LOR-113-03.75
PID: 104864
Drainage Report – Stage 3

Ohio Department of Transportation
District 3
906 Clark Avenue
Ashland, Ohio 44805

May 2020

AMERICAN STRUCTUREPOINT INC.

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TABLE OF CONTENTS

Section

1. Project Drainage Narrative

Project Drainage Narrative

Existing Drainage

Existing drainage of the project area consists of roadside ditches, drive pipes, and a limited number of culverts to connect ditches on either side of the road. The north side of the existing intersection has a closed drainage system with curb inlets along the intersection returns. A natural swale/stream flows through the intersection from the southeast corner to the northwest corner. This swale is conveyed under SR 113 and CR 51 through a combination of dual elliptical pipes, box culverts, and junction chambers. This series of large storm structures was constructed in segments. The inlet of this structure is an 8' x 3.5' box culvert while the outlet is a pair of twin 43" x 68" elliptical pipes.

Proposed Drainage

Culverts

There are two proposed culverts on the project. Culvert #1 is a proposed 27" culvert just south of SR113/CR51 roundabout, which conveys the ditch flow from the southwest corner of the intersection across CR 51 to the ditch at the southeast corner of the intersections. Culvert #2 is not used. Culvert #3, is an existing culvert which crosses both CR 51 and SR 113, which conveys the ditch flow from the southeast corner of the intersection to the existing stream along the northern portion of the project along CR 51. Culvert #3 consists of reconstructing the existing southern junction chamber, located in the northeastern corner of the intersection, and replacing the existing 3-sided box culvert with a 7' x 4' 4-sided box culvert. Additionally the Culvert #3 twin 43" x 68" elliptical pipes will be extended and headwall replaced at the outlet. Both culverts were analyzed using the 25 year flood frequency and a Flood Hazard Evaluation using a check discharge based on the 100 year flood frequency. The contributing drainage areas for each of the culverts was determined based on existing 2 ft contours developed from LIDAR data, as well as existing survey information. Outlet erosion protection has been added based on the outlet velocity of the proposed culverts. Culvert #1 has been sized utilizing the Culvert Design tool incorporated into ODOT's CDSS program. Culvert #3 was analyzed as a utilizing the AutoCAD Storm Sanitary Analysis software. The peak discharge for Culvert #1 was calculated using the rational method. The peak discharge for Culvert #3 was determined based on USGS Open File Report 2432 - "Estimation of Peak-Frequency Relations, Flood Hydrographs, and Volume - Duration - Frequency Relations of Ungaged Small Urban Streams in Ohio" per ODOT L&D Vol 2, Section 1003.1.3. The proposed extension of Culvert #3 results in a 25-year Headwater elevation of 792.28, which is 0.02ft lower than the existing 25-year headwater; and a 100-year headwater elevation of 793.57, which is 0.12ft lower than the existing.

Inlet Spacing

Inlet spread calculations were run for the curb and gutter turnouts along the four legs of the intersection. Curb and gutter turnouts will consist of a 7' wide face of curb opening which curve back using 2' radii on either side. The back of the turnout will be 3' wide and drain down the roadway sideslopes over rock channel protection to a proposed roadside ditch. The inlet spacing was completed using the Inlet Spacing tool incorporated into ODOT's CDSS program. A CB-3A catch basin was used as a conservative equivalent to a curb and gutter turnout. The rock channel protection along the slideslopes was designed by assuming a ditch condition between the curb and gutter turnout and the ditch bottom.

Storm Sewer Calculations

A proposed storm sewer system was designed to tie in into existing drainage systems along the north leg. This system connects to an existing 18" storm pipe running under CR 51 and existing 8" storm pipes coming from the property along the northeast corner of the intersection. Another proposed storm sewer system was designed along the east leg of the roundabout to convey storm water from the north side of SR 113 to the box culvert inlet along the south side of SR 113. The storm sewers were sized using a 10 year design storm and hydraulic grade line was checked using a 25 year design storm. The proposed storm sewers have been sized utilizing the Storm Sewer analysis tool incorporated into ODOT's CDSS program.

Ditch Design

Roadside ditches have been utilized along all four legs of the intersection to collect pavement runoff directly from shoulders or curb turnouts in curb and gutter sections. Ditches were analyzed using a 10 year storm frequency to determine the depth of flow and checked to make sure that it was greater than 1' below the edge of pavement. Shear stress was analyzed using a 5 year storm to determine the channel lining. Appropriate lining was determined according to ODOT LDM Volume 2 and from ODOT's CDSS program.

Best Management Practice (BMP) Design

Vegetated filter strips were used as a post construction BMP for the project area. Spreadsheets are included that give detailed locations and sizes of each treatment feature. The BMP credit earned is also calculated and compared to the minimum required according to the total disturbed area for the project.

2. LD-35 Drainage Design Criteria

Form LD-35
Revised January 2015

PROJECT INFORMATION:

COUNTY	ROUTE	SECTION	PID
LOR	113	03.75	104864

PIPE POLICY:

The Pipe Policy of ODOT will be used for this project.

(Attach a copy of the written pipe policy or furnish a link to the policy. In lieu of a written policy, documentation of locally funded construction practices may be provided)

POST CONSTRUCTION BMP POLICY:

The Post Construction BMP Policy of ODOT will be used for this project.

If a policy other than ODOT's is being used, the following BMP's are permitted:

DRAINAGE WATERSHED(S):

Mouth Vermilion River (041000120204)

PROJECT SPECIFIC INFORMATION AFFECTING DRAINAGE:

Project will utilize roadside ditches, culverts, drive pipes, curb and gutter with turnouts and paved gutters to direct roadway runoff to proposed ditches. The project will also remove and replace a large culvert running through the intersection.

3. Culvert Calculations

UNIVERSAL CULVERT DESIGN

PID : 104864 **Date :** 04/14/2020 **Project :** LOR-113-03.75 **Location :** Under CR 51

Description : Culvert #1 - Sta. 212+22.75 (CR 51) **Designer :** MTL

HEADWATER CONTROL CODES:

INLET - Inlet Control.
OUTLET - Outlet Control.
OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 791.15 **Outlet Invert Elevation (ft.) :** 789.68 **Tailwater Elevation (ft.) :** 789.68 **Overflow Elevation (ft.) :** 796.40

Allowable Headwater Elevation (ft.) : 794.80 **or** Diameter + 2 ft. *(whichever is less)*

Pipe Length (ft.) : 97.00 **Culvert Slope (ft./ft.) :** 0.0152 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 31.90 **@** 25 yrs. **Flood Discharge (cfs) :** 39.95 **@** 100 yrs.

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR SMOOTH			**Entrance Type :** Half Headwall								**Entrance Loss (Ke) :** 0.20		
31.90	1	30 in.	794.21	794.67	2 - F	7.87	2.50	1.92	0.0240	OUTLET**	0.00	D	0.00
31.60	1	27 in.	794.71	796.46	2 - F	8.68	2.25	1.94	0.0240	OUTLET**	0.30	D - 1	0.00
24.10	1	24 in.	795.73	800.08	2 - F	8.32	2.00	1.74	0.0240	OUTLET**	7.80	D - 2	0.00
39.95	1	30 in.	794.94	796.35	2 - F	8.97	2.50	2.13	0.0240	OUTLET**	0.00	F	0.00
31.65	1	27 in.	795.84	799.20	2 - F	8.69	2.25	1.94	0.0240	OUTLET**	8.30	F - 1	0.00
24.15	1	24 in.	797.49	804.92	2 - F	8.33	2.00	1.74	0.0240	OUTLET**	15.80	F - 2	0.00
CULVERT TYPE : CIRCULAR CORRUGATED			**Entrance Type :** Half Headwall								**Entrance Loss (Ke) :** 0.90		
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
31.90	1	36 in.	793.99	794.41	1 - A	7.06	1.88	1.83	0.0240	OUTLET*	0.00	D	0.00
31.90	1	30 in.	794.81	795.13	2 - F	7.87	2.50	1.92	0.0240	OUTLET**	0.00	D - 2	0.00
31.90	1	42 in.	793.73	N/A	1 - C	6.88	1.70	1.75	0.0240	INLET	0.00	D + 1	0.00

