

Ohio Department of Transportation

# FRA-161-15.80 Noise Walls – 81” Barrier Drainage An

PID 117607

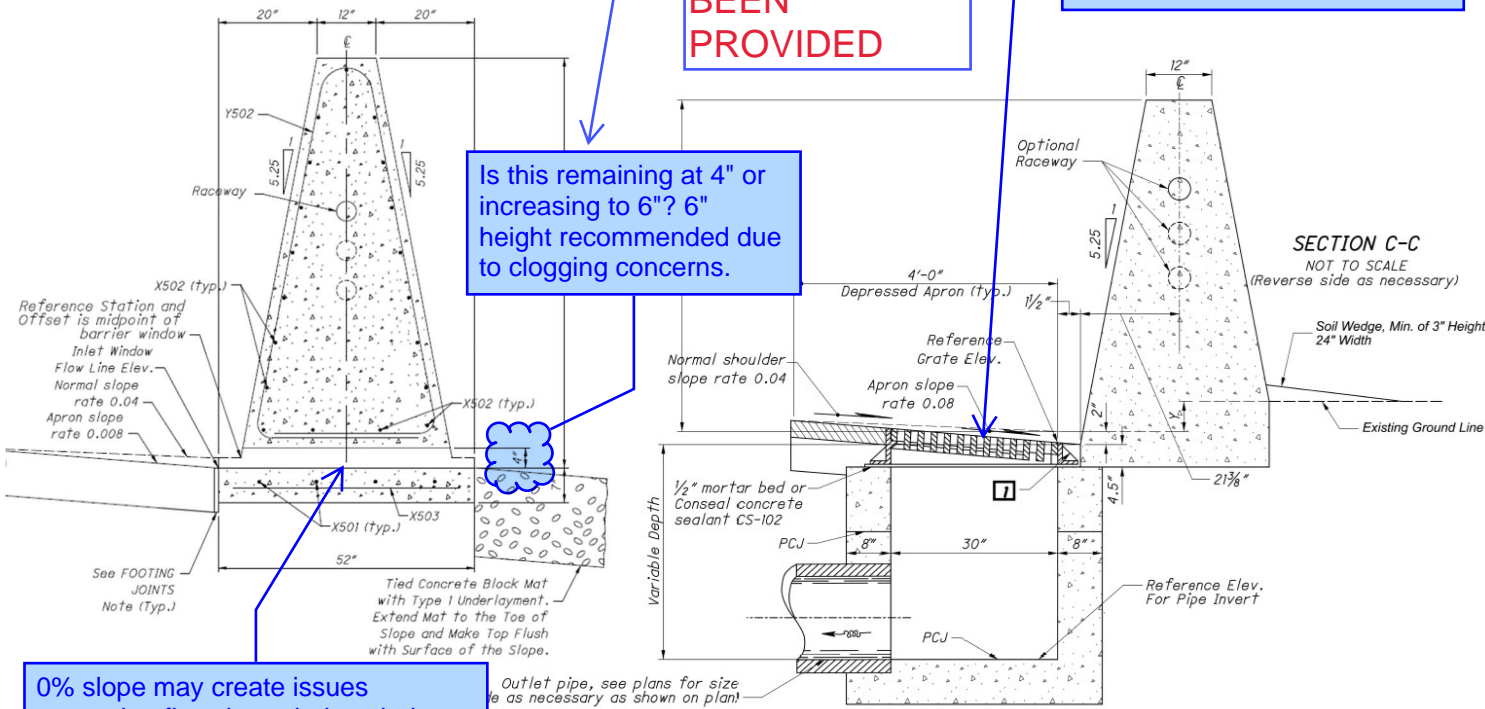
March 27, 2024

ARCADIS  
RESPONSE:  
COMPLIED

ARCADIS  
RESPONSE:  
REVISING TO  
6" AND A NEW  
DETAIL HAS  
BEEN  
PROVIDED

Locations without a window should not be analyzed as an I-2-10. The best option in CDSS is to analyze as a CB-3A. Apply throughout the inlet spacing calculations. A new preliminary SCD which also includes a window has been developed for use with 81" barrier and will be published in July. The drawing is available in PW for use in the plans. We will defer to the project team.

Is this remaining at 4" or increasing to 6"? 6" height recommended due to clogging concerns.



0% slope may create issues conveying flow through the window, however, conservatism in placing per spread appears to have been considered in the design. Will defer concerns to COC if they are maintaining.

ARCADIS RESPONSE: COC HAS ACCEPTED MAINTENANCE (PLEASE SEE NEXT SHEET FOR REFERENCE)

## Montoya, Katherine

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**From:** Lucas, Scott E. <SELucas@columbus.gov>  
**Sent:** Friday, March 29, 2024 8:33 AM  
**To:** Curry, Julie A.; Montoya, Katherine  
**Subject:** RE: FRA-161 Noise Walls, PID 117607 - Barrier Drainage Update

Thanks Julie.

Katie,

We do not have an issue in maintaining the proposed design.

