EGGLESTON DRAIN #0545

SECTION 17, T7N-R6E,
FLINT TOWNSHIP,
GENESEE COUNTY, MICHIGAN

PRELIMINARY ENGINEERING REPORT (PHASE I)

DECEMBER 2009

• PREPARED FOR •

JEFFREY WRIGHT
GENESEE COUNTY DRAIN COMMISSIONER
DIVISION OF SURFACE WATER MANAGEMENT
G-4608 BEECHER ROAD
FLINT, MI 48532
(810) 732-1590

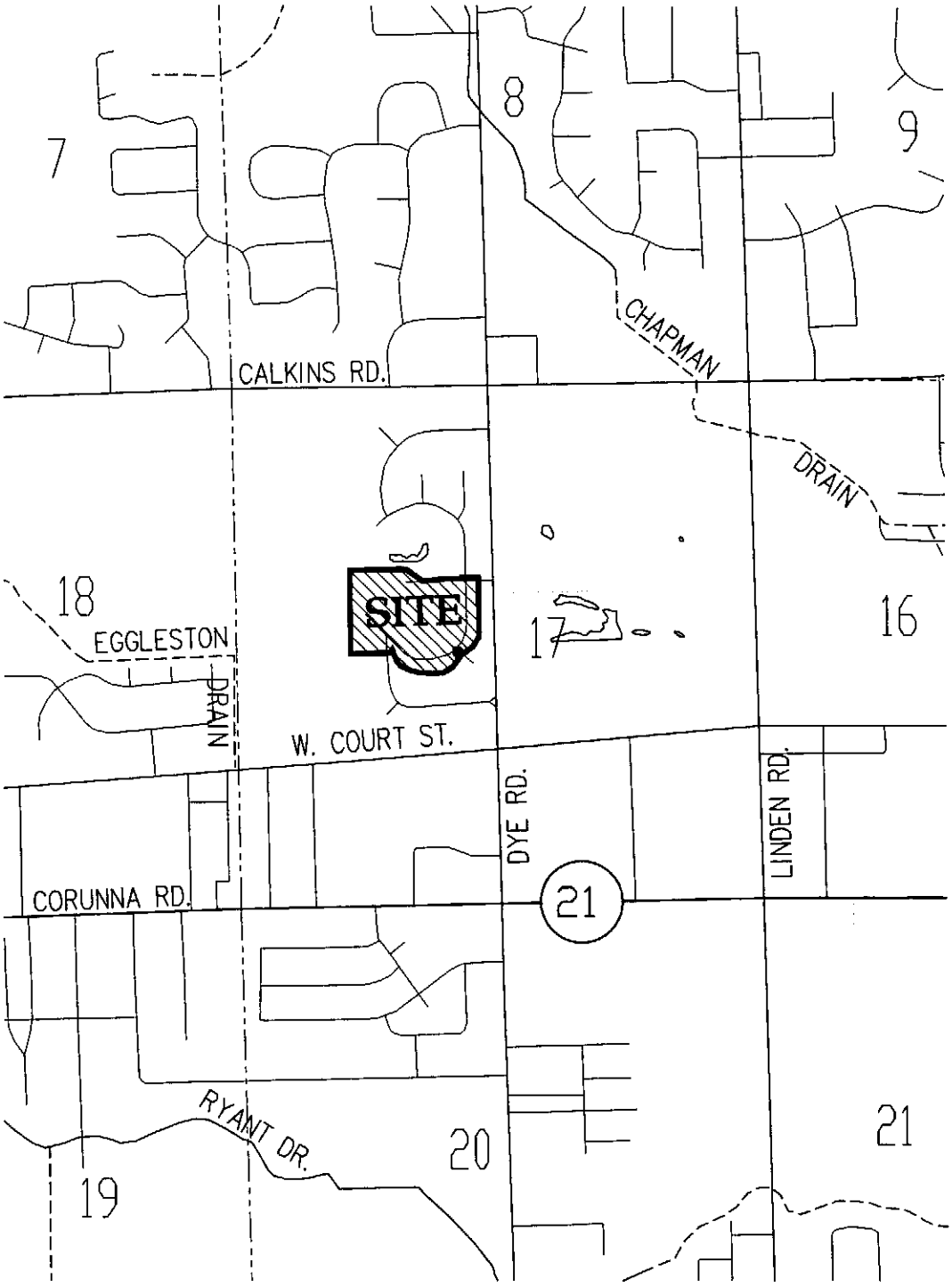
• PREPARED BY •

KRAFT ENGINEERING & SURVEYING, INC.
409 W. SEVENTH STREET
FLINT, MI 48503
PHONE: (810) 234-2694
FAX: (810) 234-2696
E-mail: mail@kraftengineering.com

° CIVIL ENGINEERS ° SURVEYORS ° LAND PLANNERS

TABLE OF CONTENTS

SITE LOCATION MAP



SUMMARY

The purpose of this report is to identify existing drainage concerns and issues, and to offer solutions for drainage problems occurring within the Eggleston Drain Drainage District. The study area is located north of Court Street and west of Dye Road in the southern half of the Dyewood Subdivisions and immediately to the west of the subdivision in Section 17 of Flint Township. The study area includes approximately twenty seven (27) acres of land, all tributary to the Eggleston Drain and all within the existing drainage district.[1]

Presently there are drainage problems and concerns within the Dyewood Subdivision where existing residential properties are subject to flooding due to the lack of an adequate drainage system. Residents submitted a petition to the County Drain Commissioner of the County of Genesee, dated June 2, 2009. Various residents of the Dyewood Subdivision signed the petition calling for the cleaning, deepening, widening, straightening, extending, tiling, relocating, maintaining of the drain known and designated as the Eggleston Drain #0545.

A Board of Determination meeting was held at the Flint Township Hall on September 15, 2009. The recorded meeting minutes indicate that many of the residents had concerns about drainage problems and issues within the Dyewood Subdivisions. Residents expressed concerns over drainage improvements that will be necessary to facilitate the proposed Dyewood Subdivision road pavement rehabilitation project that is currently being designed by Kraft Engineering and Surveying, Inc. as a consultant to the Genesee County Road Commission. Following the petition and public comments, the Board of Determination determined that the Eggleston Drain project was necessary.

The existing drainage system for the study area consists of a combination of open ditch and storm sewer pipe. The downstream end of the existing main line drain system begins at the existing Eggleston Drain approximately 1,300 feet West of the Northwest corner of Lot 58 of Dyewood No. 4 Subdivision. An open ditch then proceeds Easterly 1,000 feet to the end of a 27 inch storm sewer. The existing 27 inch storm sewer then proceeds Easterly 300 feet, and Northeasterly 491 feet across South Dyewood Drive to the Northeasterly corner of Lot 61 of said Dyewood No. 4. A 12 inch storm sewer then proceeds Easterly 629 feet across the Islamic Center property to the Southeasterly corner of Lot 96 of Dyewood No. 5 Subdivision and point of ending. There is also a total of 603 feet of 12 inch storm sewer branches running along South Dyewood Drive to each side of the 27 inch storm sewer crossing this road.

We have determined from the meeting minutes, and from our direct observation of the study area that there are two main drainage issues relating to drainage concerns in this study area. The main issues to be addressed by this study therefore are as follows:

1. The existing storm sewer outlet system outside of the public road right-of-way within Dyewood Subdivision is not currently a public county drain; it does not have continuous easement right-of-way; and the size, capacity, and structural condition of all of the existing storm sewer are of concern.

[1] See Page 1 "Site Location Map"

2. The existing open ditch outlet west of the Dyewood Subdivision running Westerly to the existing Eggleston Drain needs some cleanout and maintenance work, and it does not have any easement right-of-way.

From our observations, the existing storm sewer pipe in the subdivision does not exhibit any obvious visible major problems and it appears to be in reasonable working order. The existing open ditch west of the subdivision has sediment accumulation in the bottom, it is overgrown with brush and trees, and it needs some maintenance work. The Eggleston Drain itself is also overgrown and in need of maintenance.

