

Ohio Department of Transportation

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

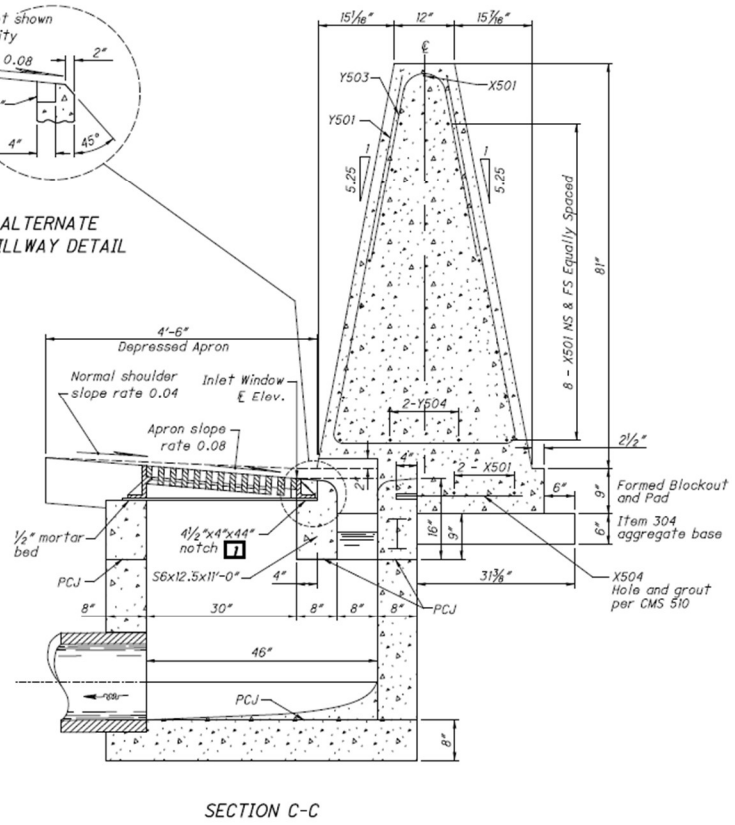
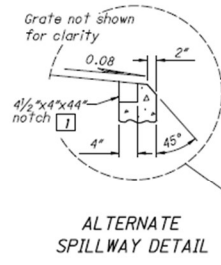
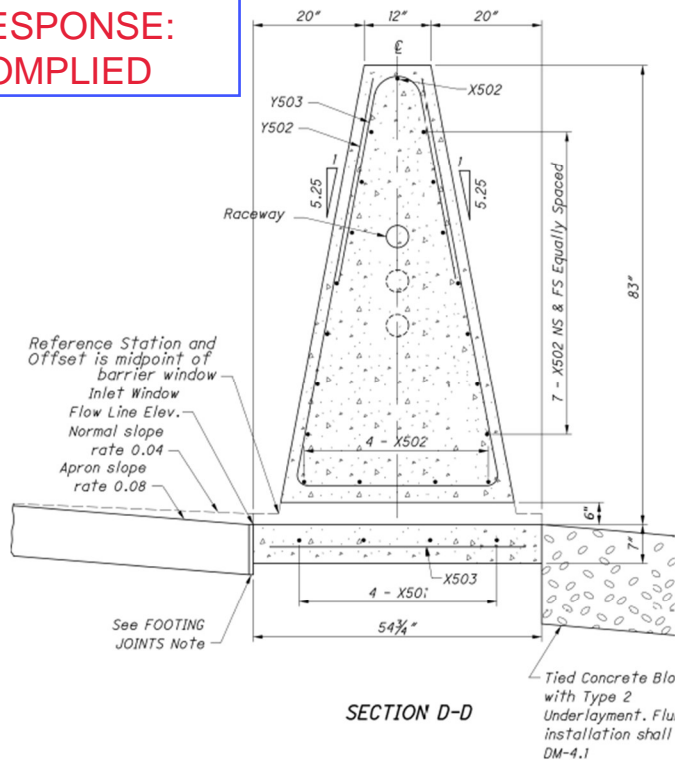
PID 117607

