12-1077M

2025 Kansas State University Master Plan Update
Sanitary Sewer Collection System

March 12, 2013

BG Consultants
Engineers • Architects • Surveyors

FINAL REPORT

TABLE OF CONTENTS

APPENDIX

SECTION 1
EXISTING INFRASTRUCTURE SUMMARY

1.2 SYSTEM BOUNDARY

The collection system boundary can generally be described as East of Dennison, West of North Manhattan Avenue, South of Jardine Drive and North of Anderson Avenue. Once north of Jardine Drive, the collection system drains to City of Manhattan sewer system to the east west and north. Included with this report is a map of the existing system, which illustrates the system configuration and drainage basin delineation.

1.3 SYSTEM DEVELOPMENT

This system inventory was developed following the review of as-built drawings and the data compiled from on-site field investigation of system manholes. Minor discrepancies may exist in the system inventory due to assumptions that were made in the field or inconsistencies associated with as-built drawings. These inconsistencies may only be found and corrected through Level 2 (full entry) manhole inspections, dye testing and Closed Circuit Television (CCTV) inspection of the sewer mains.

1.1 SUMMARY

The Kansas State University sanitary sewer collection system has approximately 26,750 feet of 8” through 24” diameter gravity sewer main. There are many service lateral pipes that are 4 inch and 6 inch in diameter which are part of the collection system but outside the current scope of this collection system evaluation. Approximately 168 manholes were inspected during this evaluation. The following table shown below summarizes the evaluated sewer main segments according to material type, diameter and overall length.

	Gravity Sewer Diameter (inches)							
Material	8	10	12	15	18	20	24	Total
Concrete			253					253
HDPE			650					650
VCP	9,233	3,700	3,812	1,755	1,020	1,120	365	21,005
PVC	976	309	3,114	425				4,824
Total	10,209	4,009	7,829	2,180	1,020	1,120	365	26,732

Table 1: Sewer Main Summary Table

A Pipe Summary Report and Manhole Summary Report with manhole inspection photos of the evaluated portion of the system can be found in the Appendix.

END OF SECTION

SECTION 2
EVALUATION PROCESS

2.1 EVALUATION PROCESS

The sanitary sewer evaluation process consisted of the following major processes by BG Consultants:

1. Reviewed existing electronic AutoCAD data and established field survey requirements.
2. Conducted field investigation of manholes: surveyed top of rim, surveyed flow lines of pipes and took inspection photos.
3. Processed survey data and compared to the existing KSU as-built drawings.
4. Established a best fit sewer collection system layout in AutoCAD including pipe size, pipe material and invert elevations.
5. Imported AutoCAD data into the SewerCAD program and built the Sewer CAD model.
6. Established existing “Estimated” Building Average Daily Flow (ADF) values and “Measured” Building ADF values (consistent with water master plan estimates).
7. Evaluated the proposed Kansas State project and phasing plan (10/15/2012) which identified:
    a. Proposed Building Name and Use/Type
    b. Approximate Gross Square Foot Area
    c. Map Reference to Identify Building Location
8. Developed ADF and Peak Daily Flow (PDF) for each proposed building.
9. Developed and calibrated the SewerCAD model to show the existing and proposed estimated ADF and PDF conditions.
10. Identified conduits that had 25% or less remaining capacity and created 2 system maps for the following scenarios:
    a. Existing Conditions:
        i. Dry Weather Conditions (Peak Factor = 1)
        ii. Wet Weather Conditions (Peak Factor =3)
    b. Proposed Conditions:
        i. Dry Weather Conditions (Peak Factor = 1)
        ii. Wet Weather Conditions (Peak Factor = 3)
11. Developed total infrastructure improvements cost estimates for existing and proposed campus build out conditions.
12. Developed infrastructure improvement recommendations

END OF SECTION

SECTION 3
EXISTING ADF AND PDF RATES AND MODELING

3.1 EXISTING AVERAGE DAILY FLOW

To determine the Average Daily Flow conveyed by the sewer system, water use data was collected from numerous sources that included Johnson Controls, the City of Manhattan, and K-State personnel. All of this data was evaluated in order to determine an average daily water demand for each building on the K-State Campus during a week day in a winter month and when students are in session. A table that summarizes the demands that were used is located in the "2025 Kansas State University Master Plan Update Water Distribution Study".

No water use data could be provided for roughly half of the buildings that are supplied by the main distribution system. A demand for each of these buildings was determined based on a comparison in size and usage of similar buildings that have a known demand. The total K-State average daily demand of 962,546 gallons was also taken into consideration when determining the demands for these buildings.

3.2 COMPUTER MODELING

A sewer model was developed in SewerCAD based on the system layout that was developed in AutoCAD and the estimated building ADF rates. The total daily flow from each building was assessed to a 10 hour operational period and then fitted to a diurnal patter that is estimated to replicate campus water use. The model was then processed for ADF and then a corresponding Peak Daily Flow (PDF).

Peak Daily Flow (PDF) conditions within the collection system follow rainfall events. The increased flow from ADF to PDF is due to the stormwater Inflow and Infiltration (I&I) that enters into the sanitary sewer system unintentionally by system owners. I&I enters the system through broken or vented manhole lids (Inflow) and/or through deteriorated pipe conditions such as broken or offset pipe joints (Infiltration) when the ground has become saturated. Groundwater that is typically present above the sewer pipe elevation can also infiltrate through broken pipes. Campus Creek may have the potential of directly infiltrating into the collection system during certain times of the year.

Estimated existing "Clear Pipe" Average Daily Flow (ADF) flow conditions do not appear to exceed the current system capacity. However, as Peaking Factors are assessed to the estimated ADF, the remaining system capacity reduces and pipe and manhole surcharging occurs.

3.3 SEWER PIPE MODELING RESULTS

With the limited existing sewer flow data available, it is reasonable to expect a minimum Peaking Factor of 3. As increasing Peaking Factors are assessed to the ADF, the system capacity is reduced. The following chart summarizes this condition:

Flow Condition	25 % Remaining Capacity or Less
ADF	0 Pipe Segments
PF 3.0	34 Pipe Segments

Table 2: Pipe Segment Capacity Results Existing Conditions

3.4 SEWER MANHOLE MODELING RESULTS

The following table indicates the number of manholes that are surcharged to a percentage of total manhole height.

	Surcharge Value (In percentage of total manhole depth)			
Flow Condition	5-25	25-50	50-75	75-100
ADF	38			
PF 3.0	67	4	2	3

Table 3: Manhole Surcharge Table Existing Conditions

For a PF 3 condition, the model results indicate that 3 manholes are at or very close to Sanitary Sewer Overflow (SSO's) conditions and 34 pipe segments have 25% or less capacity remaining before surcharge conditions occur. The complete tabulation results for the evaluated pipes and manholes are included in the Appendix of this report.

END OF SECTION

SECTION 4
PROPOSED ADF AND PDF RATES AND MODELING

4.1 PROPOSED AVERAGE DAILY FLOW

The proposed ADF and PDF rates are based on sewer loading rates from these buildings at full occupancy. The building name, use type, total gross square footage and location and were provided by Kansas State University through two documents:

- The 2025 project and phasing plan worksheet
- The 2025 campus building layout plan.

From that information, ADF rates were calculated based on estimating the total usable floor space, occupants (units) per square foot, the resulting number of occupants, average daily load per occupant and average daily load per building. The following parameters were utilized:

a. Gross to Net Area Space Factors:
   i. Academic: 1.50
   ii. Student Life: 1.54
   iii. Athletics: 1.39
   iv. Research: 1.75

b. Average Daily Water Use:
   v. Student Classroom: 10 gallons per student per day
   vi. Student Resident: 85 gallons per student per day

The 2025 project and phasing plan worksheet was amended to include the calculated ADF values for each building. These flow rates were then added to the Existing ADF values to establish the Proposed ADF values. This worksheet and the 2025 campus building layout plan are located in the appendix of this report.

4.2 COMPUTER MODELING

The computer modeling process for ADF and PDF was similar to the process that was followed under the existing conditions model development.

4.3 SEWER PIPE MODELING RESULTS

The increase in flow from the proposed buildings shows an increase in sewer segments that have capacity concerns. The following chart summarizes this condition.

SECTION 5
EVALUATION CONSIDERATIONS

5.1 EVALUATION CONSIDERATIONS:

1. Average Daily Flow Peaking Factors (ADF PF) depend on:
   a. Material and Age of the system
   b. Amount of Rainfall and Proximity to groundwater and creeks (Campus Creek)
   c. Cross connections (sump pumps, rain gutters, foundation drains and storm drains)
   d. System deterioration level (Crack, Break, Fracture, Broken and Collapse)

2. The actual ADF and Peak Wet Weather Flow capacity projections were estimated based on the best information available at the time this report was produced. Ultimately, these estimates should be verified against actual Flow Monitoring data. This is the most precise way to calibrate the model to establish more accurate ADF peaking factors that can be used for planning purposes.

3. It should be noted that the ADF and PDF SewerCAD modeling results were based on "Clear Pipe" conditions, but it is possible that "Constricting Pipe" conditions may exist (such as a root intrusions, collapsed pipes or offset joints) which could produce significantly different field conditions.

4. No CCTV information was available during the development of this report. CCTV Inspection and Evaluation would provide the following information:
   a. Accurate sewer main size and material type for the entire sewer main segment
   b. Sewer main tap conditions and locations from upstream and downstream manholes.
   c. Defective system components including: offset joints, broken sections, collapsed sections, root intrusions, vertical sags and vertical deformations.
   d. Baseline system condition to be used in Capital Improvement Program

5.2 ADDITIONAL INFORMATION

The following pictures are for comparative purposes only. They are not of the Kansas State Collection System, but are of other systems in Kansas similar in age, material type and expected deterioration.

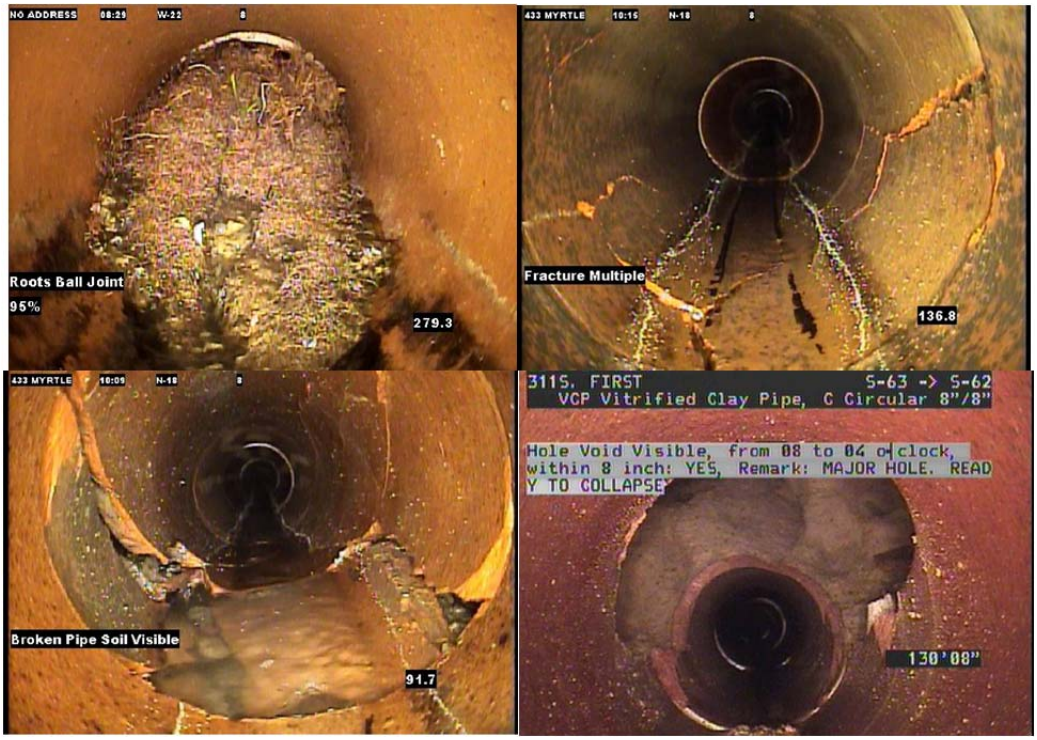

Figure 2: Sewer Pipe CCTV Inspection Photos

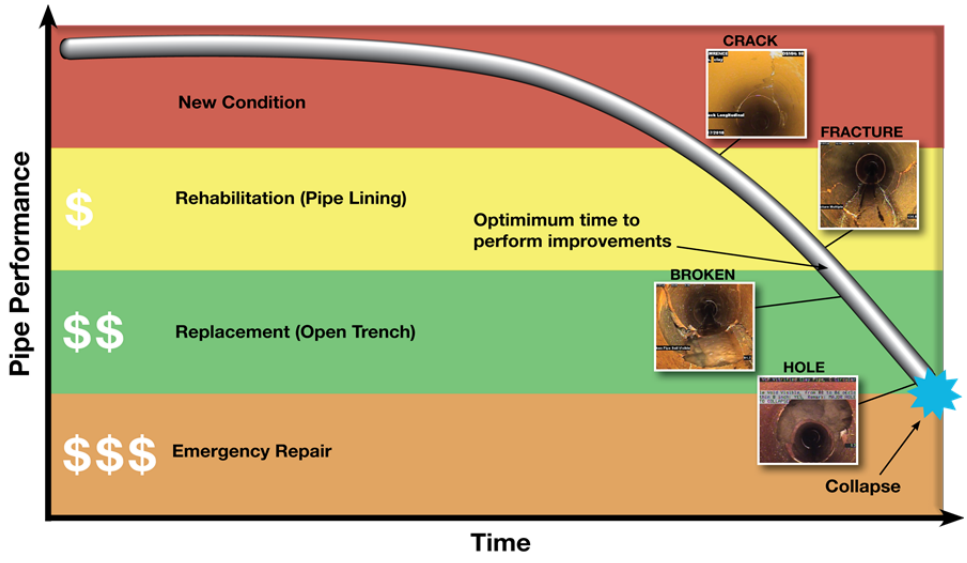

Figure 1: Sewer Pipe Degradation Curve

END OF SECTION

SECTION 6
IMPROVEMENT RECOMMENDATIONS AND COST ESTIMATE

6.0 EXISTING CONDITIONS ADF

Under Existing Conditions for the Average Daily Flow (ADF), the sanitary sewer collection system performs as intended and no major system capacity issues are present.

6.2 EXISTING CONDITIONS PDF (PF=3)

Under Existing Conditions for the Peak Daily Flow (PDF) (Peak Factor = 3), the sewer model shows there are approximately 34 sewer pipe segments that are flowing between 75% - 100% full. Out of these 34 sewer pipe segments, 3 manholes are at a potential Sanitary Sewer Overflow (SSO) condition. These manholes include the following: MH 108, MH 114 and MH 115. At this time, there is no immediate recommendation other than to monitor these manholes during peak flow events.

6.3 PROPOSED CONDITIONS ADF

Under Proposed Conditions for the ADF, the sewer model shows approximately 12 sewer pipe segments that are flowing between 75% and 100% full. Out of these sewer pipe segments, 6 manholes are at a potential SSO condition. These potential SSO conditions are mainly due to the estimated flows generated from the proposed buildings east of Mosier Hall. The existing sewer main that would convey this flow is 6 inch diameter and would have to be upsized. See Proposed Conditions System Map in the appendix.

6.4 PROPOSED CONDITIONS PDF (PF=3)

Under Proposed Conditions for the PDF (Peak Factor =3), the sewer model shows there are approximately 84 sewer pipe segments that are flowing between 75%-100% full. Out of these sewer pipe segments, 35 manholes are at a potential SSO condition.

6.5 RECOMMENDATIONS

- It is recommended to perform Closed Circuit Television (CCTV) Inspection of the sewer mains to properly quantify the deteriorated state. It is very possible that deteriorated conditions exist that require immediate rehabilitation. If and when this CCTV inspection is performed, it is recommended to conduct it in accordance with the North American Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) industry standard.

- It is recommended to perform a sewer flow monitoring study to verify the SewerCAD model predictions, match diurnal flow patterns, and confirm the PDF rate that will dictate the existing infrastructure improvements.
- It is recommended to improve the sanitary sewer infrastructure as the proposed building construction sequence dictates so that all the wastewater is conveyed safely without SSO's or system back-ups.
- As buildings are constructed, it is recommended to improve pipes to the diameter that is required for full build-out conditions.

6.6 EXISTING PDF IMPROVEMENT COST ESTIMATES

ENGINEER OPINION OF PROBABLE COST
2025 KANSAS STATE UNIVERSITY MASTER PLAN UPDATE
SANITARY SEWER COLLECTION SYSTEM
EXISTING PEAK DAILY FLOW (PF=3) CONDITIONS

Bid Item	Description	Quantity	Units	Unit Price	Total
1	Mobilization and Incidentals	1	LS	-	$ 200,004.00
2	CCTV Cleaning, Inspection and Evaluation	26,600	LF	$ 2.50	$ 66,500.00
3	Standard Precast Manhole (8' -0" Height)	60	EA	$ 3,846.00	$ 230,760.00
4	8" Diameter PVC Sewer Main	80	LF	$ 55.00	$ 4,400.00
5	10" Diameter PVC Sewer Main	2,850	LF	$ 60.00	$ 171,000.00
6	15" Diameter PVC Sewer Main	100	LF	$ 75.00	$ 7,500.00
7	18" Diameter PVC Sewer Main	1,550	LF	$ 85.00	$ 131,750.00
8	21" Diameter PVC Sewer Main	450	LF	$ 100.00	$ 45,000.00
9	24" Diameter PVC Sewer Main	1,120	LF	$ 110.00	$ 123,200.00
10	30" Diameter PVC Sewer Main	365	LF	$ 130.00	$ 47,450.00
11	Building Service Connection	45	EA	$ 4,000.00	$ 180,000.00
12	Flowable Fill	1,870	CY	$ 90.00	$ 168,300.00
13	Concrete Surfacing	2,240	SY	$ 100.00	$ 224,000.00
				Construction Contingency	$ 159,986.40
				Total Construction Cost	$ 1,759,850.40
				Engineering and Inspection Services	$ 439,962.60
				Total Project Cost	$ 2,199,813.00

6.7 PROPOSED PDF IMPROVEMENT COST ESTIMATE

ENGINEER OPINION OF PROBABLE COST
2025 KANSAS STATE UNIVERSITY MASTER PLAN UPDATE
SANITARY SEWER COLLECTION SYSTEM
PROPOSED PEAK DAILY FLOW (PF=3) CONDITIONS

Bid Item	Description	Quantity	Units	Unit Price	Total
1	Mobilization and Incidentals	1	LS	-	$ 394,902.00
2	CCTV Cleaning, Inspection and Evaluation	26,600	LF	$ 2.50	$ 66,500.00
3	Standard Precast Manhole (8' -0" Height)	105	EA	$ 3,846.00	$ 403,830.00
4	8" Diameter PVC Sewer Main	1,450	LF	$ 55.00	$ 79,750.00
5	10" Diameter PVC Sewer Main	6,100	LF	$ 60.00	$ 366,000.00
6	12" Diameter PVC Sewer Main	2,350	LF	$ 65.00	$ 152,750.00
7	15" Diameter PVC Sewer Main	2,450	LF	$ 75.00	$ 183,750.00
8	18" Diameter PVC Sewer Main	1,550	LF	$ 85.00	$ 131,750.00
9	21" Diameter PVC Sewer Main	1,150	LF	$ 100.00	$ 115,000.00
10	24" Diameter PVC Sewer Main	1,150	LF	$ 110.00	$ 126,500.00
11	30" Diameter PVC Sewer Main	370	LF	$ 130.00	$ 48,100.00
12	Building Service Connection	45	EA	$ 4,000.00	$ 180,000.00
13	Flowable Fill	4,025	CY	$ 90.00	$ 362,250.00
14	Concrete Surfacing	4,830	SY	$ 100.00	$ 483,000.00
				Construction Contingency	$ 309,408.20
				Total Construction Cost	$ 3,403,490.20
				Engineering and Inspection Services	$ 850,872.55
				Total Project Cost	$ 4,254,362.75

APPENDIX

PIPE SUMMARY REPORT
KANSAS STATE UNIVERSITY SEWER MASTER PLAN
BG PROJECT NUMBER 12-1077M

Label	Up MH	Invert (Start) (ft)	Down MH	Invert (Stop) (ft)	Conduit Shape	Material	Manning's n	Diameter (in)	Length (ft)	Slope (%)
12	1689	1099	185	1096.96	Circular Pipe	PVC	0.01	8	54	3.80%
13	185	1095.96	186	1095.97	Circular Pipe	PVC	0.01	8	81	0.00%
14	186	1095.82	187	1095.03	Circular Pipe	PVC	0.01	8	97	0.80%
15	189	1100.85	188	1100.69	Circular Pipe	PVC	0.01	12	66	0.20%
16	188	1100.5	187	1095.44	Circular Pipe	PVC	0.01	12	54	9.40%
17	187	1094.98	190	1094.83	Circular Pipe	PVC	0.01	12	133	0.10%
18	190	1094.74	191	1094.51	Circular Pipe	PVC	0.01	12	85	0.30%
19	191	1094.46	192	1093.12	Circular Pipe	PVC	0.01	12	204	0.70%
20	192	1092.95	193	1087.87	Circular Pipe	PVC	0.01	12	209	2.40%
21	193	1086.24	194	1085.09	Circular Pipe	PVC	0.01	12	78	1.50%
22	194	1084.95	195	1081.98	Circular Pipe	PVC	0.01	12	93	3.20%
23	195	1081.84	196	1076.74	Circular Pipe	PVC	0.01	12	155	3.30%
24	196	1076.27	197	1074.13	Circular Pipe	PVC	0.01	12	110	1.90%
25	197	1074.07	178	1073.74	Circular Pipe	PVC	0.01	12	86	0.40%
26	178	1073.7	177	1071	Circular Pipe	PVC	0.01	12	286	0.90%
27	177	1070.93	175	1070.2	Circular Pipe	PVC	0.01	12	191	0.40%
28	175	1070.06	174	1065.4	Circular Pipe	PVC	0.01	12	187	2.50%
29	174	1064.89	161	1061.55	Circular Pipe	PVC	0.01	12	291	1.10%
30	160	1063.35	161	1061.76	Circular Pipe	PVC	0.01	10	57	2.80%
31	1634	1070.04	174	1064.92	Circular Pipe	PVC	0.01	8	48	10.70%
32	176	1073.96	175	1072.36	Circular Pipe	PVC	0.01	8	145	1.10%
33	1650	1078.21	177	1070.96	Circular Pipe	PVC	0.01	8	21	34.50%
35	161	1061.36	162	1060.89	Circular Pipe	PVC	0.01	12	184	0.30%
36	162	1060.73	163	1060.68	Circular Pipe	PVC	0.01	12	105	0.00%
37	163	1060.59	164	1060.28	Circular Pipe	PVC	0.01	12	57	0.50%
38	164	1060.23	165	1060.36	Circular Pipe	PVC	0.01	12	43	-0.30%
39	165	1060.18	166	1060.01	Circular Pipe	PVC	0.01	12	55	0.30%
40	166	1059.88	167	1059.6	Circular Pipe	PVC	0.01	12	251	0.10%
41	167	1059.44	168	1059.22	Circular Pipe	PVC	0.01	12	111	0.20%
42	168	1059.14	169	1059.1	Circular Pipe	PVC	0.01	12	42	0.10%
43	179	1073.92	169	1059.89	Circular Pipe	VCP	0.013	6	366	3.80%
44	1613	1068.04	169	1060.47	Circular Pipe	VCP	0.013	8	316	2.40%

