2015 SRF Project Plan
Village of Vermontville Wastewater System
Vermontville, Eaton County, Michigan
SECTIONS 20, 21 and 28 T3N, R6W

Prepared for:

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I - PROJECT BACKGROUND

A. Study Area Characteristics

1. Delineation of the Study Area -The area to be studied is located within the Village of Vermontville whose limits are shown on Figure 1 located in Appendix A. Vermontville, a small HUD low to moderate income village, is located in sections 20, 21 and 28, T3N, R6W, in western Eaton County approximately 3.5 miles north east of the Village of Nashville and 13 miles northwest of Charlotte. The Village of Vermontville covers 1.2 square miles and is located approximately 30 miles west of Lansing in the northeastern quadrant of Eaton County. The village is centrally located in Vermontville Township. The Village of Vermontville was incorporated in 1867. The Village has an estimated population of 793, based on an interpolation of 2010 Census data.

   The Village of Vermontville is a rural community located between the Grand Rapids, Battle Creek and Kalamazoo metropolitan areas. The Village is known for its annual Maple Syrup Festival which draws an estimated 30,000 people to the Village the last weekend in April. Vermontville offers a relaxed atmosphere, a safe quality of life and good public schools. Most of the Village's residents commute to employment centers located outside of the Village for employment. The Village contains typical goods and services businesses including hardware, banking, restaurant/food service, bar, pharmacy, gasoline service and retail food.

2. Land Use in the Study Area – The Village is located southwest of the City of Lansing, North of Battle Creek, and southeast Grand Rapids, along the western border of Eaton County. The total land area of the Village of Vermontville is approximately 713 acres or just over one square mile in area. Surrounding the Village of Vermontville is Vermontville Township, with a total of 2,100 residents. Vermontville Township is approximately 35 square miles or 22,439 acres in area.

   For the purposes of this study, land uses within the Village have been consolidated into the following categories:

   i) Agricultural: Land that is, or has recently been, primarily used for the raising of various crops, orchards, and typical farm animals. This category is typically a commercial farm that raises cash crops or pasture for farm animals.

   ii) Single Family Residential: Land that is used primarily for one family on one parcel of land.

   iii) Multi-Family Residential: Land that is used to house two or more families. These homes may have been originally intended for one family, but have since been divided into separate apartment units. This land use may also include apartment buildings.

   iv) Parks/Schools/Institutional: Land that includes parks, playgrounds, schools, churches, cemeteries, and publicly owned buildings (fire station, village offices, etc.). No dwelling units are present on this category.

   v) Commercial: Land used for the sale of goods or services. This category may include gas stations, retail shops, auto repair and sales, restaurants, self-storage and specialty type businesses.

   vi) Vacant: Land not used for any other category and does not have any developed use. This may include forested land, open land, wetlands, fallow fields, or vacant lots.

   vii) Industrial: Land used for production, storage, manufacturing, or assembly purposes.

This may include developed uses such as factories, warehouses and other heavy production business. This use does not typically allow for direct sales on the premises.

The above land uses are shown in the Village of Vermontville 2001 Land Use Map (see Figure 2). This map has not been updated since 2001, however, it should be noted that there has not been any significant changes to land uses with the Village since 2001. Figure 3 shows the existing zoning within the Village.

Future Master Plan: The Village has identified the following list of possible long-term activities to address the identified needs of the community as listed in the community's Master Plan:

Economic Development – Land uses will be balanced to achieve an environment that enhances and strengthens local businesses and a diverse tax base.

a. Identify industrial uses that are compatible with the public sewer and lagoon system.

b. Identify sites in the Village that are suitable for new industrial sites.

c. Develop a "Central Business District – CBD" plan that offers new solutions to the parking problems within the Village and enhances economic opportunity to local businesses.

d. Purchase or develop property in the Village to create more parking in the commercial center.

e. Create an ordinance that regulates multi-family housing units and determines the areas in which they are allowed.

Historical Preservation – The Village of Vermontville will be a community that offers a unique historical experience through the encouragement of maintenance and restoration of historically significant buildings and landmarks.

a. Identify historical structures, landmarks and other features that are historically significant in the community.

b. Develop a Village Historical District that encourages the preservation of historical community features.

Natural Features, Open Space and Recreation – Complementing the community's rural character, the Village will offer a network of natural areas developed in cooperation with the private sector and area institutions. Development in environmentally sensitive areas will be discouraged. The creation or expansion of recreational pathways or trails will be a priority.

a. Identify and map existing and potential trail systems.

b. Identify significant woodlots, wetlands, and other environmentally sensitive areas not suitable for development.

c. Develop a combined recreation plan for the Township and Village.

Residential Development – The Village will encourage attractive and creative neighborhood forms for a diverse population, which will provide efficient and aesthetic use of land while enhancing the rural character of the Village.

a. Develop site plan and land division standards that require all development be carefully and thoughtfully located with respect to natural features, suitability of

soils for on-site utility systems or availability of public water and sewer.

b. Identify potential locations for a manufactured home community.

Utilities, Infrastructure and Other Public Services – Public facilities, including utilities and roadways, will be located to complement the Village's Land Use Plan and designed to serve the public safely while conserving the community natural resources.

a. New utilities, facilities, and infrastructure will effectively guide and direct growth in the Vermontville Community. The Village does not have the financial resources to invest in Utilities and Infrastructure, so it is anticipated that new utilities and infrastructure will be developer driven and financed.

Rural Character Preservation – The rural character of the community will be preserved by protecting significant open lands, important transportation corridors, scenic views, road side trees, other natural vegetation, and rural night sky conditions.

a. Establish zoning standards that create buffers between intense and non-intense land uses.

b. Create site plan standards that require a lighting plan to be submitted, ensuring preservation of night sky conditions.

c. Create a tree ordinance that encourages minimal loss of natural vegetation with an emphasis on productive maple trees.

d. Identify and map scenic views and corridors.

Outside of the Village, within Vermontville Township, the land use is primarily agricultural, with accompanying single family residents. The residential areas are typically on larger lots with no high-density development generally located along the main county roads. The few existing commercial/industrial land uses are not centralized in any one particular location. Within the 20 year planning period, land use changes are not expected to significantly impact the use or flows to the Village sewer system. The Master Plan has an emphasis on protection and preservation of existing land uses, and enhancement and development of recreational areas. Over the last forty years, the population of the Village has decreased, and is projected to stabilize. With an emphasis on preservation and protection, and no population growth projected, no significant development or land use changes are anticipated for the Village within the planning period.

3. Surface and Ground Waters – The dominant hydrologic feature in the Vermontville area is the Thornapple River and its tributary streams. The Thornapple River is located approximately 1,000 feet south of the Village Limits and generally flows from East to West. Within the Village, there are a few un-named tributaries to the Thornapple River. The Surface and Groundwater map (Figure 3) shows the location of the Thornapple River and its unnamed tributaries. The existing wastewater treatment facility discharges to an unnamed tributary located just east of the treatment cells.

   The primary use of the groundwater within the Village is as the source of public water supply. The Village water system is supplied from four groundwater production wells. These wells are protected through a Wellhead Protection plan, which was approved in 2007. In their 2007 approval letter, the MDEQ concluded the following: "The municipal wells are completed in a glacial till sand and gravel aquifer. All four production wells are completed in an aquifer described as "leaky-confined", with modest protection provided to the aquifer by the overlying drift lithology (clay), and depths of the wells (128 to 180

feet). Accordingly, the aquifer in which these wells are completed should be considered as having a moderate geological sensitivity." It should be noted that the northwesterly portion of the wastewater stabilization lagoon is within the 10-year capture zone of the production wells.

B. Economic Characteristics

According to the 2010 U.S. Census, the Village of Vermontville had a Median Household Income (MHI) of $36,607 with 8.7% of the people below the poverty level. In comparison, Vermontville Township had a MHI of $49,423 and Eaton County and the State of Michigan had a MHI of $54,170 and $48,669, respectively. The Township and the Village of Vermontville were lower than the County median household earnings, but the Township surpassed the State median.

The Village MHI is nearly $18,000 less than the MHI for Eaton County, and less than the MHI for Vermontville Township. Based on Census records, the unemployment rate within the Village is higher than the unemployment rate in surrounding areas, which is a likely cause of the income gap. A larger percentage of unemployed residents in the Village will have a significant impact on median income.

A historical review of the per capita income for the Village, County, and State shows that the Village per capita income is consistently lower than the Township and County. The increase between 2000 and 2010 is significantly less that then the increases at the Township and County level.

Table 1 – Per Capita Income Comparison

Community	1990	2000	2010
Village of Vermontville	$9,790	$17,582	$17,866
Eaton County	$17,905	$22,411	$26,296
State of Michigan	$14,154	$22,168	$25,482

The unemployment rate of the Township, which includes the Village, has been cyclical since 2005 and reflects the economic hardships that have hit the entire country. Since 2005 the unemployment rate in Vermontville Township, Michigan has ranged from 4.3% in October 2006 to 11.2% in July 2009. The current unemployment rate for Vermontville Township is 6.3% in March 2013. Since 2005 the unemployment rate for the State of Michigan ranged from 6.7% in July of 2005 to 14.2% in August of 2009. The current unemployment rate for Michigan is 8.5%.

The economic trends within the Village do not indicate that any significant economic development is likely to impact sewer flows or usage within the Village.

C. Existing Wastewater Treatment Facilities

The Village of Vermontville has a municipal sewer collection system and wastewater treatment facility that was constructed in 1972. The collection system consists of gravity sewers, and three lift stations with force mains, which collect wastewater and pump it to a treatment system. The treatment system contains two oxidation lagoons followed by four infiltration basins. The system has been operating with few modifications or expansions throughout its history. Figure 5 shows a site map of the existing treatment facility, and Figure 6 contains a process flow diagram of the existing wastewater

treatment process.

1. Description of the treatment processes - The existing wastewater from the village is collected and transported to the treatment facility from one main pump station, Lift Station No. 3. From Lift Station No. 3, the wastewater is pumped to two oxidation ponds (facultative lagoons) where, according to the operation manual, flow can be directed through the ponds in either series or parallel operation. Treated effluent is then transferred to 4 different seepage basins for ultimate disposal. Oxidation pond #1 discharges to seepage basins 1 & 2 and Oxidation pond #2 discharges to seepage basins 3 & 4. It should be noted that if the ponds are operated in series, there is no way to direct treated discharge to seepage basins 1 and 2 due to the existing piping and control structure configuration. Each of the seepage basins contains overflow pipes to direct effluent from one cell to the other and ultimately to the adjacent unnamed tributary to the Thornapple River.