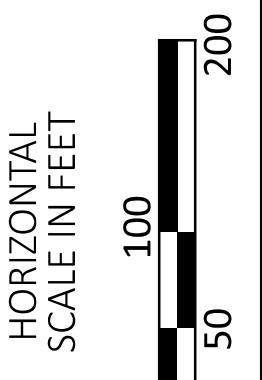
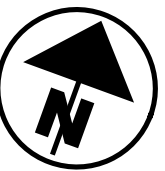
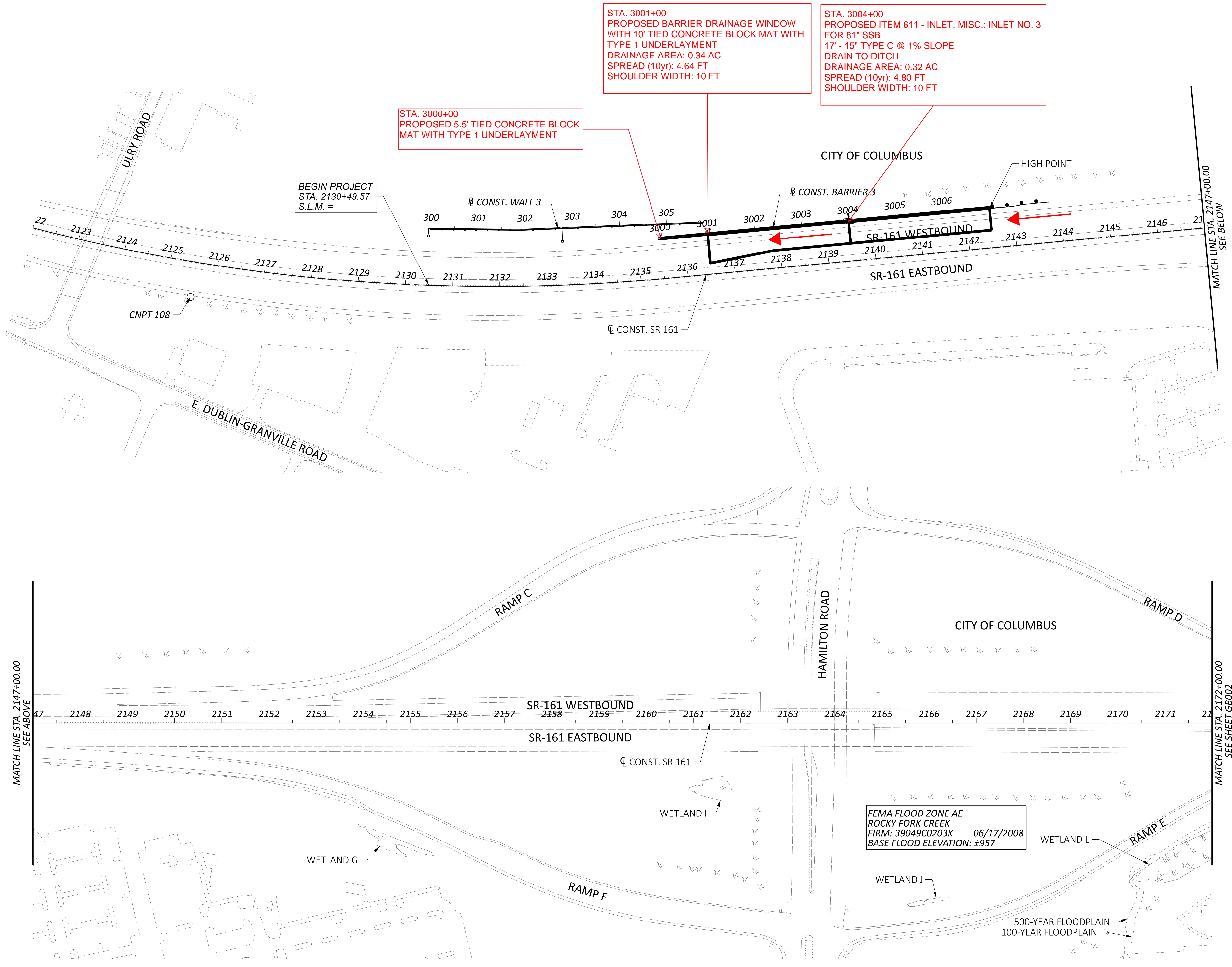
Sign and Seal

