

January 15, 2009

Mr. Tom Skjelstad
Donner Summit Public Utility District
53823 Sherritt Lane
P. O. Box 610
Soda Springs, CA 95728

Dear Tom:

The main purpose of this letter is to indicate the types and rough costs of wastewater treatment plant improvements that could be implemented to meet various possible effluent limits for ammonia-nitrogen and nitrate-nitrogen (ammonia-n and nitrate-n). Before getting to that, however, it is helpful to provide background information on DSPUD/SLCWD wastewater characteristics, existing plant design and performance, reasoning behind the treatment levels considered, and treatment concepts. This is a reconnaissance-level effort based on partial information and should not be considered to provide any recommendation regarding a specific project or project costs.

Wastewater Characteristics

Before analysis of possible wastewater treatment systems, it is essential to have a good understanding of the characteristics of the wastewater to be treated and the variability in those characteristics. In February 2008, ECO:LOGIC completed the first draft of Technical Memorandum No. 1 on Design Flows and Loads to be used for the engineering analysis of wastewater treatment plant improvements. The memorandum was updated in May 2008, but is still in draft form, pending decisions by the two Districts (DSPUD and SLCWD) on the amount of growth to be provided for. In the memorandum, several years of available influent data, including data from a special intensive monitoring effort in February 2008, are analyzed to determine the existing wastewater characteristics. The existing characteristics determined in that memorandum are indicated in Table 1. As explained in the memorandum, there is uncertainty in the characteristics due to the highly variable nature of the wastewater and the lack of extensive historical monitoring data.

Various levels of influent monitoring have been completed historically and can be considered for future implementation. A few examples of many possible monitoring levels are indicated in Table 2. Historically, DSPUD influent monitoring has been at Level 1 and, until recent years, no data were available to help define loads on weekends and holidays. Accordingly, until recent years, appropriate design concentrations for influent BOD and ammonia-n were thought to be 150 mg/L and 30 mg/L, respectively. While these values may not be too far off as monthly average values, it is important to understand and provide for shorter-term peak loading conditions and for changes in loading before and after the peaks. Based on limited special studies that have been conducted in recent years, it is now understood that weekly average concentrations in high occupancy periods (such as Christmas, New Years, and Presidents Day holidays) are probably about 50 percent greater than the previous design values and the high loads can occur rather suddenly after sustained low loads (discussed

further below). On peak days, concentrations are frequently more than double the previous design values.

To provide an adequate database for understanding the plant influent characteristics for plant performance evaluations and design, it is recommended that routine monitoring should be similar to that indicated for Level 3. The special studies indicated under Levels 3 and 4 should also be considered.

Table 1
Design Flows and Loads Summary From Technical Memorandum No. 1

Parameter	Existing Conditions	Allowance for Growth	Future Condition
Design Flows, Mgal/d			
Average Annual Flow (AAF)	0.23	TBD	TBD
Average Day Maximum Monthly Flow (ADMMF)			
Typical	0.35	TBD	TBD
High	0.43	TBD	TBD
Average Day Maximum Weekly Flow (ADMWF)			
Typical	0.43	TBD	TBD
High	0.61	TBD	TBD
Peak Day Flow (PDF)	0.97	TBD	TBD
Peak Hour Flow (PHF)	TBD	TBD	TBD
BOD Load, lb/d			
Average Annual Load (AAL)	215	TBD	TBD
Average Day Maximum Monthly Load (ADMML)	520	TBD	TBD
Average Day Maximum Weekly Load (ADMWL)	780	TBD	TBD
Peak Day Load (PDL)	900	TBD	TBD
BOD Concentration, mg/L			
AAL combined with AAF	112	TBD	TBD
ADMML combined with Typical ADMMF	178	TBD	TBD
ADMML combined with High ADMMF	145	TBD	TBD
ADMWL combined with Typical ADMWF	218	TBD	TBD
ADMWL combined with High ADMWF	153	TBD	TBD
PDL combined with ADMWF	251	TBD	TBD
PDL combined with PDF	111	TBD	TBD
TSS Loads and Concentrations	1.0 x BOD	1.0 x BOD	1.0 x BOD
TKN Loads and Concentrations	0.3 x BOD	0.3 x BOD	0.3 x BOD

Table 2
Influent Monitoring Levels

	Level 1	Level 2	Level 3	Level 4
Routine Monitoring				
Parameters	BOD, TSS	BOD, TSS	BOD, TSS, VSS, COD, TKN, Ammonia-N, Alkalinity, Temperature, pH	Same as Level 3
Frequency	Twice weekly on weekdays.	Once weekly on weekdays and once weekly on weekend (Saturday preferred) and on holidays.	BOD, TSS same as Level 2 or greater frequency. COD, Ammonia-N at least twice per week on weekdays and twice per week on weekends using same sample as BOD and TSS when possible. VSS, TKN, Alkalinity at least twice per month on weekdays and twice per month on weekends and/or holidays, using the same sample as BOD and TSS. Temperature and pH daily.	Same as Level 3
Special Studies				
Parameters	None or same as Level 2.	VSS, COD, TKN, Alkalinity	Total BOD, Filterable BOD, TSS, VSS, Total COD, Filterable COD, Membrane Filterable COD, Flocculated and Filtered COD, Total TKN, Filterable TKN, Alkalinity, pH	Same as Level 3 plus extended bioassay to verify nitrifier growth rate and unbiodegradable particulate COD.
Frequency	None or same as Level 2.	Several days per year during peak periods using same sample as BOD and TSS.	Daily for one to two weeks over peak periods. Many of the same tests on plant effluent also.	One test lasting about three months during the winter.

One of the biggest challenges to wastewater treatment plant design and operation at DSPUD is the variability in wastewater characteristics. Of course, the variability is due to the fact that Donner Summit is a resort area and part-time and transient populations in the area create sewage flows and loads that frequently far exceed those of the permanent population, particularly during weekend and holiday periods. For the same reason, average wastewater flows and loads in the winter ski season far exceed those in the fall, when there are few visitors to the area. What is believed to be a typical influent BOD loading pattern through the fall and winter months is illustrated in Figure 1. Figure 1 is based on actual plant data for 2007/2008, supplemented by estimates for days in which data was not available. The implications of this loading pattern on plant design are considered further later in this letter.

