Saxtons River Municipal Wastewater

Preliminary Engineering Report

Amendment to the 2007 Wastewater Engineering Evaluation Report

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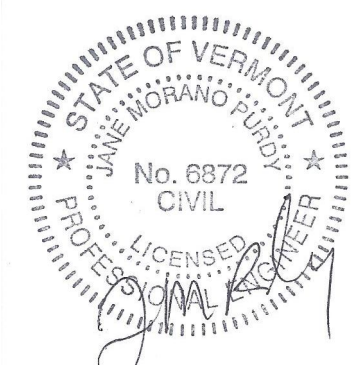

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APPENDICIES

Saxtons River Municipal Wastewater
Preliminary Engineering Report
Amendment to the 2007 Wastewater Engineering Evaluation Report

In accordance with our Agreement dated December 2, 2013, we are pleased to present this Preliminary Engineering Report Amendment. This Amendment serves as an update to the **VILLAGE OF SAXTONS RIVER CORPORATION WASTEWATER ENGINEERING EVALUATION AND REPORT** prepared by Stantec Consulting Services, Inc., dated August 2007 (herein referred to as the *2007 Report*). The *2007 Report*, as referenced throughout this Amendment, provided a thorough inspection and evaluation of the existing wastewater treatment facility, collection system and manholes, and recommended improvements with opinions of probable costs, for three options:

Option 1 Rehabilitate Existing Wastewater Treatment Facility;
Option 2 Rehabilitate and Construct New Wastewater Treatment Facilities; or
Option 3 Abandon Wastewater Treatment Facility and Construct New Pump Station and Sewers

The **PRELIMINARY ENGINEERING REPORT AMENDMENT** presented herein, includes documentation to complete the requirements of the Vermont Agency of Natural Resources Department of Environmental Conservation (VT ANR DEC) Facilities Engineering Division (FED) Step I Facilities Planning Phase and provide the Village with the most cost effective, long term solution to their wastewater issue. The report format is based on the guidelines detailed in *USDA Bulletin 1780-2*.

The original scope of work for this PER Amendment was based on the *2007 Report* and direction from the Owner and FED, and included the following:

- Comprehensive total project and life cycle costs, including details of comparative operating costs, for Option 1 (Alternative 1), minimal rehabilitation of the existing wastewater treatment facility *that will meet current standards and be approved by the state*, and Option 3 (Alternative 3), abandon the existing wastewater treatment facility and construct a pump station and a sewer force main connecting to Bellows Falls.
- A narrative of what has transpired with the project since August 2007;
- An update of the wastewater system asset inventory, and
- An Environmental Information Document (EID) for Alternative 3, including the project description, a discussion of required permits, a categorical exclusion request, an Environmental and Archeological Checklist and Archeological Resource Assessment (ARA).

Following the initial findings, the scope of work was expanded to include consideration of Option 2 (Alternative 2) to replace the existing treatment process with a new Sequencing Batch Reactor (SBR) process. This alternative was found to be the most cost effective solution. An EID was then developed for this recommended alternative.

1. Project Planning

a. Location

The current wastewater treatment facility (WWTF) is located in the Village of Saxtons River, adjacent to the Saxtons River. The location of Alternatives 1 and 2 is at the existing site surrounding the current facility.

Alternative 3 involves the placement of a new pump station at the current site and a sewer force main from the new pump station to the Bellows Falls sewer system. The proposed route leaves the WWTF and heads northeast, crosses the Saxtons River near Averill's Bridge and continues east along the Saxtons River Road (Route 121) through Rockingham and Westminster. After a second river crossing, the route continues east veering off Saxtons River Road and following a newly constructed development road cross-county to Deermont Road and then along a town road at the edge of the Oak Hill Cemetery. The proposed route terminates at an existing sewer manhole at Birch Street in Bellows Falls (Refer to Appendix A for Overall Planning Location Map).

b. Environmental Resources Present

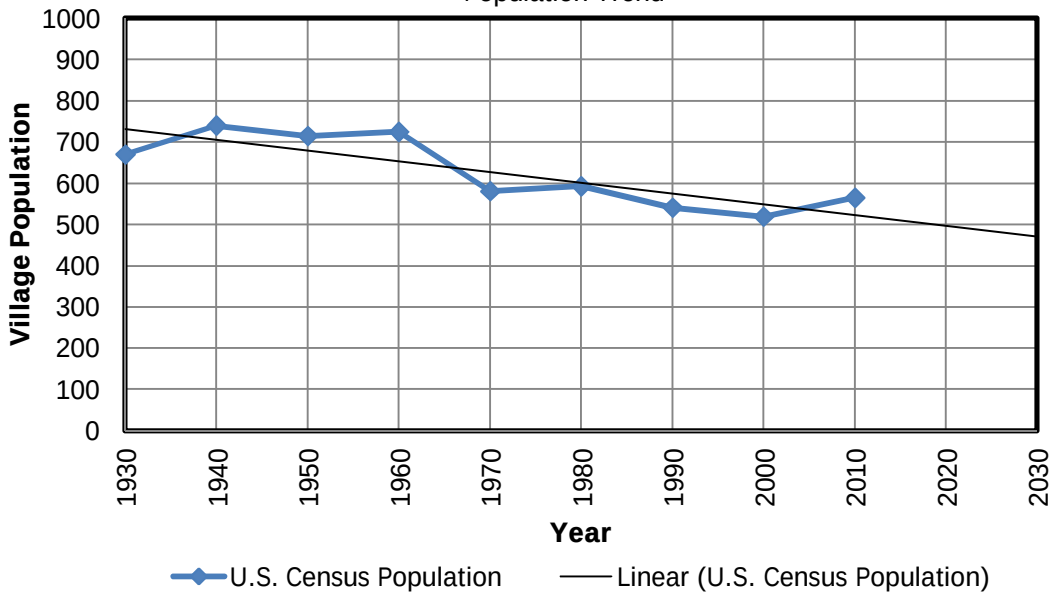
Alternatives 1 and 2 are within the existing disturbed area of the WWTF site. The site, according to FEMA Flood Insurance Rate Map No. 50025C0094E, is located outside the 100-year flood zone but within the 500-year flood zone (also referred to as the 1% and 0.2% Annual Chance Flood Hazard Zone, respectively).

