Village of Paw Paw
Clean Water Revolving Fund
Project Plan

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1.0 Introduction

The Village of Paw Paw owns and operates its municipal wastewater sewer systems. Areas outside the Village boundaries that also are served by the Village collection system include sections of Paw Paw and Waverly Townships. All areas served by Paw Paw's wastewater systems are located within Van Buren County. The Village of Paw Paw, along with the adjoining sewered townships, discharge their wastewater to a lagoon system located southwest of the village. Discharge from this facility is directed toward adjoining irrigation fields. A map of the WWTF can be found in **Appendix A**.

The purpose of this report is to provide an overview of the condition of the Village's existing Wastewater Treatment Facility (WWTF), identify immediate and long-term issues affecting the facility and its operation, and evaluate alternative methods for cost-effective improvements that remediate these issues.

To accomplish these objectives, historical operating data, effluent permit limits, and the physical condition of the WWTF were reviewed to determine future treatment needs. An evaluation of the existing WWTF, projected flows and loadings, and future economic and environmental considerations were used to identify the prioritized needs and necessary improvements. These results have been used to identify and analyze principal alternatives to meet the long-term requirements of the Village.

A copy of the feasibility study can be found in **Appendix B**.

1.1 Background Information

The Village of Paw Paw's WWTF is located southwest of the Village, on 38th Street near its intersection with Paw Paw Road.. The WWTF was originally constructed in 1972, but the treatment capacity was expanded in 1982 to 1.4 million gallons per day (MGD) from its original capacity. Since the original construction, no significant rehabilitation projects have been completed. The WWTF operates under the jurisdiction of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) National Pollutant Discharge Elimination System (NPDES). The WWTF is authorized to discharge treated effluent under the general NPDES Permit No. MI0021741. A copy of the most recent permit can be found in **Appendix C.**

Wastewater collected in the Village is pumped and/or flows by gravity to Lift Station No. 1 (at the south end of 36 ½ Street) where it is and then pumped to the WWTF. The lift station received extensive improvements in 2017 including replacement of a defective pump, flow meter, and comminutor. The station is also now under the operation of variable frequency drives (VFDs). The list station is in good shape to transmit flows to the WWTF. Under normal operating conditions, wastewater flows in series from Aerated Lagoon No. 1 to Aerated Lagoon No. 2, and then into Lagoon No. 3 for further polishing and storage. Ferric chloride or aluminum sulfate may be added to aid in phosphorus removal. Currently, chemical precipitation of phosphorus is not utilized. Each lagoon is constructed with a clay liner and outfitted with control structures to facilitate the transfer of water between lagoons.

Treated wastewater is discharged by gravity from Lagoon No. 3 to any of the seven irrigation fields. Underdrainage from the flood irrigation, overland flow, and rain/snow/groundwater runoff is collected, metered, and monitored before being discharged into the Paw Paw River.

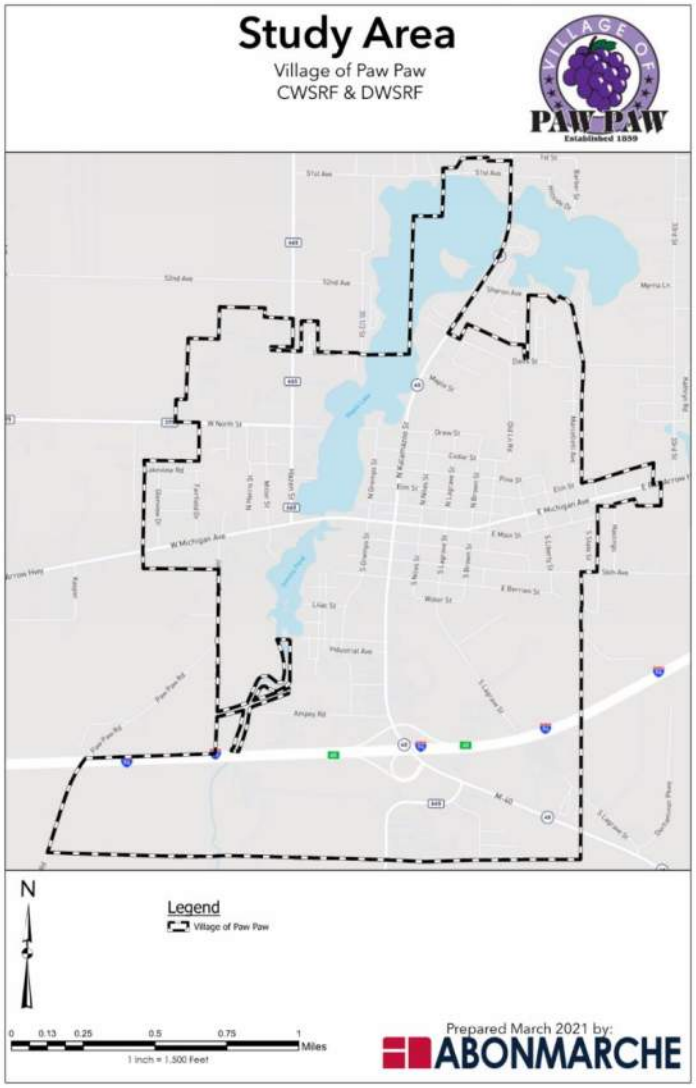
Currently, treated wastewater is only discharged from October through April, but flow through the outfall is continuous, due to intercepted groundwater flows.

2.0 Project Background

2.1 Delineation of Study Area

The Study Area consists of land within the Village of Paw Paw and portions of adjacent Paw Paw Township. The Village is located in east-central Van Buren County at the intersection of Interstate 94 and M-40, approximately 20 miles west of downtown Kalamazoo. The Village is situated between Antwerp Township to the east and Paw Paw Township to the west. The East and West Branches of the Paw Paw River join to form the South Branch in the Village, just above the bridge at Michigan Avenue at the southern end of Maple Lake. A map of the study area can be seen in **Figure 1** below.

Figure 1: Map of Study Area



2.2 Environmental Setting

2.2.1 Cultural Resources

There are currently seven (7) historic sites within the Village that are listed on the National Register of Historic Places. **Table 1** lists the sites, the location, the date the site was put on the State's Register of Historic Places, and the date a marker was placed on the site.

Table 1: Paw Paw Historic Sites

Site Name	Location	Historic Designation
Van Buren County Courthouse (Paw Paw Village Hall)	111 East Michigan Avenue	National Register - 08/21/1972
Barnum-Harrison House	West Red Arrow Highway (1 3/4 miles west of *Paw Paw)*	State Register 1981
Paw Paw Public (Carnegie) Library	129 S. Kalamazoo Street	State Register - 06/06/2002
Paw Paw Water Works Pumping Station	706 S. Kalamazoo St.	State Register 1981
St. Mark's Episcopal Church	609 E. Michigan Ave.	State Register 1987
Territorial Road	Old-US 12, west of the State Police post	Marker Erected - 07/29/1959 State Register - 09/17/1957
Van Buren County Courthouse Complex	Paw Paw Street	National Register - 08/09/1979 State Register - 1977

2.2.2 The Natural Environment

2.2.2.1 Climate

The climate in Paw Paw is continental with cold winters and warm summers. According to the NOAA's National Climatic Data Center's 1981-2010 Normals Dataset, the average annual daily temperature is 47.4 degrees F. The climate is further defined by the following:

- Temperature: The coldest month of the year is generally January, with an average temperature of 23.4 F. The warmest month is July with an average temperature of 70.0 F.

- Precipitation: The average annual precipitation is 39.69 inches with September being the month with the highest average amount of precipitation (4.19 inches). Generally, February is the driest month with an average of 2.06 inches of precipitation. The average seasonal snowfall is 98 inches with an average of 41 days of the year with at least 1 inch of snow on the ground. Thunderstorms occur on about 24 days each year.

2.2.2.2 Air Quality

The air quality trends in Michigan can be defined by the measurement of certain air pollutants. These pollutants are identified as carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO2), ozone (O3), particulate matter (PM), sulfur dioxide (SO2), and air toxins or trace metals.

The Air Quality Index (AQI) was developed by the EPA to provide a simple uniform way to report daily air pollution concentration on a numerical scale. The scale is related to potential health effects. The scale ranges as follows: Good (0-50), moderate (51-100), unhealthy for sensitive

groups (101-150), and unhealthy (151+). The unhealthy group also includes "very unhealthy" and "hazardous" classifications.

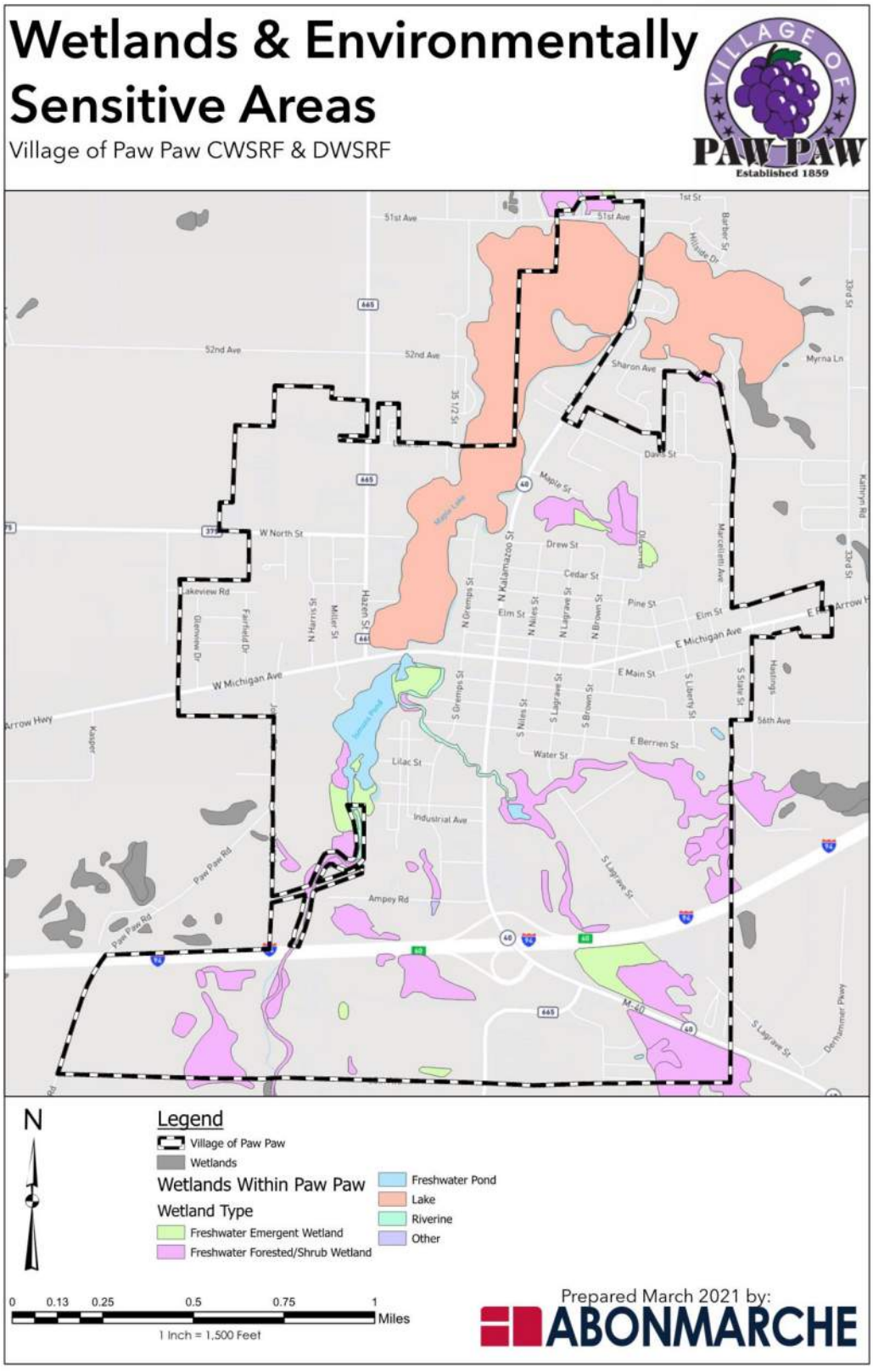
According to the EPA's AirData Air Quality System, there were 304 days during 2020 in which the Kalamazoo-Portage MSA registered an AQI above 0. During 224 of these days, the primary contributor to the index was Ozone. During the remaining 80 AQI days, the primary contributor was fine particulate matter with a diameter of fewer than 2.5 microns (PM2.5). AQI was in the good to moderate (less than 100) range for almost all of 2020. The MSA reached an unhealthy for sensitive groups (101-150) range six times and did not reach the unhealthy (151+) range in 2020. The median PSI was 38.5 (good) with a high of 115 (unhealthy – sensitive groups). The AQI 90th percentile for this year was 58 (moderate), meaning it only exceeded 58 during 10% of the year.

In 2019, there were 312 "good" days with AQI above 0 but less than 50, 50 "moderate" days between 50 and 100, and the yearly maximum was 85. 2019's median AQI was 37.5.

2.2.2.3 Wetlands

Wetlands are present in the Village and are shown on a map below. The majority of wetlands in the Village are adjacent to the Paw Paw River and Maple Lake. The Village has approximately 185 acres of wetlands and 249 acres of wetland-type soils, as defined by the National Wetlands Inventory. These areas are important habitats for a diverse array of plants and animals that are key to watershed health, in addition to contributing to the beauty of the area. The area occupied by the WWTF is located in a wetland area as defined by EGLE's Final Wetland Inventory. A map of the wetlands in and around Paw Paw can be seen below in **Figure 2.**

Figure 2: Paw Paw Wetland Map



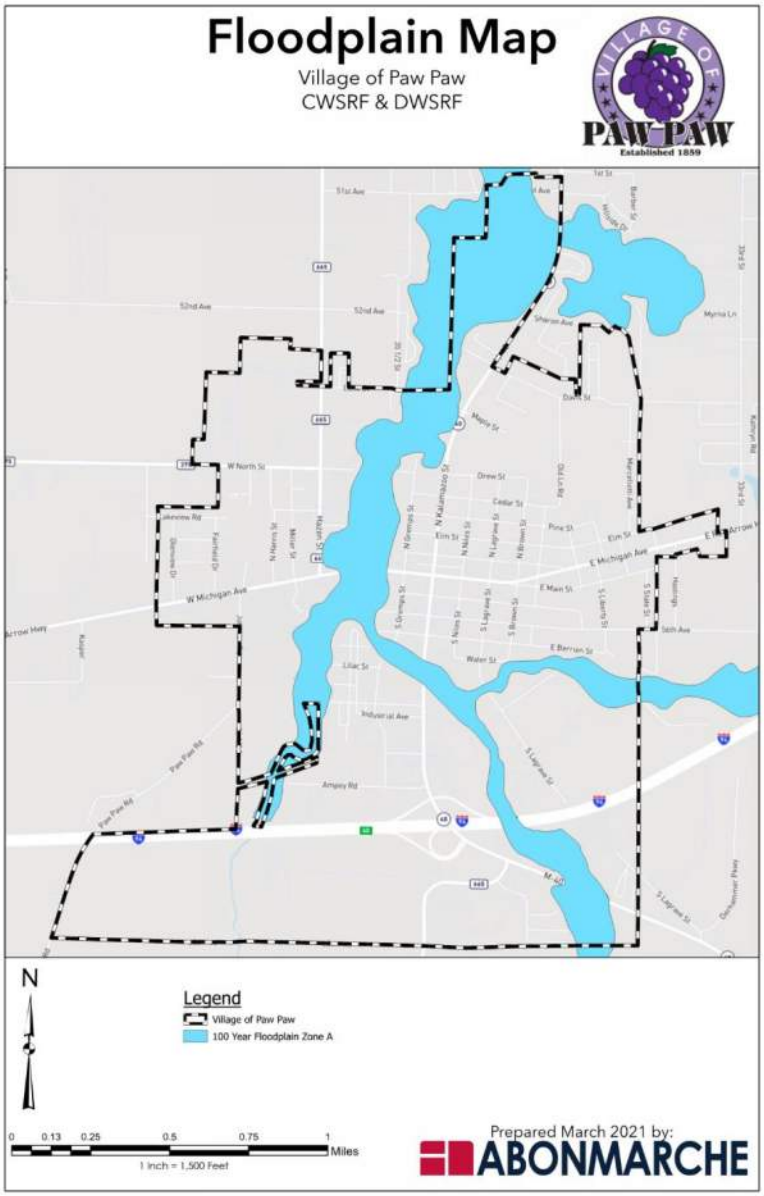
2.2.2.4 Coastal Zones

The Village of Paw Paw is not considered by the Michigan Department of Environmental Quality to be in a coastal zone.

2.2.2.5 Floodplains

Areas adjacent to Maple Lake and the Paw Paw River in the Village are categorized as Zone A, as defined by the Federal Emergency Management Agency (FEMA), shown in **Figure 3** below. Zone A consists of areas with a 1% annual chance of flooding and a 26% chance of flooding over 30 years. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones. The floodplain designates areas that are susceptible to flooding.

Figure 1: Paw Paw FEMA Floodplain Map



2.2.2.6 Natural or Wild And Scenic Rivers

There are no designated Natural or Wild and Scenic Rivers within at least 100 miles of the study area.

2.2.2.7 Major Surface Waters

The Village is located near two major surface waters: Maple Lake is located in the northwest quadrant of the Village, and the Paw Paw River runs through the Village in a northeasterly direction towards the lake.

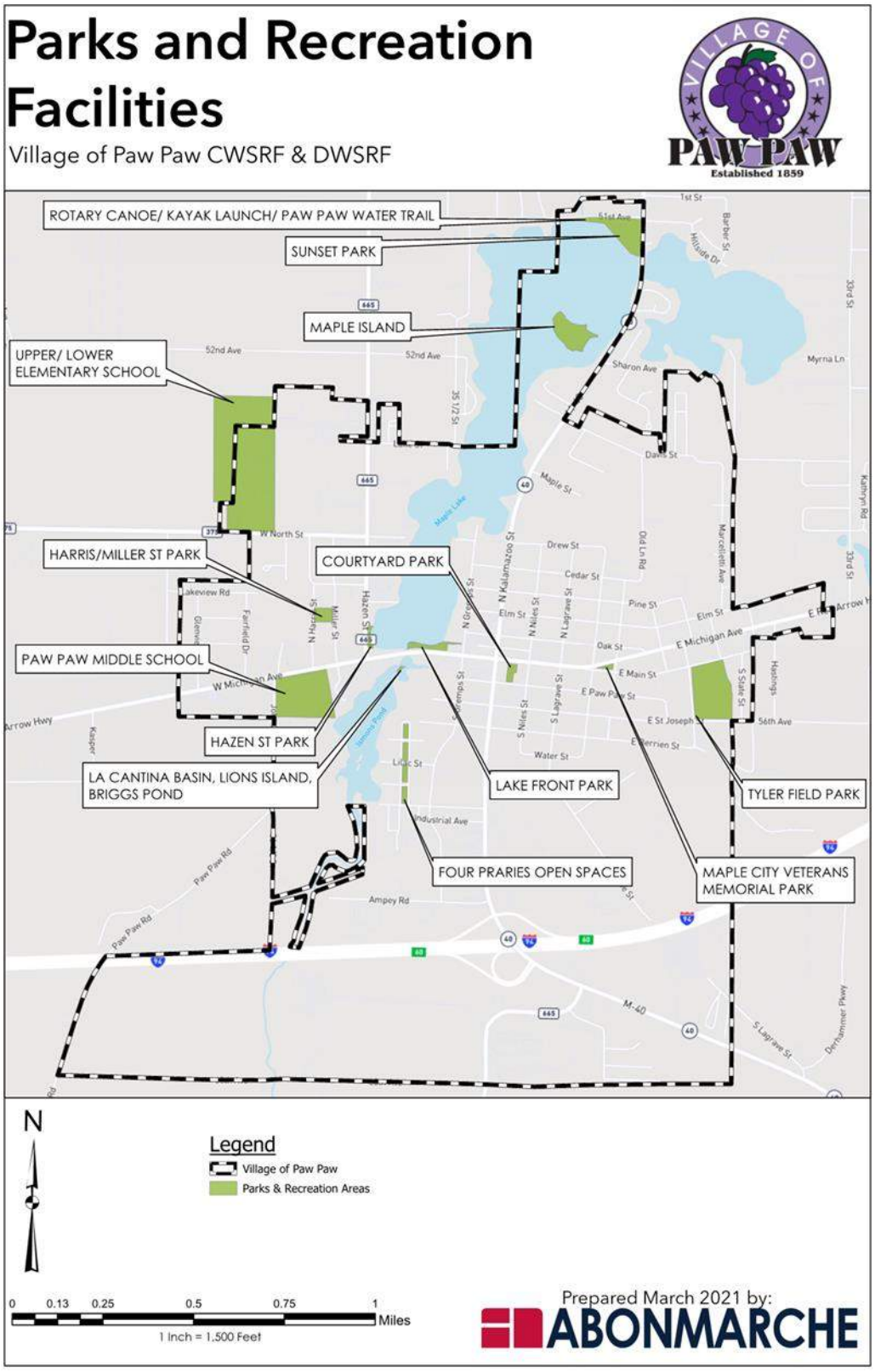
2.2.2.8 Parks and Recreational Facilities

The Village has fifteen public parks and recreational areas within the Village limits. Several recreational activities are available at the various facilities. **Table 2** below is a current and complete listing of all outdoor recreational facilities owned or operated by the Village. A map of the park and recreation facilities in and around Paw Paw can be seen in **Figure 4.**

Table 2: Parks and Recreation Facilities

Park	Location	Area (acres)	Type
Sunset Park	North end of Maple Lake, boat launch, and picnic grounds	4.5	Mini-Park
South Shore Park/Lake Front Park	Along Michigan Avenue, Amphitheatre and bathrooms	1.3	Mini-Park
Hazen Street Park	Southwest end of Maple Lake	0.1	Natural Resource Area
La Cantina Basin, Lions Island, Briggs Pond	North of Michigan Avenue at the confluence of East and West/South branches of the Paw Paw River	27.4	Natural Resource Area
Maple Lake/Maple Island	Man-made Island off N. Kalamazoo Street/M-40 near North end of Maple Lake	5	Community Park
Tyler Field	Former school athletic field now a multi-use park with ball field, football/soccer field, Kids Paradise adventure playground, etc.	10	Community Park with regional use
Harris/Miller Street Park	Between Harris and Miller Streets	1.2	Community Park
Rotary Canoe/Kayak Launch Site	Downstream and on the East side of the hydro dam	0.4	Mini-Park
Courtyard Park	Downtown Paw Paw along Michigan Avenue, South side of 200 block	0.7	Mini-Park
Four Prairies Open Space	Greenway between Lake Blvd. and Lilac Lane	0.4	Greenway
Maple City Veteran's Memorial Park	Located at the junction of East Main Street, East Michigan Avenue, and Brown Street.	0.1	Mini-Park
Paw Paw Middle School *	Activity and green space with ball fields	59.5	School Park
Upper/Lower Elementary School	Activity playground and green space	38.1	School Park

Figure 4: Paw Paw Parks and Recreation Facilities Map



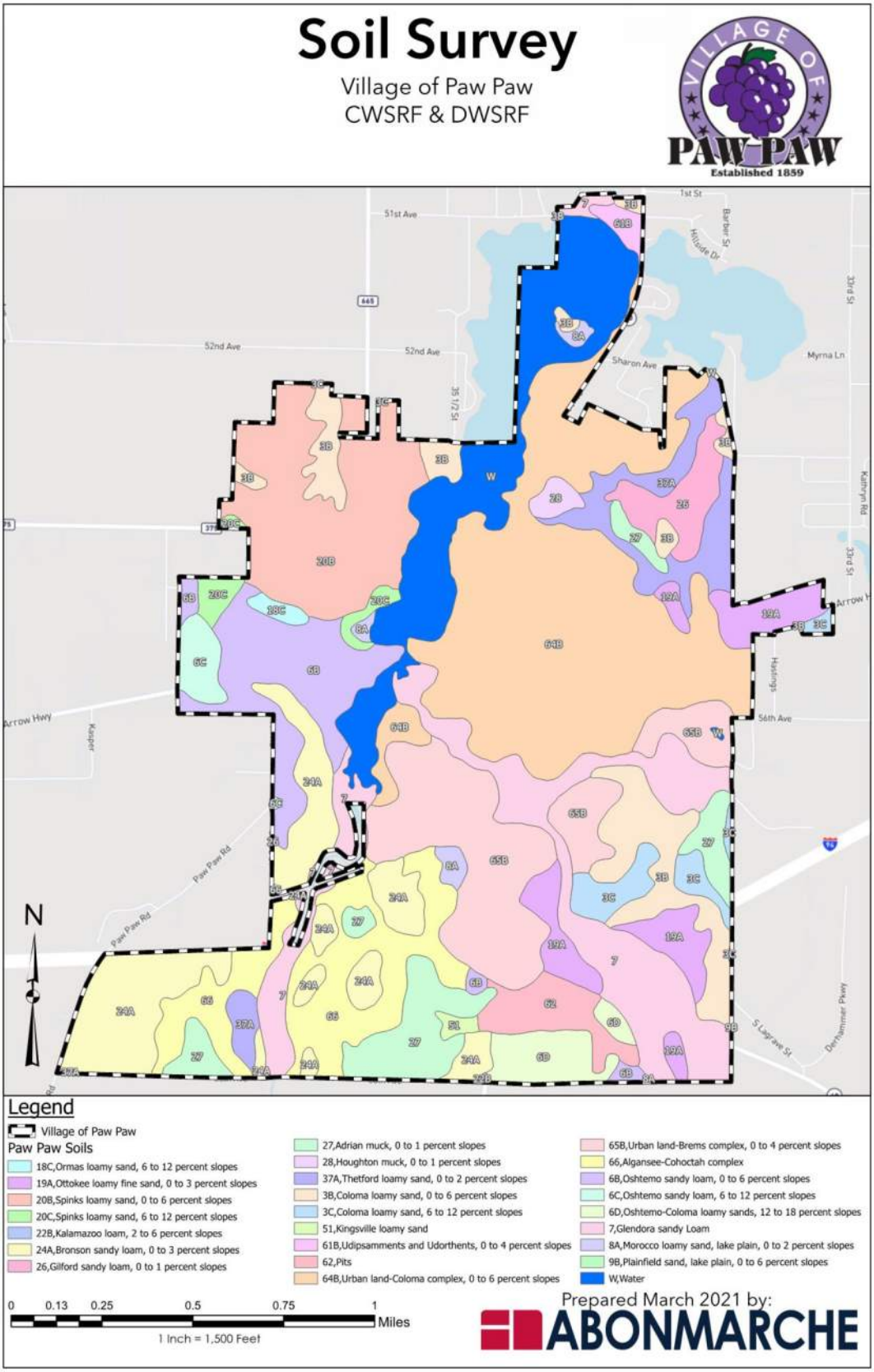
2.2.2.9 Topography, Geology, and Soils

Paw Paw's topography is relatively flat with minor slope variations near the river and Maple Lake. The area south of I-94 between County Road 665 and M-40 is the highest elevation and the area north of Maple Lake on the southwest corner of 51st Avenue and M-40 is the lowest.

According to the Soil Survey of Van Buren County, Michigan, as compiled by the United States Department of Agriculture/Soil Conservation Service, the soils and topographic conditions of Paw Paw, are primarily, "Nearly level to hilly, somewhat excessively drained and well-drained, sandy and loamy soils on outwash plains and moraines."

More specifically, the Village's predominant soil classification consists of Pewamo silt clay loam, which has a surface layer that consists of very dark gray silty clay loam about 11 inches thick. The subsoil is about 25 inches thick. It is mottled and firm. The upper part is dark gray silty clay loam, and the lower part is grayish brown silty clay. The substratum to a depth of about 60 inches is dark grayish brown and dark gray, mottled clay loam. In some places, the subsoil has less clay, and in other places it is stratified. Permeability is moderately slow. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface in winter and spring. A map of the soil profile in the areas can be seen in **Figure 5.**

Figure 5: Paw Paw Area Soil Survey



2.2.2.10 Agricultural Resources

Situated in northwest Van Buren County, Paw Paw is located amongst some of the most productive agricultural lands in the state. The area is renowned for its production of field crops, namely grapes which are used in wines, juices, and jams. Agricultural production represents a major land use in Van Buren County and it plays a significant role in the Paw Paw economy.

2.2.2.11 Endangered or Threatened Species

The Village of Paw Paw is located in Van Buren County, Michigan. Currently, five species are listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) in Van Buren County. Endangered or threatened designated species are protected under the Endangered Species Act. The following species have been listed as endangered or threatened in Van Buren County:

Plants

- Pitcher's Thistle (Cirsium pitcher) is listed by the State and USFWS as Threatened. It typically inhabits open sand-dunes and blow-out areas along Lake Michigan.

Mammals

- Indiana Bat (Myotis sodalist) is a State and Federal listed endangered species that roosts under loose or defoliating bark of dead and dying trees along streams and rivers.

- Northern Long-Eared Bat (Myotis septentrionalis) is a federally listed threatened species that roosts underneath bark or in cavities, crevices, or hollows in live or dead trees.

Insects

- Mitchell's Satyr Butterfly (Neonympha mitchellii) is the State and Federal listed endangered species that is only found in Michigan and Indiana in fens or wetlands characterized by calcareous soils which are fed by carbonate-rich water from seeps and springs.

Reptiles

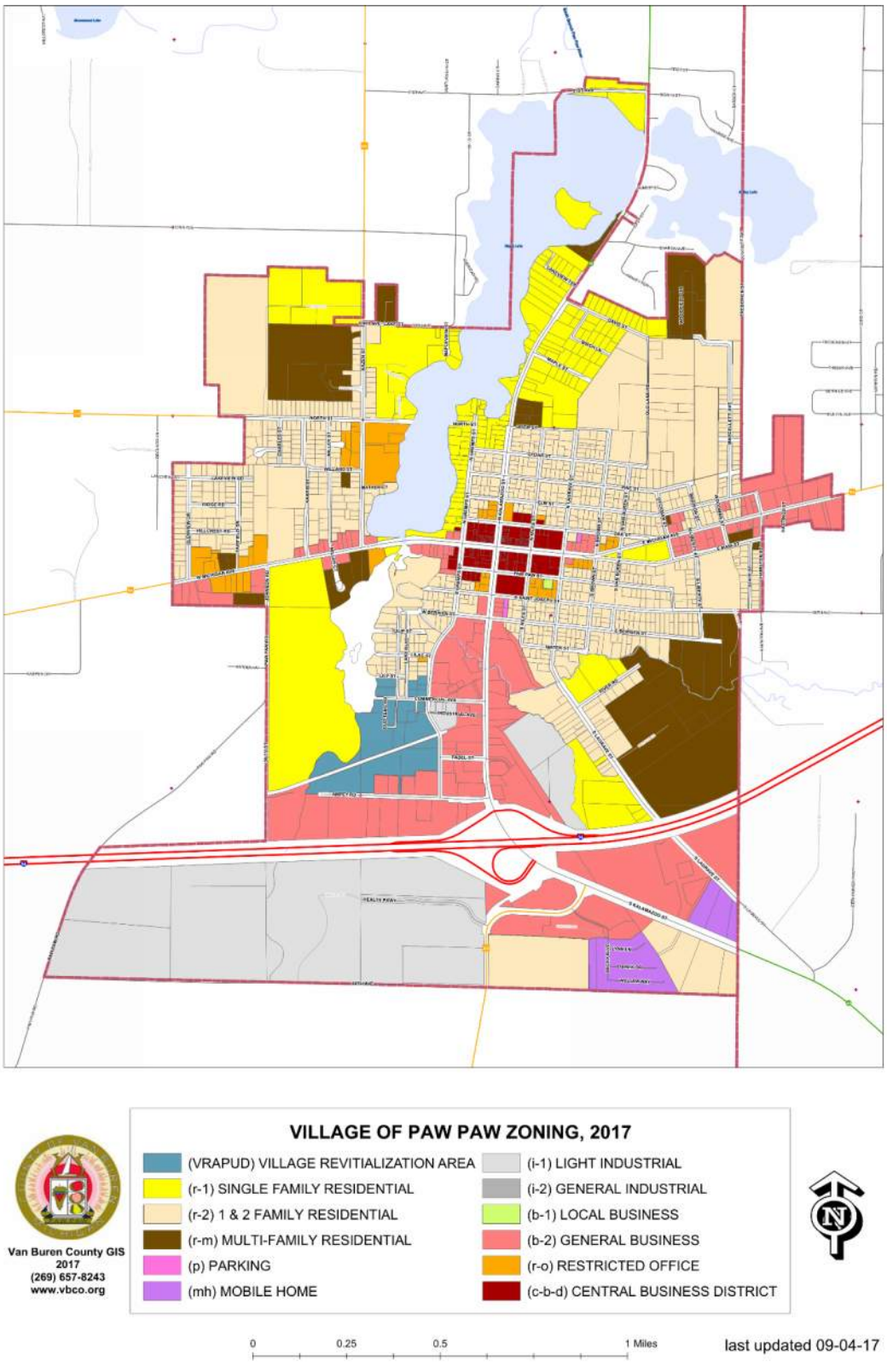
- Eastern Massasauga (*Sistrurus catenatus*) is the State and Federal listed threatened species that is only found in a variety of habitats all over a large share of the upper Midwest. Specific habitat characteristics are not defined by USFWS.

2.2.3 Land Use in the Study Area

The existing land use in the Study Area primarily includes residential, commercial, industrial, and recreational uses. **Figure 6** shows a map of future projected land uses. The existing Paw Paw Village Zoning Ordinance is up-to-date and consistent with current development trends and issues.

