Drainage Report

2023 Street and Utility Improvements

City of Montgomery, MN May 31, 2022



Submitted by:

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Real People. Real Solutions.

Certification

Drainage Report

For

2023 Street & Utility Improvement Project

City of Montgomery, MN 0M1.126823

May 31, 2022

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By:

Matthe v Smor, P.E. License No. 57832

Date: May 31, 2022

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I. Introduction

The City of Montgomery will be reconstructing or repaving the streets in the Columbia Heights neighborhood as part of their capital improvement plan for 2023. The 2023 Street & Utility Improvement project is bounded by Boulevard Avenue on the west, Hickory Avenue on the east, 4th Street to the south and 1st Street to the north. Streets in this section were given a road condition score of 1.5-2.5 (out of 5) as part of the City of Montgomery 2015-2035 Comprehensive Plan. There will be utility improvements along with the street improvements, including replacing the aging storm sewer system. The existing storm sewer infrastructure is in poor condition and insufficient to manage the more frequent and higher intensity rainfalls of today. This drainage report serves to provide some background on the project area and outline the proposed stormwater management design for the 2023 Street & Utility Improvement project.

II. Previous Studies

In 2020, the City of Montgomery contracted SEH to provide hydrologic and hydraulic modeling of the storm sewer system along Hickory Avenue to the outfall on Lexington Avenue west of Welco Drive. The purpose of the analysis was to identify how proposed improvements to the storm sewer system would affect localized flooding along the system. Existing and proposed conditions models were developed in Innovyze's XPSWMM. The study provided some recommendations on proposed ponding locations and storm sewer sizing.

III. Analysis

To understand the drainage conditions of the project area and guide the proposed stormwater management design, a hydrologic and hydraulic model was developed using Autodesk's Storm & Sanitary Analysis (SSA). SSA uses the Soil Conservation Service (SCS) Technical Release (TR-20) methodology to route watershed runoff through the system using a rainfall hydrograph. The Atlas 14 rainfall depths were used along with the NRCS's MSE 3, 24-hour rainfall distribution. The rainfall depths used for the 2-, 10-, and 100-Year rainfall events were 2.85", 4.23" and 7.18", respectively. Time of concentrations were calculated using the NRCS's TR-55 methodology. Drainage areas were delineated using a combination of LiDAR data and survey data where available. Soil types within the project area are dominated by clay loams characterized by the hydrological soil group type D.

IV. Existing Conditions

The existing land use within the project area is predominantly residential, specifically ¼ acre residential lots, with some industrial land use at the top of the watershed coming from the USP site. Runoff generated within the watershed is managed today by an aging storm sewer system that is undersized and has insufficient inlet capacity to properly capture runoff. During large rainfall events the storm sewer system is overwhelmed, and the streets convey the excess runoff down to the major low points on the Minnesota Valley Grain Co site near the railroad tracks and on Lexington Avenue. When the low point on MN Valley Grain Co site fills up, excess runoff overtops the railroad tracks and runs out onto Lexington Avenue. The ultimate discharge point for this storm sewer system is County Ditch 22 on the western side of the city, which drains to Lake Pepin to the north. Televising of the storm sewer system performed in March of 2022 (See Appendix B for report), identified a number of problematic conditions including pipes filled with dirt and roots, fractured pipes and offset joints. One benefit to the existing drainage conditions of this area is that the neighborhood sits right on top of a hill with the ground falling away more than

10 feet in elevation in all directions. This means that there are no major low points or flooding areas within the streets that are being reconstructed. There are no existing stormwater detention basins serving this area.

Figure 1: Existing Drainage Conditions can be found in Appendix A and shows the existing storm sewer layout, drainage areas, flow directions and ponding extents at the low point on Lexington Avenue and the MN Valley Grain Co site.

V. Proposed Design

As outlined in the 2015-2035 Comprehensive Plan, the City of Montgomery does not have a stormwater management plan or a capital improvement plan with proposed stormwater management improvements to guide proposed development projects within the City. For the 2023 Street & Utility Improvement project, the proposed stormwater management system has been designed to meet the MPCA's NPDES Construction Stormwater Permit requirements and follow the best and most widely accepted engineering design standards. The design is centered on three principles of stormwater management: inlet capacity, conveyance capacity, and detention. Catch basins inlets have been designed with modern high-capacity inlets and have been located at key areas to limit significant ponding within the streets and keep spreads below the centerlines of the roads for up to the 5-Year rainfall event. Storm sewer has been sized to convey collected runoff up to the 5-Year rainfall event. Lastly, a detention basin is proposed to mitigate any impacts the improved proposed storm sewer system would have on the existing downstream storm sewer.

The proposed street and trail improvements will reduce the overall impervious surfaces. Therefore, per the MCPA NPDES Construction Stormwater Permit, a permanent stormwater treatment basin is not required.

Table 1 – Impervious Calculation						
AREA (ACRES)						
Existing	9.6					
Proposed	8.7					
Difference	-0.9					

A. Railroad Detention Basin

The proposed project's outfall is the existing 30" storm sewer pipe running down Lexington Avenue. The low points in this street and on the MN Valley Grain Co site experience significant ponding today (refer to Figure 1 in Appendix A for ponding extents). Improving the upstream stormwater management system will only exacerbate this problem unless collected runoff is slowed down in a detention basin before discharging to the existing storm sewer. A stormwater detention basin is proposed on the empty City parcel located east of the Union Pacific railroad and north of Mill Avenue. This detention basin has been designed to provide 2.5 acre-feet of storage and will reduce both proposed discharge rates to the downstream system and ponding at the low points of concern compared to the existing conditions. The proposed detention basin will allow for the upstream storm sewer system to be upsized while maintaining a reduced outlet size. Additionally, the detention basin will intercept excess runoff that today flows overland down 1st Street NE and spills down Mill Avenue NE reducing ponding on the MN Valley Grain Co site. As part of the railroad detention basin, a new storm sewer pipe crossing under the railroad tracks will be constructed and connect back into the existing storm sewer line on Lexington Avenue. This railroad crossing will require coordination and permitting through Union Pacific. Union Pacific's engineering designing requirements have been included in Appendix C for reference.

B. Model Results

Table 2 below shows that the proposed design will reduce discharge rates to the existing downstream storm sewer system.

Table 2 – Discharge Rates (CFS) To County Ditch 22									
2-YEAR (2.85") 5-YEAR (3.58") 100-YEAR (7.18")									
Existing	47.8	76.2	229.3						
Proposed	45.6	47.5	203.5						
Difference	-2.2	-28.7	-25.8						

*Note: discharge rates include pipe and overland flow leaving

Lexington avenue low point

Table 3 below shows that the proposed design will reduce ponding levels in the low point on Lexington Avenue.

Table 3 – Ponding Elevation (FT) At Lexington Avenue Low Point									
2-YEAR (2.85") 5-YEAR (3.58") 100-YEAR (7.13									
Existing	1055.1	1055.5	1056.1						
Proposed	1054.3	1055.0	1056.1						
Difference	0.8	0.5	0.0						

*Note: overflow elevation @ 1055.3'

Table 4 below shows that the proposed design will reduce ponding levels in the low point on the MN Valley Grain Co property, east of the railroad tracks and Lexington Ave.

