

DD/08-230-02

June 22, 2011

Melody Ranch HOA
P.O. Box 4337
Jackson, WY 83001

ATTN: HOA Board of Directors

RE: **Melody Ranch – 3rd Well Review**

Dear Board Members:

Purpose:

At your request, Nelson Engineering has completed a review of the Third Well Report and Third Well Analysis which was completed by Jorgensen Associates (JA). The purpose of the third well study completed by JA was to determine if actual water usage from the system warrants a third well be constructed and used to supplement the Melody Ranch Public Water Supply System.

The Third Well Report is a letter dated June 2, 2011 from JA to Melody Ranch Developments which discusses the findings of the Third Well Analysis. The Third Well Analysis is a brief report which includes the Purpose, Description, Data, and Conclusions of the Analysis.

Review Overview:

Our work included a review of the methodology and data used by Jorgensen Associates to arrive at their conclusions. In completing our review, we also utilized the Melody Ranch Meter Reading Report that was compiled by the Town of Jackson and provided to us by Grand Teton Property Management. Also, our analysis included completion of our own calculations and study of theoretical, present, and projected water consumption volumes for the Melody Ranch Development and other known or potential water consumption that places demands on the system.

Methodology Review:

The methodology used by JA in assessing the need for a third well is as follows:
Cited the purpose was to determine if actual use data warrants a third well; summarized the existing water supply system and its capacity; presented and averaged the water usage based upon readings from the system's distribution meter; presented the Wyoming Department of Environmental Quality (WDEQ) minimum standards for design basis for water supply; calculated the WDEQ design basis (in gallons per day) for the build out scenario of the Melody Ranch Development; compared the available supply volumes with

projected volumes for the build out scenario and with the WDEQ minimum required volumes for the build out scenario; drew a conclusion from this methodology.

Our review agrees that the general methodology followed was appropriate for the study. We agree that the basis for making a conclusion is to compare the available supply with projected demands for the build out scenario and that the projected demands should be extrapolated from available actual usage quantities. **However, we do not agree that the basis for determining if a third well is necessary should be based upon the WDEQ standards since WDEQ standards are minimums.**

As JA's report identified, the WDEQ requires that for systems where two wells are used, each well must be capable of providing the average day demand with the largest well out of service. WDEQ also requires that the total supply be capable of providing the maximum day demand. Since the WDEQ minimums are based upon average annual demands, designing supply on this basis can often leave systems short of capacity to supply summer average day demands and significantly short of supply to provide summer maximum day demands, particularly when a well is out of service.

Data Review:

The data presented in the JA report includes monthly distribution meter readings from December 2006 through Jan 2011 and weekly distribution meter readings from June 2009 through August 2010. JA summarized the meter reading data to compute Average Day volumes and Average Day per Lot volumes. To compute volumes, JA divided the monthly water usage by the number of days in each month to determine a Monthly Average Day Volume. JA then divided the Monthly Average Day Volume by an estimated number of lots on the system in order to present a Monthly Average Day per Lot. JA also calculated a Summer Weekly Average Day in the same manner. JA proposed that the highest Monthly Average Day per Unit represented the Maximum Day Demand per Unit and utilized this value to compute a Projected Maximum Day Flow at Buildout.

We believe two factors lead to slightly lower values for the projected MDD than should be properly computed. First, since the method to determine MDD uses averages, the actual MDD value is based upon averages rather than true maximum day values. We recommend that the projected MDD based upon averages should be increased by a percentage of 5% to better represent actual maximum day flow.

Secondly, JA calculated the monthly "water to system" by subtracting a volume of water (197,000 gallons) used by the chlorination system (which is obtained from the distribution system following the distribution meter. "Notes 1" in each data exhibit indicates the 197,000 gallons as being a per day (gpd) volume. The 197,000 gallon volume was subtracted from both the monthly totals and weekly totals thus giving an incorrect number for daily use and use per unit. **This 197,000 gallon volume should be reviewed by JA (we believe it is most likely an approximation in gallons per month). Regardless of the actual volume used for chlorination, the volume is a requirement of the system, is proportional to demand and therefore, it is inappropriate to subtract this demand**

from the total supply. If water for chlorination is not deducted from the calculations, the demand per unit will be higher than reported in the JA report.