Respectfully,

**Scott Lucas, MBA, CPM**  
Infrastructure Operations Coordinator



ISA Certified Arborist OH-6674A  
Division of Infrastructure Management  
THE CITY OF  
**COLUMBUS**  
ANDREW J. GINTHER, MAYOR

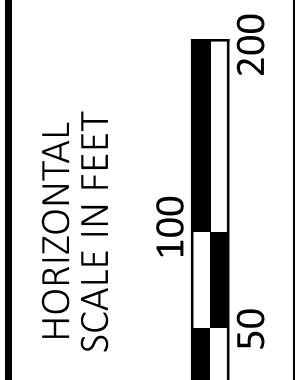
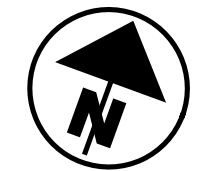
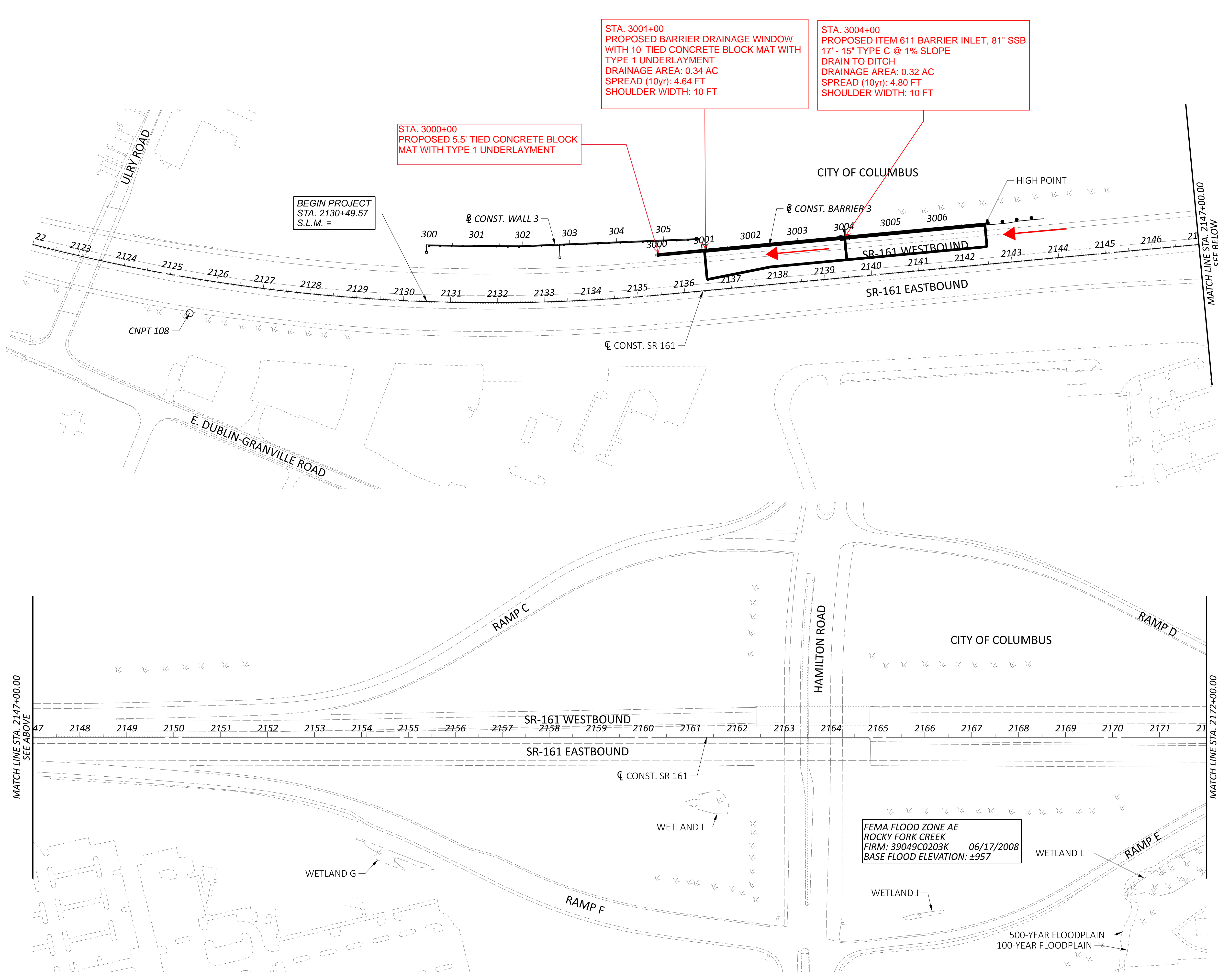
DEPARTMENT OF  
PUBLIC SERVICE

1881 E. 25<sup>th</sup> Ave.  
Columbus, OH 43219  
Direct: 614-645-6325  
Work Cell: 614-506-2544  
[www.columbus.gov](http://www.columbus.gov)