Table 4 – Ponding Elevation (FT) At Mn Valley Gain Co									
2-YEAR (2.85") 5-YEAR (3.58") 100-YEAR (7.18"									
Existing	1064.6	1064.7	1065.1						
Proposed	1063.6	1063.8	1065.0						
Difference	-1.0	-0.9	-0.1						

*Note: railroad overtops @ 1064.3'

Table 5 below shows the high-water levels and stored runoff volume in the proposed railroad detention basin for the 2-, 10- and 100-Year rainfall events.

Table 5 – Railroad Detention Basin									
BASIN CHARACTERISTICS 2-YEAR (2.85") 5-YEAR (3.58") 100-YEAR (7.18")									
BOTTOM NWL EOF		EOF	HWL (FT)	VOL. STORED (CF)	HWL (FT)	VOL. STORED (CF)	HWL (FT)	VOL. STORED (CF)	
1053.0	1057.0	1067.0	1064.7	80,853	1067.0	114,597	1067.7	132,533	

For rainfall events larger than the 5-Year, the proposed railroad detention basin will overtop and runoff will flow down to the low point on the MN Valley Grain Co site like it does today. Modeling results indicate that even with this case the proposed project is still an improvement with reducing ponding and overland flow rates. The size of the proposed basin is maxed out on the available land. In order to contain larger rainfall events a combination of increased outlet pipe and/or additional storage needs to be provided. The City owns the parcels (P.I.D. 22.999.1030 & 22.999.1040) immediately west of the railroad tracks. A second detention basin on this property could be constructed to contain larger rainfall events and improve further flooding conditions on Lexington Avenue and the MN Valley Grain Co site. To contain the 100-Year rainfall event would require ~48" outlet pipe from the proposed railroad detention basin and a second detention basin with ~16 ac-ft of storage, a volume which would take nearly all of P.I.D. 22.999.1030.

Figure 2: Proposed Drainage Conditions can be found in Appendix A and shows the proposed storm sewer layout and sizing, drainage areas, flow directions and ponding extents at the low point on Lexington Avenue and the MN Valley Grain Co site.

VI. Summary

The 2023 Street & Utility Improvement Project will significantly improve the livability of Columbia Heights neighborhood through street, trail and utility improvements. The proposed stormwater management design presented in this report has been designed to meet all the necessary permitting and design requirements and improve drainage conditions compared to the present-day.

