

**#1679 SHIAWASSEE RIVER,
CAPPELL BRANCH**

Part of Section 28, T5N-R5E
Argentine Township
Genesee County
Michigan

PRELIMINARY ENGINEERING REPORT (PHASE I)

March 2008
Rev. June 2008

Prepared For-

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-Prepared By-

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TABLE OF CONTENTS

<u>DESCRIPTION</u>	<u>PAGE</u>
Summary.....	3
Detailed Discussion of problem	4
Solutions, costs and recommendation.....	5
Capacity of downstream pipes.....	6
Tributary Areas.....	6
Existing Land Use.....	6
Hydrology.....	7
Peak Flow Computations.....	8
Hydraulics.....	8
Historic Water Levels.....	9
Stage Storage and Existing Outlet Capacity.....	9
Wetlands.....	10
Exhibit 1 – Site Location Map.....	11
Exhibit 2 – Tax ID and Address Map.....	12
Exhibit 3 – Drainage District Map.....	13
Exhibit 4 – Existing Storm Sewer Location Map.....	14
Exhibit 5 – Storm Sewer Location Map (Prior to Jan. 2008).....	15
Exhibit 6 – Plan, Profile and Report for Existing Storm Sewer.....	16
Exhibit 7 – Wetland Inventory Map.....	17
Exhibit 8 – Existing water level and Wetland Inventory Map.....	18
Exhibit 9 – Stage Storage Chart.....	19
Exhibit 10 – Volume Computation for 100 Year Storm.....	20
Exhibit 11 – Alternate Plan 2.....	21
Exhibit 12 - Alternate Plan 3.....	22
Exhibit 13 – Estimated Cost.....	23

SUMMARY

The purpose of this report is to identify the causes of the ongoing flooding in the vicinity of Bird Road South of Silver Lake Road in Sections 28, T5N-R5E, Argentine Township, Genesee County, Michigan (see Exhibit #1 site location map) and to establish the historic water levels for the area and to recommend methods to bring the waters levels back to the historic levels.

A petition was submitted to the Genesee County Drain Commissions office to help resolve flooding along the East side of BIRD road. Subsequently; a Board of Determination Meeting was held for the **#1679 Shiawassee River, Cappell Branch** on June 19, 2007 at the Argentine Township hall. Eleven area residents spoke at the meeting regarding the persistent high water level in the low area East of Bird Road and South of Silver Lake Road. Comments were made about decks, sheds, driveways and swimming pools being flooded and in some cases being ruined. References were also made regarding acres of dead trees and tiles and pipes under Bird Road that may have been cut by the telephone company. It was the opinion of the majority of the residents that spoke that something had to be done about the high water.

Following Public comment and discussion among board members, a motion was made, seconded and passed, establishing the need for a drain.

Based on our field observations, discussions with residents and comments made at the public hearing there are 5 issues that need to be addressed.

1. The cause of the flooding.
2. Solutions to resolve the flooding.
3. The ability of the downstream storm sewer to accommodate various rainfall events.
4. Determination of approximate historical water levels.
5. The impact on the existing and preexisting wetlands.

DETAILED DISCUSSION OF PROBLEM:

The area subject to flooding is the East sub-area of a 152.5 Acre tributary area that drains north along Bird Road to the Shiawassee River (See Exhibit 3 Drainage area map). The tributary area is made up of three sub-areas: (1) The East sub-area which is about 82.5 Acres, and lies East of Bird Road and South of Silver Lake Road. (2) The West sub-area which is about 61.5 acres in size and lies West of Bird Road and South of Silver Lake Road. and (3) The NW sub-area which is about 8.5 Acres in size and lies North of Silver Lake Road and West Bird Road.

As mentioned above it is the East sub-area that is experiencing unusually high water levels. Parcel owner of 10199 Silver Lake Road stated at the public hearing "back in 1995 there was a 1 foot stream and now it's a pond". Resident of 10143 Silver Lake Road states at the hearing "he has been there 9 years as a property owner. He has had no problems for the last 2-3 winters. Now the water table has been flooding onto his deck" (See Exhibit # 2 tax ID and Address map). Hundreds of dead trees can be seen from both Silver Lake and Bird Roads where water stands now. Many of these trees are Ash, however there are many large mixed hardwoods such as red oak, Maple and Hickory. Also several Black Willows have died due to extended flooding. According to www.na.fs.fed.us Black willow "flourishes at, or slightly below, water level and is not appreciably damaged by flooding". The depth of the water, near two large dead black willows trees was measured in January 2008 to be 47 Inches.

The water elevation in January 2008 was 855.1, with a water surface area of approximately 31 Acres. The historic water elevation is estimated to have been about 851.5 with a water surface area of approximately 1 Acre or less. The existing flooding has inundated in excess of 20 Acres of emergent and forested wetlands according to the "wetland inventory maps" (see exhibit #7 Wetland inventory map) as well as upland areas. Residents have reported the water over Bird Road. Which would have been at an elevation of 857 or higher. A resident at 15259 Bird Road said that there were times that he had to take a boat get to his garage

There is a catch basin on the west side of Bird Road approximately 500 Feet South of Silver Lake Road (See Exhibit #4 & #5, Storm sewer location map). There is a 10" pipe going north, out of the catch basin at an elevation of 849.6. There is a 6" pipe coming in from the West, an 8" pipe from the South and a 12" pipe from the East, all at an elevation of 849.6. Maintenance crews from the Genesee County Drain Commissioner's Office have dug up the 12" pipe on the East side of Bird Road and cleaned the pipe under the road, so that it is flowing freely. When they try to clean the pipe to the East they get about 90' and can't go any further. There was no flow coming from the East, so they installed a 6" riser to an elevation of 854.7 to provide a temporary outlet.

This riser has maintained the water surface in a range from 854.9 on 1/28/08 to 855.19 on 1/9/08. **The cause of the subject flooding is the plugged 12" pipe East of Bird Road**

SOLUTIONS:

Initially, the water level on the east side of Bird Road needs to be lowered to the lowest level possible, as soon as possible, without creating flooding or an erosion problem downstream. This would allow the Counties maintenance crews to try to locate, clean, inspect and possibly repair the existing 12" line to the east. Based on elevations taken through the ice we think its possible that this pipe may extend as far as 200' more or less east to deeper waters. If this pipe can not be located or repaired than one of the alternates below may be implemented to help eliminate future problems.

ALTERNATE 1 (Nothing)

Do nothing beyond maintenance to the existing system, Flooding will continue or get worse. Area residents are likely to incur additional losses and cost. The cost would \$14,540.

ALTERNATE 2 (Pipe)

Construct a catch basin with an overflow outlet over the existing 12" pipe on the east side of Bird Road and install a new 12" pipe 300' more or less east to the deeper waters. The estimated cost to complete would be \$39,175 (See Exhibit 11 and 13).

ALTERNATE 3 (ditch)

Construct a catch basin with an overflow outlet over the existing 12" pipe on the east side of Bird Road and excavate or dredge a ditch 300' more or less east to the deeper waters. The estimated cost to complete would be \$28,020 (See Exhibit 12 and 13).