May 22, 2024

ARCADIS  
RESPONSE:  
COMPLIED

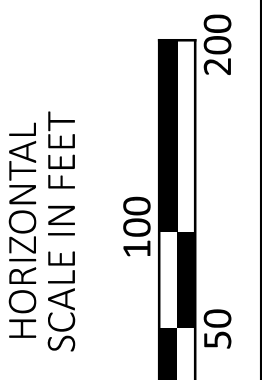
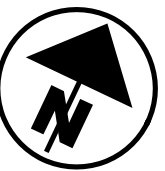
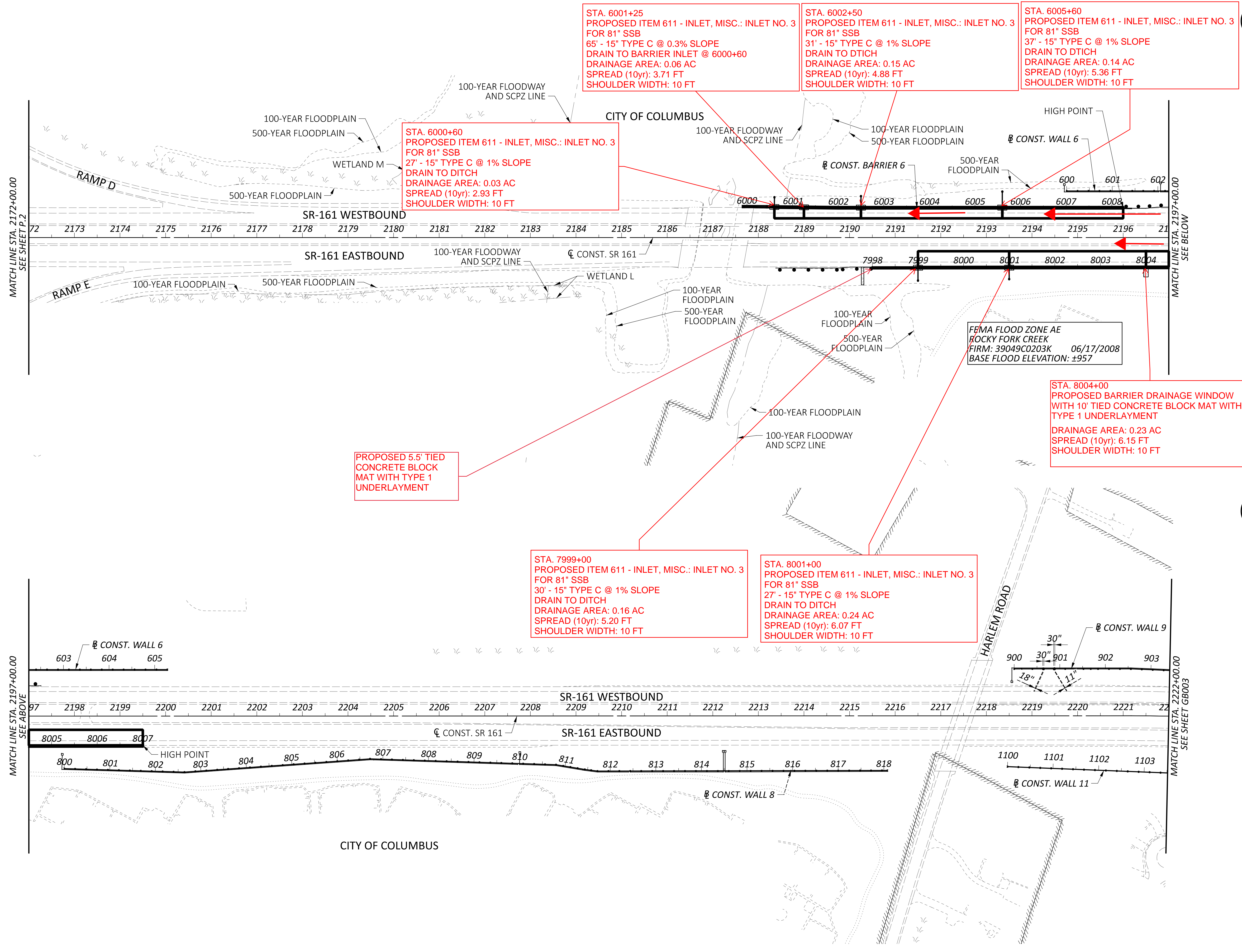
DOSD/Storm&Sanitary                                  THE CITY OF COLUMBUS DEPARTMENT OF PUBLIC UTILITIES		
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
COMMENTS	COMMENTS (COMPLIANCE REVIEW ELIGIBLE)	NO COMMENTS
tstewart		
SUBMITTAL# Tracing		05/30/2024