The Village encompasses a total area of approximately 2.89 square miles and is primarily laid out on a north-south orthogonal grid system. Commercial land uses have developed along the Village's two main corridors: M-40/Kalamazoo Street and Red Arrow Highway/Michigan Avenue and the proximity of I-94 has fueled an expansion of commercial uses outward from the downtown to the Village boundaries. There are also commercial areas in the townships at the east and west entrances to the Village on Red Arrow Highway/Michigan Avenue. Most residential development is located adjacent to downtown to the north, south, and east. These neighborhoods are characterized by older homes on small lots and many share property lines with commercial and industrial uses. A mixture of older, cottage-style homes, as well as new lakefront homes, can be found on the shores of Maple Lake. Newer, subdivision-style residential development is located on the north side of Michigan Avenue, west of Maple Lake. Industrial land uses are located west of Kalamazoo Street near Factory Street and Industrial Avenue.

Figure 6: Paw Paw Land Use Map



2.3 Population

Population projections for the Village of Paw Paw were compiled from data from the US Census Bureau. It is not expected that the Village will expand its physical limits in the near future. The projections shown are based upon the population projections created by MDOT for the areas which are located within the Village of Paw Paw. This original data is presented in **Appendix G**, however, a snapshot is provided in **Table 3.** The population is expected to grow slightly over the next 15 years.

Table 3: Population Projections

Population	Census Data*			Projected Data**		
	2010	2015	2019	2025	2030	2035
Projected Population	3,534	3,417	3,366	3,857	3,966	4,050

* - Based on 2010 US Census and Annual Estimates
** - Projected Population-based on Regional Economic Model, Inc. (REMI) Source: MDOT, Bureau of Transportation Planning, Statewide Model Unit

2.4 Economic Characteristics

2.4.1 Major Employers

A list of major employers in the Village limits is included in **Table 4** which indicates the location of the business and the number of jobs provided.

Table 4: Major Employers

Firm	Employees	Location	Product
Bronson Lakeview	585	408 Hazen Street Paw Paw, MI 49079	Health Care
Paw Paw Public Schools	333	119 Johnson St. Paw Paw, MI 49079	Education
Van Buren County	300	212/219 E. Paw Paw St Paw Paw, MI 49079	Government
Knouse Foods Plant	110	815 South Kalamazoo St Paw Paw, MI 49079	Food Processing
Walmart	100	1013 S. Kalamazoo St Paw Paw, MI 49079	Retail
St. Julian Winery	80	716 S Kalamazoo St Paw Paw, MI 49079	Beverage Company
Village of Paw Paw	39	110 Harry L Bush Blvd Paw Paw, MI 49079	Government
John Tapper Automotive	30	429 South Kalamazoo St Paw Paw, MI 49079	Automotive and Industrial Machinery

2.4.2 Income Levels

The Median Annual Household Income (MAHI) and Per Capita Income (PCI) for the Village of Paw Paw, Van Buren County, and the State of Michigan indicated in the Census Bureau's 2019 American Community Survey 5-year estimates are listed below in **Table 5**.

Table 5: 2019 Village of Paw Paw Median Annual Household Income (MAHI)

Location	MAHI (dollars)	PCI (dollars)
Village of Paw Paw	$43,226	$23,796
Van Buren County	$54,485	$28,049
State of Michigan	$57,144	$31,713

The Village has a MAHI and PCI which was significantly lower than Van Buren County as well as the State of Michigan as a whole.

2.4.3 Growth Potential

The estimated population of the Village of Paw Paw in 2019 was 3,366, a 4.8% decrease from its 2010 population of 3,534. In Paw Paw Township, the population changed by -3.12% from a population of 7,041 in the 2010 Census to 6,821 in the 2019 Census estimate. In Waverly Township, the population changed by -0.86% from 2,554 in the 2010 Census to 2,532 in the 2019 Census estimate. Over the same period (2010-2019) the population of Van Buren County dropped by approximately 0.76%, from 76,258 to 75,677.

This population data along with a recent age and population forecast study by MDOT can be found in **Appendix G**.

The total number of housing units in Van Buren County increased from 36,785 in 2010 to 37,554 in 2019 (+2.1%). Given its proximity to the nearby growing areas in Kalamazoo County, it is expected that the population in the Village will steadily increase in the coming years, as shown by the population projections.

2.5 Existing Facilities

The relevant existing facilities are discussed in the sections below. Maps of the Village's existing sewer collection system and WWTF layout can be seen in **Appendix A**.

2.5.1 Wastewater Treatment Plant Overview

The WWTF was constructed in 1972 and was expanded in 1982. Since 1982, the WWTF staff has maintained the original equipment and made the necessary repairs to keep the system operational. However, due to the age of the facility and the harsh conditions associated with the treatment of wastewater, significant improvements are required to maintain reliable treatment.

As a whole, the plant consists of a series of aerated lagoons that empty into a storage lagoon. The flow between lagoons is facilitated by series of control structures, corrugated metal pipes, and slide gates. Treated wastewater is irrigated in one of many open fields before being re-collected in a subsurface drainage system and discharged to the Paw Paw River. Currently, the WWTF facility does not operate under a Residuals Management Program.

2.5.2 Influent Measure and Control

All wastewater in the collection system ultimately flows to Lift Station No. 1 (LS #1). LS #1 is equipped with a magnetic type flow meter. The flow meter records flow and reports the reading

to two remote recorders/totalizers. The flows measured by the meter in LS #1 are used as the raw influent flows for the plant and reported in the monthly operating reports.

From LS #1, wastewater is pumped through a 16-inch forcemain to Control Structure "A" at the WWTF. The control structure was designed to route the influent to the first aerated cell through a 21-inch ductile iron pipe. Control Structure "A" is also equipped with an 18-inch corrugated metal bypass line, which feeds directly to Lagoon No.3. The control structure is outfitted with two slide gates to regulate flow. Since the construction, the bypass slide gate has been permanently closed.

Flow to Control Structure "A" can also be bypassed directly to Aerated Lagoon No. 2 using a 16-inch ductile iron pipe and air break structure connected to the 16-inch forcemain. Flow through the bypass is controlled by two gate valves.

At the time of the inspection, Control Structure "A" showed signs of significant deterioration. Both flow control gates were severely corroded and inoperable. The corrugated metal piping and concrete structure were both showing evidence of degradation due to the corrosive wastewater conditions. The functionality of the bypass gate valves was unknown, but due to the age of the valves and lack of operation, they are likely in need of repair or replacement.

2.5.3 WWTF Lagoons

The WWTF is comprised of three lagoons used to biologically treat and store wastewater. Biological treatment at the WWTF takes place in the two aerated lagoons. The addition of air provides oxygen for the aerobic degradation of organic matter. Following treatment in the Aerated Lagoons, water is directed to Lagoon No. 3 for further polishing and storage before discharge to the Irrigation Fields.

According to the 1972 construction records, all of the lagoons were constructed using a clay seal - 12" thick on the side slopes and 8" thick on the lagoon bottoms. The clay liner system does not meet current design standards but is similar to many other lagoons constructed during this period. Typically, complete reconstruction of the liner is not required, but maintenance of the berms is recommended to preserve their integrity.

2.5.3.1 Aerated Lagoons

The two aerated lagoons are each 5.0 acres at the high-water level and hold approximately 21 million gallons per lagoon. They are designed to be partially mixed and have piping provisions to operate in series or parallel. Wastewater enters Aerated Lagoon No. 1 through a pipe penetrating the clay liner on the west bank of the lagoon and flows to Aerated Lagoon No. 2 through an 18-inch corrugated metal pipe.

The center berm that divides the two aerated cells is showing evidence of significant erosion. The original 1:3 slope has been worn away and now a much steeper slope exists near the water surface. Operations Staff reported that gravel had been placed on the berm to prevent further erosion, but much of the small gravel had been washed away.

2.5.3.1.1 Aeration Equipment

Four positive displacement blowers are housed in the blower building to supply the necessary air for effective treatment and mixing. Air travels down the two distribution headers located on the center berm between Lagoon No.1 and Lagoon No. 2 and then enters the lagoons through flexible lateral pipes connected to submerged cyclone diffusers.

The aeration system is the heart of the treatment system, and functional operation is necessary to maintain reliable treatment. There were several deficiencies observed during the inspection that should be considered for repair or replacement. The main concern is the aeration headers, located on the eroding lagoon berms. Due to the location of the air header and the berm degradation, the header piping has begun to lean towards the lagoons and is at risk of total collapse into the lagoons.

While the blowers and cyclone diffusers remain operational, they are original to the 1982 expansion and have exceeded their expected useful life. Evidence of the aging infrastructure was observed in the corroded blower intake silencers, replacement blower motor, and malfunctioning diffusers.

2.5.3.2 Storage Lagoon

The storage lagoon, Lagoon No. 3, is a 24.5-acre lagoon at a high water level with a total depth of 17-feet and a working/storage depth of 12-feet. The bottom 2-feet of the lagoon is designated for sludge storage. The working volume is 95.7 million gallons and the sludge storage volume is 14 million gallons.

The primary function of the Lagoon No.3 is to serve as a polishing cell and as a storage basin for treated wastewater before discharge. Lagoon No.3 is also able to operate temporarily as a facultative lagoon to achieve biological treatment at low flow and loadings that are observed in the effluent of the aerated lagoons or during brief periods of aeration cell bypassing. The area closest to the surface produces an aerobic environment, the middle section operates as an anoxic environment, and the bottom of the lagoons is an anaerobic environment.

During normal operation, the effluent from Aerated Lagoon No. 2 flows through an 18-inch corrugated metal pipe that feeds into the lagoon in the northeast portion.

At the time of the inspection, the lagoon berms showed signs of significant deterioration. The prevailing wind and wave direction, along with the constantly changing lagoon elevation has resulted in erosion along a majority of the lagoon berms specifically along the northern and eastern berms. The clay liner is visible in many areas and the original 1:4 slope has been worn away.

2.5.3.3 Flow Control Structures and Piping

There are eight concrete flow control structures located within the lagoons. The purpose of these structures is to regulate lagoon level and facilitate flow through the lagoons. The structures are outfitted with 18" slide gates and corrugated metal transfer piping. A majority of this equipment is original to the 1972 construction, with two additional structures being added in 1982.

At the time of the site review, the visible corrugated metal pipe and slide gates showed signs of deterioration. Operators indicated that one emergency repair on a segment of corrugated metal pipe had already been completed due to a failure. Because of the age, material, and harsh environment that exists within these structures, the piping and valves that were not visible are likely in a similar condition.

2.5.4 Discharge Facilities

Effluent from Lagoon No. 3 is discharged by means of flood irrigation and overland flow in a series of irrigation areas to the south and southeast of the WWTF. Underdrains in the irrigation area capture WWTF effluent flow and rain/snow/groundwater, and discharge to the Paw Paw River. Refer to **Appendix A** for an overview of the effluent discharge facilities. The combined total of all collected water from the irrigation areas represents the final effluent discharged by the Paw Paw WWTF.

2.5.4.1 Discharge Structures and Piping

Lagoon Control Structure "E" is used to transfer wastewater from Lagoon No. 3 to Irrigation Control Structure "F". Irrigation Control Structure "F" contains a wet well with sufficient operational elevation to gravity feed to the entire irrigation distribution network. Irrigation Control Structure "F" feeds into Irrigation Control Structures "G" and "H".

Irrigation Control Structure "G" distributes treated effluent among Irrigation Areas 1, 2, and 3. Irrigation Area 1 is irrigated using flood irrigation, where effluent from Lagoon No. 3 flows through multiple risers in the field then trickles down through the soil before being intercepted by underdrains. The underdrains connect to the final effluent collection pipe network. Irrigation Areas 2 and 3 are irrigated using overland flow, where Lagoon No. 3 effluent flows through a gated pipe on the upslope side of the field. The gated pipe can be balanced to ensure wastewater is applied over the entire field. The wastewater flows down the sloped field and is collected in a ditch on the downhill side before feeding into the final effluent collection pipe network.

Irrigation Control Structure "H" distributes Lagoon No. 3 effluent among Irrigation Areas 4, 5, 6, and 7. Irrigation Areas 4 and 7 are irrigated using flood irrigation. The underdrains in these fields connect to the final effluent pipe. Irrigation Areas 5 and 6 are irrigated by overland flow. The ditches on the downhill side of these fields, designed to intercept the overland flow, connect to the final effluent pipe.

The irrigation system was modified in 1982 to include additional underdrains, interception and drainage ditches, and collection piping. All of the Irrigation Areas were tied into a common effluent collection system. The final effluent is sampled and metered at this discharge point.

A majority of the discharge piping and underdrain collection piping is buried, so the exact condition is unknown. Operators did not report any known piping deficiencies, but it is recommended to excavate a few critical areas and assess the condition of the piping. The irrigation flow is controlled by a series of slide gates that direct flow to the individual fields. These slide gates are original to the 1972/1982 installation and have exceeded their expected useful life. The functionality of the gates presents an operational challenge for WWTF staff.

2.5.5 Biosolids Profiling

According to the WWTF Operations and Maintenance Manual, the Village removed approximately 3,000,000 gallons of sludge from Lagoon #2 in 1995 and approximately 3,600,000 gallons of sludge from Lagoon #1 in 1996. As part of this feasibility study, biosolids profiling and analytical sampling was completed for all three lagoons to estimate the current volume and determine the characteristics of the biosolids.

Aerated Lagoon No. 1 contains an average sludge depth of 3.4 feet and Aerated Lagoon No. 2 contains an average sludge depth of 1.6-ft. Lagoon No. 3 contains an average sludge depth of 1-ft. Sludge samples were collected and analyzed for metal contents and total solids.

The results showed the concentrations of each parameter analyzed were below the Part 24 Ceiling Pollutant Concentrations for land application, with the exception of molybdenum in Lagoon No.1. Molybdenum levels in Lagoon No.1 were slightly above the maximum allowable concentration. With approval from EGLE, biosolids from Lagoon No.1 could be blended with biosolids from Lagoon No.2 to meet the ceiling criteria for land application.

2.5.6 Ancillary Equipment

2.5.6.1 Generator

The Village currently owns a permanent standby generator used to provide backup power to the WWTF. The generator was replaced approximately 10 years ago and remains in good condition

2.5.6.2 Chemical Feed Equipment

A chemical feed system was included during the 1982 improvements project. The chemical feed system provides a means of storing, transferring, and mixing ferric chloride or aluminum sulfate to the WWTF system to aid in the chemical removal of phosphorus.

Under the current operation, the chemical feed is not required to meet the effluent permit limits, so the equipment has not been placed into service. If future conditions dictate the need for additional phosphorus removal, minor improvements should be anticipated to get the system operating.

2.5.7 Blower Building Condition

The WWTF blower building was constructed during the 1982 construction project. The building is in fair to poor condition. A majority of the HVAC equipment has failed and the roof requires replacement. The condition of this building is critical to protect the electrical gear and aeration blowers.

2.5.8 WWTF Capacity Evaluation

Historical WWTF effluent records from January 2015 through June 2019 were reviewed and compared to NPDES permit limits. Overall, the plant has performed well throughout the period of review. The facility has exceeded the 20-year design window and continued to provide adequate treatment for the Village beyond the original planning period. Minimal growth throughout the service area has maintained flow rates within the original design capacity. As

part of the feasibility study, a detailed capacity analysis was completed to determine which assets, if any, could potentially limit the WWTF in the future.

The aeration capacity of the existing system is adequate to accommodate the current and projected future flows and organic loadings.

The main concern identified as part of the capacity evaluation was the restrictive phosphorus loading limits in the summer months (60 lb/mo, May-September). The permitted WWTF discharge includes WWTF Lagoon effluent and groundwater underflow. During the summer months, groundwater underflow contributes approximately 37 lb/mo, leaving only 23 lb/mo for WWTF Lagoon effluent discharge.

Due to the restrictive phosphorus loading limits, WWTF effluent is currently stored in Lagoon No.3 and then discharged from October through April. Lagoon No.3 contains 95.7 million gallons in storage capacity and flow must be stored for 152 days under the current operation. This results in an average daily flow capacity of 0.630 MGD. Given the current average influent flow of 0.590 MGD, the current mode of operation could potentially limit the WWTF.

Three alternatives to address summertime phosphorus loading restrictions were developed. By discharging small amounts of effluent throughout the summer months, the WWTF could regain some storage capacity and still meet final effluent phosphorus limits. The exact volume that could be discharged will depend on the WWTF effluent phosphorus concentration and groundwater underflow loading. Based on historical effluent flows and loadings, it is estimated that approximately 0.086 MGD could be discharged in the summer months. This could increase the WWTF capacity to 0.720 MGD. If flows increase beyond 0.720 MGD, additional action would be required.

The chemical feed system could be placed back online to reduce the phosphorus concentrations in the WWTF effluent. This would allow larger volumes of wastewater to be discharged within the loading limits.

Another alternative would be to install an irrigation pump at the Lagoon No.3 effluent structure. The structure is equipped with a forcemain connection that would allow the lagoon effluent to be pumped down to a low water level during the winter months and further increase the summertime storage capacity to 117.5 MG.

2.6 Fiscal Sustainability Plan

Fiscal sustainability is addressed by the selection of the most cost-effective solution to resolve the "Critical Priority" defects at the WWTF with the utilization of long-lasting materials and equipment. The useful life of the proposed improvements is equal to or greater than the terms of the proposed financing. Mechanical WTTF infrastructure has an estimated useful life of 10-20 years while more permanent fixtures have an estimated useful life of 30-50 years. With that being said, much of the infrastructure being used currently at the WWTF is from the original plant construction nearly 50 years ago. Based on this, we expect the useful life of the infrastructure to far exceed the 30-year term of the loan.

All WWTF improvements constructed as part of the project plan will be built using modern materials and construction techniques. WWTF improvements built with these materials and methods have useful lives typically exceeding the expected life estimates.

The Village of Paw Paw provides routine maintenance on its facilities and they are well cared for. This leads us to expect that the proposed improvements will continue to operate properly for decades and provide the Village of Paw Paw sufficient time to recover the capital expended in their construction.

2.7 Need for Project

2.7.1 Compliance Status

The WWTF is currently operating in compliance with the existing NPDES discharge permit. A comparison of current discharges with those allowed in the permit is discussed in Section 2.5.8. A copy of the current permit can be seen in **Appendix C.**

2.7.2 Orders

The Village of Paw Paw Wastewater Collection System and WWTP are not under any Court, State, Federal enforcement orders, or administrative consent orders at the current time.

2.7.3 Water Quality Problems

Water Quality is closely monitored in and around the Village of Paw Paw. The surface waters surrounding the Village are substantial assets to the community and are utilized for commerce and recreation by a variety of users. Fecal coliform levels associated with Sanitary Sewer Overflows (SSO's), along with other detrimental water quality effects like BOD, are major concerns due to their impact on the environment and public use of these resources.

2.7.4 Projected Needs for the Next 20 Years (CIP Plan)

Based on the findings of the WWTF investigation, a 20-year Capital Improvement Plan was developed to address the short-term and long-term needs identified at the WWTF. The sections below outline the scope of the proposed short-term and long-term projects, as well as the project cost considerations.

2.7.4.1 Short-Term CIP

The following projects are considered imminent needs that need to be addressed in the near future:

1. Aerated Lagoon No. 1 & No. 2 Biosolids Removal

The current biosolids depth in Lagoon No.1 averages 3.4-feet and 1.6-feet in Lagoon No.2. It is recommended that biosolids are removed once the depth reaches 2-feet. This project includes dewatering each lagoon and removing the biosolids for land application disposal.

2. Aerated Lagoon Berm Maintenance and Slope Protection

Significant erosion of the lagoon berms at the water surface is occurring within both of the Aerated Lagoons. The originally installed stabilization stone is no longer at the operating level in Lagoons No.1 and No.2 and the original grade has been worn away. Clay liner repairs, berm regrading, and new stabilization stone are included in this project.

3. Lagoon No. 3 Berm Maintenance

The berms on Lagoon No.3 require clay liner repairs and regrading. Areas of concern will be repaired, and the topsoil will be regraded and reseeded.

4. Lagoon Aeration System

The existing aeration system is operating past its expected useful life. Significant improvements are required to maintain reliable operation. The project includes the installation of new blowers, air piping, diffusers, and baffles.

5. Lagoon Transfer Structures and Slide Gates

The existing lagoon transfer structures and flow control slide gates have degraded due to their age and harsh operating conditions. This project includes the replacement of all flow control slide gates and rehabilitation of the influent control structure.

6. Lagoon Transfer Piping

The existing lagoon transfer piping is a corrugated metal pipe that is showing signs of deterioration. This project includes the removal of all of the existing corrugated metal pipes and replacement with ductile iron pipes.

7. Discharge Flow Meter

The existing lagoon discharge flow meter is an aging mechanical style meter that requires confined space entry for maintenance. This project includes the installation of a magnetic (mag) meter and a flow metering structure.

8. Irrigation Flow Control Gates

The current irrigation flow control gates are unreliable and difficult to operate. At the irrigation control structures, the slide gates would be replaced to maintain functionality and operation. At Control Structure F, two gates would be replaced, and at Control Structures G and H, four gates would be replaced in each structure.

9. Blower Building Improvements

The Blower Building roof and HVAC system at the WWTF need critical upgrades. This project includes the replacement of the blower building roof and HVAC. The budget to expand the existing telemetry system has also been included to notify operators of alarm conditions at the WWTF.

2.7.4.2 Long-Term CIP Plan

The following projects are considered longer-term needs that may be addressed over a longer period:

1. Influent Forcemain

Due to the age and material of the existing forcemain, the Village should plan for repairs or maintenance of the line within the 20-year planning period.

2. Irrigation Distribution Piping

The irrigation distribution piping is mostly buried, but with continued use of the irrigation fields as the method of discharge, replacement of the piping in the future should be planned. The budget includes total replacement of all irrigation distribution piping, but it is recommended that segments of the irrigation piping be exposed and evaluated to determine the extent of repairs necessary.

3. Irrigation Underdrains

The buried underdrain piping and effluent collection pipe is now 40 years old, and it should be expected that portions of the system will need to be rehabilitated within the 20-year planning period. The budget includes total replacement of all irrigation underdrains, but it is recommended that segments of the irrigation underdrains be exposed and evaluated to determine the extent of repairs necessary.

4. Effluent Discharge Pump

Due to the lagoon storage capacity and phosphorus limitations, there is a potential that an effluent discharge pump would need to be installed at the Lagoon Effluent Control Structure within the 20-year planning period.

2.7.4.3 Future Environment without Proposed Project

All items listed in CIP projects are items in need of replacement and are currently not in ideal working condition. As the existing infrastructure degrades, some of it may fail and prevent proper plant operation. A degrading WWTF could have great impacts on public and environmental health if a premature failure of this infrastructure were to occur.

2.7.5 Summary of Project Need

Items listed as part of various CIP projects were observed to be in less than ideal condition and operating well past the expected lifespan of WWTF infrastructure. Without these improvements being made, some of these items may fail prematurely and prevent the WWTF from functioning as it should. This in turn may have negative effects on public and environmental health.

Fortunately, early identification from the 2019 inspection and the prospects for CWSRF loan funding can remediate the risks posed by this degrading infrastructure that is essential to achieving proper sanitation for the local population.

3.0 Analysis of Alternatives

3.1 Identification of Potential Alternatives

Alternatives to accomplish the capital improvement projects identified above were developed and evaluated based on their ability to meet the scope of the project while remaining within financial, regulatory, and technical constraints. The alternatives analysis presented below is required to justify the selected alternative.

Project objectives include:

- Ensure reliable wastewater service to the customers.
- Rehabilitate/repair high-priority areas of existing WWTF infrastructure.
- Provide facilities capable of providing consistent, reliable service and continued compliance with regulatory and permit requirements.
- Minimize financial burden to the sewer system users.
- Minimize environmental impact during construction of the improvements project.
- Minimize the environmental impact of WWTF operations and discharge.

The following alternatives were developed:

1. No Action
2. Improvements to Existing WWTF
3. Mechanical WWTF – Surface Water Discharge
4. Mechanical WWTF – Groundwater Discharge
5. Regional Alternative
6. Optimize Existing WWTF

The alternatives are described in detail in the following subsections. Each alternative was initially screened based on effectiveness, constructability, and financial requirements. Feasible alternatives were then subjected to a comprehensive evaluation with attention to detailed economic, technical, environmental, and public concerns.

The long-term capital improvements outlined in Section 2.7.4.2 were not identified as immediate needs, but still have large financial implications to the Village. The long-term project costs were included in Alternative 2 and Alternative 3, but not in the remaining Alternatives because the changes included in these projects would eliminate the need for long-term improvements.

Alternatives 1, 3, 5 and 6 were briefly analyzed, however, these alternatives were determined to not be feasible for the Village. Alternatives 2 and 4 were determined to be the principal alternatives for evaluation.

3.1.1 No Action

Alternative 1 includes continuing to operate the WWTF in its current condition. This would eliminate upfront capital costs to the Village, but additional maintenance and replacement costs for emergency or EGLE-mandated repairs could be required in the near future. With the current physical condition of the aeration equipment and lagoon system, action is required or the Village could begin to come out of compliance with permit requirements. No further analysis is presented on Alternative 1.

3.1.2 Improvements to the Existing WWTF

Alternative 2 was developed to improve the existing WWTF. To maintain adequate treatment of the wastewater, significant improvements are required at the WWTF.

Alternative 2 addresses all of the short-term capital improvements at the WWTF including:

- Aerated Lagoon No.1 & No.2 Biosolids Removal
- Aerated Lagoon Berm Maintenance and Slope Protection
- Lagoon No.3 Berm Maintenance
- Lagoon Aeration System - Blowers, Piping, Diffusers, Baffles
- Lagoon Transfer Structures and Slide Gates
- Lagoon Transfer Piping
- Discharge Flow Meter
- Irrigation Flow Control Gates
- Blower Building Roof and HVAC, Telemetry

Redundant Control Structures C and D would be removed as a part of this alternative. New piping from Control Structures A, B, E, and J would be installed to optimize operator control and functionality of the WWTF. The influent force main gate valves would be replaced so the aeration lagoons could function in series or parallel. The influent structure (Control Structure A) would be coated and the slide gates replaced to maintain control of the influent flow. Out of Control Structure A, a pipe would be installed directly to Lagoon 3. This would allow the operators to discharge influent flow directly into the polishing lagoon and completely bypass the aeration system if needed. This mode of operation would rarely be used but is an added option if maintenance needs to be done to Lagoons 1 and 2.

A conceptual piping demolition, new piping layout, and berm repair layout are shown in **Appendix D**.

The diffused aeration system replacement consists of removing the existing aerators and blowers, and replacing the aerators with new, fine bubble diffusers, along with new blowers in the existing building. The existing air header would be removed and replaced with a new air header suitable for providing the volume of air that the new aeration system requires to provide adequate treatment. New blower air intake and discharge piping with valves would also be replaced and connected to the new air header. The electrical gear and controls would be upgraded with the new blower packages as well.

The roof on the blower building would be replaced along with all the heating, ventilation, and air conditioning equipment.

Long-term costs for the influent force main, irrigation distribution piping, irrigation underdrains, effluent pumping, and Lagoon 3 biosolids removal should be considered for Alternative 2 because the effluent will continue to utilize the irrigation fields and underdrain collection system as the method of treated effluent disposal.

3.1.3 Mechanical WWTF – Surface Water Discharge

Alternative 3 was developed to convert the existing WWTF to a modified mechanical WWTF using Sequencing Batch Reactors (SBR). This system would utilize Lagoon 1 as an influent equalization lagoon, the SBR would be built in the area of Lagoon 2, and Lagoon 3 would be used as effluent equalization so the flow could be stored before discharge if necessary to meet permit limits.

The short-term improvements at the WWTF to achieve this alternative include lagoon site work, control structure, and piping abandonment, new mechanical WWTF site work, new buildings and upgrade existing building, additional process equipment, new electrical and electrical upgrades, and irrigation system improvements.

The lagoon site work for Alternative 3 is similar to the lagoon site work in Alternative 2. Biosolids in Lagoon No. 1 and 2 would be removed, clay liner repairs would take place in Lagoon No. 1 and Lagoon No.3, but not in Lagoon No. 2. The treatment of wastewater would be confined within the concrete tanks of the SBR. Six existing lagoon control structures and piping would be abandoned.

The new Mechanical WWTF would consist of influent equalization, grit removal equipment, SBR equipment, aerobic digester and solids handling equipment, and effluent control structure upgrades. The grit removal equipment would be used to collect the grit slurry, pump the slurry to a classifier and dewater the slurry for disposal. The SBR equipment consists of a floating decanter, aeration system, automated valves, and process piping. The aerobic digester and solids handling equipment consist of the aerobic digester, wasting sludge pumps, sludge aeration equipment, sludge storage tank, sludge dewatering press, and chemical feed system. The effluent control structure (Control Structure E) would have the same upgrades as in Alternative 2, new 18-inch draw-off piping and 18-inch slide gates.

The new site work would consist of installation of site piping and utilities, natural gas/propane service, rerouting the influent force main to the new headworks building, and providing overall site development including site grading, drainage, and a new access drive.

The existing blower building would have the same upgrades as in Alternative 2 (roof and HVAC) and be converted to house the SBR process blowers and controls. The new headworks building would house process equipment for grit removal. A new biosolids handling building would be constructed to house solids handling process equipment that would work in conjunction with an aerobic digester system. This system would stabilize the sludge produced from the SBR and also store the sludge for semi-annual sludge removal.

The new electrical system would consist of a communication network to the WWTF, a SCADA monitoring system, new motor control centers and electrical gear, and an upgrade to the standby power generator and automatic transfer switch.

At the irrigation control structures, the slide gates would be replaced to maintain functionality and operation. At Control Structure F, two gates would be replaced, and at Control Structures G and H, four gates would be replaced in each structure.

A conceptual SBR and piping layout are shown in **Appendix D**.

Long-term costs for the influent force main, irrigation distribution piping, irrigation underdrains, effluent pumping, and Lagoon 3 biosolids removal are included for Alternative 3 because the effluent will continue to utilize the irrigation fields and collection system as the method of treated effluent disposal. Refer to the section above describing the long-term costs. Due to the high capital and operating costs associated with the conversion to a Mechanical WWTF, and the potential for long-term capital improvement costs associated with the irrigation system, this alternative was determined not to be feasible. No further analysis is presented on Alternative 3.

3.1.4 Mechanical WWTF – Ground Water Discharge

Alternative 4 was developed to replace the existing WWTF with an activated sludge wastewater treatment plant. This system would abandon the current WWTF and irrigation fields and construct a new Mechanical WWTF with groundwater discharge to rapid infiltration basins (RIB).

The short-term improvements at the WWTF to achieve this alternative include lagoon site work, control structure, and piping abandonment, new mechanical WWTF site work, new buildings and, and RIB system construction.

The lagoon site work for Alternative 4 involves abandoning the existing lagoon WWTF. Biosolids in Lagoon 1, 2, and 3 would be removed, and all three lagoons would be abandoned in place. Eight control structures and piping would be abandoned.

The new mechanical WWTF would consist of grit removal, oxidation ditch equipment, secondary clarifiers, aerobic digester, and solids handling equipment. The grit removal equipment would be used to collect the grit slurry, pump the slurry to a classifier and dewater the slurry for disposal. The oxidation ditch equipment would consist of two oxidation ditches with four rotors and motors per tank. This also includes process piping, valves, and electrical equipment to run the oxidation ditches. The aerobic digester and solids handling equipment consists of the aerobic digester, return and wasting sludge pumps, sludge aeration equipment, sludge storage tank, sludge dewatering press, and chemical feed system.

The new mechanical site work would consist of installation of a new effluent disposal RIB, site piping and utilities, natural gas/propane service, rerouting force main into the headworks building, and providing overall site development including site grading, drainage, and a new access drive.

The existing blower building would have the same upgrades in Alternative 2 (roof and HVAC) and be converted to house the Mechanical WWTF process controls. The new headworks building would house process equipment for grit removal.

The new biosolids handling building would be constructed to house solids handling process equipment that would work in conjunction with an aerobic digester system. This system would stabilize the sludge produced from the oxidation ditch and also store the sludge for semi-annual sludge removal.

The new electrical system would consist of a communication network to the WWTF, a SCADA monitoring system, new motor control centers and electrical gear, and an upgrade to the standby power generator and automatic transfer switch.

A conceptual activated sludge treatment facility layout is shown in **Appendix D**.

Long-term Capital Improvement costs are not included with this alternative due to the reconstruction of the influent force main, abandonment of the irrigation fields and underdrain system, and biosolids removal in Lagoon 3 that would take place as a part of this project.

3.1.5 Regional Alternative

Alternative 5 was developed to reroute the Village's wastewater to the City of Kalamazoo WWTP. This is the closest treatment facility to the Village with potentially available capacity. With this alternative, a new force main and pump stations would be installed to pump flow from the Village's main lift station, 23 miles, to Kalamazoo's WWTP. The Village's WWTF would be decommissioned and the land could be sold or repurposed by the Village.

While this option would eliminate the need to improve or operate the existing facility, the costs associated with this alternative would not be fully known until agreements are reached with the City of Kalamazoo. Additionally, the cost for the construction of a force main and pump stations is far greater than the other alternatives. No further analysis is presented on Alternative 5.

3.1.6 Optimum Performance of Existing Facilities

From a performance-based viewpoint, the WWTF is adequately meeting the demands put on it by users. The current issues at the WWTF involve the physical condition of certain process components rather than the performance of them. All improvements made to the WWTF will involve using updated materials and equipment that will make the facility run more efficiently. Unfortunately, due to the nature of the issues at the WWTF, optimization of facilities alone will not meet the Village's needs. Alternative 6 was not analyzed in any further detail.

