Escanaba, MI

Ludington Street Drainage Assessment

July 07, 2015

City of Escanaba

Escanaba, Michigan

Draft: 03-09-15

Final: 07-07-15

c2ae

elevating human achievement

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SUMMARY

Purpose

This study was authorized by the City of Escanaba on 11-06-14. The purpose of the study is to evaluate storm water drainage issues in the 10th to 15th Streets area of Ludington Street within the City and to recommend a plan (with estimated costs) to address the drainage issues. Need for concurrent utility improvements are also to be reviewed as appropriate.

Existing Conditions

The study area is served by a 12" storm sewer, 8" sanitary sewer, and 6" water main. The sanitary sewer and water main are likely over 50 years in age. Street surface pavements are rated poor to good.

Evaluation

For the most part, the area storm drainage system appears to be undersized. City provided records and previous planning documents were reviewed.

Storm flow calculations were run on the storm sewers to determine size increases needed for adequate area drainage. Run-off used in the calculations was based on MDOT Zone 2, Ten Year Storm Rainfall Intensity Tables.

The City of Escanaba reviewed the "draft" report submitted March 2015 and met with C2AE to discuss comments in June 2015. Those discussions resulted in several costs revisions in the report and the evaluation of a second potential stormwater outfall location near the east end of Ludington Street.

Recommendations

It is recommended that an adequately sized storm drainage system (sewers) be installed to bring the surface run-off causing the drainage issues directly to the Bay. It is also recommended that other utility issues (primarily water main) be addressed at the same time to economize on construction costs and public disruption.

Estimated project costs (in 2015 dollars) are summarized in the tables below. The costs have been broken into segments to allow the City to plan for separate funding sources for each segment if desired.

Base 3rd Avenue North (Basic Marine Area) Outfall

Segment	Estimated Total Project Cost
Outfall From 3rd Ave N & 12th St to the Bay	$1,101,000
North 12th St From Ludington to 3rd Ave N	$1,396,000
Ludington St Between 11th St and 15th ST	$1,925,000
TOTAL	**$4,422,000**

Alternate Ludington/3rd Street Outfall

Segment	Estimated Total Project Cost
Outfall Ludington from 11th St to 3rd St Outfall	$4,445,000
Ludington St Between 11th St and 15th ST	$1,925,000
TOTAL	**$6,370,000**

PURPOSE

Authorization

This study and report was authorized by the City of Escanaba on 11-06-14 via execution of a letter proposal. The proposal letter was submitted by C2AE at the City's verbal request.

Study Area

The study area is Ludington Street between 10th and 15th Streets, an area that has experienced storm drainage issues for a number of years. An aerial site map and existing utilities map are included as Figures 1 and 2 on the following pages.

Scope of Work

It is anticipated that the City would address the area's drainage problems through a three stage approach:

- Phase A – Storm Drainage Assessment (should be partially eligible for SAW Grant reimbursement)
- Phase B – Mapping, design, permitting, and plans/specifications development
- Phase C – Bid and construct

This study is intended to cover Phase A – Storm Drainage Assessment

Task 1 – Stormwater System Inventory and Assessment

- Gather existing site mapping from City Engineering (SAW)
- Review and evaluate the City's 2005 "Storm Sewer Model" Report
- Inventory/inspect storm drainage structures in the assessment area (SAW) where needed to generate viable recommendations
- Develop storm drainage patterns from the existing mapping
- Assess capacity and routing for future drainage

Task 2 – Wastewater System Inventory and Assessment

- Inventory/inspect wastewater collection structures in the assessment area (SAW) where needed to generate viable recommendations
- Assess capacity and routing for continued collection system operation

Task 3 – Capital Improvements Plan Recommendation

- Provide a recommendation of improvements to address deficiencies developed in the system assessments (SAW)
- Provide a recommendation of incidental improvements that would be beneficial to undertake along with stormwater improvements such as water distribution deficiency correction
- Provide an opinion of probable project costs to undertake the above to allow inclusion in capital improvement planning

Drainage Issues

The driving force behind the study is the City's awareness of continuing surface drainage issues affecting the Ludington Street area during heavy wet weather events. The area lacks an adequate storm drainage system creating the potential for street flooding affecting traffic and for street drainage to enter private property areas.

Other Utilities

This area of Ludington Street is served by a 6" cast iron water main and an 8" vitrified clay pipe (VCP) sanitary sewer. The water main is part of the City's distribution network serving this section of the City. The sanitary sewer flows to the City's Ludington Street Pump Station across the street from the Municipal Dock. From there flows are pumped approximately ½ mile south where gravity feed to the wastewater treatment plant picks it up.

During evaluation of a second east Ludington Street outfall location (near 3rd Street), it was noted that most of the water main east of 10th Street is 8" and the sanitary sewer progressively increases in size to 20" as it nears the Ludington Pump Station.

Gas, electric, telephone, and cable are also present in the planning areas and must be coordinated with during planning, design, and construction.

SAW Program

In October 2015, the City will likely be awarded just under $1 million in Michigan SAW Program Grant funds for both wastewater and stormwater asset manage plans including a storm model. It is anticipated that some of the cost for this current study will be able to be reimbursed under the grant.

Goal

The study goal is to generate a recommended plan with estimated costs to address the drainage issues in the Ludington Study Area. Recommendations as to the appropriateness of concurrent other utility improvements are also to be considered.

Escanaba, MI
Ludington Street Drainage Assessment

Figure 1: Location Map/Aerial

N

3RD AVE NORTH
2ND AVE NORTH
1ST AVE NORTH
LUDINGTON STREET

16TH ST
15TH ST
14TH ST
13TH ST
12TH ST
11TH ST
10TH ST
9TH ST
8TH ST
17TH ST

STUDY AREA

Legend

- Sanitary Sewer
- Storm Sewer
- Water Main

Escanaba, MI
Ludington Street Drainage Assessment

Figure 2: Existing Utilities

EXISTING CONDITIONS

Drainage and Storm Sewers

This area of Ludington Street is served via a 12" storm sewer running from west to east. At 11th Street, it feeds into a 24" storm which runs north to 3rd Avenue North where it joins the 3rd Avenue 24" sewer and discharges to the Bay via a 36" sewer with 48" outfall in the Basic Marine property. The Ludington 12" also collects an additional 20 acres of run-off from the west on Ludington and North on Stephenson. The 24" on 11th Street also collects drainage from the east in the downtown area.

The 12" storm sewer in Ludington is drastically undersized. The 24" in 11th Street and the 36" outfall are also undersized for the expansive areas they currently serve. The lack of an adequately sized storm drainage system creates the potential for street drainage during heavy wet weather events to over-top the street-side curbing and affect private property. Drainage area maps and flow calculations can be found in Appendix 'A'.

The area east of 10th Street is served by 15" to 20" storm sewer feeding a 24" mainline on 1st Avenue North outletting to the Bay via a 36" at 3rd Street near the County Sherriff's complex.

Water Mains

As noted, this area of Ludington street is served by a 6" cast iron water main with individual water services to the commercial buildings typically ¾" to 1" copper. The main is likely 50+ years old. Older cast iron mains generally have leaded joints which are vulnerable to earth (bedding) movement caused leakage.

The well accepted minimum size for water main where fire hydrants are provided is 8".

Both 11th and 12th Streets between Ludington and 3rd Avenue North have 4" mains, also likely well over 50 years old with leaded joints.

Water main east of 10th Street is 8" and not currently planned for replacement.

Sanitary Sewers

The 8" clay sewer down Ludington is likely in fair to good condition except in areas where it is near later installations of other utilities (subject to disturbance of the original pipe bedding). The pipe joints are however not up to modern standards regarding ground water leakage (infiltration). The VCP pipe is strong but brittle; making it susceptible to earth/bedding movement caused structural deficiencies.

Pipe size progressively increases moving to the east to 20" as it nears the Ludington Pump Station on the south side of Ludington across from the Municipal Dock. This is also believed to be VCP.

The sanitary sewers should be internal TV inspected if it has been over 10 years since last done by the City.

Streets

The Escanaba Engineering/Public works Department maintains a "PASER" rating system for City streets to track pavement condition and project maintenance/replacement needs. City provided excerpts can be found in Appendix 'B'.

Recent condition ratings for the streets in the study area are summarized below:

- Rating Scale
  - 9-10 Excellent - Treatment: None
  - 7-8 Good – Treatment: Sealing & Patching
  - 5-6 Fair – Treatment: Preservation Treatments
  - 3-4 Poor – Treatment: Structural Renewal
  - 1-2 Failed – Treatment: Reconstruction
- Ludington St from 10th Ave to 15th Ave – Rating '2'
- 12th St from 1st Ave S to 1st Ave N – Rating '2-3'
- 12th St from 1st Ave N to 3rd Ave N – Rating '3'
- 11th St from 1st Ave N to 3rd Ave N – Rating '8'

- 1st Ave N from 11th St to 13th St – Rating '2-3'

As shown above, this area of Ludington Street and North 12th Street are due to be re-built while North 11th Street is in good condition.

Storm sewer construction could be accomplished with trench repair only but adding either water main or sanitary sewer to a proposed construction project would likely necessitate complete street repaving or re-building if inadequate base material is present (would be quantified with soil borings during a project design phase).

EVALUATION

Fieldwork

In November and December of 2014, C2AE performed several site visits and contracted with a sub-consultant to survey rim elevations and establish State Plane Coordinates for drainage structures in the study area and along the potential outfall route. The data collected is presented in Appendix 'D'.

A dozen drainage structures were inventoried at that time. If additional structure inspections are necessary, they would be accomplished under the upcoming SAW program. Because any planned drainage improvements would include replacement of drainage structures (larger pipes require larger manholes), additional structure inventories are likely not needed to achieve the goals of this study.

Drainage and Storm Sewers

As earlier noted, the storm drainage system in the area is undersized and in need of replacement. A proposed layout for improvements is shown in Figure 3 on the 2nd to last page of the main report body of this report. Sewer sizing drainage areas and flow calculations are included in Appendix 'A'. The flow calculations are based on MDOT Zone 2 Ten Year rainfall intensity tables.

An alternate outfall route down Ludington to 3rd Street and north on 3rd to just northeast of the Sherriff's Department is shown on Figure 4 as the last page in the main body of this report. The proposed outfall would parallel an existing 36" outfall coming from 1st Avenue North which would be left in service continues to serve areas north of Ludington up to 10th Street.

Water Mains

The study area water mains are judged to be undersized for fire protection where 8" minimum is the typical municipal standard and should be replaced with 8" minimum if other infrastructure is already being installed. The exception is the existing 8" water main east of 10th Street which would continue in service.

Sanitary Sewers

The area sanitary sewers are older VCP which is fine if undisturbed and with no pipe bedding settlement or movement. Pipe joints are generally less reliable and prone to groundwater leakage. The area sanitary sewers should be internal TV inspected to allow any needed repair/replacement planning to potentially coincide with other area utility work. The TV inspections should be done before a final scope for Ludington Street improvements is established.

Streets

Street surface condition in the study area varies from poor to good. 11th Street appears to be the best. The relatively narrow 11th and 12th Streets would likely be destroyed by utility construction, especially if more than one pipe is installed (i.e. sewer & water).

City review of the draft report document pointed out several items of concern affecting street reconstruction which were incorporated into project costing including the following:

- Old concrete pavement under Ludington Street to be removed
- Old trolley car track ballast under Ludington Street to be removed
- ADA pedestrian ramp construction experience in the area and its effect on sidewalk and curb replacement

RECOMMENDATIONS

Storm Sewers

Adequately sized storm sewers should be planned to alleviate the area surface drainage issues. It is recommended that proposed sizing be based on 10 year storm capacity which is a typical municipal standard. Anticipated sizing is shown in Figures 3 and 4 which follow.

The following surfaced during City review and discussion of the "draft" report:

- Past City experience in the Ludington area raised concern regarding the amount of curbing, sidewalk, and pedestrian ramp replacement that will be caused by catch basin replacements and costs for this additional effort were added to the cost estimating.
- The existing outfall easement at 3rd Avenue North through the Basic Marine property is very narrow and would likely prohibit installation of another 48" outfall here. Plans were adjusted to consider a single larger concrete box culvert through this area and costs adjusted accordingly.
- Provision (and costs were added) was made to account for providing a method to connect commercial building roof drains along the utility route to the new storm sewer either through direct pipe taps or drains to mid-block catch basins.
- The alternate outfall route down Ludington to 3rd Street was added.

Water Mains

Older water mains, where located in the same streets as planned storm sewer construction, should also be replaced to bring sizes and depth of bury up to City standards and to minimize public disruption during construction periods.

The proposed large diameter storm sewers (especially the 48") will create conflicts with other existing cross-trench utilities, specifically gas mains (2' to 4' bury) and water mains (5' to 7' cover). Gas mains can typically be relocated over the new storm but the water mains will likely need to be lowered to provide clearance under the new storm (freezing protection from the cold air filled storm sewers). Costs were added for this work.

Sanitary Sewers

The area's sanitary sewers should be internal TV inspected if the City hasn't done them in the past 10 years particularly before finalizing a scope of work for any planned other utility construction in the area. Age and material make them suspect.

Segments/Phasing

A map showing the routes for each of the recommended project segments can be found as Figures 3 and 4 on the following pages.

The recommended route for a storm water outfall is along 11th Street to 3rd Avenue where both water main and street surface replacements are needed. The alternate is along 12th Street however the existing 24" storm sewer here needs to continue in service plus the pavement is in much better condition.

The major alternative outfall location east on Ludington carries a higher cost but may lend itself better to Ludington Street reconstruction where combining project needs can produce savings for the individual projects.

Costs

Detailed construction/project costs can be found in Appendix C and are summarized below:

Base 3rd Avenue North (Basic Marine Area) Outfall

Item	Outfall From 3rd Ave N & 12th St to the Bay	North 12th St. From Ludington to 3rd Ave North	Ludington St Between 11th St and 15th St	TOTALS
Subtotal	$827,625	$1,049,570	$1,447,595	$3,324,790
10% Contingency	$82,762	$104,957	$144,760	$332,479
Construction Total	$910,387	$1,154,527	$1,592,355	$3,657,269
23% Engineering, Legal & Admin.	$190,354	$241,401	$332,947	$764,702
Project Total	**$1,100,741**	**$1,395,928**	**$1,925,301**	**$4,421,971**

Alternate Ludington/3rd Street Outfall

Item	Ludington Street Between 11th St and 3rd St Outfall	Ludington St Between 11th St and 15th St	TOTALS
Subtotal	$3,341,820	$1,447,595	$4,789,415
10% Contingency	$334,182	$144,760	$478,942
Construction Total	$3,676,002	$1,592,355	$5,268,357
23% Engineering, Legal & Admin.	$768,619	$332,947	$1,101,565
Project Total	**$4,444,621**	**$1,925,301**	**$6,369,922**

Schedule

Design could be expected to take 8-10 months depending on how winter fell within the design schedule (affects survey and field checking). Construction of each of the segments could be done in one construction season with restoration overlapping into the next construction season. Undertaking the entire area construction would likely require two full construction seasons with final paving and restoration occurring the following spring/summer.

