

PRELIMINARY ENGINEERING REPORT

FOR

DODGE ROAD BRANCH

OF THE

PARKER & SCOTHAN DRAIN NO. 1399

SECTIONS 25, 26, 27, 34, 35 & 36

FOREST TOWNSHIP

GENESEE COUNTY, MICHIGAN

PREPARED FOR:

**GENESEE COUNTY DRAIN COMMISSIONER
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FLINT, MICHIGAN 48532**

PREPARED BY:

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October 16, 2007

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FOREST TOWNSHIP
GENESEE COUNTY, MICHIGAN

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1.0 INTRODUCTION

This Preliminary Engineering report was prepared at the direction of the Genesee County Drain Commissioner. A Meeting of the Board of Determination for the No. 1399 Parker and Scothan, Dodge Road Branch, drain was held on May 23, 2006. The Board of Determination approved the necessity of a drain project.

Flint Surveying and Engineering Company prepared a Preliminary Engineering Report for the Dodge Road Branch of the Parker and Scothan Drain in 1984. No drain construction, cleanout or other drain improvements were completed at that time. The 1984 Preliminary Engineering Report was referenced during the Board of Determination Meeting. As a result of the 2006 Board of Determination Meeting, the Genesee County Drain Commissioner directed Flint Surveying and Engineering Company to update the 1984 Preliminary Engineering Report.

In reviewing the Board of Determination Meeting Minutes, the property owners present indicated that the primary problem area is at the intersection of Dodge and Oak Roads. Property owners stated that storm water has been across both Dodge Road and Oak Road. The owner of the property located in the southwest corner of the Dodge and Oak Roads intersection stated that two to three feet of water has been on part of that property in the past.

Genesee County Drain Commissioner personnel instructed Flint Surveying and Engineering Company to update the 1984 Preliminary Engineering Report by obtaining sufficient field survey work to verify the sizes and elevations of existing culverts along the route of the drain and to obtain intermittent elevations along the route of the existing drain to determine the existing grade and condition of the drain.

The Dodge Road Branch of the Parker and Scothan Drain begins in low land along Dodge Road between Oak and Henderson Roads. It traverses in the westerly direction and discharges into Branch No. 1 of the Parker and Scothan Drain approximately one-quarter mile west of the Dodge and Oak Roads intersection. The majority of the Dodge Road Branch of the Parker and Scothan Drain is located north of Dodge Road. Branch No. 1 of the Parker and Scothan Drain traverses in the southwesterly direction until it discharges into the Parker and Scothan Drain in the northwest quarter of Section 34 of Forest Township, east of M-15 (State Road). The Parker and Scothan Drain continues in the southwesterly direction and discharges into the Flint River near the center of Section 18 of Richfield Township, south of Stanley Road and west of Irish Road.

The route of the Dodge Road Branch of the Parker and Scothan Drain is shown on the attached "Existing Drain Plan". The sizes and elevations of the existing culverts are also shown on the "Existing Drain Plan".

Based on our 1984 Preliminary Report and recommendations where we recommended that the existing drain be cleaned, widened, deepened and straightened along its existing route and the existing culverts be replaced with new culverts, the calculations and recommendations for this current Preliminary Report were completed using the same criteria. The open ditch drain and culvert calculations contained herein are based on making drain improvements along the existing route and course.

2.0 DISTRICT VERIFICATION

For purposes of establishing drainage areas to be used in the drainage calculations for this Preliminary Engineering Report, Flint Surveying and Engineering Company used the drainage district for the Dodge Road Branch of the Parker Scothan Drain as described in the 1984 Preliminary Engineering Report. The drainage district encompasses land located in Sections 25, 26, 27, 35 and 36 of Forest Township, Genesee County, Michigan. These areas were used to compute the discharge from the drainage areas at the various points along the drainage route.

The Genesee County Drain Commissioner will establish the final drainage district.