UNIVERSAL CULVERT DESIGN

	FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
	39.95	1	36 in.	794.58	794.86	2 - F	7.73	2.22	2.06	0.0240	OUTLET*	0.00	F	0.00
	37.35	1	30 in.	796.03	797.07	2 - F	8.60	2.50	2.07	0.0240	OUTLET**	2.60	F - 2	0.00
	39.95	1	42 in.	794.12	N/A	1 - C	7.27	1.95	1.97	0.0240	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)														
	31.90	1	36 in.	793.99	794.41	1 - A	7.06	1.88	1.83	0.0240	OUTLET*	0.00	D	0.00
	31.90	1	42 in.	793.73	N/A	1 - C	6.88	1.70	1.75	0.0240	INLET	0.00	D + 1	0.00
	39.95	1	36 in.	794.58	794.86	2 - F	7.73	2.22	2.06	0.0240	OUTLET*	0.00	F	0.00
	39.95	1	42 in.	794.12	N/A	1 - C	7.27	1.95	1.97	0.0240	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)														
Diameter exceeds 1.25 HWA	31.90	1	60 in.	793.37	N/A	1 - C	6.74	1.45	1.57	0.0240	INLET	0.00	D	0.00
	31.90	1	66 in.	793.27	N/A	1 - C	5.93	1.40	1.53	0.0240	INLET	0.00	D + 1	0.00
	39.95	1	60 in.	793.68	N/A	1 - C	7.18	1.63	1.76	0.0240	INLET	0.00	F	0.00
	39.95	1	66 in.	793.57	N/A	1 - C	7.12	1.57	1.71	0.0240	INLET	0.00	F + 1	0.00
Diameter exceeds 1.25 HWA	15.95	2	60 in.	792.63	N/A	1 - C	4.98	1.02	1.10	0.0240	INLET	0.00	D	0.00
	15.95	2	66 in.	792.58	N/A	1 - C	4.90	0.99	1.07	0.0240	INLET	0.00	D + 1	0.00
	19.98	2	60 in.	792.84	N/A	1 - C	5.30	1.14	1.23	0.0240	INLET	0.00	F	0.00
	19.98	2	66 in.	792.77	N/A	1 - C	5.21	1.11	1.20	0.0240	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)														
Diameter exceeds 1.25 HWA	31.90	1	60 in.	793.37	N/A	1 - C	6.74	1.45	1.57	0.0240	INLET	0.00	D	0.00
	31.90	1	66 in.	793.27	N/A	1 - C	5.93	1.40	1.53	0.0240	INLET	0.00	D + 1	0.00
	39.95	1	60 in.	793.68	N/A	1 - C	7.18	1.63	1.76	0.0240	INLET	0.00	F	0.00
	39.95	1	66 in.	793.57	N/A	1 - C	7.12	1.57	1.71	0.0240	INLET	0.00	F + 1	0.00
Diameter exceeds 1.25 HWA	15.95	2	60 in.	792.63	N/A	1 - C	4.98	1.02	1.10	0.0240	INLET	0.00	D	0.00
	15.95	2	66 in.	792.58	N/A	1 - C	4.90	0.99	1.07	0.0240	INLET	0.00	D + 1	0.00

UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
19.98	2	60 in.	792.84	N/A	1 - C	5.30	1.14	1.23	0.0240	INLET	0.00	F	0.00
19.98	2	66 in.	792.77	N/A	1 - C	5.21	1.11	1.20	0.0240	INLET	0.00	F + 1	0.00

Description:	Culvert # 1			
Project:	LOR-113-03.75			
Designer:	Michael Long			
Date:	3/19/2019			
Sta.:	212+22.75	CR 51		

Area No.	**Ac**	**C**	**C*Ac**
A0	30.70	0.42	12.90
A1	5.46	0.41	2.24
111+25 Inlet Outlet	0.12	0.90	0.11
A2	0.48	0.41	0.20
112+82 Inlet Outlet	0.25	0.90	0.23
A3	0.14	0.44	0.06
212+53 Inlet Outlet	0.12	0.90	0.11
A4	1.77	0.40	0.71
B1	0.93	0.45	0.42
	39.97		16.96
		Weighted "C"	**0.42**

Notes:

Tc is 69 minutes from Ditch Analysis for Area A

Tc for 69 min for a 25 year design = 1.90 in/hr ; Q = (0.42)(1.90)(39.97) = 31.90 cfs

Tc for 69 min for a 100 year design = 2.38 in/hr; Q = (0.42)(2.38)(39.97) = 39.95 cfs

Allowable HW is 1' below pavement 794.80. Overflow is 796.40

LStutler
7/25/2019 9:37:14 AM
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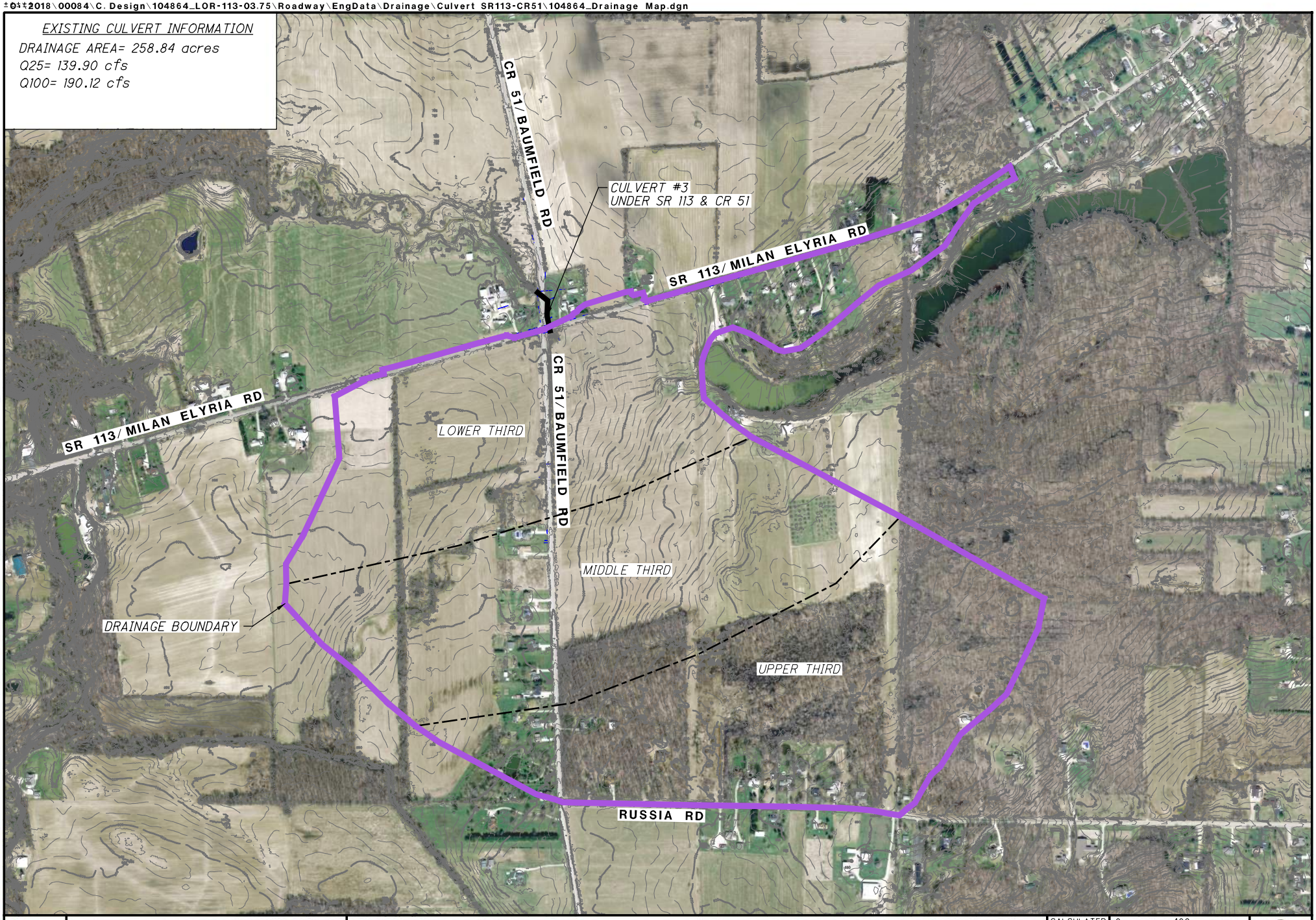


LOR-113-03.75	EXISTING DRAINAGE MAP CULVERT 3 - SR 113/ CR51	CALCULATED LZS CHECKED JS	0 400 200 800 HORIZONTAL SCALE IN FEET

AMERICAN STRUCTUREPOINT, INC.

PREPARED BY: _____ DATE: _____
CHECKD BY: _____ DATE: _____

PEAK DISCHARGE ANALYSIS

CULVERT ID: **Culvert 3**

Location **Crossing SR113 & CR51**

Drainage Area: **258.84** Acres

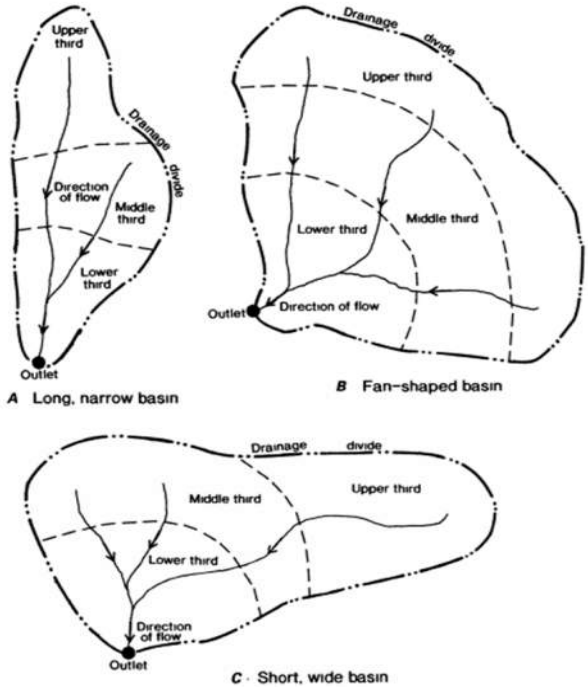
Calculations based on USGS Open File Report 2432 - "Estimation of Peak-Frequency Relations, Flood Hydrographs, and Volume - Duration - Frequency Relations of Ungaged Small Urban Streams in Ohio" per ODOT L&D Vol 2, Section 1003.1.3.

