

ENGINEER'S OPINION OF COSTS

FOR

**PROPOSED PARKS DRAIN #0471
ALTERNATIVE NO. 3**

| ITEM NO. | WORK ITEM | EST. QTY | UNIT | UNIT PRICE | TOTAL AMOUNT |
|----------|---|----------|------|--------------|---------------|
| 1 | Traffic Maintenance & Control | 1 | LS | \$ 2,000.00 | \$ 2,000.00 |
| 2 | Clearing & Grubbing | 10110 | LF | \$ 8.00 | \$ 80,880.00 |
| 3 | Machine Grading | 10110 | LF | \$ 4.00 | \$ 40,440.00 |
| 4 | Remove Culvert, Less than 24 inch Diam | 8 | Each | \$ 200.00 | \$ 1,600.00 |
| 5 | Remove Culvert, 24 inch to 48 inch Diam | 2 | Each | \$ 600.00 | \$ 1,200.00 |
| 6 | Remove Culvert, Over 48 inch Diam | 1 | Each | \$ 1,200.00 | \$ 1,200.00 |
| 7 | Remove Drainage Structure | 4 | Each | \$ 250.00 | \$ 1,000.00 |
| 8 | Remove Sewer, Less than 24 inch Diam | 100 | Ft | \$ 10.00 | \$ 1,000.00 |
| 9 | Pavement Removal & Replacement | 100 | SY | \$ 50.00 | \$ 5,000.00 |
| 10 | Open Drain Excavation, 2 FT Bottom | 1770 | LF | \$ 5.00 | \$ 8,850.00 |
| 11 | Open Drain Excavation, 4 FT Bottom | 5840 | LF | \$ 10.00 | \$ 58,400.00 |
| 12 | Restricted Open Drain Excavation, 2 FT Bottom | 200 | LF | \$ 10.00 | \$ 2,000.00 |
| 13 | Restricted Open Drain Excavation, 4 FT Bottom | 2500 | LF | \$ 15.00 | \$ 37,500.00 |
| 14 | Detention Basin Excavation | 33000 | CYD | \$ 4.00 | \$ 132,000.00 |
| 15 | Clearing | 7 | Acre | \$ 5,000.00 | \$ 35,000.00 |
| 16 | Soil Erosion & Sedimentation Control | 1 | LS | \$ 10,000.00 | \$ 10,000.00 |
| 17 | Maintenance Gravel | 50 | Ton | \$ 20.00 | \$ 1,000.00 |
| 18 | 12 in. Corrugated Steel Pipe Culvert, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 1 | 180 | LF | \$ 25.00 | \$ 4,500.00 |
| 19 | 12 in. Corrugated Steel Pipe Storm Sewer, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 2 | 140 | LF | \$ 30.00 | \$ 4,200.00 |
| 20 | 28 in. x 20 in. Corrugated Steel Pipe Culvert, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 2 | 50 | LF | \$ 40.00 | \$ 2,000.00 |
| 21 | 28 in. x 20 in. Corrugated Steel Pipe Storm Sewer, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 2 | 40 | LF | \$ 45.00 | \$ 1,800.00 |
| 22 | 24 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1 | 330 | LF | \$ 45.00 | \$ 14,850.00 |
| 23 | 30 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1 | 1990 | LF | \$ 60.00 | \$ 119,400.00 |
| 24 | 36 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1 | 1610 | LF | \$ 70.00 | \$ 112,700.00 |
| 25 | 42 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1 | 1910 | LF | \$ 82.00 | \$ 156,620.00 |
| 26 | 48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1 | 635 | LF | \$ 110.00 | \$ 69,850.00 |
| 27 | 60 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1 | 110 | LF | \$ 125.00 | \$ 13,750.00 |