The land located within the drainage district includes land located in: the Southwest $\frac{1}{4}$ of Section 25, the South $\frac{1}{2}$ of Section 26, the Southeast $\frac{1}{4}$ of Section 27, the North $\frac{1}{2}$ of Section 35, and the Northwest $\frac{1}{4}$ of Section 36, Forest Township, Genesee County. The drainage areas established for use in this Preliminary Report are:

<u>SUBCATCHMENT DESIGNATION</u>	<u>AREA (ACRES)</u>
AREA 1	13.77
AREA 2	10.32
AREA 3	11.30
AREA 4	23.14
AREA 5	32.08
AREA 6	25.99
AREA 7	26.08
AREA 8	68.61
AREA 9	61.67
<u>AREA 10</u>	<u>27.48</u>
TOTAL AREA	300.44 Acres

3.0 ROUTE AND COURSE

The point of beginning for the Dodge Road Branch of the Parker and Scothan Drain is at the inlet end (North end) of an existing 60" culvert crossing Dodge Road approximately 1,290 feet west of the intersection of Dodge and Oak Roads. From there it traverses to the east along the north side of Dodge Road to Oak Road where it crosses under Oak Road and turns to the northeast and meanders easterly across rural land and eventually terminates in low areas in the Dodge and Henderson Roads intersection area.

The route of the existing Dodge Road Branch of the Parker and Scothan Drain No. 1399 investigated for this report is shown on the "Existing Drain Plan".

4.0 HYDROLOGY REVIEW

The drainage district contains approximately 300 acres. A review of an aerial photograph that encompasses the drainage district shows that the majority of the land within the drainage district

is farmland, undeveloped land, or rural residential parcels. There are no subdivisions, or retail, commercial or industrial developments located in the drainage district. The existing land usage was used to compute the runoff from the drainage area for purposes of this preliminary engineering report.

The topography of the drainage area varies widely from level and nearly level to rolling and steeply sloping. The ground surface elevations within the drainage district vary from a low point elevation of approximately 820 near the culvert crossing Dodge Road approximately one-quarter mile west of Oak Road to a high point elevation of approximately 898 at the most remote points east of the intersection of Dodge and Oak Roads. These elevations were obtained from the Genesee County Drain Commissioner Composite Maps for Forest Township.

The elevations of the existing culverts and ditches obtained during the field survey performed by Flint Surveying and Engineering Company for this report were used to complete the preliminary design of the proposed drain improvements contained in this report.

The existing 60" culvert crossing Dodge Road at the point of beginning of the Dodge Road Branch of the Parker and Scothan Drain is at approximate elevation 815.3. The Genesee County Drain Commissioner Composite Map indicates that the elevation of Dodge Road at the 60" culvert is at approximate elevation 821.9. Therefore the maximum depth of water in the proposed drain used in the drainage calculations will be assumed at approximately 6.0' to prevent or minimize overtopping of the roadway.

5.0 SOIL CLASSIFICATIONS

Due to the large area encompassed by the drainage area, numerous soil classifications are found within the drainage area. Following is a list of the soil types mapped within the drainage area being investigated. Also shown is the map symbol and hydrologic soil group. The hydrologic soil group designations were obtained from the U.S. Department of Agriculture Natural Resources Conservation Service Web Soil Survey National Cooperative Soil Survey.

MAP SYMBOL	SOIL NAME	HYDROLOGIC SOIL GROUP
Bw	Brookston loam	B/D
Cc	Carlisle muck	A/D
CeC	Celina loam, 6 - 9% slopes	B
CIB	Celina-Conover loams, 2 - 6% slopes	B
CmB	Celina-Owosso sandy loams, 2 - 6% slopes	B
CvA	Conover loam, 0 - 2% slopes	C
CvB	Conover loam, 2 - 6% slopes	C
CwA	Conover-Metamora sandy loams, 0 - 2% slopes	C
CwB	Conover-Metamora sandy loams, 2 - 6% slopes	C
MnB	Metea loamy sand, 2 - 6% slopes	B
MnC	Metea loamy sand, 6 - 12% slopes	B
MoB	Miami loam, 2 - 6% slopes	B
MoC	Miami loam, 6 - 12% slopes	B
MtB	Miami-Metea complex, 2 - 6% slopes	B

