Report for

Village of Mt. Horeb, Wisconsin

Wastewater Utility 2009 Strategic Plan Update

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January 2010

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INTRODUCTION

Strand Associates, Inc.® prepared two Strategic Plans for the Village of Mount Horeb (Village) Wastewater Utility in 2002 and 2004. This report specifically updates the 2004 Strategic Plan.

A. Purpose and Scope

This report provides an update to the 2004 Strategic Plan prepared for the Wastewater Utility by Strand Associates, Inc. Because of the uncertainty regarding future regulations and their impact on the future options for the Village, this report outlines a potential recommended plan, identifies potential options to that plan, provides preliminary 2009 costs for the recommended plan, and provides the Village with a list of recommendations and benchmarks to initiate formal facilities planning.

B. Location of Study

Figure 1 shows the location of the study area for the Village, which includes the Capital Area Regional Planning Commission (CARPC) approved Sewer Service Area (SSA) as amended in January 2009. A total of 2,491 acres are included in the Village's Urban Service Area. The current maximum Urban Service Area, based on a population projection of 10,095 people, would be 2,912 acres or approximately 421 additional acres beyond the January 2009 amendment.

EXISTING WASTEWATER CONVEYANCE FACILITIES

A benchmarking review of the existing conveyance facilities is included to identify planning concerns regarding the conveyance system.

A. Collection System Review

Table 1 summarizes the overall conveyance system piping. The conveyance system currently has 246,000 feet of sewer and 24,000 feet of force main.

B. Infiltration/Inflow (I/I) Analysis

A benchmark review of I/I was done by comparing per capita generation of wastewater with standard United States Environmental Protection Agency (USEPA) recommendations. Table 2 shows the I/I analysis for the Village from 2004 to 2007. The annual flow rate of 74 gallons per capita per day (gpcd) based on records from 2005 to 2008 is less than the 125 gpcd benchmark for infiltration. The wet weather flow per capita of 121 gpcd from 2005 through 2008 is less than the benchmark value of 275 gpcd per day. The existing system does not have any significant system wide issues with I/I. The ongoing program of televising the sewers to indentify any local issues should be continued.

EXISTING WASTEWATER TREATMENT FACILITIES

The existing wastewater treatment facility (WWTF) has been at the current site since 1978. This section describes the existing system.

A. Introduction

Facilities were originally constructed on this site in 1978. There have been subsequent modifications and upgrades in 1989, 1996, and 2002. This section describes the existing facilities that are currently in use on the WWTF site. Figure 2 shows an aerial view of the existing site.

B. Description of Existing Facilities

Table 3 shows the overall system characteristics of the current facilities at the Village's WWTF.

C. Influent Flows and Loadings

Table 4 shows the annual average and maximum daily flows for the Village's WWTF from 2005 to 2008. Peaking factors for maximum daily flows, maximum weekly flows, and maximum monthly flows are shown in Table 5 and based on an analysis of the data presented in Table 4. This was used to determine the appropriate design flows in the following section.

Table 6 summarizes the influent 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) from 2005 to 2008. This table also indentifies maximum month to average annual loadings.

D. WWTF Performance

The existing WWTF needs to comply with the current Wisconsin Pollutant Discharge Elimination System (WPDES) permit, which expired in September 2007. A new permit is expected to be issued in 2010. No significant changes in effluent discharge requirements are anticipated for the reissued permit. Table 7 summarizes the WPDES permit limitations for this facility. Table 8 summarizes the overall effluent quality, which has exceeded current WPDES permit requirements.

WASTE LOAD AND FLOW FORECASTS

A. SSA

The SSA for the Village is shown in Figure 1. A total area of 2,491 acres is included in the currently approved SSA.

B. Population Projections

Table 9 shows the past population history of the Village and the Wisconsin Department of Administration population projections and the CARPC projections for the Village to the year 2030. The CARPC projections were used as the basis for projecting design flows and loadings for the year 2030 for the Village of Mount Horeb SSA. The projected 2030 design population for the Village's WWTF is 10,095 people.

C. Flow Projections

Table 10 summarizes the per capita contributions for each of the user classifications. The Village is predominantly residential. The average per capita flows from 2004 to 2007 was 79 gpcd. A design

value of 85 gpcd based on 2007 data will be used for flow projections for the facility. Projected 2030 design flows are summarized in Table 11.

D. Influent Loading Projections

Table 11 summarizes the per capita loadings for BOD_5 and TSS. Influent loadings will be based on per capita loadings of 0.19 per capita day (pcd) for BOD_5, 0.24 pcd for TSS, and assumed values for normal domestic wastewater for total nitrogen and total phosphorus of 0.3 pcd and 0.006 pcd, respectively. Table 12 summarizes the projected 2030 design loadings for this facility.

E. Projected Biosolids Production

The projected biosolids production, based on the 2004 Strategic Plan, would be approximately 1,210 pounds per day (lbs/day) at an anticipated yield of 0.6 pounds TSS per pound of influent BOD_5. At the projected 2030 design loadings, the resultant biosolids production would be about 1,210 lbs/day or about 2,900 gallons per day (gpd).

EXISTING FACILITIES EVALUATION

Based on the above loadings and the 2004 Strategic Plan summary, this section projects the rated capacity of the existing facilities and projects the approximate timing for expansion based on current WPDES effluent limitations.

A. Rated Capacity Summary

The 2004 Strategic Plan identified a rated capacity of 8,800 people at a BOD_5 loading of 0.17 pcd. The peak hydraulic capacity of 2.11 million gallons per day (mgd) would also be reached at a population equivalent of approximately 8,800 people at a per capita flow rate of 80 gpcd and a peaking factor of 2.95. The limiting factors at this flow rate are forward flow hydraulic capacity and final clarification capacity. Based on the population projections summarized in Table 9 and assuming liner growth from the estimated 2009 population of 6,700 people the facility would be at its design capacity for forward flow in about the year 2024.

B. Biosolids Storage Capacity Summary

Current available storage is 300,000 gpd. Based on the projected 2030 biosolids production of 2,900 gpd, there is approximately 103 days of storage would be available in 2030. At current 2005 to 2008 loadings, the approximate storage at a yield of 0.6 pounds of TSS per pound of influent BOD_5 and a concentration of 5 percent after thickening would be approximately 174 days. To meet the design BOD_5 loadings of 2014 pounds per day, approximately 696,000 gallons of thickened sludge storage (assuming a similar yield and biosolids concentration) would be required based on providing 240 days of storage.