RECOMMENDATION

The impact of the high water on the affected residents is to severe to do nothing; subsequently, Alternate 1 should not be considered. Alternates 2 and 3 are very similar. The site is in a rural sitting with no houses close by; consequently, visual impact is a low priority and economics are important. Therefore we are recommending Alternate 3. The placement of a pipe or ditch in a regulated wetland will require a MDEQ permit.

CAPACITY OF DOWNSTREAM PIPES

The storm line in Bird Road South of Silver Lake Road is a 10" PVC line at 0.27%. North of Silver Lake Road the storm system starts out as a 10" PVC pipe at 0.12% and changes to a 12" pipe at 0.14+% as you go north to the river (See Exhibit 4). Some of these pipes have been replaced recently during the repair of the nearby sanitary sewer along Bird Road. This system has adequate capacity to pass the 10 year or larger storm event with the available upstream detention (See Exhibit 6). It appears that this system functioned well until recently. If flows exceeded the system capacity, any overflow coming out of the catch basins simply flowed down the Bird Road ditch north to the Shiawassee river.

TRIBUTARY AREAS

For the purpose of this report, drainage basin maps for the three sub-areas were prepared (See Exhibit 3). These maps are based on: field observation, recent surveys by Delta Land Surveying & Engineering, Inc., and topographical information, provided by The Drain Commissioners staff from recent aerial photography. The total of all tributary areas is less than 300 acres.

EXISTING LAND USE, GROUND COVER AND SOILS

The existing land use for the tributary areas is rural farmland or large acreage parcels and low lying marsh and wetland areas. The majority of the soils in the tributary area belong to the Conover loam and the Carlisle muck soil series. The Conover series consist of somewhat poorly drained, nearly level undulating soils on till plains. The seasonal high water level may be as little as 1 to 2 feet below the surface. Conover loam belongs to the Soil Conservation Services Hydrological Soil group "C". Soils having a slow infiltration rate when thoroughly wetted and consisting chiefly of soils with a layer that impede downward movement of water or soils with moderately fine-to-fine texture." The Carlisle Muck soil Series is made up 48' or more of moderately well decomposed fibrous organic material in low lying areas. The water level is at or near the surface during the wet season. When dry this series has a high water absorption capacity. Carlisle muck belongs to the Soil Conservation Services Hydrological Soil group "A/D". (See, Soil Survey of Genesee County Michigan map sheet #48). A run-off coefficient "C" of 0.35 was used for all upland areas, North of Silver Lake Road. This value is consistent with areas that have been divided into parcels of two or more Acres. South of Silver Lake Road where Carlisle muck exist in large low lying areas the "C" value can vary from .15 to 1.0 (water) depending on the season and antecedent rainfall. A run-off coefficient of C= 0.35 was used to best represent the likely average of these low lying areas and the upland acreage parcels in this area. These values take into consideration the lack of paved streets, paved driveways, rooftops and other hard surface areas typically seen with more intense land uses.

HYDROLOGY:

The Genesee County Drain Commissioners Office allows the use of the rational method for determining peak 10-year flows where the tributary area is less than 300 acres. The rational was used for this preliminary report and for estimating peak flows and pipe sizes.

The rational method formula is
"Q=CIA"

Where: "Q" is the design flow in CFS.

"A" is the tributary area in acres.

"i₁₀" is the rainfall intensity for a ten year storm in inch per hour.

"T" is the time of concentration in minutes

"C" is the weighted composite Run-off from the contributing upstream area.

The Areas "A" and sub areas were determined from site observation and field survey.

The rainfall intensity "i₁₀" is determined from the Genesee County Drain Commission charts for a 10 year storm and is approximated by the formula:

$$i_{10}=116.37/(T+23.30)$$

The rational method takes into consideration numerous site variables including slope, land use, ground cover, antecedent rainfall, soils and other sub area characteristics. The accuracy of the rational method is directly proportionate to the Engineers knowledge and experience in determining C-values and times of concentrations.

DETENTION:

Detention volumes were calculated for the 100 year storm event using the intensity/duration tables provided by the Drain Commissioner's Office and the following formulas:

$$V=(Q_{in}-Q_{out})t \quad \text{where: } Q_{in} = \text{CIA from rational formula above in cfs}$$
$$Q_{out} = \text{allowable discharge in cfs}$$
$$t = \text{time in minutes}$$
$$V = \text{volume in cubic feet}$$

See Exhibit 10

PEAK FLOW COMPUTATIONS:

The tributary areas were analyzed and peak flows were calculated using a combination of the rational method and detention computations as described above.

To determine the time of concentration and rainfall intensity for pipe flows the following was used:

1. The overland slope was determined to be 0.4%
2. The ground cover is consistent with "short grass pasture & lawns"
3. The initial time of concentration was determined by Genesee County Drain Commission approved formulas and charts. This time in all cases was less than the 30 minute minimum; subsequently 30 minutes was used.
4. Time of travel in pipes was added to the initial time of concentration to determine subsequent times of concentration.
5. Rainfall intensity for the 10-year design storm was used (total tributary area is less than 300 acres).
6. The rainfall intensities "i" was then computed using the formula $i_{10} = 166.37 / (T_c + 23.30)$.

HYDRAULICS:

To determine pipe and channel flows the computer software StormCAD, by Haestad Methods was used. This software makes use of Manning's Equation, which takes into consideration slope, pipe or channel conditions and pipe or channel geometry.

Manning's formula is:

$$Q = 1.486 \times a \times R^{2/3} \times S^{1/2} / n$$

Where:

1.486 is the conversion factor for English units

"a" is the flow area of the pipe or channel

R is the Hydraulic radius defined as a/p where "a" is the flow area and "p" is the wetted perimeter of the pipe or channel

"n" is the Manning coefficient of friction

"s" is the slope of the pipe or channel in feet/foot

The StormCAD program also computes the hydraulic grade line and shows it graphically on the profiles (see exhibit 6) for easy analysis of the results.

HISTORICAL WATER LEVELS:

As mentioned earlier, there are hundreds of dead trees standing in the water east of Bird Road. Many of these trees are 50 to 100 years old or older. Based on comments from residents, it appears most of these trees, have died in the last 3 to 8 years. The rise in water levels, caused by the failure of the 12" line east of Bird Road, is obviously responsible for a large percentage of this dramatic loss. Among these dead trees are several Black Willow and Northern Red Oak trees. The Black willow tree typically thrives when their root system is at or near the normal water level and can tolerate flooding for extended times. However, they can't survive, permanent inundation. The water depth near some of these willows was measured to be 47" or more, which would put the grade around these willows at an elevation of about 850.6. The water depth near some 18"-24" dead red oak trees, behind 10199 Silver Lake Road, was measured to be 24" to 30". This would put the elevation of the ground around these oak trees at about 853. "Although northern red oak is found in all topographic positions, it always grows best on lower and middle slopes with northerly or easterly aspects, in coves and deep ravines, and on well-drained valley floors and above moist floodplains" (dukeforest.duke.edu). Based on this discussion it is estimated the historical water level of this area is in the approximate range of 850.6 to 853. The water level was at 856 in January 2008. The invert elevation of the plugged 12" line east of Bird Road is 850.1, this is consistent with the 850.6 low water estimate.