An EID was prepared for both Alternative 2 and Alternative 3. In summary, there are wetland resources, flood hazard areas, rare species and areas of archeological concern within or adjacent to the project area.

c. Population Trends

Below, is a graph indicating that the population trend based on past U.S. Census data appears to be declining. However, since 2000 the population has increased.

Figure 1-1
Population Trend



d. Community Engagement

The Saxtons River Village Trustees have engaged the village residents during the selection of the engineering consultants and continues to engage the community in the project. On February 8, 2014, the Trustees, together with their consultants, presented the findings and recommendations of this **PRELIMINARY ENGINEERING REPORT AMENDMENT**. The community was engaging and supportive with no significant controversy.

2. Existing Facilities

a. Location Map

The *2007 Report* includes Figure 2-1 Collection System Map, Figure 3-1 Process Schematic, and Figure 3-2 WWTF Site Plan along with photographs of existing facilities. No changes have occurred.

b. History

The *2007 Report* provides a thorough history of the Saxtons River wastewater system. No major system components have since been constructed, renovated, expanded or removed from service.

Wastewater Treatment Facility Operations

Operations of the WWTF have been relatively consistent since the *2007* Report. A de-chlorination violation occurred in October 2011, in part due to cold weather. The effluent flow meter was replaced in July 2012. On two occasions, in August 2011 and September 2013, the WWTF was struck by lightning. The strike in September damaged the effluent flow meter and the chart recorder. The flow meter was rebuilt in September, 2013 and the Chart Recorder replaced in October, 2013. According to Rob Wheeler, the WWTF Operator, calibration of the flow meter was performed at the times of installation.

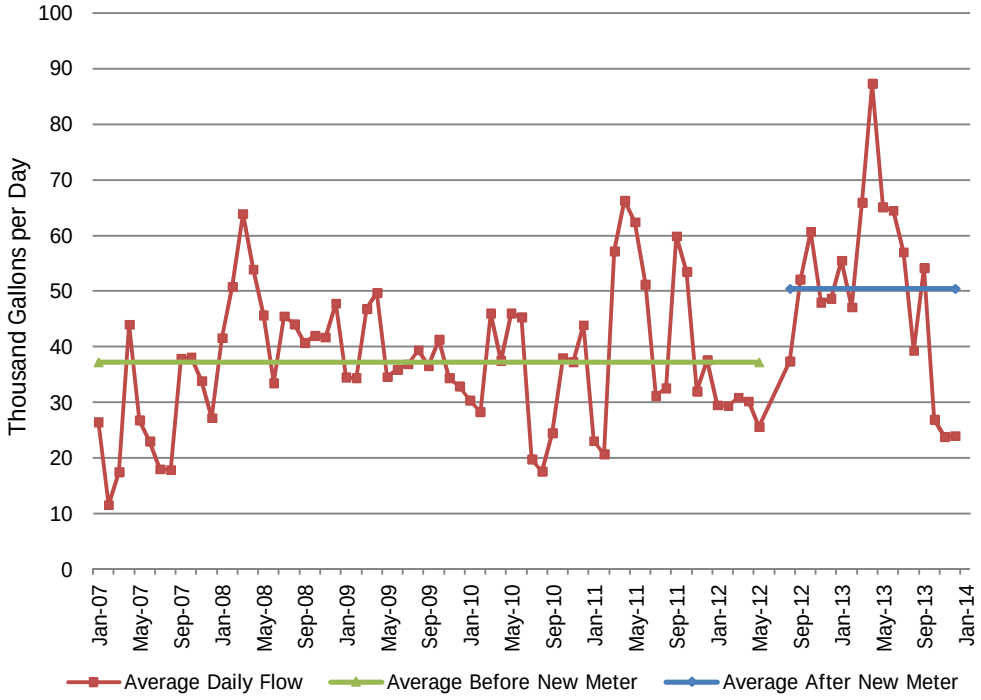
State monthly operations reports from January 2007 through December 2013 were reviewed and tabulated. The table and chart below shows the flow data for that period. Of significance, the reports indicate that, based on the faulty flow meter and chart recorder, previously recorded effluent flows may have been incorrect. Before the new meter was installed, the average daily flow rate was 37,200 GPD (January 2006 – May 2012). Since the new meter, the average daily flow rate was 50,400 GPD (August 2012 – December 2013). The Average Flow for 2013 was 50,900 GPD and is used as a basis of all related calculations in this report.

Table 2-1
Average Daily Flow Data
2007-2013

	2007	2008	2009	2010	2011	2012	2013
January	26,500	41,600	34,500	30,400	23,100	29,500	55,500
February	11,600	50,800	34,400	28,300	20,700	29,400	47,100
March	17,500	63,900	46,800	46,000	57,200	30,900	65,900
April	44,000	53,900	49,700	37,500	66,300	30,200	87,300
May	26,800	45,700	34,600	46,000	62,400	25,600	65,100
June	23,000	33,500	35,900	45,300	51,200	[1]	64,500
July	18,000	45,500	36,900	19,800	31,200	[1]	57,000
August	17,900	44,100	39,400	17,600	32,600	37,400[2]	39,300
September	37,900	40,700	36,600	24,500	59,900	52,100	54,200 [3]
October	38,100	42,000	41,300	38,000	53,500	60,700	26,900
November	33,900	41,700	34,400	37,300	32,000	48,000	23,800
December	27,200	47,800	32,900	43,900	37,600	48,700	24,000
Annual Average	26,867	45,933	38,117	34,550	43,975	39,250	50,883

Source: Vermont WR-43 Monthly Operations Reports, Saxtons River 3-1167
1. No flow meter; 2. New flow meter; 3. Lightning strike - meter and chart recorder damaged

Figure 2-1
Average Daily Flows
2007-2013



Tropical Storm Irene

On August 28, 2011, Tropical Storm Irene caused significant flooding and erosion along the Saxtons River. According to Rob Wheeler, Saxtons River WWTF Operator, floodwaters extended up to the level of the oxidation ditch at approximately elevation 448. All motors were flooded. Power supply was manually shut down and the plant continued partial operations on a gravity feed basis. The building suffered minor flood damage. A copy of the damage assessment provided to FEMA is included in Appendix C. Other damages included erosion along Plant Road leading to the WWTF and stream alteration in the area of the effluent discharge. In 2013, re-channelization of the Saxtons River was completed in order to maintain the discharge in the main channel of the Saxtons River.

