

PRELIMINARY REPORT

**OLD FARM SUBDIVISION
PRELIMINARY DESIGN DRAIN IMPROVEMENT
STUDY
FORT GRATIOT TOWNSHIP
ST. CLAIR COUNTY, MICHIGAN**

Prepared For:



County of St. Clair, Michigan

FRED FULLER, DRAIN COMMISSIONER

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OCTOBER 2002

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HURON
ENVIRONMENTAL, LLC

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FORT GRATIOT TOWNSHIP
ST. CLAIR COUNTY, MICHIGAN

1.0 INTRODUCTION AND OBJECTIVES

Huron Environmental, LLC and DCL Engineering (Huron/DCL) are pleased to present this report of the Preliminary Design Drain Improvement Study of Old Farm Subdivision. The study was conducted to assist the St. Clair County Drain Commissioner (Drain Commissioner) with improvement of drainage problems within the Old Farm Subdivision, in accordance with the Michigan Drain Code, Act No. 40 of the Public Acts of 1956, as amended, Sections 280.51 to 280.53.

The objectives of the study were to identify the locations where flooding problems exist, identify the areas drained by channels/ditches within the subdivision and the ultimate outlets of those channels/ditches, propose potential solutions to the drainage problems within Old Farm Subdivision, prioritize recommended improvements, and provide budget level cost estimates in the form of an Engineer's Cost Estimate.

2.0 SCOPE OF WORK

The following scope of work was performed to develop the preliminary design presented herein.

2.1 FIELD RECONNAISSANCE

Mr. David C. Lewandowski, P.E., of DCL and Mr. Gregory Hoffmann, E.I. of Huron performed a walking visual survey of the drain and branches during the period October 1 through October 9, 2002. Surveys of key points in the subdivision were also performed. Information gathered during the reconnaissance included:

- The location of areas exhibiting drainage problems;
- Major causes of the drainage problems, including channel and culvert obstructions;
- Locations of existing storm water conveyances (ditches, channels, sewers, etc.);
- Elevations and grades of ditches and channels;
- Divisions between watersheds in the subdivision; and
- Orientation with the drain and an overview of the watershed.

2.2 REVIEW OF EXISTING DATA AND MASTER PLANS

Huron/DCL reviewed and utilized existing data and documents concerning the Old Farm Subdivision. Documents reviewed included:

- A tax parcel map of the Old Farm Subdivision and surrounding areas provided by the office of the St. Clair County Drain Commissioner to identify property owners within the proposed District and the extents of the District.
- Drainage District maps of Districts bordering Old Farm Subdivision (Gossman Drain, among others.).

3.0 FINDINGS

Based on review of the above information and the results of the field reconnaissance activities, Huron/DCL have determined that the area known as Old Farm Subdivision is made up of two separate watersheds, with a small portion of the area's runoff flowing south to the North River Road storm system, and a larger portion flowing east into the Gossman Drain.

Numerous flooding problems have been reported on the western edge of Old Farm Subdivision – the portion that drains to the Black River. In this area, the houses on the west side of West Surrey Lane back up to a forested area. Following large storm events, as well as in the spring when the snow melts, this area becomes flooded, with the floodwaters often reaching into the backyards of many of the West Surrey Lane residents.

Two main factors have created this flooding problem. The first is that the small channel that has been dug through this forested area is not adequate to convey the amount of water that collects here. The second is that the outlet of this ditch and the culverts, which transport the water underground, are undersized. Both of these factors cause backups and extended periods of standing water in the forest and in the backyards of West Surrey Lane residents.

The north and east portions of Old Farm Subdivision drain into the Gossman Drain. Flooding problems have been reported in these parts as well. Several problem areas that contribute to flooding in this portion of the subdivision have been identified and are described below.