STAGE STORAGE AND EXISTING OUTLET CAPACITY:

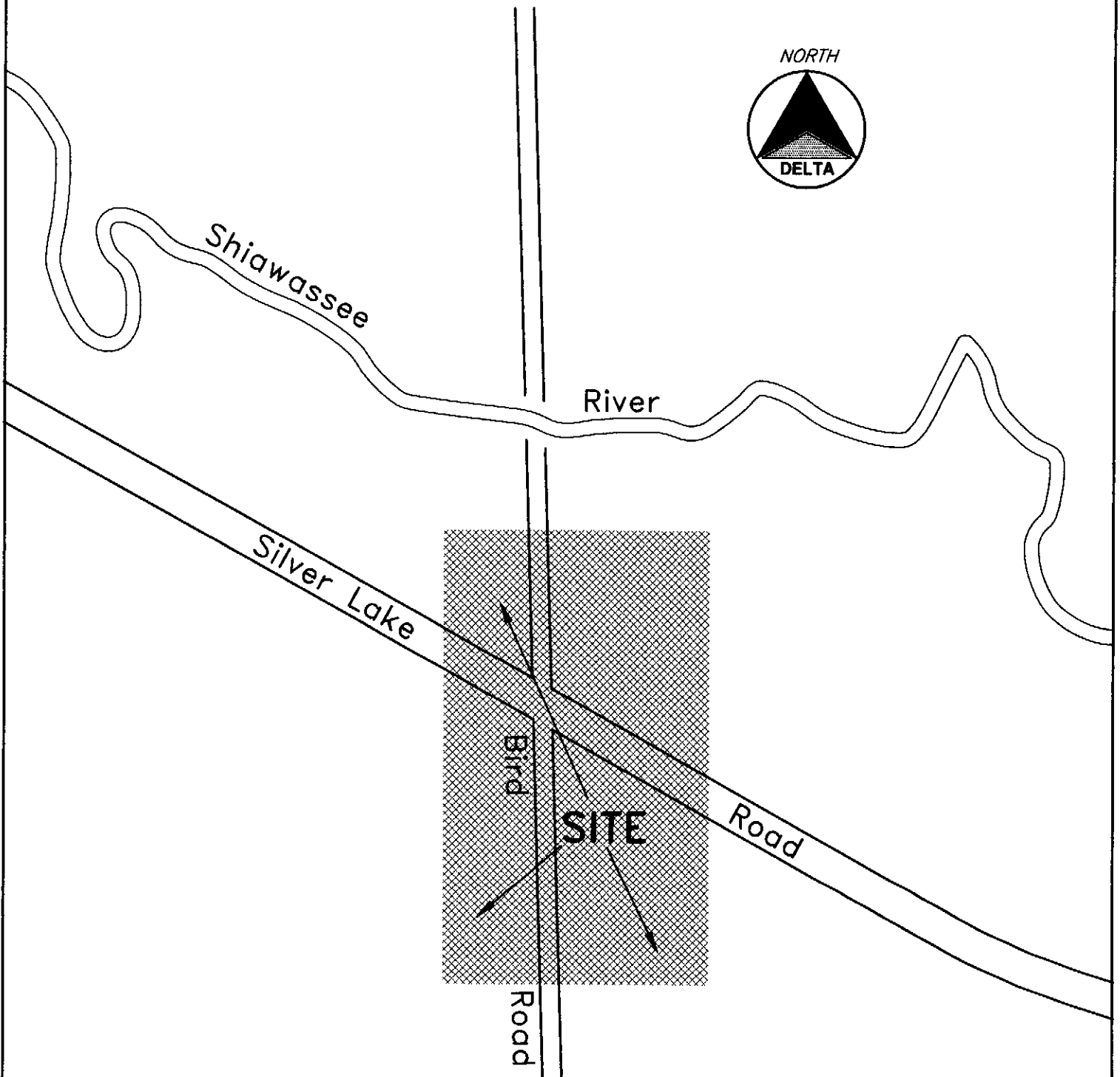
Using elevations from field observations in combination with topographical information provided, a stage storage chart (see exhibit 9) was prepared. This chart indicates that at the assumed high water level of 853.0 approximately 15 AcFt of storage volume is available. Using the Counties format to calculate the required 100 year storage volume for detention basins, and working backward, it was found that a discharge of 1.75 cfs satisfied the run-off characteristics of the tributary area, with a required storage volume of 14.03 ac-ft (see exhibit 10). Using this discharge, a hydraulic grade line was calculated through the existing storm sewer system from the outlet to catch basin I-1, for the 100 year return frequency storm. The HGL elevation at catch basin I-1 was calculated to be 852.55 (see HGL exhibit 6). This is the high water elevation that would be expected, given the existing hydrology of the tributary area and the hydraulics of the existing outlet. The Red Oak trees mentioned above could survive at this elevation. Considering the accuracy of the information available and the approximate methods used, this is reasonably close to the assumed high water elevation of 853, estimated in the above paragraph. Exhibit #8 shows the water surface of 856 in January 2008 compared to the estimated historical high water surface of 853.

WETLANDS:

Exhibit 7 was taken from the States wetland inventory map. Exhibit 8 shows wetlands relative to the existing water surface. As can be seen from exhibit 8, large areas of emergent, scrub shrub and forested wetlands are now open water. The inventory maps don't show any open water. If the historical water level could be re-established the wetland areas are likely to revert back to their original state.

