



CITY OF WEST LAKE HILLS, TEXAS
NOTICE OF CITY COUNCIL WORKSHOP
Wednesday, February 5, 2025 at 12:00 PM

Notice is hereby given that the City Council of the City of West Lake Hills, Texas, will hold a Workshop on the 5th day of February 2025 at 12:00 p.m., in the Janet Room, Municipal Building, 911 Westlake Drive, West Lake Hills, Texas, at which time the following items will be discussed, to-wit:

1. Call to Order
2. Citizen Communications The City Council welcomes public comments at this point on any issue. If the issue is listed on the agenda, the speaker may choose to comment during the Public Comment period or when the specific agenda item is taken up by the Council later in the meeting. The Council cannot respond to or discuss matters not listed on the agenda. The Council may provide factual information, refer the item to a staff member, or request the item be added to a future meeting agenda. Speakers shall limit their comments to five (5) minutes each.
3. Administration Receive a presentation and discuss findings and recommendations regarding the report on the wastewater collection system model within the City of West Lake Hills.
4. Administration Receive a presentation and discuss findings and recommendations regarding completed, ongoing and proposed street and drainage projects within the City of West Lake Hills.
5. Executive Session In accordance with Texas Government Code, Section 551.001, et seq, the City Council will recess into Executive Session (closed meeting) to discuss the following:
 - a. Texas Government Code 551.071(2) - Consultation with attorney on a matter in which the duty of the attorney under the Texas Disciplinary Rules of Professional Conduct conflict with Texas Government Code Sec. 551: Legal advice concerning election for and use of dedicated sales tax funds approved by voters.
6. Executive Session Reconvene into Open Session and take action if and as deemed appropriate in the City Councils' discretion regarding consultation with attorney.
7. Adjournment

Approved by: James Vaughan, Mayor

Certificate

I certify that the above Notice of the February 5, 2025 City Council Workshop was posted on the bulletin board at the Municipal Building, 911 Westlake Drive, West Lake Hills, Texas on Friday, January 31, 2025 by 5:00 pm. and will remain posted continuously until said meeting is convened.

Signed by: Terry Blanchard, City Secretary

The City of West Lake Hills is committed to compliance with the Americans with Disabilities Act. Reasonable accommodation and equal access to communications will be provided upon request.

All items on the agenda are for discussion and/or action. City Council reserves the right to adjourn into executive session at any time during the course of this meeting to discuss any of the matters listed above, as authorized by Texas Government Code Sections 551.071 (Consultation with Attorney), 551.072 (Deliberations about Real Property), 551.073 (Deliberations about Gifts and Donations), 551.074 (Personnel Matters), 551.076 (Deliberations about Security Devices), and 551.086 (Economic Development).



City of West Lake Hills City Council

AGENDA REPORT

Meeting Date:	<u>February 5, 2025</u>	Item Number:	<u>3</u>
Department:	<u>Building & Development Services</u>		
Prepared By:	<u>Jennifer C. Bills, Director of Building & Development</u>	Cost / Budget:	<u>n/a</u>
Exhibits:	<u>See attached</u>	Source of Funds:	<u>Wastewater Fund Street Maintenance Fund</u>

Subject

Receive a presentation and discuss findings and recommendations regarding the report on the wastewater collection system model within the City of West Lake Hills.

Recommendation

Review study, discuss finding and provide guidance to staff.

Discussion

In January 2024, Walter P. Moore was tasked with creating a wastewater collection system model and conducting a capacity analysis. This includes modeling all the existing infrastructure (lines, manholes, lift stations) and running scenarios on the existing infrastructure and conceptual future connections to the system. This will allow the city to monitor the system capacity as it relates to the infrastructure capacity, proposed redevelopment and contractual agreements with the City of Austin.

The system is broken down into four sewer sheds, Sanderling, Capital of Texas, Redbud Trail, and Hull Circle (Attachment 1). Each of these areas conveys at a different discharge point into the City of Austin system.

Preliminary Findings:

Sanderling	System is not exceeding functional capacity. The peak flow is 47.65 gallons per minute (gpm), below the contractual rate of 60 gpm.
Capital of Texas	System is not exceeding functional capacity. The peak flow is 92.55, and lift station capacity is 94 gpm, below the contractual rate of 100 gpm.
Redbud Trail	Some locations are exceeding capacity. The peak flow is 666 gpm, exceeding the contractual limitation of

	600 gpm. This study provides a summary of recommendations for upgrades and improvements to address concerns.
Hull Circle	The peak flow is 76.64 gpm, exceeding the contractual limitation of 48 gpm. Additional modelling is still in process for the extension along Wildcat Hollow (to Wild Cat Club Subdivision).

Attachments

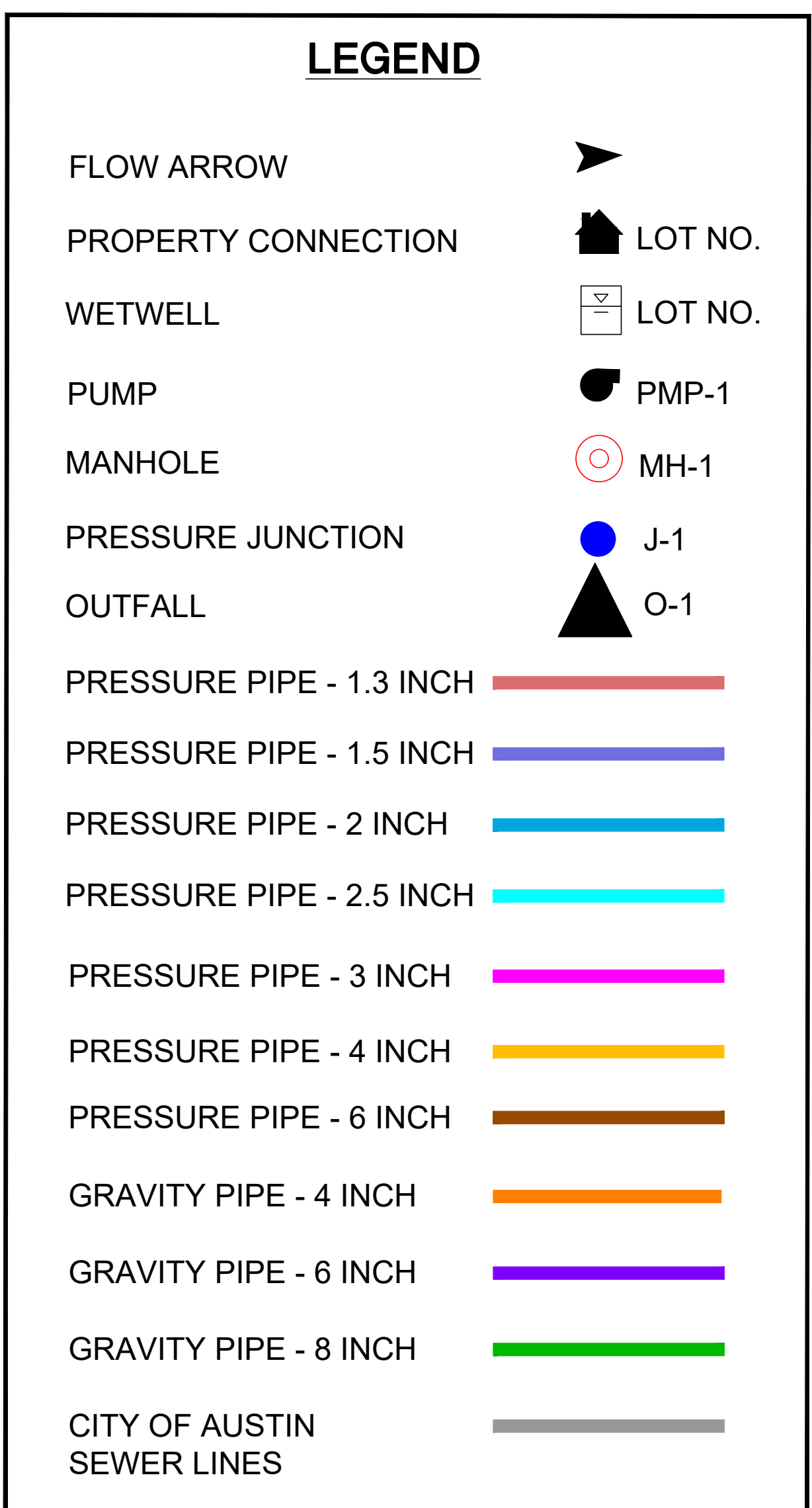
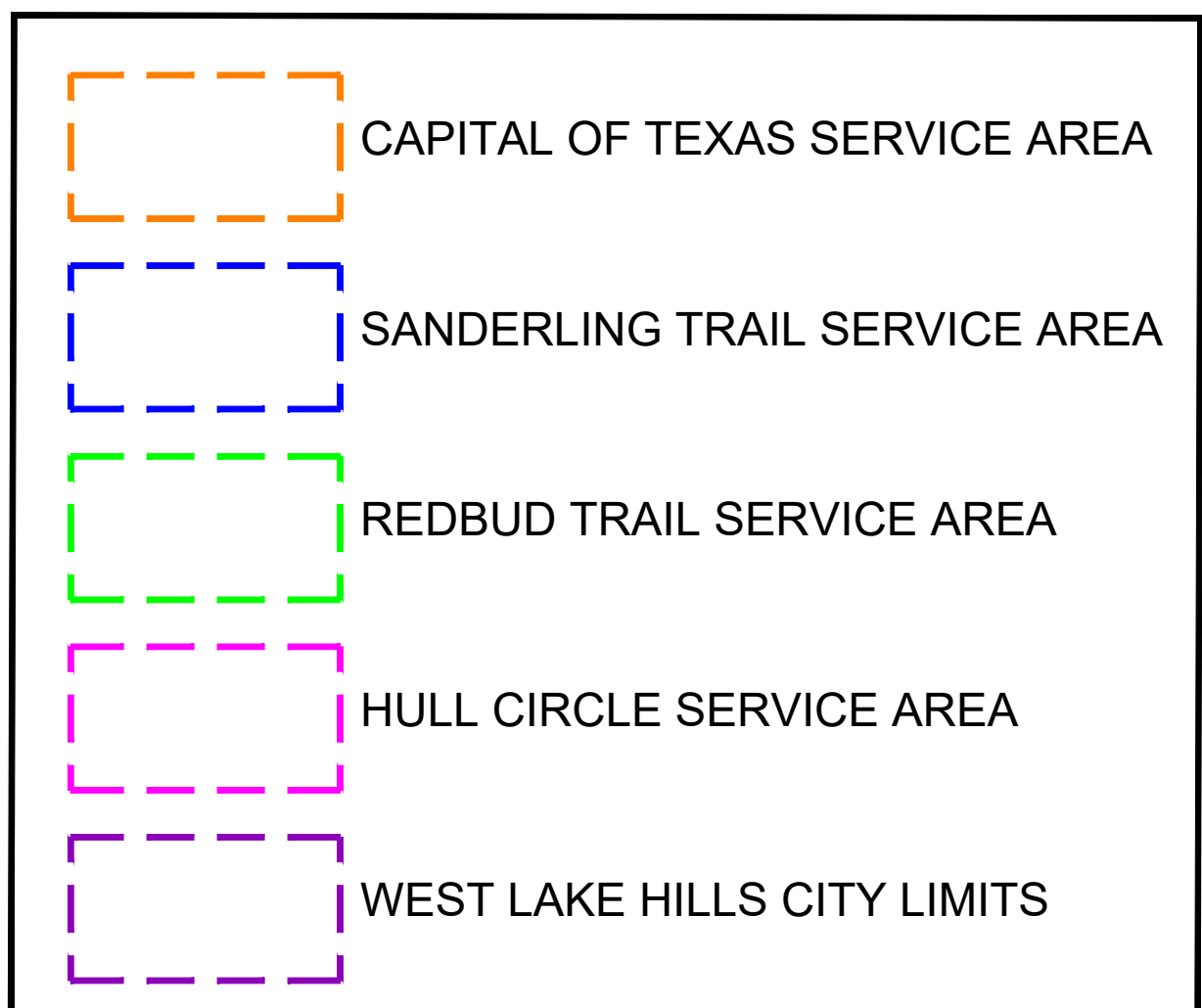
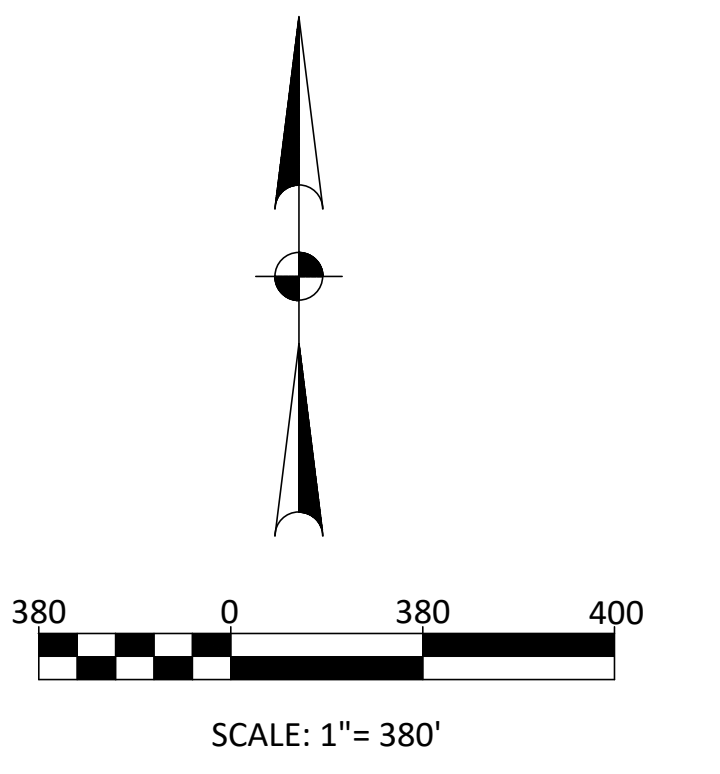
Attachment 1 – Overall System Map

Attachment 2 – Sanderling Trail Service Area WW Study

Attachment 3 – Capital of Texas Service Area WW Study

Attachment 4 – Redbud Trail Service Area WW Study

Attachment 5 – Hull Circle Service Area WW Study



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West Lake Hills Wastewater Collection System

Preliminary Draft

JANUARY 21, 2025

Prepared by
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APPENDICES

APPENDIX A	OUTFALL PROFILES
APPENDIX B	SANDERLING TRAIL AREA (F23) MODEL RESULTS FOR AVERAGE CONDITION
APPENDIX C	SANDERLING TRAIL AREA (F23) MODEL RESULTS FOR PEAK CONDITION

EXHIBITS

EXHIBIT 1	SANDERLING TRAIL SERVICE AREA (F23) WASTEWATER SEWER SHED
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1. LIST OF ABBREVIATIONS

REPORT ABBREVIATIONS

COA: City Of Austin

EGL: Energy Grade Line

Ft: Feet

Ft/s: Feet per Second

PSI: Pounds per Square Inch

GPM: Gallons per Minute

HDPE: High Density Polyethylene

HGL: Hydraulic Grade Line

LUE: Living Unit Equivalent

PVC: Poly Vinyl Chloride

WLH: West Lake Hills

MODEL ELEMENTS ABBREVIATIONS

CO – Conduit- gravity sewer main

J – Junction- low pressure system junction

L – Lateral- service line from residential or commercial property to sewer main

MH - Manhole

P – Pressure- low pressure wastewater main

T – Transition- transition from low pressure to gravity system

Tap – lateral connection to sewer main

2. DEFINITIONS

Capacity:

The maximum capacity of the gravity interceptor.

Depth:

Depth of flow in a gravity sewer main.

Discharge Point:

Point where the City of West Lake Hills collection system discharges to the City of Austin's collection system.

EGL (Energy Grade Line):

A line that represents the total energy head (pressure head, elevation head, and velocity head) in a fluid system, always above the HGL by the velocity head amount.

Flow/Capacity:

A pipe flowing at its maximum capacity (Ratio of the pipe's current capacity and the maximum capacity) would have with a value of one.

Headloss:

Headloss is the reduction in head, or pressure, that occurs as fluid flows through a pipe or other hydraulic system due to friction, turbulence, or other factors.

HGL (Hydraulic Grade Line):

A line representing the pressure head and elevation head in a fluid system, indicating the height to which water would rise in piezometer tubes along a pipeline.

LUE (Living Unit Equivalent):

A term commonly used in engineering, planning, and utility design to standardize the measurement of water demand or wastewater generation. It represents the average flow of one residential unit (typically a single-family home) for water or wastewater services. For the purposes of this study, 245 gpd was used per LUE.

3. INTRODUCTION

The City of West Lake Hills (WLH) wastewater collection system is a combination of gravity and low-pressure systems. The WLH collection system discharges to the City of Austin (COA) collection system through several different entry points. Each of these entry points, and the system as whole, has defined average and peak flow limitations defined in an agreement between the COA and WLHs. This report describes the analysis of Sanderling Trail Service Area sanitary sewer shed for peak loading based on the conditions defined in the above referenced agreement.

SANDERLING AREA (F-23)

The Sanderling Trail service area is located in the southeast corner of WLHs. The collection system, a combined gravity and pressure system that serves mainly office and commercial properties. It discharges into the COAs collection system at a manhole on Sanderling Trail. The original agreement defined this entry point as metered, but since that time the agreement has been modified to allow it to be unmetered as the gravity flows were too small to be accurately metered. As it is an unmetered entry point, peak flow calculations are determined by applying a 4.0 multiplier to average flows for each property. The model has been developed to represent the existing conditions of the collection system.

4. OBJECTIVES

The main objectives of this study are:

- To develop a wastewater model for the City of Westlake Hills to monitor the system's capacity for existing conditions, proposed redevelopment, and contractual agreement limits with the COA.
- To develop accurate GIS files of the collection system to assist with the City's asset management program.
- To develop an understanding of the maximum capacity of the existing collection system under peak flow conditions.
- To use future flow meter data to calibrate the current model and define actual operational conditions.

5. DATA COLLECTION

Existing site plan and utility plan information was collected from the City of West Lake Hills. The AutoCAD background files were geolocated with respect to NAD 83 Texas coordinate system and the analysis was performed in Central Zone projection, TX83. Information collected by WPM includes:

- West Lake Hills Wastewater Collection System Map dated February 7, 2023
- GIS mapping data from the City of West Lake's website
- Record drawings for wastewater infrastructure
- COA Annual Wastewater connection and flow summary spreadsheet
- Elevation Data from LIDAR
- Pump information, from WLH design standards. (pump curve data, wet well size)
- Probability data for low pressure systems was provided by Bentley, correlating the number of connected grinder pump connections with the maximum number of grinder pumps operating simultaneously.

5.1 RECORD DRAWINGS:

- **Gravity Connection – Plan and Profile:**
Phase 2 Plans – Full
- **Pressure Network – Plan and Profile:**
WBWW As-Built Plans

6. DESIGN CRITERIA

6.1 DESIGN CRITERIA FOR SANITARY NETWORK:

- **Average Flow:** Residential 245 gpd per LUE
Commercial 175 gpd per LUE
(Robert E. Lee Wastewater study by PBS&J, Refer section 7 for more details)
- **Maximum Peak Flow limitation:** 60 gpm
(City of Austin, Texas- Peak flow limitation at Sanderling trail entry point)
Minimum flow velocity: 2 Ft/s
- **Maximum flow velocity:** 10 Ft/s
- **Minimum pipe cover:** 4 ft
- **Maximum cover:** 15 ft
(City of Austin, Texas – Utilities Criteria Manual, Section 2)
- **Minimum slope:** 0.335% (8-Inch diameter)
(Texas Commission on Environmental Quality, Chapter 217 – Design Criteria for Domestic Wastewater Systems)
- **Pump Information:**
Type A – E-One Gator Grinder pump unit, single core
 - 9 to 15 gpm at 138 to 0 feet of total head
 - Utilized for all single family residentialType B – E-One dual core pump unit
 - 9 to 15 gpm at 138 to 0 feet of total head
 - Utilized for non-residential with average daily flows up to 3,000 gpd(West Lake Hills- Wastewater flow modelling and calculations, - II. Low Pressure System Pump Units)

6.2 REFERENCE MANUALS AND SOFTWARE

- City of Austin, Texas – Utilities Criteria Manual, Section 2
- City of Westlake Hills– Engineering Standards, Article 5: Wastewater Facilities
- Bentley E-ONE Grinder setup
- Sewer GEMS CONNECT Edition Update, Bentley Systems
- Autodesk Civil 3D
- ArcGIS Desktop

6.3 DESIGN ASSUMPTIONS

- Elevations for wastewater lines without as -built drawings was assumed to have a depth of 4 feet. Ground elevations were taken from LIDAR
- Peak flow calculations were determined by applying a 4.0 multiplier to average wastewater flows for each property
- E-one grinder pump design guide was followed for low pressure systems flow operations
- Gravity flows were estimated as flow per Living Unit Equivalent (LUE) for average and peak scenarios

- COA Annual Wastewater connection and flow summary spreadsheet utilized for modelling the existing wastewater collection system and to determine average and peak flow calculations
- WaterCAD Model (by KFA) was utilized for low pressure main modelling and for pump curves.
- Maximum peak flows capped at 90% pipe capacity
- Grinder pump wet wells-3 feet in diameter and 5 feet deep

6. METHODOLOGY

The hydraulic modelling software **SEWERGEMS** was used to create the existing wastewater collection system model to understand the system's existing capacity and limitations which can be utilized to forecast future demands or operational scenarios. Parameters used for the model development are included below.

Calculation method/ Equation used in software are:

- **Manning's Equation:**

$$V = \frac{k}{n} R^{2/3} S^{1/2}$$

Where,

V = mean velocity (m/s, Ft/s)

k = 1.49 for U.S. customary units, 1.00 for SI units

n = Manning's roughness value

- **Hazen – Williams Equation:**

$$V = kCR^{0.63} S^{0.54}$$

Where,

V = mean velocity (m/s, Ft/s)

k = 1.32 for U.S. customary units, or 0.85 for SI units

C = Hazen–Williams's roughness coefficient (unitless)

R = hydraulic radius (m, ft)

S = friction slope (m/m, ft/ft).

- **Energy Equation:**

$$\frac{p_1}{\gamma} + z_1 + \frac{V_1^2}{2g} + H_G = \frac{p_2}{\gamma} + z_2 + \frac{V_2^2}{2g} + H_L$$

Where,

p = pressure (N/m², lb/ft²)

γ = specific weight of the fluid (N/m³, lb/ft³)

z = elevation above a datum (m, ft)

V = fluid velocity (m/s, Ft/s)

g = gravitational acceleration (m/s², Ft/s²)

H_G = head gain, such as from a pump (m, ft)

H_L = combined head loss (m, ft).

E-One Extreme Flow Probability Method

The E-One Extreme Flow Probability Method was utilised for modelling grinder pumps, allowing for the estimation of extreme flows necessary for the design and analysis of the sewer system. This method predicts the maximum number of grinder pumps expected to operate simultaneously, based on the number of grinder pumps connected to the system.

The table below, provided by Bentley, provides the probability if the maximum number of pumps operating simultaneously based on the total number of grinder pump connections.

Table 3 MAXIMUM NUMBER OF GRINDER PUMPCORES OPERATING DAILY	
Number of Grinder Pump Cores Connected	Maximum Daily Number of Grinder Pump Cores Operating Simultaneously
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15
345-377	16
378-410	17
411-443	18
444-476	19
477-509	20
510-542	21
543-575	22
576-608	23
609-641	24
642-674	25
675-707	26
708-740	27
741-773	28
774-806	29
807-839	30
840-872	31
873-905	32
906-938	33
939-971	34
972-1,004	35

* Table 3, sourced from Page 14 of the Low-Pressure Sewer System using E/One Grinder Pumps Manual, has been utilized for reference, if 4 to 9 grinder pumps are connected to the system, then 3 is the maximum number of grinder pumps that are operating simultaneously.

7.1 MODELLING METHODOLOGY

- This sewer shed includes a combination of gravity and pressure systems that extends along Bee Cave Road to the discharge point (F-23) on Sanderling Trail.
- A total of 10 pump connections are installed in this area, consisting of the following types:
 - E-One Grinder (Simplex) for residential properties with up to 6.5 bathrooms (6 pumps).
 - E-One Grinder (Duplex) for all commercial and residential with more than 6.5 bathrooms (4 pumps).
- The pressure network was simulated by activating pumps based on based on Bentley's E- One Extreme Flow Probability Method (reference section 7.0 - Methodology) for peak conditions.
- Initial upstream low-pressure mains were modeled as a gravity system connecting with downstream gravity system that extends to the discharge point.
- All grinder pumps connections are added as loading counts to various manholes within the system.
- A total of 20 residential gravity connections are in this sewer shed. Gravity internal connections are connected with the laterals to the main gravity lines
- A total of 90 LUEs make up this basin

8 MODEL FLOW CALCULATIONS

Wastewater flow estimates were determined with reference to the Robert E. Lee Wastewater Study prepared by PBS&J. The land use types in this study included residential, office, commercial, and school campuses, each with their own diurnal curve. Based on this study an average daily wastewater flow of 245 gallons per LUE was identified. To calculate LUEs for non-residential properties the study applied a 7/5 weekday adjustment factor, for the non-residential properties as follows:

- 1 Residential Home = 1 LUE = 245 gpd, 7,350 gallons/month
- 1 Commercial connection LUE = 245 gpd x 5/7 = 175 gpd, 5,250 gallons per month.

In determining/modelling the peak flows for each entry point to the COA system, we converted the gallons per month flows into gallons per minute for each type of sanitary connection.