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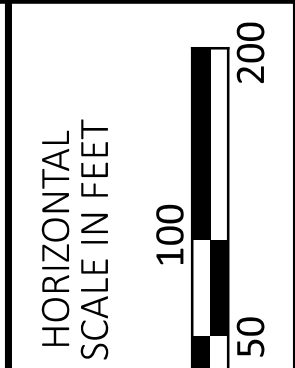
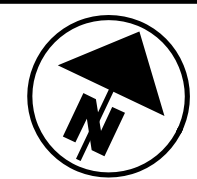
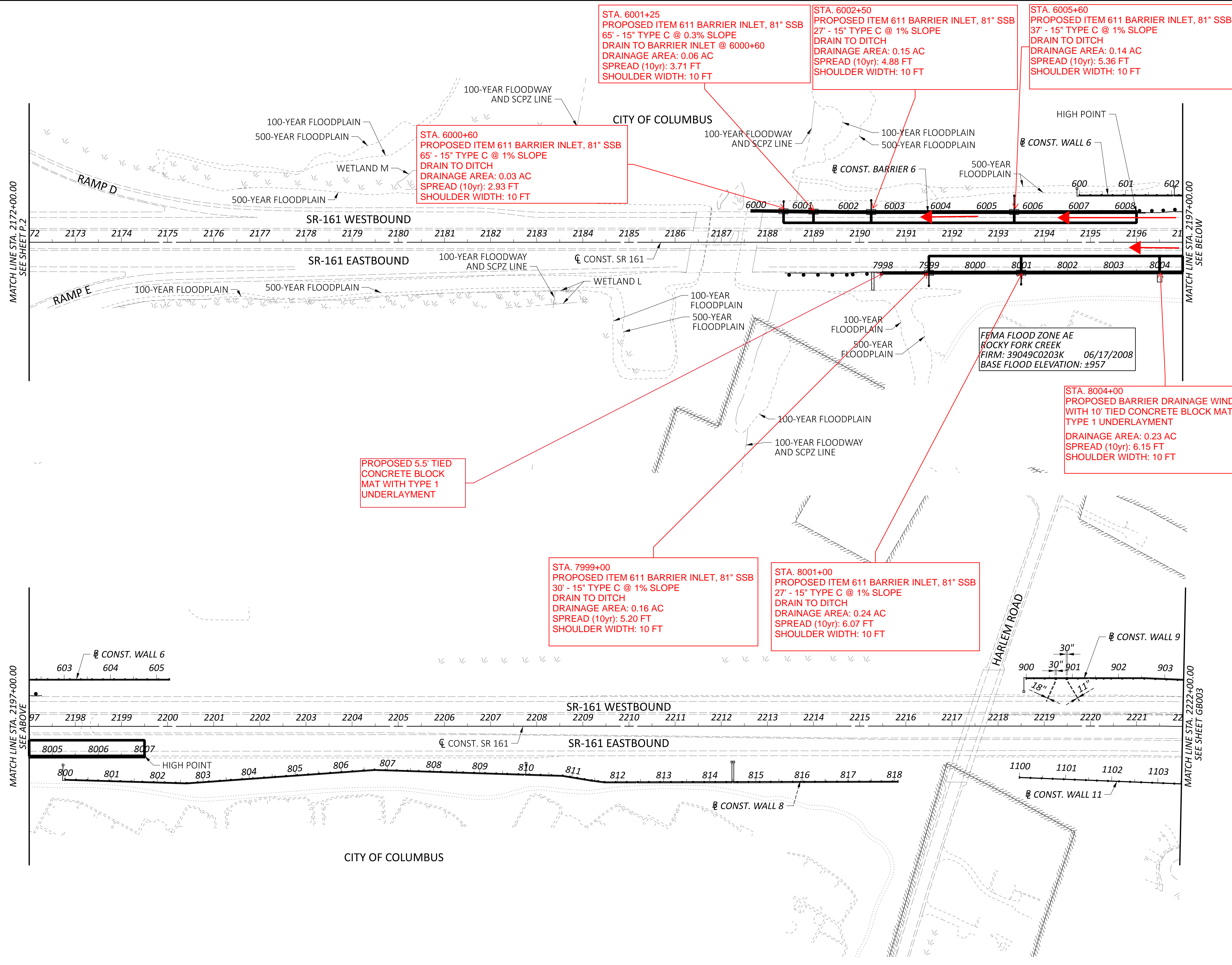
**From:** Curry, Julie A. <JACurry@columbus.gov>  
**Sent:** Wednesday, March 27, 2024 2:15 PM  
**To:** Katherine.Montoya@dot.ohio.gov  
**Cc:** Lucas, Scott E. <SELucas@columbus.gov>  
**Subject:** FW: FRA-161 Noise Walls, PID 117607 - Barrier Drainage Update

Good afternoon,



**SCHEMATIC PLAN WITH 81" BARRIER DRAINAGE AREAS AND SPREAD CALC SUMMARIES**  
 STA. 2122+00.00 TO STA. 2172+00.00

DESIGN AGENCY	
8101 NORTH HUGHES BLVD, SUITE 100 COLUMBUS, OHIO 43235 (614) 818-4900 www.arcadis.com	
DESIGNER	
MDB	
REVIEWER	
JDH 3-27-2024	
PROJECT ID	
117607	
SHEET	TOTAL
1	3



**SCHEMATIC PLAN WITH 81" BARRIER DRAINAGE AREAS AND SPREAD CALC SUMMARIES**  
 STA. 2172+00.00 TO STA. 2222+00.00

DESIGN AGENCY	
8001 NORTHCHURCH ST SUITE 100 COLUMBUS OHIO 43265 (614) 818-4900 www.arcadis.com	
DESIGNER	
MDB	
REVIEWER	
JDH 3-27-2024	
PROJECT ID	
117607	
SHEET	TOTAL
2	3

STA. 1001+00  
 PROPOSED BARRIER DRAINAGE WINDOW WITH 10' TIED CONCRETE BLOCK MAT WITH TYPE 1 UNDERLAYMENT DRAINAGE AREA: 0.07 AC  
 SPREAD (10yr): 2.92 FT  
 SHOULDER WIDTH: 10 FT

STA. 1004+00  
 PROPOSED BARRIER DRAINAGE WINDOW WITH 10' TIED CONCRETE BLOCK MAT WITH TYPE 1 UNDERLAYMENT DRAINAGE AREA: 0.07 AC  
 SPREAD (10yr): 2.92 FT  
 SHOULDER WIDTH: 10 FT

STA. 1007+00  
 PROPOSED PROPOSED BARRIER DRAINAGE WINDOW WITH 10' TIED CONCRETE BLOCK MAT WITH TYPE 1 UNDERLAYMENT DRAINAGE AREA: 0.08 AC  
 SPREAD (10yr): 3.51 FT  
 SHOULDER WIDTH: 10 FT