N

Prop. 48" Storm

Prop. 48" Storm

Prop. 36" Storm

Prop. 36" Storm

Prop. 36" Storm

Prop. 18" Storm

3RD AVE NORTH

2ND AVE NORTH

1ST AVE NORTH

LUDINGTON STREET

16TH ST

15TH ST

14TH ST

13TH ST

12TH ST

11TH ST

10TH ST

9TH ST

8TH ST

17TH ST

Legend

Sanitary Sewer

Storm Sewer

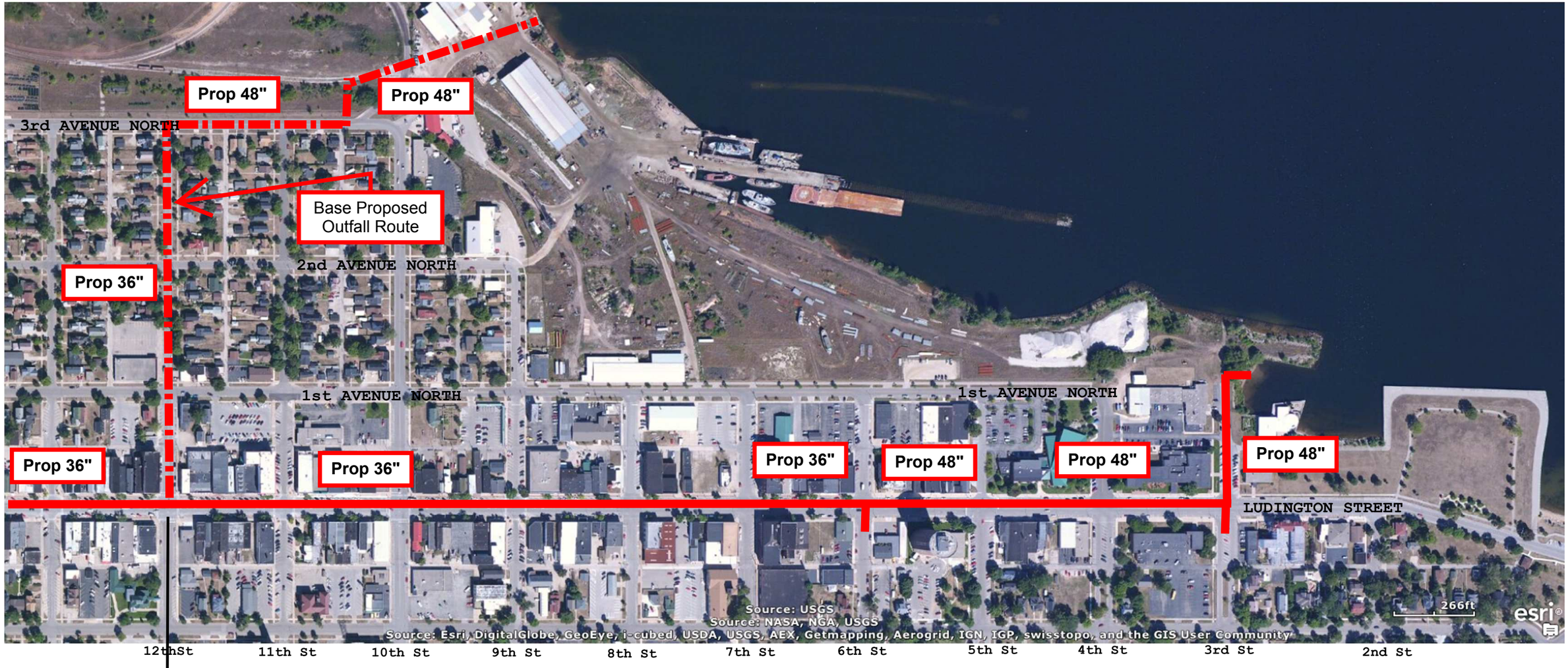
Water Main

Proposed Improvements

Escanaba, MI
Ludington Street Drainage Assessment

Figure 3: Proposed Improvements

Escanaba, MI
Ludington Street
Drainage Assessment
C2AE
07-01-15



Escanaba, MI
Ludington Street Drainage Assessment

Figure 4 : Alternate Proposed Outfall Route

Escanaba, MI
Ludington Street Drainage Assessment

APPENDIX 'A'

Storm Sewer Sizing

2015

N

1 AVE. N

STEPHENSON AVENUE

19TH ST N

18TH ST. N

EX. 36"
PROP. 48"
~~(OR SECOND 36")~~

EX. 24"
~~PROP. 42"~~
~~(OR SECOND 36")~~

~~PROP. 42"~~

EX. 24"
~~PROP. 42"~~

EX. 24"
~~PROP. 42"~~

EX. 12"
PROP. 36"

EX. 10"
PROP. 36"

EX. 10"
PROP. 36"

EX. 12"
PROP. 36"

EX. 12"
PROP. 36"

EX. 12"
~~PROP. 42"~~

EX. 12"
~~PROP. 42"~~

ND AVE. N

ST AVE. N.

LUDINGTON STR

1ST AVE. S.

2ND AVE. S

19TH ST. S

18TH ST. S

17TH ST. S

16TH ST. S

15TH ST. S

14TH ST. S

13TH ST. S

12TH ST. S

11TH ST. S

10TH ST. S

9TH ST. S

8TH ST. S

W

NOTE:
BASE MAP FURNISHED BY
THE CITY OF ESCANABA
ENGINEERING DEPARTMENT

Escanaba Ludington Street Drainage Asessment
C2AE #14-0182
Draft Conceptual Storm Sizing & Routes
11-20-14

Wilcox Professional Services
ISO 9001 CERTIFIED

DESIGNED	D. CAIN
CHECKED	
CADD DATE	11/24/04 JKD2
SCALE	1" = 150'
PART	
REV	
REV	
REV	

ESCANABA, MICHIGAN
STORM SEWER MODEL

MAP #5
3RD AVENUE NORTH
SYSTEM – MODEL

DIVISION	CONTRACT	SHEET
	11894.00012	

																			CLIENT NAME:	City of Escanaba, MI			
C =	80 - DENSE BUSINESS						Q =	CIA											PROJECT NAME:	Ludington Street Drainage Assessment			
C =	70 - LESS DENSE BUSINESS						I =	MDEQ Zone 2, 10 Yr Sto											CONTRACT NUMBER:	na			
C =	50 - RESIDENTIAL												Date:	11-20-14	CHECKED:	xxxxx			PROJECT NUMBER:	14-0182			PROPOSED SEWERS
C =	40 - SPREAD RESIDENTIAL												By:	dcc	BY:	xxxxx			LOCATION:	Ludington, 11th St & 3rd Ave to Outfall			
		MANHOLES							RUNOFF AND FLOW						TIME				SEWER - FLOW					
	UP	DOWN				TRIBUTARY	MDOT		MDOT	CITY		CITY	TOTAL	TOTAL	PIPE	PIPE	PIPE		PIPE		HGL	MH HD	
MANHOLE	STREAM	STREAM	GROUND	HGL	I	AREA	AREA	MDOT	FLOW	AREA	CITY	FLOW	FLOW	TIME	TIME	SIZE	LENGTH	PIPE	SLOPE	VELOC	SLOPE	LOSS	COMMENTS
NUMBER	INVERT	INVERT	ELEV	ELEV	(IN/HR)	ID	(AC)	C	(CFS)	(AC)	C	(CFS)	(CFS)	(MIN)	(MIN	(IN)	(FT)	N	(%)	(FPS)	(%)	(FT)	
12	603.5	603.5	609.5	608.1	-----	comments	0.0	-----	-----	21.4	-----	-----	-----	20.00	-----	-----	-----	-----	-----	-----	-----	0.20	areas L, M, Y, AA, BB,
-----	-----	-----	-----	-----	2.54	-----	0.0	0.00	0.00	21.4	0.70	38.05	38.05	-----	1.13	36	366	0.013	0.68%	5.38	0.33%	-----	CC, DD, EE, FF & GG
11	601.0	601.0	607.0	606.5	-----	J & K	0.0	-----	-----	3.3	-----	-----	-----	21.13	-----	-----	-----	-----	-----	-----	-----	0.40	
-----	-----	-----	-----	-----	2.54	-----	0.0	0.00	0.00	24.7	0.70	43.92	43.92	-----	1.01	36	377	0.013	0.66%	6.21	0.43%	-----	
10	598.5	598.5	604.5	604.6	-----	I	0.0	-----	-----	2.7	-----	-----	-----	22.14	-----	-----	-----	-----	-----	-----	-----	0.20	
-----	-----	-----	-----	-----	2.41	-----	0.0	0.00	0.00	27.4	0.70	46.22	46.22	-----	0.65	36	255	0.013	0.39%	6.54	0.48%	-----	
09	597.5	597.5	603.5	603.0	-----	G & H	0.0	-----	-----	3.4	-----	-----	-----	22.79	-----	-----	-----	-----	-----	-----	-----	0.40	
-----	-----	-----	-----	-----	2.37	-----	0.0	0.00	0.00	30.8	0.70	51.10	51.10	-----	0.89	36	385	0.013	0.13%	7.23	0.59%	-----	
08	597.0	597.0	603.0	600.6	-----	E & F	0.0	-----	-----	3.9	-----	-----	-----	23.68	-----	-----	-----	-----	-----	-----	-----	0.20	
-----	-----	-----	-----	-----	2.32	-----	0.0	0.00	0.00	34.7	0.70	56.35	56.35	-----	0.79	36	379	0.013	0.26%	7.97	0.71%	-----	
13	596.0	596.0	602.0	597.6	-----	P & Q	0.0	-----	-----	4.0	-----	-----	-----	24.47	-----	-----	-----	-----	-----	-----	-----	0.20	
-----	-----	-----	-----	-----	2.28	-----	0.0	0.00	0.00	38.7	0.70	61.77	61.77	-----	0.73	36	381	0.013	0.05%	8.74	0.86%	-----	
16	595.8	595.8	602.2	594.2	-----	O	0.0	-----	-----	3.7	-----	-----	-----	25.20	-----	-----	-----	-----	-----	-----	-----	0.20	
-----	-----	-----	-----	-----	2.25	-----	0.0	0.00	0.00	42.4	0.70	66.78	66.78	-----	0.74	36	419	0.013	0.05%	9.45	1.00%	-----	
15	595.6	595.6	601.6	589.8	-----	comments	0.0	-----	-----	4.9	-----	-----	-----	25.94	-----	-----	-----	-----	-----	-----	-----	0.20	SEE NOTE 'A'
-----	-----	-----	-----	-----	2.22	-----	0.0	0.00	0.00	47.3	0.70	73.50	73.50	-----	1.42	48	497	0.013	0.24%	5.85	0.26%	-----	BELOW
04	594.4	594.4	600.4	588.3	-----	A	0.0	-----	-----	5.6	-----	-----	-----	27.36	-----	-----	-----	-----	-----	-----	-----	0.20	SEE NOTE 'B'
-----	-----	-----	-----	-----	2.15	-----	0.0	0.00	0.00	52.9	0.60	68.24	68.24	-----	0.48	48	155	0.013	3.48%	5.43	0.23%	-----	BELOW
03	589.0	589.0	595.0	587.7	-----	x	0.0	-----	-----	0.0	-----	-----	-----	27.83	-----	-----	-----	-----	-----	-----	-----	0.20	
-----	-----	-----	-----	-----	2.14	-----	0.0	0.00	0.00	52.9	0.60	67.92	67.92	-----	0.60	48	194	0.013	2.32%	5.41	0.22%	-----	
02	584.5	584.5	595.8	586.9	-----	x	0.0	-----	-----	0.0	-----	-----	-----	28.43	-----	-----	-----	-----	-----	-----	-----	0.40	
-----	-----	-----	-----	-----	2.11	-----	0.0	0.00	0.00	52.9	0.60	66.97	66.97	-----	2.87	48	917	0.013	0.50%	5.33	0.22%	-----	
01	579.9	579.9	586.0	583.9	-----	na	0.0	-----	-----	0.0	-----	-----	-----	31.30	-----	-----	-----	-----	-----	-----	-----	1.00	
-----	-----	-----	-----	-----	2.02	-----	0.0	0.00	0.00	52.9	0.60	64.11	64.11	-----	#DIV/0!	0	0	0.013	#REF!	#DIV/0!	#DIV/0!	-----	

MANUALLY ENTER MH NO, U/S INV, D/S INV, GRND ELEV, D/S HGL, AREAS, C VALUES, PIPE SIZE & LENGTH AND MH HEAD LOSS

OUTFALL HGL = TOP OF PIPE AT FREE DISCHARGE OR WATER SURFACE IF SUBMERGED (FLOOD ELEV)

Starting HGL = 583 = historic high water elev for Lake Michigan or top of pipe at outfall - whichever is higher

NOTE 'A': Separate 3rd Ave N sewer & outfall = add area 'N' = 4.9 AC

Combined single 3rd Ave N & Outfall = add areas N, R, S, T, U, V, W, X, & Z = 30.6 AC

NOTE 'B': Separate 3rd Ave N sewer & outfall = add area 'A' = 5.6 AC

Combined single 3rd Ave N & Outfall = add areas A, B, C, & D = 16.1 AC

C = 80 - DENSE BUSINESS
C = 70 - LESS DENSE BUSINESS
C = 50 - RESIDENTIAL
C = 40 - SPREAD RESIDENTIAL

Q = CIA
I = MDEQ Zone 2, 10 Yr Sto

Date: 07-02-15 CHECKED: xxxxx
By: dcc BY: xxxxx

CLIENT NAME: City of Escanaba, MI
PROJECT NAME: Ludington Street Drainage Assessment
CONTRACT NUMBER: na
PROJECT NUMBER: 14-0182
LOCATION: Ludington, Alternate Outfall