Parks Drain #0471
Alternative No. 3

| ITEM NO. | WORK ITEM | EST. QTY | UNIT | UNIT PRICE | TOTAL AMOUNT |
|----------|---|----------|------|-------------|-------------------------|
| 28 | 36 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 2 | 100 | LF | \$ 85.00 | \$ 8,500.00 |
| 29 | 48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 2 | 50 | LF | \$ 115.00 | \$ 5,750.00 |
| 30 | 48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-V, Jacked in place under Rail Road Tracks | 60 | LF | \$ 750.00 | \$ 45,000.00 |
| 31 | Drainage Structure Covers | 23 | Each | \$ 350.00 | \$ 8,050.00 |
| 32 | 4 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft. | 2 | Each | \$ 1,500.00 | \$ 3,000.00 |
| 33 | 5 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft. | 6 | Each | \$ 2,500.00 | \$ 15,000.00 |
| 34 | 6 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft. | 14 | Each | \$ 3,500.00 | \$ 49,000.00 |
| 35 | 7 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft. | 1 | Each | \$ 4,500.00 | \$ 4,500.00 |
| 36 | 12 in Steel End Section with Steel Grate | 14 | Each | \$ 250.00 | \$ 3,500.00 |
| 37 | Steel End Section with Steel Grate for 30" Conc Pipe | 3 | Each | \$ 1,000.00 | \$ 3,000.00 |
| 38 | Steel End Section with Steel Grate for 60" Conc Pipe | 2 | Each | \$ 3,000.00 | \$ 6,000.00 |
| 39 | Outlet Weir | 2 | Each | \$ 2,500.00 | \$ 5,000.00 |
| 40 | Topsoil Surface, 4 inch | 30000 | SY | \$ 0.75 | \$ 22,500.00 |
| 41 | Chemical Fertilizer Nutrient (240 Lbs/acre) | 3000 | Lb | \$ 2.00 | \$ 6,000.00 |
| 42 | Class A seeding (200 Lbs/acre) | 2500 | Lb | \$ 4.00 | \$ 10,000.00 |
| 43 | Mulch (2 tons/acre) | 25 | Ton | \$ 300.00 | \$ 7,500.00 |
| 44 | Mulch Blanket for Open Drain Bottom | 9000 | SY | \$ 1.50 | \$ 13,500.00 |
| | Estimated Construction Cost | | | | \$ 1,134,540.00 |
| | Design Contingencies | | | | \$ 56,730.00 |
| | Construction Contingencies | | | | \$ 119,130.00 |
| | Preliminary and Design Engineering | | | | \$ 95,910.00 |
| | Construction Engineering & Inspection | | | | \$ 178,690.00 |
| | TOTAL ESTIMATED COST* | | | | \$ 1,585,000.00* |

*Not including the cost of land for the proposed detention basin, or any new drain right-of-way that may be required.

Prepared by:



KRAFT ENGINEERING AND SURVEYING, INC.

409 West Seventh Street, Flint, MI 48503-3781

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PARKS DRAIN STORM SEWER SYSTEM DESIGN, ALTERNATIVE No. 3

Alternative No. 3 Hydraulic Summary

Job Name Parks Drain, Alternative #3

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$Q = CIA \quad i(10) = \frac{166.37}{T + 23.31}$$

$$Q = CIA \quad i(25) = \frac{191.76}{T + 25.93}$$

By TLO
Date 8/30/12
Channel Parameters:
Bottom 2 Ft min.
Side Slopes 3 FT/FT
INVERT ELEV.