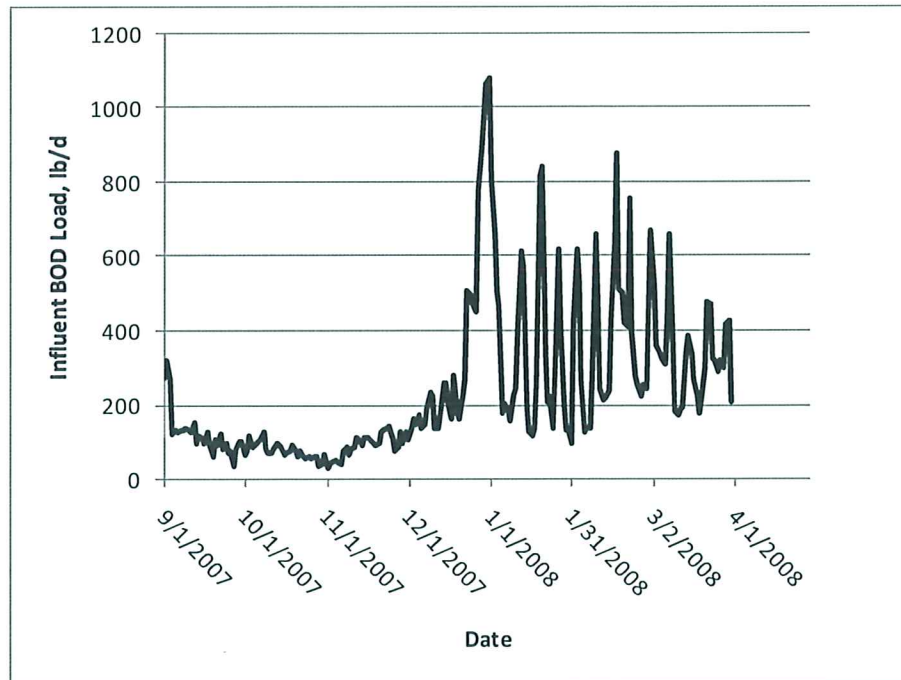


Figure 1
Influent BOD Load

Wastewater temperature is also critically important to wastewater treatment plant design. This is because most of the treatment is accomplished by microorganisms whose growth rates (and therefore the rate of wastewater treatment) are substantially slowed with low temperatures. In the current biological reactor basins, temperatures vary from about 18 °C in the summer to as low as 4 to 6 °C in the winter. However, minimum winter reactor temperatures during peak load periods are probably more like 6 to 7 °C. Further evaluations need to be done to assess influent temperatures and temperature losses throughout the plant during various wastewater flow conditions.

Existing Plant Design and Performance

The existing wastewater treatment plant includes flow equalization, screening, integrated fixed film activated sludge (IFAS) biological treatment, filtration, and chlorine disinfection. The biological treatment system is provided in two circular steel package plants that were originally designed as activated sludge systems without provisions for ammonia removal (nitrification) or nitrate removal (denitrification). During 2002 through 2006, the plants were upgraded from activated sludge to IFAS by adding webbing material supported on stainless steel frames in the reactor basins to support attached biological growth in addition to the suspended growth already in the basins. The IFAS system was designed and provided by Brentwood Industries and is called the AccuWeb system.

The AccuWeb system was designed for the purpose of providing nitrification and denitrification to meet monthly average effluent ammonia-n and nitrate-n concentrations of 5 and 10 mg/L, respectively. The first AccuWeb installation in a portion of Plant 2 (one of the steel package plants), constructed in 2002, was a demonstration project with a design capacity of 144,000 gpd. The District proceeded with the subsequent installations to complete the retrofits of Plants 1 and 2 in 2005 and 2006; however, a firm capacity for these improvements has not been established.

As part of the plant upgrade to the AccuWeb system, chemical feed facilities were added to feed ammonia during low load periods to grow enough microorganisms to handle high ammonia loads before the high loads occurred. Additionally, a chemical feed system for alkalinity was provided, since the nitrification process consumes alkalinity and could produce unacceptably low pH values and inhibit proper treatment without the alkalinity addition.

Actual plant effluent ammonia and nitrate concentrations in the late fall and winter 2007/2008 are shown in Figures 2 and 3, respectively. As indicated, the effluent ammonia-n concentrations were generally below the 5 mg/L target until mid-December, with a couple of exceptions. In late December and thereafter, however, the 5 mg/L ammonia-n target was frequently exceeded. This timing coincides with the onset of the winter peak loading conditions (see Figure 1). During peak periods throughout the winter, effluent ammonia-n concentrations were generally around 30 mg/L. Conversely, in the fall, the nitrate-n concentrations were typically well in excess of the 10 mg/L target, whereas they were lower than 10 mg/L from late December on. The reason for these performance patterns for ammonia and nitrate are as follows:

1. Nitrification removes ammonia and creates nitrate. Denitrification removes the nitrate created by nitrification.
2. During the fall, when ammonia was low but nitrate was high, nitrification was being accomplished, but denitrification was not adequate.
3. During the winter when ammonia was high and nitrate was low, adequate nitrification was not being accomplished. The low nitrate levels are believed to be due to the lack of nitrification to produce nitrates, not due to actual removal of nitrates by denitrification.

Actual plant flows during the peak loading months of December through February 2007/2008 included a maximum 30-day average flow of 0.30 Mgal/d occurring from late December to late January and a maximum 7-day average flow of 0.41 Mgal/d occurring over the Christmas/New Years holiday period. These are slightly lower than the values indicated in Table 1 for existing conditions, because Table 1 is based on several years of data and the flows in 2007/2008 were somewhat lower than in previous years.