TABLE 1 - WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
3618	Doe Trail	1	0.17	0.68
3620	Doe Trail	1	0.17	0.68
3622	Doe Trail	1	0.17	0.68
3616	Doe Trail	1	0.17	0.68
3612	Doe Trail	1	0.17	0.68
3614	Doe Trail	1	0.17	0.68
3607	Doe Trail	2	0.17	0.68
3615	Doe Trail	2	0.17	0.68
3617	Doe Trail	2	0.17	0.68
3613	Doe Trail	2	0.17	0.68
3611	Doe Trail	2	0.17	0.68
3609-A	Doe Trail	1	0.17	0.68
3609-B	Doe Trail	1	0.17	0.68
1003	Beaver Trail	1	0.17	0.68
1001	Beaver Trail	1	0.17	0.68
914	Beaver Trail	1	0.17	0.68
1002	Beaver Trail	1	0.17	0.68
913	Beaver Trail	1	0.17	0.68

TABLE 2 - WASTEWATER LOAD CALCULATIONS FOR COMMERCIAL CONNECTIONS

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
3355	Bee Cave Road	6	0.73	2.92
3421	Bee Cave Road	1	0.12	0.49
3423	Bee Cave Road	7	0.85	3.40
3425	Bee Cave Road	6	0.73	2.92
3437	Bee Cave Road	12	1.46	5.83
3509	Bee Cave Road	10	1.22	4.86
3525	Bee Cave Road	4	0.49	1.94
3601	Bee Cave Road	4	0.49	1.94
3625	Bee Cave Road	8	0.97	3.89
910	Beaver Trail	2	0.24	0.97
3633	Bee Cave Road	3	0.36	1.46
3663	Bee Cave Road	0	0.00	0.00
3701	Bee Cave Road	0	0.00	0.00
3801	Bee Cave Road	1	0.12	0.49
3811	Bee Cave Road	2	0.24	0.97
911	Westbank Drive	0	0.00	0.00
923	Westbank Drive	0	0.00	0.00
1000	Westbank Drive	0	0.00	0.00
1001	Westbank Drive	0	0.00	0.00

9 RESULT SUMMARY

Gravity System - As per Appendix-B & C, Table 1 and 5 the main gravity systems average and peak load analysis results show maximum velocities of 6.33 Ft/s and 9.32 Ft/s, respectively which is within the minimum and maximum limits per COA design standards.

System Capacity - As per Appendix-B & C, Table 3 and 8, Hydraulic Gradient Line (HGL) determined by invert elevation and depth of flow indicates that the maximum flows within the system do not exceed the pipe capacity at any point within the system.

As per Appendix-B & C, Table 5 and 10, The average and peak flow at the discharge point is 11.92 gpm and 47.65 gpm respectively and satisfies the agreement limitation of 60 gpm.

10 CONCLUSION

Utilizing Bentley's SewerGEMS software, a model of the Sanderling area collection system was created and validated. The model was analysed for average and peak loading scenarios, and it was determined to be accurate and in alignment with the City of West Lake Hills engineering calculations. The analysis shows that there are no locations within the collection system above capacity or with compromising hydraulics that could cause damage to the system. Additionally, the model results accurately indicate that the peak flow at the outfall is 47.65 gpm, which complies with the current agreement of 60 gpm.

At the time of this report, a wastewater meter was recently installed by the COA at the discharge point. Once WLH receives this data, the model can be calibrated to reflect actual average and peak flows. This flow data will also help determine if the high peaking factor of 4 times the average flow, currently required by the agreement, is reasonable.

The model can also be utilized to develop various operational scenarios to address proposed development within the sewer shed.

APPENDIX A OUTFALL PROFILES

OUTFALL PROFILES FOR
SANDERLING TRAIL SERVICE AREA (F23) SEWERSHED FOR DOE TRAIL
PROFILE- AVERAGE CONDITION

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi

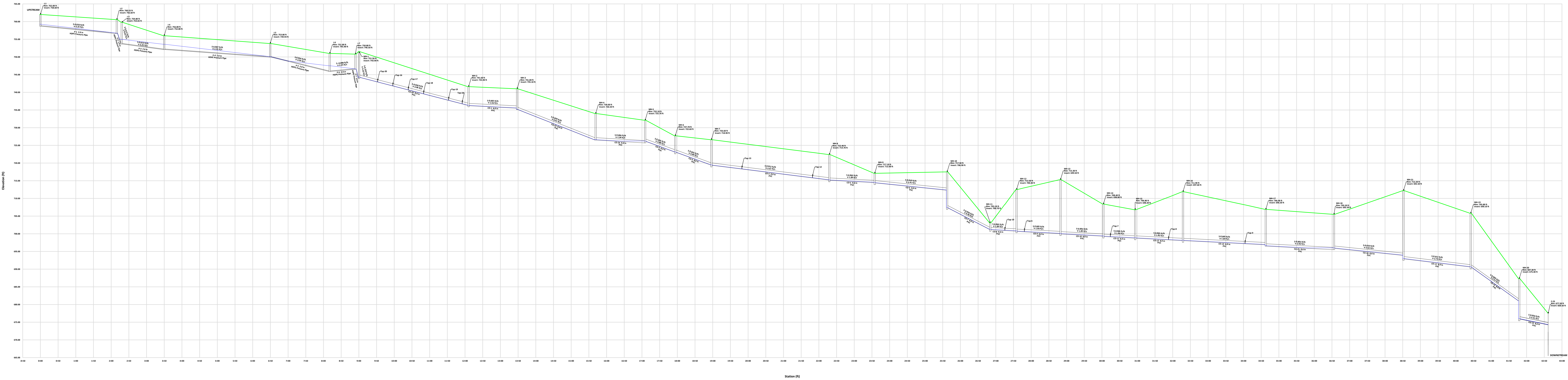


FIGURE 1: AVERAGE SCENARIO

Preliminary - Draft

OUTFALL PROFILES FOR
SANDERLING TRAIL SERVICE AREA (F23) SEWERSHED FOR DOE TRAIL
PROFILE- PEAK CONDITION

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi

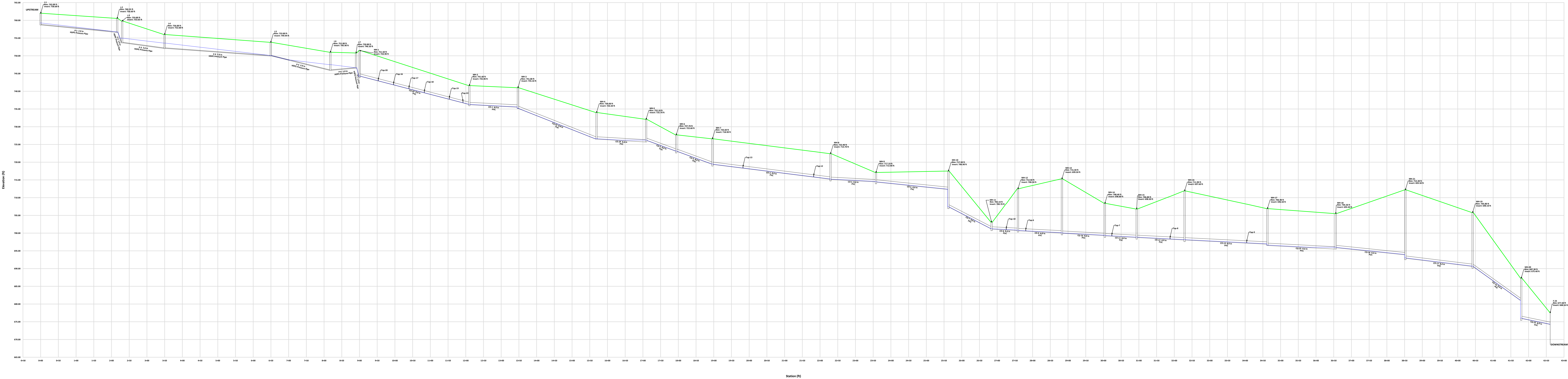


FIGURE 2: PEAK SCENARIO

Preliminary - Draft

APPENDIX B

SANDERLING TRAIL AREA (F23) MODEL

RESULTS FOR AVERAGE CONDITION

SANDERLING AREA MODEL RESULTS

TABLE 1 - GRAVITY SYSTEM, AVERAGE FLOW DATA

 Below from min. limit
 Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
CO-1	MH-2	741.60	736.20	MH-3	741.00	735.51	137.20	0.01	8.00	PVC	1.09	0.05	4.78	5.55	0.69	498.14	1.10	736.25	735.56
CO-2	MH-5	732.10	726.10	MH-6	727.70	723.13	85.10	0.04	8.00	PVC	2.60	0.05	4.62	8.33	3.00	1418.38	0.60	726.16	723.17
CO-3	MH-6	727.70	723.03	MH-7	726.60	719.45	102.10	0.04	8.00	PVC	2.60	0.05	5.24	8.33	3.61	1421.95	0.60	723.09	719.49
CO-4	MH-7	726.60	719.35	MH-8	722.40	715.21	333.40	0.01	8.00	PVC	1.74	0.05	6.55	8.37	4.16	811.76	1.00	719.41	715.26
CO-5	MH-8	722.40	715.11	MH-9	717.10	714.47	128.30	0.01	8.00	PVC	1.24	0.06	4.29	8.37	0.64	496.03	1.70	715.17	714.53
CO-6	MH-9	717.10	714.37	MH-10	717.50	712.32	204.60	0.01	8.00	PVC	1.61	0.06	3.29	8.37	2.06	722.96	1.20	714.43	712.37
CO-7	MH-10	717.50	707.31	MH-11	703.10	701.22	121.90	0.05	8.00	PVC	2.97	0.05	5.37	8.37	6.12	1721.00	0.50	707.37	701.25
CO-8	MH-11	703.10	701.12	MH-12	712.50	700.75	74.40	0.01	8.00	PVC	1.24	0.06	6.20	8.42	0.37	495.37	1.70	701.18	700.81
CO-9	MH-12	712.50	700.65	MH-13	715.30	700.03	124.10	0.01	8.00	PVC	1.24	0.06	12.89	8.48	0.62	496.44	1.70	700.71	700.09
CO-10	MH-13	715.30	699.93	MH-14	708.40	699.32	121.30	0.01	8.00	PVC	1.25	0.06	11.56	8.48	0.61	498.31	1.70	699.99	699.38
CO-11	MH-14	708.40	699.22	MH-15	706.80	698.77	89.90	0.01	8.00	PVC	1.25	0.06	7.94	8.51	0.45	497.10	1.70	699.28	698.83
CO-12	MH-15	706.80	698.75	MH-16	711.90	698.07	135.20	0.01	8.00	PVC	1.25	0.06	10.27	8.52	0.68	498.29	1.70	698.81	698.13
CO-13	MH-16	711.90	698.05	MH-17	706.90	696.88	233.90	0.01	8.00	PVC	1.25	0.06	11.27	8.55	1.17	496.80	1.70	698.11	696.94
CO-14	MH-19	705.80	690.52	MH-20	687.30	681.00	137.10	0.07	8.00	PVC	3.69	0.05	10.12	11.31	9.56	2056.41	0.50	690.59	681.03
CO-15	MH-20	687.30	675.88	F-23	677.50	674.24	81.80	0.02	8.00	PVC	2.29	0.06	6.67	11.31	1.66	1051.23	1.10	675.95	674.29
CO-16	MH-21	751.20	745.88	MH-22	749.70	744.91	122.10	0.01	8.00	PVC	0.19	0.00	4.39	0.01	0.97	637.75	0.00	745.88	744.91
CO-16	MH-18	705.50	695.87	MH-21	712.20	693.88	196.50	0.01	8.00	PVC	1.78	0.06	13.31	11.31	2.01	727.08	1.60	695.94	693.94
CO-17	MH-22	749.70	744.81	MH-23	740.02	732.10	258.30	0.05	8.00	PVC	0.48	0.00	5.74	0.02	12.71	1707.31	0.00	744.81	732.10
CO-17	MH-21	712.20	692.88	MH-19	705.80	690.62	189.90	0.01	8.00	PVC	1.89	0.06	16.58	11.31	2.28	793.29	1.40	692.95	690.67
CO-18	MH-23	740.02	730.85	MH-4	734.00	727.00	250.20	0.02	8.00	PVC	0.44	0.00	7.42	0.05	3.85	911.28	0.00	730.85	727.00
CO-18	MH-22	707.50	701.88	MH-23	701.50	695.50	30.30	0.21	8.00	PVC	2.28	0.01	5.14	0.61	6.39	3745.47	0.00	701.90	695.51
CO-19	MH-23	701.50	695.40	MH-27	691.30	687.80	32.90	0.23	8.00	PVC	2.35	0.01	4.13	0.61	7.61	3937.18	0.00	695.42	687.81
CO-20	MH-27	691.30	687.57	MH-24	677.50	669.63	240.40	0.08	8.00	PVC	1.60	0.01	5.13	0.61	17.95	2137.95	0.00	687.59	669.64
CO-21	MH-24	677.50	669.63	F-23	677.50	667.00	21.80	0.12	8.00	PVC	1.90	0.34	8.52	0.61	1.15	2770.58	0.00	669.65	668.50
CO-22	MH-1	751.50	744.20	MH-2	741.60	736.30	309.50	0.03	8.00	PVC	2.03	0.04	5.63	5.55	7.92	1197.69	0.50	744.25	736.33
CO-23	MH-3	741.00	735.10	MH-4	734.00	726.50	221.90	0.04	8.00	PVC	2.42	0.06	6.03	5.55	8.59	1500.78	0.40	735.15	726.56
CO-24	MH-4	734.00	726.50	MH-5	732.10	725.70	139.80	0.01	8.00	PVC	1.31	0.26	6.28	8.34	0.40	534.13	1.60	726.56	726.16
CO-25	MH-17	706.90	696.50	MH-18	705.50	695.50	192.80	0.01	8.00	PVC	1.37	0.26	9.53	11.31	0.63	506.66	2.20	696.57	695.94

Preliminary - Draft

SANDERLING AREA MODEL RESULTS

TABLE 1 – PRESSURE SYSTEM MODELLED AS GRAVITY SYSTEM, AVERAGE FLOW DATA (CONTINUED)

Below from min. limit

Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
P-1	J-1	762.00	758.68	J-2	760.55	756.60	216.00	0.01	2.00	HDPE Pressure Pipe	1.75	0.07	3.47	5.50	2.09	19.89	27.70	758.75	756.66
P-2	J-2	760.55	756.60	J-3	759.80	753.65	13.90	0.21	2.00	HDPE Pressure Pipe	5.90	0.05	4.88	5.50	3.00	105.56	5.20	756.67	753.68
P-3	J-3	759.80	753.65	J-4	756.00	752.08	119.90	0.01	2.00	HDPE Pressure Pipe	1.97	0.07	4.87	5.50	1.57	23.48	23.40	753.72	752.15
P-4	J-4	756.00	752.08	J-5	753.80	749.94	299.70	0.01	2.00	HDPE Pressure Pipe	1.55	0.07	3.72	5.50	2.15	16.92	32.50	752.15	750.01
P-5	J-5	753.80	749.94	J-6	751.00	745.90	168.30	0.02	2.00	HDPE Pressure Pipe	2.51	0.12	4.31	5.50	3.33	32.56	16.90	750.01	746.68
P-6	J-6	751.00	745.90	J-7	750.80	746.50	72.70	-0.01	2.00	HDPE Pressure Pipe	0.56	0.12	4.53	5.50	0.11	18.30	30.10	746.68	746.57
P-7	J-7	750.80	746.50	MH-1	751.50	743.90	10.10	0.26	2.00	HDPE Pressure Pipe	6.33	0.12	5.78	5.50	2.32	117.56	4.70	746.57	744.25

**P-1 TO P-7 pressure network is modelled as gravity based on topographic profile*

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SANDERLING AREA MODEL RESULTS

TABLE 2 – GRAVITY LATERAL SYSTEM, AVERAGE FLOW DATA

Input Data						Output Data
Label	Start Node	Invert (Start) (ft)	Stop Node	Diameter (in)	Material	Flow (gpm)
L-1	910.00	746.45	Tap-1	6.00	PVC	0.01
L-2	913.00	742.91	Tap-2	6.00	PVC	0.01
L-3	1001.00	739.10	Tap-3	6.00	PVC	0.01
L-4	1002.00	735.01	Tap-5	6.00	PVC	0.01
L-5	3437.00	723.26	Tap-6	6.00	PVC	0.06
L-6	3425.00	710.02	Tap-7	6.00	PVC	0.03
L-7	3421.00	708.40	Tap-8	6.00	PVC	0.01
L-8	3355.00	713.54	Tap-9	6.00	PVC	0.03
L-9	3509.00	726.59	Tap-10	6.00	PVC	0.05
L-10	3525.00	731.38	Tap-12	6.00	PVC	0.02
L-11	3614.00	744.16	Tap-16	6.00	PVC	0.01
L-12	3616.00	743.06	Tap-17	6.00	PVC	0.01
L-13	3618.00	742.01	Tap-18	6.00	PVC	0.01
L-14	3620.00	740.16	Tap-19	6.00	PVC	0.01
L-15	3612.00	745.17	Tap-20	6.00	PVC	0.01
L-16	3622.00	738.43	Tap-22	6.00	PVC	0.01
L-17	1003.00	732.76	Tap-24	6.00	PVC	0.01
L-18	914.00	742.40	Tap-25	6.00	PVC	0.01
L-20	Tap-13	718.61	MH-29	6.00	PVC	0.02
L-21	3601.00	741.33	MH-29	4.00	PVC	0.01
L-25	3535.00	739.40	MH-29	4.00	PVC	0.01

TABLE 3 – AVERAGE FLOW HYDRAULIC GRADE LINE

Input Data									Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Base Load (Local Sanitary) (gpm)	Population (Local Sanitary) (Capita)	Depth (Out) (ft)	Depth (In) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
J-1	762.00	758.68	0.00	5.50	5.50	2.00	0.07	0.07	1.70	758.75	758.75
J-2	760.55	756.60	5.50	5.50	0.00	0.00	0.07	0.07	1.70	756.67	756.67
J-3	759.80	753.65	5.50	5.50	0.00	0.00	0.07	0.07	1.70	753.72	753.72
J-4	756.00	752.08	3.67	5.50	1.83	1.00	0.07	0.07	1.70	752.15	752.15
J-5	753.80	749.94	5.50	5.50	0.00	0.00	0.07	0.07	1.70	750.01	750.01
J-6	751.00	745.90	5.50	5.50	0.00	0.00	0.78	0.78	18.40	746.68	746.68
J-7	750.80	746.50	5.50	5.50	0.00	0.00	0.07	0.07	1.70	746.57	746.57
MH-1	751.50	743.90	5.55	5.55	0.04	0.00	0.35	0.35	8.20	744.25	744.25
MH-2	741.60	735.90	5.55	5.55	0.04	0.00	0.35	0.35	8.20	736.25	736.25
MH-3	741.00	735.10	5.55	5.55	0.04	0.00	0.05	0.05	1.20	735.15	735.15
MH-4	734.00	726.50	3.18	8.34	5.24	5.00	0.06	0.06	1.40	726.56	726.56
MH-5	732.10	725.70	7.41	8.33	1.00	1.00	0.46	0.46	10.80	726.16	726.16
MH-6	727.70	722.60	8.33	8.33	0.09	0.00	0.49	0.49	11.50	723.09	723.09
MH-7	726.60	718.90	8.37	8.37	0.13	0.00	0.51	0.51	12.00	719.41	719.41
MH-8	722.40	714.70	8.37	8.37	0.13	0.00	0.47	0.47	11.10	715.17	715.17
MH-9	717.10	713.90	8.37	8.37	0.13	0.00	0.53	0.53	12.50	714.43	714.43
MH-10	717.50	706.90	8.37	8.37	0.13	0.00	0.47	0.47	11.10	707.37	707.37
MH-11	703.10	700.70	8.42	8.42	0.18	0.00	0.48	0.48	11.30	701.18	701.18
MH-12	712.50	700.30	8.48	8.48	0.24	0.00	0.41	0.41	9.70	700.71	700.71
MH-13	715.30	699.50	8.48	8.48	0.24	0.00	0.49	0.49	11.60	699.99	699.99
MH-14	708.40	698.80	8.51	8.51	0.27	0.00	0.48	0.48	11.30	699.28	699.28
MH-15	706.80	698.30	8.52	8.52	0.28	0.00	0.51	0.51	12.00	698.81	698.81
MH-16	711.90	697.60	8.55	8.55	0.31	0.00	0.51	0.51	12.00	698.11	698.11
MH-17	706.90	696.50	10.21	11.31	1.41	1.00	0.07	0.07	1.70	696.57	696.57
MH-18	705.50	695.50	11.31	11.31	0.31	0.00	0.44	0.44	10.40	695.94	695.94
MH-19	705.80	690.10	11.31	11.31	0.31	0.00	0.49	0.49	11.50	690.59	690.59
MH-20	687.30	675.40	11.31	11.31	0.31	0.00	0.55	0.55	13.00	675.95	675.95
MH-21	751.20	745.60	0.01	0.01	0.01	0.00	0.28	0.28	6.60	745.88	745.88
MH-21	712.20	692.50	11.31	11.31	0.31	0.00	0.45	0.45	10.60	692.95	692.95
MH-22	749.70	744.00	0.02	0.02	0.02	0.00	0.81	0.81	19.10	744.81	744.81
MH-22	707.50	701.50	0.00	0.61	0.00	0.00	0.40	0.40	9.30	701.90	701.90
MH-23	740.02	730.04	0.05	0.05	0.05	0.00	0.81	0.81	19.10	730.85	730.85
MH-23	701.50	695.00	0.61	0.61	0.00	0.00	0.42	0.42	9.80	695.42	695.42
MH-24	677.50	668.50	0.61	0.61	0.00	0.00	1.15	1.15	26.90	669.65	669.65
MH-27	691.30	687.00	0.61	0.61	0.00	0.00	0.59	0.59	13.80	687.59	687.59
MH-29	743.82	737.10	0.02	0.02	0.02	0.00	(N/A)	(N/A)	0.00	(N/A)	(N/A)

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SANDERLING AREA MODEL RESULTS

TABLE 4 – PROPERTY CONNECTION DATA

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)
910	750.45	746.45	0.01
913	746.91	742.91	0.01
1001	743.10	739.10	0.01
1002	739.01	735.01	0.01
3437	727.26	723.26	0.06
3425	714.02	710.02	0.03
3421	712.40	708.40	0.01
3355	717.54	713.54	0.03
3509	730.59	726.59	0.05
3525	735.38	731.38	0.02
3535	743.40	739.40	0.01
3622	742.43	738.43	0.01
3612	749.17	745.17	0.01
3620	744.16	740.16	0.01
3618	746.01	742.01	0.01
3616	747.06	743.06	0.01
3614	748.16	744.16	0.01
1003	736.76	732.76	0.01
914	746.40	742.40	0.01
3601	745.33	741.33	0.01

TABLE 5 – AVERAGE FLOW AT OUTFALL

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
F-23	677.50	668.50	Free Outfall	674.29	9.00	11.92

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APPENDIX C
SANDERLING TRAIL AREA (F23) MODEL
RESULTS FOR PEAK CONDITION

SANDERLING AREA MODEL RESULTS
TABLE 6 - GRAVITY SYSTEM, PEAK FLOW DATA

	Below from min. limit
	Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
CO-1	MH-2	741.60	736.20	MH-3	741.00	735.51	137.20	0.01	8.00	PVC	1.64	0.10	4.78	22.18	0.70	498.14	4.50	736.30	735.60
CO-2	MH-5	732.10	726.10	MH-6	727.70	723.13	85.10	0.04	8.00	PVC	3.89	0.10	4.62	33.32	3.02	1418.38	2.30	726.22	723.20
CO-3	MH-6	727.70	723.03	MH-7	726.60	719.45	102.10	0.04	8.00	PVC	3.90	0.10	5.24	33.32	3.63	1421.95	2.30	723.15	719.52
CO-4	MH-7	726.60	719.35	MH-8	722.40	715.21	333.40	0.01	8.00	PVC	2.62	0.11	6.55	33.48	4.17	811.76	4.10	719.47	715.30
CO-5	MH-8	722.40	715.11	MH-9	717.10	714.47	128.30	0.01	8.00	PVC	1.84	0.12	4.29	33.48	0.65	496.03	6.70	715.23	714.59
CO-6	MH-9	717.10	714.37	MH-10	717.50	712.32	204.60	0.01	8.00	PVC	2.41	0.11	3.29	33.48	2.08	722.96	4.60	714.49	712.42
CO-7	MH-10	717.50	707.31	MH-11	703.10	701.22	121.90	0.05	8.00	PVC	4.46	0.09	5.37	33.48	6.15	1721.00	1.90	707.43	701.28
CO-8	MH-11	703.10	701.12	MH-12	712.50	700.75	74.40	0.01	8.00	PVC	1.85	0.12	6.20	33.68	0.38	495.37	6.80	701.24	700.87
CO-9	MH-12	712.50	700.65	MH-13	715.30	700.03	124.10	0.01	8.00	PVC	1.85	0.12	12.89	33.93	0.63	496.44	6.80	700.77	700.15
CO-10	MH-13	715.30	699.93	MH-14	708.40	699.32	121.30	0.01	8.00	PVC	1.86	0.12	11.56	33.93	0.62	498.31	6.80	700.05	699.44
CO-11	MH-14	708.40	699.22	MH-15	706.80	698.77	89.90	0.01	8.00	PVC	1.86	0.12	7.94	34.05	0.46	497.10	6.80	699.35	698.89
CO-12	MH-15	706.80	698.75	MH-16	711.90	698.07	135.20	0.01	8.00	PVC	1.86	0.12	10.27	34.07	0.69	498.29	6.80	698.88	698.19
CO-13	MH-16	711.90	698.05	MH-17	706.90	696.88	233.90	0.01	8.00	PVC	1.86	0.12	11.27	34.19	1.18	496.80	6.90	698.18	697.00
CO-14	MH-19	705.80	690.52	MH-20	687.30	681.00	137.10	0.07	8.00	PVC	5.54	0.11	10.12	45.22	9.60	2056.41	2.20	690.66	681.07
CO-15	MH-20	687.30	675.88	F-23	677.50	674.24	81.80	0.02	8.00	PVC	3.45	0.12	6.67	45.22	1.69	1051.23	4.30	676.02	674.33
CO-16	MH-21	751.20	745.88	MH-22	749.70	744.91	122.10	0.01	8.00	PVC	0.32	0.00	4.39	0.04	0.97	637.75	0.00	745.88	744.91
CO-16	MH-18	705.50	695.87	MH-21	712.20	693.88	196.50	0.01	8.00	PVC	2.64	0.13	13.31	45.22	2.02	727.08	6.20	696.01	693.99
CO-17	MH-22	749.70	744.81	MH-23	740.02	732.10	258.30	0.05	8.00	PVC	0.85	0.01	5.74	0.10	12.71	1707.31	0.00	744.82	732.10
CO-17	MH-21	712.20	692.88	MH-19	705.80	690.62	189.90	0.01	8.00	PVC	2.81	0.13	16.58	45.22	2.30	793.29	5.70	693.02	690.73
CO-18	MH-23	740.02	730.85	MH-4	734.00	727.00	250.20	0.02	8.00	PVC	0.60	0.01	7.42	0.18	3.85	911.28	0.00	730.86	727.01
CO-18	MH-22	707.50	701.88	MH-23	701.50	695.50	30.30	0.21	8.00	PVC	3.62	0.02	5.14	2.43	6.40	3745.47	0.10	701.91	695.51
CO-19	MH-23	701.50	695.40	MH-27	691.30	687.80	32.90	0.23	8.00	PVC	3.75	0.02	4.13	2.43	7.62	3937.18	0.10	695.43	687.81
CO-20	MH-27	691.30	687.57	MH-24	677.50	669.63	240.40	0.08	8.00	PVC	2.45	0.02	5.13	2.43	17.96	2137.95	0.10	687.60	669.65
CO-21	MH-24	677.50	669.63	F-23	677.50	667.00	21.80	0.12	8.00	PVC	2.98	0.35	8.52	2.43	1.16	2770.58	0.10	669.66	668.50
CO-22	MH-1	751.50	744.20	MH-2	741.60	736.30	309.50	0.03	8.00	PVC	3.06	0.08	5.63	22.18	7.94	1197.69	1.90	744.30	736.36
CO-23	MH-3	741.00	735.10	MH-4	734.00	726.50	221.90	0.04	8.00	PVC	3.62	0.11	6.03	22.18	8.58	1500.78	1.50	735.20	726.62
CO-24	MH-4	734.00	726.50	MH-5	732.10	725.70	139.80	0.01	8.00	PVC	1.94	0.32	6.28	33.35	0.40	534.13	6.20	726.62	726.22
CO-25	MH-17	706.90	696.50	MH-18	705.50	695.50	192.80	0.01	8.00	PVC	2.04	0.33	9.53	45.22	0.63	506.66	8.90	696.64	696.01