2. Age and condition of the treatment facilities - The wastewater collection and treatment system was constructed in 1972 and only minor maintenance on the main components has been done over the last 40 years. The original transfer piping and transfer structures were constructed of corrugated metal pipe, and show signs of deterioration and are nearing their ultimate design life. Two of the transfer manholes have been replaced by Village Staff due to deterioration. The seepage basins continue to function as designed using the flood irrigation technique. There have been no substantial changes to the seepage basins other than the cutting of vegetation. In accordance with MDEQ permit requirements, a V-notch overflow weir was added to seepage basin number 4 in order to quantify the amount of direct discharge to the adjacent creek.

   Based on an inspection of the treatment facilities, and discussions with the operator, the following issues with the treatment facilities have been identified.

   - Currently the transfer pipe between ponds 1 and 2 that runs through manhole A is not operable. This prevents the oxidation ponds from operating in series. The operation of the ponds in parallel limits the detention time within the wastewater system. Presently the operator never discharges from the same pond that is being filled.
   - Due to high ground water levels in Seepage Basin 4, no effluent is sent directly to this basin.
   - The existing control valve stations are galvanized, are in poor condition and can no longer be repaired. Concrete valve stations should replace these structures.
   - Current measurement methods and techniques (manual reading of a measuring staff gauge within an adjacent structure) for discharge from the lagoons to the seepage beds is labor intensive and has the potential to provide inaccurate readings.
   - The existing fencing at the lagoons has deteriorated and needs to be replaced.
   - Access roads around the ponds are deteriorated and need some maintenance (filling and grading).
   - According to the service company hired by the Village to calibrate the existing magnetic flow meter that monitors inflow to the lagoons, the meter is outdated and is becoming unserviceable.

3. Sludge Evaluation – The original design of the oxidation ponds allowed for 2.5 feet of sludge storage at the bottom of each pond. The Village has never accepted septage or other

industrial waste into the treatment system. Village DPW personnel have measured the sludge storage volume two times in the last 10 years, as shown in Table 2.

Table 2 – Sludge Levels in Oxidation Ponds

Year	Average Sludge Level Oxidation Pond 1 (inches)	Average Sludge Level Oxidation Pond 2 (inches)
2003	8.8	3.6
2010	9.6	8.8

Sludge depths are within reasonable levels, and no sludge disposal is anticipated within the 20 year planning period. Village DPW personnel will continue to monitor levels of sludge and as such time that the levels approach 75% of the designated storage depth, a program will be developed for sludge removal. This will require contracting with company that specializes in this type of work. The scope of work will include dewatering of the lagoons to the extent possible, and removal of sludge. The selected contractor will be responsible for obtaining permits and disposing of the sludge in accordance with applicable environmental regulations. Sludge depths are still within reasonable levels and will continue to be monitored.

4. Design Capacity of the Treatment System:
   As documented in the Operation and Maintenance Manual for the facility, the treatment facility was designed for 1,000 population equivalents at a rate of 100 gallons per capita per day for a design average (DAF) flow of 100,000 gallons per day. The population of the Village is 793, and the population is not anticipated to grow beyond the design capacity of the wastewater treatment system within the 20 year planning period. The oxidation ponds are designed for 180 days of storage volume at design flow, when operated in series. An as constructed survey has been done for the lagoon facility and the as-constructed volumes have been calculated. The estimated working volumes for Pond 1 and Pond 2 are 9.49 and 8.34 million gallons respectively, which allows for 178 days of storage when operated at the design flow rate. .

   Actual flow data to the lagoons was evaluated for the years 2009, 2010, 2011 and 2012. Table 3 summarizes the total influent flow to the lagoons based on the totalizing flow meter reading from lift station number 3.

Table 3 – Annual Inflow to Lagoons

Year	**Total Inflow to Lagoons (million gallons)**
2009	33.39
2010	28.66
2011	33.41
2012	29.10
Average =	**31.14**

Average inflow during this period was 31.14 million gallons per year which is equivalent to an average daily flow (ADF) of 85,315 gallons per day (gpd). The total estimated

population equivalent for this time period is 876 for an average daily flow of 97 gallons per capita per day (gpcd). For design purposes, the assumed value of 100 gpcd appears to be a reasonable assumption.

5. Water Budget Analysis -
The wastewater facility was designed with an 8" clay liner on the base of the oxidation ponds, and a 12" clay liner on the sidewalls of the ponds. In order to determine the reliability of the clay liner in the oxidation ponds, a detailed water budget analysis was conducted for the time period from April 1, 2012 to March 31st, 2013. This time period was selected because a program was developed to accurately measure levels in the lagoons throughout the time period and not just when discharging. The method used for the water budget analysis is based on "General Guidelines for Calculating a Water Budget, Land and Water Management Division, March 2010". The complete water budget analysis is contained in Appendix C and lists all inputs and outputs. Table 4 provides a summary of the water budget analysis.

Table 4 – Water Budget Analysis Summary

Month	Total Inflow (gal)	Total Outflow (gal)	Calculated Change In Storage (gal)	Actual Change In Storage (gal)
April-12	3,011,146	5,914,703	(2,903,557)	(5,061,000)
May-12	3,288,639	7,124,201	(3,835,562)	(3,309,000)
June-12	1,869,962	4,580,888	(2,710,926)	(3,323,000)
July-12	1,808,576	2,315,392	(506,816)	(1,205,000)
August-12	2,012,548	2,965,645	(953,096)	(146,000)
September-12	1,838,614	3,230,992	(1,392,379)	(2,295,000)
October-12	2,703,886	536,373	2,167,513	2,313,000
November-12	1,397,911	-	1,397,911	841,000
December-12	1,899,612	-	1,899,612	1,518,000
January-13	2,989,102	-	2,989,102	2,852,000
February-13	2,600,949	-	2,600,949	2,273,000
March-13	2,900,654	-	2,900,654	2,160,000
Totals	**28,321,598**	**26,668,193**	**1,653,404**	**(3,382,000)**

The results of the water budget indicated that there is a 17.8% difference between the calculated water balance and the actual measured values. This would indicate that

there is a withdrawal of water somewhere in the system, or that the flow meter readings are inaccurate.

Further analysis was conducted to eliminate possible locations of leaking that may be responsible for the lost water as calculated in the water budget. One possible source of lost water is the force-main from lift station no. 3. A limited dye evaluation of lift station number 3 was done to see if there is any direct connection to a nearby stream, but no dye was detected in the stream.

The results of the hydrogeological study conducted at the treatment site were also examined to determine if there is any indication of leakage from the lagoon clay seal. The hydrogeological study did not show indications that wastewater has had a negative impact on the groundwater down-gradient of the facility. Item 7 below describes the hydrogeological study and results from the study completed.

6. Wastewater characteristics - The Village of Vermontville consists of small commercial development, residential development, and one small industrial user. The industrial user is not a heavy water user, and water meter flow data indicate that their water usage is equivalent to 2.6 population equivalents, which is just slightly more than a normal residential home. The commercial development is typical of a small downtown area: a few restaurants, post office, bank, hardware store, etc. No significant water users were identified. The wastewater into the facility can be classified as normal domestic wastewater of normal to weak strength. The majority of wastewater is from residential use and is of normal to weak strength. Table 5 lists anticipated influent parameters based on typical book values as established by Ten State Standards.

Table 5 – Anticipated Influent Parameters

Parameter	Concentration
$CBOD_5$	205 mg/l
TSS	240 mg/l
TKN	30 mg/l
Ammonia Nitrogen	25 mg/l
Phosphorus	6 mg/l

To confirm whether these values are reasonable for this facility, samples were collected and data analyzed at the Pond Influent structure, and at each of the outlet structures prior to discharge to the seepage beds. This provides us with a “snapshot” of how the lagoons are performing at the time of sampling. In accordance with the current discharge permit, testing is performed at the weir box, so there is a large quantity of data for this location. The results of the snapshot sampling are summarized in Table 6.

Table 6 – Snapshot Sample Summary

Date	Description	$CBOD_5$	TSS	NH_3	P	Fecal Coliform	pH	D.O.
3/31/2011	Pond Influent		64	15	2.81		7.80	
3/31/2011	Pond 1		21	14.9	3.5		7.80	
3/31/2011	Pond 2		22	15.7	3.81		7.70	
8/2/2012	Pond Influent	183	65	60	4.05	> 240	8.46	0.27
8/2/2012	Discharge from Structure C - Pond 2	7.31	14.8	1.94	1.58	28	9.30	6.16
8/16/2012	Discharge from Structure B - Pond 1	0.49	60	0.108	3.01	> 240	9.58	6.73
4/25/2013	Pond Influent	79	79	5.8	1.97	>240	7.72	6.06
4/25/2013	Discharge from Structure B - Pond 1	N/A	34	7.08	2.84	2600	8.61	12.98

The snapshot sample summary shows that the influent to the treatment plant is actually weaker than typical domestic wastewater. The snapshot summary also shows a 96% reduction in BOD from the influent to the discharge from structure C located at the discharge of Pond 2.

7. Hydrogeological Study - A hydrogeological investigation was undertaken in accordance "Work Plan – Hydrogeological Study: Phase I, Village of Vermontville Treatment facility", prepared by Paradigm Design July 18, 2012. The purpose of the hydrogeological study was to determine whether the existing treatment facility discharges to the groundwater, and if so, what are the implications of the groundwater discharge on required permits in accordance with State of Michigan regulatory requirements.

   To summarize, the hydrogeological study plan called for the installation of 4 observation/monitoring wells, measurement of static water levels and groundwater sampling. Monitoring wells 3 and 4 were proposed as a nested well system in order to determine if there is an upward gradient into the unnamed tributary east of the treatment facility. It should be noted that monitoring well number 4 was not installed. The well drillers advanced a drill hole to a depth of 60 feet, but did not hit an aquitard besides the stratum that Monitoring well 3 was finished in. Based on discussions with MDEQ district staff, it was decided not to install MW-4. Well logs for monitoring wells 1 through 3 and the bore hole for 4 are contained in Appendix E. Appendix E also includes sampling reports for the 3 events that have been sampled at the time of the writing of this report. A summary of the monitoring well data is provided in Table 7.

