

June 30, 2021

Mr. Jim Chapman, Supervisor
Green Charter Township
21431 Northland Drive
PO Box 233
Paris, MI 49338

RE: Sanitary Sewer Feasibility Study

Dear Mr. Chapman:

Fleis & VandenBrink Engineering (F&V) has evaluated alternatives to provide sanitary sewer service to Green Charter Township (Township) property owners along the 19 Mile corridor. This corridor generally includes those properties in a 2.5-mile stretch, along 19 Mile Road from US-131 to 200th Avenue and shown as the service area in Figure 1, attached.

Future land use of the service area is comprised of existing homes, industrial, industrial – no flow, commercial, agricultural and residential. Industrial – no flow includes properties such as the electrical substation and gravel pits where the industry does not add to the wastewater flows. Those properties surrounding the US-131 interchange were assumed to be rezoned from residential to commercial. Existing land zoned for industrial was assumed to remain zoned as industrial. Other parcels were assumed for future housing developments and expanded commercial district. Assumptions for average day flow generated by each type of land use is shown below in Table 1. Evaluation of initial, 100% built out, and build out conditions in 5-year increments can be seen in the Basis of Design attached.

Table 1. Average Day Wastewater Flow Assumptions.

Land Use	Avg Day Flow
Commercial (gpd/ac)	1,500
Industrial (gpd/ac)	1,500
Residential (gpd/ac)	500
Existing Home (gpd/ea)	250

Collection System

Sanitary sewer collection systems were evaluated to carry the wastewater from the service area to the existing sewer system. Three collection system options were evaluated, Option 1 flows south down 220th Avenue to existing sewer in 18 Mile, Option 2 flows south down Northland Drive to the existing gravity sewer and Option 3 flows south down 205th Avenue to the existing gravity sewer. Option 1 would connect to Big Rapids Township's existing sewer in 18 Mile.

Options 2 and 3 flow into the Green Charter Township's existing sewer system to the existing lift station currently being evaluated for replacement.

For each option gravity sewer would be constructed in 19 Mile Road flowing east. This gravity sewer would cross culverts for Dalziel Creek in two locations. Michigan Department of Transportation (MDOT) is currently designing the western culvert for reconstruction in 2022. MDOT has provided F&V preliminary design drawings during this study. MDOT has also provided record drawings of the eastern culvert. To cross both culverts, a steel casing would be bored and jacked underneath the culvert or creek bed. These crossing dictate the gravity sewer depth in 19 Mile Road and would range from 15 feet to 25 feet deep.

Future flows are based on buildable lot sizes. This assumes 75% of the lot is buildable due to right-of-way, setback requirements, wetlands, parking lots, etc. that will not produce wastewater. Gravity sewer sizes are based on a 70 year build out condition, as gravity sewer has an estimated useful life of 70 years. The lift stations and forcemain were sized for a 25 year build out condition. At this point the pumps and forcemain could be sized larger, if necessary, to accommodate additional flow.

Option 1

A collection system to carry the wastewater down 220th Avenue would be comprised of a series of gravity sewers, lift stations and forcemain. In general, the existing ground slopes southeast towards Dalziel Creek and the Muskegon River. For this reason, gravity sewer would pick up the flow along 19 Mile and flow to the east where a lift station would be required to pump back to 220th Avenue. 220th Avenue is sloped north and would require another lift station to pump down to 18 Mile.

In Option 1, the sewer would flow into the existing sewer in 18 Mile owned by Big Rapids Township. The existing gravity sewer in 18 Mile has a minimum capacity in an 8" sewer at 0.23%. This sewer likely has capacity to handle the 200 gpm from the proposed lift station currently, but as Big Rapids Township Industrial Park expands, the sewer would quickly reach capacity.

Downstream of the gravity sewer is an existing lift station owned by Big Rapids Township. The Industrial Park lift station is rated at 205 gpm. The lift station and forcemain would need to be upsized to accommodate Green Charter Township's flow. This restriction in lift station capacity causes this option to not be the most feasible, and the sewer downstream of the Industrial Park lift station was not evaluated further. This option is depicted in Figure 2.

Option 2

A second collection system option was evaluated to carry the wastewater down Northland Drive. This collection system was comprised of a series of gravity sewers, lift stations, and forcemain. As stated above, the existing ground slopes towards the creek and river. East of Northland Drive would be served by gravity sewer to a lift station that would pump back to Northland Drive. A lift station in Northland Drive would pump the flow south to the existing gravity sewer in Northland Drive. A parallel sewer to this forcemain would be required to serve properties on Northland Drive south of the creek to a lift station that would pump north past the creek.

Option 2 would flow into the existing gravity sewer in Northland Drive about 900 feet north of Grandville Road. The minimum sewer capacity from this connection point to the existing lift station is an 8" sewer at 0.40%. The proposed station would be rated at 200 gpm and the flow from the existing sewer district is a peak daily of 90 gpm according to flow data from 2017 through 2020. The Township's downstream sewer will have capacity for the additional flow. This option is depicted in Figure 3.

Option 3

The third option evaluated a collection system to carry the wastewater down 205th Avenue with a series of gravity sewer, lift station, and forcemain. With the existing ground sloping towards the creek and river a lift station would be required east of 205th Avenue and pump back to the west.