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SANDERLING AREA MODEL RESULTS

TABLE 6 – PRESSURE SYSTEM MODELLED AS GRAVITY SYSTEM, AVERAGE FLOW DATA (CONTINUED)

Below from min. limit

Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
P-1	J-1	762.00	758.68	J-2	760.55	756.60	216.00	0.01	2.00	HDPE Pressure Pipe	2.25	0.16	3.47	22.00	2.51	19.89	110.60	759.26	756.75
P-2	J-2	760.55	756.60	J-3	759.80	753.65	13.90	0.21	2.00	HDPE Pressure Pipe	8.62	0.16	4.88	22.00	1.78	105.56	20.80	756.75	754.97
P-3	J-3	759.80	753.65	J-4	756.00	752.08	119.90	0.01	2.00	HDPE Pressure Pipe	2.25	0.17	4.87	22.00	1.39	23.48	93.70	754.97	753.58
P-4	J-4	756.00	752.08	J-5	753.80	749.94	299.70	0.01	2.00	HDPE Pressure Pipe	2.25	0.16	3.72	22.01	3.49	16.92	130.10	753.58	750.09
P-5	J-5	753.80	749.94	J-6	751.00	745.90	168.30	0.02	2.00	HDPE Pressure Pipe	3.56	0.16	4.31	22.01	2.59	32.56	67.60	750.09	747.50
P-6	J-6	751.00	745.90	J-7	750.80	746.50	72.70	-0.01	2.00	HDPE Pressure Pipe	2.25	0.16	4.53	22.01	0.85	18.30	120.30	747.50	746.65
P-7	J-7	750.80	746.50	MH-1	751.50	743.90	10.10	0.26	2.00	HDPE Pressure Pipe	9.32	0.16	5.78	22.01	2.35	117.56	18.70	746.65	744.30

**P-1 TO P-7 pressure network is modelled as gravity based on topographic profile*

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SANDERLING AREA MODEL RESULTS

TABLE 7 - GRAVITY SYSTEM, PEAK LATERAL FLOW DATA

Input Data						Output Data
Label	Start Node	Invert (Start) (ft)	Stop Node	Diameter (in)	Material	Flow (gpm)
L-1	910.00	746.45	Tap-1	6.00	PVC	0.04
L-2	913.00	742.91	Tap-2	6.00	PVC	0.03
L-3	1001.00	739.10	Tap-3	6.00	PVC	0.03
L-4	1002.00	735.01	Tap-5	6.00	PVC	0.03
L-5	3437.00	723.26	Tap-6	6.00	PVC	0.24
L-6	3425.00	710.02	Tap-7	6.00	PVC	0.12
L-7	3421.00	708.40	Tap-8	6.00	PVC	0.02
L-8	3355.00	713.54	Tap-9	6.00	PVC	0.12
L-9	3509.00	726.59	Tap-10	6.00	PVC	0.20
L-10	3525.00	731.38	Tap-12	6.00	PVC	0.08
L-11	3614.00	744.16	Tap-16	6.00	PVC	0.03
L-12	3616.00	743.06	Tap-17	6.00	PVC	0.03
L-13	3618.00	742.01	Tap-18	6.00	PVC	0.03
L-14	3620.00	740.16	Tap-19	6.00	PVC	0.03
L-15	3612.00	745.17	Tap-20	6.00	PVC	0.03
L-16	3622.00	738.43	Tap-22	6.00	PVC	0.03
L-17	1003.00	732.76	Tap-24	6.00	PVC	0.03
L-18	914.00	742.40	Tap-25	6.00	PVC	0.03
L-20	Tap-13	718.61	MH-29	6.00	PVC	0.08
L-21	3601.00	741.33	MH-29	4.00	PVC	0.04
L-25	3535.00	739.40	MH-29	4.00	PVC	0.04

TABLE 8 - PEAK FLOW HYDRAULIC GRADE LINE

Input Data									Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Base Load (Local Sanitary) (gpm)	Population (Local Sanitary) (Capita)	Depth (Out) (ft)	Depth (In) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
J-1	762.00	758.68	0.00	22.00	22.00	2.00	0.58	0.58	13.50	759.26	759.26
J-2	760.55	756.60	22.00	22.00	0.00	0.00	0.15	0.15	3.40	756.75	756.75
J-3	759.80	753.65	22.00	22.00	0.00	0.00	1.32	1.32	31.00	754.97	754.97
J-4	756.00	752.08	14.67	22.01	7.34	1.00	1.50	1.50	35.20	753.58	753.58
J-5	753.80	749.94	22.01	22.01	0.00	0.00	0.15	0.15	3.40	750.09	750.09
J-6	751.00	745.90	22.01	22.01	0.00	0.00	1.60	1.60	37.50	747.50	747.50
J-7	750.80	746.50	22.01	22.01	0.00	0.00	0.15	0.15	3.40	746.65	746.65
MH-1	751.50	743.90	22.18	22.18	0.17	0.00	0.40	0.40	9.40	744.30	744.30
MH-2	741.60	735.90	22.18	22.18	0.17	0.00	0.40	0.40	9.40	736.30	736.30
MH-3	741.00	735.10	22.18	22.18	0.17	0.00	0.10	0.10	2.40	735.20	735.20
MH-4	734.00	726.50	12.73	33.35	20.98	5.00	0.12	0.12	2.90	726.62	726.62
MH-5	732.10	725.70	29.66	33.32	4.02	1.00	0.52	0.52	12.30	726.22	726.22
MH-6	727.70	722.60	33.32	33.32	0.35	0.00	0.55	0.55	13.00	723.15	723.15
MH-7	726.60	718.90	33.48	33.48	0.51	0.00	0.57	0.57	13.50	719.47	719.47
MH-8	722.40	714.70	33.48	33.48	0.51	0.00	0.53	0.53	12.60	715.23	715.23
MH-9	717.10	713.90	33.48	33.48	0.51	0.00	0.59	0.59	14.00	714.49	714.49
MH-10	717.50	706.90	33.48	33.48	0.51	0.00	0.53	0.53	12.60	707.43	707.43
MH-11	703.10	700.70	33.68	33.68	0.72	0.00	0.54	0.54	12.80	701.24	701.24
MH-12	712.50	700.30	33.93	33.93	0.96	0.00	0.47	0.47	11.20	700.77	700.77
MH-13	715.30	699.50	33.93	33.93	0.96	0.00	0.55	0.55	13.00	700.05	700.05
MH-14	708.40	698.80	34.05	34.05	1.08	0.00	0.55	0.55	12.80	699.35	699.35
MH-15	706.80	698.30	34.07	34.07	1.10	0.00	0.58	0.58	13.50	698.88	698.88
MH-16	711.90	697.60	34.19	34.19	1.22	0.00	0.58	0.58	13.50	698.18	698.18
MH-17	706.90	696.50	40.82	45.22	5.62	1.00	0.14	0.14	3.40	696.64	696.64
MH-18	705.50	695.50	45.22	45.22	1.22	0.00	0.51	0.51	12.10	696.01	696.01
MH-19	705.80	690.10	45.22	45.22	1.22	0.00	0.56	0.56	13.30	690.66	690.66
MH-20	687.30	675.40	45.22	45.22	1.22	0.00	0.62	0.62	14.70	676.02	676.02
MH-21	751.20	745.60	0.04	0.04	0.04	0.00	0.28	0.28	6.70	745.88	745.88
MH-21	712.20	692.50	45.22	45.22	1.22	0.00	0.52	0.52	12.30	693.02	693.02
MH-22	749.70	744.00	0.10	0.10	0.10	0.00	0.82	0.82	19.20	744.82	744.82
MH-22	707.50	701.50	0.00	2.43	0.00	0.00	0.41	0.41	9.70	701.91	701.91
MH-23	740.02	730.04	0.18	0.18	0.18	0.00	0.82	0.82	19.20	730.86	730.86
MH-23	701.50	695.00	2.43	2.43	0.00	0.00	0.43	0.43	10.20	695.43	695.43
MH-24	677.50	668.50	2.43	2.43	0.00	0.00	1.16	1.16	27.30	669.66	669.66
MH-27	691.30	687.00	2.43	2.43	0.00	0.00	0.60	0.60	14.20	687.60	687.60
MH-29	743.82	737.10	0.08	0.08	0.08	0.00	(N/A)	(N/A)	0.00	(N/A)	(N/A)

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SANDERLING AREA MODEL RESULTS

TABLE 9 - PROPERTY CONNECTION

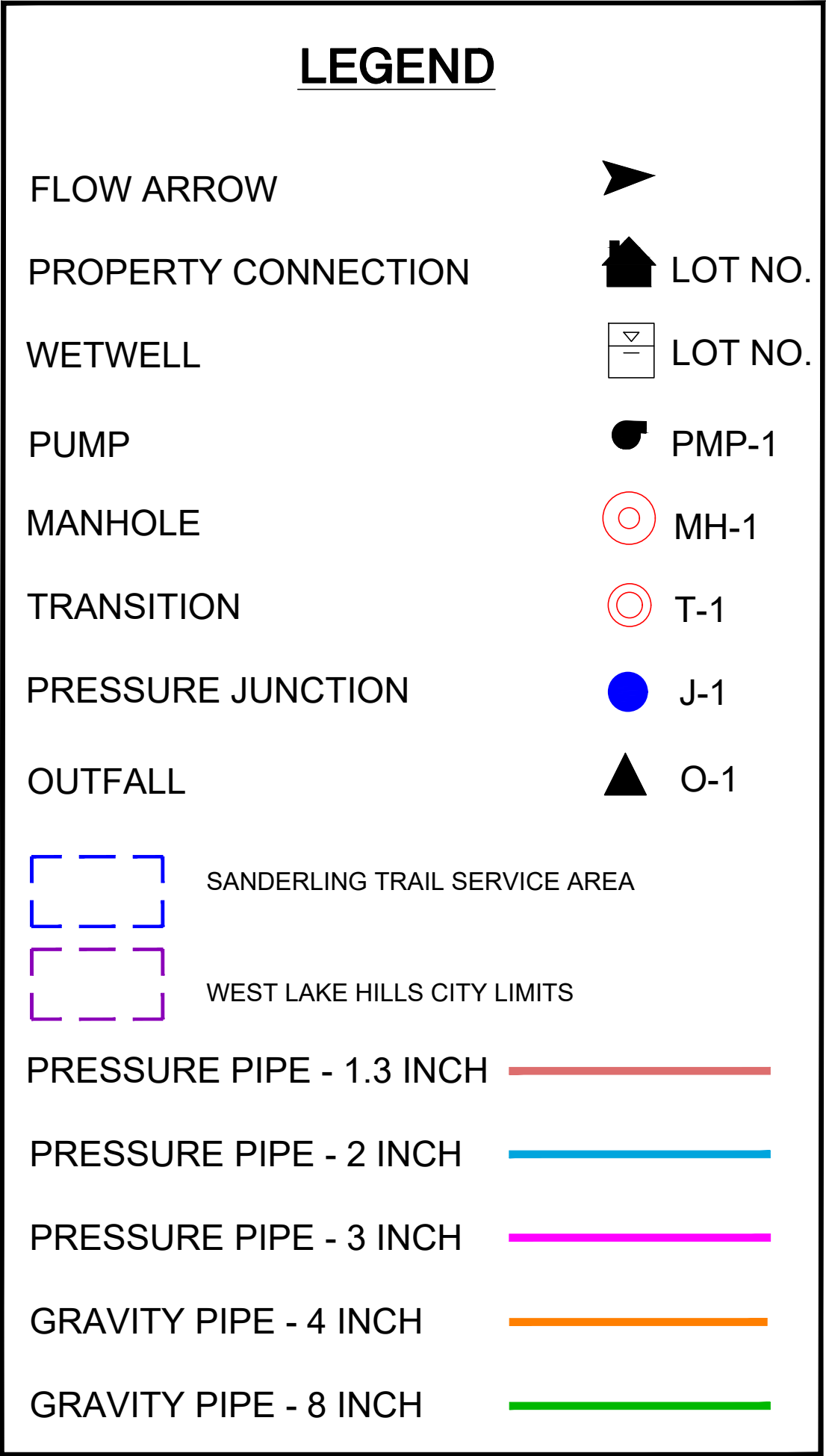
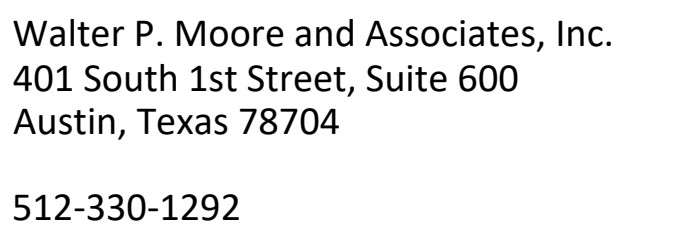
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (gpm)
910.00	750.45	746.45	0.04
913.00	746.91	742.91	0.03
1001.00	743.10	739.10	0.03
1002.00	739.01	735.01	0.03
3437.00	727.26	723.26	0.24
3425.00	714.02	710.02	0.12
3421.00	712.40	708.40	0.02
3355.00	717.54	713.54	0.12
3509.00	730.59	726.59	0.20
3525.00	735.38	731.38	0.08
3535.00	743.40	739.40	0.04
3622.00	742.43	738.43	0.03
3612.00	749.17	745.17	0.03
3620.00	744.16	740.16	0.03
3618.00	746.01	742.01	0.03
3616.00	747.06	743.06	0.03
3614.00	748.16	744.16	0.03
1003.00	736.76	732.76	0.03
914.00	746.40	742.40	0.03
3601.00	745.33	741.33	0.04

TABLE 10 - PEAK FLOW AT OUTFALL

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
F-23	672.20	665.50	Free Outfall	674.33	6.70	47.65

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EXHIBIT
SANDERLING TRAIL SERVICE AREA
COLLECTION SYSTEM MAP

[illegible]

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DRAFT REPORT ON

CITY OF WEST LAKE HILLS, TEXAS

CAPITAL OF TEXAS AREA (E151)

EXISTING SANITARY SEWER NETWORK HYDRAULIC ANALYSIS



Prepared for

City of West Lake Hills

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APPENDICES

APPENDIX A	OUTFALL PROFILES
APPENDIX B	CAPITAL OF TEXAS AREA (E151) MODEL RESULTS FOR DAY SCENARIO AVERAGE CONDITION
APPENDIX C	CAPITAL OF TEXAS AREA (E151) MODEL RESULTS FOR DAY SCENARIO PEAK CONDITION
APPENDIX D	CAPITAL OF TEXAS AREA (E151) MODEL RESULTS FOR NIGHT SCENARIO PEAK CONDITION

EXHIBITS

EXHIBIT 1	CAPITAL OF TEXAS (E151) SEWERSHED
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1. LIST OF ABBREVIATIONS**REPORT ABBREVIATIONS**

COA: City Of Austin

EGL: Energy Grade Line

Ft: Feet

Ft/s: Feet per Second

PSI: Pounds per Square Inch

GPM: Gallons per Minute

HDPE: High Density Polyethylene

HGL: Hydraulic Grade Line

LUE: Living Unit Equivalent

PVC: Poly Vinyl Chloride

WLH: West Lake Hills

MODEL ELEMENTS ABBREVIATIONS

CO – Conduit- gravity sewer main

J – Junction- low pressure system junction

L – Lateral- service line from residential or commercial property to sewer main

MH - Manhole

P – Pressure- low pressure wastewater main

T – Transition- transition from low pressure to gravity system

Tap – lateral connection to sewer main

STREET ABBREVIATIONS

BCR - Bee Cave Road

COT Hwy- Capital of Texas Highway

2. DEFINITIONS

Capacity:

The maximum capacity of the gravity interceptor.

Depth:

Depth of flow in a gravity sewer main.

Discharge Point:

Point where the City of West Lake Hills collection system discharges to the City of Austin's collection system.

EGL (Energy Grade Line):

A line that represents the total energy head (pressure head, elevation head, and velocity head) in a fluid system, always above the HGL by the velocity head amount.

Flow/Capacity:

A pipe flowing at its maximum capacity (Ratio of the pipe's current capacity and the maximum capacity) would have with a value of one.

Headloss:

Headloss is the reduction in head, or pressure, that occurs as fluid flows through a pipe or other hydraulic system due to friction, turbulence, or other factors.

HGL (Hydraulic Grade Line):

A line representing the pressure head and elevation head in a fluid system, indicating the height to which water would rise in piezometer tubes along a pipeline.

LUE (Living Unit Equivalent):

A term commonly used in engineering, planning, and utility design to standardize the measurement of water demand or wastewater generation. It represents the average flow of one residential unit (typically a single-family home) for water or wastewater services. For the purposes of this study, 245 gpd was used per LUE.

3. INTRODUCTION

The City of West Lake Hills (WLH) wastewater collection system is a combination of gravity and low-pressure systems. The WLH collection system discharges to the City of Austin (COA) collection system through several different entry points. Each of these entry points, and the system as whole, has defined average and peak flow limitations defined in an agreement between the COA and WLHs. This report describes the analysis of Capital of Texas service area sanitary sewer shed for peak loading based on the conditions defined in the above referenced agreement.

CAPITAL OF TEXAS SERVICE AREA (E151)

The Capital of Texas Service Area, located on the far west side of West Lake Hills (WLH) along Bee Cave Road, operates as a low-pressure system primarily serving office and commercial properties. Its flows discharge into the Village Lift Station, situated at the Village Shopping Centre. The lift station then pumps these flows into the City of Austin (COA) system along Capital of Texas Highway, adhering to a peak flow limit of 100 gpm. The firm capacity of the Village Lift Station is 94 gpm.

The Village Shopping Center (701 lot) contributes gravity flows directly to the Village Lift Station.

Peak flow calculations for unmetered entry points are determined by applying a multiplier of 4.0 to the average flows for each property. A model has been developed to represent the current conditions of the collection system accurately.

4. OBJECTIVES

The main objectives of this study are

- To develop a wastewater model for the City of Westlake Hills to monitor the system's capacity for existing conditions, proposed redevelopment, and contractual agreement limits with the COA.
- To develop accurate GIS files of the collection system to assist with the City's asset management program.
- To develop an understanding of the maximum capacity of the existing collection system under Average and peak flow conditions.
- To develop various scenarios, including sub-basins transfers, to get the maximum capacity out of the existing systems lift stations and interceptors while maintaining contractual limits at discharge points.
- To use future flow meter data to calibrate the current model and define actual operational conditions.

5. DATA COLLECTION

Existing site plan and utility plan information was collected from the City of West Lake Hills. The AutoCAD background files were geolocated with respect to NAD 83 Texas coordinate system and the analysis was performed in Central Zone projection, TX83. Information collected by WPM includes:

- West Lake Hills Wastewater Collection System Map dated February 7, 2023
- GIS mapping data from the City of West Lake's website
- Record drawings for wastewater infrastructure
- COA Annual Wastewater connection and flow summary spreadsheet
- Elevation Data from LIDAR
- Pump information, from WLH design standards. (pump curve data, wet well size, pump cycle times based on wastewater generation)
- Probability data for low pressure systems was provided by Bentley, correlating the number of connected grinder pump connections with the maximum number of grinder pumps operating simultaneously.

5.1 CAPITAL OF TEXAS RECORD DRAWINGS

- Bee Cave Road - "Phase 2 Plans – Full"
- St John Neuman Church internal connection- "t_John_Neumann_WW_Plan" & "5455 Bee Caves WW plans"
- Village Lift Station Details- "Village LS As-Built Drawing"
- Village Lift Station Pump curve Details- "Flights Perf. Curve"
- For Internal Pressure Connections of lots 5455,5500,5524,5522,5656,5858,5902 and 515- "Bee Caves Road_5455 WW plans, Bee Caves Road_5500, Bee Caves Road_5524-5522, Bee Caves Road_5604, Bee Caves Road_5656-5858, Bee Caves Road_5902, Cap of TX Hwy_515"

6 DESIGN CRITERIA

6.1 DESIGN CRITERIA FOR SANITARY NETWORK:

- **Average Flow:** Residential 245 gpd per LUE
Commercial 175 gpd per LUE
(Robert E. Lee Wastewater study by PBS&J, Refer section 7 for more details)
- **Maximum Peak Flow limitation:** 100 gpm
(City of Austin, Texas- Peak flow limitation at Capital of Texas trail entry point)
- **Minimum flow velocity:** 2 ft/s
- **Maximum flow velocity:** 10 ft/s
- **Minimum pipe cover:** 4 ft
- **Maximum cover:** 15 ft
(City of Austin, Texas – Utilities Criteria Manual, Section 2)
- **Minimum slope:** 0.335% (8-inch diameter)
(Texas Commission on Environmental Quality, Chapter 217 – Design Criteria for Domestic Wastewater Systems)
- **Pump Information:**
 - Type B – E-One dual core pump unit
 - 9 to 15 gpm at 138 to 0 feet of total head
 - Utilized for non-residential with average daily flows up to 3,000 gpd
 - Utilized for average daily flows up to 20,000 gpd
 - Type C – Myers WGL20 dual core pump unit
 - 0 to 45 gpm at 105 to 20 feet of total head
 - Utilized for non-residential with average daily flows up to 5,000 gpd
 - Type E – Myers WG30H
 - 0 to 92 gpm at 97 to 45 feet of total head
 - Utilized for average daily flows up to 20,000 gpd

(West Lake Hills- Wastewater flow modelling and calculations, - II. Low Pressure System Pump Units)

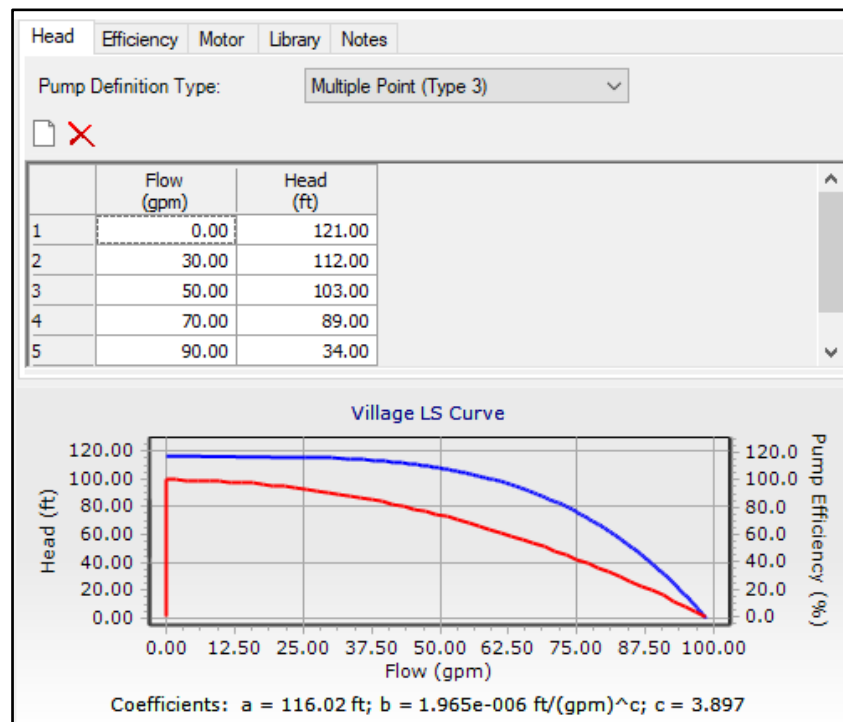
6.2 REFERENCE MANUALS AND SOFTWARE

- City of Austin, Texas – Utilities Criteria Manual, Section 2
- City of Westlake Hills– Engineering Standards, Article 5: Wastewater Facilities
- Bentley E-ONE Grinder setup
- Sewer GEMS CONNECT Edition Update, Bentley Systems
- AutoCAD Civil 3D
- ArcGIS

6.3 DESIGN ASSUMPTIONS

- Peak flow calculations were determined by applying a 4.0 multiplier to average wastewater flows for each property
- E-one grinder pump design guide was followed for low pressure systems flow operations
- Gravity flows were estimated as flow per Living Unit Equivalent (LUE) for average and peak scenarios

- COA Annual Wastewater connection and flow summary spreadsheet utilized for modelling the existing wastewater collection system and to determine average and peak flow calculations
- WaterCAD Model (by KFA) was utilized for low pressure main modelling and for pump curves.
- Maximum peak flows capped at 90% pipe capacity
- Elevations for wastewater lines without as -built drawings was assumed to have a depth of 4 feet. Ground elevations were taken from LIDAR
- Grinder pump wet wells-3 feet in diameter and 5 feet deep
- Pressure system laterals - 1.5-inch diameter HDPE pipe
- Gravity system laterals - 4-inch diameter PVC pipe
- For night scenario, considered 10 gpm gravity flow incoming from 701 lot which is less than average flow as per the flow spreadsheet.
- Design Flow at Village Lift Station (See figure below)



7 METHODOLOGY

The hydraulic modelling software **SEWERGEMS** was used to create the existing wastewater collection system model to understand the system's existing capacity and limitations which can utilized to forecast future demands or operational scenarios. Parameters used for the model development are included below.