Inter-Municipal Wastewater Treatment Agreement

The Saxtons River Village Corporation and the Bellows Falls Village Corporation worked together to develop an inter-municipal agreement with the intent *"to effect a basis for mutual understanding under which sewage will be transported by Saxtons River to Bellows Falls' wastewater treatment facility."* The Agreement was executed on February 13, 2012 and is included in Appendix D.

c. Conditions of Existing Facilities

A WWTF Equipment Condition Assessment was included in the *2007 Report* along with the design criteria detail for each major component (refer to Table 2-2 and Appendix B of the *2007 Report*). Below is an update to the equipment assessment. Included in Appendix E is an update to major components details. As shown, many of the system components have exceeded their life expectancy.

Table 2-2
Equipment Inventory & Assessment

Equipment	Year Installed	Approx. Age	Expected Life	Remaining Life
Headworks				
Manual Bar Rack	1972	42	50	8
Manual Bar Rack Concrete Channel	1972	42	50	8
Muffin Monster (grinder)	2000	14	10	0
Muffin Monster electrical	1990	24	35	11
Muffin Monster Concrete Channel	1990	24	50	26
Influent Sampler	1990	24	20	0
Oxidation Canal				
Concrete	1972	42	50	8
Rotor	1990	24	20	0
Electrical	1972	42	35	0
Discharge Weir	1972	42	20	0
Influent Piping	1972	42	50	8
Clarifier				
Influent well	1972	42	20	0
Baffle skirt	1990	24	20	0
Scrapers	1972	42	20	0
Effluent weirs	1972	42	20	0
Concrete	1972	42	50	8
Solids Handling				
Sludge wet well	1972	42	50	8
Sludge pumps (2)	2000	14	20	6
Sludge storage tank concrete	1972	42	50	8
Sludge storage tank aeration system	1972	42	20	0
Sludge storage tank roof/cover	1980	34	20	0
Portable decant pump	2012	2	20	18
Chlorine Contact Tank				
Concrete	1972	42	50	8
Baffles	1999	15	20	5
Effluent flow measurement	2013	1	15	14
Effluent weirs	1972	42	20	0
De-chlorination mixer	1972	42	20	0
Chemical Feed System				
Chlorination pumps	2001	13	10	0
De-chlorination pumps	2001	13	10	0
Storage and containment	2001	13	20	7
Effluent sampler	1990	24	20	0
Operations Building				
Bathroom fixtures	1972	42	30	0
Electrical heating system	1972	42	30	0
Doors	1972	42	30	0
Roof	1972	42	20	0
Site				
Process valves	1972	42	30	0
Sodium hypochlorite feed piping	2004	10	5	0
Sodium bisulfate feed piping	1990	24	20	0

Basis of update reference: *2007 Report Table 3-2*

d. Financial Status of Existing Facilities

Table 2-3
WWTF 2012-2013 Budget

Expense Description	Budget
BF Administration Charges	48,886.00
Debt Services/Bond Payment	0.00
Capital Reserve	39,526.00
Chemicals	3,200.00
Lab Fees	1,850.00
Line Maintenance	3,500.00
Office Supplies	0.00
Plant Maintenance	8,000.00
Sludge Removal	13,500.00
Training/Safety Equipment	0.00
Administration	1,500.00
Electricity	10,000.00
Insurance	5,000.00
Telephone	550.00
TOTAL	$ 135,512.00

e. Water/Energy/Waste Audits

In 1998, Vermont Rural Water assisted the Village with an Inflow/Infiltration Study of the sewer system (no records were available). The system was smoke tested in 2002 to determine if there were any cracks, leaks or breaks in the system. Several houses were identified with possible sewer gas leaks and homeowners notified. No other audits have been conducted.

3. Need for Project

Saxtons River Village Corporation has been considering this project for many years and was proactive in conducting an evaluation of their wastewater facilities back in 2007. Due to the age and condition of the WWTF, the Village understands that an upgrade is inevitable. In 2013, the Village contracted with Marquise & Morano, LLC to complete the Preliminary Engineering and the Final Design of the Wastewater Pump Station and Related Sewer Mains as the presumed selected project based on the findings of the *2007 Report* and other updates.

a. Health, Sanitation, and Security

is the *2007 Report* includes a copy of the most recent VT ANR DEC Discharge Permit No. 3-1167, authorizing the discharge of treated and disinfected sanitary wastewater from the WWTF to the Saxtons River. Effluent limitations, monitoring requirements and other special conditions are made part of the permit. The permit expired on March 5, 2005 and the state anticipates a 2016 renewal schedule.

b. Aging Infrastructure

As indicated in Table 2-2, the WWTF consists of many components that have already exceeded their life expectancy.

c. Reasonable Growth

No additional treatment capacity is proposed for either of the WWTF upgrade options. For Alternative 3, sizing of the pumps needed to transport wastewater from Saxtons River to Bellows Falls takes into account reasonable growth within the Village of Saxtons River. The pumps are sized to meet maximum peak hourly flow which allows for flow increases by pumping for a longer period.

4. Alternatives Considered

The alternatives evaluation included the development of a preliminary scope, estimated construction costs and annual operation costs. Below, is a summary of the wastewater treatment alternatives considered:

Alternative 1 Rehabilitate the existing wastewater treatment process in a manner *that will meet current standards and be approved by the VT ANR DEC.*

Alternative 2 Replace the existing wastewater treatment process with a new process.

Alternative 3 Abandon existing wastewater treatment facility and construct a new pump station and approximately 19,500 feet of sewer force main to connect to Bellows Falls wastewater system.

a. Alternative 1 WWTF Upgrade – Existing Oxidation Ditch Process

The existing treatment facility, constructed in 1972, consists of a single oxidation ditch activated sludge process and clarifier. No redundancy of major process equipment was constructed. The VT ANR DEC now requires WWTF redundancy of even minor treatment equipment and processes. In addition, ANR DEC no longer issues emergency discharge permits during the upgrade of a WWTF. Since there is no back-up secondary process, a temporary treatment process is needed as part of the upgrade to the oxidation ditch process. A preliminary scope for a facility upgrade was prepared and submitted to the ANR DEC Wastewater Management Program for review and granted conceptual approval.