Exhibits 1 – 13

EXHIBIT #1 SITE LOCATION MAP
FOR SECTION 28, ARGENTINE TOWNSHIP, GENESEE COUNTY, MICHIGAN



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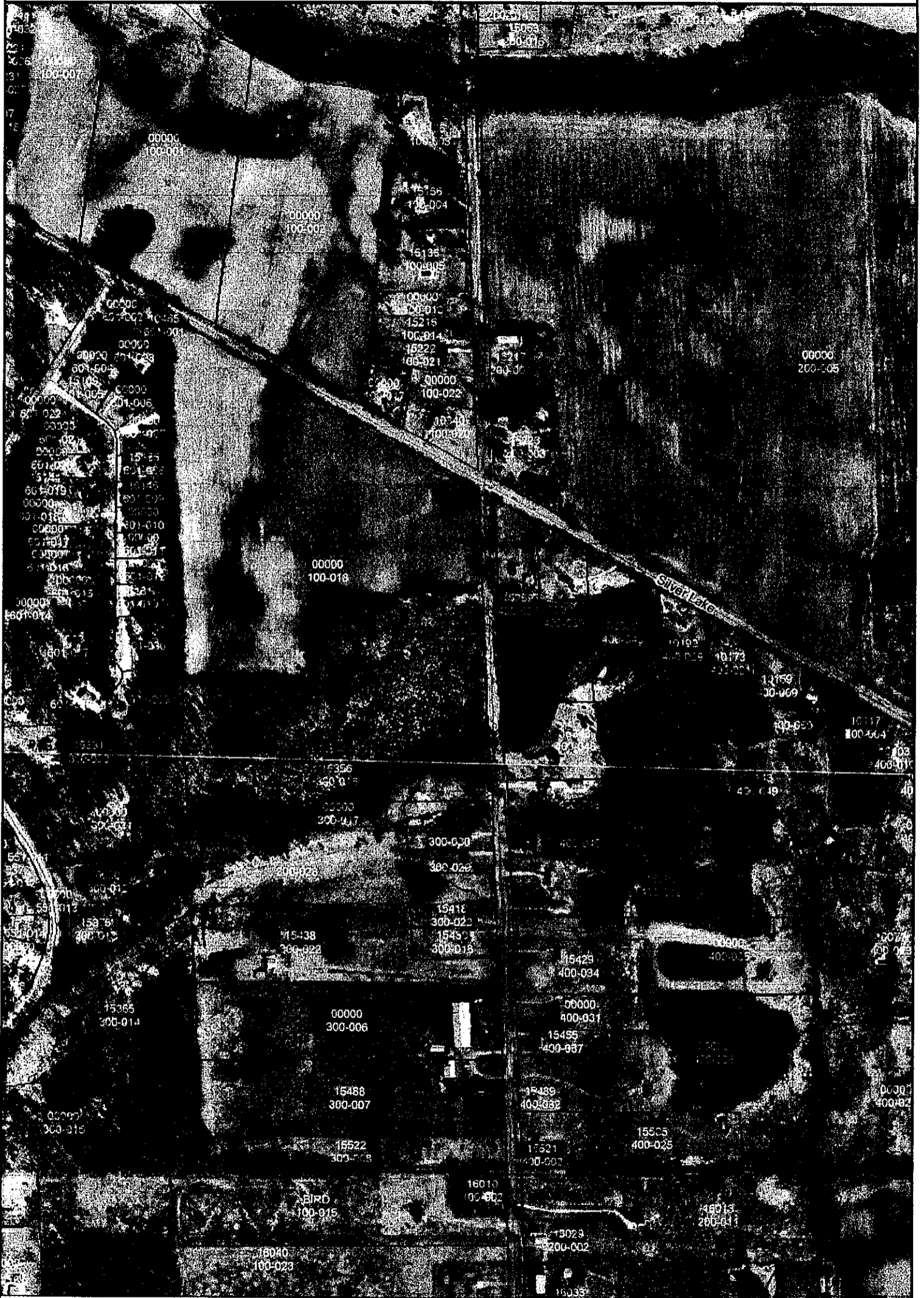
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Date 04-28-2008

EXHIBIT #2 TAX I.D. & ADDRESS MAP
 FOR SECTION 28, ARGENTINE TOWNSHIP, GENESEE COUNTY, MICHIGAN



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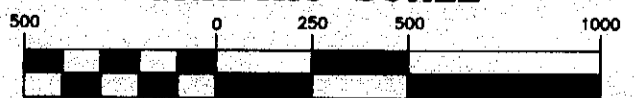
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Date 04-28-2008

GRAPHIC SCALE



1 inch = 500 ft.

EXHIBIT #3 DRAINAGE DISTRICT MAP
 FOR SECTION 28, ARGENTINE TOWNSHIP, GENESEE COUNTY, MICHIGAN



SHIAWASSEE RIVER

DRAIN DISTRICT AREAS

NORTHWEST AREA = 8.5 Ac.
 WEST AREA = 61.5 Ac.
 EAST AREA = 82.5 Ac.
 TOTAL AREA = 152.5 Ac.

TOTAL NORTHWEST AREA 8.5 Ac.

NW #4
2.5 Ac.

NW #3
1.2 Ac.

NW #2
0.9 Ac.

NW #1
3.9 Ac.

SILVER LAKE

WEST AREA
61.5 Ac.

EAST AREA
82.5 Ac.

ROAD

ROAD

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GRAPHIC SCALE

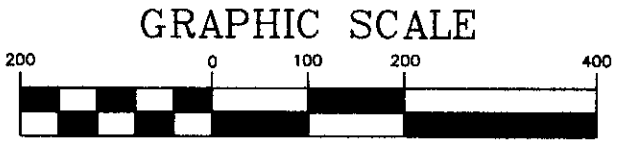


1 inch = 500 ft.

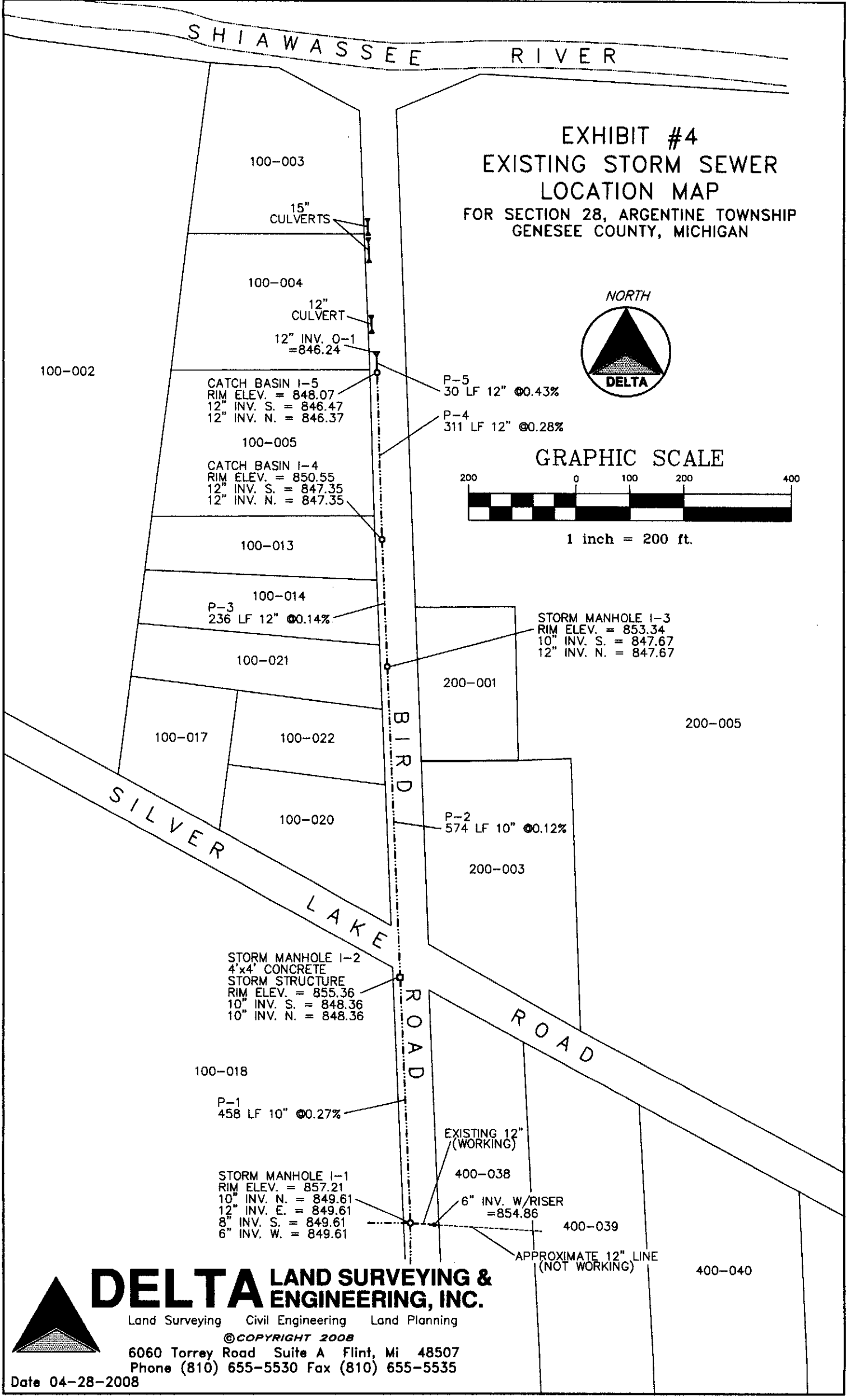
Date 04-28-2008

SHIAWASSEE RIVER

EXHIBIT #4
EXISTING STORM SEWER
LOCATION MAP
 FOR SECTION 28, ARGENTINE TOWNSHIP
 GENESEE COUNTY, MICHIGAN



1 inch = 200 ft.