BASIN DEVELOPMENT FACTOR

ASPECT	THIRD	CODE	REMARKS
Channel Improvements	Lower	1	
	Middle	1	
	Upper	1	
Channel Linings	Lower		
	Middle		
	Upper		
Storm Sewer	Lower		
	Middle		
	Upper		
Curb & Gutter Streets	Lower		
	Middle		
	Upper		

BDF=	3

Figure 9. Schematic of typical drainage basin shapes and subdivision into thirds (from Sauer and others, 1983)



CULVERT ID: **Culvert 3**

Location **Crossing SR113 & CR51**

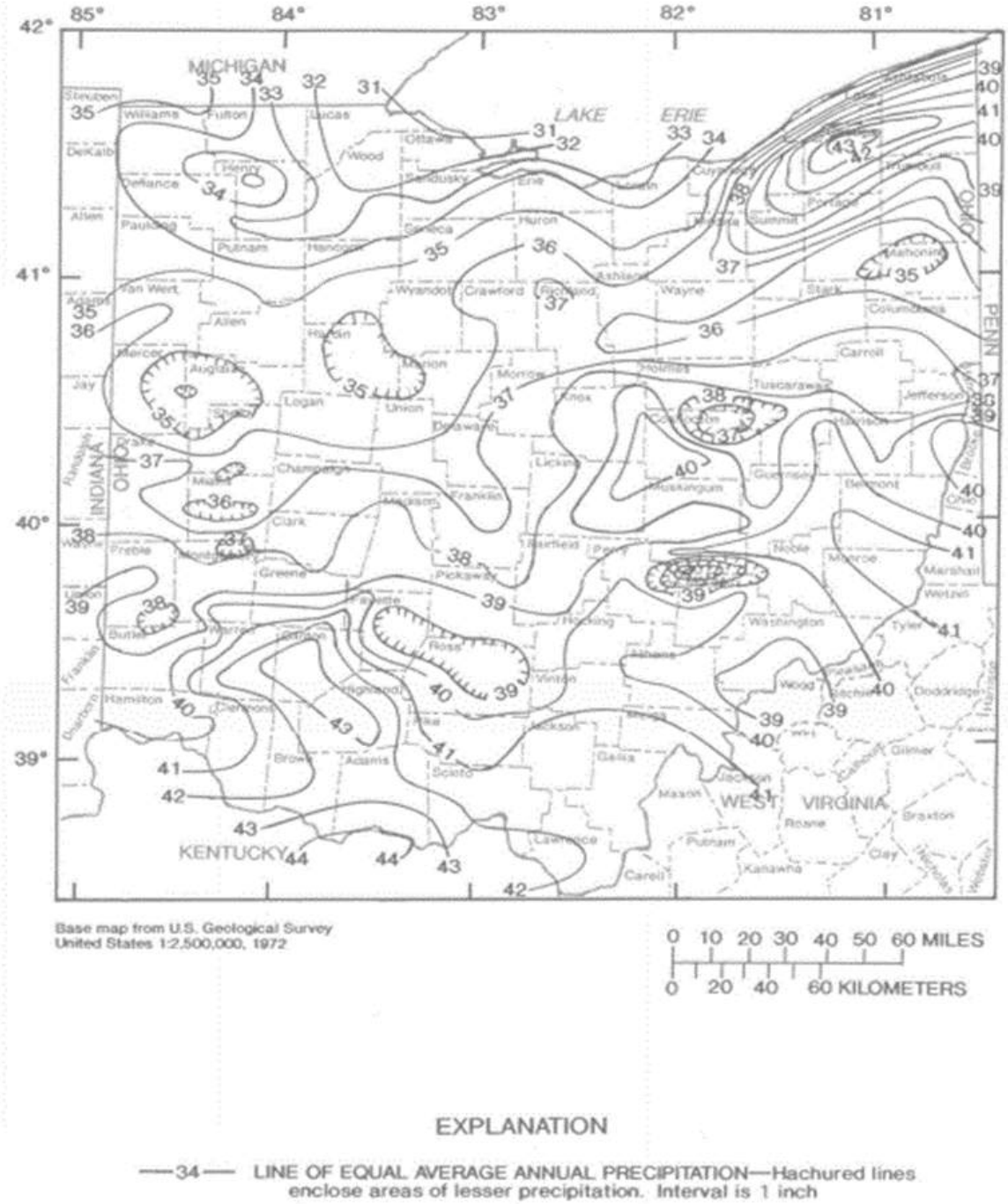
Drainage Area: **258.84** Acres

Calculations based on USGS Open File Report 2432 - "Estimation of Peak-Frequency Relations, Flood Hydrographs, and Volume - Duration - Frequency Relations of Ungaged Small Urban Streams in Ohio" per ODOT L&D Vol 2, Section 1003.1.3.

AVERAGE ANNUAL PRECIPITATION

P= 33.5 (Figure 8)

Figure 8. Average annual precipitation for Ohio for 1931-80 (modified from Harstine, 1991).



AMERICAN STRUCTUREPOINT, INC.

PREPARED BY: _____ DATE: _____
CHECKD BY: _____ DATE: _____

PEAK DISCHARGE ANALYSIS

CULVERT ID: **Culvert 3**

Location **Crossing SR113 & CR51**

Drainage Area: **258.84** Acres

Calculations based on USGS Open File Report 2432 - "Estimation of Peak-Frequency Relations, Flood Hydrographs, and Volume - Duration - Frequency Relations of Ungaged Small Urban Streams in Ohio" per ODOT L&D Vol 2, Section 1003.1.3.

PEAK REGRESSION ANALYSIS

A= 0.404 mi^2

P= 33.5 (Figure 8)

BDF= 3

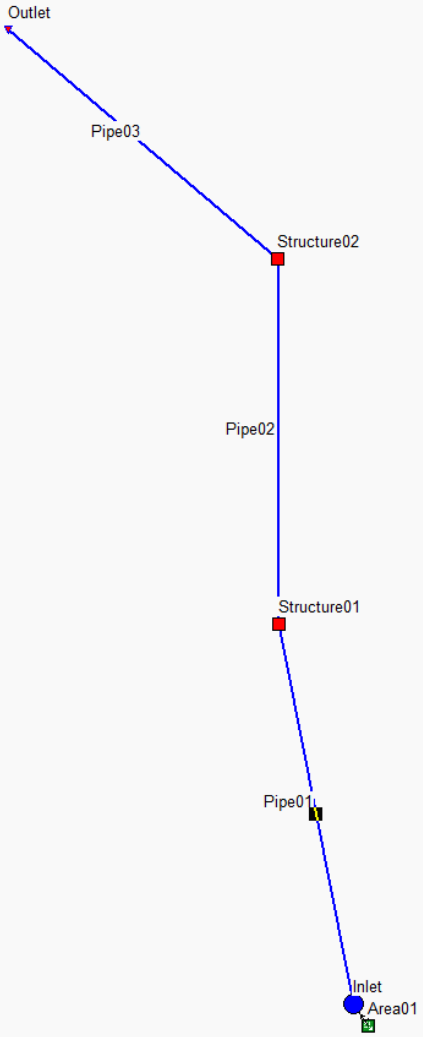
Table 8. Equations for estimating peak discharges of small urban streams in Ohio.

Equation number	Equation	SER	SEP
(1)	$UQ_2 = 155(A)^{0.68}(P\text{-}30)^{0.50}(13\text{-}BDF)^{-0.50}$	±32.3	±34.3
(2)	$UQ_5 = 200(A)^{0.71}(P\text{-}30)^{0.63}(13\text{-}BDF)^{-0.44}$	±32.8	±34.8
(3)	$UQ_{10} = 228(A)^{0.74}(P\text{-}30)^{0.68}(13\text{-}BDF)^{-0.41}$	±33.7	±36.0
(4)	$UQ_{25} = 265(A)^{0.76}(P\text{-}30)^{0.72}(13\text{-}BDF)^{-0.37}$	±35.0	±37.6
(5)	$UQ_{50} = 293(A)^{0.78}(P\text{-}30)^{0.74}(13\text{-}BDF)^{-0.35}$	±35.9	±38.8
(6)	$UQ_{100} = 321(A)^{0.79}(P\text{-}30)^{0.76}(13\text{-}BDF)^{-0.33}$	±36.9	±40.1

UQ_2=	**49.51**	**cfs**
UQ_5=	**84.01**	**cfs**
UQ_{10}=	**106.32**	**cfs**
UQ_{25}=	**139.90**	**cfs**
UQ_{50}=	**163.10**	**cfs**
UQ_{100}=	**190.12**	**cfs**