POTENTIAL SOLUTIONS

Four alternative plans were developed to address drainage issues in the study area. Each plan would provide a drainage system that would provide a drainage outlet for the study area. The existing and/or proposed drainage system would collect drainage from all roads, yards, fields, and other areas within the study drainage area. The four alternative plans are described in detail later in this report.

DRAINAGE AREAS

For hydrologic analysis and preliminary design, a drainage area map was prepared showing the tributary areas.[2] The map is based upon aerial photogrammetry from the Genesee County Drain Commission, ca. 2002, current tax parcel and zoning information from Genesee County Equalization, existing as-built drawings of public record, satellite imagery from the National Map, 3/27/1999, and current survey data by Kraft Engineering & Surveying, Inc.

The drainage basin, and sub-basin areas were delineated on the Drainage Area Map. From the map, it has been determined that a total of 27 acres will be served by the proposed enclosed drainage system in the #0545 Eggleston Drain area. Additional area west of the Dyewood Subdivision area will drain directly to the open ditch between the Eggleston Drain and the Dyewood Subdivision area.[2]

[2] See Exhibit Nos. 9 – 12 "Drainage Maps"

LAND USE:

The existing land use within the drainage area consists of single family residential homes and vacant land. Parts of Dyewood No. 4 and Dyewood No. 5 Subdivisions are included within the study drainage area, along with the Southerly side of the Islamic property lying between North Dyewood Drive and South Dyewood Drive.

SOIL TYPES

Soil types have been determined from the "Soil Survey of Genesee County, Michigan", Map Sheet #24, April 1972, USDA. The predominant soil classification in this area is Perrin Loamy Sand and Boyer Loamy Sand.

The hydrologic soil groups for the above soils, as defined by the Soil Conservation services, are as follows:

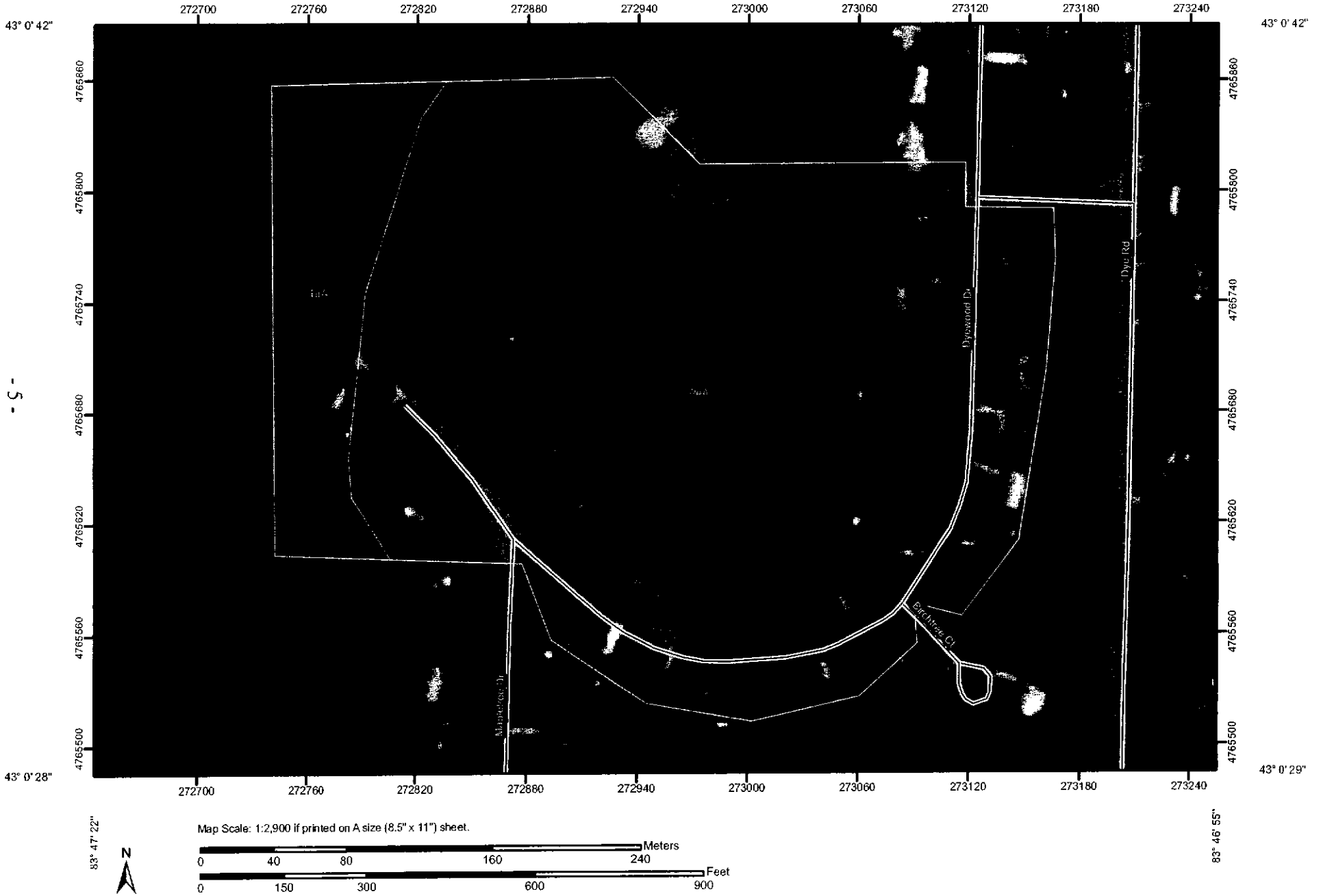
Map Unit Legend

Genesee County, Michigan (MI049)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BrA	Boyer loamy sand, 0 to 2 percent slopes	3.6	12.8%
PeA	Perrin loamy sand, 0 to 2 percent slopes	24.5	87.2%
Totals for Area of Interest		**28.1**	**100.0%**

PeA: The Perrin series consists of moderately well drained, nearly level and gently sloping sandy and loamy soils on washout plains and river terraces.

BrA: The Boyer series consists of well drained, nearly level to moderately steep soils that formed in sandy and loamy deposits.

Soil Map—Genesee County, Michigan



HYDROLOGY

For this report, and for purposes of estimating pipe sizes and costs, the Rational Method has been used to determine peak runoff at various points of concentration in this watershed.

Use of the rational method is approved by the Genesee County Drain Commission for determining the 10-year flood flows for areas less than 300 acres in size. The standard form of the rational formula is:

$Qp = C * i * A$ | where Qp is the peak flow in cubic feet per second,'C' is a coefficient of runoff determined by surface conditions, 'i' is the rainfall intensity in inches/hour, and 'A' is the watershed area in acres.

In the Rational Method, many factors such as: land usage, land form, impervious surface area, rainfall, soils, slopes and conveyances are taken into account in the determination of the three factors.

The value for C is generally determined either by weighted averaging for the area under consideration, or by Engineer's estimation and judgment, or by consulting the Genesee County Drain Commission's regulatory chart based upon standard land usage patterns. For this report, the Genesee County Drain Commission's regulatory chart based upon standard land usage patterns was used to determine 'C'.

The rainfall intensity "i" may be determined from tabulated values, or from I.D.F. (Intensity, Duration, Frequency) charts for Genesee County, or from the formula:

$i\ (10\text{-yr}) = 166.37 / (tc + 23.305)$ where 'tc' is the time of concentration in minutes for the drainage basin in question. For this report, the formula method was used.

Areas for 'A' were determined from the drainage area map.

ESTIMATED PEAK FLOWS

The mapped drainage areas were analyzed and peak flows determined using the Rational Method. A runoff coefficient of 0.25 was used for the large vacant grass/field/wooded areas, and a runoff coefficient of 0.35 was used for the subdivision residential lots along South Dyewood Drive.

