KELLER associates

Technical Memo

TO: Wayne Shepherd, PE, Public Works Director
City of Mountain Home

FROM: Susan Burnham, P.E.

DATE: November 30, 2015

SUBJECT: Wastewater Declining Balance Update

Background

Periodic reviews of the wastewater system are necessary to address changes in conditions since completion of the 2011 facilities plan update. An evaluation of the Mountain Home wastewater treatment facilities was completed in March 2013, based on new population data, the reuse requirements in effect at the time, and flow data through 2012. Subsequently, a new reuse permit for the land application area was put into effect, and several more years' worth of flow data are now available. The purpose of this technical memorandum is to update the declining balance for the wastewater system (treatment components only), and to identify remaining capacities of the storage lagoons and land application area.

Population and Flow Update

Another 33 months of flow and loading data (2013 through September 2015) was analyzed in the preparation of this update. In addition, population estimates from 2010 on were reviewed and revised based on 2014 Census Bureau estimates and recent housing starts (residential building permits issued by the City each year). The population estimate for 2014 is 3% less than 2010 census numbers; the population decline is evident in the decreased flows from 2010 through 2014.

The historical summary showing flows, estimated populations, and calculated average and maximum day per capita flows (Table 2.3 in the 2011 Wastewater Facilities Planning Study Update) was updated accordingly, as shown on the following page.

The reduction in flows between 2010 and 2014 is substantially more than would be expected solely due to the decrease in population. As a result, per capita flows for those years are lower than previously estimated. The current five-year average per capita flow is about 10% lower than per capita design values from the 2011 facilities plan update. In general, per capita flows have been on a downward trend since 1997. Therefore, the 2011-2015 average per capita flows of 94 gallons per capita per day (gpcd) is considered appropriate for projections of future flow.

Table 2.3, rev. Oct. 2015 – Historical Flow Summary

Year	City Estimated Population	Average Flow (MGD)	Peak Daily Flow (MGD)	Peak Monthly Flow (MGD)	System Average Per Capita Flow (gpcd)*	System Max Day Per Capita Flow (gpcd)*
1997	9,990	1.832	2.786	1.983	183	279
1998	10,515	1.844	3.047	2.316	175	290
1999	10,743	1.664	2.532	1.748	155	236
2000	11,143	1.728	2.510	2.170	155	225
2001	11,375	1.614	3.020	1.960	142	265
2002	11,566	1.573	2.139	1.640	136	185
2003	11,910	1.555	2.817	1.674	132	239
2004	12,163	1.724	3.103	1.920	142	255
2005	12,560	1.390	2.862	1.727	111	228
2006	13,015	1.540	2.659	1.717	118	204
2007	13,364	1.481	1.845	1.533	111	138
2008	13,851	1.476	2.402	1.605	107	173
2009	14,091	1.573	3.830	1.820	112	272
2010	14,206	1.548	3.260	1.787	109	229
2011	14,153	1.493	2.180	1.625	105	154
2012	14,063	1.407	3.050	1.562	100	217
2013	13,857	1.244	1.570	1.321	90	113
2014	13,780	1.193	2.050	1.294	87	149
2015 (9 months)	13,877	1.243	1.480	1.347	90	107
1997-2015 Average	12,638	1.533	2.586	1.724	124	208
2011-2015 Average	13,946	1.316	2.066	1.430	94	148
DESIGN (2011 WW Facilities Planning Study Update)					**103**	**210**
REVISED VALUES (based on 2011-2015)					**94**	**217**

*Per capita flows include residential, commercial, public, and industrial sources. Residential contributions are estimated at 75% of total based on potable water consumption records.

Another issue related to population is the rate of growth. The facilities plan update included a steady growth scenario with a growth rate of 3.5%, reflecting historical growth and expectations at the time. Recent changes in population trends suggest that a lower growth

rate may be applicable. Accordingly, a long-term growth rate of 2% is used for projecting expansion timing.

Table 2.5 from the 2011 Wastewater Facilities Planning Study Update was updated to reflect the revised population and per capita flow values in Table 2.3, and a projected long-term growth rate of 2%. The peak hour flow is still assumed to be approximately 130% times the maximum day flow (per the 2011 Wastewater Facilities Planning Study Update, and subsequently validated in a large event observed January 19, 2012 following snowmelt and rain).

Table 2.5, rev. Oct. 2015 – Future System Flows - "Steady" Growth Scenario

Estimated Year	Total Population	Average Day Flow (MGD)	Maximum Day Flow (MGD)	Peak Hour Flow (MGD)
2015*	13,880	1.30	3.01	3.96
2020	15,320	1.45	3.33	4.37
2025	16,910	1.60	3.67	4.82
2030	18,670	1.76	4.05	5.33
2035	20,610	1.95	4.47	5.88

* 2015 peak hour value based on peaking factor from 2012 data, but is less than 2012 peak hour because of population decrease.

Organic Loading and Aeration

Influent BOD concentrations have risen somewhat since 2012, but still remain lower than they were 10 years ago. The average BOD concentration over the past five years was 179 mg/L, which is about the same as the 2008-2012 average. Based on an influent BOD concentration of 179 mg/L plus 109 lbs/day BOD from septage and assuming that aeration will be needed when BOD loadings exceed 70 lbs/acre/day, aeration would be needed when the population reaches 21,100. (However, as noted in the facilities planning study, determining when additional oxygen will be needed should be based on observed low dissolved oxygen and odors rather than on loading rates.)

Land Application Area and Storage

Substantial changes since completion of the previous declining balance update have been brought about by issuance of the new wastewater reuse permit in January 2014.