C. Existing Site Use

Wastewater treatment has been provided for the Village at this site since 1978. Substantial portions of past projects remain in use, which includes the following:

1. Aerated Grit Tank (1978)
2. Primary Sedimentation Tanks (1978-modified in 1989)
3. Final Clarifiers (1978)
4. Effluent Filter-North (1978-refurbished in 1989)
5. Chlorine Contact Tank (1979-expanded in 1989)
6. Cascade Aerator (1978)
7. Aerobic Digestion (1978)
8. Administration Building (1978-expanded in 1989)
9. Screening and Grit Classifier Building (1989)
10. Aeration Tanks and Blower Building (1989)
11. Effluent Filter-South (1989)
12. Gravity Belt Thickener (1989)
13. Circular Biosolids Storage Tanks (1989)
14. Phosphorus Removal/Storage Building (1996)
15. Sewer Utility Garage (2002)

Effective use and/or reuse of existing facilities is one key consideration in maintaining equitable sewer utility rates. Two options identified in the 2004 Strategic Plan Update are available for continued use of the existing site:

1. Membrane Bioreactors
2. Biosolids Processing and Storage

Details regarding each option are discussed separately.

1. Membrane Bioreactors

Membrane bioreactors are a technology with a relatively small footprint capable of producing high quality effluent. One planning option considered in the 2004 Strategic Plan was installation of membranes in conjunction with reuse of the existing aeration tanks. This technology has developed during the past ten years and costs are now relatively stable. The proposed costs contained in the 2004 Strategic Plan indicated the capital costs for this technology were about 16 percent greater than the capital costs for a more conventional technology. Updated cost proposals obtained for this update indicated similar costs in 2009 as were included in the 2004 opinion of probable project cost. In addition, it was estimated the operating costs would be approximately 13 percent higher for membranes than more conventional technology.

As a result of these cost differentials, the Mount Horeb Wastewater Utility purchased approximately 100 acres of land in 2006 at a cost of about $1,000,000. A total of 20 acres of this site is reserved for a future forward flow WWTF. Dane County is considering purchasing a portion of the property not reserved for a future WWTF for a county park.

Detailed alternative evaluations in future facilities planning effort should review the costs of the membrane bioreactors against more conventional technology. The exact configuration of the membranes will depend upon effluent limits for phosphorus removal. The potential options for phosphorus effluent limits will be discussed under *Proposed Facilities Development, A.*, *Current and Potential Regulatory Trends* in the following section.

2. Biosolids Processing and Storage

Another potential use for the existing facilities would be for biosolids stabilization, thickening, and additional biosolids storage. The reused facilities would include the existing aeration tanks, final clarifiers, and aerobic digestion. There use in the preliminary recommended plan is discussed later in this report.

In addition to treatment facilities reuse, the existing Administration Building no longer meets the current needs of the utility because of increasing lab testing and Village growth. Construction of a new Administration Building specifically designed to meet current needs would better provide for the future needs of the Sewer Utility. This facility would include a new lab designed to meet current NR 149 requirements, shower and locker rooms facilities for staff, improved maintenance facilities, an operations room that would also provide for staff training, and offices.

PROPOSED FACILITIES DEVELOPMENT

This section reviews potential WPDES permit limits and develops a preliminary recommended plan based on constructing new forward flow facilities on the Village's proposed site and reuse of the existing facilities for enhanced biosolids stabilization, processing, and storage.

A. Current and Potential Regulatory Trends

This section discusses current and potential regulatory trends that could affect the WPDES permit requirements for the Village's WWTF. The key trends include the following:

1. Nutrient Criteria (Phosphorus and Nitrogen)
2. Chlorides (NR 106)
3. Antidegradation (NR 207)
4. Stream Reclassification
5. Thermal Standards
6. Biosolids Disposal and Beneficial Reuse Regulations

Projected impacts of these regulations for each of these items are discussed separately.

1. Nutrient Criteria (Phosphorus and Nitrogen)

The Wisconsin Department of Natural Resources (WDNR) is currently developing rules for phosphorus criteria that, when implemented in WPDES permits, could result in a significantly lower effluent phosphorus limit than the current 1 milligram per liter (mg/L) limit contained in the WPDES permit. The proposed criteria and draft implementation language would potentially require an effluent phosphorus limit of 0.075 mg/L on a monthly average basis. This potential limit would likely require a second stage membrane separation process to lower the effluent phosphorus from about a 0.2 mg/L limit attainable with enhanced chemical addition and effluent filtration to the 0.075 mg/L limit.

At the time this Strategic Plan Update was finalized, the WDNR had an anticipated start date to promulgate nitrogen criteria by about 2012. A notice of intent to sue the USEPA and require

over promulgation of both nitrogen and phosphorus criteria for Wisconsin was filed in November 2009 by Clean Water Advocates.

At the time of this Strategic Plan Update, the WDNR intended to provide draft phosphorus rules to the Natural Resources Board in early 2010. Public hearings would be regarding on these rules with a potential promulgation date of late 2010 or early 2011.

The Village's WPDES permit, which expired on September 30, 2007, will likely be reissued prior to the promulgation date. Based on the standard 5-year permit length, this would likely defer any more stringent effluent phosphorus limits until about the year 2018. This will allow the Village to explore options other than advanced treatment technologies including the potential for effluent trading with agriculture in the headwaters area of the Sugar River watershed.

On the national level, there are two other potential items that could generate reduced WPDES limits for both nitrogen and phosphorus. The first is the redefinition of secondary treatment to include nutrient removal (nitrogen and phosphorus). The National Resources Defense Council (NRDC) has filed suit to redefine secondary treatment. Proposed limits in the lawsuit have effluent total nitrogen varying from 3 to 8 mg/L and effluent total phosphorus varying from 0.1 to 0.3 mg/L. The second is a request by NRDC that USEPA prepare a total maximum daily load (TMDL) for nitrogen and phosphorus for the Mississippi-Atchafalaya River Basin (MARB), which could require lower phosphorus and new total nitrogen limits.

2. Chlorides

The Village currently has WPDES permit provisions that include activities designed to reduce effluent chlorides. This will likely continue since water softening by residential, commercial, and schools results in effluent chlorides that exceed the chronic criteria of 395 micrograms per liter. The Village is actively working with major dischargers of chlorides (including schools) to reduce their use of chlorides.