Appendix A: Figures

2023 Street & Utility Improvement Project

City of Montgomery, MN

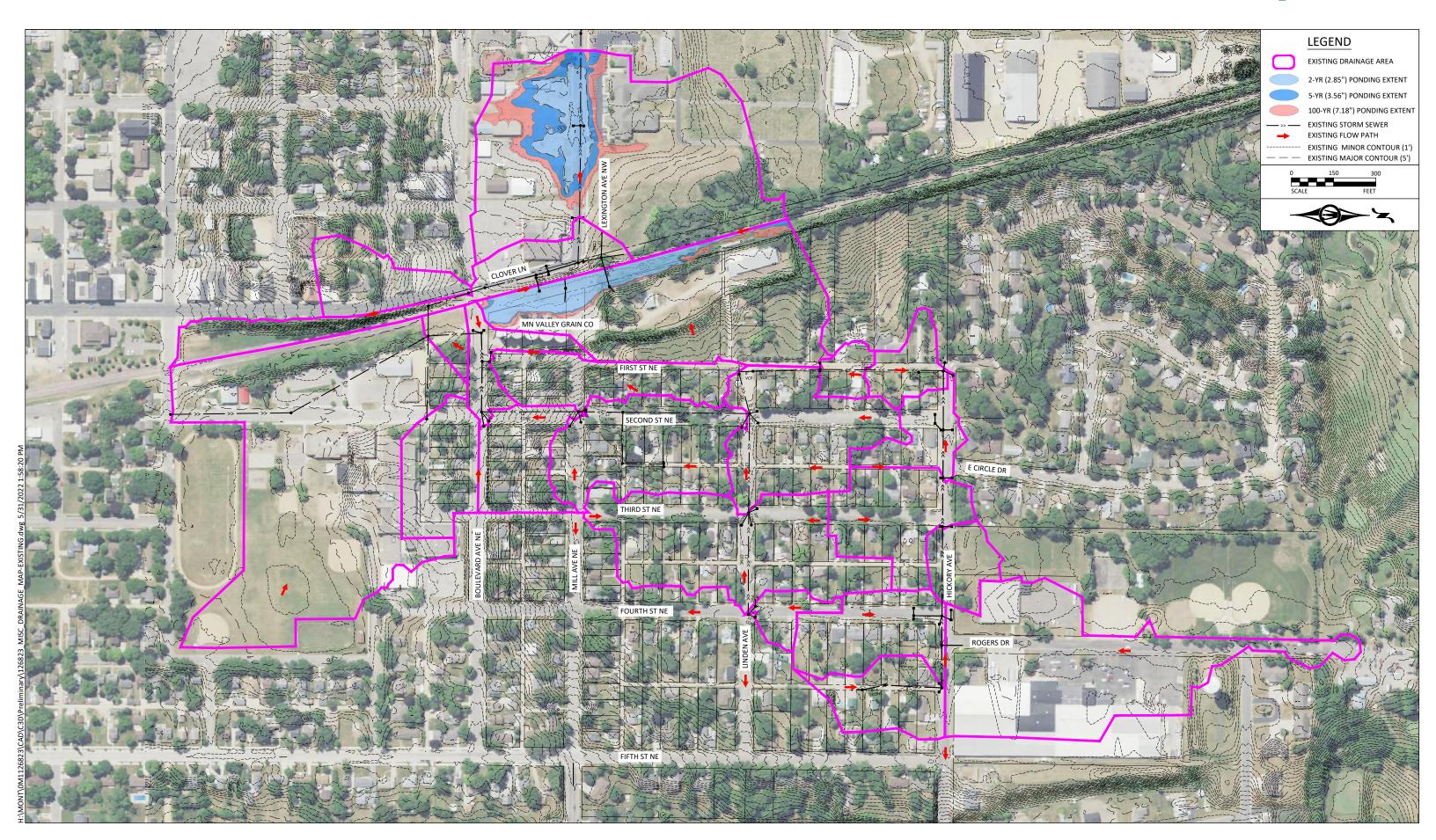


Figure 1: Existing Drainage Conditions May 2022



2023 Street & Utility Improvement Project

City of Montgomery, MN

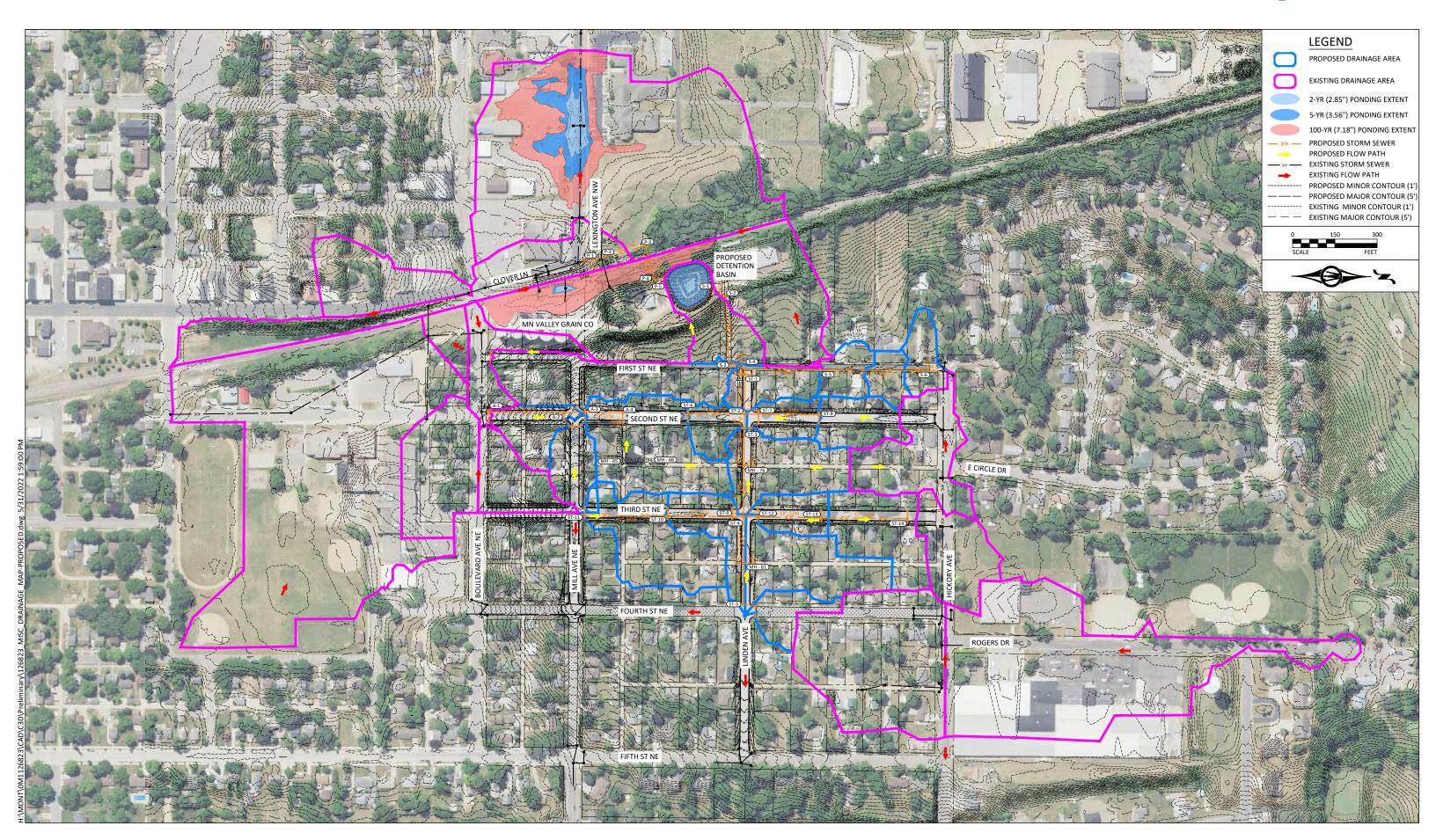


Figure 2: Proposed Drainage Conditions May 2022



Appendix B: Televising

Montgomery

TV/Clean Storm March 2022



16281 Baseline Ave. • Shakopee, MN 55379 Phone: 952.445.3173 • Fax: 952.496.9117 Website: www.pipe-services.com

Montgomery

TV/Clean Storm March 2022

Montgomery MN Significant Findings TV Storm March 2022

Pipe ID#	Findings						
05-06	Could not get past the dirt and roots						
	Could not clean or root cut pipe. Manhole in alley needed to be located						
	before cutting could be done.						
30A-30	Could not TV this line. Pipe takes a 45 degree angle. Could not go in						
30-31	Pipe is fractured and has large deposits. Camera could not pass						
30-31R	Large deposit could not complete inspection						
31-32	Pipe is half full of dirt						
31-32R	Pipe 90 degree up. Could not complete inspection						
35-36	Could not go downstream. Upstream is a clean out. Going from						
	downstream to upstream large offset joint could not proceed over to						
	complete inspection						
37-38	At 220 ft large pipe crossing through storm pipe						

PipeTech View Search Results

Search Criteria:	Data Totals:	
Criteria And/Or	Field	Total
City = 'Montgomery'	Total Length:	2528.5
	Length Surveyed:	1606

20 Matching Pipe Segments:

#	Pipe Segment Reference	Upstream MH	Downstream MH	Height (Diameter)	Total Length	Length Surve
1	An other style model and the second state of t	01	02	12	99	99
2	03-01	03	01	12	12.5	12.5
3	04-01	04	01	12	25	25
4	05-06	05	06	10	130	129.4
5	09-10	09	10	12	350	61.7
6	09-10	09	10	12	350	350
7	11-09	11	09	12	36	36
8	12-09	12	09	12	26	26
9	16-17	16	17	12	329	329
10	18-16	18	16	12	25	25
11	19-16	19	16	12	40	40
12	20-19	20	19	12	54	54
13	30-30A	30	30A	8	0	0
14	30-31	30	31	12	111	44.2
15	30-31R	30	31	12	111	41.2
16	31-32	31	32	12	69	8.2
17	31-32R	31	32	12	69	2
18	35-36	35	36	12	52	12.8
19	37-38	37	38	18	320	220
20	37-38R	37	38	18	320	90

PIPE SERV 16281 Baseline Ave. Shakopee, MN 5537 952.445.3173	VICES	te: Distances are indicated from the Downstream MH. Closed Circuit Television Inspection				
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Surveyor's Name Shawn Blake	Certificate Number U-314-06020629	Street Add 4th St		on Details		
Direction	Purpose	Weathe		Sewer Use	Length Surveyed	
Downstream Additional Information	Routine Assessment	Dry	03/14/202	2 Stormwater	99	
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₩ ► • 19.9 OBR	Obstacle - Rocks		5 to 7			
	Access Point - Manhole		End c	of inspection.		

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Customer City of Montgomery	Pip	e Segment Ref. Upst 03-01	ream MH 03	Downstrea 01		Size Materia 12 Concrete P (non-reinford	ipe 12.5
Surveyor's Nar Shawn Blake	ne	Certificate Number U-314-06020629	Street Add 4th St		Location	Details	
Direction Upstream		Purpose Routine Assessment	Weathe Dry		Date 03/14/2022	Sewer Use Stormwater	Length Surveye
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		Description Access Point - Catch Basin		Posi	tion Comme End of in	e nt nspection.	
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0.0		Water Level Access Point - Manhole			Begin in	spection.	

Survey	f nery		e Segment Ref. Ups 04-01	otream MH 04	Downstrea 01	am MH Size		
Shaw	o r's Nam n Blake	le	Certificate Number U-314-06020629	Street Add 4th St		Location Det		
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10	pstream		Purpose Routine Assessment		Weather Dry	E	Date Sewer Use	Length Surveyed
Add	ditional Inform	ation	Routine Assessment		biy		Gioiniwater] [120.4
	Ftg. 129.4 127.3 126.6 122.7	Code MSA RMJ	Description Survey Abandoned Roots, Medium, Joint Roots, Medium, Joint Joint Offset (displaced):	Medium		5 to 7	Cannot proceed pass the roo root cut. 10% roots at joint. 10% roots at joint. Offset about 1 inch.	ots, pipe needs to be
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	•64.3	MWLS	Water Level: Sag				Sag about 2 inch's of water.	
₩ ▼	•59.3	DAE	Deposits Attached: Encr	rustation		7 to 11	5% deposits at joint.	
	•12.9	JOM	Joint Offset (displaced):				Offset about 1 inch.	
	•7.9	JOM	Joint Offset (displaced):	Medium			Offset about 1 inch.	
	0.0	MWL AMH	Water Level Access Point - Manhole				Begin inspection.	