Calculation method/ Equation used in software are:

- **Manning's Equation:**

$$V = \frac{k}{n} R^{2/3} S^{1/2}$$

Where,

V = mean velocity (m/s, ft/s)

k = 1.49 for U.S. customary units, 1.00 for SI units

n = Manning's roughness value

- **Hazen – Williams Equation:**

$$V = kCR^{0.63} S^{0.54}$$

Where,

V = mean velocity (m/s, ft/s)

k = 1.32 for U.S. customary units, or 0.85 for SI units

C = Hazen–Williams's roughness coefficient (unitless)

R = hydraulic radius (m, ft)

S = friction slope (m/m, ft/ft).

- **Energy Equation:**

$$\frac{p_1}{\gamma} + z_1 + \frac{V_1^2}{2g} + H_G = \frac{p_2}{\gamma} + z_2 + \frac{V_2^2}{2g} + H_L$$

Where,

p = pressure (N/m², lb/ft²)

γ = specific weight of the fluid (N/m³, lb/ft³)

z = elevation above a datum (m, ft)

V = fluid velocity (m/s, ft/s)

g = gravitational acceleration (m/s², ft/s²)

HG = head gain, such as from a pump (m, ft)

HL = combined head loss (m, ft).

E-One Extreme Flow Probability Method

The E-One Extreme Flow Probability Method was utilised for modelling grinder pumps, allowing for the estimation of extreme flows necessary for the design and analysis of the sewer system.

This method predicts the maximum number of grinder pumps expected to operate simultaneously, based on the number of grinder pumps connected to the system.

The table below, provided by Bentley, provides the probability if the maximum number of pumps operating simultaneously based on the total number of grinder pump connections.

Table 3 MAXIMUM NUMBER OF GRINDER PUMPCORES OPERATING DAILY	
Number of Grinder Pump Cores Connected	Maximum Daily Number of Grinder Pump Cores Operating Simultaneously
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15
345-377	16
378-410	17
411-443	18
444-476	19
477-509	20
510-542	21
543-575	22
576-608	23
609-641	24
642-674	25
675-707	26
708-740	27
741-773	28
774-806	29
807-839	30
840-872	31
873-905	32
906-938	33
939-971	34
972-1,004	35

* Table 3, sourced from Page 14 of the Low-Pressure Sewer System using E/One Grinder Pumps Manual, has been utilized for reference, if 4 to 9 grinder pumps are connected to the system, then 3 is the maximum number of grinder pumps that are operating simultaneously.

7.1 MODELLING METHODOLOGY

- This sewer shed is a low-pressure system, located at the southwest of the Westlake Hills (WLH) region, along Bee Cave Road, with its discharge point at Capital of Texas Highway outfall (E151).
- A total of 9 pump connections are installed in this area, consisting of the following types:
 - E-One Grinder (Duplex) for all commercial and residential with more than 6.5 bathrooms (5 pumps)
 - Myers WGL 20 (1 pump) lot number 5902, near to the Bee Cave Road
 - Myers WG30 H (3 pumps) St. John Neumann Church (5455 Bee Cave) and the West Lake Medical Center (5656/5858 Bee Cave)
- The basin comprises a total of 273 Living Unit Equivalents (LUEs).

DAY SCENARIO-

- The St. John Neumann Church (5455 Bee Cave) and the West Lake Medical Center (5656/5858 Bee Cave) are set up to store daily flows and pump over night at off-peak times. So, these pump connections were inactive for day scenario to determine the flows for day average and day peak scenarios.
- The network was simulated using Bentley's E-One Extreme Flow Probability Method (refer to Section 5.0 - Methodology). With 5 grinder pumps, the probability of a maximum of 3 grinder cores operating simultaneously was determined.
- A total of 4 pumps were modeled as active in the network (3 E-One pumps and 1 Myers WG20 pump)
- The Village Shopping Center (701) discharges gravity flows directly to the Village Lift Station. Wastewater loads from Village Shopping Center were considered based on the scenario.

NIGHT SCENARIO-

- The St. John Neumann Church (5455 Bee Cave) and the West Lake Medical Center (5656/5858 Bee Cave) are set up to store daily flows and pump over night at off-peak times. So, these pump connections were active for night scenario to determine the flows for night peak scenario.
- All other low-pressure connections were modelled inactive.
- The Village Shopping Center (701) discharges gravity flows directly to the Village Lift Station. Wastewater loads from Village Shopping Center were considered based on the scenario.

8 MODEL FLOW CALCULATIONS

Wastewater flow estimates were determined with reference to the Robert E. Lee Wastewater Study prepared by PBS&J. The land use types in this study included residential, office, commercial, and school campuses, each with their own diurnal curve. Based on this study an average daily wastewater flow of 245 gallons per LUE was identified. To calculate LUEs for non-residential properties the study applied a 7/5 weekday adjustment factor, for the non-residential properties as follows:

- 1 Residential connection LUE = 245 gpd, 7,350 gallons/month
- 1 Commercial connection LUE = 245 gpd x 5/7 = 175 gpd, 5,250 gallons per month.

In determining/modelling the peak flows for each entry point to the COA system, we converted the gallons per month flows into gallons per minute for each type of sanitary connection.

TABLE 1 - WASTEWATER LOAD CALCULATIONS FOR COMMERCIAL CONNECTIONS

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
5500	Bee Cave Road	1	0	0
5522	Bee Cave Road	12	1	6
5604	Bee Cave Road	5	1	2
5656/5858	Bee Cave Road	57	7	28
5902	Bee Cave Road	11	1	5
515	Capital of Texas Hwy	11	1	5
5455	Bee Cave Road	15	2	7
701	Capital of Texas Hwy	161	20	78

9 RESULTS SUMMARY

9.1 DAY SCENARIO AVERAGE CONDITION

Gravity System - As per Appendix-B, Table 1, the main gravity system for day scenario average load analysis results shows velocities range from **0.13 Ft/s to 0.53 Ft/s** respectively, though low-flow areas might need monitoring to avoid sediment deposition. Conduits are under than lower limit per COA design standards.

Pressurized System - As per Appendix-B, Table 3, the main pressure systems average analysis results show maximum velocity of **3.78 Ft/s**, respectively which satisfy the maximum limits per COA design standards.

System Capacity - As per Appendix-B, Table 1 and Table 2, Hydraulic Gradient Line (HGL) determined by invert elevation and depth of flow indicates that the maximum flows within the system exceed the pipe capacity at any point within the system.

As per Appendix-B, Table 5, the flow at the discharge point (E151) is recorded as **92.55 gpm**, which is within the agreement limitation of 100 gpm.

9.2 DAY SCENARIO PEAK CONDITION

Gravity System - As per Appendix-C, Table 1, the main gravity system for day scenario peak load analysis results shows velocities range from **0.50 Ft/s to 0.53 Ft/s** respectively, though low-flow areas might need monitoring to avoid sediment deposition. Conduits are within the minimum and maximum limits per COA design standards.

Pressurized System - As per Appendix-C, Table 3, the main Pressure systems peak load analysis results show maximum velocities of **5.82 Ft/s**, respectively which satisfy the maximum limits per COA design standards.

System Capacity - As per Appendix-C, Table 1 and Table 2, Hydraulic Gradient Line (HGL) determined by invert elevation and depth of flow indicates that the maximum flows within the system exceed the pipe capacity at any point within the system.

As per Appendix-C, Table 5, the peak flow at day at the discharge point (E151) is recorded as **92.55 gpm**, which is within the agreement limitation of 100 gpm.

9.3 NIGHT SCENARIO PEAK CONDITION

Gravity System - As per Appendix-D, Table 1, the main gravity system for night scenario peak load analysis results shows velocities range from **0.06 Ft/s to 0.94 Ft/s** respectively, though low-flow areas might need monitoring to avoid sediment deposition. Conduits are within the minimum and maximum limits per COA design standards.

Pressurized System - As per Appendix-D, Table 3, the main Pressure systems average load analysis results show maximum velocities of **6.59 Ft/s**, respectively which satisfy the maximum limits per COA design standards.

System Capacity - As per Appendix-D, Table 1 and Table 2, Hydraulic Gradient Line (HGL) determined by invert elevation and depth of flow indicates that the maximum flows within the system exceed the pipe capacity at any point within the system.

As per Appendix-D, Table 5, the peak flow at day at the discharge point (E151) is recorded as **92.55 gpm**, which is within the agreement limitation of 100 gpm.

The capacity of the Village Lift Station is 94 gpm. Per pump configuration and lift station details, Village lift station discharge is around 92.55 gpm in each scenario, which is within the agreement limitation of 100 gpm.

10 CONCLUSION

Utilizing Bentley's SewerGEMS software, a model of the Capital of Texas Service area collection system was created and validated. The model was analysed for day (average and peak) and night scenarios, and it was determined to be accurate and in alignment with the City of West Lake Hills engineering calculations. The analysis shows that there are no locations within the collection system above capacity or with compromising hydraulics that could cause damage to the system. Additionally, the model results accurately indicate that the peak flow at the outfall is 92.55 gpm, which complies with the current agreement of 100 gpm.

The model can also be utilized to develop various operational scenarios to address proposed development within the sewer shed.

APPENDIX A OUTFALL PROFILES

OUTFALL PROFILES FOR
CAPITAL OF TEXAS AREA (E151) SEWERSHED FORM BEE CAVE ROAD TO E151 OUTFALL
PROFILE- DAY SCENARIO AVERAGE CONDITION

LEGEND

EXISTING GROUND
LEVEL

HGL

VELOCITY

SLOPE

PRESSURE

V-ft/s

S-ft/ft

PRE-psi

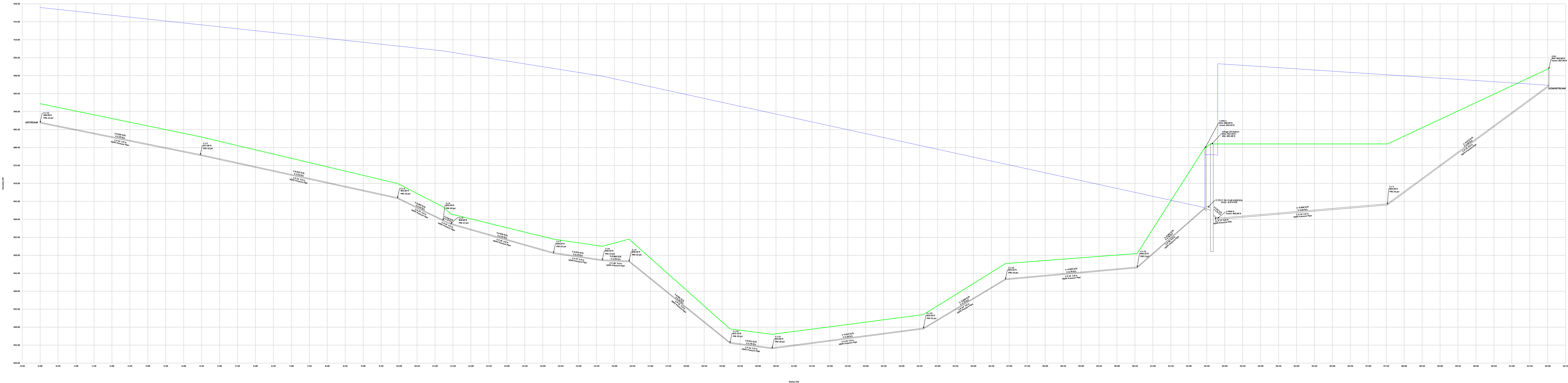


FIGURE 1: DAY SCENARIO AVERAGE CONDITION

Preliminary - Draft



OUTFALL PROFILES FOR
CAPITAL OF TEXAS AREA (E151) SEWERSHED FROM BEE CAVE ROAD TO E151 OUTFALL
PROFILE- NIGHT SCENARIO

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi



FIGURE 3: NIGHT SCENARIO

Preliminary - Draft

APPENDIX B
CAPITAL OF TEXAS AREA (E151)
MODEL RESULTS FOR DAY SCENARIO
AVERAGE CONDITION

CAPITAL OF TEXAS AREA (E151) MODEL RESULTS

TABLE 1 - GRAVITY SYSTEM, DAY SCENARIO AVERAGE FLOW DATA

	Below from min. limit
	Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
C-CO-1	701 Capital of Tx Hwy	881.94	864.14	Village Lift Station	881.00	862.50	46.00	0.036	8.00	PVC	0.13	0.67	17.48	20.00	0.00	1434.81	1.40	878.00	878.00
C-CO-2	MH-5	880.00	863.00	Village Lift Station	881.00	862.50	18.10	0.028	8.00	PVC	0.53	0.67	17.08	83.38	0.00	1251.81	6.70	878.00	878.00

TABLE 2 – COLLECTION SYSTEM HYDRAULIC GRADE LINE (MANHOLE), DAY SCENARIO AVERAGE FLOW DATA

Input Data							Output Data				
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Depth (In) (ft)	Population (Local Sanitary) (Capita)	Base Load (Local Sanitary) (gpm)	Depth (Out) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
701 COT Hwy	881.94	864.10	0.00	20.00	1.00	20.00	13.90	13.90	245.00	878	878
C-MH-1	880.00	862.50	83.38	83.38	0.00	0.00	15.50	15.50	273.30	878	878

Preliminary - Draft

CAPITAL OF TEXAS AREA (E151) MODEL RESULTS

TABLE 3 – PRESSURE PIPE, DAY SCENARIO AVERAGE FLOW DATA

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
C-P-1	5500 BCR	856.35	C-PMP-1	857.35	9.40	4.00	HDPE Pressure Pipe	-0.107	0.34	13.17	0.00	858.35	858.35
C-P-2	C-PMP-1	857.35	C-J-8	848.50	77.90	1.50	HDPE Pressure Pipe	0.114	2.39	13.17	1.63	901.50	899.87
C-P-7	5604 BCR	863.61	C-PMP-4	864.61	16.30	4.00	HDPE Pressure Pipe	-0.061	0.34	13.22	0.00	865.61	865.61
C-P-12	5904/5902 BCR	899.88	C-PMP-7	899.99	11.80	4.00	HDPE Pressure Pipe	-0.009	1.11	43.41	0.02	901.88	901.86
C-P-13	C-PMP-7	899.99	C-J-2	901.00	108.20	2.00	HDPE Pressure Pipe	-0.009	4.43	43.41	5.07	934.71	929.63
C-P-14	515 BCR	900.22	C-PMP-8	901.22	10.90	4.00	HDPE Pressure Pipe	-0.091	0.35	13.58	0.00	902.22	902.22
C-P-15	C-PMP-8	901.22	C-J-2	901.00	445.80	2.00	HDPE Pressure Pipe	0.000	1.39	13.58	2.43	932.06	929.63
C-P-16	C-J-1	864.00	E151	897.00	449.80	4.00	HDPE Pressure Pipe	-0.073	2.36	92.55	2.93	900.26	897.33
C-P-17	Village Lift Station	861.00	C-PMP-9	860.00	16.40	4.00	HDPE Pressure Pipe	0.061	2.36	92.55	0.11	878.00	877.89
C-P-18	C-PMP-9	860.00	C-J-1	864.00	472.80	4.00	HDPE Pressure Pipe	-0.008	2.36	92.55	3.08	903.34	900.26
C-P-19	C-J-2	901.00	C-J-12	886.80	137.10	2.00	HDPE Pressure Pipe	0.104	5.82	56.99	10.65	929.63	918.99
C-P-20	C-PMP-4	864.61	C-J-5	859.60	21.00	1.50	HDPE Pressure Pipe	0.238	2.40	13.22	0.44	907.34	906.90
C-P-22	C-J-12	886.80	C-J-3	877.80	446.10	3.00	HDPE Pressure Pipe	0.020	2.59	56.99	4.80	918.99	914.18
C-P-23	C-J-3	877.80	C-J-4	865.80	549.50	3.00	HDPE Pressure Pipe	0.022	2.59	56.99	5.92	914.18	908.27
C-P-24	C-J-4	865.80	C-J-5	859.60	126.80	3.00	HDPE Pressure Pipe	0.049	2.59	56.99	1.37	908.27	906.90
C-P-25	C-J-5	859.60	C-J-6	858.60	22.00	3.00	HDPE Pressure Pipe	0.046	3.19	70.20	0.35	906.90	906.55
C-P-26	C-J-6	858.60	C-J-7	850.50	285.80	3.00	HDPE Pressure Pipe	0.028	3.19	70.20	4.53	906.55	902.02
C-P-27	C-J-7	850.50	C-J-8	848.50	136.00	3.00	HDPE Pressure Pipe	0.015	3.19	70.20	2.15	902.02	899.87
C-P-28	C-J-8	848.50	C-J-9	848.20	74.70	3.00	HDPE Pressure Pipe	0.004	3.78	83.38	1.63	899.87	898.24
C-P-30	C-J-13	846.50	C-MH-1	863.00	189.90	3.00	HDPE Pressure Pipe	-0.087	3.78	83.38	4.14	867.39	863.25
C-P-31	C-J-9	848.20	C-J-14	825.50	281.20	3.00	HDPE Pressure Pipe	0.081	3.78	83.38	6.13	898.24	892.11
C-P-32	C-J-14	825.50	C-J-15	824.00	117.40	3.00	HDPE Pressure Pipe	0.013	3.78	83.38	2.56	892.11	889.55
C-P-33	C-J-15	824.00	C-J-10	829.50	421.50	3.00	HDPE Pressure Pipe	-0.013	3.78	83.38	9.19	889.55	880.37
C-P-34	C-J-10	829.50	C-J-16	843.20	228.50	3.00	HDPE Pressure Pipe	-0.060	3.78	83.38	4.98	880.37	875.39
C-P-35	C-J-16	843.20	C-J-13	846.50	366.90	3.00	HDPE Pressure Pipe	-0.009	3.78	83.38	8.00	875.39	867.39

Preliminary - Draft

CAPITAL OF TEXAS AREA (E151) MODEL RESULTS
TABLE 4 – PRESSURE JUNCTION, DAY SCENARIO AVERAGE FLOW DATA

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
C-J-1	881.00	864.00	900.26	16.00
C-J-2	905.00	901.00	929.63	12.00
C-J-3	883.00	877.80	914.18	16.00
C-J-4	870.00	865.80	908.27	18.00
C-J-5	863.50	859.60	906.90	20.00
C-J-6	861.50	858.60	906.55	21.00
C-J-7	854.50	850.50	902.02	22.00
C-J-8	852.50	848.50	899.87	22.00
C-J-9	854.50	848.20	898.24	22.00
C-J-10	833.50	829.50	880.37	22.00
C-J-12	892.20	886.80	918.99	14.00
C-J-13	850.50	846.50	867.39	9.00
C-J-14	829.50	825.50	892.11	29.00
C-J-15	828.00	824.00	889.55	28.00
C-J-16	847.70	843.20	875.39	14.00

TABLE 5 – OUTFALL, DAY SCENARIO AVERAGE FLOW DATA

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
E151	902.00	897.00	Free Outfall	897.33	5.00	92.55

Preliminary - Draft

APPENDIX C
CAPITAL OF TEXAS AREA (E151)
MODEL RESULTS FOR DAY SCENARIO
PEAK CONDITION

CAPITAL OF TEXAS AREA (E151) MODEL RESULTS

TABLE 1 - GRAVITY SYSTEM, DAY SCENARIO PEAK FLOW DATA

	Below from min. limit
	Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
C-CO-1	701 COT Hwy	881.94	864.14	Village Lift Station	881.00	862.50	46.00	0.036	8.00	PVC	0.50	0.67	17.48	78.00	0.01	1434.81	5.40	878.01	878.00
C-CO-2	C-MH-1	880.00	863.00	Village Lift Station	881.00	862.50	18.10	0.028	8.00	PVC	0.53	0.67	17.08	83.38	0.00	1251.81	6.70	878.00	878.00

TABLE 2 – COLLECTION SYSTEM HYDRAULIC GRADE LINE (MANHOLE), DAY SCENARIO PEAK FLOW DATA

Input Data							Output Data				
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Depth (In) (ft)	Population (Local Sanitary) (Capita)	Base Load (Local Sanitary) (gpm)	Depth (Out) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
701 COT Hwy	881.94	864.10	0.00	78.00	1.00	78.00	13.91	13.91	245.10	878.01	878.01
C-MH-1	880.00	862.50	83.38	83.38	0.00	0.00	15.50	15.50	273.30	878	878

Preliminary - Draft

CAPITAL OF TEXAS AREA (E151) MODEL RESULTS
TABLE 3 – PRESSURE PIPE, DAY SCENARIO PEAK FLOW DATA

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
C-P-1	5500 BCR	856.35	C-PMP-1	857.35	9.40	4.00	HDPE Pressure Pipe	-0.107	0.34	13.17	0.00	858.35	858.35
C-P-2	C-PMP-1	857.35	C-J-8	848.50	77.90	1.50	HDPE Pressure Pipe	0.114	2.39	13.17	1.63	901.50	899.87
C-P-7	5604 BCR	863.61	C-PMP-4	864.61	16.30	4.00	HDPE Pressure Pipe	-0.061	0.34	13.22	0.00	865.61	865.61
C-P-12	5904/5902 BCR	899.88	C-PMP-7	899.99	11.80	4.00	HDPE Pressure Pipe	-0.009	1.11	43.41	0.02	901.88	901.86
C-P-13	C-PMP-7	899.99	C-J-2	901.00	108.20	2.00	HDPE Pressure Pipe	-0.009	4.43	43.41	5.07	934.71	929.63
C-P-14	515 BCR	900.22	C-PMP-8	901.22	10.90	4.00	HDPE Pressure Pipe	-0.091	0.35	13.58	0.00	902.22	902.22
C-P-15	C-PMP-8	901.22	C-J-2	901.00	445.80	2.00	HDPE Pressure Pipe	0.000	1.39	13.58	2.43	932.06	929.63
C-P-16	C-J-1	864.00	E151	897.00	449.80	4.00	HDPE Pressure Pipe	-0.073	2.36	92.55	2.93	900.26	897.33
C-P-17	Village Lift Station	861.00	C-PMP-9	860.00	16.40	4.00	HDPE Pressure Pipe	0.061	2.36	92.55	0.11	878.00	877.89
C-P-18	C-PMP-9	860.00	C-J-1	864.00	472.80	4.00	HDPE Pressure Pipe	-0.008	2.36	92.55	3.08	903.34	900.26
C-P-19	C-J-2	901.00	C-J-12	886.80	137.10	2.00	HDPE Pressure Pipe	0.104	5.82	56.99	10.65	929.63	918.99
C-P-20	C-PMP-4	864.61	C-J-5	859.60	21.00	1.50	HDPE Pressure Pipe	0.238	2.40	13.22	0.44	907.34	906.90
C-P-22	C-J-12	886.80	C-J-3	877.80	446.10	3.00	HDPE Pressure Pipe	0.020	2.59	56.99	4.80	918.99	914.18
C-P-23	C-J-3	877.80	C-J-4	865.80	549.50	3.00	HDPE Pressure Pipe	0.022	2.59	56.99	5.92	914.18	908.27
C-P-24	C-J-4	865.80	C-J-5	859.60	126.80	3.00	HDPE Pressure Pipe	0.049	2.59	56.99	1.37	908.27	906.90
C-P-25	C-J-5	859.60	C-J-6	858.60	22.00	3.00	HDPE Pressure Pipe	0.046	3.19	70.20	0.35	906.90	906.55
C-P-26	C-J-6	858.60	C-J-7	850.50	285.80	3.00	HDPE Pressure Pipe	0.028	3.19	70.20	4.53	906.55	902.02
C-P-27	C-J-7	850.50	C-J-8	848.50	136.00	3.00	HDPE Pressure Pipe	0.015	3.19	70.20	2.15	902.02	899.87
C-P-28	C-J-8	848.50	C-J-9	848.20	74.70	3.00	HDPE Pressure Pipe	0.004	3.78	83.38	1.63	899.87	898.24
C-P-30	C-J-13	846.50	C-MH-1	863.00	189.90	3.00	HDPE Pressure Pipe	-0.087	3.78	83.38	4.14	867.39	863.25
C-P-31	C-J-9	848.20	C-J-14	825.50	281.20	3.00	HDPE Pressure Pipe	0.081	3.78	83.38	6.13	898.24	892.11
C-P-32	C-J-14	825.50	C-J-15	824.00	117.40	3.00	HDPE Pressure Pipe	0.013	3.78	83.38	2.56	892.11	889.55
C-P-33	C-J-15	824.00	C-J-10	829.50	421.50	3.00	HDPE Pressure Pipe	-0.013	3.78	83.38	9.19	889.55	880.37
C-P-34	C-J-10	829.50	C-J-16	843.20	228.50	3.00	HDPE Pressure Pipe	-0.060	3.78	83.38	4.98	880.37	875.39
C-P-35	C-J-16	843.20	C-J-13	846.50	366.90	3.00	HDPE Pressure Pipe	-0.009	3.78	83.38	8.00	875.39	867.39