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

DESIGN AGENCY	
8101 NORTH LUGBURN BLVD, SUITE 100 COLUMBUS, OHIO 43235 (614) 818-4900 www.arcadis.com	
DESIGNER	
MDB	
REVIEWER	
JDH 5-15-2024	
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 SUITE 100 COLUMBUS OHIO 43265 (614) 818-4900 www.arcadis.com	
DESIGNER	
MDB	
REVIEWER	
JDH 5-22-2024	
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 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 - INLET, MISC.: INLET NO. 3  
 FOR 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  
 PONDED SPREAD (60yr): 0.92 FT  
 SHOULDER WIDTH: 10 FT

STA. 1012+25  
 PROPOSED ITEM 611 - INLET, MISC.: INLET NO. 3  
 FOR 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

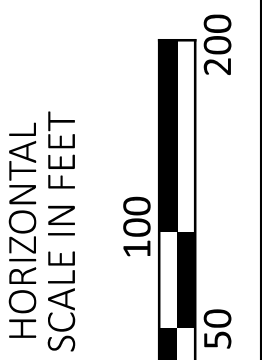
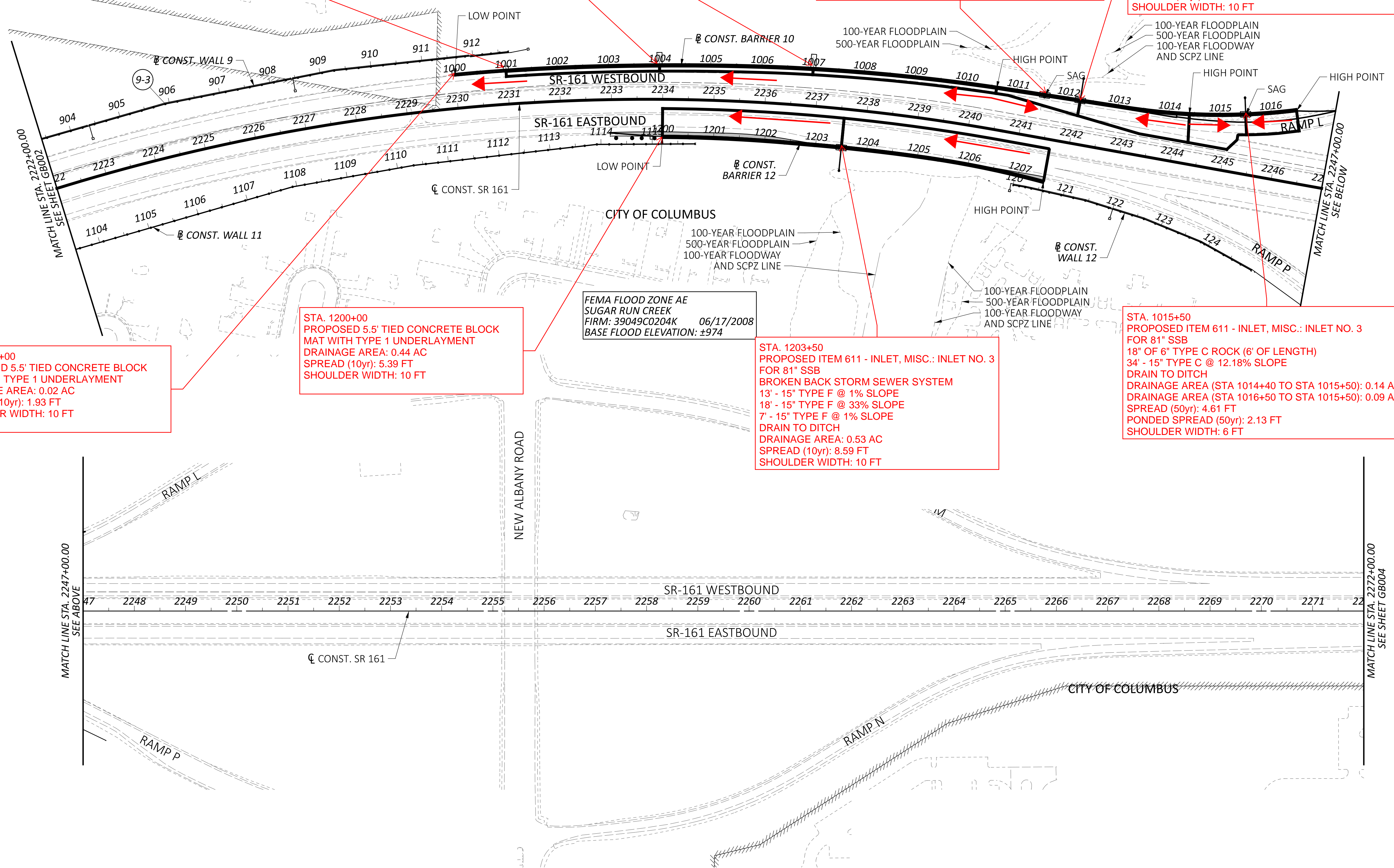
STA. 1000+00  
 PROPOSED 5.5' TIED CONCRETE BLOCK  
 MAT WITH TYPE 1 UNDERLAYMENT  
 DRAINAGE AREA: 0.02 AC  
 SPREAD (10yr): 1.93 FT  
 SHOULDER WIDTH: 10 FT