A lift station will be required along 205th Avenue to pass Dalziel Creek and tie into the existing gravity in 205th Avenue. The existing gravity sewer in 205th Avenue at Spruce Road has a minimum sewer capacity from this connection point to the existing lift station in an 8" sewer at 0.37%. The proposed station would be rated at 200 gpm and the Township's downstream sewer will have capacity for this additional flow. This option is depicted in Figure 4.

Big Rapids Downstream Capacity

In December 2020, a hydraulic capacity analysis was conducted on the City of Big Rapids' sanitary sewer network. The attached Figure G1 shows the results of this analysis. Many of the sewers along the Muskegon River, downstream of Green Charter Township's system connection point, are at or near capacity. The City is currently bidding out a project for sewer upgrades to Hemlock Park to be constructed in 2021. The City is also working to upgrade the other sewer restrictions as funding allows.

The City of Big Rapids' wastewater treatment plant has a hydraulic treatment capacity of 2.4 million gallons per day (MGD) and currently treats an average daily flow of approximately 1.0 MGD. However, due to the increased wastewater strength observed in recent years the treatment plant is currently limited to approximately 1.23 MGD by its biological treatment capacity.

In a 25 year build out condition, the Township would be looking to add an average of 0.1 MGD. The treatment plant currently has capacity for this additional flow; however, a detailed analysis of remaining plant capacity and additional authorization from the City would be required prior to expanding the service area.

Existing 205th Lift Station

One of the primary goals of this study was to determine if the existing 205th lift station has enough capacity to accommodate additional flow from the proposed service area along the 19 Mile corridor.

The existing Green Charter Township lift station is rated at 430 gpm. Flow data from 2017 to 2020 shows the lift station has a peak flow of approximately 65 gpm. The 19 Mile corridor service area has an estimated peak flow of 200 gpm for the 25 year build out conditions. This is within the existing station's capacity; therefore, it is not anticipated additional pumping capacity will be needed in the near future.

Property Rights

Property rights may need to be obtained for various components of the sewer system. The piping in 19 Mile and adjoining streets is expected to be in public rights-of-way (ROW) and, therefore, already have the rights needed. The lift stations for each option have the potential to be in the ROW if there is adequate space. Adequate space will be determined by ROW width, existing utilities and lift station configuration. If there is not adequate space for the lift stations, property rights can be obtained by easements. Cost estimates for each option include property

acquisition. Acquisition would need to be negotiated with the property owner and prices can vary widely.

Cost Estimates

The preliminary opinion of probable cost to provide sanitary sewer to the service area is shown in Table 2 below. The total cost includes non-construction project costs such as land purchase, design and construction engineering, permitting and legal and bond counsel. Each estimate includes full construction of all sewers, lift stations and forcemain required for each option.

It is recommended that any option chosen is constructed in phases driven by demand and available funds. Annual operating costs for the sanitary sewer system are not included in this estimate. This estimate represents conceptual estimates in 2022 dollars to be used for planning purposes. Unit prices includes grass restoration only as it is anticipated most sewers could be located in the grass. Surface restoration including paving and road reconstruction would be additional costs. A unit price has been added for each creek crossing for the additional costs to bore and jack under the creek bed or box culvert.

Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates. Detailed cost estimates are attached.

Table 2. Full Project Cost Estimate

Description	Amount
Option 1 – 220 th Ave.	\$10,100,000
Option 2 – Northland Dr.	\$9,200,000
Option 3 – 205 th Ave.	\$8,800,000

Recommendation

After evaluating each alternative, F&V recommends Option 3, the 205th Avenue route. This option is most cost effective when comparing full project cost estimates.

The initial sewer constructed as Phase 1, shown in Figure 5, would serve the largest area along 19 Mile by gravity sewer. Currently 205th Avenue is largely undeveloped which would decrease construction costs of the forcemain versus directional drilling in a heavily populated area.

After the initial sewer area is constructed, the remaining gravity sewer, lift stations and forcemain can be constructed as demand and funding allows.

A cost estimate for Phase 1 is attached.