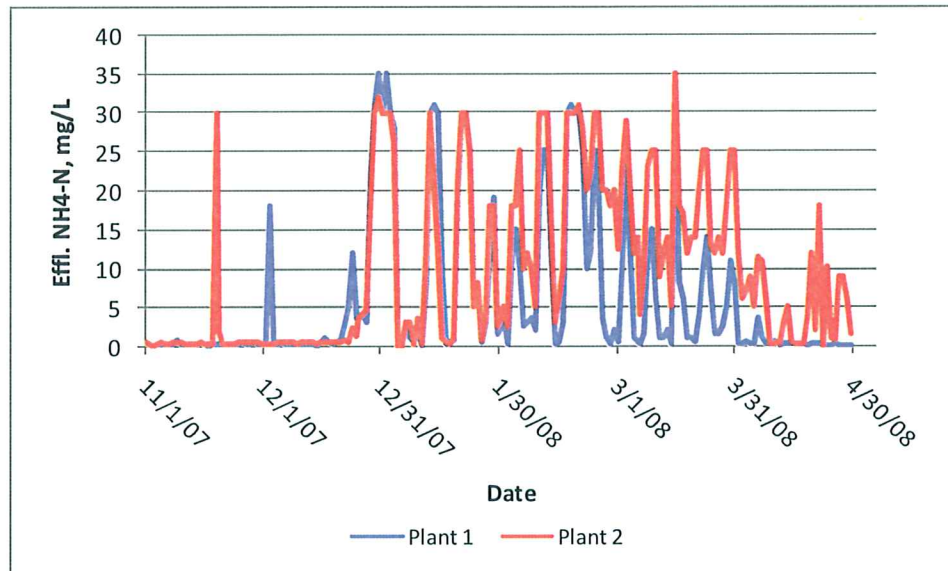


Figure 2
Effluent Ammonia-N (NH₄-N), 2007/2008

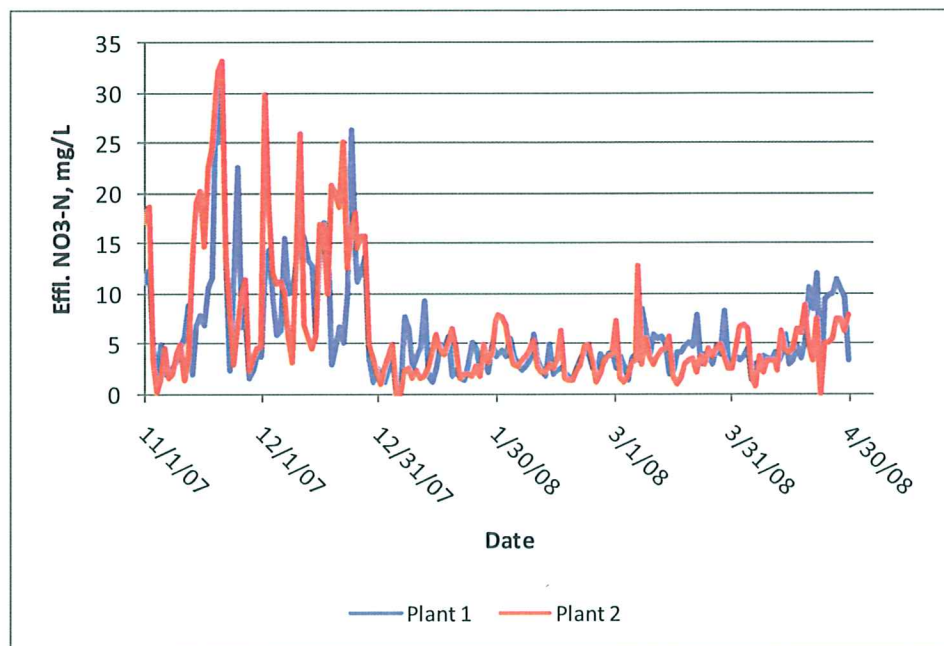


Figure 3
Effluent Nitrate-N (NO₃-N), 2007/2008

Effluent Ammonia and Nitrate Concentrations Considered for Possible Plant Improvements

As requested by the District, various possible permitting limits for effluent ammonia and nitrate are considered herein as the basis for analysis of plant improvements. The various levels considered and the reasons for them are indicated in Table 3. Actual permit ammonia and nitrate limits that will be included in the District's new NPDES permit are not known, because the permit is currently being developed by the State of California Regional Water Quality Control Board, Central Valley Region (RWQCB).

Table 3
Effluent Ammonia and Nitrate Concentrations Considered for this Analysis

Scenario	Max. Effluent Conc., mg/L		Explanation
	Ammonia-N	Nitrate-N	
1	5	NA	The AccuWeb system was intended to meet a 5 mg/L ammonia-n limit. Although it was also intended to meet a 10 mg/L nitrate-n limit, substantial removal of nitrate has not occurred and it is possible that the nitrate limit could be substantially relaxed in the new permit.
2	1	NA	It is likely that a stringent ammonia-n limit will be included in the new permit.
3	1	10	This scenario includes the stringent ammonia-n limit and the existing nitrate-n limit of 10 mg/L.
4	1	2	This scenario includes the stringent ammonia-n limit and a stringent nitrate-n limit intended to minimize algae growth stimulation in the South Yuba River.

The reason for an ammonia limit is primarily that ammonia is toxic to fish in the South Yuba River. The degree of toxicity and the allowable concentration of ammonia in the effluent are dependent on the amount of dilution in the South Yuba River and on temperature and pH. Considering worst-case conditions, it is likely that a stringent effluent ammonia-n limit, perhaps around 1 mg/L could be established.

There are two main concerns regarding nitrate: 1) it causes methemoglobinemia ("blue babies") in human infants, with long-term exposure to concentrations exceeding 10 mg/L as nitrogen, and 2) it can stimulate and/or support algae growth when other conditions (temperature, solar exposure, and other nutrients) are favorable for such growth (ammonia discharges produce the same impact).