Preliminary - Draft

TABLE 4 – PRESSURE JUNCTION, DAY SCENARIO PEAK FLOW DATA

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
C-J-1	881.00	864.00	900.26	16.00
C-J-2	905.00	901.00	929.63	12.00
C-J-3	883.00	877.80	914.18	16.00
C-J-4	870.00	865.80	908.27	18.00
C-J-5	863.50	859.60	906.90	20.00
C-J-6	861.50	858.60	906.55	21.00
C-J-7	854.50	850.50	902.02	22.00
C-J-8	852.50	848.50	899.87	22.00
C-J-9	854.50	848.20	898.24	22.00
C-J-10	833.50	829.50	880.37	22.00
C-J-12	892.20	886.80	918.99	14.00
C-J-13	850.50	846.50	867.39	9.00
C-J-14	829.50	825.50	892.11	29.00
C-J-15	828.00	824.00	889.55	28.00
C-J-16	847.70	843.20	875.39	14.00

TABLE 5 – OUTFALL, DAY SCENARIO PEAK FLOW DATA

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
E151	902.00	897.00	Free Outfall	897.33	5.00	92.55

Preliminary - Draft

APPENDIX D
CAPITAL OF TEXAS AREA (E151)
MODEL RESULTS FOR NIGHT
SCENARIO PEAK CONDITION

CAPITAL OF TEXAS AREA (E151) MODEL RESULTS

TABLE 1 - GRAVITY SYSTEM, NIGHT SCENARIO PEAK FLOW DATA

Below from min. limit

Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
C-CO-1	701 COT Hwy	881.94	864.14	Village Lift Station	881.00	862.50	46.00	0.036	8.00	PVC	0.06	0.67	17.48	10.00	0.00	1434.81	0.70	878.00	878.00
C-CO-2	C-MH-1	880.00	863.00	Village Lift Station	881.00	862.50	18.10	0.028	8.00	PVC	0.94	0.67	17.08	147.28	0.01	1251.81	11.80	878.01	878.00

TABLE 2 – COLLECTION SYSTEM HYDRAULIC GRADE LINE (MANHOLE), NIGHT SCENARIO PEAK FLOW DATA

Input Data							Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Depth (In) (ft)	Depth (Out) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
701 COT Hwy	881.94	864.10	0.00	10.00	13.90	13.90	245.00	878.00	878.00
C-MH-1	880.00	862.50	147.28	147.28	15.51	15.51	273.40	878.01	878.01

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CAPITAL OF TEXAS AREA (E151) MODEL RESULTS

TABLE 3 – PRESSURE PIPE, NIGHT SCENARIO PEAK FLOW DATA

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
C-P-8	56 BCR Medical Cent	921.54	C-PMP-5	922.54	26.30	4.00	HDPE Pressure Pipe	-0.038	1.65	64.53	0.09	923.54	923.45
C-P-9	C-PMP-5	922.54	C-J-4	865.80	428.10	2.00	HDPE Pressure Pipe	0.133	6.59	64.53	41.84	985.93	944.09
C-P-10	58 BCR Medical Cent	875.63	C-PMP-6	876.63	15.50	4.00	HDPE Pressure Pipe	-0.065	1.14	44.66	0.03	877.63	877.60
C-P-11	C-PMP-6	876.63	C-J-3	877.80	163.60	2.00	HDPE Pressure Pipe	-0.007	4.56	44.66	8.09	955.94	947.86
C-P-16	C-J-1	864.00	E151	897.00	449.80	4.00	HDPE Pressure Pipe	-0.073	2.36	92.55	2.93	900.26	897.33
C-P-17	Village Lift Station	861.00	C-PMP-9	860.00	16.40	4.00	HDPE Pressure Pipe	0.061	2.36	92.55	0.11	878.00	877.89
C-P-18	C-PMP-9	860.00	C-J-1	864.00	472.80	4.00	HDPE Pressure Pipe	-0.008	2.36	92.55	3.08	903.34	900.26
C-P-21	BCR St, Neumann Cl	822.00	C-PMP-10	822.10	30.40	2.00	HDPE Pressure Pipe	-0.003	3.89	38.09	1.12	824.00	822.88
C-P-23	C-J-3	877.80	C-J-4	865.80	549.50	3.00	HDPE Pressure Pipe	0.022	2.03	44.66	3.77	947.86	944.09
C-P-24	C-J-4	865.80	C-J-5	859.60	126.80	3.00	HDPE Pressure Pipe	0.049	4.96	109.19	4.56	944.09	939.53
C-P-25	C-J-5	859.60	C-J-6	858.60	22.00	3.00	HDPE Pressure Pipe	0.046	4.96	109.19	0.79	939.53	938.74
C-P-26	C-J-6	858.60	C-J-7	850.50	285.80	3.00	HDPE Pressure Pipe	0.028	4.96	109.19	10.27	938.74	928.48
C-P-27	C-J-7	850.50	C-J-8	848.50	136.00	3.00	HDPE Pressure Pipe	0.015	4.96	109.19	4.88	928.48	923.60
C-P-28	C-J-8	848.50	C-J-9	848.20	74.70	3.00	HDPE Pressure Pipe	0.004	4.96	109.19	2.68	923.60	920.92
C-P-30	C-J-13	846.50	C-MH-1	863.00	189.90	3.00	HDPE Pressure Pipe	-0.087	4.96	109.19	6.82	870.07	863.25
C-P-31	C-J-9	848.20	C-J-14	825.50	281.20	3.00	HDPE Pressure Pipe	0.081	4.96	109.19	10.10	920.92	910.81
C-P-32	C-J-14	825.50	C-J-15	824.00	117.40	3.00	HDPE Pressure Pipe	0.013	4.96	109.19	4.22	910.81	906.60
C-P-33	C-J-15	824.00	C-J-10	829.50	421.50	3.00	HDPE Pressure Pipe	-0.013	4.96	109.19	15.14	906.60	891.46
C-P-34	C-J-10	829.50	C-J-16	843.20	228.50	3.00	HDPE Pressure Pipe	-0.060	4.96	109.19	8.21	891.46	883.25
C-P-35	C-J-16	843.20	C-J-13	846.50	366.90	3.00	HDPE Pressure Pipe	-0.009	4.96	109.19	13.18	883.25	870.07
C-P-36	C-PMP-10	822.10	C-MH-1	863.00	409.00	2.00	HDPE Pressure Pipe	-0.100	3.89	38.09	15.06	878.22	863.17

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CAPITAL OF TEXAS AREA (E151) MODEL RESULTS
TABLE 4 – PRESSURE JUNCTION, NIGHT SCENARIO PEAK FLOW DATA

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
C-J-1	881.00	864.00	900.26	16.00
C-J-3	883.00	877.80	947.86	30.00
C-J-4	870.00	865.80	944.09	34.00
C-J-5	863.50	859.60	939.53	35.00
C-J-6	861.50	858.60	938.74	35.00
C-J-7	854.50	850.50	928.48	34.00
C-J-8	852.50	848.50	923.60	32.00
C-J-9	854.50	848.20	920.92	31.00
C-J-10	833.50	829.50	891.46	27.00
C-J-13	850.50	846.50	870.07	10.00
C-J-14	829.50	825.50	910.81	37.00
C-J-15	828.00	824.00	906.60	36.00
C-J-16	847.70	843.20	883.25	17.00

TABLE 5 – OUTFALL, NIGHT SCENARIO PEAK FLOW DATA

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
E151	902.00	897.00	Free Outfall	897.33	5.00	92.55

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EXHIBIT
CAPITAL OF TEXAS (E151) SEWERSHED

DRAFT REPORT ON

CITY OF WEST LAKE HILLS, TEXAS

REDBUD TRAIL SERVICE AREA

(F24-2, F24-10, G-M54, G23-69, G23-M50)

EXISTING SANITARY SEWER NETWORK HYDRAULIC ANALYSIS



Prepared for
City of West Lake Hills
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Preliminary - Draft

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APPENDICES

APPENDIX A	OUTFALL PROFILES
APPENDIX B	FOREST VIEW (F24-2) DRIVE AREA MODEL RESULTS
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APPENDIX D	RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS
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APPENDIX F	RIDGEWOOD ROAD AREA (G23-M50) MODEL RESULTS

EXHIBITS

EXHIBIT 1	REDBUD TRAIL SERVICE AREA WASTEWATER SEWER SHED
EXHIBIT 2	REDBUD FOREST VIEW, SOUTH (F24-2) SEWER SHED THAT FLOWS TO ROCKY RIVER LIFT STATION
EXHIBIT 3	REDBUD FOREST VIEW, NORTH (F24-2) ROCKY RIVER LIFT STATION FORCE MAIN AND CONTRIBUTE SEWER SHED
EXHIBIT 4	REDBUD FOREST VIEW, NORTH & SOUTH SEWER SHED (F24-2)
EXHIBIT 5	REDBUD TRAIL (F24-10) SEWER SHED
EXHIBIT 6	REDBUD RIDGEWOOD (G23-M54, G23-69, G23-M50) SEWER SHED

1. LIST OF ABBREVIATIONS

REPORT ABBREVIATIONS

COA: City Of Austin
EGL: Energy Grade Line
Ft: Feet
Ft/s: Feet per Second
PSI: Pounds per Square Inch
GPM: Gallons per Minute
HDPE: High Density Polyethylene
HGL: Hydraulic Grade Line
LUE: Living Unit Equivalent
PVC: Poly Vinyl Chloride
WLH: West Lake Hills

REDBUD TRAIL MODEL SUB- BASINS (DISCHARGE POINT)

Redbud Forest View (F24-2) Area- **RF**
 Redbud Trail Area (F24-10)- **RR**
 Redbud Ridgewood Area (G23-M50, G23-M54,
 G23-69)- **RW**

MODEL ELEMENTS ABBREVIATIONS

CO – Conduit- gravity sewer main
J – Junction- low pressure system junction
L – Lateral- service line from residential or
 commercial property to sewer main
MH - Manhole
P – Pressure- low pressure wastewater main
T – Transition- transition from low pressure to
 gravity system
Tap – lateral connection to sewer main

STREET ABBREVIATIONS

BCR - Bee Cave Road
BLD - Brady Lane
BRT - Blue Ridge Trail
BT - Buckeye Trail
BV - Bruna Vista Circle
FVD - Forest View Drive
GRD - Gregory Drive
JRD - Jefferey Drive
LBD - Las Brisas Drive
MC - Mcconnell Drive
NPR - North Peak Road
ORD - Oak Ridge Drive
RBT - Redbud Trail
RCD - Rocky Creek Drive
RD - Rollingwood Drive
RLR - Rocky Ledge Road
RRC - Rocky River Cove
RRR - Rocky River Road
RWD - Ridgewood Drive
RR - Reveille Drive
SCD - Sugar Creek Drive
SSD - Sugar Shack Drive
WBD - Westbrook Drive
WHD - West Haven Drive
WD - Westlake Drive
WSD - West Spring Drive
WWT - Westwood Terrace

2. DEFINITIONS

Capacity:

The maximum capacity of the gravity interceptor.

Depth:

Depth of flow in a gravity sewer main.

Discharge Point:

Point where the City of West Lake Hills collection system discharges to the City of Austin's collection system.

EGL (Energy Grade Line):

A line that represents the total energy head (pressure head, elevation head, and velocity head) in a fluid system, always above the HGL by the velocity head amount.

Flow/Capacity:

A pipe flowing at its maximum capacity (Ratio of the pipe's current capacity and the maximum capacity) would have with a value of one.

Headloss:

Headloss is the reduction in head, or pressure, that occurs as fluid flows through a pipe or other hydraulic system due to friction, turbulence, or other factors.

HGL (Hydraulic Grade Line):

A line representing the pressure head and elevation head in a fluid system, indicating the height to which water would rise in piezometer tubes along a pipeline.

LUE (Living Unit Equivalent):

A term commonly used in engineering, planning, and utility design to standardize the measurement of water demand or wastewater generation. It represents the average flow of one residential unit (typically a single-family home) for water or wastewater services. For the purposes of this study, 245 gpd was used per LUE.

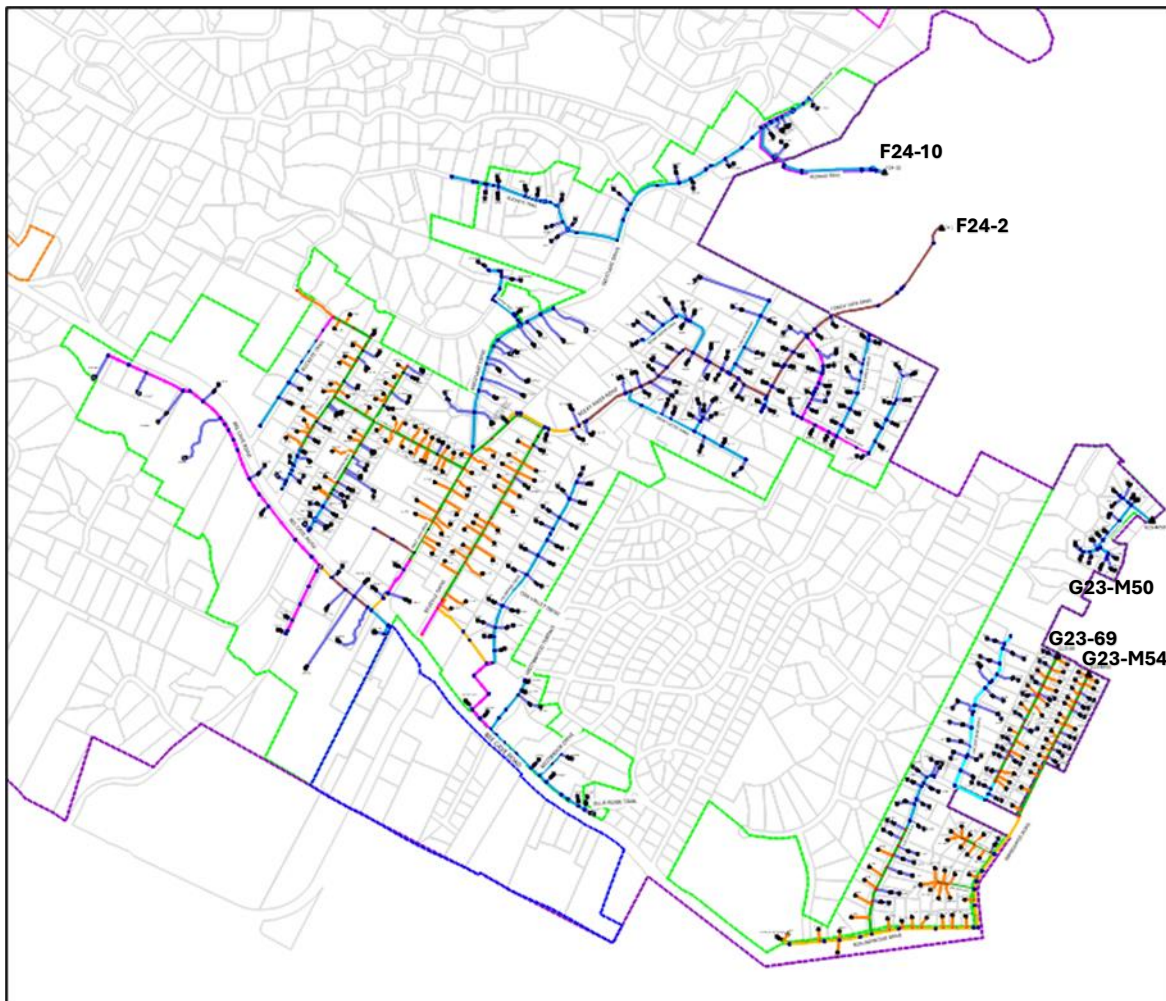
3. INTRODUCTION

The City of West Lake Hills (WLH) wastewater collection system is a combination of gravity and low-pressure systems. The WLH collection system discharges to the City of Austin (COA) collection system through several different entry points. Each of these entry points, and the system as whole, has defined average and peak flow limitations defined in an agreement between the COA and WLHs. This report describes the analysis of Redbud Trail service area sanitary sewer shed for peak loading based on the conditions defined in the above referenced agreement.

REDBUD TRAIL SERVICE AREA (F24-2, F24-10, G23-M50, G23-M54, G23-69)

The Redbud Trail Service Area is the largest sewer shed within the West Lake Hills (WLHs) collection system. It is primarily located on the northern side of Bee Cave Road and is divided into Three sub-basins based on their respective discharge points to the City of Austin's collection system:

1. Redbud Forest View North and South (**RF, F24-2**)
2. Redbud Trail Area (**RR, F24-10**)
3. Redbud Ridgewood Area (**RW: G23-M50, G23-M54, G23-69**)



4. OBJECTIVES

The main objectives of this study are

- To develop a wastewater model for the City of Westlake Hills to monitor the system's capacity for existing conditions, proposed redevelopment, and contractual agreement limits with the COA.
- To develop accurate GIS files of the collection system to assist with the City's asset management program.
- To develop an understanding of the maximum capacity of the existing collection system under peak flow conditions.
- To develop various scenarios, including sub-basins transfers, to get the maximum capacity out of the existing systems lift stations and interceptors while maintaining contractual limits at discharge points.
- To use future flow meter data to calibrate the current model and define actual operational conditions.

5. DATA COLLECTION

Existing site plan and utility plan information was collected from the City of West Lake Hills. The AutoCAD background files were geolocated with respect to NAD 83 Texas coordinate system and the analysis was performed in Central Zone projection, TX83. Information collected by WPM includes:

- West Lake Hills Wastewater Collection System Map dated February 7, 2023
- GIS mapping data from the City of West Lake's website
- Record drawings for wastewater infrastructure
- COA annual wastewater connection and flow summary spreadsheet
- Elevation data from LIDAR
- Pump information from WLH design standards. (pump curve data, wet well size)
- Probability data for low pressure systems was provided by Bentley, correlating the number of connected grinder pump connections with the maximum number of grinder pumps operating simultaneously.

5.1 REDBUD FOREST VIEW SOUTH AND NORTH (F24-2) RECORD DRAWINGS

- Bee Cave Road and Westlake Drive- "Phase 2 Plans – Full"
- Mcconnell Drive, West haven Drive, West Spring Drive, Westlake Drive, Reveille Drive- "Phase 3 South Plans"
- Buckeye Trail- "Buckeye Trail Plans"
- Rocky River Road, Rocky Ledge Road, Rocky River Cove, Oak Ridge Drive, Rocky Creek Drive, Forest View Drive- "WLH Phase 3 S-2004-0625 Plan, Connection Review details"
- Pump Details- "Connection Reviews and Pump Specs, Model Info-Add Belmont Village to Phase 4SW 6-11"
- Lift Station Details- "Attachment A - Engineering Design Report Phase 2 WW Collection System LS, Phase_1_Lift_Station"

5.2 REDBUD AREA (F24-10) RECORD DRAWINGS

- Redbud Trail, Westlake Drive- "Phase 4 North Plans"

5.3 REDBUD RIDGEWOOD AREA (G23-M50, G23-M54, G23-69) RECORD DRAWINGS

- North Peak Road, Rollingwood Drive, Gregory Drive, Jefferey Drive- "Phase 1 WW Collection system Set"
- West bank Lift Station Data- "West bank Lift station 90% drawings"

6. DESIGN CRITERIA

6.1 DESIGN CRITERIA FOR SANITARY NETWORK:

- **Average Flow:** Residential 245 gpd per LUE
Commercial 175 gpd per LUE
(Robert E. Lee Wastewater study by PBS&J, Refer section 7 for more details)
- **Maximum Peak Flow limitation:** 600 gpm
(City of Austin, Texas- Peak flow limitation at Redbud trail service area combined entry point)
- **Minimum flow velocity:** 2 ft/s
- **Maximum flow velocity:** 10 ft/s
- **Minimum pipe cover:** 4 ft
- **Maximum cover:** 15 ft
(City of Austin, Texas – Utilities Criteria Manual, Section 2)
- **Minimum slope:** 0.335% (8-Inch diameter)
(Texas Commission on Environmental Quality, Chapter 217 – Design Criteria for Domestic Wastewater Systems)
- **Pump Information:**
 - Type A – E-One Gator Grinder pump unit, single core
 - 9 to 15 gpm at 138 to 0 feet of total head
 - Utilized for all single family residential
 - Type B – E-One dual core pump unit
 - 9 to 15 gpm at 138 to 0 feet of total head
 - Utilized for non-residential with average daily flows up to 3,000 gpd
 - Type D – Myers WGL20H dual core pump unit
 - 0 to 19 gpm at 128 to 10 feet of total head
 - Utilized for average daily flows up to 3,000 gpd with high head conditions
 - Type E – Myers WG30H
 - 0 to 92 gpm at 97 to 45 feet of total head
 - Utilized for average daily flows up to 20,000 gpd

(West Lake Hills- Wastewater flow modelling and calculations, - II. Low Pressure System Pump Units)

6.2 REFERENCE MANUALS AND SOFTWARE

- City of Austin, Texas – Utilities Criteria Manual, Section 2
- City of Westlake Hills– Engineering Standards, Article 5: Wastewater Facilities
- Bentley E-ONE Grinder setup
- Sewer GEMS CONNECT Edition Update, Bentley Systems
- Autodesk Civil 3D
- ArcGIS Desktop

6.3 DESIGN ASSUMPTIONS

- Elevations for wastewater lines without as -built drawings was assumed to have a depth of 4 feet. Ground elevations were taken from LIDAR
- Peak flow calculations were determined by applying a 4.0 multiplier to average wastewater flows for each property
- E-one grinder pump design guide was followed for low pressure systems flow operations
- Gravity flows were estimated per Living Unit Equivalent (LUE)
- COA Annual Wastewater connection and flow summary spreadsheet utilized for modelling the existing wastewater collection system and to determine average and peak flow calculations
- WaterCAD Model (by KFA) was utilized for low pressure main modelling and for pump curves.
- Maximum peak flows capped at 90% pipe capacity
- Grinder pump wet wells-3 feet in diameter and 5 feet deep
- Pressure system laterals - 1.5-inch diameter HDPE pipe
- Gravity system laterals - 4-inch diameter PVC pipe

6.3.1 REDBUD FOREST VIEW SOUTH AND NORTH (F24-2)

- System lateral configuration per WaterCAD file provided by K Friese+Associates
- Pressure system grinder pumps E-One, Residential 9 to 15 gpm, Commercial 9 to 15 gpm other commercial pumps are Myers WG20H 0 to 19 gpm, Myers WG30H 0 to 92 gpm.
- Design Flow at Rocky River Lift Station – 185 gpm (See figure below)

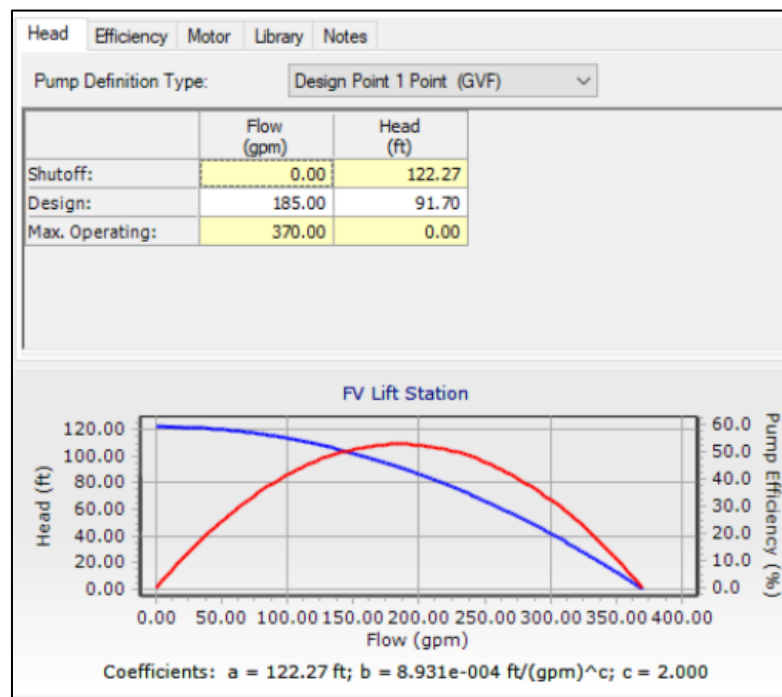


Figure: Pump Curve considered for Rocky River Lift Station

6.3.2 REDBUD AREA (F24-10)

- System lateral configuration per WaterCAD file provided by K Friese+Associates
- Pressure system grinder pumps E-One, Residential 9 to 15 gpm

6.3.3 REDBUD RIDGEWOOD AREA (GM-M50, G23-M52, G23-M54, G23-69)

- Pressure system grinder pumps E-One, Residential 9 to 15 gpm, Commercial 9 to 15 gpm
- In the absence of record or field data for the West Lake lift station, the minimum slope for the inlet and outlet pipes was used
- The lift station logs (McDonalds = West Bank) indicate it pumps 446 gpd. West Bank Lift station has dual pumps and has VFD's to control discharge to a maximum of 90 gpm
- Design Flow at Westbank lift station (See figure below)

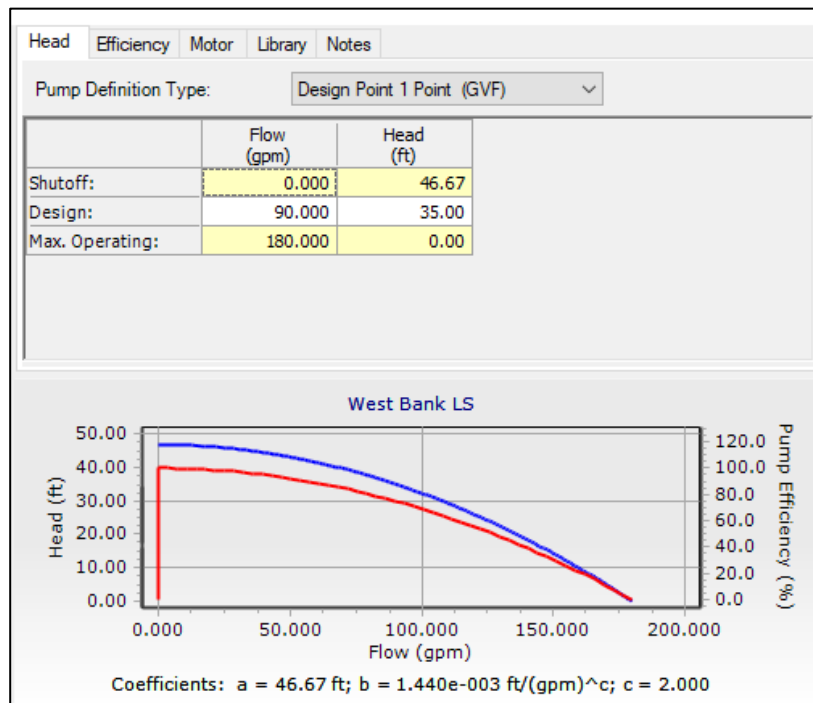


Figure: Pump Curve considered for Westbank Lift Station

7. METHODOLOGY

The hydraulic modelling software **SEWERGEMS** was used to create the existing wastewater collection system model to understand the system's existing capacity and limitations which can be utilized to forecast future demands or operational scenarios. Parameters used for the model development are included below.

