



July 15, 2010 *OK*

Susanne Kubic P.E., Drain Engineer  
Genesee County Drain Commissioner's Office  
4608 Beecher Road  
Flint, MI 48532

RE: Lakeside Landing Drainage Study  
Genesee County, MI

Sue:

This letter report summarizes the results of the drainage study that Spicer Group completed for your office. The study was completed in the vicinity of Lakeside Landing Road in Fenton Township as property owners in the area have been experiencing ongoing and continually worsening flooding and have asked your office for assistance to address the existing flooding problem.

Background

Landowners submitted an application to establish a drainage district and a county drain to address the existing flooding problem. The area where flooding occurs historically has drained and has been serviced by a private clay drainage tile. This tile has recently deteriorated and failed thus creating a drainage problem. The private tile drainage is evident upon review of historic aerial photographs. The landowners wish to have the drainage outlet capacity restored or repaired.

Landowners have stated that old clay tile kept the flooding of the Lakeside Landing area limited to low areas in the woods which would drain within a few days following large runoff events. With the failure of the tile, water stands at higher levels and longer durations than it has in past based on the knowledge of the residents and as it appears on old aerial photos. Landowners have testified that the flooding has adversely impacted property by flooding roads and driveways. Also, it is apparent the flooding and longstanding water is killing trees.

In an attempt to address the problem, a berm and a pump have been installed to maintain dry access to driveways. It is our understanding that the pump is not always functional. We understand the pump must operate continuously and thus is prone to failure and in need of regular inspection and repair. In the past, the pump has failed during runoff events and flooding has occurred.

When the residents submitted an application for the Genesee County Drain Commissioner to establish the drainage district, the Drain Commissioner's maintenance crew was sent out to locate the pipe. This work has resulted in temporarily relieving the flooding, but the tile continues to fail. Furthermore, since the tile is not a county drain, there is not access nor are there easements to the tile. Recently, your office installed a catch basin along the tile near Fenton Road to facilitate the location of the drain. The flow line elevation of the tile at this location is 870.2 feet.

Although the attempts to locate the existing tile have provided some relief, reconstruction or replacement of this tile is needed. The Drain Commissioner's office hired Spicer Group to complete a preliminary drainage study and to develop alternatives and cost estimates completing a drainage improvement project and establishing a county drain.

The engineering study is outlined in this letter and includes the following items:

- Identification of potential shortest route to install a new drain to relieve the flooding.
- Hydrologic and hydraulic calculations.
- Development of design alternatives.
- Preparation of a preliminary cost estimate.

#### Description

The flooding occurs between Lakeside Landing and Fenton Road. The standing water was observed at and elevation of 871.9 feet. The standing water lies adjacent to Lakeside Landing and is visibly impounded by a berm with a small outlet that drains to a catch basin and flows to a pump station. This adjacent area did not consistently gather standing water until five years ago pursuant to testimony and aerial maps.

#### Potential Relief Drain Route

A field investigation was performed to identify possible routes across Fenton Road. It was determined the most appropriate route, having the least impact to resources would be crossing Fenton Road near the sag in the vertical profile of the road adjacent to a natural valley that exists on the East side of the road. This route will require approximately 275 feet of drain be installed to the flooding area at an elevation of approximately 870 feet at the upstream end.

The utilization of existing drainage infrastructure east of Fenton Road was ruled out because the existing easements have numerous private utilities in place and the storm sewer inverts are too high to relieve the flooded areas.

Establishing the historic route of the private drain to be a county drain was considered (Alternative 5); however, this route length is 1,700 feet, being substantially longer than other alternatives. It also requires drain right-of-way easements from numerous landowners whom have not been willing and open to granting them.