The existing NPDES discharge limit of 10 mg/L for nitrate-n is based on the potential human health impact. However, because the DSPUD effluent discharged into the South Yuba River is diluted into a large volume of natural runoff on an annual basis and the dilution occurs before use as a drinking water supply, wastewater effluent can contain nitrate concentrations far exceeding 10 mg/L without resulting in any human health impact. It is for this reason that DSPUD has requested a revision in

the current nitrate-n limit of 10 mg/L to a much higher level that would effectively eliminate the need for nitrate removal from the plant effluent. It is unknown whether this request will be granted by the RWQCB.

Complicating the request for relief on the nitrate limit are recent concerns regarding algae growth stimulation in the South Yuba River. This is particularly problematic in that algae can use nitrate to extremely low concentrations if other conditions are favorable for their growth. Recognizing this, the Lahontan Regional Water Quality Control Board established a limit of 0.5 mg/L for total nitrogen (includes all forms of nitrogen, including ammonia and nitrate) in storm water runoff in the Lake Tahoe basin. However, current wastewater treatment technologies do not reasonably allow treatment to such low levels of total nitrogen. The current limit of technology is around 3 mg/L. This level is difficult to meet, even for agencies with warmer wastewaters and much more consistent flow and load patterns, as compared to DSPUD. Although it may not be practical for such low levels to be reliably met at DSPUD, Scenario 4 listed in Table 3 and considered herein is based on an ammonia-n limit of 1 mg/L and a nitrate-n limit of 2 mg/L. With nitrite and organic nitrogen included, the effluent total nitrogen might be around 5 mg/L.

General Treatment Concepts

Regardless of which levels of treatment are considered (see Table 3), special design and operational features must be included to address the highly variable nature and cold winter temperatures of the DSPUD wastewater. This is because all alternatives require a high degree of ammonia removal (nitrification) and the bacteria that accomplish this treatment (ammonia oxidizing bacteria (AOB) or nitrifiers) are slow growers, particularly with cold temperatures. Accordingly, it is necessary to grow a population of microorganisms adequate to treat the peak loads before those peak loads actually occur. This will require chemical addition of substantial quantities of ammonia during the fall to build the population required in the winter. Also, ammonia should be added during low load periods (most weekdays and other low occupancy periods) throughout the winter to sustain a consistent population of AOB. Ammonia addition is already practiced at DSPUD, but a more defined control strategy (see Figure 4 and discussion below) and new automated controls are warranted.

The ammonia addition strategy assumed for this analysis, based on actual plant influent data for the fall and winter of 2007/2008, is illustrated in Figure 4. The actual wastewater influent TKN (TKN includes ammonia and organic nitrogen, but the organic nitrogen is converted to ammonia in the treatment process) is generally of the same form as the BOD loading pattern shown in Figure 1, however, TKN concentrations are about 25 to 30 percent those of BOD. As shown in Figure 4, supplemental ammonia would be added to gradually ramp up the influent ammonia load during the fall and then sustain a relatively consistent load through the winter. The length of the ramp-up period and the plateau level for influent TKN load are subject to optimization; however, the general concept would be consistent with that shown in Figure 4.