3. Antidegradation [NR 207 of the Wisconsin Administrative Code (WAC)]

Existing dischargers are prohibited from increasing the mass discharged from their facilities as a result of community growth without proceeding with a formal antidegradation procedures contained in NR 207. In its simplest form, the limits would be revised based on the ratio of proposed design flow to current design flow. This would potentially reduce effluent limits for BOD_5, TSS, and ammonia to about 75 percent of current WPDES permit limits. The resulting limiting BOD_5 and TSS would be approximately 11 mg/L or a value that would be met with effluent filtration. Limits for ammonia would also be reduced but it is anticipated these would be greater than the current WPDES permit limits for ammonia because of a change in regulations that occurred after the last WPDES permit was reissued. Antidegradation would likely have less impact on future WPDES limits than a potential stream reclassification.

4. Stream Reclassification

The WDNR has indicated it is has stream data that could potentially support a reclassification of the West Branch of the Sugar River from its current full fish and aquatic classification to a trout stream. This change would potentially significantly lower the BOD_5 and TSS limits to a 5 mg/L standard. This reclassification would require modification to the existing NR 104 of the WAC.

5. Thermal Standards

The WDNR is currently considering thermal standards, which would affect the Village's WPDES permit. The Natural Resources Board may consider these rules for adoption in early 2010. Depending on the stream classification, the Village could be required to meet thermal limits for discharges from August through January for a cold water stream classification and November for a warm water fishery.

6. Biosolids Disposal and Beneficial Reuse Regulations

Because of concerns over the presence of phosphorus in soils and their release during runoff, there are proposed rules that would restrict the application rate of biosolids to adding only enough to meet crop phosphorus requirements. These are typically about one-third of the nitrogen crop requirements. This may reduce the desirability of beneficial reuse or require about two-thirds more approved sites for land application. Depending on site availability or the desirability of beneficial reuse, the Village may need to reconsider its current thickened liquid disposal system to reduce hauling costs.

Because of the uncertainty regarding nutrient criteria, stream reclassification, and biosolids disposal, detailed facilities planning should be delayed until there is more certainty regarding the potential rules, which would apply to the Village's WPDES permit. In particular, the proposed phosphorus criteria would potentially affect the choice of technologies. Based on current available technology, a two-step process using conventional technology to lower the phosphorus to about 0.2 mg/L followed by a second step reducing the effluent from 0.2 mg/L to 0.075 mg/L would likely be required. The second step is required to optimize chemical use while maintaining the integrity of biological treatment. The second step chemical and operating costs would be significant and effluent trading may be a more economical way to achieve compliance while still meeting the phosphorus criteria objectives.

B. Proposed Facilities (Forward Flow)

This section outlines preliminary design for forward flow facilities based on the design flows and loadings presented above. The proposed facilities presented in this update are based on construction of a new influent pumping station at the existing site with all new forward flow treatment being located at the Village's new site located across Sand Rock Road from the existing site. The facilities included would be designed to meet the following effluent limitations:

Effluent BOD_5	10 mg/L monthly average
Effluent TSS	10 mg/L monthly average
Effluent Phosphorus	0.2 mg/L monthly average

1. Influent Pumping Station

A new influent pumping station would be provided adjacent to the existing primary sedimentation tanks. Flow would be rerouted around the existing screening building since the hourly peak flow rate of 2.53 mgd exceeds the 2.11 mgd hydraulic capacity of screening and grit removal building. In addition, at this flow rate there is significant surcharging in the influent sewers, which routinely allows for solids deposition, and under peak flow conditions could result

in a potential sanitary sewer overflow discharge if the sewer surcharging exceeds the manhole casting elevation.

This station would be designed with a peak instantaneous flow rate of 3.43 mgd. Standby power will be required to operate this facility in accordance with NR 110 of the WAC.

2. Screening and Grit Removal

New screening and grit removal facilities will be provided to meet the peak instantaneous flow of 3.43 mgd. These facilities would be located at the new site upstream of all forward flow treatment. Facilities would be provided to store removed screening material and grit. The influent screens would be designed with a one-eighth-inch opening.

4. Biological Phosphorus Removal

The current method of phosphorus removal is addition of alum and chemical precipitation. The proposed forward flow plant would include tanks to provide biological phosphorus removal as a way to reduce both the costs associated with chemical addition and to reduce the amount of biosolids for disposal. These facilities would be designed to allow for influent BOD_5 loadings to be routed around the biological phosphorus removal to allow for denitrification in the downstream activated sludge system.

5. Activated Sludge with Denitrification

A new diffused air-activated sludge facility configured for nitrification/denitrification would be provided. The aeration tank volume would be based on a loading of 15 pounds BOD_5/ 1000 cubic feet/day. The overall volume would be 1,300,000 gallons based on a design loading of 2015 lbs/day, a maximum month peaking factor of 1.2 and a recycle loading of 1.1 times the maximum month loading. Two trains of 650,000 gpd would be provided with approximate dimensions of 60 feet wide by 70 feet long with a sidewater depth of 20 feet.

A blower building in conjunction with return activated sludge (RAS) pumping would be constructed adjacent to the new aeration tanks. The preliminary air requirements for the blowers would be approximately 2,200 standard cubic feet per minute (scfm) or a total of three blowers each with 1,100 scfm of capacity are assumed.

6. Final Clarifiers and RAS Pumping

Two new final clarifiers would be provided with a surface overflow rate of 600 gpd/square foot based on the peak hourly design flow rate of 2.53 mgd. Each clarifier would be 50 feet in diameter with a 14-foot sidewater depth.

New RAS pumping housed in a building with the blowers would have a capacity varying between 300 gpm and 900 gpm. Three RAS pumps would be provided each with a capacity of 450 gpm.

7. Effluent Filtration

The preliminary recommended plan would include cloth filtration but this requirement will depend on the final effluent limits for suspended solids, total nitrogen, and total phosphorus. These would be based on a peak hourly flow rate of 1.83 mgd.

8. Ultraviolet (UV) Disinfection

Seasonal disinfection would be provided with UV disinfection with a design based on the peak hourly flow rate of 2.53 mgd.

9. Administration Building

A new administration building would provide adequate lab space, records storage, employee locker rooms and showers, a map room and two garage storage bays to supplement existing garage based storage. This building would have approximately 4,400 square feet of which approximately 1,800 square feet would be drive-through vehicle storage.