Along Quaker Hill Drive, some of the driveway and road culverts are off grade and partially blocked. This impairs their ability to efficiently convey water from the front yard ditches that connect to them. This has caused localized flooding at many points along this road. Along Vinyard Lane and Surrey Lane, the channel that runs along the back property line of the residents on the south and east sides of those roads (Branch No. 3) is partially blocked in several places. These blockages include undersized culverts, filled in culverts, and debris located in the ditch. On the north end of the subdivision, several of the underground storm sewer lines that drain to the channel behind the properties on the north end of Old Forge Drive (Branch No. 2) are blocked or partially blocked. The channel north of Old Forge Drive is also in need of maintenance, including clean out of the channel itself and culverts which have been installed by homeowners. There is also one point in which the channel has been filled in, with no culvert or other opening visible anywhere. This situation has created an impassable obstruction in the channel.

4.0 BASIS OF DESIGN

4.1 HURON/DCL'S DESIGN APPROACH

Huron/DCL's drain improvement design approach for developed areas is based on using a modified, watershed-level rehabilitation approach. Traditional drain improvement design focuses on alleviation of specific problem areas (e.g. a channel reach with inadequate conveyance capacity, an undersized or silted-in culvert, or a vegetation-clogged channel reach.) This approach quite often results in transference of the problems to downstream reaches, the need for continued maintenance, and generally less aesthetically pleasing drainage channels.

The watershed-level approach acknowledges that watercourses evolve in concert with and in response to their surrounding watershed and its integral ecological systems. This applies not only to natural streams but also to man-made, channelized ditches. As such, a watershed-level approach to drainage design accounts for the cause/effect ramifications of each specific remedy, solely and in conglomeration, within the entire watershed.

Ultimately, watershed-level restoration design would achieve hydrodynamic equilibrium throughout the watershed's hydraulic systems through a single project or a series of projects. However, this is rarely possible in the developed environment and would be cost prohibitive in any case. However, it is also true that surface flow systems possess the inherent ability to achieve hydrodynamic equilibrium through their own geomorphological mechanisms. Unfortunately, in heavily modified systems (channelized streams with encroached floodplains) these very same mechanisms can yield a multitude of problems within the modified channel (e.g., erosion of channel banks, sedimentation at culverts, etc., resulting in localized flooding and poor water quality) if not considered in the design. Understanding these constraints and opportunities, Huron/DCL's design approach for wholly or partially developed watersheds, such as the watersheds within Old Farm Subdivision, seeks to promote the system's inherent geomorphological mechanisms to attain sustainable hydrodynamic equilibrium. Such an approach provides for flood control mechanisms within the watershed, minimizes both construction and maintenance costs, and promotes water quality treatment within the system.

4.2 DESIGN APPROACH FOR OLD FARM SUBDIVISION

Huron/DCL have developed a preliminary design for Old Farm Subdivision, applying the basis of design, presented above, to the specific characteristics and conditions of the watershed. Application of Huron/DCL's design approach means that the proposed remedies will seek to improve drainage and flood control by returning the channels to a state of hydrodynamic equilibrium and creating low maintenance conditions for long-term operation by increasing culvert sizes, increasing floodplain sizes, and retaining the hydrologic benefits of the forested areas in and around Old Farm Subdivision. Because of the effectiveness of incorporating storm water storage components into the design to reduce peak flows during storm events and improve water quality, as well as the abundance of potential water storage

areas in the forested areas of the subdivision, water storage has been included in the design. The result will be improved function of the system as a method of drainage and flood control, as well as improvement of the water quality in the Drain and protection of the ecology around the Drain.

The specific improvements proposed by Huron/DCL are listed in Section 5 of this report.

Because Huron/DCL's design approach to drainage improvements is markedly different from the conventional methods that are most familiar and because Huron/DCL's design approach provides additional benefits beyond short-term alleviation of drainage problems, the remainder of Section 4 of this report describes the additional advantages of and reasons for applying this approach to Old Farm Subdivision.

4.3 ECONOMY

The primary objective of Huron/DCL's design approach is providing adequate drainage and flood protection while reducing the long-term costs associated with drainage and flood control. Conventional drain improvement methods focus on alleviating flood problems by addressing conveyance issues where the problems occur without investigating or addressing the root causes of the flooding or considering the effects of the improvements downstream in following years. Experience shows that these methods, which have been in practice for many years, ultimately result in additional costs for more improvements downstream and for long-term maintenance of the drains. Scientists have been applying their expertise to this problem for years and have developed new approaches to flood control that alleviate these problems and provide drainage improvement at a lower total cost. In addition to long-term economy, this approach provides numerous other advantages, and there are many compelling reasons to proceed with this approach to drainage improvement on Old Farm Subdivision, as described in the following sections.