To determine the rainfall intensity, the following information was used:

- Flow lengths were determined from the drainage area maps. The overall slope of the tributary area in the South Dyewood Drive area is flat.
- The types of cover in the drainage district were generally determined to be 'Grass Fields, Lawns, and Roadways.'
- Time of Concentration for sheet and waterway flows was determined using engineering judgement and the formula approved by the Genesee County Drain Commission.
- A minimum initial time of concentration of 30 minutes was selected. Pipeline transmission times were added to that to determine the downstream time of concentrations.
- The Genesee County Drain Commission's previously mentioned formula was then used to calculate the rainfall intensity for each drainage area.

Ten year flood flows were calculated for each map point, 1 thru 13, utilizing the overall drainage maps which can be found in Exhibits 5 thru 8 at the back of this report. The estimated ten year flood flows are summarized as follows:

#0545 EGGLESTON DRAIN IMPROVEMENTS

Location/Point No.	Description	Estimated Peak Flows (cfs) Alt. No. 1	Alt. No. 2	Alt. No. 3	Alt No. 4
Pt. 1-2	Inlet	2.33	2.33	2.33	2.33
Pt. 2-4	Storm Sewer	--	--	4.11	4.11
Pt. 2-7	Storm Sewer	4.11	4.11	--	--
Pt. 4-5	Storm Sewer	--	--	--	4.95
Pt. 4-9	Storm Sewer	--	--	5.49	--
Pt. 5B-5	Storm Sewer	2.27	2.27	2.27	1.73
Pt. 5-10	Storm Sewer	4.19	4.19	4.79	7.70
Pt. 7-8	Storm Sewer	8.71	8.79	3.39	4.87
Pt. 8-9	Storm Sewer	--	--	9.19	--
Pt. 8-10	Storm Sewer	14.41	14.41	--	10.66
Pt. 9-10	Storm Sewer	--	--	19.06	--
Pt. 10-12	Storm Sewer	18.68	18.68	18.79	17.62
Pt. 11A-11	Storm Sewer	1.97	1.97	1.97	1.97
Pt. 11-12	Storm Sewer	4.09	4.09	4.09	4.09
Pt. 12-13	Storm Sewer	25.81	25.82	26.06	25.21
Pt. 13-Outlet	Storm Sewer	26.42	26.51	26.75	25.88

HYDRAULICS

To estimate both pipe, and channel sizes for this report, Genesee County Drain Commission standard calculations have been used. [3]

Hydraulic computations for both open channel flow and for enclosed pipe flow have been computed using "Manning's Equation", with standard Manning's friction coefficients specified by the Genesee County Drain Commission.

Manning's Equation derives from the empirical Chezy-Manning relationship used to study the relationship of channel velocity to parameters slope, channel bed condition, and shape. Its general form is:

V = 1.486 * R^(2/3) * S0^(1/2) / n - | where 'V' is average velocity, 'S0' is the slope, 'n' is the Manning's friction coefficient, 1.486 is a conversion factor to English Customary units, and 'R' is the hydraulic radius of the conveyance, determined from its geometry using the equation:

R = A / P | where 'A' is the cross-sectional area of flow, and 'P' is the wetted perimeter.

By substitution of V (average velocity) = Q (discharge) / A (area of cross-section), the equation may be solved for Q and placed in its common form (U.S. customary units) as:

Q = 1.486 * A * R^(2/3) * S0^(1/2) / n

Values for 'n' were chosen from the GCDC-SWM's tabulated values.

[3] See Exhibit Nos. 5 - 8, Storm Sewer System Design (spreadsheets)

ALTERNATIVES, DISCUSSION AND ESTIMATED COSTS

There are four alternatives that have been developed to establish and provide a drainage system to provide for the study area. All four alternatives would include improvements to the existing open ditch west of Dyewood No. 4 Subdivision, and east of the existing Eggleston Drain. Currently this existing open ditch is overgrown with trees and brush, and the ditch bottom is filled with sediment (approximately 1.7 feet of sediment depth at the end of the existing 27 inch storm sewer). The Genesee County Drain Commissioner – Division of Surface Water Management (GCDC-SWM) could maintain this open ditch once an easement has been obtained.

Alternatives Nos. 1 thru 4 are discussed as follows:

Alternative No. 1: See Exhibit No. 9 for a map of this alternative. This alternative would maintain the existing drainage system, except the existing storm sewer branches along South Dyewood Drive would be replaced.

The existing main line 27 inch and 12 inch storm sewer would remain in place as it currently exists, at least for the time being. Although sections of the existing main line storm sewer do not meet current standards, there are no obvious visible major problems with the existing sewer, the residents have not reported any known flooding issues, and it appears to be in reasonable working order. The existing sewer should be televised to make sure there are no internal structural problems if it is left in place. The main line storm sewer could be upgraded at a later time under a new petition if deemed necessary. The capacity of the existing main line sewer could be improved after the open ditch outlet has been cleaned out.

There are existing 12 foot wide platted drainage easements within the subdivision along the platted lot lines. These easements may need to be upgraded as determined by the GCDC - SWM. There is not any known existing easements along the 12 inch storm sewer crossing the Islamic Center property. New easement(s) for this section of sewer would need to be obtained.

The existing 12 inch storm sewer branches along South Dyewood Drive would be replaced with new 15 inch storm sewer as part of the proposed Road Rehabilitation project for the Dyewood Subdivision that is currently in the design stage.

The estimated cost of Alternative No. 1, not including the cost of land or right-of-way, is as follows:

	Alternative No. 1		
1.	Estimated Net Construction Cost	=	$41,998.00
2.	Estimated Total Engineering Cost	=	$11,339.00
	Estimated Total Project Cost	=	**$53,337.00**

See Exhibit No. 1 for detailed Cost Estimate for Alternative No. 1.

Alternative No. 2: See Exhibit No. 10 for a map of this alternative. This alternative would rebuild the existing storm sewer system at its current location.

The existing 27 inch and 12 inch main line storm sewer would be replaced at its current location with a new larger storm sewer to meet current design standards. The existing 12 inch storm sewer branches along South Dyewood Drive would be replaced with new 15 inch storm sewer as part of the proposed Road Rehabilitation project for the Dyewood Subdivision that is currently in the design stage.

Easements would have to be obtained as noted under Alternative No. 1.

The estimated cost of Alternative No. 2, not including the cost of land or right-of-way, is as follows:

	Alternative No. 2		
1.	Estimated Net Construction Cost	=	$149,914.00
2.	Estimated Total Engineering Cost	=	$ 40,477.00
	Estimated Total Project Cost	=	**$190,391.00**

See Exhibit No. 2 for detailed Cost Estimate for Alternative No. 2.

Alternative No. 3: See Exhibit No. 11 for a map of this alternative. This alternative would rebuild the existing main line 27" storm sewer at its current location, and the existing main line 12" storm sewer crossing the Islamic Center property would be relocated along the rear lot lines adjacent to the Islamic Center property.

The existing 27 inch main line storm sewer would be replaced at its current location with a new larger storm sewer to meet current design standards. The existing 12 inch main line storm sewer across the Islamic Center property would be relocated across the rear lot lines of Lots 62 thru 64 of Dyewood No. 4 and Lots 97 thru 101 of Dyewood No. 5, and its size would be increased with a new larger storm sewer to meet current design standards. The existing 12 inch storm sewer branches along South Dyewood Drive would be replaced with new 15 inch storm sewer as part of the proposed Road Rehabilitation project for the Dyewood Subdivision that is currently in the design stage.

The existing 12 foot wide platted drainage easements within the subdivisions may have to be upgraded as determined as determined by the GCDC- SWM. Eight new easements would be required along the rear lot lines of said Lots 62 thru 64 and Lots 97 thru 101. This alternative would not require an easement from the Islamic Center property.

The estimated cost of Alternative No. 3, not including the cost of land or right-of-way, is as follows:

	Alternative No. 3		
1.	Estimated Net Construction Cost	=	$155,892.00
2.	Estimated Total Engineering Cost	=	$ 42,091.00
	Estimated Total Project Cost	=	**$197,983.00**

See Exhibit No. 3 for detailed Cost Estimate for Alternative No. 3.