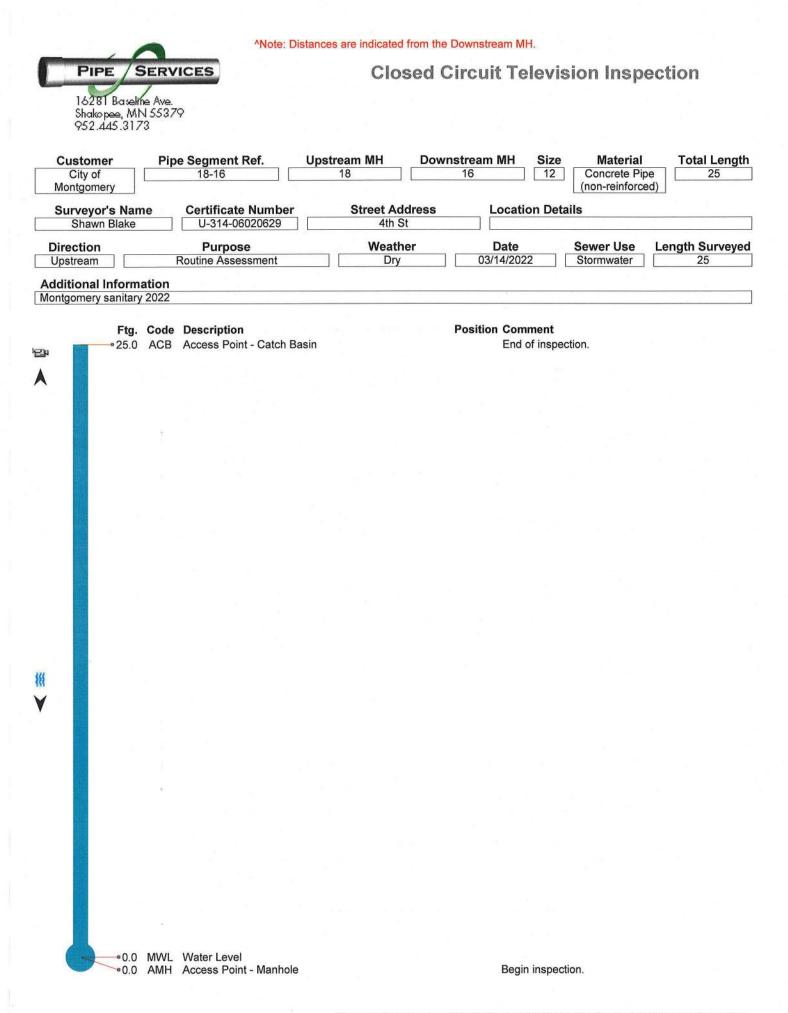
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Customer City of Montgomery	Pipe Se	gment Ref. Up 19-10	ostream MH 09	Downstream 10	MH	Size 12	Material Concrete Pi (non-reinforce	be	otal Length 350
Surveyor's Nam Shawn Blake		rtificate Number J-314-06020629	Street Add Linden A		ocation	n Detai	ls		
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Additional Informa Montgomery sanitary									
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Direction	Purpose	Weather Date Sewer Use Length Surveyed
	Routine Assessment	Dry 03/15/2022 Stormwater 350
Additional Information Montgomery sanitary 2022		
Ftg. Code	Description Access Point - Manhole Water Level	Position Comment Begin inspection.
•317.0 DAE •313.2 DAE	Deposits Attached: Encrustation Deposits Attached: Encrustation	7 to 4 5% deposits at joint.7 to 4 5% deposits at joint.
•284.3 DSF	Deposits Settled: Fine	5 to 7
•266.2 DSF	Deposits Settled: Fine	5 to 7
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	Deposits Attached: Encrustation Deposits Attached: Encrustation	7 to 4 5% deposits at joint. 7 to 4 5% deposits at joint.
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Direction Upstream			Purpose Routine Assessment	Weather Dry	Date 03/14/2022	Sewer Use Stormwater	Length Surveyed					
Additional Montgomery	/ sanitary Ftg.	2022 Code	Description		Position Comment							
	•36.0	ACB	Access Point - Catch Basin		End of inspe	ction.						
		*										
*												
-	•4.6	DSF	Deposits Settled: Fine		5 to 7							
	•0.0	MWL	Water Level									
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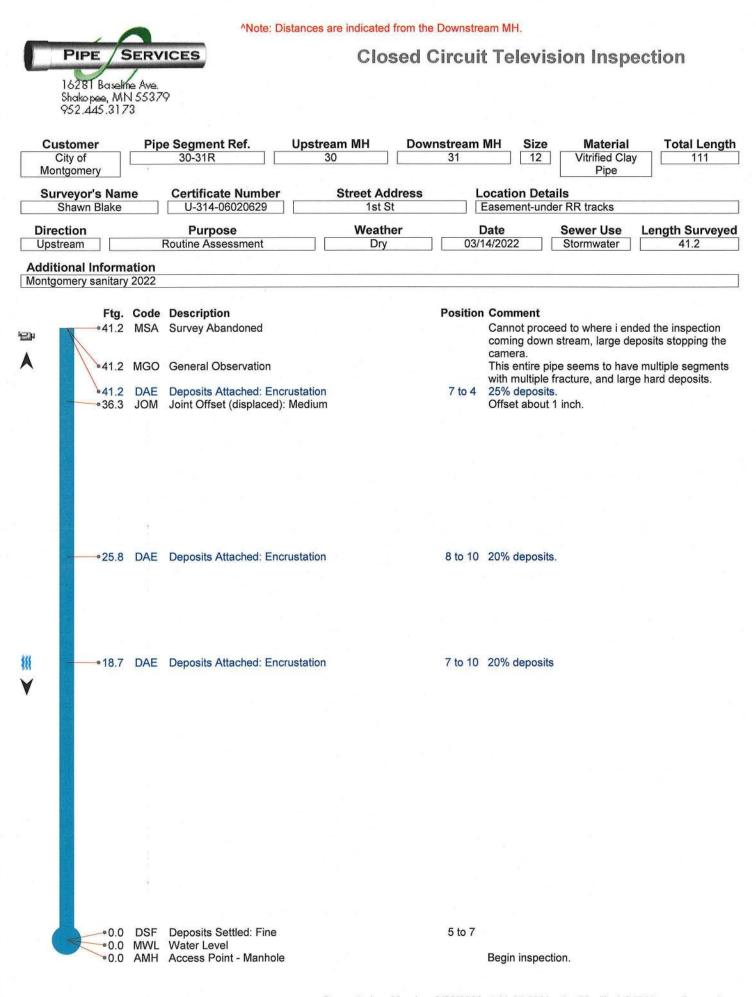
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111

Begin inspection.

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		AMH	Description Access Point - Manhole Water Level		Position	Comment Begin inspecti	on.	
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а. С								
	• 30.8	FM	Fracture Multiple		7 to 5			
		2						
	•23.7	JOM	Joint Offset (displaced): Medium	1				
·								
***	•19.9	MWLS	Water Level: Sag			Sag about 2 in	ch's of water.	
	•12.7	DAE	Deposits Attached: Encrustation	1	7 to 7	15% deposits	at joint.	
		4						
	•0.0		General Observation			fractures and I	nts up to this poir nard deposits.	
	•0.0	MSA	Survey Abandoned			Cannot procee	ed pass the large	deposits.