STA. 1011+55  
 PROPOSED ITEM 611 BARRIER INLET, 81" SSB 70' - 15" TYPE C @ 0.5% SLOPE DRAIN TO BARRIER INLET @ 1012+25 DRAINAGE AREA (STA 1010+60 TO STA 1011+55): 0.03 AC DRAINAGE AREA (STA 1012+55 TO STA 1011+55): 0.07 AC SPREAD (50yr): 3.16 FT PONDSED SPREAD (50yr): 0.92 FT SHOULDER WIDTH: 10 FT

STA. 1012+25  
 PROPOSED ITEM 611 BARRIER INLET, 81" SSB BROKEN BACK STORM SEWER SYSTEM 13' - 15" TYPE F @ 1% SLOPE 23' - 15" TYPE F @ 53.7% SLOPE 9' - 15" TYPE F @ 1% SLOPE DRAIN TO DITCH DRAINAGE AREA: 0.13 AC SPREAD (10yr): 6.06 FT SHOULDER WIDTH: 10 FT

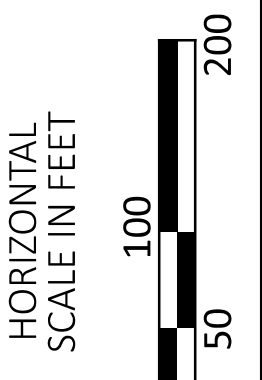
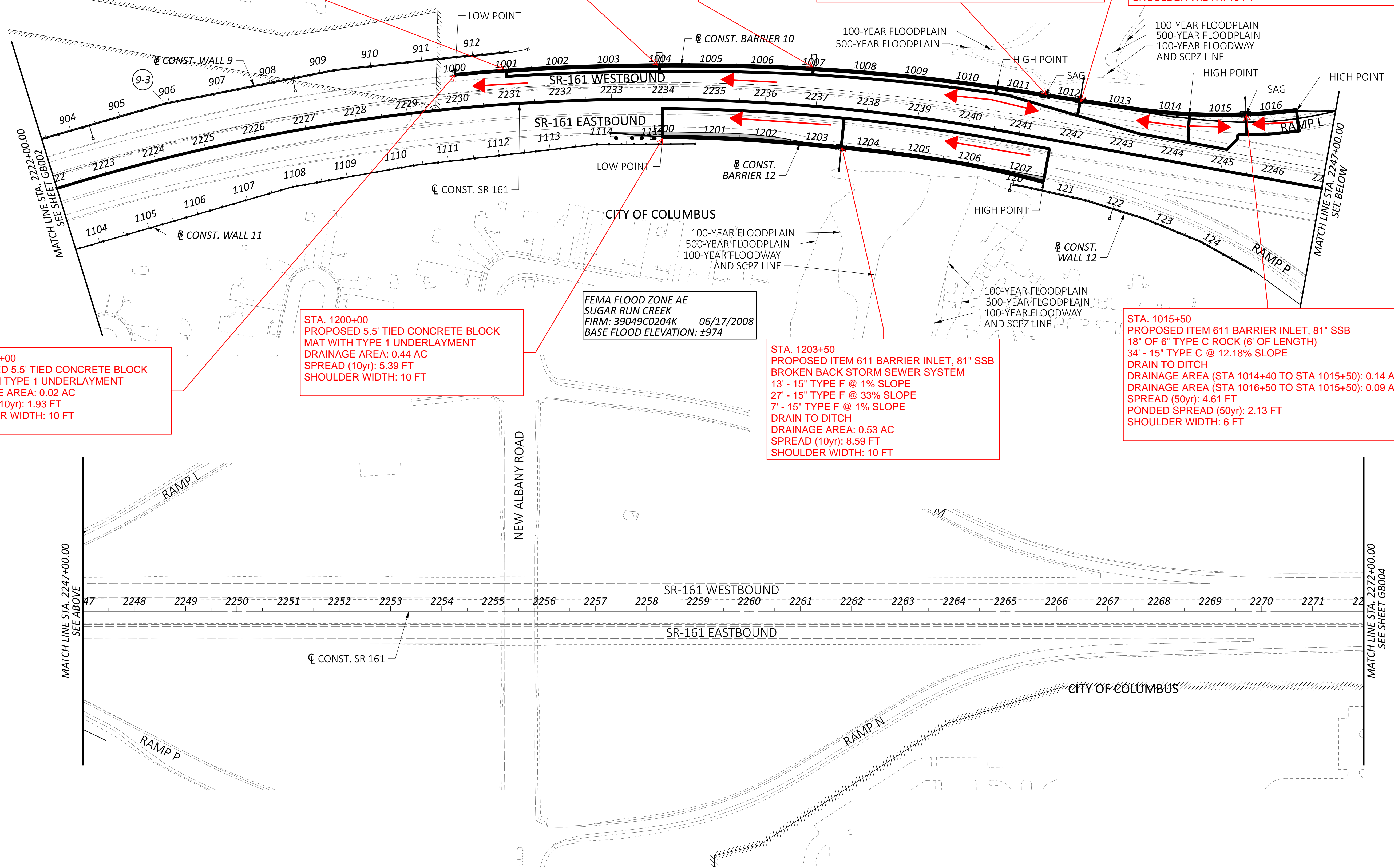
STA. 1000+00  
 PROPOSED 5.5' TIED CONCRETE BLOCK MAT WITH TYPE 1 UNDERLAYMENT DRAINAGE AREA: 0.02 AC SPREAD (10yr): 1.93 FT SHOULDER WIDTH: 10 FT