ALTERNATIVES, DISCUSSION AND ESTIMATED COSTS CONTINUED

Alternative No. 4: See Exhibit No. 12 for a map of this alternative. This alternative would rebuild the existing main line 27" storm sewer at its current location Southwesterly of South Dyewood Drive, and the existing main line 12" storm sewer crossing the Islamic Center property would be relocated along South Dyewood Drive.

The existing 27 inch main line storm sewer would be replaced at its current location Southwesterly of South Dyewood Drive with a new larger storm sewer to meet current design standards. The existing 12 inch main line storm sewer crossing the Islamic Center property would be relocated to the right-of-way of South Dyewood Drive between Lot 62 of Dyewood No. 4 and Lot 97 of Dyewood No 5, and its size would be increased with a new larger storm sewer to meet current design standards. The existing 12" storm sewer branch on South Dyewood Drive Northwesterly of Lot 58 of Dyewood No. 4 would be replaced with a new 15" storm sewer as part of the proposed road rehabilitation project for the Dyewood Subdivision that is currently in the design stage.

The existing platted easements Southwesterly of South Dyewood Drive may have to be upgraded as determined by the GCDC - SWM. Some new easements may be required along the road in order to fit the new storm sewer along the road curve. This alternative would not require an easement from the Islamic Center property.

The estimated cost of Alternative No. 4, not including the cost of land or right-of-way is as follows:

	Alternative No. 4		
1.	Estimated Net Construction Cost	=	$164,593.00
2.	Estimated Total Engineering Cost	=	$ 44,440.00
	Estimated Total Project Cost	=	**$209,033.00**

See Exhibit No. 4 for detailed Cost Estimate for Alternative No. 4.

RECOMMENDATIONS:

The recommended solution to properly address all drainage problems and concerns, and to meet current design standards to provide the required drainage capacity for the study area is to construct Alternative No. 2. Alternative No. 2 would upgrade the entire existing drainage system at its current location and along its existing established route in the most cost effective and practical manner.

Alternative No. 1 is not recommended because the size of the existing storm sewer does not meet current design standards and the exact structural condition of the existing pipe and drainage structures is unknown, and is of concern. The existing main line 27 inch and 12 inch storm sewer is in reasonable working order and could be utilized until a County Drain project is ready to be constructed. The residents have not reported any known flooding issues related to this existing storm sewer system.

Alternative Nos. 3 and 4 are both more costly than Alternative No. 2. Alternative Nos. 3 and 4 could be considered if easement acquisition becomes an issue that cannot be solved.

EXHIBIT NO. 1

#0545 EGGLESTON DRAIN COST ESTIMATE ALTERNATIVE NO. 1

ITEM	AMOUNT	UNIT	UNIT COST	TOTAL
Driveway Removal and Replacement	100	SY	$ 30.00	$ 3,000
15" Sewer, Class III, Trench Detail 1	200	LF	$ 35.00	$ 7,000
15" Sewer, Class III, Trench Detail 2	403	LF	$ 40.00	$ 16,120
4 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	3	EA	$ 1,200.00	$ 3,600
Drainage Structure Covers	1200	LB	$ 1.50	$ 1,800
Topsoil Surface, 4"	2500	SY	$ 2.00	$ 5,000
Chemical Fertilizer Nutrient (240 Lbs/Acre)	120	LB	$ 3.00	$ 360
Class A Seeding (200 Lbs/Acre)	100	LB	$ 4.00	$ 400
Mulch (2 Tons/Acre)	1	TON	$ 400.00	$ 400
Soil Erosion & Sedimentation Control Measures	1	LSUM	$ 500.00	$ 500

Subtotal				$ 38,180
Contingency @ 10 percent				$ 3,818
Estimated Net Construction Costs				$ 41,998
Estimated Preliminary and Final Engineering Design				$ 5,040
Estimated Construction Engineering				$ 6,300
Engineering Total				$ 11,339
Total Estimated Project Cost (not including Land or Right-of-Way)				$ 53,337

EXHIBIT NO. 2

#0545 EGGLESTON DRAIN COST ESTIMATE ALTERNATIVE NO. 2

ITEM	AMOUNT	UNIT	UNIT COST	TOTAL
Road Surface Removal and Replacement	75	SY	$ 50.00	$ 3,750
Driveway Removal and Replacement	100	SY	$ 30.00	$ 3,000
Clearing and Grubbing	0.25	ACRE	$ 15,000.00	$ 3,750
15" Sewer, Class III, Trench Detail 1	200	LF	$ 35.00	$ 7,000
18" Sewer, Class III, Trench Detail 1	629	LF	$ 40.00	$ 25,160
30" Sewer, Class III, Trench Detail 1	214	LF	$ 55.00	$ 11,770
36" Sewer, Class III, Trench Detail 1	504	LF	$ 65.00	$ 32,760
15" Sewer, Class III, Trench Detail 2	403	LF	$ 40.00	$ 16,120
30" Sewer, Class III, Trench Detail 2	73	LF	$ 60.00	$ 4,380
4 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	2	EA	$ 1,200.00	$ 2,400
5 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	4	EA	$ 2,000.00	$ 8,000
Drainage Structure Covers	1650	LB	$ 1.50	$ 2,475
Steel End Pipe Section for 36" Concrete Pipe with Steel Bar Grate	1	EA	$ 1,200.00	$ 1,200
Plain Riprap	30	SY	$ 40.00	$ 1,200
Topsoil Surface, 4"	5000	SY	$ 2.00	$ 10,000
Chemical Fertilizer Nutrient (240 Lbs/Acre)	240	LB	$ 3.00	$ 720
Class A Seeding (200 Lbs/Acre)	200	LB	$ 4.00	$ 800
Mulch (2 Tons/Acre)	2	TON	$ 400.00	$ 800
Soil Erosion & Sedimentation Control Measures	1	LSUM	$ 1,000.00	$ 1,000

Subtotal				$ 136,285
Contingency @ 10 percent				$ 13,629
Estimated Net Construction Costs				$ 149,914
Estimated Preliminary and Final Engineering Design				$ 17,990
Estimated Construction Engineering				$ 22,487
Engineering Total				$ 40,477
Total Estimated Project Cost (not including Land or Right-of-Way)				$ 190,391

EXHIBIT NO. 3

#0545 EGGLESTON DRAIN COST ESTIMATE ALTERNATIVE NO. 3

ITEM	AMOUNT	UNIT	UNIT COST	TOTAL
Road Surface Removal and Replacement	75	SY	$ 50.00	$ 3,750
Driveway Removal and Replacement	100	SY	$ 30.00	$ 3,000
Clearing and Grubbing	0.25	ACRE	$ 15,000.00	$ 3,750
15" Sewer, Class III, Trench Detail 1	200	LF	$ 35.00	$ 7,000
18" Sewer, Class III, Trench Detail 1	770	LF	$ 40.00	$ 30,800
30" Sewer, Class III, Trench Detail 1	194	LF	$ 55.00	$ 10,670
36" Sewer, Class III, Trench Detail 1	504	LF	$ 65.00	$ 32,760
15" Sewer, Class III, Trench Detail 2	403	LF	$ 40.00	$ 16,120
30" Sewer, Class III, Trench Detail 2	73	LF	$ 60.00	$ 4,380
4 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	5	EA	$ 1,200.00	$ 6,000
5 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	4	EA	$ 2,000.00	$ 8,000
Drainage Structure Covers	2700	LB	$ 1.50	$ 4,050
Steel Pipe End Section for 36" Concrete Pipe with Steel Bar Grate	1	EA	$ 1,200.00	$ 1,200
Topsoil Surface, 4"	3750	SY	$ 2.00	$ 7,500
Chemical Fertilizer Nutrient (240 Lbs/Acre)	180	LB	$ 3.00	$ 540
Class A Seeding (200 Lbs/Acre)	150	LB	$ 4.00	$ 600
Mulch (2 Tons/Acre)	1.5	TON	$ 400.00	$ 600
Soil Erosion & Sedimentation Control Measures	1	LSUM	$ 1,000.00	$ 1,000