#### Alternatives

Five alternatives were considered to reestablish the historic drainage. Each of the alternatives outlet to the same downstream waterway and watershed as the original clay tile does. The alternatives considered include the following:

1. Relief drain that meets Genesee County drain standards.
2. Open cut Fenton Road and install a 15" concrete drain tile.
3. Jack and bore Fenton Road with a 15" concrete drain tile.
4. Directional drill Fenton Road with a 10" H.D.P.E. pipe.
5. Rebuild existing 4" to 6" private tile system in place

#### Alternative 1 – Relief Drain meeting Genesee County drain standards

This alternative assumes a concrete crossing sized according to the Genesee County Drain Commissioner standards using the 25-year storm for the County Road crossing with watersheds less than two square

miles. This alternative requires Fenton Road to be open cut during construction. The crossing size required was determined to be 30" concrete pipe. An estimate has not been prepared for this alternative as it would be more expensive than the other alternatives considered and was identified by your office as not feasible.

**Alternative 2 – Open cut Fenton Road with a 15" concrete drain tile**

This alternative was considered primarily to understand the costs associated with open cutting Fenton Road compared to trenchless alternatives. This alternative provides the same level of service as Alternative 3. It assumes the road would be reconstructed with 8 foot gravel shoulder on both sides. This has been determined to not be feasible due to traffic control issues for closing Fenton Road for a long duration of time.

**Alternative 3 – Jack and bore Fenton Road with a 15" concrete drain tile**

This alternative assumes that typical jack and bore operation would be used to install a concrete drain under Fenton Road with minimal disruption. This method uses a machine that augers out the soil in the path of the pipe and then immediately pushes the pipe in place. An advantage of this method is that the soil is removed from the pipe route instead of being displaced, reducing the risk of ground fracture, heaving or road damage. Another advantage is that the pipe grade can be controlled more precisely and can be flatter than directional drilling. Installing a larger pipe is also feasible using this method.

It is anticipated that numerous utilities require coordination and likely relocation to make this alternative feasible. To construct this alternative a bore pit adjacent to Fenton Road would be excavated and the bore machine would be set in the pit. Upon completion of the bore operation a structure would be constructed at this location and the bore pit would be filled and the area restored. At this time it is assumed that an area sufficient to construct the bore pit is either free of utilities or could be prepared to make this process feasible. There are numerous contractors in Michigan with the capabilities to perform jack and bore operations.

**Alternative 4 – Directional drill Fenton Road with a 10" H.D.P.E. pipe**

This alternative assumes a 10" high density polyethylene pipe would be constructed across Fenton Road through the process of directional drilling. This process uses a machine that pushes a directional drill head along the pipe route injecting drilling mud along the way to prevent a collapse. It then pulls the fused pipe (pressurized) back to the machine. A disadvantage of this method is that it displaces the soil along the pipe route increasing soil pressure on the pipe which can cause ground fracture, heaving or road damage. Another disadvantage is that it is not possible to maintain a precise and consistent pipe grade and low and high points will occur in the installed pipe. A 10" pipe was selected since a smaller pipe will have maintenance issues and a larger pipe is not acceptable for the depth of cut under the road.

It is anticipated that numerous utilities require coordination and possibly require relocation to make this alternative feasible. To construct this alternative a drill pit would be excavated adjacent to Fenton Road. An area on the opposite side of the road, equal to the length of pipe to be pulled, would need to be available to stage the pipe and pipe fusing equipment. Upon completion of the directional drilling operation the pit would be filled and the area restored. At this time it is assumed that an area sufficient to construct the pit is either free of utilities or could be prepared to make this process feasible. There are some contractors in Michigan with the capabilities to perform directional drilling.

**Alternative 5 – Locate and reconstruct the private tile drainage along its existing path**

This alternative assumes that failed and failing tile would be located and replaced. The route of the entire existing 4” to 6” clay tile that would need to be replaced is not completely known at this time. It is apparent that its length is significantly longer than the other alternatives considered. This alternative would provide restrictive conveyance capacity and the surface flooding time after rain events would be significantly longer than the other alternatives considered. This alternative would require drain right-of-way be granted by landowners to rebuild the private tile where it currently exists. We understand the landowners would not be agreeable to granting the required easements for this alternative. Cost estimates were not prepared for this alternative because it was determined not feasible.