| UPSTREAM STRUCT. | DOWNSTREAM STRUCT. | CONVEYANCE | INCREMENT AREA AI | TOTAL AREA A | RUNOFF COEF. C | EQUIVALENT AREA CAI | TOTAL EQUIV. AREA TOTAL CAI | TIME T | RAINFALL INTENSITY | DESIGN FLOW Q = I TOTAL CAI | DIAMETER OF PIPE / OR EQUIVALENT | SLOPE OF PIPE / DITCH | PIPE CAPACITY FLOWING FULL | VELOCITY PIPE FLOWING FULL | DISTANCE BETWEEN STRUCTURES | TIME OF FLOW | NORMAL DEPTH REQD. FOR DITCH | OPEN CHAN. VELOCITY AT NORMAL DEPTH | CHECK CAPACITY AT NORMAL DEPTH | DROP AT STRUCTURE | UPPER END | LOWER END | GROUND / RIM | BW | m | A | P | R | n | DESCRIPTION | | | | | | | |
|---|--------------------|--------------|-------------------|--------------|----------------|---------------------|-----------------------------|--------|--------------------|-----------------------------|----------------------------------|-----------------------|----------------------------|----------------------------|-----------------------------|--------------|------------------------------|-------------------------------------|--------------------------------|-------------------|-----------|-----------|--------------|-------|------|-------|-------|------|-------|-----------------------------|--|--|--|--|--|--|--|
| | | | AC. | AC. | | | | MIN. | IN/HR | C.F.S. | IN. | % | C.F.S. | FT/SEC | FT. | MIN. | FT. | FPS | C.F.S. | FT. | ELEV | ELEV | ELEV | | | | | | | | | | | | | | |
| 10 YEAR DESIGN STORM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1a | 1c | Open Drain | 2.08 | 2.08 | 0.30 | 0.62 | 0.62 | 60.00 | 2.00 | 1.25 | N/A | 0.30 | N/A | N/A | 300 | 2.20 | 1.00 | 2.28 | 11.38 | 0.00 | 810.00 | 809.10 | 812.00 | 2.00 | 3 | 5.00 | 5.16 | 0.97 | 0.035 | Open Drain | | | | | | | |
| 1c | 1d | Open Drain | 10.44 | 12.52 | 0.30 | 3.13 | 3.76 | 150.00 | 0.96 | 3.61 | N/A | 0.30 | N/A | N/A | 1910 | 10.71 | 1.50 | 2.97 | 28.99 | 0.00 | 809.10 | 803.37 | 810.00 | 2.00 | 3 | 9.75 | 6.74 | 1.45 | 0.035 | Open Drain | | | | | | | |
| 1d | 1e | Open Drain | 65.80 | 78.32 | 0.30 | 19.74 | 23.50 | 160.71 | 0.90 | 21.24 | N/A | 0.30 | N/A | N/A | 1760 | 8.16 | 2.00 | 3.59 | 57.52 | 0.00 | 803.37 | 798.09 | 804.00 | 2.00 | 3 | 16.00 | 8.32 | 1.92 | 0.035 | Open Drain | | | | | | | |
| 10 YEAR DESIGN STORM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2a | 2b | PIPE | 51.81 | 51.81 | 0.30 | 15.54 | 15.54 | 95.00 | 1.41 | 21.85 | 24 | 0.80 | 21.91 | 6.98 | 330 | 0.79 | N/A | N/A | N/A | N/A | 805.70 | 803.06 | 812.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 2a | 2b | PIPE | | | | | | | | 21.85 | 30 | 0.45 | 29.79 | 6.07 | 1080 | 2.96 | N/A | N/A | N/A | N/A | 803.06 | 798.20 | 804.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 10 & 25 YEAR DESIGN STORM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2b | 4a | Open Drain | 50.48 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1e | 4a | Open Drain | 43.03 | 223.64 | 0.30 | 12.91 | 67.09 | 168.87 | 0.87 | 58.08 | N/A | 0.30 | N/A | N/A | 1305 | 6.02 | 2.00 | 3.61 | 72.27 | 0.00 | 798.09 | 794.18 | 800.00 | 4.00 | 3 | 20.00 | 10.32 | 1.94 | 0.035 | Open Drain | | | | | | | |
| 4a | 4b | Rd X-ing | 20.65 | 244.29 | 0.30 | 6.20 | 73.29 | 174.88 | 0.84 | 61.52 | 36 | 0.75 | 62.54 | 8.85 | 50 | 0.09 | N/A | N/A | N/A | N/A | 794.18 | 793.80 | 800.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 4b | 7b | PIPE | | 244.29 | 0.30 | | 73.29 | 174.98 | 0.95 | 69.95 | 42 | 0.50 | 77.03 | 8.01 | 1200 | 2.50 | N/A | N/A | N/A | N/A | #REF! | #REF! | 796.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 4b | 7b | Open Drain | | | | | 92.56 | 177.48 | 0.94 | 87.26 | N/A | 0.30 | N/A | N/A | 350 | 1.61 | 2.00 | 3.62 | 79.65 | 0.00 | #REF! | 780.00 | 780.00 | 5.00 | 3 | 22.00 | 11.32 | 1.94 | 0.035 | Open Drain | | | | | | | |
| 7b | 7c | Deten. Basin | 66.10 | 374.64 | 0.30 | 19.83 | 112.39 | | | | N/A | 0.20 | N/A | N/A | 300 | 1.68 | 2.00 | 2.97 | 95.17 | 0.00 | 780.00 | 779.40 | 780.00 | 10.00 | 3 | 32.00 | 16.32 | 1.96 | 0.035 | Detention Basin Allowable | | | | | | | |