10. Electrical Service

A new electrical service would be provided for the forward flow facilities. This new service would be connected with the existing service to the existing WWTF.

11. Standby Power

A new standby generator sized to run all of the wastewater essential WWTF equipment would be provided at the existing site. Electrical connections would be provided between the existing site and the new forward flow facilities since the standby generator would be located at the existing site.

12. Potable Water

Continued use of the existing on-site well is not recommended for the new forward flow facilities due to water quality and capacity concerns. A connection from the Village's public water supply to the new forward flow facilities and also the existing flow facilities should be included in the proposed site development.

Figure 2 shows the proposed layout for the new forward flow facilities located at the new site acquired by the Wastewater Utility.

C. Proposed Facilities (Biosolids-Interim)

Construction of new forward flow treatment facilities at the proposed site would allow the existing facilities to be used for biosolids stabilization and storage. Figure 3 shows the proposed reuse of existing facilities including routing of the forward flow from the new site through the existing site facilities to the existing outfall on the West Branch of the Sugar River.

1. Aerobic Digestion (Existing Aeration Tanks)

The existing aeration tanks have a volume of 549,000 gallons. This would provide approximately 47 days of aerobic detention time at a daily wasting volume of 11,600 gpd. Waste activated sludge would be discharged from the new facility at an approximate 10,000 mg/L concentration. Air would be provided to the aerobic digestion facilities using the existing aeration blowers. The existing ceramic diffusers would be replaced with membrane diffusers.

2. Gravity Thickeners (Existing Final Clarifiers)

The current operation provides sludge decanting within the existing aerobic digester. Using the existing final clarifiers as gravity thickeners would eliminate the need for decanting in the aerobic digester. If necessary, polymer could be added to aid in thickening.

3. Gravity Belt Thickener

The gravity belt thickener would be fed from the existing final clarifiers now functioning as gravity thickeners. The existing gravity belt thickener would be retained.

4. Existing Thickened Sludge Storage

The existing thickened sludge storage is 300,000 gallons. This would provide 104 days of biosolids at the projected 2030 design loadings. An additional 4 to 10 feet of storage could potentially be added to these structures, which would provide an additional 60,000 to 140,000 gallons or provide an additional 20 to 50 days of storage. However, this would still not meet the required 180 days of storage or the operationally desirable 240 days of storage at design loadings.

5. Existing Aerobic Digestion

Since the existing forward flow is convertible to aerobic digestion, the existing aerobic digester could be converted to thickened sludge storage. With a volume of 330,000 gallons, this would provide 114 days of storage at the design BOD_5 loading of 2014 lbs/day. This would provide a total of 228 days of storage at 2030 design condition.

SUMMARY AND RECOMMENDATIONS-NEW SITE DEVELOPMENT

A. Preliminary Opinion of Probable Project Cost

Table 13 shows the opinion of probable project costs for both the new forward flow facilities and modifications to existing facilities. All costs are based upon December 2009 costs. These costs include construction of new forward flow facilities and modifications to the existing facilities for biosolids processing, thickening, and storage.

B. Alternatives to Preliminary Proposed Plan

The proposed alternative included in this Strategic Plan Update is based upon an effluent phosphorus limit of 0.2 mg/L by incorporating cloth. Effluent limitations of 0.075 mg/L for a monthly average

phosphorus limit would require additional capital expenditures of $ 4,300,000 based on December 2009 costs. Prior to implementing a technical solution to meet the more stringent limits, the Village should consider nontechnical approaches to compliance including effluent trading.

C. Potential Impacts of Preliminary Recommended Plan on System Users

The projected impacts on system users of the preliminary recommended plan are summarized in Table 14. These impacts are based on maintaining the annual 5 percent rate increase from 2010 through 2013, with the first debt payment associated with new facilities occurring in 2014. The rate impacts are also based on the Village receiving approximately $25,000 dollars per year in connection fees resulting from development. The proposed annual debt service costs are based upon a 3 percent Wisconsin Clean Water Fund loan without any grant assistance and/or loan forgiveness. Based on the recent federal government action, there may be a minimum 30 percent loan forgiveness for future Clean Water Fund projects. This would reduce the projected rate increase for 2014 to approximately 3 to 5 percent.

D. Recommendations

The following is a list of recommendations for consideration by the Village Wastewater Utility:

1. Continue to monitor potential Village growth. Based on the current population of 6,700 and the design population of 8,800 and an assumed housing density of 2.5 people per household, the existing facility could serve up to another 840 single-family residences. Planning, design, and construction of the proposed new site facilities would likely take about 4 years from the time that planning begins. The Utility should monitor housing starts on an annual basis to determine the time when planning for expanded facilities should begin.

2. Monitor the development of the proposed nutrient removal rules. Based on a permit reissuance in 2010 and assuming a 5-year permit reissuance period, nutrient limits may not be included in the Village's WPDES permit before 2015. A potential compliance date of 2018 is possible if the WPDES permit reissued in 2015 has a 3-year compliance schedule. Depending on the final limits, the Village may also wish to pursue nontechnical options for compliance including trading.

3. The majority of the Wastewater Utility's debt will be eliminated in 2013. If construction of new facilities is delayed beyond that date, revenue generated by the Wastewater Utility should be used to provide funding for the construction of the expanded WWTF.

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Table 1
Conveyance System Summary

Gravity Sewers and Interceptors		
Diameter (in)	**Approximate Lineal Feet**	**Approximate (in-dia-mi)**
6	632	0.7
8	196,675	298.0
10	6,546	12.4
12	779	1.8
15	7,353	20.9
Total	**246,100**	**333.8**
Force Mains		
Diameter (in)	**Approximate Lineal Feet**	
2	1,201	
2.5	828	
4	2,679	
6	8,057	
8	2,032	
10	10,000	
Total	**24,797**	

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Table 2
Infiltration/Inflow Analysis

INFILTRATION ANALYSIS						
Year	**Estimated Population**	**Industrial Flow[1] (mgd)**	**Commercial Flow[2] (mgd)**	**Metered Annual Average Flow (mgd)**	**Adjusted Annual Average Flow[3] (mgd)**	**Estimated Annual Average Per Capita Flow (gpd)**
2004	6234	0	0.065	0.401	0.336	64
2005	6364	0.0005	0.066	0.455	0.3885	71
2006	6494	0	0.061	0.419	0.358	65
2007	6623	0	0.058	0.443	0.385	67
Annual Average		**0.00**	**0.06**	**0.43**	**0.37**	**67**

[1] Industrial Flow based upon Village of Mount Horeb water sales data.
[2] Commercial Flow based upon Village of Mount Horeb water sales data.
[3] Metered Annual Average Flow minus Industrial and Commercial Flows. Includes residential, public, and average I/I.