3.2 Analysis of Principal Alternatives

3.2.1 Monetary Evaluation

The monetary evaluation includes a present worth analysis. This analysis does not identify the source of funds but compares cost uniformly for each alternative over the 20-year planning period. The present worth is the sum which, if invested now at a given interest rate, would provide the same funds required to pay projected costs within the planning period. The total present worth, used to compare the alternatives, is the sum of the initial capital cost, plus the present worth of Operation, Maintenance, and Replacement (OM&R) costs, minus the present worth of the salvage value at the end of the 20-year planning period. The real discount rate used in computing the present worth cost is established by the USDA Rural Development and is currently set at 1.5%.

The salvage value is calculated at the end of 20 years where portions of the project structures or equipment may have a salvage value, which is determined by using a straight-line depreciation. In general, concrete structures, earthwork basins, and piping have a useful life of 30-50 years and mechanical equipment has a useful life of 10-20 years.

The cost of labor, equipment, and materials is not escalated over the 20-year life since it assumes an increase in these costs will apply equally to all alternatives. The interest charge

during construction (capitalized interest) would not significantly influence the comparison of alternatives and was not included in the cost-effective analysis.

To ensure uniformity of the cost comparisons, the following cost comparison details were specifically addressed and were applied in the present worth analysis as per the EGLE guidance.

- Capital costs were included for all identified improvements.
- Sunk costs were excluded from the present worth cost. Sunk costs for the project include existing land, existing waterworks facilities, and outstanding bond indebtedness.
- Operation, Maintenance, and Replacement, (OM&R) costs were included in the present worth cost.
- The economic comparison is based on a 20-year planning period and a real discount interest rate of 1.5%, USDA Rural Development
- Salvage values were included in the present worth cost.
- Energy costs escalation was assumed equal between the alternatives and therefore are not adjusted over the 20-year period.

A detailed breakdown of project costs is included in **Appendix F** for Alternative 2 and 4. **Table 6** compares the cost difference for the alternatives. Alternative 2 has the lowest estimated net present worth at $28,763,000.

Table 6: Present Worth Summary of Principal Alternatives

Alternative	Project Cost	Annual OM&R Cost	Net Present Worth of OM&R Cost	Total Present Worth	Salvage Value	Net Present Worth
2	$13,764,000	$925,000	$15,881,000	$29,645,000	$882,000	$28,763,000
4	$20,608,000	$1,399,000	$24,019,000	$44,627,000	$3,643,000	$40,984,000

3.2.2 Environmental Evaluation

Environmental impacts are similar for the construction of Alternatives 2 and 4, which include construction at the existing WWTF site.

Alternative 2 would continue the discharge of treated effluent to the existing outfall stream. Surface water discharge permit limits are put in place to protect the receiving waters. Because of the neighboring facilities that also discharge into the common stream, effluent permit limits for the WWTF are likely to remain stringent. In the case of Alternative 4, a new groundwater discharge permit would be required. This permit would set discharge limits to protect the receiving groundwater from continuously discharged effluent.

3.2.3 Energy Efficiency Evaluation

Existing utility records for the WWTF were reviewed and analyzed to determine the effect of each alternative on the Village's electricity usage. Alternative 2 would maintain a similar treatment process to the existing WWTF. Based on the mixing requirements for current design standards, a marginal increase in electricity usage is possible. Further energy analysis on the blower technology and operation would be completed as part of the detailed design before implementing this alternative. Alternative 4 involves the construction of a Mechanical WWTF. The Mechanical WWTF would require significantly more energy to process the wastewater and handle the solids generated by the treatment process.

3.2.4 Implementability and Public Participation

The public was given a chance to review and comment on this project plan, including all of the alternatives that were considered. Additionally, a formal public hearing will be held after the comment period to ensure further opportunity for public participation. Other neighboring communities had the same access as local citizens.

The Village in its collection of ordinances does have the authority to implement the project plan. With the new proposed improvements mainly consisting of replacement of existing features to serve the same function on the same footprint, there are no foreseen site-related hardships related to the project's implementation.

Concerns related to financial burden are expected to be remediated by funding the project through low-interest loans from CWSRF. With this work needing to be done to ensure proper upkeep of essential community sanitation systems, the cost related to this project is unavoidable.

3.2.5 Technical and Other Considerations

In addition to the monetary, environmental, and energy considerations used to analyze the alternatives, a number of additional factors should be considered for each of the principal alternatives. Primary advantages and disadvantages for each principal alternative have been identified.

Alternative 2 – Improvements to the Existing WWTF

Advantages

Alternative 2 continues the operation of the WWTF similarly with minor modifications to improve facility operation and maintenance. Replacing flow control slide gates and onsite piping would allow for operational flexibility and reliability. Additionally, this alternative has lower OM&R costs than Alternative 4.

Disadvantages

The lagoon treatment systems have limitations in regards to unforeseen future conditions as it relates to effluent permit limits, treatment flexibility, and WWTF capacity expansion. The treatment technology recommended for Alternative 2 is a reliable, efficient method of wastewater treatment, but if future permit limits or design conditions change significantly from the current standards, additional equipment may be required.

Alternative 4 – Mechanical WWTF – Ground Water Discharge

Advantages

Alternative 4 would reduce the footprint of the WWTF, and eliminate the potential future capacity concerns related to the nutrient limits associated with a surface water discharge.

Disadvantages

Alternative 4 OM&R costs are higher than Alternative 2. Additionally, the Village would need to employ a Class D licensed operator to operate the Mechanical WWTF.

4.0 Selected Alternatives

Based on the Analysis of Alternatives, it was determined that Alternative 2 - Improvements to the Existing WWTF is the recommended alternative. Alternative 4 – Packaged Wastewater Treatment Plant also meets the project objectives, but has a higher capital cost than Alternative 2, and additional OM&R costs. Conceptual drawings showing these two alternatives can be seen in **Appendix D.**

Additional discussion of the recommended alternative, Alternative 2, is presented below.

Alternative 2 addresses all of the short-term and long-term capital improvement needs as identified in Section IV. Due to the criticality and interdependence of the short-term capital improvement items, it is recommended that the Village complete the projects listed below in a single project:

- Aerated Lagoon No.1 & No.2 Biosolids Removal
- Aerated Lagoon Berm Maintenance and Slope Protection
- Lagoon No.3 Berm Maintenance
- Lagoon Aeration System - Blowers, Piping, Diffusers, Baffles
- Lagoon Transfer Structures and Slide Gates
- Lagoon Transfer Piping
- Discharge Flow Meter
- Irrigation Flow Control Gates
- Blower Building Roof and HVAC, Telemetry
- Perimeter Fence Replacement

The estimated cost to address the short-term needs is $5,374,000. The recommended next steps to complete this project are outlined in Section VII and should be implemented to continue the process of improving the Village of Paw Paw's treatment system.

The remaining $8,540,000 of long-term capital improvements included in Alternative 2 were not identified as critical needs. These items are independent of one another and could be implemented on an as-needed basis. Detailed descriptions and budgets for each project are provided within this report. It is recommended that the Village begin to budget for the longer-term capital improvements.

4.1 Relevant Design Parameters

Design parameters, other than statutory rules and regulations set forth by EGLE, will consist of designing the proposed improvements to ensure the necessary capacity as determined by the visual inspection of the WWTF. Improvements will also ensure fiscal sustainability as well as addressing water and energy conservation. A basis of design showing the relevant design parameters can be seen in **Appendix E**.

4.2 Project Maps

A map of the proposed system improvements included in the Selected Alternative is shown in **Appendix D**.

4.3 Controlling Factors

The selected alternative was chosen based on several key factors. These include provisions outlined in the NPDES permit, expected continuity of population levels and local land use, and expected continuity of wastewater compositions and volumes to the WWTF.

4.4 Sensitive Features

The Village of Paw Paw and its existing WWTF are near the East, West, and Main Branches of the Paw Paw River as well as Maple and Ackley lakes. The selection and prioritization of projects reflect the importance of these sensitive environmental features to the well-being of the Paw Paw Area.

4.5 Schedule of Design and Construction

The proposed projects will be undertaken as a single-phase to occur throughout the 2022 and 2023 construction seasons. Longer-term needs identified in this report will take place in the future at an undetermined time.

Table 7: Anticipated Project Construction Schedule

Description	Activity	Time Frame
Submit CWSRF Project Plan	Planning	June 2021
Project Plan on PPL	Funding	October 2021
Short Term CIP: • Aerated Lagoon No.1 & No.2 Biosolids Removal • Aerated Lagoon Berm Maintenance and Slope Protection • Lagoon No.3 Berm Maintenance • Lagoon Aeration System - Blowers, Piping, Diffusers, Baffles • Lagoon Transfer Structures and Slide Gates • Lagoon Transfer Piping • Discharge Flow Meter • Irrigation Flow Control Gates • Blower Building Roof and HVAC, Telemetry • Perimeter Fence Replacement	Design	Fall 2021- Spring 2022
	Construction	Summer 2022 - Summer 2023
Long Term CIP: • Influent Forcemain • Irrigation Distribution Piping and Underdrains • Effluent Pump • Lagoon 3: Biosolids Removal	Design	Future
	Construction	Future

4.6 Cost Summary

Cost estimates for the various projects can be seen below in **Tables 8 and 9.** Detailed cost estimates can be found in **Appendix F.**

Table 8: Short-Term CIP Cost Summary

#	Project Description	Estimated Cost
1	Aerated Lagoon #1 and #2 Biosolids Removal	$ 846,000
2	Aerated Lagoon Berm Restoration and Slope Protection	$ 877,000
3	Lagoon #3 Berm Restoration	$ 753,000
4	Lagoon Aeration System - Blowers, Piping, Diffusers, Baffles	$ 1,880,000
5	Lagoon Transfer Structures and Slide Gates	$ 346,000
6	Lagoon Transfer Piping	$ 332,000
7	Discharge Flow Meter	$ 21,000
8	Irrigation Flow Control Gates	$ 106,000
9	Blower Building Roof, HVAC Improvements, and Telemetry	$ 63,000
10	Site Containment Fencing	$ 150,000
Total - Short Term CIP		**$ 5,374,000**

Table 9: Long-Term CIP Cost Summary

#	Project Description	Estimated Cost
1	Influent Forcemain	$ 220,000
2	Irrigation Distribution Piping	$ 3,810,000
3	Irrigation Underdrains	$ 2,520,000
4	Effluent Pumping	$ 60,000
5	Lagoon #3 Biosolids Removal	$ 1,930,000
Total - Long Term CIP		**$ 8,540,000**

4.7 Authority to Implement the Selected Alternative

The Village of Paw Paw owns and operates the WWTF. Their existing ordinances provide the necessary authority to implement the selected alternative and make the necessary changes to their rate structure to repay construction loans or bonds associated with the proposed work.

4.8 User Cost

If CWSRF funds are obtained for these projects in the form of a 30-year loan at an interest rate of 2.125% (based on 2021 published interest rates), sanitary sewer rates will need to be adjusted to cover the additional debt service to cover principal and interest payments based on the following data:

Project Cost:	$5,374,000
Interest Rate:	2.125%
Term:	30 Years

The Village would be required to generate an additional $20,350 monthly to repay the CWSRF loan. Based on the count of 2,047 sanitary services in the system, this would equate to a monthly increase of $9.95 per average user.

This analysis assumes the Village would obtain the loan money for all proposed projects as part of a single phase of construction. If funding is obtained in multiple phases, the increase in user fees could be phased appropriately. It also assumes that the Village will not receive any principal forgiveness from EGLE. It has been recent practice for EGLE to provide significant principal loan forgiveness to disadvantaged communities to help reduce the impact on rate payers.

4.9 Disadvantaged Community

The village of Paw Paw has disadvantaged community status as determined by the most recent filings with EGLE.

4.10 Useful Life

As stated in previous sections, concrete structures, earthwork basins, and piping have a useful life of 30-50 years and mechanical equipment has a useful life of 10-20 years. With mechanical equipment making up only a small portion of the proposed improvements, it can be expected that the useful life for all of the improvements in this project plan should last longer than the term of the loan.

5.0 Evaluation Of Environmental Impacts

5.1 Analysis of Impacts

5.1.1 Direct Impacts

Direct impacts on the environment would be both long and short term. The expenditure of monetary resources for construction, the use of energy for construction, and the short-term disturbance to the community due to construction are all primary direct impacts.

Short-term impacts will be related to construction. Minor impacts will include the increase in noise and dust at the construction sites, along with emissions from both gasoline and diesel engines. Impacts resulting from construction practices will cease or be repaired after the project. During the period of construction, the adverse impacts can be significantly reduced through proper soil erosion control procedures, air pollution control equipment, noise barriers, mufflers, efficient construction methods, and limitations to the allowed hours of work.

Long-term effects of the proposed alternative would include the decreased risk of health issues related to sewer backups and overflows. Also, a reduction in the amount of energy used at the WWTP due to updated equipment would result in the construction of these improvements. Future growth within the community utilizing the existing system capacity would also be a long-term beneficial impact, which can be controlled using existing ordinances and land use plans.

Adverse impacts upon sensitive environmental areas will be either non-existent or minimal. Construction of sewer work will take place in the existing footprint of the Village's WWTF. Some construction will encroach upon wetlands and flood plains but will be short-term. There are no historical or archeological sites anticipated to be disturbed within the proposed plan area.

5.1.2 Indirect Impacts

Indirect impacts are the result of the development and operation of the proposed project. The proposed construction will result in impacts to development trends, water quality, and environmental trade-offs.

The project plan will eliminate and shore up defects and deficiencies at the WWTF. Replacement of plant infrastructure minimizes the effects of sewage discharges, specifically, the introduction of fecal coliforms, which are detrimental to the public health and welfare in the short term and the addition of these pollutants is a threat to overall water quality in the long term that could result from failure of this infrastructure. The mitigation of these risks will have a long-term beneficial impact on the surface water quality within the Study Area.

The proposed alternative will also provide an increase in system efficiency, which will allow for some future development. The new growth could lead to a higher-density residential pattern and an increase in population. The increased capacity within the system would also create the potential for industry. Most new industries would typically be small manufacturing which prefer to locate in small rural settings with water, sewers, utilities, and good transportation systems. Some benefits of industrial development include an improved economic base, the provision of local jobs, and a reduction of local unemployment. An adverse effect would be the introduction of

industrial wastes into the collection and treatment system. However, this could be minimized by requiring pre-treatment before dumping into the system.

6.0 Mitigation Measures

6.1.1 Short-Term Construction-Related Mitigation Measures

6.1.1.1 General Construction

The primary adverse impacts are related to the construction work required for WWTF construction. These impacts can be minimized through efficient and cost-effective design and construction practices, soil erosion control procedures, air pollution control equipment, noise control, and mufflers. The project will also be segmented to allow a balanced construction cycle to minimize inconvenience to the community as a whole.

Efficient, cost-effective design of the project plan will result in more construction per dollar cost, as well as provide a lower maintenance cost system than that which is in place now.

Soil erosion control procedures, such as the use of silt fences, erosion control blankets, watering, and the immediate seeding of disturbed areas with help to control erosion caused by rainfall and wind.

Air pollution can be minimized by proper maintenance through proper muffling of equipment and by limiting construction to acceptable times during the daytime hours.

Any work within wetland areas would be mitigated by prohibiting the disposal of spoils within the wetland (and requiring disposal off-site), specifying the use of construction mats/wash down areas, scheduling work for drier seasons, etc.

The following measures could be taken to avoid, eliminate, or mitigate potential adverse impacts on the environment:

- Traffic Control – Flagmen, Warning Signs, Barricades, Cones, etc.
- Dust Control – Calcium Chloride and Water.
- Noise Control – Designate Work Hours, Mufflers, No Work on Weekend or Holidays.
- Soil Erosion and Sedimentation Control – Seeding, Sodding, Rip Rap, Erosion-Control Blankets, Silt Fence, etc.
- Restoration – Pavement, Gravel, Topsoil, Seed, Fertilizer, Mulch, Sod.

6.2 Mitigation of Long-Term Impacts

6.2.1 Siting Decisions

The location of the WWTF and the associated improvements cannot be relocated and do not need to be. Conducting work in the footprint of the existing WWTF minimizes long-term, negative impacts of construction.

6.2.2 Operational Impacts

Continued use of up-to-date wastewater treatment infrastructure will minimize the long-term impacts that come from the normal operation of such a facility. These improvements themselves will help minimize operational impacts.

6.3 Mitigation of Indirect Impacts

6.3.1 Master Plan and Zoning

Updates to the Village's Master Plan and Zoning Ordinances do not provide for much change in land use of the area served by the plant. The area's expected population change should sufficiently be supported by the plant's current capacity. This work will only enhance the plant's ability to support the Village's future visions rather than hinder them.

6.3.2 Ordinances

Based on population projections, the plant's current capacities, and current land-use patterns, no additional ordinances are expected to be needed to address any growth-related problems. If loading of some pollutants comes to exceed what is allowed by the NPDES permit, chemical treatment can easily be re-instated back into the plant's processes to remediate these concerns.

6.3.3 Staging of Construction

Construction of the recommended improvements will be staged in a way that makes sense financially and logistically while minimizing impacts to the normal functioning of the WWTF. The most critical improvements will be made first to maximize the project's utility.

7.0 Public Participation

7.1 Public Meetings on Project Alternatives

No public meeting was held to discuss the plan before the formal public hearing. Abonmarche has been working closely with staff to develop the contents of the plan. Village council members and the general public had the required 30 day period to review the project plan and submit questions to Abonmarche and Village Staff before the formal public hearing.

7.2 PUBLIC HEARING ADVERTISEMENT

A public hearing was scheduled for May 24, 2021, and an advertisement was posted in the local newspaper on April 22, 2021. Advertisements and links to electronic copies of the report were provided online at www.pawpaw.net. Documents can also be obtained from the Bid Room at www.abonmarche.com. Hard copies, located at Village Hall and the Paw Paw District Library. A copy of the advertisement along with an affidavit of advertising is included in **Appendix H**.

7.3 PUBLIC HEARING TRANSCRIPT

The transcript of the Public Hearing along with the sign-in sheet and adopted resolution accepting the Plan is included in **Appendix H**.

7.3.1 Comments Received and Answered

7.4 Adoption of Project Plan

On July xx, 2021, the Village Council members present voted X-X to approve Resolution xx-xx adopting the Final CWSRF Project Plan for WWTF Improvements and Designating an Authorized Project Representative.

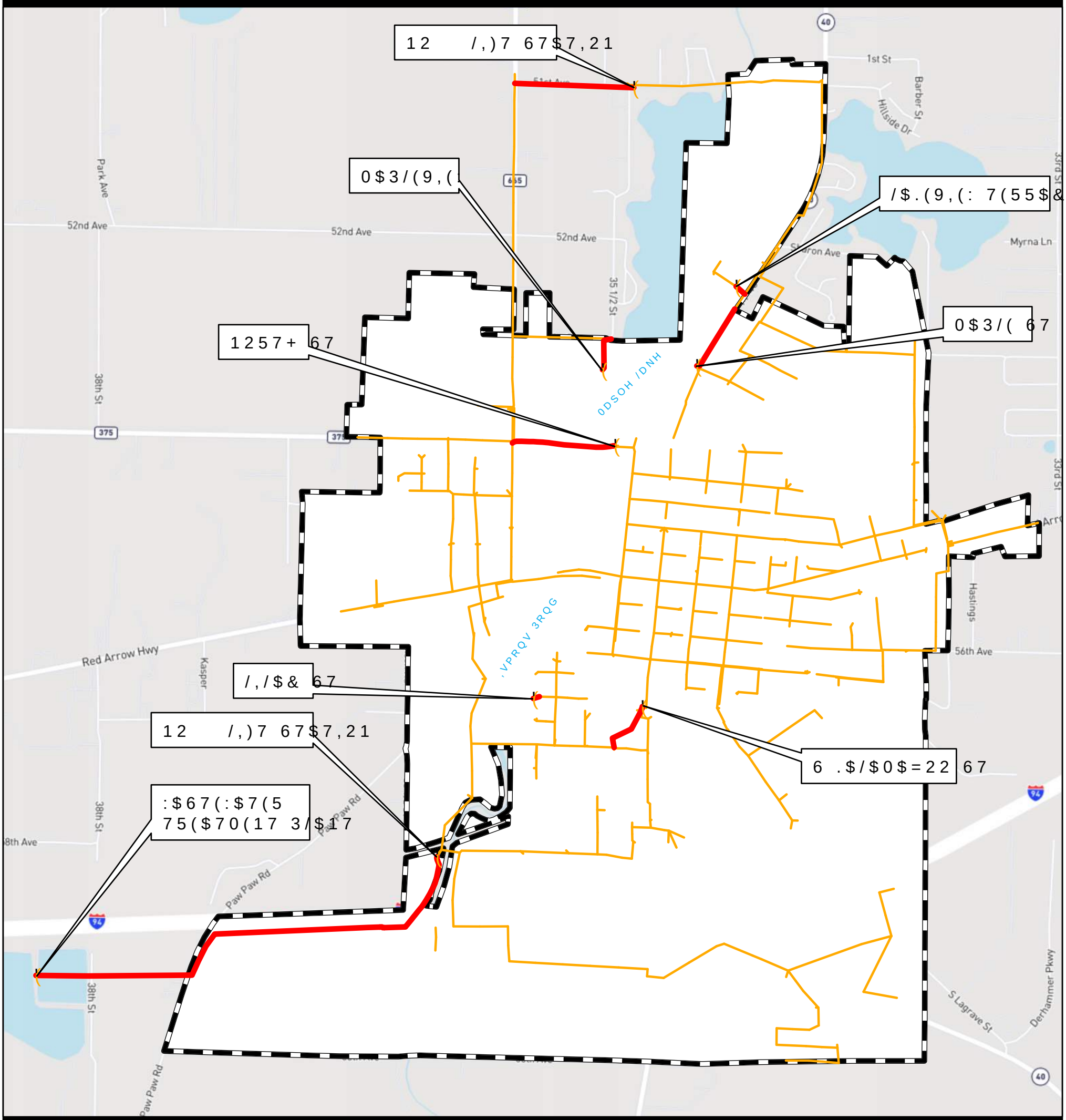
A copy of the resolution is included in **Appendix I**.

APPENDIX A:

EXISTING WASTEWATER SYSTEM MAPS

A-1: ..... EXISTING SANITARY SEWER SYSTEM MAP

A-2: ..... EXISTING WWTF SITE PLAN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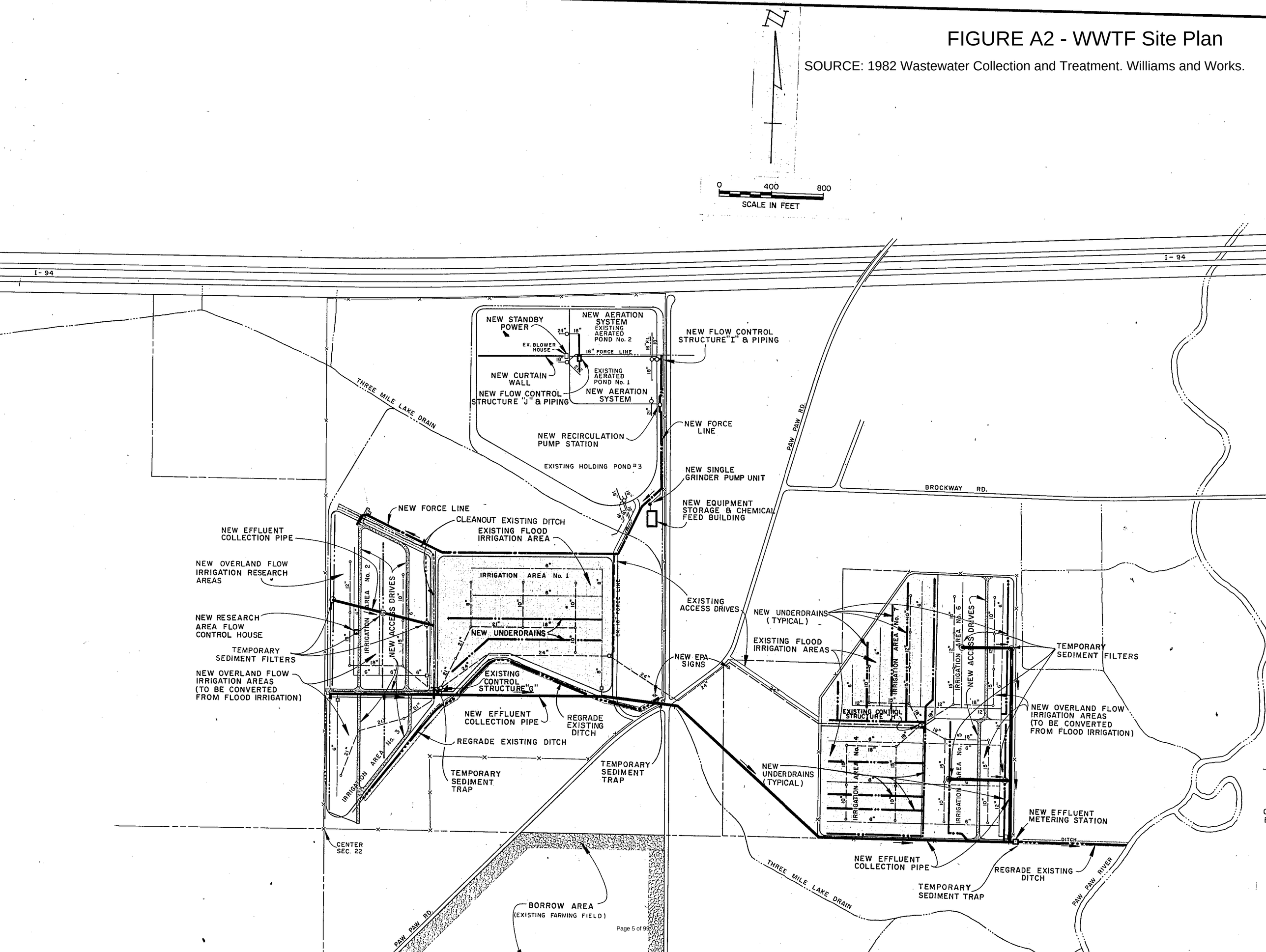
12 /,)7 67$7,21
0DSOH /DNH
, VPRQV 3RQG
1st St
Barber St
Hillside Dr
Myrna Ln
Park Ave
52nd Ave
52nd Ave
52nd Ave
35 1/2 St
33rd St
38th St
38th St
38th St
Red Arrow Hwy
Kasper
Paw Paw Rd
Paw Paw Rd
Hastings
56th Ave
S Lagrave St
Derhammer Pkwy
375
375
655
94
94
40
40

ABONMARCHE

FIGURE A2 - WWTF Site Plan

SOURCE: 1982 Wastewater Collection and Treatment. Williams and Works.



APPENDIX B:

WWTF FEASIBILITY STUDY

B-1:.....WATERWATER TREATMENT FACILITY INVESTIGATION REPORT AND FEASIBILITY STUDY (FLEIS & VANDERBRINK)

Village of Paw Paw

Wastewater Treatment Facility

FEASIBILITY STUDY

PREPARED FOR:

VILLAGE OF PAW PAW

VAN BUREN COUNTY, MICHIGAN

ABONMARCHE

FLEIS&VANDENBRINK

DESIGN. BUILD. OPERATE.

Date: November 2019
Project No.: 840560

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EXECUTIVE SUMMARY

This Feasibility Study was completed to evaluate the current performance and physical condition of the Village of Paw Paw Wastewater Treatment Facility (WWTF). The wastewater collection system and pump stations were not included as part of this evaluation. The study includes recommended upgrades to the WWTF and reflects the short-term and long-term needs of the community. The 20-year planning period for this report is from 2019 through 2039.

This report presents the results of the engineering and scientific evaluations performed to determine the facility needs, develop alternatives to address identified deficiencies, and to define the scope of the recommended improvements. Background information on the existing system is also provided along with the rationale used to define alternatives capable of meeting the wastewater treatment needs of the community. The viable alternatives were compared and evaluated based on their financial and technical feasibility.

The Village WWTF was originally constructed in 1972, but the treatment capacity was expanded in 1982 to 1.4 million gallons per day (MGD) in order to meet the growing demands of the service area. The current average flow received by the WWTF is approximately 590,000 gallons per day (gpd). Based on our evaluation of the physical condition of the WWTF with input from Village Staff, the current deficiencies identified at the WWTF include:

- Aging aeration infrastructure
- Corroded transfer structures and piping
- Decreased functionality of flow control slide gates
- Eroded lagoon berm
- Blower building roof and HVAC equipment failure

As the needs were evaluated, two principal alternatives were developed to meet the project objectives and serve the long-term needs (20-year planning period) of the Village. These alternatives are described below.

Alternative 2 involves improvements to the existing Lagoon WWTF including a new aeration system, distribution piping, flow control gates, and berm maintenance. Long-term capital improvements for the Irrigation system and surface water discharge are also included with this alternative.

Alternative 4 involves abandoning the existing Lagoon WWTF and constructing a new Mechanical WWTF with groundwater discharge facilities.

A detailed cost analysis was performed for the two principal alternatives. Estimated capital costs are presented in Table 1 below along with the net present worth for each alternative. The net present worth analysis incorporates Operation, Maintenance and Replacement (OM&R) costs, and salvage value for each alternative.

Table 1: Alternative Cost Estimates, 20-Year Planning Period

Alternative	Total Capital Cost	Net Present Worth
2 – Optimize Existing WWTF	$13,764,000	$28,763,000
4 – Mechanical WWTF	$20,608,000	$40,984,000

The monetary evaluation revealed that Alternative 2 has the most economical net present worth. Alternative 2 is technically feasible and would address all of the short-term and long term needs at the WWTF. Due to the criticality and interdependence of the short-term needs identified in Alternative 2, it is recommended that the Village implement the projects identified below into a single project:

- Lagoon No.1 and No.2 Biosolids Removal
- Lagoon No.1 and No.2 Berm Repairs and Slope Protection

- Lagoon No.3 Berm Repairs
- Lagoon Aeration System Improvements
- Lagoon Transfer Structures and Slide Gates
- Lagoon Transfer Piping
- Discharge Flow Meter Replacement
- Irrigation Flow Control Gate Replacement
- Blower Building Roof, HVAC, and Telemetry

The estimated cost to address the short-term needs is $5,224,000. The recommended next steps to complete this project have been identified and should be implemented to continue the process of improving the Village of Paw Paw treatment system.

The remaining $8,540,000 of long-term capital improvements included in Alternative 2 were not identified as critical needs. These items are independent of one another and could be implemented on an as-needed basis. Detailed descriptions and budgets for each project are provided within this report. It is recommended that the Village begin to budget for the longer-term capital improvements.

I. INTRODUCTION

A. Objectives

The purpose of this Feasibility Study is to evaluate alternatives for the Village of Paw Paw Wastewater Treatment Facility (WWTF) to meet the long-term wastewater treatment needs of the service area. In order to accomplish this objective, historical operating data, effluent permit limits, and physical condition of the WWTF were reviewed to determine the future treatment needs. An evaluation of the existing WWTF, projected flows and loadings, and future economic and environmental considerations have been used to identify the prioritized needs and necessary improvements. These results have been used to identify and analyze principal alternatives to meet the long-term requirements of the Village.

B. Project Background

The Village of Paw Paw WWTF is located west of the Village, on Paw Paw Road. The WWTF was originally constructed in 1972, but the treatment capacity was expanded in 1982 to 1.4 million gallons per day (MGD). Since the original construction, no significant rehabilitation projects have been completed.

The WWTF operates under the jurisdiction of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) National Pollutant Discharge Elimination System (NPDES). The WWTF is authorized to discharge treated effluent under the general NPDES Permit No. MI0021741.

The WWTF accepts wastewater flow from the Village's sanitary sewer collection system. The WWTF and collection system are operated by Village staff. A map of the sanitary collection system and WWTF can be found in Figure A1 and Figure A2 of Appendix A.

Wastewater is collected throughout the Village and is pumped and/or flows by gravity to the Main Lift Station. Wastewater is screened at the Main Lift Station and then pumped to the WWTF. Under normal operating conditions, wastewater flows in series from Aerated Lagoon No. 1 to Aerated Lagoon No. 2, and then into Lagoon No. 3 for further polishing and storage. Ferric chloride or aluminum sulfate may be added to aid in phosphorus removal. Currently, chemical precipitation of phosphorus is not utilized. Each lagoon is constructed with a clay liner and outfitted with control structures to facilitate the transfer of water between lagoons. Treated wastewater is discharged by gravity from Lagoon No. 3 to any of the seven irrigation fields. Underdrainage from the flood irrigation, overland flow, and rain/snow/groundwater runoff is collected, metered, and monitored before being discharged into the Paw Paw River. Currently, treated wastewater is only discharged during the months of October through April, but flow through the outfall is continuous, due to intercepted groundwater flows.

II. DESIGN CRITERIA

A. Development of Design Criteria

Specific design criteria was developed for the WWTF in order to evaluate the performance of the treatment system and understand the extent of the improvements required at the facility. The 1982 WWTF Basis of Design and current wastewater flow characteristics were reviewed and used as a baseline for the proposed future design criteria. The design criteria takes into account the possible increases in service population through population projections.

The design criteria was determined based on a 20-year planning period. For this study, the planning period is 2019 to 2039.

B. Population Projections

The WWTF provides treatment and disposal for wastewater collected throughout the Village and portions of Waverly and Paw Paw Township. The Village's estimated 2018 population was 3,385 persons.

The 20-year population projections for the Village of Paw Paw are constrained by the area of potential growth. The Village's average annual growth rate from 1930 to 2010 was 0.93%. According to US Census Bureau data, the Village's estimated population in 2018 (3,385) was less than it was in 2010 (3,534 persons).

Figure 1 and Table 2 below illustrate the historic and projected Village population data. Based on data from the West Michigan Regional Planning commission and the 2016 State Revolving Fund Application, a conservative projected increase in Village population of 1.0% was used to evaluate the future needs of the system.