| | | Deten. Basin | 12.35 | 386.99 | 0.30 | 3.71 | 116.10 | | | 77.40 | 42 | 0.51 | 77.80 | 8.09 | | | | | | | | | | | | | | | | Outflow of 0.20 cfs/acre | | | | | | | |
| 7c | 7d | PIPE | | | 0.30 | | 116.10 | 179.09 | 0.82 | 77.40 | 42 | 0.51 | 77.80 | 8.09 | 710 | 1.46 | N/A | N/A | N/A | N/A | 777.00 | 773.38 | 780.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 7d | 8a | Rd X-ing | 37.72 | 37.72 | 0.30 | 11.32 | 11.32 | 180.55 | 0.82 | 86.64 | 48 | 0.32 | 87.98 | 7.01 | 50 | 0.12 | N/A | N/A | N/A | N/A | 773.38 | 773.22 | 778.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 8a | 8b | PIPE | 3.59 | 41.31 | 0.30 | 1.08 | 12.39 | 180.67 | 0.82 | 96.74 | 48 | 0.40 | 98.37 | 7.83 | 635 | 1.35 | N/A | N/A | N/A | N/A | 773.22 | 770.68 | 778.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 10 YEAR DESIGN STORM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 4c | Rd X-ing | 46.11 | 46.11 | 0.30 | 13.83 | 13.83 | 90.00 | 1.47 | 20.31 | 27 | 0.84 | 30.73 | 7.73 | 44 | 0.09 | 1.50 | 4.98 | 48.51 | 0.00 | N/A | N/A | 798.00 | 2.00 | 3 | 9.75 | 6.74 | 1.45 | 0.035 | Existing 27" Sewer | | | | | | | |
| 4c | 5a | Rd X-ing | 7.60 | 53.71 | 0.30 | 2.28 | 16.11 | 90.09 | 1.47 | 23.64 | 42 | 0.70 | 91.14 | 9.48 | 54 | 0.09 | N/A | N/A | N/A | N/A | 788.90 | 788.52 | 798.00 | N/A | N/A | N/A | N/A | N/A | N/A | Existing 42" Sewer | | | | | | | |
| 5a | 5b | PIPE | 17.81 | 71.52 | 0.30 | 5.34 | 21.46 | 90.19 | 1.47 | 31.45 | 30 | 0.51 | 31.72 | 6.46 | 910 | 2.35 | N/A | N/A | N/A | N/A | 788.52 | 783.88 | 792.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 5b | pond | PIPE | 29.12 | 100.64 | 0.30 | 8.74 | 30.19 | 92.54 | 1.44 | 43.36 | 36 | 0.50 | 51.07 | 7.23 | 500 | 1.15 | N/A | N/A | N/A | N/A | 783.88 | 781.38 | 782.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| pond | 6 | PIPE | 20.00 | 120.64 | 0.30 | 6.00 | 36.19 | 93.69 | 1.42 | 51.46 | 36 | 0.60 | 55.94 | 7.92 | 535 | 1.13 | N/A | N/A | N/A | N/A | 781.38 | 778.17 | 780.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 6 | 8b | PIPE | 20.00 | 140.64 | 0.30 | 6.00 | 42.19 | 94.81 | 1.41 | 59.42 | 36 | 0.70 | 60.42 | 8.55 | 625 | 1.22 | N/A | N/A | N/A | N/A | 778.17 | 773.80 | 778.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 25 YEAR DESIGN STORM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8b | 9a | PIPE | 21.40 | 590.34 | 0.30 | 6.42 | 177.10 | 181.89 | 0.92 | 163.42 | 60 | 0.34 | 164.43 | 8.38 | 100 | 0.20 | N/A | N/A | N/A | N/A | 770.68 | 770.34 | 778.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Storm Sewer | | | | | | | |
| 8b | 9a | Open Drain | | | | | | | | 145.22 | N/A | 0.10 | N/A | N/A | 615 | 3.39 | 3.50 | 3.02 | 163.92 | 0.00 | 770.34 | 769.72 | 776.00 | 5.00 | 3.00 | 54.25 | 16.07 | 3.38 | 0.035 | Open Drain | | | | | | | |
| 9a | 9b | Open Drain | 24.43 | 614.77 | 0.20 | 4.89 | 122.95 | 182.08 | 0.92 | 113.35 | N/A | 0.10 | N/A | N/A | 1585 | 8.74 | 3.50 | 3.02 | 163.92 | 0.00 | 769.72 | 768.14 | 776.00 | 5.00 | 3 | 54.25 | 16.07 | 3.38 | 0.035 | Open Drain | | | | | | | |
| 9b | 9c | PIPE | 67.90 | 682.67 | 0.30 | 20.37 | 143.32 | 190.83 | 0.88 | 126.80 | 48 | 0.15 | 60.24 | 4.80 | 60 | 0.31 | N/A | N/A | N/A | N/A | 768.14 | 768.05 | 774.00 | N/A | N/A | N/A | N/A | N/A | N/A | Proposed Rail Road Crossing | | | | | | | |
| 9c | Crapo | Open Drain | 0.00 | 682.67 | 0.20 | 0.00 | 143.32 | 191.14 | 0.88 | 126.61 | N/A | 0.11 | N/A | N/A | 1070 | 5.63 | 3.50 | 3.17 | 171.93 | 0.00 | 768.05 | 766.87 | 772.00 | 5.00 | 3 | 54.25 | 16.07 | 3.38 | 0.035 | Open Drain | | | | | | | |
| 25 YEAR DESIGN STORM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ex.36 inch at Rail Road Crossing | | | | | | | | | | | 36 | 2.89 | 122.77 | | | | | | | | | | | | | | | | | | | | | | | | |
| Proposed additional 36" Casing next to existing 36" under Rail Road | | | | | | | | | | | 48 | 0.15 | 60.24 | | | | | | | | | | | | | | | | | | | | | | | | |
| For information only, 25 year Storm | | | | | | | 204.80 | 190.83 | 0.88 | 126.80 | | | 183.01 | | | | | | | | | | | | | | | | | | | | | | | | |