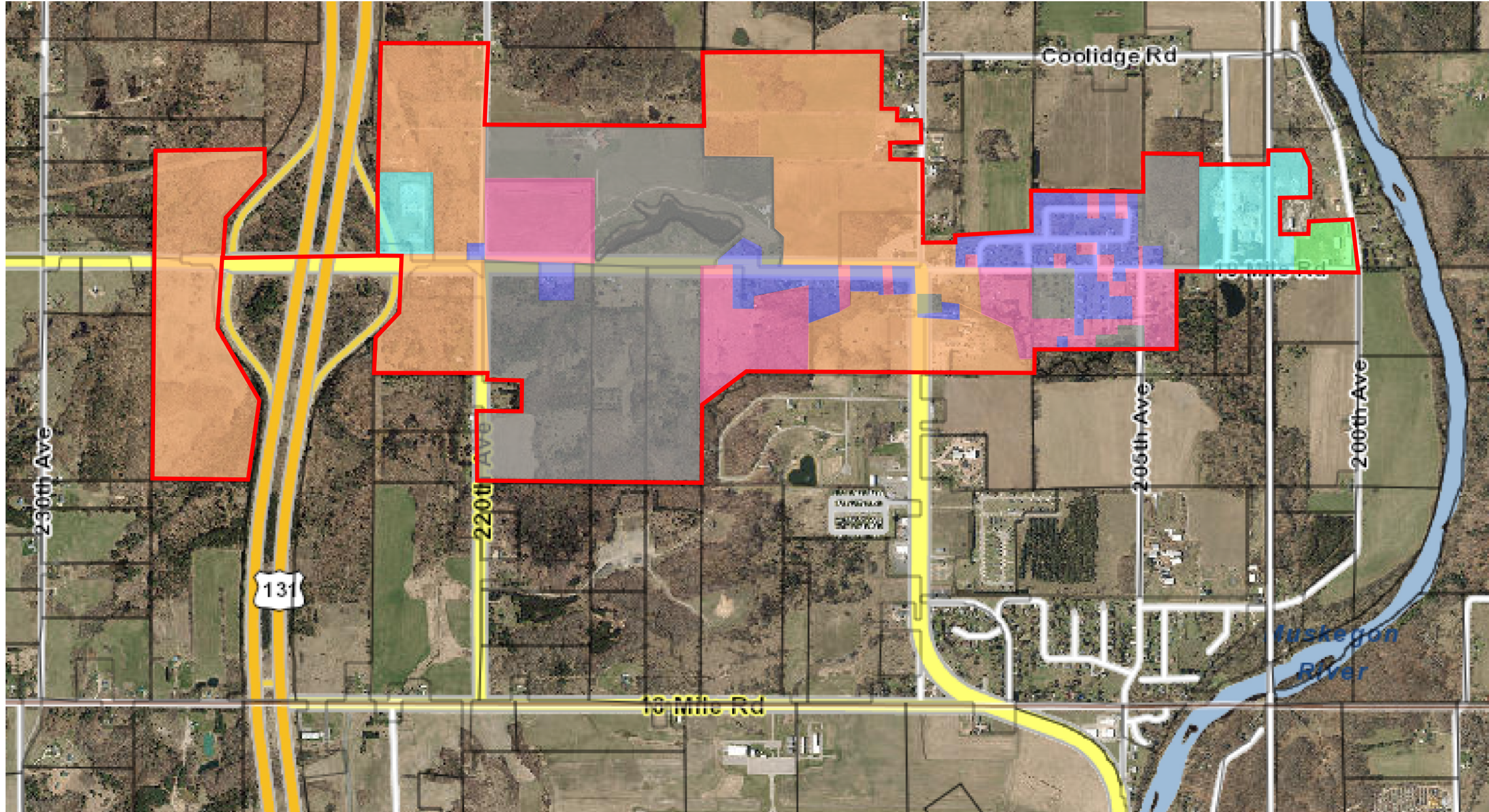
Sincerely,

FLEIS & VANDENBRINK



Steven M. Bishop, PE
Project Manager

Attachments: Figures 1-5, Figure G-1, Basis of Design, Cost Estimate



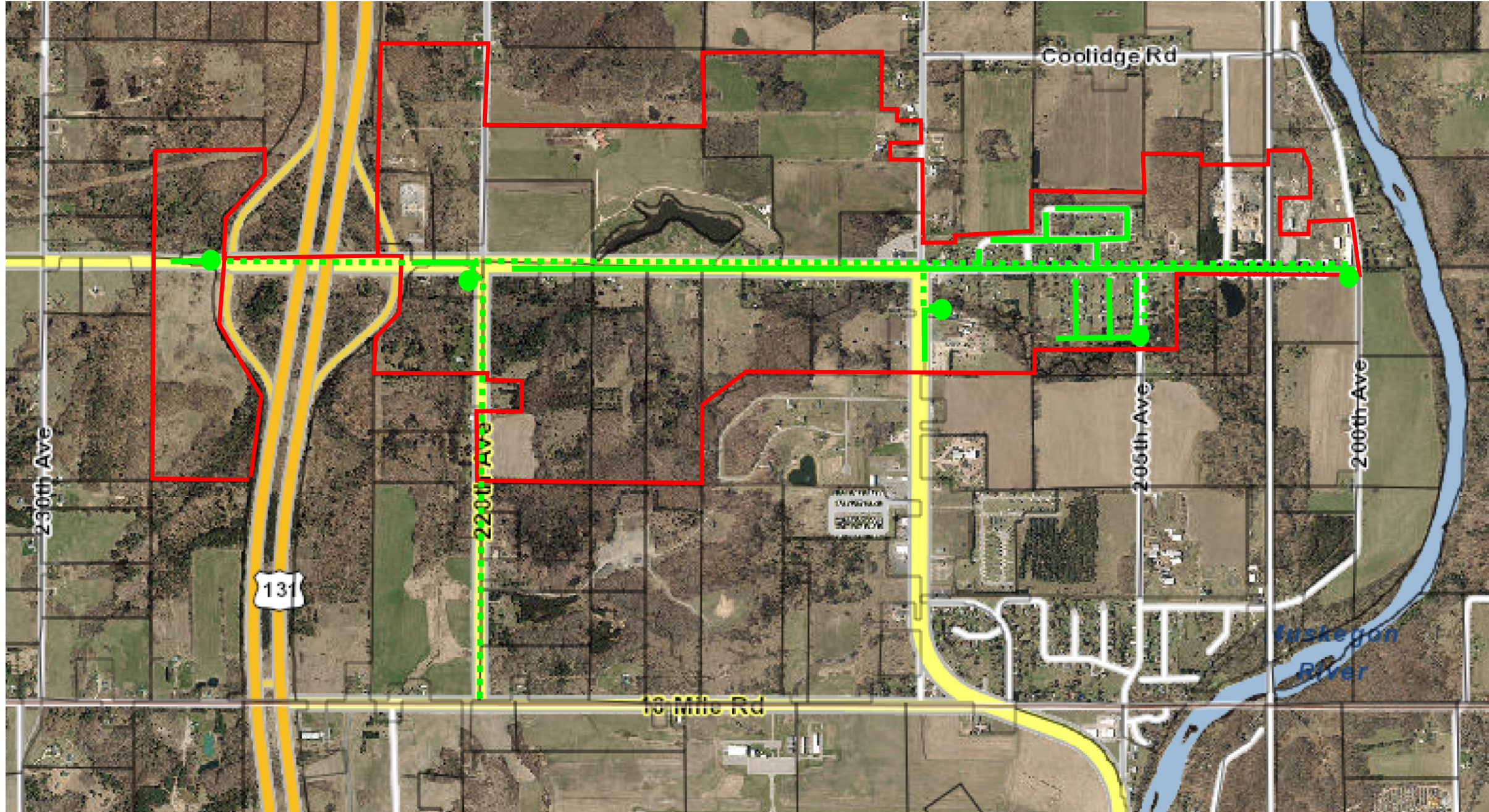
- Service Area
- Commercial
- Industrial
- Industrial - No Flow
- Residential
- Existing Home
- Agricultural