As is typical in water supply, the JA compiled usage data shows a drastic difference in demand from winter to summer. Winter use is indicative of domestic uses and losses whereas summer usage indicates domestic uses, losses and irrigation. JA's report summarized the data from an annual average standpoint and identified Maximum Day values by identifying the peak usage month which was typically August. We believe that the large degree of variation in seasonal uses warrants consideration of Winter Averages and Summer Averages. A summary of demand values calculated by Nelson Engineering follows:

• Summer Average Day: (July – Sept for yrs 2007 thru 2010)	2053 gpd/lot
• Winter Average Day: (Dec 2010-March 2010)	480 gpd/lot
• Maximum Month Average Day: (August 2007)	2656 gpd/lot
• Annual Average Day:	1004 gpd/lot
• Current Summer Average Day: (2053 x 332 lots)	681,600 gpd
• Projected Buildout Summer Average Day: (2053 x 367 lots)	753,450 gpd
• Projected Buildout Winter Average Day: (480 x 367 lots)	176,160 gpd
• Projected Annual Average Day: (1004 x 367 lots)	367,470 gpd
• Projected Maximum Month Average Day: (2656 x 367 lots)	974,752 gpd
• Projected MDD as 5% greater than Maximum Month Avg: 1.05 x 974,752 =	1,023,490 gpd
• Supply Well #1: (375 gpm)	540,000 gpd
• Supply Well #2: (375 gpm)	540,000 gpd
• Combined Flow Rate of Wells #1 and #2	972,000 gpd

Data above for Current Summer ADD and Buildout Summer ADD compared to available supply volumes shows that in the summer months, adequate supply is not available to provide current or buildout scenario summer ADD when one of the two existing wells is out of service. Additionally, the combined capacity of the two existing wells is less than the MDD.

Certainly it should be understood that the numbers presented by both Jorgensen Associates and Nelson Engineering are not precise but are presented as a representation of the volumes available and consumed or to be consumed. Since the volumes JA has presented in their report show that the projected Maximum Daily Flow at Buildout is a mere 4000 gallons below the Combined Flow Rate of the two existing wells, it takes only a minimal peaking factor (1.005 or 0.5%) to increase the Projected MDD at Buildout (which was based upon averages) to a value that exceeds the Combined Flow rate of both wells.

Based upon these considerations, we recommend that a third well be constructed and added to the system. The capacity of a third well should be at least equal 375 gpm (the capacity of one of the existing wells).

Minimum Use Data and Leakage:

The data presented by JA for average day per unit shows each month of water usage. Clearly, summer uses are higher due to irrigation demands and the maximum day per lot figure was determined from this data as discussed above. However, it is also important to review the minimum average day per lot figures which were presented. A review of the minimum figures which occur during the winter months of December through March reveals that the system distributes volumes between approximately 410 and 475 gallons per day per lot during winter. These average volumes per lot are significantly higher than are common for homes in the Jackson Hole area. Typical wintertime water use should be in the range of 225 to 375 gallons per day per unit, depending upon the occupancy and size of the homes. The high consumption rate in winter may be due to leakage within the system. Although one might assume that leakage rates are similar in the summer and the winter, it is possible that additional leakage occurs from the irrigation piping in the summer during periods when irrigation is being applied.