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 - INLET, MISC.: INLET NO. 3  
 FOR 81" SSB  
 BROKEN BACK STORM SEWER SYSTEM  
 13' - 15" TYPE F @ 1% SLOPE  
 18' - 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 - INLET, MISC.: INLET NO. 3  
 FOR 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  
 PONDED 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 OHIO 43235 (614) 818-4900 www.arcadis.com
DESIGNER	
MDB	
REVIEWER	
JDH 5-22-2024	
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	CB-3A	300.00	0.90	0.32	5.00	2.10	10.00	0.0143	0.0416	0.0156	10.00	0.1700	5.32	1.22	0.31	1.53	0.203	4.89
3001+00	I-2-10	300.00	0.90	0.34	5.00	1.72	10.00	0.0208	0.0416	0.0156	10.00	0.1700	5.32	1.61	0.33	1.94	0.207	4.98



# 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	CB-3A	265.00	0.90	0.14	5.00	5.32	10.32	0.0016	0.0416	0.0156	10.00	0.1700	5.26	0.65	0.01	0.66	0.223	5.36
6002+50	CB-3A	310.00	0.90	0.15	5.00	4.72	10.00	0.0032	0.0416	0.0156	10.00	0.1700	5.32	0.70	0.03	0.73	0.204	4.91
6001+25	CB-3A	125.00	0.90	0.06	5.00	2.47	10.00	0.0025	0.0416	0.0156	10.00	0.0000	5.32	0.33	0.01	0.34	0.161	3.86
6000+60	CB-3A	65.00	0.90	0.03	5.00	1.50	10.00	0.0025	0.0416	0.0156	10.00	0.0000	5.32	0.18	0.00	0.18	0.125	3.02



# 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	CB-3A	300.00	0.90	0.24	5.00	4.42	10.00	0.0025	0.0416	0.0156	10.00	0.1700	5.32	0.98	0.17	1.15	0.252	6.07
7999+00	CB-3A	200.00	0.90	0.16	5.00	3.07	10.00	0.0025	0.0416	0.0156	10.00	0.1700	5.32	0.84	0.09	0.93	0.233	5.61





# 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	CB-3A	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	CB-3A	215.00	0.90	0.21	5.00	2.92	10.00	0.0029	0.0416	0.0156	10.00	0.1700	6.50	1.03	0.20	1.23	0.252	6.06	
1011+55	CB-3A	70.00	0.90	0.04	5.00	1.23	10.00	0.0029	0.0416	0.0156	10.00	0.1700	6.50	*****	*****	0.43	0.170	4.09	End

### SUMP DATA

**Total Flow (cfs) :** 0.60

**Ponded Depth (ft.) :** 0.062

**Spread on Pavement (ft.) :** 1.98



# 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	CB-3A	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	CB-3A	100.00	0.90	0.09	5.00	1.00	10.00	0.0107	0.0416	0.0156	10.00	0.1700	6.50	*****	*****	0.54	0.145	3.49	End

## SUMP DATA

**Total Flow (cfs) :** 1.38

**Ponded Depth (ft.) :** 0.149

**Spread on Pavement (ft.) :** 2.78



# 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	CB-3A	401.00	0.90	0.53	5.00	5.48	10.48	0.0019	0.0416	0.0156	10.00	0.1700	5.23	1.70	0.79	2.49	0.357	8.59
1200+00	I-2-6	350.00	0.90	0.44	5.00	2.02	10.00	0.0159	0.0416	0.0156	10.00	0.1700	5.32	1.46	1.44	2.90	0.253	6.08