Figure 1: Paw Paw Population Data and Projections

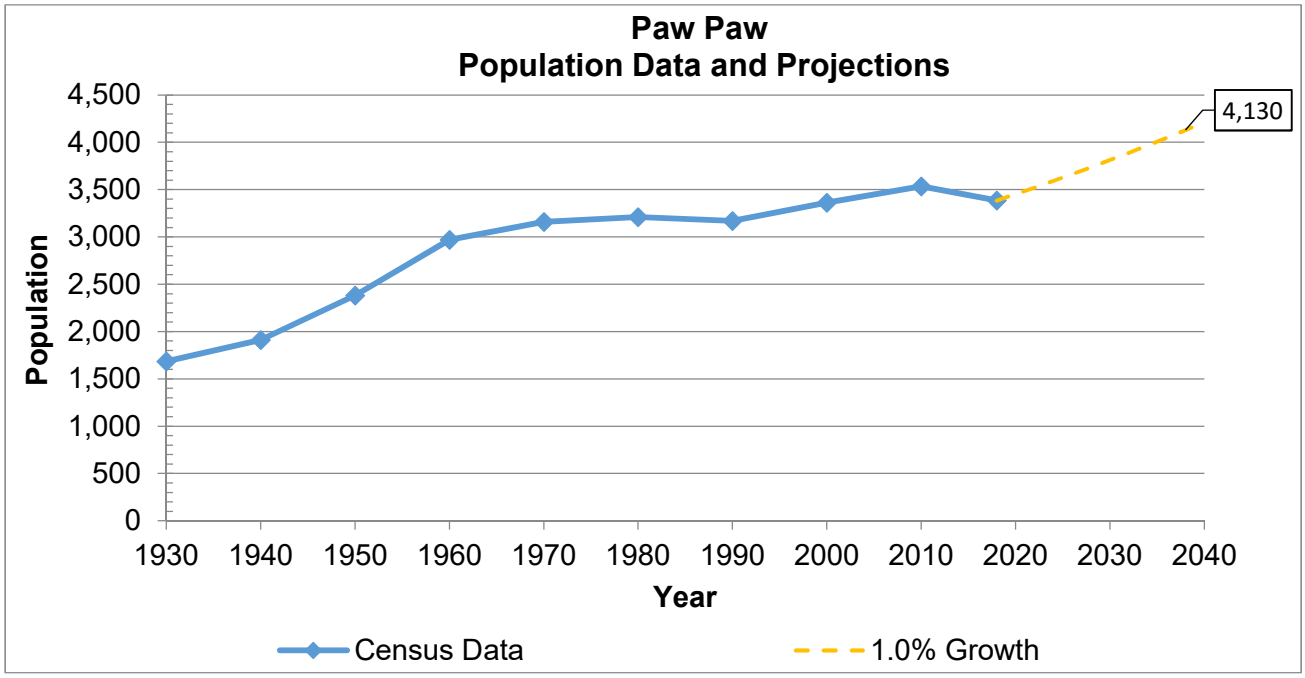

Table 2: Village Population and Projections	
	Total Village Population
Estimated (2018)	3,385*
Projected (2039)	4,130

*2018 US Census Bureau estimate

C. Wastewater Characteristics

A detailed review of operating records from January 2015 through June 2019 was completed to evaluate the current influent wastewater volume and quality.

1. Wastewater Volume

A flow meter at the main lift station records the daily flow pumped to the WWTF. During the period of review, the WWTF received an average daily flow of approximately 0.590 million gallons per day (MGD). Daily flow rates ranged from 0.245 MGD to 1.535 MGD. Future flow projections are based on the available historical flow data and projected population growth. Assuming wastewater is generated at the current rate, the projected average daily flow rate is 0.727 MGD in 2039.

2. Wastewater Quality

Composite samples of the raw influent wastewater are collected at the WWTF and analyzed for the parameters summarized below. A summary of influent sampling results along with the 1982 WWTF design information are presented in Table 3 below.

Table 3: Concentrations and Loading			
Parameter	**Unit**	**Influent Sampling (2015-2019)***	**Basis of Design (1982)****
BOD	Conc. (mg/L)	344	412
	Loading (lb/d)	1,692	4,810
TSS	Conc. (mg/L)	260	-
	Loading (lb/d)	1,272	-
Ammonia	Conc. (mg/L)	23	-
	Loading (lb/d)	113	-
Phosphorus	Conc. (mg/L)	5.0	-
	Loading (lb/d)	25	-

***average daily flow of 590,000 gpd used to calculate loading**

****average daily design flow of 1.4 MGD used to calculate loading**

D. Basis of Design

Based on the review of historical WWTF records and projected future wastewater flows, the basis of design presented below was developed to evaluate the future needs of the WWTF for a 20-year planning period. Further details are provided in Appendix C. Effluent permit limits are governed by the Village's NPDES Permit (Appendix B). The current permit has expired and a new permit has not yet been issued, but for the purposes of this study and alternatives evaluated, the existing permit limits were assumed to be the same.

Table 4: WWTF Basis of Design

1982 WWTF Design Flows and Loadings:					
Average Daily Flow (ADF):		1.40	MGD		
Maximum Daily Flow:		2.09	MGD		
20-Year Design Sewage Characteristics:					
		Average Day		Maximum Day	
		mg/L	lbs/day	mg/L	lbs/day
	BOD:	412	4,810	989	17,250
Current WWTF Flows and Loadings:					
Number of Customers:		4,798	*May 2016 SRF application		
Average Daily Flow (ADF):		0.59	MGD		
Maximum Daily Flow:		1.54	MGD		
Current Influent Sewage Characteristics:					
Average Daily Concentration and Loads					
		mg/L	lbs/day		
	BOD:	344	1,712		
	TSS:	260	1,272		
	Total P:	5.0	23.0		
	NH3-N:	20.0	95.0		
2039 Projected WWTF Flows and Loadings:					
2039 Projected Number of Customers:		5,913			
2039 Projected Influent Flow:		0.727	MGD		
Plant Capacity - Average Daily Flow (ADF):		1.400	MGD		
Plant Capacity - Maximum Daily Flow:		2.090	MGD		
20-Year Design Sewage Characteristics:					
		Average Day		Maximum Day	
		mg/L	lbs/day	mg/L	lbs/day
	BOD:	412	4,813	412	7,181
	TSS:	300	3,505	300	5,229
	Total P:	10.0	117	10	174
	NH3-N:	25.0	292	25	436

III. Evaluation of Wastewater Treatment Facility

A. General

The WWTF was constructed in 1972 and was expanded in 1982. Since 1982, the WWTF staff has maintained the original equipment and made the necessary repairs to keep the system operational. However, due to the age of the facility and the harsh conditions associated with the treatment of wastewater, significant improvements are required to maintain reliable treatment.

B. Influent Flow Measurement and Control

All wastewater in the collection system ultimately flows to Lift Station No. 1 (LS #1). LS #1 is equipped with a magnetic type flow meter. The flow meter records flow and reports the reading to two remote recorders/totalizers. The flows measured by the meter in LS #1 are used as the raw influent flows for the plant and reported in the monthly operating reports. From LS #1, wastewater is pumped through a 16-inch forcemain to Control Structure “A” at the WWTF. The control structure was designed to route the influent to the first aerated cell through a 21-inch ductile iron pipe. Control Structure “A” is also equipped with an 18-inch corrugated metal bypass line, which feeds directly to Lagoon No.3. The control structure is outfitted with two slide gates to regulate flow. Since the construction, the bypass slide gate has been permanently closed.

Flow to Control Structure “A” can also be bypassed directly to Aerated Lagoon No. 2 by means of a 16-inch ductile iron pipe and air break structure connected to the 16-inch forcemain. Flow through the bypass is controlled by two gate valves.

At the time of the inspection, Control Structure “A” showed signs of significant deterioration. Both flow control gates were severely corroded and inoperable. The corrugated metal piping and concrete structure were both showing evidence of degradation due to the corrosive wastewater conditions. The functionality of the bypass gate valves was unknown, but due to the age of the valves and lack of operation, they are likely in need of repair or replacement.

C. WWTF Lagoons

The WWTF is comprised of three lagoons used to biologically treat and store wastewater. Biological treatment at the WWTF takes place in the two aerated lagoons. The addition of air provides oxygen for aerobic degradation of organic matter. Following treatment in the Aerated Lagoons, water is directed to Lagoon No. 3 for further polishing and storage prior to discharge to the Irrigation Fields. According to the 1972 construction records, all of the lagoons were constructed using a clay seal - 12” thick on the side slopes and 8” thick on the lagoon bottoms. The clay liner system does not meet current design standards, but is similar to many other lagoons constructed during this time period. Typically, complete reconstruction of the liner is not required, but maintenance of the berms is recommend to preserve their integrity**.**

1. Aerated Lagoons

The two aerated lagoons are each 5.0 acres at the high-water level and hold approximately 21 million gallons per lagoon. They are designed to be partially mixed and have piping provisions to operate in series or parallel. Wastewater enters Aerated Lagoon No. 1 through a pipe penetrating the clay liner on the west bank of the lagoon and flows to Aerated Lagoon No. 2 through an 18-inch corrugated metal pipe.

The center berm that divides the two aerated cells is showing evidence of significant erosion. The original 1:3 slope has been worn away and now a much steeper slope exists near the water surface. Operations Staff reported that gravel had been placed on the berm to prevent further erosion, but much of the small gravel had been washed away.

2. Aeration Equipment

Four positive displacement blowers are housed in the blower building to supply the necessary air for effective treatment and mixing. Air travels down the two distribution headers located on the center berm between Lagoon No.1 and Lagoon No. 2 and then enter the lagoons through flexible lateral pipes connected to submerged cyclone diffusers.

The aeration system is the heart of the treatment system, and functional operation is necessary to maintain reliable treatment. There were several deficiencies observed during the inspection that should be considered for repair or replacement. The main concern is the aeration headers, located on the eroding lagoon berms. Due to the location of the air header and the berm degradation, the header piping has begun to lean towards the lagoons and is at risk of total collapse into the lagoons. While the blowers and cyclone diffusers remain operational, they are original to the 1982 expansion and have exceeded their expected useful life. Evidence of the aging infrastructure was observed in the corroded blower intake silencers, replacement blower motor, and malfunctioning diffusers.

3. Lagoon No. 3

The Lagoon No. 3 is a 24.5 acre lagoon at high water level with a total depth of 17-feet and a working/storage depth of 12-feet. The bottom 2-feet of the lagoon is designated for sludge storage. The working volume is 95.7 million gallons and the sludge storage volume is 14 million gallons.

The primary function of the Lagoon No.3 is to serve as a polishing cell and as a storage basin for treated wastewater prior to discharge. Lagoon No.3 is also able to operate temporarily as a facultative lagoon to achieve biological treatment at low flow and loadings that are observed in the effluent of the aerated lagoons or during brief periods of aeration cell bypassing. The area closest to the surface produces an aerobic environment, the middle section operates as an anoxic environment, and the bottom of the lagoons are an anaerobic environment.

During normal operation, the effluent from Aerated Lagoon No. 2 flows through and 18-inch corrugated metal pipe which feeds into the lagoon in the northeast portion.

At the time of the inspection, the lagoon berms showed signs of significant deterioration. The prevailing wind and wave direction, along with the constantly changing lagoon elevation has resulted in erosion along a majority of the lagoon berms specifically along the northern and eastern berms. The clay liner is visible in many areas and the original 1:4 slope has been worn away.

4. Flow Control Structures and Piping

There are eight concrete flow control structures located within the lagoons. The purpose of these structures is to regulate lagoon level and facilitate flow through the lagoons. The structures are outfitted with 18” slide gates and corrugated metal transfer piping. A majority of this equipment is original to the 1972 construction, with two additional structures being added in 1982.

At the time of the site review, the visible corrugated metal pipe and slide gates showed signs of deterioration. Operators indicated that one emergency repair on a segment of corrugated metal pipe had already been completed due to a failure. Because of the age, material, and harsh environment that exists within these structures, it is likely that the piping and valves that were not visible are in similar condition.

D. Discharge Facilities

Effluent from Lagoon No. 3 is discharged by means of flood irrigation and overland flow in a series of irrigation areas to the south and southeast of the WWTF. Underdrains in the irrigation area capture WWTF effluent flow and rain/snow/groundwater, and discharge to the Paw Paw River. Refer to Figure A2 in Appendix A for an overview of the effluent discharge facilities. The combined total of all collected water from the irrigation areas represents the final effluent discharged by the Paw Paw WWTF.

1. Effluent Discharge Structures

Lagoon Control Structure “E” is used to transfer wastewater from Lagoon No. 3 to Irrigation Control Structure “F”. Irrigation Control Structure “F” contains a wet well with sufficient operational elevation to gravity feed to the entire irrigation distribution network. Irrigation Control Structure “F” feeds into Irrigation Control Structures “G” and “H”.

Irrigation Control Structure “G” distributes treated effluent among Irrigation Areas 1, 2, and 3. Irrigation Area 1 is irrigated by means of flood irrigation, where effluent from Lagoon No. 3 flows through multiple risers in the field then trickles down through the soil before being intercepted by underdrains. The underdrains connect to the final effluent collection pipe network. Irrigation Areas 2 and 3 are irrigated by means of overland flow, where Lagoon No. 3 effluent flows through a gated pipe on the upslope side of the field. The gated pipe can be balanced to ensure wastewater is applied over the entire field. The wastewater flows down the sloped field and is collected in a ditch on the downhill side before feeding into the final effluent collection pipe network.

Irrigation Control Structure “H” distributes Lagoon No. 3 effluent among Irrigation Areas 4, 5, 6, and 7. Irrigation Areas 4 and 7 are irrigated by means of flood irrigation. The underdrains in these fields connect to the final effluent pipe. Irrigation Areas 5 and 6 are irrigated by overland flow. The ditches on the downhill side of these fields, designed to intercept the overland flow, connect to the final effluent pipe.

The irrigation system was modified in 1982 to include additional underdrains, interception and drainage ditches, and collection piping. All of the Irrigation Areas were tied into a common effluent collection system. The final effluent is sampled and metered at this discharge point.

A majority of the discharge piping and underdrain collection piping is buried, so the exact condition is unknown. Operators did not report any known piping deficiencies, but it is recommended to excavate a few critical areas and assess the condition of the piping. The irrigation flow is controlled by a series of slide gates that direct flow to the individual fields. These slide gates are original to the 1972/1982 installation and have exceeded their expected useful life. The functionality of the gates presents an operational challenge for WWTF staff.

E. Biosolids Profiling

According to the WWTF Operations and Maintenance Manual, the Village removed approximately 3,000,000 gallons of sludge from Lagoon #2 in 1995 and approximately 3,600,000 gallons of sludge from Lagoon #1 in 1996. As part of this feasibility study, biosolids profiling and analytical sampling was completed for all three lagoons to estimate the current volume and determine the characteristics of the biosolids. The detailed results of the biosolids profiling and sampling are summarized in Appendix E. Aerated Lagoon No. 1 contains an average sludge depth of 3.4 feet and Aerated Lagoon No. 2 contains an average sludge depth of 1.6-ft. Lagoon No. 3 contains an average sludge depth of 1-ft. Sludge samples were collected and analyzed for metal contents and total solids. The results showed the concentrations of each parameter analyzed were below the Part 24 Ceiling Pollutant Concentrations for land application, with the exception of molybdenum in Lagoon No.1. Molybdenum levels in Lagoon No.1 were slightly above the maximum allowable concentration. With approval from EGLE, biosolids from Lagoon No.1 could be blended with biosolids from Lagoon No.2 to meet the ceiling criteria for land application.

F. Ancillary Equipment

1. Generator

The Village currently owns a permanent standby generator used to provide backup power to the WWTF. The generator was replaced approximately 10 years ago and remains in good condition.

2. Chemical Feed Equipment

A chemical feed system was included during the 1982 improvements project. The chemical feed system provides a means of storing, transferring, and mixing ferric chloride or aluminum sulfate to the WWTF system to aid in the chemical removal of phosphorus.

Under the current operation, the chemical feed is not required to meet the effluent permit limits, so the equipment has not been placed into service. If future conditions dictate the need for additional phosphorus removal, minor improvements should be anticipated to get the system operation.

G. Building Conditions

The WWTF blower building was constructed during the 1982 construction project. The building is in fair to poor condition. A majority of the HVAC equipment has failed and the roof is in need of replacement. The condition of this building is critical to protect the electrical gear and aeration blowers.

H. WWTF Capacity Evaluation

Historical WWTF effluent records from January 2015 through June 2019 were reviewed and compared to NPDES permit limits. Overall, the plant has performed well throughout the period of review. The facility has exceeded the 20-year design window and continued to provide adequate treatment for the Village beyond the original planning period. Minimal growth throughout the service area has maintained flow rates within the original design capacity. As part of the feasibility study, a detailed capacity analysis was completed to determine which assets, if any, could potentially limit the WWTF in the future.

The aeration capacity of the existing system is adequate to accommodate the current and projected future flows and organic loadings.

The main concern identified as part of the capacity evaluation was the restrictive phosphorus loading limits in the summer months (60 lb/mo, May-September). The permitted WWTF discharge includes WWTF Lagoon effluent and groundwater underflow. During the summer months, groundwater under flow contributes approximately 37 lb/mo, leaving only 23 lb/mo for WWTF Lagoon effluent discharge.

Due to the restrictive phosphorus loading limits, WWTF effluent is currently stored in Lagoon No.3 and then discharged during the months of October through April. Lagoon No.3 contains 95.7 million gallons in storage capacity and flow must be stored for 152 days under the current operation. This results in an average daily flow capacity of 0.630 MGD. Given the current average influent flow of 0.590 MGD, the current mode of operation could potentially limit the WWTF.

Three alternatives to address summertime phosphorus loading restrictions were developed. By discharging small amounts of effluent throughout the summer months, the WWTF could regain some storage capacity and still meet final effluent phosphorus limits. The exact volume that could be discharged will depend on the WWTF effluent phosphorus concentration and groundwater underflow loading. Based on historical effluent flows and loadings, it is estimated that approximately 0.086 MGD could be discharged in the summer months. This could increase the WWTF capacity to 0.720 MGD. If flows increase beyond 0.720 MGD, additional action would be required.

The chemical feed system could be placed back online to reduce the phosphorus concentrations in the WWTF effluent. This would allow larger volumes of wastewater to be discharged within the loading limits. Another alternative would be to install an irrigation pump at the Lagoon No.3 effluent structure. The structure is equipped with a forcemain connection that would allow the lagoon effluent to be pumped down to low water level during the winter months and further increase the summertime storage capacity to 117.5 MG.

IV. Capital Improvement Plan (CIP)

Based on the findings of this Feasibility Study, a 20-year Capital Improvement Plan was developed to address the short term and long-term needs identified at the WWTF. The sections below outline the scope of the proposed short-term and long-term projects, as well as the project cost considerations.

A. Short-Term CIP (1-5 Year)

1. **Aerated Lagoon No. 1 & No. 2 Biosolids Removal**
   The current biosolids depth in Lagoon No.1 averages 3.4-feet and 1.6-feet in Lagoon No.2. It is recommended that biosolids are removed once the depth reaches 2-feet. This project includes dewatering each lagoon and removing the biosolids for land application disposal.

   Budget: $846,000

2. **Aerated Lagoon Berm Maintenance and Slope Protection**
   Significant erosion of the lagoon berms at the water surface is occurring within both of the Aerated Lagoons. The originally installed stabilization stone is no longer at the operating level in Lagoons No.1 and No.2 and the original grade has been worn away. Clay liner repairs, berm regrading, and new stabilization stone are included in with this project.

   Budget: $877,000

3. **Lagoon No. 3 Berm Maintenance**
   The berms on Lagoon No.3 require clay liner repairs and regrading. Areas of concern will be repaired, and the topsoil will be regraded and reseeded.

   Budget: $753,000

4. **Lagoon Aeration System**
   The existing aeration system is operating past its expected useful life. Significant improvements are required to maintain reliable operation. The project includes the installation of new blowers, air piping, diffusers, and baffles.

   Budget: $**1,880,000**

5. **Lagoon Transfer Structures and Slide Gates**
   The existing lagoon transfer structures and flow control slide gates have degraded due to their age and harsh operating conditions. This project includes the replacement of all flow control slide gates and rehabilitation of the influent control structure.

   Budget: $**346,000**

6. **Lagoon Transfer Piping**
   The existing lagoon transfer piping is corrugated metal pipe that is showing signs of deterioration. This project includes the removal of all of the existing corrugated metal pipe and replacement with ductile iron pipe.

   Budget: $**332,000**

7. **Discharge Flow Meter**
   The existing lagoon discharge flow meter is an aging mechanical style meter that requires confined space entry for maintenance. This project includes the installation of mag meter and flow metering structure.

   Budget: $**21,000**

8. **Irrigation Flow Control Gates**
   The current irrigation flow control gates are unreliable and difficult to operate. At the irrigation control structures, the slide gates would be replaced to maintain functionality and operation. At Control Structure F, two gates would be replaced, and at Control Structures G and H, four gates would be replaced in each structure.

   Budget: $**106,000**

9. **Blower Building Improvements**
   The Blower Building roof and HVAC system at the WWTF is in need of critical upgrades. This project includes the replacement of the blower building roof and HVAC. Budget to expand the existing telemetry system has also been included to notify operators of alarm conditions at the WWTF.

   Budget: $**63,000**

B. Long-Term CIP (10-20+ Year)

1. **Influent Forcemain**
   Due to the age and material of the existing forcemain, the Village should plan for repairs or maintenance of the line within the 20-year planning period.

   Budget: $220,000

2. **Irrigation Distribution piping**
   The irrigation distribution piping is mostly buried, but with continued use of the irrigation fields as the method of discharge, replacement of the piping in the future should be planned. The budget includes total replacement of all irrigation distribution piping, but it is recommended that segments of the irrigation piping be exposed and evaluated to determine the extent of repairs necessary.

   Budget: $3,810,000

3. **Irrigation Underdrains**
   The buried underdrain piping and effluent collection pipe is now 40 years old, and it should be expected that portions of the system will need to be rehabilitated within the 20-year planning period. The budget includes total replacement of all irrigation underdrains, but it is recommended that segments of the irrigation underdrains be exposed and evaluated to determine the extent of repairs necessary.

   Budget: $2,520,000

4. **Effluent Discharge Pump**
   Due to the lagoon storage capacity and phosphorus limitations, there is a potential that an effluent discharge pump would need to be installed at the Lagoon Effluent Control Structure within the 20-year planning period.

Budget: $**60,000**

5. **Lagoon No. 3 Biosolids Removal**
   The current biosolids depth in Lagoon 3 averages 1-foot. It is recommended biosolids are removed once the depth reaches 2-feet. This project includes dewatering Lagoon No. 3 and removing 2-feet of biosolids for land application disposal.

   Budget: $**1,930,000**

C. CIP Cost Summary

Table 5: Village of Paw Paw WWTF CIP

Short Term CIP		
Project No.	Project Description	Budget
1	Aerated Lagoon No.1 & No.2 Biosolids Removal	$ 846,000
2	Aerated Lagoon Berm Maintenance and Slope Protection	$ 877,000
3	Lagoon No.3 Berm Maintenance	$ 753,000
4	Lagoon Aeration System - Blowers, Piping, Diffusers, Baffles	$ 1,880,000
5	Lagoon Transfer Structures and Slide Gates	$ 346,000
6	Lagoon Transfer Piping	$ 332,000
7	Discharge Flow Meter	$ 21,000
8	Irrigation Flow Control Gates	$ 106,000
9	Blower Building Roof and HVAC, Telemetry	$ 63,000
	Subtotal:	$ 5,224,000
Long Term CIP		
Project No.	Project Description	Budget
1	Influent Forcemain	$ 220,000
2	Irrigation Distribution Piping	$ 3,810,000
3	Irrigation Underdrains	$ 2,520,000
4	Effluent Pumping	$ 60,000
5	Lagoon No. 3 Biosolids Removal	$ 1,930,000
	Subtotal:	$ 8,540,000

V. Analysis of Alternatives

A. Identification of Potential Alternatives

Alternatives to accomplish the capital improvement projects identified above were developed and evaluated based on their ability to meet the scope of the project while remaining within financial, regulatory, and technical constraints. The alternatives analysis presented below is a component of most federal and state funding applications, and is required to justify the selected alternative.

Project objectives include:

- Ensure reliable wastewater service to the customers.
- Rehabilitate/repair high priority areas of existing WWTF infrastructure.
- Provide facilities capable of providing consistent reliable service and continued compliance with regulatory and permit requirements.
- Minimize financial burden to the sewer system users.
- Minimize environmental impact during construction of the improvements project.
- Minimize environmental impact of WWTF operations and discharge.

The following alternatives were developed:

1. No Action
2. Optimize Existing WWTF
3. Mechanical WWTF – Surface Water Discharge
4. Mechanical WWTF – Groundwater Discharge
5. Regional Alternative

The alternatives are described in detail in the following subsections. Each alternative was initially screened based on effectiveness, constructability, and financial requirements. Feasible alternatives were then subjected to a comprehensive evaluation with attention to detailed economic, technical, environmental, and public concerns.

The long-term capital improvements outlined in Section IV were not identified as immediate needs, but still have large financial implications to the Village. The long term project costs were included in Alternative 2 and Alternative 3, but not in the remaining Alternatives because the changes included in these project would eliminate the need for the long term improvements.

Alternatives 1, 3, and 5 were briefly analyzed, however, these alternatives were determined to not be feasible for the Village. Alternatives 2 and 4 were determined to be the principal alternatives for evaluation.

B. Description of Alternatives

1. Alternative 1 – No Action

Alternative 1 includes continuing to operate the WWTF in its current condition. This would eliminate upfront capital costs to the Village, but additional maintenance and replacement costs for emergency or EGLE mandated repairs could be required in the near future. With the current physical condition of the aeration equipment and lagoon system, action is required. No further analysis is presented on Alternative 1.

2. Alternative 2 – Optimize Existing WWTF

Alternative 2 was developed to optimize the existing WWTF. In order to maintain adequate treatment of the wastewater, significant improvements are required at the WWTF.

WWTF Improvements

Alternative 2 addresses all of the short-term capital improvements at the WWTF including:

- Aerated Lagoon No.1 & No.2 Biosolids Removal
- Aerated Lagoon Berm Maintenance and Slope Protection
- Lagoon No.3 Berm Maintenance
- Lagoon Aeration System - Blowers, Piping, Diffusers, Baffles
- Lagoon Transfer Structures and Slide Gates
- Lagoon Transfer Piping
- Discharge Flow Meter
- Irrigation Flow Control Gates
- Blower Building Roof and HVAC, Telemetry

Redundant Control Structures C and D would be removed as a part of this alternative. New piping from Control Structures A, B, E and J would be installed to optimize operator control and functionality of the WWTF. The influent force main gate valves would be replaced so the aeration lagoons could function in series or parallel. The influent structure (Control Structure A) would be coated and the slide gates replaced to maintain control of the influent flow. Out of Control Structure A, a pipe would be installed directly to Lagoon 3. This would allow the operators to discharge influent flow directly into the polishing lagoon and completely bypass the aeration system if needed. This mode of operation would rarely be used, but is an added option if maintenance needs to be done to Lagoons 1 and 2.

A conceptual piping demolition, new piping layout, and berm repair layout is shown in Figure A3 of Appendix A.

The diffused aeration system replacement consists of removing the existing aerators and blowers, and replacing the aerators with new, fine bubble diffusers, along with new blowers in the existing building. The existing air header would be removed and replaced with a new air header suitable for providing the volume of air that the new aeration system requires to provide adequate treatment. New blower air intake and discharge piping with valves would also be replaced and connected to the new air header. The electrical gear and controls would be upgraded with the new blower packages as well.

The roof on the blower building would be replaced and all the heating, ventilation, and air conditioning equipment would be replaced.

Long-term costs for the influent force main, irrigation distribution piping, irrigation underdrains, effluent pumping and Lagoon 3 biosolids removal should be considered for Alternative 2 because the effluent will continue to utilize the irrigation fields and underdrain collection system as the method of treated effluent disposal.

3. Alternative 3 – Mechanical WWTF – Surface Water Discharge

Alternative 3 was developed to convert the existing WWTF to a modified mechanical WWTF using Sequencing Batch Reactors (SBR). This system would utilize Lagoon 1 as an influent equalization lagoon, the SBR would be built in the area of Lagoon 2, and Lagoon 3 would be used as effluent equalization so the flow could be stored prior to discharge if necessary to meet permit limits.

WWTF Improvements

The short-term improvements at the WWTF to achieve this alternative include lagoon site work, control structure and piping abandonment, new mechanical WWTF site work, new buildings and upgrade existing building, additional process equipment, new electrical and electrical upgrades, and irrigation system improvements.

The lagoon site work for Alternative 3 is similar to the lagoon site work in Alternative 2. Biosolids in Lagoon No. 1 and 2 would be removed, clay liner repairs would take place in Lagoon No. 1 and Lagoon No.3, but not in Lagoon No. 2. The treatment of wastewater would be confined within the concrete tanks of the SBR. Six existing lagoon control structures and piping would be abandoned.

The new Mechanical WWTF would consist of influent equalization, grit removal equipment, SBR equipment, aerobic digester and solids handling equipment, and effluent control structure upgrades. The grit removal equipment would be used to collect the grit slurry, pump the slurry to a classifier and dewater the slurry for disposal. The SBR equipment consist of a floating decanter, aeration system, automated valves, and process piping. The aerobic digester and solids handling equipment consists of the aerobic digester, wasting sludge pumps, sludge aeration equipment, sludge storage tank, sludge dewatering press and chemical feed system. The effluent control structure (Control Structure E) would have the same upgrades as in Alternative 2, new 18-inch draw off piping and 18-inch slide gates.

The new site work would consist of installation of site piping and utilities, natural gas/propane service, rerouting the influent force main to the new headworks building, and providing overall site development including site grading, drainage and a new access drive.

The existing blower building would have the same upgrades in Alternative 2 (roof and HVAC), and be converted to house the SBR process blowers and controls. The new headworks building would house process equipment for grit removal. A new biosolids handling building would be constructed to house solids handling process equipment that would work in conjunction with an aerobic digester system. This system would stabilize the sludge produced from the SBR and also store the sludge for semi-annual sludge removal.

The new electrical system would consist of a communication network to the WWTF, a SCADA monitoring system, new motor control centers and electrical gear and an upgrade to the standby power generator and automatic transfer switch.

At the irrigation control structures, the slide gates would be replaced to maintain functionality and operation. At Control Structure F, two gates would be replaced, and at Control Structures G and H, four gates would be replaced in each structure.

A conceptual SBR and piping layout is shown in Figure A4 of Appendix A.

Long-term costs for the influent force main, irrigation distribution piping, irrigation underdrains, effluent pumping and Lagoon 3 biosolids removal are included for Alternative 3 because the effluent will continue to utilize the irrigation fields and collection system as the method of treated effluent disposal. Refer to the section above describing the long-term costs.

Due to the high capital and operating costs associated with the conversion to a Mechanical WWTF, and the potential for long term capital improvement costs associated with the irrigation system, this alternative was determined not to be feasible. No further analysis is presented on Alternative 3.

4. Alternative 4 – Mechanical WWTF – Ground Water Discharge

Alternative 4 was developed to replace the existing WWTF with an activated sludge wastewater treatment plant. This system would abandon the current WWTF and irrigation fields and construct a new Mechanical WWTF with ground water discharge to rapid infiltration basins (RIB).

WWTF Improvements

The short-term improvements at the WWTF to achieve this alternative include lagoon site work, control structure and piping abandonment, new mechanical WWTF site work, new buildings and, and RIB system construction.

The lagoon site work for Alternative 4 involves abandoning the existing lagoon WWTF. Biosolids in Lagoon 1, 2 and 3 would be removed, and all three lagoons would be abandoned in place. Eight control structures and piping would be abandoned.

The new mechanical WWTF would consist of grit removal, oxidation ditch equipment, secondary clarifiers, aerobic digester, and solids handling equipment. The grit removal equipment would be used to collect the grit slurry, pump the slurry to a classifier and dewater the slurry for disposal. The oxidation ditch equipment would consist of two oxidation ditches with four rotors and motors per tank. This also includes process piping, valves, and electrical equipment to run the oxidation ditches. The aerobic digester and solids handling equipment consists of the aerobic digester, return and wasting sludge pumps, sludge aeration equipment, sludge storage tank, sludge dewatering press and chemical feed system.

The new mechanical site work would consist of installation of a new effluent disposal RIB, site piping and utilities, natural gas/propane service, rerouting force main into the headworks building, and providing overall site development including site grading, drainage and a new access drive.

The existing blower building would have the same upgrades in Alternative 2 (roof and HVAC) and be converted to house the Mechanical WWTF process controls. The new headworks building would house process equipment for grit removal.

The new biosolids handling building would be constructed to house solids handling process equipment that would work in conjunction with an aerobic digester system. This system would stabilize the sludge produced from the oxidation ditch and also store the sludge for semi-annual sludge removal.

The new electrical system would consist of a communication network to the WWTF, a SCADA monitoring system, new motor control centers and electrical gear and an upgrade to the standby power generator and automatic transfer switch.

A conceptual activated sludge treatment facility layout is shown in Figure A5 of Appendix A.

Long-term Capital Improvement costs are not included with this alternative due to the reconstruction of the influent force main, abandonment of the irrigation fields and underdrain system, and biosolids removal in Lagoon 3 that would take place as a part of this project.

5. Alternative 5 – Regional Alternative

Alternative 5 was developed to reroute the Village's wastewater to the City of Kalamazoo WWTP. This is the closest treatment facility to the Village with potentially available capacity. With this alternative, a new force main and pump stations would be installed to pump flow from the Village's main lift station, 23 miles, to Kalamazoo's WWTP. The Village's WWTF would be decommissioned and the land could be sold or repurposed by the Village.