INFLOW ANALYSIS						
Year	**Estimated Population**	**Industrial Flow[1] (mgd)**	**Commercial Flow[2] (mgd)**	**Metered Maximum Weekly Flow[3] (mgd)**	**Adjusted Maximum Weekly Flow[4] (mgd)**	**Estimated Maximum Average Per Capita Flow (gpd)**
2005	6364	0.0005	0.066	0.505	0.4385	79
2006	6494	0	0.061	0.488	0.427	75
2007	6623	0	0.058	1.13	1.072	171
Annual Average		**0.00**	**0.06**	**0.71**	**0.65**	**108**

[1] Industrial Flow based upon Village of Mount Horeb water sales data.
[2] Commercial Flow based upon Village of Mount Horeb water sales data.
[3] Maximum Weekly Flow measured at the WWTP during the entire calendar year. Includes residential, public, and average I/I.
[4] Metered Maximum Weekly Flow minus Industrial and Commercial Flows.

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Table 3
Wastewater Treatment Facilities Summary

Description	No.	Unit Specifications
Mechanically Cleaned Bar Screen	1	
Type		Rotating Screen with Washer
Capacity		2.11 mgd
Aerated Grit Tank	1	
Size		9 ft 9 in x 10 ft 0 in x 8 ft 6in SWD
Volume		6,200 gallons
Hydraulic retention time		5.5 minutes at 1.627 mgd
Primary Sedimentation	2	
Type		Rectangular
Size		12 ft x 42 ft x 7.25 ft SWD
Volume, each		27,300 gallons
Surface area, each		504 square ft
Side water depth		7.2 ft
Surface overflow rate		1,600 gpd/sq ft at 1.62 mgd
		604 gpd/sq ft at 0.609 mgd
Aeration Basins	3	
Size		20 ft x 68 ft x 18 ft SWD
Volume, total		549,000 gallons
Allowable BOD loading		1,090 lbs/day at 15 lbs BOD/1,000cf/day
Aeration Blowers	3	
Type		Positive displacement
Capacity, each		500scfm
Final Clarifiers	2	
Diameter		35 ft
Side water depth		10 ft
Surface area, total		1,864 sq ft
Surface overflow rate		869 gpd/sq ft at 1.62 mgd
Effluent Sand Filters	2	
Type		Shallow Bed, Traveling Bridge
Size, each		9 ft x 24 ft
Surface area, total		432 sq ft
Loading rate		2.6 gpm/sq ft at 1.62 mgd
Chlorine Contact Tank	1	
Size		19 ft x 25 ft x 6.5 ft SWD
Volume		23,000 gallons
Detention time		54 min at 0.609 mgd
Chlorinators	2	
Type		Gaseous chlorine, flow paced
Capacity, total		150 lb/day
Dechlorination	1	
Type		Sulfur dioxide, flow paced
Capacity, total		150 lb/day
Postaeration	1	
Size		8 ft 8 in x 14 ft 2 in x 9 ft 3 in SWD
Aera		123 sq ft
Volume		8,510 gallons

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Table 3
Wastewater Treatment Facilities Summary

Description	No.	Unit Specifications
Detention time		20 min at 0.609 mgd
Post Aeration Blowers	2	
Capacity, each		50 cfm @ 5 psi
Aerobic Digestion Tanks	2	
Size		26 ft x 60 ft x 14 ft SWD
Volume, each		165,000 gallons
Allowable flow		11,000 gpd with decant
Solids retention time		30 days at 11,000 gpd
Digest Blowers	4	
Type		Positive displacement
Capacity, each		500 cfm
Gravity Belt Thickener	1	
Size		1 meter
Loading rate		600 lb/hr
Biosolids Storage Tanks	2	
Volume, total		300,000 gallons

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Table 4
Annual Average and Maximum Daily Flows

	Influent Flow (mgd)			
Month	**2005**	**2006**	**2007**	**2008**
January	0.469	0.416	0.417	0.526
February	0.474	0.412	0.426	0.468
March	0.465	0.416	0.479	0.652
April	0.432	0.449	0.559	0.876
May	0.427	0.476	0.482	0.674
June	0.424	0.466	0.453	0.791
July	0.405	0.441	0.41	0.631
August	0.41	0.421	0.761	0.519
September	0.407	0.425	0.619	0.508
October	0.411	0.429	0.521	0.475
November	0.415	0.413	0.472	0.463
December	0.42	0.426	0.453	0.461
Average	**0.430**	**0.433**	**0.504**	**0.587**

	Maximum Daily Flow (mgd)			
Month	**2005**	**2006**	**2007**	**2008**
January	0.617	0.523	0.512	0.84
February	0.731	0.509	0.506	0.587
March	0.68	0.484	0.732	0.886
April	0.491	0.59	0.848	1.227
May	0.491	0.596	0.556	0.81
June	0.504	0.562	0.572	1.368
July	0.463	0.511	0.474	0.847
August	0.45	0.504	1.563	0.592
September	0.538	0.493	0.831	0.617
October	0.486	0.54	0.657	0.566
November	0.49	0.49	0.565	0.536
December	0.51	0.501	0.554	0.602
Maximum	**0.731**	**0.596**	**1.563**	**1.368**

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Table 5
Peaking Factors-Design Flows

Year	Maximum Daily Factor	Maximum Weekly Factor	Maximum Monthly Factor
2005	2.33	1.83	1.49
2006	3.10	2.24	1.51
2007	1.38	1.13	1.10
2008	1.70	1.17	1.10
Average	**2.13**	**1.59**	**1.30**

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Table 6
Influent Loadings (BOD_5 and TSS)

	Influent BOD_5 Loadings (lbs/day)			
Month	**2005**	**2006**	**2007**	**2008**
January	1,330	1,273	1,276	1,154
February	1,372	1,378	1,187	1,300
March	1,187	1,464	1,071	1,077
April	1,247	1,427	1,184	1,096
May	1,378	1,318	1,174	1,254
June	1,368	1,446	1,281	1,267
July	1,094	1,125	998	1,352
August	1,245	1,081	1,460	1,164
September	1,222	1,035	1,404	1,102
October	1,186	1,084	1,582	1,188
November	1,260	1,164	1,236	1,240
December	1,201	1,162	1,269	1,396
Average	**1,257**	**1,246**	**1,260**	**1,216**
Maximum	1,378	1,464	1,582	1,396

