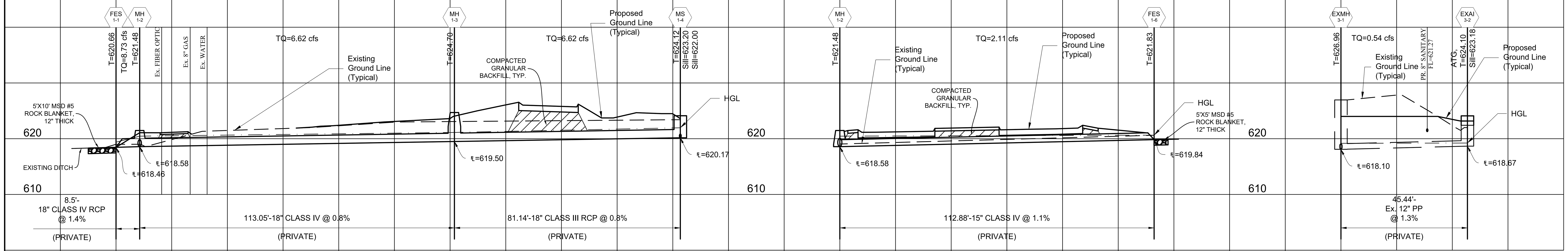
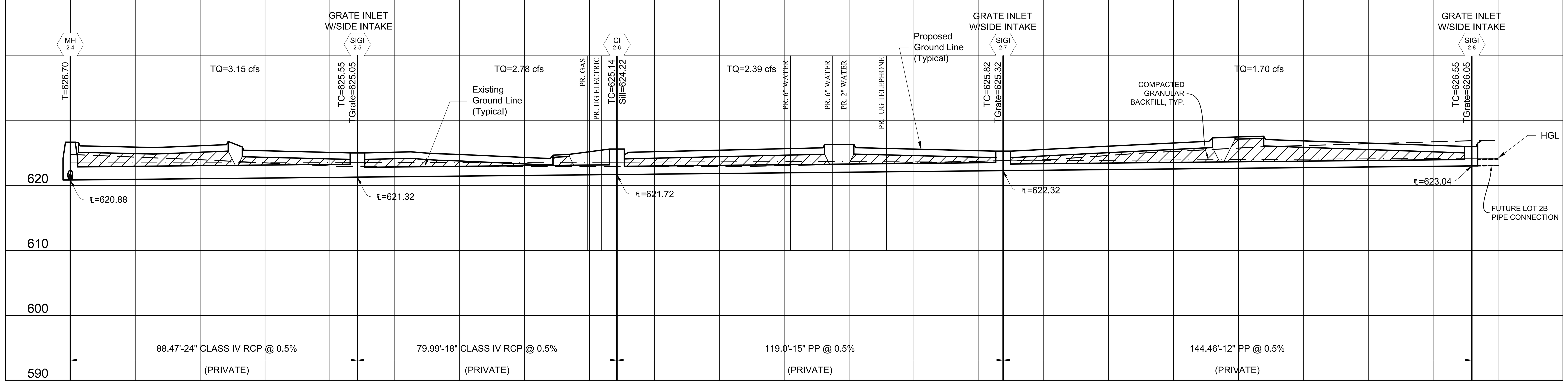
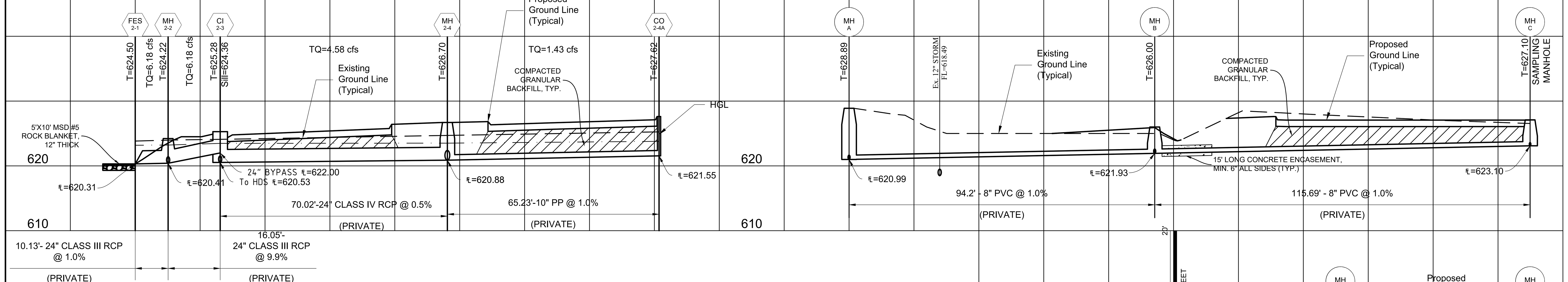
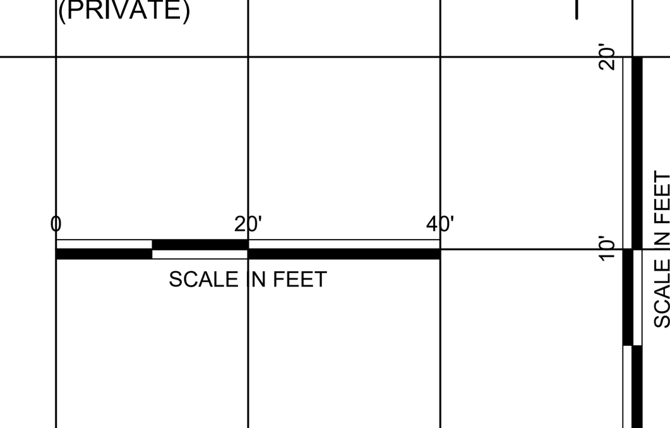