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Date 04-28-2008

SHIAWASSEE RIVER

EXHIBIT #5
 STORM SEWER LOCATION MAP
 PRIOR TO 01/2008
 FOR SECTION 28, ARGENTINE TOWNSHIP
 GENESEE COUNTY, MICHIGAN



GRAPHIC SCALE



1 inch = 200 ft.

100-002

100-003

15" CULVERTS

100-004

12" CULVERT
 12" INV. = 844.42

100-005

590 LF 12" @0.55%

100-013

10Q-014

10Q-021

100-017

100-022

100-020

SILVER LAKE

BIRD ROAD

200-001

200-005

STORM MANHOLE
 RIM ELEV. = 853.34
 10" INV. S. = 847.67
 12" INV. N. = 847.67

574 LF 10" @0.12%

200-003

4'x4' CONCRETE
 STORM STRUCTURE
 RIM ELEV. = 855.36
 10" INV. S. = 848.36
 10" INV. N. = 848.36

100-018

458 LF 10" @0.27%

EXISTING 12" (WORKING)

400-038

STORM MANHOLE
 RIM ELEV. = 857.21
 10" INV. N. = 849.61
 12" INV. E. = 849.61
 8" INV. S. = 849.61
 6" INV. W. = 849.61

6" INV. W/RISER = 854.86

400-039

APPROXIMATE 12" LINE (NOT WORKING)