STA. 1200+00  
 PROPOSED 5.5' TIED CONCRETE BLOCK MAT WITH TYPE 1 UNDERLAYMENT DRAINAGE AREA: 0.44 AC SPREAD (10yr): 5.39 FT SHOULDER WIDTH: 10 FT

FEMA FLOOD ZONE AE  
 SUGAR RUN CREEK  
 FIRM: 39049C0204K 06/17/2008  
 BASE FLOOD ELEVATION: ±974

STA. 1203+50  
 PROPOSED ITEM 611 BARRIER INLET, 81" SSB BROKEN BACK STORM SEWER SYSTEM 13' - 15" TYPE F @ 1% SLOPE 27' - 15" TYPE F @ 33% SLOPE 7' - 15" TYPE F @ 1% SLOPE DRAIN TO DITCH DRAINAGE AREA: 0.53 AC SPREAD (10yr): 8.59 FT SHOULDER WIDTH: 10 FT

STA. 1015+50  
 PROPOSED ITEM 611 BARRIER INLET, 81" SSB 18" OF 6" TYPE C ROCK (6' OF LENGTH) 34' - 15" TYPE C @ 12.18% SLOPE DRAIN TO DITCH DRAINAGE AREA (STA 1014+40 TO STA 1015+50): 0.14 AC DRAINAGE AREA (STA 1016+50 TO STA 1015+50): 0.09 AC SPREAD (50yr): 4.61 FT PONDSED SPREAD (50yr): 2.13 FT SHOULDER WIDTH: 6 FT



**SCHEMATIC PLAN WITH 81" BARRIER DRAINAGE AREAS AND SPREAD CALC SUMMARIES**  
 STA. 2222+00.00 TO STA. 2272+00.00

DESIGN AGENCY	
<b>ARCADIS</b>	8101 NORTH HICKORY SUITE 100 COLUMBUS, OH 43235 (614) 818-4900 www.arcadis.com
DESIGNER	
MDB	
REVIEWER	
JDH 3-27-2024	
PROJECT ID	
117607	
SHEET	TOTAL
3	3

# Appendix A

## Inlet Spacing Design Analysis



# INLET SPACING DESIGN

**PID :** 117607    **Date :** 12-30-1899    **Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 3 - 3007+00 to 3001+00

**Designer :** MDB

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.33

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	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.)
3007+00	Begin																	
3004+00	I-2-10	300.00	0.90	0.32	5.00	2.10	10.00	0.0143	0.0416	0.0156	10.00	0.1700	5.32	1.45	0.09	1.53	0.203	4.89
3001+00	I-2-10	300.00	0.90	0.34	5.00	1.77	10.00	0.0208	0.0416	0.0156	10.00	0.1700	5.32	1.49	0.23	1.71	0.198	4.75



# INLET SPACING DESIGN

**PID :** 117607    **Date :** 12-30-1899    **Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 6 - 6008+25 to 6000+60

**Designer :** MDB

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.33

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	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.)
6008+25	Begin																	
6005+60	I-2-10	265.00	0.90	0.14	5.00	5.32	10.32	0.0016	0.0416	0.0156	10.00	0.1700	5.26	0.66	0.00	0.66	0.223	5.36
6002+50	I-2-10	310.00	0.90	0.15	5.00	4.74	10.00	0.0032	0.0416	0.0156	10.00	0.1700	5.32	0.72	0.00	0.72	0.203	4.88
6001+25	I-2-10	125.00	0.90	0.06	5.00	2.53	10.00	0.0025	0.0416	0.0156	10.00	0.0000	5.32	0.31	0.00	0.31	0.154	3.71
6000+60	I-2-10	65.00	0.90	0.03	5.00	1.53	10.00	0.0025	0.0416	0.0156	10.00	0.0000	5.32	0.16	0.00	0.16	0.122	2.93





# INLET SPACING DESIGN

**PID :** 117607    **Date :** 12-30-1899    **Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 8 - 8007+00 to 7999+00

**Designer :** MDB

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.33

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	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.)
8007+00	Begin																	
8004+00	I-2-10	300.00	0.90	0.23	5.00	4.75	10.00	0.0022	0.0416	0.0156	10.00	0.1700	5.32	1.10	0.00	1.10	0.256	6.15
8001+00	I-2-10	300.00	0.90	0.24	5.00	4.42	10.00	0.0025	0.0416	0.0156	10.00	0.1700	5.32	1.15	0.00	1.15	0.252	6.07
7999+00	I-2-10	200.00	0.90	0.16	5.00	3.22	10.00	0.0025	0.0416	0.0156	10.00	0.1700	5.32	0.76	0.00	0.76	0.216	5.20



# INLET SPACING DESIGN

**PID :** 117607    **Date :** 12-30-1899    **Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 10 - 1010+60 to 1000+00

**Designer :** MDB

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.33

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	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.)
1010+60	Begin																	
1007+00	I-2-10	360.00	0.90	0.08	5.00	5.19	10.19	0.0056	0.0416	0.0156	10.00	0.1700	5.28	0.39	0.00	0.39	0.146	3.51
1004+00	I-2-10	300.00	0.90	0.07	5.00	3.51	10.00	0.0104	0.0416	0.0156	10.00	0.1700	5.32	0.33	0.00	0.33	0.121	2.92
1001+00	I-2-10	300.00	0.90	0.07	5.00	3.58	10.00	0.0100	0.0416	0.0156	10.00	0.0000	5.32	0.32	0.00	0.33	0.122	2.92



# INLET SPACING DESIGN

**PID :** 116707    **Date :** 12-30-1899    **Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 10 - 1010+60 to 1014+40 (50 YR Design)