Calculation method/ Equation used in software are:

- **Manning's Equation:**

$$V = \frac{k}{n} R^{2/3} S^{1/2}$$

Where,

V = mean velocity (m/s, ft/s)

k = 1.49 for U.S. customary units, 1.00 for SI units

n = Manning's roughness value

- **Hazen – Williams Equation:**

$$V = kCR^{0.63} S^{0.54}$$

Where,

V = mean velocity (m/s, ft/s)

k = 1.32 for U.S. customary units, or 0.85 for SI units

C = Hazen-Williams's roughness coefficient (unitless)

R = hydraulic radius (m, ft)

S = friction slope (m/m, ft/ft).

- **Energy Equation:**

$$\frac{p_1}{\gamma} + z_1 + \frac{V_1^2}{2g} + H_G = \frac{p_2}{\gamma} + z_2 + \frac{V_2^2}{2g} + H_L$$

Where,

p = pressure (N/m², lb/ft²)

γ = specific weight of the fluid (N/m³, lb/ft³)

z = elevation above a datum (m, ft)

V = fluid velocity (m/s, ft/s)

g = gravitational acceleration (m/s², ft/s²)

HG = head gain, such as from a pump (m, ft)

HL = combined head loss (m, ft).

E-One Extreme Flow Probability Method

The E-One Extreme Flow Probability Method was utilized for modelling grinder pumps, allowing for the estimation of extreme flows necessary for the design and analysis of the sewer system. This method predicts the maximum number of grinder pumps expected to operate simultaneously, based on the number of grinder pumps connected to the system.

The table below, provided by Bentley, provides the probability if the maximum number of pumps operating simultaneously based on the total number of grinder pump connections.

Table 3 MAXIMUM NUMBER OF GRINDER PUMPCORES OPERATING DAILY	
Number of Grinder Pump Cores Connected	Maximum Daily Number of Grinder Pump Cores Operating Simultaneously
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15
345-377	16
378-410	17
411-443	18
444-476	19
477-509	20
510-542	21
543-575	22
576-608	23
609-641	24
642-674	25
675-707	26
708-740	27
741-773	28
774-806	29
807-839	30
840-872	31
873-905	32
906-938	33
939-971	34
972-1,004	35

* Table 3, sourced from Page 14 of the Low-Pressure Sewer System using E/One Grinder Pumps Manual, has been utilized for reference, if 4 to 9 grinder pumps are connected to the system, then 3 is the maximum number of grinder pumps that are operating simultaneously.

7.1 REDBUD FOREST VIEW (F24-2) SEWER SHED MODELLING METHODOLOGY

The Redbud Forest View area has been divided into north and south networks for analysis and simplified modelling. This sewer shed includes residential, office, commercial, and school connections. The wastewater loads, based on the total of 524 Living Unit Equivalents (LUEs), were used to determine the flow for the system analysis.

The modelling approach adopted for both the north and south sub-basins incorporates the following standardized methodologies:

- **E-One Grinder Pumps:** Each sub-basin has a set of E-One grinder pumps. The number of active pumps is determined using the E-One Extreme Flow Probability Method, and the corresponding flow is directed to the nearest manhole. The remaining inactive pumps are represented as loading counts at various manholes in the system.
- **Gravity Property Connections:** Each sub-basin includes gravity property connections, which are connected to laterals leading to the main gravity lines. Flow from these gravity connections is considered at 0.68 gpm per connection for peak scenarios.

7.1.1 REDBUD FOREST VIEW SOUTH SUB-BASIN SEWER SHED MODELLING

- The south network is the collection system that conveys flow to the Rocky River Lift Station.
- This area is a combined pressure and gravity collection system.
- A total of 99 pump connections are installed in this area, consisting of the following types:
 - E-One Grinder (Simplex) for residential properties with up to 6.5 bathrooms (86 pumps).
 - E-One Grinder (Duplex) for all commercial and residential with more than 6.5 bathrooms (11 pumps).
 - Myers WG 30H (1 pump) lot number 4615, near to the Bee Cave Road
 - Myers WG 20H (1 pump) lot number 4407, near to the Bee Cave Road
- The pressure network was simulated by activating pumps based on based on Bentley's E- One Extreme Flow Probability Method (reference section 7.0 - Methodology) for peak conditions.
- Out of the 97 E-One grinder pumps, only 8 are activate in the overall model based on the E-One extreme flow probability.
- A total of 11 pumps were modeled as active in the network (8 E-One pumps and 3 Myers WG pumps)
- A total of 74 residential gravity connections are in this sub-basin. Gravity internal connections are connected with the laterals to the main gravity lines
- A total of 446 LUE's make up this sub-basin.

7.1.2 REDBUD FOREST VIEW NORTH SUB-BASIN SEWER SHED MODELLING

- The north network begins at the Rocky River Lift Station and extends to the discharge point (F24-2) on Forest View Drive.
- The Redbud Forest View north sub-basin is a low-pressure system in which the Forest View Drive main line was modeled as a gravity system, and Oak Ridge Drive and Cedar Peak Drive were modeled low pressure systems
- Utilized the E-One Extreme Flow Probability Method for grinder pumps. This approach facilitates the estimation of extreme flows necessary for sewer system design and analysis.
- The Forest View North sub-basin includes a total of 78 E-One grinder pumps
- Based on Bentley's E-One Extreme Flow Probability Method (reference section 7.0-Methodology) for peak conditions. 2 grinder pumps were modeled as pumping simultaneously during peak flow conditions for Cedar Peak Drive and Oak Ridge. The remaining 76 pumps are added as loading counts to various manholes on Forest View Drive main line sanitary system.

Below are the pumping connections (Loading counts) considered to manholes on Forest View per street: -

- Rocky Ledge & Buena Vista Road- 11 pumps
- Rocky River Cove- 8 pumps
- Rocky River Road- 5 pumps
- Westbrook Drive, Rocky Creek Drive, Oak Ridge Drive & Cedar Park Drive- 26 pumps
- Remaining low-pressure connections direct to the Forest View Main Drive- 26 pumps
- Wastewater loads were based on the 78 Living Unit Equivalentents (LUEs)

7.2 REDBUD TRAIL (F24-10) SEWER SHED MODELLING METHODOLOGY

- The Redbud Trail (F24-10) basin is a low-pressure system that extends to the discharge point (F24-10) on Red Bud Trail.
- The model includes a total of 18 E-One grinder pumps.
- Based on Bentley's E-One Extreme Flow Probability Method (reference section 7.0-Methodology) for peak conditions. 4 grinder pumps were modeled as pumping simultaneously during peak flow conditions.
- The model includes a total of 18 pumps, with a probability of 4 pumps being active at a time, considering the E-One probability method to determine the peak flows.
- Wastewater loads were based on the 38 Living Unit Equivalentents (LUEs)

7.3 REDBUD RIDGEWOOD SEWER SHED MODELLING METHODOLOGY

This sewer shed includes three major sub-networks that outfall to GM-M50, G23-M54, and G23-69 discharge points.

7.3.1 REDBUD RIDGEWOOD (G23-M54) SEWER SHED MODELLING METHODOLOGY

- The sewer shed includes a combination of gravity and pressure systems and includes the Westbank Shopping Centre lift station as a critical component of the network.
- The model includes a total of 23 E-One grinder pumps.
- Based on Bentley's E-One Extreme Flow Probability Methods (reference section 7.0-Methodology) for peak conditions. 5 grinder pumps were modeled as pumping simultaneously during peak flow conditions.
- 23 E-One grinder pumps in the network, with 5 pumps currently active. The remaining 18 pumps are added as loading counts to various manholes within the system.
- Gravity wastewater loads were based on 51 connections.
- A total of 183 LUEs make up this sub-basin.

7.3.2 REDBUD RIDGEWOOD (G23-69) SEWER SHED MODELLING METHODOLOGY

- This sewer shed is a combined pressure and gravity collection system.
- Based on Bentley's E-One Extreme Flow Probability Methods (reference section 7.0-Methodology) for peak conditions. 6 grinder pumps were modeled as pumping simultaneously during peak flow conditions.
- Out of the 27 E-One grinder pumps present in the system, 6 grinder pumps are active. The remaining 21 pumps are added as loading counts to various manholes within the system.
- Gravity wastewater loads were based on 13 connections.
- A total of 41 LUEs make up this sub-basin.

7.3.3 REDBUD RIDGEWOOD (G23-M50) SEWER SHED MODELLING METHODOLOGY

- The Redbud Ridgewood (G23-M50) basin is a low-pressure system that extends to the discharge point (G23-M50) on Sugar Shack Drive.
- The model includes a total of 15 E-One grinder pumps.
- Based on Bentley's E-One Extreme Flow Probability Method (reference section 7.0-Methodology) for peak conditions. 3 grinder pumps were modeled as pumping simultaneously during peak flow conditions.
- The model includes a total of 15 pumps, with a probability of 3 pumps being active at a time, considering the E-One probability method to determine the peak flows.
- A total of 15 LUEs make up this sub-basin.

8. MODEL FLOW CALCULATIONS

Wastewater flow estimates were determined with reference to the Robert E. Lee Wastewater Study prepared by PBS&J. The land use types in this study included residential, office, commercial, and school campuses, each with their own diurnal curve. Based on this study an average daily wastewater flow of 245 gallons per LUE was identified. To calculate LUEs for non-residential properties the study applied a 7/5 weekday adjustment factor, for the non-residential properties as follows:

- 1 Residential connection LUE = 245 gpd, 7,350 gallons/month
- 1 Commercial connection LUE = 245 gpd x 5/7 = 175 gpd, 5,250 gallons per month.

In determining/modelling the peak flows for each entry point to the COA system, we converted the gallons per month flows into gallons per minute for each type of sanitary connection.

8.1 REDBUD FOREST VIEW SOUTH AREA (F24-2)

TABLE 1 - WASTEWATER LOAD CALCULATIONS FOR COMMERCIAL CONNECTIONS

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
3520	Bee Cave Road	4	0.49	1.94
3530	Bee Cave Road	9	1.09	4.38
3600	Bee Cave Road	0	0.00	0.00
3620	Bee Cave Road	12	1.46	5.83
3700	Bee Cave Road	14	1.70	6.81
3701	Bee Cave Road	0	0.00	0.00
3736	Bee Cave Road	11	1.34	5.35
3823	Bee Cave Road	0	0.00	0.00
3825	Bee Cave Road	0	0.00	0.00
3839	Bee Cave Road	12	1.46	5.83
3901	Bee Cave Road	12	1.46	5.83
3924	Bee Cave Road	9	1.09	4.38
3939	Bee Cave Road	20	2.43	9.72
4010	Bee Cave Road	1	0.12	0.49
4015	Bee Cave Road	10	1.22	4.86
4201	Bee Cave Road	0	0.00	0.00
4238	Bee Cave Road	6	0.73	2.92
4301	Bee Cave Road	0	0.00	0.00
4310	Bee Cave Road	57	6.93	27.71
4407	Bee Cave Road	19	2.31	9.24
4611	Bee Cave Road	0	0.00	0.00
4615	Bee Cave Road	42	5.10	20.42
4701	Bee Cave Road	4	0.49	1.94
204	Eanes School Road	20	2.43	9.72
100	Westlake Drive	3	0.36	1.46
101	Westlake Drive	18	2.19	8.75
102	Westlake Drive	6	0.73	2.92

TABLE 2 – WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS FOR SOUTH SUB-BASIN

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)	Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
525	Buckeye Trail	1	0.17	0.68	302	Westhaven Drive	1	0.17	0.68
519	Buckeye Trail	1	0.17	0.68	304	Westhaven Drive	1	0.17	0.68
200	Buckeye Trail	1	0.17	0.68	310	Westhaven Drive	1	0.17	0.68
799	Buckeye Trail	1	0.17	0.68	300	Westhaven Drive	1	0.17	0.68
777	Buckeye Trail	1	0.17	0.68	204	Westhaven Drive	1	0.17	0.68
517	Buckeye Trail	1	0.17	0.68	108	Westhaven Drive	1	0.17	0.68
302	Buckeye Trail	1	0.17	0.68	306	Westhaven Drive	1	0.17	0.68
210	Buckeye Trail	1	0.17	0.68	308	Westhaven Drive	1	0.17	0.68
308	Buckeye Trail	1	0.17	0.68	106	Westhaven Drive	1	0.17	0.68
309	Buckeye Trail	1	0.17	0.68	302	Westhaven Drive	1	0.17	0.68
307	Buckeye Trail	1	0.17	0.68	304	Westhaven Drive	1	0.17	0.68
300	Buckeye Trail	1	0.17	0.68	310	Westhaven Drive	1	0.17	0.68
601	Buckeye Trail	1	0.17	0.68	300	Westhaven Drive	1	0.17	0.68
801	Buckeye Trail	1	0.17	0.68	201	Westhaven Drive	1	0.17	0.68
205	Buckeye Trail	1	0.17	0.68	100	Westhaven Drive	1	0.17	0.68
203	Buckeye Trail	1	0.17	0.68	213	Westhaven Drive	1	0.17	0.68
200	McConnell Drive	1	0.17	0.68	102	Westhaven Drive	1	0.17	0.68
104	McConnell Drive	1	0.17	0.68	111	Westhaven Drive	1	0.17	0.68
105	McConnell Drive	1	0.17	0.68	203	Westhaven Drive	1	0.17	0.68
204	McConnell Drive	1	0.17	0.68	205	Westhaven Drive	1	0.17	0.68
102	McConnell Drive	1	0.17	0.68	209	Westhaven Drive	1	0.17	0.68
202	McConnell Drive	1	0.17	0.68	211	Westhaven Drive	1	0.17	0.68
107	McConnell Drive	1	0.17	0.68	303	Westhaven Drive	1	0.17	0.68
206	McConnell Drive	1	0.17	0.68	207	Westhaven Drive	1	0.17	0.68
300	McConnell Drive	1	0.17	0.68	311	Westhaven Drive	1	0.17	0.68
302	McConnell Drive	1	0.17	0.68	305	Westhaven Drive	1	0.17	0.68
306	McConnell Drive	1	0.17	0.68	109A	Westhaven Drive	1	0.17	0.68
208	McConnell Drive	1	0.17	0.68	109B	Westhaven Drive	1	0.17	0.68
205	McConnell Drive	1	0.17	0.68	103	Westhaven Drive	1	0.17	0.68
207	McConnell Drive	1	0.17	0.68	105	Westhaven Drive	1	0.17	0.68
305	McConnell Drive	1	0.17	0.68	107	Westhaven Drive	1	0.17	0.68
303	McConnell Drive	1	0.17	0.68	208	Westhaven Drive	1	0.17	0.68
209	McConnell Drive	1	0.17	0.68	104	Westhaven Drive	1	0.17	0.68
309	McConnell Drive	1	0.17	0.68	200	Westhaven Drive	1	0.17	0.68
203	McConnell Drive	1	0.17	0.68	301	Westhaven Drive	1	0.17	0.68
201	McConnell Drive	1	0.17	0.68	212	Westhaven Drive	1	0.17	0.68
304	McConnell Drive	1	0.17	0.68	309	Westhaven Drive	1	0.17	0.68
301	McConnell Drive	1	0.17	0.68	201	West Spring Drive	1	0.17	0.68
106	Westhaven Drive	1	0.17	0.68	203	West Spring Drive	1	0.17	0.68
16	Las Brisas Drive	1	0.17	0.68	18	Las Brisas Drive	1	0.17	0.68
4	Las Brisas Drive	1	0.17	0.68	2	Las Brisas Drive	1	0.17	0.68

**TABLE 2 – WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS FOR
SOUTH SUB-BASIN (CONTINUED)**

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)	Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
200	West Spring Drive	1	0.17	0.68	407	Westlake Drive	1	0.17	0.68
105	West Spring Drive	1	0.17	0.68	200	Westlake Drive	1	0.17	0.68
109	West Spring Drive	1	0.17	0.68	105	Reveille Road	1	0.17	0.68
103	West Spring Drive	1	0.17	0.68	112	Reveille Road	1	0.17	0.68
202	West Spring Drive	1	0.17	0.68	312	Reveille Road	1	0.17	0.68
102	West Spring Drive	1	0.17	0.68	201	Reveille Road	1	0.17	0.68
107	West Spring Drive	1	0.17	0.68	118	Reveille Road	1	0.17	0.68
100	West Spring Drive	1	0.17	0.68	211	Reveille Road	1	0.17	0.68
104	West Spring Drive	1	0.17	0.68	200	Reveille Road	1	0.17	0.68
108	West Spring Drive	1	0.17	0.68	202	Reveille Road	1	0.17	0.68
207	West Spring Drive	1	0.17	0.68	116	Reveille Road	1	0.17	0.68
204	West Spring Drive	1	0.17	0.68	207	Reveille Road	1	0.17	0.68
106	West Spring Drive	1	0.17	0.68	209	Reveille Road	1	0.17	0.68
403	Westlake Drive	1	0.17	0.68	303	Reveille Road	1	0.17	0.68
501	Westlake Drive	1	0.17	0.68	314	Reveille Road	1	0.17	0.68
503	Westlake Drive	1	0.17	0.68	213A	Reveille Road	1	0.17	0.68
607	Westlake Drive	1	0.17	0.68	213B		1		
601	Westlake Drive	1	0.17	0.68	114	Reveille Road	1	0.17	0.68
605	Westlake Drive	1	0.17	0.68	107	Reveille Road	1	0.17	0.68
505	Westlake Drive	1	0.17	0.68	301	Reveille Road	1	0.17	0.68
906	Westlake Drive	1	0.17	0.68	215A	Reveille Road	1	0.17	0.68
808	Westlake Drive	1	0.17	0.68	215B		1		
305	Westlake Drive	1	0.17	0.68	219A	Reveille Road	1	0.17	0.68
307	Westlake Drive	1	0.17	0.68	219B		1		
309A	Westlake Drive	1	0.17	0.68	305	Reveille Road	1	0.17	0.68
309B		1			310	Reveille Road	1	0.17	0.68
311A	Westlake Drive	1	0.17	0.68	308	Reveille Road	1	0.17	0.68
311B		1			208	Reveille Road	1	0.17	0.68
302	Westlake Drive	1	0.17	0.68	5	Las Brisas Drive	1	0.17	0.68
303	Westlake Drive	1	0.17	0.68	11	Las Brisas Drive	1	0.17	0.68
210	Westlake Drive	1	0.17	0.68	14	Las Brisas Drive	1	0.17	0.68
401	Westlake Drive	1	0.17	0.68	15	Las Brisas Drive	1	0.17	0.68
205	Westlake Drive	1	0.17	0.68	1	Las Brisas Drive	1	0.17	0.68
209	Westlake Drive	1	0.17	0.68	3	Las Brisas Drive	1	0.17	0.68
409	Westlake Drive	1	0.17	0.68	10	Las Brisas Drive	1	0.17	0.68
113	Westlake Drive	1	0.17	0.68	12	Las Brisas Drive	1	0.17	0.68
211	Westlake Drive	1	0.17	0.68	8	Las Brisas Drive	1	0.17	0.68
111	Westlake Drive	1	0.17	0.68	9	Las Brisas Drive	1	0.17	0.68
405	Westlake Drive	1	0.17	0.68	7	Las Brisas Drive	1	0.17	0.68
17	Las Brisas Drive	1	0.17	0.68	13	Las Brisas Drive	1	0.17	0.68
6	Las Brisas Drive	1	0.17	0.68					

**TABLE 3 – WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS FOR
NORTH SUB-BASIN**

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)	Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
4	Rocky River Cove	1	0.17	0.68	804	Cedar Park Drive	1	0.17	0.68
10	Rocky River Cove	1	0.17	0.68	807	Cedar Park Drive	1	0.17	0.68
6	Rocky River Cove	1	0.17	0.68	803	Cedar Park Drive	1	0.17	0.68
8	Rocky River Cove	1	0.17	0.68	809	Cedar Park Drive	1	0.17	0.68
7	Rocky River Cove	1	0.17	0.68	802	Rock Creek Drive	1	0.17	0.68
5	Rocky River Cove	1	0.17	0.68	808	Rock Creek Drive	1	0.17	0.68
9	Rocky River Cove	1	0.17	0.68	810	Rock Creek Drive	1	0.17	0.68
613	Rocky River Road	1	0.17	0.68	800	Rock Creek Drive	1	0.17	0.68
700	Rocky River Road	1	0.17	0.68	806	Rock Creek Drive	1	0.17	0.68
702	Rocky River Road	1	0.17	0.68	801	Rock Creek Drive	1	0.17	0.68
609	Rocky River Road	1	0.17	0.68	804	Rock Creek Drive	1	0.17	0.68
705	Rocky River Road	1	0.17	0.68	811	Rock Creek Drive	1	0.17	0.68
708	Rocky River Road	1	0.17	0.68	803	Rock Creek Drive	1	0.17	0.68
505	Rocky River Road	1	0.17	0.68	807	Westbrook Drive	1	0.17	0.68
500	Rocky River Road	1	0.17	0.68	702	Westbrook Drive	1	0.17	0.68
608	Rocky River Road	1	0.17	0.68	803	Westbrook Drive	1	0.17	0.68
606	Rocky River Road	1	0.17	0.68	800	Westbrook Drive	1	0.17	0.68
805	Rocky River Road	1	0.17	0.68	801	Westbrook Drive	1	0.17	0.68
701	Rocky River Road	1	0.17	0.68	802	Westbrook Drive	1	0.17	0.68
809	Rocky River Road	1	0.17	0.68	804	Westbrook Drive	1	0.17	0.68
709	Rocky River Road	1	0.17	0.68	101	Westbrook Drive	1	0.17	0.68
710	Rocky River Road	1	0.17	0.68	805	Westbrook Drive	1	0.17	0.68
707	Rocky River Road	1	0.17	0.68	309	Oak Ridge Drive	1	0.17	0.68
806	Rocky River Road	1	0.17	0.68	402	Oak Ridge Drive	1	0.17	0.68
808	Rocky River Road	1	0.17	0.68	407	Oak Ridge Drive	1	0.17	0.68
499	Rocky River Road	1	0.17	0.68	405	Oak Ridge Drive	1	0.17	0.68
704	Rocky River Road	1	0.17	0.68	311	Oak Ridge Drive	1	0.17	0.68
703	Rocky River Road	1	0.17	0.68	409	Oak Ridge Drive	1	0.17	0.68
501	Rocky River Road	1	0.17	0.68	313	Oak Ridge Drive	1	0.17	0.68
709	Forest View Drive	1	0.17	0.68	505	Rocky Ledge Road	1	0.17	0.68
901	Forest View Drive	1	0.17	0.68	613A	Rocky Ledge Road	1	0.17	0.68
801	Forest View Drive	1	0.17	0.68	613B	Rocky Ledge Road	1	0.17	0.68
804	Forest View Drive	1	0.17	0.68	618A	Rocky Ledge Road	1	0.17	0.68
806	Forest View Drive	1	0.17	0.68	618B	Rocky Ledge Road	1	0.17	0.68
803	Forest View Drive	1	0.17	0.68	611	Rocky Ledge Road	1	0.17	0.68
805	Forest View Drive	1	0.17	0.68	603	Rocky Ledge Road	1	0.17	0.68
802	Forest View Drive	1	0.17	0.68	616	Rocky Ledge Road	1	0.17	0.68
903	Forest View Drive	1	0.17	0.68	400A	Buena Vista Circle	1	0.17	0.68
800	Forest View Drive	1	0.17	0.68	400B	Buena Vista Circle	1	0.17	0.68
801	Cedar Park Drive	1	0.17	0.68	403	Buena Vista Circle	1	0.17	0.68
802	Cedar Park Drive	1	0.17	0.68	401	Buena Vista Circle	1	0.17	0.68
805	Cedar Park Drive	1	0.17	0.68	402B	Buena Vista Circle	1	0.17	0.68
					402A	Buena Vista Circle	1	0.17	0.68

8.2 REDBUD TRAIL AREA (F24-10)

TABLE 4 - WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS FOR REDBUD AREA

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
906	Westlake Drive	1	0.17	0.68
808	Westlake Drive	1	0.17	0.68
1113	Westlake Drive	1	0.17	0.68
1109	Westlake Drive	1	0.17	0.68
1107	Westlake Drive	1	0.17	0.68
911	Westlake Drive	1	0.17	0.68
1011	Westlake Drive	1	0.17	0.68
200	Westhaven Drive	1	0.17	0.68
302	Buckeye Trail	1	0.17	0.68
210	Buckeye Trail	1	0.17	0.68
308	Buckeye Trail	1	0.17	0.68
309	Buckeye Trail	1	0.17	0.68
307	Buckeye Trail	1	0.17	0.68
300	Buckeye Trail	1	0.17	0.68
205	Buckeye Trail	1	0.17	0.68
203	Buckeye Trail	1	0.17	0.68
96	Redbud Trail	1	0.17	0.68
98	Redbud Trail	1	0.17	0.68

TABLE 5 - WASTEWATER LOAD CALCULATIONS FOR COMMERCIAL CONNECTIONS FOR REDBUD AREA

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
96	Red Bud Trail	3	0.36	1.46
911	Westlake Drive	10	1.22	4.86
1011	Westlake Drive	3	0.36	1.46
1107	Westlake Drive	2	0.24	0.97
1109	Westlake Drive	2	0.24	0.97