PROPOSED SEWERS

MANHOLES					RUNOFF AND FLOW									TIME		SEWER - FLOW							
MANHOLE NUMBER	UP STREAM INVERT	DOWN STREAM INVERT	GROUND ELEV	HGL ELEV	I (IN/HR)	TRIBUTARY AREA ID	MDOT AREA (AC)	MDOT C	MDOT FLOW (CFS)	CITY AREA (AC)	CITY C	CITY FLOW (CFS)	TOTAL FLOW (CFS)	TOTAL TIME (MIN)	PIPE TIME (MIN	PIPE SIZE (IN)	PIPE LENGTH (FT)	PIPE N	PIPE SLOPE (%)	VELOC (FPS)	HGL SLOPE (%)	MH HD LOSS (FT)	COMMENTS
9	597.5	597.5	603.5	603.8	-----	xx	0.0	-----	-----	30.0	-----	-----	-----	22.80	-----	-----	-----	-----	-----	-----	-----	0.20	
-----	-----	-----	-----	-----	2.37	-----	0.0	0.00	0.00	30.0	0.70	49.77	49.77	-----	1.89	36	800	0.013	0.69%	7.04	0.56%	-----	
L & 9th	592.0	592.0	600.0	599.0	-----	xx	0.0	-----	-----	10.0	-----	-----	-----	24.69	-----	-----	-----	-----	-----	-----	-----	0.40	
-----	-----	-----	-----	-----	2.28	-----	0.0	0.00	0.00	40.0	0.50	45.60	45.60	-----	3.10	36	1200	0.013	0.25%	6.45	0.47%	-----	
L & 6th	589.0	589.0	593.0	593.2	-----	xx	0.0	-----	-----	50.0	-----	-----	-----	27.79	-----	-----	-----	-----	-----	-----	-----	0.20	
-----	-----	-----	-----	-----	2.14	-----	0.0	0.00	0.00	90.0	0.45	86.67	86.67	-----	2.90	48	1200	0.013	0.58%	6.90	0.36%	-----	
L & 3rd	582.0	582.0	592.0	588.4	-----	xx	0.0	-----	-----	40.0	-----	-----	-----	30.69	-----	-----	-----	-----	-----	-----	-----	0.40	
-----	-----	-----	-----	-----	2.05	-----	0.0	0.00	0.00	130.0	0.45	119.93	119.93	-----	0.87	48	500	0.013	0.42%	9.54	0.70%	-----	
Outfall	579.9	579.9	586.0	583.9	-----	xx	0.0	-----	-----	5.0	-----	-----	-----	31.57	-----	-----	-----	-----	-----	-----	-----	1.00	
-----	-----	-----	-----	-----	2.32	-----	0.0	0.00	0.00	135.0	0.50	156.60	156.60	-----	#DIV/0!	0	0	0.013	#DIV/0!	#DIV/0!	#DIV/0!	-----	
					-----		0.0	-----	-----	0.0	-----	-----	-----	#DIV/0!	-----	-----	-----	-----	-----	-----	-----	0.00	
-----	-----	-----	-----	-----	0.00	-----	0.0	0.00	0.00	135.0	0.00	0.00	0.00	-----	#DIV/0!	0	0	0.013	#DIV/0!	#DIV/0!	#DIV/0!	-----	
				#DIV/0!	-----		0.0	-----	-----	0.0	-----	-----	-----	#DIV/0!	-----	-----	-----	-----	-----	-----	-----	0.00	
-----	-----	-----	-----	-----	0.00	-----	0.0	0.00	0.00	135.0	0.00	0.00	0.00	-----	#DIV/0!	0	0	0.013	#DIV/0!	#DIV/0!	#DIV/0!	-----	
				#DIV/0!	-----		0.0	-----	-----	0.0	-----	-----	-----	#DIV/0!	-----	-----	-----	-----	-----	-----	-----	0.00	
-----	-----	-----	-----	-----	0.00	-----	0.0	0.00	0.00	135.0	0.00	0.00	0.00	-----	#DIV/0!	0	0	0.013	#DIV/0!	#DIV/0!	#DIV/0!	-----	
				#DIV/0!	-----		0.0	-----	-----	0.0	-----	-----	-----	#DIV/0!	-----	-----	-----	-----	-----	-----	-----	0.00	
-----	-----	-----	-----	-----	0.00	-----	0.0	0.00	0.00	135.0	0.00	0.00	0.00	-----	#DIV/0!	0	0	0.013	#DIV/0!	#DIV/0!	#DIV/0!	-----	
				#DIV/0!	-----		0.0	-----	-----	0.0	-----	-----	-----	#DIV/0!	-----	-----	-----	-----	-----	-----	-----	0.00	
-----	-----	-----	-----	-----	0.00	-----	0.0	0.00	0.00	135.0	0.00	0.00	0.00	-----	#DIV/0!	0	0	0.013	#DIV/0!	#DIV/0!	#DIV/0!	-----	
				#DIV/0!	-----		0.0	-----	-----	0.0	-----	-----	-----	#DIV/0!	-----	-----	-----	-----	-----	-----	-----	0.00	
-----	-----	-----	-----	-----	0.00	-----	0.0	0.00	0.00	135.0	0.00	0.00	0.00	-----	#DIV/0!	0	0	0.013	#DIV/0!	#DIV/0!	#DIV/0!	-----	
				0.0	-----		0.0	-----	-----	0.0	-----	-----	-----	#DIV/0!	-----	-----	-----	-----	-----	-----	-----	0.00	
-----	-----	-----	-----	-----	0.00	-----	0.0	0.00	0.00	135.0	0.00	0.00	0.00	-----	#DIV/0!	0	0	0.013	#REF!	#DIV/0!	#DIV/0!	-----	

MANUALLY ENTER MH NO, U/S INV, D/S INV, GRND ELEV, D/S HGL, AREAS, C VALUES, PIPE SIZE & LENGTH AND MH HEAD LOSS
OUTFALL HGL = TOP OF PIPE AT FREE DISCHARGE OR WATER SURFACE IF SUBMERGED (FLOOD ELEV)
Starting HGL = 583 = historic high water elev for Lake Michigan or top of pipe at outfall - whichever is higher

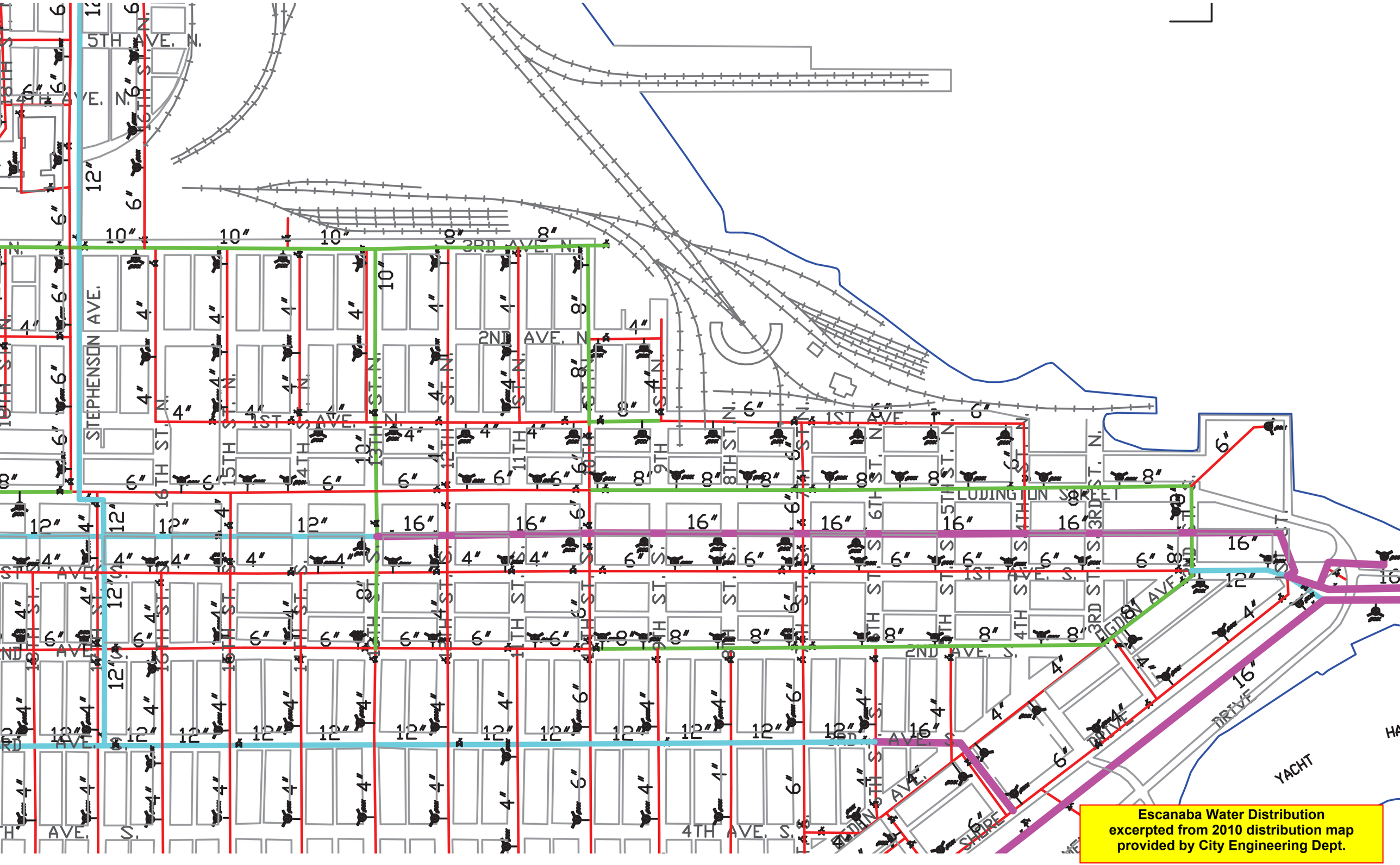
MH 9 data from base outfall route calcs
xx = areas from 2005 study drainage area maps

Escanaba, MI
Ludington Street Drainage Assessment

APPENDIX 'B'

Other Utilities and Streets

2015



Escanaba Water Distribution
excerpted from 2010 distribution map
provided by City Engineering Dept.

Last Rating Entered Report

Escanaba

Report Module: Road Surface Management Analysis

Today's Date: 11/11/2014

Grouped By: Surface Subtype

Report Filter

Field Name	Operator	Value(s)
Road Segment	=	Manually Selected Items (Saved Network Name): C2AE.StormSewerStudyArea

C2AE
Rec'd 11-11-14 from
City Engineering Dept.

Rating	Quality	Treatment
9-10	Excellant	None
7-8	Good	Sealing & Patching
5-6	Fair	Preservation Treatments
3-4	Poor	Structural Renewal
1-2	Failed	Reconstruction

Last Rating Entered Report

PRNo	Road Name	Segment Name	From Description	To Description	P.O.B	P.O.E	Length	City/Twp	Act51	NFC	Last Resurf	Last Eval	Last Rating
Surface Subtype: Asphalt Local Curbed													
1351508	S 10th St												
		N 10th St	Ludington St	1st Ave N	0.760	0.834	0.074	Escanaba	CtyMajSt	MinArt	0	2013	6
		N 10th St	1st Ave N	2nd Ave N	0.834	0.915	0.081	Escanaba	CtyMajSt	MinArt	0	2013	6
		N 10th St	2nd Ave N	3rd Ave N	0.915	1.004	0.089	Escanaba	CtyMajSt	MinArt	0	2013	6
1351506	S 11th St												
		N 11th St	1st	2nd Ave N	0.946	1.027	0.081	Escanaba	CtyMinSt	Local	0	2014	8
		N 11th St	2nd Ave N	3rd	1.027	1.117	0.090	Escanaba	CtyMinSt	Local	0	2014	8
1351605	S 12th St												
		N 12th St	1st	2nd Ave N	1.013	1.094	0.081	Escanaba	CtyMinSt	Local	0	2014	3
		N 12th St	2nd Ave N	3rd	1.094	1.184	0.090	Escanaba	CtyMinSt	Local	0	2014	3
1351606	S 13th St												
		N 13th St	1st	2nd Ave N	1.014	1.095	0.081	Escanaba	CtyMinSt	Local	0	2014	4
		N 13th St	2nd Ave N	3rd	1.095	1.185	0.090	Escanaba	CtyMinSt	Local	0	2014	4
1351407	1st Ave N												
		1st Ave N	N 14th St	N 14th St	0.071	0.073	0.002	Escanaba	CtyMajSt	MajColl	0	2014	3
		1st Ave N	N 14th St	N 13th St	0.073	0.145	0.072	Escanaba	CtyMajSt	MajColl	0	2014	3
		1st Ave N	N 13th St	N 12th St	0.145	0.217	0.072	Escanaba	CtyMajSt	MajColl	0	2014	3
		1st Ave N	N 12th St	N 11th St	0.217	0.288	0.071	Escanaba	CtyMajSt	MajColl	0	2014	3
		1st Ave N	N 11th St	N 11th St	0.288	0.290	0.002	Escanaba	CtyMajSt	MajColl	0	2014	2
		1st Ave N	N 11th St	N 10th St	0.290	0.359	0.069	Escanaba	CtyMajSt	MajColl	0	2014	2
		1st Ave N	N 10th St	N 10th St	0.359	0.360	0.001	Escanaba	CtyMajSt	MajColl	0	2014	5
		1st Ave N	N 10th St	N 9th St	0.360	0.432	0.072	Escanaba	CtyMajSt	MajColl	0	2014	5
1351603	2nd Ave N												
		2nd Ave N	N 15th St	N 14th St	0.408	0.483	0.075	Escanaba	CtyMinSt	Local	0	2014	3
		2nd Ave N	N 14th St	N 13th St	0.484	0.554	0.070	Escanaba	CtyMinSt	Local	0	2014	3
		2nd Ave N	N 13th St	N 12th St	0.554	0.628	0.074	Escanaba	CtyMinSt	Local	0	2014	3
		2nd Ave N	N 12th St	N 11th St	0.628	0.700	0.072	Escanaba	CtyMinSt	Local	0	2014	3
		2nd Ave N	N 11th St	N 10th St	0.700	0.771	0.071	Escanaba	CtyMinSt	Local	0	2014	3
		2nd Ave N	N 10th St	9th	0.774	0.841	0.067	Escanaba	CtyMinSt	Local	0	2014	7
1349505	3rd Ave N												