**Hydrology and Hydraulics**

Hydrology and hydraulic calculations were reviewed from a previous study for the private residents when the flooding began to worsen. These calculations have been updated to reflect the historic drainage patterns and to consider the effect of installing a relief drain using either an open cut method or a trenchless method. Using the trenchless method, replacement of Fenton Road could be avoided, but the size of the pipe that can be installed is smaller. It appears the landowners were satisfied with the drainage capacity of the existing 4” to 6” until it began to fail; therefore, dewatering duration of up to 36 hours was considered to be acceptable after storm events.

The drainage area was determined by a combination of GIS analysis using the 2-foot contours from Genesee County and a field investigation. The drainage area was determined to be 43.8 acres, bounded approximately by Log Cabin Road, Fenton Road, Wenwood Road and the homes along Lake Fenton. A GIS file of the drainage area used in these calculations can be provided upon request.

The design storm flow and volume for the proposed alternatives were determined based on the NRCS TR-55 method since the time of concentration is less than an hour. Rainfall values were selected based on NRCS values for Genesee County, and were generally in agreement with values from the Rainfall Frequency Atlas of the Midwest (Huff, Angel). The following summarizes the Hydrology and Hydraulic analysis performed for the 10-year, 25-year and 100-year events:

	<u>10-Yr Event</u>	<u>25-Yr Event</u>	<u>100-Yr Event</u>
Rainfall Depth	3.13 in.	3.6 in.	4.36 in.
Peak Runoff	26.4 cfs	36.5 cfs	54.0 cfs
Runoff Volume	3.49 ac-ft	4.65 ac-ft	6.62 ac-ft
<u>Alternative 1 - 30" Concrete Pipe, open cut</u>			
Peak Outflow	14.6 cfs	17.0 cfs	21.4 cfs
Peak Storage Volume	0.81 ac-ft	1.19 ac-ft	2.00 ac-ft
Peak Stage	870.4	870.54	870.82
<u>Alternative 2 - 15" Concrete Pipe, Open Cut Fenton Road</u>			
Peak Outflow	6.4 cfs	7.0 cfs	7.7 cfs
Peak Storage Volume	1.26 ac-ft	1.88 ac-ft	3.04 ac-ft
Peak Stage	870.56	870.78	871.09
Dewatering Duration	18 hours		20 hours
<u>Alternative 3 - 15" Concrete Pipe, Jack and Bore Fenton Road</u>			
Peak Outflow	6.4 cfs	7.0 cfs	7.7 cfs
Peak Storage Volume	1.26 ac-ft	1.88 ac-ft	3.04 ac-ft
Peak Stage	870.56	870.78	871.09
Dewatering Duration	18 hours		20 hours

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<u>Alternative 4 - 10" H.D.P.E Pipe, Direction Drill Fenton Road</u>			
Peak Outflow	3.2 cfs	3.5 cfs	3.8 cfs
Peak Storage Volume	1.61 ac-ft	2.36 ac-ft	3.78 ac-ft
Peak Stage	870.69	870.92	871.28
Dewatering Duration	24 hours		33 hours

Alternative 5 -Locate and reconstruct the private tile drainage  
Does not provide 10, 25 or 100 year conveyance capacity, therefore these events were not analyzed.

#### Required Easements

Drain right-of-way easements are required for the construction of the relief drain requiring research of parcel ownership during final design. Coordination with the Genesee County Road Commission will also be required in order to construct the relief drain in Fenton Road right-of-way.

#### Cost Estimates

Attached please find the cost estimates for the alternatives 2, 3 and 4. Alternative 1 and 5 were determined not feasible therefore estimates were not prepared for either.

#### Permitting

Permitting may be required for specific aspects of certain alternatives and have not been considered under the scope of work performed. Permit activities will need to be performed by the County or considered during the final steps of the project.

#### Next Step

Upon authorization to proceed with "Step Two" of the scope of work, a preliminary plan of the selected alternative will be prepared as well as a drainage district description, a drainage district map and route and course description.

Please contact us at (989) 754-4717 if you have any questions or concerns.