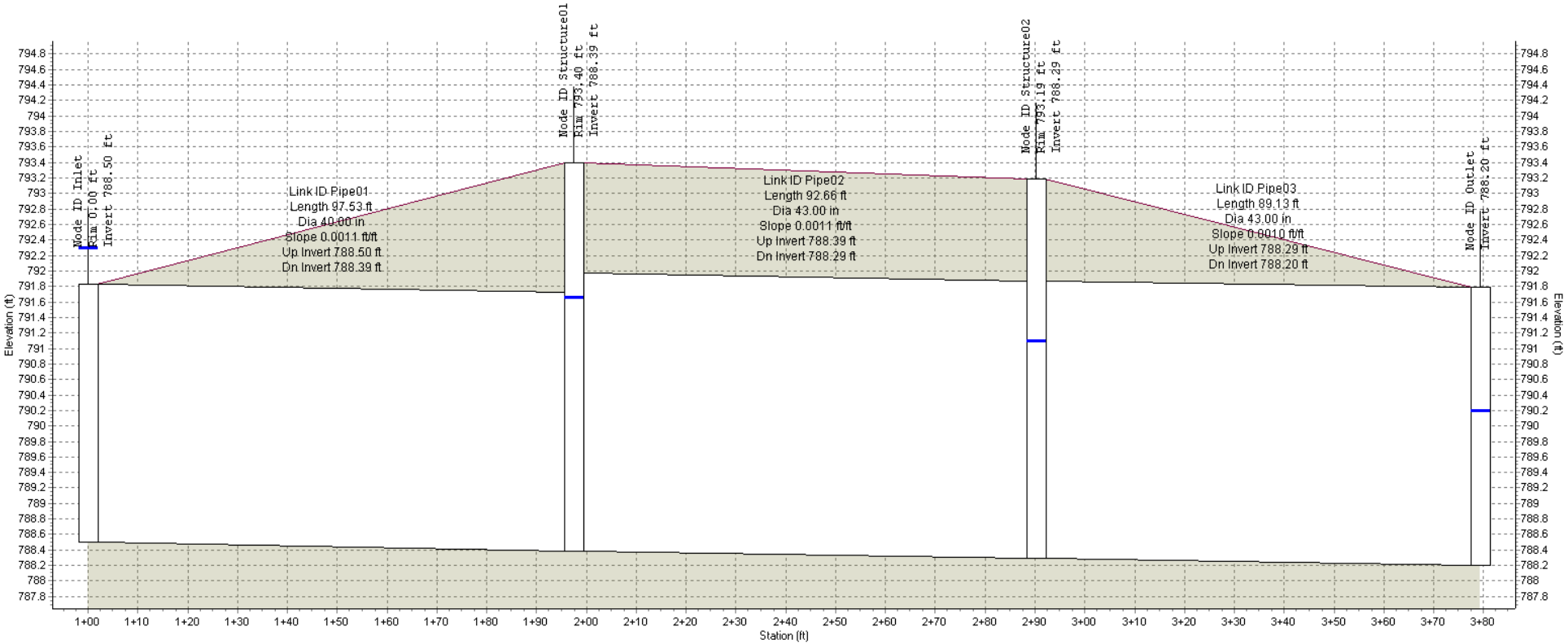
PLAN VIEW

CULVERT 3 – SR 113 & CR51 – Existing



PROFILE PLOT

CULVERT 3 – SR 113 & CR51 – Existing (25yr)

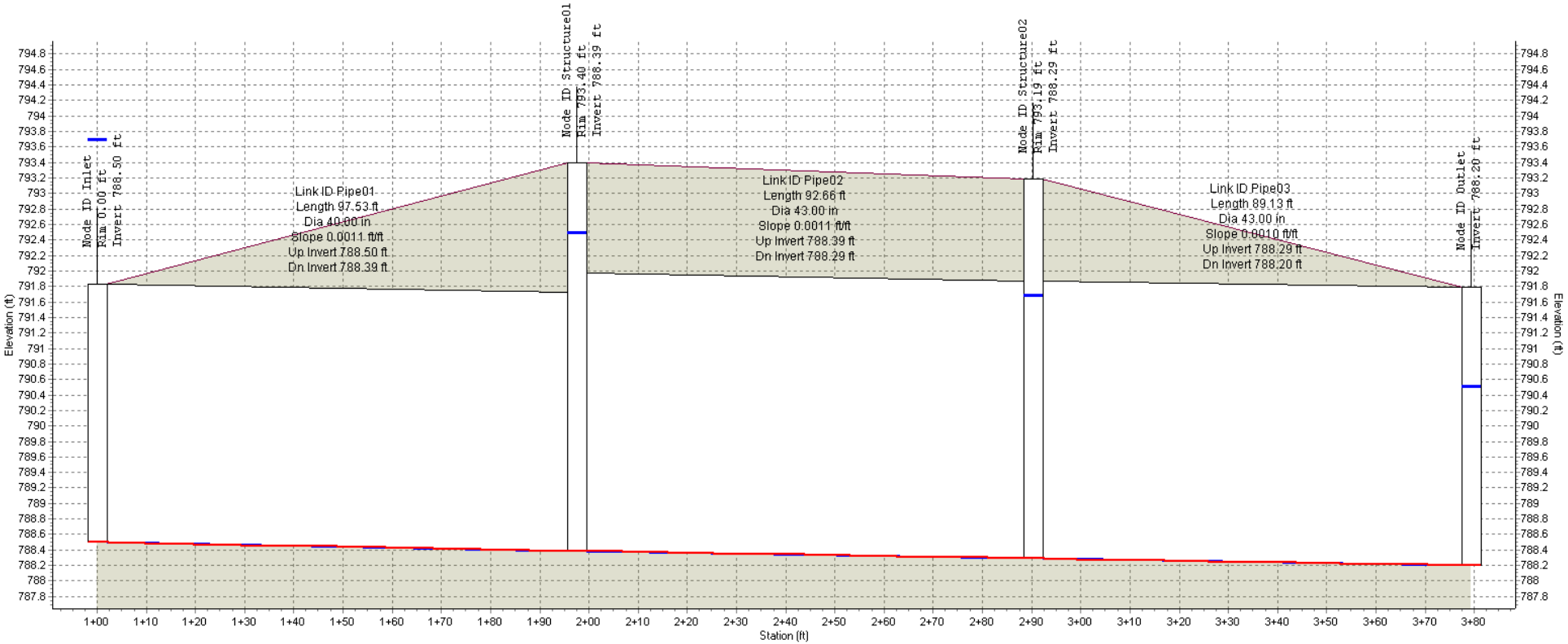


Node ID:	Inlet	Structure01	Structure02	Outlet
Rim (ft):	0.00	793.40	793.19	
Invert (ft):	788.50	788.39	788.29	788.20
Min Pipe Cover (ft):	0.00	1.43	1.32	
Max HGL (ft):	792.30	791.66	791.10	790.20

Link ID:	Pipe01	Pipe02	Pipe03
Length (ft):	97.53	92.66	89.13
Dia (in):	40.00	43.00	43.00
Slope (ft/ft):	0.0011	0.0011	0.0010
Up Invert (ft):	788.50	788.39	788.29
Dn Invert (ft):	788.39	788.29	788.20
Max Q (cfs):	139.51	139.51	139.51
Max Vel (ft/s):	5.29	4.70	5.79
Max Depth (ft):	3.30	3.04	2.41

PROFILE PLOT

CULVERT 3 – SR 113 & CR51 – Existing (100yr)



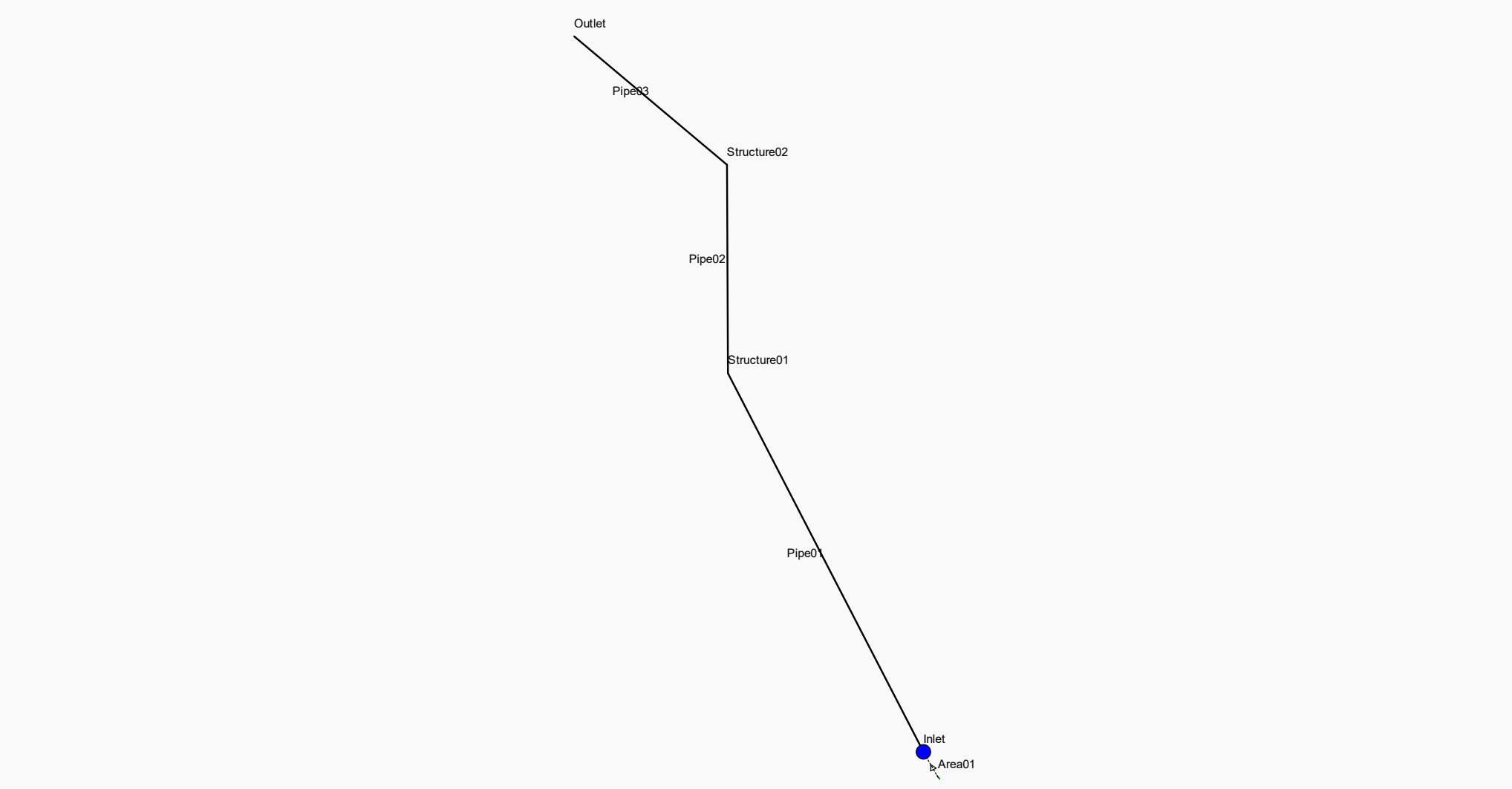
Node ID:	Inlet	Structure01	Structure02	Outlet
Rim (ft):	0.00	793.40	793.19	
Invert (ft):	788.50	788.39	788.29	788.20
Min Pipe Cover (ft):	0.00	1.43	1.32	
Max HGL (ft):	793.69	792.50	791.68	790.51