Green Charter Township

Figure 1.
Future Land Use.





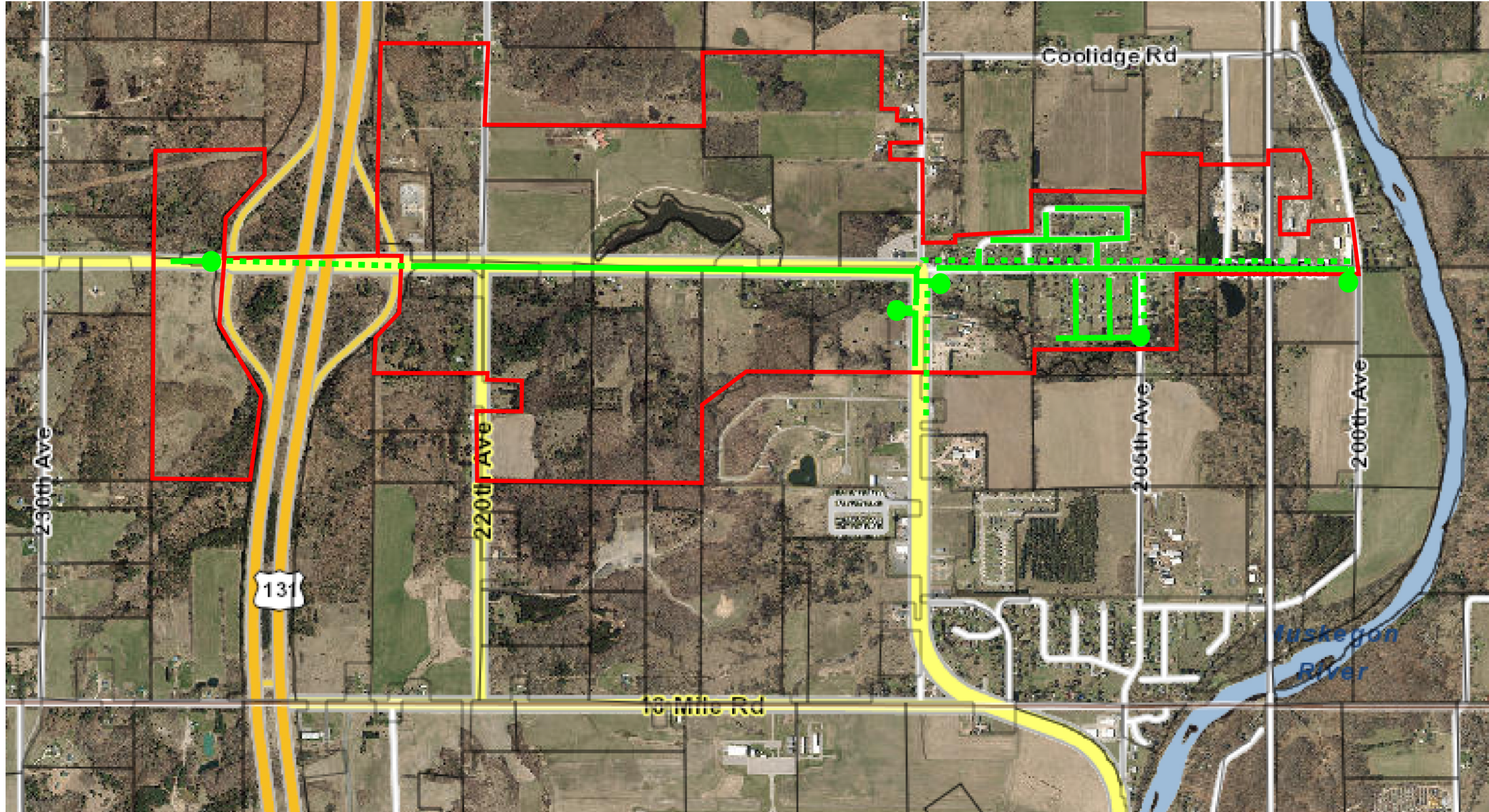
- Service Area
- Gravity Sewer
- ... Forcemain
- Pump Station