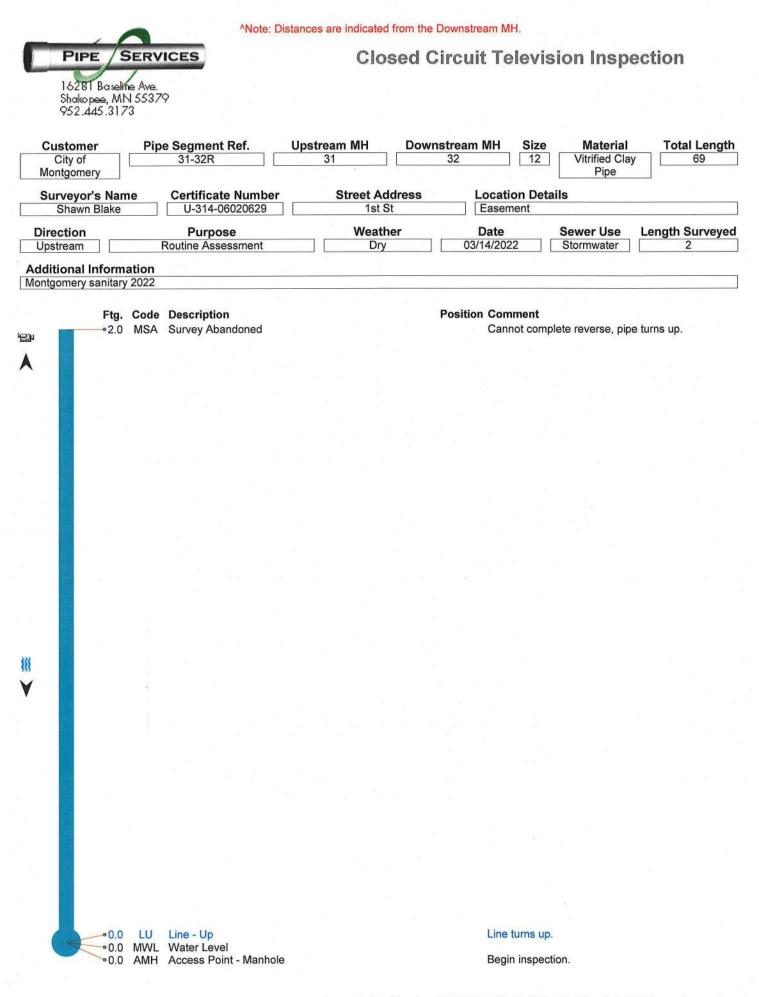


Generated on Monday, 3/28/2022 at 11:05 AM by the PipeTech® TV inspection system.

PIPE /	SERV	and a second	[^] Note: Distances are indicated from the Downstream MH. Closed Circuit Television Inspection								
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Customer City of Montgomery	Pip	e Segment Ref. 31-32	Upstream 31	MH D	ownstream 32	MH Siz		y 69	ength		
Surveyor's Nar Shawn Blake	ne	Certificate Number U-314-06020629	Str	r eet Addres 1st St	S	Location De Easement	etails				
Direction Downstream		Purpose Routine Assessment		Weather Dry	03	Date /14/2022	Sewer Use Stormwater	Length Surv 8.2	/eyed		
Additional Inform	nation										
Ftg.	Code AMH		e		Positio	n Comment Begin inspe					
¥ *8.2	WW	Water Level									

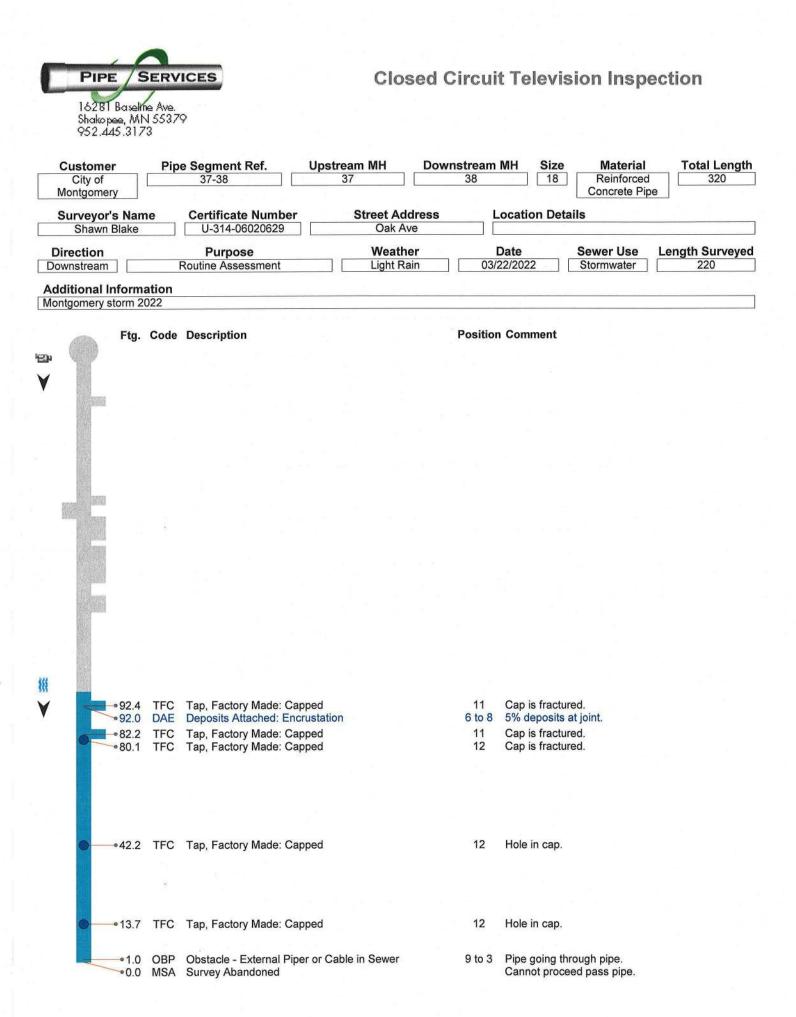
Y											
•0.0	MSA	Survey Abandoned				Cannot pro pipe.	ceed pass the larg	e amount of dirt	in		

Generated on Monday, 3/28/2022 at 11:05 AM by the PipeTech® TV inspection system.