Table 7 – Summary of Monitoring Well Data

	Well Number	Groundwater Elevation, ft	Dissolved Oxygen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	Nitrite Oxygen (mg/L)	Total Phosphorus (mg/L)	pH pH Units	Dissolved Sodium (mg/L)	Chloride (mg/L)
First Event (January 29, 2013)	MW-1	882.67	1.82	0.1	1.8	0.063	<0.0100	7.4	7.9	8.6
	MW-2	870.25	2.96	0.24	<0.050	<0.050	<0.0100	7.1	14	41
	MW-3	834.40	6.56	0.055	<0.050	<0.050	<0.0100	7.1	29	68
Second Event (March 20, 2013)	MW-1	886.06	3.30	<0.050	3.8	<0.050	0.0164	7.7	5.5	17
	MW-2	873.81	2.50	0.24	1.6	0.13	0.0163	10.7	55	15
	MW-3	834.67	1.18	0.081	<0.050	<0.050	0.0124	7.4	29	79
Third Event (April 23, 2013)	MW-1	891.69	2.01	<0.050	5.1	<0.050	0.0148	7.4	4.7	18
	MW-2	876.72	4.19	0.35	0.14	0.13	0.0129	11.4	53	6.2
	MW-3	835.07	2.46	0.075	<0.050	<0.050	0.0106	7.2	36	88

The static water levels for the 3 wells were triangulated to determine the direction of groundwater flow. Figure 8 shows the location of the monitoring wells and the direction of groundwater flow from the treatment site. In the case of all three sampling events, the direction of flow is from the northwest to the southeast which makes sense relative to the unnamed tributary to the east which flows from north to south. It is interesting to note that the static water level in MW-1 went from 882.67 in January of 2013 to 891.69 (9.02' rise) in April 2013. MW-2 went from 870.25 to 876.72 (6.47' rise) over the same time period. MW-3 stayed relatively consistent between 834.40 and 835.07. The water level in the unnamed tributary directly adjacent to MW-3 was measured at 835.13 on 2/28/2013. This would indicate that the static level of MW-3 reflects the level in the unnamed tributary and that the groundwater is most likely venting to the stream.

Reviewing the analytical data indicates elevated levels of nitrates in MW-1 and MW-2 which would most likely due to the application of fertilizers on the farm field located due north of the subject site. MW-1 consistently showed higher levels of nitrates. MW-3 consistently had nitrate levels below detection levels indicating that wastewater is not migrating off site, at least in the vicinity MW-3. The other observation is the pH level in MW-2 was elevated (basic) for the March 20th and April 23rd sampling events. This could be explained if the farm to the north applied lime to their fields.

D. Existing Wastewater Collection System

A map illustrating the current sanitary sewer collection system is included in Appendix A. The existing system includes the following major components and approximate quantities: 25,900 lineal feet of 8 inch collector sewer; 5,000 lineal feet (total) of 4" and 6" sanitary sewer force main; 3 lift stations; and 2,020 lineal feet of 2" diameter pressure sewer which serves 7 parcels with individual grinder pump stations. Almost all of the existing gravity sewer piping is asbestos cement. There are no combined sewer or equalization basins within the collection system.

A majority of the existing sanitary sewer system was installed in 1972 (42 years old), approximately 24,800 lineal feet of which is asbestos cement pipe. There have been two sanitary sewer extensions since 1972: 1) North Sherman Street, approximately 650 lineal feet of 8" sanitary sewer installed in 1986 (25 years old) ; and 2) the Allegan Road Sewer Extension, approximately 2,020 lineal feet of 2 inch pressure sewer installed in 1998 (13 years old). All of the sanitary sewers in are in good condition and only require normal maintenance. There have only been a couple of sewer line breaks in the last 22 years.

As indicated above, there are three lift stations with the collection system. All three were installed in 1972 (42 years old). The capacities and characteristics of the lift stations are described below:

Lift Station No. 1:

Pneumatic ejector manufactured by USEMCO.
Duplex pumping station with each pump rated 50 gpm at 41' of TDH.
5 horsepower motors running at 1,750 rpm
2 – Compressors rated at 32.08 CFM, 20.57 psi, at 810 rpm

Lift Station No. 2

Duplex pumping station manufactured by USEMCO
Original Pump basis of design had each pump rated for 200 gpm at 67' of TDH
Current Pumps: 12 HP ABS, 230 volt, 3 phase, 1750 RPM

Lift Station No. 3

Duplex pumping station manufactured by USEMCO
Original Pump basis of design had each pump rated for 250 gpm at 109' of TDH
Current Pumps: 28.2 HP ABS, 230 volt, 3 phase, 1750 RPM
Based on flow meter in the station, current pump rate is 210 gpm.

1. Sewer System Evaluation and Survey (SSES) - A preliminary Infiltration/Inflow analysis was completed as part of the S2 Grant application. As part of the preliminary analysis, wastewater flow data was collected and evaluated for the period of November 1, 2006 to October 31, 2011 (see Appendix C). Inflow data is based on flow meter data from Lift Station Number 3 which collects wastewater from the entire collection system and conveys it directly to the oxidation ponds. The flow data was reviewed and analyzed to determine if there is was an indication of excessive infiltration or inflow. The preliminary analysis indicated that the system was receiving excessive infiltration and/or inflow. Based on that, in the fall of 2012 and the spring of 2013 the Village conducted an Infiltration and Inflow (I&I) analysis in an effort to identify the sources of inflow and infiltration and to evaluate the costs effectiveness of their elimination. The program included placing flow meters in 4 different manholes throughout the collection system to evaluate variability of flows from different parts of the Village.

   Based on this I&I evaluation, it was recommended that a Sewer System Evaluation and Survey (SSES) be conducted in an effort to identify sources for inflow and develop a program to remove extraneous water from the system. Based on the flow monitoring, data evaluations and inspections completed as a part of the SSES, Paradigm Design has concluded that the existing collection system is in relatively good condition for its age but does experience excessive inflow into the system which is likely due to clear water connections to the sanitary sewer system. Due to the volume of information in the SSES study, this information is contained in a separate document titled "2013 Sanitary Sewer Evaluation Survey. Village of Vermontville Wastewater System, Vermontville, Eaton County, Michigan." a copy of which is available on request. Following is a copy of the Executive Summary of that report:

   The Village of Vermontville hired Paradigm Design, Inc. to prepare this Sanitary Sewer System Evaluation (SSES) as a result of an S2 Grant Application to the State of Michigan to help fund the preparation of a SRF Project plan for upcoming Sanitary Sewer Upgrades to the existing lagoons. The I&I Analysis completed as a part of the S2 Grant Application indicated that Infiltration into the system was not excessive (less than 120 gpcd) but that inflow into the system was excessive (greater than 275 gpcd). Based on the fact that inflow was considered excessive, an SSES was recommended.

The Village of Vermontville's sewer system is an aging system. Most of the system was constructed in 1972 (42 years old). The major elements completed as a part of the SSES to evaluate the sanitary sewer system included:

- Additional Flow Monitoring to supplement flow data collected during the Infiltration & Inflow (I&I) study.
- Inspection of 15 Sanitary Sewer Manholes (approximately 20% of the sewer collection system manholes)
- Closed Circuit Televising (CCTV) of approximately 5,400 feet of sanitary sewer (Approximately 20% of the gravity sewer in the sewer collection system).
- Door to Door Inspections to estimate the number of clear water connections to the sanitary sewer.

Additional flow data was collected in the fall of 2013 from September 10, 2013 to September to October 9, 2013 utilizing Marsh-McBirney FLO-DAR Sensor and Hach Flow Loggers at various points within the collection system. The existing and supplemental flow monitoring data was analyzed to determine representative dry-weather and wet-weather flows which was used to evaluate infiltration and inflow. Dry weather flows are evaluated to characterize the system infiltration while wet weather flows were evaluated to characterize the system inflow. Dry weather flow is comprised of two parts, base sewage flow and ground water infiltration (GWI) entering the collection system through cracked pipes, leaky joints/connections, and defective manholes. Wet weather flow is comprised of the base sewage flow, ground water infiltration (GWI), and rain dependent inflow/infiltration (RDII) entering the collection system through cracked sewer pipes, leaky sewer joints, defective manholes, and other more direct sources such as leaky manhole lids, and illicit connections including catch basins, roof and yard drains, and foundation drains. The data collected indicates that the Village of Vermontville's sanitary sewer collection system has excessive inflows but does not have excessive infiltration.

Inspections were completed on 15 of the 77 system manholes (approximately 20%) from ground level on September 17, 2013 without confined space entry utilizing an IBAK Panoramo 3D scanner. All inspections were performed by NASSCO Certified MACP Inspectors. Observations and measurements included invert depths, pipe location and materials, wall construction and condition, lid and frame type and condition, infiltration through manhole walls and connections. The inspections found the manholes, for their age, to be in good structural condition with limited cracking of the manhole walls, missing brick or significant mortar deterioration.

Internal inspection of the Village's existing sanitary sewer system by closed-circuit television (CCTV) was completed by Plummer's Environmental Services LLC from September 7, 2013 to September 9, 2013, during which approximately 5,400 lineal feet, approximately 20%, of sanitary sewer was televised. For the age of the system, the piping was in good condition with limited defects. Observed defects included a pipe break, defective taps, encrustation and scale indicative of infiltration, settled deposits, a few signs of infiltration, obstructions, line deviations, etc. Table 8 below identifies the defects that should be addressed:

Table 8 – Defects Identified during CCTV Inspections

CCTV Set Up #	Street	Location	Remarks
2 - MH16 to MH15	Spring St	267' from MH16	Pipe repair – Prior to any resurfacing on Spring Street replace section of pipe.
3/4 – MH15 to MH14	Spring St	74' from MH15	Intruding lateral (1.75")
7/8 – MH21 to MH20	First St	5' and 18' from MH20	Debris in line
9/10 – MH62 to MH21	East Side	154' from MH62	Intruding lateral (2")
15 – MH17 to MH15	First St	459' from MH17	Piece of Cast Iron sewer - Prior to any resurfacing on Spring Street replace section of pipe.
18/19 – MH2 to MH3	W. Forest	131' from MH2	Debris in line
20 – MH47 to MH46	Third St	200' from MH46	Grease in line preventing televising
22/23 – MH45 to MH13	Third St	44' from MH45	Intruding lateral (5")

Staff from Paradigm Design, Inc. went door to door in several areas throughout the Village looking for possible clear water connections to the sanitary sewer system. The Village has 333 homes/businesses connected to the sanitary sewer system. A total of 258 homes/businesses were visited. We were allowed entry into 106, refused entry into 9 and no one was available at 143. Of the 106 homes/businesses, 25 had a clear water connection to the sanitary sewer. The remaining 81 did not appear to have any clear water connections to the sanitary sewer. Depending on the area of the Village, the door to door survey results indicate that approximately 25-50% of the homes in the Village have a sump pump connection to the sanitary sewer system.

Based on the flow monitoring, data evaluations and inspections completed, Paradigm Design has concluded that the existing collection system is in relatively good condition for its age but does experience excessive inflow into the system which is likely due to clear water connections to the sanitary sewer system.

2. SSES Cost Effective Analysis - A cost effective analysis was completed to determine which sources of excessive I&I can be removed economically from the sanitary sewer collection system. The costs to transport and treat the excessive flows were compared to costs of rehabilitating the system for each I&I source identified. Costs used in this analysis were developed using a 20 year planning period and an interest rate of 4.625%. All costs are presented in Present Worth Dollars.