While this option would eliminate the need to improve or operate the existing facility, the costs associated with this alternative would not be fully known until agreements are reached with the City of Kalamazoo. Additionally, the cost for construction of a force main and pump stations is far greater than the other alternatives. No further analysis is presented on Alternative 5.

C. Analysis of Principal Alternatives

1. Monetary Evaluation

The monetary evaluation includes a present worth analysis. This analysis does not identify the source of funds, but compares cost uniformly for each alternative over the 20-year planning period. The present worth is the sum which, if invested now at a given interest rate, would provide the same funds required to pay projected costs within the planning period. The total present worth, used to compare the alternatives, is the sum of the initial capital cost, plus the present worth of Operation, Maintenance, and Replacement (OM&R) costs, minus the present worth of the salvage value at the end of the 20-year planning period. The real discount rate used in computing the present worth cost is established by the USDA Rural Development and is currently set at 1.5%.

The salvage value is calculated at the end of 20 years where portions of the project structures or equipment may have a salvage value, which is determined by using a straight-line depreciation. In general, concrete structures, earthwork basins, and piping have a useful life of 30-50 years and mechanical equipment has a useful life of 10-20 years.

The cost of labor, equipment and materials is not escalated over the 20-year life since it assumes any increase in these costs will apply equally to all alternatives. The interest charge during construction (capitalized interest) would not significantly influence the comparison of alternatives and was not included in the cost effective analysis.

To ensure uniformity of the cost comparisons, the following cost comparison details were specifically addressed and were applied in the present worth analysis as per the EGLE guidance.

- Capital costs were included for all identified improvements.
- Sunk costs were excluded from the present worth cost. Sunk costs for the project include existing land, existing waterworks facilities, and outstanding bond indebtedness.
- Operation, Maintenance, and Replacement, (OM&R) costs were included in the present worth cost.
- The economic comparison is based on a 20-year planning period and a real discount interest rate of 1.5%, USDA Rural Development
- Salvage values were included in the present worth cost.
- Energy costs escalation was assumed equal between the alternatives and therefore are not adjusted over the 20-year period.

A detailed breakdown of project costs is included in Appendix D for Alternative 2 and 4. Table 6 compares the costs difference for the alternatives. Alternative 2 has the lowest estimated net present worth at $28,763,000.

Table 6: Summary of Present Worth Cost Analysis

Alternative	Project Cost	Annual OM&R Cost	Net Present Worth of OM&R Cost	Total Present Worth	Salvage Value	Net Present Worth
2	$13,764,000	$925,000	$15,881,000	$29,645,000	$882,000	$28,763,000
4	$20,608,000	$1,399,000	$24,019,000	$44,627,000	$3,643,000	$40,984,000

2. Environmental Evaluation

Environmental impacts are similar for construction of Alternatives 2 and 4, which include construction at the existing WWTF site.

Receiving Water Quality

Alternative 2 would continue the discharge of treated effluent to the existing outfall stream. Surface water discharge permit limits are put in place to protect the receiving waters. Because of the neighboring facilities that also discharge into the common stream, effluent permit limits for the WWTF are likely to remain stringent. In the case of Alternative 4, a new groundwater discharge permit would be required. This permit would set discharge limits to protect the receiving groundwater from continuously discharged effluent.

3. Energy Efficiency Evaluation

Existing utility records for the WWTF were reviewed and analyzed to determine the effect of each alternative on the Village's electricity usage. Alternative 2 would maintain a similar treatment process to the existing WWTF. Based on the mixing requirements for current design standards, a marginal increase in electricity usage is possible. Further energy analysis on the blower technology and operation would be completed as part of the detailed design prior to implementing this alternative. Alternative 4 involves the construction of a Mechanical WWTF. The Mechanical WWTF would require significantly more energy to process the wastewater and handle the solids generated by the treatment process.

D. Additional Considerations

In addition to the monetary, environmental, and energy considerations used to analyze the alternatives, a number of additional factors should be considered for each of the principal alternatives. Primary advantages and disadvantages for each principal alternative have been identified.

Alternative 2 – Optimize Existing Facilities

Advantages

Alternative 2 continues operation of the WWTF in a similar manner with minor modifications to improve facility maintenance. Replacing flow control slide glades and onsite piping would allow for operational flexibility and reliability. Additionally, this alternative has lower OM&R costs than Alternative 4.

Disadvantages

The lagoon treatment systems has limitations in regards to unforeseen future conditions as it relates to effluent permit limits, treatment flexibility, and WWTF capacity expansion. The treatment technology recommend for Alternative 2 is a reliable, efficient method of wastewater treatment, but if future permit limits or design conditions change significantly from the current standards, additional equipment may be required.

Alternative 4 – Mechanical WWTF – Ground Water Discharge

Advantages

Alternative 4 would reduce the footprint of the WWTF, and eliminate the potential future capacity concerns related to the nutrient limits associated with a surface water discharge.

Disadvantages

Alternative 4 OM&R costs are higher than Alternative 2. Additionally, the Village would need to employ a Class D licensed operator to operate the Mechanical WWTF.

VI. RECOMMENDED ALTERNATIVE

Based on the Analysis of Alternatives, it was determined that Alternative 2 - Optimize Existing WWTF is the recommended alternative. Alternative 4 – Packaged Wastewater Treatment Plant also meets the project objectives, but has a higher capital cost than Alternative 2, and additional OM&R costs.

Additional discussion of the recommended alternative, Alternative 2, is presented below.

A. Implementation of Recommended Alternative

Alternative 2 addresses all of the short-term and long-term capital improvement needs identified in Section IV. Due to the criticality and interdependence of the short-term capital improvement items, it is recommended that the Village complete the projects listed below in a single project:

- Lagoon No.1 and No.2 Biosolids Removal
- Lagoon No.1 and No.2 Berm Repairs and Slope Protection
- Lagoon No.3 Berm Repairs
- Lagoon Aeration System Improvements
- Lagoon Transfer Structures and Slide Gates
- Lagoon Transfer Piping
- Discharge Flow Meter Replacement
- Irrigation Flow Control Gate Replacement
- Blower Building Roof, HVAC, and Telemetry

The estimated cost to address the short-term needs is $5,224,000. The recommended next steps to complete this project are outlined in Section VII and should be implemented to continue the process of improving the Village of Paw Paw's treatment system.

The remaining $8,540,000 of long-term capital improvements included in Alternative 2 were not identified as critical needs. These items are independent of one another and could be implemented on an as-needed basis. Detailed descriptions and budgets for each project are provided within this report. It is recommended that the Village begin to budget for the longer-term capital improvements.

B. Funding

Options for funding municipal wastewater system projects include Municipal Bonds, Clean Water State Revolving Fund (SRF) and United States Department of Agricultural (USDA) Rural Development (RD).

Issuing municipal bonds is one option to finance wastewater system projects. The municipal bond rate is dependent on the loan term and the Village's credit rating. Financing the project with municipal bonds does not put restrictions on project schedule, project delivery methods, or bidding requirements. However, the interest rate would be the highest of the available options.

Financing through the SRF program is another option. The SRF program is a federal-state partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects. The interest rate for SRF loans is 2.0% for 20-year loans in fiscal year 2020. Financing the project through the SRF program requires a project plan to be completed to qualify for funding. The feasibility study can be used as part of the project plan. The SRF program requires following a quarterly schedule for design and bidding of projects and limits project delivery methods. The SRF program also requires compliance with Davis-Bacon prevailing wage rates for labor and compliance with American Iron and Steel requirements which may increase construction costs.

The USDA RD Water & Waste Disposal Loan & Grant Program provides long-term, low-interest loans for rural areas with populations of 10,000 or less. The Village may be eligible for a 40-year loan at a below market rate (3%). The fixed interest rate is calculated based on the needs for the project and the median household

income of the area to be served. If funds are available, a grant may be combined with a loan if necessary to keep user costs reasonable as determined by the USDA. The current interest rate for communities which qualify for the poverty rate or intermediate rate is 1.75% and 2.375% respectively. The Village is located in an area that is eligible for USDA RD funding. USDA RD funded projects limits project delivery methods and requires competitive bidding for construction, which generally prohibits sole-sourcing of equipment. The RD funding process can be started by holding an application conference with RD Area Specialist. A Preliminary Engineering Report (PER) is required as part of the application process. This Feasibility Study can be used as part of the PER.

A municipal financial advisor should be consulted to provide planning and to determine the best source of funding for the project.

VII. Recommended Next Steps

This Feasibility Study has been completed in order to evaluate alternative improvement options to meet the long-term wastewater treatment needs of the Village. A comprehensive analysis of the principal alternatives revealed Alternative 2 as the selected alternative. The results of this feasibility study can be used to help select the desired course of action for improvements to the Village of Paw Paw's Wastewater System.

The following next steps are recommended to help the Village continue the process of upgrading the wastewater system and obtaining funding for the Wastewater System Improvements project.

1. Work with a municipal financial advisor to determine a financing plan and the potential rate impacts to customers.
2. Evaluate rate impacts and funding options.
3. Apply for funding for the project.
4. Authorize design of the project.
5. Issue the project for bid.

APPENDIX C:

NATION POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

C-1: .....VILLAGE OF PAW PAW NPDES PERMIT

PERMIT NO. MI0021741

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act (33 U.S.C. 1251 *et seq*., as amended; the "Federal Act"); Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); Part 41, Sewerage Systems, of the NREPA; and Michigan Executive Order 2011-1,

Village of Paw Paw
110 Harry L. Bush Boulevard
PO Box 179
Paw Paw, Michigan 49079

is authorized to discharge from the **Paw Paw Wastewater Treatment Plant (WWTP)** located at

38360 Paw Paw Road
Paw Paw, Michigan 49079

designated as **Paw Paw WWTP**

to the receiving water named the South Branch Paw Paw River in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

This permit is based on a complete application submitted on March 27, 2012.

This permit takes effect on August 1, 2014. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules. On its effective date this permit shall supersede NPDES Permit No. MI0021741, expiring October 1, 2012.

This permit and the authorization to discharge shall expire at midnight, **October 1, 2017**. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application which contains such information, forms, and fees as are required by the Department of Environmental Quality (Department) by **April 4, 2017**.

Issued _____

_____
Philip Argiroff, Chief
Permits Section
Water Resources Division

PERMIT FEE REQUIREMENTS

In accordance with Section 324.3120 of the NREPA, the permittee shall make payment of an annual permit fee to the Department for each October 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by January 15 for notices mailed by December 1. The fee is due no later than 45 days after receiving the notice for notices mailed after December 1.

Annual Permit Fee Classification: Municipal Minor, 1 MGD to less than 10 MGD (IP)

In accordance with Section 324.3132 of the NREPA, the permittee shall make payment of an annual biosolids land application fee to the Department if the permittee land applies biosolids. In response to the Department's annual notice, the permittee shall submit the fee, which shall be postmarked no later than January 31 of each year.

CONTACT INFORMATION

Unless specified otherwise, all contact with the Department required by this permit shall be made to the Kalamazoo District Supervisor of the Water Resources Division. The Kalamazoo District Office is located at 7953 Adobe Road, Kalamazoo, Michigan 49009-5025, Telephone: 269-567-3500, Fax: 269-567-9440.

CONTESTED CASE INFORMATION

Any person who is aggrieved by this permit may file a sworn petition with the Michigan Administrative Hearing System within the Michigan Department of Licensing and Regulatory Affairs, c/o the Michigan Department of Environmental Quality, setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Department of Licensing and Regulatory Affairs may reject any petition filed more than 60 days after issuance as being untimely.

PART I

Section A. Limitations and Monitoring Requirements

1. Final Effluent Limitations, Monitoring Point 001A

During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee is authorized to discharge treated municipal wastewater from Monitoring Point 001A through Outfall 001. Outfall 001 discharges to the South Branch Paw Paw River. Such discharge shall be limited and monitored by the permittee as specified below.

	Maximum Limits for Quantity or Loading				Maximum Limits for Quality or Concentration				Monitoring	Sample
Parameter	**Monthly**	**7-Day**	**Daily**	**Units**	**Monthly**	**7-Day**	**Daily**	**Units**	**Frequency**	**Type**
Intermediate Monitoring – between lagoons and fields										
Lagoon Flow to Fields	(report)	---	(report)	MGD	---	---	---	---	Daily	Report Total Daily Flow
Effluent Monitoring										
Discharge Flow	(report)	---	(report)	MGD	---	---	---	---	Daily	Report Total Daily Flow
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)										
May-Sept	---	100	---	lbs/day	---	---	7.0	mg/l	Weekly	24-Hr Composite
Oct-Nov	340	500	---	lbs/day	17	---	25	mg/l	Weekly	24-Hr Composite
Dec-Apr	400	700	---	lbs/day	20	35	---	mg/l	Weekly	24-Hr Composite
Total Suspended Solids										
May-Sept	280	420	---	lbs/day	20	30	---	mg/l	Weekly	24-Hr Composite
Oct-Apr	400	600	---	lbs/day	20	30	---	mg/l	Weekly	24-Hr Composite
Ammonia Nitrogen (as N)										
May-Sept	---	42	---	lbs/day	---	---	3.0	mg/l	Weekly	24-Hr Composite
Oct-Nov	---	180	---	lbs/day	---	---	9.0	mg/l	Weekly	24-Hr Composite
Dec-Apr	---	---	---	---	---	---	(report)	mg/l	Weekly	24-Hr Composite
Total Phosphorus (as P)										
May-Sept	60	---	---	lbs/month	---	---	---	---	Weekly	24-Hr Composite
Oct-Apr	---	---	---	---	1.0	---	---	mg/l	Weekly	24-Hr Composite
Fecal Coliform Bacteria	---	---	---	---	200	400	---	cts/100 ml	Weekly	Grab
Total Mercury	---	---	---		(report)	---	---	ng/l	Quarterly	Grab
Chronic Toxicity										
Effective date through April 30, 2015	---	---	---	---	(report)	---	---	TU_C	Quarterly	24-Hr Composite
Beginning May 1, 2015										
May-Sept	---	---	---	---	3.0	---	---	TU_C	Quarterly	24-Hr Composite
Oct-Apr	---	---	---	---	2.4	---	---	TU_C	Quarterly	24-Hr Composite
Acute Toxicity	---	---	---	---	(report)	---	---	TU_A	Quarterly	24-Hr Composite
	12-Month Rolling Average				**12-Month Rolling Average**					
Total Mercury										
May-Sept	0.00003	---	---	lbs/day	2.0	---	---	ng/l	Quarterly	Calculation
Oct-Apr	0.00004	---	---	lbs/day	2.0	---	---	ng/l	Quarterly	Calculation

PART I

Section A. Limitations and Monitoring Requirements

Parameter	Maximum Limits for Quantity or Loading: Monthly	7-Day	Daily	Units	Quality or Concentration: Monthly	7-Day	Daily	Units	Monitoring Frequency	Sample Type
					Minimum Daily	Maximum Daily				
pH	---	---	---	---	6.5	---	9.0	S.U.	Weekly	Grab
Dissolved Oxygen	---	---	---	---	4.0	----	----	mg/l	Weekly	Grab

The following design flow was used in determining the above limitations, but is not to be considered a limitation or actual capacity: 1.7 MGD (May through September) and 2.4 MGD (October through April).

a. Narrative Standard
The receiving water shall contain no turbidity, color, oil films, floating solids, foams, settleable solids, or deposits as a result of this discharge in unnatural quantities which are or may become injurious to any designated use.

b. Sampling Locations
All parameters in Part I.A.1 except flow monitoring shall be sampled of the final effluent prior to discharge to the Paw Paw River. The Department may approve alternate sampling locations which are demonstrated by the permittee to be representative of the effluent.

c. Quarterly Monitoring
Quarterly samples shall be taken during the months of January, April, July, and October. If the facility does not discharge during these months, the permittee shall sample the next discharge occurring during that quarter. If the facility does not discharge during a quarter, a sample is not required for that quarter. For any month in which a sample is not taken, the permittee shall enter "*G" on the Discharge Monitoring Report.

d. Final Effluent Limitation for Total Mercury
The final limit for total mercury is the Discharge Specific Level Currently Achievable (LCA) based on a multiple discharger variance from the water quality-based effluent limit of 1.3 ng/l, pursuant to Rule 323.1103(9) of the Water Quality Standards. Compliance with the LCA shall be determined as a 12-month rolling average. The 12-month rolling average shall be determined by adding the present monthly average result to the preceding 11 monthly average results then dividing the sum by 12. . For facilities with quarterly monitoring requirements for total mercury, quarterly monitoring shall be equivalent to 3 months of monitoring in calculating the 12-month rolling average. Facilities that monitor more frequently than monthly for total mercury must determine the monthly average result, which is the sum of the results of all data obtained in a given month divided by the total number of samples taken, in order to calculate the 12-month rolling average. If the 12-month rolling average for any quarter is less than or equal to the LCA, the permittee will be considered to be in compliance for total mercury for that quarter, provided the permittee is also in full compliance with the Pollutant Minimization Program for Total Mercury, set forth in Part I.A.6.

e. Total Mercury Testing Requirements
The analytical protocol for total mercury shall be in accordance with EPA Method 1631, Revision E, "Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry." The quantification level for total mercury shall be 0.5 ng/l, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

PART I

Section A. Limitations and Monitoring Requirements

The use of clean technique sampling procedures is required unless the permittee can demonstrate to the Department that an alternative sampling procedure is representative of the discharge. Guidance for clean technique sampling is contained in: EPA Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (Sampling Guidance)*, EPA-821-R96-001, July 1996. Information and data documenting the permittee's sampling and analytical protocols and data acceptability shall be submitted to the Department upon request.

f. Whole Effluent Toxicity Final Requirements

Test species shall include *Ceriodaphnia dubia*. Testing and reporting procedures shall follow procedures contained in EPA/600/4-91/002, "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (Fourth Edition)." The chronic toxic unit value (TU_C) for *Ceriodaphnia dubia* shall be reported on the Discharge Monitoring Report (DMR). If multiple chronic toxicity tests are performed during the month, and monthly average TU_C value shall be reported. Completed toxicity test reports for each test conducted shall be retained by the permittee in accordance with the requirements of Part II.B.5. of this permit and shall be available for review by the Department upon request. Toxicity test data acceptability is contingent upon validation of the test method by the testing laboratory. Such validation shall be submitted to the Department upon request.

1) When *Ceriodaphnia dubia* monitoring shows persistent exceedance of the 3.0 TU_C limit (May through September) or 2.4 TU_C limit (October through April) for effluent toxicity, the Department will determine whether the permittee must implement the toxicity control program requirements specified in 2) below.

2) Upon written notification by the Department, the following conditions apply. Within 90 days of the notification, the permittee shall implement a Toxicity Reduction Evaluation (TRE). The objective of the TRE shall be to reduce the toxicity of the final effluent from monitoring point 001A to $\leq$ 3.0 TU_C (May through September) or 2.4 TU_C limit (October through April). The following documents are available as guidance to reduce toxicity to acceptable levels: Phase I, EPA/600/6-91/005F (chronic),; Phase II, EPA/600/R-92/080 (acute and chronic); Phase III, EPA/600/R-92/081 (acute and chronic); and Publicly Owned Treatment Works (POTWs), EPA/833B-99/002. Annual reports shall be submitted to the Department within 30 days of the completion of the last test of each annual cycle.

PART I

Section A. Limitations and Monitoring Requirements

2. Facility Operation and Maintenance

The permittee shall comply with the inspection, operation and maintenance program requirements specified below. An alternate facility operations program may be approved by the Department.

a. Lagoon Inspection

The permittee shall inspect the lagoon facilities three (3) times weekly year-round unless otherwise authorized by the Department. These inspections shall include:

1) the lagoon dikes for vegetative growth, erosion, slumping, animal burrowing or breakthrough, and condition of lagoon liner;

2) the lagoon for growth of aquatic plants, offensive odors, insect infestations, scum, floating sludge, and septic conditions;

3) the depth of the water in each cell and the freeboard;

4) the control structures and pump stations to ensure that valves, gates and alarms are set correctly and properly functioning;

5) the lagoon security fence and warning signs; and

6) analysis for Dissolved Oxygen in each lagoon cell at least one (1) time weekly, except when the lagoons are ice-covered. The data shall be kept as retained self-monitoring. See Part II.C.3.

The permittee shall initiate steps to correct any condition that is not in accordance with the facility maintenance program outlined in Part I.A.2. of this permit. A record of the inspections shall be maintained by the permittee for a period of three (3) years.

b. Facility Maintenance

The permittee shall implement a Facility Maintenance Program that incorporates the following management practices unless otherwise authorized by the Department.

1) Vegetation shall be maintained at a height not more than six (6) inches above the ground on lagoon dikes and around the fencing.

2) At all times, the facility shall be maintained to prevent the negative effects of floating material and/or water perimeter emergent rooted aquatic plants on Dissolved Oxygen concentrations, treatment efficiency, nuisance organisms, offensive odors, or other measurable impacts. However, in no case, even without demonstrated impact, shall the floating material and/or water perimeter emergent rooted aquatic plants exceed 40 percent cover.

3) Dike damage due to erosion or animal burrowing shall be corrected immediately and steps taken to prevent occurrences in the future.

4) The integrity of the lagoon liner shall be protected. Liner damages shall be corrected immediately and steps taken to prevent future occurrences.

5) The occurrence of scum, floating sludge, offensive odors, insect infestations, and septic conditions shall be minimized.

6) A schedule for the inspection and maintenance of the collection system, lift stations, mechanical and electrical systems, transfer stations, and control structures shall be developed and implemented.

PART I

Section A. Limitations and Monitoring Requirements

c. Lagoon Drawdown Conditions
The permittee shall observe the following conditions when drawing down a cell for transfer or discharge unless otherwise authorized by the Department.

1) Water discharged shall be removed from the surface two (2) feet of the cell at a rate of less than one (1) foot per day.

2) The permittee shall maintain a minimum of two (2) feet of freeboard in all cells at all times.

3) The permittee shall maintain a minimum of two (2) feet of water in all cells at all times.

3. Groundwater Monitoring for Lagoon Exfiltration/Leakage

Based on the information submitted in the permit application, the permittee may be required to install groundwater monitoring wells and conduct groundwater monitoring. The intent of such monitoring, if required, will be to demonstrate that the lagoons have not impacted, and are not likely to impact surface waters, in accordance with the Part 4, Water Quality Standards (Part 4 Rules), promulgated under Part 31, Water Resources Protection, of the NREPA, or groundwater above the standard described in R 323.2222 of Part 22, Groundwater Quality Administrative Rules (Part 22 Rules), promulgated pursuant to Part 31. Information that may be considered by the Department in making this determination include, but is not limited to: the date when the lagoon was constructed; construction design methods and materials, including whether liner specifications meet R 323.2237 of the Part 22 Rules or providing equivalency as allowed in R 323.2237; and indications of whether there is a direct vent to surface waters and if such vent complies with surface water quality standards.

If the Department determines the permittee needs to conduct groundwater monitoring to verify and assure that leakage from the lagoons to the groundwaters and/or surface waters of the state is not causing unacceptable impacts, the following conditions shall apply:

a. The permittee shall install groundwater monitoring wells around the perimeter of the lagoons to document both groundwater water quality impacts and groundwater flow. A plan for the monitoring wells shall be submitted to the Department for approval within 90 days of notification by the Department. Within 90 days of approval of the plan, unless the Department approves an extended period (not to exceed 180 days), the groundwater monitoring wells shall be installed.

b. The permittee shall submit a groundwater monitoring plan to the Department for approval. The monitoring plan shall include monitoring of the groundwater elevation and the following parameters: total phosphorus, dissolved phosphorus, total inorganic nitrogen, sodium, chloride, pH, and specific conductance. Monitoring shall be conducted quarterly until the permittee is notified by the Department that the monitoring can end or be reduced.

c. The permittee shall begin implementation of the monitoring plan within 90 days of approval of the monitoring plan, or upon installation of the monitoring well, whichever occurs last. The result of the monitoring shall be submitted to the Department quarterly.

d. Upon written notification by the Department that unacceptable leakage is impacting surface waters and/or groundwater, the permittee shall develop a work plan to address the leakage. Within 6 months of such notification, the permittee shall submit an approvable lagoon leakage remediation work plan to the Department. The purpose of the work plan is to control exfiltration from the lagoon treatment system. The study shall include remediation methods, procedures, time schedules, and staff, as appropriate.

e. The permittee shall begin implementation of the lagoon leakage remediation work plan within 30 days of approval of the work plan.

PART I

Section A. Limitations and Monitoring Requirements

f. The permittee shall complete implementation of the lagoon leakage remediation work plan and submit an approvable final report with supporting data to the Department on or before within one (1) year of approval of the work plan. The final report shall include a plan and schedule for continued maintenance and monitoring of the lagoon treatment system.

4. Request for Discharge of Water Treatment Additives

In the event a permittee proposes to discharge water additives, the permittee shall submit a request to discharge water additives to the Department for approval. Such requests shall be sent to the Permits Section, Water Resources Division, Department of Environmental Quality, P.O. Box 30458, Lansing, Michigan 48909, with a copy to the Department contact listed on the cover page of this permit. Instructions to submit a request electronically may be obtained via the Internet (http://www.michigan.gov/deqnpdes; then click on Applicable Rules and Regulations which is under the Information banner and then click on Water Treatment Additive Discharge Application Instructions). Written approval from the Department to discharge such additives at specified levels shall be obtained prior to discharge by the permittee. Additional monitoring and reporting may be required as a condition for the approval to discharge the additive.

A request to discharge water additives shall include all of the following water additive usage and discharge information:

a. Safety Data Sheet (formerly known as Material Safety Data Sheet);

b. the proposed water additive discharge concentration with supporting calculations;

c. the discharge frequency (i.e., number of hours per day and number of days per year);

d. the monitoring point from which the product is to be discharged;

e. the type of removal treatment, if any, that the water additive receives prior to discharge;

f. product function (i.e. microbiocide, flocculant, etc.);

g. a 48-hour LC_{50} or EC_{50} for a North American freshwater planktonic crustacean (either *Ceriodaphnia sp., Daphnia sp., or Simocephalus sp*.); and

h. the results of a toxicity test for one (1) other North American freshwater aquatic species (other than a planktonic crustacean) that meets a minimum requirement of R 323.1057(2) of the Water Quality Standards.

Prior to submitting the request, the permittee may contact the Permits Section by telephone at 517-284-5568 or via the Internet at the address given above to determine if the Department has the product toxicity data required by items g. and h. above. If the Department has the data, the permittee will not need to submit product toxicity data.

PART I

Section A. Limitations and Monitoring Requirements

5. Additional Monitoring Requirements

As a condition of this permit, the permittee shall monitor the discharge from Monitoring Point 001A for the constituents listed below. This monitoring is an application requirement of 40 CFR 122.21(j), effective December 2, 1999. Testing shall be conducted in October 2014, May 2015, August 2016, and March 2017. Grab samples shall be taken for total mercury, available cyanide, total phenols, and parameters listed under Volatile Organic Compounds. For all other parameters, 24-hour composite samples shall be taken.

Test species for whole effluent toxicity monitoring shall include fathead minnow for acute and chronic testing **and** *Ceriodaphnia dubia* for acute testing. Testing and reporting procedures shall follow procedures contained in EPA600/4-91/002, "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (Fourth Edition)." When the effluent ammonia nitrogen (as N) concentration is greater than 3 mg/l, the pH of the toxicity test shall be maintained at a pH of 8 Standard Units. Acute and chronic toxicity data shall be included in the reporting for the toxicity test results. Toxicity test data acceptability is contingent upon the validation of the test method by the testing laboratory. Such validation shall be submitted to the Department upon request.

The results of such monitoring shall be submitted with the application for reissuance (see the cover page of this permit for the application due date). The permittee shall notify the Department within 14 days of completing the monitoring for each month specified above in accordance with Part II.C.5. Additional reporting requirements are specified in Part II.C.11. The permittee shall report to the Department any whole effluent toxicity test results greater than 1.0 TU_A or for fathead minnow 1.0 TU_C within five (5) days of becoming aware of the result. If, upon review of the analysis, it is determined that additional requirements are needed to protect the receiving waters in accordance with applicable water quality standards, the permit may then be modified by the Department in accordance with applicable laws and rules.

Whole Effluent Toxicity
acute toxicity (fathead minnow and C. dubia)
chronic toxicity (fathead minnow)

Hardness
calcium carbonate

Metals (Total Recoverable), Cyanide and Total Phenols (Quantification levels in parentheses)

antimony (1 µg/l)	arsenic (1 µg/l)	available cyanide (2 µg/l) using Method OIA – 1677	
barium (5 µg/l)	beryllium (1 µg/l)	boron (20 µg/l)	cadmium (0.2 µg/l)
chromium (5 µg/l)	copper (1 µg/l)	lead (1 µg/l)	nickel (5 µg/l)
selenium (1 µg/l)	silver (0.5 µg/l)	thallium (1 µg/l)	zinc (5 µg/l)
total phenolic compounds			

Volatile Organic Compounds

acrolein	acrylonitrile	benzene	bromoform
carbon tetrachloride	chlorobenzene	chlorodibromomethane	chloroethane
2-chloroethylvinyl ether	chloroform	dichlorobromomethane	1,1-dichloroethane
1,2-dichloroethane	trans-1,2-dichloroethylene	1,1-dichloroethylene	1,2-dichloropropane
1,3-dichloropropylene	ethylbenzene	methyl bromide	methyl chloride
methylene chloride	1,1,2,2,-tetrachloroethane	tetrachloroethylene	toluene
1,1,1-trichloroethane	1,1,2-trichloroethane	trichloroethylene	vinyl chloride

Acid-Extractable Compounds

p-chloro-m-cresol	2-chlorophenol	2,4-dichlorophenol	2,4-dimethylphenol
4,6-dinitro-o-cresol	2,4-dinitrophenol	2-nitrophenol	4-nitrophenol
Pentachlorophenol	phenol	2,4,6-trichlorophenol	

Base/Neutral Compounds

acenaphthene	acenaphthylene	anthracene	benzidine
benzo(a)anthracene	benzo(a)pyrene	3,4-benzofluoranthene	benzo(ghi)perylene

PART I

Section A. Limitations and Monitoring Requirements

benzo(k)fluoranthene	bis(2-chloroethoxy)methane	bis(2-chloroethyl)ether	bis(2-chloroisopropyl)ether
bis(2-ethylhexyl)phthalate	4-bromophenyl phenyl ether	butyl benzyl phthalate	2-chloronaphthalene
4-chlorophenyl phenyl ether	chrysene	di-n-butyl phthalate	di-n-octyl phthalate
dibenzo(a,h)anthracene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene
3,3'-dichlorobenzidine	diethyl phthalate	dimethyl phthalate	2,4-dinitrotoluene
2,6-dinitrotoluene	1,2-diphenylhydrazine	fluoranthene	fluorene
Hexachlorobenzene	hexachlorobutadiene	hexachlorocyclo-pentadiene	hexachloroethane
indeno(1,2,3-cd)pyrene	isophorone	naphthalene	nitrobenzene
n-nitrosodi-n-propylamine	n-nitrosodimethylamine	n-nitrosodiphenylamine	phenanthrene
pyrene	1,2,4-trichlorobenzene		

6. Pollutant Minimization Program for Total Mercury

The goal of the Pollutant Minimization Program is to maintain the effluent concentration of total mercury at or below 1.3 ng/l. The permittee shall continue to implement the Pollutant Minimization Program approved on June 27, 2005, and modifications thereto, to proceed toward the goal. The Pollutant Minimization Program includes the following:

a. an annual review and semi-annual monitoring of potential sources of mercury entering the wastewater collection system;

b. a program for quarterly monitoring of influent for mercury; and

c. implementation of reasonable cost-effective control measures when sources of mercury are discovered. Factors to be considered include significance of sources, economic considerations, and technical and treatability considerations.

On or before March 31 of each year, the permittee shall submit a status report for the previous calendar year to the Department that includes 1) the monitoring results for the previous year, 2) an updated list of potential mercury sources, and 3) a summary of all actions taken to reduce or eliminate identified sources of mercury.

Any information generated as a result of the Pollutant Minimization Program set forth in this permit may be used to support a request to modify the approved program or to demonstrate that the Pollutant Minimization Program requirement has been completed satisfactorily.

A request for modification of the approved program and supporting documentation shall be submitted in writing to the Department for review and approval. The Department may approve modifications to the approved program (approval of a program modification does not require a permit modification), including a reduction in the frequency of the requirements under items a. & b.

This permit may be modified in accordance with applicable laws and rules to include additional mercury conditions and/or limitations as necessary.

7. Untreated or Partially Treated Sewage Discharge Reporting and Testing Requirements

In accordance with Section 324.3112a of the NREPA, if untreated sewage, including sanitary sewer overflows (SSO) and combined sewer overflows (CSO), or partially treated sewage is directly or indirectly discharged from a sewer system onto land or into the waters of the state, the entity responsible for the sewer system shall immediately, but not more than 24 hours after the discharge begins, notify, by telephone, the Department, local health departments, a daily newspaper of general circulation in the county in which the permittee is located, and a daily newspaper of general circulation in the county or counties in which the municipalities whose waters may be affected by the discharge are located that the discharge is occurring.

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Section A. Limitations and Monitoring Requirements

The permittee shall also annually contact municipalities, including the superintendent of a public drinking water supply with potentially affected intakes, whose waters may be affected by the permittee's discharge of combined sewage, and if those municipalities wish to be notified in the same manner as specified above, the permittee shall provide such notification. Such notification shall also include a daily newspaper in the county of the affected municipality.