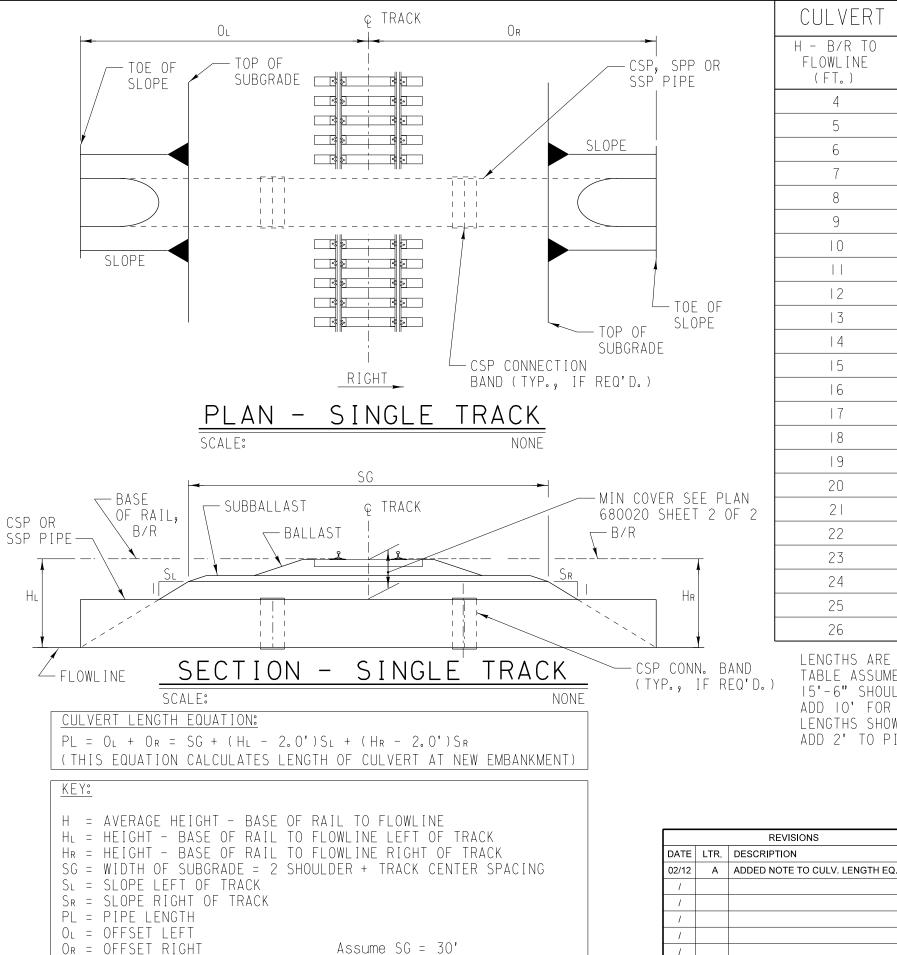
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				37.5	Medium		D (22)			
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	₩ ▼		1 A							
•0.0 MWL Water Level			MAU	Water Loval	,					

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189.2 TFC Tap, Factory Made: Capped 12	
186.7 TFC Tap, Factory Made: Capped 12	
184.1 TFC Tap, Factory Made: Capped 12	
183.7 DAE Deposits Attached: Encrustation 4 to 5 5% deposits at joint. 181.5 TFC Tap, Factory Made: Capped 12	
12 179.1 TFC Tap, Factory Made: Capped 12	
176.4 TFC Tap, Factory Made: Capped 12	
173.8 TFC Tap, Factory Made: Capped 12	
• 171.3 TFC Tap, Factory Made: Capped 12 170.3 DAE Dependent Encrystation 7 to 4 5% dependent et joint	
170.2 DAE Deposits Attached: Encrustation 7 to 4 5% deposits at joint. 168.7 TFC Tap, Factory Made: Capped 12	
168.7 TFC Tap, Factory Made: Capped 12 168.0 OBR Obstacle - Rocks 4 to 6	
V 168.0 DAE Deposits Attached: Encrustation 7 to 4 5% deposits at joint.	
166.0 TFC Tap, Factory Made: Capped 11	
163.5 TFC Tap, Factory Made: Capped 1 163.3 DAE Deposits Attached: Encrustation 7 to 4 5% deposits at joint.	
161.1 TFC Tap, Factory Made: Capped 1	
158.5 TFC Tap, Factory Made: Capped 11	
155.9 TFC Tap, Factory Made: Capped 11	
155.4 DAE Deposits Attached: Encrustation 7 to 8 5% deposits at joint. 153.3 TFC Tap, Factory Made: Capped 11	
153.3 TFC Tap, Factory Made: Capped 11 153.1 DAE Deposits Attached: Encrustation 7 to 4 5% deposits at joint.	
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147.9 TFC Tap, Factory Made: Capped 11 147.9 DAE Deposits Attached: Encrustation 7 to 4 5% deposits at joint.	
147.9 DAE Deposits Attached: Encrustation 7 to 4 5% deposits at joint. 145.9 TFC Tap, Factory Made: Capped 11	
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• 140.7 TFC Tap, Factory Made: Capped 11	
• 137.9 TFC Tap, Factory Made: Capped 11	
130.1TFCTap, Factory Made: Capped11Hole in cap130.1DAEDeposits Attached: Encrustation7 to 45% deposits at joint.	
127.5 TFC Tap, Factory Made: Capped 11 Cap is cracked.	
•127.0 DAE Deposits Attached: Encrustation 4 to 5 5% deposits at joint.	
106.9 DAE Deposits Attached: Encrustation 7 to 8 5% deposits at joint.	
♦ 97.3 DAE Deposits Attached: Encrustation 3 to 5 5% deposits at joint.	



			^Note: Distances an	re indicated from the	Downstre	am MH.		
C	PIPE / 5 16281 Baselin Shako pee, MP 952.445.317	ne Ave.	Ŷ	Closed C	ircui	t Televisio	on Inspe	ection
	ustomer City of ontgomery	Pip	e Segment Ref. Upstrea 37-38R 37		astream 38	18	Material Reinforced Concrete Pip	Total Length 320
Su	urveyor's Nan Shawn Blake	ne	U-314-06020629	Street Address Oak Ave	L	ocation Details	I	
	ection stream		Purpose Routine Assessment	Weather Light Rain			ewer Use	Length Surveyed
Addi	itional Inform gomery storm 2							
ł©ł			Description Survey Abandoned		Position	Comment End of reverse.		
•								
		TFC	Tap, Factory Made: Capped		1	Hole in cap.		
	••70.1	TFC	Tap, Factory Made: Capped		12	Broken cap.		
₩ ₩								
	30.3 30.3	DAE ID	Deposits Attached: Encrustation Infiltration - Dripper		6 to 9 9 to 10	5% deposits at jo	pint.	
	•21.8	RPR	Point Repair - Pipe Replaced			PVC.		
	0.0 0.0		Water Level Access Point - Manhole			Begin inspection		

Appendix C: Supporting Materials



LENGTHS ARE ROUNDED TO THE NEAREST EVEN NUMBER OF FEET TABLE ASSUMES 15'-O" SHOULDER FOR SINGLE TRACK AND 13' CENTERS, 15'-6" SHOULDER FOR 20' TRACK CENTERS, ADD IO' FOR EACH ACCESS ROAD, LENGTHS SHOWN ARE FOR STANDARD CROSS SECTIONS FOR TANGENT TRACK, ADD 2' TO PIPE LENGTH (TO OUTSIDE OF CURVE) IF SUPER ELEVATION IS 2" OR GREATER.