**Designer :** MDB

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.) :** 0.33

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	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.)	
1010+60	Begin																		
1011+55	I-2-10	95.00	0.90	0.03	5.00	1.97	10.00	0.0034	0.0416	0.0156	10.00	0.1700	6.50	*****	*****	0.17	0.117	2.80	Sag
1014+40	Begin																		
1012+25	I-2-10	215.00	0.90	0.21	5.00	2.92	10.00	0.0029	0.0416	0.0156	10.00	0.1700	6.50	1.23	0.00	1.23	0.252	6.06	
1011+55	I-2-10	70.00	0.90	0.04	10.00	1.49	11.49	0.0029	0.0416	0.0156	10.00	0.1700	6.17	*****	*****	0.22	0.132	3.16	End

## SUMP DATA

**Total Flow (cfs) :** 0.39

**Ponded Depth (ft.) :** 0.054

**Spread on Pavement (ft.) :** 0.92



# INLET SPACING DESIGN

**PID :** 116707    **Date :** 12-30-1899    **Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 10 - 1014+40 to 1016+50

**Designer :** MDB

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.) :** 0.33

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	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.)	
1014+40	Begin																		
1015+50	I-2-10	110.00	0.90	0.14	5.00	1.23	10.00	0.0059	0.0416	0.0156	10.00	0.1700	6.50	*****	*****	0.84	0.192	4.61	Sag
1016+50	Begin																		
1015+50	I-2-10	100.00	0.90	0.09	10.00	1.05	11.05	0.0107	0.0416	0.0156	10.00	0.1700	6.26	*****	*****	0.52	0.143	3.44	End

### SUMP DATA

**Total Flow (cfs) :** 1.36

**Ponded Depth (ft.) :** 0.125

**Spread on Pavement (ft.) :** 2.13



# INLET SPACING DESIGN

**PID :** 117607    **Date :** 12-30-1899    **Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 12 - 1207+51 to 1200+00

**Designer :** MDB

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.33

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	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.)
1207+51	Begin																	
1203+50	I-2-10	401.00	0.90	0.53	5.00	5.48	10.48	0.0019	0.0416	0.0156	10.00	0.1700	5.23	2.49	0.00	2.49	0.357	8.59
1200+00	I-2-6	350.00	0.90	0.44	5.00	2.17	10.00	0.0159	0.0416	0.0156	10.00	0.1700	5.32	1.22	0.89	2.11	0.224	5.39

Date: 03/27/2024  
 Calculated By: MDB  
 Checked By: JDH



MAH-680 Barrier Window - Flume Shear Stress

Inlet Station	Embankment Slope	D = Water Surface Depth (per CDSS spread calculations)	Shear Stress (L&D 1102.3.2)	Tied Concrete Block Mat Acceptable (<12 lbs/ft <sup>2</sup> )
	ft/ft	ft	tac = 62.4DS	
<b>Wall 3</b>				
3001+00	0.50	0.198	6.18	✓
<b>Wall 8</b>				
8004+00	0.50	0.256	7.99	✓
<b>Wall 10</b>				
1007+00	0.50	0.146	4.56	✓
1004+00	0.50	0.121	3.78	✓
1001+00	0.50	0.122	3.81	✓
<b>Wall 12</b>				
1200+00	0.50	0.224	6.99	✓

# Appendix B

## Storm Sewer Analysis



# STORM SEWER SYSTEM

PID : 117607

Date :

Project : FRA-161-15.80

Location : Franklin County

Description : Wall 3 - 3004+00

Designer : MDB

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE		
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S		
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'		
R1	R2	3004+00	0.32	0.29	5.00	6.61	7.34	1.9	2.1	15	17.0	0.0100	972.23	4.13	6.02	0.0014	973.00	977.73	4.73	4.25	I Barrier
	begin	3004+00	0.32	0.29									972.06				972.98	973.56			0.015

For future reference only, Min. Tc of 10 minutes per Vol. 2 - 1104.3.4. Will not impact conduit sizes for this project.

ARCADIS RESPONSE:  
COMPLIED AND UPDATED  
TC TO 10 MINUTES





# STORM SEWER SYSTEM

**PID :** 117607

**Date :**

**Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 6 - 6001+25 to 6000+60

**Designer :** MDB

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
R1	R2	6001+25	0.06	0.05	5.00	6.61	7.15	0.4	0.4	15	65.0	0.0029	958.84	1.65	3.26	0.0000	959.40	963.84	4.44	3.75	I Barrier
	begin	6000+60	0.06	0.05									958.65				959.40	963.57			0.015
R2	R3	6000+60	0.03	0.03	5.66	6.40	7.11	0.5	0.6	15	23.0	0.0109	957.65	2.98	6.28	0.0001	958.18	963.57	5.39	4.67	I Barrier
	final	6000+60	0.09	0.08									957.40				958.18	958.90			0.015



# STORM SEWER SYSTEM

**PID :** 117607      **Date :**      **Project :** FRA-161-15.80      **Location :** Franklin County  
**Description :** Wall 6 - 6002+50      **Designer :** MDB

**Rainfall Area:** C      **Just Full Capacity Frequency (yrs.) :** 10      **Hydraulic Gradient Frequency (yrs.) :** 25  
**Minimum Pipe Size :** 15.00      **Tailwater Elevation (ft.):** 0.00

JUNCTION		STATION	Δ AREA	Δ CA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
R1	R2	6002+50	0.15	0.14	5.00	6.61	7.32	0.9	1.0	15	27.0	0.0107	957.69	3.42	6.24	0.0003	958.23	964.02	5.79	5.08	I Barrier
	begin	6002+50	0.15	0.14									957.40				958.22	958.90			0.015