KRAFT ENGINEERING AND SURVEYING , INC.

EXHIBIT 9a

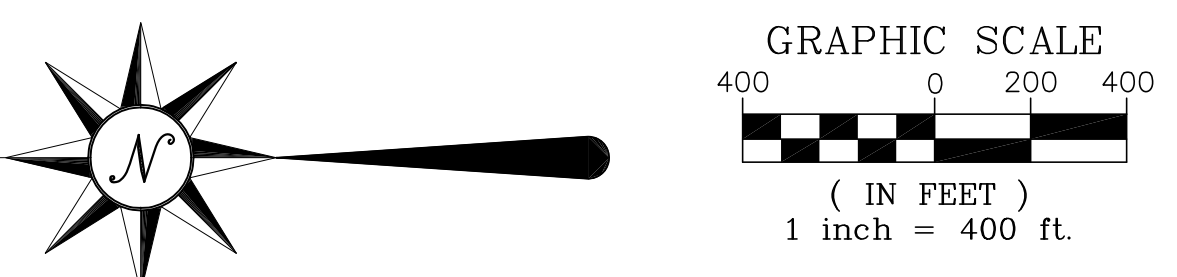
409 W. 7th St.
Flint, MI 48503

RATIONAL METHOD Q=CIA
DETENTION POND VOLUME CALCULATIONS

Area= **386.99**
C= **0.30**
Qout= **77.40**

ALTERNATIVE NO. 3

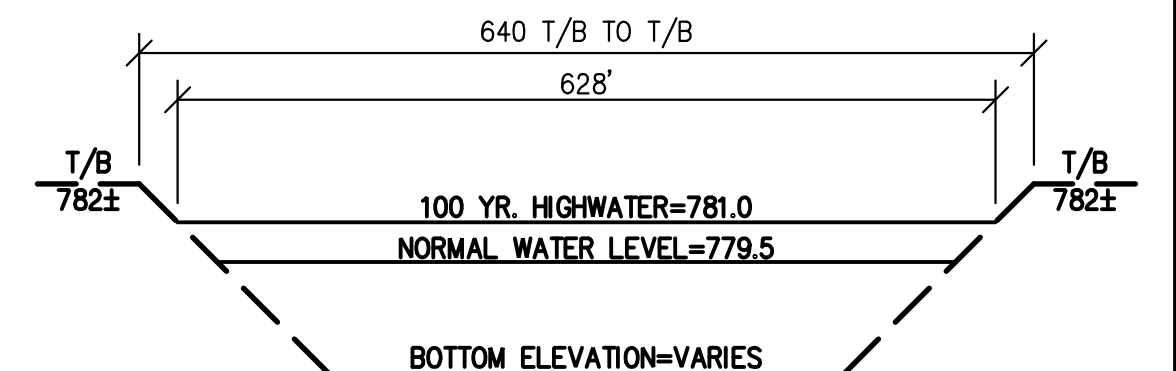
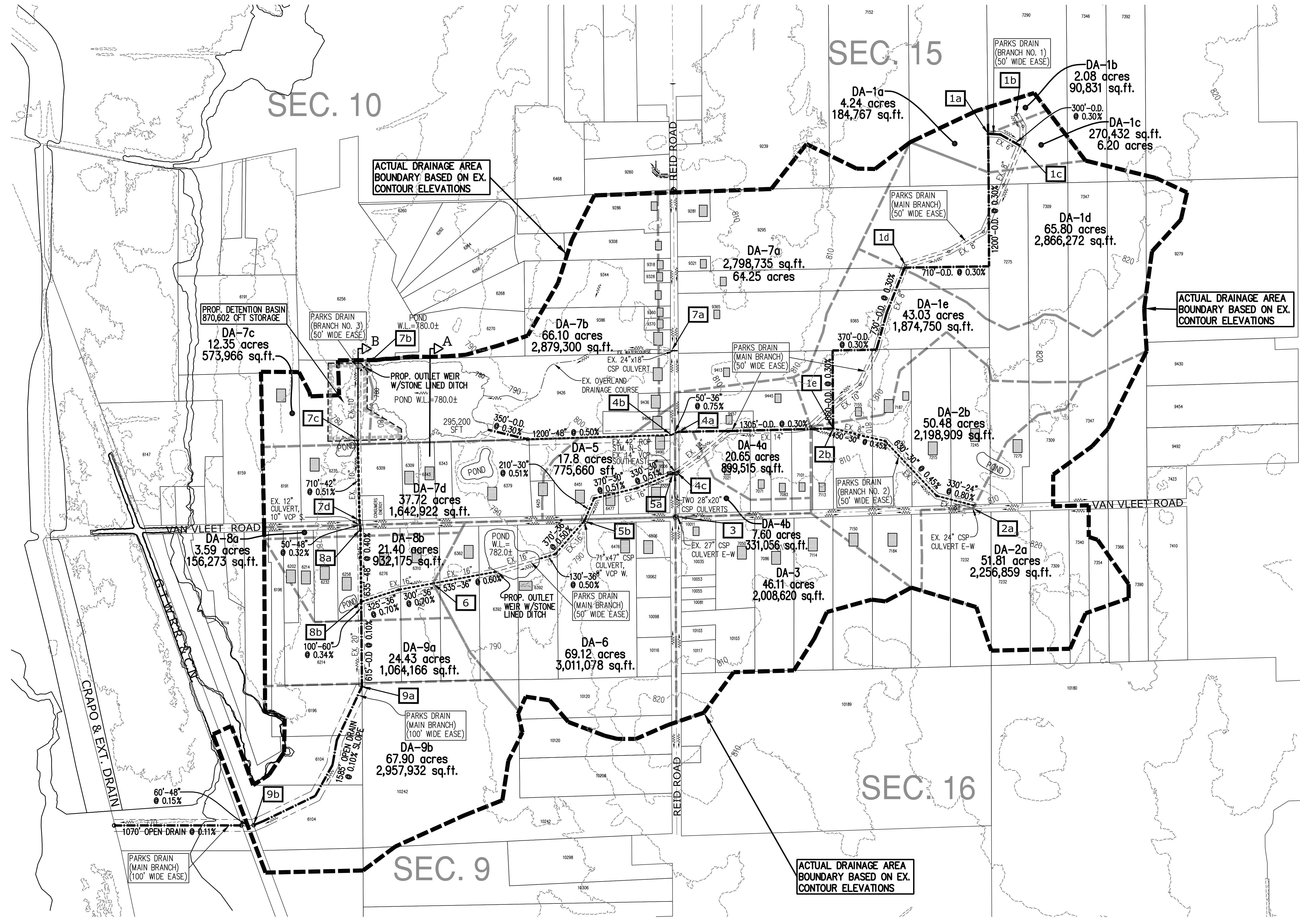
| Time conc min | I 100 | CwA | Qin | Qout/Qallow | Qin-Qout Ft ³ /s | V=(Qin-Qout)*Tc*60 Ft ³ | RETENTION (X2 OF DET) |
|------------------|-------------|---------------|---------------|--------------|--------------------------------|---------------------------------------|--------------------------|
| 10 | 5.77 | 116.10 | 669.88 | 77.40 | 592.48 | 355,487.81 | 710,975.63 |
| 20 | 4.60 | 116.10 | 534.05 | 77.40 | 456.65 | 547,975.44 | 1,095,950.88 |
| 30 | 3.90 | 116.10 | 452.78 | 77.40 | 375.38 | 675,680.94 | 1,351,361.88 |
| 40 | 3.40 | 116.10 | 394.73 | 77.40 | 317.33 | 761,591.52 | 1,523,183.04 |
| 50 | 3.00 | 116.10 | 348.29 | 77.40 | 270.89 | 812,673.00 | 1,625,346.00 |
| 60 | 2.70 | 116.10 | 313.46 | 77.40 | 236.06 | 849,822.84 | 1,699,645.68 |
| 70 | 2.50 | 116.10 | 290.24 | 77.40 | 212.84 | 893,938.50 | 1,787,877.00 |