Label	Up MH	Invert (Start) (ft)	Down MH	Invert (Stop) (ft)	Conduit Shape	Material	Manning's n	Diameter (in)	Length (ft)	Slope (%)
45	169	1058.42	170	1057.58	Circular Pipe	VCP	0.013	12	135	0.60%
46	170	1057.73	171	1050.11	Circular Pipe	VCP	0.013	12	564	1.40%
49	172	1048.58	173	1048.29	Circular Pipe	VCP	0.013	12	51	0.60%
51	173	1048.29	150	1046.85	Circular Pipe	VCP	0.013	12	245	0.60%
52	150	1046.85	151	1046.5	Circular Pipe	VCP	0.013	12	61	0.60%
53	151	1046.55	152	1044.98	Circular Pipe	VCP	0.013	10	241	0.70%
54	152	1044.91	104	1040.81	Circular Pipe	VCP	0.013	10	693	0.60%
55	146	1049.93	147	1049.15	Circular Pipe	VCP	0.013	8	132	0.60%
56	147	1049.11	148	1048.24	Circular Pipe	VCP	0.013	8	104	0.80%
57	148	1048.13	149	1047.21	Circular Pipe		0.013	8	112	0.80%
58	149	1047.21	103	1042.91	Circular Pipe	VCP	0.013	8	516	0.80%
59	133	1059.41	134	1058.01	Circular Pipe	VCP	0.013	8	150	0.90%
60	134	1057.56	136	1055.34	Circular Pipe	VCP	0.013	8	210	1.10%
61	135	1063.92	137	1059.14	Circular Pipe	VCP	0.013	8	94	5.10%
62	137	1059.05	138	1056.12	Circular Pipe	VCP	0.013	8	272	1.10%
63	136	1055.04	139	1050.95	Circular Pipe	VCP	0.013	8	432	0.90%
64	138	1056	103	1042.91	Circular Pipe	VCP	0.013	8	425	3.10%
65	103	1042.65	104	1041.48	Circular Pipe	VCP	0.013	10	23	5.10%
66	104	1040.61	101	1039.65	Circular Pipe	VCP	0.013	10	120	0.80%
67	139	1050.8	101	1039.65	Circular Pipe	VCP	0.013	8	418	2.70%
68	101	1039.44	100	1037.96	Circular Pipe	VCP	0.013	10	11	13.50%
69	100	1037.39	105	1035	Circular Pipe	VCP	0.013	10	135	1.80%
70	105	1033.79	113	1033.46	Circular Pipe	VCP	0.013	20	63	0.50%
71	159	1054.71	158	1051.39	Circular Pipe	VCP	0.013	8	135	2.50%
72	158	1051.14	157	1050.35	Circular Pipe	VCP	0.013	15	208	0.40%
73	157	1050.27	156	1049.43	Circular Pipe	VCP	0.013	15	268	0.30%
74	156	1049.18	155	1048.52	Circular Pipe	VCP	0.013	15	224	0.30%
75	155	1048.5	154	1048.05	Circular Pipe	VCP	0.013	15	224	0.20%
76	154	1047.6	153	1046.08	Circular Pipe	VCP	0.013	15	250	0.60%
77	153	1045.98	145	1042.45	Circular Pipe	VCP	0.013	15	277	1.30%
78	145	1042.36	144	1041.95	Circular Pipe	VCP	0.013	15	73	0.60%
79	144	1041.95	140	1039.48	Circular Pipe	VCP	0.013	18	427	0.60%
80	142	1048.61	141	1040.27	Circular Pipe	VCP	0.013	8	167	5.00%
81	141	1039.67	140	1039.53	Circular Pipe	VCP	0.013	10	11	1.30%
83	140	1039.19	106	1036.61	Circular Pipe	VCP	0.013	18	292	0.90%
84	107	1038.32	108	1037.2	Circular Pipe	VCP	0.013	8	198	0.60%

Label	Up MH	Invert (Start) (ft)	Down MH	Invert (Stop) (ft)	Conduit Shape	Material	Manning's n	Diameter (in)	Length (ft)	Slope (%)
87	112	1056.21	111	1055.6	Circular Pipe	VCP	0.013	8	26	2.30%
88	111	1055.55	110	1050.1	Circular Pipe	VCP	0.013	8	214	2.50%
89	110	1049.84	109	1043.7	Circular Pipe	VCP	0.013	8	101	6.10%
90	109	1043.54	108	1038	Circular Pipe	VCP	0.013	8	127	4.40%
91	108	1037.22	114	1036.4	Circular Pipe	VCP	0.013	8	202	0.40%
92	113	1033.46	116	1031.94	Circular Pipe	VCP	0.013	20	289	0.50%
93	114	1036.11	115	1034.7	Circular Pipe	VCP	0.013	8	233	0.60%
94	115	1034.81	117	1033.84	Circular Pipe	VCP	0.013	8	177	0.50%
95	117	1033.7	120	1032.2	Circular Pipe	VCP	0.013	8	356	0.40%
96	116	1031.84	118	1030.52	Circular Pipe	VCP	0.013	20	284	0.50%
97	118	1030.33	119	1029.4	Circular Pipe	VCP	0.013	20	221	0.40%
98	132	1061.02	131	1054.4	Circular Pipe	VCP	0.013	8	123	5.40%
99	131	1054.3	130	1052.31	Circular Pipe	VCP	0.013	8	209	1.00%
100	130	1052.2	129	1050.62	Circular Pipe	VCP	0.013	8	223	0.70%
101	129	1050.4	128	1048.33	Circular Pipe	VCP	0.013	8	250	0.80%
102	126	1035.1	125	1033.83	Circular Pipe	VCP	0.013	10	32	4.00%
103	125	1033.71	124	1032.1	Circular Pipe		0.013	10	79	2.00%
104	127	1030.93	124	1030.3	Circular Pipe	VCP	0.013	12	104	0.60%
105	128	1047.41	127	1031	Circular Pipe	VCP	0.013	12	305	5.40%
106	124	1030.3	123	1029.22	Circular Pipe	VCP	0.013	12	21	5.10%
107	123	1027.71	122	1027.6	Circular Pipe	VCP	0.013	24	74	0.10%
108	119	1029.4	123	1027.8	Circular Pipe	VCP	0.013	20	263	0.60%
109	120	1032	121	1030.4	Circular Pipe	VCP	0.013	8	350	0.50%
110	121	1030.3	122	1029.6	Circular Pipe	VCP	0.013	8	13	5.40%
111	102	1040.67	99	1039.72	Circular Pipe	VCP	0.013	8	148	0.60%
112	99	1039.02	97	1038.65	Circular Pipe	PVC	0.01	15	167	0.20%
113	97	1038.7	96	1038.46	Circular Pipe	PVC	0.01	15	89	0.30%
115	96	1039.18	92	1038.94	Circular Pipe	PVC	0.01	15	95	0.30%
116	92	1038.51	91	1037.5	Circular Pipe	VCP	0.013	8	134	0.80%
117	91	1037.3	90	1036.6	Circular Pipe	VCP	0.013	8	61	1.10%
119	93	1038.71	90	1037.03	Circular Pipe	VCP	0.013	10	195	0.90%
121	90	1036.59	89	1036.4	Circular Pipe	PVC	0.01	15	74	0.30%
122	89	1036.4	88	1034.34	Circular Pipe	VCP	0.013	10	231	0.90%
123	88	1034.7	87	1033.43	Circular Pipe	VCP	0.013	10	147	0.90%
124	87	1033.43	86	1031.9	Circular Pipe	VCP	0.013	10	167	0.90%
125	86	1031.7	84	1030.3	Circular Pipe	VCP	0.013	10	165	0.80%

Label	Up MH	Invert (Start) (ft)	Down MH	Invert (Stop) (ft)	Conduit Shape	Material	Manning's n	Diameter (in)	Length (ft)	Slope (%)
126	88	1034.6	84	1029.3	Circular Pipe	VCP	0.013	8	459	1.20%
127	122	1027.34	85	1026.3	Circular Pipe	VCP	0.013	24	207	0.50%
128	84	1029	85	1027.52	Circular Pipe	VCP	0.013	12	10	14.80%
129	85	1026.19	61	1026.22	Circular Pipe	VCP	0.013	24	64	0.00%
130	61	1025.99	63	1025.92	Circular Pipe	VCP	0.013	24	20	0.30%
131	62	1026	64	1025.8	Circular Pipe	VCP	0.013	12	20	1.00%
132	64	1026	65	1025.23	Circular Pipe	VCP	0.013	12	96	0.80%
133	65	1025.22	66	1025.1	Circular Pipe	VCP	0.013	12	108	0.10%
134	48	1065.01	49	1058.3	Circular Pipe	VCP	0.013	8	37	18.10%
135	49	1057.79	50	1054.61	Circular Pipe	VCP	0.013	8	258	1.20%
136	50	1054.83	51	1051.9	Circular Pipe	VCP	0.013	8	152	1.90%
137	51	1051.41	52	1050.5	Circular Pipe	PVC	0.01	8	50	1.80%
138	52	1049.8	53	1048.2	Circular Pipe	PVC	0.01	6	77	2.10%
139	53	1047.8	54	1045	Circular Pipe	PVC	0.01	8	229	1.20%
140	54	1044.1	55	1042.42	Circular Pipe	PVC	0.01	8	44	3.80%
141	55	1042.42	58	1038.22	Circular Pipe	VCP	0.013	8	105	4.00%
142	58	1038.02	56	1036.8	Circular Pipe	PVC	0.01	8	31	3.90%
143	56	1035.39	57	1034.9	Circular Pipe	PVC	0.01	8	73	0.70%
144	57	1034.79	59	1031.93	Circular Pipe	VCP	0.013	8	196	1.50%
145	59	1031.3	60	1028.12	Circular Pipe	VCP	0.013	8	187	1.70%
146	60	1027.73	67	1026.8	Circular Pipe	VCP	0.013	10	117	0.80%
147	67	1026.7	68	1025.5	Circular Pipe	VCP	0.013	12	199	0.60%
148	66	1024.8	69	1023.54	Circular Pipe		0.013	12	270	0.50%
149	69	1023.2	70	1022.3	Circular Pipe	VCP	0.013	12	247	0.40%
150	68	1025.38	71	1021.5	Circular Pipe	VCP	0.013	12	528	0.70%
151	70	1022.03	198	1021.08	Circular Pipe	Concrete	0.013	12	253	0.40%
152	71	1021.5	199	1020.21	Circular Pipe	VCP	0.013	15	192	0.70%
153	199	1020.27	200	1019.61	Circular Pipe	VCP	0.013	15	39	1.70%
154	198	1021.08	201	1020.13	Circular Pipe	VCP	0.013	12	256	0.40%
155	201	1019.74	200	1019.7	Circular Pipe	VCP	0.013	18	6	-0.70%
157	45	1074.73	35	1066.2	Circular Pipe	VCP	0.013	6	139	6.10%
158	35	1066.17	33	1066	Circular Pipe	PVC	0.01	10	173	0.10%
159	34	1082	33	1079.82	Circular Pipe	PVC	0.01	8	103	2.10%
160	33	1065.74	32	1064.63	Circular Pipe	VCP	0.013	10	131	0.80%
161	32	1064.4	31	1062.12	Circular Pipe	VCP	0.013	10	223	1.00%
162	31	1062	28	1061	Circular Pipe	VCP	0.013	10	191	0.50%

Label	Up MH	Invert (Start) (ft)	Down MH	Invert (Stop) (ft)	Conduit Shape	Material	Manning's n	Diameter (in)	Length (ft)	Slope (%)
163	30	1066	29	1065.2	Circular Pipe	VCP	0.013	8	122	0.70%
164	29	1065.33	27	1064.9	Circular Pipe	VCP	0.013	8	79	0.50%
165	23	1058.79	22	1052.1	Circular Pipe	VCP	0.013	8	90	7.40%
166	22	1052.1	21	1050.5	Circular Pipe	VCP	0.013	10	281	0.60%
167	27	1064.84	21	1050.53	Circular Pipe	VCP	0.013	8	203	7.00%
168	28	1061	18	1049.61	Circular Pipe	VCP	0.013	10	292	3.90%
169	24	1054.75	20	1050.43	Circular Pipe		0.013	12	85	5.10%
170	21	1050.5	20	1050.43	Circular Pipe	VCP	0.013	10	5	1.40%
171	20	1050.43	18	1049.61	Circular Pipe	VCP	0.013	10	61	1.30%
172	18	1049.5	17	1048.04	Circular Pipe	HDPE	0.013	12	62	2.40%
173	17	1048.02	16	1046.9	Circular Pipe	VCP	0.013	10	58	1.90%
174	36	1068.81	37	1067.14	Circular Pipe	VCP	0.013	8	56	3.00%
175	37	1065.43	38	1054.7	Circular Pipe	VCP	0.013	8	123	8.70%
176	38	1054.7	39	1052.4	Circular Pipe	VCP	0.013	8	120	1.90%
177	39	1052.34	4859	1048.98	Circular Pipe	VCP	0.013	8	168	2.00%
181	14	1039.4	13	1037.8	Circular Pipe	HDPE	0.013	12	103	1.60%
182	13	1035.39	12	1035.2	Circular Pipe	HDPE	0.013	12	53	0.40%
187	42	1050.31	43	1047.63	Circular Pipe	PVC	0.01	10	79	3.40%
188	43	1047.94	44	1047.4	Circular Pipe	PVC	0.01	12	15	3.60%
189	44	1033	206	1032.91	Circular Pipe	VCP	0.013	12	60	0.10%
207	171	1049.82	172	1048.85	Circular Pipe	VCP	0.013	12	286	0.30%
208	106	1036.4	105	1033.9	Circular Pipe	VCP	0.013	18	294	0.90%
209	4859	1048.3	16	1046.94	Circular Pipe	VCP	0.013	8	250	0.50%
210	16	1046.8	-15	1040.82	Circular Pipe	HDPE	0.013	12	310	1.90%
211	-15	1040.77	14	1039.46	Circular Pipe	HDPE	0.013	12	122	1.10%
214	201	1019.65	OF-2		Circular Pipe		0.013	12	55	
225	92	1039.04	93	1039.35	Circular Pipe	VCP	0.013	10	11	-2.80%
227	63	1025.51	OF-13		Circular Pipe		0.013	12	33	
230	12	1035.2	OF-16		Circular Pipe		0.013	12	42	
231	206	1032.89	OF-17		Circular Pipe		0.013	12	31	
232	96	1038.46	MH-A	1038.41	Circular Pipe	PVC	0.01	12	23	0.20%
233	MH-A	1038.49	93	1038.86	Circular Pipe	VCP	0.013	10	80	-0.50%

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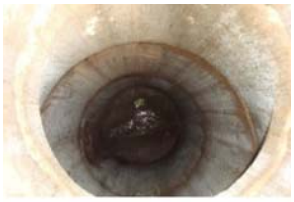
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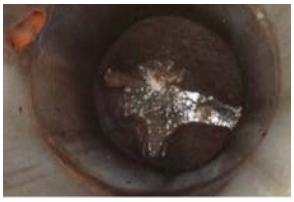
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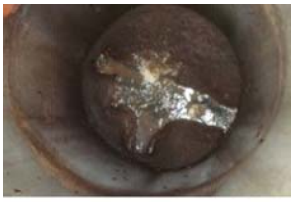
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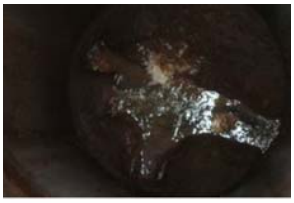
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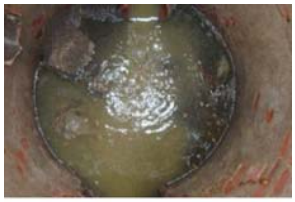
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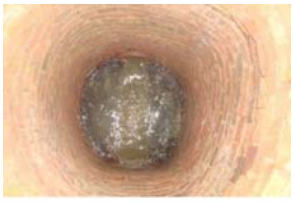
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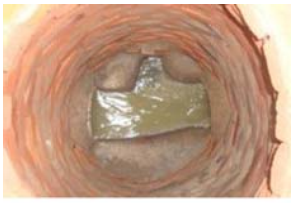
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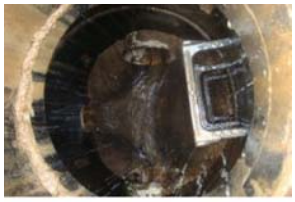
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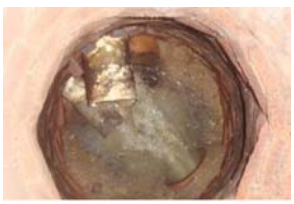
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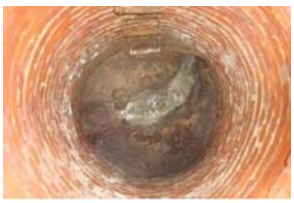
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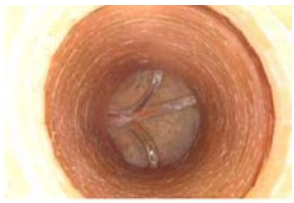
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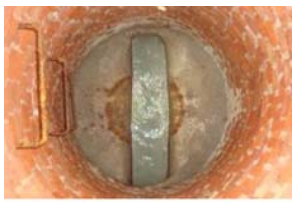
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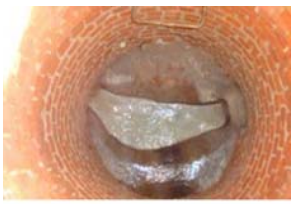
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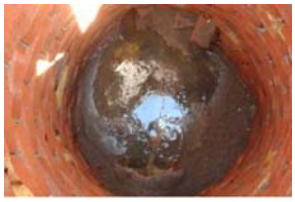
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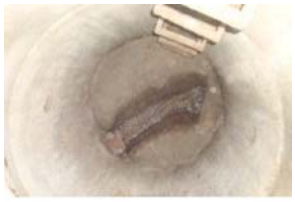
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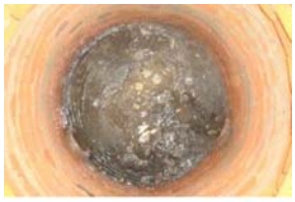
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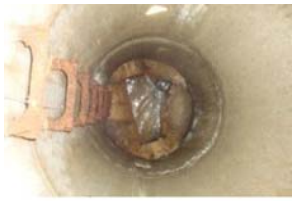
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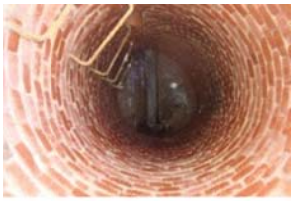
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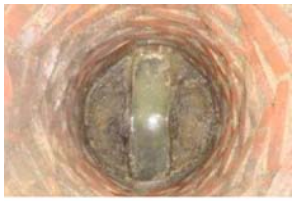
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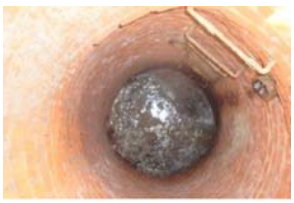
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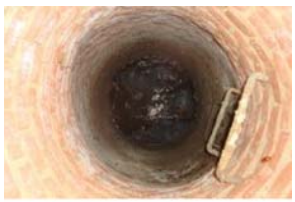
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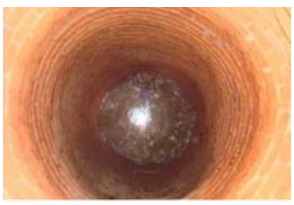
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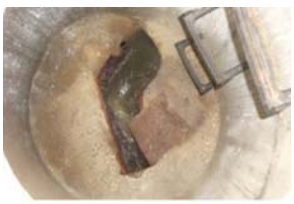
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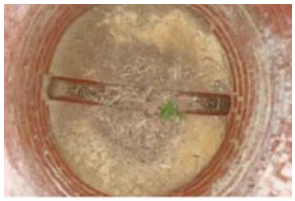
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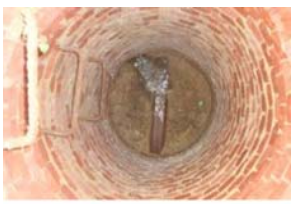
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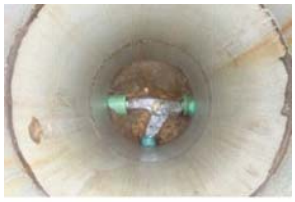
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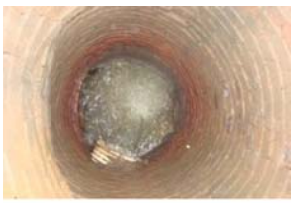
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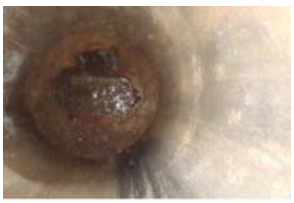
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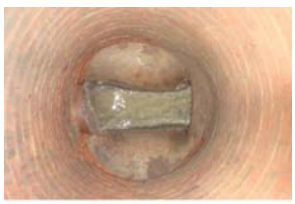
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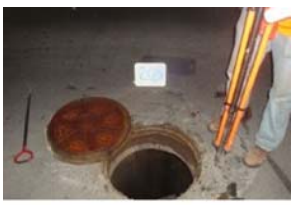
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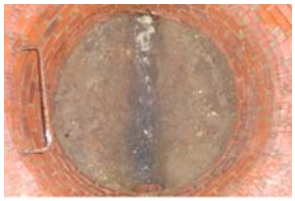

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MANHOLE SUMMARY REPORT
KANSAS STATE UNIVERSITY SEWER MASTER PLAN
BG PROJECT NUMBER 12-1077M

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)
MH-A	1,045.52	1,038.41	7.11
SS12	1,047.50	1,035.20	12.3
SS13	1,049.17	1,035.39	13.78
SS14	1,050.05	1,039.40	10.65
SS-15	1,050.27	1,040.77	9.5
SS16	1,053.84	1,046.80	7.04
SS17	1,055.24	1,048.02	7.22
SS18	1,062.44	1,049.50	12.94
SS20	1,066.79	1,050.43	16.36
SS21	1,066.88	1,050.50	16.38
SS22	1,062.12	1,052.10	10.02
SS23	1,064.79	1,058.79	6
SS24	1,065.77	1,054.75	11.02
SS27	1,073.01	1,064.84	8.17
SS28	1,072.55	1,061.00	11.55
SS29	1,073.36	1,065.20	8.16
SS30	1,073.98	1,065.74	8.24
SS31	1,074.32	1,062.00	12.32
SS32	1,085.85	1,064.40	21.45
SS33	1,087.27	1,065.74	21.53
SS34	1,085.46	1,082.00	3.46
SS35	1,088.02	1,066.17	21.85
SS36	1,075.50	1,068.81	6.69
SS37	1,074.79	1,065.43	9.36
SS38	1,067.85	1,054.70	13.15
SS39	1,064.32	1,052.34	11.98
SS42	1,057.17	1,050.31	6.86
SS43	1,054.63	1,047.63	7
SS44	1,054.35	1,033.00	21.35
SS45	1,085.53	1,074.73	10.8
SS48	1,073.42	1,065.01	8.41
SS49	1,072.27	1,057.79	14.48
SS50	1,069.24	1,054.53	14.71
SS51	1,066.78	1,051.41	15.37
SS52	1,066.56	1,049.80	16.76
SS53	1,064.07	1,047.80	16.27
SS54	1,048.84	1,044.10	4.74
SS55	1,049.09	1,042.42	6.67
SS56	1,041.54	1,035.39	6.15
SS57	1,039.71	1,034.79	4.92
SS58	1,042.94	1,038.02	4.92

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)
SS59	1,036.14	1,031.30	4.84
SS60	1,033.63	1,027.73	5.9
SS61	1,034.31	1,025.99	8.32
SS62	1,034.69	1,026.00	8.69
SS63	1,033.81	1,025.51	8.3
SS64	1,033.89	1,025.80	8.09
SS65	1,033.68	1,025.22	8.46
SS66	1,032.59	1,024.80	7.79
SS67	1,032.23	1,026.70	5.53
SS68	1,032.11	1,025.38	6.73
SS69	1,031.43	1,023.20	8.23
SS70	1,030.43	1,022.03	8.4
SS71	1,029.87	1,021.50	8.37
SS84	1,035.09	1,029.00	6.09
SS85	1,034.40	1,026.19	8.21
SS86	1,037.59	1,031.70	5.89
SS87	1,037.34	1,033.43	3.91
SS88	1,039.22	1,034.34	4.88
SS89	1,043.54	1,036.40	7.14
SS90	1,042.54	1,036.59	5.95
SS91	1,043.83	1,037.30	6.53
SS92	1,045.52	1,038.51	7.01
SS93	1,046.42	1,038.71	7.71
SS96	1,046.46	1,038.46	8
SS97	1,051.00	1,038.65	12.35
SS99	1,046.22	1,039.02	7.2
SS100	1,046.79	1,037.39	9.4
SS101	1,046.94	1,039.44	7.5
SS102	1,049.17	1,040.67	8.5
SS103	1,049.75	1,042.65	7.1
SS104	1,049.35	1,040.61	8.74
SS105	1,042.77	1,033.79	8.98
SS106	1,045.16	1,036.40	8.76
SS107	1,047.14	1,038.32	8.82
SS108	1,044.60	1,037.20	7.4
SS109	1,051.03	1,043.54	7.49
SS110	1,056.82	1,049.84	6.98
SS111	1,066.24	1,055.55	10.69
SS112	1,068.86	1,056.21	12.65
SS113	1,045.32	1,033.46	11.86
SS114	1,044.80	1,036.11	8.69
SS115	1,042.69	1,034.70	7.99
SS116	1,045.66	1,031.84	13.82
SS117	1,042.38	1,033.70	8.68
SS118	1,044.91	1,030.33	14.58
SS119	1,041.58	1,029.40	12.18