	Influent TSS Loadings (lbs/day)			
Month	**2,005**	**2,006**	**2,007**	**2,008**
January	1,553	1,322	1,252	1,180
February	1,664	1,464	1,144	1,456
March	1,450	1,724	1,047	990
April	1,531	2,258	1,240	1,191
May	1,699	1,520	1,331	1,405
June	2,164	2,592	1,787	1,596
July	1,331	1,504	1,197	1,600
August	1,306	1,338	1,847	1,493
September	1,382	1,212	1,889	1,428
October	1,316	1,131	2,160	1,398
November	1,346	1,240	1,405	1,583
December	1,307	1,343	1,213	1,753
Average	**1,504**	**1,554**	**1,459**	**1,423**

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Table 7
WPDES Permit Limits (Expired September 30, 2007)

	Daily Maximum	Daily Minimum	Average Weekly	Average Monthly	Sample Frequency	Sample Type
Flow					(MGD) Continuous	
BOD_5						
May 1-Sept 30			15 mg/L	15 mg/L	3x weekly	24-hr. comp.
Oct 1-Apr 30			22 mg/L	22 mg/L		
Suspended Solids						
May 1-Sept 30			15 mg/L	15 mg/L	3x weekly	24-hr. comp.
Oct 1-Apr 30			22 mg/L	22 mg/L		
Ammonia-Nitrogen						
May 1-Sept 30			1.0 mg/L		2x weekly	24-hr. comp.
Oct 1-Apr 30			4.0 mg/L			
Chlorine Residual						
May 1-Sept 30	38 µg/L		8.3 µg/L		Daily	Grab
Fecal Coliform				400/100mL	weekly	Grab
Dissolved Oxygen		6.0 mg/L			3x weekly	Grab
pH (standard units)	9 (std.u.)	6 (std.u.)			3x weekly	Grab
Phosphorous, Total				1.0 mg/L	3x weekly	24-hr. comp.
Chloride			660 mg/L		Monthly	24-hr. comp.

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Table 8
Wastewater Treatment Plant Effluent Quality

Summary of Effluent Quality (mg/L) unless noted[1,2]				
Parameter	**2005**	**2006**	**2007**	**2008**
BOD_5	3.08	2.67	2.77	2.95
TSS	2.57	2.27	2.25	2.60
Ammonia-N	0.07	0.06	0.27	0.05
Phosphorus	0.65	0.73	0.63	0.64
Fecal Coliforms[3]	35.54	25.75	19.64	3.78

[1] Effluent values taken from discharge monitoring Reports 2005-2008.

[2] Annual Average Effluent values are shown and are based on the average of the monthly average effluent values.

[3] Permit requires monitoring of fecal coliforms from May to September only. Fecal coliform results are in the number of colonies per 100 mL.

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Table 9
Population Projections

Year	Census	Estimated Population[1]	WDOA Projections	CARPC Projections
1980	3,251			
1990	4,182			
2000	5,860			
2004		6,234		
2005		6436[2]		
2006		6,494		
2007		6,623		
2010		6,957	7,083	6,976
2015			7,793	7,651
2020			8,522	8,392
2025			9,235	9,204
2030			9,911	10,095

[1] Population estimated by linearly interpolating the 1980-2000 census data to 2005 WDOA estimate.
[2] WDOA estimate.

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Table 10
Per Capita Flow Contributions

User Classification	Per Capita Contributions (gallons/day)				
	2004	**2005**	**2006**	**2007**	**Average**
Residential	65	54	54	63	59
Commercial	13	10	10	10	11
Public Authority	3	3	3	3	3
Industrial	0	0	0	0	0
Approximate Infiltration/Inflow	18		2	9	9
Total Per Capita[1]	**99**	**66**	**68**	**85**	**79**

[1] Populations used in analysis are shown on Table 4.02-1.

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Table 11
Projected 2030 Design Flows

Design Flow[1]	2030 (mgd)
Annual Average	0.86
Maximum Monthly Average	1.12
Maximum Weekly Average	1.37
Maximum Daily Average	1.83
Peak hourly	2.53
Peak Instantaneous	3.43

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Table 12
Projected 2030 Design Loadings

Design Parameter	2005-2008 Annual Average Loading (lb/day)	Population Growth Loading (lb/day)	Future Industrial Loading (lb/day)	2030 Design Average Loading (lb/day)
BOD_5	1,245	673	96	2014
TSS	1,485	938	121	2544
TKN	163	89	13	265
Estimated P	24	26	3	53