Last Rating Entered Report

PRNo	Road Name	Segment Name	From Description	To Description	P.O.B	P.O.E	Length	City/Twp	Act51	NFC	Last Resurf	Last Eval	Last Rating
Surface Subtype: Asphalt Local Curbed													
		3rd Ave N	N 15th St	N 14th St	1.050	1.122	0.072	Escanaba	CtyMajSt	MinArt	0	2014	7
		3rd Ave N	N 14th St	N 13th St	1.122	1.195	0.073	Escanaba	CtyMajSt	MinArt	0	2014	7
		3rd Ave N	N 13th St	N 13th St	1.195	1.196	0.001	Escanaba	CtyMajSt	MinArt	0	2014	7
		3rd Ave N	N 13th St	N 12th St	1.196	1.267	0.071	Escanaba	CtyMajSt	MinArt	0	2014	7
		3rd Ave N	N 12th St	N 11th St	1.267	1.340	0.073	Escanaba	CtyMajSt	MinArt	0	2014	7
		3rd Ave N	N 11th St	N 10th St	1.340	1.409	0.069	Escanaba	CtyMajSt	MinArt	0	2014	7
1351805	US 2												
		Ludington St	N 15th St	N 14th St	12.940	13.012	0.072	Escanaba	CtyMajSt	MinArt	0	2014	2
		Ludington St	N 14th St	N 14th St & S 14th St	13.012	13.013	0.001	Escanaba	CtyMajSt	MinArt	0	2014	2
		Ludington St	N 14th St & S 14th St	S 13th St & N 13th St	13.013	13.085	0.072	Escanaba	CtyMajSt	MinArt	0	2014	2
		Ludington St	S 13th St & N 13th St	S 12th St & N 12th St	13.085	13.157	0.072	Escanaba	CtyMajSt	MinArt	0	2014	2
		Ludington St	S 12th St & N 12th St	11th St & N 11th St	13.157	13.227	0.070	Escanaba	CtyMajSt	MinArt	0	2014	2
		Ludington St	11th St & N 11th St	11th St	13.227	13.231	0.004	Escanaba	CtyMajSt	MinArt	0	2014	2
		Ludington St	11th St	N 10th St & S 10th St	13.231	13.299	0.068	Escanaba	CtyMajSt	MinArt	0	2014	2
		Ludington St	N 10th St & S 10th St	N 10th St	13.299	13.300	0.001	Escanaba	CtyMajSt	MinArt	0	2014	2
		Ludington St	N 10th St	S 9th St & N 9th St	13.300	13.371	0.071	Escanaba	CtyMajSt	MinArt	0	2014	2
Total Centerline Mileage for Asphalt Local Curbed: 2.337													
Surface Subtype: Asphalt-No Curb													
1351603	2nd Ave N												
		2nd Ave N	N 14th St	N 14th St	0.483	0.484	0.001	Escanaba	CtyMinSt	Local	0	2005	7
		2nd Ave N	N 10th St	N 10th St	0.771	0.774	0.003	Escanaba	CtyMinSt	Local	0	2005	3
Total Centerline Mileage for Asphalt-No Curb: 0.004													
Surface Subtype: Asphalt-Standard													
1351508	S 10th St												
		S 10th St	1st Ave S	Ludington St	0.683	0.760	0.077	Escanaba	CtyMajSt	MinArt	0	2013	4
1351506	S 11th St												
		11th St	1st Ave S	Ludington St	0.794	0.871	0.077	Escanaba	CtyMajSt	MajColl	0	2013	3
		N 11th St	Ludington St	Ludington St	0.871	0.872	0.001	Escanaba	CtyMajSt	MajColl	0	2013	3
		N 11th St	Ludington St	Ludington St	0.872	0.873	0.001	Escanaba	CtyMajSt	MajColl	0	2013	3

Last Rating Entered Report

PRNo	Road Name	Segment Name	From Description	To Description	P.O.B	P.O.E	Length	City/Twp	Act51	NFC	Last Resurf	Last Eval	Last Rating
Surface Subtype: Asphalt-Standard													
		N 11th St	Ludington St	1st Ave N	0.873	0.946	0.073	Escanaba	CtyMajSt	MajColl	0	2013	3
1351605	S 12th St												
		S 12th St	1st Ave S	Ludington St	0.862	0.939	0.077	Escanaba	CtyMajSt	MajColl	0	2013	3
		N 12th St	Ludington St	1st Ave N	0.939	1.013	0.074	Escanaba	CtyMajSt	MajColl	0	2013	2
1351606	S 13th St												
		S 13th St	1st Ave S	Ludington St	0.863	0.940	0.077	Escanaba	CtyMajSt	MajColl	0	2013	2
		N 13th St	Ludington St	Ludington St	0.940	0.941	0.001	Escanaba	CtyMajSt	MajColl	0	2013	3
		N 13th St	Ludington St	1st Ave N	0.941	1.014	0.073	Escanaba	CtyMajSt	MajColl	0	2013	3
1351607	S 14th St												
		S 14th St	1st Ave S	Ludington St	1.182	1.259	0.077	Escanaba	CtyMajSt	MajColl	0	2013	7
		S 14th St	Ludington St	Ludington St	1.259	1.260	0.001	Escanaba	CtyMajSt	MajColl	0	2013	7
		N 14th St	Ludington St	1st Ave N	1.260	1.332	0.072	Escanaba	CtyMajSt	MajColl	0	2013	6
		N 14th St	1st Ave N	2nd Ave N	1.332	1.413	0.081	Escanaba	CtyMajSt	MajColl	0	2013	6
		N 14th St	2nd Ave N	3rd Ave N	1.413	1.505	0.092	Escanaba	CtyMajSt	MajColl	0	2013	6
Total Centerline Mileage for Asphalt-Standard: 0.854													
Surface Subtype: Concrete-Standard													
1351407	1st Ave N												
		1st Ave N	N 15th St	N 14th St	0.000	0.071	0.071	Escanaba	CtyMajSt	MajColl	0	2014	3
Total Centerline Mileage for Concrete-Standard: 0.071													
Total Centerline Mileage for all Roads: 3.266													

Escanaba, MI
Ludington Street Drainage Assessment

APPENDIX 'C'

Costs

2015

Escanaba, MI

Ludington Street Drainage Assessment

Project Number 14-0182

Opinion of Probable Project Costs

Date: 11-07-14

Last Revision: ~~01-05-15~~ 07-07-15

Original 3rd Ave (Basic Marine) Outfall Location

Item	Description	Unit	Price	Outfall From 3rd Ave N & 12th St to the Bay		North 12th Street From Ludington to 3rd Ave North		Ludington Street Between 9th Street and 15th Street		TOTALS	
				Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
101	General Conditions, Bonds, Insurances, and Mobilization	LS	$150,000	0.3	$45,000	0.3	$45,000	0.4	$60,000	1	$150,000
102	Public Relations Program	LS	$4,500	0.2	$900	0.4	$1,800	0.4	$1,800	1	$4,500
103	Preconstruction Audiovisual Coverage	LS	$3,500	0.2	$700	0.4	$1,400	0.4	$1,400	1	$3,500
104	Environmental Mitigation, Erosion and Dust Control	LS	$3,000	0.3	$900	0.3	$900	0.4	$1,200	1	$3,000
105	Traffic Control	LS	$25,000	0.2	$5,000	0.2	$5,000	0.6	$15,000	1	$25,000
106	Utility Location Investigation	EA	$800	4	$3,200	3	$2,400	8	$6,400	15	$12,000
107	Rock, Boulder or Concrete Rubble Excavation	CY	$95	20	$1,900		$0		$0	20	$1,900
108	Temporary Water Service to Buildings During Utility Installation	EA	$450	2	$900	35	$15,750	36	$16,200	73	$32,850
109	8" Thickness Class 52 Ductile Iron Water Main w/ Gran. Fill	LF	$90	185	$16,650	1,290	$116,100	1,350	$121,500	2,825	$254,250
110	6" Thickness Class 52 Ductile Iron Water Main w/ Gran. Fill	LF	$80	40	$3,200	100	$8,000	80	$6,400	220	$17,600
111	2" Type 'K' Copper Water Service (allowance estimate)	LF	$55		$0		$0	70	$3,850	70	$3,850
112	1" Type 'K' Water Service	LF	$40	40	$1,600	1,225	$49,000	1,190	$47,600	2,455	$98,200
113	8" Gate Valve and Box	EA	$2,000	2	$4,000	7	$14,000	11	$22,000	20	$40,000
114	2" Corporation Stop with Saddle	EA	$900		$0		$0	2	$1,800	2	$1,800
115	1” Corporation Stop	EA	$300	2	$600	35	$10,500	34	$10,200	71	$21,300
116	2" Curb Stop and Box	EA	$800		$0		$0	2	$1,600	2	$1,600
117	1” Curb Stop and Box	EA	$400	2	$800	35	$14,000	34	$13,600	71	$28,400
118	Hydrant Assembly with 6” Gate Valve	EA	$4,500		$0	3	$13,500	4	$18,000	7	$31,500
119	Remove Existing Hydrant and Return to Owner	EA	$900		$0	3	$2,700	4	$3,600	7	$6,300
120	Connect to Existing 8" - 10" Water Main	EA	$3,500	2	$7,000	1	$3,500	2	$7,000	5	$17,500
121	Connect to Existing 4" - 6" Water Main	EA	$2,500	1	$2,500	2	$5,000	5	$12,500	8	$20,000
122	Connect to Existing 2" Water Service	EA	$400		$0		$0	2	$800	2	$800
123	Connect to Existing 1/2” to 1" Water Service	EA	$200	2	$400	35	$7,000	34	$6,800	71	$14,200
124	Water Main Relocations Under New Larger Storm Sewer	EA	$3,000		$0	2	$6,000	4	$12,000	6	$18,000
125	8" SDR 26 PVC Sanitary Sewer w/ Granular Fill (repairs)	LF	$120	15	$1,800	15	$1,800		$0	30	$3,600
126	6” SDR 26 PVC Lateral w/ Granular Fill (repairs)	LF	$50		$0	170	$8,500	180	$9,000	350	$17,500
127	Connect to Existing 4" to 6" Lateral (repairs)	EA	$300		$0	17	$5,100	18	$5,400	35	$10,500
128	4'x8' Precast Conc. Box Culvert Outlet Combing w/ Existing Sto.	LS	$40,000	1	$40,000		$0		$0	1	$40,000
129	48"RCSP-IV RCSP MDOT End Section	LS	$25,000		$0		$0		$0	0	$0
130	48" RCSP-IV Storm Sewer w/ Granular Fill	LF	$400	1,350	$540,000		$0		$0	1,350	$540,000
131	36" RCSP-IV Storm Sewer w/ Granular Fill	LF	$300		$0	1,290	$387,000	1,135	$340,500	2,425	$727,500
132	24" RCSP-IV Storm Sewer w/ Granular Fill	LF	$210	30	$6,300		$0		$0	30	$6,300
133	18" RCSP-IV Storm Sewer w/ Granular Fill	LF	$125		$0		$0	215	$26,875	215	$26,875
134	12" SDR 26 PVC Storm Sewer w/ Granular Fill	LF	$60		$0	30	$1,800	15	$900	45	$2,700
135	12" SDR 26 PVC Catch Basin Lead w/ Granular Fill	LF	$55	100	$5,500	280	$15,400	600	$33,000	980	$53,900
136	6" Connection for Roof Drains on Commercial Buildings	EA	$3,000					40	$120,000	40	$120,000
137	Remove Existing 8" to 21" Sewer	LF	$22		$0	1,290	$28,380	1,350	$29,700	2,640	$58,080
138	18” to 24" Connection to Existing Sewer	EA	$1,200	1	$1,200		$0		$0	1	$1,200
139	12” to 15" Connection to Existing Sewer	EA	$700		$0	1	$700	2	$1,400	3	$2,100
140	8” to 10" Connection to Existing Sewer	EA	$400	2	$800	1	$400	1	$400	4	$1,600
141	18” to 24" Connection to Existing Manhole or Structure	EA	$900	2	$1,800		$0		$0	2	$1,800