| 80 | 2.30 | 116.10 | 267.02 | 77.40 | 189.62 | 910,190.88 | 1,820,381.76 |
| 90 | 2.10 | 116.10 | 243.80 | 77.40 | 166.40 | 898,579.98 | 1,797,159.96 |
| 100 | 1.90 | 116.10 | 220.58 | 77.40 | 143.18 | 859,105.80 | 1,718,211.60 |
| 110 | 1.80 | 116.10 | 208.97 | 77.40 | 131.57 | 868,392.36 | 1,736,784.72 |
| 120 | 1.70 | 116.10 | 197.36 | 77.40 | 119.96 | 863,747.28 | 1,727,494.56 |
| 130 | 1.60 | 116.10 | 185.76 | 77.40 | 108.36 | 845,170.56 | 1,690,341.12 |
| 140 | 1.50 | 116.10 | 174.15 | 77.40 | 96.75 | 812,662.20 | 1,625,324.40 |
| 150 | 1.45 | 116.10 | 168.34 | 77.40 | 90.94 | 818,465.85 | 1,636,931.70 |
| 160 | 1.40 | 116.10 | 162.54 | 77.40 | 85.14 | 817,303.68 | 1,634,607.36 |
| 170 | 1.30 | 116.10 | 150.93 | 77.40 | 73.53 | 749,966.22 | 1,499,932.44 |
| 180 | 1.25 | 116.10 | 145.12 | 77.40 | 67.72 | 731,389.50 | 1,462,779.00 |
| 190 | 1.20 | 116.10 | 139.32 | 77.40 | 61.92 | 705,846.96 | 1,411,693.92 |
| 200 | 1.15 | 116.10 | 133.51 | 77.40 | 56.11 | 673,338.60 | 1,346,677.20 |
| 210 | 1.10 | 116.10 | 127.71 | 77.40 | 50.31 | 633,864.42 | 1,267,728.84 |