Sincerely,

**Timothy A. Inman, P.E., P.S., CFM**  
Project Manager

**SPICER GROUP, INC**  
230 S. Washington Avenue  
Saginaw, MI 48607  
Phone: (989) 754-4717 ext. 5540  
Cell: (989) 239-4907

C: SGI File # 118162SG2009

**PRELIMINARY ESTIMATE OF COST**  
**Drainage Infrastructure Improvements - Alternative 2, Open Cut Fenton Road**  
**Lakeside Landing Subdivision**  
**Genesee County, MI**  
**6/15/2010**

<b>Item No.</b>	<b>Estimated Quantity</b>	<b>Unit</b>	<b>Description</b>	<b>Unit Price</b>	<b>Amount</b>
<b><u>DRAINAGE IMPROVEMENTS</u></b>					
1.	1	Each	3 ft. diameter concrete manhole structure Includes risers and trash rack	\$1,500.00	\$1,500.00
2.	2	Each	4 ft. diameter concrete manhole structure	\$3,500.00	\$7,000.00
3.	275	Lin. Ft.	15" R.C.P. (CL-76, CL IV) Storm Sewer	\$40.00	\$11,000.00
4.	1	Lump Sum	15" R.C.P. Flared End Section w/ Trash Grate	Lump Sum	\$600.00
5.	500	Lin. Ft.	6" Corrugated Plastic Tile with Sock	\$15.00	\$7,500.00
<b><u>EROSION CONTROL</u></b>					
6.	1	Each	Plain Riprap Energy Dissipator Includes riprap and geotextile	\$1,500.00	\$1,500.00
<b><u>SITE WORK</u></b>					
7.	1	Lump Sum	Cleanup, Restoration, Seeding, and Soil Erosion and Sediment Control	Lump Sum	\$4,000.00
8.	1	Lump Sum	Traffic Control	Lump Sum	\$20,000.00
<b><u>FENTON ROAD RECONSTRUCTION</u></b>					
9.	140	Sq. Yds.	HMA Pavement Removal	\$3.00	\$420.00
10.	470	Cu. Yds	Granular Backfill Compacted in Place	\$7.50	\$3,525.00
11.	230	Sq. Yds.	12" Aggregate Base Course	\$15.00	\$3,450.00
12.	17	Ton	2" MDOT 13A Bituminous -- Leveling Course	\$85.00	\$1,445.00
13.	13	Ton	1 1/2" MDOT 13A Bituminous -- Wearing Course	\$85.00	\$1,105.00
14.	90	Sq. Yds.	8' Gravel Shoulder	\$10.00	\$900.00
15.	30	Cu. Yds.	Topsoil	\$20.00	\$600.00
<b>SUB-TOTAL ESTIMATED CONSTRUCTION COST-----</b>					<b>\$64,545.00</b>