Escanaba, MI

Ludington Street Drainage Assessment

Project Number 14-0182

Opinion of Probable Project Costs

Date: 11-07-14

Last Revision: ~~01-05-15~~ 07-07-15

Original 3rd Ave (Basic Marine) Outfall Location

Item	Description	Unit	Price	Outfall From 3rd Ave N & 12th St to the Bay		North 12th Street From Ludington to 3rd Ave North		Ludington Street Between 9th Street and 15th Street		TOTALS	
				Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
142	96” Pre-cast Concrete Manhole (or cast-in-place structure)	EA	$10,500	3	$31,500		$0		$0	3	$31,500
143	84” Pre-cast Concrete Manhole (or 48" Tee-Line Manhole)	EA	$9,000	2	$18,000		$0		$0	2	$18,000
144	72” Pre-cast Concrete Manhole	EA	$7,500		$0	1	$7,500		$0	1	$7,500
145	60” Pre-cast Concrete Manhole	EA	$6,500		$0	5	$32,500	7	$45,500	12	$78,000
146	24" Pre-cast Concrete Catch Basin	EA	$2,600	4	$10,400	14	$36,400	24	$62,400	42	$109,200
147	Remove Existing 48" Manhole	EA	$275		$0	2	$550	4	$1,100	6	$1,650
148	Remove Existing Catch Basin	EA	$250	4	$1,000	10	$2,500	13	$3,250	27	$6,750
149	12" Gravel Base in Type 'A' Pavement Areas (Trench Only)	LF	$30	610	$18,300		$0		$0	610	$18,300
150	3" Type 'A' Pavement Replacement (Trench Only)	LF	$35	610	$21,350		$0		$0	610	$21,350
151	Concrete or Asphalt Curb and Gutter Removal	LF	$5	610	$3,050	875	$4,375	240	$1,200	1,725	$8,625
152	Asphalt Pavement Removal, 2" - 5"	SY	$5	1,015	$5,075	3,025	$15,125	6,600	$33,000	10,640	$53,200
153	Road Subbase and Base Removal, 18"	SY	$3		$0	3,025	$9,075	6,600	$19,800	9,625	$28,875
154	Concrete Pavement Removal, 4"-8"	SY	$5		$0	2,500	$12,500	2,500	$12,500	5,000	$25,000
155	Trolley Car Ballast Removal & Replacement w/ Gran. Material	SY	$5		$0		$0	1,200	$6,000	1,200	$6,000
156	Sand Sub-Base, Cl II, 6"	SY	$12		$0	3,025	$36,300	6,600	$79,200	9,625	$115,500
157	22A Aggregate Base, 12" Thickness	SY	$12		$0	3,025	$36,300	6,600	$79,200	9,625	$115,500
158	3" HMA, LVSP	SY	$18		$0	3,025	$54,450	6,600	$118,800	9,625	$173,250
159	6" Concrete Driveway Replacement, Includes 4" Sand Base	SY	$50	10	$500	10	$500		$0	20	$1,000
160	3" Asphalt Driveway Replacement, Includes 6" Gravel Base	SY	$45	10	$450	10	$450		$0	20	$900
161	6" Concrete Sidewalk or Pedestrian Ramp	SF	$6	200	$1,200	400	$2,400	800	$4,800	1,400	$8,400
162	ADA Truncated Dome for Pedestrian Ramps	SF	$40	40	$1,600	80	$3,200	160	$6,400	280	$11,200
163	Concrete Curb & Gutter, with 6" Gravel Base	LF	$25	610	$15,250	875	$21,875	240	$6,000	1,725	$43,125
164	Manhole or Catch Basin Casting Adjustment Prior to Final Paving	EA	$350	6	$2,100	6	$2,100	12	$4,200	24	$8,400
165	Valve Box Adjustment Prior to Final Paving	EA	$140	5	$700	6	$840	13	$1,820	24	$3,360
166	Pavement Marking	LS	$4,000		$0		$0	1	$4,000	1	$4,000
167	24" Heavy Rip-Rap	SY	$90	50	$4,500		$0		$0	50	$4,500
	Subtotal				**$827,625**		**$1,049,570**		**$1,447,595**		**$3,324,790**
	10% Contingency				**$82,763**		**$104,957**		**$144,760**		**$332,479**
	Construction Total				**$910,388**		**$1,154,527**		**$1,592,355**		**$3,657,269**
	23% Engineering, Legal & Administrative				**$190,354**		**$241,401**		**$332,947**		**$764,702**
	Project Total				**$1,100,741**		**$1,395,928**		**$1,925,301**		**$4,421,971**
..											
	Note: Costs do not include sanitary sewer replacement- recommend City TV inspection prior to finalizing project scope.										
..											

Escanaba, MI

Ludington Street Drainage Assessment

Project Number 14-0182

Opinion of Probable Project Costs

Date: 11-07-14

Last Revision: ~~01-05-15~~ 07-07-15

					Alternate 3rd Street Outfall Location					
					Ludington Street Between 9th Street and 15th Street		**Ludington Street Between 9th Street and 3rd St Outfall**		**TOTALS**	
Item	**Description**	**Unit**	**Price**		**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
101	General Conditions, Bonds, Insurances, and Mobilization	LS	$150,000		0.4	$60,000	0.6	$90,000	1	$150,000
102	Public Relations Program	LS	$4,500		0.4	$1,800	0.6	$2,700	1	$4,500
103	Preconstruction Audiovisual Coverage	LS	$3,500		0.4	$1,400	0.6	$2,100	1	$3,500
104	Environmental Mitigation, Erosion and Dust Control	LS	$3,000		0.4	$1,200	0.6	$1,800	1	$3,000
105	Traffic Control	LS	$25,000		0.6	$15,000	0.8	$20,000	1	$35,000
106	Utility Location Investigation	EA	$800		8	$6,400	18	$14,400	26	$20,800
107	Rock, Boulder or Concrete Rubble Excavation	CY	$95			$0	20	$1,900	20	$1,900
108	Temporary Water Service to Buildings During Utility Installation	EA	$450		36	$16,200	20	$9,000	56	$25,200
109	8" Thickness Class 52 Ductile Iron Water Main w/ Gran. Fill	LF	$90		1,350	$121,500	700	$63,000	2,050	$184,500
110	6" Thickness Class 52 Ductile Iron Water Main w/ Gran. Fill	LF	$80		80	$6,400	40	$3,200	120	$9,600
111	2" Type 'K' Copper Water Service (allowance estimate)	LF	$55		70	$3,850	35	$1,925	105	$5,775
112	1" Type 'K' Water Service	LF	$40		1,190	$47,600	595	$23,800	1,785	$71,400
113	8" Gate Valve and Box	EA	$2,000		11	$22,000	5	$10,000	16	$32,000
114	2" Corporation Stop with Saddle	EA	$900		2	$1,800	1	$900	3	$2,700
115	1” Corporation Stop	EA	$300		34	$10,200	17	$5,100	51	$15,300
116	2" Curb Stop and Box	EA	$800		2	$1,600	1	$800	3	$2,400
117	1” Curb Stop and Box	EA	$400		34	$13,600	17	$6,800	51	$20,400
118	Hydrant Assembly with 6” Gate Valve	EA	$4,500		4	$18,000	2	$9,000	6	$27,000
119	Remove Existing Hydrant and Return to Owner	EA	$900		4	$3,600	2	$1,800	6	$5,400
120	Connect to Existing 8" - 10" Water Main	EA	$3,500		2	$7,000	3	$10,500	5	$17,500
121	Connect to Existing 4" - 6" Water Main	EA	$2,500		5	$12,500	2	$5,000	7	$17,500
122	Connect to Existing 2" Water Service	EA	$400		2	$800	1	$400	3	$1,200
123	Connect to Existing 1/2” to 1" Water Service	EA	$200		34	$6,800	17	$3,400	51	$10,200
124	Water Main Relocations Under New Larger Storm Sewer	EA	$3,000		4	$12,000	10	$30,000	14	$42,000
125	8" SDR 26 PVC Sanitary Sewer w/ Granular Fill (repairs)	LF	$120			$0	200	$24,000	200	$24,000
126	6” SDR 26 PVC Lateral w/ Granular Fill (repairs)	LF	$50		180	$9,000	450	$22,500	630	$31,500
127	Connect to Existing 4" to 6" Lateral (repairs)	EA	$300		18	$5,400	45	$13,500	63	$18,900
128	4'x8' Precast Conc. Box Culvert Outlet Combing w/ Existing Sto.	LS	$40,000			$0		$0	0	$0
129	48"RCSP-IV RCSP MDOT End Section	LS	$25,000			$0	1	$25,000	1	$25,000
130	48" RCSP-IV Storm Sewer w/ Granular Fill	LF	$400			$0	1,700	$680,000	1,700	$680,000
131	36" RCSP-IV Storm Sewer w/ Granular Fill	LF	$300		1,135	$340,500	2,250	$675,000	3,385	$1,015,500
132	24" RCSP-IV Storm Sewer w/ Granular Fill	LF	$210			$0	60	$12,600	60	$12,600
133	18" RCSP-IV Storm Sewer w/ Granular Fill	LF	$125		215	$26,875		$0	215	$26,875
134	12" SDR 26 PVC Storm Sewer w/ Granular Fill	LF	$60		15	$900		$0	15	$900
135	12" SDR 26 PVC Catch Basin Lead w/ Granular Fill	LF	$55		600	$33,000	1,200	$66,000	1,800	$99,000
136	6" Connection for Roof Drains on Commercial Buildings	EA	$3,000		40	$120,000	90	$270,000	130	$390,000
137	Remove Existing 8" to 21" Sewer	LF	$22		1,350	$29,700	3,900	$85,800	5,250	$115,500
138	18” to 24" Connection to Existing Sewer	EA	$1,200			$0	2	$2,400	2	$2,400
139	12” to 15" Connection to Existing Sewer	EA	$700		2	$1,400	2	$1,400	4	$2,800
140	8” to 10" Connection to Existing Sewer	EA	$400		1	$400		$0	1	$400
141	18” to 24" Connection to Existing Manhole or Structure	EA	$900			$0		$0	0	$0

Escanaba, MI											
Ludington Street Drainage Assessment											
Project Number 14-0182											
Opinion of Probable Project Costs					**Alternate 3rd Street Outfall Location**						
Date: 11-07-14											
Last Revision: ~~01-05-15~~ 07-07-15					**Ludington Street**		**Ludington Street**				
					Between 9th Street		**Between 9th Street**				
					and 15th Street		**and 3rd St Outfall**		**TOTALS**		
Item	**Description**	**Unit**	**Price**		**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**	
142	96” Pre-cast Concrete Manhole (or cast-in-place structure)	EA	$10,500			$0	2	$21,000	2	$21,000	
143	84” Pre-cast Concrete Manhole (or 48" Tee-Line Manhole)	EA	$9,000			$0	7	$63,000	7	$63,000	
144	72” Pre-cast Concrete Manhole	EA	$7,500			$0		$0	0	$0	
145	60” Pre-cast Concrete Manhole	EA	$6,500		7	$45,500	9	$58,500	16	$104,000	
146	24" Pre-cast Concrete Catch Basin	EA	$2,600		24	$62,400	52	$135,200	76	$197,600	
147	Remove Existing 48" Manhole	EA	$275		4	$1,100	17	$4,675	21	$5,775	
148	Remove Existing Catch Basin	EA	$250		13	$3,250	25	$6,250	38	$9,500	
149	12" Gravel Base in Type 'A' Pavement Areas (Trench Only)	LF	$30			$0		$0	0	$0	
150	3" Type 'A' Pavement Replacement (Trench Only)	LF	$35			$0		$0	0	$0	
151	Concrete or Asphalt Curb and Gutter Removal	LF	$5		240	$1,200	540	$2,700	780	$3,900	
152	Asphalt Pavement Removal, 2" - 5"	SY	$5		6,600	$33,000	14,800	$74,000	21,400	$107,000	
153	Road Subbase and Base Removal, 18"	SY	$3		6,600	$19,800	14,800	$44,400	21,400	$64,200	
154	Concrete Pavement Removal, 4"-8"	SY	$5		2,500	$12,500	7,100	$35,500	9,600	$48,000	
155	Trolley Car Ballast Removal & Replacement w/ Gran. Material	SY	$5		1,200	$6,000	3,500	$17,500	4,700	$23,500	
156	Sand Sub-Base, Cl II, 6"	SY	$12		6,600	$79,200	14,800	$177,600	21,400	$256,800	
157	22A Aggregate Base, 12" Thickness	SY	$12		6,600	$79,200	14,800	$177,600	21,400	$256,800	
158	3" HMA, LVSP	SY	$18		6,600	$118,800	14,800	$266,400	21,400	$385,200	
159	6" Concrete Driveway Replacement, Includes 4" Sand Base	SY	$50			$0	20	$1,000	20	$1,000	
160	3" Asphalt Driveway Replacement, Includes 6" Gravel Base	SY	$45			$0	20	$900	20	$900	
161	6" Concrete Sidewalk or Pedestrian Ramp	SF	$6		800	$4,800	1,800	$10,800	2,600	$15,600	
162	ADA Truncated Dome for Pedestrian Ramps	SF	$40		160	$6,400	360	$14,400	520	$20,800	
163	Concrete Curb & Gutter, with 6" Gravel Base	LF	$25		240	$6,000	540	$13,500	780	$19,500	
164	Manhole or Catch Basin Casting Adjustment Prior to Final Paving	EA	$350		12	$4,200	25	$8,750	37	$12,950	
165	Valve Box Adjustment Prior to Final Paving	EA	$140		13	$1,820	28	$3,920	41	$5,740	
166	Pavement Marking	LS	$4,000		1	$4,000	1	$4,000	2	$8,000	
167	24" Heavy Rip-Rap	SY	$90			$0	50	$4,500	50	$4,500	
	Subtotal					**$1,447,595**		**$3,341,820**		**$4,789,415**	
	10% Contingency					**$144,760**		**$334,182**		**$478,942**	
	Construction Total					**$1,592,355**		**$3,676,002**		**$5,268,357**	
	23% Engineering, Legal & Administrative					**$332,947**		**$768,619**		**$1,101,565**	
	Project Total					**$1,925,301**		**$4,444,621**		**$6,369,922**	
..											
	Note: Costs do not include sanitary sewer replacement- recommend City TV inspection prior										
..											

COUNTY MATERIALS CORPORATION
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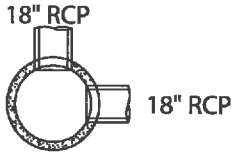
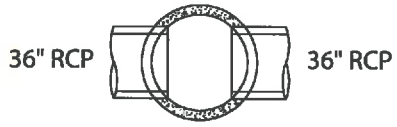
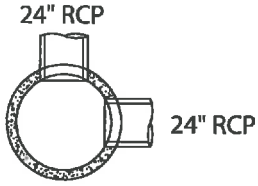
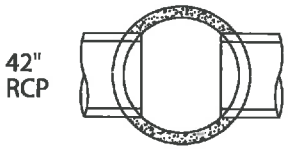
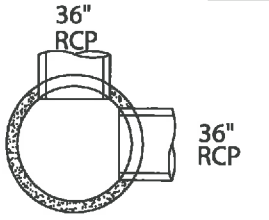
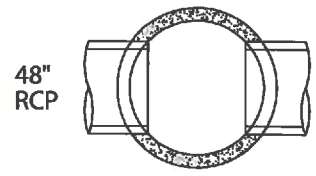
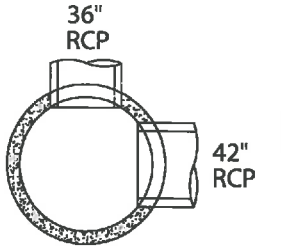
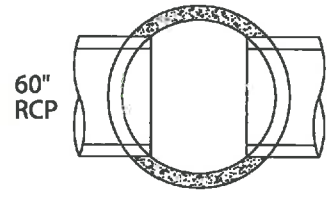
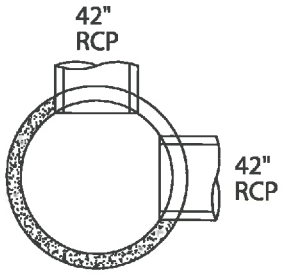
Drawing #: A3
Date: 0109

Storm Sewer Systems

Storm Manhole Sizing Chart (48" - 96")

MANHOLE DIAMETER	MAXIMUM PIPE SIZE FOR PRECAST STRUCTURES	
	STRAIGHT	RIGHT ANGLE
48"		
60"		
72"		
84"		
96"		