At the conclusion of the discharge, written notification shall be submitted in accordance with and on the "Report of Discharge Form" available via the internet at: http://www.deq.state.mi.us/csosso/ , or, alternatively for combined sewer overflow discharges, in accordance with notification procedures approved by the Department.

In addition, in accordance with Section 324.3112a of the NREPA, each time a discharge of untreated sewage or partially treated sewage occurs, the permittee shall test the affected waters for *Escherichia coli* to assess the risk to the public health as a result of the discharge and shall provide the test results to the affected local county health departments and to the Department. The testing shall be done at locations specified by each affected local county health department but shall not exceed 10 tests for each separate discharge event. The affected local county health department may waive this testing requirement, if it determines that such testing is not needed to assess the risk to the public health as a result of the discharge event. The results of this testing shall be submitted with the written notification required above, or, if the results are not yet available, submit them as soon as they become available. This testing is not required, if the testing has been waived by the local health department, or if the discharge(s) did not affect surface waters.

Permittees accepting sanitary or municipal sewage from other sewage collection systems are encouraged to notify the owners of those systems of the above reporting and testing requirements.

8. Facility Contact

The "Facility Contact" was specified in the application. The permittee may replace the facility contact at any time, and shall notify the Department in writing within 10 days after replacement (including the name, address and telephone number of the new facility contact).

a. The facility contact shall be (or a duly authorized representative of this person):
- for a corporation, a principal executive officer of at least the level of vice president; or a designated representative if the representative is responsible for the overall operation of the facility from which the discharge originates, as described in the permit application or other NPDES form,
- for a partnership, a general partner,
- for a sole proprietorship, the proprietor, or
- for a municipal, state, or other public facility, either a principal executive officer, the mayor, village president, city or village manager or other duly authorized employee.

b. A person is a duly authorized representative only if:
- the authorization is made in writing to the Department by a person described in paragraph a. of this section; and
- the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the facility (a duly authorized representative may thus be either a named individual or any individual occupying a named position).

Nothing in this section obviates the permittee from properly submitting reports and forms as required by law.

9. Monthly Operating Reports

Part 41 of Act 451 of 1994 as amended, specifically Section 324.4106 and associated Rule 299.2953, requires that the permittee file with the Department, on forms prescribed by the Department, reports showing the

PART I

Section A. Limitations and Monitoring Requirements

effectiveness of the treatment facility operation and the quantity and quality of liquid wastes discharged into waters of the state.

Since this permit includes modifications to the monitoring requirements in the previously-issued permit, the previously approved treatment facility monitoring program shall be revised. Within thirty (30) days of the effective date of this permit, the permittee shall submit to the Department a revised treatment facility monitoring program to meet this requirement. Upon approval by the Department the permittee shall implement the revised treatment facility monitoring program. The reporting forms and guidance are available on the DEQ web site at http://www.michigan.gov/deq/0,1607,7-135-3313_44117---,00.html. The permittee may use alternative operating forms if they are consistent with the approved monitoring program. These forms shall be maintained on site and shall be provided to the Department for review upon request. These treatment facility monitoring records shall be maintained for a minimum of three years.

PART I

Section C. Residuals Management Program

1. Industrial Waste Pretreatment Program

It is understood that the permittee does not receive the discharge of any type or quantity of substance which may cause interference with the operation of the treatment works; and, therefore, the permittee is not required to immediately develop an industrial pretreatment program in accordance with Section 307 of the Federal Act. The permittee is required to comply with Section 307 of the Federal Act upon accepting any such discharge for treatment. The permittee is required to notify the Department within thirty days if any user discharges or proposes to discharge such wastes to the permittee for treatment.

Under no circumstances shall the permittee allow introduction of the following wastes into the waste treatment system:

a. pollutants which cause pass through or interference;

b. pollutants which create a fire hazard or explosion hazard in the sewerage system, including, but not limited to wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21;

c. pollutants which will cause corrosive structural damage to the sewerage system; but in no case, discharges with pH less than 5.0, unless the works is specifically designed to accommodate such discharges;

d. solid or viscous pollutants in amounts which will cause obstruction to the flow in the sewerage system resulting in interference;

e. any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the treatment plant;

f. heat in amounts which will inhibit biological activity in the treatment plant resulting in interference; but in no case, heat in such quantities that the temperature at the treatment plant exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless the Department, upon request of the permittee, approves alternate temperature limits;

g. pollutants which result in the presence of toxic gases, vapors or fumes within the sewerage system in a quantity that may cause acute worker health and safety problems; and

h. any trucked or hauled pollutants, except at discharge points designated by the permittee.

If information is gained by the Department that the permittee receives or is about to receive industrial wastes, then this permit may be modified in accordance with applicable laws and rules to incorporate the requirements of Section 307 of the Federal Act.

PART II

Section A. Definitions

1. Residuals Management Program for Land Application of Biosolids

A permittee seeking authorization to land apply bulk biosolids or prepare bulk biosolids for land application shall develop and submit a Residuals Management Program (RMP) to the Department (see Part I.D.1.e) for approval. Effective upon Department approval of the permittee's RMP, the permittee is authorized to land apply bulk biosolids or prepare bulk biosolids for land application in accordance with the requirements established in R323.2401 through R323.2418 of the Michigan Administrative Code (Part 24 Rules) which can be obtained via the internet (http://www.michigan.gov/deq/ and on the left side of the screen click on Water, Biosolids & Industrial Pretreatment, Biosolids, then click on Biosolids Laws and Rules Information which is under the Laws & Rules banner in the center of the screen). The permittee's approved RMP, and any approved modifications thereto, are enforceable requirements of this permit. Incineration, landfilling and other residual disposal activities shall be conducted in accordance with Part II.D.7. of this permit.

a. RMP Approval and Implementation
A permittee seeking approval of an RMP shall submit the RMP to the Department (see Part I.D.1.e) at least 180 days prior to the land application of biosolids. The permittee may utilize the RMP Electronic Form which can be obtained via the internet (http://www.michigan.gov/deq/ and on the left side of the screen click on Water, Biosolids & Industrial Pretreatment, Biosolids then click on RMP Electronic Form which is under the Downloads banner in the center of the screen) or obtain detailed requirements from the Department. The RMP shall become effective and shall be implemented by the permittee upon written approval by the Department.

b. Annual Report
On or before October 30 of each year, the permittee shall submit an annual report to the Biosolids Program, Water Resources Division, Department of Environmental Quality, P.O. Box 30458, Lansing, MI 48909-7958 for the previous fiscal year of October 1 through September 30. At a minimum, the report shall contain:

1) a certification that current residuals management practices are in accordance with the approved RMP, or a proposal for modification to the approved RMP; and

2) a completed Biosolids Annual Report Form which can be obtained via the internet (http:/www.michigan.gov/deq/ and on the left side of the screen click on Water, Biosolids & Industrial Pretreatment, Biosolids then click on Biosolids Annual Report Form which is under the Downloads banner in the center of the screen) or from the Department.

c. Modifications to the Approved RMP
Prior to implementation of modifications to the RMP, the permittee shall submit proposed modifications to the Department (see Part I.D.1.e.) for approval. The approved modification shall become effective upon the date of approval. Upon written notification, the Department may impose additional requirements and/or limitations to the approved RMP as necessary to protect public health and the environment from any adverse effect of a pollutant in the biosolids.

d. Recordkeeping
Records required by the Part 24 Rules shall be kept for a minimum of five years. However, the records documenting cumulative loading for sites subject to cumulative pollutant loading rates shall be kept as long as the site receives biosolids.

e. Contact Information
RMP related submittals to the Department shall be to the Kalamazoo District Supervisor of the Water Resources Division. The Kalamazoo District Office is located at 7953 Adobe Road, Kalamazoo, Michigan 49009-5025, Telephone: 269-567-3500, Fax: 269-567-9440.

PART II

Part II may include terms and /or conditions not applicable to discharges covered under this permit.

Section A. Definitions

Acute toxic unit (TU_A) means $100/LC_{50}$ where the LC_{50} is determined from a whole effluent toxicity (WET) test which produces a result that is statistically or graphically estimated to be lethal to 50% of the test organisms.

Annual monitoring frequency refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Authorized public agency means a state, local, or county agency that is designated pursuant to the provisions of section 9110 of Part 91 of the NREPA to implement soil erosion and sedimentation control requirements with regard to construction activities undertaken by that agency.

Best management practices (BMPs) means structural devices or nonstructural practices that are designed to prevent pollutants from entering into storm water, to direct the flow of storm water, or to treat polluted storm water.

Bioaccumulative chemical of concern (BCC) means a chemical which, upon entering the surface waters, by itself or as its toxic transformation product, accumulates in aquatic organisms by a human health bioaccumulation factor of more than 1000 after considering metabolism and other physiochemical properties that might enhance or inhibit bioaccumulation. The human health bioaccumulation factor shall be derived according to R 323.1057(5). Chemicals with half-lives of less than 8 weeks in the water column, sediment, and biota are not BCCs. The minimum bioaccumulation concentration factor (BAF) information needed to define an organic chemical as a BCC is either a field-measured BAF or a BAF derived using the biota-sediment accumulation factor (BSAF) methodology. The minimum BAF information needed to define an inorganic chemical as a BCC, including an organometal, is either a field-measured BAF or a laboratory-measured bioconcentration factor (BCF). The BCCs to which these rules apply are identified in Table 5 of R 323.1057 of the Water Quality Standards.

Biosolids are the solid, semisolid, or liquid residues generated during the treatment of sanitary sewage or domestic sewage in a treatment works. This includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes and a derivative of the removed scum or solids.

Bulk biosolids means biosolids that are not sold or given away in a bag or other container for application to a lawn or home garden.

Certificate of Coverage (COC) is a document, issued by the Department, which authorizes a discharge under a general permit.

Chronic toxic unit (TU_C) means $100/MATC$ or $100/IC_{25}$, where the maximum acceptable toxicant concentration (MATC) and IC_{25} are expressed as a percent effluent in the test medium.

Class B biosolids refers to material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with the Part 24 Rules. Processes include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

Combined sewer system is a sewer system in which storm water runoff is combined with sanitary wastes.

PART II

Section B. Monitoring Procedures

Daily concentration is the sum of the concentrations of the individual samples of a parameter divided by the number of samples taken during any calendar day. If the parameter concentration in any sample is less than the quantification limit, regard that value as zero when calculating the daily concentration. The daily concentration will be used to determine compliance with any maximum and minimum daily concentration limitations (except for pH and dissolved oxygen). When required by the permit, report the maximum calculated daily concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the Discharge Monitoring Reports (DMRs).

For pH, report the maximum value of any *individual* sample taken during the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs and the minimum value of any *individual* sample taken during the month in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. For dissolved oxygen, report the minimum concentration of any *individual* sample in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Daily loading is the total discharge by weight of a parameter discharged during any calendar day. This value is calculated by multiplying the daily concentration by the total daily flow and by the appropriate conversion factor. The daily loading will be used to determine compliance with any maximum daily loading limitations. When required by the permit, report the maximum calculated daily loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMRs.

Daily monitoring frequency refers to a 24-hour day. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Department means the Michigan Department of Environmental Quality.

Detection level means the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Discharge means the addition of any waste, waste effluent, wastewater, pollutant, or any combination thereof to any surface water of the state.

Discharge point is the location where the point source discharge is directed to surface waters of the state or to a separate storm sewer. It includes the location of all point source discharges where storm water exits the facility, including *outfalls* which discharge directly to surface waters of the state, and *points of discharge* which discharge directly into separate storm sewer systems.

EC_{50} means a statistically or graphically estimated concentration that is expected to cause 1 or more specified effects in 50% of a group of organisms under specified conditions.

Fecal coliform bacteria monthly
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a discharge event. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the period in which the discharge event occurred was partially in each of two months, the calculated monthly value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a reporting month. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

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Section B. Monitoring Procedures

Fecal coliform bacteria 7-day
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days of discharge during a discharge event. If the number of daily concentrations determined during the discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean value for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. If the 7-day period was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days in a reporting month. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. The first calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

Flow-proportioned sample is a composite sample with the sample volume proportional to the effluent flow.

General permit means a National Pollutant Discharge Elimination System permit issued authorizing a category of similar discharges.

Geometric mean is the average of the logarithmic values of a base 10 data set, converted back to a base 10 number.

Grab sample is a single sample taken at neither a set time nor flow.

IC_{25} means the toxicant concentration that would cause a 25% reduction in a nonquantal biological measurement for the test population.

Illicit connection means a physical connection to a municipal separate storm sewer system that primarily conveys non-storm water discharges other than uncontaminated groundwater into the storm sewer; or a physical connection not authorized or permitted by the local authority, where a local authority requires authorization or a permit for physical connections.

Illicit discharge means any discharge to, or seepage into, a municipal separate storm sewer system that is not composed entirely of storm water or uncontaminated groundwater. Illicit discharges include non-storm water discharges through pipes or other physical connections; dumping of motor vehicle fluids, household hazardous wastes, domestic animal wastes, or litter; collection and intentional dumping of grass clippings or leaf litter; or unauthorized discharges of sewage, industrial waste, restaurant wastes, or any other non-storm water waste directly into a separate storm sewer.

Individual permit means a site-specific NPDES permit.

Inlet means a catch basin, roof drain, conduit, drain tile, retention pond riser pipe, sump pump, or other point where storm water or wastewater enters into a closed conveyance system prior to discharge off site or into waters of the state.

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Section B. Monitoring Procedures

Interference is a discharge which, alone or in conjunction with a discharge or discharges from other sources, both: 1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and 2) therefore, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or, of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent state or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including state regulations contained in any state sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act. [This definition does not apply to sample matrix interference].

Land application means spraying or spreading biosolids or a biosolids derivative onto the land surface, injecting below the land surface, or incorporating into the soil so that the biosolids or biosolids derivative can either condition the soil or fertilize crops or vegetation grown in the soil.

LC_{50} means a statistically or graphically estimated concentration that is expected to be lethal to 50% of a group of organisms under specified conditions.

Maximum acceptable toxicant concentration (MATC) means the concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration that did not cause the occurrence of a specific adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specific adverse effect and above which all tested concentrations caused such an occurrence.

Maximum extent practicable means implementation of best management practices by a public body to comply with an approved storm water management program as required by a national permit for a municipal separate storm sewer system, in a manner that is environmentally beneficial, technically feasible, and within the public body's legal authority.

MGD means million gallons per day.

Monthly concentration is the sum of the daily concentrations determined during a reporting period divided by the number of daily concentrations determined. The calculated monthly concentration will be used to determine compliance with any maximum monthly concentration limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly concentration in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the seven day period was partially in each of two months, the monthly average shall be reported on the DMR of the month in which the last day of discharge occurred.

For minimum percent removal requirements, the monthly influent concentration and the monthly effluent concentration shall be determined. The calculated monthly percent removal, which is equal to 100 times the quantity [1 minus the quantity (monthly effluent concentration divided by the monthly influent concentration)], shall be reported in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Monthly loading is the sum of the daily loadings of a parameter divided by the number of daily loadings determined during a reporting period. The calculated monthly loading will be used to determine compliance with any maximum monthly loading limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly loading in the "AVERAGE" column under "QUANTITY OR LOADING" on the DMR. If the seven day period was partially in each of two months, the monthly average shall be reported on the DMR of the month in which the last day of discharge occurred..

Monthly monitoring frequency refers to a calendar month. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Municipal separate storm sewer means a conveyance or system of conveyances designed or used for collecting or conveying storm water which is not a combined sewer and which is not part of a publicly-owned treatment works as defined in the Code of Federal Regulations at 40 CFR 122.2.

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Section B. Monitoring Procedures

Municipal separate storm sewer system (MS4) means all separate storm sewers that are owned or operated by the United States, a state, city, village, township, county, district, association, or other public body created by or pursuant to state law, having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under state law, such as a sewer district, flood control district, or drainage district, or similar entity, or a designated or approved management agency under Section 208 of the Federal Act that discharges to the waters of the state. This term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

National Pretreatment Standards are the regulations promulgated by or to be promulgated by the Federal Environmental Protection Agency pursuant to Section 307(b) and (c) of the Federal Act. The standards establish nationwide limits for specific industrial categories for discharge to a POTW.

No observed adverse effect level (NOAEL) means the highest tested dose or concentration of a substance which results in no observed adverse effect in exposed test organisms where higher doses or concentrations result in an adverse effect.

Noncontact cooling water is water used for cooling which does not come into direct contact with any raw material, intermediate product, by-product, waste product or finished product.

Nondomestic user is any discharger to a POTW that discharges wastes other than or in addition to water-carried wastes from toilet, kitchen, laundry, bathing or other facilities used for household purposes.

Outfall is the location at which a point source discharge enters the surface waters of the state.

Part 91 agency means an agency that is designated by a county board of commissioners pursuant to the provisions of section 9105 of Part 91 of the NREPA; an agency that is designated by a city, village, or township in accordance with the provisions of section 9106 of Part 91 of the NREPA; or the Department for soil erosion and sedimentation activities under Part 615, Part 631, or Part 632 pursuant to the provisions of section 9115 of Part 91 of the NREPA.

Part 91 permit means a soil erosion and sedimentation control permit issued by a Part 91 agency pursuant to the provisions of Part 91 of the NREPA.

Partially treated sewage is any sewage, sewage and storm water, or sewage and wastewater, from domestic or industrial sources that is treated to a level less than that required by the permittee's National Pollutant Discharge Elimination System permit, or that is not treated to national secondary treatment standards for wastewater, including discharges to surface waters from retention treatment facilities.

Point of discharge is the location of a point source discharge where storm water is discharged directly into a separate storm sewer system.

Point source discharge means a discharge from any discernible, confined, discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, or rolling stock. Changing the surface of land or establishing grading patterns on land will result in a point source discharge where the runoff from the site is ultimately discharged to waters of the state.

Polluting material means any material, in solid or liquid form, identified as a polluting material under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

POTW is a publicly owned treatment works.

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Section B. Monitoring Procedures

Pretreatment is reducing the amount of pollutants, eliminating pollutants, or altering the nature of pollutant properties to a less harmful state prior to discharge into a public sewer. The reduction or alteration can be by physical, chemical, or biological processes, process changes, or by other means. Dilution is not considered pretreatment unless expressly authorized by an applicable National Pretreatment Standard for a particular industrial category.
Public (as used in the MS4 individual permit) means all persons who potentially could affect the authorized storm water discharges, including, but not limited to, residents, visitors to the area, public employees, businesses, industries, and construction contractors and developers.

Public body means the United States; the state of Michigan; a city, village, township, county, school district, public college or university, or single-purpose governmental agency; or any other body which is created by federal or state statute or law.

Qualifying storm event means a storm event causing greater than 0.1 inch of rainfall and occurring at least 72 hours after the previous measurable storm event that also caused greater than 0.1 inch of rainfall.

Quantification level means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

Quarterly monitoring frequency refers to a three month period, defined as January through March, April through June, July through September, and October through December. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Regional Administrator is the Region 5 Administrator, U.S. EPA, located at R-19J, 77 W. Jackson Blvd., Chicago, Illinois 60604.

Regulated area means the permittee's urbanized area, where urbanized area is defined as a place and its adjacent densely-populated territory that together have a minimum population of 50,000 people as defined by the United States Bureau of the Census and as determined by the latest available decennial census.

Secondary containment structure means a unit, other than the primary container, in which significant materials are packaged or held, which is required by State or Federal law to prevent the escape of significant materials by gravity into sewers, drains, or otherwise directly or indirectly into any sewer system or to the surface or ground waters of this state.

Separate storm sewer system means a system of drainage, including, but not limited to, roads, catch basins, curbs, gutters, parking lots, ditches, conduits, pumping devices, or man-made channels, which is not a combined sewer where storm water mixes with sanitary wastes, and is not part of a POTW.

Significant industrial user is a nondomestic user that: 1) is subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; or 2) discharges an average of 25,000 gallons per day or more of process wastewater to a POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process waste stream which makes up five (5) percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the permittee as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's treatment plant operation or violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

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Significant materials Significant Materials means any material which could degrade or impair water quality, including but not limited to: raw materials; fuels; solvents, detergents, and plastic pellets; finished materials such as metallic products; hazardous substances designated under Section 101(14) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see 40 CFR 372.65); any chemical the facility is required to report pursuant to Section 313 of Emergency Planning and Community Right-to-Know Act (EPCRA); polluting materials as identified under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code); Hazardous Wastes as defined in Part 111 of the NREPA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

Significant spills and significant leaks means any release of a polluting material reportable under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

Special-use area means secondary containment structures required by state or federal law; lands on Michigan's List of Sites of Environmental Contamination pursuant to Part 201, Environmental Remediation, of the NREPA; and areas with other activities that may contribute pollutants to the storm water for which the Department determines monitoring is needed.

Stoichiometric means the quantity of a reagent calculated to be necessary and sufficient for a given chemical reaction.

Storm water means storm water runoff, snow melt runoff, surface runoff and drainage, and non-storm water included under the conditions of this permit.

SWPPP means the Storm Water Pollution Prevention Plan prepared in accordance with this permit.

Tier I value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier I toxicity database.

Tier II value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier II toxicity database.

Total maximum daily loads (TMDLs) are required by the Federal Act for waterbodies that do not meet Water Quality Standards. TMDLs represent the maximum daily load of a pollutant that a waterbody can assimilate and meet Water Quality Standards, and an allocation of that load among point sources, nonpoint sources, and a margin of safety.

Toxicity reduction evaluation (TRE) means a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

Water Quality Standards means the Part 4 Water Quality Standards promulgated pursuant to Part 31 of the NREPA, being R 323.1041 through R 323.1117 of the Michigan Administrative Code.

Weekly monitoring frequency refers to a calendar week which begins on Sunday and ends on Saturday. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

WWSL is a wastewater stabilization lagoon.

WWSL discharge event is a discrete occurrence during which effluent is discharged to the surface water up to 10 days of a consecutive 14 day period.

3-portion composite sample is a sample consisting of three equal-volume grab samples collected at equal intervals over an 8-hour period.

PART II

Section B. Monitoring Procedures

7-day concentration
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily concentrations determined. If the number of daily concentrations determined during the WWSL discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations. When required by the permit, report the maximum calculated 7-day concentration for the WWSL discharge event in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days in a reporting month divided by the number of daily concentrations determined. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations in the reporting month. When required by the permit, report the maximum calculated 7-day concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

7-day loading
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily loadings determined. If the number of daily loadings determined during the WWSL discharge event is less than 7 days, the number of actual daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations. When required by the permit, report the maximum calculated 7-day loading for the WWSL discharge event in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred

FOR ALL OTHER DISCHARGES – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days in a reporting month divided by the number of daily loadings determined. If the number of daily loadings determined is less than 7, the actual number of daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations in the reporting month. When required by the permit, report the maximum calculated 7-day loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

24-hour composite sample is a flow-proportioned composite sample consisting of hourly or more frequent portions that are taken over a 24-hour period. A time-proportioned composite sample may be used upon approval of the Department if the permittee demonstrates it is representative of the discharge.

PART II

Section C. Reporting Requirements

1. Representative Samples

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations promulgated pursuant to Section 304(h) of the Federal Act (40 CFR Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants), unless specified otherwise in this permit. **Test procedures used shall be sufficiently sensitive to determine compliance with applicable effluent limitations**. Requests to use test procedures not promulgated under 40 CFR Part 136 for pollutant monitoring required by this permit shall be made in accordance with the Alternate Test Procedures regulations specified in 40 CFR 136.4. These requests shall be submitted to the Chief of the Permits Section, Water Resources Division, Michigan Department of Environmental Quality, P.O. Box 30273, Lansing, Michigan, 48909-7773. The permittee may use such procedures upon approval.

The permittee shall periodically calibrate and perform maintenance procedures on all analytical instrumentation at intervals to ensure accuracy of measurements. The calibration and maintenance shall be performed as part of the permittee's laboratory Quality Control/Quality Assurance program.

3. Instrumentation

The permittee shall periodically calibrate and perform maintenance procedures on all monitoring instrumentation at intervals to ensure accuracy of measurements.

4. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information: 1) the exact place, date, and time of measurement or sampling; 2) the person(s) who performed the measurement or sample collection; 3) the dates the analyses were performed; 4) the person(s) who performed the analyses; 5) the analytical techniques or methods used; 6) the date of and person responsible for equipment calibration; and 7) the results of all required analyses.

5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the Department.

PART II

Section D. Management Responsibilities

1. Start-up Notification

If the permittee will not discharge during the first 60 days following the effective date of this permit, the permittee shall notify the Department within 14 days following the effective date of this permit, and then 60 days prior to the commencement of the discharge.

2. Submittal Requirements for Self-Monitoring Data

Part 31 of the NREPA, specifically Section 324.3110(3) and R 323.2155(2) of Part 21, allows the Department to specify the forms to be utilized for reporting the required self-monitoring data. Unless instructed on the effluent limitations page to conduct "Retained Self-Monitoring" the permittee shall submit self-monitoring data via the Department's Electronic Environmental Discharge Monitoring Reporting (e2-DMR) system.

The permittee shall utilize the information provided on the e2-Reporting website at https://secure1.state.mi.us/e2rs/ to access and submit the electronic forms. Both monthly summary and daily data shall be submitted to the Department no later than the 20th day of the month following each month of the authorized discharge period(s). The permittee may be allowed to submit the electronic forms after this date if the Department has granted an extension to the submittal date.

3. Retained Self-Monitoring Requirements

If instructed on the effluent limits page (or otherwise authorized by the Department in accordance with the provisions of this permit, to conduct retained self-monitoring, the permittee shall maintain a year-to-date log of retained self-monitoring results and, upon request, provide such log for inspection to the staff of the Department. Retained self-monitoring results are public information and shall be promptly provided to the public upon request.

The permittee shall certify, in writing, to the Department, on or before January 10th (April 1st for animal feeding operation facilities) of each year, that: 1) all retained self-monitoring requirements have been complied with and a year-to-date log has been maintained; and 2) the application on which this permit is based still accurately describes the discharge. With this annual certification, the permittee shall submit a summary of the previous year's monitoring data. The summary shall include maximum values for samples to be reported as daily maximums and/or monthly maximums and minimum values for any daily minimum samples.

Retained self-monitoring may be denied to a permittee by notification in writing from the Department. In such cases, the permittee shall submit self-monitoring data in accordance with Part II.C.2., above. Such a denial may be rescinded by the Department upon written notification to the permittee. Reissuance or modification of this permit or reissuance or modification of an individual permittee's authorization to discharge shall not affect previous approval or denial for retained self-monitoring unless the Department provides notification in writing to the permittee.

4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

Monitoring required pursuant to Part 41 of the NREPA or Rule 35 of the Mobile Home Park Commission Act (Act 96 of the Public Acts of 1987) for assurance of proper facility operation shall be submitted as required by the Department.

PART II

Section D. Management Responsibilities

5. Compliance Dates Notification

Within 14 days of every compliance date specified in this permit, the permittee shall submit a *written* notification to the Department indicating whether or not the particular requirement was accomplished. If the requirement was not accomplished, the notification shall include an explanation of the failure to accomplish the requirement, actions taken or planned by the permittee to correct the situation, and an estimate of when the requirement will be accomplished. If a written report is required to be submitted by a specified date and the permittee accomplishes this, a separate written notification is not required.

6. Noncompliance Notification

Compliance with all applicable requirements set forth in the Federal Act, Parts 31 and 41 of the NREPA, and related regulations and rules is required. All instances of noncompliance shall be reported as follows:

a. 24-Hour Reporting
Any noncompliance which may endanger health or the environment (including maximum and/or minimum daily concentration discharge limitation exceedances) shall be reported, verbally, within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission shall also be provided within five (5) days.

b. Other Reporting
The permittee shall report, in writing, all other instances of noncompliance not described in a. above at the time monitoring reports are submitted; or, in the case of retained self-monitoring, within five (5) days from the time the permittee becomes aware of the noncompliance.

Written reporting shall include: 1) a description of the discharge and cause of noncompliance; and 2) the period of noncompliance, including exact dates and times, or, if not yet corrected, the anticipated time the noncompliance is expected to continue, and the steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

7. Spill Notification

The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwaters of the state, unless the permittee has determined that the release is not in excess of the threshold reporting quantities specified in the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code), by calling the Department at the number indicated on the second page of this permit (or, if this is a general permit, on the COC); or, if the notice is provided after regular working hours, call the Department's 24-hour Pollution Emergency Alerting System telephone number, 1-800-292-4706 (calls from **out-of-state** dial 1-517-373-7660).

Within ten (10) days of the release, the permittee shall submit to the Department a full written explanation as to the cause of the release, the discovery of the release, response (clean-up and/or recovery) measures taken, and preventative measures taken or a schedule for completion of measures to be taken to prevent reoccurrence of similar releases.

PART II

Section D. Management Responsibilities

8. Upset Noncompliance Notification

If a process "upset" (defined as an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee) has occurred, the permittee who wishes to establish the affirmative defense of upset, shall notify the Department by telephone within 24 hours of becoming aware of such conditions; and within five (5) days, provide in writing, the following information:

a. that an upset occurred and that the permittee can identify the specific cause(s) of the upset;

b. that the permitted wastewater treatment facility was, at the time, being properly operated and maintained (note that an upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation); and

c. that the permittee has specified and taken action on all responsible steps to minimize or correct any adverse impact in the environment resulting from noncompliance with this permit.

No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

In any enforcement proceedings, the permittee, seeking to establish the occurrence of an upset, has the burden of proof.

9. Bypass Prohibition and Notification

a. Bypass Prohibition
Bypass is prohibited, and the Department may take an enforcement action, unless:

1) bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

2) there were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass; and

3) the permittee submitted notices as required under 9.b. or 9.c. below.

b. Notice of Anticipated Bypass
If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least ten (10) days before the date of the bypass, and provide information about the anticipated bypass as required by the Department. The Department may approve an anticipated bypass, after considering its adverse effects, if it will meet the three (3) conditions listed in 9.a. above.

c. Notice of Unanticipated Bypass
The permittee shall submit notice to the Department of an unanticipated bypass by calling the Department at the number indicated on the second page of this permit (if the notice is provided after regular working hours, use the following number: 1-800-292-4706) as soon as possible, but no later than 24 hours from the time the permittee becomes aware of the circumstances.

PART II

Section D. Management Responsibilities

d. Written Report of Bypass
A written submission shall be provided within five (5) working days of commencing any bypass to the Department, and at additional times as directed by the Department. The written submission shall contain a description of the bypass and its cause; the period of bypass, including exact dates and times, and if the bypass has not been corrected, the anticipated time it is expected to continue; steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass; and other information as required by the Department.

e. Bypass Not Exceeding Limitations
The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of 9.a., 9.b., 9.c., and 9.d., above. This provision does not relieve the permittee of any notification responsibilities under Part II.C.11. of this permit.

f. Definitions

1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

10. Bioaccumulative Chemicals of Concern (BCC)

Consistent with the requirements of R 323.1098 and R 323.1215 of the Michigan Administrative Code, the permittee is prohibited from undertaking any action that would result in a lowering of water quality from an increased loading of a BCC unless an increased use request and antidegradation demonstration have been submitted and approved by the Department.

11. Notification of Changes in Discharge

The permittee shall notify the Department, in writing, as soon as possible but no later than 10 days of knowing, or having reason to believe, that any activity or change has occurred or will occur which would result in the discharge of: 1) detectable levels of chemicals on the current Michigan Critical Materials Register, priority pollutants or hazardous substances set forth in 40 CFR 122.21, Appendix D, or the Pollutants of Initial Focus in the Great Lakes Water Quality Initiative specified in 40 CFR 132.6, Table 6, which were not acknowledged in the application or listed in the application at less than detectable levels; 2) detectable levels of any other chemical not listed in the application or listed at less than detection, for which the application specifically requested information; or 3) any chemical at levels greater than five times the average level reported in the complete application (see the first page of this permit, for the date(s) the complete application was submitted). Any other monitoring results obtained as a requirement of this permit shall be reported in accordance with the compliance schedules.

PART II

Section D. Management Responsibilities

12. Changes in Facility Operations

Any anticipated action or activity, including but not limited to facility expansion, production increases, or process modification, which will result in new or increased loadings of pollutants to the receiving waters must be reported to the Department by a) submission of an increased use request (application) and all information required under R 323.1098 (Antidegradation) of the Water Quality Standards or b) by notice if the following conditions are met: 1) the action or activity will not result in a change in the types of wastewater discharged or result in a greater quantity of wastewater than currently authorized by this permit; 2) the action or activity will not result in violations of the effluent limitations specified in this permit; 3) the action or activity is not prohibited by the requirements of Part II.C.10.; and 4) the action or activity will not require notification pursuant to Part II.C.11. Following such notice, the permit or, if applicable, the facility's COC may be modified according to applicable laws and rules to specify and limit any pollutant not previously limited.

13. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall submit to the Department 30 days prior to the actual transfer of ownership or control a written agreement between the current permittee and the new permittee containing: 1) the legal name and address of the new owner; 2) a specific date for the effective transfer of permit responsibility, coverage and liability; and 3) a certification of the continuity of or any changes in operations, wastewater discharge, or wastewater treatment.

If the new permittee is proposing changes in operations, wastewater discharge, or wastewater treatment, the Department may propose modification of this permit in accordance with applicable laws and rules.

14. Operations and Maintenance Manual

For wastewater treatment facilities that serve the public (and are thus subject to Part 41 of the NREPA), Section 4104 of Part 41 and associated Rule 2957 of the Michigan Administrative Code allow the Department to require an Operations and Maintenance (O&M) Manual from the facility. An up-to-date copy of the O&M Manual shall be kept at the facility and shall be provided to the Department upon request. The Department may review the O&M Manual in whole or in part at its discretion and require modifications to it if portions are determined to be inadequate.