Design Criteria

The scope of Alternative 1 consists of the following:

- New influent bar rack and sewage grinding system. A “Muffin Monster” type grinder was deemed adequate by ANR DEC Wastewater Management Program engineers. However, their preference would be to construct an automatic self-cleaning screening system, which is normally a standard piece of the treatment process in all other WWTF upgrades. In some States, an influent screen is now mandatory. As indicated by the operator, the existing grinder system does not provide much grinding or shredding. To maintain these grinders, the blades/cutters must be replaced every 5 years, if not sooner. The cost estimate and scope only includes a new “Muffin Monster” type grinder although the long term recommendation, if the alternative is selected, should include an influent screen.
- Utilization of the existing oxidation ditch with major structural improvements to the ditch. Provide a different type of aeration system than the present rotor to provide for redundancy of treatment if the aeration unit was out of service. The installation of an Aire-O2 type aeration system with stand-by (spare) aerators. Major structural modifications consisting of either concrete repair or replacement of the concrete structure. The ANR DEC Wastewater Management Division will not require a second duplicate oxidation ditch. However, a requirement is to purchase and store stand-by aeration equipment.

- Modification and relocation of the influent and effluent piping to provide for an anoxic selector zone within the oxidation ditch to assist with nitrogen removal. These influent and effluent pipes are critical to developing an anoxic zone and to enable the facility to meet the effluent quality. The construction of a gravity sewer to relocate the influent location to the ditch.
- The construction of two (2) secondary clarifiers that would meet the State and Federal redundancy requirements for treatment processes. The existing clarifier is inadequately sized. A second clarifier is a redundancy requirement of the ANR DEC.
- The construction of a chlorine contact tank that meets the State requirements for 30 minute detention time. The existing tank is inadequate in size to meet the requirement and is also submerged during the 100-year flood event.
- The addition of new chemical metering pumps for chlorination and de-chlorination.
- Installation of a generator to provide for emergency power to meet the State requirements for primary treatment and disinfection. There is currently no generator.
- New 3-Phase 480 Volt main power. The existing incoming power consists of 3 Phase 208 Volt.
- Process piping required for the upgrade for influent, effluent, RAS and WAS requirements.
- Extend final discharge outfall into main channel of the Saxtons River.
- Miscellaneous improvements to the existing building including heating, electrical, ventilation, and weather proofing.
- Expansion and upgrade of the aerated sludge holding tanks for operational improvements and reliability. The upgrade shall include a new tank cover system and aeration.
- Secondary treatment and disinfection during construction is a requirement of ANR DEC. This is an expensive operation that will consist of a portable wastewater treatment facility with influent pumps to pump all of the wastewater into the temporary tanks, tanks, aeration blowers, controls, and a separate new power supply due to the limitations of the existing power feed or a generator that would operate continuously.
- Abandonment of the clarifier and Chlorine Contact Tank.

Map

Refer to Appendix F, Exhibit 1 for a General Plan of Upgrade Alternative 1.

Design Discussion

Based on the evaluation of the oxidation ditch, it appears the concrete panels are not tied together adequately and there is the potential for groundwater to enter the ditch if the groundwater table is excessively high. The ditch is shallow with only a depth of 3.5 feet of wastewater and is only 7.0 feet below the surrounding ground surface. Water would not enter cracks or voids between the sections unless the head was adequate to overcome the pressure. The concrete ditch is over 40 years old with an expectant remaining life of 10 to 15 years, but the integrity and life expectancy is questionable. The preliminary options for ditch improvements would be to: 1) empty the ditch, assess and seal all voids, cracks and sections, install a liner and then possibly install concrete ballast; or to 2) empty, remove all concrete and replace the concrete in its entirety. It is a recommendation to remove and replace the concrete in the oxidation ditch.

The upgrade to the oxidation ditch would consist of the relocation of piping, the removal of the rotor and structural modifications associated with the rotor removal, cleaning and complete reconstruction of the ditch, and the installation of AireO2 type aerators to provide mixing and aeration. Due to the new effluent nitrogen limits, a control system is recommended for the system.

For the facility to meet the effluent criteria now imposed for nitrogen and enable the installation of two (2) clarifiers, the recommendation is to relocate the influent and effluent piping to create an anoxic zone within the ditch and to construct clarifiers to the west of the ditch. Each clarifier would be 22 feet in diameter to meet the design requirements and new piping would be required for RAS as shown on the exhibit. The clarifier effluent would then enter a new chlorine contact tank, which would be considerably larger than the existing contact tank to meet State design guidelines. The effluent piping would connect to the existing piping east of the present tank.

Opinion of Probable Costs

An opinion of probable construction costs was developed based on sizing the equipment and processes to meet the design requirements and Guidelines, obtaining quotes from equipment manufacturers' representatives and previous experience with the construction of treatment facilities. The estimated project cost summary also includes an allowance for engineering, administration, fiscal and legal costs. The total estimated construction cost, including a 15% contingency, is $2,545,686 and the Total Project Cost is $3,091,960 and is presented in detail in the table below.

Table 4-1
Alternative 1
WWTF Upgrade - Existing Oxidation Ditch Process
Project Cost Summary

Headworks - Grinder, Bar Rack, Flow Measuring	
Site Work	$4,000
Concrete	$14,000
Building	$20,000
Equipment	$30,000
Miscellaneous	$5,000
Subtotal Headworks =	$73,000
Oxidation Ditch - Aerator/Mixers, Baffles, Miscellaneous	
Demolition & Disposal	$30,000
Earthwork	$30,000
Concrete & Baffles	$95,000
Equipment	$208,000
Upgrade RAS Pumping	$20,000
Railings	$8,600
Miscellaneous	$10,000
Grit Removal	$15,000
Temporary Pumping & Power	$40,000
Temporary Treatment	$380,000
Subtotal Oxidation Ditch =	$836,600

Clarifiers - Bridge, Drive, Launders, Scrapers	
Site Work	$75,000
Concrete	$160,000
Equipment	$91,500
Railings	$7,000
Miscellaneous	$10,000
Subtotal Clarifiers =	$343,500
Chlorine/Dechlorination Contact Tank (CCT) - Tank, Mixer, Effluent Flow, Railings	
Site Work	$50,000
Concrete	$81,000
Equipment	$14,500
Railings and gratings	$16,000
Miscellaneous	$10,000
Subtotal CCT =	$171,500
Yard Piping and Miscellaneous Items	
Gravity Sewer and Manholes	$160,000
Extend Final Discharge Outfall	$25,000
Sludge Holding Tank Expansion	$117,000
Control Building Upgrade	$40,600
Generator	$30,000
Miscellaneous	$10,000
Subtotal Yard Piping & Miscellaneous =	$382,600
Electrical and Instrumentation	$356,440
Contractor Mobilization/Demobilization	$50,000
Subtotal Construction Cost =	$2,213,640
Contingency @ 15%	$332,046
Total Construction Cost =	**$2,545,686**
Engineering	$442,728
Legal and Fiscal	$88,546
Borings	$5,000
Permits	$10,000
Subtotal =	$546,274
TOTAL PROJECT COST (Alternate 1) =	**$3,091,960**