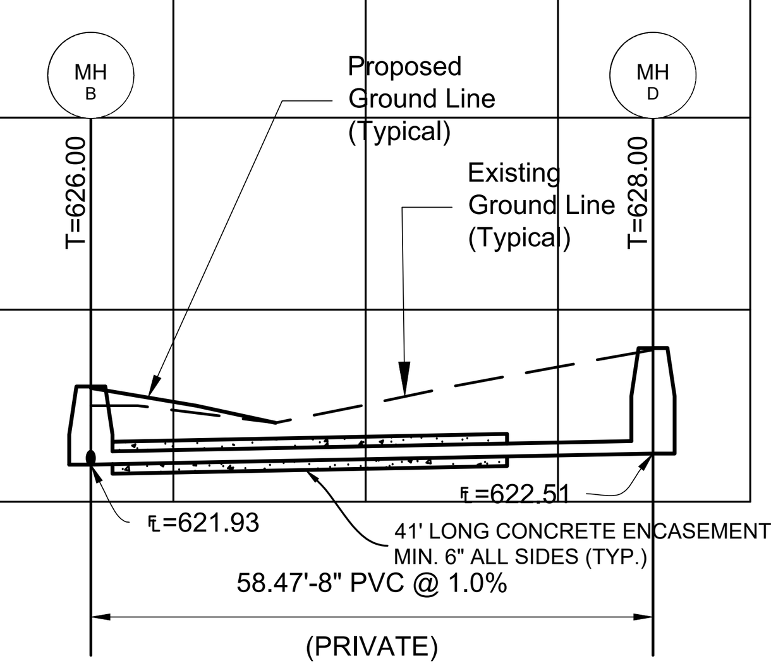
ATTENTION SEWER CONTRACTOR:

For Sewer Pipe (storm, sanitary, and combined) with a design grade less than one percent (1%), verification of the pipe grade will be required for each installed reach of sewer, prior to any surface restoration or installation of any surface improvements. The Contractor's field supervisor will be required to provide daily documentation verifying that the as-built pipe grade meets the design grade through the submittal of signed cut sheets to the MSD Inspector upon request. Field surveyed verification must be made under the direction of a licensed land surveyor or registered engineer. The Contractor will be required to remove and replace any sewer reach having an as-built grade which is flatter than the design grade by more than 0.1%. Sewers with grades greater than the design slope may be left in place, provided no other sewer grade is reduced by this variance in the as-built grade. The City of O'Fallon also reserves the right to require the Contractor to remove and replace any sewer (at any time prior to construction approval) for which the as-built grade does not comply with the grade tolerance stated above. The Sewer Contractor shall be responsible for any costs associated with the field verification of the sewer grade, or removal and replacement of the sewer pipe or associated appurtenances.










```
        Description =  System 1 (Current)
         Sewer Type =  Storm
      System Number =  1
  Return Period (yr) =        15
Rainfall duration (min) =     20
Runoff Factor Multiplier =  1.00
  Starting HGL Elev. (ft) =  0.00
Use St. Louis Co./MSD Losses? =  Y
```