From the SSES data collected, inspections and analysis, four (4) sources of I&I were identified including Manhole covers vent, sump pump connections, protruding private services and infiltration at private service connections to the sewer main. Table 9 below identifies the assumed flows and rehabilitation costs for each in the analysis.

Table 9 – Flow & Cost Assumptions

Inflow/Infiltration Flow Assumptions by Defect				
Type of Defect	Criteria	Infiltration (gpm)	Inflow (gpm)	Notes
Manhole Cover Vents	Per hole	0	1.5	
Sump Pump Connections		0	33*	*Assume 1/3 hp sump pump, 10' head, 200 gph capacity
Protruding Service Lateral at Main		0.375	0.3	
Infiltration at Service Connection to Main	Dripper	0.5	0	
Rehabilitation Costs by Defect				
Type of Defect	Unit	Cost		Notes
Replace vented cover with solid cover	Each	$500.00		
Sump Pump Connections	Each	$50.00**		**Cost to notify resident of ordinance violation and follow up on disconnection
Protruding Service Lateral at Main	Each	$550.00***		Work will be completed by trenchless methods
Infiltration at Service Connection to Main - dripper	Each	$5000.00		

Transport and treat costs were developed from current operation costs and the difference in construction costs with and without I&I removal. The cost per 1000 gallons for infiltration was $5.76 and $220.91 for inflow. Derivation of these costs are included in Appendix H.

An annual cost comparison was developed by comparing the cost for continued transport and treat of the excessive I&I versus the rehabilitation cost to remove the I&I source. A ratio of 1.0 or greater indicates the removal of the I&I source is cost effective and is recommended. Table 10 below shows the cost effectiveness for each I&I source identified.

Table 10 – Cost Effect Analysis

			A	B	
I&I Source	Infiltration*	Inflow**	Transport & Treat	Rehabilitation	Cost Effect Analysis
	(gpm)	(gpm)	Cost ($/yr)	Cost ($/yr)	(A/B)
Hse Sump Pump Connection	0	33	$65,610.27	$50.00	1312.21
MH Cover – Vented	0	3	$5,964.57	$500.00	11.93
Infiltration at Service Connection to Main - dripper	0.5	0	$761.90	$5,000.00	0.15
Protruding Service Lateral at Main	0.375	0	$571.43	$550.00	1.04

3. SSES Recommendations - It is recommended that a Clear Water Disconnect program be created to eliminate inflows into the sanitary sewer collection system, that the grade 4 and 5 defects observed in the CCTV inspections be corrected, that the Main Discharge Magnetic Flow Meter be replaced, that Lift Station No. 1 be replaced and that the Village include monies in the sanitary sewer budget to inspect the remaining 62 manholes and CCTV the remaining sanitary sewer lines over the next 5 years to document existing conditions and to aid in budgeting maintenance activities in the future.

4. Collection System Condition – The gravity and force main collection system within the Village is in fair to good condition, and has only experienced two main breaks, which were repaired. The lift stations have been in service for 42 years, and have been regularly maintained and repaired as needed. Due to the age of the lift stations, some deterioration has been found, as follows:
    - The lift station cans are showing signs of deterioration. The Village preforms yearly maintenance including scraping of the interior of the can and painting. The floors are in poor condition in LS#2 & LS#3 and need to be replaced.
    - The Lift Stations were installed in the early 1970's. LS#1 and LS#2 have had improvements to the pumps, level controls and motor controls since the original installation. Both pumps in LS #3 were rebuilt in 2014 due to failure of both pumps. The Village hired Paradigm to evaluate the condition of LS #2 and LS #3. The evaluation dated August 12, 2014 (copy in Appendix B) noted the piping configuration on the suction and discharge side of the pumps is not ideal and recommend the pumps and piping be replaced at a minimum. Increased maintenance and operational issues within the system have been noticed over the past 5 years. The Village has been investing nearly $7,000 per year into LS#3 which is the main lift station which handles all of the Village's flows.
    - The existing sump pump within LS #3 is being replaced approximately 2 times per year. The source of the frequent failure of the sump pump is unknown.

- A screen/sewage basket has been installed on LS #3 to prevent plugging of the pumps. This screen has to be cleaned weekly, which causes an on-going maintenance issue.
- Lid switches that operate lighting and fans at the lift stations do not work and need to be replaced on all three lift stations. Lights and venting are currently operated manually upon entry to the stations.
- LS#1 recently had all the valves replaced because it wouldn't pump. This pneumatic system is very old and has difficulty keeping up with peak flows. Operation and maintenance of this unit is a concern to the DPW Director and Staff. This Lift Station gets checked at least 3 times a week to evaluate and check its performance, which includes inspecting the belts and tightening as required. Annual oil changes are necessary to this pneumatic system.
- During heavy rains, 6" and greater, both pumps within LS#3 operate and can barely keep up with the flow.

5. Sewer Bypasses and Overflows – There are no known sewer bypasses, overflows, combined sewers or CSO's within the Village of Vermontville.

E. Environmental Setting

1. Cultural Resources - Based on review of National, State and local historical databases, there are 5 known historical sites within the Village of Vermontville. These include: A) The Vermontville Chapel and Academy; B) The Vermontville Opera House; C) The William U. Benedict House; D) The First Congregational Church and E) the Vermontville Methodist Episcopal Church. Below is a brief description of each site:

   A. The Vermontville Chapel and Academy is a rectangular, two-story front-gable frame Greek Revival building covered in clapboard siding and stands on a low, rubble foundation. The chapel measures approximately forty-feet long by thirty-feet wide and has undergone only minor alterations. Originally, a small belfry or cupola measuring approximately eight feet square rose above the front gable east end but has been removed.

   B. The Vermontville Opera House is a rectangular, three-story structure containing a level-floor auditorium with rear gallery above a first story. The building has a mansard roof and walls faced in concrete block on the first story and red brick above. A square tower standing at the building's corner has a bell-shaped roof with a weathervane at its apex. The building's lower story contained the township and village offices and fire department, but now houses the public library. The opera house proper occupies the second story and is reached through a double-door entry at the head of a staircase in the tower front. Segmental-arch windows also pierce the second-story walls and have cut stone sills and caps with keystones. The building's main cornice appears to be of pressed metal, with brackets and a broad frieze displaying decorative bosses.

   C. The William U. Benedict House is a two-story, L-shaped, clapboard-covered building with an attached, flat-roofed, open porch and a one-story, gable-roofed, rear ell. Raised pediments surmount large vertical one-over-one lights. The first story portico is accented by spindle-work decoration. Asphalt shingling tops the principal building and the l-shaped rear ell's rooflines.

D. The First Congregational Church is a rectangular, one-story building, five bays in length, sixty-and-one-half feet long by forty feet wide, located on the southwest corner of the village square. The exterior is painted white and strongly resembles certain New England meeting houses of the late eighteen century. The building has a gable roof, trusses, corner buttresses, a square central entrance tower with a belfry, a Greek entablature, and an octagonal spire that reaches upward approximately 110 feet. The spire is eight-sided, and is framed with rafters whose lower portions are curved to shape the flare of the roof. An ornamental sheet metal ceiling and cove cornice were installed. The framing is still sound and the building is well maintained. Originally, the church was heated by two wood stoves.

E. The Vermontville Methodist Episcopal Church is a simple, Late Victorian, rectangular, gable-roof, white-painted, clapboard-sided building. It is now sheathed in aluminum siding. The church has pointed-arch stained glass windows and is fronted by a bracketed, square tower topped by a belfry with louvered openings (a tall spire has disappeared). The sanctuary retains its Late Victorian pews and chancel rail and has a paneled, pressed-metal ceiling. A two-story, gable-roofed parish house is attached to the side of the church building.

2. The Natural Environment

Climate: The climate in the project area is typical for Michigan, causing no foreseen adverse conditions that may affect the project other than those conditions that normally affect the construction season. The average high temperature is 82 degrees Fahrenheit, with 17 degrees Fahrenheit as the average low temperature. Precipitation averages from 1.83 – 3.61 inches per month throughout the year. The average frost line is 36 inches, with the typical construction season in the State of Michigan running from April through November.

Air Quality: No additional population growth is anticipated due to the population growth, and no changes are expected that will adversely affect local air quality.

Wetlands: Wetlands are generally located adjacent to streams and creeks within the Village of Vermontville. A general map based on the national wetlands inventory database is shown on Figure 9 in Appendix A. Only minor disturbance to wetlands is anticipated for this project and any construction activity within a wetland will require a permit from the Michigan Department of Environmental Quality (MDEQ).

Coastal Zones: There are no coastal zones within or nearby of the project area.

Floodplains: The Village of Vermontville does not participate in the National Flood Insurance program and therefore there are no floodplain maps available. There may be floodplains associated with the surface waters within the Village, but there should be very little impact due to this project. Any activity within a regulated floodplain will require a permit from the MDEQ.

Natural or Wild and Scenic River: There are no natural or scenic designated rivers within the project area.

Major Surface Waters: A map of drains and streams is shown in Figure 4 in Appendix A.

Recreational Facilities: Parks and recreational facilities is shown on Figure 1 in Appendix A.

Topography: See Figure 10 in Appendix A for USGS topographic map of the project area.

Geology: Local Geology does not impact any of the project alternatives.

Soils: Soils within the Village are mostly Loams, relatively heavy soils. Other than the specific soils used for the clay liner in the existing lagoons, soils within the project area are suitable for the intended uses.

Agricultural Resources: Farmland can be classified as “prime farmland”, “unique farmland”, or “farmland that is of statewide or local importance”, pursuant to the Farmland Protection Act. Prime farmland has the best combination of physical and chemical characteristics for producing food, forage, fiber, and oilseed crops. Prime farmland does exist within the study area, as shown in Figure 10.

Fauna and Flora: The Michigan Natural Features inventory indicates that one threatened species may be present in the unnamed Creek that is adjacent to the seepage beds for the wastewater treatment plant. The threatened species is the Slippershell Mussel (*Alasmidonta viridis).* There are also two other mussel species that are listed as being of special concern, these being the Rainbow (*Villosa iris)* Mussel and the Ellipse (*Venustaconcha)* Mussel. The Slippershell mussel inhabits the headwaters or creeks tributary to Rivers, and lives in the sandy or gravelly bottom. It is important to limit siltation of the area to preserve the habitat of these mussels.

A review of the USFWS “Section 7 Consultation” website was conducted to identify any listed species and associated habitat that may be present in the project area. Section 7 Consultation requires federal agencies to evaluate their actions or actions they fund or authorize to ensure they do not jeopardize the existence of any listed species. A review of the USFWS database revealed that the endangered Indiana bat (*Myotis sodalis*), the threatened Copperbelly water snake (*Nerodia erythrogaster neglecta*), the candidate Eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*), and the threatened Prairie fringed orchid (*Platanthera leucophaea*) have been previously found within Eaton County during past biological surveys.