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)
SS120	1,040.26	1,032.00	8.26
SS121	1,038.04	1,030.30	7.74
SS122	1,037.57	1,027.34	10.23
SS123	1,037.23	1,027.71	9.52
SS124	1,037.37	1,030.30	7.07
SS125	1,038.73	1,033.71	5.02
SS126	1,040.30	1,035.10	5.2
SS127	1,039.31	1,030.93	8.38
SS128	1,057.63	1,047.41	10.22
SS129	1,065.85	1,050.40	15.45
SS130	1,070.18	1,052.20	17.98
SS131	1,066.29	1,054.30	11.99
SS132	1,067.02	1,061.02	6
SS133	1,069.81	1,059.41	10.4
SS134	1,066.54	1,057.56	8.98
SS135	1,068.52	1,063.92	4.6
SS136	1,067.95	1,055.04	12.91
SS137	1,065.60	1,059.05	6.55
SS138	1,063.12	1,056.00	7.12
SS139	1,061.01	1,050.80	10.21
SS140	1,052.05	1,039.19	12.86
SS141	1,052.10	1,039.67	12.43
SS142	1,053.09	1,048.61	4.48
SS144	1,055.49	1,041.95	13.54
SS145	1,053.76	1,042.36	11.4
SS146	1,060.55	1,049.93	10.62
SS147	1,061.46	1,049.11	12.35
SS148	1,059.28	1,048.13	11.15
SS149	1,055.96	1,047.21	8.75
SS150	1,052.13	1,046.85	5.28
SS151	1,053.10	1,046.50	6.6
SS152	1,051.23	1,044.91	6.32
SS153	1,054.62	1,045.98	8.64
SS154	1,056.41	1,047.60	8.81
SS155	1,059.68	1,048.50	11.18
SS156	1,063.95	1,049.18	14.77
SS157	1,059.56	1,050.27	9.29
SS158	1,067.94	1,051.14	16.8
SS159	1,068.33	1,054.71	13.62
SS160	1,067.34	1,063.35	3.99
SS161	1,067.76	1,061.36	6.4
SS162	1,069.89	1,060.73	9.16
SS163	1,069.31	1,060.59	8.72
SS164	1,068.49	1,060.23	8.26
SS165	1,071.10	1,060.18	10.92
SS166	1,070.95	1,059.88	11.07

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)
SS167	1,065.95	1,059.44	6.51
SS168	1,065.39	1,059.14	6.25
SS169	1,065.04	1,058.42	6.62
SS170	1,065.28	1,057.58	7.7
SS171	1,058.33	1,049.82	8.51
SS172	1,058.35	1,048.58	9.77
SS173	1,056.86	1,048.29	8.57
SS174	1,073.66	1,064.89	8.77
SS175	1,082.93	1,070.06	12.87
SS176	1,081.99	1,073.96	8.03
SS177	1,083.10	1,070.93	12.17
SS178	1,084.42	1,073.70	10.72
SS179	1,079.17	1,073.92	5.25
SS185	1,102.94	1,095.96	6.98
SS186	1,104.47	1,095.82	8.65
SS187	1,106.18	1,094.98	11.2
SS188	1,108.83	1,100.50	8.33
SS189	1,107.32	1,100.85	6.47
SS190	1,109.79	1,094.74	15.05
SS191	1,109.42	1,094.46	14.96
SS192	1,106.34	1,092.95	13.39
SS193	1,099.12	1,086.24	12.88
SS194	1,096.05	1,084.95	11.1
SS195	1,094.70	1,081.84	12.86
SS196	1,094.72	1,076.27	18.45
SS197	1,087.42	1,074.07	13.35
SS198	1,029.74	1,021.08	8.66
SS199	1,029.22	1,020.21	9.01
SS200	1,029.54	1,019.61	9.93
SS201	1,029.71	1,019.65	10.06
SS206	1,043.54	1,032.89	10.65
SS1613	1,074.04	1,068.04	6
SS1634	1,076.04	1,070.04	6
SS1650	1,084.21	1,078.21	6
SS1689	1,102.87	1,099.00	3.87
SS4859	1,061.24	1,048.30	12.94

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
EXISTING CONDITIONS
SEWER PIPES
Dry Loading Conditions (ADF)

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
12	1689	185	PVC	8	1.31	54	0.038	1,370.36	0.63	2.33
13	185	186	PVC	8	1.33	81	0	-78.34	0	52.58
14	186	187	PVC	8	3.31	97	0.008	636.28	0.53	15.8
15	189	188	PVC	12	70.03	66	0.002	1,023.49	1.66	17.71
16	188	187	PVC	12	72.66	54	0.094	6,363.16	6	7.51
17	187	190	PVC	12	78.54	133	0.001	698.09	1.27	22.65
18	190	191	PVC	12	78.52	85	0.003	1,081.31	1.73	18.24
19	191	192	PVC	12	81.2	204	0.007	1,684.74	2.37	14.94
20	192	193	PVC	12	83.84	209	0.024	3,240.81	3.74	11.08
21	193	194	PVC	12	96.91	78	0.015	2,524.04	3.16	13.38
22	194	195	PVC	12	102.14	93	0.032	3,714.77	4.15	11.41
23	195	196	PVC	12	102.16	155	0.033	3,770.63	4.19	11.33
24	196	197	PVC	12	117.83	110	0.019	2,899.38	3.5	14.1
25	197	178	PVC	12	117.79	86	0.004	1,287.66	1.98	20.44
26	178	177	PVC	12	117.79	286	0.009	2,019.73	2.72	16.39
27	177	175	PVC	12	128.07	191	0.004	1,285.11	1.98	21.32
28	175	174	PVC	12	129	187	0.025	3,281.46	3.81	13.54
29	174	161	PVC	12	131.67	291	0.011	2,227.01	2.91	16.5
30	160	161	PVC	10	49.37	57	0.028	2,135.04	1.52	10.5
31	1634	174	PVC	8	2.63	48	0.107	2,302.67	1.27	11.39
32	176	175	PVC	8	1.6	145	0.011	740.62	0.42	3.46
33	1650	177	PVC	8	10.47	21	0.345	4,142.64	2.7	15.59
35	161	162	PVC	12	169.77	184	0.003	1,050.59	1.73	27.18
36	162	163	PVC	12	175.72	105	0	453.61	0.95	43.18
37	163	164	PVC	12	175.56	57	0.005	1,532.99	2.24	55.71
38	164	165	PVC	12	175.52	43	-0.003	-1,142.96	0.21	69.56
39	165	166	PVC	12	175.53	55	0.003	1,155.68	1.83	26.34
40	166	167	PVC	12	175.61	251	0.001	694.28	1.28	34.29
41	167	168	PVC	12	182.25	111	0.002	925.43	1.57	30.09
42	168	169	PVC	12	182.19	42	0.001	641.50	1.21	36.48
43	179	169	Vitrified Clay	6	10.54	366	0.038	493.05	1.12	10.11
44	1613	169	Vitrified Clay	8	0.08	316	0.024	839.42	0.43	0.81
45	169	170	Vitrified Clay	12	192.31	135	0.006	1,261.32	1.95	31.58
46	170	171	Vitrified Clay	12	193.37	564	0.014	1,858.61	2.56	21.78
49	172	173	Vitrified Clay	12	194.20	51	0.006	1,205.77	1.88	27.35
51	173	150	Vitrified Clay	12	204.11	245	0.006	1,225.88	1.91	27.7
52	150	151	Vitrified Clay	12	203.94	61	0.006	1,211.21	1.89	30.8
53	151	152	Vitrified Clay	10	203.94	241	0.007	793.67	2.02	34.59
54	152	104	Vitrified Clay	10	204.15	693	0.006	756.36	1.95	35.5
55	146	147	Vitrified Clay	8	35.03	132	0.006	416.9	0.69	19.6
56	147	148	Vitrified Clay	8	35.06	104	0.008	496.04	0.71	18
57	148	149	Vitrified Clay	8	37.89	112	0.008	491.54	0.7	18.76

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
58	149	103	Vitrified Clay	8	38.03	516	0.008	495.09	0.69	18.76
59	133	134	Vitrified Clay	8	79.66	150	0.009	523.95	1.02	26.35
60	134	136	Vitrified Clay	8	79.72	210	0.011	557.62	1.01	25.55
61	135	137	Vitrified Clay	8	21.9	94	0.051	1,222.99	1.27	9.27
62	137	138	Vitrified Clay	8	21.97	272	0.011	562.89	0.72	13.49
63	136	139	Vitrified Clay	8	79.83	432	0.009	527.71	0.91	26.29
64	138	103	Vitrified Clay	8	44.48	425	0.031	951.81	1.22	14.72
65	103	104	Vitrified Clay	10	82.52	23	0.051	2,217.84	1.32	13.18
66	104	101	Vitrified Clay	10	286.61	120	0.008	879.52	2.18	39.3
67	139	101	Vitrified Clay	8	79.94	418	0.027	885.78	1.06	20.3
68	101	100	Vitrified Clay	10	366.54	11	0.135	3,606.91	5.9	21.53
69	100	105	Vitrified Clay	10	366.58	135	0.018	1,308.38	2.9	36.22
70	105	113	Vitrified Clay	20	1,514.26	63	0.005	4,518.92	1.83	39.93
71	159	158	Vitrified Clay	8	0.04	135	0.025	850.5	0.36	1.58
72	158	157	Vitrified Clay	15	179.69	208	0.004	1,786.73	0.88	21.41
73	157	156	Vitrified Clay	15	179.82	268	0.003	1,623.12	0.75	28.18
74	156	155	Vitrified Clay	15	891.83	224	0.003	1,573.71	1.26	56.57
75	155	154	Vitrified Clay	15	891.94	224	0.002	1,299.45	1.02	60.85
76	154	153	Vitrified Clay	15	892.06	250	0.006	2,260.63	1.38	43.67
77	153	145	Vitrified Clay	15	892.2	277	0.013	3,272.85	1.67	36.56
78	145	144	Vitrified Clay	15	892.24	73	0.006	2,172.74	1.2	45.01
79	144	140	Vitrified Clay	18	1,089.54	427	0.006	3,585.61	1.36	37.81
80	142	141	Vitrified Clay	8	57.77	167	0.05	1,211.99	1.71	14.86
81	141	140	Vitrified Clay	10	57.77	11	0.013	1,109.35	1	18.6
83	140	106	Vitrified Clay	18	1,147.48	292	0.009	4,431.46	1.47	34.72
84	107	108	Vitrified Clay	8	3.2	198	0.006	407.90	0.35	32.44
87	112	111	Vitrified Clay	8	16.23	26	0.023	830.72	1.01	17.05
88	111	110	Vitrified Clay	8	202.52	214	0.025	865.50	1.98	32.91
89	110	109	Vitrified Clay	8	202.49	101	0.061	1,337.21	2.54	26.3
90	109	108	Vitrified Clay	8	202.5	127	0.044	1,132.73	2.23	28.6
91	108	114	Vitrified Clay	8	205.73	202	0.004	345.55	0.96	55.56
92	113	116	Vitrified Clay	20	1,525.45	289	0.005	4,528.15	1.84	39.99
93	114	115	Vitrified Clay	8	205.68	233	0.006	421.9	1.02	58.23
94	115	117	Vitrified Clay	8	205.71	177	0.005	401.49	0.91	50.72
95	117	120	Vitrified Clay	8	205.79	356	0.004	352.04	0.78	54.93
96	116	118	Vitrified Clay	20	1,525.58	284	0.005	4,256.73	1.74	41.38
97	118	119	Vitrified Clay	20	1,525.70	221	0.004	4,050.36	1.67	42.53
98	132	131	Vitrified Clay	8	16.25	123	0.054	1,258.20	1.38	7.93
99	131	130	Vitrified Clay	8	16.26	209	0.01	529.21	0.73	12.01
100	130	129	Vitrified Clay	8	32.4	223	0.007	456.51	0.78	18.04
101	129	128	Vitrified Clay	8	32.21	250	0.008	493.50	0.73	17.31
102	126	125	Vitrified Clay	10	23.03	32	0.04	1,958.97	1.33	7.63
103	125	124	Vitrified Clay	10	23.04	79	0.02	1,403.79	1.04	8.92
104	127	124	Vitrified Clay	12	54.84	104	0.006	1,244.53	0.7	14.32
105	128	127	Vitrified Clay	12	55.07	305	0.054	3,708.99	1.6	8.49
106	124	123	Vitrified Clay	12	77.64	21	0.051	3,626.22	1.72	10.12
107	123	122	Vitrified Clay	24	1,583.15	74	0.001	3,914.52	1.13	44.26
108	119	123	Vitrified Clay	20	1,525.84	263	0.006	4,870.01	1.88	43.07
109	120	121	Vitrified Clay	8	205.81	350	0.005	366.69	0.68	53.58
110	121	122	Vitrified Clay	8	205.8	13	0.054	1,258.50	1.43	27.37

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
111	102	99	Vitrified Clay	8	110.99	148	0.006	434.52	1	34.49
112	99	97	PVC	15	135.75	167	0.002	1,774.04	0.77	20.27
113	97	96	PVC	15	135.79	89	0.003	1,957.19	0.75	17.83
115	96	92	PVC	15	(N/A)	95	0.003	1,894.37	(N/A)	(N/A)
116	92	91	Vitrified Clay	8	25.46	134	0.009	502.42	0.46	15.31
117	91	90	Vitrified Clay	8	25.47	61	0.011	580.98	0.49	28.07
119	93	90	Vitrified Clay	10	116.37	195	0.004	653.03	0.72	28.55
121	90	89	PVC	15	224.13	74	0.003	1,909.78	0.85	23.14
122	89	88	Vitrified Clay	10	236.46	231	0.009	928.6	1.15	45.04
123	88	87	Vitrified Clay	10	(N/A)	147	0.009	914	(N/A)	(N/A)
124	87	86	Vitrified Clay	10	118.28	167	0.009	941.21	0.89	23.96
125	86	84	Vitrified Clay	10	118.34	165	0.008	905.78	0.82	24.41
126	88	84	Vitrified Clay	8	118.35	459	0.012	582.78	0.99	30.57
127	122	85	Vitrified Clay	24	1,789.05	207	0.005	7,196.64	1.74	49.96
128	84	85	Vitrified Clay	12	236.69	10	0.148	6,151.52	2.45	13.4
129	85	61	Vitrified Clay	24	2,025.66	64	0	-2,198.21	0.06	70.06
130	61	63	Vitrified Clay	24	2,025.61	20	0.003	6,006.65	1.53	40.01
131	62	64	Vitrified Clay	12	0.01	20	0.01	1,599.01	0.13	10.5
132	64	65	Vitrified Clay	12	0.05	96	0.008	1,432.06	0.22	0.5
133	65	66	Vitrified Clay	12	0.09	108	0.001	533	0.14	1.03
134	48	49	Vitrified Clay	8	172.91	37	0.181	2,309.59	3.63	18.48
135	49	50	Vitrified Clay	8	172.98	258	0.012	602.11	1.43	51.25
136	50	51	Vitrified Clay	8	175.29	152	0.019	752.99	1.54	32.83
137	51	52	PVC	8	187.56	50	0.018	951.16	1.81	30.11
138	52	53	PVC	6	187.57	77	0.021	471.91	1.97	43.8
139	53	54	PVC	8	191.31	229	0.012	779.61	1.55	33.71
140	54	55	PVC	8	203.57	44	0.038	1,377.67	2.27	27.67
141	55	58	Vitrified Clay	8	203.6	105	0.04	1,084.69	1.91	29.37
142	58	56	PVC	8	203.6	31	0.039	1,398.68	2.24	25.78
143	56	57	PVC	8	203.62	73	0.007	577.64	1.2	40.97
144	57	59	Vitrified Clay	8	203.67	196	0.015	655.13	1.29	38.26
145	59	60	Vitrified Clay	8	210.9	187	0.017	707.24	1.33	37.43
146	60	67	Vitrified Clay	10	210.94	117	0.008	876.7	0.95	33.37
147	67	68	Vitrified Clay	12	211.02	199	0.006	1,241.70	0.83	27.87
148	66	69	Vitrified Clay	12	0.19	270	0.005	1,092.33	0.28	1.11
149	69	70	Vitrified Clay	12	0.29	247	0.004	965.22	0.3	1.38
150	68	71	Vitrified Clay	12	214.37	528	0.007	1,370.72	0.85	26.73
151	70	198	Concrete	12	0.39	253	0.004	979.83	0.33	1.66
152	71	199	Vitrified Clay	15	214.47	192	0.007	2,376.41	0.66	26.47
153	199	200	Vitrified Clay	15	214.49	39	0.017	3,771.53	0.89	54.23
154	198	201	Vitrified Clay	12	0.49	256	0.004	974.08	0.36	1.74
155	201	200	Vitrified Clay	18	214.49	6	-0.007	-3,849.31	0	59.86
157	45	35	Vitrified Clay	6	80.88	139	0.061	623.84	2.07	37.47
158	35	33	PVC	10	99.31	173	0.001	400.72	0.58	33.94
159	34	33	PVC	8	0.03	103	0.021	1,025.72	0.37	0.42
160	33	32	Vitrified Clay	10	99.38	131	0.008	905.16	0.88	22.37
161	32	31	Vitrified Clay	10	107.68	223	0.01	994.3	0.95	22.22
162	31	28	Vitrified Clay	10	107.74	191	0.005	711.52	0.69	26.3
163	30	29	Vitrified Clay	8	29.26	122	0.007	439.18	0.68	27.65
164	29	27	Vitrified Clay	8	29.28	79	0.005	400.12	0.59	18.33

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
165	23	22	Vitrified Clay	8	98.55	90	0.074	1,478.65	2.27	24.13
166	22	21	Vitrified Clay	10	98.64	281	0.006	742.01	0.88	24.63
167	27	21	Vitrified Clay	8	29.33	203	0.07	1,439.95	1.41	16.69
168	28	18	Vitrified Clay	10	169.44	292	0.039	1,942.10	1.75	19.96
169	24	20	PVC	8	69.86	85	0.051	1,589.46	2.14	24.75
170	21	20	Vitrified Clay	10	127.97	5	0.014	1,163.50	1.13	25.3
171	20	18	Vitrified Clay	10	197.85	61	0.013	1,140.10	1.34	28.2
172	18	17	HDPE	12	367.31	62	0.024	3,189.89	2.18	22.91
173	17	16	PVC	12	367.33	58	0.019	2,888.62	2.02	24.09
174	36	37	Vitrified Clay	8	158.56	56	0.03	936.57	1.89	27.82
175	37	38	Vitrified Clay	8	159.12	123	0.087	1,601.85	2.73	26.79
176	38	39	Vitrified Clay	8	169.65	120	0.019	750.84	1.61	32.29
177	39	4859	Vitrified Clay	8	169.7	168	0.02	766.99	1.59	32
181	14	13	HDPE	12	540.94	103	0.016	2,590.81	1.94	31.01
182	13	12	HDPE	12	540.96	53	0.004	1,244.61	1.16	46.09
187	42	43	PVC	10	8.95	79	0.034	2,354.50	0.96	22.96
188	43	44	PVC	12	8.96	15	0.036	3,944.08	0.96	3.53
189	44	206	Vitrified Clay	12	8.98	60	0.001	619.29	0.26	8.39
207	171	172	Vitrified Clay	12	194.29	286	0.003	931.22	1.57	31
208	106	105	Vitrified Clay	18	1,147.66	294	0.009	4,347.35	1.37	36.02
209	4859	16	Vitrified Clay	8	169.76	250	0.005	400.01	0.98	45.46
210	16	-15	HDPE	12	540.34	310	0.019	2,887.12	2.23	29.31
211	-15	14	HDPE	12	540.38	122	0.011	2,154.02	1.74	34.15
214	201	OF-2		12	214.98	55	18.539	68,848.67	10.64	4.09
225	92	93	Vitrified Clay	10	(N/A)	11	-0.028	-1,650.77	(N/A)	(N/A)
227	63	OF-13		12	2,025.60	33	31.076	89,138.29	40.58	10.41
230	12	OF-16	PVC	12	540.98	42	24.648	########	24.84	5.21
231	206	OF-17		12	8.98	31	33.319	92,299.11	9.52	0.81
232	96	MH-A	PVC	12	92.9	23	0.002	969.21	0.69	24.59
233	MH-A	93	Vitrified Clay	10	92.9	80	0.007	807.89	0.87	22.91
234	213	212	Vitrified Clay	6	0.03	133	0.022	369.29	0.35	3.01
235	212	211	Vitrified Clay	6	0.08	168	0.017	333.14	0.38	1.24
236	211	210	Vitrified Clay	6	0.15	266	0.02	353.45	0.5	1.58
237	210	209	Vitrified Clay	6	0.23	308	0.018	341.98	0.56	1.97
238	209	208	Vitrified Clay	6	0.31	315	0.018	339.65	0.61	2.29
239	208	142	Vitrified Clay	6	0.32	32	0.016	321.02	0.59	2.39

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
EXISTING CONDITIONS
SEWER PIPES
Wet Loading Conditions PF=3

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
12	1689	185	PVC	8	3.9	54	0.038	1,370.36	0.78	3.92
13	185	186	PVC	8	3.92	81	0	-78.34	0	53.9
14	186	187	PVC	8	10.4	97	0.008	636.28	0.7	19.5
15	189	188	PVC	12	70.03	66	0.002	1,023.49	1.66	17.71
16	188	187	PVC	12	77.90	54	0.094	6,363.16	6.01	7.77
17	187	190	PVC	12	96.16	133	0.001	698.09	1.28	25.07
18	190	191	PVC	12	96.05	85	0.003	1,081.31	1.74	20.14
19	191	192	PVC	12	103.91	204	0.007	1,684.74	2.38	16.83
20	192	193	PVC	12	111.69	209	0.024	3,240.81	3.77	12.7
21	193	194	PVC	12	150.84	78	0.015	2,524.04	3.21	16.57
22	194	195	PVC	12	166.47	93	0.032	3,714.77	4.22	14.42
23	195	196	PVC	12	166.43	155	0.033	3,770.63	4.26	14.33
24	196	197	PVC	12	213.39	110	0.019	2,899.38	3.6	19.95
25	197	178	PVC	12	213.23	86	0.004	1,287.66	2.03	27.53
26	178	177	PVC	12	213.06	286	0.009	2,019.73	2.78	22.22
27	177	175	PVC	12	243.86	191	0.004	1,285.11	2.03	29.52
28	175	174	PVC	12	246.6	187	0.025	3,281.46	3.89	18.57
29	174	161	PVC	12	254.21	291	0.011	2,227.01	2.97	22.81
30	160	161	PVC	10	148.07	57	0.028	2,135.04	2.12	17.83
31	1634	174	PVC	8	7.86	48	0.107	2,302.67	1.63	16.98
32	176	175	PVC	8	4.73	145	0.011	740.62	0.59	5.73
33	1650	177	PVC	8	31.4	21	0.345	4,142.64	3.74	23
35	161	162	PVC	12	368.18	184	0.003	1,050.59	1.79	47.91
36	162	163	PVC	12	386.15	105	0	453.61	0.99	70.93
37	163	164	PVC	12	385.87	57	0.005	1,532.99	2.31	63.39
38	164	165	PVC	12	385.78	43	-0.003	-1,142.96	0.23	76.65
39	165	166	PVC	12	385.47	55	0.003	1,155.68	1.88	40
40	166	167	PVC	12	385.41	251	0.001	694.28	1.31	53.22
41	167	168	PVC	12	405.73	111	0.002	925.43	1.6	48.01
42	168	169	PVC	12	405.66	42	0.001	641.5	1.23	57.71
43	179	169	Vitrified Clay	6	31.46	366	0.038	493.05	1.55	17.12
44	1613	169	Vitrified Clay	8	0.08	316	0.024	839.42	0.43	0.81
45	169	170	Vitrified Clay	12	435.63	135	0.006	1,261.32	2	44.3
46	170	171	Vitrified Clay	12	438.53	564	0.014	1,858.61	2.62	33.05
49	172	173	Vitrified Clay	12	440.53	51	0.006	1,205.77	1.9	42.33
51	173	150	Vitrified Clay	12	470.28	245	0.006	1,225.88	1.94	43.09
52	150	151	Vitrified Clay	12	470.19	61	0.006	1,211.21	1.92	47.19
53	151	152	Vitrified Clay	10	470.16	241	0.007	793.67	2.04	55.38
54	152	104	Vitrified Clay	10	470.23	693	0.006	756.36	1.97	57.09
55	146	147	Vitrified Clay	8	105.03	132	0.006	416.90	0.96	34.25
56	147	148	Vitrified Clay	8	105.06	104	0.008	496.04	1.01	31.26
57	148	149	Vitrified Clay	8	113.49	112	0.008	491.54	1	32.67
58	149	103	Vitrified Clay	8	113.63	516	0.008	495.09	0.97	32.57
59	133	134	Vitrified Clay	8	238.91	150	0.009	523.95	1.43	47.38