STRUCTURES UPR/LWR	FLOWLINES UPR/LWR	SIZE/ ANGLE	LENGTH/ CURVED?	n	AREA/ PI	Qadd	Qtotal/ Qfull	ConS/ ReqdS	Yn/ Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C	LOSSES V/T	COND U/L	HGL UPR/LWR	UPR STR TOP/FRBD
Upstream		2'x2'														
Sewer	620.16	0°														
FES 1-6	619.84	15"	112.88	0.013	1.03	2.51	2.51	1.12	0.52	2.05	2.05	0.17	0.11	OC	620.69	621.83
MH 1-2	618.58	0°	N		2.44		6.84	0.15	0.63	1.83	0.06	0.00	0.00	FP	620.41	1.14
AI 1-4	620.17	18"	81.14	0.013	1.71	5.49	5.49	0.83	0.81	3.26	3.11	0.22	0.50	OC	621.58	624.12
MH 1-3	619.50	69°	N		3.21		9.57	0.27	0.90	1.36	0.15	0.00	0.00	OJ	620.86	2.54
MH 1-3	619.50	18"	113.05	0.013	0.00	0.00	5.49	0.81	0.82	3.11	3.11	0.31	0.04	OC	620.86	624.70
MH 1-2	618.58	88°	N		1.70		9.50	0.27	0.90	1.83	0.15	0.00	0.10	FP	620.41	3.84
MH 1-2	618.58	18"	8.50	0.013	0.00	0.00	8.00	1.41	0.87	7.51	4.53	0.75	0.26	OF	620.41	621.48
FES 1-1	618.46	0°	N		1.70		12.51	0.58	1.10	0.87	0.32	0.00	0.07	ND	619.33	1.07

```
        Description =  System 1 (Future, with  Lot 2B developed)
         Sewer Type =  Storm
      System Number =  1
  Return Period (yr) =        15
Rainfall duration (min) =     20
Runoff Factor Multiplier =  1.00
  Starting HGL Elev. (ft) =  0.00
Use St. Louis Co./MSD Losses? =  Y
```

STRUCTURES UPR/LWR	FLOWLINES UPR/LWR	SIZE/ ANGLE	LENGTH/ CURVED?	n	AREA/ PI	Qadd	Qtotal/ Qfull	ConS/ ReqdS	Yn/ Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C	LOSSES V/T	COND U/L	HGL UPR/LWR	UPR STR TOP/FRBD
Upstream		2'x2'														
Sewer	620.16	0°														
FES 1-6	619.84	15"	112.88	0.013	0.76	2.11	2.11	1.12	0.48	1.72	1.72	0.12	0.06	OC	620.64	621.83
MH 1-2	618.58	0°	N		2.77		6.84	0.11	0.58	1.88	0.05	0.00	0.00	FP	620.46	1.19
AI 1-4	620.17	18"	81.14	0.013	2.06	6.62	6.62	0.83	0.92	3.75	3.75	0.54	0.29	OF	621.96	624.12
MH 1-3	619.50	69°	N		3.21		9.57	0.40	1.00	1.63	0.22	0.00	0.00	FP	621.13	2.16
MH 1-3	619.50	18"	113.05	0.013	0.00	0.00	6.62	0.81	0.92	3.75	3.75	0.54	0.00	OF	621.13	624.70
MH 1-2	618.58	88°	N		1.70		9.50	0.40	1.00	1.88	0.22	0.00	0.13	FP	620.46	3.57
MH 1-2	618.58	18"	8.50	0.013	0.00	0.00	8.73	1.41	0.92	7.66	4.94	0.70	0.27	OF	620.46	621.48
FES 1-1	618.46	0°	N		1.70		12.51	0.69	1.14	0.92	0.38	0.00	0.11	ND	619.38	1.02

```
        Description =  System 1 (Current)
         Sewer Type =  Storm
      System Number =  1
  Return Period (yr) =       100
Rainfall duration (min) =     20
Runoff Factor Multiplier =  1.35
  Starting HGL Elev. (ft) =  0.00
Use St. Louis Co./MSD Losses? =  Y
```