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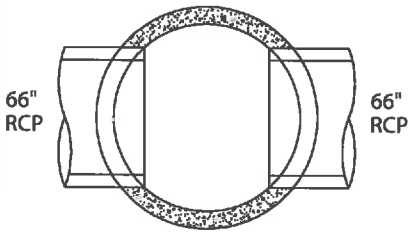
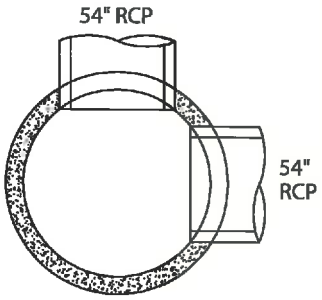
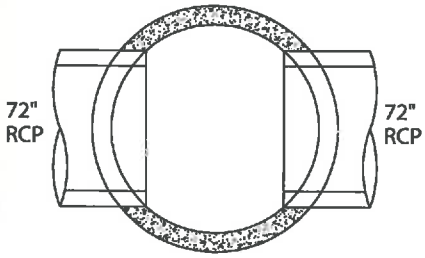
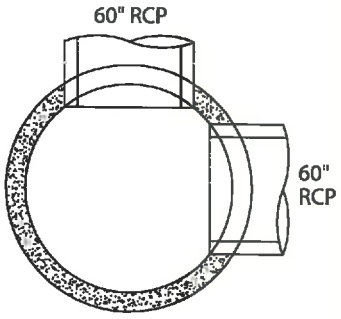
Drawing #: A3.1
Date: 0109

Storm Sewer Systems

Storm Manhole Sizing Chart (108" - 144")

MANHOLE DIAMETER	MAXIMUM PIPE SIZE FOR PRECAST STRUCTURES	
	STRAIGHT	RIGHT ANGLE
108"	 (BASED ON 8'-0" RISER HEIGHT)	
120"	 (BASED ON 8'-0" RISER HEIGHT)	
144"	PLEASE CALL FOR ASSISTANCE (6'-0" MAX RISER HEIGHT)	

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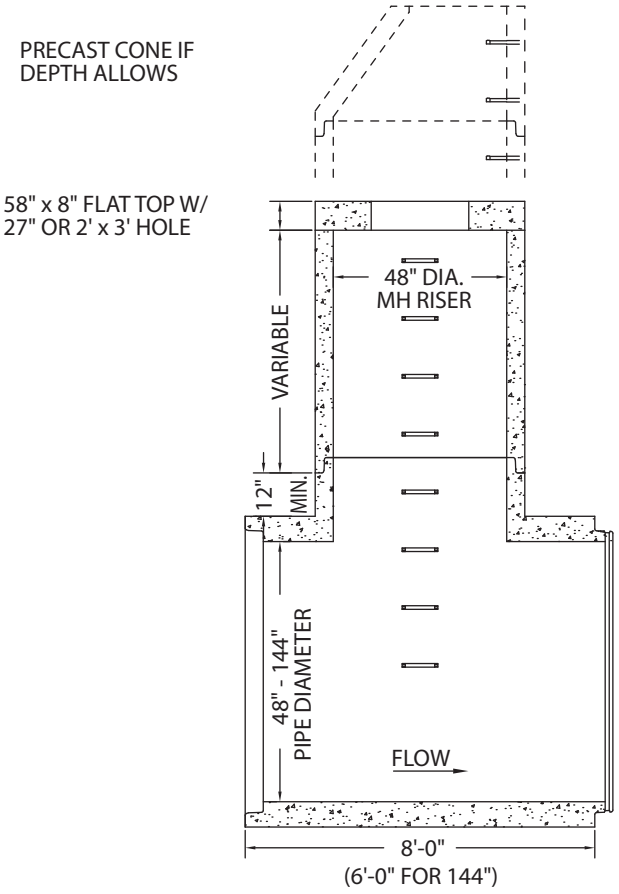
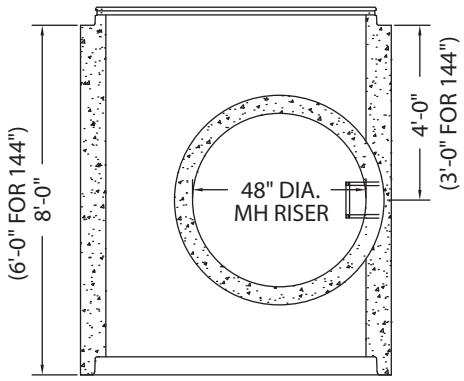
Drawing #: A9
Date: 0109

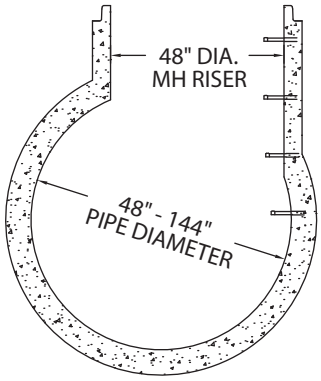
Storm Sewer Systems
Storm Tee Manhole
(D.O.T. MH, Type 6)



PROFILE



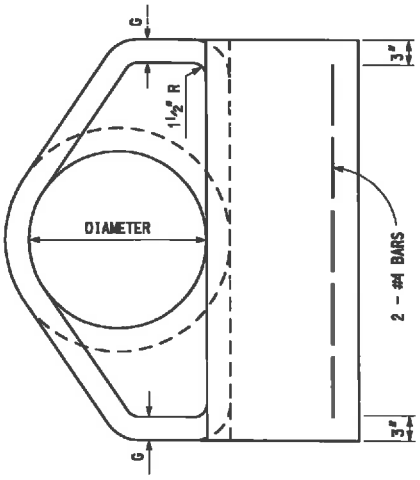
PLAN



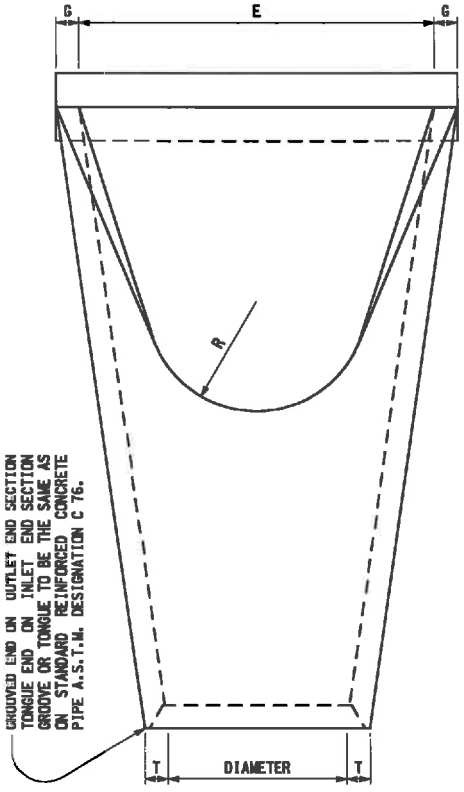
SECTION

SPECIFICATIONS:

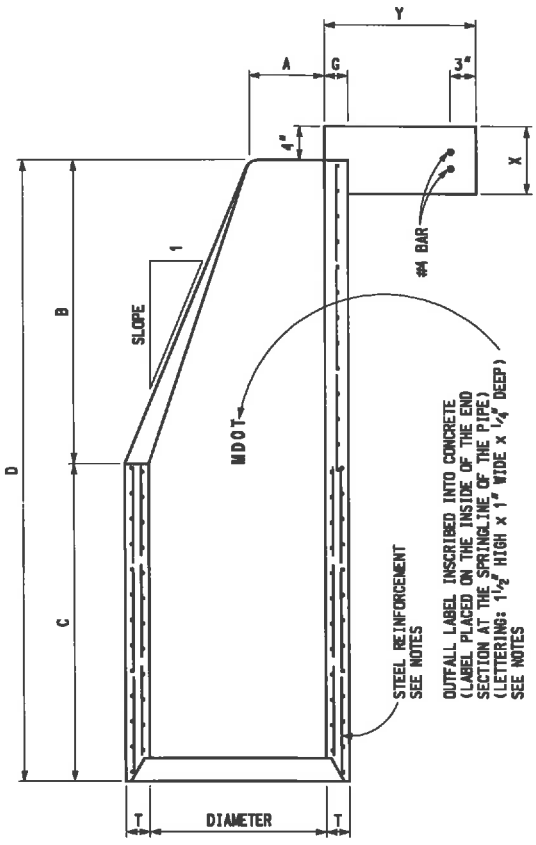
* MANUFACTURED TO ASTM C-478 SPECIFICATIONS
* CONCRETE STRENGTH - 4000 P.S.I.
* STEEL DESIGN IN ACCORDANCE WITH A.S.T.M. C-478
* ALL REINFORCING DESIGNED FOR 1" MIN. COVER
* STEP - STEEL, PLASTIC COATED, 16" ON CENTER



END ELEVATION



PLAN VIEW



LONGITUDINAL SECTION

MDOT
Michigan Department of Transportation

PREPARED BY
DESIGN
SUPPORT AREA

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Gloria J. Jeff

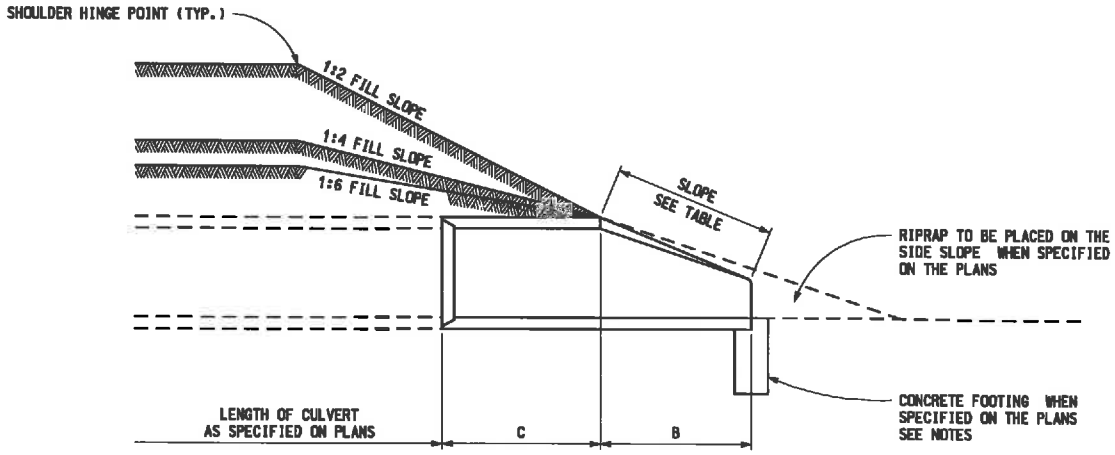
APPROVED BY: John C. Fraser
ENGINEER OF DELIVERY

APPROVED BY: [signature]
ENGINEER OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

PRECAST CONCRETE END SECTION FOR PIPE CULVERT

11-17-2005	4-21-2005	R-86-D	SHEET
F-H-W-A- APPROVAL	PLAN DATE		1 OF 2



SLOPE DETAIL

TABLE OF DIMENSIONS

PIPE DIAMETER (INCHES)	APPROX. SLOPE	T (INCHES)	A (INCHES)	B (INCHES)	C (INCHES)	D (INCHES)	E (INCHES)	G (INCHES)	R (INCHES)	X (INCHES)	Y (INCHES)
12	2.4 to 1	2	4	24	49	73	24	2	9	8	18
15	2.4 to 1	2 1/4	6	27	46	73	30	2 1/4	11	8	18
18	2.3 to 1	2 1/2	9	27	46	73	36	2 1/2	12	8	18
21	2.4 to 1	2 3/4	9	36	37 1/2	73 1/2	42	2 3/4	13	8	18
24	2.5 to 1	3	9 1/2	43 1/4	30 1/2	73 1/2	48	3	14	8	18
27	2.5 to 1	3 1/4	10 1/2	49 1/4	24 1/2	73 1/2	54	3 1/4	14 1/2	8	18
30	2.5 to 1	3 1/2	12	54	19 3/4	73 3/4	60	3 1/2	15	8	18
36	2.5 to 1	4	15	63	34 3/4	97 3/4	72	4	20	8	18
42	2.5 to 1	4 1/2	21	63	35	98	78	4 1/2	22	10	24
48	2.5 to 1	5	24	72	26	98	84	5	22	10	24
54	2.0 to 1	5 1/2	27	65	33 1/4	98 1/4	90	5 1/2	24	10	24
60	1.9 to 1	6	35	60	39	99	96	5	*	12	24
66	1.7 to 1	6 1/2	30	72	27	99	102	5 1/2	*	12	24
72	1.8 to 1	7	36	78	21	99	108	6	*	12	24
78	1.8 to 1	7 1/2	36	90	21	111	114	6 1/2	*	12	24
84	1.6 to 1	8	36	90 1/2	21	111 1/2	120	6 1/2	*	12	24

* AS FURNISHED BY THE MANUFACTURER

NOTES:

CONCRETE IN THESE END SECTIONS SHALL BE THE SAME GRADE AND STRENGTH AS SPECIFIED FOR REINFORCED CONCRETE PIPE, A.S.T.M. DESIGNATION C 76 CLASS II, EXCEPT AS MODIFIED BY THE STANDARD SPECIFICATION.

REINFORCEMENT IN THE "C" PORTION SHALL BE THE SAME AS SPECIFIED FOR REINFORCED CONCRETE, A.S.T.M. DESIGNATION C 76 CLASS II FOR THE SIZE OF CONNECTING PIPE.

REINFORCEMENT IN THE "B" PORTION SHALL HAVE A CROSS-SECTIONAL AREA EQUAL TO THAT OF ONE LAYER OF STEEL IN THE "C" PORTION.

THE END OF THE PIPE CULVERT SHALL BE PLACED IN THE CONCRETE END SECTION SO THAT THE FLOW LINES ARE FLUSH. THE JOINT SHALL BE COMPLETELY FILLED WITH MORTAR.

TO CHANGE THE FILL SLOPE TO THE SLOPE OF THE END SECTION USE A TRANSITION SLOPE OF APPROXIMATELY 10' IN LENGTH TO PROVIDE A PLEASING APPEARANCE.

VARIATIONS IN DIMENSIONS - THE THICKNESS OF CONCRETE, THE POSITION OF STEEL, AND THE INTERNAL DIAMETER OF THE PIPE SHALL CONFORM WITH THE VARIATIONS IN DIMENSIONS AS PROVIDED IN THE SPECIFICATIONS FOR REINFORCED CONCRETE CULVERT, STORM DRAINS, AND SEWER PIPE, A.S.T.M. DESIGNATION C 76.