Green Charter Township

Figure 2.
Option 1 - 220th Avenue.





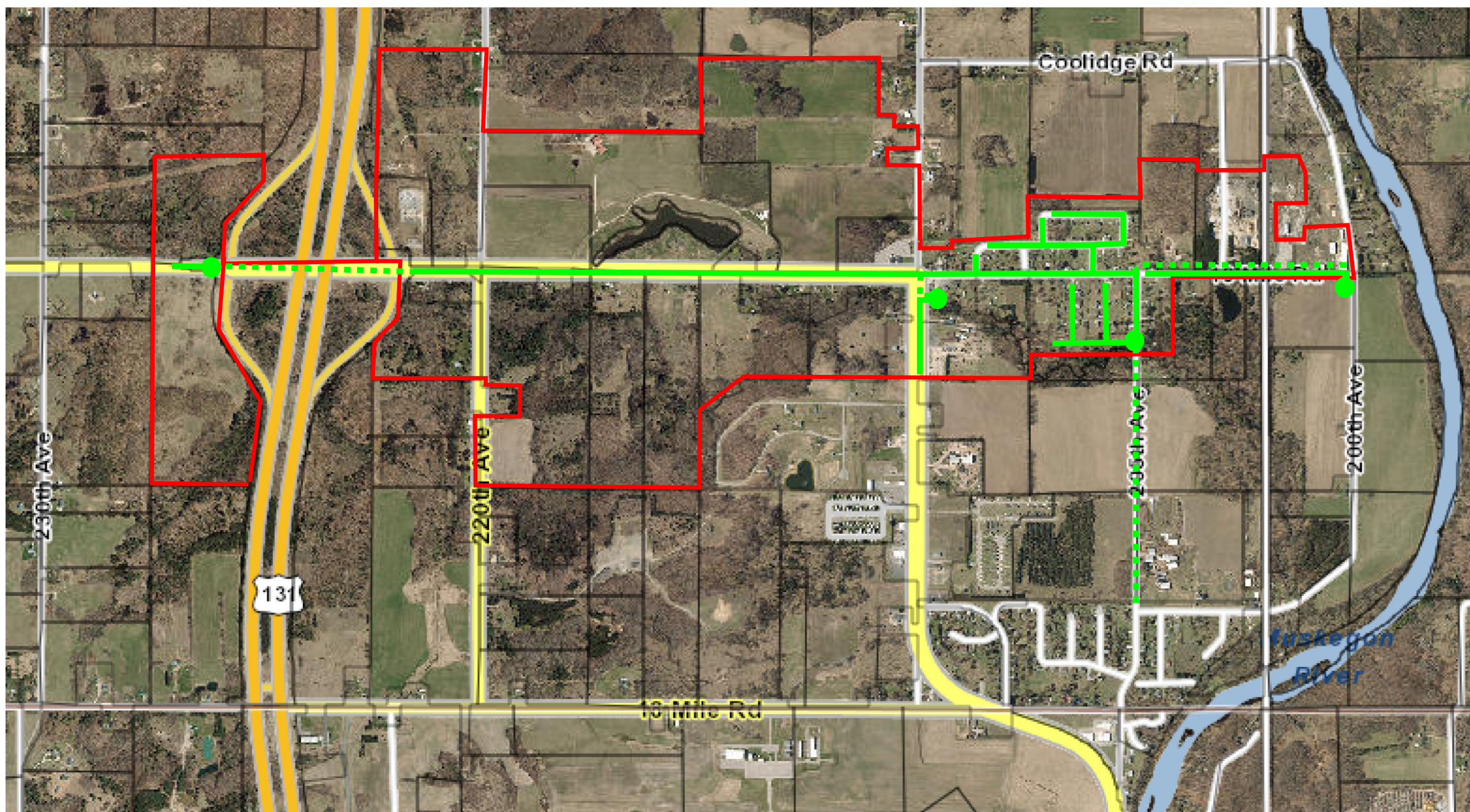
- Service Area
- Gravity Sewer
- - - Forcemain
- Pump Station



Green Charter Township

Figure 3.
Option 2 - Northland Drive.