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
60	134	136	Vitrified Clay	8	238.97	210	0.011	557.62	1.44	45.71
61	135	137	Vitrified Clay	8	65.65	94	0.051	1,222.99	1.74	15.74
62	137	138	Vitrified Clay	8	65.72	272	0.011	562.89	1	23.04
63	136	139	Vitrified Clay	8	239.08	432	0.009	527.71	1.31	47.21
64	138	103	Vitrified Clay	8	133.03	425	0.031	951.81	1.72	25.26
65	103	104	Vitrified Clay	10	246.67	23	0.051	2,217.84	1.99	22.52
66	104	101	Vitrified Clay	10	716.42	120	0.008	879.52	2.23	68.54
67	139	101	Vitrified Clay	8	239.19	418	0.027	885.78	1.62	35.52
68	101	100	Vitrified Clay	10	955.59	11	0.135	3,606.91	6.1	35.15
69	100	105	Vitrified Clay	10	955.63	135	0.018	1,308.38	3	63.46
70	105	113	Vitrified Clay	20	4,395.09	63	0.005	4,518.92	2.12	79.83
71	159	158	Vitrified Clay	8	0.04	135	0.025	850.5	0.36	100
72	158	157	Vitrified Clay	15	538.79	208	0.004	1,786.73	1.23	100
73	157	156	Vitrified Clay	15	538.92	268	0.003	1,623.12	1.07	100
74	156	155	Vitrified Clay	15	2,674.73	224	0.003	1,573.71	1.76	100
75	155	154	Vitrified Clay	15	2,674.84	224	0.002	1,299.45	1.46	100
76	154	153	Vitrified Clay	15	2,674.96	250	0.006	2,260.63	2.03	100
77	153	145	Vitrified Clay	15	2,675.10	277	0.013	3,272.85	2.52	84.19
78	145	144	Vitrified Clay	15	2,675.14	73	0.006	2,172.74	1.82	98.39
79	144	140	Vitrified Clay	18	3,266.54	427	0.006	3,585.61	1.99	74.94
80	142	141	Vitrified Clay	8	172.57	167	0.05	1,211.99	2.34	25.49
81	141	140	Vitrified Clay	10	172.57	11	0.013	1,109.35	1.37	69.97
83	140	106	Vitrified Clay	18	3,439.28	292	0.009	4,431.46	2.2	66.21
84	107	108	Vitrified Clay	8	9.5	198	0.006	407.90	0.47	100
87	112	111	Vitrified Clay	8	48.66	26	0.023	830.72	1.43	34.49
88	111	110	Vitrified Clay	8	607.44	214	0.025	865.5	2.74	61.77
89	110	109	Vitrified Clay	8	607.34	101	0.061	1,337.21	3.61	100
90	109	108	Vitrified Clay	8	607.33	127	0.044	1,132.73	3.18	100
91	108	114	Vitrified Clay	8	616.82	202	0.004	345.55	1.36	100
92	113	116	Vitrified Clay	20	4,429.63	289	0.005	4,528.15	2.14	83.1
93	114	115	Vitrified Clay	8	616.66	233	0.006	421.90	1.48	100
94	115	117	Vitrified Clay	8	616.44	177	0.005	401.49	1.33	100
95	117	120	Vitrified Clay	8	616.53	356	0.004	352.04	1.15	100
96	116	118	Vitrified Clay	20	4,429.51	284	0.005	4,256.73	1.99	88.85
97	118	119	Vitrified Clay	20	4,429.65	221	0.004	4,050.36	1.88	91.04
98	132	131	Vitrified Clay	8	48.69	123	0.054	1,258.20	1.92	13.43
99	131	130	Vitrified Clay	8	48.65	209	0.01	529.21	1.01	20.49
100	130	129	Vitrified Clay	8	97.07	223	0.007	456.51	1.1	31.32
101	129	128	Vitrified Clay	8	96.57	250	0.008	493.50	1.05	30
102	126	125	Vitrified Clay	10	69.07	32	0.04	1,958.97	1.87	12.84
103	125	124	Vitrified Clay	10	69.06	79	0.02	1,403.79	1.46	15.09
104	127	124	Vitrified Clay	12	164.6	104	0.006	1,244.53	1.02	24.56
105	128	127	Vitrified Clay	12	165.14	305	0.054	3,708.99	2.32	15.97
106	124	123	Vitrified Clay	12	233.13	21	0.051	3,626.22	2.47	17.18
107	123	122	Vitrified Clay	24	4,605.01	74	0.001	3,914.52	1.28	81.17
108	119	123	Vitrified Clay	20	4,429.76	263	0.006	4,870.01	2.1	83.18
109	120	121	Vitrified Clay	8	616.55	350	0.005	366.69	1.06	100
110	121	122	Vitrified Clay	8	616.38	13	0.054	1,258.50	2.21	49.38
111	102	99	Vitrified Clay	8	332.89	148	0.006	434.52	1.39	65.58
112	99	97	PVC	15	407	167	0.002	1,774.04	1.08	33.75
113	97	96	PVC	15	407.04	89	0.003	1,957.19	1.09	30.95
115	96	92	PVC	15	(N/A)	95	0.003	1,894.37	(N/A)	(N/A)

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
116	92	91	Vitrified Clay	8	99.22	134	0.009	502.42	0.64	30.14
117	91	90	Vitrified Clay	8	99.24	61	0.011	580.98	0.68	51.63
119	93	90	Vitrified Clay	10	325.76	195	0.004	653.03	1.07	49.92
121	90	89	PVC	15	671.78	74	0.003	1,909.78	1.21	42.28
122	89	88	Vitrified Clay	10	708.61	231	0.009	928.6	1.66	70.82
123	88	87	Vitrified Clay	10	(N/A)	147	0.009	914.00	(N/A)	(N/A)
124	87	86	Vitrified Clay	10	354.36	167	0.009	941.21	1.29	42.51
125	86	84	Vitrified Clay	10	354.41	165	0.008	905.78	1.21	43.42
126	88	84	Vitrified Clay	8	354.42	459	0.012	582.78	1.46	56.28
127	122	85	Vitrified Clay	24	5,221.40	207	0.005	7,196.64	1.97	76.39
128	84	85	Vitrified Clay	12	708.84	10	0.148	6,151.52	3.67	40.09
129	85	61	Vitrified Clay	24	5,930.20	64	0	-2,198.21	0.1	88.92
130	61	63	Vitrified Clay	24	5,930.14	20	0.003	6,006.65	1.76	80.83
131	62	64	Vitrified Clay	12	0.01	20	0.01	1,599.01	0.13	10.5
132	64	65	Vitrified Clay	12	0.05	96	0.008	1,432.06	0.22	0.5
133	65	66	Vitrified Clay	12	0.09	108	0.001	533	0.14	1.03
134	48	49	Vitrified Clay	8	518.71	37	0.181	2,309.59	5.14	32.18
135	49	50	Vitrified Clay	8	518.78	258	0.012	602.11	1.99	83.04
136	50	51	Vitrified Clay	8	525.64	152	0.019	752.99	2.21	61.54
137	51	52	PVC	8	562.41	50	0.018	951.16	2.6	62.66
138	52	53	PVC	6	562.42	77	0.021	471.91	2.81	100
139	53	54	PVC	8	573.51	229	0.012	779.61	2.25	63.78
140	54	55	PVC	8	610.27	44	0.038	1,377.67	3.3	50.13
141	55	58	Vitrified Clay	8	610.3	105	0.04	1,084.69	2.78	53.66
142	58	56	PVC	8	610.3	31	0.039	1,398.68	3.28	46.19
143	56	57	PVC	8	610.32	73	0.007	577.64	1.76	95.47
144	57	59	Vitrified Clay	8	610.37	196	0.015	655.13	1.9	76.43
145	59	60	Vitrified Clay	8	631.95	187	0.017	707.24	1.97	73.69
146	60	67	Vitrified Clay	10	631.99	117	0.008	876.7	1.42	62.9
147	67	68	Vitrified Clay	12	632.07	199	0.006	1,241.70	1.22	50.52
148	66	69	Vitrified Clay	12	0.19	270	0.005	1,092.33	0.28	1.11
149	69	70	Vitrified Clay	12	0.29	247	0.004	965.22	0.3	1.38
150	68	71	Vitrified Clay	12	641.72	528	0.007	1,370.72	1.27	48.1
151	70	198	Concrete	12	0.39	253	0.004	979.83	0.33	1.66
152	71	199	Vitrified Clay	15	641.82	192	0.007	2,376.41	1.02	37.96
153	199	200	Vitrified Clay	15	641.84	39	0.017	3,771.53	1.34	62.02
154	198	201	Vitrified Clay	12	0.49	256	0.004	974.08	0.36	1.74
155	201	200	Vitrified Clay	18	641.84	6	-0.007	-3,849.31	0.01	66.31
157	45	35	Vitrified Clay	6	242.58	139	0.061	623.84	2.89	72.15
158	35	33	PVC	10	297.76	173	0.001	400.72	0.8	64.22
159	34	33	PVC	8	0.03	103	0.021	1,025.72	0.37	0.42
160	33	32	Vitrified Clay	10	297.83	131	0.008	905.16	1.28	39.5
161	32	31	Vitrified Clay	10	322.58	223	0.01	994.30	1.37	39.2
162	31	28	Vitrified Clay	10	322.64	191	0.005	711.52	1.03	47.23
163	30	29	Vitrified Clay	8	87.71	122	0.007	439.18	0.93	40.82
164	29	27	Vitrified Clay	8	87.73	79	0.005	400.12	0.83	31.84
165	23	22	Vitrified Clay	8	295.6	90	0.074	1,478.65	3.14	42.58
166	22	21	Vitrified Clay	10	295.69	281	0.006	742.01	1.24	43.87
167	27	21	Vitrified Clay	8	87.78	203	0.07	1,439.95	1.96	32.85
168	28	18	Vitrified Clay	10	507.54	292	0.039	1,942.10	2.52	35.17
169	24	20	PVC	8	209.51	85	0.051	1,589.46	2.97	44.25
170	21	20	Vitrified Clay	10	383.47	5	0.014	1,163.50	1.64	46.98

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
171	20	18	Vitrified Clay	10	593	61	0.013	1,140.10	1.93	51.18
172	18	17	HDPE	12	1,100.56	62	0.024	3,189.89	3.14	40.66
173	17	16	PVC	12	1,100.58	58	0.019	2,888.62	2.93	43.17
174	36	37	Vitrified Clay	8	475.66	56	0.03	936.57	2.65	50.45
175	37	38	Vitrified Clay	8	477.27	123	0.087	1,601.85	3.83	48.88
176	38	39	Vitrified Clay	8	508.8	120	0.019	750.84	2.27	60.34
177	39	4859	Vitrified Clay	8	508.85	168	0.02	766.99	2.26	85.8
181	14	13	HDPE	12	1,620.69	103	0.016	2,590.81	2.86	57.31
182	13	12	HDPE	12	1,620.71	53	0.004	1,244.61	1.7	97.15
187	42	43	PVC	10	26.8	79	0.034	2,354.50	1.35	25.9
188	43	44	PVC	12	26.81	15	0.036	3,944.08	1.3	5.9
189	44	206	Vitrified Clay	12	26.83	60	0.001	619.29	0.36	14.17
207	171	172	Vitrified Clay	12	441.03	286	0.003	931.22	1.59	48.42
208	106	105	Vitrified Clay	18	3,439.46	294	0.009	4,347.35	2.08	74.11
209	4859	16	Vitrified Clay	8	508.91	250	0.005	400.01	1.39	100
210	16	-15	HDPE	12	1,619.04	310	0.019	2,887.12	3.25	56.64
211	-15	14	HDPE	12	1,619.08	122	0.011	2,154.02	2.56	64.73
214	201	OF-2		12	642.33	55	18.539	68,848.67	15.96	6.81
225	92	93	Vitrified Clay	10	(N/A)	11	-0.028	-1,650.77	(N/A)	(N/A)
227	63	OF-13		12	5,930.11	33	31.076	89,138.29	46.06	17.47
230	12	OF-16	PVC	12	1,620.73	42	24.648	103,200.59	37.08	8.73
231	206	OF-17		12	26.83	31	33.319	92,299.11	12.27	1.35
232	96	MH-A	PVC	12	228.52	23	0.002	969.21	1.01	35.84
233	MH-A	93	Vitrified Clay	10	228.52	80	0.007	807.89	1.27	39.56
234	213	212	Vitrified Clay	6	0.03	133	0.022	369.29	0.35	3.01
235	212	211	Vitrified Clay	6	0.08	168	0.017	333.14	0.38	1.24
236	211	210	Vitrified Clay	6	0.15	266	0.02	353.45	0.5	1.58
237	210	209	Vitrified Clay	6	0.23	308	0.018	341.98	0.56	1.97
238	209	208	Vitrified Clay	6	0.31	315	0.018	339.65	0.61	2.29
239	208	142	Vitrified Clay	6	0.32	32	0.016	321.02	0.59	9.19

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
EXISTING CONDITIONS
MANHOLES
Dry Loading Conditions (ADF)

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
12	1,047.50	1,035.20	12.3	0.05	0%
13	1,049.17	1,035.39	13.78	0.46	3%
14	1,050.05	1,039.40	10.65	0.31	3%
15	1,050.27	1,040.77	9.5	0.34	4%
16	1,053.84	1,046.80	7.04	0.29	4%
17	1,055.24	1,048.02	7.22	0.24	3%
18	1,062.44	1,049.50	12.94	0.23	2%
20	1,066.79	1,050.43	16.36	0.24	1%
21	1,066.88	1,050.50	16.38	0.19	1%
22	1,062.12	1,052.10	10.02	0.21	2%
23	1,064.79	1,058.79	6	0.12	2%
24	1,065.77	1,054.75	11.02	0.1	1%
27	1,073.01	1,064.84	8.17	0.07	1%
28	1,072.55	1,061.00	11.55	0.17	1%
29	1,073.36	1,065.20	8.16	0.25	3%
30	1,073.98	1,065.74	8.24	0.38	5%
31	1,074.32	1,062.00	12.32	0.22	2%
32	1,085.85	1,064.40	21.45	0.19	1%
33	1,087.27	1,065.74	21.53	0.19	1%
34	1,085.46	1,082.00	3.46	0	0%
35	1,088.02	1,066.17	21.85	0.28	1%
36	1,075.50	1,068.81	6.69	0.19	3%
37	1,074.79	1,065.43	9.36	0.14	1%
38	1,067.85	1,054.70	13.15	0.22	2%
39	1,064.32	1,052.34	11.98	0.21	2%
42	1,057.17	1,050.31	6.86	0.04	1%
43	1,054.63	1,047.63	7	0.35	5%
44	1,054.35	1,033.00	21.35	0.08	0%
45	1,085.53	1,074.73	10.8	0.12	1%
48	1,073.42	1,065.01	8.41	0.12	1%
49	1,072.27	1,057.79	14.48	0.24	2%
50	1,069.24	1,054.53	14.71	0.52	4%
51	1,066.78	1,051.41	15.37	0.2	1%
52	1,066.56	1,049.80	16.76	0.22	1%
53	1,064.07	1,047.80	16.27	0.22	1%
54	1,048.84	1,044.10	4.74	0.17	4%
55	1,049.09	1,042.42	6.67	0.2	3%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
56	1,041.54	1,035.39	6.15	0.27	4%
57	1,039.71	1,034.79	4.92	0.26	5%
58	1,042.94	1,038.02	4.92	0.17	3%
59	1,036.14	1,031.30	4.84	0.25	5%
60	1,033.63	1,027.73	5.9	0.28	5%
61	1,034.31	1,025.99	8.32	0.8	10%
62	1,034.69	1,026.00	8.69	0.01	0%
63	1,033.81	1,025.51	8.3	0.1	1%
64	1,033.89	1,025.80	8.09	0.21	3%
65	1,033.68	1,025.22	8.46	0.01	0%
66	1,032.59	1,024.80	7.79	0.01	0%
67	1,032.23	1,026.70	5.53	0.28	5%
68	1,032.11	1,025.38	6.73	0.27	4%
69	1,031.43	1,023.20	8.23	0.01	0%
70	1,030.43	1,022.03	8.4	0.02	0%
71	1,029.87	1,021.50	8.37	0.25	3%
84	1,035.09	1,029.00	6.09	0.13	2%
85	1,034.40	1,026.19	8.21	1.43	17%
86	1,037.59	1,031.70	5.89	0.2	3%
87	1,037.34	1,033.43	3.91	0.2	5%
88	1,039.22	1,034.34	4.88	0.46	9%
89	1,043.54	1,036.40	7.14	0.29	4%
90	1,042.54	1,036.59	5.95	0.29	5%
91	1,043.83	1,037.30	6.53	0.09	1%
92	1,045.52	1,038.65	6.87	0.1	1%
93	1,044.81	1,037.89	6.92	0.24	3%
96	1,046.46	1,038.46	8	0.22	3%
97	1,051.00	1,038.65	12.35	0.27	2%
99	1,046.22	1,039.02	7.2	0.23	3%
100	1,046.79	1,037.39	9.4	0.3	3%
101	1,046.94	1,039.44	7.5	0.18	2%
102	1,049.17	1,040.67	8.5	0.23	3%
103	1,049.75	1,042.65	7.1	0.11	2%
104	1,049.35	1,040.61	8.74	0.33	4%
105	1,042.77	1,033.79	8.98	0.66	7%
106	1,045.16	1,036.40	8.76	0.53	6%
107	1,047.14	1,038.32	8.82	0.04	0%
108	1,044.60	1,037.20	7.4	0.39	5%
109	1,051.03	1,043.54	7.49	0.19	3%
110	1,056.82	1,049.84	6.98	0.18	3%
111	1,066.24	1,055.55	10.69	0.22	2%
112	1,068.86	1,056.21	12.65	0.06	0%
113	1,045.32	1,033.46	11.86	0.67	6%
114	1,044.80	1,036.11	8.69	0.33	4%
115	1,042.69	1,034.70	7.99	0.45	6%
116	1,045.66	1,031.84	13.82	0.69	5%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
117	1,042.38	1,033.70	8.68	0.37	4%
118	1,044.91	1,030.33	14.58	0.71	5%
119	1,041.58	1,029.40	12.18	0.64	5%
120	1,040.26	1,032.00	8.26	0.36	4%
121	1,038.04	1,030.30	7.74	0.18	2%
122	1,037.57	1,027.34	10.23	0.68	7%
123	1,037.23	1,027.71	9.52	0.89	9%
124	1,037.37	1,030.30	7.07	0.1	1%
125	1,038.73	1,033.71	5.02	0.07	1%
126	1,040.30	1,035.10	5.2	0.06	1%
127	1,039.31	1,030.93	8.38	0.14	2%
128	1,057.63	1,047.41	10.22	0.08	1%
129	1,065.85	1,050.40	15.45	0.12	1%
130	1,070.18	1,052.20	17.98	0.12	1%
131	1,066.29	1,054.30	11.99	0.08	1%
132	1,067.02	1,061.02	6	0.05	1%
133	1,069.81	1,059.41	10.4	0.18	2%
134	1,066.54	1,057.56	8.98	0.17	2%
135	1,068.52	1,063.92	4.6	0.06	1%
136	1,067.95	1,055.04	12.91	0.18	1%
137	1,065.60	1,059.05	6.55	0.09	1%
138	1,063.12	1,056.00	7.12	0.1	1%
139	1,061.01	1,050.80	10.21	0.14	1%
140	1,052.05	1,039.19	12.86	0.52	4%
141	1,052.10	1,039.67	12.43	0.13	1%
142	1,053.09	1,048.61	4.48	0.1	2%
144	1,055.49	1,041.95	13.54	0.57	4%
145	1,053.76	1,042.36	11.4	0.56	5%
146	1,060.55	1,049.93	10.62	0.13	1%
147	1,061.46	1,049.11	12.35	0.12	1%
148	1,059.28	1,048.13	11.15	0.13	1%
149	1,055.96	1,047.21	8.75	0.13	1%
150	1,052.13	1,046.85	5.28	0.28	5%
151	1,053.10	1,046.50	6.6	0.34	5%
152	1,051.23	1,044.91	6.32	0.3	5%
153	1,054.62	1,045.98	8.64	0.45	5%
154	1,056.41	1,047.60	8.81	0.55	6%
155	1,059.68	1,048.50	11.18	0.76	7%
156	1,063.95	1,049.18	14.77	0.67	5%
157	1,059.56	1,050.27	9.29	0.28	3%
158	1,067.94	1,051.14	16.8	0.27	2%
159	1,068.33	1,054.71	13.62	0	0%
160	1,067.34	1,063.35	3.99	0.09	2%
161	1,067.76	1,061.36	6.4	0.27	4%
162	1,069.89	1,060.73	9.16	0.43	5%
163	1,069.31	1,060.59	8.72	0.4	5%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
164	1,068.49	1,060.23	8.26	0.76	9%
165	1,071.10	1,060.18	10.92	0.26	2%
166	1,070.95	1,059.88	11.07	0.34	3%
167	1,065.95	1,059.44	6.51	0.3	5%
168	1,065.39	1,059.14	6.25	0.36	6%
169	1,065.04	1,058.42	6.62	0.26	4%
170	1,065.28	1,057.58	7.7	0.37	5%
171	1,058.33	1,049.82	8.51	0.31	4%
172	1,058.35	1,048.58	9.77	0.27	3%
173	1,056.86	1,048.29	8.57	0.28	3%
174	1,073.66	1,064.89	8.77	0.16	2%
175	1,082.93	1,070.06	12.87	0.14	1%
176	1,081.99	1,073.96	8.03	0.02	0%
177	1,083.10	1,070.93	12.17	0.21	2%
178	1,084.42	1,073.70	10.72	0.16	1%
179	1,079.17	1,073.92	5.25	0.05	1%
185	1,102.94	1,095.96	6.98	0.36	5%
186	1,104.47	1,095.82	8.65	0.03	0%
187	1,106.18	1,094.98	11.2	0.23	2%
188	1,108.83	1,100.50	8.33	0.08	1%
189	1,107.32	1,100.85	6.47	0.18	3%
190	1,109.79	1,094.74	15.05	0.18	1%
191	1,109.42	1,094.46	14.96	0.15	1%
192	1,106.34	1,092.95	13.39	0.11	1%
193	1,099.12	1,086.24	12.88	0.13	1%
194	1,096.05	1,084.95	11.1	0.11	1%
195	1,094.70	1,081.84	12.86	0.11	1%
196	1,094.72	1,076.27	18.45	0.14	1%
197	1,087.42	1,074.07	13.35	0.2	1%
198	1,029.74	1,021.08	8.66	0.02	0%
199	1,029.22	1,020.21	9.01	0.41	5%
200	1,029.54	1,019.61	9.93	1.01	10%
201	1,029.71	1,019.65	10.06	0.04	0%
206	1,043.54	1,032.89	10.65	0.01	0%
208	1,053.47	1,049.22	4.25	0.01	0%
209	1,067.37	1,055.15	12.22	0.01	0%
210	1,073.75	1,065.40	8.35	0.01	0%
211	1,077.63	1,070.77	6.86	0.01	0%
212	1,081.60	1,073.82	7.78	0.01	0%
213	1,081.42	1,076.66	4.76	0	0%
1613	1,074.04	1,068.04	6	0.01	0%
1634	1,076.04	1,070.04	6	0.02	0%
1650	1,084.21	1,078.21	6	0.02	0%
1689	1,102.87	1,099.00	3.87	0.02	1%
4859	1,061.24	1,048.30	12.94	0.3	2%
MH-A	1,045.52	1,038.41	7.11	0.27	4%