8.3 REDBUD RIDGEWOOD AREA (G23-M54)

TABLE 6 - WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS FOR RIDGEWOOD AREA(G23-M54)

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)	Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
417	Ridgewood Road	1	0.17	0.68	6	North Peak Road	1	0.17	0.68
410	Ridgewood Road	1	0.17	0.68	12	North Peak Road	1	0.17	0.68
412	Ridgewood Road	1	0.17	0.68	3	North Peak Road	1	0.17	0.68
414	Ridgewood Road	1	0.17	0.68	2	North Peak Road	1	0.17	0.68
416	Ridgewood Road	1	0.17	0.68	15	North Peak	1	0.17	0.68
418	Ridgewood Road	1	0.17	0.68	18	North Peak Road	1	0.17	0.68
419	Ridgewood Road	1	0.17	0.68	3313	Gentry Drive	1	0.17	0.68
420	Ridgewood Road	1	0.17	0.68	3315	Gentry Drive	1	0.17	0.68
421	Ridgewood Road	1	0.17	0.68	5001	Jeffery Place	1	0.17	0.68
425	Ridgewood Road	1	0.17	0.68	5002	Jeffery Place	1	0.17	0.68
426	Ridgewood Road	1	0.17	0.68	5003	Jeffery Place	1	0.17	0.68
428	Ridgewood Road	1	0.17	0.68	5004	Jeffery Place	1	0.17	0.68
429	Ridgewood Road	1	0.17	0.68	5007	Jeffery Place	1	0.17	0.68
430	Ridgewood Road	1	0.17	0.68	5005	Jeffery Place	1	0.17	0.68
431	Ridgewood Road	1	0.17	0.68	5000	Jeffery Place	1	0.17	0.68
434	Ridgewood Road	1	0.17	0.68	5006	Jeffery Place	1	0.17	0.68
438	Ridgewood Road	1	0.17	0.68	5008	Jeffery Place	1	0.17	0.68
440	Ridgewood Road	1	0.17	0.68	5002	Gregory Place	1	0.17	0.68
442	Ridgewood Road	1	0.17	0.68	5008	Gregory Place	1	0.17	0.68
423	Ridgewood Road	1	0.17	0.68	5007	Gregory Place	1	0.17	0.68
432	Ridgewood Road	1	0.17	0.68	5004	Gregory Place	1	0.17	0.68
422	Ridgewood Road	1	0.17	0.68	5000	Gregory Place	1	0.17	0.68
427	Ridgewood Road	1	0.17	0.68	5001	Gregory Place	1	0.17	0.68
10	North Peak Road	1	0.17	0.68	5003	Gregory Place	1	0.17	0.68
9	North Peak Road	1	0.17	0.68	5006	Gregory Place	1	0.17	0.68
5	North Peak Road	1	0.17	0.68	5003	Rollingwood Drive	1	0.17	0.68
8	North Peak Road	1	0.17	0.68	5007	Rollingwood Drive	1	0.17	0.68
14	North Peak Road	1	0.17	0.68	5001	Rollingwood Drive	1	0.17	0.68
19	North Peak Road	1	0.17	0.68	5009	Rollingwood Drive	1	0.17	0.68
4	North Peak Road	1	0.17	0.68	5011	Rollingwood Drive	1	0.17	0.68
21	North Peak Road	1	0.17	0.68	5103	Rollingwood Drive	1	0.17	0.68
16	North Peak Road	1	0.17	0.68	5013	Rollingwood Drive	1	0.17	0.68
20	North Peak Road	1	0.17	0.68	5105	Rollingwood Drive	1	0.17	0.68
11	North Peak Road	1	0.17	0.68	5005	Rollingwood Drive	1	0.17	0.68
13	North Peak Road	1	0.17	0.68	5100	Rollingwood Drive	1	0.17	0.68

TABLE 7 - WASTEWATER LOAD CALCULATIONS FOR COMMERCIAL CONNECTIONS FOR RIDGEWOOD AREA(G23-M54)

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
3316	Bee Cave Road	0	0	0
3300	Bee Cave Road	113	14	55

8.4 REDBUD RIDGEWOOD AREA (G23-69)

TABLE 8 - WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS FOR RIDGEWOOD AREA(G23-69)

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)	Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
414	Brady Lane	1	0.17	0.68	422	Brady Lane	1	0.17	0.68
415	Brady Lane	1	0.17	0.68	423	Brady Lane	1	0.17	0.68
416	Brady Lane	1	0.17	0.68	421	Brady Lane	1	0.17	0.68
420	Brady Lane	1	0.17	0.68	431	Brady Lane	1	0.17	0.68
413	Brady Lane	1	0.17	0.68	435	Brady Lane	1	0.17	0.68
419	Brady Lane	1	0.17	0.68	429	Brady Lane	1	0.17	0.68
428	Brady Lane	1	0.17	0.68	426	Brady Lane	1	0.17	0.68
437	Brady Lane	1	0.17	0.68	11	Sugar Creek Drive	1	0.17	0.68
417	Brady Lane	1	0.17	0.68	1	Sugar Creek Drive	1	0.17	0.68
418	Brady Lane	1	0.17	0.68	12	Sugar Creek Drive	1	0.17	0.68
430	Brady Lane	1	0.17	0.68	6	Sugar Creek Drive	1	0.17	0.68
438	Brady Lane	1	0.17	0.68	4	Sugar Creek Drive	1	0.17	0.68
439	Brady Lane	1	0.17	0.68	16	Sugar Creek Drive	1	0.17	0.68
441	Brady Lane	1	0.17	0.68	8	Sugar Creek Drive	1	0.17	0.68
442	Brady Lane	1	0.17	0.68	13	Sugar Creek Drive	1	0.17	0.68
427	Brady Lane	1	0.17	0.68	9	Sugar Creek Drive	1	0.17	0.68
432	Brady Lane	1	0.17	0.68	3	Sugar Creek Drive	1	0.17	0.68
434	Brady Lane	1	0.17	0.68	2	Sugar Creek Drive	1	0.17	0.68
433	Brady Lane	1	0.17	0.68	15	Sugar Creek Drive	1	0.17	0.68
412	Brady Lane	1	0.17	0.68	14	Sugar Creek Drive	1	0.17	0.68
424	Brady Lane	1	0.17	0.68					

8.5 REDBUD RIDGEWOOD AREA (G23-M50)

**TABLE 9 - WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS FOR
RIDGEWOOD AREA(G23-50)**

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
14	Sugar Shack Drive	1	0.17	0.68
15	Sugar Shack Drive	1	0.17	0.68
16	Sugar Shack Drive	1	0.17	0.68
18	Sugar Shack Drive	1	0.17	0.68
19	Sugar Shack Drive	1	0.17	0.68
12	Sugar Shack Drive	1	0.17	0.68
9	Sugar Shack Drive	1	0.17	0.68
10	Sugar Shack Drive	1	0.17	0.68
5	Sugar Shack Drive	1	0.17	0.68
3	Sugar Shack Drive	1	0.17	0.68
7	Sugar Shack Drive	1	0.17	0.68
17	Sugar Shack Drive	1	0.17	0.68
11	Sugar Shack Drive	1	0.17	0.68
6	Sugar Shack Drive	1	0.17	0.68
4	Sugar Shack Drive	1	0.17	0.68

9. RESULTS SUMMARY

9.1 REDBUD FOREST VIEW (F24-2) SEWER SHED

9.1.1 EXISTING SCENARIO

Gravity System - Appendix-B, Table 1, the main gravity system for peak load analysis results shows maximum velocity **7.33 Ft/s**, aligning with the self-cleaning and capacity requirements. Most of the conduits are within the minimum (3 fps) and maximum (10 fps) limits per COA design standards.

Pressurized System - Appendix-B, Table 1 and 3, the pressure systems for peak load analysis results show maximum velocities of **16.46 Ft/s for RF-P-424 & 19.72 Ft/s for RF-P435** which are above the maximum limits per COA design standards. Remaining pipe velocities satisfy the maximum limits per COA design standards.

System Capacity - Appendix-B, Table 1 and 3, Hydraulic Gradient Line (HGL) determined by invert elevation and depth of flow indicates that the maximum flows within the system do not exceed the pipe capacity at any point within the system for gravity lines and pressure lines are handling current flows.

The peak flow from the south sub basin to the rocky river lift station is **316.64 gpm**. The peak flow at the discharge point (Forest view) is **420.16 gpm** for the north network with considering Rocky River lift station peak flow.

The current flow summary for the Rocky River Lift Station and Forest View outfall is outlined below:

- **Total flow from the South sub-basin to Rocky River Lift Station: 316.64 GPM**
- **Discharged flow from Rocky River Lift Station to Forest View Outfall: 316.78 GPM**
- **Total flow from the North sub-basin to Forest View Outfall: 103.38 GPM**
- **Total Flow at the Forest View Outfall (F24-2): 420.16 GPM**

The conduit capacities in the southern network range from 5% to 50% full, with pressure pipes flowing at full capacity. The velocities in the northern network pressure pipes, following discharge from the lift station, remain within acceptable limits.

9.1.2 FUTURE SCENARIO

The model was run for different scenarios, and the current and future scope of increasing the capacity of Rocky River Lift Station was examined.

To assess the future capacity of the Rocky River Lift Station, the following two key design criteria were considered:

1. **Gravity Conduits:** These should remain at approximately 50% of the pipe's depth, without exceeding 50% of the pipe's total capacity.
2. **Pressure Pipe Velocity:** The velocity in the pressure pipes should not exceed 10 feet per second (Ft/s).

The analysis was performed with the assumption that the Rocky River Lift Station flow is **500 GPM** with a **125 ft head**.

Flow Analysis with Additional LUEs:

The system was analysed with the addition of **370 new (LUEs)**, The additional flow contributions from each area are summarized as follows:

- **Reveille Road:** 150 additional residential gravity connections, contributing **102 GPM**
- **Westlake Drive:** 200 additional residential gravity connections, contributing **136 GPM**
- **Westheaven Drive:** 10 additional residential pressure connections, contributing **44 GPM**
(Pressure Internal connections)
- **McConnell Drive:** 10 additional residential pressure connections, contributing **44 GPM**
(Pressure Internal connections)

Total Additional Flow: 326 GPM (20 pressure connections and 350 gravity connections)

For internal pressure connections, as per the **E-One Extreme Flow Probability Method**, out of every 10 pumps, 4 are active and discharging flow at full capacity.

Overall Model Analysis for the Forest View Area:

After considering the additional LUEs and calculating the resulting flow, the total system flow is as follows:

- **Total flow from the South sub-basin to Rocky River Lift Station: 640.98 GPM**
- **Discharged flow from Rocky River Lift Station to Forest View Outfall: 636.51 GPM**
- **Total flow from the North sub-basin to Forest View Outfall: 103.38 GPM**
- **Total Flow at the Forest View Outfall (F24-2): 739.89 GPM**

Model Analysis Summary per Street:

- **Reveille Road:**
 - **Flow Contribution:** 102 GPM
 - **Pressure Pipe Average Velocity:** 5 ft/s
 - **Gravity Conduits:** 30-49% full
- **Westlake Drive:**
 - **Flow Contribution:** 136 GPM
 - **Pressure Pipe Average Velocity:** 4.5 ft/s
 - **Gravity Conduits:** 30-45% full, with velocities ranging from 4 to 9 ft/s
- **Westheaven Drive:**
 - **Flow Contribution:** 44 GPM
 - **Pressure Pipe Average Velocity:** 5.88 ft/s
 - **Gravity Conduits:** 30-40% full, with velocities ranging from 1.5 to 4.5 ft/s
- **McConnell Drive:**
 - **Flow Contribution:** 44 GPM
 - **Pressure Pipe Average Velocity:** 5.85 ft/s
 - **Gravity Conduits:** 10-47% full, with velocities ranging from 4 to 9 ft/s

9.2 REDBUD TRAIL (F24-10) SEWER SHED

Pressurized System - Appendix- C, Table 1, the pressure systems peak load analysis results show maximum velocities of **5.16 Ft/s** which is under the maximum limits per COA design standards.

Appendix C, Table 2, the Hydraulic Gradient Line (HGL), determined by the invert elevation and depth of flow, indicates that the system's maximum flows are currently operating below full capacity. However, future flow increases should be considered to ensure long-term sustainability.

Appendix C, Table 3, the peak flow at the discharge point is **50.51 gpm**

9.3 REDBUD RIDGEWOOD (G23-M54) SEWER SHED

9.3.1 EXISTING SCENARIO

Gravity System - Appendix- D, Table 1, the main gravity systems peak load analysis results show maximum velocity of **8.76 Ft/s** which is within the minimum and maximum limits per COA design standards.

Pressurized System - Appendix- D, Table 3, the pressure systems average and peak load analysis results show maximum velocity of **2.75 Ft/s** which is under the maximum limits per COA design standards.

System Capacity - As per as per Appendix- D, Table 1, 3 and 5, The system has adequate capacity for the current load, with significant capacity for increased flow, especially in the gravity system.

The peak flow at the discharge point (West Bank lift stations) is **132.10 gpm** and the total peak flow at the discharge point is **104.71 gpm** for the overall network.

As per the analysis of existing network, the current flow summary for the West bank Lift Station and G23-M54 outfall is outlined below:

- **Total flow at West Bank Lift Station: 132.10 GPM**
- **Discharged flow from West Bank Lift Station to Ridgewood Road network: 78.11 GPM**
- **Total flow from the Ridgewood Road network to G23-M54 outfall: 26.60 GPM**
- **Total flow at the G23-M54 outfall: 104.71 GPM**

The conduit capacities range from 10% to 15% full, with pressure pipes flowing at full capacity. The velocities for pressure pipes, following discharge from the lift station, remain within acceptable limits.

9.3.2 FUTURE SCENARIO

The model was run for different scenarios, and the current and future scope of increasing capacity of West Bank Shopping Centre lift station was examined.

To assess the future capacity of the West bank Lift Station, the following two key design criteria were considered:

1. **Gravity Conduits:** These should remain at approximately 50% of the pipe's depth, without exceeding 50% of the pipe's total capacity.
2. **Pressure Pipe Velocity:** The velocity in the pressure pipes should not exceed 10 feet per second (Ft/s).

The analysis was performed with the assumption that the pump flow at the West Bank Lift Station is **204 GPM** with a **100 ft head**.

Flow Analysis with Additional LUEs:

The system was analysed with the addition of 150 new (LUEs) with additional flow of 72.9 gpm at 3300 Bee Cave Rd.

Overall Flow Analysis for the G23-M54 Area:

After considering the additional LUEs and calculating the resulting flow, the total system flow is as follows:

- **Total flow at West Bank Lift Station: 205 GPM**
- **Discharged flow from West Bank Lift Station to Ridgewood Road network: 200.15 GPM**
- **Total flow from the Ridgewood Road network to G23-M54 outfall: 26.60 GPM**
- **Total flow at the G23-M54 outfall: 226.75 GPM**

9.4 REDBUD RIDGEWOOD (G23-69) SEWER SHED

Gravity System - Appendix- E, Table 1, the main gravity systems peak load analysis results show maximum velocity of **4.78 Ft/s** which is within the minimum and maximum limits per COA design standards. Hydraulic grades show sufficient pressure head for the given elevations.

Pressurized System - Appendix- E, Table 3, the pressure systems average and peak load analysis results show maximum velocity of **2.58 Ft/s** which satisfy the maximum limits per COA design standards.

System Capacity - Appendix- E, Table 1,3 and 5, the G23-69 system operates under low-flow conditions, with unused capacity evident in the gravity and pressure systems.

Appendix- E, Table 8, the peak flow at the discharge point is **49.67 gpm**

9.5 REDBUD RIDGEWOOD (G23-M50) SEWER SHED

Pressurized System - Appendix- F, Table 1, the pressure systems average and peak load analysis results show maximum velocity of **4.14 Ft/s** which satisfy the maximum limits per COA design standards. Maximum pressures range from 7 PSI to 13 PSI, indicating consistent but moderate pressures across the system.

System Capacity - Appendix- F, Table 1, The pressure system operates under low to moderate pressures, suggesting it is functioning within its capacity.

Appendix- F, Table 3, the peak flow at the discharge point is **40.51 gpm**

10 CONCLUSION

Utilizing Bentley's SewerGEMS software, a model of the Red Bud Trail Service Area collection system was created and validated. The model was analysed for peak loading scenarios, and it was determined to be mostly accurate and in alignment with the City of West Lake Hills engineering calculations. The analysis also identified a few locations within the collection system that exceed capacity or exhibit compromised hydraulics, potentially causing damage to the system.

The Red Bud Trail Service Area, being the largest area in the system, comprises several sub-systems that contribute to the peak flow limitation set by the Agreement for flows directed toward the Red Bud Trail siphon in the COA system. This "Combined" Entry Point consists of several metered and unmetered Entry Points, with a total peak flow limitation of 600 gpm.

According to the analysis, the peak combined flow for the Red Bud Trail Service Area is 666 gpm, which exceeds the agreement limitation of 600 gpm. Scenarios were modeled to assess the current and future potential for increasing the capacities of the Rocky River and West Bank Shopping Centre lift stations.

10.1 REDBUD FOREST VIEW (F24-2) SEWER SHED

The conduit capacities in the southern network range from 5% to 50% full, with pressure pipes flowing at full capacity. The velocities in the northern network pressure pipes, following discharge from the lift station, remain within acceptable limits.

Based on the flow analysis, adding 370 LUEs (with an additional 326 GPM flow) to the Rocky River Lift Station will result in:

- **Pressure pipes maintaining velocities under 10 ft/s.**
- **Gravity lines remaining at or below 50% full capacity** in the southern network.

However, some improvements are required to handle the increased flow:

1. **Increase the Capacity of the Rocky River Lift Station:** The current station needs to be upgraded to manage the increased flow.
2. **Upgrade the Initial Force Main Diameter:** The diameter of the force main after the lift station should be increased from **4 inches to 6 inches** to accommodate higher flow rates and manage the sudden changes in velocity after discharge.
3. **Velocity Issues on Forest Main Drive:** Two pressure pipes on Forest Main Drive exceed the 10-Ft/s velocity limit due to steep slopes, which needs further mitigation.

Summary of Recommendations:

1. **Upgrade the Rocky River Lift Station** to handle the increased flow of 326 gpm from the additional 370 LUEs.
2. Increase the force main diameter from **4 inches to 6 inches** to manage the increased flow and mitigate velocity surges after discharge from lift station.
3. **Implement velocity control measures** on Forest Main Drive to reduce the pressure pipe velocities above 10 Ft/s due to steep slopes.

10.2 REDBUD RIDGEWOOD (G23-M54) SEWER SHED

As per the analysis of existing conditions, the current flow summary for the West bank Lift Station and G23-M54 outfall is outlined below:

- **Total flow at West Bank Lift Station: 132.10 GPM**
- **Discharged flow from West Bank Lift Station to Ridgewood Road network: 78.11 GPM**
- **Total flow from the Ridgewood Road network to G23-M54 outfall: 26.60 GPM**
- **Total flow at the G23-M54 outfall: 104.71 GPM**

The conduit capacities range from 10% to 15% full, with pressure pipes flowing at full capacity. The velocities for pressure pipes, following discharge from the lift station, remain within acceptable limits.

Based on the flow analysis, adding 150 LUEs (with an additional 72.9 GPM flow) to the West bank Lift Station will result in:

- **Pressure pipes maintaining velocities under 10 ft/s.**
- **Gravity lines remaining at or below 50% full capacity**