Unique Features: There are no unique features within the study area.

II - NEED FOR THE PROJECT

1. Compliance Status - The Village of Vermontville treatment facility has a National Pollutant Discharge Elimination System (NPDES) permit which is currently in effect. A copy of the NPDES permit is located in Appendix B. This permit requires the effluent to meet certain parameters upon discharge.

   The wastewater treatment system has generally been in compliance with permit limits. A few violations occurred over a period from 2007 to 2010 and are summarized in Table 11 below.

Table 11 – DMR Permit Violations Last 5 Years

Year and Month	Parameter	DMR Result	Permit Limit
2012			
No Violations			
2011			
No Violations			
2010			
September	F. Coli (Monthly)	413 cts/100 ml	200 cts/100 ml
	F. Coli (Daily)	534 cts/100 ml	400 cts/100 ml
October	BOD_5	6.46 mg/l	4.0 mg/l
	F.Coli (Daily)	759 cts/100 ml	400 cts/100 ml
2009			
April	Total Phosphorus	1.162 mg/l	1.0 mg/l
May	Suspended Solids	13.5 mg/l	10 mg/l
June	Ammonia Nitrogen	1.156 mg/l	1.0 mg/l
August	BOD_5	7.4 mg/l	4.0 mg/l
	Suspended Solids	20 mg/l	1.0 mg/l
2008			
April	Total Phosphorus	2.299 mg/l	1/0 mg/l
2007			
September	Dissolved Oxygen	3.73 mg/l	4 mg/l (min)
	Suspended Solids	17 mg/l	10 mg/l
October	Suspended Solids	11.6 mg/l	10 mg/l

It should be noted that the April 2, 2010 letter from the MDEQ (formerly MDNRE) incorrectly identifies the permit limit for Dissolved Oxygen as 5.0 mg/l daily minimum whereas the permit required 4.0 mg/l daily minimum. Based on this, two of the three dissolved oxygen violations listed for 2007 are not violations. A copy of the April 2, 2010 letter from the MDEQ documenting these violations is contained in Appendix B. It should also be noted that the Village switched laboratories in April 2010 due to concerns about quality control at the previous laboratory. It is possible that some of the violations prior to the laboratory change may be due to laboratory error.

2. Documentation of the need for the facility improvements – There are no court orders or consent orders, or compliance schedules in effect for the wastewater collection or treatment facilities. MDEQ letters and meeting minutes show that MDEQ has concerns regarding the age and discharge method at the treatment facility.

   One of the concerns that have been expressed by the MDEQ is that the wastewater treatment facility continues to discharge wastewater to the seepage basins, as per the original design of the facility. The plant operates under a MDEQ issued NPDES permit, which allows for a surface water discharge, but under the permit, a groundwater discharge is not allowed.

   The following is a summary of letters and correspondence between the MDEQ, Village staff, and the Village Consultants. Copies of the letters and meeting minutes are shown in Appendix B.

   - Letter from the Michigan Department of Natural Resources and Environment (MDNRE) dated 4-2-2010 regarding effluent violations and requesting information on system operation. In this letter, staff expressed concern that the facility which was originally designed with a life expectancy of 20 years, now in its 40th year of operation, has potentially reached the end of its life expectancy. The effluent violations listed are those shown above in Table 9.
   - Meeting minutes dated 5-26-2010 from a meeting with the MDEQ and the Village. The MDEQ asked the Village to consider performing a Capital Improvement Analysis to study the current system and rate structure and develop a plan for long term operation, including financing future improvements down the road. Key items discussed in this meeting include the fact that the system was originally designed with a 20 year life expectancy and the system is now in its 38th year of operation (at the time the letter was written).
   - Letter from the Village of Vermontville to the MDNRE dated June 17, 2010 responding to the MDNRE and providing a draft work plan for addressing their concerns.
   - Letter from Paradigm Design dated June 17, 2010 to the Village of Vermontville outlining a proposed work plan to address MDNRE concerns. The work plan proposed by Paradigm Design, Inc. suggested completing a study and determining the best method of discharge which would be completed by December 31, 2012.
   - Memorandum from MDNRE Lansing District staff dated 6-17-2010 which indicates that the Village may be in violation of Part 31 of NREPA. MDNRE indicated that the

decision on the discharge method must be made earlier than the December 31, 2012 date suggested by Paradigm.

Paradigm Design has been diligently working towards completing the work requested by the MDNRE in its April 2, 2010 letter and addressing the comments from the June 17, 2010 memorandum. This Project Plan includes an analysis and condition of the capital assets of the wastewater collection and treatment system, along with an analysis of potential improvements that may be needed.

Based on the age and condition of the Village wastewater collection and treatment system, the Village may need to make substantial improvements to the facility in order to bring it into compliance with current regulations. These improvements will likely cost hundreds of thousands of dollars. The Village, being a small HUD low to moderate community, with a limited tax base does not have the finances for such an undertaking.

3. Projected Needs for the Next 20 Years – Based on projected population data, the wastewater needs of the Village of Vermontville are not expected to increase significantly in the next twenty years. The current treatment plant is designed for a Village population of 1000 people producing 100 gpcd, which is sufficient for the needs of the Village for the 20 year planning period and beyond. The Village currently has only one industrial customer, who produces wastewater that is similar in quantity and quality to a residential or small commercial customer. No additional industrial or commercial flows are anticipated in the Village.

   In the Township, growth pressure is not anticipated, and the rural agricultural nature of the Township is not expected to change. Currently, large residential lot sizes combined with acceptable soil types allow for adequate usage of onsite septic systems in the Township. Connection of areas within the Township to the Village wastewater system has not been requested, and is not anticipated.

4. Future Environment without the Proposed Project – If the wastewater collection and treatment system continue to operate under the status quo, the system will continue to age and deteriorate, and unauthorized environmental discharges may occur due to equipment failure.

   With the current design of the wastewater treatment system, the Village cannot significantly alter the method of operation without modifications and replacement of structures and piping. Without piping modifications, the system will have to continue with parallel pond operation followed by discharge to the seepage basins, because the piping and structures do not allow for any other method of operation.

   The collection system appears to have a problem with inflow of water into the system, which is leading to high water level alarms, and overloaded pump stations during significant rain events. A Sanitary Sewer Evaluation Study (SSES) has been completed to define the source of the excessive inflow, and to develop cost estimates for alternatives once the sources are identified.

5. Population Data - Population data is critical for forecasting estimated wastewater flows. Per the 2010 census data, the Village of Vermontville has a population of 793. Table 12

below provides historical population data as well as projected population trends. The project population trends are based on information published by the Tri-County Regional Planning Commission.

Table 12 – Population Data

Year	Population (actual or projected)	Source
1970	857	Census
1980	832	Census
1990	776	Census
2000	789	Census
2010	793	Tri- County P.C.
2012	793	Interpolation
2015	793	Tri- County P.C.
2017	796	Interpolation
2020	799	Tri- County P.C.
2022	804	Interpolation
2025	811	Tri- County P.C.
2030	827	Tri- County P.C.
2032	833	Interpolation
2035	842	Tri- County P.C.
2045	879	Tri- County P.C.

The population within the Village has decreased over the last 40 years, and expected to remain stable or increase only slightly over the 20 year planning period. The population is not projected to expand beyond the design capacity of the current wastewater treatment facility.

III – ANALYSIS OF ALTERNATIVES

A. Waste Water Treatment (WWT) System Alternatives

1. No Action Alternative – The wastewater treatment has several structures which have deteriorated, and are no longer usable, which is limiting the method of operation at the wastewater treatment plant. The current facility is discharging wastewater primarily to the groundwater, although it is operating under a NPDES surface water discharge permit. The MDEQ has written several letters communicating to the Village that they need to correct the permitting issue, or they will be considered in violation of Part 31 or PA 451.

   Currently, piping does not exist that would allow for a discharge from the ponds to the surface water (an unnamed tributary to the Thornapple River). Therefore, without modification and upgrades of the wastewater structures and piping, the facility will not be able to comply with the NPDES permit which allows for only a surface water discharge. Considering all of these items the no action alternative is not a practical solution.

2. **WWT Alternate 1:** Modification to meet Groundwater Discharge Requirements (Optimize existing treatment facility) – It may be possible to apply for and obtain a groundwater discharge permit in accordance with Part 31. This would require further hydrogeological investigation in order to determine the impact of a groundwater discharge. The existing lagoon system will not meet the groundwater discharge requirements for nitrogen of 5 mg/l or less, so in order to be approved it would have to be documented that the groundwater discharge does not migrate offsite, that it vents to the nearby stream and that it does not impact a useable aquifer. Also, the seepage beds would have to have the capability of reducing phosphorus below 1.0 mg/l. Considering that the existing seepage basins are over 40 years old, the soils would have to be sampled to determine if they had the adsorptive capacity to reduce phosphorus to the required level. Operation issues include: discharge to seepage beds 1 and 2 is not possible from pond 2 and seepage bed 4 is not used due to ground water seepage in that bed. In addition, based on current operations, the seepage basins do not have the capacity to completely infiltrate all of the wastewater without some overflow to the nearby creek. This Alternative would require additional property for construction of additional seepage beds or for spray irrigation.

   The oxidation ponds could operate more efficiently and remove wastewater pollutants to a higher degree if the facility could be operated in series rather than in parallel. The transfer structure and piping that allows transfer of wastewater between ponds 1 and 2 would have to be replaced (Structure A). Other structures within the treatment facility also contain deteriorated gates and piping, and in order to insure acceptable operations, these would also need to be replaced.

   3. **WWT Alternate 2 (Filter):** Modification of existing WWTP for Surface Water Discharge meeting current NPDES Permit Requirements –This alternative would consist of modifications of the existing wastewater oxidation ponds to allow for proper isolation with the ability to discharge to the surface water in accordance with current NPDES requirements. The existing seepage beds will be abandoned as well

as the existing ground water discharge component. The current facility has the capacity to provide 180 days of storage of design flow during non-dischage months therefore improvements to the storage capacity will not be required. Per discussions with the MDEQ, the NPDES permit will likely be a semi-annual discharge permit allowing discharge March 1 to May 31 and October 1 to December 31. Phosphorus limits would need to meet 1.0 mg/l during March, April, October, November & December and 0.5 mg/l during May. In order to meet the phosphorus limits, a chemical feed system and filtration will be required.

A maximum yearly design flow of 36 million gallons is anticipated based on the original basis of design. Historical flow in Appendix C shows the average yearly flows are approximately 31 million gallons. The chemical feed and filter will need to be sized to handle the maximum design flows and storage volume requirements.