400-040



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Date 04-28-2008

EXHIBIT #6 PLAN, PROFILE & REPORT

FOR SECTION 28, ARGENTINE TOWNSHIP, GENESEE COUNTY, MICHIGAN

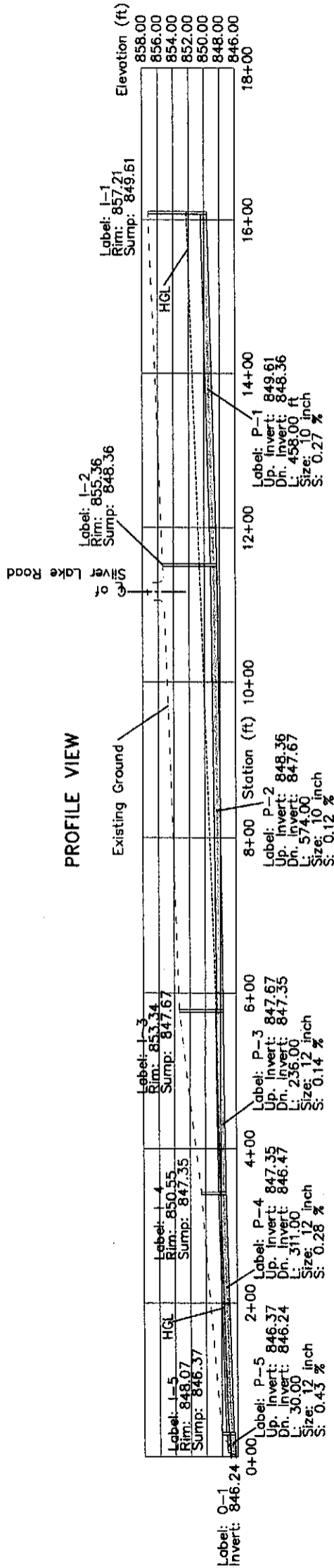
LEGEND

- P-1 Pipe #1
- I-1 Inlet Structure #1
- Existing Ground - - - -
- HGL - - - - -

PLAN VIEW

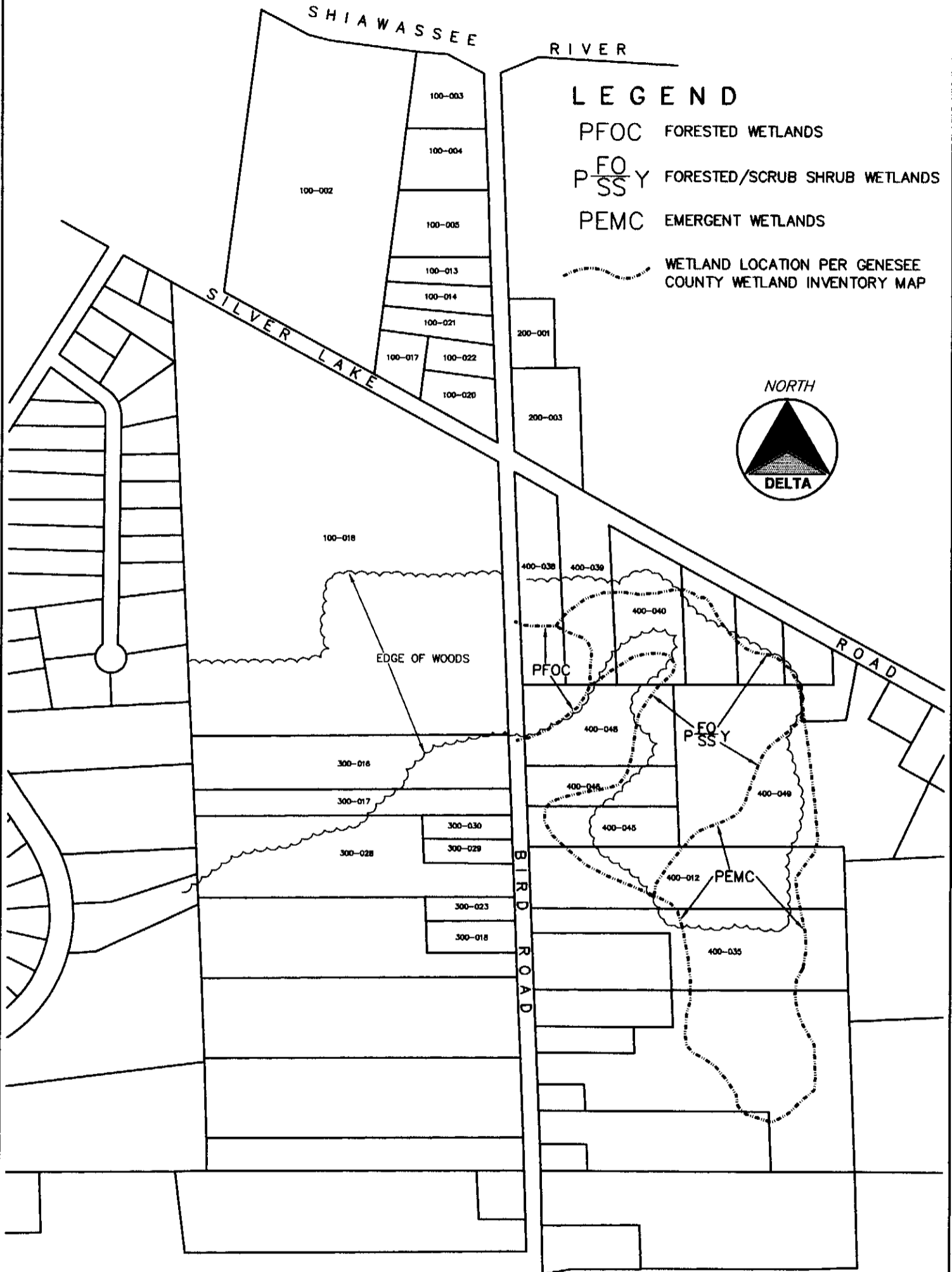


PROFILE VIEW



Label	Upstream Node	Downstream Node	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (%)	Section Size (inch)	Mannings (n)	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Rim Elevation (ft)	Downstream Rim Elevation (ft)	Upstream HGL Elevation (ft)	Downstream HGL Elevation (ft)	Average Velocity (ft/s)	System Rational Flow (cfs)	Upstream Rational Flow (cfs)	Hydraulic Slope (%)
P-1	I-1	I-2	0.0	0.00	0.00	0.00	0.00	1.70	458	0.27	10 inch	0.01	1.49	849.61	848.36	857.21	855.36	852.27	850.64	3.12	0.00	0.00	0.36
P-2	I-2	I-3	0.0	0.00	0.00	0.00	0.00	1.70	574	0.12	10 inch	0.01	0.99	848.36	847.67	855.36	853.34	850.64	848.60	3.12	0.00	0.00	0.36
P-3	I-3	I-4	3.9	0.35	1.36	0.27	2.07	2.07	236	0.14	12 inch	0.01	1.71	847.67	847.35	853.34	850.55	848.60	848.08	3.06	0.37	3.00	0.22
P-4	I-4	I-5	0.9	0.35	0.32	0.27	2.16	2.16	311	0.28	12 inch	0.01	2.46	847.35	846.47	850.55	848.07	848.08	847.10	3.85	0.46	0.69	0.31
P-5	I-5	O-1	1.2	0.35	0.42	0.27	2.27	2.27	30	0.43	12 inch	0.01	3.05	846.37	846.24	848.07	846.24	847.01	846.88	4.25	0.57	0.92	0.44

EXHIBIT #7 WETLAND INVENTORY MAP
 FOR SECTION 28, ARGENTINE TOWNSHIP, GENESEE COUNTY, MICHIGAN



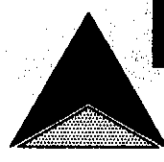
LEGEND

PFOC FORESTED WETLANDS

PFOSSY FORESTED/SCRUB SHRUB WETLANDS

PEMC EMERGENT WETLANDS

WETLAND LOCATION PER GENESEE COUNTY WETLAND INVENTORY MAP



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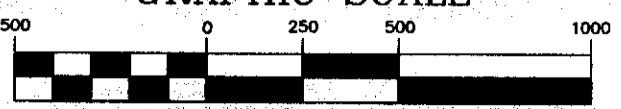
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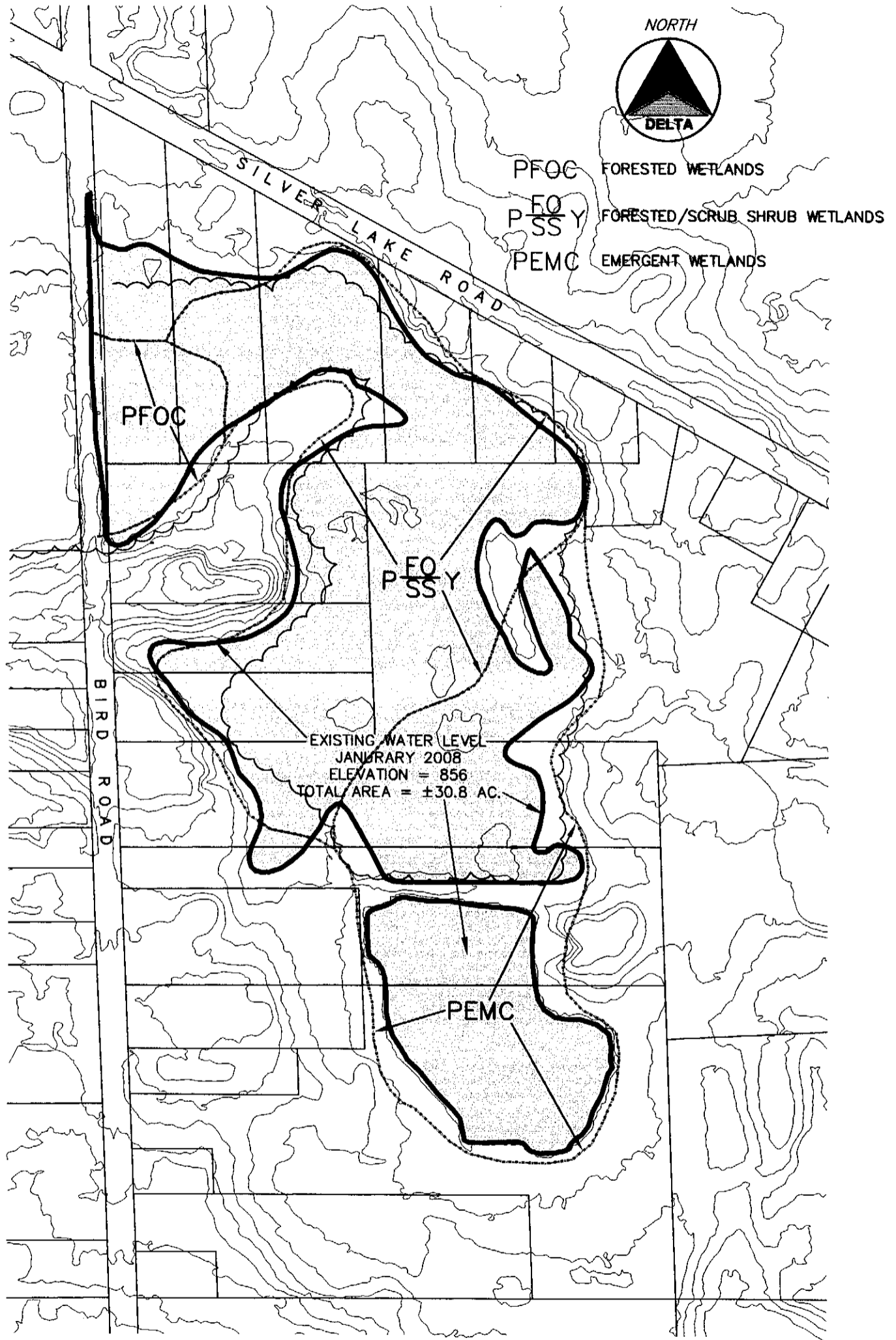
Date 04-28-2008

GRAPHIC SCALE



1 inch = 500 ft.

EXHIBIT #8 EXISTING WATER LEVEL & WETLAND MAP
 FOR SECTION 28, ARGENTINE TOWNSHIP, GENESEE COUNTY, MICHIGAN



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Date 04-28-2008

GRAPHIC SCALE



1 inch = 300 ft.