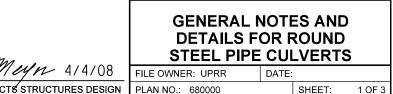
H. M. M.
George J. Meyn 414/08
UPRR - MGR SPECIAL PROJECTS STRUCTURES DESIGN

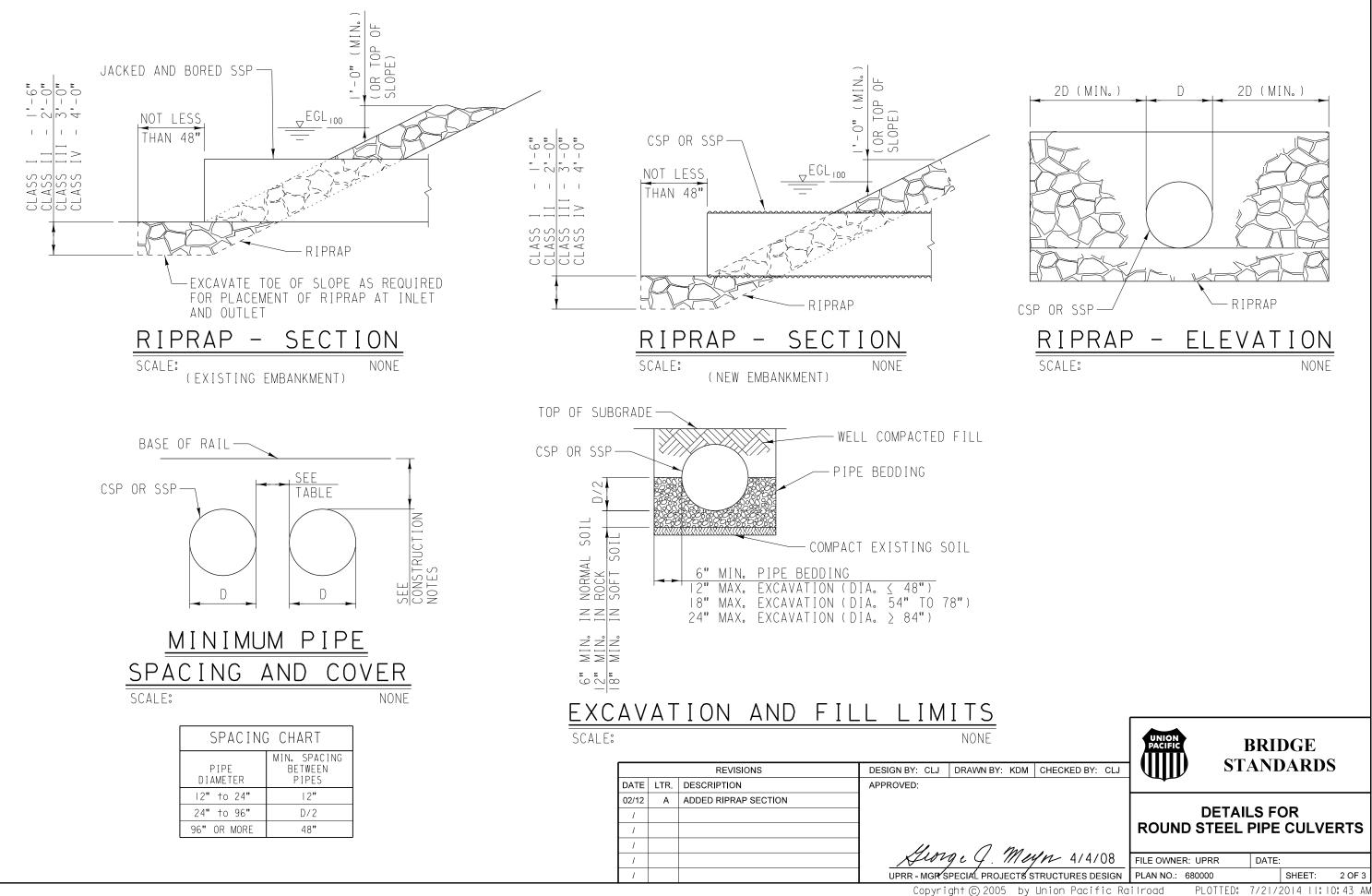
APPROVED:

FOR	STAND	ARD C	ROSS	SECTI	ONS	
13' TRACK CENTERS 20' TRACK CENTERS						
	SLOPE			SLOPE		
1.5:1	2:	3: 1	1.5:1	2:	3:	
50	52	56	58	60	64	
52	56	62	60	64	70	
56	60	68	64	68	76	
58	64	74	66	72	82	
62	68	80	70	76	88	
64	72	86	72	80	94	
68	76	92	76	84	100	
70	80	98	78	88	106	
74	84	104	82	92	2	
76	88	110	84	96	8	
80	92	116	88	100	124	
82	96	122	90	104	30	
86	100	128	94	108	136	
88	104	134	96	112	42	
92	108	140	100	116	48	
94	112	146	102	120	154	
98	116	152	106	124	160	
100	120	158	108	128	166	
104	124	164	2	132	72	
106	128	170	4	136	78	
110	132	176	8	140	84	
112	136	182	120	44	190	
116	140	188	124	148	196	

DESIGN BY: CLJ DRAWN BY: KDM CHECKED BY: CLJ

BRIDGE **STANDARDS**





GENERAL NOTES

CORROSION PROTECTION:

The engineer shall obtain site specific information on corrosiveness of the soil which may require an increase in material thickness or protective coatings based on local experience.

WELL COMPACTED FILL:

Well compacted fill shall be well graded granular soil free of any organic material, stones larger than $1/_{\rm 2}$ inches, frozen lumps, debris or excessive moisture. Fill shall be compacted to 100% of maximum dry density as defined in ASTM International DI557 (Modified Proctor). If 100% compaction cannot be achieved in proximity of existing structure, 95% compaction may be accepted. Fill shall be placed and compacted in layers not to exceed 6 inches. Fill shall be placed simultaneously on both sides of the pipe and between multiple pipes. CLSM may be used in lieu of well compacted fill.

CONTROLLED LOW-STRENGTH MATERIAL (CLSM) FILL:

Controlled Low-Strength Material is a self-compacting, cementitious fill material with an unconfined compressive strength of 50 to 300 psi. The mixture shall consist of water, Portland cement, fly ash, and sound fine or coarse aggregate or both. The mix design shall allow adequate flowability without segregation of aggregates. Hardening time is of prime importance and CLSM should develop 50 psi in about one hour. The maximum layer of thickness for CLSM shall be 3 feet. Additional layers shall not be placed until the CLSM has lost sufficient moisture to be walked on without indenting more than two inches. Pipe spacing may be reduced with CLSM.

PIPE BEDDING:

Pipe bedding shall be granular material such as aggregates ordinarily specified and used in the construction of highway base and subbase. These aggregates include crushed stone, natural or crushed gravel, natural or manufactured sands, crushed slag or a homogeneous mixture of these materials. Pipe bedding shall be compacted to 100% of maximum dry density as defined in ASTM International D1557 (Modified Proctor). If 100% compaction cannot be achieved in proximity of existing structure, 95% compaction may be accepted. Recommended gradation is as follows:

<u>SCREEN SIZE</u>	<u>% PASSING (BY WEIGHT)</u>
l inch	100
V₂inch	60-90
¾ inch	20-40
No. 4	10-20
No. 200	less than 5%

Union Pacific sealant ballast, item no. 562-5428, may be used.

FIBER OPTIC CABLE:

Contact the Union Pacific "Call Before You Dig" number 90 days (no less than 60 days) prior to the proposed construction start date. Prior to construction, confirm that all necessary relocations have been completed. The CBYD number is: 1-800-336-9193.

RIPRAP:

Class of riprap shall be specified by the engineer. Riprap shall be placed in such a manner as to avoid segregation of various sizes of rock, and distributed so that there will be no large accumulation of either the larger or smaller sizes of stone. Individual rocks shall be placed in tight contact with one another in such a way to produce the least amount of void spaces. Riprap shall be solid, unfractured rock or concrete, bulky in shape with sharp angular edges.