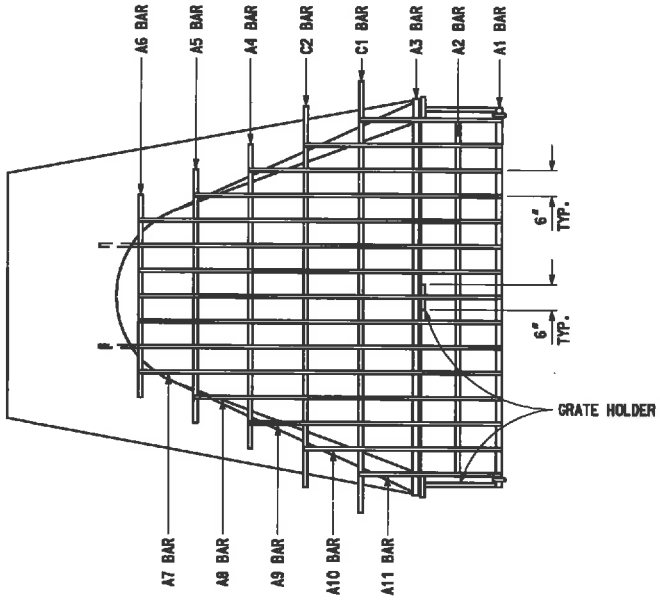
PLACE CONCRETE FOOTING WHEN CULVERT GRADE IS 4% OR MORE, OR WHEN SPECIFIED ON THE ROAD PLANS.

OUTFALL LABEL TO BE USED ONLY WHERE STORMWATER WILL DISCHARGE DIRECTLY TO THE WATERS OF THE STATE.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

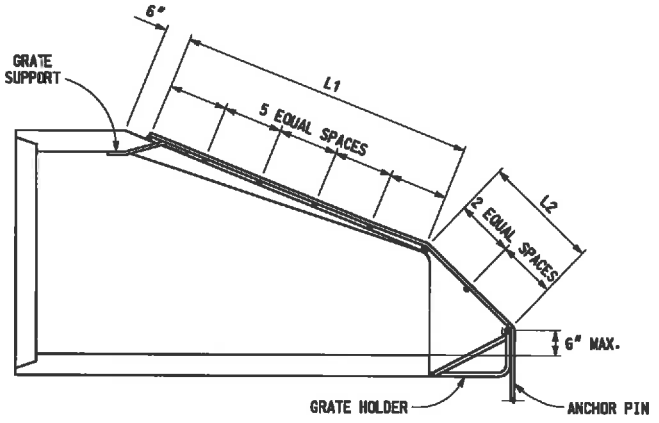
PRECAST CONCRETE END SECTION FOR PIPE CULVERT

11-17-2005 F.H.W.A. APPROVAL	4-21-2005 PLAN DATE	R-86-D	SHEET 2 OF 2



PLAN VIEW

STEEL REINFORCEMENT QUANTITIES				
DIAMETER		36"		
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)
A1	#10	1	78"	28
A2	#8	1	72"	16
A3	#10	1	80"	28
A4	#8	1	72"	16
A5	#8	1	60	13
A6	#8	1	48"	10
A7	#6	7	82½"	72
A8	#6	2	70½"	18
A9	#6	2	58½"	15
A10	#6			
A11	#6	2	34½"	9
C1	#8	1	96"	21
C2	#8	1	84"	18
ANCHOR PIN	#8	2	36"	16
GRATE HOLDER	#8	2	20"	9
GRATE SUPPORT	#8	3	48"	31
TOTAL STEEL WEIGHT (LBS)				320



LONGITUDINAL SECTION

STEEL REINFORCEMENT QUANTITIES							
DIAMETER		42"			48"		
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)
A1	#10	1	84"	30	1	90"	32
A2	#8	1	72"	16	1	84"	18
A3	#10	1	86"	30	1	94"	33
A4	#8	1	72"	16	1	72"	16
A5	#8	1	60"	13	1	60"	13
A6	#8	1	48"	10	1	48"	10
A7	#6	7	86¼"	75	7	97¾"	85
A8	#6	2	74¼"	19	2	83¾"	21
A9	#6	2	62¼"	16	2	69¾"	17
A10	#6	2	50¼"	13	2	55¾"	14
A11	#6	2	38¼"	10	2	41¾"	10
C1	#8	1	96"	21	1	108"	23
C2	#8	1	96"	21	1	96"	21
ANCHOR PIN	#6	2	36"	9	2	36"	9
GRATE HOLDER	#6	2	20"	5	2	20"	5
GRATE SUPPORT	#8	3	48"	31	3	48"	31
TOTAL STEEL WEIGHT (LBS)				335			358

DIMENSIONS		
DIAMETER	L1	L2
36"	60"	22½"
42"	60"	26¼"
48"	70"	27¾"

GRATE FOR 36" THROUGH 48" DIAMETER PIPE WITH CONCRETE END SECTION

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

STEEL GRATES FOR END SECTIONS

9-14-2001 F.H.W.A. APPROVAL	2-26-2001 PLAN DATE	R-92-C	SHEET 3 OF 6

Escanaba, MI
Ludington Street Drainage Assessment

APPENDIX 'D'

Field Work

2015

1211 Ludington Street
Escanaba, MI 49829
P: 906.233.9360
F: 906.233.9389
www.c2ae.com

Memo

To: **14-0182 file B-10**

From: **DCC**

Date: ~~**12-16-14**~~ **rev 04-16-15**

Re: **Escanaba Ludington Street**
Drainage Assessment
Field Work Summary

Summary of field work performed in conjunction with the Escanaba drainage study:

- General Site Visits – November 2014
    - General site visits were made during November to confirm nature of the problem area and likely routes for utility (primarily storm sewer) improvements
- Structure Survey - Week of 11-17-14
    - C2AE subconsultant, TriMedia, performed a structure survey along the likely routes for utility improvements to be recommended as part of the drainage study
    - Surveyors established State Plane Coordinates and casting top elevations for manhole and drainage structures on Ludington, 11th Street, 12th Street, 3rd Ave. North, and along the related storm outfall sewer through the Basic Marine property.
    - The data allowed the structures to be accurately placed on report drawings and more importantly, provides information for storm sewer flow calculations, future construction drawings, and future Asset Management Plan databases.
    - A total of 99 structures were surveyed and their coordinates and elevations are noted on the attached location map. The raw survey data will also be available for future use in the City's SAW program asset databases.
- Structure Inventory – Spring/Summer 2015 as needed
    - Ten structures were inventoried on 04-02-15 with summary results attached.
    - This information will also be available for future use in utility design and development of the City's SAW program Asset Management Plan.
    - This memo will be updated on completion of any future inventory work.

Point #	Northing	Easting	Elevation	Description
1	350323.82	26236444.58	590.19	BM WATER
2	350323.87	26236444.59	590.18	BM WATER
100	352565.82	26231554.88	579.93	OUTFALL
101	352472.23	26231195.31	591.73	MH-401
102	352453.23	26230874.43	595.83	MH-402
103	352263.58	26230861.29	599.47	MH-403
104	352259.46	26230707.56	600.35	MH-404
105	352252.59	26230717.70	600.43	MH-404-2
106	352219.67	26230739.86	599.79	CB-404A
107	352220.40	26230698.80	600.10	CB-404B
108	351767.43	26230717.25	601.58	MH-405
109	351744.46	26230736.49	601.03	CB-405A
110	351744.83	26230699.34	600.80	CB-405B
111	351780.46	26230698.86	600.94	CB-405C
112	351781.25	26230737.12	601.16	CB-405D
113	351347.73	26230710.57	601.92	MH-406
114	351347.73	26230727.66	601.90	MH-406-2
115	351356.01	26230735.80	601.35	CB-406A
116	351306.50	26230743.25	601.19	CB-406B
117	351306.75	26230692.49	601.03	CB-406C

Point Table

Point #	Northing	Easting	Elevation	Description
118	351357.68	26230695.87	600.98	CB-406D
119	351022.24	26230712.66	602.43	MH-407
120	350960.68	26230716.80	601.94	MH-407-2
121	351023.95	26230692.89	601.64	CB-407A
122	351023.00	26230741.15	601.75	CB-407B
123	350864.44	26230741.46	601.86	CB-407C
124	350864.62	26230692.66	601.91	CB-407D
125	350911.41	26230690.40	601.49	CB-407E
126	350910.97	26230680.94	601.37	CB-407F
127	350975.48	26230690.40	601.35	CB-407G
128	350959.75	26230338.42	602.96	MH-408
129	350977.70	26230308.29	602.00	CB-408A
130	350911.22	26230310.59	602.50	CB-408B
131	350961.06	26229957.39	603.50	MH-409
132	350976.66	26229930.93	602.40	CB-409A
133	350911.47	26229919.75	602.60	CB-409B
134	350911.35	26229930.61	602.82	CB-409C
135	350875.39	26229934.28	602.91	CB-409D
136	350865.44	26229981.36	603.03	CB-409E
137	350961.46	26229835.73	603.55	MH-410

Point Table

Point #	Northing	Easting	Elevation	Description
138	350960.33	26229576.96	604.52	MH-411
139	350976.67	26229550.83	603.49	CB-411A
140	350911.56	26229550.92	603.86	CB-411B
141	350908.86	26229547.50	603.76	CB-411C
142	350892.63	26229604.98	603.84	CB-411D
143	350962.44	26229198.23	606.97	MH-412
144	350976.92	26229171.50	606.54	CB-412A
145	350911.85	26229172.06	606.42	CB-412B
146	350961.03	26229020.09	608.28	MH-413
147	350960.99	26228854.91	609.53	MH-414
148	350977.62	26228829.96	608.82	CB-414A
149	350912.20	26228829.77	608.97	CB-414B
150	351122.82	26229957.15	603.09	MH-445
151	351128.44	26229931.13	602.89	CB-445A
152	351129.46	26229983.81	602.67	CB-445B
153	351347.79	26230336.67	601.97	MH-433
154	351354.20	26230357.59	601.50	CB-433A
155	351313.41	26230357.86	601.53	CB-433B
156	351314.37	26230318.06	601.66	CB-433C
157	351354.36	26230317.51	601.51	CB-433D

Point Table

Point #	Northing	Easting	Elevation	Description
158	351343.70	26229969.77	602.89	MH-435
159	351355.40	26229976.86	602.34	CB-435A
160	351354.80	26229937.91	602.54	CB-435B
161	351314.52	26229936.18	602.50	CB-435C
162	351763.84	26230327.02	602.17	MH-434
163	351782.39	26230318.72	601.71	CB-434A
164	351783.70	26230356.59	601.72	CB-434B
165	351745.05	26230358.11	601.59	CB-434C
166	351745.52	26230317.78	601.76	CB-434D
167	352261.24	26230338.74	601.58	MH-420 CB- LID
168	352218.17	26230357.14	601.32	CB-420A
169	352219.29	26230318.65	601.22	CB-420B
200	352172.58	26230909.55	599.46	MH-SAN
201	351739.49	26230907.67	601.64	MH-SAN
202	351340.27	26230907.43	601.42	MH-SAN
203	351319.27	26230908.38	601.17	MH-SAN
204	351319.36	26231053.08	600.83	MH-SAN
205	351348.17	26230939.90	601.21	MH-STORM
206	351320.89	26230762.96	601.64	MH-SAN
207	351320.40	26230673.63	601.66	MH-SAN

Point Table

Point #	Northing	Easting	Elevation	Description
208	351319.69	26230527.22	601.80	MH-SAN
209	351764.90	26230527.59	602.23	MH-SAN
210	352218.66	26230528.33	601.21	MH-SAN
211	352274.99	26230527.07	601.84	MH-SAN
212	352217.58	26230148.57	603.52	MH-SAN
213	351763.34	26230148.34	602.62	MH-SAN
214	351320.40	26230147.93	602.21	MH-SAN
215	351322.83	26229769.01	603.21	MH-SAN
216	351738.94	26229768.85	603.26	MH-SAN
217	352219.32	26229770.96	604.78	MH-SAN
218	352221.21	26229390.83	605.34	MH-SAN
219	351763.09	26229389.69	604.85	MH-SAN
220	351324.43	26229388.93	605.02	MH-SAN
221	351333.30	26229203.98	607.06	MH-SAN
222	351334.65	26228844.07	611.17	MH-SAN
223	350945.03	26228843.37	609.89	MH-SAN
224	350944.79	26228857.09	609.77	MH-SAN
225	350945.68	26229198.19	607.20	MH-SAN
226	350944.44	26229576.84	604.83	MH-SAN
227	350944.93	26229956.77	603.65	MH-SAN

Point Table

Point #	Northing	Easting	Elevation	Description
228	350943.54	26230336.78	603.32	MH-SAN
229	350943.24	26230715.59	602.04	MH-SAN
230	350943.03	26231096.88	600.98	MH-SAN

Escanaba, MI
Ludington Street Drainage Assessment

Structure Suvey Map
C2AE
Nov 2014

CITY OF ESCANABA, MICHIGAN
LUDINGTON STREET DRAINAGE ASSESSMENT
DELTA COUNTY, MICHIGAN

MAP #1

c2ae elevating human achievement
www.c2ae.com

REVISIONS

SCALE: 1" = 150'
PROJ. #: 141126
DATE: 12/2014
SHEET 1

PRELIMINARY

TriMedia Environmental & Engineering

Manhole Inventory

Structure ID:	#154	**Structure Size:** 48"	**Date:** 4-2-15
Rim Elevation:			**Crew:** KRH
Structure Type:	Catch Basin		**Time:**
Location:	12th St. & 1st Ave N.		**Weather:**
Comments:	NE		

COVER INFORMATION

Cover Type:	C1 - Grate	**Shield Installed:**	
Ring Diameter:	22" - Rect.	**Number of holes:**	24 - 4"x1½"
Cover Condition:	Gd	**Cover Recommendations:**	Gd
Comments:			

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:			
Steps:			
Walls:	Conc	Gd	
Apron:			
Channel:			
Comments:			

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
6"	SW	3.88				Gd

DRAWING:

See sketches pgs. 11 & 12

1/12

C2AE

Manhole Inventory

Structure ID: #155 **Structure Size:** 48" **Date:** 4-2-15
Rim Elevation: **Crew:** KRH
Structure Type: Catch Basin **Time:**
Location: 12th St. & 1st Ave N **Weather:**
Comments: SE

