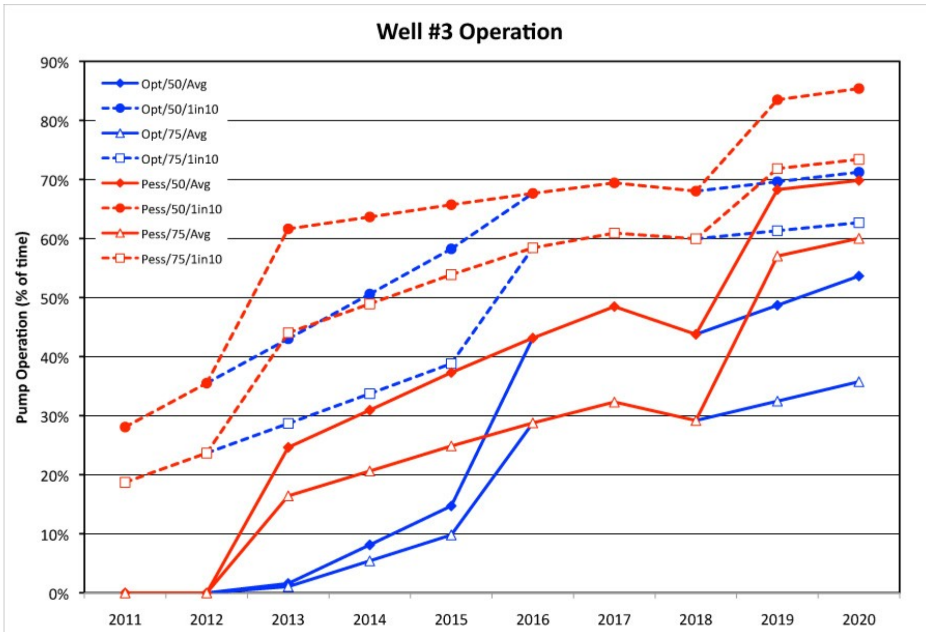

Figure 2. Frequency of Operation of Well #3

and breaches that threshold when Well #1 also shuts down. We can also see that the 75 gpm option is adequate so long as Well #1 continues to operate .

The last analyses deal with the amount of water that will require treatment. Figure 3 provides the results. In looking at them, it is important to remember that the compliant wells increase their output when Well #3 must operate more than 60% of the time.

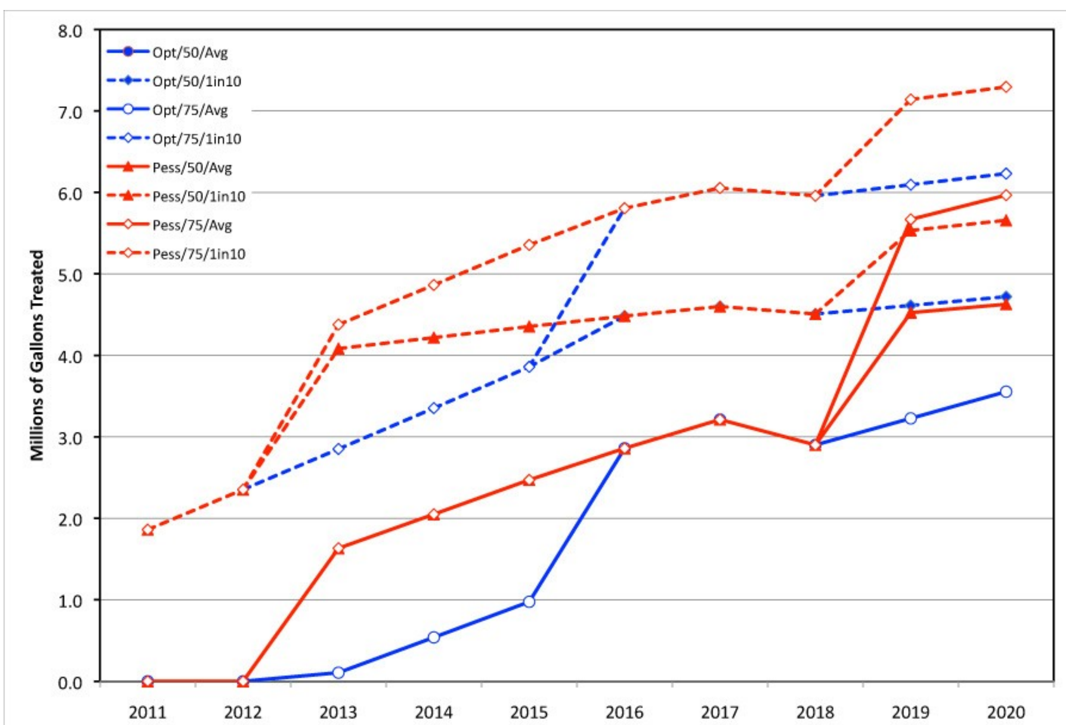

Figure 3. Water Requiring Treatment

During the first few years of operation, the treatment facility will have to handle as much as about 4 million gallons of water, depending on the life of Well #2. Between 2016 and 2018, it will need to treat 3 to 6 million gallons. Note that the amount of water treated does not depend strongly on the capacity of the treatment system. That is because the compliant wells meet most of the demand. Only when the incremental water needed amounts to more than about 4 million gallons (that is 50 gpm running 60% of the time for 3 months) does the amount treated depend on the capacity.

Cost

Assessing cost is beyond the scope of this study, with the possible exception of the cost to treat the water. A reasonable approach to recovering the treatment cost would be to impose a surcharge for the Summer months – June, July and August. The surcharge could depend on the amount of treated water needed. The table below gives the percentage of water that would have to be treated for the various conditions already discussed.

Capacity	50 gpm				75 gpm			
Well Life	Optimistic	Optimistic	Pessimistic	Pessimistic	Optimistic	Optimistic	Pessimistic	Pessimistic
Demand	Average	1 in 10	Average	1 in 10	Average	1 in 10	Average	1 in 10
2011	0	13.0%	0	13.0%	0	13.0%	0	13.0%
2012	0	16.2%	0	16.2%	0	16.2%	0	16.2%
2013	0.9%	19.3%	13.5%	27.7%	0.9%	19.3%	13.5%	29.6%
2014	4.4%	22.4%	16.7%	28.1%	4.4%	22.4%	16.7%	32.5%
2015	7.8%	25.4%	19.9%	28.6%	7.8%	25.4%	19.9%	35.2
2016	22.7%	29.1%	22.7%	29.1%	22.7%	29.1%	22.7%	37.7%
2017	25.3%	29.7%	25.3%	29.7%	25.3%	29.7%	25.3%	39.0%
2018	22.7%	28.8%	22.7%	28.8%	22.7%	28.8%	22.7%	38.1%
2019	25.1%	29.3%	35.2%	35.2%	25.1%	29.3%	44.1%	45.4
2020	27.5%	29.8%	35.8%	35.8%	27.5%	29.8%	46.1%	46.1

One way to calculate the surcharge would be to 1) determine the added cost to treat the water water and 2) multiply that by he fraction of water treated to yield the surcharge.. Fr example, consider the year 2016 and assume the cost of untreated water is $1.00 per thousand gallons and of treated water is $4.00 per thousand gallons. The added cost is $3.00 and between 22.7% and 29.1% of the water is treated. So the surcharge should be between 68 cents and 87 cents per thousand gallons. It might be reasonable to charge 75 cents per thousand gallons.