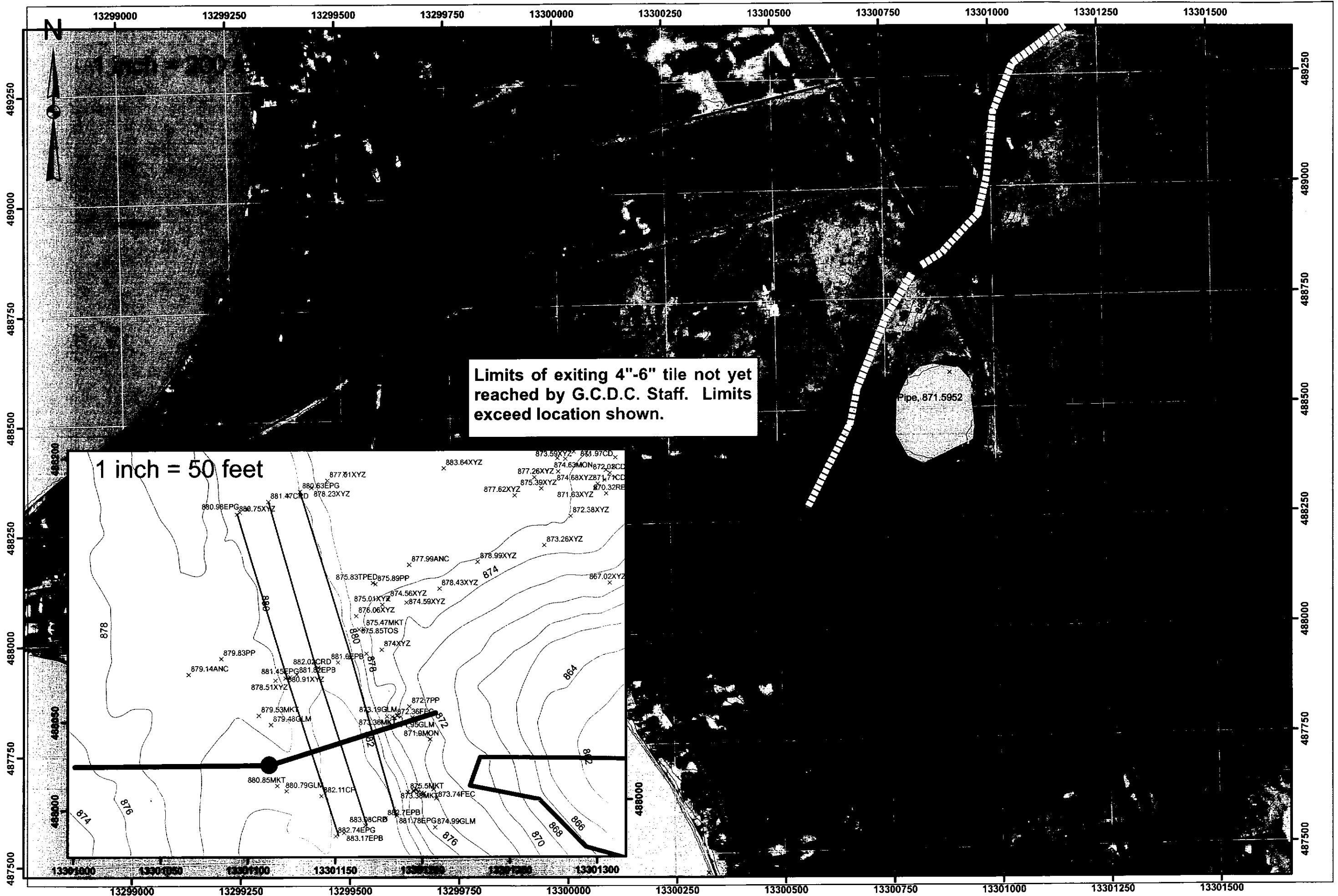
**PRELIMINARY ESTIMATE OF COST**  
**Drainage Infrastructure Improvements - Alternative 3, Concrete Jack and Bore**  
**Lakeside Landing Subdivision**  
**Genesee County, MI**  
**6/15/2010**

<b>Item No.</b>	<b>Estimated Quantity</b>	<b>Unit</b>	<b>Description</b>	<b>Unit Price</b>	<b>Amount</b>
<b><u>DRAINAGE IMPROVEMENTS</u></b>					
1.	1	Each	3 ft. diameter concrete manhole structure Includes risers and trash rack	\$1,500.00	\$1,500.00
2.	2	Each	4 ft. diameter concrete manhole structure	\$3,500.00	\$7,000.00
3.	175	Lin. Ft.	15" R.C.P. (CL-76, CL IV) Storm Sewer	\$40.00	\$7,000.00
4.	1	Lump Sum	15" R.C.P. Flared End Section w/ Trash Grate	Lump Sum	\$600.00
5.	500	Lin. Ft.	6" Corrugated Plastic Tile with Sock	\$15.00	\$7,500.00
<b><u>EROSION CONTROL</u></b>					
6.	1	Each	Plain Riprap Energy Dissipator Includes riprap and geotextile	\$1,500.00	\$1,500.00
<b><u>SITE WORK</u></b>					
7.	1	Lump Sum	Cleanup, Restoration, Seeding, and Soil Erosion and Sediment Control	Lump Sum	\$3,000.00
8.	1	Lump Sum	Traffic Control	Lump Sum	\$5,000.00
<b><u>BORE AND JACK UNDER FENTON ROAD</u></b>					
9.	100	Lin. Ft.	Bore and Jack 15" R.C.P. Storm Sewer	\$300.00	\$30,000.00
<b>SUB-TOTAL ESTIMATED CONSTRUCTION COST-----</b>					<b>\$63,100.00</b>