| 220 | 1.00 | 116.10 | 116.10 | 77.40 | 38.70 | 510,800.40 | 1,021,600.80 |
| 230 | 0.95 | 116.10 | 110.29 | 77.40 | 32.89 | 453,911.67 | 907,823.34 |
| 240 | 0.93 | 116.10 | 107.97 | 77.40 | 30.57 | 440,211.02 | 880,422.05 |
| 270 | 0.83 | 116.10 | 96.36 | 77.40 | 18.96 | 307,160.26 | 614,320.52 |
| 300 | 0.73 | 116.10 | 84.75 | 77.40 | 7.35 | 132,314.58 | 264,629.16 |
| 330 | 0.66 | 116.10 | 76.62 | 77.40 | -0.78 | -15,364.40 | -30,728.81 |
| 360 | 0.62 | 116.10 | 71.98 | 77.40 | -5.42 | -117,068.98 | -234,137.95 |
| 390 | 0.59 | 116.10 | 68.50 | 77.40 | -8.90 | -208,324.82 | -416,649.64 |
| 420 | 0.55 | 116.10 | 63.85 | 77.40 | -13.55 | -341,375.58 | -682,751.16 |
| 450 | 0.53 | 116.10 | 61.53 | 77.40 | -15.87 | -428,451.93 | -856,903.86 |
| 480 | 0.50 | 116.10 | 58.05 | 77.40 | -19.35 | -557,323.20 | -1,114,646.40 |
| 510 | 0.48 | 116.10 | 55.73 | 77.40 | -21.67 | -663,207.26 | -1,326,414.53 |
| 540 | 0.45 | 116.10 | 52.24 | 77.40 | -25.16 | -815,065.74 | -1,630,131.48 |
| 570 | 0.43 | 116.10 | 49.92 | 77.40 | -27.48 | -939,757.52 | -1,879,515.04 |
| 600 | 0.41 | 116.10 | 47.60 | 77.40 | -29.80 | -1,072,808.28 | -2,145,616.56 |