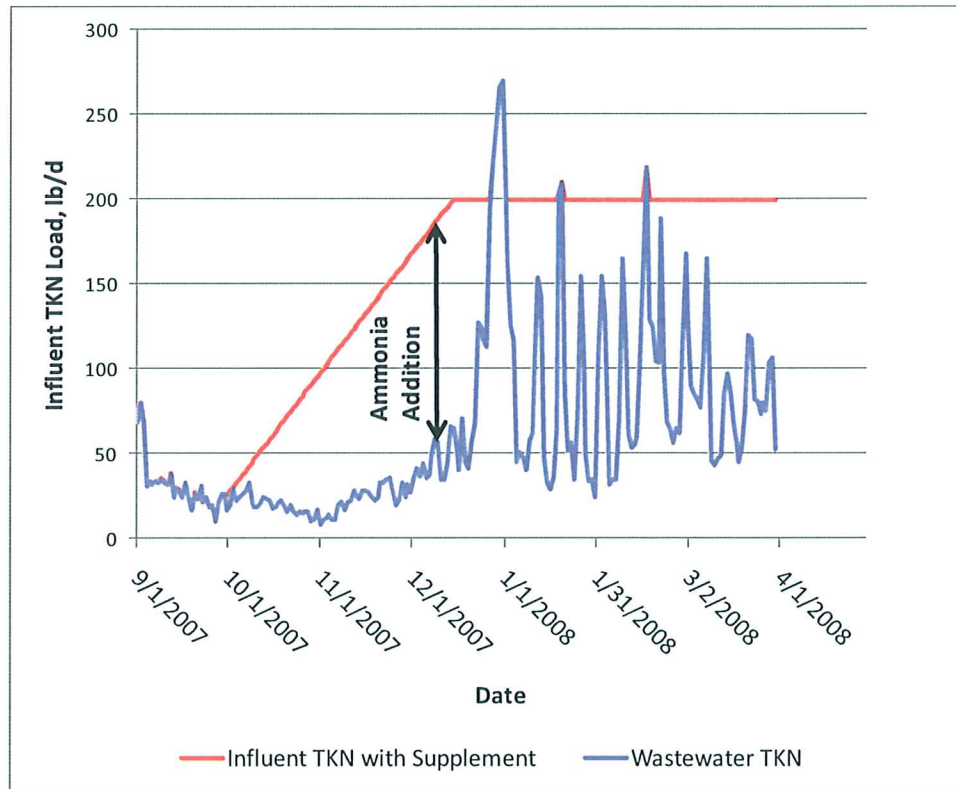


Figure 4
Ammonia Addition Strategy

The benefits of ammonia addition were confirmed by preparing wastewater treatment plant simulations with and without ammonia addition using BioWin process simulation software. BioWin simulates bacterial growth kinetics and resultant transformations in wastewater characteristics throughout wastewater treatment plants. Seven-month long dynamic simulations were prepared using the 2007/2008 DSPUD influent BOD and TKN loads shown in Figures 1 and 4, as well as other corresponding wastewater characteristics. Process temperatures were gradually varied from 18 °C in the fall to 6 °C before Christmas and thereafter, to represent estimated actual conditions in 2007/2008 at DSPUD. The wastewater treatment system modeled was a nitrifying activated sludge system with a solids retention time of 15 days. The results of the process simulations are shown in Figures 5 and 6. As indicated, without supplemental ammonia addition, effluent ammonia concentrations were highly variable and reached almost 20 mg/L. With ammonia addition, however, effluent ammonia concentrations were much more stable, with peaks under 1.5 mg/L. It is noted that the simulation results without ammonia feeding are better than actual results indicated in Figure 2, even though actual operations included some ammonia feed (but only in relatively small amounts in parts of November and December). This suggests that the actual process with the AccuWeb system did not perform as well as a plain activated sludge system with a 15-day SRT.

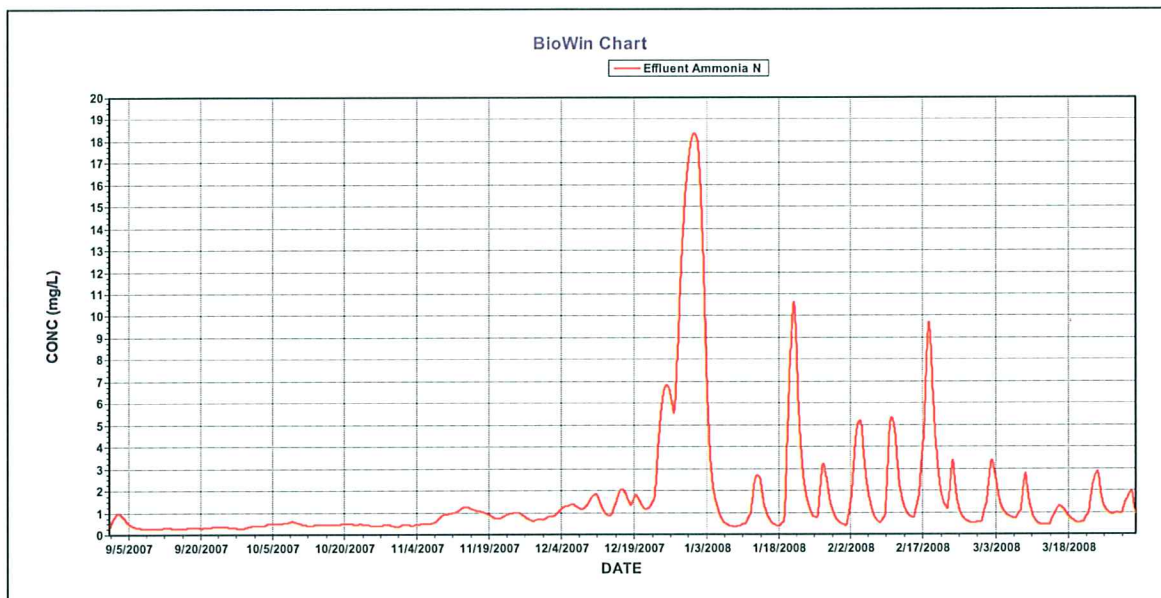


Figure 5
Process Simulation Results for Effluent Ammonia-N
Without Supplemental Ammonia Feed

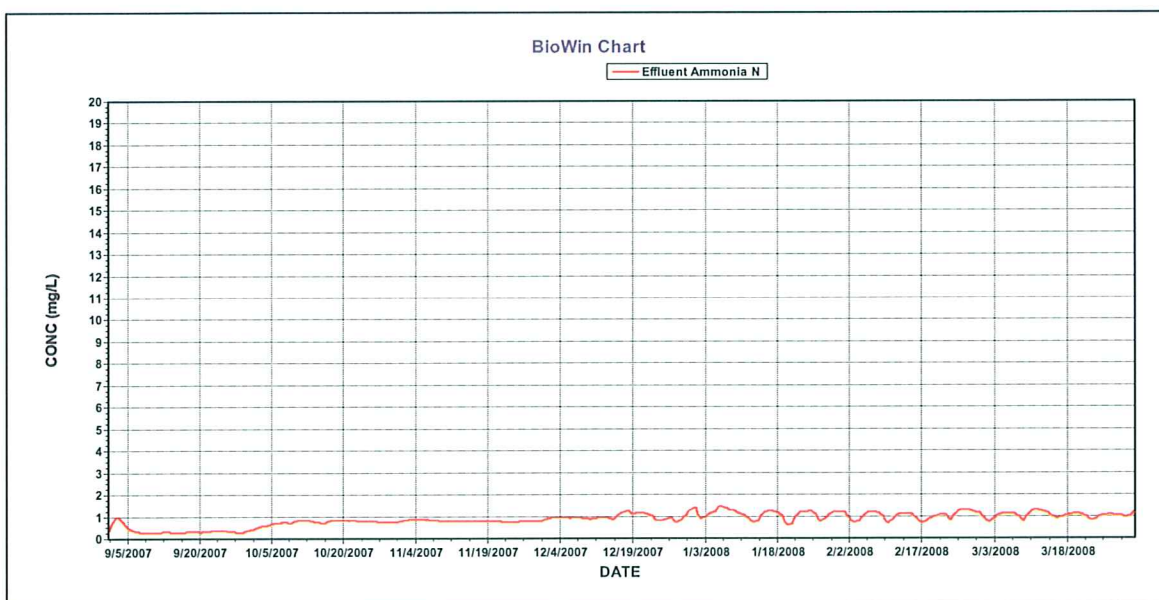


Figure 6
Process Simulation Results for Effluent Ammonia-N With Supplemental Ammonia Feed