Link ID:	Pipe01	Pipe02	Pipe03
Length (ft):	97.53	92.66	89.13
Dia (in):	40.00	43.00	43.00
Slope (ft/ft):	0.0011	0.0011	0.0010
Up Invert (ft):	788.50	788.39	788.29
Dn Invert (ft):	788.39	788.29	788.20
Max Q (cfs):	189.77	189.77	189.77
Max Vel (ft/s):	7.12	5.88	6.72
Max Depth (ft):	3.33	3.49	2.85

AutoDesk Storm and Sanitary Analysis

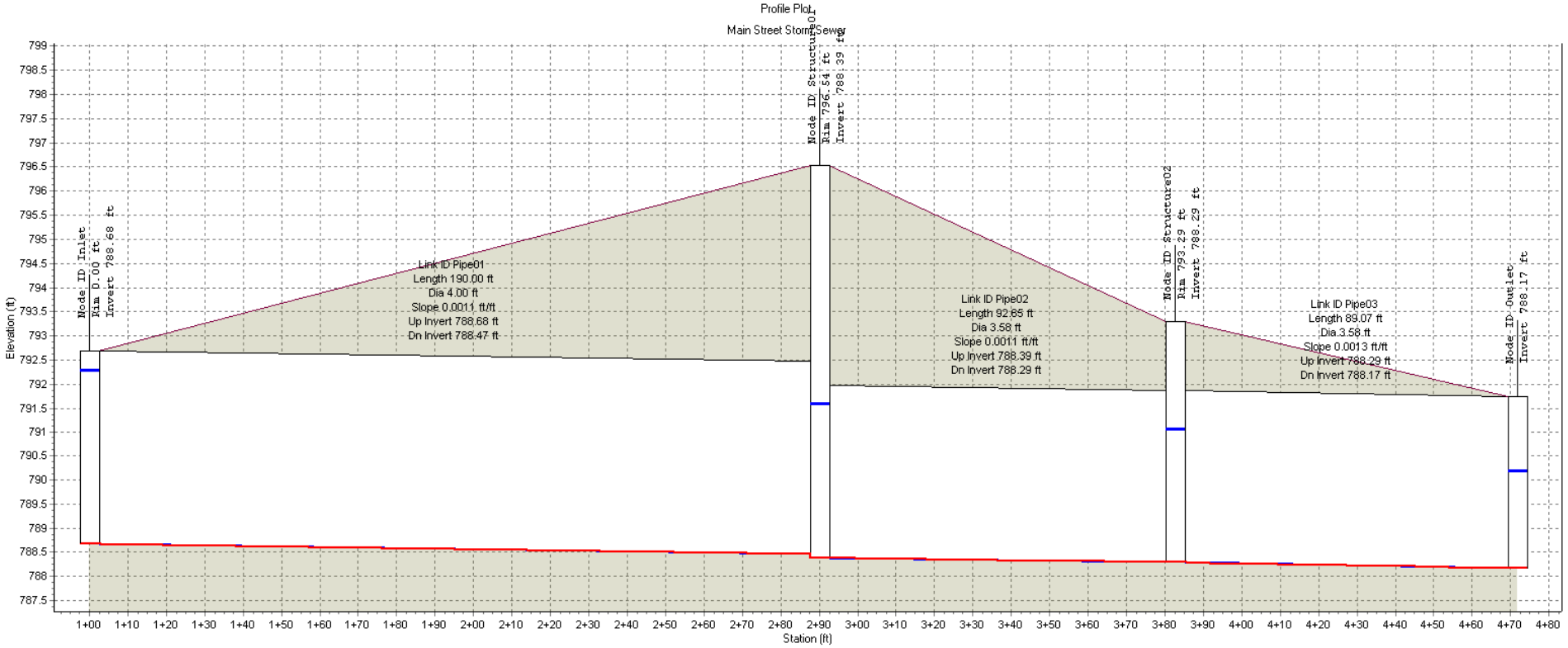
PLAN VIEW

CULVERT 3 – SR 113 & CR51 – Proposed (Box)



PROFILE PLOT

CULVERT 3 – SR 113 & CR51 – Proposed - Box (25yr)

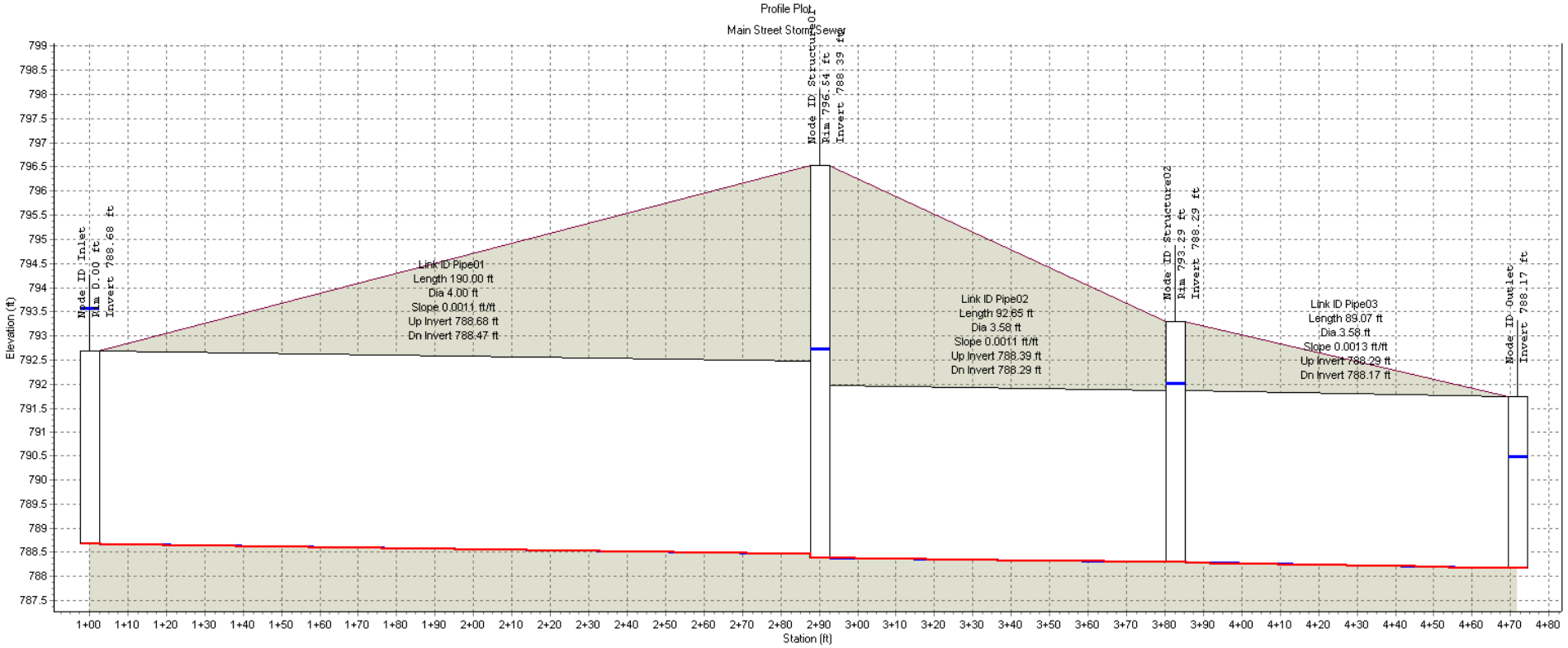


Node ID:	Inlet	Structure01	Structure02	Outlet
Rim (ft):	0.00	796.54	793.29	
Invert (ft):	788.68	788.39	788.29	788.17
Min Pipe Cover (ft):	0.00	4.07	1.42	
Max HGL (ft):	792.28	791.59	791.07	790.17