MtC	Miami-Metea complex, 6 – 12% slopes	B
MtD	Miami-Metea complex, 12 – 18% slopes	B
SvC	Spinks-Oakville loamy sands, 6 – 12% slopes	A
Wa	Walkill silt loam	C/D

The hydrologic soil groups, as defined by SCS are:

- A. (Low Runoff Potential). Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels. These soils have a high rate of water transmission.
- B. Soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.
- C. Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.
- D. (High Runoff Potential). Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

6.0 SITE OBSERVATIONS

Flint Surveying and Engineering Company completed a preliminary survey of the existing drainage route starting at the culvert crossing Dodge Road approximately one-quarter mile west of Oak Road to the low areas located east of the Dodge and Henderson Road intersection. During this survey, the existing culverts were surveyed and intermittent elevations of the existing open ditch drain were obtained. This information was used in the analysis of the existing drainage system.

7.0 DESIGN CRITERIA

7.1 GENERAL

The Genesee County Drain Commissioner "Storm Sewer Design Parameters for Genesee County, Revised November 1, 2006" were used to compute the storm water discharge from the drainage district. Because the overall drainage area is 300 acres, the 10 year storm event was used in the drainage calculations. Because the overall drainage area exceeds 100 acres, the HydroCad computer program was used to estimate the peak discharges at various points along the route of the drain and to compute the hydraulics of the channels and culverts.

HydroCad is a computer aided design program for modeling the hydrology and hydraulics of storm water runoff. It combines the most used capabilities of TR-20 and TR-55, plus many other techniques and features not provided by either program. The results obtained from HydroCad have been found to be within 1% of the results obtained from TR-20. In addition to

the culvert flow data obtained from HydroCad, the culverts were also analyzed using the HY8, Version 6.1 Federal Highway Administration Culvert Analysis computer program.

The Federal Highway Administration HY-8 Hydraulic Design for Culverts computer program and the HydroCalc Hydraulics culvert and channel analysis computer program were also used for sizing the preliminary culverts and open ditch drain sections.

The following coefficients of roughness (n) were used: 0.035 for open channel flow, 0.013 for concrete pipe, and 0.024 for corrugated metal pipe.

The information obtained from HydroCad, HY8 and HydroCalc analyses is included in the Exhibits as Drainage Calculations.

7.2 RAINFALL INFORMATION

A 10 Year Type II 24 Hour Storm Event was used for this analysis. The 24-hour rainfall data used was obtained from National Weather Service publications. The 24-hour rainfalls for Genesee County are as follows:

<u>FREQUENCY (YEARS)</u>	<u>RAINFALL (INCHES)</u>
1	2.1
2	2.3
5	3.0
10	3.5
25	3.9
50	4.2
100	4.6

8.0 DRAINAGE CALCULATIONS

The calculations for the following data are included in this report as HydroCad Analysis.

8.1 HYDROCAD ANALYSIS OF DRAINAGE AREAS

The HydroCad analysis of the Dodge Road Branch of the Parker and Scothan Drain drainage areas (HydroCad Subcatchment Areas) indicates the following:

<u>DRAINAGE AREA (SUBCATCHMENT NO.)</u>	<u>PEAK DISCHARGE</u>
1	8.56 CFS
2	14.23 CFS
3	5.92 CFS
4	13.61 CFS
5	39.48 CFS
6	37.57 CFS
7	32.63 CFS
8	81.97 CFS

234 cfs

9
10

58.37 CFS
25.24 CFS

8.2 HYDROCAD ANALYSIS OF PROPOSED OPEN DRAIN DITCHES

The HydroCad analysis of the Dodge Road Branch of the Parker and Scothan Drain proposed open drain ditches (HydroCad Reaches) indicates the following:

<u>PROPOSED DITCH (REACH NO.)</u>	<u>PEAK FLOW DISCHARGE</u>
1 (I to J)	22.72 CFS
2 (G to H)	37.78 CFS
3 (E to F)	68.31 CFS
4 (D to E)	178.59 CFS
5 (C to D)	218.08 CFS
6 (D to P)	37.57 CFS
7 (A to B)	221.93 CFS