The need to add ammonia directly impacts the layout of treatment systems that can be considered if a nitrate-n limit must be met, whether at the 10 mg/L level or below. When ammonia is added to create a relatively high influent load while flows are relatively low, such as in November and early December in Figure 4, very high influent TKN concentrations will be produced; perhaps as high as 200 mg/L. If 10 percent of this nitrogen load is taken up in the waste sludge (the actual amount would probably be much lower), that would leave around 180 mg/L to be oxidized to nitrate. To get down to 10 mg/L would require about 95 percent removal. That level of removal is not possible with the layout of the existing reactor basins. The existing layout includes anoxic basins ahead of aeration basins. The ammonia is oxidized to nitrate in the aeration basins and part of the aeration basin contents are recirculated back to the anoxic basins for nitrate removal. The degree of nitrate removal is limited by the allowable recirculation rate as compared to the plant influent flow rate. Generally, only about 70 to 80 percent removal of nitrate is possible with this type of system. However, without special mitigation measures, the fractional removal is generally lower with an IFAS system. This is because high dissolved oxygen concentrations must be maintained in the aeration basins of an IFAS system to allow oxygen to penetrate into the layer of microorganisms attached to the media, as needed to support nitrification. This high oxygen concentration will be present in the flow recirculated back to the anoxic basins and the bacteria there will use the oxygen preferentially to using nitrate as needed for denitrification. Mitigation of the high level of oxygen recirculation would require an enlarged anoxic basin and addition of an organic substrate for bacteria to metabolize as they use the oxygen.

Because of the phenomenon described above, nitrate removal accomplished in the anoxic basins upstream from the aeration basins must be supplemented by additional nitrate removal downstream from the aeration basins. Accordingly, if denitrification is to be provided, a four-stage process should be used. The first two stages would be anoxic and aerobic with a recirculation flow as currently exists at DSPUD. Stages three and four would be an additional anoxic zone for denitrification and an additional aeration zone to strip nitrogen bubbles from the anoxic basin outflow and to add oxygen to the final effluent.

Another critical issue with respect to denitrification is that it requires an adequate amount of organic substrate. That is because denitrification is accomplished when bacteria consume and metabolize organic matter using nitrate as a substitute for oxygen for their respiration. Denitrification cannot occur without the proper balance of organic matter and nitrate. The organic matter in the wastewater influent is generally measured as BOD or COD. To reach effluent nitrate levels around 10 mg/L with typical domestic wastewater, the ratio of BOD to TKN in the influent should be around 4:1 or greater. Unfortunately, the ratio of BOD to TKN in the DSPUD wastewater is marginal and may be closer to 3:1 at times. Thus, even without any supplemental TKN (ammonia) addition, a supplemental organic feed source may be needed to obtain acceptable denitrification. When ammonia is added, the resultant influent BOD to TKN ratio is made much lower, necessitating the addition of substantial quantities of organic matter. A common solution is to add methanol to supplement denitrification; however, other organic substrates are possible.

In the four-stage reactor system described above, the influent BOD would be the primary organic substrate in the pre- anoxic basins (those upstream from the aeration basins) and added methanol (or other suitable substance) would be the primary organic substrate in the post-anoxic basins (those downstream from the main aeration basins).

Another option for accomplishing denitrification downstream from the aeration basins would be to use denitrification filters. In such systems, methanol or another substrate, is added to granular media filters used downstream from the main biological treatment system. The methanol addition promotes the growth of bacteria in the filters to accomplish denitrification. This option is not considered herein because it could jeopardize meeting a 2 NTU turbidity limit downstream from the filters, unless two stages of filters were to be used.

In addition to biological nitrification and denitrification, it is possible to remove ammonia and total nitrogen with physical/chemical processes such as ammonia stripping, ion exchange, and breakpoint chlorination. Historically, there has been only limited use of these physical/chemical processes for nitrogen removal in municipal wastewater treatment plants. In recent years, such uses have fallen into disfavor as compared to biological treatment, due to cost, reliability, side effects, and other concerns. Reverse osmosis could be considered, but would be extremely expensive and would produce a brine residual that would be very difficult and expensive to handle or dispose of. Therefore, physical/chemical treatment is not considered further in this letter.

The key findings from the information provided above, are:

1. Reliable nitrification to meet any ammonia limit considered will require supplemental ammonia addition during the fall and low-load periods in the winter.
2. If there is a nitrate limit (whether 10 mg/L or lower), a four-stage process should be used and substantial addition of methanol or another substrate would be required

It is noted that neither of the features noted in Item 2 above are currently incorporated in the existing treatment system.

Consideration of Possible Plant Improvements

In this section, possible plant improvements are considered and rough “ballpark” costs are indicated for upgrading the existing biological treatment system to meet the various plant effluent concentrations for ammonia-n and nitrate-n indicated in Table 3. The costs to upgrade the biological treatment system do not include other plant components that may be needed, such as filtration, disinfection, and sludge handling improvements. Because this is a reconnaissance-level investigation, not all appropriate alternatives have been considered and process design calculations and facilities requirements and costs are partly based on approximate information and reasonable assumptions.

All of the analyses are based on existing flows and loads, the design values for which are indicated in Table 1. Costs for any expansion in capacity would be in addition to the costs considered herein. It will be noted that the existing NPDES permitted capacity is 0.52 Mgal/d, until plant improvements with a greater capacity are certified. At the time the permit was developed, the plant design was based on a peak three-day average flow of 0.52 Mgal/d. This flowrate was incorporated in the permit, but it was indicated in the permit to be a monthly average flow allowance. As noted in Table 1, the existing average day maximum weekly flow is in the range of 0.43 Mgal/d in typical years to 0.61 Mgal/d in high flow years (such as 2005/2006). These values are roughly comparable to the previous design capacity of 0.52 Mgal/d as a peak three-day average.

Possible plant improvements for each effluent quality scenario are discussed briefly below.