The new reuse permit defines eight hydraulic management units, with a total permitted application area of 577 acres. This represents a 4% reduction from the 600 acres previously assumed as irrigable. More significantly, the permit specifies an assumed irrigation efficiency of 80% for the four pivots (three existing, one future) compared to the 70% previously used for both the handlines and pivots. Higher assumed irrigation efficiency translates to lower allowable application rates. Since the pivots cover about 80% of the

permitted area, the change in assumed irrigation efficiency has a significant effect on the allowable overall application rates.

Permit changes relative to usable acres and assumed irrigation efficiency for pivots were taken into account in creating the following revised Table 4.7. (The land application acreages are based on irrigation with effluent only, without supplemental irrigation water.) The revised table provides estimated populations when the current storage and land application facilities are expected to reach capacity. Since funding, property acquisition, design, and construction take time, these activities should be started before the full capacity of a component is reached; therefore, milestones for 85% capacity are also shown in the table to ensure that the facilities are available when needed.

Table 4.7, rev. Oct. 2015 – Water Balance Results

Approx. Population	Approx. Year (2% growth)	Avg. Flow, mgd	Storage, MG	Add'l Storage Needed, MG	Acres of Land App.	Add'l Acres Needed	Condition
13,880	2015	1.24	172	-	190	-	Current
16,500	2024	1.55	212	-	263	-	Storage 85% capacity
19,000	2030	1.79	250	-	333	-	Storage at full capacity
20,610	2035	1.94	273	24	377	-	20-yr design
27,200	2049	2.56	362	113	490	-	Land app. site 85% capacity
30,400	2054	2.86	410	161	577	-	Land app. site at full capacity
33,800	2060	3.18	464	214	699	122	-
37,350	2065	3.51	508	258	749	172	-
76,960 (build-out)	-	7.23	1066	817	1651	1074	Build-out

Table 4.7 is based on the assumption that alfalfa is grown on all management units. (Alfalfa on the site is typically cut four to five times a year, which is considered "more frequent cuttings" for determining water usage from ETIdaho -- Evapotranspiration and Net Irrigation Requirements for Idaho). The actual crops and their water usage should be considered in determining when additional land application area will be needed.

Though alfalfa is the primary crop on the site, silage corn and wheat are used for crop rotation and also on management units with shallower soils (identified in Soil and Groundwater Investigation for the Wastewater Reuse Site for the City of Mountain Home, January 2015). Both these crops use less water than alfalfa. For example, if silage corn is grown on the management area for Pivot 3 (as has been done numerous years in the past), the existing reuse area would reach capacity when the population is about 28,800 (vs. 30,400).

Updated Treatment Plant Improvement Milestones

As shown in Table 4.7, the storage capacity of the treatment system will be reached first. The next lagoon expansion will be needed before the population reaches approximately 19,000 (about 2000 additional Equivalent Dwelling Units (EDUs), assuming 2.56 people per EDU), and should be started in the next 10 years.

For planning purposes, the addition of aeration or recirculation to Cells 1 and 2 is anticipated to be needed when the population reaches 21,000 (about 2800 additional EDUs).

At a wastewater flow of 94 gpcd, the 640-acre City-owned land application area is anticipated to serve a population of about 30,400 (assuming 577 irrigable acres planted to alfalfa). This would allow for the addition of 6470 EDUs.

As flows increase and the acreage used for land application is increased accordingly, the irrigation pump will eventually need to operate continuously during the peak use period to satisfy crop demand. At that point, the pump capacity would need to be increased. Since the contact time for disinfection is dependent on the pump rate, upsizing the pump would also require upsizing the chlorine contact facilities to maintain a sufficient contact time and upgrading the chlorine delivery system to supply chlorine at a higher rate. The irrigation pump capacity is expected to be adequate for the next 20 years (though other issues and concerns may warrant modifications to the disinfection system before the pump capacity is reached).

In addition to the lagoons and land application site, the wastewater treatment plant includes headworks facilities with pumping and screening equipment. The City recently added a third screw pump at the headworks to bring the total pumping capacity to 12 MGD (8 MGD firm capacity with one pump out of service). This provides redundancy and adequate capacity for peak hour flows well beyond the next 20 years. The automatic screen, sized for a peak hydraulic flow of 9.6 MGD, also has sufficient capacity for peak flows beyond 20 years.

Based on this analysis, expansion of the lagoon storage and the addition of aeration are the only capacity-driven improvements expected to be needed at the wastewater treatment plant in the next 20 years. However, Keller Associates recommends the City proceed with other operational measures (e.g. algae control) and facility replacements as needed.

Collection System

Though the scope of this planning effort did not include additional evaluation or modeling of the collection system, it is worth mentioning that Keller Associates recommends that the City proceed with previously identified Priority 1 collection system pipeline improvements (unless long-term flow monitoring can justify potentially delaying these improvements).

Priority 1 improvements were intended to address existing deficiencies in areas where the City is likely to experience growth.

Based on the lower growth rates and correspondingly lower flows in the past several years, it may be that the City will be able to postpone many of the capacity-driven Priority 3 and 4 improvements beyond the 20-year planning horizon.

Declining Balance Summary

The following table provides a summary of the estimated population milestones when additional wastewater facilities need to be in service.

Wastewater System Declining Balance Summary

Improvement	Available EDUs*	Approx. Service Population
New Storage Cell 10	2005	19,000
Lagoon aeration or recirculation	2780	21,000
Additional Land Application area	6470	30,400
Priority 1 collection system improvements	varies	varies

**Available EDUs is based on current number of users and is not adjusted to reflect vacancy rates, buildable lots, or undeveloped land within the city limits.*