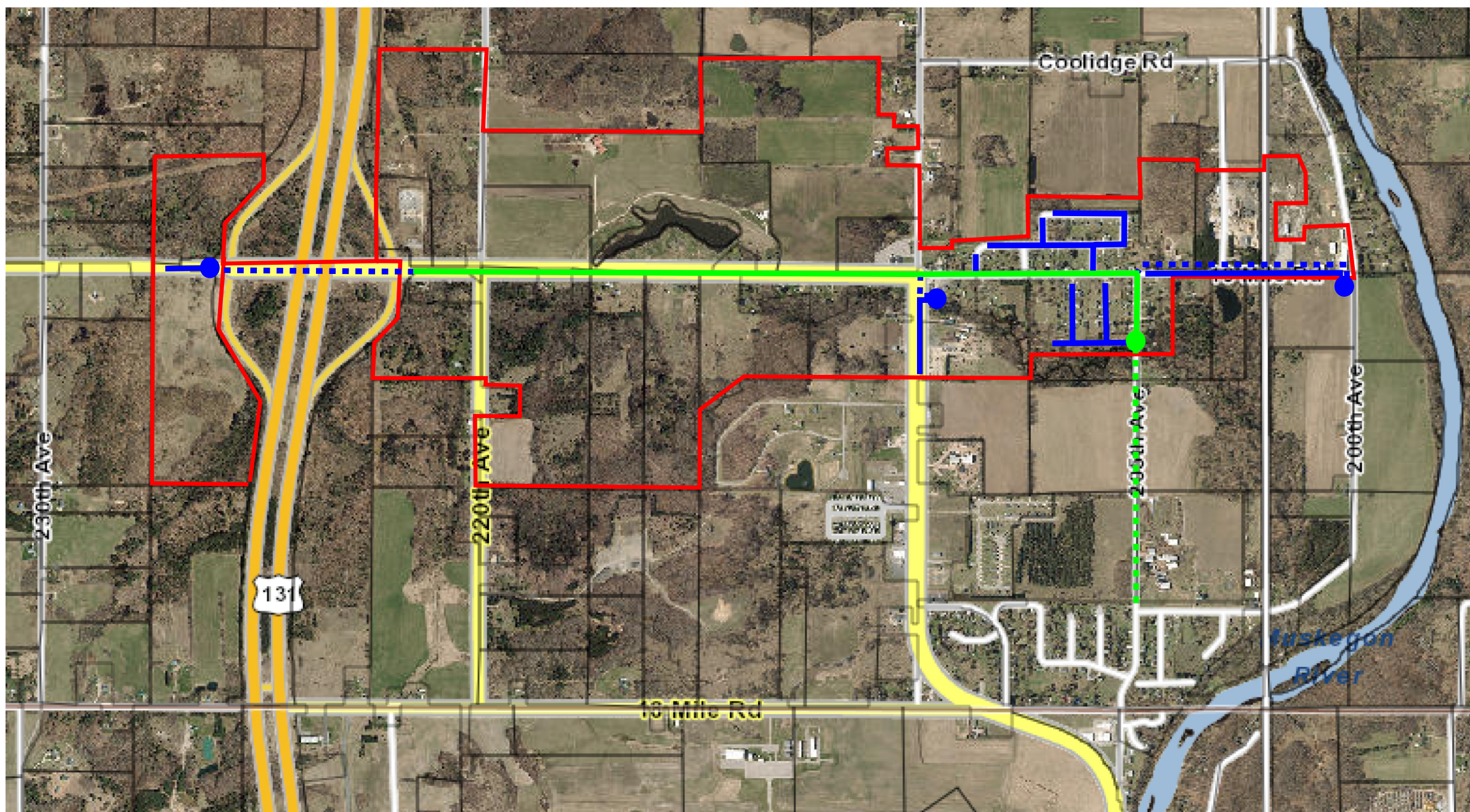
- Service Area
- Gravity Sewer
- ... Forcemain
- Pump Station



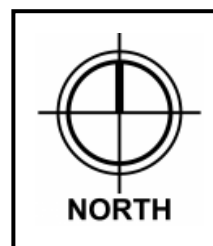
Green Charter Township

Figure 4.
Option 3 - 205th Avenue.