Subtotal				$ 141,720
Contingency @ 10 percent				$ 14,172
Estimated Net Construction Costs				$ 155,892
Estimated Preliminary and Final Engineering Design				$ 18,707
Estimated Construction Engineering				$ 23,384
Engineering Total				$ 42,091
Total Estimated Project Cost (not including Land or Right-of-Way)				$ 197,983

EXHIBIT NO.4

#0545 EGGLESTON DRAIN COST ESTIMATE ALTERNATIVE NO. 4

ITEM	AMOUNT	UNIT	UNIT COST	TOTAL
Road Surface Removal and Replacement	200	SY	$ 50.00	$ 10,000
Driveway Removal and Replacement	250	SY	$ 30.00	$ 7,500
Clearing and Grubbing	0.25	ACRE	$ 15,000.00	$ 3,750
15" Sewer, Class III, Trench Detail 1	200	LF	$ 35.00	$ 7,000
36" Sewer, Class III, Trench Detail 1	504	LF	$ 65.00	$ 32,760
15" Sewer, Class III, Trench Detail 2	54	LF	$ 40.00	$ 2,160
18" Sewer, Class III, Trench Detail 2	745	LF	$ 45.00	$ 33,525
21" Sewer, Class III, Trench Detail 2	349	LF	$ 50.00	$ 17,450
30" Sewer, Class III, Trench Detail 2	73	LF	$ 55.00	$ 4,015
4 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	6	EA	$ 1,200.00	$ 7,200
5 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	3	EA	$ 2,000.00	$ 6,000
Drainage Structure Covers	2500	LB	$ 1.50	$ 3,750
Steel Pipe End Section for 36" Concrete Pipe with Steel Bar Grate	1	EA	$ 1,200.00	$ 1,200
Topsoil Surface, 4"	5000	SY	$ 2.00	$ 10,000
Chemical Fertilizer Nutrient (240 Lbs/Acre)	240	LB	$ 3.00	$ 720
Class A Seeding (200 Lbs/Acre)	200	LB	$ 4.00	$ 800
Mulch (2 Tons/Acre)	2	TON	$ 400.00	$ 800
Soil Erosion & Sedimentation Control Measures	1	LSUM	$ 1,000.00	$ 1,000

Subtotal				$ 149,630
Contingency @ 10 percent				$ 14,963
Estimated Net Construction Costs				$ 164,593
Estimated Preliminary and Final Engineering Design				$ 19,751
Estimated Construction Engineering				$ 24,689
Engineering Total				$ 44,440
Total Estimated Project Cost (not including Land or Right-of-Way)				$ 209,033

EXHIBIT NO. 5

STORM SEWER SYSTEM DESIGN
ALTERNATIVE NO. 1

$Q = A \frac{1.486}{n} R^{2/3} S^{1/2}$ $\quad Q = C\,I\,A \quad I = \frac{166.37}{T + 23.31}^{10}$

Job Name DYE WOOD
By Tim O'Dell
Date December 17, 2009

STRUCTURE #	INCREMENT AREA Ai	INCREMENT AREA Ai	TOTAL AREA A	RUNOFF COEF. C	EQUIVALENT AREA C A I	TOTAL EQUIV. AREA TOTAL C A I	TIME T	RAINFALL INTENSITY I	FLOW Q = I TOTAL C A I	DIAMETER OF PIPE	LENGTH OF PIPE TO NEXT STRUCT.	SLOPE OF PIPE	SLOPE OF H.G.	VELOCITY OF FLOW	TIME OF FLOW	
	SFT	AC.	AC.				MIN.	IN/HR	C.F.S.	IN.	FT.	%	%	FT/SEC	MIN.	
1	92800	2.13	2.13	0.35	0.75	0.75	30.00	3.12	2.33	12	25	2.16		7.22	0.06	Existing Storm sewer
2	71450	1.64	3.77	0.35	0.57	1.32	30.06	3.12	4.11	12	470	0.25		2.46	3.19	Existing Storm sewer
7	286200	6.57	10.34	0.25	1.64	2.96	33.25	2.94	8.71	12	159	0.82		4.45	0.60	Existing Storm sewer
8	346300	7.95	18.29	0.25	1.99	4.95	33.85	2.91	14.41	27	214	0.22		3.96	0.90	Existing Storm sewer to DS #10
5B	90600	2.08	2.08	0.35	0.73	0.73	30.00	3.12	2.27	12	25	0.30		2.69	0.15	Existing Storm sewer
5	77100	1.77	3.85	0.35	0.62	1.35	30.15	3.11	4.19	15	163	0.36		3.42	0.79	Proposed Storm sewer to DS #6
6	0	0.00	3.85	0.35	0.00	1.35	30.95	3.07	4.13	15	186	0.36		3.42	0.91	Proposed Storm sewer to DS #10
10	0	0.00	22.14	0.35	0.00	7.75	34.75	2.87	18.68	27	73	0.22		3.96	0.31	Existing Storm sewer to DS #12
11A	78400	1.80	1.80	0.35	0.63	0.63	30.00	3.12	1.97	12	25	1.48		5.98	0.07	Existing Storm sewer
11	84950	1.95	3.75	0.35	0.68	1.31	30.07	3.12	4.09	15	254	0.40		3.61	1.17	Proposed Storm sewer to DS #12
12	0	0.00	25.89	0.35	0.00	9.06	35.06	2.85	25.83	27	204	0.23		4.05	0.84	Existing Storm sewer
13	44400	1.02	26.91	0.35	0.36	9.42	36.00	2.81	26.42	27	300	0.23		4.05	1.24	Existing Storm sewer to Open Drain

EXHIBIT NO. 6

STORM SEWER SYSTEM DESIGN
ALTERNATIVE NO. 2

$Q = A \frac{1.486}{n} R^{2/3} S^{1/2}$ $\quad Q = CIA \quad I = \frac{166.37}{T + 23.31}^{10}$

Job Name DYE WOOD
By Tim O'Dell
Date December 17, 2009

STRUCTURE #	INCREMENT AREA Ai	INCREMENT AREA Ai	TOTAL AREA A	RUNOFF COEF. C	EQUIVALENT AREA C A I	TOTAL EQUIV. AREA TOTAL C A I	TIME T	RAINFALL INTENSITY I	FLOW Q= I TOTAL C A I	DIAMETER OF PIPE	LENGTH OF PIPE TO NEXT STRUCT.	SLOPE OF PIPE	SLOPE OF H.G.	VELOCITY OF FLOW	TIME OF FLOW	
	SFT	AC.	AC.				MIN.	IN/HR	C.F.S.	IN.	FT.	%	%	FT/SEC	MIN.	
1	92800	2.13	2.13	0.35	0.75	0.75	30.00	3.12	2.33	12	25	2.16		7.22	0.06	Existing Storm sewer
2	71450	1.64	3.77	0.35	0.57	1.32	30.06	3.12	4.11	18	470	0.20		2.88	2.72	Proposed Storm sewer
7	286200	6.57	10.34	0.25	1.64	2.96	32.78	2.97	8.79	18	159	0.60		4.99	0.53	Proposed Storm sewer
8	346300	7.95	18.29	0.25	1.99	4.95	33.31	2.94	14.54	30	214	0.22		4.25	0.84	Proposed Storm sewer to DS #10
5B	90600	2.08	2.08	0.35	0.73	0.73	30.00	3.12	2.27	12	25	0.30		2.69	0.15	Existing Storm sewer
5	77100	1.77	3.85	0.35	0.62	1.35	30.15	3.11	4.19	15	163	0.36		3.42	0.79	Proposed Storm sewer
6	0	0.00	3.85	0.35	0.00	1.35	30.95	3.07	4.13	15	186	0.36		3.42	0.91	Proposed Storm sewer to DS #10
10	0	0.00	22.14	0.35	0.00	7.75	34.15	2.90	18.68	30	73	0.22		4.25	0.29	Proposed Storm sewer to DS #12
11A	78400	1.80	1.80	0.35	0.63	0.63	30.00	3.12	1.97	12	25	1.48		5.98	0.07	Existing Storm sewer
11	84950	1.95	3.75	0.35	0.68	1.31	30.07	3.12	4.09	15	254	0.40		3.61	1.17	Proposed Storm sewer
12	0	0.00	25.89	0.35	0.00	9.06	34.44	2.88	26.11	36	204	0.23		4.90	0.69	Proposed Storm sewer
13	44400	1.02	26.91	0.35	0.36	9.42	35.81	2.81	26.51	36	300	0.23		4.90	1.02	Proposed Storm sewer to Drain Outlet