STRUCTURES UPR/LWR	FLOWLINES UPR/LWR	SIZE/ ANGLE	LENGTH/ CURVED?	n	AREA/ PI	Qadd	Qtotal/ Qfull	ConS/ ReqdS	Yn/ Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C	LOSSES V/T	COND U/L	HGL UPR/LWR	UPR STR TOP/FRBD
Upstream		2'x2'														
Sewer	620.16	0°														
FES 1-6	619.84	15"	112.88	0.013	1.03	3.39	3.39	1.12	0.62	2.76	2.76	0.41	0.10	OF	621.19	621.83
MH 1-2	618.58	0°	N		3.29		6.84	0.27	0.74	2.10	0.12	0.00	0.00	FP	620.68	0.64
AI 1-4	620.17	18"	81.14	0.013	1.71	7.41	7.41	0.83	0.99	4.19	4.19	0.40	0.36	FP	622.17	624.12
MH 1-3	619.50	69°	N		4.33		9.57	0.50	1.05	1.90	0.27	0.00	0.00	FP	621.40	1.95
MH 1-3	619.50	18"	113.05	0.013	0.00	0.00	7.41	0.81	1.00	4.19	4.19	0.56	0.00	FP	621.40	624.70
MH 1-2	618.58	88°	N		2.30		9.50	0.50	1.05	2.10	0.27	0.00	0.16	FP	620.68	3.30
MH 1-2	618.58	18"	8.50	0.013	0.00	0.00	10.80	1.41	1.08	7.97	6.11	0.54	0.47	OF	620.68	621.48
FES 1-1	618.46	0°	N		2.30		12.51	1.05	1.26	1.08	0.58	0.00	0.13	ND	619.54	0.80

```
        Description =  System 1 (Future, with  Lot 2B developed)
         Sewer Type =  Storm
      System Number =  1
  Return Period (yr) =       100
Rainfall duration (min) =     20
Runoff Factor Multiplier =  1.35
  Starting HGL Elev. (ft) =  0.00
Use St. Louis Co./MSD Losses? =  Y
```

STRUCTURES UPR/LWR	FLOWLINES UPR/LWR	SIZE/ ANGLE	LENGTH/ CURVED?	n	AREA/ PI	Qadd	Qtotal/ Qfull	ConS/ ReqdS	Yn/ Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C	LOSSES V/T	COND U/L	HGL UPR/LWR	UPR STR TOP/FRBD
Upstream		2'x2'														
Sewer	620.16	0°														
FES 1-6	619.84	15"	112.88	0.013	0.76	2.85	2.85	1.12	0.56	2.32	2.32	0.22	0.07	OC	621.07	621.83
MH 1-2	618.58	0°	N		3.74		6.84	0.19	0.68	2.20	0.08	0.00	0.00	FP	620.78	0.76
AI 1-4	620.17	18"	81.14	0.013	2.06	8.94	8.94	0.83	1.15	5.06	5.06	0.58	0.53	FP	622.94	624.12
MH 1-3	619.50	69°	N		4.34		9.57	0.72	1.16	2.33	0.40	0.00	0.00	FP	621.83	1.18
MH 1-3	619.50	18"	113.05	0.013	0.00	0.00	8.94	0.81	1.16	5.06	5.06	0.81	0.00	FP	621.83	624.70
MH 1-2	618.58	88°	N		2.30		9.50	0.72	1.16	2.20	0.40	0.00	0.24	FP	620.78	2.87
MH 1-2	618.58	18"	8.50	0.013	0.00	0.00	11.79	1.41	1.16	8.05	6.67	0.46	0.49	OF	620.78	621.48
FES 1-1	618.46	0°	N		2.30		12.51	1.25	1.31	1.16	0.69	0.00	0.21	ND	619.62	0.70

HGL = HYDRAULIC GRADE LINE (15-YEAR, 20-MINUTE)
TQ = TOTAL FLOW (15-YEAR, 20-MINUTE)

RCP= REINFORCED CONCRETE PIPE
PVC= POLYVINYL CHLORIDE
PP= POLYPROPYLENE

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Underground facilities, structures & utilities have been plotted from available surveys, records & information, and therefore, do not necessarily reflect the actual existence, nonexistence, size, type, number of, or location of these facilities, structures, & utilities.