# STORM SEWER SYSTEM

**PID :** 117607

**Date :**

**Project :** FRA-161-15.80

**Location :** Franklin County

**Description :** Wall 6 - 6005+60

**Designer :** MDB

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
R1	R2	6005+60	0.14	0.13	5.00	6.61	7.30	0.8	0.9	15	37.0	0.0100	958.77	3.28	6.02	0.0003	959.22	964.81	5.59	4.79	I Barrier
	begin	6005+60	0.14	0.13									958.40				959.21	959.90			0.015



# STORM SEWER SYSTEM

**PID :** 117607      **Date :**      **Project :** FRA-161-15.80      **Location :** Franklin County  
**Description :** Wall 8 - 7999+00      **Designer :** MDB  
**Rainfall Area:** C      **Just Full Capacity Frequency (yrs.) :** 10      **Hydraulic Gradient Frequency (yrs.) :** 25  
**Minimum Pipe Size :** 15.00      **Tailwater Elevation (ft.):** 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
R1	R2	7999+00	0.16	0.14	5.00	6.61	7.32	1.0	1.1	15	30.0	0.0100	958.70	3.40	6.02	0.0004	959.24	964.18	4.94	4.23	I Barrier
	begin	7999+00	0.16	0.14									958.40				959.23	959.90			0.015



# STORM SEWER SYSTEM

**PID :** 117607      **Date :**      **Project :** FRA-161-15.80      **Location :** Franklin County  
**Description :** Wall 8 - 8001+00      **Designer :** MDB

**Rainfall Area:** C      **Just Full Capacity Frequency (yrs.) :** 10      **Hydraulic Gradient Frequency (yrs.) :** 25  
**Minimum Pipe Size :** 15.00      **Tailwater Elevation (ft.):** 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL			DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
R1	R2	8001+00	0.24	0.22	5.00	6.61	7.33	1.4	1.6	15	27.0	0.0100	960.27	3.81	6.02	0.0008	960.90	964.62	3.72	3.10	I Barrier	
	begin	8001+00	0.24	0.22									960.00				960.87	961.50			0.015	



# STORM SEWER SYSTEM

PID : 117607

Date :

Project : FRA-161-15.80

Location : Franklin County

Description : Wall 10 - 1012+25 to 1011+55

Designer : MDB

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
R1	R2	1011+55	0.07	0.06	5.00	6.61	7.18	0.4	0.5	15	70.0	0.0049	986.55	2.08	4.20	0.0001	986.97	990.68	3.71	2.88	I Barrier
	begin	1012+25	0.07	0.06									986.21				986.97	990.77			0.015
R2	R3	1012+25	0.07	0.06	5.56	6.43	7.11	0.8	0.9	15	45.0	0.0100	986.21	3.24	6.02	0.0003	986.58	990.77	4.19	3.31	I Barrier
	final	1012+25	0.14	0.13									985.76				986.57	987.26			0.015

Consider analyzing broken back conduits in three sections to outlet. Verify outlet RCP not required. MHs can be used to represent bends. Apply to both broken back locations.

ARCADIS RESPONSE:  
COMPLIED.



# STORM SEWER SYSTEM

**PID :** 117607      **Date :**      **Project :** FRA-161-15.80      **Location :** Franklin County  
**Description :** Wall 10 - 1015+50      **Designer :** MDB  
**Rainfall Area:** C      **Just Full Capacity Frequency (yrs.) :** 10      **Hydraulic Gradient Frequency (yrs.) :** 25  
**Minimum Pipe Size :** 15.00      **Tailwater Elevation (ft.):** 0.00

JUNCTION		STATION	Δ AREA	Δ CA	BEGIN	RAINFALL			DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
R1	R2	1015+50	0.24	0.22	5.00	6.61	7.35	1.4	1.6	15	34.0	0.1218	984.78	9.27	21.01	0.0008	985.02	990.82	5.80	4.79	I Barrier	
	begin	1015+50	0.24	0.22									980.64				981.51	982.15			0.015	



# STORM SEWER SYSTEM

**PID :** 117607      **Date :**      **Project :** FRA-161-15.80      **Location :** Franklin County  
**Description :** Wall 12 - 1203+50      **Designer :** MDB

**Rainfall Area:** C      **Just Full Capacity Frequency (yrs.) :** 10      **Hydraulic Gradient Frequency (yrs.) :** 25  
**Minimum Pipe Size :** 15.00      **Tailwater Elevation (ft.):** 0.00