COVER INFORMATION

Cover Type: CI - Grate **Shield Installed:**
Ring Diameter: 22" **Number of holes:** 29 - 1½"x6"
Cover Condition: Gd **Cover Recommendations:**
Comments: Grate

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:	Conc	Gd	
Steps:	2 - steel	Poor	
Walls:	Conc	Gd	
Apron:			
Channel:			
Comments:			

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
6"	NW	4.46				Gd

DRAWING:

2/12

C2AE

Manhole Inventory

Structure ID:	#156	**Structure Size:** 48"	**Date:** 4-2-15
Rim Elevation:			**Crew:** KRH
Structure Type:	Catch Basin		**Time:**
Location:	12th St. E 1st Ave. N.		**Weather:**
Comments:	SW – C13		

COVER INFORMATION

Cover Type:	C.I. – Grate	**Shield Installed:**	
Ring Diameter:	22"	**Number of holes:**	29 – 1¼"x6"
Cover Condition:	Gd.	**Cover Recommendations:**	
Comments:	Vented		

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:	conc	Gd	
Steps:			
Walls:	conc	Gd	
Apron:			
Channel:			
Comments:	Frame offset 3"		

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
6"	NE	4.06				Gd

DRAWING:

3/17

C2AE

Manhole Inventory

Structure ID:	#157	**Structure Size:**	48"	**Date:**	4-2-15
Rim Elevation:				**Crew:**	KRH
Structure Type:	Catch Basin			**Time:**	
Location:	12th St & 1st Ave N			**Weather:**	
Comments:	NW				

COVER INFORMATION

Cover Type:	C1 - Grate	**Shield Installed:**	
Ring Diameter:	27" - Rect.	**Number of holes:**	24 - 4"x 1½"
Cover Condition:	Gd	**Cover Recommendations:**	
Comments:			

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:			
Steps:	2 - Steel	Poor	
Walls:	Conc.	Gd	
Apron:			
Channel:			
Comments:			

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
6"	SE	4016				Gd

DRAWING:

4/12

C2AE

Manhole Inventory

Structure ID:	#163	**Structure Size:**	**Date:** 4-2-15
Rim Elevation:			**Crew:** KRH
Structure Type:	Catch Basin		**Time:**
Location:	12th St & 2nd Ave. N.		**Weather:**
Comments:	NW		

COVER INFORMATION

Cover Type:	C1 – Grate	**Shield Installed:**	
Ring Diameter:	27" Rect.	**Number of holes:**	24 – 4"x 1.5"
Cover Condition:	Gd	**Cover Recommendations:**	
Comments:			

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:			
Steps:	1 – steel	poor	
Walls:	Brick	Good	
Apron:			
Channel:			
Comments:			

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
6"	SE	4.50'				Gd

DRAWING:

5/12

C2AE

Manhole Inventory

Structure ID: #164 **Structure Size:** 36" **Date:** 4-2-15
Rim Elevation: **Crew:** KRH
Structure Type: Catch Basin **Time:**
Location: 17th St & 2nd Ave N **Weather:**
Comments: NE

COVER INFORMATION

Cover Type: C1 **Shield Installed:**
Ring Diameter: 22" Rect **Number of holes:** 24 - 4" x 1½"
Cover Condition: Gd **Cover Recommendations:**
Comments:

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:			
Steps:	2 - Steel	Poor	
Walls:	Block	Gd	
Apron:			
Channel:			
Comments:			

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
6"	SW	4.60				Gd

DRAWING:

6/12

C2AE

Manhole Inventory

Structure ID:	#165	**Structure Size:**	**Date:** 4-2-15
Rim Elevation:			**Crew:** KRH
Structure Type:	Catch Basin		**Time:**
Location:	12th St & 2nd Ave N, SE		**Weather:**
Comments:			

COVER INFORMATION

Cover Type:	CI - Grate	**Shield Installed:**	
Ring Diameter:	22"	**Number of holes:**	24 - 4"x1½"
Cover Condition:	Good	**Cover Recommendations:**	
Comments:			

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:			
Steps:	2 - Steel	Poor	
Walls:	Block	Good	
Apron:			
Channel:			
Comments:			

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
6"	NW	4.20				Good

DRAWING:

7/12

C2AE

Manhole Inventory

Structure ID: #166 **Structure Size:** 36" **Date:** 4-2-15
Rim Elevation: **Crew:** KRH
Structure Type: Catch Basin **Time:**
Location: 12th St. & 2nd Ave N **Weather:**
Comments: SW

COVER INFORMATION

Cover Type: CI - Grate **Shield Installed:**
Ring Diameter: 22" - Rect **Number of holes:** 24 - 4"x 1½"
Cover Condition: Gd **Cover Recommendations:**
Comments:

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:			
Steps:	2 - Steel	Poor	
Walls:	Block	Gd	
Apron:			
Channel:			
Comments:			

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
6"	NE	4.20				Gd

DRAWING:

8/12

C2AE

Manhole Inventory

Structure ID: #168 **Structure Size:** 24" **Date:** 4-2-15
Rim Elevation: **Crew:** KRH
Structure Type: Catch Basin **Time:**
Location: 12th St & 3rd Ave. No. **Weather:**
Comments: SE

COVER INFORMATION

Cover Type: C/- Grate **Shield Installed:**
Ring Diameter: 22" **Number of holes:** 24 - 4"x 1.5"
Cover Condition: Gd **Cover Recommendations:**
Comments:

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:			
Steps:	NA		
Walls:	Brick	Good	
Apron:			
Channel:			
Comments:			

PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
12"	NW	3.62'		Conc.		Gd

DRAWING:

9/12

C2AE

Manhole Inventory

Structure ID: #169 **Structure Size:** 24" **Date:** 4-2-15
Rim Elevation: **Crew:** KRH
Structure Type: Catch Basin **Time:**
Location: 12th St & 3rd Ave N, **Weather:**
Comments: SW

COVER INFORMATION

Cover Type: CI - Grate **Shield Installed:**
Ring Diameter: 22" - Rect. **Number of holes:** 24 -
Cover Condition: Good **Cover Recommendations:**
Comments:

STRUCTURE OBSERVATIONS:

	TYPE	CONDITION	RECOMMENDATIONS
Chimney:			
Steps:	N/A		
Walls:	Brick	Gd	
Apron:			
Channel:			

Comments:

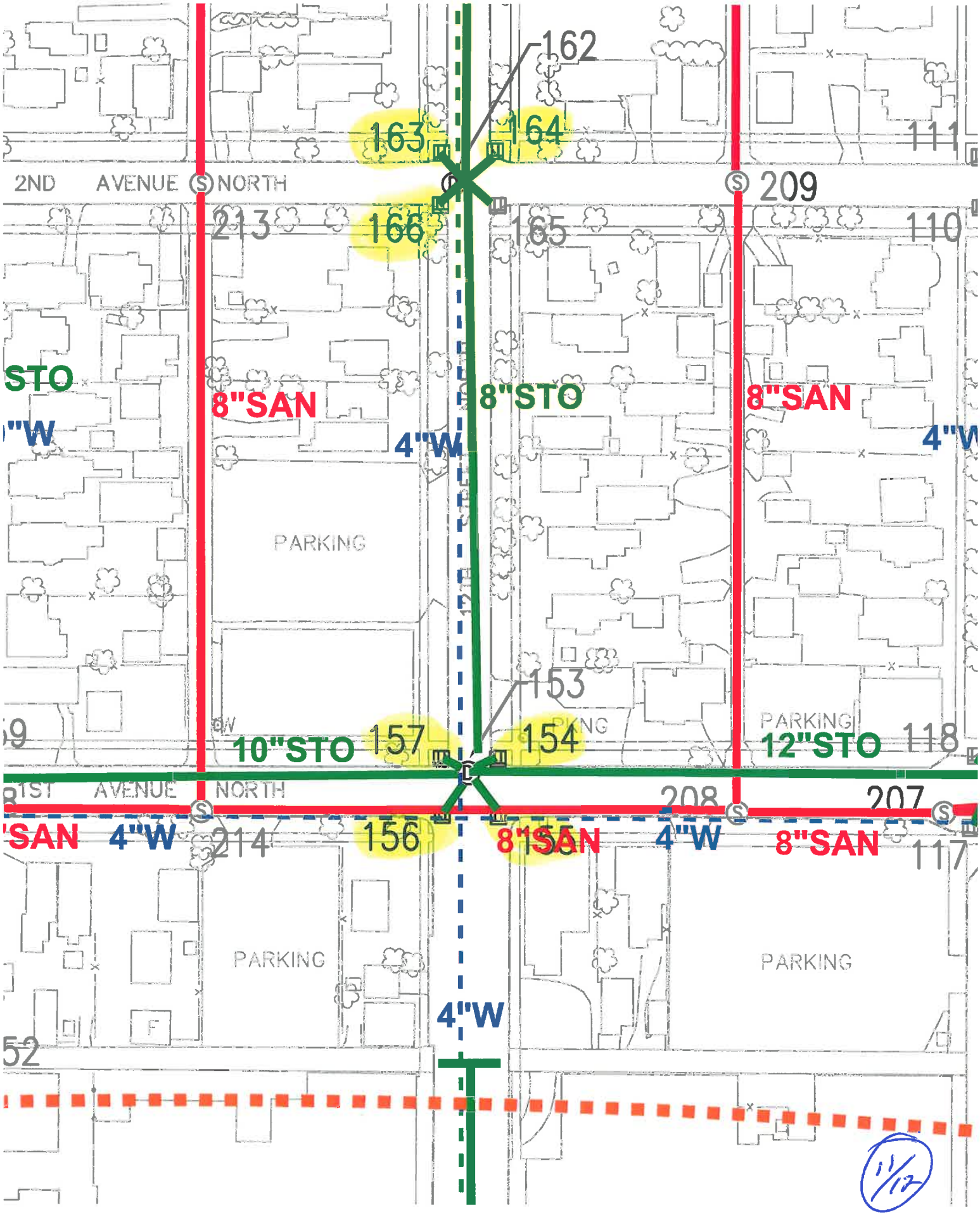
PIPES:

Dia	Direction	Invert	Elevation	Material	To Structure	Comments
12"	NE	4120		Conc		Good

DRAWING:

10/12

C2AE


162
163
164
111
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209
213
166
165
110
STO
8"SAN
8"STO
8"SAN
"W
4"W
4"W
PARKING
153
PARKING
PARKING
118
10"STO
157
154
12"STO
1ST AVENUE NORTH
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4"W
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PARKING
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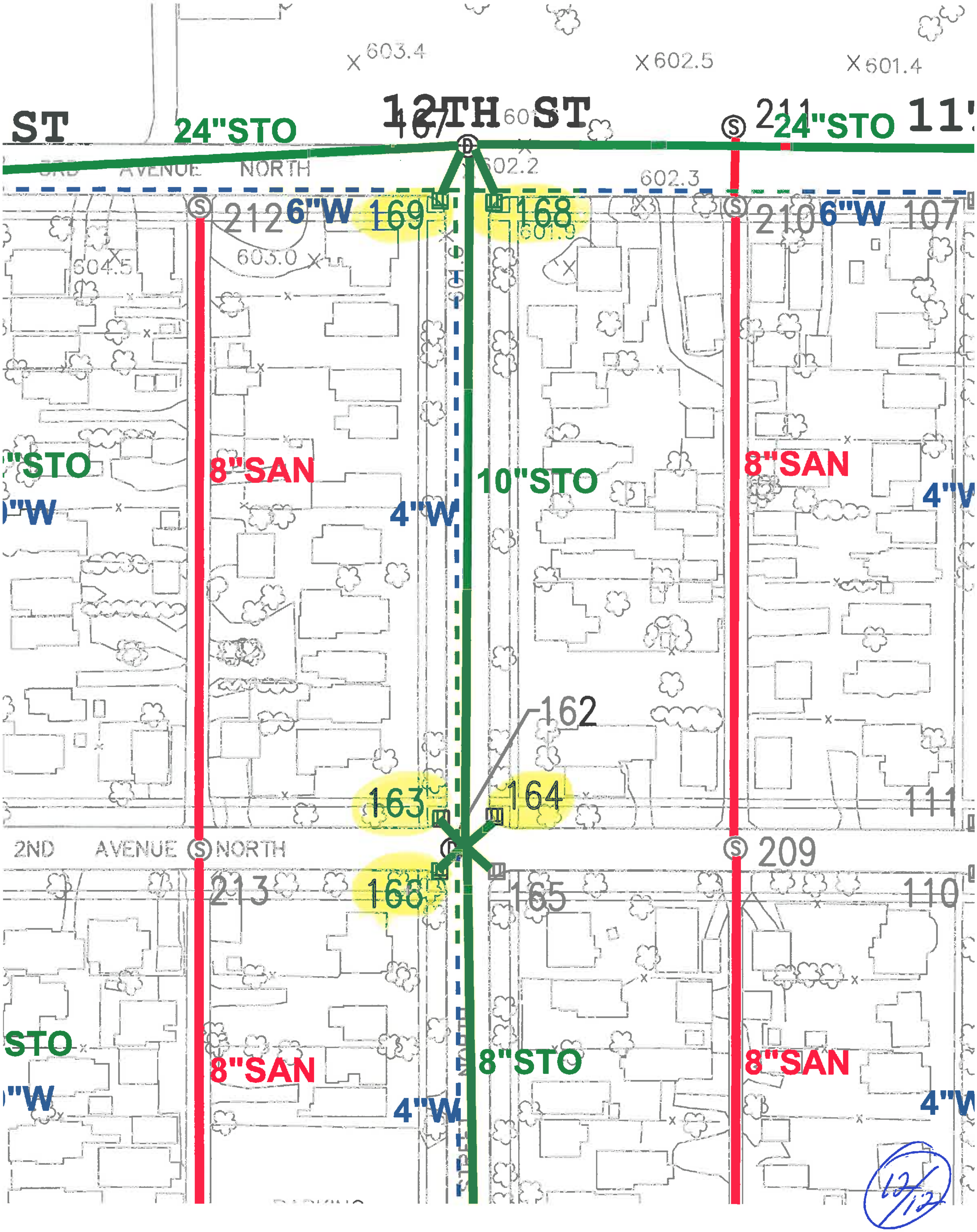
4"W
52



12TH ST
ST
24"STO
24"STO
AVENUE NORTH
603.4
602.5
601.4
602.2
602.3
212
6"W
169
168
210
6"W
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211
167
11
604.5
603.0
601.9
8"SAN
10"STO
8"SAN
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12/12