8.3 HYDROCAD ANALYSIS OF PROPOSED CULVERTS

The HydroCad analysis of the Dodge Road Branch of the Parker and Scothan Drain proposed culverts (HydroCad Ponds) indicates the following:

<u>PROPOSED CULVERT (POND NO.)</u>	<u>PEAK FLOW DISCHARGE</u>
1 (J to K)	8.56 CFS
2 (H to I)	22.63 CFS
3 (L to M)	5.92 CFS
4 (F to G)	36.33 CFS
5 (N to O)	39.48 CFS
6 (P to Q)	37.57 CFS
7 (B to C)	209.69 CFS

8.4 SUMMARY OF HYDROCAD ANALYSIS

DESIGN POINTS A to B (REACH 7)

Open Ditch Along the North Side of Dodge Road West of Oak Road

From HydroCad Analysis:

Inflow Area = 300.44 Acres
Inflow = 221.93 CFS

Ditch Bottom	4'
Side Slopes	1 on 2
Grade	0.26%
Length	1,264'
Depth	4.42'
Flow Velocity	3.84 FPS

DESIGN POINTS B TO C (CULVERT 7)

Culvert Under Oak Road North of Dodge Road Intersection

From HydroCad Analysis:

Inflow Area = 272.96 Acres

Inflow = 209.69 CFS

	<u>EXISTING</u>	<u>PROPOSED</u>
Culvert Size	18" CMP	72" RCP
Grade	0.21%	1.00%
Length	200'	50'
Headwater Depth		6.12'
Flow Controlled By		Barrel

DESIGN POINTS C TO D (REACH 5)

North Side of Dodge Road East of Oak Road

From HydroCad Analysis:

Inflow Area = 272.96 Acres

Inflow = 218.08 CFS

Ditch Bottom	4'
Side Slopes	1 on 2
Grade	0.34%
Length	1,893'
Peak Depth	4.08'
Peak Flow Velocity	4.24 FPS

DESIGN POINTS D TO E (REACH 4)

North Side of Dodge Road East of Oak Road

From HydroCad Analysis:

Inflow Area = 185.30 Acres

Inflow = 178.59 CFS

Ditch Bottom	4'
Side Slopes	1 on 2
Grade	0.50%
Length	2,208'
Peak Depth	3.38'
Peak Flow Velocity	4.60 FPS

DESIGN POINTS E TO F (REACH 3)

North Side of Dodge Road West of Henderson Road

From HydroCad Analysis:

Inflow Area = 84.61 Acres

Inflow = 68.31 CFS

Ditch Bottom	2'
Side Slopes	1 on 2
Grade	1.07%
Length	561'
Peak Depth	2.18'
Peak Flow Velocity	4.89 FPS

DESIGN POINTS F TO G (CULVERT 4)

Culvert Under Dodge Road 1090' West of Henderson Road

From HydroCad Analysis:

Inflow Area = 58.53 Acres
Inflow = 36.33 CFS

	<u>EXISTING</u>	<u>PROPOSED</u>
Culvert Size	18" CMP	36" CMP
Grade	1.09%	2.00%
Length	46'	50'
Headwater Depth	13.17'	3.29'
Flow Controlled By		Inlet

DESIGN POINTS G TO H (REACH 2)

South Side of Dodge Road West of Henderson Road

From HydroCad Analysis:

Inflow Area = 58.53 Acres
Inflow = 37.78 CFS

Ditch Bottom	2'
Side Slopes	1 on 2
Grade	0.83%
Length	964'
Peak Depth	1.75'
Peak Flow Velocity	3.82 FPS

DESIGN POINTS H TO I (CULVERT 2)

Culvert Under Dodge Road 130' West of Henderson Road

From HydroCad Analysis:

Inflow Area = 24.09 Acres
Inflow = 22.63 CFS

	<u>EXISTING</u>	<u>PROPOSED</u>
Culvert Size	18" CMP	30" CMP
Grade	1.14%	2.00%
Length	44'	50'
Headwater Depth	13.06'	2.68'
Flow Controlled By		Inlet

DESIGN POINTS I TO J (REACH 1)

North Side of Dodge Road West of Henderson Road

From HydroCad Analysis:

Inflow Area = 24.09 Acres
Inflow = 22.72 CFS

Ditch Bottom	2'
Side Slopes	1 on 2
Grade	2.00%
Length	102'
Peak Depth	1.14'
Peak Flow Velocity	4.67 FPS

DESIGN POINTS J TO K (CULVERT 1)

Culvert Under Henderson Road 50' North of Dodge Road

From HydroCad Analysis:

Inflow Area = 13.77 Acres
Inflow = 8.56 CFS

	<u>EXISTING</u>	<u>PROPOSED</u>
Culvert Size	18" CMP	18" CMP
Grade	2.17%	2.00%
Length	46'	50'
Headwater Depth	2.35'	2.39'
Flow Controlled By		Inlet

DESIGN POINTS D TO P (REACH 6)

North Side of Dodge Road East of Oak Road, Culvert 6 to Reach 5

From HydroCad Analysis:

Inflow Area = 25.99 Acres
Inflow = 37.57 CFS

Ditch Bottom	2'
Side Slopes	1 on 2
Grade	0.21%
Length	482'
Peak Depth	2.39'
Peak Flow Velocity	2.28 FPS

DESIGN POINTS P TO Q (CULVERT 6)

Culvert Under Dodge Road 1923' East of Oak Road

From HydroCad Analysis:

Inflow Area = 25.99 Acres
Inflow = 37.57 CFS

	<u>EXISTING</u>	<u>PROPOSED</u>
Culvert Size	18" CMP	36" CMP
Grade	1.14%	1.00%
Length	44'	50'
Headwater Depth	33.82'	3.58'
Flow Controlled By		Barrel

DESIGN POINTS N TO O (CULVERT 5)

Culvert Under Dodge Road 1679' West of Henderson Road

From HydroCad Analysis:

Inflow Area = 32.08 Acres
Inflow = 39.48 CFS

	<u>EXISTING</u>	<u>PROPOSED</u>
Culvert Size	18" CMP	36" CMP
Grade	1.59%	2.00%
Length	44'	50'
Headwater Depth	37.23'	3.58'
Flow Controlled By		Inlet

DESIGN POINTS L TO M (CULVERT 3)

Culvert Under Henderson Road 165' South of Dodge Road

From HydroCad Analysis:

Inflow Area = 11.30 Acres
Inflow = 5.92 CFS

	<u>EXISTING</u>	<u>PROPOSED</u>
Culvert Size	15" CMP	18" CMP
Grade	1.59%	2.00%
Length	44'	50'
Headwater Depth	2.60'	1.52'
Flow Controlled By		Inlet

8.5 MISCELLANEOUS PRELIMINARY CULVERT DESIGN

DESIGN POINTS A to B (Driveway Culverts)

From HydroCad Analysis:

Inflow Area = 300.44 Acres
Inflow = 221.93 CFS

	<u>PROPOSED</u>
Culvert Size	72" CMP
Grade	0.26%
Headwater Depth	7.1'

DESIGN POINTS C to D (Driveway Culverts)

From HydroCad Analysis:

Inflow Area = 272.96 Acres
Inflow = 218.08 CFS

Culvert Size
Grade
Headwater Depth

PROPOSED
72" CMP
0.34%
7.0'

DESIGN POINTS D TO E (Driveway Culverts)

From HydroCad Analysis:

Inflow Area = 185.30 Acres
Inflow = 178.59 CFS

Culvert Size
Grade
Headwater Depth

PROPOSED
72" CMP
0.50%
6.0'

DESIGN POINTS E TO F (Driveway Culverts)

From HydroCad Analysis:

Inflow Area = 84.61 Acres
Inflow = 68.31 CFS

Culvert Size
Grade
Headwater Depth

PROPOSED
48" CMP
1.07%
4.2'