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
EXISTING CONDITIONS
MANHOLES
Wet Loading Conditions (PF=3.0)

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
12	1,047.50	1,035.20	12.3	0.09	1%
13	1,049.17	1,035.39	13.78	1.04	8%
14	1,050.05	1,039.40	10.65	0.57	5%
15	1,050.27	1,040.77	9.5	0.65	7%
16	1,053.84	1,046.80	7.04	0.54	8%
17	1,055.24	1,048.02	7.22	0.43	6%
18	1,062.44	1,049.50	12.94	0.41	3%
20	1,066.79	1,050.43	16.36	0.43	3%
21	1,066.88	1,050.50	16.38	0.36	2%
22	1,062.12	1,052.10	10.02	0.37	4%
23	1,064.79	1,058.79	6	0.2	3%
24	1,065.77	1,054.75	11.02	0.16	1%
27	1,073.01	1,064.84	8.17	0.11	1%
28	1,072.55	1,061.00	11.55	0.29	3%
29	1,073.36	1,065.20	8.16	0.34	4%
30	1,073.98	1,065.74	8.24	0.46	6%
31	1,074.32	1,062.00	12.32	0.39	3%
32	1,085.85	1,064.40	21.45	0.33	2%
33	1,087.27	1,065.74	21.53	0.33	2%
34	1,085.46	1,082.00	3.46	0	0%
35	1,088.02	1,066.17	21.85	0.54	2%
36	1,075.50	1,068.81	6.69	0.34	5%
37	1,074.79	1,065.43	9.36	0.25	3%
38	1,067.85	1,054.70	13.15	0.4	3%
39	1,064.32	1,052.34	11.98	0.4	3%
42	1,057.17	1,050.31	6.86	0.06	1%
43	1,054.63	1,047.63	7	0.37	5%
44	1,054.35	1,033.00	21.35	0.14	1%
45	1,085.53	1,074.73	10.8	0.22	2%
48	1,073.42	1,065.01	8.41	0.21	2%
49	1,072.27	1,057.79	14.48	0.48	3%
50	1,069.24	1,054.53	14.71	0.71	5%
51	1,066.78	1,051.41	15.37	0.37	2%
52	1,066.56	1,049.80	16.76	1.17	7%
53	1,064.07	1,047.80	16.27	0.43	3%
54	1,048.84	1,044.10	4.74	0.31	7%
55	1,049.09	1,042.42	6.67	0.36	5%
56	1,041.54	1,035.39	6.15	0.67	11%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
57	1,039.71	1,034.79	4.92	0.51	10%
58	1,042.94	1,038.02	4.92	0.31	6%
59	1,036.14	1,031.30	4.84	0.49	10%
60	1,033.63	1,027.73	5.9	0.52	9%
61	1,034.31	1,025.99	8.32	1.62	19%
62	1,034.69	1,026.00	8.69	0.01	0%
63	1,033.81	1,025.51	8.3	0.17	2%
64	1,033.89	1,025.80	8.09	0.21	3%
65	1,033.68	1,025.22	8.46	0.01	0%
66	1,032.59	1,024.80	7.79	0.01	0%
67	1,032.23	1,026.70	5.53	0.51	9%
68	1,032.11	1,025.38	6.73	0.48	7%
69	1,031.43	1,023.20	8.23	0.01	0%
70	1,030.43	1,022.03	8.4	0.02	0%
71	1,029.87	1,021.50	8.37	0.44	5%
84	1,035.09	1,029.00	6.09	0.23	4%
85	1,034.40	1,026.19	8.21	1.9	23%
86	1,037.59	1,031.70	5.89	0.36	6%
87	1,037.34	1,033.43	3.91	0.35	9%
88	1,039.22	1,034.34	4.88	0.64	13%
89	1,043.54	1,036.40	7.14	0.55	8%
90	1,042.54	1,036.59	5.95	0.51	9%
91	1,043.83	1,037.30	6.53	0.19	3%
92	1,045.52	1,038.65	6.87	0.2	3%
93	1,044.81	1,037.89	6.92	0.42	6%
96	1,046.46	1,038.46	8	0.33	4%
97	1,051.00	1,038.65	12.35	0.44	4%
99	1,046.22	1,039.02	7.2	0.41	6%
100	1,046.79	1,037.39	9.4	0.53	6%
101	1,046.94	1,039.44	7.5	0.29	4%
102	1,049.17	1,040.67	8.5	0.44	5%
103	1,049.75	1,042.65	7.1	0.19	3%
104	1,049.35	1,040.61	8.74	0.57	7%
105	1,042.77	1,033.79	8.98	1.33	15%
106	1,045.16	1,036.40	8.76	1.01	12%
107	1,047.14	1,038.32	8.82	6.28	71%
108	1,044.60	1,037.20	7.4	7.4	100%
109	1,051.03	1,043.54	7.49	2.65	35%
110	1,056.82	1,049.84	6.98	0.32	5%
111	1,066.24	1,055.55	10.69	0.41	4%
112	1,068.86	1,056.21	12.65	0.11	1%
113	1,045.32	1,033.46	11.86	1.33	11%
114	1,044.80	1,036.11	8.69	8.69	100%
115	1,042.69	1,034.70	7.99	7.72	97%
116	1,045.66	1,031.84	13.82	1.54	11%
117	1,042.38	1,033.70	8.68	6.43	74%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
118	1,044.91	1,030.33	14.58	1.61	11%
119	1,041.58	1,029.40	12.18	1.25	10%
120	1,040.26	1,032.00	8.26	3.53	43%
121	1,038.04	1,030.30	7.74	0.33	4%
122	1,037.57	1,027.34	10.23	1.26	12%
123	1,037.23	1,027.71	9.52	1.62	17%
124	1,037.37	1,030.30	7.07	0.17	2%
125	1,038.73	1,033.71	5.02	0.13	3%
126	1,040.30	1,035.10	5.2	0.11	2%
127	1,039.31	1,030.93	8.38	0.25	3%
128	1,057.63	1,047.41	10.22	0.14	1%
129	1,065.85	1,050.40	15.45	0.2	1%
130	1,070.18	1,052.20	17.98	0.21	1%
131	1,066.29	1,054.30	11.99	0.14	1%
132	1,067.02	1,061.02	6	0.09	2%
133	1,069.81	1,059.41	10.4	0.32	3%
134	1,066.54	1,057.56	8.98	0.3	3%
135	1,068.52	1,063.92	4.6	0.1	2%
136	1,067.95	1,055.04	12.91	0.31	2%
137	1,065.60	1,059.05	6.55	0.15	2%
138	1,063.12	1,056.00	7.12	0.17	2%
139	1,061.01	1,050.80	10.21	0.24	2%
140	1,052.05	1,039.19	12.86	0.99	8%
141	1,052.10	1,039.67	12.43	0.51	4%
142	1,053.09	1,048.61	4.48	0.17	4%
144	1,055.49	1,041.95	13.54	1.12	8%
145	1,053.76	1,042.36	11.4	1.34	12%
146	1,060.55	1,049.93	10.62	0.23	2%
147	1,061.46	1,049.11	12.35	0.21	2%
148	1,059.28	1,048.13	11.15	0.22	2%
149	1,055.96	1,047.21	8.75	0.22	3%
150	1,052.13	1,046.85	5.28	0.43	8%
151	1,053.10	1,046.50	6.6	0.51	8%
152	1,051.23	1,044.91	6.32	0.48	8%
153	1,054.62	1,045.98	8.64	0.86	10%
154	1,056.41	1,047.60	8.81	1.73	20%
155	1,059.68	1,048.50	11.18	2.73	24%
156	1,063.95	1,049.18	14.77	3.96	27%
157	1,059.56	1,050.27	9.29	2.96	32%
158	1,067.94	1,051.14	16.8	2.16	13%
159	1,068.33	1,054.71	13.62	0	0%
160	1,067.34	1,063.35	3.99	0.15	4%
161	1,067.76	1,061.36	6.4	0.41	6%
162	1,069.89	1,060.73	9.16	0.71	8%
163	1,069.31	1,060.59	8.72	0.48	6%
164	1,068.49	1,060.23	8.26	0.84	10%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
165	1,071.10	1,060.18	10.92	0.4	4%
166	1,070.95	1,059.88	11.07	0.53	5%
167	1,065.95	1,059.44	6.51	0.46	7%
168	1,065.39	1,059.14	6.25	0.58	9%
169	1,065.04	1,058.42	6.62	0.41	6%
170	1,065.28	1,057.58	7.7	0.48	6%
171	1,058.33	1,049.82	8.51	0.48	6%
172	1,058.35	1,048.58	9.77	0.42	4%
173	1,056.86	1,048.29	8.57	0.43	5%
174	1,073.66	1,064.89	8.77	0.23	3%
175	1,082.93	1,070.06	12.87	0.19	1%
176	1,081.99	1,073.96	8.03	0.04	0%
177	1,083.10	1,070.93	12.17	0.3	2%
178	1,084.42	1,073.70	10.72	0.22	2%
179	1,079.17	1,073.92	5.25	0.09	2%
185	1,102.94	1,095.96	6.98	0.36	5%
186	1,104.47	1,095.82	8.65	0.06	1%
187	1,106.18	1,094.98	11.2	0.25	2%
188	1,108.83	1,100.50	8.33	0.08	1%
189	1,107.32	1,100.85	6.47	0.18	3%
190	1,109.79	1,094.74	15.05	0.2	1%
191	1,109.42	1,094.46	14.96	0.17	1%
192	1,106.34	1,092.95	13.39	0.13	1%
193	1,099.12	1,086.24	12.88	0.17	1%
194	1,096.05	1,084.95	11.1	0.14	1%
195	1,094.70	1,081.84	12.86	0.14	1%
196	1,094.72	1,076.27	18.45	0.18	1%
197	1,087.42	1,074.07	13.35	0.28	2%
198	1,029.74	1,021.08	8.66	0.02	0%
199	1,029.22	1,020.21	9.01	0.51	6%
200	1,029.54	1,019.61	9.93	1.11	11%
201	1,029.71	1,019.65	10.06	0.07	1%
206	1,043.54	1,032.89	10.65	0.01	0%
208	1,053.47	1,049.22	4.25	0.01	0%
209	1,067.37	1,055.15	12.22	0.01	0%
210	1,073.75	1,065.40	8.35	0.01	0%
211	1,077.63	1,070.77	6.86	0.01	0%
212	1,081.60	1,073.82	7.78	0.01	0%
213	1,081.42	1,076.66	4.76	0	0%
1613	1,074.04	1,068.04	6	0.01	0%
1634	1,076.04	1,070.04	6	0.03	1%
1650	1,084.21	1,078.21	6	0.04	1%
1689	1,102.87	1,099.00	3.87	0.03	1%
4859	1,061.24	1,048.30	12.94	1.43	11%
MH-A	1,045.52	1,038.41	7.11	0.38	5%

Kansas State Univ. - Master Plan
Project & Phasing Plan

Date: 15 October 2012

Building Name, Use Type as Gross Area as Provided by Kansas State University				Building Average Daily Flow Calculations (BG Consultants, Inc.)							
Project Name	**Use / Type**	**Approx. Total GSF**	**Map Reference**	**Space Factor**	**Approx. Total NSF**	**SQ FT Per Unit**	**Units**	**GPDPU**	**GPD**	**ADF (GPM)**	**Loading MH**
PLANNED											
College of Business Administration - New Building	Academic	120,000	W	1.5	80,000	20	4,000	10	40000	67	60
General Classroom Building (North of Waters Hall)	Academic	66,000	Q	1.5	44,000	20	2,200	10	22000	37	101
College of Veterinary Medicine Master Plan	Academic/Research										
Coles 1		58,500	J	1.5	39,000						
Teaching & Student Center		18,500	J	1.5	12,333						
Coles 2		69,500	J	1.5	46,333						
KS VDL		78,000	J	1.5	52,000						
Collaborative Lab		27,000	J	1.5	18,000						
Equine Center		17,000	J	1.5	11,333						
Clinic		12,500	J	1.5	8,333						
LARC Addition		15,500	J	1.5	10,333						
		296,500			197,667	20	9,883	10	98833	165	212
Cardwell Hall Expansion	Academic	16,200	L	1.5	10,800	20	540	10	5400	9	135
International Student Center Expansion	Student Life	13,000	S	1.54	8,442	100	84	85	7175	12	106
Kramer Complex	Student Life	256,500	D	1.54	166,558	100	1,666	85	141575	236	City Main
Dining Center Renovation/Expansion or Replacement											
New Residence Hall(s)											
College of Engineering Complex - Phase IV	Academic	80,000	G	1.5	53,333	20	2,667	10	26667	44	33
Indoor Rowing Facility	Athletics	10,000	A	1.5	6,667	100	67	10	667	1	79
TOTAL GSF - Planned New Construction		**858,200**			**567,467**						
MASTER PLAN PROPOSED											
K-State Union Additions	Student Life		I								
East		20,000		1.54	12,987	100	130	10	1299	2	
Southwest		36,000		1.54	23,377	100	234	10	2338	4	
Southeast		33,000		1.54	21,429	100	214	10	2143	4	
		89,000								10	16
Seaton Hall Additions	Academic		H								
East Wing		75,000		1.5	50,000	20	2,500	10	25000	42	134
		75,000									
North of College of Engineering Complex (Lot A-28)	Academic/Research		F								
South		88,000		1.5	58,667	20	2,933	10	29333	49	
East		112,000		1.5	74,667	20	3,733	10	37333	62	

Project Name	Use / Type	Approx. Total GSF	Map Reference	Space Factor	Approx. Total NSF	SQ FT Per Unit	Units	GPDPU	GPD	ADF (GPM)	Loading MH
North		88,000		1.5	58,667	20	2,933	10	29333	49	
		288,000								160	45
Ackert Hall Addition	Academic	76,000	E	1.5	50,667	20	2,533	10	25333	42	133
North of Dickens Hall	Academic	100,000	U	1.5	66,667	20	3,333	10	33333	56	88
East of Justin Hall	Academic	66,000	V	1.5	44,000	20	2,200	10	22000	37	61
Performing Arts - New Building (Lot A-2)	Performing Arts	64,400	X	1.39	46,331	100	463	10	4633	8	199
North of Performing Arts - New Bldg (Lot A-2)	Academic	37,500		1.5	25,000	20	1,250	10	12500	21	199
North of Waters Hall (Lot A-17)	Academic/Research		P								
Bldg 1		60,000		1.5	40,000	20	2,000	10	20000	33	
Bldg 2		38,000		1.5	25,333	20	1,267	10	12667	21	
Bldg 3		88,000		1.5	58,667	20	2,933	10	29333	49	
		186,000								103	138
Northwest of Waters Hall (Lot A-18)	Academic/Research	88,000	P	1.5	58,667	20	2,933	10	29333	49	138
Mid-Campus Drive Infill	Academic/Research		K								
Dole Hall Addition		60,000		1.5	40,000	20	2,000	10	20000	33	
North of Umburger Hall - New Bldg		68,000		1.5	45,333	20	2,267	10	22667	38	
		128,000								71	151
SW of Weber Hall Site Infill	Academic/Research	96,000	O	1.5	64,000	20	3,200	10	32000	53	213
Parking Garage (East of Weber Hall)	Structured Parking	384,000	R								
1,200 cars at 320 gsf/space											
North of Parking Garage	Academic/Research	50,000		1.5	33,333	20	1,667	10	16667	28	213
North of Weber Hall (Lot B-16/17)	Collaborative Research		N								
Bldg 1		164,000		1.75	93,714	20	4,686	10	46857	78	
Bldg 2		88,000		1.75	50,286	20	2,514	10	25143	42	
		252,000								120	212
North of Realigned Jardine Drive (Lot B-18)	Collaborative Research		M								
Bldg 1		172,000		1.75	98,286	20	4,914	10	49143	82	
Bldg 2		140,000		1.75	80,000	20	4,000	10	40000	67	
Bldg 3		96,000		1.75	54,857	20	2,743	10	27429	46	
Bldg 4		76,000		1.75	43,429	20	2,171	10	21714	36	
Bldg 5		108,000		1.75	61,714	20	3,086	10	30857	51	
		592,000								282	212
Peters Athletic Center Additions	Athletics/Rec		B								
Natatorium (West)		45,000		1.39	32,374	100	324	10	3237	5	
East		18,000		1.39	12,950	100	129	10	1295	2	
		63,000								8	176
New Tennis Center	Athletics/Rec	7,000		1.39	5,036	20	252	10	2518	4	176
Derby Complex	Student Life	217,000	T	1.54	140,909	100	1,409	85	119773	200	132
Dining Renovation and Expansion											

Project Name	Use / Type	Approx. Total GSF	Map Reference	Space Factor	Approx. Total NSF	SQ FT Per Unit	Units	GPDPU	GPD	ADF (GPM)	Loading MH
New Residence Hall(s)											
Facilities Expansion on Claflin Road (West of College Ave)	Support		C								
TOTAL GSF - Proposed Master Plan Footprints		**2,547,400**									

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
PROPOSED CONDITIONS
SEWER PIPES
Dry Loading Condtions (ADF)

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
12	1689	185	PVC	8	1.31	54	0.038	1,370.36	0.63	2.33
13	185	186	PVC	8	1.33	81	0	-78.34	0	52.58
14	186	187	PVC	8	3.31	97	0.008	636.28	0.53	15.8
15	189	188	PVC	12	70.03	66	0.002	1,023.49	1.66	17.71
16	188	187	PVC	12	72.66	54	0.094	6,363.16	6	7.51
17	187	190	PVC	12	78.54	133	0.001	698.09	1.27	22.65
18	190	191	PVC	12	78.52	85	0.003	1,081.31	1.73	18.24
19	191	192	PVC	12	81.2	204	0.007	1,684.74	2.37	14.94
20	192	193	PVC	12	83.84	209	0.024	3,240.81	3.74	11.08
21	193	194	PVC	12	96.91	78	0.015	2,524.04	3.16	13.38
22	194	195	PVC	12	102.14	93	0.032	3,714.77	4.15	11.41
23	195	196	PVC	12	102.16	155	0.033	3,770.63	4.19	11.33
24	196	197	PVC	12	117.83	110	0.019	2,899.38	3.5	14.1
25	197	178	PVC	12	117.79	86	0.004	1,287.66	1.98	20.44
26	178	177	PVC	12	117.79	286	0.009	2,019.73	2.72	16.39
27	177	175	PVC	12	128.07	191	0.004	1,285.11	1.98	21.32
28	175	174	PVC	12	144.25	187	0.025	3,281.46	3.82	14.31
29	174	161	PVC	12	146.89	291	0.011	2,227.01	2.92	17.4
30	160	161	PVC	10	49.37	57	0.028	2,135.04	1.52	10.5
31	1634	174	PVC	8	2.63	48	0.107	2,302.67	1.27	12.06
32	176	175	PVC	8	22.6	145	0.011	740.62	0.89	11.97
33	1650	177	PVC	8	10.47	21	0.345	4,142.64	2.7	15.59
35	161	162	PVC	12	190.78	184	0.003	1,050.59	1.73	29.45
36	162	163	PVC	12	196.73	105	0	453.61	0.95	46.03
37	163	164	PVC	12	196.59	57	0.005	1,532.99	2.25	56.59
38	164	165	PVC	12	196.55	43	-0.003	-1,142.96	0.21	70.39
39	165	166	PVC	12	196.54	55	0.003	1,155.68	1.84	27.88
40	166	167	PVC	12	196.62	251	0.001	694.28	1.28	36.42
41	167	168	PVC	12	202.4	111	0.002	925.43	1.56	31.77
42	168	169	PVC	12	202.34	42	0.001	641.50	1.21	38.61
43	179	169	Vitrified Clay	6	10.54	366	0.038	493.05	1.12	10.11
44	1613	169	Vitrified Clay	8	0.08	316	0.024	839.42	0.43	0.81
45	169	170	Vitrified Clay	12	210.46	135	0.006	1,261.32	1.95	32.72
46	170	171	Vitrified Clay	12	211.82	564	0.014	1,858.61	2.56	22.79
49	172	173	Vitrified Clay	12	212.89	51	0.006	1,205.77	1.88	28.73
51	173	150	Vitrified Clay	12	225.18	245	0.006	1,225.88	1.91	29.12
52	150	151	Vitrified Clay	12	225.03	61	0.006	1,211.21	1.89	36.44
53	151	152	Vitrified Clay	10	349.23	241	0.007	793.67	2.08	46.42
54	152	104	Vitrified Clay	10	349.44	693	0.006	756.36	2	49.27
55	146	147	Vitrified Clay	8	35.03	132	0.006	416.9	0.69	19.6
56	147	148	Vitrified Clay	8	35.06	104	0.008	496.04	0.71	18
57	148	149	Vitrified Clay	8	37.89	112	0.008	491.54	0.7	18.76