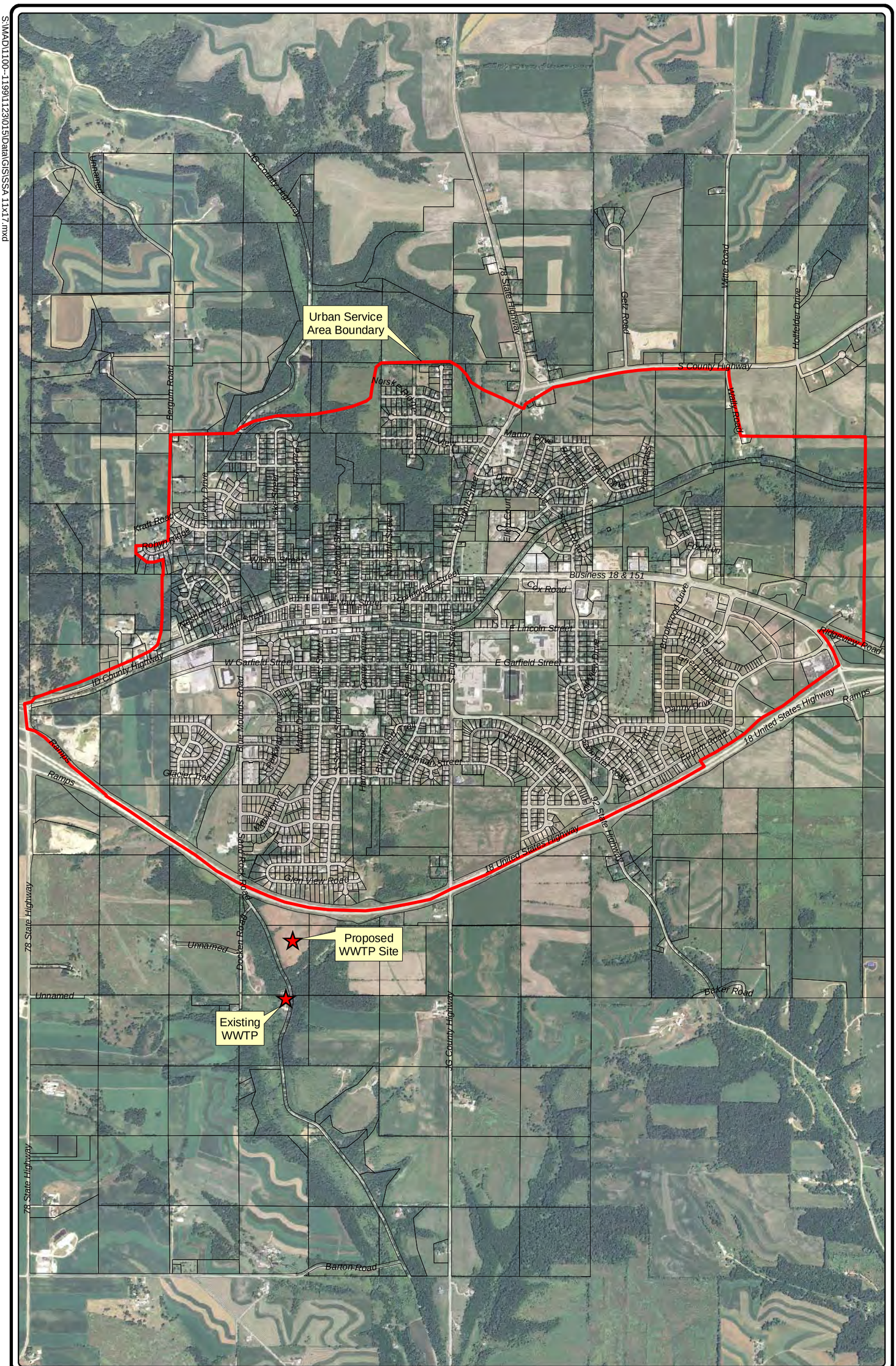
Table 13
Preliminary Opinion of Probable Project Cost (December 2009)

	Preliminary Capital Costs
Influent Pumping Station	$ 510,000
Screening and Grit Removal	$ 1,474,000
Aeration Tanks	$ 3,100,000
Final Clarifiers	$ 2,060,000
RAS/Blower Building	$ 1,573,000
Administration Building	$ 1,158,000
Emergency Generator	$ 106,000
UV Disinfection	$ 285,000
Cloth Filtration	$ 1,100,000
Biosolids Storage/Dewatering	$ 1,206,000
Total	$ 12,572,000

Note: Costs included in this preliminary opinion include, piping, sitework, electrical, Contractor's general conditions, contingencies, and technical services.

Table 14
Preliminary 2014 User Charge Impact (December 2009 Costs)

	Phase I Forward Flow
Influent Pumping Station	$ 510,000
Screening and Grit Removal	$ 1,474,000
Aeration Tanks	$ 3,100,000
Final Clarifiers	$ 2,060,000
RAS/Blower Building	$ 1,573,000
Administration Building	$ 1,158,000
Emergency Generator	$ 106,000
UV Disinfection	$ 285,000
Cloth Filtration	$ 1,100,000
Biosolids Storage/Dewatering	$ 1,206,000
Total Phase Costs	$ 12,572,000
Annual Debt Service	$845,000
Debt Service Prior to Project	$583,800
Increase in Debt Service in 2014	$261,200.00
Revenue Prior to Project	$1,582,598
Operation Cost Increases	$20,000
Impact Fee Collection	$25,000
Hauled Waste Revenue	$0
Increased Rates	$1,838,798
Percent Increase	16.2%



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SEWER SERVICE AREA

WASTEWATER TREATMENT PLANT FACILITIES PLANNING
VILLAGE OF MOUNT HOREB
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES, INC. ENGINEERS