4. **WWT Alternate 3 (Polishing Pond):** Modification of existing WWTP for Surface Water Discharge meeting current NPDES Permit Requirements –This alternative would consist of modifications of the existing wastewater oxidation ponds to allow for proper isolation with the ability to discharge to the surface water in accordance with current NPDES requirements. The existing seepage beds will be abandoned as well as the existing ground water discharge component. The current facility has the capacity to provide 180 days of storage of design flow during non-dischage months therefore improvements to the storage capacity will not be required. Per discussions with the MDEQ, the NPDES permit will likely be a semi-annual discharge permit allowing discharge March 1 to May 31 and October 1 to December 31. Phosphorus limits would need to meet 1.0 mg/l during March, April, October, November & December and 0.5 mg/l during May. In order to meet the phosphorus limits, a chemical feed system and polishing pond will be required.

   A maximum yearly design flow of 36 million gallons is anticipated based on the original basis of design. Historical flow in Appendix C shows the average yearly flows are approximately 31 million gallons. The chemical feed and polishing pond will need to be sized to handle the maximum design flows and storage volume requirements.

5. **Regional Alternatives:** The closest municipal wastewater treatment facility to Vermontville is Nashville, which is 5 miles away, while Charlotte is 13 miles away. Neither of these facilities have been designed to be regional facilities. In addition, it is not cost effective to transport the wastewater from Vermontville the distance required for treatment at either of these facilities.

B. Wastewater Collection and Transmission Alternatives

1. No Action – With the no action alternative, the wastewater collection facilities will continue operating as they are, with aging pump stations, and few fail safes to insure that unauthorized discharges do not occur. In addition, the pump station capacities will continue to be taxed during large storm events, with a potential to overflow due to excessive inflows and limited hydraulic capacities.

After approximately 42 years in service, the mechanical components within the wastewater collection system have exceeded their useful life, and are subject to increasing frequency of failure, and limitations on obtaining repair parts. Technology improvements would also help make the system more reliable and include fail safes that the current system does not have, such as on-line or cellular monitoring, and remote operation capabilities. The lift stations are experiencing issues and need to be updated or replaced. The no action option also does not address wet weather flows the system is experiencing.

2. Optimum Performance of Existing Facilities – The collection facilities are already operating at current optimum levels. There are no optimization options that would improve the performance of the existing collection system.

3. **Collection Alternate 1:** Upgrade Pump Stations and Collection Piping to Accept Wet Weather Flows – It is possible to upgrade portions of the gravity collection system, the pump stations and the existing forcemains to accept the 25 year, 24 hour design storm wet weather flows. This would require upgrading all three lift stations and would require replacement of the existing 6 inch forcemain from Lift Station 2 to with an 8 inch forcemain and the 6 inch forcemain from Lift Station 3 to the lagoons will need to be upgraded to a 10 inch. In addition, the 8 inch gravity sewer in West Main Street between North Main and Spring Street and the 8 inch pipe in Spring Street from West Main to Lift Station No. 2 will need to be upgraded to 10 inch pipe. The existing 8 inch pipe in North Main between Third Street and Forest Streets as well as the 8 inch in Forest and Nut Street will need to be replaced with 12 inch pipe.

4. **Collection Alternate 2:** Remove Wet Weather Flows from the Collection System and Upgrade Select System Improvements – Currently, it is estimated that more than 50% of the homes within the Village have illegal connections to the sanitary sewer via basement sump pumps. Replace the pumps, valves and piping in Lift Station No. 3 based on the conditions described in the letter dated August 12, 2012 which evaluated Lift Station No. 2 and No. 3. Per the recommendations of SSES Study completed in 2013 and the Lift Station Evaluation completed August 12, 2014, this alternative will include replacing Lift Station No. 1 due to its aging technology, upgrading Lift Station No. 3, correcting pipe defects identified during the SSES and creation and execution of a Clear Water Disconnect program.

5. **Regional Alternatives:** There are no regional alternatives that will address the problems with the Vermontville sewer collection system.

C. Analysis of Principal Alternatives

The principal alternatives selected for further study are:

Wastewater Treatment System

- Modify existing lagoon to meet Groundwater Permit requirements
- Modify existing lagoon to meet Surface water Permit requirements

Wastewater Collection System

- Upgrade Pumps and piping to accept wet weather flows
- Remove Wet Weather Flows from the Collection System and Select System Improvements

1. Monetary Evaluation of the Wastewater Treatment Alternatives – Included in Appendix H are capital cost estimates and operational cost estimates for three principal alternatives related to the wastewater treatment system. Modification to a groundwater discharge plant will include hydrogeological work to insure that the treatment will be acceptable, and include replacement of valves and piping, along with renovation and possible soil replacement at the existing seepage beds, and land acquisition to allow for enough land to discharge the wastewater. This alternative will also include additional ongoing operating and maintenance costs to sample groundwater wells on a quarterly or semi-annual basis, depending on what the permit requires.

   The cost estimate for modification of the existing wastewater treatment facility to a surface water discharge system will also require replacement of valves and piping, and the addition of a discharge outfall line for discharge into the surface water. In order to meet the current permit limits, a chemical feed system, and a filter or polishing pond for phosphorus removal will be required. Ongoing operation and maintenance costs will increase, since electrical power will be required to operate the equipment, and more frequent maintenance and testing will be required. Wastewater will need to be sampled prior to and during the effluent disposal periods, and ongoing checks will need to be made at the facility, just as they are currently. A present worth analysis of both alternatives is included in Table 13. The present worth analysis is based on a 20 year planning period, and a discount rate of 4 5/8%.

Table 13 – Present Worth of Principal Treatment System Alternatives

Principal Alternative	Useful Life	Initial Cost	Annual O & M Cost	PW of O & M	Salvage Value	PW of SV	Net Present Worth
WWT Alt. 1. - Modify lagoons to meet GW discharge permit							
	Salvage Value @ 20 Years*	$770,913			$385,457	$156,050.78	$614,862
	20 years**	$448,681			$ -		$448,681
			$ 47,400	$609,951.73			$609,952
					Grand Total WWT Alt. 1		$1,673,500
WWT Alt 2. – Modify lagoons to meet SW permit (FILTER)							
	Salvage Value @ 20 years*	$382,883			$191,442	$77,504.46	$305,379
	20 years**	$639,685			$ -		$639,685
			$57,300	$737,346.71			$737,347
					Grand Total WWT Alt. 2		$1,682,400
WWT Alt 3. – Modify lagoons to meet SW permit (POLISHING POND)							
	Salvage Value @ 20 years*	$655,405			$327,703	$132,669.27	$522,736
	20 years**	$164,798			$ -		$164,798
			$38,100	$490,277.66			$490,278
					Grand Total WWT Alt. 2		$1,177,800
* Piping, manholes and valves are assumed to have a useful life of 40 years.							
**All mechanical and electrical equipment are assumed to have a useful life of 20 years.							

2. Monetary Evaluation of the Collection System Alternatives - Included in Appendix H are capital cost estimates and operational cost estimates for the two principal alternatives related to the wastewater collection system. Both collection system alternatives have a similar operation and maintenance cost, with only slightly higher energy costs due to needing larger pumps to pump inflows into the system. Table 14 provides a present worth analysis of the principal collection system alternatives. The planning period for the present worth analysis is 20 years, and the discount rate used was 4 1/8%.

Table 14 – Present Worth Analysis of Principal Collection System Alternatives

Principal Alternative	Useful Life	Initial Cost	Annual O & M Cost	PW of O & M	Salvage Value	PW of SV	Net Present Worth
Collection Alt 1. – Upgrade pumps and piping due to inflow							
	Salvage Value @ 20 years*	$1,125,979			$ 562,989	$227,924,34	$898,054
	20 years**	$1,358,197			$ -		$1,358,197
			$5,700	$73,348.63			$73,349
					Grand Total Collection Alt. 1		$2,329,600
Collection Alt 2. – Upgrade pumps and controls							
	Salvage Value @ 20 years*	$169,884			$ 84,942	$34,388.49	$135,496
	20 years**	$12,548			$ -		$12,548
	Ineligible Costs	$414,414			$ 207,207	$83,887.00	$330,527
			$2,300	$29,596.81			$29,597
					Grand Total WWT Alt. 2		$508,200
* Piping, manholes and valves are assumed to have a useful life of 40 years.							
**All mechanical and electrical equipment are assumed to have a useful life of 20 years.							

3. Staging and Partitioning of Construction – For the two WWTP alternatives considered, staging or partitioning construction is not necessary. Neither one of the alternatives are being constructed to accommodate growth, and therefore staging does not alter the outcome, but only delays addressing the problems with current operations of the wastewater plant. Neither of the wastewater treatment system alternatives are large enough to warrant consideration of a multiyear or staged project.

   For the collection system alternatives, consideration of a multi-year or staged project would be reasonable. For the first alternative, replacement of piping and pumps, the project will be very disruptive to the community, with deep construction and large excavations needed, and many road closings. However, the project is not so large that it could not be construction in one construction season. If the project were constructed in multi-year phases, then additional administrative and mobilization costs would be incurred, raising overall capital costs. Therefore, reconstruction of the collection system to accept wet weather flows would be best completed in a single phase project.

   Alternative 2, removal of inflow into the system will likely occur over several years. The key to removing wet weather flows is public education, which takes time, and enforcement. Community forums and meetings will need to be held to inform the public of the problem, and enlist their help and cooperation in addressing the clear water connection problems. Other local governmental units such as the building and plumbing inspectors will also need to become a part of the team helping to address the issues. The sewer use ordinance and

local ordinances will also need to be examined to insure that the Village has the necessary legal authority and enforcement provisions to address any work that may be needed on private property. A proposed phasing schedule is shown as follows:

Table 15 – Phasing schedule for Removal of wet weather flows from the Collection System

Year	Activity
Year 1	Begin public education and outreach Review and update of Ordinance as necessary to provide enforcement provisions
Year 2 and on	Continued Public Education & enforcement

4. The Environmental Evaluation

The environmental impacts of both wastewater treatment alternatives are similar, with all construction occurring at the current wastewater treatment site. A comparison of the potential environmental impacts from both alternatives is shown in Table 16.