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
58	149	103	Vitrified Clay	8	38.03	516	0.008	495.09	0.69	18.76
59	133	134	Vitrified Clay	8	153.16	150	0.009	523.95	1.26	37.02
60	134	136	Vitrified Clay	8	226.72	210	0.011	557.62	1.43	44.36
61	135	137	Vitrified Clay	8	37.65	94	0.051	1,222.99	1.46	12.02
62	137	138	Vitrified Clay	8	37.72	272	0.011	562.89	0.85	22.75
63	136	139	Vitrified Clay	8	226.83	432	0.009	527.71	1.3	45.79
64	138	103	Vitrified Clay	8	411.98	425	0.031	951.81	2.54	45.98
65	103	104	Vitrified Clay	10	450.02	23	0.051	2,217.84	2.73	30.55
66	104	101	Vitrified Clay	10	799.38	120	0.008	879.52	2.33	74.8
67	139	101	Vitrified Clay	8	226.94	418	0.027	885.78	1.6	34.55
68	101	100	Vitrified Clay	10	1,091.01	11	0.135	3,606.91	6.41	37.72
69	100	105	Vitrified Clay	10	1,091.05	135	0.018	1,308.38	3.15	69.8
70	105	113	Vitrified Clay	20	3,383.73	63	0.005	4,518.92	2.11	64.59
71	159	158	Vitrified Clay	8	0.04	135	0.025	850.5	0.36	1.58
72	158	157	Vitrified Clay	15	179.69	208	0.004	1,786.73	0.88	21.41
73	157	156	Vitrified Clay	15	179.82	268	0.003	1,623.12	0.75	28.18
74	156	155	Vitrified Clay	15	891.83	224	0.003	1,573.71	1.26	56.57
75	155	154	Vitrified Clay	15	891.94	224	0.002	1,299.45	1.02	60.85
76	154	153	Vitrified Clay	15	892.06	250	0.006	2,260.63	1.38	43.67
77	153	145	Vitrified Clay	15	892.2	277	0.013	3,272.85	1.67	36.56
78	145	144	Vitrified Clay	15	892.24	73	0.006	2,172.74	1.2	45.01
79	144	140	Vitrified Clay	18	1,089.54	427	0.006	3,585.61	1.36	37.81
80	142	141	Vitrified Clay	8	1,191.77	167	0.05	1,211.99	3.79	80.49
81	141	140	Vitrified Clay	10	1,191.77	11	0.013	1,109.35	2.24	94.47
83	140	106	Vitrified Clay	18	2,281.48	292	0.009	4,431.46	2.03	50.86
84	107	108	Vitrified Clay	8	3.2	198	0.006	407.90	0.35	32.44
87	112	111	Vitrified Clay	8	16.23	26	0.023	830.72	1.01	17.05
88	111	110	Vitrified Clay	8	202.52	214	0.025	865.50	1.98	32.91
89	110	109	Vitrified Clay	8	202.49	101	0.061	1,337.21	2.54	26.3
90	109	108	Vitrified Clay	8	202.5	127	0.044	1,132.73	2.23	28.6
91	108	114	Vitrified Clay	8	205.73	202	0.004	345.55	0.96	55.56
92	113	116	Vitrified Clay	20	3,395.24	289	0.005	4,528.15	2.11	64.62
93	114	115	Vitrified Clay	8	205.68	233	0.006	421.9	1.02	58.23
94	115	117	Vitrified Clay	8	205.71	177	0.005	401.49	0.91	50.72
95	117	120	Vitrified Clay	8	205.79	356	0.004	352.04	0.78	54.93
96	116	118	Vitrified Clay	20	3,395.42	284	0.005	4,256.73	1.97	67.51
97	118	119	Vitrified Clay	20	3,395.53	221	0.004	4,050.36	1.86	70.08
98	132	131	Vitrified Clay	8	104.67	123	0.054	1,258.20	2.4	19.51
99	131	130	Vitrified Clay	8	104.57	209	0.01	529.21	1.28	30.15
100	130	129	Vitrified Clay	8	120.34	223	0.007	456.51	1.14	35.07
101	129	128	Vitrified Clay	8	119.74	250	0.008	493.50	1.11	33.52
102	126	125	Vitrified Clay	10	23.03	32	0.04	1,958.97	1.33	7.63
103	125	124	Vitrified Clay	10	23.04	79	0.02	1,403.79	1.04	8.92
104	127	124	Vitrified Clay	12	141.73	104	0.006	1,244.53	0.9	22.79
105	128	127	Vitrified Clay	12	142.17	305	0.054	3,708.99	2.02	14.58
106	124	123	Vitrified Clay	12	164.29	21	0.051	3,626.22	1.99	14.5
107	123	122	Vitrified Clay	24	3,523.31	74	0.001	3,914.52	1.24	74.17
108	119	123	Vitrified Clay	20	3,395.66	263	0.006	4,870.01	2.08	72.54
109	120	121	Vitrified Clay	8	205.81	350	0.005	366.69	0.68	53.58

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
110	121	122	Vitrified Clay	8	205.8	13	0.054	1,258.50	1.43	27.37
111	102	99	Vitrified Clay	8	110.99	148	0.006	434.52	1	34.49
112	99	97	PVC	15	135.75	167	0.002	1,774.04	0.77	20.27
113	97	96	PVC	15	135.79	89	0.003	1,957.19	0.75	17.83
115	96	92	PVC	15	(N/A)	95	0.003	1,894.37	(N/A)	(N/A)
116	92	91	Vitrified Clay	8	25.46	134	0.009	502.42	0.46	15.31
117	91	90	Vitrified Clay	8	25.47	61	0.011	580.98	0.49	28.07
119	93	90	Vitrified Clay	10	116.37	195	0.004	653.03	0.72	28.55
121	90	89	PVC	15	224.13	74	0.003	1,909.78	0.85	23.14
122	89	88	Vitrified Clay	10	236.46	231	0.009	928.6	1.15	47.47
123	88	87	Vitrified Clay	10	(N/A)	147	0.009	914	(N/A)	(N/A)
124	87	86	Vitrified Clay	10	167.28	167	0.009	941.21	1.07	28.52
125	86	84	Vitrified Clay	10	167.34	165	0.008	905.78	0.99	29.13
126	88	84	Vitrified Clay	8	167.35	459	0.012	582.78	1.2	36.65
127	122	85	Vitrified Clay	24	3,728.97	207	0.005	7,196.64	1.9	64.52
128	84	85	Vitrified Clay	12	334.69	10	0.148	6,151.52	2.99	24.91
129	85	61	Vitrified Clay	24	4,063.46	64	0	-2,198.21	0.09	80.18
130	61	63	Vitrified Clay	24	4,128.21	20	0.003	6,006.65	1.69	60.9
131	62	64	Vitrified Clay	12	0.01	20	0.01	1,599.01	0.13	10.5
132	64	65	Vitrified Clay	12	0.05	96	0.008	1,432.06	0.22	0.5
133	65	66	Vitrified Clay	12	0.09	108	0.001	533	0.14	1.03
134	48	49	Vitrified Clay	8	172.91	37	0.181	2,309.59	3.63	18.48
135	49	50	Vitrified Clay	8	172.98	258	0.012	602.11	1.43	51.25
136	50	51	Vitrified Clay	8	175.29	152	0.019	752.99	1.54	32.83
137	51	52	PVC	8	187.56	50	0.018	951.16	1.81	30.11
138	52	53	PVC	6	187.57	77	0.021	471.91	1.97	43.8
139	53	54	PVC	8	191.31	229	0.012	779.61	1.55	33.71
140	54	55	PVC	8	203.57	44	0.038	1,377.67	2.27	27.67
141	55	58	Vitrified Clay	8	203.6	105	0.04	1,084.69	1.91	29.37
142	58	56	PVC	8	203.6	31	0.039	1,398.68	2.24	25.78
143	56	57	PVC	8	203.62	73	0.007	577.64	1.2	40.97
144	57	59	Vitrified Clay	8	203.67	196	0.015	655.13	1.29	38.26
145	59	60	Vitrified Clay	8	210.9	187	0.017	707.24	1.33	37.43
146	60	67	Vitrified Clay	10	328.19	117	0.008	876.7	1.24	42.38
147	67	68	Vitrified Clay	12	328.27	199	0.006	1,241.70	1.08	35.1
148	66	69	Vitrified Clay	12	0.19	270	0.005	1,092.33	0.28	1.11
149	69	70	Vitrified Clay	12	0.29	247	0.004	965.22	0.3	1.38
150	68	71	Vitrified Clay	12	331.62	528	0.007	1,370.72	1.09	33.52
151	70	198	Concrete	12	0.39	253	0.004	979.83	0.33	1.66
152	71	199	Vitrified Clay	15	331.72	192	0.007	2,376.41	0.85	30.71
153	199	200	Vitrified Clay	15	382.49	39	0.017	3,771.53	1.32	57.78
154	198	201	Vitrified Clay	12	0.49	256	0.004	974.08	0.36	1.74
155	201	200	Vitrified Clay	18	382.49	6	-0.007	-3,849.31	0.01	62.8
157	45	35	Vitrified Clay	6	360.88	139	0.061	623.84	3.27	88.91
158	35	33	PVC	10	379.31	173	0.001	400.72	0.86	77.54
159	34	33	PVC	8	0.03	103	0.021	1,025.72	0.37	0.42
160	33	32	Vitrified Clay	10	456.38	131	0.008	905.16	1.5	50.23
161	32	31	Vitrified Clay	10	464.68	223	0.01	994.3	1.57	48.05
162	31	28	Vitrified Clay	10	464.74	191	0.005	711.52	1.17	58.92

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
163	30	29	Vitrified Clay	8	29.26	122	0.007	439.18	0.68	27.65
164	29	27	Vitrified Clay	8	29.28	79	0.005	400.12	0.59	18.33
165	23	22	Vitrified Clay	8	98.55	90	0.074	1,478.65	2.27	24.13
166	22	21	Vitrified Clay	10	98.64	281	0.006	742.01	0.88	24.63
167	27	21	Vitrified Clay	8	29.33	203	0.07	1,439.95	1.41	16.69
168	28	18	Vitrified Clay	10	526.44	292	0.039	1,942.10	2.39	35.58
169	24	20	PVC	8	69.86	85	0.051	1,589.46	2.14	24.75
170	21	20	Vitrified Clay	10	127.97	5	0.014	1,163.50	1.13	25.3
171	20	18	Vitrified Clay	10	197.85	61	0.013	1,140.10	1.34	28.2
172	18	17	HDPE	12	724.31	62	0.024	3,189.89	2.57	32.38
173	17	16	PVC	12	724.33	58	0.019	2,888.62	2.38	34.14
174	36	37	Vitrified Clay	8	158.56	56	0.03	936.57	1.89	27.82
175	37	38	Vitrified Clay	8	159.12	123	0.087	1,601.85	2.73	26.79
176	38	39	Vitrified Clay	8	169.65	120	0.019	750.84	1.61	32.29
177	39	4859	Vitrified Clay	8	169.7	168	0.02	766.99	1.59	32
181	14	13	HDPE	12	915.44	103	0.016	2,590.81	2.27	41.07
182	13	12	HDPE	12	915.46	53	0.004	1,244.61	1.34	63.77
187	42	43	PVC	10	8.95	79	0.034	2,354.50	0.96	22.96
188	43	44	PVC	12	8.96	15	0.036	3,944.08	0.96	3.53
189	44	206	Vitrified Clay	12	8.98	60	0.001	619.29	0.26	8.39
207	171	172	Vitrified Clay	12	212.94	286	0.003	931.22	1.57	32.5
208	106	105	Vitrified Clay	18	2,294.18	294	0.009	4,347.35	1.92	58.01
209	4859	16	Vitrified Clay	8	169.76	250	0.005	400.01	0.98	45.46
210	16	-15	HDPE	12	914.84	310	0.019	2,887.12	2.59	39.59
211	-15	14	HDPE	12	914.88	122	0.011	2,154.02	2.03	45.48
214	201	OF-2		12	382.98	55	18.539	68,848.67	15.64	5.36
225	92	93	Vitrified Clay	10	(N/A)	11	-0.028	-1,650.77	(N/A)	(N/A)
227	63	OF-13		12	4,128.20	33	31.076	89,138.29	44.17	14.65
230	12	OF-16	PVC	12	915.48	42	24.648	########	27.76	6.65
231	206	OF-17		12	8.98	31	33.319	92,299.11	9.52	0.81
232	96	MH-A	PVC	12	92.9	23	0.002	969.21	0.69	24.59
233	MH-A	93	Vitrified Clay	10	92.9	80	0.007	807.89	0.87	22.91
234	213	212	Vitrified Clay	6	141.78	133	0.022	369.29	1.71	100
235	212	211	Vitrified Clay	6	1,134.08	168	0.017	333.14	2.91	100
236	211	210	Vitrified Clay	6	1,134.15	266	0.02	353.45	3	100
237	210	209	Vitrified Clay	6	1,134.23	308	0.018	341.98	2.88	100
238	209	208	Vitrified Clay	6	1,134.31	315	0.018	339.65	2.78	100
239	208	142	Vitrified Clay	6	1,134.32	32	0.016	321.02	2.6	100

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
PROPOSED CONDITIONS
SEWER PIPES
Wet Loading Conditions PDF (PF=3)

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
12	1689	185	PVC	8	3.9	54	0.038	1,370.36	0.78	3.92
13	185	186	PVC	8	3.92	81	0	-78.34	0	53.9
14	186	187	PVC	8	10.4	97	0.008	636.28	0.7	19.5
15	189	188	PVC	12	70.03	66	0.002	1,023.49	1.66	17.71
16	188	187	PVC	12	77.9	54	0.094	6,363.16	6.01	7.77
17	187	190	PVC	12	96.16	133	0.001	698.09	1.28	25.07
18	190	191	PVC	12	96.05	85	0.003	1,081.31	1.74	20.14
19	191	192	PVC	12	103.91	204	0.007	1,684.74	2.38	16.83
20	192	193	PVC	12	111.69	209	0.024	3,240.81	3.77	12.7
21	193	194	PVC	12	150.84	78	0.015	2,524.04	3.21	16.57
22	194	195	PVC	12	166.47	93	0.032	3,714.77	4.22	14.42
23	195	196	PVC	12	166.43	155	0.033	3,770.63	4.26	14.33
24	196	197	PVC	12	213.39	110	0.019	2,899.38	3.6	19.95
25	197	178	PVC	12	213.23	86	0.004	1,287.66	2.03	27.53
26	178	177	PVC	12	213.06	286	0.009	2,019.73	2.78	22.22
27	177	175	PVC	12	243.86	191	0.004	1,285.11	2.03	29.52
28	175	174	PVC	12	291.86	187	0.025	3,281.46	3.94	20.15
29	174	161	PVC	12	299.58	291	0.011	2,227.01	3	24.87
30	160	161	PVC	10	148.07	57	0.028	2,135.04	2.12	17.83
31	1634	174	PVC	8	7.86	48	0.107	2,302.67	1.63	18.44
32	176	175	PVC	8	67.73	145	0.011	740.62	1.25	20.43
33	1650	177	PVC	8	31.40	21	0.345	4,142.64	3.74	23
35	161	162	PVC	12	431.19	184	0.003	1,050.59	1.81	54.87
36	162	163	PVC	12	449.18	105	0	453.61	0.99	81.09
37	163	164	PVC	12	448.93	57	0.005	1,532.99	2.33	65.5
38	164	165	PVC	12	448.85	43	-0.003	-1,142.96	0.24	78.5
39	165	166	PVC	12	448.59	55	0.003	1,155.68	1.89	44.37
40	166	167	PVC	12	448.55	251	0.001	694.28	1.32	58.51
41	167	168	PVC	12	465.90	111	0.002	925.43	1.61	52.7
42	168	169	PVC	12	465.91	42	0.001	641.50	1.24	63.22
43	179	169	Vitrified Clay	6	31.46	366	0.038	493.05	1.55	17.12
44	1613	169	Vitrified Clay	8	0.08	316	0.024	839.42	0.43	0.81
45	169	170	Vitrified Clay	12	490.02	135	0.006	1,261.32	2.01	46.72
46	170	171	Vitrified Clay	12	493.73	564	0.014	1,858.61	2.63	100
49	172	173	Vitrified Clay	12	496.72	51	0.006	1,205.77	1.91	100
51	173	150	Vitrified Clay	12	533.56	245	0.006	1,225.88	1.94	100
52	150	151	Vitrified Clay	12	533.25	61	0.006	1,211.21	1.92	100
53	151	152	Vitrified Clay	10	905.98	241	0.007	793.67	2.2	100
54	152	104	Vitrified Clay	10	906.13	693	0.006	756.36	2.1	100
55	146	147	Vitrified Clay	8	105.03	132	0.006	416.9	0.96	85.72
56	147	148	Vitrified Clay	8	105.06	104	0.008	496.04	1.01	100
57	148	149	Vitrified Clay	8	113.49	112	0.008	491.54	1	100
58	149	103	Vitrified Clay	8	113.63	516	0.008	495.09	0.97	100
59	133	134	Vitrified Clay	8	459.41	150	0.009	523.95	1.74	100

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
60	134	136	Vitrified Clay	8	679.97	210	0.011	557.62	2	100
61	135	137	Vitrified Clay	8	112.90	94	0.051	1,222.99	2.06	100
62	137	138	Vitrified Clay	8	112.97	272	0.011	562.89	1.18	100
63	136	139	Vitrified Clay	8	680.08	432	0.009	527.71	1.84	100
64	138	103	Vitrified Clay	8	1,235.53	425	0.031	951.81	3.53	100
65	103	104	Vitrified Clay	10	1,349.17	23	0.051	2,217.84	3.9	100
66	104	101	Vitrified Clay	10	2,254.80	120	0.008	879.52	2.63	100
67	139	101	Vitrified Clay	8	680.19	418	0.027	885.78	2.37	100
68	101	100	Vitrified Clay	10	3,129.12	11	0.135	3,606.91	7.48	100
69	100	105	Vitrified Clay	10	3,129.16	135	0.018	1,308.38	3.65	100
70	105	113	Vitrified Clay	20	10,004.79	63	0.005	4,518.92	2.76	100
71	159	158	Vitrified Clay	8	0.04	135	0.025	850.5	0.36	100
72	158	157	Vitrified Clay	15	538.79	208	0.004	1,786.73	1.23	100
73	157	156	Vitrified Clay	15	538.92	268	0.003	1,623.12	1.07	100
74	156	155	Vitrified Clay	15	2,674.73	224	0.003	1,573.71	1.76	100
75	155	154	Vitrified Clay	15	2,674.84	224	0.002	1,299.45	1.46	100
76	154	153	Vitrified Clay	15	2,674.96	250	0.006	2,260.63	2.03	100
77	153	145	Vitrified Clay	15	2,675.10	277	0.013	3,272.85	2.52	100
78	145	144	Vitrified Clay	15	2,675.14	73	0.006	2,172.74	1.82	100
79	144	140	Vitrified Clay	18	3,266.54	427	0.006	3,585.61	1.99	100
80	142	141	Vitrified Clay	8	3,574.57	167	0.05	1,211.99	5.58	100
81	141	140	Vitrified Clay	10	3,574.57	11	0.013	1,109.35	3.33	100
83	140	106	Vitrified Clay	18	6,841.28	292	0.009	4,431.46	3.04	100
84	107	108	Vitrified Clay	8	9.5	198	0.006	407.90	0.47	100
87	112	111	Vitrified Clay	8	48.66	26	0.023	830.72	1.43	34.49
88	111	110	Vitrified Clay	8	607.44	214	0.025	865.50	2.74	61.77
89	110	109	Vitrified Clay	8	607.34	101	0.061	1,337.21	3.61	100
90	109	108	Vitrified Clay	8	607.33	127	0.044	1,132.73	3.18	100
91	108	114	Vitrified Clay	8	616.82	202	0.004	345.55	1.36	100
92	113	116	Vitrified Clay	20	10,040.16	289	0.005	4,528.15	2.76	100
93	114	115	Vitrified Clay	8	616.66	233	0.006	421.90	1.48	100
94	115	117	Vitrified Clay	8	616.44	177	0.005	401.49	1.33	100
95	117	120	Vitrified Clay	8	616.53	356	0.004	352.04	1.15	100
96	116	118	Vitrified Clay	20	10,040.31	284	0.005	4,256.73	2.58	100
97	118	119	Vitrified Clay	20	10,040.39	221	0.004	4,050.36	2.43	100
98	132	131	Vitrified Clay	8	313.95	123	0.054	1,258.20	3.36	37.24
99	131	130	Vitrified Clay	8	313.66	209	0.01	529.21	1.8	55.4
100	130	129	Vitrified Clay	8	361.25	223	0.007	456.51	1.62	67.15
101	129	128	Vitrified Clay	8	359.82	250	0.008	493.5	1.6	63.39
102	126	125	Vitrified Clay	10	69.07	32	0.04	1,958.97	1.87	12.84
103	125	124	Vitrified Clay	10	69.06	79	0.02	1,403.79	1.46	16.6
104	127	124	Vitrified Clay	12	426.32	104	0.006	1,244.53	1.34	100
105	128	127	Vitrified Clay	12	427.43	305	0.054	3,708.99	2.97	75.79
106	124	123	Vitrified Clay	12	494.43	21	0.051	3,626.22	2.95	100
107	123	122	Vitrified Clay	24	10,427.27	74	0.001	3,914.52	1.63	100
108	119	123	Vitrified Clay	20	10,040.49	263	0.006	4,870.01	2.72	100
109	120	121	Vitrified Clay	8	616.55	350	0.005	366.69	1.06	100
110	121	122	Vitrified Clay	8	616.38	13	0.054	1,258.50	2.21	100
111	102	99	Vitrified Clay	8	332.89	148	0.006	434.52	1.39	65.58
112	99	97	PVC	15	407	167	0.002	1,774.04	1.08	33.75
113	97	96	PVC	15	407.04	89	0.003	1,957.19	1.09	30.95

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
115	96	92	PVC	15	(N/A)	95	0.003	1,894.37	(N/A)	(N/A)
116	92	91	Vitrified Clay	8	99.22	134	0.009	502.42	0.64	30.14
117	91	90	Vitrified Clay	8	99.24	61	0.011	580.98	0.68	51.63
119	93	90	Vitrified Clay	10	325.76	195	0.004	653.03	1.07	49.92
121	90	89	PVC	15	671.78	74	0.003	1,909.78	1.21	42.28
122	89	88	Vitrified Clay	10	708.61	231	0.009	928.60	1.66	76.89
123	88	87	Vitrified Clay	10	(N/A)	147	0.009	914.00	(N/A)	(N/A)
124	87	86	Vitrified Clay	10	501.36	167	0.009	941.21	1.54	51.91
125	86	84	Vitrified Clay	10	501.41	165	0.008	905.78	1.44	53.13
126	88	84	Vitrified Clay	8	501.42	459	0.012	582.78	1.72	71.47
127	122	85	Vitrified Clay	24	11,043.61	207	0.005	7,196.64	2.5	100
128	84	85	Vitrified Clay	12	1,002.84	10	0.148	6,151.52	4.41	88.82
129	85	61	Vitrified Clay	24	12,045.85	64	0	-2,198.21	0.21	100
130	61	63	Vitrified Clay	24	12,239.88	20	0.003	6,006.65	2.23	100
131	62	64	Vitrified Clay	12	0.01	20	0.01	1,599.01	0.13	10.5
132	64	65	Vitrified Clay	12	0.05	96	0.008	1,432.06	0.22	0.5
133	65	66	Vitrified Clay	12	0.09	108	0.001	533.00	0.14	1.03
134	48	49	Vitrified Clay	8	518.71	37	0.181	2,309.59	5.14	32.18
135	49	50	Vitrified Clay	8	518.78	258	0.012	602.11	1.99	83.04
136	50	51	Vitrified Clay	8	525.64	152	0.019	752.99	2.21	61.54
137	51	52	PVC	8	562.41	50	0.018	951.16	2.6	62.66
138	52	53	PVC	6	562.42	77	0.021	471.91	2.81	100
139	53	54	PVC	8	573.51	229	0.012	779.61	2.25	63.78
140	54	55	PVC	8	610.27	44	0.038	1,377.67	3.3	50.13
141	55	58	Vitrified Clay	8	610.3	105	0.04	1,084.69	2.78	53.66
142	58	56	PVC	8	610.3	31	0.039	1,398.68	3.28	46.19
143	56	57	PVC	8	610.32	73	0.007	577.64	1.76	95.47
144	57	59	Vitrified Clay	8	610.37	196	0.015	655.13	1.9	76.43
145	59	60	Vitrified Clay	8	631.95	187	0.017	707.24	1.97	81.76
146	60	67	Vitrified Clay	10	983.74	117	0.008	876.70	1.78	100
147	67	68	Vitrified Clay	12	983.82	199	0.006	1,241.70	1.54	67.16
148	66	69	Vitrified Clay	12	0.19	270	0.005	1,092.33	0.28	1.11
149	69	70	Vitrified Clay	12	0.29	247	0.004	965.22	0.3	1.38
150	68	71	Vitrified Clay	12	993.47	528	0.007	1,370.72	1.59	63.13
151	70	198	Concrete	12	0.39	253	0.004	979.83	0.33	1.66
152	71	199	Vitrified Clay	15	993.57	192	0.007	2,376.41	1.31	46.01
153	199	200	Vitrified Clay	15	1,145.84	39	0.017	3,771.53	1.94	68.5
154	198	201	Vitrified Clay	12	0.49	256	0.004	974.08	0.36	1.74
155	201	200	Vitrified Clay	18	1,145.84	6	-0.007	-3,849.31	0.03	71.63
157	45	35	Vitrified Clay	6	1,082.58	139	0.061	623.84	4.52	100
158	35	33	PVC	10	1,137.76	173	0.001	400.72	1.19	100
159	34	33	PVC	8	0.03	103	0.021	1,025.72	0.37	0.42
160	33	32	Vitrified Clay	10	1,368.83	131	0.008	905.16	2.16	100
161	32	31	Vitrified Clay	10	1,393.58	223	0.01	994.30	2.27	100
162	31	28	Vitrified Clay	10	1,393.64	191	0.005	711.52	1.72	100
163	30	29	Vitrified Clay	8	87.71	122	0.007	439.18	0.93	40.82
164	29	27	Vitrified Clay	8	87.73	79	0.005	400.12	0.83	31.84
165	23	22	Vitrified Clay	8	295.60	90	0.074	1,478.65	3.14	42.58
166	22	21	Vitrified Clay	10	295.69	281	0.006	742.01	1.24	43.87
167	27	21	Vitrified Clay	8	87.78	203	0.07	1,439.95	1.96	32.85
168	28	18	Vitrified Clay	10	1,578.54	292	0.039	1,942.10	3.55	68.43

Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
169	24	20	PVC	8	209.51	85	0.051	1,589.46	2.97	44.25
170	21	20	Vitrified Clay	10	383.47	5	0.014	1,163.50	1.64	46.98
171	20	18	Vitrified Clay	10	593	61	0.013	1,140.10	1.93	55.3
172	18	17	PVC	12	2,171.56	62	0.024	3,189.89	3.81	61.63
173	17	16	PVC	12	2,171.58	58	0.019	2,888.62	3.53	92.07
174	36	37	Vitrified Clay	8	475.66	56	0.03	936.57	2.65	50.45
175	37	38	Vitrified Clay	8	477.27	123	0.087	1,601.85	3.83	48.88
176	38	39	Vitrified Clay	8	508.80	120	0.019	750.84	2.27	60.34
177	39	4859	Vitrified Clay	8	508.85	168	0.02	766.99	2.26	100
181	14	13	PVC	12	2,744.19	103	0.016	2,590.81	3.36	100
182	13	12	PVC	12	2,744.21	53	0.004	1,244.61	1.99	100
187	42	43	PVC	10	26.8	79	0.034	2,354.50	1.35	25.9
188	43	44	PVC	12	26.81	15	0.036	3,944.08	1.3	5.9
189	44	206	Vitrified Clay	12	26.83	60	0.001	619.29	0.36	14.17
207	171	172	Vitrified Clay	12	497.21	286	0.003	931.22	1.6	100
208	106	105	Vitrified Clay	18	6,879.04	294	0.009	4,347.35	2.9	100
209	4859	16	Vitrified Clay	8	508.91	250	0.005	400.01	1.39	100
210	16	-15	PVC	12	2,742.54	310	0.019	2,887.12	3.79	100
211	-15	14	PVC	12	2,742.58	122	0.011	2,154.02	2.99	100
214	201	OF-2		12	1,146.33	55	18.539	68,848.67	22.6	8.98
225	92	93	Vitrified Clay	10	(N/A)	11	-0.028	-1,650.77	(N/A)	(N/A)
227	63	OF-13		12	12,239.81	33	31.076	89,138.29	57.9	25.03
230	12	OF-16	PVC	12	2,744.23	42	24.648	103,200.59	42.57	11.23
231	206	OF-17		12	26.83	31	33.319	92,299.11	12.27	1.35
232	96	MH-A	PVC	12	228.52	23	0.002	969.21	1.01	35.84
233	MH-A	93	Vitrified Clay	10	228.52	80	0.007	807.89	1.27	39.56
234	213	212	Vitrified Clay	6	425.28	133	0.022	369.29	2.37	100
235	212	211	Vitrified Clay	6	3,402.08	168	0.017	333.14	3.92	100
236	211	210	Vitrified Clay	6	3,402.15	266	0.02	353.45	4.08	100
237	210	209	Vitrified Clay	6	3,402.23	308	0.018	341.98	3.96	100
238	209	208	Vitrified Clay	6	3,402.31	315	0.018	339.65	3.9	100
239	208	142	Vitrified Clay	6	3,402.32	32	0.016	321.02	3.72	100

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
PROPOSED CONDITIONS
MANHOLES
Dry Loading Conditions ADF

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
12	1,047.50	1,035.20	12.3	0.07	1%
13	1,049.17	1,035.39	13.78	0.64	5%
14	1,050.05	1,039.40	10.65	0.41	4%
15	1,050.27	1,040.77	9.5	0.45	5%
16	1,053.84	1,046.80	7.04	0.39	6%
17	1,055.24	1,048.02	7.22	0.34	5%
18	1,062.44	1,049.50	12.94	0.32	2%
20	1,066.79	1,050.43	16.36	0.24	1%
21	1,066.88	1,050.50	16.38	0.19	1%
22	1,062.12	1,052.10	10.02	0.21	2%
23	1,064.79	1,058.79	6	0.12	2%
24	1,065.77	1,054.75	11.02	0.1	1%
27	1,073.01	1,064.84	8.17	0.07	1%
28	1,072.55	1,061.00	11.55	0.3	3%
29	1,073.36	1,065.20	8.16	0.25	3%
30	1,073.98	1,065.74	8.24	0.38	5%
31	1,074.32	1,062.00	12.32	0.49	4%
32	1,085.85	1,064.40	21.45	0.4	2%
33	1,087.27	1,065.74	21.53	0.42	2%
34	1,085.46	1,082.00	3.46	0	0%
35	1,088.02	1,066.17	21.85	0.65	3%
36	1,075.50	1,068.81	6.69	0.19	3%
37	1,074.79	1,065.43	9.36	0.14	1%
38	1,067.85	1,054.70	13.15	0.22	2%
39	1,064.32	1,052.34	11.98	0.21	2%
42	1,057.17	1,050.31	6.86	0.04	1%
43	1,054.63	1,047.63	7	0.35	5%
44	1,054.35	1,033.00	21.35	0.08	0%
45	1,085.53	1,074.73	10.8	0.27	3%
48	1,073.42	1,065.01	8.41	0.12	1%
49	1,072.27	1,057.79	14.48	0.24	2%
50	1,069.24	1,054.53	14.71	0.52	4%
51	1,066.78	1,051.41	15.37	0.2	1%
52	1,066.56	1,049.80	16.76	0.22	1%
53	1,064.07	1,047.80	16.27	0.22	1%
54	1,048.84	1,044.10	4.74	0.17	4%
55	1,049.09	1,042.42	6.67	0.2	3%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
56	1,041.54	1,035.39	6.15	0.27	4%
57	1,039.71	1,034.79	4.92	0.26	5%
58	1,042.94	1,038.02	4.92	0.17	3%
59	1,036.14	1,031.30	4.84	0.25	5%
60	1,033.63	1,027.73	5.9	0.35	6%
61	1,034.31	1,025.99	8.32	1.22	15%
62	1,034.69	1,026.00	8.69	0.01	0%
63	1,033.81	1,025.51	8.3	0.15	2%
64	1,033.89	1,025.80	8.09	0.21	3%
65	1,033.68	1,025.22	8.46	0.01	0%
66	1,032.59	1,024.80	7.79	0.01	0%
67	1,032.23	1,026.70	5.53	0.35	6%
68	1,032.11	1,025.38	6.73	0.34	5%
69	1,031.43	1,023.20	8.23	0.01	0%
70	1,030.43	1,022.03	8.4	0.02	0%
71	1,029.87	1,021.50	8.37	0.32	4%
84	1,035.09	1,029.00	6.09	0.16	3%
85	1,034.40	1,026.19	8.21	1.67	20%
86	1,037.59	1,031.70	5.89	0.24	4%
87	1,037.34	1,033.43	3.91	0.24	6%
88	1,039.22	1,034.34	4.88	0.5	10%
89	1,043.54	1,036.40	7.14	0.29	4%
90	1,042.54	1,036.59	5.95	0.29	5%
91	1,043.83	1,037.30	6.53	0.09	1%
92	1,045.52	1,038.65	6.87	0.1	1%
93	1,044.81	1,037.89	6.92	0.24	3%
96	1,046.46	1,038.46	8	0.22	3%
97	1,051.00	1,038.65	12.35	0.27	2%
99	1,046.22	1,039.02	7.2	0.23	3%
100	1,046.79	1,037.39	9.4	0.58	6%
101	1,046.94	1,039.44	7.5	0.31	4%
102	1,049.17	1,040.67	8.5	0.23	3%
103	1,049.75	1,042.65	7.1	0.25	4%
104	1,049.35	1,040.61	8.74	0.62	7%
105	1,042.77	1,033.79	8.98	1.08	12%
106	1,045.16	1,036.40	8.76	0.77	9%
107	1,047.14	1,038.32	8.82	0.04	0%
108	1,044.60	1,037.20	7.4	0.39	5%
109	1,051.03	1,043.54	7.49	0.19	3%
110	1,056.82	1,049.84	6.98	0.18	3%
111	1,066.24	1,055.55	10.69	0.22	2%
112	1,068.86	1,056.21	12.65	0.06	0%
113	1,045.32	1,033.46	11.86	1.08	9%
114	1,044.80	1,036.11	8.69	0.33	4%
115	1,042.69	1,034.70	7.99	0.45	6%
116	1,045.66	1,031.84	13.82	1.13	8%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
117	1,042.38	1,033.70	8.68	0.37	4%
118	1,044.91	1,030.33	14.58	1.17	8%
119	1,041.58	1,029.40	12.18	1.02	8%
120	1,040.26	1,032.00	8.26	0.36	4%
121	1,038.04	1,030.30	7.74	0.18	2%
122	1,037.57	1,027.34	10.23	1.02	10%
123	1,037.23	1,027.71	9.52	1.48	16%
124	1,037.37	1,030.30	7.07	0.14	2%
125	1,038.73	1,033.71	5.02	0.07	1%
126	1,040.30	1,035.10	5.2	0.06	1%
127	1,039.31	1,030.93	8.38	0.23	3%
128	1,057.63	1,047.41	10.22	0.13	1%
129	1,065.85	1,050.40	15.45	0.22	1%
130	1,070.18	1,052.20	17.98	0.23	1%
131	1,066.29	1,054.30	11.99	0.2	2%
132	1,067.02	1,061.02	6	0.13	2%
133	1,069.81	1,059.41	10.4	0.25	2%
134	1,066.54	1,057.56	8.98	0.3	3%
135	1,068.52	1,063.92	4.6	0.08	2%
136	1,067.95	1,055.04	12.91	0.31	2%
137	1,065.60	1,059.05	6.55	0.12	2%
138	1,063.12	1,056.00	7.12	0.31	4%
139	1,061.01	1,050.80	10.21	0.23	2%
140	1,052.05	1,039.19	12.86	0.76	6%
141	1,052.10	1,039.67	12.43	0.8	6%
142	1,053.09	1,048.61	4.48	0.54	12%
144	1,055.49	1,041.95	13.54	0.57	4%
145	1,053.76	1,042.36	11.4	0.56	5%
146	1,060.55	1,049.93	10.62	0.13	1%
147	1,061.46	1,049.11	12.35	0.12	1%
148	1,059.28	1,048.13	11.15	0.13	1%
149	1,055.96	1,047.21	8.75	0.13	1%
150	1,052.13	1,046.85	5.28	0.29	5%
151	1,053.10	1,046.50	6.6	0.44	7%
152	1,051.23	1,044.91	6.32	0.4	6%
153	1,054.62	1,045.98	8.64	0.45	5%
154	1,056.41	1,047.60	8.81	0.55	6%
155	1,059.68	1,048.50	11.18	0.76	7%
156	1,063.95	1,049.18	14.77	0.67	5%
157	1,059.56	1,050.27	9.29	0.28	3%
158	1,067.94	1,051.14	16.8	0.27	2%
159	1,068.33	1,054.71	13.62	0	0%
160	1,067.34	1,063.35	3.99	0.09	2%
161	1,067.76	1,061.36	6.4	0.29	5%
162	1,069.89	1,060.73	9.16	0.46	5%
163	1,069.31	1,060.59	8.72	0.41	5%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
164	1,068.49	1,060.23	8.26	0.77	9%
165	1,071.10	1,060.18	10.92	0.28	3%
166	1,070.95	1,059.88	11.07	0.36	3%
167	1,065.95	1,059.44	6.51	0.32	5%
168	1,065.39	1,059.14	6.25	0.39	6%
169	1,065.04	1,058.42	6.62	0.28	4%
170	1,065.28	1,057.58	7.7	0.38	5%
171	1,058.33	1,049.82	8.51	0.33	4%
172	1,058.35	1,048.58	9.77	0.28	3%
173	1,056.86	1,048.29	8.57	0.29	3%
174	1,073.66	1,064.89	8.77	0.17	2%
175	1,082.93	1,070.06	12.87	0.14	1%
176	1,081.99	1,073.96	8.03	0.08	1%
177	1,083.10	1,070.93	12.17	0.21	2%
178	1,084.42	1,073.70	10.72	0.16	1%
179	1,079.17	1,073.92	5.25	0.05	1%
185	1,102.94	1,095.96	6.98	0.36	5%
186	1,104.47	1,095.82	8.65	0.03	0%
187	1,106.18	1,094.98	11.2	0.23	2%
188	1,108.83	1,100.50	8.33	0.08	1%
189	1,107.32	1,100.85	6.47	0.18	3%
190	1,109.79	1,094.74	15.05	0.18	1%
191	1,109.42	1,094.46	14.96	0.15	1%
192	1,106.34	1,092.95	13.39	0.11	1%
193	1,099.12	1,086.24	12.88	0.13	1%
194	1,096.05	1,084.95	11.1	0.11	1%
195	1,094.70	1,081.84	12.86	0.11	1%
196	1,094.72	1,076.27	18.45	0.14	1%
197	1,087.42	1,074.07	13.35	0.2	1%
198	1,029.74	1,021.08	8.66	0.02	0%
199	1,029.22	1,020.21	9.01	0.45	5%
200	1,029.54	1,019.61	9.93	1.05	11%
201	1,029.71	1,019.65	10.06	0.05	0%
206	1,043.54	1,032.89	10.65	0.01	0%
208	1,053.47	1,049.22	4.25	4.25	100%
209	1,067.37	1,055.15	12.22	12.22	100%
210	1,073.75	1,065.40	8.35	8.35	100%
211	1,077.63	1,070.77	6.86	6.86	100%
212	1,081.60	1,073.82	7.78	7.78	100%
213	1,081.42	1,076.66	4.76	4.76	100%
1613	1,074.04	1,068.04	6	0.01	0%
1634	1,076.04	1,070.04	6	0.02	0%
1650	1,084.21	1,078.21	6	0.02	0%
1689	1,102.87	1,099.00	3.87	0.02	1%
4859	1,061.24	1,048.30	12.94	0.3	2%
MH-A	1,045.52	1,038.41	7.11	0.27	4%

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY

PROPOSED CONDITIONS

MANHOLES

Wet Loading Conditions PDF (PF=3.0)

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
12	1,047.50	1,035.20	12.3	0.11	1%
13	1,049.17	1,035.39	13.78	1.71	12%
14	1,050.05	1,039.40	10.65	1.17	11%
15	1,050.27	1,040.77	9.5	1.93	20%
16	1,053.84	1,046.80	7.04	1.29	18%
17	1,055.24	1,048.02	7.22	0.65	9%
18	1,062.44	1,049.50	12.94	0.61	5%
20	1,066.79	1,050.43	16.36	0.43	3%
21	1,066.88	1,050.50	16.38	0.36	2%
22	1,062.12	1,052.10	10.02	0.37	4%
23	1,064.79	1,058.79	6	0.2	3%
24	1,065.77	1,054.75	11.02	0.16	1%
27	1,073.01	1,064.84	8.17	0.11	1%
28	1,072.55	1,061.00	11.55	0.57	5%
29	1,073.36	1,065.20	8.16	0.34	4%
30	1,073.98	1,065.74	8.24	0.46	6%
31	1,074.32	1,062.00	12.32	3.63	29%
32	1,085.85	1,064.40	21.45	5.71	27%
33	1,087.27	1,065.74	21.53	6.91	32%
34	1,085.46	1,082.00	3.46	0	0%
35	1,088.02	1,066.17	21.85	7.85	36%
36	1,075.50	1,068.81	6.69	0.34	5%
37	1,074.79	1,065.43	9.36	0.25	3%
38	1,067.85	1,054.70	13.15	0.4	3%
39	1,064.32	1,052.34	11.98	0.4	3%
42	1,057.17	1,050.31	6.86	0.06	1%
43	1,054.63	1,047.63	7	0.37	5%
44	1,054.35	1,033.00	21.35	0.14	1%
45	1,085.53	1,074.73	10.8	10.8	100%
48	1,073.42	1,065.01	8.41	0.21	2%
49	1,072.27	1,057.79	14.48	0.48	3%
50	1,069.24	1,054.53	14.71	0.71	5%
51	1,066.78	1,051.41	15.37	0.37	2%
52	1,066.56	1,049.80	16.76	1.17	7%
53	1,064.07	1,047.80	16.27	0.43	3%
54	1,048.84	1,044.10	4.74	0.31	7%
55	1,049.09	1,042.42	6.67	0.36	5%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
56	1,041.54	1,035.39	6.15	0.67	11%
57	1,039.71	1,034.79	4.92	0.51	10%
58	1,042.94	1,038.02	4.92	0.31	6%
59	1,036.14	1,031.30	4.84	0.49	10%
60	1,033.63	1,027.73	5.9	0.99	17%
61	1,034.31	1,025.99	8.32	2.13	26%
62	1,034.69	1,026.00	8.69	0.01	0%
63	1,033.81	1,025.51	8.3	0.25	3%
64	1,033.89	1,025.80	8.09	0.21	3%
65	1,033.68	1,025.22	8.46	0.01	0%
66	1,032.59	1,024.80	7.79	0.01	0%
67	1,032.23	1,026.70	5.53	0.67	12%
68	1,032.11	1,025.38	6.73	0.63	9%
69	1,031.43	1,023.20	8.23	0.01	0%
70	1,030.43	1,022.03	8.4	0.02	0%
71	1,029.87	1,021.50	8.37	0.56	7%
84	1,035.09	1,029.00	6.09	0.27	4%
85	1,034.40	1,026.19	8.21	2.83	34%
86	1,037.59	1,031.70	5.89	0.44	7%
87	1,037.34	1,033.43	3.91	0.43	11%
88	1,039.22	1,034.34	4.88	0.74	15%
89	1,043.54	1,036.40	7.14	0.55	8%
90	1,042.54	1,036.59	5.95	0.51	9%
91	1,043.83	1,037.30	6.53	0.19	3%
92	1,045.52	1,038.65	6.87	0.2	3%
93	1,044.81	1,037.89	6.92	0.42	6%
96	1,046.46	1,038.46	8	0.33	4%
97	1,051.00	1,038.65	12.35	0.44	4%
99	1,046.22	1,039.02	7.2	0.41	6%
100	1,046.79	1,037.39	9.4	9.4	100%
101	1,046.94	1,039.44	7.5	7.5	100%
102	1,049.17	1,040.67	8.5	0.44	5%
103	1,049.75	1,042.65	7.1	7.1	100%
104	1,049.35	1,040.61	8.74	8.74	100%
105	1,042.77	1,033.79	8.98	8.98	100%
106	1,045.16	1,036.40	8.76	8.76	100%
107	1,047.14	1,038.32	8.82	6.28	71%
108	1,044.60	1,037.20	7.4	7.4	100%
109	1,051.03	1,043.54	7.49	2.65	35%
110	1,056.82	1,049.84	6.98	0.32	5%
111	1,066.24	1,055.55	10.69	0.41	4%
112	1,068.86	1,056.21	12.65	0.11	1%
113	1,045.32	1,033.46	11.86	11.86	100%
114	1,044.80	1,036.11	8.69	8.69	100%
115	1,042.69	1,034.70	7.99	7.99	100%
116	1,045.66	1,031.84	13.82	13.82	100%

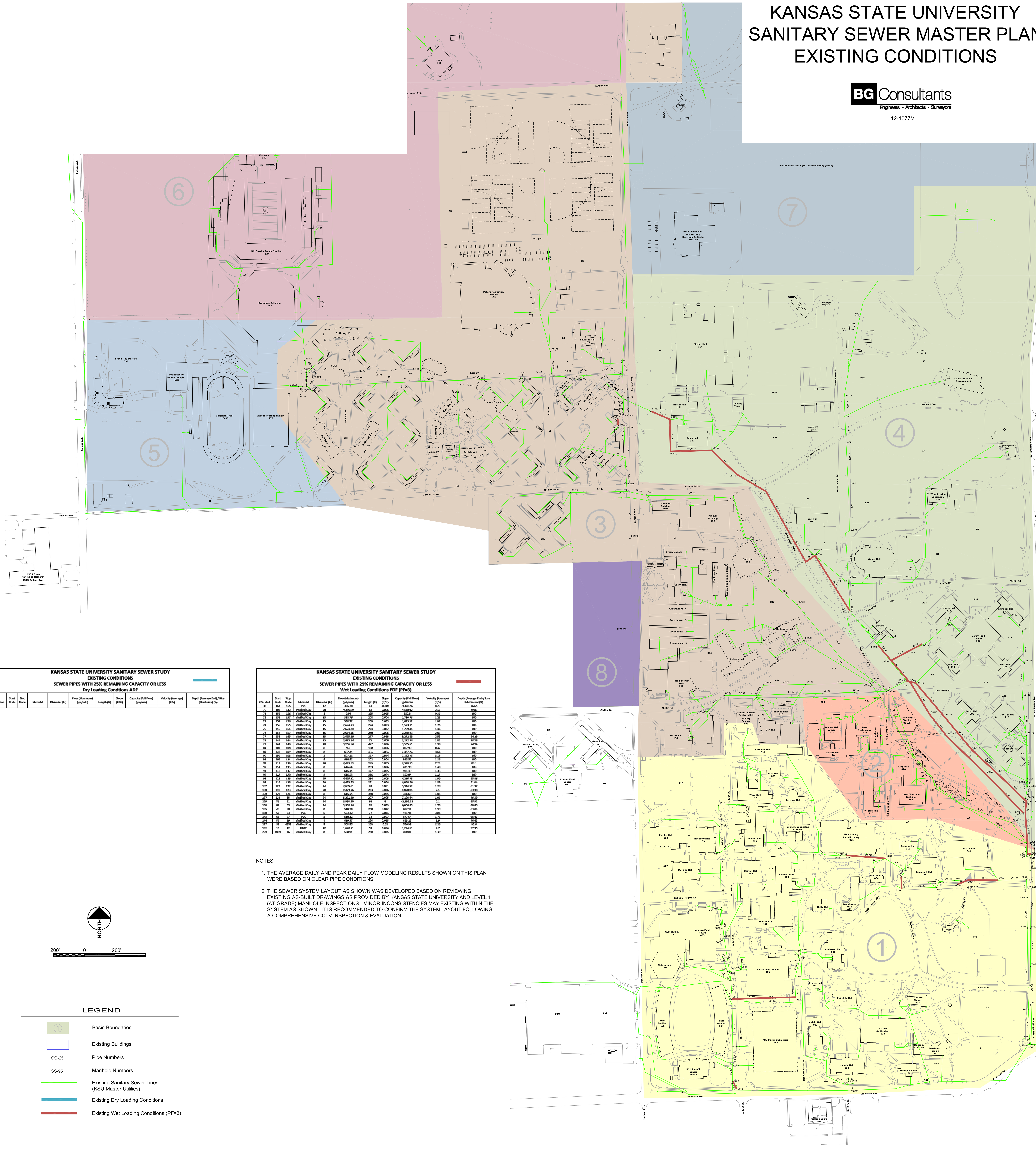
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
117	1,042.38	1,033.70	8.68	7.06	81%
118	1,044.91	1,030.33	14.58	14.43	99%
119	1,041.58	1,029.40	12.18	9.65	79%
120	1,040.26	1,032.00	8.26	4.16	50%
121	1,038.04	1,030.30	7.74	1.34	17%
122	1,037.57	1,027.34	10.23	4.13	40%
123	1,037.23	1,027.71	9.52	4.54	48%
124	1,037.37	1,030.30	7.07	1.97	28%
125	1,038.73	1,033.71	5.02	0.13	3%
126	1,040.30	1,035.10	5.2	0.11	2%
127	1,039.31	1,030.93	8.38	1.38	16%
128	1,057.63	1,047.41	10.22	0.23	2%
129	1,065.85	1,050.40	15.45	0.42	3%
130	1,070.18	1,052.20	17.98	0.45	3%
131	1,066.29	1,054.30	11.99	0.37	3%
132	1,067.02	1,061.02	6	0.23	4%
133	1,069.81	1,059.41	10.4	5.28	51%
134	1,066.54	1,057.56	8.98	6.05	67%
135	1,068.52	1,063.92	4.6	0.14	3%
136	1,067.95	1,055.04	12.91	5.27	41%
137	1,065.60	1,059.05	6.55	4.19	64%
138	1,063.12	1,056.00	7.12	7.12	100%
139	1,061.01	1,050.80	10.21	2.71	27%
140	1,052.05	1,039.19	12.86	12.12	94%
141	1,052.10	1,039.67	12.43	12.43	100%
142	1,053.09	1,048.61	4.48	4.48	100%
144	1,055.49	1,041.95	13.54	11.41	84%
145	1,053.76	1,042.36	11.4	11.4	100%
146	1,060.55	1,049.93	10.62	0.23	2%
147	1,061.46	1,049.11	12.35	0.95	8%
148	1,059.28	1,048.13	11.15	1.9	17%
149	1,055.96	1,047.21	8.75	2.77	32%
150	1,052.13	1,046.85	5.28	5.28	100%
151	1,053.10	1,046.50	6.6	6.6	100%
152	1,051.23	1,044.91	6.32	6.32	100%
153	1,054.62	1,045.98	8.64	8.64	100%
154	1,056.41	1,047.60	8.81	8.81	100%
155	1,059.68	1,048.50	11.18	9.82	88%
156	1,063.95	1,049.18	14.77	11.04	75%
157	1,059.56	1,050.27	9.29	9.29	100%
158	1,067.94	1,051.14	16.8	8.49	51%
159	1,068.33	1,054.71	13.62	4.92	36%
160	1,067.34	1,063.35	3.99	0.15	4%
161	1,067.76	1,061.36	6.4	0.45	7%
162	1,069.89	1,060.73	9.16	0.81	9%
163	1,069.31	1,060.59	8.72	0.5	6%