Operational costs and expenses have been developed and are presented in the table below. Electrical charges and annual budget information were utilized to develop the annual costs in addition to the determination of the horsepower requirements for the equipment. The annual estimated cost for facility operation is $109,072. The cost for the operator is based on an estimated average 3 hour per day presence. The Saxtons River Village Corporation presently pays a lump sum fee to Bellows Falls for operations. However, the details of the scope are not included in the estimated operations costs. The estimated annual operation and maintenance (O&M) costs presented herein do not include the cost for billing, reports, emergencies, or a capital reserve account. The budgeted capital reserve in 2012-2013 was $39,500.

Table 4-2
Alternative 1
WWTF Upgrade - Existing Oxidation Ditch Process
Operation & Maintenance Cost Summary

Electricity	Hp	Continuous kW	Daily	Annual
Grinder	3	1.6		
Aeration	7.5	4		
Clarifiers	2 @ 2	2		
Mixers	2 @ 1/4	0.2		
RAS Pump	7.5	4		
Sludge Blower	5	2.6		
Totals =	27.5	14.4		
	24/7 @ $0.15/ kWH =		$51.84	$18,922
Operator				
Average 4 hours per day @ $35			$140.00	$51,100
Chemicals				
Current = $3,200.				
Budget for alkalinity adjustment for nitrification.				$6,000.00
Sludge Disposal				
Current budget = $13,500.				$13,500
Miscellaneous				
Phone (Current = $550)				$550
Supplies & Misc. Maintenance Items (Current = $8000)				$4,000
Lab Testing (Current = $1850)				$3,000
Insurance (Current = $5000)				$7,000
Heat				$5,000
				$19,550
			Subtotal =	$109,072
Present Worth of Operation & Maintenance* =				**$1,854,333**

*Federal requirements: i = 1.6%; n = 20 years

NOTE: Estimate does not include Administrative costs for billing, or Funding Capital Reserve Account.

b. Alternative 2 WWTF Upgrade – New Sequencing Batch Reactor (SBR) Process

Because of the temporary treatment requirement during the oxidation ditch process upgrade and the aging facility components in Alternative 1, a second WWTF upgrade alternative was considered. This alternative consists of an influent screening facility, a Sequencing Batch Reactor (SBR) treatment process, and ultraviolet disinfection. The footprint of the SBR facility is small and will not require temporary treatment during construction, two secondary clarifiers or a large chlorine contact tank. The preliminary scope was submitted to ANR DEC Wastewater Management Program for review and granted conceptual approval.

Design Criteria

Alternative 2 consists of the construction of an SBR activated sludge treatment process, a head works facility with screening and flow metering, a ultraviolet (UV) disinfection system, an influent pump station, a generator and other miscellaneous improvements. The treatment process was selected for evaluation due to the ease and simplicity of operation and proven track record for producing a high quality effluent. The process would be located to the west of the existing oxidation ditch.

The scope of Alternative 2 consists of the following:

- The construction of a headworks building which includes an automatic self-cleaning inclined screen, a bypass channel with bar rack, aeration blowers and control room.
- The construction of an influent pump station with valve vault and flow meter.
- A dual tank SBR activated sludge process with aeration blowers, “jet” aeration pumps, automatic decanter and submersible WAS pumps.
- An ultraviolet disinfection system meeting the State requirements.
- A stand-by auxiliary generator for treatment and disinfection.
- New 3-Phase 480 Volt main power.
- Process piping required for the new headworks and treatment system.
- Extend final discharge outfall into main channel of the Saxtons River.
- Chemical feed pumps for the addition of alkalinity to assist with nitrogen removal.
- Miscellaneous improvements to the existing building including heating, electrical, ventilation, and weather proofing.
- Expansion of the aerated sludge holding tanks, aeration system improvements and new tank cover.
- Decommission the ditch, clarifier and chlorine contact tank.

Map

Refer to Appendix F, Exhibit 2 for a General Plan of Upgrade Alternative 2 and Exhibit 2-1 for Hydraulic Profile.

Design Discussion

To provide effective and efficient treatment, the SBR tanks will have a twenty (20) foot side water depth. Due to the apparent height of the groundwater table at the facility and the high cost for sheet piling to construct deep tanks, the recommendation includes the installation of an influent pump station to enable the tanks to be approximately seven (7) feet below grade, which eliminates the need for sheet piles and deep excavation. The influent pump station will be low head, low horsepower (5 hp) submersible pumps. An adjacent valve vault will include an influent mag-meter to measure the influent flow.

The SBR system is a simple automated treatment system which treats the wastewater through a fill, settle, and draw operation. While one tank is filling with influent wastewater, the other is in the settle and discharge mode. The SBR tanks will each be aerated by a small 5 hp blower and small submersible Jet aeration pump, which are off during the settle and draw part of the process. The entire treatment process is controlled via a programmable logic controller (PLC).

The sludge wasting pumps will be submersible pumps as well. With this type of treatment, no clarifiers are required as the clarification is accomplished in each of the SBR tanks.

The discharge of the treated wastewater is drawn or discharged through a decanter which starts out at a discharge rate of about 700 gpm and reduces to approximately 400 gpm. This type of discharge allows for the utilization of a pressurized UV disinfection system, which eliminates the requirement of a large chlorine contact tank. This UV system also eliminates the need for chemical metering pumps for sodium hypochlorite and sodium bi-sulfite.

The SBR process is a proven technology for nitrogen removal and produces a high quality effluent. With this alternative, there is no need for temporary treatment of the wastewater as the existing process can remain in operation during construction.

Opinion of Probable Costs

The total estimated construction cost, including a 15% contingency, is $2,034,534 and the Total Project Cost is $2,474,132. The project cost summary is presented in the table below.