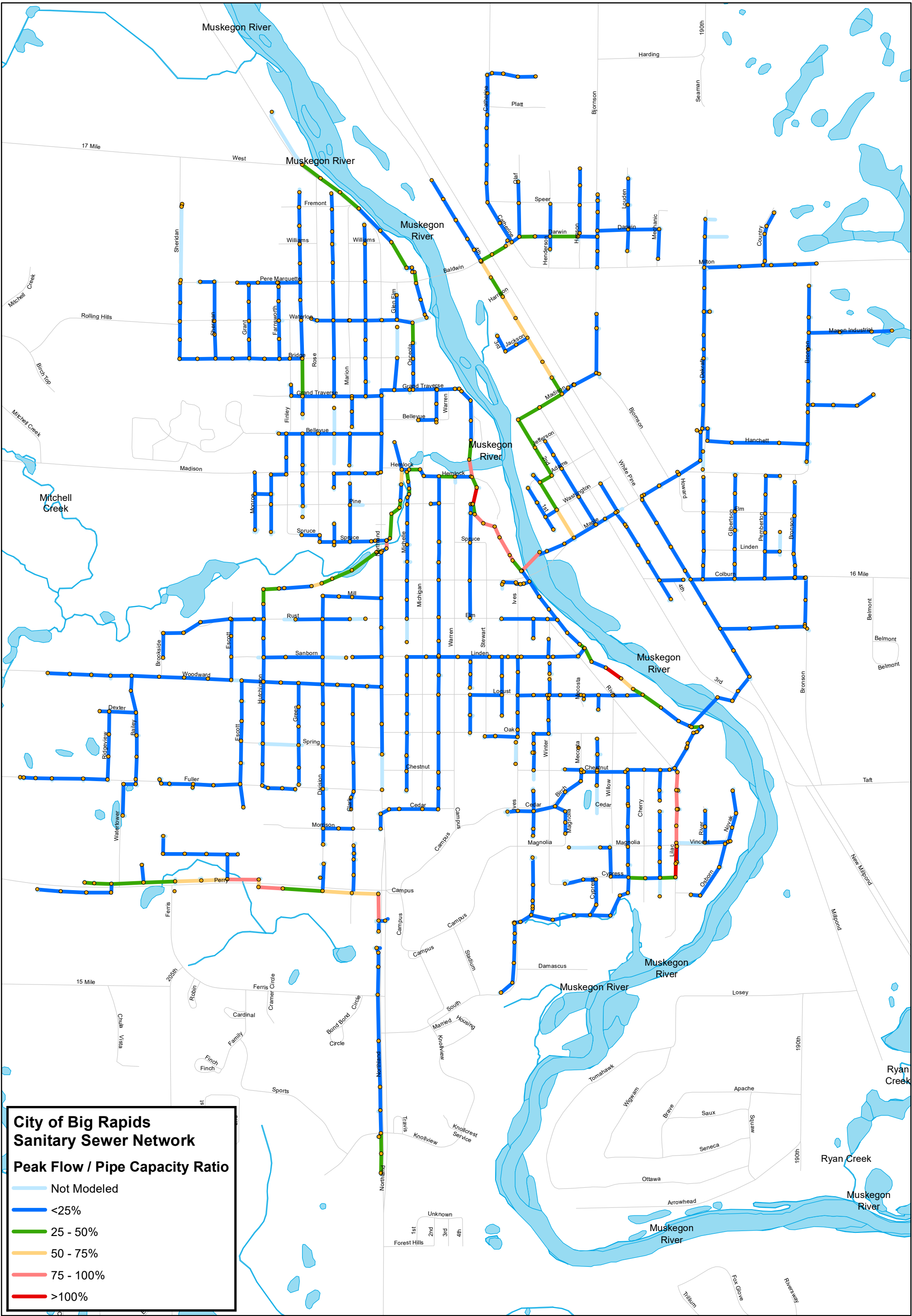
- Service Area
- Gravity Sewer
- Forcemain
- Pump Station
- Future Gravity Sewer
- Future Forcemain
- Future Pump Station



Green Charter Township

Figure 5.
Recommended Phase 1.





Green Charter Township Township

Basis of Design

Project No. 844150
Engineer: DKS
Date: 06/16/2021

FUTURE LAND USE	INITIAL SIZE (ACRES)	INITIAL WASTEWATER (GPD)	FUTURE SIZE (ACRES)	BUILDABLE SIZE (ACRES)*	BUILT- OUT WASTEWATER (GPD)	FUTURE PERCENT DEVELOPMENT (IN YEARS); BASE YEAR 2022						FUTURE FLOW (GPD) (IN YEARS); BASE YEAR 2022					
						0-5	6-10	11-15	16-20	21-25	70	0-5	6-10	11-15	16-20	21-25	70
Residential	2	1,000	84	63	31,500	5%	10%	13%	18%	20%	50%	1,575	3,150	4,095	5,670	6,300	15,750
Existing Home	46	21,750	59	44	21,750	5%	5%	10%	15%	20%	40%	1,088	1,088	2,175	3,263	4,350	8,700
Commercial	24	36,000	371	278	417,375	5%	10%	13%	18%	20%	50%	20,869	41,738	54,259	75,128	83,475	208,688
Agricultural	272	0	272	204	0	100%	100%	100%	100%	100%	100%	0	0	0	0	0	0
Industrial	5	7,500	10	8	11,250	60%	60%	60%	60%	65%	70%	6,750	6,750	6,750	6,750	7,313	7,875
Industrial - No Flow	41	0	41	31	0	100%	100%	100%	100%	100%	100%	0	0	0	0	0	0
Total Average Daily Flow (gpd)		66,250			481,875							30,281	52,725	67,279	90,810	101,438	241,013
Peak Hourly Flow; 2.8 peaking factor (gpd)		185,500			1,349,250							84,788	147,630	188,381	254,268	284,025	674,835

* Buildable size refers to 75% of future size that will produce wastewater due to ROW, property setbacks, parking lots, etc.