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Depth (Structure) (ft)	Depth (Maximum) (ft)	Surcharge %
164	1,068.49	1,060.23	8.26	0.86	10%
165	1,071.10	1,060.18	10.92	0.43	4%
166	1,070.95	1,059.88	11.07	0.59	5%
167	1,065.95	1,059.44	6.51	0.5	8%
168	1,065.39	1,059.14	6.25	0.63	10%
169	1,065.04	1,058.42	6.62	0.43	6%
170	1,065.28	1,057.58	7.7	0.5	6%
171	1,058.33	1,049.82	8.51	2.91	34%
172	1,058.35	1,048.58	9.77	3.87	40%
173	1,056.86	1,048.29	8.57	4.11	48%
174	1,073.66	1,064.89	8.77	0.25	3%
175	1,082.93	1,070.06	12.87	0.2	2%
176	1,081.99	1,073.96	8.03	0.14	2%
177	1,083.10	1,070.93	12.17	0.3	2%
178	1,084.42	1,073.70	10.72	0.22	2%
179	1,079.17	1,073.92	5.25	0.09	2%
185	1,102.94	1,095.96	6.98	0.36	5%
186	1,104.47	1,095.82	8.65	0.06	1%
187	1,106.18	1,094.98	11.2	0.25	2%
188	1,108.83	1,100.50	8.33	0.08	1%
189	1,107.32	1,100.85	6.47	0.18	3%
190	1,109.79	1,094.74	15.05	0.2	1%
191	1,109.42	1,094.46	14.96	0.17	1%
192	1,106.34	1,092.95	13.39	0.13	1%
193	1,099.12	1,086.24	12.88	0.17	1%
194	1,096.05	1,084.95	11.1	0.14	1%
195	1,094.70	1,081.84	12.86	0.14	1%
196	1,094.72	1,076.27	18.45	0.18	1%
197	1,087.42	1,074.07	13.35	0.28	2%
198	1,029.74	1,021.08	8.66	0.02	0%
199	1,029.22	1,020.21	9.01	0.59	7%
200	1,029.54	1,019.61	9.93	1.19	12%
201	1,029.71	1,019.65	10.06	0.09	1%
206	1,043.54	1,032.89	10.65	0.01	0%
208	1,053.47	1,049.22	4.25	4.25	100%
209	1,067.37	1,055.15	12.22	12.22	100%
210	1,073.75	1,065.40	8.35	8.35	100%
211	1,077.63	1,070.77	6.86	6.86	100%
212	1,081.60	1,073.82	7.78	7.78	100%
213	1,081.42	1,076.66	4.76	4.76	100%
1613	1,074.04	1,068.04	6	0.01	0%
1634	1,076.04	1,070.04	6	0.03	1%
1650	1,084.21	1,078.21	6	0.04	1%
1689	1,102.87	1,099.00	3.87	0.03	1%
4859	1,061.24	1,048.30	12.94	2	15%
MH-A	1,045.52	1,038.41	7.11	0.38	5%

KANSAS STATE UNIVERSITY
SANITARY SEWER MASTER PLAN
EXISTING CONDITIONS

BG Consultants
Engineers • Architects • Surveyors

12-1077M



KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
EXISTING CONDITIONS
SEWER PIPES WITH 25% REMAINING CAPACITY OR LESS
Dry Loading Condtions ADF

CO-Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
EXISTING CONDITIONS
SEWER PIPES WITH 25% REMAINING CAPACITY OR LESS
Wet Loading Conditions PDF (PF=3)

CO-Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
38	164	165	PVC	12	385.78	43	-0.003	-1,142.96	0.23	76.65
70	105	113	Vitrified Clay	20	4,395.09	63	0.005	4,518.92	2.12	79.83
71	159	158	Vitrified Clay	8	0.04	135	0.025	850.5	0.36	100
72	158	157	Vitrified Clay	15	538.79	208	0.004	1,786.73	1.23	100
73	157	156	Vitrified Clay	15	538.92	268	0.003	1,623.12	1.07	100
74	156	155	Vitrified Clay	15	2,674.73	224	0.003	1,573.71	1.76	100
75	155	154	Vitrified Clay	15	2,674.84	224	0.002	1,299.45	1.46	100
76	154	153	Vitrified Clay	15	2,674.96	250	0.006	2,260.63	2.03	100
77	153	145	Vitrified Clay	15	2,675.10	277	0.013	3,272.85	2.52	84.19
78	145	144	Vitrified Clay	15	2,675.14	73	0.006	2,172.74	1.82	98.39
79	144	140	Vitrified Clay	18	3,266.54	427	0.006	3,585.61	1.99	74.94
84	107	108	Vitrified Clay	8	9.5	198	0.006	407.90	0.47	100
89	110	109	Vitrified Clay	8	607.34	101	0.061	1,337.21	3.61	100
90	109	108	Vitrified Clay	8	607.33	127	0.044	1,132.73	3.18	100
91	108	114	Vitrified Clay	8	616.82	202	0.004	345.55	1.36	100
92	113	116	Vitrified Clay	20	4,429.63	289	0.005	4,528.15	2.14	83.1
93	114	115	Vitrified Clay	8	616.66	233	0.006	421.90	1.48	100
94	115	117	Vitrified Clay	8	616.44	177	0.005	401.49	1.33	100
95	117	120	Vitrified Clay	8	616.53	356	0.004	352.04	1.15	100
96	116	118	Vitrified Clay	20	4,429.51	284	0.005	4,256.73	1.99	88.85
97	118	119	Vitrified Clay	20	4,429.65	221	0.004	4,050.36	1.88	91.04
107	123	122	Vitrified Clay	24	4,605.01	74	0.001	3,914.52	1.28	81.17
108	119	123	Vitrified Clay	20	4,429.76	263	0.006	4,870.01	2.1	83.18
109	120	121	Vitrified Clay	8	616.55	350	0.005	366.69	1.06	100
127	122	85	Vitrified Clay	24	5,221.40	207	0.005	7,196.64	1.97	76.39
129	85	61	Vitrified Clay	24	5,930.20	64	0	-2,198.21	0.1	88.92
130	61	63	Vitrified Clay	24	5,930.14	20	0.003	6,006.65	1.76	80.83
135	49	50	Vitrified Clay	8	518.78	258	0.012	602.11	1.99	83.04
138	52	53	PVC	6	562.42	77	0.021	471.91	2.81	100
143	56	57	PVC	8	610.32	73	0.007	577.64	1.76	95.47
144	57	59	Vitrified Clay	8	610.37	196	0.015	655.13	1.9	76.43
177	39	4859	Vitrified Clay	8	508.85	168	0.02	766.99	2.26	85.8
182	13	12	HDPE	12	1,620.71	53	0.004	1,244.61	1.7	97.15
209	4859	16	Vitrified Clay	8	508.91	250	0.005	400.01	1.39	100

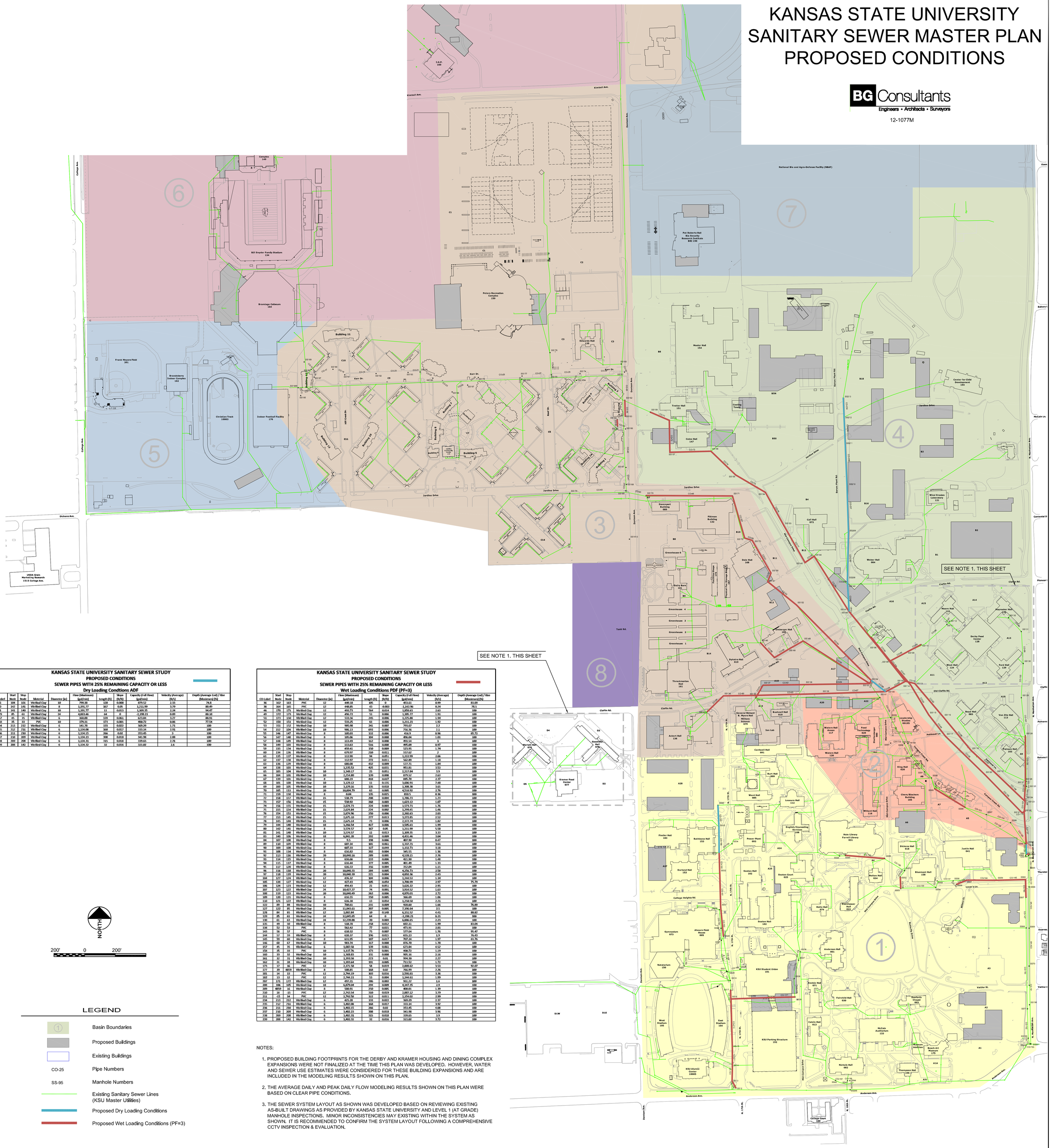
NOTES:

1. THE AVERAGE DAILY AND PEAK DAILY FLOW MODELING RESULTS SHOWN ON THIS PLAN WERE BASED ON CLEAR PIPE CONDITIONS.
2. THE SEWER SYSTEM LAYOUT AS SHOWN WAS DEVELOPED BASED ON REVIEWING EXISTING AS-BUILT DRAWINGS AS PROVIDED BY KANSAS STATE UNIVERSITY AND LEVEL 1 (AT GRADE) MANHOLE INSPECTIONS. MINOR INCONSISTENCIES MAY EXISTING WITHIN THE SYSTEM AS SHOWN. IT IS RECOMMENDED TO CONFIRM THE SYSTEM LAYOUT FOLLOWING A COMPREHENSIVE CCTV INSPECTION & EVALUATION.

KANSAS STATE UNIVERSITY
SANITARY SEWER MASTER PLAN
PROPOSED CONDITIONS

BG Consultants
Engineers • Architects • Surveyors

12-1077M



KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
PROPOSED CONDITIONS
SEWER PIPES WITH 25% REMAINING CAPACITY OR LESS
Dry Loading Condtions ADF

CO-Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
66	104	101	Vitrified Clay	10	799.38	120	0.008	879.52	2.33	74.8
80	142	141	Vitrified Clay	8	1,191.77	367	0.05	1,211.99	3.79	80.49
81	141	140	Vitrified Clay	10	1,191.77	11	0.013	1,309.35	2.34	94.47
129	85	61	Vitrified Clay	24	4,063.46	64	0	-2,198.21	0.09	80.38
157	45	35	Vitrified Clay	6	360.88	339	0.061	673.84	3.27	88.91
158	35	33	PVC	10	379.31	173	0.001	400.72	0.86	77.54
234	213	212	Vitrified Clay	6	141.78	133	0.022	369.29	1.71	100
235	212	211	Vitrified Clay	6	1,134.08	368	0.017	333.14	2.91	100
236	213	230	Vitrified Clay	6	1,134.15	266	0.02	353.45	3	100
237	210	209	Vitrified Clay	6	1,134.23	308	0.018	341.98	2.88	100
238	209	208	Vitrified Clay	6	1,134.31	315	0.018	339.65	2.76	100
239	208	142	Vitrified Clay	6	1,134.32	32	0.016	321.02	2.6	100

KANSAS STATE UNIVERSITY SANITARY SEWER STUDY
PROPOSED CONDITIONS
SEWER PIPES WITH 25% REMAINING CAPACITY OR LESS
Wet Loading Conditions PDF (PF=3)

CO-Label	Start Node	Stop Node	Material	Diameter (in)	Flow (Maximum) (gal/min)	Length (ft)	Slope (ft/ft)	Capacity (Full Flow) (gal/min)	Velocity (Average) (ft/s)	Depth (Average End) / Rise (Maximum) (%)
36	162	165	PVC	12	449.18	105	0	453.61	0.99	81.09
38	164	165	PVC	12	448.85	43	-0.003	1,342.96	0.24	78.5
46	170	171	Vitrified Clay	12	493.71	564	0.014	1,858.63	2.63	100
49	172	173	Vitrified Clay	12	496.72	51	0.006	1,209.77	1.91	100
51	173	150	Vitrified Clay	12	533.56	245	0.006	1,225.88	1.94	100
52	150	151	Vitrified Clay	12	533.25	61	0.006	1,211.23	1.92	100
53	151	152	Vitrified Clay	10	905.98	241	0.007	793.67	2.2	100
54	152	106	Vitrified Clay	10	906.13	693	0.006	756.36	2.1	100
55	146	147	Vitrified Clay	8	105.03	132	0.006	416.9	0.96	85.72
56	147	148	Vitrified Clay	8	105.06	104	0.008	496.04	1.01	100
57	148	149	Vitrified Clay	8	113.49	112	0.008	493.54	1	100
58	149	103	Vitrified Clay	8	113.63	516	0.008	495.09	0.97	100
59	133	134	Vitrified Clay	8	459.41	150	0.009	523.95	1.74	100
60	134	136	Vitrified Clay	8	679.97	210	0.011	557.62	2	100
61	135	137	Vitrified Clay	8	112.90	94	0.051	1,222.99	2.06	100
62	137	138	Vitrified Clay	8	112.97	272	0.011	562.89	1.18	100
63	136	139	Vitrified Clay	8	680.08	432	0.009	527.71	1.84	100
64	138	103	Vitrified Clay	8	1,235.53	495	0.031	951.81	3.53	100
65	103	104	Vitrified Clay	10	1,349.17	23	0.051	2,217.84	3.9	100
66	104	101	Vitrified Clay	10	2,254.80	120	0.008	879.52	2.63	100
67	139	101	Vitrified Clay	8	680.19	418	0.027	885.78	2.37	100
68	101	100	Vitrified Clay	10	3,129.12	11	0.135	3,606.91	7.48	100
69	100	105	Vitrified Clay	10	3,129.16	135	0.018	1,308.38	3.65	100
70	105	113	Vitrified Clay	20	10,004.79	63	0.005	4,518.92	2.76	100
71	159	158	Vitrified Clay	8	0.04	135	0.025	850.5	0.36	100
72	158	157	Vitrified Clay	15	538.79	208	0.004	1,788.73	1.23	100
73	157	156	Vitrified Clay	15	538.92	260	0.003	1,631.12	1.07	100
74	156	155	Vitrified Clay	15	2,624.73	224	0.003	1,573.71	1.76	100
75	155	154	Vitrified Clay	15	2,624.84	234	0.002	1,299.45	1.46	100
76	154	153	Vitrified Clay	15	2,674.96	250	0.006	2,360.63	2.65	100
77	153	145	Vitrified Clay	15	2,675.10	277	0.013	3,272.85	2.52	100
78	145	144	Vitrified Clay	15	2,675.14	73	0.006	2,272.74	1.82	100
79	144	140	Vitrified Clay	18	3,266.54	427	0.006	3,585.61	1.99	100
80	142	141	Vitrified Clay	8	3,574.57	167	0.05	1,211.99	5.58	100
81	141	140	Vitrified Clay	10	3,574.57	11	0.013	1,309.35	3.33	100
83	140	106	Vitrified Clay	18	6,841.28	292	0.009	4,431.46	3.04	100
84	107	108	Vitrified Clay	8	9.5	198	0.006	407.90	0.47	100
89	110	109	Vitrified Clay	8	607.34	301	0.061	1,337.71	3.61	100
90	109	108	Vitrified Clay	8	607.33	127	0.044	1,132.73	3.18	100
91	108	114	Vitrified Clay	8	616.82	202	0.004	345.55	1.36	100
92	113	116	Vitrified Clay	20	10,040.16	289	0.005	4,528.15	2.76	100
93	114	115	Vitrified Clay	8	616.66	233	0.006	421.90	1.48	100
94	115	117	Vitrified Clay	8	616.44	177	0.005	401.49	1.33	100
95	117	120	Vitrified Clay	8	636.53	356	0.004	352.04	1.15	100
96	116	118	Vitrified Clay	20	10,040.33	284	0.005	4,256.73	2.58	100
97	118	119	Vitrified Clay	20	10,040.39	221	0.004	4,050.36	2.43	100
104	127	124	Vitrified Clay	12	426.32	304	0.006	1,244.53	1.34	100
105	128	127	Vitrified Clay	12	427.43	305	0.054	3,708.99	2.97	75.79
106	124	123	Vitrified Clay	12	494.43	21	0.051	3,626.22	2.95	100
107	123	122	Vitrified Clay	24	10,427.27	74	0.001	3,914.52	1.63	100
108	119	121	Vitrified Clay	20	10,040.49	263	0.006	4,970.03	2.72	100
109	120	121	Vitrified Clay	8	636.55	350	0.005	366.09	1.06	100
110	121	122	Vitrified Clay	8	636.38	13	0.054	1,258.50	2.23	100
122	89	88	Vitrified Clay	10	708.61	231	0.009	908.60	1.66	76.39
127	122	85	Vitrified Clay	24	11,043.61	207	0.005	7,196.64	2.5	100
128	86	85	Vitrified Clay	12	1,007.84	10	0.148	6,151.52	4.41	88.82
129	85	61	Vitrified Clay	24	12,045.85	64	0	-2,198.21	0.23	100
130	61	63	Vitrified Clay	24	12,239.88	20	0.003	6,006.65	2.23	100
135	49	50	Vitrified Clay	8	538.78	258	0.012	692.11	1.99	83.04
138	52	53	PVC	6	562.42	77	0.021	471.91	2.83	100
143	56	57	PVC	8	610.32	71	0.007	577.64	1.76	95.47
144	57	59	Vitrified Clay	8	610.37	196	0.015	655.13	1.9	76.43
145	59	60	Vitrified Clay	8	631.95	187	0.017	707.24	1.97	81.76
146	60	67	Vitrified Clay	10	983.74	117	0.008	876.70	1.78	100
157	45	35	Vitrified Clay	6	1,087.58	339	0.061	673.84	4.52	100
158	35	33	PVC	10	1,317.76	173	0.001	400.72	1.19	100
160	33	32	Vitrified Clay	10	1,368.83	131	0.008	905.16	2.16	100
161	32	31	Vitrified Clay	10	1,393.58	223	0.01	994.30	2.27	100
162	31	28	Vitrified Clay	10	1,393.64	191	0.005	711.52	1.72	100
173	17	16	PVC	12	2,171.58	58	0.019	2,888.62	3.53	92.07
177	39	4059	Vitrified Clay	8	508.85	168	0.02	766.99	2.26	100
181	14	13	PVC	12	2,744.19	103	0.016	2,590.83	3.36	100
182	13	12	PVC	12	2,744.21	53	0.004	1,244.61	1.99	100
207	171	172	Vitrified Clay	12	497.21	286	0.003	931.22	1.6	100
208	106	105	Vitrified Clay	18	6,879.04	294	0.009	4,347.35	2.9	100
209	4059	16	Vitrified Clay	8	508.91	250	0.005	400.01	1.99	100
210	18	-15	PVC	12	2,742.54	310	0.019	2,887.12	3.79	100
211	-15	14	PVC	12	2,742.58	122	0.011	2,154.02	2.99	100
234	213	212	Vitrified Clay	6	425.28	133	0.023	369.29	2.37	100
235	212	211	Vitrified Clay	6	3,402.08	368	0.017	333.14	3.92	100
236	211	230	Vitrified Clay	6	3,402.15	266	0.02	353.45	4.08	100
237	210	209	Vitrified Clay	6	3,402.23	308	0.018	341.98	3.96	100
238	209	208	Vitrified Clay	6	3,402.31	315	0.018	339.65	3.9	100
239	208	142	Vitrified Clay	6	3,402.32	32	0.016	321.02	3.72	100

NOTES:

1. PROPOSED BUILDING FOOTPRINTS FOR THE DERBY AND KRAMER HOUSING AND DINING COMPLEX EXPANSIONS WERE NOT FINALIZED AT THE TIME THIS PLAN WAS DEVELOPED. HOWEVER, WATER AND SEWER USE ESTIMATES WERE CONSIDERED FOR THESE BUILDING EXPANSIONS AND ARE INCLUDED IN THE MODELING RESULTS SHOWN ON THIS PLAN.
2. THE AVERAGE DAILY AND PEAK DAILY FLOW MODELING RESULTS SHOWN ON THIS PLAN WERE BASED ON CLEAR PIPE CONDITIONS.
3. THE SEWER SYSTEM LAYOUT AS SHOWN WAS DEVELOPED BASED ON REVIEWING EXISTING AS-BUILT DRAWINGS AS PROVIDED BY KANSAS STATE UNIVERSITY AND LEVEL 1 (AT GRADE) MANHOLE INSPECTIONS. MINOR INCONSISTENCIES MAY EXISTING WITHIN THE SYSTEM AS SHOWN. IT IS RECOMMENDED TO CONFIRM THE SYSTEM LAYOUT FOLLOWING A COMPREHENSIVE CCTV INSPECTION & EVALUATION.

NORTH

200' 0 200'

LEGEND

- Basin Boundaries
- Proposed Buildings
- Existing Buildings
- CO-25 — Pipe Numbers
- SS-95 — Manhole Numbers
- Existing Sanitary Sewer Lines (KSU Master Utilities)
- Proposed Dry Loading Conditions
- Proposed Wet Loading Conditions (PF=3)