Date: 05/22/2024  
 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^2)
	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	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	3004+00	0.32	0.29	10.00	5.32	5.99	1.5	1.7	15	17.0	0.0100	972.23	3.88	6.02	0.0009	972.96	977.73	4.77	4.25	I Barrier
	begin	3004+00	0.32	0.29									972.06				972.95	973.56			0.015



# 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 To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.) (25 yrs.)	(cfs.) (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	6001+25 begin	0.06 0.06	0.05 0.05	10.00	5.32	5.93	0.3	0.3	15	65.0	0.0183	958.84 957.65	2.96	8.15	0.0000	959.02 958.38	963.84 963.57	4.82	3.75	I Barrier 0.015
R2	R3	6000+60 final	0.03 0.09	0.03 0.08	10.37	5.25	5.90	0.4	0.5	15	27.0	0.0093	957.65 957.40	2.66	5.79	0.0001	958.16 958.16	963.57 958.90	5.41	4.67	I Barrier 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	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	6002+50	0.15	0.14	10.00	5.32	5.97	0.7	0.8	15	31.0	0.0094	957.69	3.07	5.82	0.0002	958.21	964.02	5.81	5.08	I Barrier
	begin	6002+50	0.15	0.14									957.40				958.20	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	10.00	5.32	5.97	0.7	0.8	15	37.0	0.0100	958.77	3.07	6.02	0.0002	959.20	964.81	5.61	4.79	I Barrier
	begin	6005+60	0.14	0.13									958.40				959.19	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.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
R1	R2	7999+00	0.16	0.14	10.00	5.32	5.98	0.8	0.9	15	30.0	0.0100	958.70	3.20	6.02	0.0002	959.21	964.18	4.97	4.23	I Barrier
	begin	7999+00	0.16	0.14									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 - 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	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.)	HY GR	CROWN	'n'
R1	R2	8001+00	0.24	0.22	10.00	5.32	5.98	1.1	1.3	15	27.0	0.0100	960.27	3.59	6.02	0.0005	960.86	964.62	3.76	3.10	I Barrier
	begin	8001+00	0.24	0.22									960.00				960.85	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	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.) (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	10.00	5.32	5.88	0.3	0.4	15	70.0	0.0049	986.55	1.95	4.20	0.0000	986.96	990.68	3.72	2.88	I Barrier
	begin	1012+25	0.07	0.06									986.21				986.95	990.77			0.015
R2	R3	1012+25	0.07	0.06	10.60	5.20	5.87	0.7	0.7	15	13.0	0.0100	986.21	3.06	6.02	0.0002	986.88	990.77	3.89	3.31	I Barrier
		1012+25	0.14	0.13									986.08				986.87	989.08			0.015
R3	R4	1012+25	0.00	0.00	10.67	5.19	5.86	0.7	0.7	15	23.0	0.4778	986.08	11.89	41.63	0.0002	986.20	989.08	2.88	1.75	I Barrier
		1012+25	0.14	0.13									975.09				975.88	978.09			0.015
R4	R5	1012+25	0.00	0.00	10.70	5.18	5.85	0.7	0.7	15	9.0	0.0100	975.09	3.04	6.02	0.0002	975.79	978.09	2.30	1.75	I Barrier
	final	1012+25	0.14	0.13									975.00				975.79	976.25			0.015



# 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	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	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	10.00	5.32	6.00	1.1	1.3	15	34.0	0.1218	984.78	8.71	21.01	0.0005	985.00	990.82	5.82	4.79		I Barrier	
	begin	1015+50	0.24	0.22									980.64				981.49	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