Table 16 – Comparison of Environmental Impacts of Wastewater Treatment Alternatives

WWT Alternative 1 – Optimization of the Existing Facility		
Environmental Factor	Permanent Impact?	Mitigation Measures
Cultural Resources	No Impact	None required
Air Quality	No Impact	None required
Wetlands	No	None required
Floodplains	No	None required
Recreational Facilities	No Impact	None required
Agricultural Resources	No Impact	None required
Flora and Fauna	Unknown	Prevent siltation to Creek
Unique Features	No Impact	None required
WWT Alternative 2 & 3 – Modification to a Surface Water Discharge		
Environmental Factor	Permanent Impact?	Mitigation Measures
Cultural Resources	No Impact	None required
Air Quality	No Impact	None required
Wetlands	Potential impact to voluntary wetlands at the wastewater ponds	Wetlands mitigation may be required
Floodplains	No	None required
Recreational Facilities	No Impact	None required
Agricultural Resources	No Impact	None required
Flora and Fauna	Unknown	Prevent siltation to Creek
Unique Features	No Impact	None required

In order to determine if there will be any impacts to threatened or endangered species at the wastewater treatment site, a further environmental evaluation of the habitat suitability at the treatment site may be required. Construction related impacts can be mitigated by minimizing the removal of trees and vegetation, and using sedimentation filters, silt fences, and maintaining vegetative buffers to prevent any sediment laden run-off from entering the creek.

Under **WWT Alternative 2**, the voluntary wetlands that have been created by discharging wastewater into the seepage beds will change, as wastewater would no longer be discharged to these beds. Seepage bed no. 4 will likely not change, as wastewater has not been discharged to this bed due to the presence of natural standing water on this site.

The environmental impacts of the collection system alternatives vary widely, with one alternative being disruptive and requiring large excavations, and the other being primarily done on private property, and involving plumbing modifications. A comparison of the potential environmental impacts from both alternatives is shown in Table 17.

Table 17 – Comparison of Environmental Impacts of Collection System Alternatives

Collection Alternative 1 – Upgrade Pumps and Piping to accept wet weather flows		
Environmental Factor	Permanent Impact?	Mitigation Measures
Cultural Resources	Possible-construction in ROW adjacent to Historic Buildings	Protection of Historic Buildings
Air Quality	No Impact	None required
Wetlands	None in proposed construction area	None required
Floodplains	No	None required
Recreational Facilities	No Impact	None required
Agricultural Resources	No Impact	None required
Flora and Fauna	Unknown	Implement tree removal restrictions if needed
Unique Features	No Impact	None required
Collection Alternative 2 – SSES with removal of wet weather flows		
Environmental Factor	Permanent Impact?	Mitigation Measures
Cultural Resources	Plumbing changes possible	None required
Air Quality	No Impact	None required
Wetlands	No impact	
Floodplains	No	None required
Recreational Facilities	No Impact	None required
Agricultural Resources	No Impact	None required
Flora and Fauna	No Impact	None required
Unique Features	No Impact	None required

5. Implementability and Public Participation – The public will be given opportunities to comment on the proposed and selected alternatives. Both treatment system alternatives will have a similar and minor impact on the public, other than the change in user costs. The treatment site is not open to the public, and the proposed changes at the site from either alternative will have little to no impact to the community or neighboring communities. No inter-municipal agreements are required to implement the project, and there are no other competing uses for the wastewater treatment site.

The collection system alternatives will have a greater impact on the public. For **collection system alternative 1,** the reconstruction of approximately 40 percent of the existing gravity sewer system will result in temporary traffic disruptions, and increases in noise and dust within the project construction areas.

A great deal of public involvement and participation will be required while implementing **collection system alternative 2**. The public will need to be made aware of the need to remove excessive inflows into the sewer system, and costs and methods for removal of those flows. No inter-municipal agreements are needed to implement either collection system alternative, although strong cooperation within the local unit of government will be needed.

The biggest impact to the community will be the financial burden that will be placed on users. Table 18 shows the current and proposed user costs (flat rate plus usage rate based on estimated 3,150 gallons per month) if treatment system and collection system alternatives were to be implemented, along with sewer rates for other communities of similar size in the region.

Table 18 – Comparison of Monthly Sewer User Rates

Community or Alternative	Flat Rate	Usage rate (per 1000 gallons	Total Monthly cost*
Vermontville Current	$15.00	$2.51	$22.91
Vermontville – Proposed	$25.00	$3.49	$36.00
Potterville	$30.33	$2.75	$38.99
Charlotte	$21.82	$3.94	$34.22
Nashville	$13.05	$4.58	$27.48
Bellevue	$12.00	$11.50	$48.22
Parma	$30.00	None	$30.00

* Based on a typical monthly usage of 3,150 gallons

6. Technical and Other Considerations

   The primary technical consideration for both treatment system alternatives is the regulatory requirements that the village will be required to meet.

   For **WWT Alternative 1**, which is continued operation of the lagoons followed by seepage beds, additional hydrogeological work is required to prove that the groundwater from the seepage beds is venting directly to the surface water, and not impacting any usable aquifers. This type of analysis can be costly and time consuming. If the underlying geology is complex, it may require several years of study and reevaluation before conclusions can be finalized regarding the suitability of the site for a groundwater disposal. There are also no guarantees that the site will be found to have groundwater which vents directly to the nearby unnamed Creek. Costs to perform additional hydrogeological work have been included in the estimated costs for this alternative.

   For **WWT Alternative 2 & 3**, which is conversion of the lagoons to meet the existing surface water permit limits, additional treatment steps will be required to remove phosphorus. The ammonia removal is most readily done using an aeration system that

will aerate the lagoons to provide oxygen for denitrification. Phosphorus removal can be done using a filter system or polishing pond along with a chemical feed system, to cause precipitation and filtration of phosphorus from the effluent.

Per Ten State Standards for a facultative treatment pond, it is recommended that the average BOD_5 loading range be between 15 to 35 pounds per acre per day at the mean operating depth in the primary cells, with a minimum of 180 days of detention time. Assuming a loading rate of 0.17 pounds of BOD_5 per capita per day and design population of 1,000 provides for a daily loading of 170 pounds per day. If the lagoons are operated in series, the daily loading rate for the facultative lagoons is 20.2 lbs/acre/day, which is within the acceptable loading range as recommended by Ten State Standards. The estimated detention time is 95 days and 83.4 days for pond 1 and pond 2 respectively. Total detention time would be 178 days for both ponds. Although this is slightly less than the required detention time of 180 days, the design population is not projected to reach 1,000 persons within the 20-year planning period, which provides for enough excess capacity so that the 180 day detention time requirement would be met.

Another technical consideration is the reliability of the treatment system. For both **WWT alternatives 1 and 2**, the primary means of treatment is via electrical energy, time, bacterial action, sunlight, and wind. For alternative 1, soil filtering is also used as means of treatment. Since chemical usage is less critical for treatment under this alternative, alternative 1 is considered slightly more reliable.

Although **WWT alternative 2** would require chemical treatment and a filter or polishing pond with electrical power in order to meet the permit limits, the lagoons still serve to provide reliability to the system. In the event of a power outage or other emergency, the lagoons would be available to store wastewater until the emergency event passed, therefore no back-up power source is required.

Other technical considerations include sludge handling, growth capacity, alternative siting's and routings and sites of environmental contamination. Both alternatives will generate sludge over time. Both alternatives do not include growth capacity in their proposed design. Alternative siting's and routings have not been considered for either alternative, since moving the existing wastewater treatment system would be very expensive, but provide no clear benefit. A review of the list of contaminated sites in Michigan found that no sites of environmental contamination exist within ½ mile of the existing wastewater treatment plant site. The closest site of environmental contamination is a Leaking Underground Storage tank located at 495 E. Main Street.

For the collection system alternatives, technical considerations include improving the reliability and safeguards at the lift stations. The current lift stations are 42 years old and are approaching their useful life. Improvements to the motor and level controls have been made since the original installation and are functional. Both of the collection system alternatives would propose to upgrade the existing pumps and piping to become more reliable.

The list of sites of environmental contamination does not include any sites that are directly on the streets where sewer replacement would be proposed for collection

system alternative 1. One site, the JJ Party Store site, located at 495 E. Main Street, is kitty corner across from an area where sewer replacement would be proposed. Because of the large excavations in the central business district that would be required for **collection system alternative 1**, sites of environmental contamination are more likely to be encountered then for **collection system alternative 2**.

IV – Selected Alternatives

A. Description of Selected Alternatives **WWT Alternate 3** and **Collection System Alternate 2** – the selected alternative is to modify the existing wastewater treatment system to a surface water discharge to meet the current NPDES permit using a polishing pond, to implement a clear water disconnect program to remove wet weather flows from the collection system and to correct piping deficiencies identified in the SSES report. This alternative would also include the replacement of Lift Station #1 and pump and piping improvements to Lift Station #3.

1. Relevant Design Parameters – The proposed alternatives were selected because they constitute the lowest cost alternatives that will address the problems of the wastewater treatment and collection systems. The Surface water discharge alternative has the lowest capital cost, but somewhat higher operating costs, due to additional operator time at the facility.

   The primary drawback to the groundwater discharge is that it will require additional time and hydrogeological studies before the nature of the geology under the site can be determined, and may not be feasible depending on the results of the study. If the geology of the site does not indicate that groundwater venting is occurring, then the money and time spent will have been wasted, and the facility will not receive a permit that can be met economically. The modifications of the treatment plant to meet the existing surface water permit conditions could be designed and implemented in a quicker time frame and with more certainty, allowing the project to move forward and the treatment system to comply with permit conditions.

   Controlling Factors – the primary factor that will shape the design of the treatment plant will be the ability of the facility to meet permit limits. This means that the design must allow for parallel operation of the facility, and isolation of each cell. In order to reliability and consistently meet the discharge limitations, phosphorus precipitation and filter/polishing pond system will be required. This will involve the installation of a chemical tank and chemical feed system that will precipitate the phosphorus, and a filter/polishing pond that will then remove the precipitated phosphorus from the wastewater.

   Another factor that influences the design of both collection and treatment system alternatives are the general design and permit requirements in Michigan. The design of the treatment and collection systems improvements within the public rights-of-way will be constructed in accordance with the Ten State Standards. The design and construction of any improvements that occur on private property as a result of the SSES recommendations will be completed in accordance with state and local plumbing codes.

   The permits required for construction of the selected alternatives are:

   - Wastewater system construction permit, to be obtained from the MDEQ.
   - Soil Erosion and Sedimentation control permits, from the Eaton County Drain Commission.
   - NPDES General Permit, to be obtained from the MDEQ.

2. Special Assessment District Projects – The project proposed will not provide any special or unique benefit to any particular customer within the current sewer service area. No additional customers or extensions of the service are proposed as a part of this project. Costs are anticipated to be spread equally among the approximately 370 existing customers.

3. Project Maps – Figure 1 shows the location of the proposed treatment facility, and existing wastewater collection system. Figure 12 shows a process flow diagram for the proposed treatment facility and Figure 13 shows a schematic of the treatment building and processes.

4. Sensitive Features – Figures 4 and 9 are maps showing wetlands, rivers and streams, and other sensitive ecosystems. No wetlands are present in the areas proposed for construction, other than the voluntary wetlands associated with the current wastewater treatment plant operations.