4.4 WATER QUALITY IMPROVEMENTS - REGULATORY DRIVERS

On December 8, 1999 the United States Environmental Protection Agency (EPA) promulgated the "Phase II Storm Water Regulations" by Federal Register Notice. These regulations expand the existing National Pollutant Discharge Elimination System (NPDES) storm water program to address storm water discharges from small municipal separate storm sewer systems (MS4s) (those serving less than 100,000 persons), requiring that those systems acquire NPDES permits to discharge. The regulations require that any regulated small MS4 operator (Fort Gratiot, or the St. Clair County Drain Commission, would be included) develop and implement a storm water management program designed to reduce the discharge of pollutants from their MS4 to protect water quality, and state that the storm water management program must include six minimum measures. One of these measures is Implementation of "Pollution Prevention/Good Housekeeping for Municipal Operations," including the recommendation that flood management projects incorporate "...additional water quality protection devices or practices." Further, the Michigan Department of Environmental Quality (MDEQ) is in the process of revising their regulations to include these federal Phase II Storm Water provisions by reference. The implementation date is

expected to be March 2003, by which time each regulated MS4 operator must have applied for a permit, including having a watershed plan, among other things.

In addition to the permitting issues discussed above, the St. Clair River has been identified by the MDEQ as an impaired waterway and, as such, there has been a Remedial Action Plan (RAP) developed for the River. This RAP requires implementation of corrective measures on waterways that discharge to the St. Clair River in order to improve the water quality of the St. Clair River. As with most of St. Clair County, storm water in Old Farm Subdivision, eventually flows into the St. Clair River.

In short, there are water quality requirements for Old Farm Subdivision on the immediate horizon, and the design items in Section 5 address water quality improvements in a tangible, measurable way.

4.5 ECOLOGICAL QUALITY

As a growing, developing area, Fort Gratiot has an interest in improving the quality of life that is attainable in their communities. By protecting the ecological quality of the waterways within its boundaries, this community can improve the local quality of life by providing opportunities to see and hear wildlife and to experience more natural, aesthetically pleasing views of drainage features; drainage features that have been functionally improved by their return to a more natural state.

5.0 RECOMMENDED IMPROVEMENTS

There are several possibilities for alleviation of the flooding problems in Old Farm Subdivision. The different possibilities are described below, along with Huron/DCL's assessment of each.

Approximately half Old Farm Subdivision drains to the Black River, while much of it drains into Gossman Drain to the east. Subsection 5.1 describes the proposed improvements to the portion of the subdivision that drains to the Black River, which will be referred to in this report as the "Sunset" Drainage District. The following subsections describe the proposed improvements to the portions of the subdivision that drain to Gossman Drain. In the interest of clarity, each improvement/treatment method is listed below in the same order as it is listed for each Drain/Branch in the Engineer's Cost Estimate, presented in Table 1.

5.1 SUNSET DRAINAGE IMPROVEMENTS

The main flooding problems in the Old Farm Drainage District that have been brought to the attention of Huron/DCL have been located on the western edge of the district. The flooding in the forested area to the west of West Surrey Lane often encroaches upon the backyards of West Surrey Lane properties. It is undesirable to completely remove the floodwaters from this area; it is a healthy, productive forested wetland that would be destroyed if too much storm water were removed too quickly. This forested wetland is an ideal storage area for storm water, providing not only water storage, but important wildlife habitat and aesthetic appeal as well. However, it will be possible to alleviate the residential drainage problems nearby without destroying the qualities of the wetland.

It should be noted that these improvements would require creation of a new Drainage District for this area (as noted before, to be referred to as "Sunset" Drainage District). Permits for wetland work from the DEQ would also be necessary for an unknown portion of the work proposed below.