DESIGN POINTS G TO H (Driveway Culverts)

From HydroCad Analysis:

Inflow Area = 58.53 Acres
Inflow = 37.78 CFS

Culvert Size
Grade
Headwater Depth

PROPOSED
36" CMP
0.83%
3.4'

9.0 RECOMMENDATIONS

We recommend that the existing drain be cleaned, widened, deepened and straightened along its existing route to provide the needed capacity as determined by the drainage calculations. Included with this we recommend that the existing undersized culverts be removed and replaced with new culverts sized to meet the flows as determined by the drainage calculations.

10.0 ENGINEER'S PRELIMINARY OPINION OF COST

The Engineer's Preliminary Opinion of Cost is included on the following sheet. The quantities contained therein reflect the major items of work but are only a preliminary estimate for this report. Actual quantities would be determined as part of the final construction plan preparation and actual costs would be based on contractors' bids.

FLINT SURVEYING AND ENGINEERING CO.

5370 MILLER ROAD, SUITE 13
SWARTZ CREEK, MI 48473-1536

**DODGE ROAD BRANCH OF PARKER AND SCOTHAN DRAIN NO. 1399
FOREST TOWNSHIP, GENESEE COUNTY**

**GENESEE COUNTY DRAIN COMMISSIONER
FSE PROJECT NO. 23758**

October 16, 2007

PRELIMINARY ENGINEER'S OPINION OF COST					
ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1	CLEARING AND GRUBBING	L.F.	7,796	\$ 3.00	\$ 23,388.00
2	OPEN DRAIN EXCAVATION, 2 FT. BOTTOM	L.F.	2,431	\$ 8.00	\$ 19,448.00
3	OPEN DRAIN EXCAVATION, 4 FT. BOTTOM	L.F.	5,365	\$ 12.00	\$ 64,380.00
4	MACHINE GRADING	L.F.	7,796	\$ 2.00	\$ 15,592.00
5	18" CSP, ROAD CULVERT	L.F.	100	\$ 25.00	\$ 2,500.00
6	30" CSP, ROAD CULVERT	L.F.	50	\$ 30.00	\$ 1,500.00
7	36" CSP, ROAD CULVERT	L.F.	150	\$ 35.00	\$ 5,250.00
8	72" RCP, ROAD CULVERT	L.F.	50	\$ 100.00	\$ 5,000.00
9	36" CSP, DRIVEWAY CULVERT	L.F.	60	\$ 30.00	\$ 1,800.00
10	48" CSP, DRIVEWAY CULVERT	L.F.	170	\$ 50.00	\$ 8,500.00
11	72" CSP, DRIVEWAY CULVERT	L.F.	300	\$ 80.00	\$ 24,000.00
12	ROAD SURFACE REMOVAL AND/OR REPLACEMENT	S.Y.	375	\$ 25.00	\$ 9,375.00
13	SHOULDER REMOVAL AND/OR REPLACEMENT	S.Y.	250	\$ 10.00	\$ 2,500.00
14	PLAIN RIPRAP	S.Y.	100	\$ 25.00	\$ 2,500.00
15	TOPSOIL SURFACE, 4"	S.Y.	43,000	\$ 2.00	\$ 86,000.00
16	CLASS 1 SEEDING (200 LBS/ACRE)	LBS	450	\$ 5.00	\$ 2,250.00
17	CLASS 2 SEEDING (125 LBS/ACRE)	LBS	670	\$ 3.00	\$ 2,010.00
18	CHEMICAL FERTILIZER NUTRIENT (240 LBS/ACRE)	LBS	2,148	\$ 2.00	\$ 4,296.00
19	MULCH (2 TONS/ACRE)	TON	17.9	\$ 200.00	\$ 3,580.00
20	TRAFFIC CONTROL	L.S.	1	\$ 1,000.00	\$ 1,000.00
21	SOIL EROSION CONTROL MEASURES	L.S.	1	\$ 5,000.00	\$ 5,000.00
					\$ 289,869.00