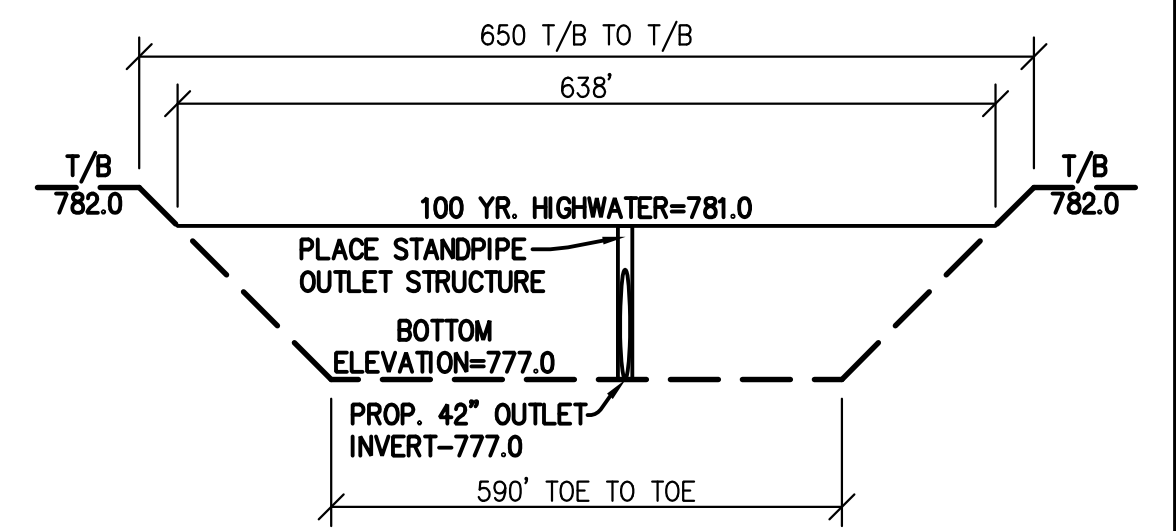
LEGEND

- 810 --- EX. SURFACE CONTOUR LINE
- EX. 14" --- EX. STORM SEWER
- EX. OPEN DRAIN
- EX. DRAINAGE FLOW ARROW
- 8326 EX. BUILDING/HOUSE W/ADDRESS
- PROP. STORM SEWER
- PROP. OPEN DRAIN (O.D.)
- SUB DRAINAGE AREA BOUNDARY
- DRAINAGE AREA BOUNDARY BASED ON EX. CONTOUR ELEVATIONS
- 1d DRAINAGE POINT LOCATION

NOTE:
THE EXISTING 8" TO 12" STORM SEWER IS A CLAY PIPE (VCP) AND THE EXISTING 14" TO 20" STORM SEWER PIPE IS A CONCRETE PIPE (RCP)



EXISTING LAKE/POND CROSS SECTION A-A
442,800 CFT. OF STORAGE



PROPOSED DETENTION BASIN CROSS SECTION B-B
870,600 CFT. OF STORAGE
TOTAL VOLUME REQUIRED:
910,191 CFT.
TOTAL VOLUME PROVIDED:
1,313,400 CFT.

ALTERNATIVE NO. 3:
REPLACE THE EXISTING OPEN DRAIN WITH NEW OPEN DRAIN, AND REPLACE EXISTING PIPE WITH NEW PIPE AND/OR OPEN DRAIN BASED ON THE LOCATION AND PROXIMITY TO EXISTING HOMES AND YARDS, WHILE IMPROVING THE DRAIN ALIGNMENT WHEN PRACTICAL. ALSO RE-ROUTE THE SOUTH SIDE (SOUTH OF REID ROAD) OF THE DRAINAGE AREA TO A PROPOSED DETENTION BASIN TO REDUCE THE SIZE OF THE PIPE SYSTEM.

UTILITY STATEMENT
THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR/ENGINEER MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR/ENGINEER FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE APPROXIMATE LOCATION AS INDICATED, ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR/ENGINEER HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

PRELIMINARY NOT FOR CONSTRUCTION PURPOSES

KES JOB NO. 2012-07

SCALE: 1" = 400'

GENESEE COUNTY DRAIN COMMISSIONER

PREPARED FOR:
GENESEE COUNTY DRAIN COMMISSIONER
DIVISION OF SURFACE WATER MNGT.
G-4608 BEECHER ROAD, FLINT, MI 48532-2617
PHONE: (810) 732-1590 FAX (810) 732-1474
WEBSITE: GDCOWS.COM/SWM

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

PARKS DRAIN #0471
PART OF SECTIONS 9, 10, 15 & 16
T6N-R5E, GAINES TWP,
GENESEE COUNTY, MICHIGAN

EXHIBIT NO. 10
DRAINAGE MAP
ALTERNATIVE NO. 3

| | | | |
|-------------------------|---------------------|------------|-------------------|
| REVISIONS 09.27.2013 | DRN. BY: RADO | 04.11.2013 | SHEET NO: E-14 |
| | DSN. BY: T.L.O. | " | |
| | CKD. BY: M.R.P. | " | |
| | APPR. BY: M.R.P. | " | |