Item 1 - Clean Out Existing Channel

Although generally free of vegetation, the existing channel has become somewhat filled with leaves and other debris. A minor clean out of this channel would do much to improve its conveyance capacity. In addition to the removal of leaves and debris, this clean out may involve the cutting and removal of any roots that may have grown into the channel.

Item 2 - Extend Drainage Channel Within the Forested Wetland

Presently, the drainage channel begins just west of the property located at 3621 Sunset Lane and provides very little drainage benefit to the properties to the north. This channel will be extended north through the forested area, well away from the properties along West Surrey Lane. The beginning of the new channel will be extended so it will provide benefits for the majority of the properties along the west side of Sunset Lane and West Surrey Lane. The channel will be dug approximately 2 feet deep – deep enough to provide the needed flood protection, yet shallow enough so as not to drain the high groundwater table in the forested wetland.

Item 3 - Create Small Retention Area Near Channel Outlet

A small retention area will be excavated near the channel's outlet, before the storm water is sent underground through a culvert system to the Black River. This retention area will provide two important benefits. First, it will increase the storage volume that the forest can sustain, reducing the frequency of floodwaters extending past the forest and into residential areas. Second, it will reduce the velocity of the water before it enters the culvert system. This velocity reduction will allow the sediments to settle out before it is discharged to the Black River. By making the retention area shallow, the occurrence of standing water will be reduced. A small levee (1 foot high) will be constructed surrounding the retention area to reduce the possibilities of overflow.

Item 4 - Install Retention Area Outlet

An outlet for the retention area must be constructed to discharge water to the underground culvert system. The elevation of the outlet shall be set just below ground level to allow the retention area to fill before water is discharged to the culvert system. The outlet shall be constructed in a manner such that water is allowed to pass through, but leaves and other debris are not.

Item 5 - Replace Undersized Culvert System

The culvert system that extends from the channel outlet to the North River Road Storm System is too small to adequately convey the amount of storm water that flows to it. These culverts must be replaced from the channel outlet to North River Road with larger culverts.

5.2 ADDING LANDS TO GOSSMAN DRAINAGE DISTRICT

Huron/DCL propose that the portions of Old Farm Subdivision that currently drain east to Gossman Drain be added to the Gossman Drainage District. Doing this has several advantages. First, the drainage problems that have been identified for Old Farm Subdivision will be eliminated. Second, any drainage problems located in the Gossman Drainage District can be investigated and eliminated at the same time. Third, it will be possible to ensure that the Gossman Drain can manage any increases in runoff resulting from Old Farm Subdivision drainage improvements.

Item 1 - Clean Out Branch No. 3.

Branch No. 3 is filled in with debris, including branches, brush, soil, and debris in many areas. It will be necessary to remove this to improve the conveyance abilities in the channel.

Item 2 - Clean Out/Replace Filled, Partially Filled, and Undersized Culverts in Branch No. 3.

On several of the properties along Vinyard Lane and Surrey Lane the channel has been filled in and culverts have been installed. Some of these culverts have become filled in or partially filled in with sediment. Cleaning out these culverts or replacing them with new, properly sized culverts will greatly improve the flow in the channel. Some are not filled in, but are too small to properly convey the storm

water that flows in the channel. These undersized culverts restrict flow, causing flooding and sedimentation buildup. Properly sized culverts will minimize this problem, reducing both flooding and sedimentation problems.

Item 3 - Clean Underground Sewers that Discharge to Branch No. 2.

There are several underground storm water sewers that discharge to Branch No. 2, traveling underneath Old Forge Drive from points along the south side of the road. Some of these sewers have become blocked and are in need of maintenance. The blockages have impaired the function of the storm sewers, causing localized flooding problems at certain points along the south side of Old Forge Drive. The maintenance would involve typical sewer cleaning which would dislodge any blockages and greatly improve the sewers' ability to drain storm water to Branch No. 2.

Item 4 - Clean Out Branch Nos. 1 and 2.

Branch Nos. 1 and 2 have similar problems to Branch No. 3. A clean out of branches, brush, soil, and debris will improve the conveyance ability of the channel.

Item 5 - Replace/Clean Out Filled, Partially Filled, and Undersized Culverts in Branch No. 2.