Wastewater Flow Assumptions (Avg Day)	
Commercial (gpd/ac)	1500
Industrial (gpd/ac)	1500
Industrial- No Flow (gpd/ac)	0
Residential (gpd/ac)	500
Existing Home (gpd)	250
Agricultural (gpd)	0

Green Charter Township

19 Mile Corridor Sanitary Sewer Feasibility Study

Option 1: 220th Ave. Route⁴

Project Cost Estimate³



Job: 849560

By: DKS

Date: 6/30/2021

Description ¹	Size	Unit	Qty.	Unit Price ²	Amount
Gravity Sewer	8"	Ft	19,030	\$175	\$3,330,250
	10"	Ft	70	\$205	\$14,350
Creek Crossings	8"	Each	2	\$20,000	\$40,000
Forcemain	2"	Ft	3,480	\$75	\$261,000
	4"	Ft	10,500	\$75	\$787,500
	6"	Ft	5,260	\$95	\$499,700
Lift Station	30 gpm	Each	2	\$315,000	\$630,000
	50 gpm	Each	1	\$315,000	\$315,000
	150 gpm	Each	1	\$575,000	\$575,000
	200 gpm	Each	1	\$575,000	\$575,000
Subtotal (Rounded)					\$7,000,000
Contingency (20%)					\$1,400,000
Subtotal (Rounded)					\$8,400,000
Engineering, Bonding, & Legal (20%)					\$1,680,000
Property Acquisition					\$50,000
Total (Rounded)					\$10,100,000

¹ Unit price includes grass restoration only. Surface restoration including paving and road reconstruction would be additional costs.

² All costs are 2022 dollars.

³ Project costs do not include costs associated with the purchase of additional capacity at the WWTP.

⁴ Estimate does not include any upgrades needed to the Big Rapids Township infrastructure.

Green Charter Township

19 Mile Corridor Sanitary Sewer Feasibility Study

Option 2: Northland Dr. Route

Project Cost Estimate³



Job: 844150

By: DKS

Date: 6/30/2021

Description ¹	Size	Unit	Qty.	Unit Price ²	Amount
Gravity Sewer	8"	Ft	13,530	\$175	\$2,367,750
	10"	Ft	6,300	\$205	\$1,291,500
Creek Crossings	10"	Each	2	\$20,000	\$40,000
Forcemain	2"	Ft	8,580	\$75	\$643,500
	6"	Ft	1,700	\$95	\$161,500
Lift Station	30 gpm	Each	2	\$315,000	\$630,000
	50 gpm	Each	2	\$315,000	\$630,000
	200 gpm	Each	1	\$575,000	\$575,000
Subtotal (Rounded)					\$6,300,000
Contingency (20%)					\$1,260,000
Subtotal (Rounded)					\$7,600,000
Engineering, Bonding, & Legal (20%)					\$1,520,000
Property Acquisition					\$50,000
Total (Rounded)					\$9,200,000

¹ Unit price includes grass restoration only. Surface restoration including paving and road reconstruction would be additional costs.

² All costs are 2022 dollars.

³ Project costs do not include costs associated with the purchase of additional capacity at the WWTP.

Green Charter Township

19 Mile Corridor Sanitary Sewer Feasibility Study

Option 3: 205th Ave. Route

Project Cost Estimate³



Job: 844150
By: DKS
Date: 6/30/2021

Description ¹	Size	Unit	Qty.	Unit Price ²	Amount
Gravity Sewer	8"	Ft	10,130	\$175	\$1,772,750
	10"	Ft	9,850	\$205	\$2,019,250
Creek Crossings	10"	Each	2	\$20,000	\$40,000
Forcemain	2"	Ft	5,200	\$75	\$390,000
	6"	Ft	3,450	\$95	\$327,750
Lift Station	30 gpm	Each	2	\$315,000	\$630,000
	50 gpm	Each	1	\$315,000	\$315,000
	200 gpm	Each	1	\$575,000	\$575,000
Subtotal (Rounded)					\$6,100,000
Contingency (20%)					\$1,220,000
Subtotal (Rounded)					\$7,300,000
Engineering, Bonding, & Legal (20%)					\$1,460,000
Property Acquisition					\$50,000
Total (Rounded)					\$8,800,000

¹ Unit price includes grass restoration only. Surface restoration including paving and road reconstruction would be additional costs.

² All costs are 2022 dollars.

³ Project costs do not include costs associated with the purchase of additional capacity at the WWTP.

Green Charter Township

19 Mile Corridor Sanitary Sewer Feasibility Study

Recommendation: 205th Ave. Route

Phase 1: Project Cost Estimate³



Job: 844150

By: DKS

Date: 6/30/2021

Description ¹	Size	Unit	Qty.	Unit Price ²	Amount
Gravity Sewer	10"	Ft	9,850	\$205	\$2,019,250
Creek Crossings	10"	Each	2	\$20,000	\$40,000
Forcemain	6"	Ft	3,450	\$95	\$327,750
Lift Station	200 gpm	Each	1	\$575,000	\$575,000
Subtotal (Rounded)					\$3,000,000
Contingency (20%)					\$600,000
Subtotal (Rounded)					\$3,600,000
Engineering, Bonding, & Legal (20%)					\$720,000
Property Acquisition					\$15,000
Total (Rounded)					\$4,300,000

¹ Unit price includes grass restoration only. Surface restoration including paving and road reconstruction would be additional costs.

² All costs are 2022 dollars.

³ Project costs do not include costs associated with the purchase of additional capacity at the WWTP.