At a minimum, the O&M Manual shall include the following information: permit standards; descriptions and operation information for all equipment; staffing information; laboratory requirements; record keeping requirements; a maintenance plan for equipment; an emergency operating plan; safety program information; and copies of all pertinent forms, as-built plans, and manufacturer's manuals.

Certification of the existence and accuracy of the O&M Manual shall be submitted to the Department at least sixty days prior to start-up of a new wastewater treatment facility. Recertification shall be submitted sixty days prior to start-up of any substantial improvements or modifications made to an existing wastewater treatment facility.

PART II

Section D. Management Responsibilities

15. Signatory Requirements

All applications, reports, or information submitted to the Department in accordance with the conditions of this permit and that require a signature shall be signed and certified as described in the Federal Act and the NREPA.

The Federal Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

The NREPA (Section 3115(2)) provides that a person who at the time of the violation knew or should have known that he or she discharged a substance contrary to this part, or contrary to a permit, COC, or order issued or rule promulgated under this part, or who intentionally makes a false statement, representation, or certification in an application for or form pertaining to a permit or COC or in a notice or report required by the terms and conditions of an issued permit or COC, or who intentionally renders inaccurate a monitoring device or record required to be maintained by the Department, is guilty of a felony and shall be fined not less than $2,500.00 or more than $25,000.00 for each violation. The court may impose an additional fine of not more than $25,000.00 for each day during which the unlawful discharge occurred. If the conviction is for a violation committed after a first conviction of the person under this subsection, the court shall impose a fine of not less than $25,000.00 per day and not more than $50,000.00 per day of violation. Upon conviction, in addition to a fine, the court in its discretion may sentence the defendant to imprisonment for not more than 2 years or impose probation upon a person for a violation of this part. With the exception of the issuance of criminal complaints, issuance of warrants, and the holding of an arraignment, the circuit court for the county in which the violation occurred has exclusive jurisdiction. However, the person shall not be subject to the penalties of this subsection if the discharge of the effluent is in conformance with and obedient to a rule, order, permit, or COC of the Department. In addition to a fine, the attorney general may file a civil suit in a court of competent jurisdiction to recover the full value of the injuries done to the natural resources of the state and the costs of surveillance and enforcement by the state resulting from the violation.

16. Electronic Reporting

Upon notice by the Department that electronic reporting tools are available for specific reports or notifications, the permittee shall submit electronically all such reports or notifications as required by this permit.

PART II

Section E. Activities Not Authorized by This Permit

1. Duty to Comply

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit, more frequently than, or at a level in excess of, that authorized, shall constitute a violation of the permit.

It is the duty of the permittee to comply with all the terms and conditions of this permit. Any noncompliance with the Effluent Limitations, Special Conditions, or terms of this permit constitutes a violation of the NREPA and/or the Federal Act and constitutes grounds for enforcement action; for permit or Certificate of Coverage (COC) termination, revocation and reissuance, or modification; or denial of an application for permit or COC renewal.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

2. Operator Certification

The permittee shall have the waste treatment facilities under direct supervision of an operator certified at the appropriate level for the facility certification by the Department, as required by Sections 3110 and 4104 of the NREPA. Permittees authorized to discharge storm water shall have the storm water treatment and/or control measures under direct supervision of a storm water operator certified by the Department, as required by Section 3110 of the NREPA.

3. Facilities Operation

The permittee shall, at all times, properly operate and maintain all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures.

4. Power Failures

In order to maintain compliance with the effluent limitations of this permit and prevent unauthorized discharges, the permittee shall either:

a. provide an alternative power source sufficient to operate facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit; or

b. upon the reduction, loss, or failure of one or more of the primary sources of power to facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit, the permittee shall halt, reduce or otherwise control production and/or all discharge in order to maintain compliance with the effluent limitations and conditions of this permit.

5. Adverse Impact

The permittee shall take all reasonable steps to minimize or prevent any adverse impact to the surface waters or groundwaters of the state resulting from noncompliance with any effluent limitation specified in this permit including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the discharge in noncompliance.

PART II

Section E. Activities Not Authorized by This Permit

6. Containment Facilities

The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the NREPA.

7. Waste Treatment Residues

Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit, or other pollutants or wastes) removed from or resulting from treatment or control of wastewaters, including those that are generated during treatment or left over after treatment or control has ceased, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the NREPA, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwaters of the state.

8. Right of Entry

The permittee shall allow the Department, any agent appointed by the Department, or the Regional Administrator, upon the presentation of credentials and, for animal feeding operation facilities, following appropriate biosecurity protocols:

a. to enter upon the permittee's premises where an effluent source is located or any place in which records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect process facilities, treatment works, monitoring methods and equipment regulated or required under this permit; and to sample any discharge of pollutants.

9. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Act and Rule 2128 (R 323.2128 of the Michigan Administrative Code), all reports prepared in accordance with the terms of this permit, shall be available for public inspection at the offices of the Department and the Regional Administrator. As required by the Federal Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Act and Sections 3112, 3115, 4106 and 4110 of the NREPA.

10. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or the facility's COC, or to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

PART II

Section E. Activities Not Authorized by This Permit

1. Discharge to the Groundwaters

This permit does not authorize any discharge to the groundwaters. Such discharge may be authorized by a groundwater discharge permit issued pursuant to the NREPA.

2. POTW Construction

This permit does not authorize or approve the construction or modification of any physical structures or facilities at a POTW. Approval for the construction or modification of any physical structures or facilities at a POTW shall be by permit issued under Part 41 of the NREPA.

3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypass" (Part II.C.9. pursuant to 40 CFR 122.41(m)), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond the permittee's control, such as accidents, equipment breakdowns, or labor disputes.

4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee may be subject under Section 311 of the Federal Act except as are exempted by federal regulations.

5. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Federal Act.

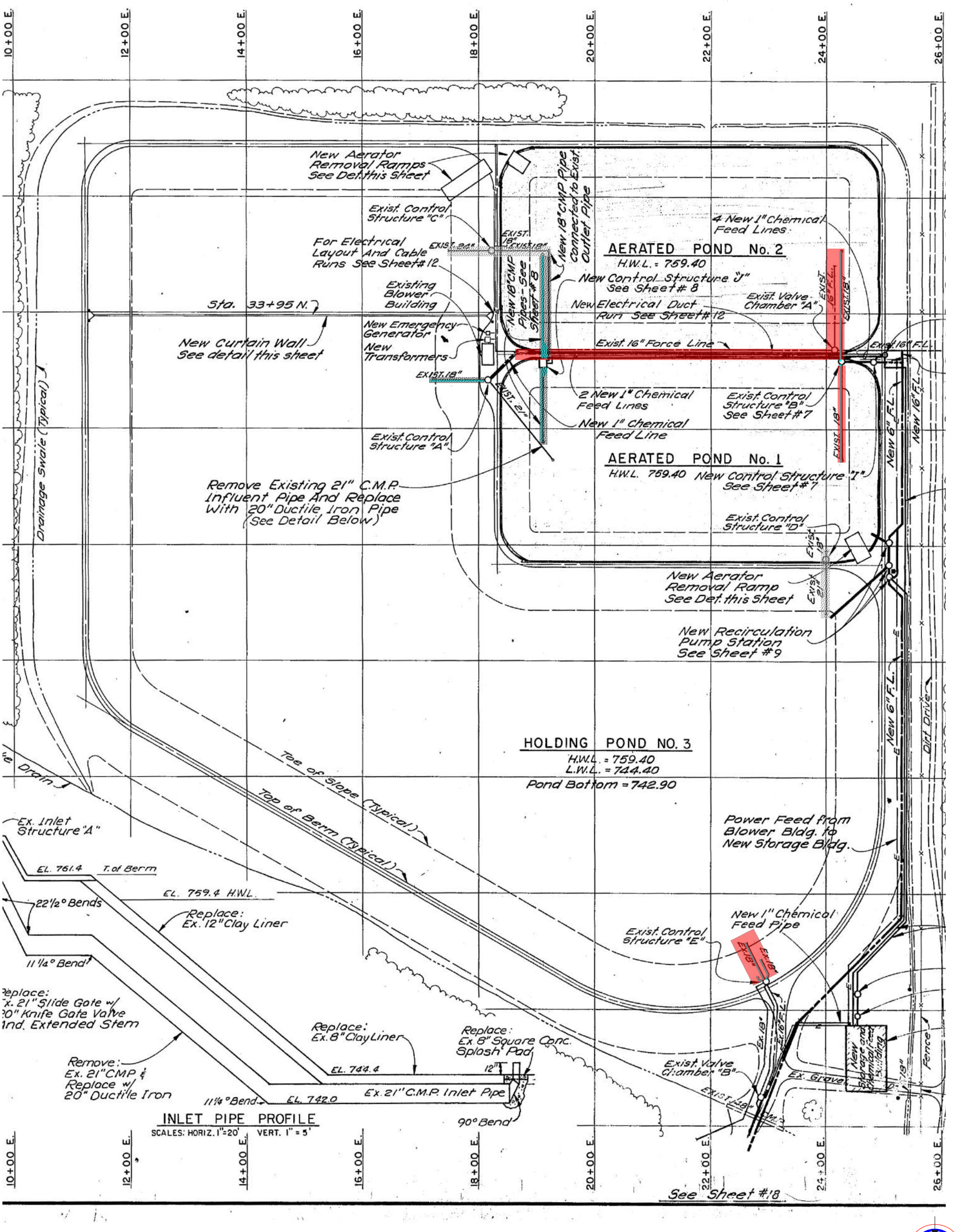
6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Department of Environmental Quality permits, or approvals from other units of government as may be required by law.

APPENDIX D:

WWTF IMPROVEMENTS CONCEPT DRAWINGS

D-1: .....CONCEPT DRAWINGS



REMOVE PIPING

ABANDON CMP AND STRUCTURE IN PLACE

VILLAGE OF PAW PAW

VAN BUREN COUNTY

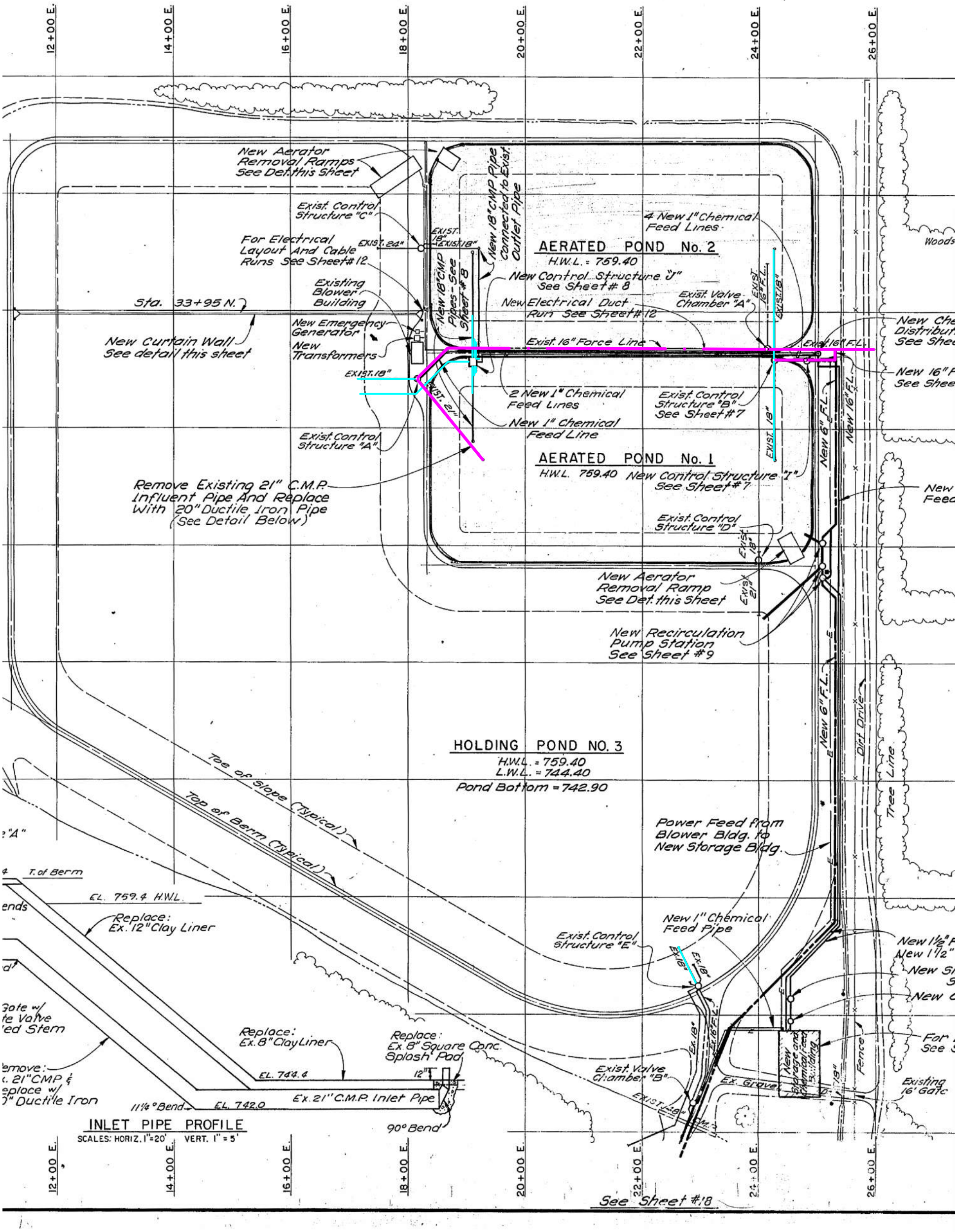
WWTF FEASIBILITY STUDY

FIGURE A3.1 - PROPOSED DEMO

F&V PROJECT NO. 840560

F&V

coreyt/M:\Proj\839001-841000\840560 Paw Paw - WW Lagoon Treatment Plant Eval\Cad\Plns\Lagoon Site Plan.dwg



PROPOSED DUCTILE IRON PIPE

EXISTING FORCEMAIN

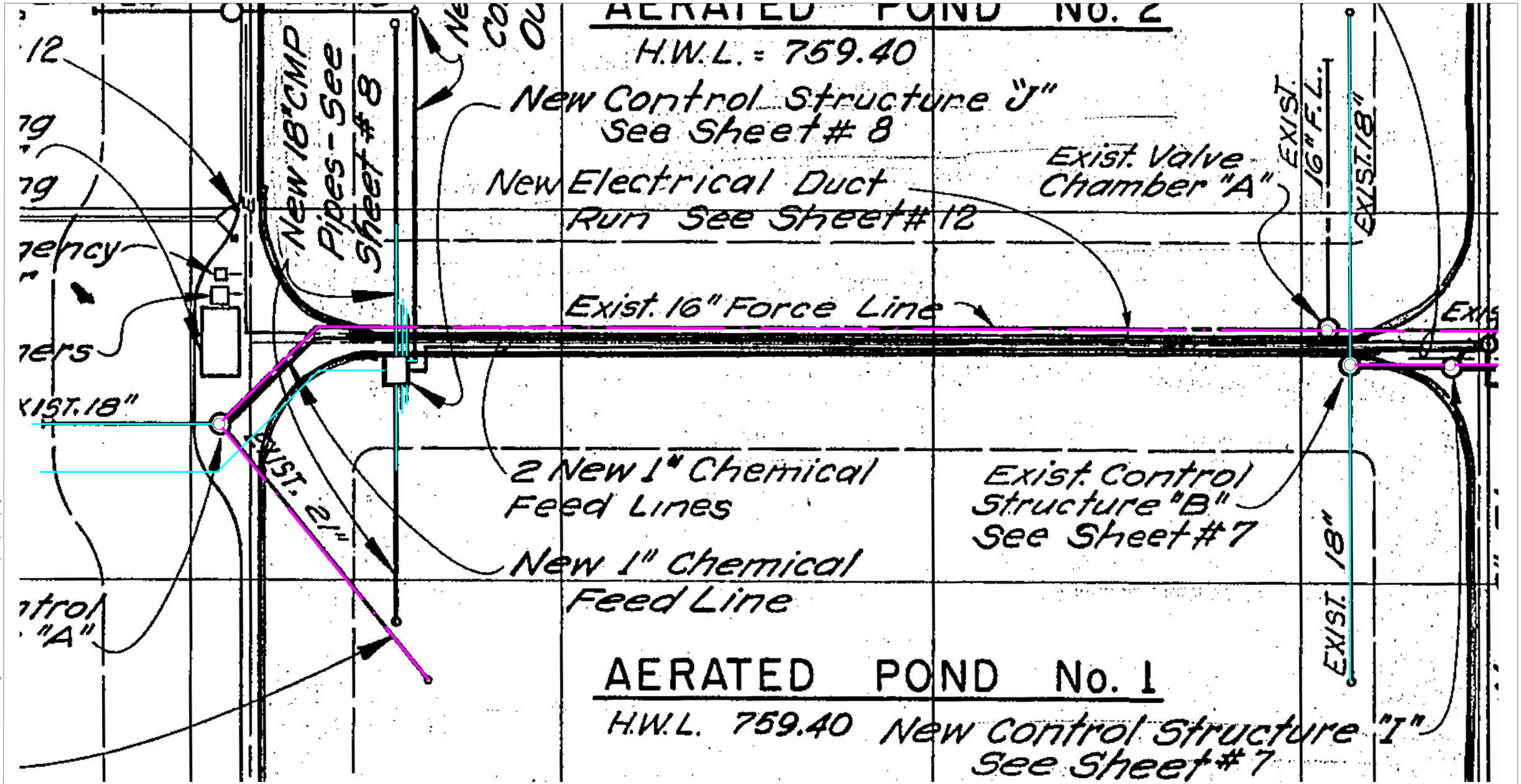
EXISTING CONTROL STRUCTURE

VILLAGE OF PAW PAW
VAN BUREN COUNTY
WWTF FEASIBILITY STUDY

FIGURE 3.2 - PROPOSED PIPING

F&V PROJECT NO. 840560

coreyt/M:\Proj\839001-841000\840560 Paw Paw - WW Lagoon Treatment Plant Eval\Cad\Plns\Lagoon Site Plan.dwg



PROPOSED DUCTILE IRON PIPE

EXISTING FORCEMAIN

EXISTING CONTROL STRUCTURE

NORTH

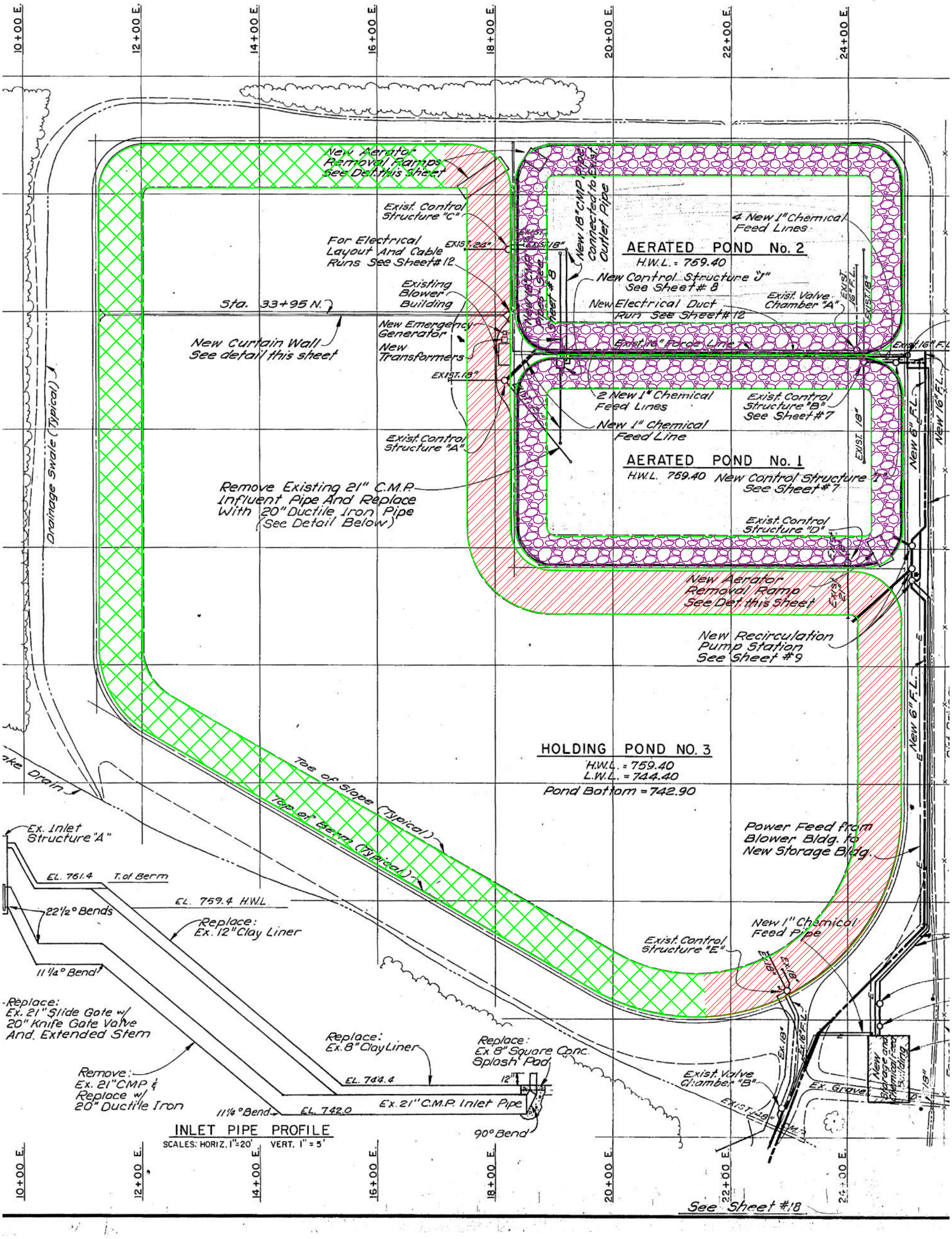
VILLAGE OF PAW PAW
VAN BUREN COUNTY
WWTF FEASIBILITY STUDY

FIGURE 3.2.1 - PROPOSED PIPING DETAIL

F&V PROJECT NO. 840560

F&V

scotth/M:\Proj839001-841000\840560 Paw Paw - WW Lagoon Treatment Plant Eval\Cad\Plns\Lagoon Site Plan.dwg



CLAY BERM REPAIR & SEED/TOPSOIL

MINOR CLAY BERM REPAIR & SEED/TOPSOIL

CLAY BERM REPAIR & EROSION CONTROL GRAVEL

VILLAGE OF PAW PAW

VAN BUREN COUNTY

WWTF FEASIBILITY STUDY

FIGURE 3.3 - BERM REHAB

F&V PROJECT NO. 840560

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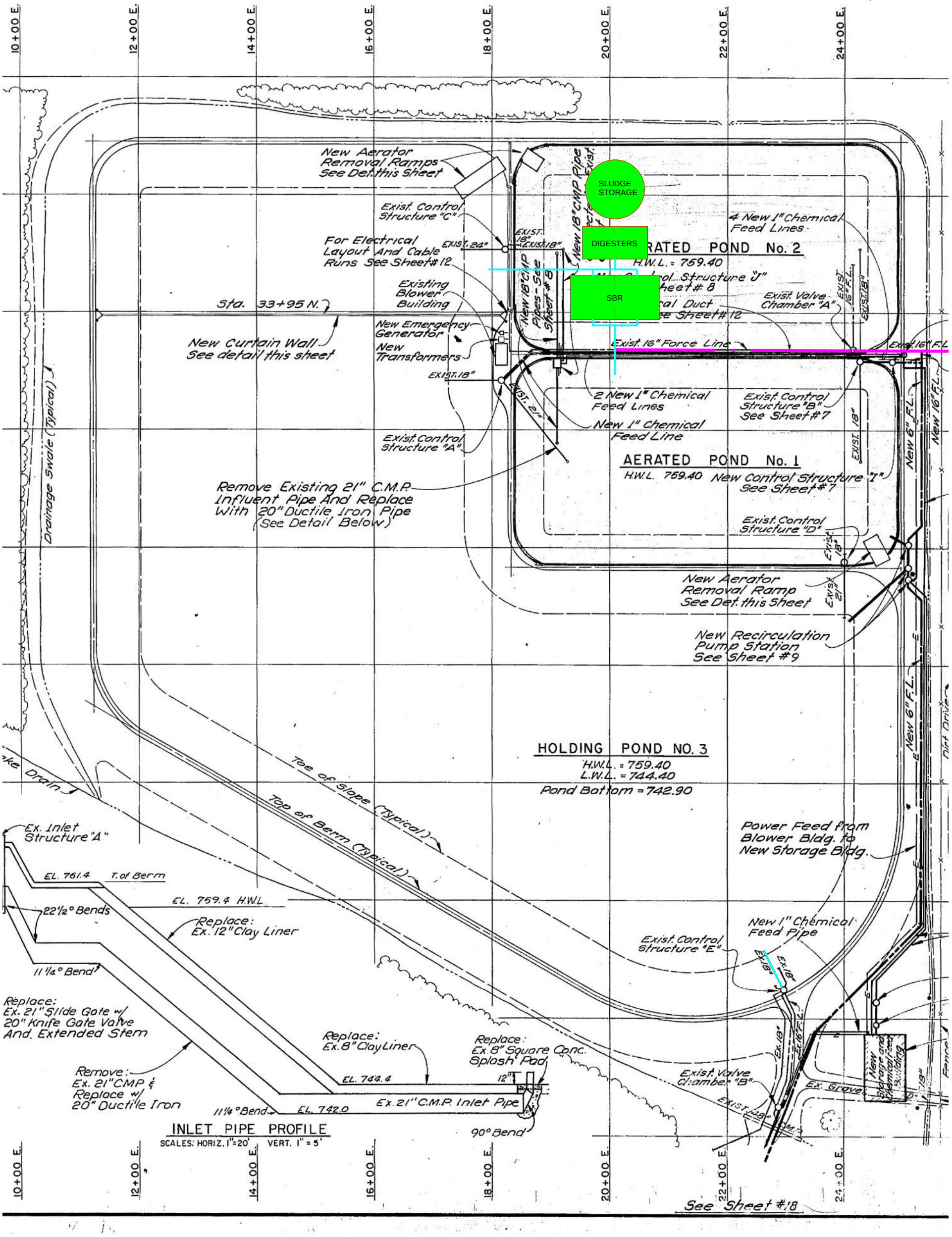

CONCRETE TREATMENT TANKS

PROPOSED DUCTILE IRON PIPE

EXISTING FORCEMAIN

VILLAGE OF PAW PAW

VAN BUREN COUNTY

WWTF FEASIBILITY STUDY

FIGURE A4 - ALT. 3 LAYOUT

F&V PROJECT NO. 840560

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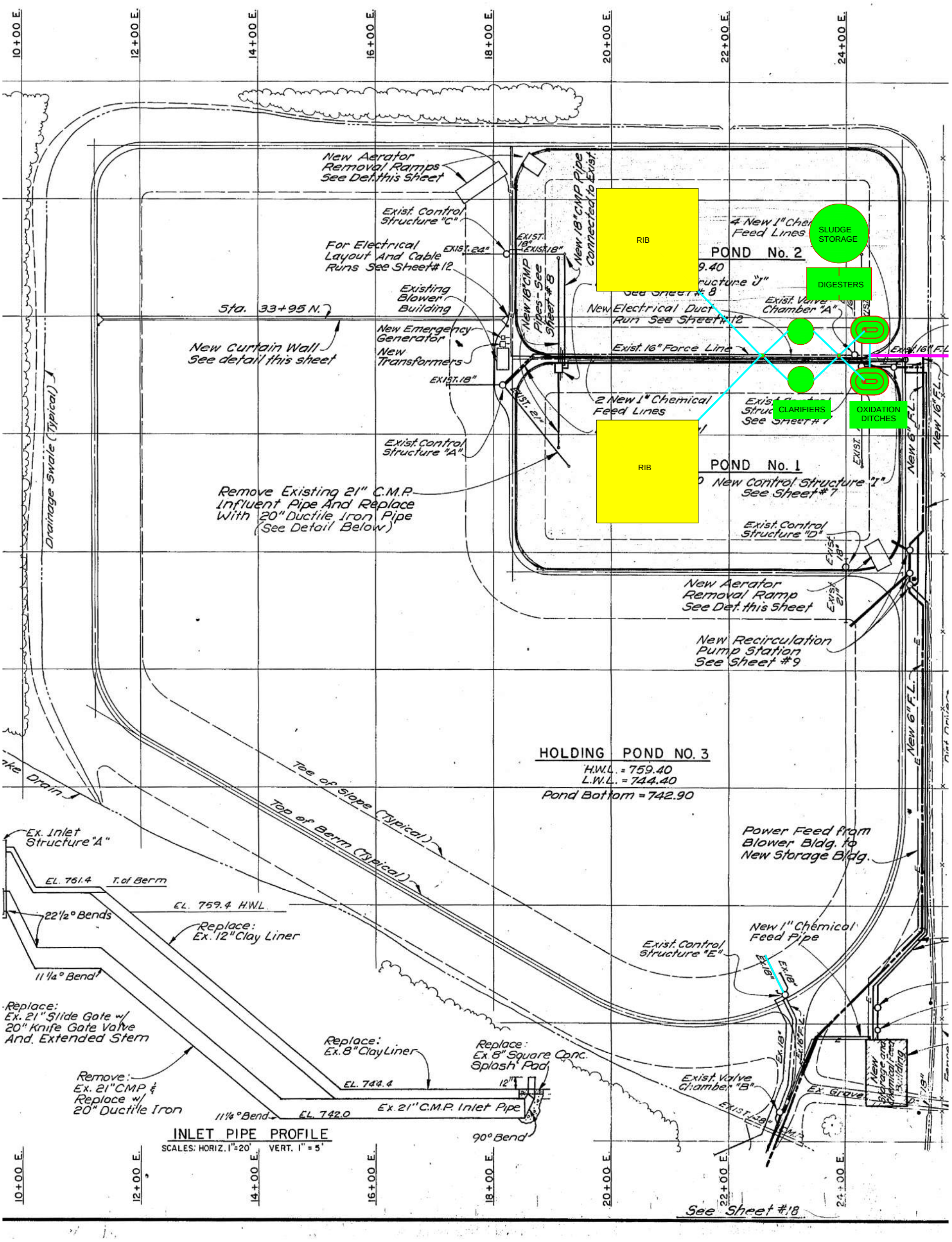

CONCRETE TREATMENT TANKS

PROPOSED DUCTILE IRON PIPE

EXISTING FORCEMAIN

RIB

VILLAGE OF PAW PAW

VAN BUREN COUNTY

WWTF FEASIBILITY STUDY

FIGURE A5 - ALT. 4 LAYOUT

F&V PROJECT NO. 840560

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APPENDIX E:

WWTF BASIS OF DESIGN

E-1: .....WWTF BASIS OF DESIGN

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Village of Paw Paw
Preliminary Basis of Design Summary
Wastewater System Feasibility Study

Community:	Village of Paw Paw
Type of Sewer System:	Separate Sanitary and Storm Sewer
Type of Treatment:	Aerated Lagoons
Disposal Method:	Overland Flow/Surface Water Discharge

Current WWTF Flows and Loadings:

Number of Customers:	4,798	*May 2016 SRF application
Average Daily Flow (ADF):	0.59	MGD
Maximum Daily Flow:	1.54	MGD

Current Influent Sewage Characteristics:

Average Daily Concentration and Loads

	mg/L	lbs/day
BOD:	344	1712
TSS:	260	1272
Total P:	5.0	23.0
NH3-N:	20.0	95.0

2039 Projected WWTF Flows and Loadings:

2039 Projected Number of Customers:	5,913	
2039 Projected Influent Flow:	0.727	MGD
Plant Capacity - Average Daily Flow (ADF):	1.400	MGD
Plant Capacity - Maximum Daily Flow:	2.090	MGD

20-Year Design Sewage Characteristics:

	Average Daily Flow		Maximum Daily Flow	
	mg/L	lbs/day	mg/L	lbs/day
BOD:	412	4,813	412	7,181
TSS:	300	3,505	300	5,229
Total P:	10.0	117	10	174
NH3-N:	25.0	292	25	436

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Village of Paw Paw
Preliminary Basis of Design Summary
Wastewater System Feasibility Study

Community:	Village of Paw Paw
Type of Sewer System:	Separate Sanitary and Storm Sewer
Type of Treatment:	Aerated Lagoons
Disposal Method:	Overland Flow/Surface Water Discharge

Aerated Lagoons:

Pond Properties:

Number of Ponds:	2	
Bottom of Pond Elevation:	744	ft
Top of Berm Elevation:	761	ft
High Water Level:	759	ft
Freeboard:	2	ft
Slope of Berm:	1:3	
Pond Area at HWL:	5.0	acres
Useable Volume:	19.8	million gallons/pond
Detention Time:	14	days/pond @ 1.4 MGD

Storage Lagoon:

Pond Properties:

Number of Ponds:	1	
Bottom of Pond Elevation:	743	ft
Top of Berm Elevation:	761	ft
High Water Level:	759	ft
Freeboard:	2	ft
Slope of Berm:	1:4	
Pond Area at HWL:	28.1	acres
Working Volume:	117.5	million gallons
Detention Time:	68	days @ 1.4 MGD

APPENDIX F:

DETAILED COST ESTIMATES OF FEASIBLE ALTERNATIVES

F-1:.....DETAILED COST ESTIMATES

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Village of Paw Paw - Feasibility Study	*Project No.*	840560
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Alternative 2 - Optimize Existing WWTF**		