Exhibit #9 Stage-Storage

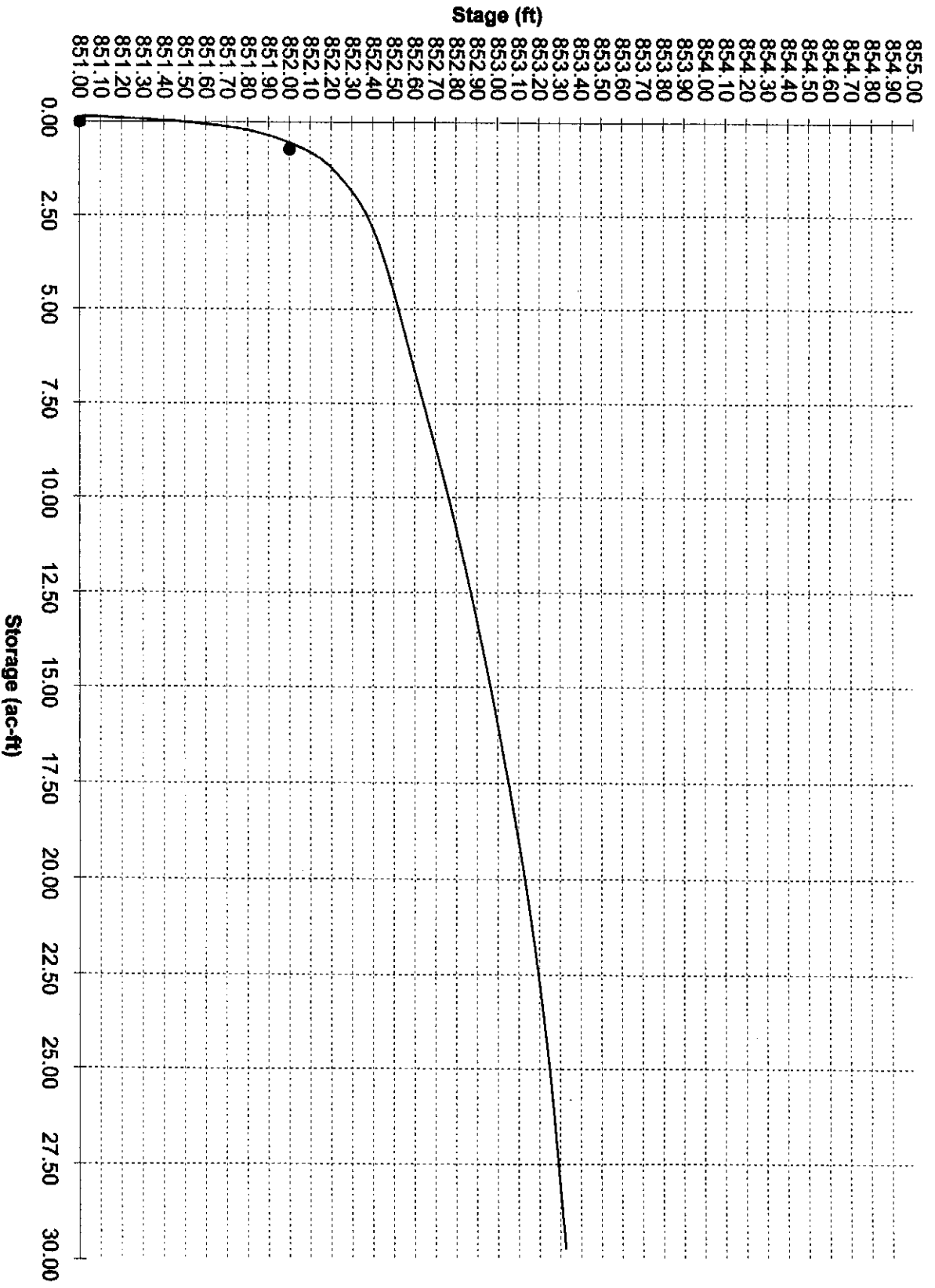


Exhibit #10

GENESEE COUNTY DRAIN COMMISSION STORMWATER DETENTION DESIGN 100 YEAR STORM

PROJECT **Cappell #1679** **1.75 cfs discharge @ .35**

1. DETERMINATION OF ALLOWABLE DISCHARGE

BASIN AREA	144	AC (INPUT)
MAXIMUM DISCHARGE	1.75	CFS (INPUT)

2. DEVELOPED COEFFICIENT OF RUNOFF

Wt. C = **0.35** (INPUT)