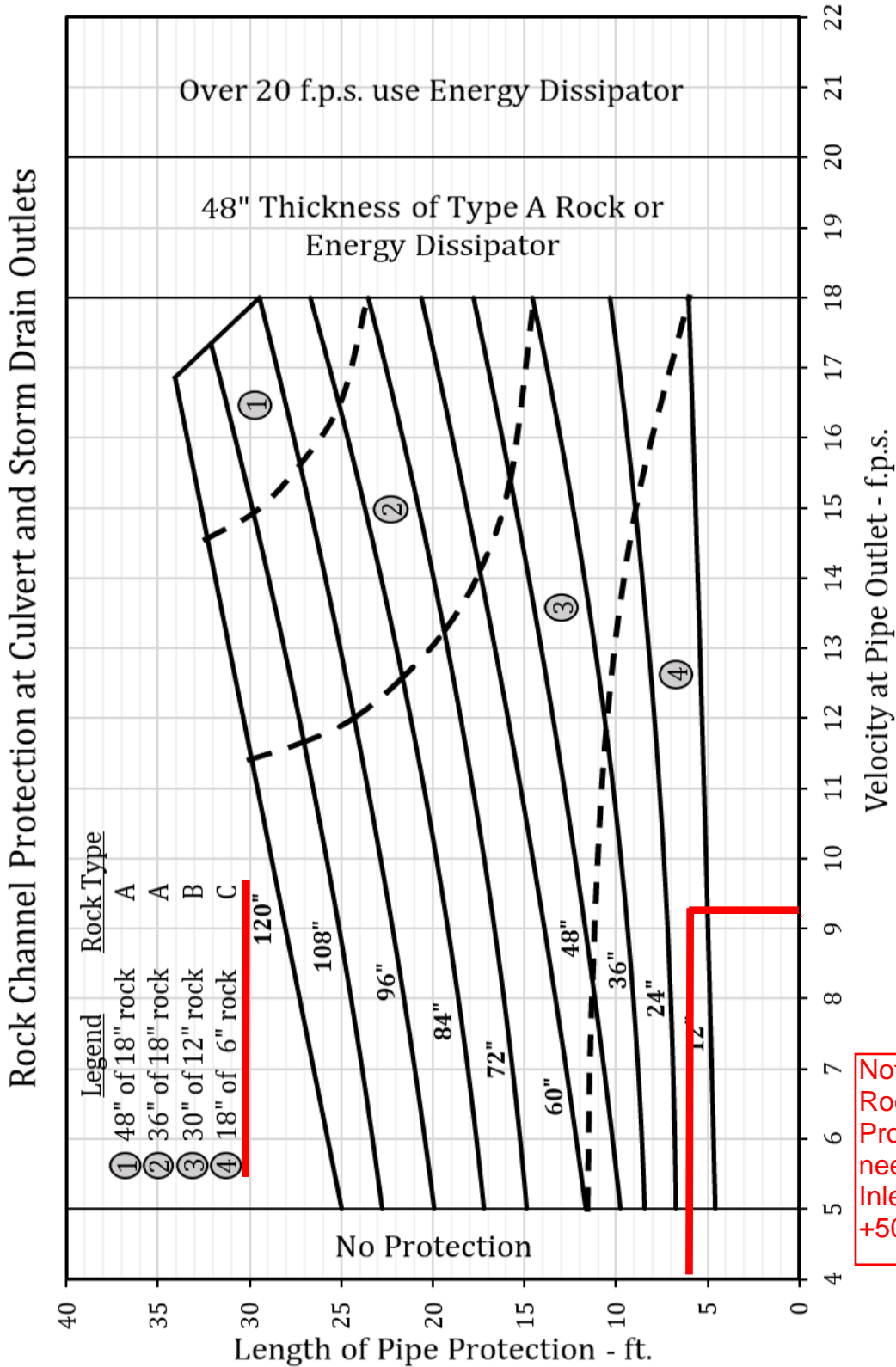
JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
R1	R2	1203+50	0.54	0.49	5.00	6.61	7.31	3.2	3.6	15	47.0	0.0100	981.24	4.72	6.02	0.0040	981.96	986.59	4.63	4.10	I Barrier
	begin	1203+50	0.54	0.49									980.77				981.78	982.27			0.015



# ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS

1002-4

REFERENCE SECTION  
1002.2.3



Note to Reviewer - Rock Channel Protection is only needed for Basin Inlet @ Sta. 1015 +50.

# Appendix C

## Post Construction BMP Calculation Analysis



### Post Construction - Project Summary

**Project Data**

		Units
Project EDA	7.95	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	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)	7.95	acres
Ain (New Impervious Area in New Permanent R/W)	0	acres
<b>T% (Treatment Percent)</b>	<b>20.00</b>	<b>%</b>
<b>Treatment Requirement</b>	<b>1.59</b>	<b>acres</b>

**BMPs Provided**

BMP Name	BMP Type	Contributing Drainage Area (acres)	Contributing Drainage Area in ODOT R/W (acres)
VFS1	Vegetated Filter Strip	0.32	0.32
VFS2	Vegetated Filter Strip	0.19	0.19
VFS3	Vegetated Filter Strip	0.7	0.7
VFS4	Vegetated Filter Strip	0.66	0.66

**Treatment Provided**

<b>Total Area with ODOT R/W Treated (acres)</b>	<b>1.87</b>
<b>Treatment Requirements (acres)</b>	<b>1.59</b>
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



# Ohio Department of Transportation - Office of Hydraulic Engineering

## Post-Construction BMP Calculation Spreadsheet

### 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)
Filter Strip #1	SR 161	300+00	305+59	RT	N/A	15' Min.	3:1 Max	559	0.32	14,146	174.6	1,571.8
Filter Strip #2	SR 161	602+00	605+28	RT	N/A	24' Min.	3:1 Max	328	0.19	8,411	103.8	934.6
Filter Strip #3	SR 161	810+50	818+08	RT	N/A	23' Min.	3:1 Max	758	0.7	30,479	376.3	3,386.6
Filter Strip #4	SR 161	900+00	912+00	RT	N/A	21' Min.	3:1 Max	1,200	0.66	28,768	355.2	3,196.4
Filter Strip #5								0			0.0	0.0
Filter Strip #6								0			0.0	0.0
Filter Strip #7								0			0.0	0.0
Filter Strip #8								0			0.0	0.0
Filter Strip #9								0			0.0	0.0
Filter Strip #10								0			0.0	0.0

**Total Treatment Credit Earned from Vegetated Filter Strips** 1.87 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