Scenario 1: 5 mg/L Ammonia-N Limit and No Nitrate Limit. For this scenario, it is believed that the existing AccuWeb system could be upgraded by converting the existing anoxic basins to additional aerobic basins and by the addition of more sophisticated chemical feed equipment and controls. However, at this time, no input from Brentwood Industries has been received to confirm the capability of the AccuWeb system and needed improvements, so this evaluation is preliminary. The estimated construction cost for this alternative is around \$500,000. Higher operation and maintenance costs (as compared to historical values) will result due these improvements and changes in operational strategies.

Scenario 2: 1 mg/L Ammonia-N Limit and No Nitrate Limit. For this scenario, the same improvements as described for Scenario 1 would be implemented. Additionally, the influent flow equalization basin and the reactor basins would be covered to retain heat. The estimated construction cost for these improvements is about \$1 million.

Scenario 3: 1 mg/L Ammonia-N Limit and 10 mg/L Nitrate-N Limit. As stated previously, the implementation of a nitrate limit would necessitate a transition to a four-stage reactor basin layout, with the following sequence: Anoxic 1, Aerobic 1, Anoxic 2, Aerobic 2. Additionally, methanol (or other substrate) storage and feed facilities would be required. On a preliminary basis, it is estimated that the existing reactor basins, if converted to all-aerobic as described above and if the AccuWeb systems are retained, would serve only to satisfy the requirements for Aerobic 1 (not confirmed with Brentwood Industries). Therefore, additional reactor basins would have to be constructed. Adding new basins and interconnecting them with the existing basins would be complicated by the fact that the secondary clarifiers are contained within the center of the existing reactor basins and large recirculation flows are required between Aerobic 1 and Anoxic 1. Although a scheme for adding additional tanks and interconnecting them with the existing basins in an IFAS system expansion may be possible, the specific requirements for such a system could not be confirmed with Brentwood Industries for this letter; therefore, this concept is not considered further herein. For this analysis, a worst-case scenario is developed involving conversion to a new membrane bioreactor (MBR) system. In this case, the existing treatment tanks would be used for additional equalization storage, emergency storage, and/or for sludge handling, and a new covered reactor basin complex would be constructed for the MBR system.

In an MBR system, clarifiers and effluent filters are replaced with membrane filters submerged in the biological treatment system mixed liquor. Wastewater effluent is pulled through the membranes by pumping, leaving the solids in the reactor basins. The membranes would have a nominal pore size around 0.04 micron to provide an absolute barrier to mixed liquor solids. The MBR effluent would typically have a turbidity under 0.2 NTU. By contrast, the existing biological treatment and granular media filtration system is designed to have an effluent turbidity under 2 NTU.

MBR systems have several distinct advantages, when compared to activated sludge and IFAS systems:

1. The need for clarifiers and granular media filters is eliminated as mentioned above.
2. Since solids settling in a clarifier is no longer required, mixed liquor solids can be increased to about 8,000 to 10,000 mg/L, compared to 3,000 to 4,000 mg/L in activated sludge and IFAS systems. This means that reactor basins can be 1/3 to 1/2 the size required for conventional activated sludge. This is particularly important if basins are to be covered to conserve heat, such as would be highly beneficial at DSPUD. IFAS systems with attached growth media also require much less volume than conventional activated sludge.
3. A much higher quality effluent is produced with high reliability.
4. Because membrane filters remove many colloidal solids that cannot be removed by clarification, there is frequently a benefit in further removals of heavy metals or other constituents of concern that have a particulate or colloidal fraction.
5. The MBR effluent is much easier to disinfect, leading to reliable effluent coliform compliance with lower chlorine doses. Additionally, if a switch is made to ultraviolet (UV) light disinfection, the required size of the UV facilities is substantially reduced as compared to systems without membrane filtration.
6. In general, MBRs are state-of-the-art treatment systems that produce the highest quality effluent, assuring more reliable compliance with current treatment standards and a better chance of meeting new and/or more stringent standards in the future.

The MBR system would include two concrete reactor basin trains, with each train including a pre-anoxic zone, an aeration zone, and a post-anoxic zone, each of which could be further staged. These would be followed by membrane basins that could be either concrete or prefabricated steel packaged units with the membranes installed. The membrane basins would include air scouring to keep the membranes clean and would therefore act as additional aerobic reactor volume. All reactor and membrane basins would be covered or inside a building. Permeate pumps for pulling the effluent through the membranes, blowers for air scour and for process aeration, mixed liquor recirculation pumps, chemical feed systems, and other ancillary facilities also would be inside a building.

A BioWin model of the treatment system described above was developed and is shown in Figure 7. In the figure, it can be noted that the first anoxic and aerobic basins (Anoxic 1 and Aerobic 1) were

staged into two compartments each to improve performance. A seven-month dynamic simulation of this treatment system using the 2007/2008 flows and loads previously discussed in this letter was completed. Supplemental ammonia feeding in accordance with Figure 4 was included in the simulation. Methanol was added to Anoxic 2 as needed to produce low effluent nitrate concentrations. The effluent ammonia-n and nitrate-n concentrations resulting from the simulation are shown in Figure 8. As seen in Figure 8, the 1 mg/L ammonia limit was always met, except for two small excursions that would not cause a permit violation with typical averaging allowed. Furthermore, these excursions could be eliminated by adjusting the supplemental ammonia feed pattern. The 10 mg/L nitrate-n limit was consistently met. Since a permit limit for nitrate would typically be based on a monthly average, nitrate concentrations could have been substantially higher without causing a violation. This means it would have been possible to feed less methanol than included in the simulation.