4. DETERMINATION OF DETENTION VOLUME

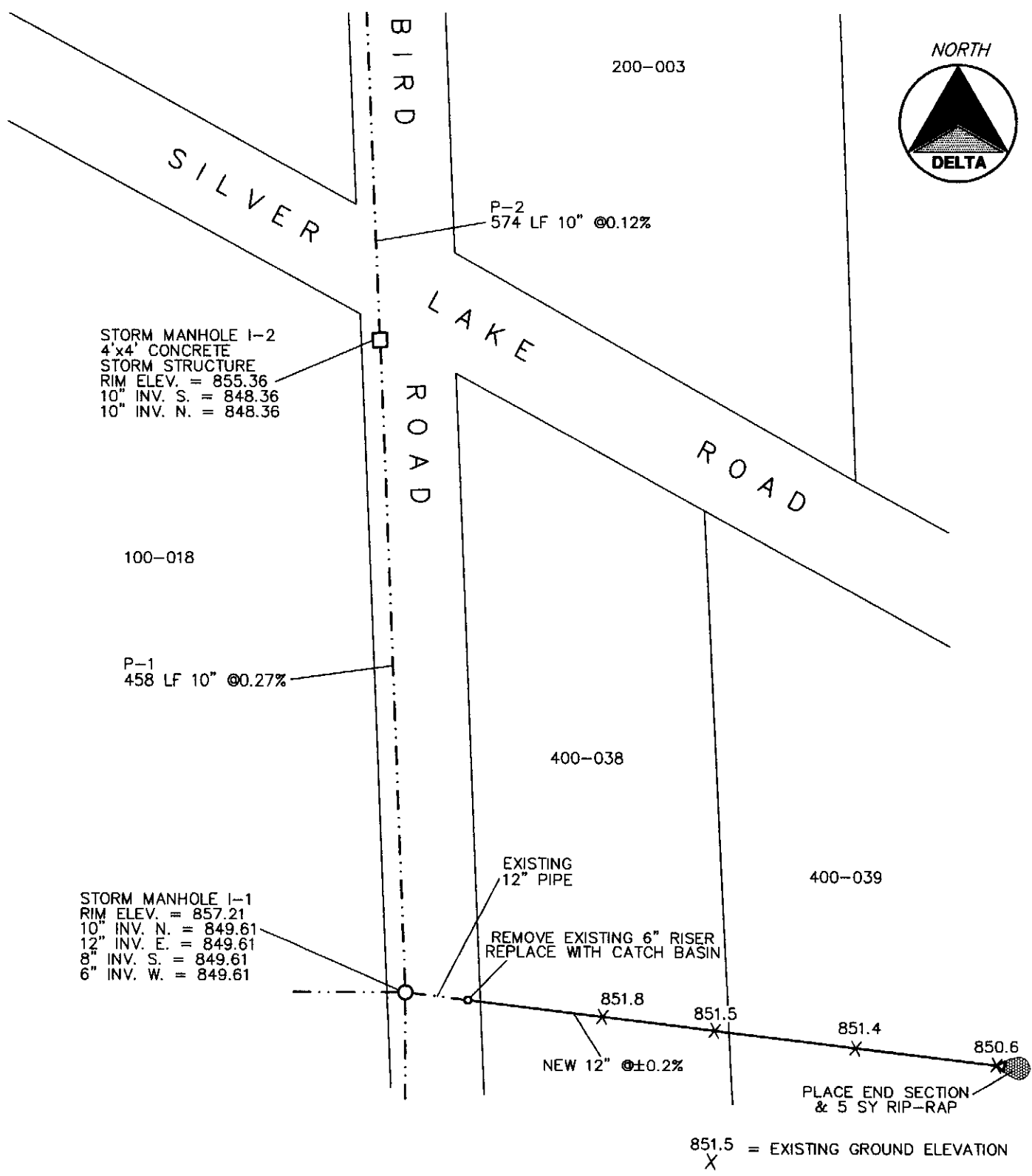
STORAGE VOLUME CALCULATION

Tc (MIN)	i100 (IN/HR)	CwA (A IN AC)	Qin (CFS)	Avg. Qout (CFS)	Qin-Qout (CFS)	VOL (CF)
100	1.83	50.40	92.00	1.75	90.25	541500
200	1.02	50.40	51.29	1.75	49.54	594504
300	0.71	50.40	35.56	1.75	33.81	608549
325	0.66	50.40	33.03	1.75	31.28	609875
350	0.61	50.40	30.83	1.75	29.08	610676
375	0.57	50.40	28.91	1.75	27.16	611049
400	0.54	50.40	27.21	1.75	25.46	611070
425	0.51	50.40	25.70	1.75	23.95	610799

MIN.VOLUME TO BE STORED:

611070 CF
14.03 AcFt

EXHIBIT #11 ALTERNATE PLAN "2"
FOR SECTION 28, ARGENTINE TOWNSHIP, GENESEE COUNTY, MICHIGAN



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 Land Surveying Civil Engineering Land Planning
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 Phone (810) 655-5530 Fax (810) 655-5535
 Date 04-28-2008

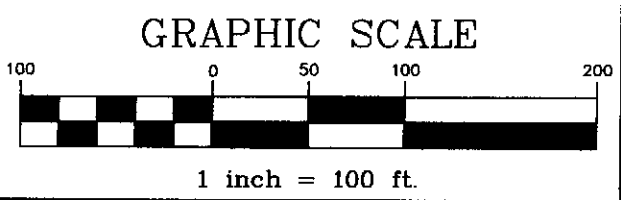
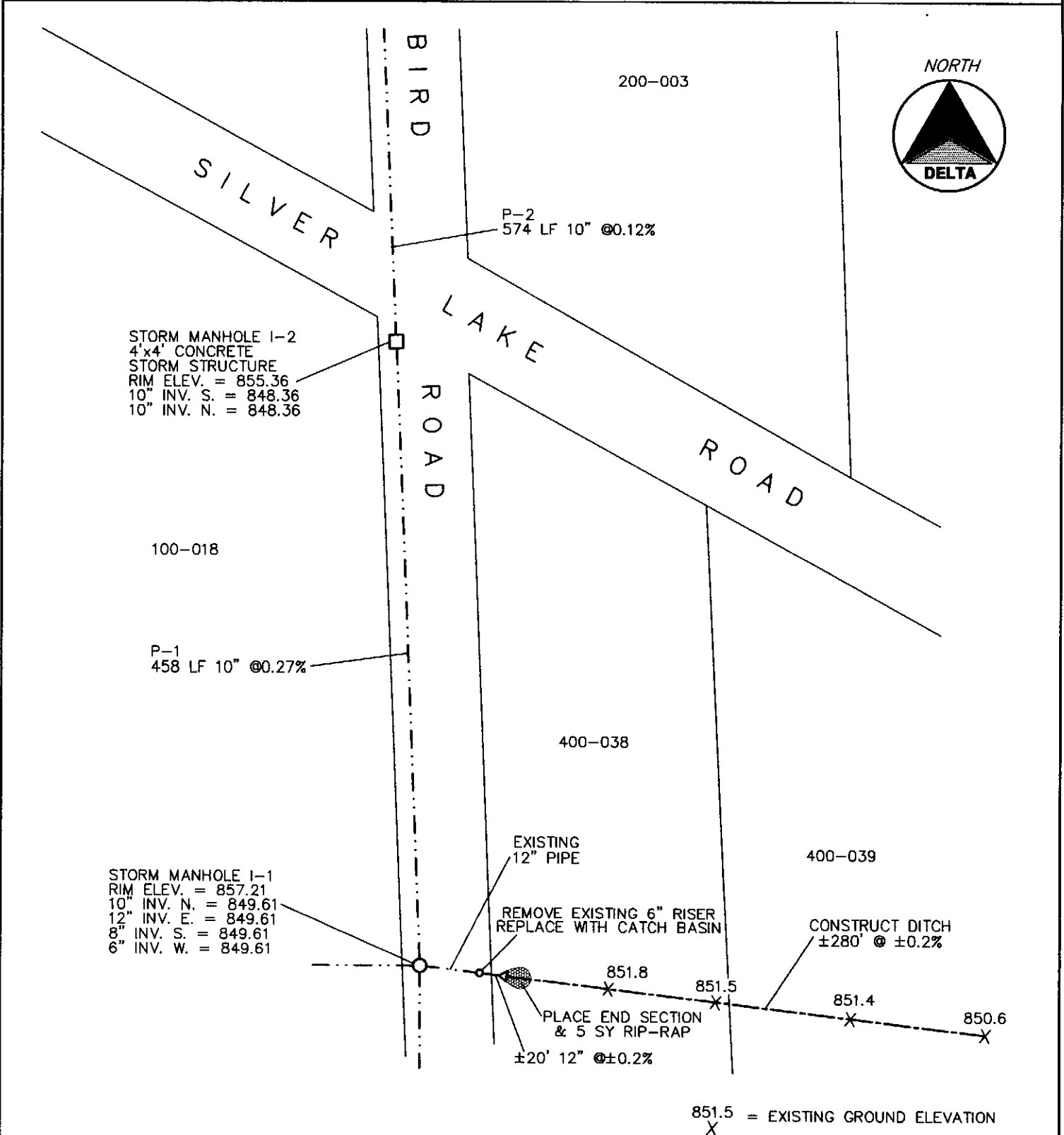


EXHIBIT #12 ALTERNATE PLAN "3"
 FOR SECTION 28, ARGENTINE TOWNSHIP, GENESEE COUNTY, MICHIGAN



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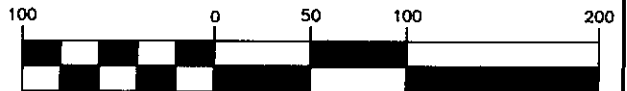
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GRAPHIC SCALE



1 inch = 100 ft.