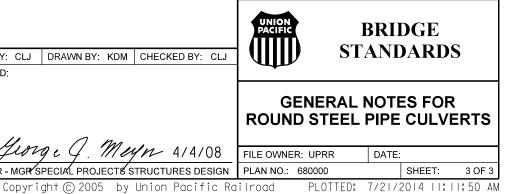
Individual rocks shall vary as shown:

	AVERAGE WEIGHT					
RIPRAP	PER STONE	DIMENSION		UNIT OF	LAYER	TYPICAL
CLASS	<u>(LBS.)</u>	(INCHES)	ITEM NO.	MEASURE	<u>THICKNESS</u>	VELOCITIES
I	50 to 200	9 to 14	562-2764	Ton	'-6"	6 - 8 fps
ΙI	200 to I,000	14 to 24	562-3430	Ton	2'-0"	8 - 12 fps
III	I,000 to 4,000	24 to 38	562-4096	Ton	3'-0"	> 12 fps
ΙV	> 4,000	> 38	562-4762	Ton	4'-0"	SPECIAL CASES

The entire mass of riprop shall well distributed within the limits specified. However, the following allowances shall be acceptable to produce the required riprop protection:

Riprap Class III - 15% of Riprap Class I and 15% of Riprap Class II. Riprap Class IV - 15% of Riprap Class I, 15% of Riprap Class II, and 15% of Riprap Class III.	Riprap Riprap	Class Class	II III	_	15% of Riprap Class I, 15% of Riprap Class II,
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		REVISIONS	DESIGN BY: CLJ	DRAWN BY: KD
DATE	LTR.	DESCRIPTION	APPROVED:	
02/12	A	RELOCATED GENERAL NOTES		
6/13	В	CHANGED FILL REQUIREMENTS		
7/14	С	CHANGED FILL REQUIREMENTS		
1			11	1 no
1			XUOT	9 c 4 . 111.
/			UPRR - MGR S	PECIAL PROJECT



If a proposed turnout is located within 500 feet of a bridge, refer to Section 1.30 – Structures. Turnouts shall not be installed within 100' of a rail bridge.

Resources:

- A. UPRR Industrial Track Specifications, Section 4.80 Track
- B. UPRR Std. Dwg.:
 - i. 0017 Facing Point Turnout Arrangement
 - ii. 0050 Design Data for Turnout Layout
 - iii. 0080 Standard Turnout Applications
 - iv. 5001 Nomenclature for Most Turnouts
- C. AREMA Manual Chapter 5, Part 3.4 Speeds of Trains through Level Turnouts

3.30 DERAILS

Derail application, type, and location of proposed derails shall correspond with *UPRR Std. Dwg. 2000*. Power operated derails with special ties and components may be required if a POTO is used.

Resources:

- A. UPRR Industrial Track Specifications, Section 4.80 Track
- B. UPRR Std. Dwg. 2000 Permanent Derail Installation Instructions

3.40 DRAINAGE

A comprehensive hydrologic and hydraulic Drainage Study is required when the following occurs:

- A. Additional runoff is discharged towards UPRR's right-of-way.
- B. A UPRR drainage structure is being added, removed, or modified.
- C. A drainage structure is being added, removed, or modified upstream or downstream of a UPRR structure.

The Drainage Study and all drainage improvement designs, plans, drawings, and exhibits shall be submitted through UPRR's EDS system under the "Structures" category.

The Drainage Study for UPRR owned or maintained track must include, but is not limited to:

- A. Top of rail elevations.
- B. The 50-year and 100-year water surface elevations for both the existing and proposed conditions.
- C. Flow rates for both events.
- D. Location map of drainage area(s), including UPRR mileposts and engineering stations.
- E. Size of the drainage area(s).
- F. Location of the water flowing along the right-of-way.
- G. Location where the water leaves the right-of-way.

The following UPRR criteria for sizing bridges and culverts on <u>UPRR owned or maintained track</u> is used to determine the adequacy of existing and proposed structures:

- A. The 50-year flood elevation shall not come into contact with the crown of the culvert or the low chord of the bridge, whichever is applicable.
- B. The 100-year flood elevation shall not exceed the track subgrade elevation at the structure.
- C. Both UPRR's criteria and local criteria shall be evaluated, and the more restrictive shall be adopted in sizing the drainage structure or replacement.
- D. If the existing structure opening more than satisfies the foregoing criteria, a smaller section which satisfies the criteria set forth above may be recommended.

- E. Minimum preferred culvert diameter allowed under UPRR owned or maintained track is 36 inches (36").
- F. The use of any drainage culverts other than helical lockseam corrugated metal pipe (CMP) or smooth steel pipe (SSP) will require prior acceptance by UPRR before installation.
- G. The use of elliptical or arch pipe is strictly prohibited.

If an existing bridge or culvert does not meet design criteria, UPRR will consider and evaluate alternatives such as relief bridges on the overbank floodplain, raising track grades, or other measures. All drainage structures shall be designed, at a minimum, to meet the latest edition of the AREMA Manual. If the drainage structure falls within a FEMA-designated floodplain or floodway, the water surface elevation for a 100-year event shall be determined, regardless of line classification.

The Drainage Study for Industry owned or maintained track must include, but is not limited to:

- A. Top of rail elevations.
- B. The 25-year and 50-year water surface elevations for both the existing and proposed conditions.
- C. Flow rates for both events.
- D. Location map of drainage area(s), including UPRR mileposts and engineering stations.
- E. Size of the drainage area(s).
- F. Location of the water flowing along the right-of-way.
- G. Location where the water leaves the right-of-way.

The following UPRR criteria for sizing bridges and culverts on <u>Industry owned or maintained track</u> is used to determine the adequacy of existing and proposed structures:

- A. The 25-year flood elevation shall not come into contact with the crown of the culvert or the low chord of the bridge, whichever is applicable.
- B. The 50-year flood elevation shall not exceed the track subgrade elevation at the structure.
- C. Both UPRR's criteria and local criteria shall be evaluated, and the more restrictive shall be adopted in sizing the drainage structure or replacement.
- D. If the existing structure opening more than satisfies the foregoing criteria, a smaller section which satisfies the criteria set forth above may be recommended.
- E. Minimum preferred culvert diameter allowed under Industry owned or maintained track is 30 inches (30").
- F. The use of any drainage culverts other than CMP or SSP will require prior acceptance by UPRR before installation.
- G. The use of elliptical or arch pipe is strictly prohibited.

Resources:

- A. UPRR Industrial Track Specifications, Section 4.40 Shoring
- B. UPRR Bridge Std. Plan:
 - i. 680000 General Notes and Details for Round Steel Pipe Culverts
 - ii. 680010 Construction Notes and Table for Smooth Steel Pipe Culverts
 - iii 680021 Construction Notes Corrugated Metal Pipe Culverts
 - iv. 680030 Construction Notes and Table for Structural Plate Pipe Culverts
- C. UPRR General Conditions and Specifications:
 - i. Section 33 42 00 Culverts
 - ii. Section 33 42 16 Reinforced Concrete Box Culverts
 - iii. Section 33 42 20 Smooth Steel Pipe Culverts
 - iv. Section 31 37 00 Rip Rap
 - v. Section 40 05 39 Reinforced Concrete Pipe
- D. UPRR Engineering Track Maintenance Field Handbook:
 - i. Section 1.2 Drainage
 - ii. Section 1.3 Surface Drainage
 - iii. Section 1.4 Subsurface Drainage