Link ID:	Pipe01	Pipe02	Pipe03
Length (ft):	190.00	92.65	89.07
Dia (ft):	4.00	3.58	3.58
Slope (ft/ft):	0.0011	0.0011	0.0013
Up Invert (ft):	788.68	788.39	788.29
Dn Invert (ft):	788.47	788.29	788.17
Max Q (cfs):	139.52	139.62	140.33
Max Vel (ft/s):	5.20	4.76	5.86
Max Depth (ft):	3.36	2.99	2.39

PROFILE PLOT

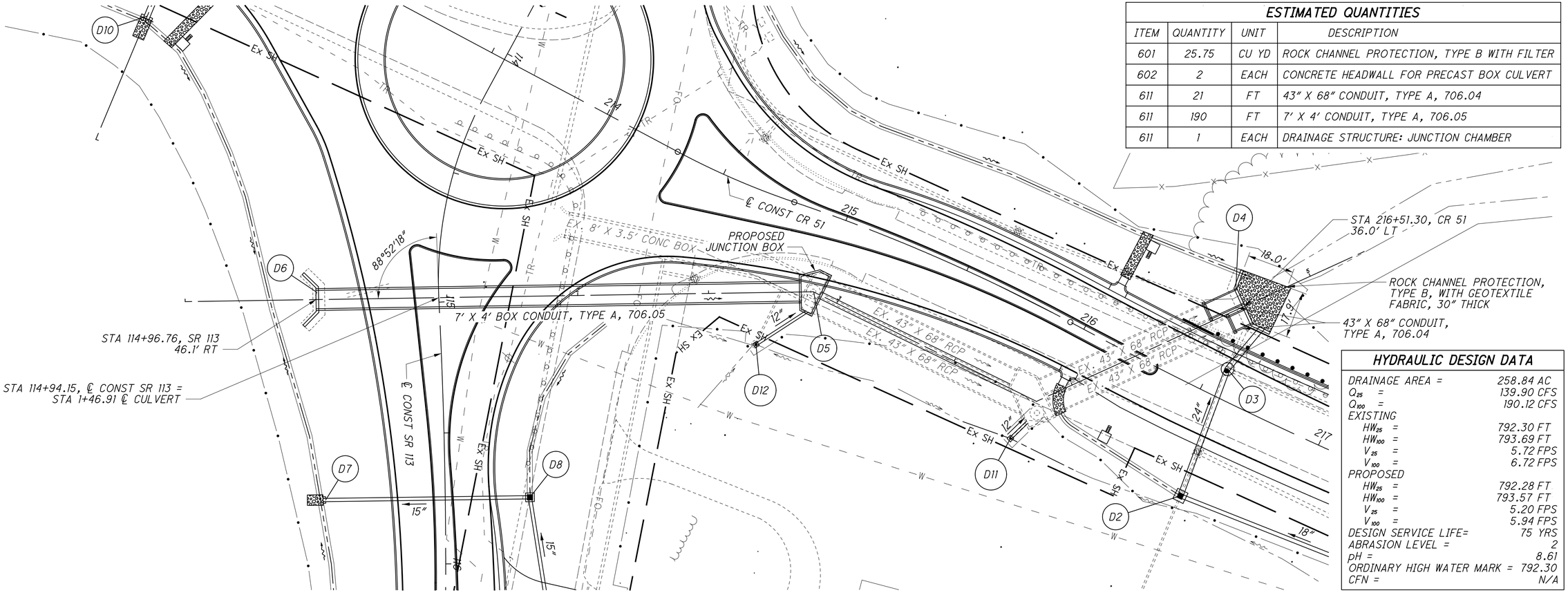
CULVERT 3 – SR 113 & CR51 – Proposed - Box (100yr)



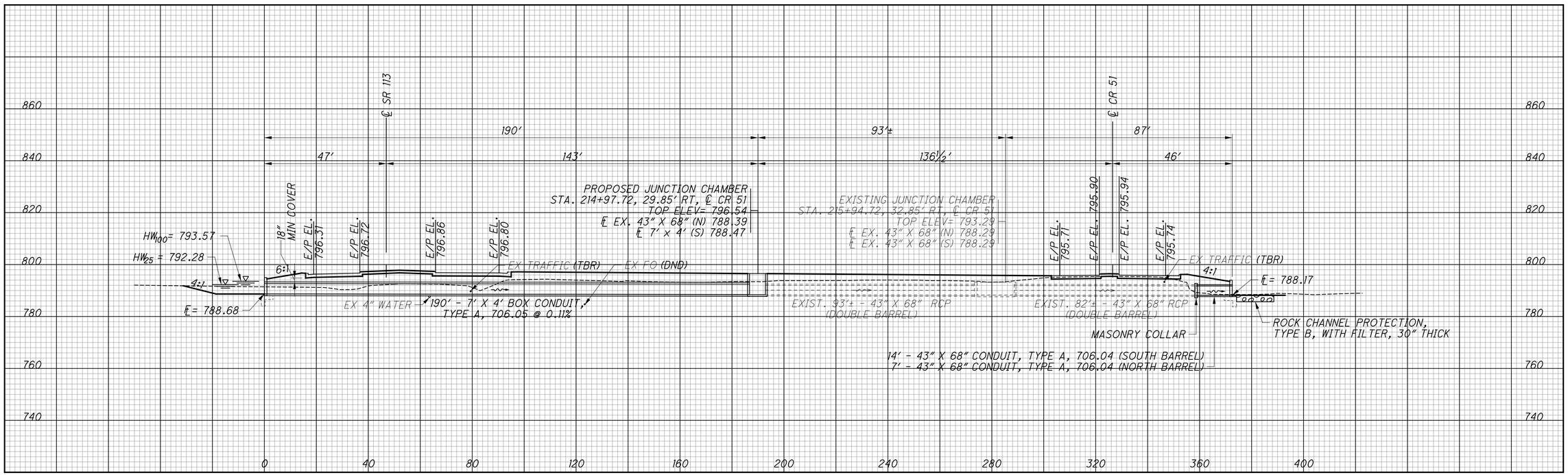
Node ID:	Inlet	Structure01	Structure02	Outlet
Rim (ft):	0.00	796.54	793.29	
Invert (ft):	788.68	788.39	788.29	788.17
Min Pipe Cover (ft):	0.00	4.07	1.42	
Max HGL (ft):	793.57	792.72	792.01	790.48

Link ID:	Pipe01	Pipe02	Pipe03
Length (ft):	190.00	92.65	89.07
Dia (ft):	4.00	3.58	3.58
Slope (ft/ft):	0.0011	0.0011	0.0013
Up Invert (ft):	788.68	788.39	788.29
Dn Invert (ft):	788.47	788.29	788.17
Max Q (cfs):	190.08	190.08	190.08
Max Vel (ft/s):	5.94	5.83	6.56
Max Depth (ft):	4.00	3.58	2.95

ESTIMATED QUANTITIES			
ITEM	QUANTITY	UNIT	DESCRIPTION
601	25.75	CU YD	ROCK CHANNEL PROTECTION, TYPE B WITH FILTER
602	2	EACH	CONCRETE HEADWALL FOR PRECAST BOX CULVERT
611	21	FT	43" X 68" CONDUIT, TYPE A, 706.04
611	190	FT	7' X 4' CONDUIT, TYPE A, 706.05
611	1	EACH	DRAINAGE STRUCTURE: JUNCTION CHAMBER



HYDRAULIC DESIGN DATA	
DRAINAGE AREA =	258.84 AC
Q_{25} =	139.90 CFS
Q_{100} =	190.12 CFS
EXISTING	
HW_{25} =	792.30 FT
HW_{100} =	793.69 FT
V_{25} =	5.72 FPS
V_{100} =	6.72 FPS
PROPOSED	
HW_{25} =	792.28 FT
HW_{100} =	793.57 FT
V_{25} =	5.20 FPS
V_{100} =	5.94 FPS
DESIGN SERVICE LIFE=	75 YRS
ABRASION LEVEL =	2
pH =	8.61
ORDINARY HIGH WATER MARK =	792.30
CFN =	N/A



HORIZONTAL SCALE IN FEET
0 10 20 40

CALCULATED NRV
CHECKED MTL

CULVERT DETAIL
BOX CULVERT

LOR-113-03.75

62
93

lstutler
4/14/2020 4:52:30 PM
O:\2018\00084\C Design\104864_LOR-113-03.75\Roadway Sheets\104864_DC002.dgn

4. Inlet Spacing Calculations

INLET SPACING DESIGN

PID : 104864 **Date :** 03/12/2019 **Project :** LOR-113-03.75 **Location :** SR 113 (West Leg)