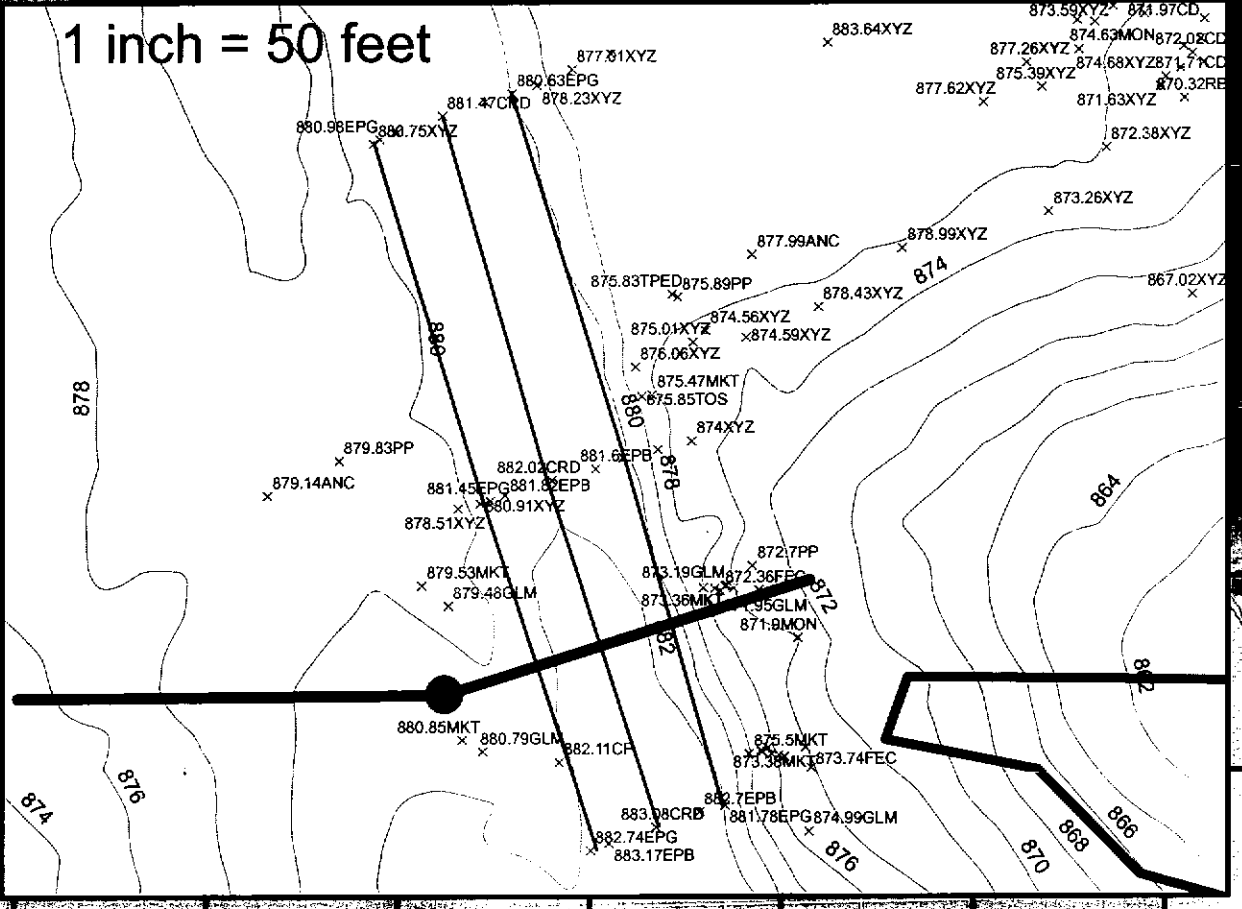
**PRELIMINARY ESTIMATE OF COST**  
**Drainage Infrastructure Improvements - Alternative 4, HDPE Directional Drill**  
**Lakeside Landing Subdivision**  
**Genesee County, MI**  
**6/15/2010**