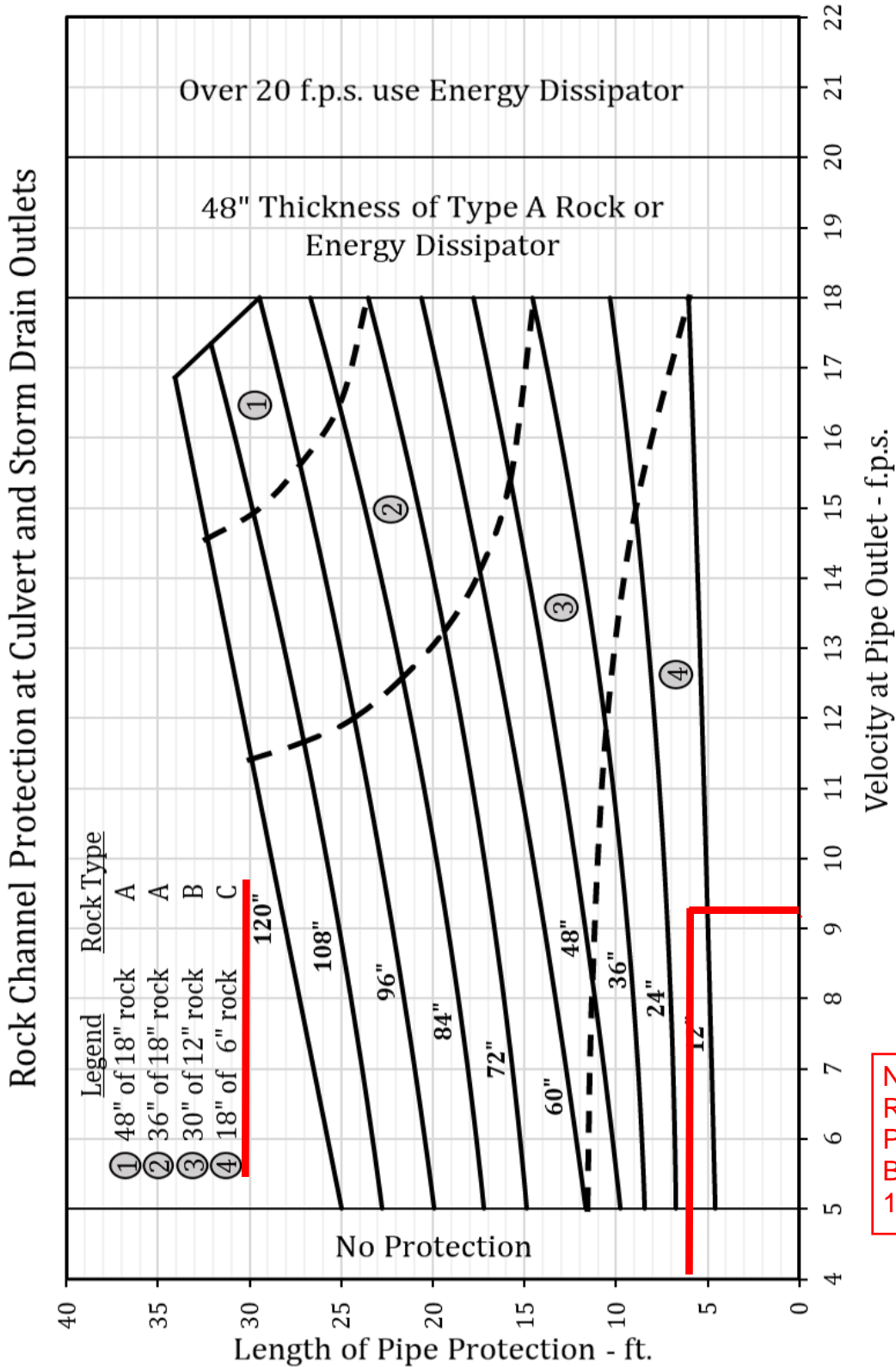
Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE		
From	To	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.) (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	10.00	5.32	6.00	2.6	2.9	15	13.0	0.0100	981.24	4.48	6.02	0.0027	982.11	986.59	4.48	4.10	I Barrier
	begin	1203+50	0.54	0.49								981.11				982.08	984.11			0.015	
R2	R3	1203+50	0.00	0.00	10.05	5.31	6.00	2.6	2.9	15	18.0	0.3356	981.11	15.79	34.89	0.0027	981.36	984.11	2.75	1.75	I Barrier
		1203+50	0.54	0.49								975.07				976.04	978.07			0.015	
R3	R4	1203+50	0.00	0.00	10.07	5.31	5.99	2.6	2.9	15	7.0	0.0100	975.07	4.47	6.02	0.0027	975.99	978.07	2.08	1.75	I Barrier
	final	1203+50	0.54	0.49								975.00				975.97	976.25			0.015	

# ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS

1002-4

REFERENCE SECTION  
1002.2.3



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



# 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