Description :112+13 to 114+02 Left Side **Designer :** MTL

Rainfall Area: A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
112+13	Begin																		
140+77	CB-3A	77.00	0.90	0.04	10.00	1.14	11.14	0.0062	0.0833	0.0160	2.00	0.0000	4.21	******	******	0.15	0.129	1.55	Sag
114+02	Begin																		
140+77	CB-3A	92.00	0.90	0.09	10.00	0.88	10.88	0.0110	0.0833	0.0160	2.00	0.0000	4.25	******	******	0.36	0.161	1.94	End

SUMP DATA

Total Flow (cfs) : 0.51 **Ponded Depth (ft.) :** 0.050 **Spread on Pavement (ft.) :** 2.00

INLET SPACING DESIGN

PID : 104864 **Date :** 03/12/2019 **Project :** LOR-113-03.75 **Location :** SR 113 (West Leg)

Description : 109+51 to 114+02 Right Side **Designer :** MTL

Rainfall Area: A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
109+51	Begin																		
21+75	CB-3A	174.00	0.90	0.12	10.00	2.04	12.07	0.0065	0.0833	0.0160	2.00	0.0000	4.06	0.43	0.00	0.43	0.188	3.36	
130+51	CB-3A	155.00	0.90	0.12	10.00	1.75	11.78	0.0070	0.0833	0.0160	2.00	0.0000	4.10	******	******	0.45	0.190	3.45	Sag
114+02	Begin																		
130+51	CB-3A	62.00	0.90	0.13	10.00	0.80	10.84	0.0053	0.0833	0.0160	2.00	0.0000	4.26	******	******	0.49	0.203	4.30	End

SUMP DATA

Total Flow (cfs) : 0.94 **Ponded Depth (ft.) :** 0.103 **Spread on Pavement (ft.) :** 5.31

INLET SPACING DESIGN

PID : 104864 **Date :** 03/12/2019 **Project :** LOR-113-03.75 **Location :** SR 113 (East Leg)

Description :114+02 to 118+15 Left Side **Designer :** MTL

Rainfall Area: A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
114+02	Begin																		
61+71	CB-3A	173.00	0.90	0.13	10.00	1.69	11.71	0.0094	0.0833	0.0160	2.00	0.0000	4.11	******	******	0.49	0.186	3.20	Sag
118+15	Begin																		
61+71	CB-3A	173.00	0.90	0.11	10.00	2.18	12.22	0.0056	0.0833	0.0160	2.00	0.0000	4.03	******	******	0.41	0.190	3.46	End

SUMP DATA

Total Flow (cfs) : 0.90 **Ponded Depth (ft.) :** 0.098 **Spread on Pavement (ft.) :** 5.03

INLET SPACING DESIGN

PID : 104864 **Date :** 03/12/2019 **Project :** LOR-113-03.75 **Location :** SR 113 (East Leg)

Description :114+02 to 117+01 Right Side **Designer :** MTL

Rainfall Area: A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
114+02	Begin																		
116+58	CB-3A	207.00	0.90	0.16	10.00	3.00	13.00	0.0041	0.0833	0.0160	2.00	0.0000	3.92	******	******	0.58	0.223	5.51	Sag
117+01	Begin																		
116+58	CB-3A	44.00	0.90	0.02	10.00	1.38	11.38	0.0014	0.0833	0.0160	2.00	0.0000	4.17	******	******	0.07	0.128	1.54	End

SUMP DATA

Total Flow (cfs) : 0.65 **Ponded Depth (ft.) :** 0.068 **Spread on Pavement (ft.) :** 3.14

INLET SPACING DESIGN

PID : 104864 **Date :** 10/15/2019 **Project :** LOR-113-03.75 **Location :** CR 51 (South Leg)

Description :212+46 to 213+55 Left Side **Designer :** MTL

Rainfall Area: A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
212+46	Begin																		
131+72	CB-3A	8.00	0.90	0.01	10.00	0.36	10.36	0.0010	0.0833	0.0160	2.00	0.0000	4.34	******	******	0.03	0.094	1.13	Sag
213+55	Begin																		
131+72	CB-3A	59.00	0.90	0.12	10.00	0.78	10.82	0.0050	0.0833	0.0160	2.00	0.0000	4.26	******	******	0.45	0.200	4.11	End

SUMP DATA

Total Flow (cfs) : 0.48 **Ponded Depth (ft.) :** 0.045 **Spread on Pavement (ft.) :** 1.94

INLET SPACING DESIGN

PID : 104864 **Date :** 03/12/2019 **Project :** LOR-113-03.75 **Location :** CR 51 (South Leg)

Description :210+67 to 213+55 Right Side **Designer :** MTL

Rainfall Area: A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
210+67	Begin																		
160+43	CB-3A	182.00	0.90	0.11	10.00	1.90	11.90	0.0085	0.0833	0.0160	2.00	0.0000	4.08	******	******	0.39	0.175	2.51	Sag
213+55	Begin																		
160+43	CB-3A	89.00	0.90	0.10	10.00	0.81	10.81	0.0120	0.0833	0.0160	2.00	0.0000	4.26	******	******	0.38	0.162	1.95	End

SUMP DATA

Total Flow (cfs) : 0.78 **Ponded Depth (ft.) :** 0.084 **Spread on Pavement (ft.) :** 4.15

INLET SPACING DESIGN

PID : 104864 **Date :** 03/12/2019 **Project :** LOR-113-03.75 **Location :** CR 51 (North Leg)

Description :213+55 to 217+45 Left Side **Designer :** MTL

Rainfall Area: A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
213+55	Begin																		
216+05	CB-3A	174.00	0.90	0.16	10.00	2.36	12.36	0.0047	0.0833	0.0160	2.00	0.0000	4.01	******	******	0.57	0.217	5.16	Sag
217+45	Begin																		
216+05	CB-3A	139.00	0.90	0.08	10.00	1.94	11.94	0.0048	0.0833	0.0160	2.00	0.0000	4.08	******	******	0.29	0.172	2.36	End

SUMP DATA

Total Flow (cfs) : 0.85 **Ponded Depth (ft.) :** 0.093 **Spread on Pavement (ft.) :** 4.70

INLET SPACING DESIGN

PID : 104864 **Date :** 03/12/2019 **Project :** LOR-113-03.75 **Location :** CR 51 (North Leg)

Description :213+55 to 216+06 Right Side **Designer :** MTL

Rainfall Area: A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
213+55	Begin																		
150+05	CB-3A	186.00	0.90	0.14	10.00	2.17	12.25	0.0065	0.0833	0.0160	2.00	0.0000	4.03	******	******	0.49	0.198	3.93	End

5. Storm Sewer Calculations

STORM SEWER SYSTEM

PID : 104864 **Date :** 10/15/2019 **Project :** LOR-113-03.75 **Location :** CR 51 (North Leg)

Description :CR 51 (North Leg) **Designer :** MTL

Rainfall Area: A **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 788.17

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
1	2	217+90	14.68	6.61	40.00	2.34	2.72	15.5	18.0	18	132.0	0.0250	792.97	8.75	15.48	0.0390	796.48	794.47	-2.01	0.00	HW Half He
begin		216+61	14.68	6.61									789.67				791.33	792.30			0.015
EX	2		0.15	0.11	10.00	4.94	2.72	0.5	0.3	8	20.0	0.0100	790.82	3.00	1.13	0.0007	791.34	795.85	4.51	4.36	CB 2-2B
begin		216+61	14.83	6.71									790.62				791.33	792.30			0.015
2	3	216+61	0.14	0.13	40.25	2.33	2.72	15.9	18.6	24	51.0	0.0080	789.28	6.34	18.91	0.0090	791.33	792.30	0.97	1.02	CB 2-3
		216+56	14.97	6.84									788.87				790.87	795.87			0.015
EX	3		2.68	1.88	10.00	4.94	5.62	9.3	10.5	18	20.0	0.0090	790.00	5.25	9.29	0.0134	791.50	795.60	4.10	4.10	CB 2-2B
begin		216+56	17.65	8.71									789.82				791.19	795.87			0.015
3	4	216+56	0.00	0.00	40.39	2.33	2.72	20.3	23.7	24	20.0	0.0120	788.87	7.77	23.10	0.0146	790.87	795.87	5.00	5.00	MH 3
final		216+61	17.65	8.71									788.63				790.49	790.63			0.015

STORM SEWER SYSTEM

PID : 104864 **Date :** 10/22/2019 **Project :** LOR-113-03.75 **Location :** SR 113 (East Leg)

Description :SR 113 (East Leg) **Designer :** MTL

Rainfall Area: A **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 790.50

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
9	8	116+29	3.74	1.84	30.00	2.81	3.25	5.2	6.0	15	56.0	0.0204	792.51	6.93	8.59	0.0114	793.60	793.76	0.16	0.00	HW Half He
begin		115+75	3.74	1.84									791.37				792.96	793.62			0.015
8	7	115+75	0.72	0.37	30.13	2.81	3.25	6.2	7.2	15	79.0	0.0110	791.37	5.41	6.32	0.0164	792.96	793.62	0.66	1.00	CB 2-2B
final		115+75	4.46	2.21									790.50				791.66	791.75			0.015