FIGURE 1
1123.015

FIGURE 2
1-123-015

STRAND ASSOCIATES, INC. ENGINEERS

EXISTING FACILITIES
WASTEWATER UTILITY 2009 STRATEGIC PLAN UPDATE
VILLAGE OF MOUNT HOREB, DANE COUNTY WISCONSIN

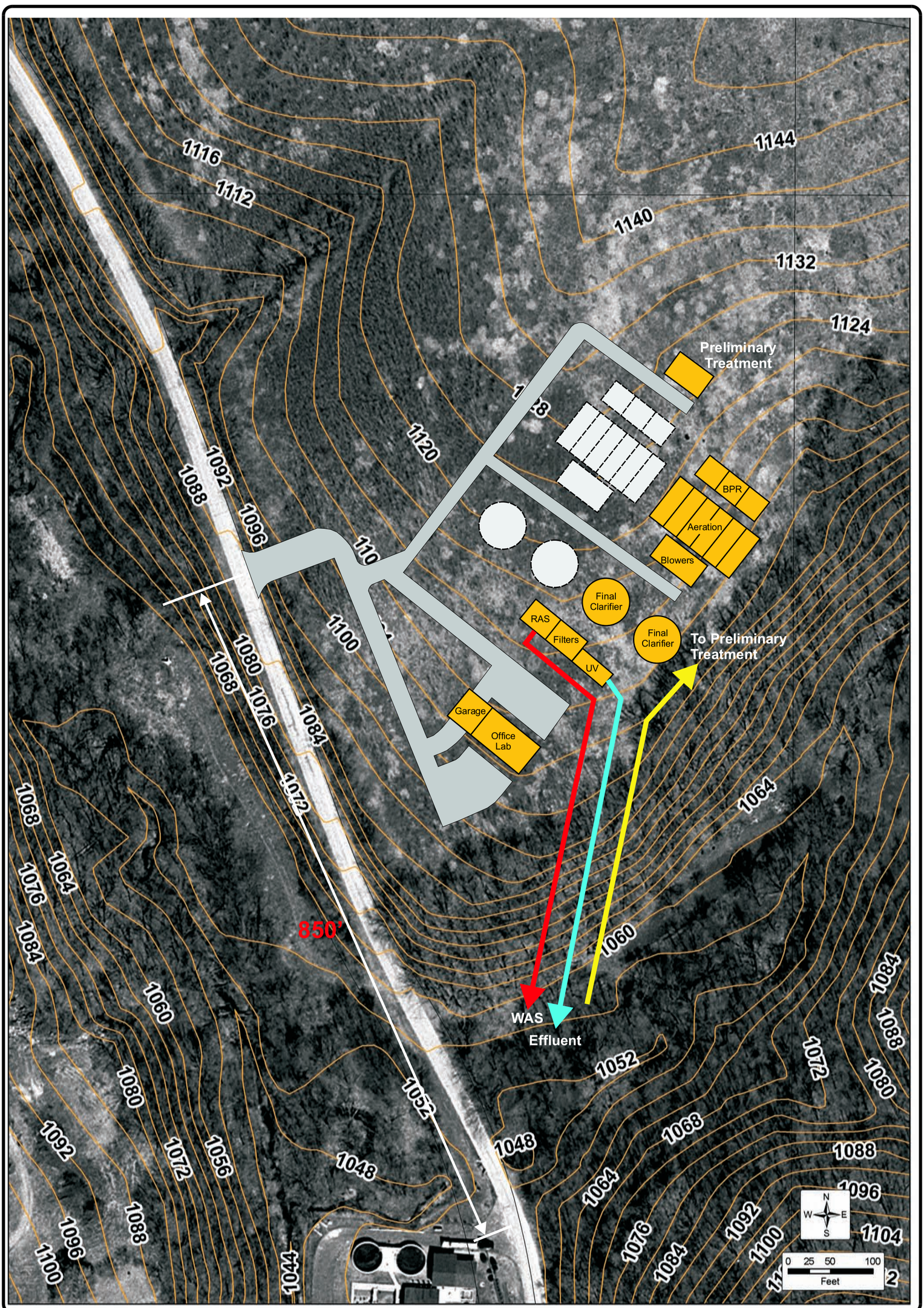

FIGURE 3
1-123-015

STRAND ASSOCIATES, INC.® ENGINEERS

PRELIMINARY PROPOSED SITE LAYOUT - FORWARD FLOW
WASTEWATER UTILITY 2009 STRATEGIC PLAN UPDATE
VILLAGE OF MOUNT HOREB, DANE COUNTY WISCONSIN

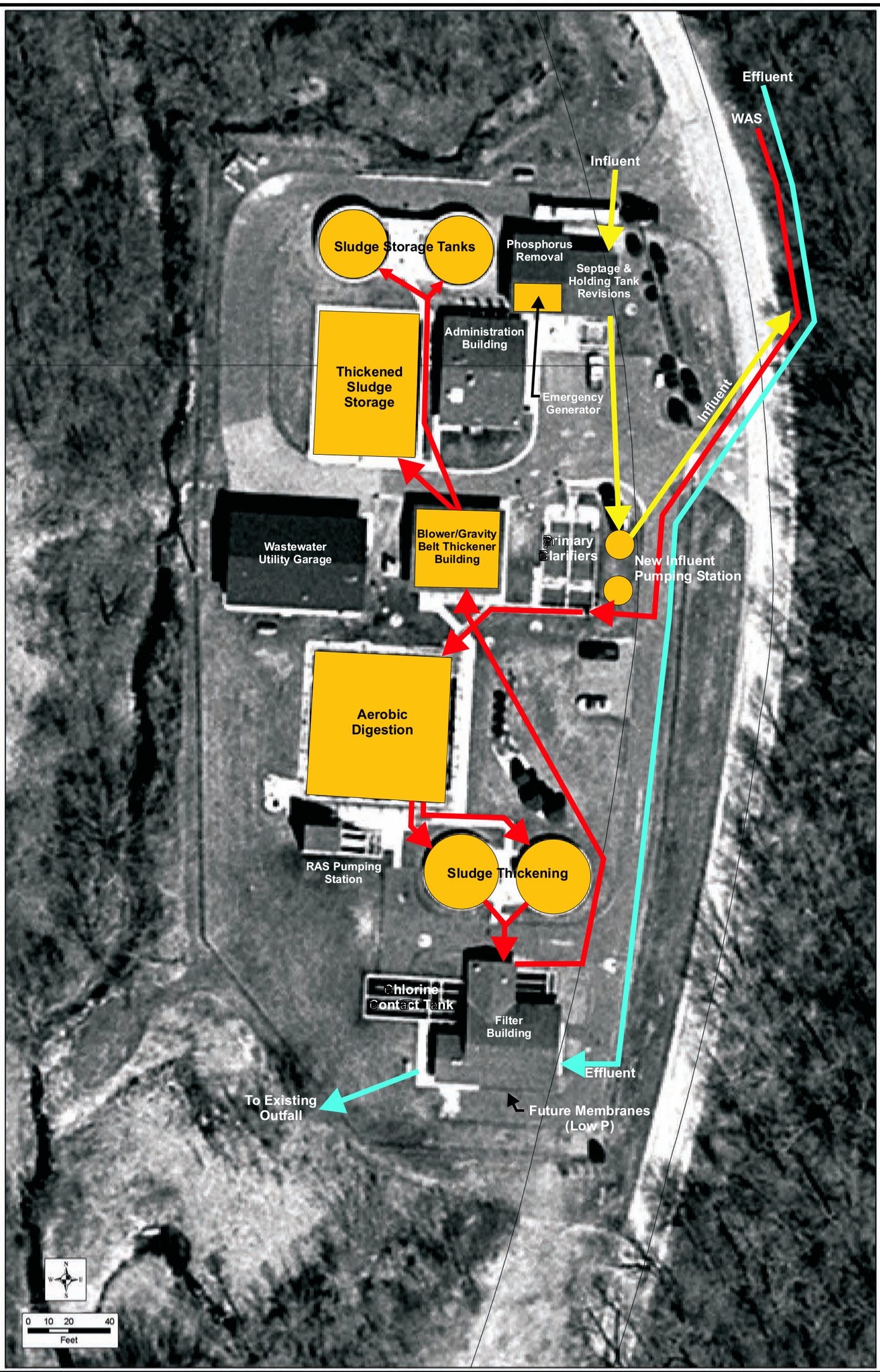

FIGURE 4
1-123-015

STRAND ASSOCIATES, INC.® ENGINEERS

EXISTING FACILITIES REUSE
WASTEWATER UTILITY 2009 STRATEGIC PLAN UPDATE
VILLAGE OF MOUNT HOREB, DANE COUNTY WISCONSIN