EXHIBIT NO. 7

STORM SEWER SYSTEM DESIGN
ALTERNATIVE NO. 3

$$Q = A \frac{1.486}{n} R^{2/3} S^{1/2} \qquad Q = CIA \qquad I = \frac{166.37}{T + 23.31}$$

10

Job Name DYE WOOD
By Tim O'Dell
Date December 1, 2009

STRUCTURE #	INCREMENT AREA Ai	INCREMENT AREA Ai	TOTAL AREA A	RUNOFF COEF. C	EQUIVALENT AREA C A I	TOTAL EQUIV. AREA TOTAL C A I	TIME T	RAINFALL INTENSITY I	FLOW Q = I TOTAL C A I	DIAMETER OF PIPE	LENGTH OF PIPE TO NEXT STRUCT.	SLOPE OF PIPE	SLOPE OF H.G.	VELOCITY OF FLOW	TIME OF FLOW	
	SFT	AC.	AC.				MIN.	IN/HR	C.F.S.	IN.	FT.	%	%	FT/SEC	MIN.	
1	92800	2.13	2.13	0.35	0.75	0.75	30.00	3.12	2.33	12	25	2.16		7.22	0.06	Existing Storm sewer
2	71450	1.64	3.77	0.35	0.57	1.32	30.06	3.12	4.11	18	185	0.20		2.88	1.07	Proposed Storm sewer
3	21800	0.50	4.27	0.35	0.18	1.49	31.13	3.06	4.57	18	130	0.20		2.88	0.75	Proposed Storm sewer
3A	21800	0.50	4.77	0.35	0.18	1.67	31.88	3.01	5.03	18	130	0.20		2.88	0.75	Proposed Storm sewer
4	21800	0.50	5.27	0.35	0.18	1.85	32.63	2.97	5.49	18	140	0.25		3.22	0.72	Proposed Storm sewer
4A	21800	0.50	5.77	0.35	0.18	2.02	31.88	3.01	6.09	18	185	0.30		3.53	0.87	Proposed Storm sewer
5B	90600	2.08	2.08	0.35	0.73	0.73	30.00	3.12	2.27	12	25	0.30		2.69	0.15	Existing Storm sewer
5	77100	1.77	3.85	0.35	0.62	1.35	30.15	3.11	4.19	15	163	0.36		3.42	0.79	Proposed Storm sewer
6	0	0.00	3.85	0.35	0.00	1.35	30.95	3.07	4.13	15	186	0.36		3.42	0.91	Proposed Storm sewer
7	199100	4.57	4.57	0.25	1.14	1.14	32.75	2.97	3.39	12	159	0.82		4.45	0.60	Existing Storm sewer
8	346300	7.95	12.52	0.25	1.99	3.13	33.35	2.94	9.19	27	20	0.22		3.96	0.08	Existing Storm sewer
9	0	0.00	0.00	0.35	0.00	6.50	33.43	2.93	19.06	30	194	0.22		4.25	0.76	Proposed Storm sewer
10	0	0.00	0.00	0.35	0.00	6.50	34.19	2.89	18.81	30	73	0.22		4.25	0.29	Proposed Storm sewer
11A	78400	1.80	1.80	0.35	0.63	0.63	30.00	3.12	1.97	12	25	1.48		5.98	0.07	Existing Storm sewer
11	84950	1.95	3.75	0.35	0.68	1.31	30.07	3.12	4.09	15	254	0.40		3.61	1.17	Proposed Storm sewer
12	0	0.00	25.89	0.35	0.00	9.06	34.53	2.88	26.06	36	204	0.23		4.90	0.69	Proposed Storm sewer
13	44400	1.02	26.91	0.35	0.36	9.42	35.27	2.84	26.75	36	300	0.23		4.90	1.02	Proposed Storm sewer to Outlet Drain

EXHIBIT NO. 8

STORM SEWER SYSTEM DESIGN
ALTERNATIVE NO. 4

$Q = A \frac{1.486}{n} R^{2/3} S^{1/2}$ $\quad Q = C I A \quad I = \frac{166.37}{T + 23.31}^{10}$

Job Name DYE WOOD
By Tim O'Dell
Date December 1, 2009

STRUCTURE #	INCREMENT AREA Ai	INCREMENT AREA Ai	TOTAL AREA A	RUNOFF COEF. C	EQUIVALENT AREA C A I	TOTAL EQUIV. AREA TOTAL C A I	TIME T	RAINFALL INTENSITY I	FLOW Q = I TOTAL C A I	DIAMETER OF PIPE	LENGTH OF PIPE TO NEXT STRUCT.	SLOPE OF PIPE	SLOPE OF H.G.	VELOCITY OF FLOW	TIME OF FLOW	
	SFT	AC.	AC.				MIN.	IN/HR	C.F.S.	IN.	FT.	%	%	FT/SEC	MIN.	
1	92800	2.13	2.13	0.35	0.75	0.75	30.00	3.12	2.33	12	25	2.16		7.22	0.06	Existing Storm sewer
2	71450	1.64	3.77	0.35	0.57	1.32	30.06	3.12	4.11	18	200	0.20		2.88	1.16	Proposed Storm sewer
3	0	0.00	3.77	0.35	0.00	1.32	31.22	3.05	4.03	18	275	0.20		2.88	1.59	Proposed Storm sewer
4	43560	1.00	4.77	0.35	0.35	1.67	32.81	2.96	4.95	18	270	0.20		2.88	1.56	Proposed Storm sewer
5B	68800	1.58	1.58	0.35	0.55	0.55	30.00	3.12	1.73	12	25	0.30		2.69	0.15	Existing Storm sewer
5	55300	1.27	7.62	0.35	0.44	2.67	34.37	2.88	7.70	21	163	0.20		3.19	0.85	Proposed Storm sewer
6	0	0.00	7.62	0.35		2.67	35.22	2.84	7.59	21	186	0.20		3.19	0.97	Proposed Storm sewer
7	286200	6.57	6.57	0.25	1.64	1.64	32.75	2.97	4.87	12	159	0.82		4.45	0.60	Existing Storm sewer
8	346300	7.95	14.52	0.25	1.99	3.63	33.35	2.94	10.66	27	214	0.22		3.96	0.90	Existing Storm sewer
10	0	0.00	22.14	0.35	0.00	6.30	36.19	2.80	17.62	30	73	0.22		4.25	0.29	Proposed Storm sewer
11A	78400	1.80	1.80	0.35	0.63	0.63	30.00	3.12	1.97	12	25	1.48		5.98	0.07	Existing Storm sewer
11	84950	1.95	3.75	0.35	0.68	1.31	30.07	3.12	4.09	15	254	0.40		3.61	1.17	Proposed Storm sewer
12	0	0.00	25.89	0.35	0.00	9.06	36.49	2.78	25.21	36	204	0.23		4.90	0.69	Proposed Storm sewer
13	44400	1.02	26.91	0.35	0.36	9.42	37.23	2.75	25.88	36	300	0.23		4.90	1.02	Proposed Storm sewer to Outlet Drain

EGGLESTON DRAIN NO. 0545

(PART OF THE WEST 1/2, SECTION 17, T7N-R6E, FLINT TOWNSHIP, GENESEE COUNTY, MICHIGAN)

(ALTERNATIVE NO. 1)

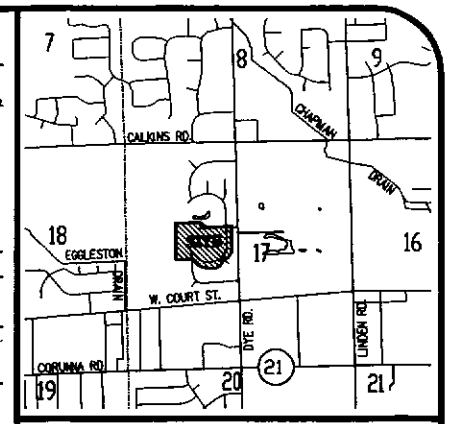
GRAPHIC SCALE
100 0 50 100
(IN FEET)
1 inch = 100 ft.