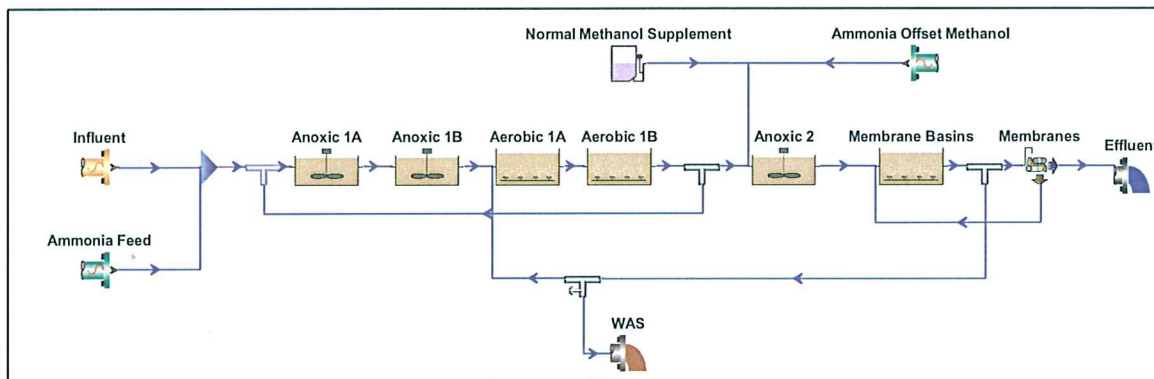


Figure 7
BioWin Model of 4-Stage MBR System for Nitrification and Denitrification

The total construction cost for improvements based on the MBR option as described above is estimated to be around \$10 million.

Scenario 4: 1 mg/L Ammonia-N Limit and 2 mg/L Nitrate-N Limit. The improvements required under this scenario would be almost identical to those of Scenario 3. The only differences would be a larger volume for the post-anoxic basins and a larger methanol storage and feed system, both as needed for more nitrate removal. Within the accuracy of this analysis, the construction cost would be essentially the same as Scenario 3 - around \$10 million. Annual operation and maintenance costs would be higher due to higher methanol consumption and more careful operation.

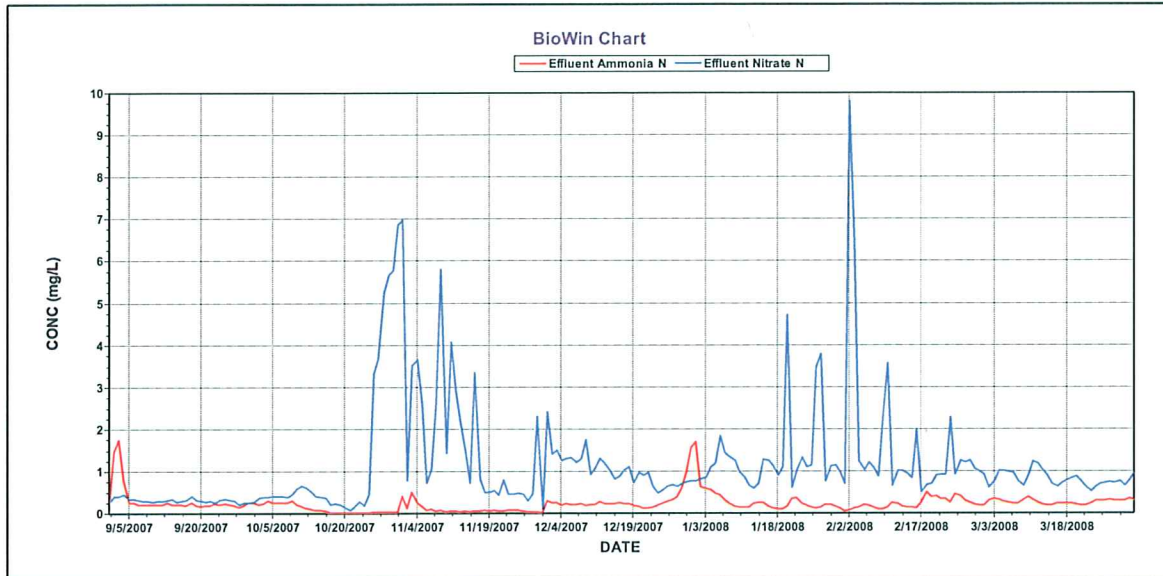


Figure 8
Simulation Results for 4-Stage MBR System

Summary and Concluding Remarks

The following is a summary of the key findings of this investigation:

1. Influent wastewater characteristics are highly variable and somewhat uncertain due to a lack of adequate historical data, particularly through peak loading periods.
2. The existing wastewater treatment plant has not reliably removed ammonia (nitrification) or nitrate (denitrification) under existing flow and load conditions.
3. The high variability of the DSPUD wastewater and the almost sudden onset of peak loading conditions in the cold winter months will necessitate supplemental ammonia addition to bring the biological treatment system up to capacity for nitrification in the fall and to sustain capacity between and through load peaks in the winter.
4. If a nitrate-n limit is imposed either at 10 mg/L or a lower level, a four-stage (anoxic-aerobic-anoxic-aerobic) biological treatment system and methanol (or other substrate) addition would be recommended.
5. Rough "ballpark" construction cost estimates for upgrading the biological treatment system to meet various effluent ammonia-n and nitrate-n concentrations are as follows:

Mr. Tom Skjelstad
Donner Summit Public Utility District
January 15, 2009
Page 17

Ammonia-N Limit, mg/L	Nitrate-N Limit, mg/L	Biological Treatment System "Ballpark" Construction Cost, \$ Million
5	NA	0.5
1	NA	1.0
1	10	10 (a)
1	2	10 (a)

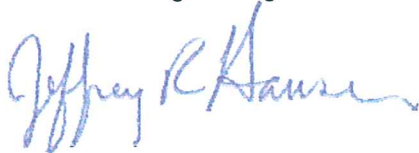
(a) Based on conversion to an MBR system. An IFAS upgrade may be possible at a lower cost, depending on input from Brentwood Industries.

As previously noted, this is a reconnaissance investigation. Not all options have been considered and analyses are based partial data and assumptions. To date, we have not been able to coordinate with Brentwood Industries to incorporate their thoughts on upgrading the existing AccuWeb system.

We would be happy to discuss this letter with you and the Boards of DSPUD and SLCWD.

Sincerely,

ECO:LOGIC Engineering



Jeffrey Hauser, P.E.
Principal Engineer