<b>Item No.</b>	<b>Estimated Quantity</b>	<b>Unit</b>	<b>Description</b>	<b>Unit Price</b>	<b>Amount</b>
<b><u>DRAINAGE IMPROVEMENTS</u></b>					
1.	1	Each	3 ft. diameter concrete manhole structure Includes risers and trash rack	\$1,500.00	\$1,500.00
2.	2	Each	4 ft. diameter concrete manhole structure	\$3,500.00	\$7,000.00
3.	175	Lin. Ft.	15" H.D.P.E. Dual Wall Storm Sewer	\$25.00	\$4,375.00
4.	1	Lump Sum	10" Flared End Section w/ Trash Grate	Lump Sum	\$600.00
5.	500	Lin. Ft.	6" Corrugated Plastic Tile with Sock	\$15.00	\$7,500.00
<b><u>EROSION CONTROL</u></b>					
6.	1	Each	Plain Riprap Energy Dissipator Includes riprap and geotextile	\$1,500.00	\$1,500.00
<b><u>SITE WORK</u></b>					
7.	1	Lump Sum	Cleanup, Restoration, Seeding, and Soil Erosion and Sediment Control	Lump Sum	\$6,000.00
8.	1	Lump Sum	Traffic Control	Lump Sum	\$5,000.00
<b><u>DIRECTION BORE UNDER FENTON ROAD</u></b>					
9.	100	Lin. Ft.	10" H.D.P.E. Storm Sewer (Directional Drilled)	\$70.00	\$7,000.00
<b>SUB-TOTAL ESTIMATED CONSTRUCTION COST-----</b>					<b>\$40,475.00</b>





Limits of exiting 4"-6" tile not yet reached by G.C.D.C. Staff. Limits exceed location shown.



1 inch = 50 feet

Pipe, 871.5952

13299000 13299250 13299500 13299750 13300000 13300250 13300500 13300750 13301000 13301250 13301500

489250 489000 488750 488500 488250 488000 487750 487500

878 876 874 872 870 868 866 864 862 860 858 856 854 852 850 848 846 844 842 840 838 836 834 832 830 828 826 824 822 820 818 816 814 812 810 808 806 804 802 800 798 796 794 792 790 788 786 784 782 780 778 776 774 772 770 768 766 764 762 760 758 756 754 752 750 748 746 744 742 740 738 736 734 732 730 728 726 724 722 720 718 716 714 712 710 708 706 704 702 700 698 696 694 692 690 688 686 684 682 680 678 676 674 672 670 668 666 664 662 660 658 656 654 652 650 648 646 644 642 640 638 636 634 632 630 628 626 624 622 620 618 616 614 612 610 608 606 604 602 600 598 596 594 592 590 588 586 584 582 580 578 576 574 572 570 568 566 564 562 560 558 556 554 552 550 548 546 544 542 540 538 536 534 532 530 528 526 524 522 520 518 516 514 512 510 508 506 504 502 500 498 496 494 492 490 488 486 484 482 480 478 476 474 472 470 468 466 464 462 460 458 456 454 452 450 448 446 444 442 440 438 436 434 432 430 428 426 424 422 420 418 416 414 412 410 408 406 404 402 400 398 396 394 392 390 388 386 384 382 380 378 376 374 372 370 368 366 364 362 360 358 356 354 352 350 348 346 344 342 340 338 336 334 332 330 328 326 324 322 320 318 316 314 312 310 308 306 304 302 300 298 296 294 292 290 288 286 284 282 280 278 276 274 272 270 268 266 264 262 260 258 256 254 252 250 248 246 244 242 240 238 236 234 232 230 228 226 224 222 220 218 216 214 212 210 208 206 204 202 200 198 196 194 192 190 188 186 184 182 180 178 176 174 172 170 168 166 164 162 160 158 156 154 152 150 148 146 144 142 140 138 136 134 132 130 128 126 124 122 120 118 116 114 112 110 108 106 104 102 100 98 96 94 92 90 88 86 84 82 80 78 76 74 72 70 68 66 64 62 60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0