The Contractor shall be responsible for verifying the actual location of all underground facilities, structures, & utilities, either shown or not shown on these plans. The underground facilities, structures, & utilities shall be located in the field prior to any grading, excavation or construction of improvements. These provisions shall in no way absolve any party from complying with the Underground Facility Safety and Damage Prevention Act, Chapter 319, RSMO.

```
        Description =  System 3
         Sewer Type =  Storm
      System Number =  3
  Return Period (yr) =        15
Rainfall duration (min) =     20
Runoff Factor Multiplier =  1.00
  Starting HGL Elev. (ft) =  619.18
Use St. Louis Co./MSD Losses? =  Y
```

STRUCTURES UPR/LWR	FLOWLINES UPR/LWR	SIZE/ ANGLE	LENGTH/ CURVED?	n	AREA/ PI	Qadd	Qtotal/ Qfull	ConS/ ReqdS	Yn/ Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C	LOSSES V/T	COND U/L	HGL UPR/LWR	UPR STR TOP/FRBD
EXAI 3-2	618.67	12"	45.44	0.013	0.26	0.54	0.54	1.25	0.25	0.69	0.69	0.01	0.04	OC	619.23	624.10
EXMH 3-1	618.10	0°	N		2.08		4.00	0.02	0.31	1.08	0.01	0.00	0.00	FP	619.18	4.87

L E G E N D

```
   UPR - At upper end of pipe              Yn - Normal depth (ft)                 COND - Flow condition code at each pipe end:
   LWR - At lower end of pipe              Yc - Critical depth (ft)                      FP - full pipe flow
  SIZE - Sewer size (diam or WxH)                                                        OC - open channel flow
 ANGLE - Downstream deflection (deg)  PARTIAL - Conditions at lower end of pipe          ND - set to normal depth
LENGTH - Pipe length (ft)                FULL - Conditions assuming full pipe flow       CD - set to critical depth
CURVED - Pipe is curved?                    V - Velocity (fps)                           OF - initially set to open channel
     n - Manning's roughness factor         Y - Depth (ft)                                    depth then set to full pipe flow
  AREA - Upper drainage area (ac)       Vhead - Velocity head (ft)                       OJ - open channel flow but hydraulic
    PI - Runoff factor (cfs/ac)                                                               jump may occur downstream
  Qadd - Added flowrate (cfs)          LOSSES - Major and minor head losses
Qtotal - Total flowrate (cfs)               F - Friction in pipe (ft)              HGL - Hydraulic grade line elevation (ft)
 Qfull - Pipe full capacity (cfs)           C - Curve in pipe (ft)
  ConS - Construction slope of pipe (%)     V - Velocities in upper structure (ft)  TOP - Elev. of top of upper struct (ft msl)
 ReqdS - Minimum required slope (%)         T - Turns in upper structure (ft)      FRBD - Difference btwn upper HGL and TOP (ft)
```

Notes:
1. Friction losses computed w/ Manning's formula if full pipe flow or back-calculated if open channel flow (simulating flow profile)
2. HGL at upper structure includes structure losses calculated with actual inflowing velocities using iterative procedure
3. Velocity and turn structure loss components only computed for incoming pipes with invert elevations below outlet crown elevation

```
        Description =  System 3
         Sewer Type =  Storm
      System Number =  3
  Return Period (yr) =       100
Rainfall duration (min) =     20
Runoff Factor Multiplier =  1.35
  Starting HGL Elev. (ft) =  619.18
Use St. Louis Co./MSD Losses? =  Y
```

STRUCTURES UPR/LWR	FLOWLINES UPR/LWR	SIZE/ ANGLE	LENGTH/ CURVED?	n	AREA/ PI	Qadd	Qtotal/ Qfull	ConS/ ReqdS	Yn/ Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C	LOSSES V/T	COND U/L	HGL UPR/LWR	UPR STR TOP/FRBD
EXAI 3-2	618.67	12"	45.44	0.013	0.26	0.73	0.73	1.25	0.29	0.93	0.93	0.02	0.06	OC	619.26	624.10
EXMH 3-1	618.10	0°	N		2.80		4.00	0.04	0.36	1.08	0.01	0.00	0.00	FP	619.18	4.84

```
        Description =  System 2 (including future Lot 2B drainage)
         Sewer Type =  Storm
      System Number =  2
  Return Period (yr) =        15
Rainfall duration (min) =     20
Runoff Factor Multiplier =  1.00
  Starting HGL Elev. (ft) =  623.18
Use St. Louis Co./MSD Losses? =  Y
```