Table 4-3
Alternative 2
WWTF Upgrade – New Sequencing Batch Reactor (SBR) Process
Project Cost Summary

Headworks - Screen, Controls, UV Disinfection and Flow Measuring	
Site Work	$12,000
Concrete	$45,200
Building including HVAC	$85,000
Equipment	$230,000
Miscellaneous	$10,000
Subtotal Headworks =	$382,200
SBR - Tanks, Equipment, Controls, Pumps, Piping and Blowers	
Influent Pump Station	$95,000
Site Work	$24,000
Concrete	$215,800
Equipment	$400,000
Railings	$7,200
Miscellaneous	$10,000
Subtotal SBR =	$752,000
Yard Piping and Miscellaneous Items	
Gravity Sewer and Manholes	$80,000
Extend Final Discharge Outfall	$25,000
Sludge Holding Tank Expansion	$117,000
Control Building Upgrade	$40,600
Generator	$30,000
Miscellaneous	$10,000
Subtotal Yard Piping & Miscellaneous =	$302,600
Electrical and Instrumentation	$282,360
Contractor Mob/Demob	$50,000
Subtotal Construction Cost **=**	$1,769,160
Contingency @ 15%	$265,374
Total Construction Cost =	**$2,034,534**

Engineering	$353,832
Legal and Fiscal	$70,766
Borings	$5,000
Permits	$10,000
Subtotal =	$439,598
TOTAL PROJECT COST (Alternative 2) =	**$2,474,132**

The estimated O&M costs have been developed for this alternative and are estimated to be $104,364 per year. The power consumption is less with this alternative than the oxidation ditch alternative. The O&M costs are presented in the table below. The cost estimate for O&M does not include administrative costs for billing or reporting and a capital reserve account.

Table 4-4
Alternative 2
WWTF Upgrade – New Sequencing Batch Reactor (SBR) Process
Operation & Maintenance Cost Summary

Electricity	Hp	Continuous kW	Daily	Annual
Screen	2	0.1		
Aeration Blower	5	2.1		
Jet Motive Pump	5	2.6		
UV System		1.6		
Sludge Blower	5	2.6		
Influent Pump Station	5	0.6		
Totals =	27.5	9.6		
	24/7 @ $0.15/ kWH =		$34.56	$12,614
Operator				
Average 4 hours per day @ $35			$140.00	$51,100
Chemicals				
Current = $3,200				
Budget for alkalinity adjustment for nitrification				$6,000
Sludge Disposal				
Current budget = $13,500.				$13,500
UV Lamp				
Replacement Lamps (4 total)				$1,600
Miscellaneous				
Phone (Current = $550)				$550
Supplies & Misc. Maintenance Items (Current = $8000)				$4,000
Lab Testing (Current = $1850)				$3,000
Insurance (Current = $5000)				$7,000
Heat				$5,000
				$19,550
			Subtotal =	$104,364
Present Worth of Operation &Maintenance* =				**$1,774,292**

*Federal requirements: i = 1.6%; n = 20 years
NOTE: Does not include administrative costs for billing or funding Capital Reserve Account

c. Alternative 3 Pump Station-Force Main to Bellows Falls

This alternative consists of the elimination and abandonment of the Saxtons River wastewater treatment facility and the construction of a pump station at the facility. The pump station will pump the wastewater through a force main located primarily along the Saxtons River Road (Rte. 121) and ultimately discharge into the Bellows Falls sewage collection system. The approximate length of the force main is 19,000 feet. The proposed route is different than the route proposed in the previous reports. The previous evaluation concluded that the force main would be located entirely within Route 121 corridor and extend a total length of 21,000 feet. Subsequent evaluation reports determined that the 6-inch main collector sewer, installed in the mid-1980s in North Westminster was in adequate in capacity to accept the Saxtons River discharge thereby resulting in a longer force main. The 6-inch main sewer did not meet the minimum slope requirements for a 6-inch sewer. The cost to replace this sewer would be at least twice as much as the cost of a force main.

Design Criteria

The scope of this alternative is presented below:

- Abandonment of the WWTF structures.
- Construction of a new gravity sewer to bypass the oxidation ditch to a pump station wet well.
- Construction of an influent pump station with submersible pumps, valve vault with flow meter and control system. Due to the high potential for failure and overflows of untreated wastewater to the river with pump failures and no back-up, the recommendation is to have a spare third pump on hand.
- Construction of a small building to house the pump station control system, an odor control system and storage of the odor control chemicals.
- New 3-Phase 480 Volt main power for the pump station.
- The installation of a stand-by generator as required by ANR Guidelines.
- The installation of insulated force main piping on the two (2) long highway bridges over the Saxtons River.
- Environmental permitting requirements of the State of Vermont for the entire length of force main and archaeological investigations.
- The installation of double cleanouts and gate valves on the force main as required by ANR Facilities Engineering Division.
- The installation of air release valves as required by design to eliminate air entrapment in high spots of the force main piping.
- Ledge removal as required for adequate bury of the force main.

Map

Refer to Appendix F, Exhibit 3 for a General Plan of Upgrade Alternative 3 Pump Station-Force Main.

Design Discussion

The pump station will consist of an eight (8) foot diameter concrete wet well and a concrete valve vault that includes both gate and check valves, pressure gauges, and a flow meter to meter the flow to the Bellows Falls system. The flow meter will be a Magnetic flow meter type that is in-line with the force main piping.

Due to the head conditions, elevations and the length of the force main piping, the pumps will be 35-40 hp. The pumps are each required to meet the State standard for peak hourly flow, which, based on the design capacity is 265 gallons per minute (gpm). The recommendation is to install two (2) submersible pumps.

Opinion of Probable Costs

A cost estimate has been prepared based on previous projects, equipment selection, and proposals from suppliers. The total estimated construction cost, including a 15% contingency, is $2,678,120 and the Total Estimated Project Cost is $3,317,032.