35'± T/B TO T/B
EX. OPEN DITCH OVERGROWN WITH MEDIUM BRUSH & SMALL TREES
8'± DEPTH
8'± TOE TO TOE

EXISTING OPEN DITCH CROSS SECTION A-A

200-017
DYEWOOD DRIVE
DYE WOOD NO. 5
DYE ROAD
ISLAMIC CENTER PROPERTY 100-014
7.95 ACS
6.57 ACS
2.13 ACS
1.64 ACS
1.80 ACS
1.95 ACS
1.02 ACS
1.77 ACS
2.08 ACS
EX. OPEN DITCH
EX. 27" STM.
EX. 12" STM
EX. 12' DRAINAGE EASEMENT
PLAT LINE
100-008
100-010
100-044
100-013
100-014
100-015
100-016
100-017
100-018
DYE WOOD NO. 4
DYE WOOD NO. 3
MAPLETREE DRIVE
MAPLETREE CT.
COURT STREET
EX. EGGLESTON TRUNK (TILE)
EX. EGGLESTON DRAIN DITCH

LOCATION MAP



LEGEND

- 750 — EX. CONTOUR LINE
- LOT LINE
- EX. STORM MANHOLE
- EX. STORM SEWER
- DRAINAGE AREA BOUNDARY
- DRAINAGE SUB-AREA BOUNDARY
- (5) DRAINAGE REFERENCE POINT
- PROPOSED STORM SEWER

KES JOB NO. 200921

SCALE: 1" = 100'	PREPARED FOR: GCDC-SWM, G-4608 BEECHER ROAD, FLINT, MICHIGAN 48532, PHONE: 810.732.1590	Three full working days before you dig, call the MISS DIG System at 1-800-482-7171	PREPARED BY: KRAFT ENGINEERING & SURVEYING, INC. engineers - surveyors - planners, 409 WEST SEVENTH STREET FLINT, MICHIGAN 48503, PHONE: 810.234.2694 or 810.234.2695 FAX: 810.234.2696, E-MAIL: MAIL@KRAFTENGINEERING.COM	EGGLESTON DRAIN, PART OF THE WEST 1/2, SECTION 17, T7N-R6E, FLINT TOWNSHIP, GENESEE COUNTY, MICHIGAN	EXHIBIT NO. 9, DRAINAGE MAP, ALTERNATIVE NO. 1	REVISIONS	SHEET NO: 20

DRN. BY:	RADO	12.11.09	
DSN. BY:	T.L.O.	"	
CKD. BY:	M.R.P.	"	
APPR. BY:	M.R.P.	"	

EGGLESTON DRAIN NO. 0545

(PART OF THE WEST 1/2, SECTION 17, T7N-R6E,
FLINT TOWNSHIP, GENESEE COUNTY, MICHIGAN)

(ALTERNATIVE NO. 2)

GRAPHIC SCALE
100 0 50 100
(IN FEET)
1 inch = 100 ft.

35'± T/B TO T/B
EX. OPEN DITCH OVERGROWN WITH MEDIUM BRUSH & SMALL TREES
6'± DEPTH
6'± TOE TO TOE

EXISTING OPEN DITCH
CROSS SECTION A-A

200-017

ISLAMIC CENTER PROPERTY 100-014

DYEWOOD DRIVE

DYE WOOD NO. 5

DYE WOOD NO. 4

DYE WOOD NO. 3

DYE ROAD

SOUTH DYEWOOD DRIVE

MAPLETREE CT.

MAPLETREE DRIVE

COURT STREET

EX. EGGLESTON DRAIN (TILE)

EX. OPEN DITCH

PROP. 18" STM. @ 0.80%

PROP. 15" STM. @ 0.40%

PROP. 30" STM. @ 0.20%

EX. 12" STM.

EX. 12' DRAINAGE EASEMENT

PROP. 27" STM. @ 0.20%

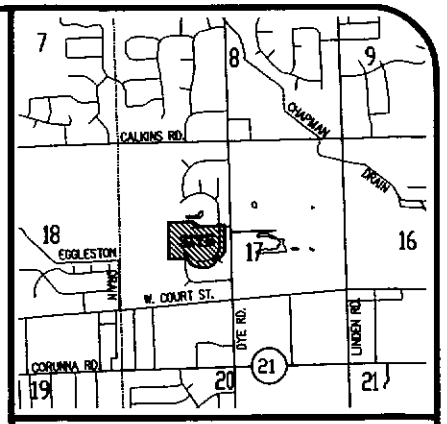
EX. 27" STM.

7.95 ACS
6.57 ACS
2.13 ACS
1.64 ACS
1.80 ACS
1.95 ACS
1.02 ACS
1.70 ACS
2.08 ACS

100-008 100-010 100-044 100-013 100-014 100-015 100-016 100-017 100-018

LOT 57 503-004
LOT 58 503-005
LOT 59 503-006
LOT 60 503-007
LOT 61 503-008
LOT 62 503-009
LOT 63 503-010
LOT 64 503-011
LOTS 65/66 503-013
LOTS 66/67 503-014
LOTS 85/86 504-001
LOT 77 504-004
LOT 78 504-005
LOT 79 504-006
LOT 80 504-007
LOT 81 504-008
LOT 85 504-012
LOT 86 504-013
LOT 87 504-014
LOT 88 504-015
LOT 89 504-016
LOT 90 504-017
LOT 91 504-018
LOT 92 504-019
LOT 93 504-020
LOT 94 504-021
LOT 95 504-022
LOT 96 504-023
LOT 97 504-024
LOT 98 504-025
LOT 100 504-027
LOT 101 504-028

LOCATION MAP



LEGEND

- 750 EX. CONTOUR LINE
- LOT LINE
- EX. STORM MANHOLE
- DRAINAGE DISTRICT BOUNDARY
- DRAINAGE SUB-AREA BOUNDARY
- (5) DRAINAGE REFERENCE POINT
- PROPOSED STORM SEWER

KES JOB NO. 200921

SCALE: 1" = 100'	PREPARED FOR: GCDC-SWM, G-4608 BEECHER ROAD, FLINT, MICHIGAN 48532, PHONE: 810.732.1590	Three full working days before you dig, call the MISS DIG System at 1-800-482-7171	PREPARED BY: KRAFT ENGINEERING & SURVEYING, INC. engineers - surveyors - planners, 409 WEST SEVENTH STREET FLINT, MICHIGAN 48503, PHONE: 810.234.2694 or 810.234.2695 FAX: 810.234.2696, E-MAIL: MAIL@KRAFTENGINEERING.COM	EGGLESTON DRAIN, PART OF THE WEST 1/2, SECTION 17, T7N-R6E, FLINT TOWNSHIP, GENESEE COUNTY, MICHIGAN	EXHIBIT NO. 10, DRAINAGE MAP, ALTERNATIVE NO. 2	REVISIONS	SHEET NO: 21

DRN. BY:	RADO	12.11.09	
DSN. BY:	T.L.O.	"	
CKD. BY:	M.R.P.	"	
APPR. BY:	M.R.P.	"	

EGGLESTON DRAIN NO. 0545

(PART OF THE WEST 1/2, SECTION 17, T7N-R6E,
FLINT TOWNSHIP, GENESEE COUNTY, MICHIGAN)

(ALTERNATIVE NO. 3)

GRAPHIC SCALE
100 0 50 100
(IN FEET)
1 inch = 100 ft.