STRUCTURES UPR/LWR	FLOWLINES UPR/LWR	SIZE/ ANGLE	LENGTH/ CURVED?	n	AREA/ PI	Qadd	Qtotal/ Qfull	ConS/ ReqdS	Yn/ Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C	LOSSES V/T	COND U/L	HGL UPR/LWR	UPR STR TOP/FRBD
Upstream		12''														
Sewer	623.11	0°														
EOP 2-8A	623.11	12"	6.97	0.013	0.35	1.13	1.13	1.00	0.39	1.43	1.43	0.01	0.00	FP	624.23	626.55
SIGI 2-8	623.04	64°	N		3.22		3.58	0.10	0.45	1.19	0.03	0.00	0.00	FP	624.23	2.32
SIGI 2-8	623.04	12"	144.46	0.013	0.17	0.57	1.70	0.50	0.60	2.16	2.16	0.33	0.07	FP	624.23	626.05
SIGI 2-7	622.32	64°	N		3.35		2.52	0.23	0.55	1.50	0.07	0.00	0.01	FP	623.82	1.82
SIGI 2-7	622.32	15"	119.00	0.013	0.20	0.69	2.39	0.50	0.64	1.95	1.95	0.16	0.01	FP	623.82	625.32
CI 2-6	621.72	33°	N		3.45		4.60	0.14	0.62	1.90	0.06	0.00	0.03	FP	623.62	1.50
CI 2-6	621.72	18"	79.99	0.013	0.11	0.39	2.78	0.50	0.64	1.57	1.57	0.06	0.00	FP	623.62	625.14
SIGI 2-5	621.32	57°	N		3.54		7.45	0.07	0.63	2.23	0.04	0.00	0.02	FP	623.55	1.52
SIGI 2-5	621.32	24"	88.47	0.013	0.11	0.37	3.15	0.50	0.60	1.00	1.00	0.02	0.00	FP	623.55	625.05
MH 2-4	620.88	86°	N		3.37		16.00	0.02	0.62	2.63	0.02	0.00	0.02	FP	623.51	1.50
Upstream		10''														
Sewer	621.55	0°														
CO 2-4A	621.55	10"	65.23	0.013	0.34	1.43	1.43	1.03	0.49	2.62	2.62	0.28	0.00	FP	623.79	627.62
MH 2-4	620.88	2°	N		4.20		2.23	0.42	0.54	2.63	0.11	0.00	0.00	FP	623.51	3.83
MH 2-4	620.88	24"	70.02	0.013	0.00	0.00	4.58	0.50	0.73	1.46	1.46	0.03	0.00	FP	623.51	626.70
CI 2-3	620.53	54°	N		3.54		16.04	0.04	0.75	2.94	0.03	0.00	0.01	FP	623.47	3.19
CI 2-3	622.15	24"	16.05	0.013	0.52	1.60	6.18	10.84	0.39	1.97	1.97	0.01	0.23	OC	623.47	625.28
MH 2-2	620.41	50°	N		3.08		74.69	0.07	0.88	2.81	0.06	0.00	0.01	FP	623.22	1.81
MH 2-2	620.41	24"	10.13	0.013	0.00	0.00	6.18	0.99	0.72	1.97	1.97	0.01	0.00	FP	623.22	624.22
FES 2-1	620.31	0°	N		1.70		22.53	0.07	0.88	2.87	0.06	0.00	0.03	FP	623.18	1.00

```
        Description =  System 2 (including future Lot 2B drainage)
         Sewer Type =  Storm
      System Number =  2
  Return Period (yr) =       100
Rainfall duration (min) =     20
Runoff Factor Multiplier =  1.35
  Starting HGL Elev. (ft) =  623.18
Use St. Louis Co./MSD Losses? =  Y
```