Item	Description	Unit	Qty.	Unit Price	Amount
1	**WWTF Lagoon Site Work**				**$1,759,000**
	Lagoon Dewatering & Bypass pumping	LS	1	$51,000	$51,000
	Remove Biosolids from Aerated Lagoons	Gal	5,500,000	$0.10	$550,000
	Gravel Drive	SYD	900	$15	$14,000
	Site Restoration	LS	1	$30,000	$30,000
	Aerated Lagoons				
	Top soil stripping and grading	SYD	25,000	$3	$75,000
	Clay Liner Repair	CY	3,000	$40	$120,000
	Geotextile Fabric	SYD	29,000	$2	$44,000
	Slope Stabilization Rock	CY	4,000	$85	$340,000
	Holding Pond				
	Top soil stripping and grading	SYD	43,000	$2	$86,000
	Clay Liner Repair	CY	8,000	$40	$320,000
	Seed and Topsoil	SYD	43,000	$3	$129,000
2	**WWTF Control Structure and Piping Rehabilitation**				**$572,000**
3	**Diffused Aeration System**				**$1,335,000**
	Remove Existing Aeration System	LS	1	$20,000	$20,000
	Diffused Aeration System	LS	1	$900,000	$900,000
	Electrical and Controls	LS	1	$90,000	$90,000
	Baffles	LS	2	$70,000	$140,000
	Air Header Piping	LF	1,250	$100	$125,000
	Blower Process Piping and Valves	LS	1	$60,000	$60,000
4	**Blower Building Improvements**				**$40,000**
	HVAC	LS	1	$20,000	$20,000
	Blower Bldg. Roof	SF	760	$26.00	$20,000
5	**Telemetry**				**$5,000**
	Telemetry	LS	1	$5,000	$5,000
6	**General Conditions and OH&P**		10%		$371,000
				Construction Total	**$4,082,000**
7	**Contingency**		10%		$408,000
8	**Engineering & Administration**		18%		$734,000
9	**Sub Total Short Term Capital Improvement Costs**				**$5,224,000**
10	**Long Term Capital Improvement Costs**				**$8,540,000**
				Total Project Cost:	**$13,764,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Village of Paw Paw - Feasibility Study	*Project No.*	840560
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Alternative 4 - Mechanical WWTF - GW discharge**		

Item	Description	Unit	Qty.	Unit Price	Amount
1	**Abandon Existing Lagoon WWTF**				**$1,683,000**
	Lagoon Dewatering	LS	1	$15,000	$15,000
	Remove Biosolids	Gal	12,400,000	$0.12	$1,488,000
	Lagoon Earthwork	LS	1	$100,000	$100,000
	Abandon Existing Control Structures	EA	8	$10,000	$80,000
2	**New Mechanical WWTF Site Work**				**$270,000**
	Site Development (grading, drainage, driveway)	LS	1	$140,000	$140,000
	Site Piping/Utilities (well, water, sanitary, and process)	LS	1	$50,000	$50,000
	Natural Gas/Propane Service to WWTP Facilities	LS	1	$30,000	$30,000
	Re-route FM	LF	200	$250	$50,000
3	**Buildings**				**$1,450,000**
	Headworks	SF	1,000	$250	$250,000
	Blower/Control Building	SF	2,000	$250	$500,000
	Chemical Feed System Improvements	LS	1	$200,000	$200,000
	Biosolids Handling Building	SF	2,000	$250	$500,000
4	**Process Equipment/Structures**				**$9,512,000**
	Grit Removal	LS	1	$470,000	$470,000
	Oxidation Ditch	LS	1	$2,630,000	$2,630,000
	Clarifiers	LS	1	$2,150,000	$2,150,000
	Aerobic Digesters & Solids Handling Equipment	LS	1	$4,200,000	$4,200,000
	Effluent Control Structure	LS	1	$62,000	$62,000
5	**Electrical/SCADA**				**$520,000**
	Communication/Telephone/Internet Service to WWTP Facilities	LS	1	$20,000	$20,000
	SCADA System/Remote Monitoring	LS	1	$100,000	$100,000
	Motor Control Centers/Electrical Gear	LS	1	$200,000	$200,000
	Standby Power Generator/Transfer Switch	LS	1	$200,000	$200,000
6	**Rapid Infiltration Basin**				**$1,200,000**
	RIB and Piping	LS	1	$1,200,000	$1,200,000
7	**General Conditions and OH&P**		10%		$1,464,000
				Construction Total	**$16,100,000**
8	**Contingency**		10%		$1,610,000
9	**Engineering & Administration**		18%		$2,898,000
				Total Project Cost:	**$20,608,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

APPENDIX G:

POPULATION AND ECONOMIC DATA

G-1:.....CENSUS POPULATION DATA

G-2:.....MDOT POPULATION PROJECTIONS

G-3: .....MEDIAN HOUSEHOLD INCOME DATA

G-4:.....PER CAPITA INCOME DATA

Annual Estimates of the Resident Population for Counties in Michigan: April 1, 2010 to July 1, 2019

Geographic Area	April 1, 2010		Population Estimate (as of July 1)									
	Census	Estimates Base	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
St. Joseph County, Michigan	61,295	61,303	61,288	61,068	60,992	60,989	61,015	60,804	60,790	60,710	60,912	60,964
Sanilac County, Michigan	43,114	43,106	43,087	42,705	42,306	41,901	41,661	41,464	41,405	41,242	41,192	41,170
Schoolcraft County, Michigan	8,485	8,485	8,472	8,477	8,350	8,263	8,137	8,121	7,967	8,013	8,044	8,094
Shiawassee County, Michigan	70,648	70,668	70,634	69,998	69,329	68,903	68,808	68,505	68,542	68,400	68,133	68,122
Tuscola County, Michigan	55,729	55,722	55,698	55,400	54,708	54,216	53,923	53,726	53,276	52,815	52,633	52,245
Van Buren County, Michigan	76,258	76,269	76,149	75,936	75,298	75,318	75,226	75,060	75,267	75,303	75,481	75,677
Washtenaw County, Michigan	344,791	345,163	345,717	349,753	352,303	356,040	360,021	362,975	366,135	368,807	369,483	367,601
Wayne County, Michigan	1,820,584	1,820,473	1,815,081	1,803,189	1,795,929	1,780,225	1,771,679	1,764,872	1,760,612	1,757,217	1,754,453	1,749,343
Wexford County, Michigan	32,735	32,735	32,739	32,640	32,521	32,479	32,851	32,889	33,081	33,234	33,446	33,631

Note: The estimates are based on the 2010 Census and reflect changes to the April 1, 2010 population due to the Count Question Resolution program and geographic program revisions. All geographic boundaries for the 2019 population estimates are as of January 1, 2019. For population estimates methodology statements, see http://www.census.gov/programs-surveys/popest/technical-documentation/methodology.html.

Suggested Citation:
Annual Estimates of the Resident Population for Counties in Michigan: April 1, 2010 to July 1, 2019 (CO-EST2019-ANNRES-26)
Source: U.S. Census Bureau, Population Division
Release Date: March 2020

Annual Estimates of the Resident Population for Incorporated Places in Michigan: April 1, 2010 to July 1, 2019

Geographic Area	April 1, 2010		Population Estimate (as of July 1)									
	Census	Estimates Base	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ortonville village, Michigan	1,442	1,439	1,437	1,447	1,457	1,468	1,470	1,463	1,462	1,458	1,448	1,443
Otisville village, Michigan	864	864	862	855	846	841	835	832	837	835	836	835
Otsego city, Michigan	3,956	3,965	3,966	3,939	3,937	3,935	3,959	3,960	3,960	3,990	3,993	3,994
Otter Lake village, Michigan	389	389	389	387	388	388	386	386	384	382	380	378
Ovid city, Michigan	1,603	1,586	1,587	1,591	1,593	1,602	1,601	1,591	1,597	1,608	1,614	1,613
Owendale village, Michigan	241	241	241	238	236	234	233	230	228	227	226	224
Owosso city, Michigan	15,194	15,180	15,167	15,014	14,854	14,749	14,715	14,635	14,623	14,562	14,475	14,441
Oxford village, Michigan	3,436	3,434	3,436	3,458	3,479	3,507	3,548	3,541	3,549	3,552	3,541	3,556
Parchment city, Michigan	1,804	1,800	1,803	1,814	1,827	1,836	1,839	1,837	1,840	1,841	1,834	1,828
Parma village, Michigan	769	763	763	759	757	754	754	751	748	747	746	744
Paw Paw village, Michigan	3,534	3,514	3,506	3,488	3,454	3,446	3,436	3,417	3,406	3,389	3,378	3,366
Peck village, Michigan	632	635	635	627	619	610	606	601	601	598	596	595
Pellston village, Michigan	822	822	821	825	823	828	831	830	829	833	838	843
Pentwater village, Michigan	857	862	859	858	854	852	854	852	850	851	853	848

Annual Estimates of the Resident Population for Minor Civil Divisions in Michigan: April 1, 2010 to July 1, 2019

Geographic Area	April 1, 2010		Population Estimate (as of July 1)									
	Census	Estimates Base	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Keeler township, Van Buren County, Michigan	2,169	2,176	2,175	2,180	2,167	2,167	2,169	2,160	2,159	2,162	2,156	2,159
Lawrence township, Van Buren County, Michigan	3,259	3,261	3,257	3,252	3,227	3,232	3,232	3,228	3,235	3,239	3,244	3,244
Paw Paw township, Van Buren County, Michigan	7,041	7,043	7,031	7,001	6,939	6,932	6,916	6,886	6,879	6,849	6,830	6,821
Pine Grove township, Van Buren County, Michigan	2,949	2,947	2,942	2,938	2,918	2,927	2,928	2,918	2,927	2,927	2,941	2,948
Porter township, Van Buren County, Michigan	2,466	2,466	2,463	2,453	2,439	2,438	2,433	2,425	2,438	2,451	2,465	2,460
South Haven city, Van Buren County, Michigan	4,400	4,413	4,406	4,393	4,360	4,364	4,364	4,354	4,361	4,357	4,349	4,345
South Haven charter township, Van Buren County, Michigan	3,983	3,966	3,959	3,945	3,919	3,918	3,916	3,905	3,914	3,935	3,957	3,993
Waverly township, Van Buren County, Michigan	2,554	2,556	2,552	2,545	2,521	2,526	2,519	2,515	2,517	2,521	2,524	2,532
Ann Arbor city, Washtenaw County, Michigan	113,934	113,988	114,173	115,539	116,079	116,820	118,716	119,884	120,919	121,493	121,429	119,980
Ann Arbor charter township, Washtenaw County, Michigan	4,361	4,349	4,352	4,397	4,420	4,463	4,483	4,485	4,520	4,531	4,543	4,520

co	COUNTY	TAZ	MCD	Census POP05	Census POP10	MDOT POP15	MDOT POP20	MDOT POP25	MDOT POP30	MDOT POP35	Census HH05	Census HH10	MDOT HH15	MDOT HH20	MDOT HH25	MDOT HH30	MDOT HH35
11	BERRIEN	171	St. Joseph city	1432	1713	1683	1662	1650	1642	1634	531	607	597	590	585	580	575
11	BERRIEN	172	St. Joseph city	3668	3597	3535	3491	3467	3449	3434	1942	1861	1829	1807	1790	1774	1757
11	BERRIEN	173	St. Joseph city	1822	1527	1500	1482	1472	1464	1457	955	750	737	728	722	715	709
11	BERRIEN	174	St. Joseph city	1627	1528	1501	1483	1472	1465	1458	751	692	680	672	666	660	654
11	BERRIEN	175	Benton Harbor city	1745	1547	1505	1471	1445	1423	1400	598	532	523	517	512	507	502
11	BERRIEN	176	Benton Harbor city	1318	1300	1265	1237	1215	1196	1177	455	329	323	319	316	314	311
11	BERRIEN	177	Benton Harbor city	1939	2122	2065	2018	1983	1952	1921	869	860	845	835	827	820	812
11	BERRIEN	178	Benton Harbor city	2743	2430	2364	2311	2271	2235	2200	892	807	794	784	777	770	762
11	BERRIEN	179	Benton Harbor city	2997	2639	2568	2510	2466	2427	2389	963	862	847	837	829	822	814
11	BERRIEN	180	Benton Ch twp	3210	2548	2512	2488	2479	2474	2470	1224	1210	1189	1176	1166	1156	1145
11	BERRIEN	181	Benton Ch twp	1906	2046	2017	1998	1990	1986	1983	873	852	838	828	821	814	807
11	BERRIEN	182	Benton Ch twp	839	918	905	897	893	892	891	385	377	371	367	364	361	357
11	BERRIEN	183	Benton Ch twp	5891	5445	5367	5317	5296	5286	5279	2402	2110	2075	2051	2034	2016	1998
11	BERRIEN	184	Benton Ch twp	3711	3791	3736	3701	3687	3679	3674	1669	1589	1563	1545	1531	1518	1505
11	BERRIEN	185	Hagar twp	3899	3671	3612	3572	3552	3539	3528	1664	1526	1501	1485	1474	1462	1450
11	BERRIEN	186	St. Joseph Ch twp	3029	3114	3074	3050	3042	3041	3042	1346	1269	1249	1236	1227	1217	1208
11	BERRIEN	187	St. Joseph Ch twp	1953	2043	2014	1997	1990	1988	1986	898	886	871	862	855	848	840
11	BERRIEN	188	St. Joseph Ch twp	4809	4872	4808	4770	4758	4755	4755	1921	1930	1899	1879	1864	1850	1835
11	BERRIEN	189	Watervliet city	1773	1735	1708	1689	1680	1674	1669	731	671	659	652	646	640	634
11	BERRIEN	190	Watervliet twp	3403	3102	3085	3085	3101	3124	3149	1362	1283	1290	1303	1321	1339	1356
11	BERRIEN	191	Coloma twp	3014	2832	2806	2795	2800	2810	2821	1299	1181	1165	1155	1148	1142	1136
11	BERRIEN	192	Coloma twp	2127	2188	2168	2159	2162	2170	2178	852	851	839	832	827	822	817
11	BERRIEN	193	Coloma city	1501	1483	1457	1438	1428	1420	1413	631	600	590	583	578	573	568
11	BERRIEN	194	Bainbridge twp	3132	2850	2829	2824	2833	2848	2865	1159	1129	1116	1110	1108	1105	1102
11	BERRIEN	195	Lincoln twp	3289	3832	3823	3835	3866	3907	3949	1250	1470	1480	1497	1520	1542	1565
11	BERRIEN	196	Lincoln twp	10918	10859	10833	10863	10951	11063	11181	4296	4438	4464	4514	4579	4644	4709
11	BERRIEN	197	Royalton twp	4332	4766	4802	4862	4948	5046	5146	1305	1683	1769	1863	1963	2064	2165
11	BERRIEN	198	Sodus twp	2106	1932	1891	1861	1841	1824	1808	899	804	791	782	776	770	764
11	BERRIEN	199	Pipestone twp	2529	2312	2322	2344	2378	2418	2459	852	851	864	882	902	922	943
11	BERRIEN	200	Berrien twp	5242	5080	5083	5112	5169	5237	5309	1673	1761	1780	1808	1843	1877	1912
11	BERRIEN	201	Bridgman city	2408	2291	2265	2251	2249	2251	2255	1019	945	931	921	915	909	902
11	BERRIEN	202	Lake Ch twp	3167	2972	2963	2969	2992	3021	3051	1182	1201	1196	1198	1204	1210	1215
11	BERRIEN	203	Baroda twp	2932	2801	2805	2824	2858	2898	2940	1132	1112	1116	1126	1139	1153	1166
11	BERRIEN	204	Oronoko twp	2616	2495	2429	2377	2337	2302	2268	979	944	929	918	911	903	896
11	BERRIEN	205	Oronoko twp	4966	4902	4772	4667	4588	4518	4450	1622	1438	1414	1398	1387	1376	1364
11	BERRIEN	206	Berrien Springs villa	1926	1800	1766	1741	1725	1713	1702	737	749	736	728	722	716	709
11	BERRIEN	207	New Buffalo city	2244	1883	1835	1798	1770	1745	1721	970	841	832	827	825	823	821
11	BERRIEN	208	New Buffalo twp	2616	2386	2374	2375	2388	2406	2426	1122	1099	1121	1150	1182	1214	1246
11	BERRIEN	209	Chikaming twp	3653	3100	3062	3040	3035	3036	3038	1686	1457	1436	1422	1412	1403	1393
11	BERRIEN	210	Three Oaks village	1745	1622	1593	1573	1561	1552	1544	446	398	392	387	384	380	377
11	BERRIEN	211	Three Oaks twp	1090	952	938	928	924	921	919	755	672	660	652	646	641	635
11	BERRIEN	212	Buchanan city	4462	4456	4376	4318	4285	4260	4237	1928	1891	1859	1838	1822	1806	1789
11	BERRIEN	213	Bertrand twp	274	291	291	292	296	299	303	100	99	101	103	105	107	110
11	BERRIEN	214	Weesaw twp	2004	1936	1900	1874	1859	1847	1836	812	790	776	767	761	754	747
11	BERRIEN	215	Galien twp	1644	1452	1460	1476	1499	1526	1554	625	596	602	611	623	634	645
11	BERRIEN	216	Buchanan twp	3592	3523	3495	3486	3495	3512	3531	1339	1315	1309	1311	1317	1323	1328
11	BERRIEN	217	Niles city	1891	1898	1862	1836	1820	1808	1797	949	950	934	923	915	907	898
11	BERRIEN	218	Niles city	3783	3798	3726	3674	3643	3618	3595	1612	1763	1732	1712	1697	1681	1666
11	BERRIEN	219	Niles city	2530	2540	2492	2457	2436	2420	2405	1100	1255	1234	1219	1208	1198	1187
11	BERRIEN	220	Niles city	1746	1753	1720	1696	1681	1670	1660	744	793	779	770	763	756	749
11	BERRIEN	221	Niles twp	6548	6985	6941	6932	6961	7004	7052	2685	2659	2640	2636	2639	2643	2646
11	BERRIEN	222	Niles twp	6729	7179	7133	7124	7154	7198	7247	2682	2656	2637	2633	2636	2640	2644
11	BERRIEN	223	Niles city	1605	1611	1581	1559	1545	1535	1525	735	716	704	696	689	683	677
11	BERRIEN	224	Bertrand twp	2206	2366	2366	2377	2402	2431	2462	815	942	960	982	1008	1034	1060
14	CASS	299	Dowagiac city	2295	2182	2169	2176	2197	2226	2243	931	876	867	871	887	894	897
14	CASS	300	Dowagiac city	2401	2285	2271	2278	2299	2329	2347	1028	917	908	911	927	934	937
14	CASS	301	Dowagiac city	1361	1413	1404	1408	1420	1439	1449	667	561	555	557	566	570	572
14	CASS	302	Cassopolis village	1871	1774	1725	1692	1670	1654	1628	757	709	689	678	678	670	659
14	CASS	303	La Grange twp	1584	1726	1721	1732	1753	1782	1800	691	642	641	648	666	676	684
14	CASS	304	Silver Creek twp	3585	3218	3210	3232	3273	3328	3364	1398	1268	1267	1284	1319	1342	1358
14	CASS	305	Wayne twp	2987	2654	2673	2715	2775	2846	2901	1087	1026	1051	1090	1146	1190	1230
14	CASS	306	Pokagon twp	2297	2029	2047	2083	2132	2189	2235	870	807	831	865	913	952	986
14	CASS	307	Marcellus village	1132	1198	1190	1194	1204	1220	1228	464	446	441	442	449	452	453
14	CASS	308	Marcellus twp	1588	1341	1338	1346	1363	1386	1401	622	544	544	551	566	575	582
14	CASS	309	Volinia twp	1190	1112	1113	1125	1144	1167	1183	455	426	430	439	456	468	477
14	CASS	310	Penn twp	1884	1774	1762	1766	1782	1804	1816	802	714	705	706	718	722	723
14	CASS	311	Newberg twp	1717	1632	1631	1645	1668	1699	1720	694	658	660	672	694	708	720
14	CASS	312	Howard twp	2962	2918	2907	2923	2957	3002	3031	1179	1155	1150	1162	1190	1206	1216
14	CASS	313	Howard twp	3463	3290	3277	3295	3333	3384	3416	1477	1419	1412	1426	1460	1480	1493
14	CASS	314	Milton twp	2995	3878	3988	4134	4305	4494	4660	1001	1386	1499	1631	1789	1931	2064
14	CASS	315	Edwardsburg village	1140	1259	1218	1189	1168	1150	1126	542	515	500	492	491	485	477
14	CASS	316	Ontwa twp	4949	5290	5302	5361	5454	5569	5653	2010	2092	2116	2169	2254	2318	2370
14	CASS	317	Jefferson twp	2678	2541	2617	2716	2832	2960	3073	935	938	1018	1112	1223	1322	1416
14	CASS	318	Porter twp	3989	3798	3794	3825	3880	3950	3998	1635	1597	1602	1629	1680	1714	1741
14	CASS	319	Calvin twp	2156	2037	2073	2128	2195	2272	2337	840	805	847	901	968	1027	1081
14	CASS	320	Mason twp	2792	2945	2970	3021	3091	3173	3239	1014	1104	1134	1181	1244	1296	1343
80	VAN BUREN	2023	South Haven city	2214	1975	1888	1872	1872	1881	1888	1151	935	919	913	913	914	916
80	VAN BUREN	2024	South Haven city	2533	2425	2368	2329	2311	2316	2320	1036	1022	1006	998	998	999	1000
80	VAN BUREN	2025	South Haven twp	2397	2437	2466	2509	2554	2594	2617	941	980	992	1025	1054	1078	1097
80	VAN BUREN	2026	South Haven twp	1650	1546	1528	1541	1572	1600	1621	781	645	639	650	668	683	694
80	VAN BUREN	2027	Covert twp	3040	2888	2859	2866	2880	2888	2894	1170	1003	991	992	994	996	997
80	VAN BUREN	2028	Bangor city	1937	1885	1875	1898	1936	1964	1982	755	707	710	720	736	751	763
80	VAN BUREN	2029	Geneva twp	3805	3573	3514	3494	3499	3501	3503	1468	1324	1305	1300	1301	1303	1304
80	VAN BUREN	2030	Columbia twp	2673	2588	2571	2585	2615	2643	2665	1026	964	961	968	983	996	1005
80	VAN BUREN	2031	Bangor twp	2152	2147	2176	2236	2288	2336	2369	761	777	795	829	861	887	910
80	VAN BUREN	2032	Pine Grove twp	3714	3778	3863	4002	4128	4247	4338	1394	1443	1498	1585	1666	1739	1804
80	VAN BUREN	2033	Bloomingdale twp	3260	3103	3068	3080	3100	3111	3120	1234	1201	1194	1195	1198	1200	1201
80	VAN BUREN	2034	Lawrence twp	3328	3259	3248	3265	3300	3330	3354	1249	1224	1220	1231	1247	1261	1274
80	VAN BUREN	2035	Arlington twp	2080	2073	2100	2157	2206	2252	2283	770	752	769	801	831	856	878
80	VAN BUREN	2036	Hartford city	2604	2688	2768	2886	2995	3099	3183	978	899	945	1010	1072	1129	1180
80	VAN BUREN	2037	Hartford twp	3243	3274	3336	3440	3545	3631	3699	1146	1164	1201	1263	1321	1372	1417
80	VAN BUREN	2038	Paw Paw village	3477	3534	3612	3740	3857	3966	4050	1483	1499	1555	1644	1727	1801	1868
80	VAN BUREN	2039	Paw Paw twp	3737	3594	3559	3571	3608	3639	3658	1417	1396	1391	1394	1405	1417	1426
80	VAN BUREN	2040	Waverly twp	2531	2554	2602	2685	2760	2830	2883	954	959	989	1040	1087	1129	1166
80	VAN BUREN	2041	Almena twp	4647	4992	5343	5646	5934	6188	6429	1625	1839	2049	2259	2437	2597	2748
80	VAN BUREN	2042	Keeler twp	2405	2169	2075	2022	1996	1982	1973	910	816	804	798	793	791	790
80	VAN BUREN	2043	Hamilton twp	1657	1489	1406	1379	1362	1353	1346	594	551	541	537	535	533	532
80	VAN BUREN	2044	Lawton village	1895	1900	1930	1987	2037	2084	2118	638	730	753	792	821	849	869
80	VAN BUREN	2045	Mattawan village	2272	1997	1873	1797	1766	1747	1733	1006	788	773	764	759	756	754
80	VAN BUREN	2046	Antwerp twp	3068	3793	4273	4649	4963	5181	5336	889	1353	1607	1804	2000	2163	2305
80	VAN BUREN	2047	Antwerp twp	4268	4405	4691	5121	5513	5867	6197	1406	1586	1828	2100	2323	2527	2700
80	VAN BUREN	2048	Decatur village	1890	1819	1806	1816	1843	1861	1871	759	701	699	704	714	723	729
80	VAN BUREN	2049	Decatur twp	1963	1907	1898	1912	1945	1974	1996	760	702	704	713	728	742	753
80	VAN BUREN	2050	Porter twp	2456	2466	2507	2582	2649	2711	2756	978	968	982	1025	1080	1125	1158

Table: ACSST5Y2019.S1903

	Michigan						Van Buren County, Michigan						Paw Paw village, Michigan					
	Number		Percent Distribution		Median income (dollars)		Number		Percent Distribution		Median income (dollars)		Number		Percent Distribution		Median income (dollars)	
Label	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error
HOUSEHOLD INCOME BY RACE AND HISPANIC OR LATINO ORIGIN OF HOUSEHOLDER																		
Households	3,935,041	±8,563	3,935,041	±8,563	57,144	±216	29,411	±528	29,411	±528	54,485	±1,786	1,375	±168	1,375	±168	43,226	±4,897
One race--																		
White	3,183,051	±7,623	80.9%	±0.1	61,400	±243	26,415	±470	89.8%	±0.7	57,082	±2,405	1,271	±166	92.4%	±5.8	44,504	±6,457
Black or African American	527,956	±2,678	13.4%	±0.1	35,322	±398	847	±131	2.9%	±0.4	28,771	±3,998	0	±10	0.0%	±1.8	-	**
American Indian and Alaska Native	19,528	±747	0.5%	±0.1	43,453	±2,117	210	±84	0.7%	±0.3	-	**	11	±13	0.8%	±1.0	-	**
Asian	101,311	±1,140	2.6%	±0.1	86,611	±1,882	170	±42	0.6%	±0.1	97,813	±69,980	0	±10	0.0%	±1.8	-	**
Native Hawaiian and Other Pacific Islander	937	±178	0.0%	±0.1	59,508	±20,225	0	±24	0.0%	±0.1	-	**	0	±10	0.0%	±1.8	-	**
Some other race	34,198	±1,234	0.9%	±0.1	44,286	±1,733	952	±133	3.2%	±0.5	41,818	±14,721	49	±62	3.6%	±4.4	-	**
Two or more races	68,060	±1,711	1.7%	±0.1	45,242	±1,735	817	±160	2.8%	±0.5	42,537	±8,183	44	±46	3.2%	±3.3	-	**
Hispanic or Latino origin (of any race)	140,493	±1,731	3.6%	±0.1	48,256	±937	2,178	±140	7.4%	±0.5	42,176	±4,626	123	±93	8.9%	±6.4	43,210	±24,752
White alone, not Hispanic or Latino	3,087,557	±7,330	78.5%	±0.1	61,750	±252	25,452	±446	86.5%	±0.7	57,920	±2,069	1,197	±166	87.1%	±7.4	44,196	±9,084
HOUSEHOLD INCOME BY AGE OF HOUSEHOLDER																		
15 to 24 years	157,278	±2,703	4.0%	±0.1	30,853	±464	909	±190	3.1%	±0.6	37,003	±4,583	62	±67	4.5%	±4.9	-	**
25 to 44 years	1,167,034	±4,333	29.7%	±0.1	63,027	±445	7,993	±305	27.2%	±0.8	57,725	±3,890	383	±93	27.9%	±7.8	48,341	±7,227
45 to 64 years	1,547,395	±3,323	39.3%	±0.1	69,897	±405	12,181	±289	41.4%	±0.9	67,141	±2,998	510	±136	37.1%	±7.5	44,333	±27,046
65 years and over	1,063,334	±4,133	27.0%	±0.1	44,061	±231	8,328	±230	28.3%	±0.7	40,185	±1,702	420	±108	30.5%	±5.9	29,426	±7,365
FAMILIES																		
Families	2,517,441	±8,128	2,517,441	±8,128	72,600	±364	20,380	±523	20,380	±523	66,975	±2,431	806	±110	806	±110	59,531	±17,621
With own children of householder under 18 years	1,016,547	±6,997	40.4%	±0.2	70,381	±637	8,098	±377	39.7%	±1.3	62,767	±3,297	393	±101	48.8%	±11.9	49,977	±39,340
With no own children of householder under 18 years	1,500,894	±4,891	59.6%	±0.2	73,857	±308	12,282	±363	60.3%	±1.3	70,190	±3,136	413	±118	51.2%	±11.9	59,609	±19,963
Married-couple families	1,853,456	±10,342	73.6%	±0.2	86,923	±348	15,613	±513	76.6%	±1.8	77,081	±2,548	519	±108	64.4%	±12.2	75,795	±11,735
With own children under 18 years	672,898	±7,183	26.7%	±0.2	96,983	±486	5,629	±305	27.6%	±1.2	81,104	±4,933	282	±95	35.0%	±12.3	69,625	±26,790
Female householder, no spouse present	475,082	±3,924	18.9%	±0.2	35,135	±402	3,240	±292	15.9%	±1.4	33,069	±2,874	154	±73	19.1%	±8.6	-	**
With own children under 18 years	252,073	±3,324	10.0%	±0.1	26,515	±361	1,706	±242	8.4%	±1.2	25,367	±5,318	50	±56	6.2%	±7.0	-	**
Male householder, no spouse present	188,903	±2,663	7.5%	±0.1	49,283	±695	1,527	±263	7.5%	±1.2	44,195	±6,210	133	±88	16.5%	±10.2	42,813	±13,584
With own children under 18 years	91,576	±2,115	3.6%	±0.1	42,000	±996	763	±182	3.7%	±0.9	36,717	±8,418	61	±65	7.6%	±7.8	-	**
FAMILY INCOME BY FAMILY SIZE																		
2-person families	1,252,208	±5,360	49.7%	±0.2	63,733	±313	10,176	±394	49.9%	±1.5	61,982	±3,130	391	±126	48.5%	±12.2	44,896	±21,726
3-person families	536,991	±5,129	21.3%	±0.2	76,449	±643	4,076	±356	20.0%	±1.6	68,877	±4,998	158	±81	19.6%	±9.3	68,188	±28,519
4-person families	430,428	±5,154	17.1%	±0.2	93,492	±793	3,290	±257	16.1%	±1.2	81,071	±6,455	118	±86	14.6%	±10.6	125,050	±95,233
5-person families	191,036	±2,185	7.6%	±0.1	86,517	±950	1,795	±244	8.8%	±1.2	82,971	±9,780	84	±51	10.4%	±6.3	76,071	±24,364
6-person families	67,930	±1,926	2.7%	±0.1	79,417	±1,463	596	±165	2.9%	±0.8	63,636	±23,188	55	±78	6.8%	±10.0	-	**
7-or-more person families	38,848	±1,488	1.5%	±0.1	70,375	±2,157	447	±118	2.2%	±0.6	48,209	±7,503	0	±10	0.0%	±3.1	-	**
FAMILY INCOME BY NUMBER OF EARNERS																		
No earners	430,572	±3,691	17.1%	±0.1	43,003	±363	3,252	±275	16.0%	±1.3	39,934	±3,245	137	±67	17.0%	±7.5	-	**
1 earner	810,706	±4,636	32.2%	±0.2	52,026	±362	6,381	±419	31.3%	±1.8	45,527	±3,340	233	±106	28.9%	±12.4	43,688	±12,076
2 earners	997,130	±6,629	39.6%	±0.2	94,460	±432	8,406	±445	41.2%	±1.9	83,908	±3,505	377	±111	46.8%	±13.0	70,982	±15,471
3 or more earners	279,033	±2,694	11.1%	±0.1	119,246	±866	2,341	±269	11.5%	±1.3	103,843	±9,397	59	±39	7.3%	±5.0	79,712	±24,421
NONFAMILY HOUSEHOLDS																		
Nonfamily households	1,417,600	±5,755	1,417,600	±5,755	33,711	±225	9,031	±533	9,031	±533	30,584	±1,723	569	±196	569	±196	19,917	±13,613
Female householder	744,373	±4,689	52.5%	±0.2	30,102	±191	4,457	±328	49.4%	±3.0	26,022	±1,438	408	±165	71.7%	±14.3	-	**
Living alone	631,818	±4,479	44.6%	±0.2	27,120	±202	3,823	±293	42.3%	±2.7	23,918	±2,213	354	±154	62.2%	±14.1	16,594	±12,923
Not living alone	112,555	±2,009	7.9%	±0.1	54,889	±946	634	±135	7.0%	±1.5	49,211	±8,396	54	±44	9.5%	±7.6	-	**
Male householder	673,227	±3,681	47.5%	±0.2	39,259	±388	4,574	±428	50.6%	±3.0	38,210	±3,591	161	±96	28.3%	±14.3	20,268	±10,373
Living alone	532,201	±3,285	37.5%	±0.2	34,533	±432	3,816	±407	42.3%	±3.1	33,131	±4,158	131	±83	23.0%	±12.6	20,804	±8,686
Not living alone	141,026	±2,454	9.9%	±0.2	61,970	±914	758	±116	8.4%	±1.2	57,778	±8,884	30	±35	5.3%	±6.0	-	**

	Michigan		Van Buren County, Michigan		Paw Paw village, Michigan	
Label	**Estimate**	**Margin of Error**	**Estimate**	**Margin of Error**	**Estimate**	**Margin of Error**
Per capita income in the past 12 months (in 2019 inflation-adjusted dollars)	31,713	±129	28,049	±944	23,796	±5,228