Table 4-5
Alternative 3
Pump Station- Force Main to Bellows Falls
Project Cost Summary

	Number	Unit	Unit Price	Total
Force Main				
Pipe	19,100	LF	$65	$1,241,500
Gate Valves	20	EA	$1,800	$36,000
Clean-outs	20	EA	$5,500	$110,000
Air Releases	7	EA	$10,000	$70,000
Rock Excavation	1570	CY	$150	$235,500
Pavement Repair	530	SY	$60	$31,800
Bridge Crossings	400	LF	$350	$140,000
			Subtotal Force Main =	$1,864,800
Pump Station				
Site Work				$43,000
Structures, Pumps and Piping				$155,000
Odor Control				$40,000
Generator				$40,000
Miscellaneous				$10,000
			Subtotal Pump Station =	$288,000
Yard Piping and Miscellaneous Items				
Gravity Sewer and Manholes				$44,000
Miscellaneous				$10,000
Subtotal Yard Piping & Misc. =				$54,000
Electrical and Instrumentation				$72,000
Contractor Mod/Demob				$50,000
			Subtotal Construction Cost =	$2,328,800
			Contingency @ 15%	$349,320
			Total Construction Cost =	**$2,678,120**

Engineering	$465,760
Legal and Fiscal	$93,152
Borings and Survey	$30,000
Permits	$50,000
Subtotal Project Costs =	$638,912
TOTAL PROJECT COST (Alternative 3) =	**$3,317,032**

The estimated operation and maintenance cost, based on the present electrical power factors and charges, chemicals for the odor control system, operations, and sludge disposal is estimated to be $62,131. In addition, the cost for the discharge and treatment to the Bellows Falls system, in accordance with the written and executed agreement, is an additional $61,123 the first year. The total cost for O&M for the first year is therefore $123,253. This cost does not include administrative costs for billing or reporting as well as cost for a capital reserve account.

Table 4-6
Alternative 3
Pump Station- Force Main to Bellows Falls
Operation & Maintenance Cost Summary

Electricity	Hp	Continuous kW	Daily	Annual
Pump	40	3.6		
Totals =	40	3.6		
	24/7 @ $0.15/ kWH =		$12.96	$4,730
Operator				
Average 2 hours per day @ $35			$70.00	$25,550
Chemicals				
For odor control				$25,000
Sludge Disposal				
Current budget = $13,500.				$0
Miscellaneous				
Phone - Current = $550				$350
Supplies & Misc. Maintenance Items - Current = $8000				$2,000
Lab Testing - Current =$1850				$500
Insurance - Current = $5000				$3,000
Heat				$1,000
				$6,850
Bellows Falls WWTF Fee				
Rate until July1, 2014 = $0.00329/gallon				
Estimated flow = 50,900 gpd			$167.46	$61,123
			Subtotal =	$123,253
Present Worth of Operation & Maintenance* =				**$2,095,429**

*Federal requirements: i = 1.6%; n = 20 years

NOTE: Estimate does not include Administrative costs for billing, or Funding Capital Reserve Account.

According to the current Inter-Municipal Wastewater Treatment Agreement, the annual cost for the discharge and treatment to Bellows Falls increases by 3 percent every year thereafter. With the first year cost at $61,123 and the annual increase of 3 percent, the cost in 5 years (2019) will be $70,858 or an increase of approximately $9,735.

In addition, this does not include the effect of the added discharge from Saxtons River on the capacity of the Bellows Falls treatment plant due to the recent nitrogen limits imposed by the USEPA and the State of Vermont. Based upon the assigned nitrogen numbers, the present average daily flow of 50,900 gpd and estimating the total nitrogen per day from Saxtons River, the additional flow would use approximately 50 percent of the present reserve capacity at the Bellows Falls WWTF. Also, Saxtons River residents would be responsible for a percentage of the costs associated with future upgrades to the Bellows Falls Wastewater Treatment Facility. An upgrade to that facility can be assumed to occur within the next 20 years.

d. Environmental Impacts

Project Review Sheets were prepared by the Vermont Department of Environmental Conservation and the Natural Resources Board relative to the permits needed for each alternative project (Appendix G, Exhibits 1 and 2).

Flood Hazard Areas

Any proposed facility or structure within a flood hazard area will be protected from the 500-year flood (also known as the 0.2% Annual Chance Flood). Refer to Preliminary Hydraulic Profile Appendix F, Exhibit 2-1 and WWTF Flood Zone Map in Appendix G, Exhibit 3.

Environmental Information Document

Based on the findings reported in the Environmental Information Document for Alternative 2 (Appendix G, Exhibit 4), it is our opinion that the impacts on wetland resources and flood hazard areas will not be significant and that appropriate wetlands and/or stream alteration permits will be authorized.

Archeological Resource Assessment (ARA)

The ARA prepared by Hartgen Archeological Associates, includes a description of archeological and historical resources located within or adjacent to the project area (Alternative 3); historical maps and interpretation of potential historic resources within the project area; observations and photographs of existing conditions to assess present land use and evidence of prior disturbance; and an evaluation of the historic and precontact archeological sensitivity of the project area. Based on the findings of archeological sensitivity, a Phase 1B investigation and construction monitoring is recommended for Alternative 3 (Appendix G, Exhibit 5).

Growth Center Rule

In order to meet the **MUNICIPAL POLLUTION CONTROL PRIORITY SYSTEM RULE** that require *towns to demonstrate that the project will serve designated growth centers and that scattered development will not occur,* the following strategy is designed to insure that the project *will not contribute to scattered development*:

- Alternative 3 includes the proposed sanitary sewer from the site of the Saxtons River WWTF, through No. Westminster and into Bellows Falls (each designated village centers), consists of a 6-inch PVC force main with no individual service connections proposed. No future connection into the force main outside these village centers would be allowed unless evidence of a failed on-site system exists.

- Saxtons River Village Corporation would propose to implement this strategy through rules, ordinances and/or other legally enforceable mechanisms, working together with the Bellows Falls Village Corporation, Town of Rockingham and Town of Westminster if this was the selected alternative.

e. Land Requirements

Temporary construction and permanent land easements across private property would be required for Alternative 3 in order to construct the sewer force main along the cross-county route in No. Westminster.

f. Potential Construction Problems

One of the known issues for the pump station-force main alternative is that ledge would be encountered and would require blasting to allow construction of the force main. Ledge is visible along the route and a quantity was estimated for the cost estimate.

5. Comparison of Alternatives

Of the three (3) alternatives evaluated, Alternative 2, the WWTF new treatment process upgrade, has the least total estimated project cost of $2,474,100. The highest total estimated project cost is for Alternative 1, the oxidation ditch upgrade, at $3,092,000.

The alternative with the lowest annual operation and maintenance cost is Alternative 2, the WWTF upgrade with the SBR process and UV disinfection, with an estimated annual cost of $104,400 and present worth O&M of $1,774,300.

Alternative 3 to construct a pump station and force main, pumping all of the wastewater to the Bellows Falls WWTF for treatment, has a total estimated project cost of $3,317,000.

a. Life Cycle Cost Analysis

For an accurate total cost comparison, both the State and Federal agencies require a total present worth analysis. This comparison includes the total estimated capital cost and converts the annual cost of O&M to a present worth value. The total present worth comparison is presented in the table below. As shown the lowest present worth alternative is the WWTF upgrade with the SBR process.