35'± T/B TO T/B
EX. OPEN DITCH OVERGROWN WITH MEDIUM BRUSH & SMALL TREES
8'± DEPTH
6'± TOE TO TOE
EXISTING OPEN DITCH CROSS SECTION A-A

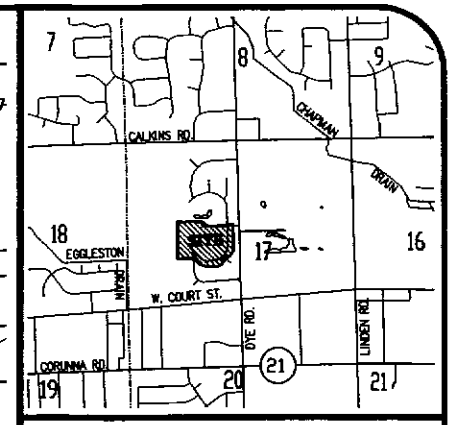
200-017
200-016
100-015
100-014
100-013
100-044
100-010
100-008
EX. OPEN DITCH
EX. EGGLESTON DRAIN (TILE)
EX. 27" RCP (BOTTOM DITCH)
PROP. 36" STM. @ 0.20%
EX. 27" E=758.72

ISLAMIC CENTER PROPERTY 100-014
7.95 ACS
4.57 ACS
1.64 ACS
2.13 ACS
1.80 ACS
1.95 ACS
1.02 ACS
0.50 ACS
1.77 ACS
2.08 ACS

DYEWOOD DRIVE
DYE WOOD NO. 5
DYE ROAD
DYE WOOD NO. 4
DYE WOOD NO. 3
SOUTH EVERWOOD DRIVE
MAPLETREE DRIVE
MAPLETREE CT.
COURT STREET
PLAT LINE
EX. 12" STM.
PROP. 18" STM. @ 0.20%
PROP. 15" STM. @ 0.20%
EX. 12' DRAINAGE EASEMENT

LOT 60 503-007
LOT 61 503-008
LOT 62 503-009
LOT 63 503-010
LOT 64 503-011
LOT 56 503-005
LOT 57 503-004
LOT 59 503-006
LOTS 85/86 503-013
LOTS 86/87 503-014
LOTS 85/86 504-001
LOT 77 504-004
LOT 78 504-005
LOT 79 504-006
LOT 80 504-007
LOT 81 504-008
LOT 85 504-012
LOT 86 504-013
LOT 87 504-014
LOT 88 504-015
LOT 89 504-016
LOT 90 504-017
LOT 91 504-018
LOT 92 504-019
LOT 93 504-020
LOT 94 504-021
LOT 85 504-022
LOT 86 504-023
LOT 97 504-024
LOT 98 504-025
LOT 99 504-026
LOT 100 504-027
LOT 101 504-028

LOCATION MAP



LEGEND

- 750 EX. CONTOUR LINE
- LOT LINE
- EX. STORM MANHOLE
- DRAINAGE AREA BOUNDARY
- DRAINAGE SUB-AREA BOUNDARY
- (5) DRAINAGE REFERENCE POINT
- PROPOSED STORM SEWER

KES JOB NO. 200921

SCALE: 1" = 100'	PREPARED FOR: GCDC-SWM, G-4608 BEECHER ROAD, FLINT, MICHIGAN 48532, PHONE: 810.732.1590	Three full working days before you dig, call the MISS DIG System at 1-800-482-7171	PREPARED BY: KRAFT ENGINEERING & SURVEYING, INC. engineers - surveyors - planners, 409 WEST SEVENTH STREET FLINT, MICHIGAN 48503, PHONE: 810.234.3694 or 810.234.3695 FAX: 810.234.3696, E-MAIL: MAIL@KRAFTENGINEERING.COM	EGGLESTON DRAIN, PART OF THE WEST 1/2 SECTION 17, T7N-R6E, FLINT TOWNSHIP, GENESEE COUNTY, MICHIGAN	EXHIBIT NO. 11, DRAINAGE MAP, ALTERNATIVE NO. 3

REVISIONS			
DRN. BY:	RADO	12.11.09	SHEET NO: 22
DSN. BY:	T.L.O.	"	
CKD. BY:	M.R.P.	"	
APPR. BY:	M.R.P.	"	

EGGLESTON DRAIN NO. 0545

(PART OF THE WEST 1/2, SECTION 17, T7N-R6E,
FLINT TOWNSHIP, GENESEE COUNTY, MICHIGAN)

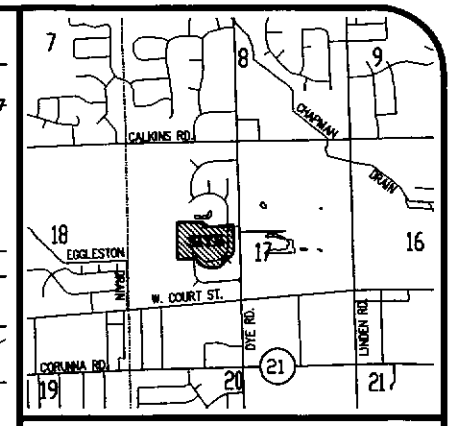
(ALTERNATIVE NO. 4)

GRAPHIC SCALE
100 0 50 100
(IN FEET)
1 inch = 100 ft.

35'± T/B TO T/B
EX. OPEN DITCH OVERGROWN WITH MEDIUM BRUSH & SMALL TREES
8'± DEPTH
6'± TOE TO TOE
EXISTING OPEN DITCH CROSS SECTION A-A

200-017
7.95 ACS
ISLAMIC CENTER PROPERTY 100-014
6.57 ACS
1.64 ACS
2.13 ACS
1.80 ACS
1.95 ACS
1.02 ACS
1.77 ACS
2.08 ACS
DYE WOOD NO. 5
DYE WOOD NO. 4
DYE WOOD NO. 3
DYE ROAD
DYEWOOD DRIVE
SOUTH DYEWOOD DRIVE
MAPLETREE DRIVE
MAPLETREE CT.
COURT STREET
EX. OPEN DITCH
EX. EGGLESTON DRAIN (TILE)
PROP. 36" STM. @ 0.20%
PROP. 30" STM. @ 0.20%
PROP. 24" STM. @ 0.20%
PROP. 18" STM. @ 0.20%
PROP. 15" STM. @ 0.20%
PROP. 12" STM. @ 0.20%
EX. 12" STM
EX. 12' DRAINAGE EASEMENT
PLAT LINE
100-008
100-010
100-044
100-013
100-014
100-015
100-016
100-017
100-018

LOCATION MAP



LEGEND

- 750 EX. CONTOUR LINE
- LOT LINE
- EX. STORM MANHOLE
- DRAINAGE AREA BOUNDARY
- DRAINAGE SUB-AREA BOUNDARY
- (5) DRAINAGE REFERENCE POINT
- PROPOSED STORM SEWER

KES JOB NO. 200921

SCALE: 1" = 100'	PREPARED FOR: GCDC-SWM, G-4608 BEECHER ROAD, FLINT, MICHIGAN 48532, PHONE: 810.732.1590	Three full working days before you dig, call the MISS DIG System at 1-800-482-7171	PREPARED BY: KRAFT ENGINEERING & SURVEYING, INC. engineers · surveyors · planners, 409 WEST SEVENTH STREET FLINT, MICHIGAN 48503, PHONE: 810.234.2694 or 810.234.2695 FAX: 810.234.2696, E-MAIL: MAIL@KRAFTENGINEERING.COM	EGGLESTON DRAIN, PART OF THE WEST 1/2, SECTION 17, T7N-R6E, FLINT TOWNSHIP, GENESEE COUNTY, MICHIGAN	EXHIBIT NO. 12, DRAINAGE MAP, ALTERNATIVE NO. 4	REVISIONS	SHEET NO: 23

DRN. BY:	RADO	12.10.09	
DSN. BY:	T.L.O.	"	
CKD. BY:	M.R.P.	"	
APPR. BY:	M.R.P.	"	