5. Mitigation of Environmental Impacts – Mitigation of environmental impacts associated with the proposed construction would cost a small fraction of the total budget of the project. The specific impacts are temporary and inherent to any construction project. Costs of mitigation have been included in the cost estimates accompanying the analysis of the principal alternatives.

6. Schedule of Design and Construction – The Village would like to be considered for FY 2016 Q2 financing and are hoping construction can begin in May 2016 with an October 2016 completion. The major project activities and milestones are outlined in Appendix I. This schedule takes into account the time required for design, financing, bidding, construction, and seasonal restrictions on construction.

7. Cost Summary – Table 19 outlines all costs, including planning, design, construction and operation and maintenance of the selected alternatives. The confidence level of these costs are moderate, and are based on available bidding prices from the 2014 construction season, with a small inflationary factor taken into account for potential material cost increases.

Table 19 – Cost Summary

Description of Cost	Amount
Planning Cost	$20,000
Design and Construction Engineering Cost	$145,682
Construction Cost	$779,047.50
Construction Contingencies Cost	$77,905
Total Project Cost	$1,022,634.50
Annual Operation and Maintenance Cost	$40,400

* Design cost includes engineering design, construction inspection, and administrative and legal costs.

9. Authority to Implement the Selected Alternative - The Village of Vermontville is familiar with the legal, technical, financial and managerial aspects necessary to complete municipal utility improvements. The village has overseen the preparation of engineering design and bidding for other municipal projects. The village has the staff and resources to manage all aspects of the proposed project.

10. User Costs – The estimated capital construction costs, and operation and maintenance costs are shown above, and detailed in Appendix H. It should be noted that the user charge estimates are based on a debt retirement period of 20 years, and an interest rate of 2%.

    The project costs will be paid for by revenues generated by a rate increase on the current customer base. The current cost to residential customers for sewer service is approximately $22.91 per month (based on 3,150 gallons usage). The new costs to residential users will be about $36.00 per month. This is an increase of $13.09 per month.

11. Useful Life – The projected life of the assets for the selected alternatives are shown on the construction cost estimates included in Appendix H The average weighted useful life for WWT Alternate 3 is 36 years and the average weighted useful life for Collection System Alternate 2 is 38 years.

V – Evaluation of Environmental Impacts

A. Analysis of the Impact – The project was evaluated for beneficial or adverse, short-term and long term, and irreversible and irretrievable impacts, whether these impacts are direct, indirect, or cumulative.

1. Direct Impacts – Direct impacts are environmental impacts directly attributed to the construction and operation of the project. The proposed project was evaluated for several different area of potential direct impact. The results of the evaluation are presented below.

    - Cultural Resources – The cultural resources identified with the Village of Vermontville consist of several buildings with historical significance. The proposed project will not impact those buildings, other than it may include possible plumbing modifications to exclude wet weather flows from the sewer system. In Appendix I are letters to and from the State Historic Preservation Office confirming that this project is cleared under Federal regulations for the Protection of Public Properties. There are no recreational facilities in the area of the proposed project.
    - Air Quality – The only direct impact this project will have on air quality is a temporary construction impact from dust. This should be a minimal problem as the construction of the treatment system should only last several months, and the contract will provide for dust control measures to be used throughout. The construction related to the collection system will consist of mechanical upgrades to the lift stations, or work on private property. All work will be short term, and the contract will provide for dust control measures to be used throughout.
    - Natural Setting and Sensitive Ecosystems - The project will not change the character or usage of any lands, since the bulk of the construction will occur on land that has been utilized for wastewater treatment for approximately 40 years. The project will not have a direct impact on any floodplains, or wild or scenic rivers. A Michigan Natural Features Inventory review proposed construction area has indicated that the project may be inhabited by the endangered Slippershell Mussel. The area of proposed construction is essentially the area of the existing wastewater lagoons, with little to no disturbance proposed to the existing creek. Sedimentation traps and silt fence will be used to prevent any sediment laden run-off from entering the Creek.
    - Human Social and Economic Impacts – The only direct economic impact is the increased cost to the residential user. There are no other direct human impacts such as social justice issues or dislocation of employment. There may be a temporary increase in employment due to jobs that may be created during the construction project.

2. Indirect Impacts – Indirect impacts are defined as impacts from induced growth, impacts to wildlife due to habitat fragmentation, or changes to surface waters due to change in storm water runoff. The proposed project was evaluated for several different areas of potential indirect impacts. The results of the evaluation are presented below.

    - Changes in rate, density and type of development – The Village of Vermontville has seen little changes to the rate, density, or type of development over the last 40 years. This project is unlikely to change that trend. If anything, the increase in sewer rates may cause a slight decrease in the growth and development within the Village.

- Changes in Land Use – There is no planned development that would be affected by this project or the proposed construction.
- Changes in Air or Water Quality – There will be no changes to air quality due to construction of this project. Changes to water quality may occur at the treatment plant, as water will no longer be directed to the volunteer wetlands which have developed as a result of water being discharged to the seepage basins. Any changes to these wetlands will be done in accordance to the MDEQ regulations, and mitigation will occur if required.
- Changes in the Natural Setting – there are no anticipated changes to the natural setting that would occur as a result of the construction of the project.
- Impacts to human, social, and economic resources – there are no indirect impacts on human, social, or economic resources anticipated as a result of this project.
- Resource Consumption and Waste Generation – the resources that will be consumed as a result of this project are electrical power at the lift stations. Waste in the form of sludge will also be generated at the treatment facility. The amount of electrical power and waste generated will be approximately the same as that already generated over the last 40 years. Any sludge that will eventually need to be disposed of will be disposed in accordance with an approved PERM, via land application.

3. Cumulative Impacts – Cumulative Impacts include the total of all impacts to a particular resource that have occurred, are occurring, and are likely occur too occur as a result of any action or influence, including the direct and reasonably foreseeable indirect impacts of a construction activity. Within the Village of Vermontville, there are no other planned infrastructure improvements that would result in a cumulative impact from the proposed project.

VI – Mitigation

A. General - Where impacts cannot be avoided, mitigation of adverse impacts must be considered. Various impacts will be analyzed and mitigative measures addressed in the following section.

Short-Term Construction Related Mitigation – The project will be designed to minimize construction related impacts. Construction impacts to air, water, and noise are commonly short-term and temporary in nature. In addition, surface transportation traffic patterns may be altered during construction. Typical impacts include:

- Noise from construction equipment and related activities at the site
- Noise and dust from delivery of materials through residential areas
- Air pollution from burning debris
- Traffic and Safety Control
- Sedimentation and erosion

Mitigation of construction related impacts will include the following mitigative measures.

- Dust and Noise Control – The contract documents will require that the contractor employ dust control measures as needed depending on the climate and wind conditions. Dust control measures include the use of approved dust control chemicals, the use of water, and cleanup to minimize dust generation. Construction times will be restricted to normal daylight hours on the weekdays. Noise on the construction site will be generated by motorized vehicles, equipment, and power tools. The noise from construction will not be excessive compared to normal construction projects, and will be temporary in nature.

- Soil erosion and sediment runoff are major sources of concern as a possible adverse impact of construction projects. Accelerated sedimentation caused by construction will be controlled before it leaves the project area and enters the unnamed Creek south of the treatment site. Erosion and sediment control measures such as silt fence, sediment traps, and temporary grassing will be employed, as appropriate, during the construction phase. Vegetation cover will be replaced as soon as possible. Contractors will be required to obtain and follow the provisions of an approved soil and sedimentation control permit. A certified storm water operator will conduct weekly inspections and also inspect the site within 24 hours of a rain event. All excavated soils will be deposited in an environmentally non-sensitive upland area. All staging areas used for construction equipment will be placed in a non-sensitive upland areas with any disturbed areas replanted upon completion of the project as an erosion control measure.

- Traffic and Safety Control – All traffic detours and signage as required by MDOT, the Eaton County Road Commission, and the Village will be employed. The contractor will be required by the contract documents to follow all MIOSHA safety regulations.

- Other – all roads, vegetation, and utilities will be restored to a condition at least as good as that prior to construction

B. Mitigation of Long-Term Impacts **-** Every effort will be made during the planning and construction of the project to avoid long term or irreversible adverse impacts.
   1. General Construction – the construction at the wastewater treatment plant site will be adjacent to the voluntary wetlands that are associated with the operation of the existing plant site, and adjacent to an unnamed creek. Mitigative measures will be used to limit the impact of the proposed project on these wetlands. The following is a list of mitigative measures which will be utilized:
      - All disturbed areas adjacent to the creek will be restored to existing grade. Disposal of soils will be to an upland location.
      - Native soils will be used as surface backfill whenever possible.
      - Sedimentation basins, silt fences, and other techniques will be utilized whenever possible to minimize construction impacts.
   2. Siting Decisions – The improvements to the Village of Vermontville treatment site and pump stations are occurring at the existing locations, on land the Village already owns.
   3. Operational Impacts – The renovation at the wastewater lagoons and pumps stations will not result in any additional odors, aerosols, noise or operational accidents. The existing treatment facilities are located on a large parcel of land already owned by the Village, which has been used for wastewater treatment for approximately 40 years. The site is surrounded by agricultural lands with few residents.

C. Mitigation of Indirect Impacts - As discussed above, secondary growth induced from the project is not anticipated. The service area has not been expanded, and the design flow for the project has not been increased.

VII – Public Participation

A. Public Meetings on Project Alternatives

a. The technical data describing the problems addressed in the Project Plan, was presented at multiple meetings at the Village of Vermontville offices. These meetings were held to educate Village Staff and the public on the need for the project, the various alternatives available, the cost of the various alternatives and the impacts. The following meetings were held (copies of the public notices and meeting minutes can be found in Appendix I).

i. An informational presentation was made at the Council Meeting held on January 9, 2014.

ii. An informational presentation was made at a Public Meeting held on February 13, 2014

1. The public meeting was noticed in the Maple Valley News on January 11, 2014 and on January 25, 2014.

iii. An informational presentation was made at the Council Meeting – December 11, 2014

iv. An Informational presentation was made at the Public Meeting held on January 8, 2015

1. The public meeting was noticed in the Maple Valley News on December 20, 2014

B. The Formal Public Hearing

i. Public Hearing Advertisement

1. The Formal Public Hearing was held on March 12, 2015. The meeting was advertised in the Maple Valley news on February 7, 2015. Copies of the advertisement and the affidavit can be found in Appendix I.

ii. Public Hearing Transcript

1. A copy of the Public Hearing Transcript and meeting sign in sheet is included in Appendix I along with the Council Meeting minutes.

C. Adoption of the Project Plan

a. Council Meeting – April 9, 2015

i. Resolution Adopting Final Plan

1. A copy of the Resolution is included in Appendix I.