Table 5-1
Total Present Worth Comparison

Cost Description	Alternative 1 WWTF - OD	Alternative 2 WWTF - SBR	Alternative 3 Pump/Force Main
Total Project Cost	$3,092,000	$2,474,100	$3,317,000
Present Worth O&M Cost	$1,854,300	$1,774,300	$2,095,400
Total Present Worth	**$4,946,300**	**$4,248,400**	**$5,412,400**

Note: Figures rounded to nearest hundred

b. Non-Monetary Factors

There are other factors that should be considered in the comparison as well as cost and these are provided in the table below. These other factors are environmental and economic impacts as well as impacts to the public. Since the previous studies showed that the pump station force main would be the recommended alternative, the study was geared to that end by conducting an archaeological resource assessment (ARA) along the route and preliminary wetlands evaluation and inventory and field walking the alternate route for verification of the practicality of the route.

Table 5-2
Comparison of Alternatives
Environmental and Economic Factors

Criterion	Alternatives		
	I	II	III
Cost-Effectiveness	2	1	3
Meets USEPA and ANR Policy Requirements	2	1	1
Downstream Water Quality-Saxtons River	1	1	1
Land Disturbance	2	1	3
Short Term Public Inconvenience	1	1	3
Adverse Economic Impact	1	1	2
Use of Resources - Power, Fuel	2	1	3
Impacts on Wetlands	1	1	3
Impact on WWTF Performance	1	1	1
Impacts on O & M Costs	2	1	3
Impact on WWTF Reserve Capacity	1	1	2
Implementation of the Alternative	2	1	2
Permit Costs	1	1	3
Short Term Financial Impacts	1	1	2
Long Term Financial Impacts	2	1	3
Maintenance Requirements	2	2	1
Chemical Usage	2	1	3
Aesthetic Considerations	2	3	1
User Fees (Present)	1	1	3
User Fees (Future)	1	1	3
Future Costs @ WWTF upgrades	2	1	3
Constructability	2	1	2
Total	**34**	**25**	**51**

The lowest score is considered the best with the least impact.

6. Proposed Project (Recommended Alternative)

Based on the cost comparison for both capital and life cycle, and environmental factors, the recommended alternative is Alternative 2, the new treatment process.

a. Preliminary Project Design

The recommended alternative is to construct a new treatment process at the Saxtons River WWTF. The selected alternative allows the existing facility to continue to operate during the construction of the new process. The Sequencing Batch Reactor process combined with an automatic influent screen and a pressurized ultraviolet disinfection system is a simple process to operate requiring minimal operator attention.

The wastewater will first enter the headworks building where non-biodegradable materials will be removed, washed and compressed for deposit into a dumpster. A bar rack will be provided in a screen bypass channel for emergency or screen maintenance. The headworks screen requires water for washing down the solid matter. This will require a new well pump at a minimum.

The screened wastewater will enter an 8 foot diameter wet well and be pumped to the process tanks for treatment. The SBR tanks will operate automatically with a PLC system.

The aeration blowers will be located within the dry side of the headworks building along with the electrical switch gear and controls, and the ultraviolet disinfection equipment. The headworks building construction will include energy efficiency and “green” infrastructure.

The final discharge outfall will be extended into the main channel of the Saxtons River.

The existing control building will be upgraded and retrofitted. Improvements will include door replacement, electrical upgrades, mechanical ventilation and heating system, reroofing and other energy and weather related improvements.

The sludge storage tank system will be improved with the addition of another cell, new roof and cover, and aeration system.

b. Project Schedule

The project schedule is to first finalize the PER Amendment and submit to the Vermont ANR DEC for review and approval. An income survey is recommended and should be conducted as soon as possible. The income survey should assist the Village in obtaining grant funding for the project if USDA funding is requested.

Once the Amended PER has been approved by the Agencies, the preliminary and final design process should begin. The first step is to submit a request to ANR for an amendment to the Planning Loan and then prepare a Basis for Final Design for approval by ANR for permitting and proceeding with design. A schedule for implementation is included below.

c. Permit Requirements

With the Basis for Final Design approved, the design phase can proceed and the applicable permit applications prepared.

d. Sustainability Considerations

The system will meet the water and energy efficiency guidelines and the new building will meet "green infrastructure" guidelines. The system capacity can remain at 105,000 gpd.

e. Total Project Cost Estimate (Engineer's Opinion of Probable Costs)

The total estimated project cost is $ 2,474,100.

f. Annual Operating Budget

The annual estimated operating costs for the selected alternative is $104,400 with an additional $31,000 for billings and administration, and a set aside for capital reserve. The actual amount for the capital reserve will be developed and agreed to by the funding agency.

g. Implementation Schedule

Table 6-1
Implementation Schedule

PER Documents Completion	15-May-14
FED Step II Loan Amendment[1]	1-Jul-14
FED Step I Project Approval[1]	7-Jul-14
Saxtons River Bond Vote	1-Aug-14
Submit Basis of Final Design[2]	15-Aug-14
FED Step II Loan Approval[1]	31-Aug-14
Engineering Final Design Starts	1-Sep-14
Basis of Final Design Approval[2]	1-Oct-14
30% Design Completion & Submittal[1,2]	1-Nov-14
60% Design Completion & Submittal[1,2]	1-Jan-15
90% Design Completion & Submittal[1,2]	15-Mar-15
Permit Applications Submittal	15-Mar-15
Step III Loan Application[3]	1-Apr-15
Final Documents Submittal[1,2]	15-May-15
FED Step II Project Approval[1,2]	15-Jun-15
Step III Loan Approval[3]	15-Jun-15
Advertise for Bids	30-Jun-15
Anticipated Construction Start	1-Sep-15
Anticipated Construction End	1-Sep-16
Post Construction (9 month)	1-Jun-17

[1] Submit to and reviewed by VT Facilities Engineering Division
[2] Submit to and reviewed by VT WMD Wastewater Management Program
[3] Submit to and reviewed by Construction Funding Agency (FED or USDA)

7. Conclusions and Recommendations

The conclusion from the evaluation set forth in this report is that the least expensive alternative is to construct and operate the new treatment system. It is the recommendation that the Village proceed with implementation of the recommended alternative.

Responses to FED review comments related to this PER Amendment have been incorporated into this final document and also included in Appendix H.