Almost half of the length of Branch No. 2 has been filled in with culverts installed to allow for water conveyance through the channel. Some of these culverts are filled or partially filled with sediment, and others, and some may be undersized. Cleaning filled culverts and replacing undersized culverts will reduce the occurrence of both flooding and sedimentation.

Item 6 - Remove Obstruction in Branch No. 2.

Near the east end of Branch No. 2, a small covered drive has been built over the channel. No culvert or other means of water conveyance could be visually detected underneath the structure. This represents a considerable obstruction in the channel and must be removed to allow the water to flow properly. If the property owner desires a drain crossing at that location, arrangements can be made to install one.

Item 7 - Create Small Retention Area On Branch No. 1.

This retention area will be constructed in the same manner as the retention area described in Item 3, although it would be deeper to account for the depth of the current channel. No outlet structure would be necessary, as the water would continue to flow through an open channel after exiting the retention area. After the confluence of Branch Nos. 2 and 3, the resulting channel (Branch No. 1) flows through an undeveloped wooded area. This would be an ideal location to build a small retention area that could provide important water quality benefits by removing sediments from the storm water before it is discharged into the lower portions of Gossman Drain.

5.3 CREATING A NEW DRAINAGE DISTRICT

Instead of simply adding lands to Gossman Drain, the work suggested in Section 5.2 could be performed if a new Drainage District were created with an outlet to Gossman Drain. However, it would still be necessary to add the Drain and the lands drained by it to Gossman Drainage District. Additionally, there would be no assurances that Gossman Drain would be able to handle the increased flow created by these drainage improvements upstream in Old Farm Subdivision. It is possible that the drainage problems in Old Farm Subdivision will just be transferred downstream to other regions of the Gossman Drainage District. By looking at the watershed as a whole – adding new lands to Gossman Drain – the adequacy of the channel downstream can be taken into consideration. If the channel were adequate, no further work would be necessary downstream of Old Farm Subdivision. If not, the appropriate measures could be taken, and the drainage problems would be solved instead of merely being transferred downstream.

5.4 FORT GRATIOT DPW INVOLVEMENT WITH DRAINAGE IMPROVEMENTS

Another possibility for correcting the drainage problems in the eastern portion of Old Farm Subdivision is for Fort Gratiot Township to assign some of the improvements listed in subsection 5.2 to the Fort Gratiot Department of Public Works (DPW), avoiding involvement of the St. Clair County Drain Commissioner altogether. Items 1 through 6 in Section 5.2 would be the best candidates for completion by the DPW. If done correctly, these improvements would do much to improve the drainage problems in Old Farm Subdivision.

A project of this scope may require more resources than the Fort Gratiot DPW is willing to employ. Also, little could be done to address water quality issues without the creation of Item 7 of section 5.2 – the detention area.

As with the option discussed in subsection 5.3, this option poses the risk of transferring the drainage problems downstream. An approach that takes the entire watershed into account – as discussed in subsection 5.2 – provides the best opportunity for ensuring that the drainage problems are solved, not merely transferred to another part of the Township.

Two additional items could best be performed by the Fort Gratiot DPW instead of the St. Clair County Drain Commission.

1. Localized flooding problems have been observed in the front yards of properties along Quaker Hill Drive. One of the causes of these problems is sediment deposition in the culverts, filling them with dirt

and silt, and impeding their ability to convey water. Removing the dirt and silt from these culverts will help to improve the drainage along this street.

2. Undersized and poorly graded culverts are additional causes of the localized flooding problems along Quaker Hill Drive. Undersized culverts cause water backups because when large storm events occur, the water cannot be conveyed through them to an outlet quickly enough. Poorly graded culverts tend to cause localized flooding problems during and after any amount of rainfall, not just large storm events. If a culvert is installed too high for the ditch in which it is located, or if it does not have a proper slope, water will not be able to drain through it effectively. The water will instead collect below the culvert, flooding the ditch and the adjacent yard. Several driveways that cross the ditches on either side of Quaker Hill Drive are poorly graded. A culvert that runs underneath Sturbridge Lane at Quaker Hill Drive is poorly graded as well.