STRUCTURES UPR/LWR	FLOWLINES UPR/LWR	SIZE/ ANGLE	LENGTH/ CURVED?	n	AREA/ PI	Qadd	Qtotal/ Qfull	ConS/ ReqdS	Yn/ Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C	LOSSES V/T	COND U/L	HGL UPR/LWR	UPR STR TOP/FRBD
Upstream		12''														
Sewer	623.11	0°														
EOP 2-8A	623.11	12"	6.97	0.013	0.35	1.52	1.52	1.00	0.45	1.94	1.94	0.01	0.00	FP	625.06	626.55
SIGI 2-8	623.04	64°	N		4.35		3.58	0.18	0.52	2.01	0.06	0.00	0.00	FP	625.05	1.49
SIGI 2-8	623.04	12"	144.46	0.013	0.17	0.77	2.29	0.50	0.75	2.92	2.92	0.59	0.12	FP	625.05	626.05
SIGI 2-7	622.32	64°	N		4.53		2.52	0.41	0.65	1.99	0.13	0.00	0.02	FP	624.31	1.00
SIGI 2-7	622.32	15"	119.00	0.013	0.20	0.93	3.23	0.50	0.77	2.63	2.63	0.30	0.02	FP	624.31	625.32
CI 2-6	621.72	33°	N		4.66		4.60	0.25	0.72	2.22	0.11	0.00	0.05	FP	623.94	1.01
CI 2-6	621.72	18"	79.99	0.013	0.11	0.53	3.75	0.50	0.75	2.12	2.12	0.10	0.00	FP	623.94	625.14
SIGI 2-5	621.32	57°	N		4.78		7.45	0.13	0.74	2.48	0.07	0.00	0.03	FP	623.80	1.20
SIGI 2-5	621.32	24"	88.47	0.013	0.11	0.50	4.25	0.50	0.70	1.35	1.35	0.03	0.00	FP	623.80	625.05
MH 2-4	620.88	86°	N		4.55		16.00	0.04	0.72	2.86	0.03	0.00	0.03	FP	623.74	1.25
Upstream		10''														
Sewer	621.55	0°														
CO 2-4A	621.55	10"	65.23	0.013	0.34	1.93	1.93	1.03	0.60	3.54	3.54	0.50	0.00	FP	624.24	627.62
MH 2-4	620.88	2°	N		5.67		2.23	0.77	0.62	2.86	0.19	0.00	0.00	FP	623.74	3.38
MH 2-4	620.88	24"	70.02	0.013	0.00	0.00	6.18	0.50	0.86	1.97	1.97	0.05	0.00	FP	623.74	626.70
CI 2-3	620.53	54°	N		4.78		16.04	0.07	0.88	3.14	0.06	0.00	0.01	FP	623.67	2.96
CI 2-3	622.15	24"	16.05	0.013	0.52	2.16	8.34	10.84	0.45	2.66	2.66	0.02	0.38	OC	623.67	625.28
MH 2-2	620.41	50°	N		4.16		74.69	0.14	1.03	2.84	0.11	0.00	0.02	FP	623.25	1.61
MH 2-2	620.41	24"	10.13	0.013	0.00	0.00	8.34	0.99	0.84	2.66	2.66	0.01	0.00	FP	623.25	624.22
FES 2-1	620.31	0°	N		2.30		22.53	0.14	1.03	2.87	0.11	0.00	0.05	FP	623.18	0.97

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MO Cert. of Authority - Prof. Engineering #000067 & Prof. Surveying #000014
IL Dept. Financial & Prof. Reg. Prof. Design & Engineering Corp. #184.000879

REVISIONS

2	04-25-22	EAS	City of O'Fallon comments
4	05-13-22	EAS	BID SET

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Prepared for:
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SEWER PROFILES & METERING STRUCTURE
RANGE USA INDOOR GUN RANGE

9100 Veterans Memorial Parkway
O'Fallon, MO

Eric A. Skelton - Professional Engineer (PE-2000150069)
STATE OF MISSOURI
ERIC A. SKELTON
NUMBER
E-2000150069
REGISTERED PROFESSIONAL ENGINEER
06-09-22

Designed	EAS
Drawn	EAS
Checked	EAS
Date	March 19, 2022
Project Number	21100
Sheet Number	C5.0 of