6. Ditch Analysis Calculations

Left Side					Right Side			
Direction	Slope	Width	Ditch Bottom Elev	STA	Ditch Bottom Elev	Width	Slope	Direction
				SR 113				
Ex. Ditch		*0*	*797.13*	107+10.00	*796.88*	*0*		*Ex. Ditch*
↓		2	796.40	107+50	796.60	2		↓
↓		2	796.10	108+00	796.30	2		↓
↓		2	795.80	108+50	796.00	2		↓
↓		2	795.50	109+00	795.70	2		↓
↓		2	795.20	109+50	795.40	2		↓
↓	0.60%	2	794.90	110+00	795.10	2	0.60%	↓
↓		2	794.60	110+50	794.80	2		↓
↓		2	794.30	111+00	794.50	2		↓
↓		2	794.00	111+50	794.20	2		↓
↓		2	793.70	112+00	793.90	2		↓
↓		2	793.40	112+50	793.60	2		↓
See NW Corner								See SW Corner
								See SE Corner
				115+00	789.30	2		↑
See NE Corner				115+50	790.10	2		↑
D8 (CB 2-2B)		2	**793.62**	**115+75**	**790.50**	2	1.60%	**D7 (HW)**
				116+00	790.90	2		↑
↑	2.35%	2	792.51	116+29	791.36	2		↑
↑		2	793.00	116+50	791.70	2		↑
↑		2	793.25	117+00	792.20	2		↑
↑		2	793.50	117+50	792.70	2		↑
↑	0.50%	2	793.75	118+00	793.20	2		↑
↑		2	794.00	118+50	793.70	2	1.00%	↑
↑		2	794.25	119+00	794.20	2		↑
↑		2	794.50	119+50	794.70	2		↑
↑		0	796.40	120+00	795.20	2		↑
↑		0	796.80	120+50	795.70	2		↑
↑		0	797.20	120+90.39	*796.10*	*0*		*Ex. Ditch*

Left Side					Right Side			
Direction	Slope	Width	Ditch Bottom Elev	STA	Ditch Bottom Elev	Width	Slope	Direction
				CR 51				
Ex. Ditch		*0*	*794.30*	208+26.54	*791.10*	*0*		*Ex. Ditch*
↑		2	794.45	208+50	790.80	2		↓
↑	0.30%	2	794.60	209+00	790.65	2		↓
↑		2	794.75	209+50	790.50	2		↓
↑		2	794.90	210+00	790.35	2		↓
↓		2	794.07	210+50	790.20	2	0.30%	↓
↓		2	793.23	211+00	790.05	2		↓
↓	1.67%	2	792.40	211+50	789.90	2		↓
↓		2	791.57	212+00	789.75	2		↓
CULV		2	**791.15**	**212+25**	**789.68**	2		**CULV**
See SW Corner								See SE Corner
See SE Corner								
↓	0.60%	2	792.30	215+00				See NE Corner
↓		2	792.00	215+50				
↓	1.80%	2	791.10	216+00				
↓		2	790.20	216+50				
				217+00				
				217+50				
				218+00	793.10	2	0.40%	↑
				218+50	793.30	2		↑
				218+85.00	*793.50*	*0*		*Ex. Ditch*

Left Side					Right Side			
Direction	Slope	Width	Ditch Bottom Elev	STA	Ditch Bottom Elev	Width	Slope	Direction

NW Corner		SLOPE =	0.62%
STA	BASELINE	DIST	ELEV
112+50	**SR 113**	0.00	**793.40**
140+75	NW	34.00	793.19
141+00	NW	58.28	793.04
141+25	NW	82.56	792.89
141+50	NW	102.58	792.77
141+75	NW	123.28	792.64
142+00	NW	144.03	792.51
142+25	NW	164.68	792.39
215+00	**CR 51**	178.52	**792.30**

SW Corner		SLOPE =	1.55%
STA	BASELINE	DIST	ELEV
112+50	**SR 113**	0.00	**793.60**
130+50	SW	24.83	793.21
130+75	SW	46.12	792.88
131+00	SW	67.88	792.55
131+25	SW	86.82	792.25
131+50	SW	109.12	791.91
131+75	SW	133.50	791.53
212+25	**CR 51**	157.88	**791.15**

NW Corner		SLOPE =	0.40%
STA	BASELINE	DIST	ELEV
152+00	NE	0	793.92
152+25	NE	17.79	793.85
152+50	NE	37.38	793.77
152+75	NE	58.34	793.69
115+75	**SR 113**	76.12	**793.62**

SE Corner		SLOPE =	0.30%
STA	BASELINE	DIST	ELEV
212+25	**CR 51**	0.00	**789.68**
160+50	SE	16.62	789.63
160+75	SE	36.05	789.57
161+00	SE	61.05	789.50
161+25	SE	80.53	789.44
161+50	SE	104.43	789.37
115+00	**SR 113**	127.95	**789.30**

7. BMP Calculations

Ohio Department of Transportation - Office of Hydraulic Engineering

Post-Construction BMP Calculation Spreadsheet

Post Construction - Project Summary

Project Data		Units
Project EDA	5.41	acres
Is the Project Routine Maintenance per L&D Vol. 2, Sec. 1112.2	No	
BMPs Required?	**BMPs Required**	NA
Ain (New Impervious Area in New Permanent R/W	0.40	acres
Does Entire Site Drain to Large River (>100 sq. miles)?	No	
Water Quality Treatment Required	**Yes**	
Water Quantity Treatment Required	**No**	
Treatment Percent and Treatment Requirement		
Aix (Project EDA that is inside the existing right-of-way)	3.45	acres
Ain (New Impervious Area in New Permanent R/W)	0.4	acres
T% (Treatment Percent)	**28.31**	**%**
Treatment Requirement	**1.53**	**acres**

BMPs Provided

BMP Name	BMP Type	Contributing Drainage Area (acres)	Contributing Drainage Area in ODOT R/W (acres)
VFS-1	Vegetated Filter Strip	0.37	0.37
VFS-2	Vegetated Filter Strip	0.10	0.10
VFS-3	Vegetated Filter Strip	0.81	0.81
VFS-4	Vegetated Filter Strip	0.20	0.20
VFS-5	Vegetated Filter Strip	0.06	0.06

Treatment Provided

Total Area with ODOT R/W Treated (acres)	**1.54**
Treatment Requirements (acres)	**1.53**
Treatment Check	**Good**

BMP Submittal Requirements (Per L&D, Vol. 2, Sec. 1116.2)

1. Estimated Project Earth Disturbed Area	Yes	**Good**
2. Treatment Percent Calculation	Yes	**Good**
3. BMP Selected for use	Yes	**Good**
4. Drainage area mapping for post-construction BMPs that show the total contributing drainage area and the amount of contributing area within ODOT right-of-way	Yes	**Good**
5. Plan sheets showing locations of post-construction BMP	Yes	**Good**
6. Calculations for each BMP	Yes	**Good**
7. Explanation for any area that is not treated	Yes	**Good**

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Vegetated Filter Strip

Filter Strip	Route	Begin Station	End Station	Side	Pavement Width (FT)	Filter Strip Width (FT)	Filter Strip Slope (z:1)	Filter Strip Length (FT)	Drainage Area (acres)	Filter Strip Area (SF)	Item 659 Topsoil Volume (CY)	Item 670 Erosion Protection Area (SY)
VFS-1	SR 113	107+50	112+13	LT	20 MAX	15 MIN	6.4	463	0.3666	6,379	78.8	708.8
VFS-2	SR 113	118+15	119+50	LT	20 MAX	15 MIN	4 MIN	135	0.1001	2,060	25.4	228.9
VFS-3	CR 51 / SR 113	208+27 (CR 51)	120+50 (SR 113)	RT	20 MAX	15 MIN	4 MIN	1,104	0.8092	24,744	305.5	2,749.3
VFS-4	CR 51	210+25	131+80 (SW)	LT	20 MAX	15 MIN	4 MIN	223	0.2029	3,897	48.1	433.0
VFS-5	CR 51	217+50	218+25	RT	18	17	4	75	0.0575	1,248	15.4	138.7
								0			0.0	0.0
								0			0.0	0.0
								0			0.0	0.0
								0			0.0	0.0
								0			0.0	0.0

Total Treatment Credit Earned from Vegetated Filter Strips **1.5363** **acres**

(Treatment is for quality only, not quantity)

	BMP Design Considerations	Answer	Design Check
1	Is the min. filter strip width 15-25 ft wide depending on L&D Table 1117-3?	Yes	Good
2	Is the slope 3:1 or flatter for 34 ft or narrower pavement drainage width	Yes	Good
3	Is the slope 6:1 or flatter for 35 - 48 ft pavement drainage width	NA	Good
4	Is the only contributing drainage to the filter strip from the road and shoulder?	Yes	Good
5	Does any concentrated flow or any outlets discharge to the filter strip?	No	Good
6	Is 4" of Item 659, Topsoil, included for the filter strip?	Yes	Good
7	Is Item 670, Slope Erosion Protection, included for the filter strip?	Yes	Good

8. Proposed Drainage Area Maps

HORIZONTAL SCALE IN FEET
0 25 50 100

PROPOSED DRAINAGE AREA MAP

LOR-113-03.75

1/2

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0 100 200 400
HORIZONTAL SCALE IN FEET

PROPOSED DRAINAGE AREA MAP

LOR-113-03.75

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