6.0 CONCLUSIONS

The drainage system within Old Farm Subdivision is currently impaired in its ability to adequately drain the watershed it serves, as evidenced by flooding in the watershed during heavy and moderate storm events and spring snow melt. Poor design and poor maintenance of the channels and culverts have made it impossible to convey the volume and flow of water necessary to avoid flooding problems in this subdivision.

Old Farm Subdivision's drainage problems can greatly reduced if a new drainage district is created for the western portion of Old Farm Subdivision and adding the northern parts of Old Farm Subdivision to Gossman Drain, which is already the recipient of the storm water runoff from a significant portion of Old Farm Subdivision. Creating a new drainage district – Sunset Drainage District – will allow the improvements suggested in subsection 5.1 to be performed, improvements which will address the flooding problems in that area and allow for water storage and improved water quality by using the forested wetland that exists there. Adding the northern parts of Old Farm Subdivision that already drain into Gossman Drain to that District is the best method for making the improvements suggested in subsection 5.2. As stated earlier, adding these lands will not only allow for the suggested improvements; it will also help ensure that the watershed can handle the effects of the recommended improvements. The drainage problems will then be solved, instead of just being transferred downstream to other parts of the Township.

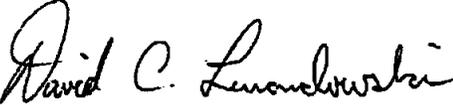
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The following are attached and complete this report:

Table 1	Engineer's Cost Estimate
Sheet 1	Surrounding Districts
Sheet 2	Proposed Changes
Sheet 3	Proposed Changes with Surrounding Districts

Respectfully Submitted,

HURON ENVIRONMENTAL, LLC
DCL ENGINEERING


David C. Lewandowski, P.E.
Principal Engineer, DCL Engineering

GPH

Attachments



**Engineer's Cost Estimate
Old Farm Subdivision
Preliminary Design**
Fred Fuller - St. Clair County Drain Commissioner
Fort Gratiot, Michigan
December, 2002

Item No.	Description	Unit	Estimated Quantity	Unit Price	Item Price
IMPROVEMENTS - ADDING LANDS TO GOSSMAN DRAINAGE DISTRICT					
1	Clean Out Branch No. 3	LF	1,800	\$0.35	\$630.00
2	Replace/Clean Out Filled, Partially Filled, and Undersized Culverts in Branch No. 3	LF	550	\$20.00	\$11,000.00
3	Clean Underground Sewers that Discharge to Branch No. 2	LUMP SUM	1	\$1,000.00	\$1,000.00
4	Clean Out Branch No. 2	LF	3,300	\$0.35	\$1,155.00
5	Replace/Clean Out Filled, Partially Filled, and Undersized Culverts in Branch No. 2	LF	1,000	\$20.00	\$20,000.00
6	Remove Obstruction in Branch No. 2.	LUMP SUM	1	\$1,000.00	\$1,000.00
7	Clean Out Branch No. 1.	LF	800	\$0.35	\$280.00
8	Create Small Detention Area on Branch No. 1	SQ. FT.	2,500	\$0.56	\$1,400.00
Subtotal:					\$36,465.00
IMPROVEMENTS - EXISTING GOSSMAN DRAIN					
9	Clean Out Branch No. 1.	LF	6,000	\$0.35	\$2,100.00
10	Replace 48-inch culverts on Branch No. 1.	LF	172	\$150.00	\$25,800.00
11	Replace/Clean Out Residential Culverts Along Dykeman St.	LF	150	\$20.00	\$3,000.00
12	Construct Headwalls on Culverts U.S. of Parker Rd.	#	5	\$1,200.00	\$6,000.00
13	Excavate Low-Flow Channel from Connie Lane to Parker Rd.	LF	3,300	\$4.50	\$14,850.00
14	Plant Trees Where Appropriate Along Main Branch.	Lump Sum	1	\$1,000.00	\$1,000.00
Subtotal:					\$52,750.00
Total Estimated Constr. Costs (Min.):					\$89,215.00
Contingency (10%):					\$8,921.50
Total Estimated Constr. Costs (Max.):					\$98,136.50