The fact that the assembled data points to leakage is a concern. Our estimates indicate that leakage may account for 25% to 50% of the water use in the winter months. It is practical to recognize, and even accept, that leakage will account for up to 10% or perhaps as much 15% of production. However, at Melody Ranch it appears that leakage far exceeds an acceptable amount. **Therefore, in agreement with JA, we also recommend that a process be undertaken to identify and correct leaks within the system.**

Unmetered Uses:

JA's Third Well Report Letter discusses that "at least four known unmetered uses" are on the system. The four known uses presented in the letter are irrigated common areas within the development. In addition, we understand that the Melody Ranch Homeowner's Board was informed that the Ranch Complex east of Melody Ranch Road, west of Flat Creek and North of South Park Loop has been served water from the Melody Ranch water system (MRPWS) for many years. It is unknown if this use is limited to domestic uses within the home or if irrigation of the property has also occurred via this service. It is also unknown if this use is still connected to the system or if JA's study included considerations for this use although it does not appear so.

It is recommended that all unmetered uses be retrofit with meters. By installing meters, the volumes of these uses can be quantified and in turn utilized to ascertain more accurate per residential lot volumes within the subdivision which can be used to make additional projections about build out volumes. Meters added to these irrigation systems may also aid in determining if leakage is occurring within these systems.

It is also recommended that MRHOA determine if the Ranch Complex mentioned above is still connected to the MRPWS.

Additional Considerations:

During our review of the presented data, we also considered other potential issues and assumptions that could affect the JA analysis. The additional considerations we made are presented as the following questions:

1. Is the number of lots used in the computations accurate?
2. In making projections for build out, is it accurate to simply multiply the resulting Monthly Maximum Day Demand per Lot by the number of lots at build out when the computed values include many small lots and townhomes and the majority of the remaining lots to be developed are larger lots which can be expected to use more water than the smaller lots?
3. Is actual Maximum Day Demand higher than the highest computed Monthly Average Day Demand or highest Weekly Average Day Demand?
4. Does this methodology account for additional uses such as the Teton County Park which will be added to the system?

Our opinions on these questions are as follows:

1. The number of lots used in the projections may be somewhat inaccurate. (For example, the same number of lots was used for 2008 and for 2009, when in actuality, there were probably more developed lots in 2009 than in 2008.) However, JA's estimates for the number of lots can be considered acceptable because although the numbers may not be precise, no reasonable variation in the number of lots for a given year will yield a higher value for MDD/lot than in 2008.
2. Although development of larger lots in the future may use more water than smaller lots, it is often appropriate to determine averages for the purposes of making projections about the future. Also, we feel that this possible underestimation of volume is offset by the fact that unmetered uses are included in the computation for MDD/lot which has the effect of increasing the MDD/lot for the purposes of making the build out projections.
3. Dividing the weekly and monthly volume totals by the number of days of flow yields *average* maximum flows. **The JA report should have considered that the Actual Maximum Day Demand will be higher than the presented average values.**
4. JA's methodology does not account for any additional uses other than the undeveloped residential lots. We obtained Teton County/ Jackson Parks and Recreation's (TCJPR) preliminary plans for development of a Park at the corner of Kestrel Lane and South Park Loop Road. The park development includes bathrooms, a drinking fountain, and significant irrigation systems. **The water uses of the future TCJPR Park, particularly the irrigation demands, should be added to the projected uses and MDD computations. It is likely that this park, added to the volumes projected by JA, will elevate the projected MDD to beyond the 972,000 gallon per day capacity of the combined wells.**

Conclusions:

Although additional metering and quantification of other existing and future uses is recommended within this report (and doing so may either reduce or enlarge the presented volumes somewhat) it is reasonable to draw conclusions from the data presented. As stated in the *Data Review* section of this report, we believe that a third well should be added to this MRPWS in order to ensure that if a well goes out of service, adequate water will continue to be available to the users.

Even by initiating a recommended proactive leakage identification program and repairing leaks in the system, it should be expected that irrigation uses will remain high and that the summer ADD for this system will exceed the capacity of a single well.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read "D. Dufault". The signature is stylized and cursive.

Dave Dufault, PE
Project Engineer