APPENDIX A

OUTFALL PROFILES

OUTFALL PROFILES FOR
REDBUD FOREST VIEW, SOUTH (F24-2) SEWER SHED THAT FLOWS TO ROCKY
RIVER LIFT STATION

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi

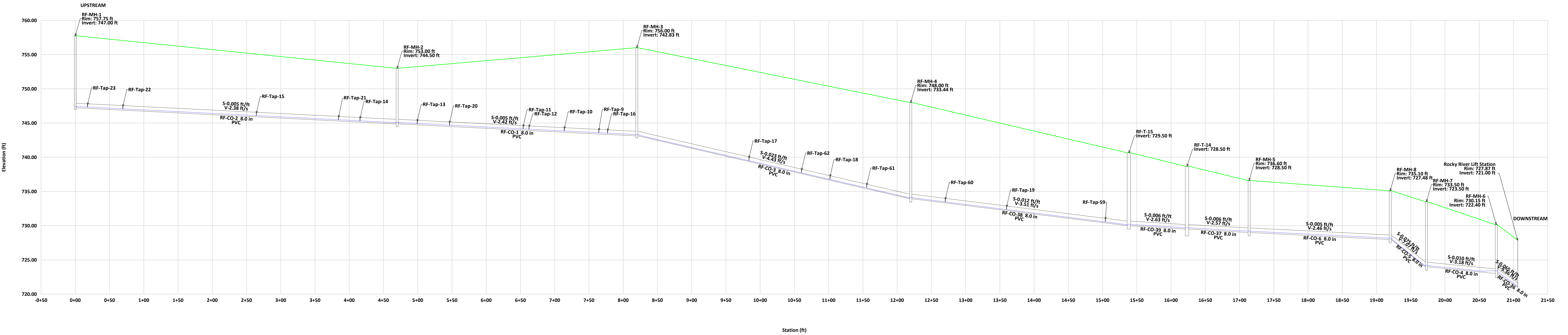


FIGURE 1: REVEILLE ROAD OUTFALL PROFILE

Preliminary - Draft

OUTFALL PROFILES FOR
REDBUD FOREST VIEW, SOUTH (F24-2) SEWER SHED THAT FLOWS TO ROCKY
RIVER LIFT STATION

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi

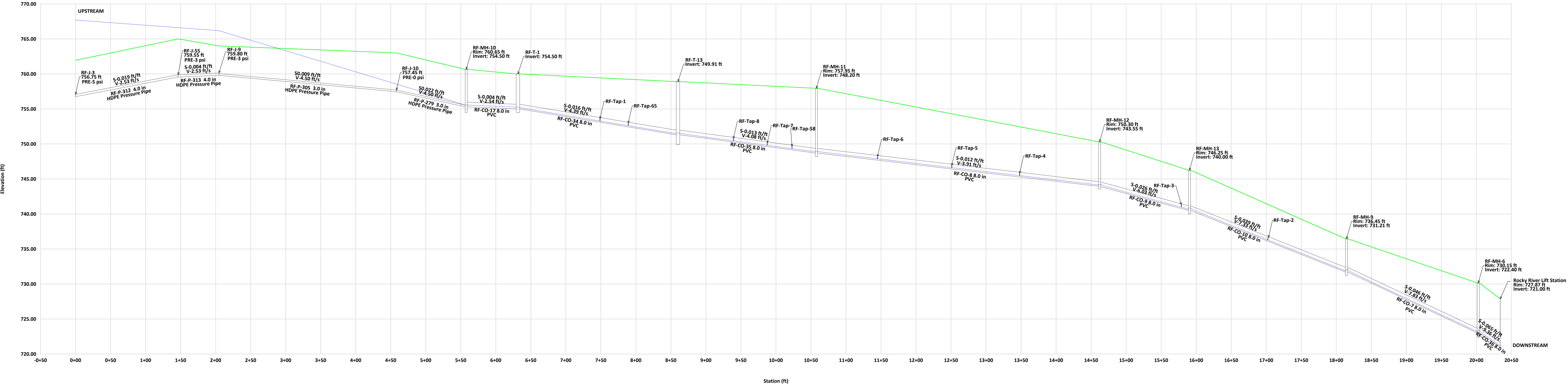


FIGURE 2: WESTLAKE DRIVE OUTFALL PROFILE

Preliminary - Draft

OUTFALL PROFILES FOR
REDBUD FOREST VIEW, NORTH (F24-2)
ROCKY RIVER LIFT STATION FORCE MAIN AND CONTRIBUTING SEWER SHED

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi

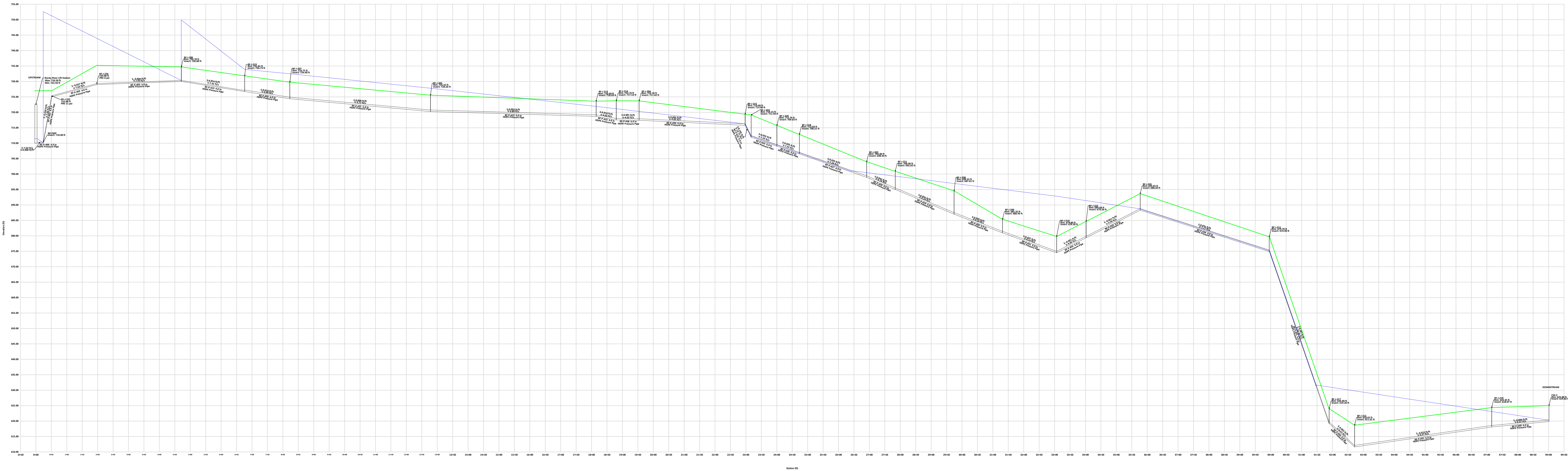


FIGURE 3: FOREST VIEW DRIVE OUTFALL PROFILE

Preliminary - Draft

OUTFALL PROFILES FOR
REDBUD TRAIL (F24-10) SEWER SHED

LEGEND

EXISTING GROUND LEVEL

HGL

VELOCITY

SLOPE

PRESSURE

V-ft/s

S-ft/ft

PRE-psi

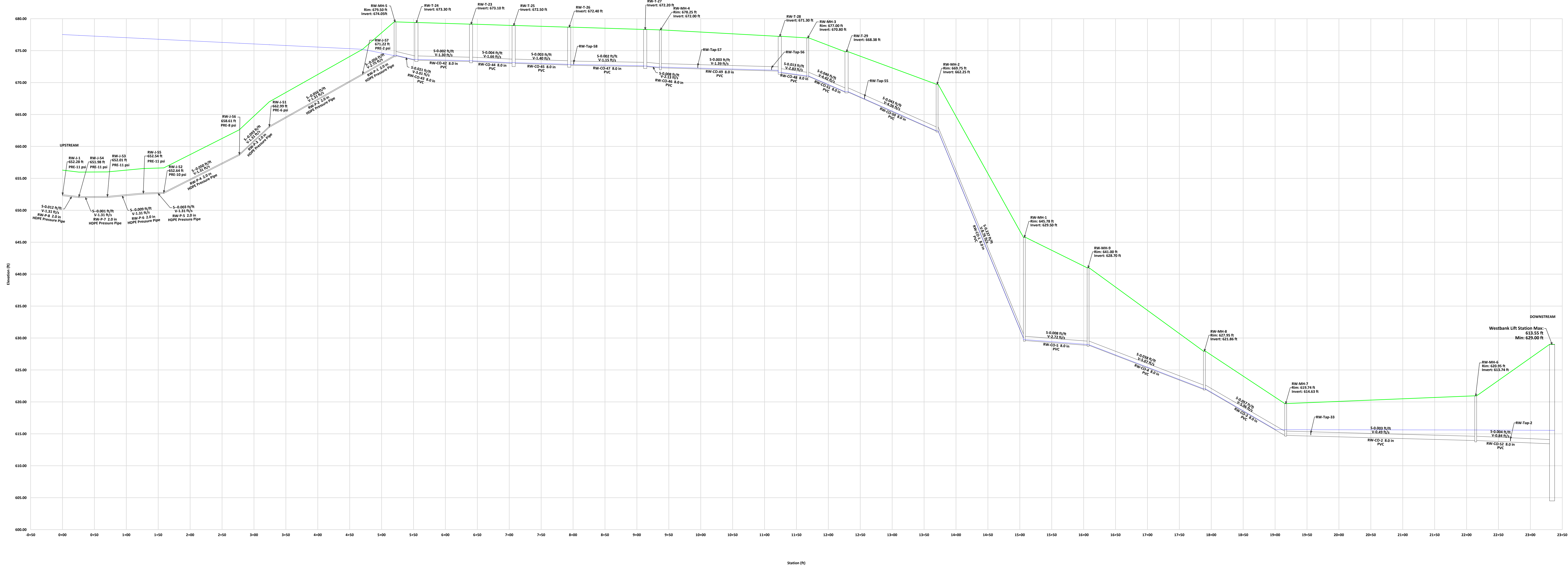


FIGURE 4: WESTLAKE DRIVE OUTFALL PROFILE

Preliminary - Draft

OUTFALL PROFILES FOR
REDBUD RIDGEWOOD (G23-M54) SEWER SHED

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi



OUTFALL PROFILES FOR
REDBUD RIDGEWOOD (G23-M54) SEWER SHED

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi

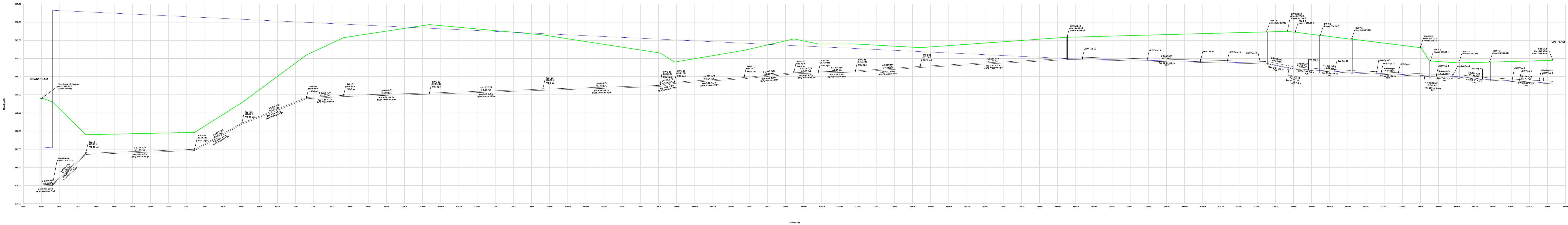


FIGURE 6: RIDGEWOOD DRIVE OUTFALL PROFILE

Preliminary - Draft

OUTFALL PROFILES FOR
REDBUD RIDGEWOOD (G23-69) SEWER SHED

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi

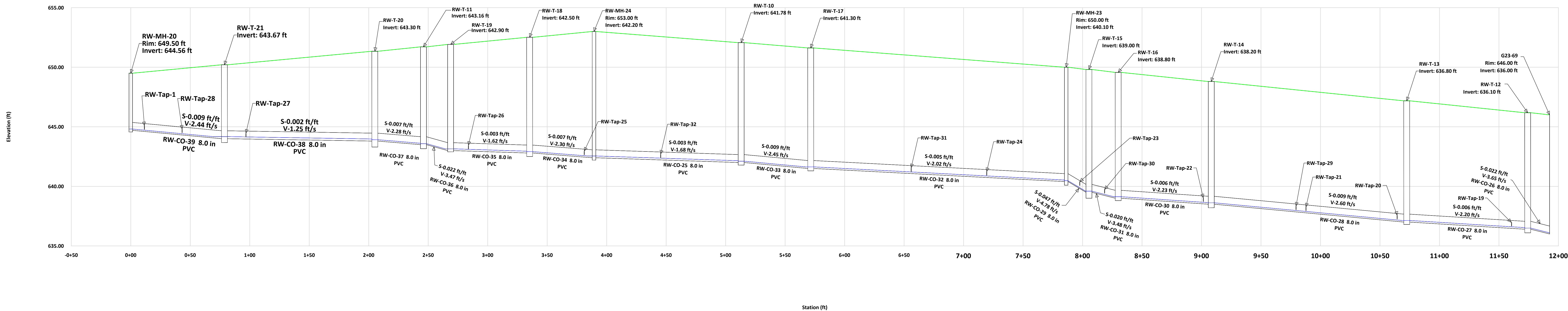


FIGURE 7: BRADY LANE OUTFALL PROFILE

Preliminary - Draft

OUTFALL PROFILES FOR
REDBUD RIDGEWOOD (G23-M50) SEWER SHED

LEGEND	
EXISTING GROUND LEVEL	
HGL	
VELOCITY	V-ft/s
SLOPE	S-ft/ft
PRESSURE	PRE-psi

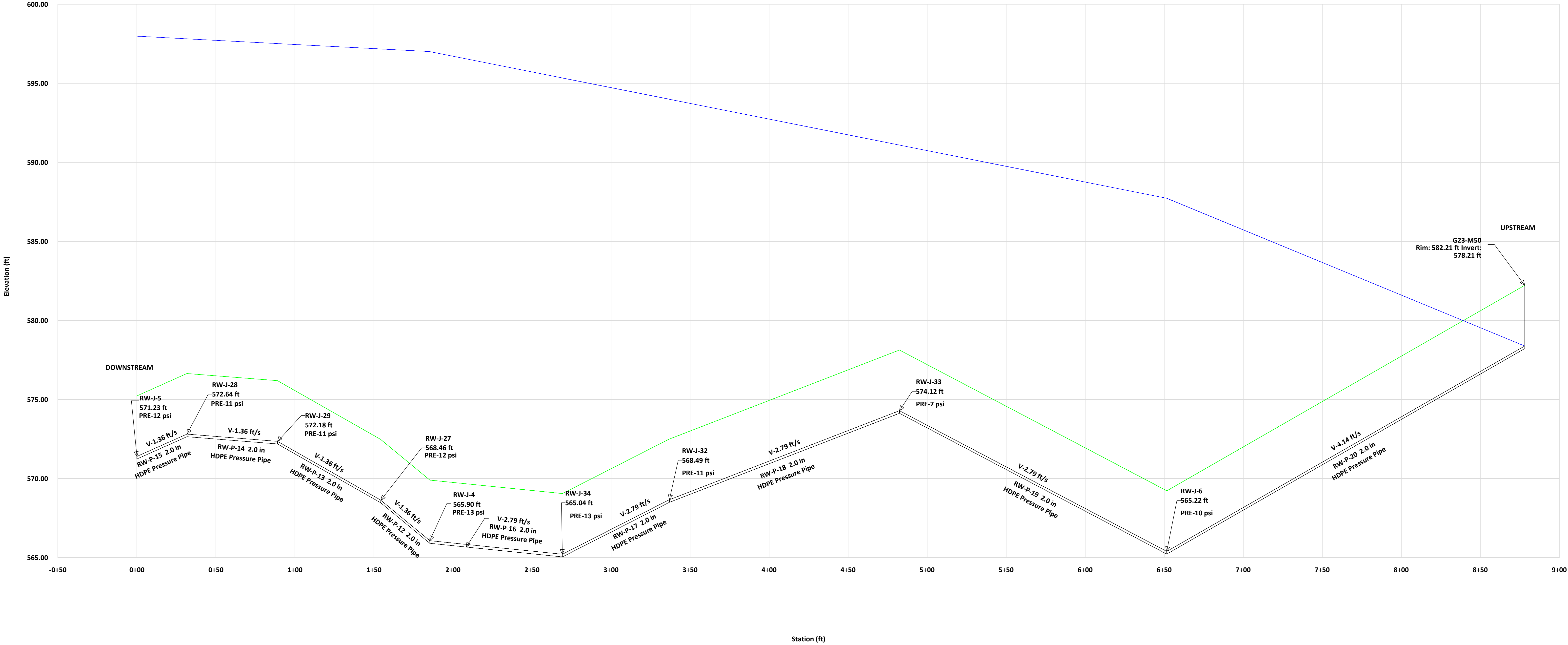


FIGURE 8: SUGAR SHACK OUTFALL PROFILE

Preliminary - Draft

APPENDIX-B

FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS

FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS
TABLE 1- GRAVITY SYSTEM, FLOW DATA

Below from min. limit

Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-CO-1	RF-MH-2	753.00	744.88	RF-MH-3	756.00	743.13	350.00	0.005	8.00	PVC	2.42	0.21	9.83	88.60	1.75	496.66	17.80	745.08	743.34
RF-CO-2	RF-MH-1	757.75	747.23	RF-MH-2	753.00	744.88	469.90	0.005	8.00	PVC	2.38	0.20	8.65	83.84	2.34	496.72	16.90	747.43	745.08
RF-CO-3	RF-MH-3	756.00	743.13	RF-MH-4	748.00	733.94	400.00	0.023	8.00	PVC	4.43	0.21	12.80	91.32	9.19	1131.56	8.10	743.34	734.15
RF-CO-4	RF-MH-7	733.50	724.00	RF-MH-6	730.15	723.02	102.00	0.010	8.00	PVC	3.18	0.44	7.65	94.89	0.07	706.57	13.40	724.21	724.14
RF-CO-5	RF-MH-8	735.10	727.98	RF-MH-7	733.50	724.00	53.00	0.075	8.00	PVC	7.07	0.15	7.64	94.89	4.10	2146.13	4.40	728.19	724.09
RF-CO-6	RF-MH-5	736.60	729.00	RF-MH-8	735.10	727.98	205.90	0.005	8.00	PVC	2.46	0.20	6.69	94.89	1.03	494.13	19.20	729.21	728.18
RF-CO-7	RF-MH-9	736.45	731.71	RF-MH-6	730.15	723.02	188.10	0.046	8.00	PVC	7.83	0.51	5.27	265.98	7.93	1650.18	16.10	732.07	724.14
RF-CO-8	RF-MH-11	757.95	748.70	RF-MH-12	750.30	743.95	404.30	0.012	8.00	PVC	3.91	0.28	7.13	150.09	4.73	787.79	19.10	748.97	744.23
RF-CO-9	RF-MH-12	750.30	743.90	RF-MH-13	746.25	740.50	128.40	0.026	8.00	PVC	6.02	0.35	5.41	227.63	3.37	1221.99	18.60	744.23	740.86
RF-CO-10	RF-MH-13	746.25	740.50	RF-MH-9	736.45	731.71	224.20	0.039	8.00	PVC	7.33	0.27	4.58	265.98	8.96	1510.01	17.60	740.86	731.90
RF-CO-11	RF-MH-16	839.95	827.80	RF-MH-19	815.00	809.35	211.30	0.087	8.00	PVC	6.74	0.20	8.23	65.98	18.40	2326.79	2.80	827.98	809.58
RF-CO-12	RF-MH-19	815.00	809.40	RF-MH-20	796.85	792.00	186.60	0.093	8.00	PVC	6.94	0.13	4.56	66.66	17.50	2411.44	2.80	809.58	792.07
RF-CO-13	RF-MH-20	796.85	783.35	RF-MH-25	768.55	762.00	443.90	0.048	8.00	PVC	6.29	0.24	9.36	115.18	21.35	1686.44	6.80	783.58	762.24
RF-CO-14	RF-MH-27	847.90	843.50	RF-MH-14	844.25	838.90	75.00	0.061	8.00	PVC	4.34	0.10	4.21	23.37	4.60	1923.19	1.20	843.60	839.00
RF-CO-15	RF-MH-26	886.45	882.35	RF-MH-28	865.00	862.00	188.20	0.108	8.00	PVC	5.38	0.07	2.88	23.37	20.41	2611.50	0.90	882.45	862.04
RF-CO-16	RF-MH-28	865.00	862.00	RF-MH-27	847.90	843.35	168.80	0.110	8.00	PVC	5.43	0.18	3.11	23.37	18.50	2642.19	0.90	862.10	843.60
RF-CO-17	RF-MH-10	760.65	755.30	RF-T-1	760.00	755.00	73.80	0.004	8.00	PVC	2.54	0.26	4.51	143.29	0.30	444.16	32.30	755.56	755.26
RF-CO-18	RF-MH-20	796.85	783.40	RF-T-4	791.95	784.00	155.30	0.004	8.00	PVC	1.54	0.15	10.03	25.41	0.52	432.07	5.90	784.11	783.58
RF-CO-19	RF-T-4	791.95	784.00	RF-MH-21	791.15	784.35	117.70	0.003	8.00	PVC	1.38	0.11	6.71	24.05	0.35	375.19	6.40	784.46	784.11
RF-CO-20	RF-MH-21	791.15	784.35	RF-T-5	792.85	786.00	11.30	0.146	8.00	PVC	2.98	0.07	6.16	2.04	1.57	3066.13	0.10	786.03	784.46
RF-CO-21	RF-MH-25	768.55	762.00	RF-T-10	758.50	752.00	162.10	0.062	8.00	PVC	6.97	0.24	5.86	117.90	10.00	1928.86	6.10	762.24	752.24
RF-CO-22	RF-T-10	758.50	752.00	RF-MH-12	750.30	744.00	257.40	0.031	8.00	PVC	5.38	0.19	5.73	120.62	8.11	1332.02	9.10	752.24	744.13
RF-CO-23	RF-MH-23	795.70	791.10	RF-T-9	796.00	790.70	49.70	0.008	8.00	PVC	2.46	0.16	4.28	48.52	0.38	641.97	7.60	791.25	790.87
RF-CO-24	RF-MH-24	797.15	789.35	RF-T-8	797.50	788.60	22.00	0.034	8.00	PVC	4.32	0.36	7.68	49.16	0.33	1399.58	3.50	789.50	789.18
RF-CO-25	RF-T-7	797.75	788.60	RF-T-8	797.50	789.00	119.40	0.003	8.00	PVC	1.76	0.36	8.16	49.16	0.02	400.07	12.30	789.18	789.15
RF-CO-26	RF-T-7	797.75	789.00	RF-T-6	798.00	787.35	121.10	0.014	8.00	PVC	3.04	0.13	9.03	49.84	1.69	853.27	5.80	789.15	787.46
RF-CO-27	RF-T-6	798.00	787.35	RF-T-3	798.00	787.00	10.40	0.034	8.00	PVC	4.31	0.15	10.16	49.84	0.35	1388.54	3.60	787.50	787.15
RF-CO-28	RF-T-3	798.00	787.00	RF-MH-20	796.85	785.00	227.00	0.009	8.00	PVC	2.59	0.14	10.76	51.20	2.03	674.37	7.60	787.15	785.12
RF-CO-29	RF-T-5	792.85	786.00	RF-T-2	804.25	798.00	196.30	0.061	8.00	PVC	1.50	0.02	5.88	0.68	11.99	1919.47	0.00	798.02	786.03
RF-CO-30	RF-T-2	804.25	798.00	RF-MH-22	811.00	805.00	66.30	0.106	8.00	PVC	0.00	0.01	5.46	0.00	6.98	2577.49	0.00	805.00	798.02
RF-CO-31	RF-T-11	796.58	790.50	RF-MH-24	797.15	789.35	109.80	0.010	8.00	PVC	2.74	0.13	6.27	49.20	1.19	740.38	6.60	790.65	789.46
RF-CO-32	RF-T-9	796.00	790.70	RF-T-12	796.20	790.60	38.80	0.003	8.00	PVC	1.58	0.18	4.78	48.52	0.07	347.44	14.00	790.87	790.80
RF-CO-33	RF-T-12	796.20	790.60	RF-T-11	796.58	790.50	71.70	0.001	8.00	PVC	1.25	0.18	5.17	49.20	0.15	249.21	19.70	790.80	790.65
RF-CO-34	RF-T-1	760.00	755.00	RF-T-13	758.90	751.30	228.50	0.016	8.00	PVC	4.39	0.26	5.63	144.65	3.70	936.82	15.40	755.26	751.57
RF-CO-35	RF-T-13	758.90	751.30	RF-MH-11	757.95	748.70	197.70	0.013	8.00	PVC	4.08	0.27	7.76	147.37	2.60	837.20	17.60	751.57	748.97
RF-CO-37	RF-T-14	738.69	729.50	RF-MH-5	736.60	729.00	90.70	0.006	8.00	PVC	2.57	0.21	7.73	94.72	0.50	523.41	18.10	729.71	729.21
RF-CO-38	RF-MH-4	748.00	733.94	RF-T-15	740.65	730.00	318.50	0.012	8.00	PVC	3.51	0.18	11.69	94.72	4.00	810.02	11.70	734.15	730.15

Preliminary - Draft

FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS
TABLE 1- GRAVITY SYSTEM, FLOW DATA (CONTINUED)

Below from min. limit

Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-CO-39	RF-T-15	740.65	730.00	RF-T-14	738.69	729.50	84.80	0.006	8.00	PVC	2.63	0.20	9.26	94.72	0.52	542.80	17.50	730.21	729.69
RF-CO-40	RF-MH-14	844.25	838.90	RF-T-16	840.94	835.00	54.30	0.072	8.00	PVC	4.65	0.08	4.98	24.05	3.96	2093.83	1.10	839.00	835.05
RF-CO-41	RF-T-16	840.94	835.00	RF-T-17	836.29	830.25	76.20	0.062	8.00	PVC	4.40	0.08	5.32	24.05	4.80	1940.37	1.20	835.10	830.30
RF-CO-42	RF-T-17	836.29	830.25	RF-MH-15	835.10	829.90	19.50	0.018	8.00	PVC	2.74	0.12	4.95	24.05	0.33	989.79	2.40	830.35	830.03
RF-CO-43	RF-MH-15	835.10	829.90	RF-T-18	837.86	828.50	210.80	0.007	8.00	PVC	2.11	0.13	6.62	36.40	1.39	578.90	6.30	830.03	828.64
RF-CO-44	RF-T-18	837.86	828.50	RF-MH-16	839.95	828.00	159.10	0.003	8.00	PVC	1.60	0.14	9.99	38.44	0.51	386.45	9.90	828.64	828.13
RF-CO-45	RF-T-19	840.46	829.50	RF-MH-16	839.95	828.00	75.80	0.020	8.00	PVC	3.50	0.12	10.79	49.49	1.55	1044.04	4.70	829.65	828.10
RF-CO-46	RF-T-20	840.59	829.85	RF-T-19	840.46	829.50	19.90	0.018	8.00	PVC	3.35	0.13	10.18	49.49	0.40	978.54	5.10	830.00	829.60
RF-CO-47	RF-MH-17	842.00	831.00	RF-T-21	841.69	830.00	47.20	0.021	8.00	PVC	3.59	0.19	10.68	48.81	0.92	1083.05	4.50	831.15	830.23
RF-CO-48	RF-T-21	841.69	830.00	RF-T-20	840.59	829.85	164.50	0.001	8.00	PVC	1.06	0.19	10.55	49.49	0.22	198.15	25.00	830.23	830.00
RF-CO-49	RF-MH-18	835.60	831.85	RF-T-22	839.06	831.65	115.00	0.002	8.00	PVC	1.35	0.17	4.92	47.45	0.23	280.75	16.90	832.03	831.80
RF-CO-50	RF-T-22	839.06	831.65	RF-MH-17	842.00	831.00	97.50	0.007	8.00	PVC	2.29	0.14	8.54	48.81	0.67	580.04	8.40	831.80	831.13
RF-CO-51	RF-MH-30	760.00	756.75	RF-MH-29	758.20	754.90	262.30	0.007	3.00	PVC	0.00	0.13	3.03	0.00	1.15	48.82	0.00	756.75	755.60
RF-CO-52	RF-MH-29	758.20	754.90	RF-MH-1	757.75	754.00	76.10	0.012	3.00	PVC	3.65	0.24	3.28	80.44	1.36	64.52	124.70	755.60	754.24
RF-CO-53	RF-MH-31	903.50	899.50	RF-MH-26	886.45	882.10	393.60	0.044	2.00	PVC	0.00	0.08	4.01	0.00	17.05	45.28	0.00	899.50	882.45
RF-CO-54	RF-MH-6	730.15	723.02	Rocky River Lift Station	727.00	721.00	64.10	0.032	8.00	PVC	2.02	0.67	5.90	316.64	0.14	1342.24	23.60	724.14	724.00

Preliminary - Draft

FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS
TABLE 1- PRESSURE SYSTEM MODELLED AS GRAVITY SYSTEM, FLOW DATA (CONTINUED)

Below from min. limit

Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-P-419	RF-J-206	734.70	730.00	RF-J-219	731.81	726.73	205.10	0.016	4.00	HDPE Pressure Pipe	8.37	0.33	4.56	327.78	12.11	161.62	202.80	744.13	732.02
RF-P-420	RF-J-219	731.81	726.73	RF-J-207	729.75	724.40	146.30	0.016	6.00	HDPE Pressure Pipe	3.84	0.50	4.71	338.78	1.27	469.25	72.20	732.02	730.74
RF-P-421	RF-J-207	729.75	724.40	RF-J-205	725.55	720.26	455.60	0.009	6.00	HDPE Pressure Pipe	3.97	0.50	4.82	349.78	4.21	346.53	100.90	730.74	726.53
RF-P-422	RF-J-205	725.55	720.26	RF-J-213	723.60	718.69	536.60	0.003	6.00	HDPE Pressure Pipe	4.09	0.50	4.60	360.83	5.26	187.92	192.00	726.53	721.27
RF-P-423	RF-J-213	723.60	718.69	RF-J-214	723.76	717.53	65.10	0.018	6.00	HDPE Pressure Pipe	4.22	0.50	5.07	371.71	0.67	498.35	74.60	721.27	720.60
RF-P-424	RF-J-215	719.40	715.80	RF-J-203	719.15	711.94	19.80	0.195	6.00	HDPE Pressure Pipe	16.46	0.45	4.90	382.60	3.86	1816.86	21.10	716.25	712.39
RF-P-425	RF-J-203	719.15	711.94	RF-J-220	715.76	709.03	83.20	0.035	6.00	HDPE Pressure Pipe	8.27	0.36	6.47	382.84	3.10	717.47	53.40	712.39	709.29
RF-P-426	RF-J-220	715.76	709.03	RF-J-218	712.83	706.51	72.90	0.035	6.00	HDPE Pressure Pipe	8.23	0.36	6.03	382.78	2.71	713.03	53.70	709.48	706.77
RF-P-427	RF-J-218	712.83	706.51	RF-J-202	704.00	698.93	217.90	0.035	6.00	HDPE Pressure Pipe	8.25	0.45	5.20	382.62	7.58	715.49	53.50	706.96	699.38
RF-P-428	RF-J-202	704.00	698.93	RF-J-221	700.90	695.02	92.70	0.042	6.00	HDPE Pressure Pipe	8.93	0.48	4.98	383.00	1.41	793.71	48.30	699.38	697.98
RF-P-429	RF-J-221	700.90	695.02	RF-J-208	694.55	687.01	190.50	0.042	6.00	HDPE Pressure Pipe	4.34	0.50	6.21	382.61	2.08	792.62	48.30	697.98	695.90
RF-P-430	RF-J-208	694.55	687.01	RF-J-209	685.35	680.95	157.00	0.039	6.00	HDPE Pressure Pipe	4.34	0.50	5.47	382.56	1.71	756.78	50.60	695.90	694.18
RF-P-431	RF-J-209	685.35	680.95	RF-J-216	679.80	674.50	175.30	0.037	6.00	HDPE Pressure Pipe	4.34	0.50	4.35	382.53	1.91	737.53	51.90	694.18	692.27
RF-P-432	RF-J-216	679.80	674.50	RF-J-222	684.68	679.36	95.60	-0.051	6.00	HDPE Pressure Pipe	4.76	0.50	4.81	419.67	1.24	878.23	47.80	692.27	691.03
RF-P-433	RF-J-222	684.68	679.36	RF-J-201	693.65	688.30	175.10	-0.051	6.00	HDPE Pressure Pipe	4.77	0.48	4.83	420.02	2.27	880.05	47.70	691.03	688.77
RF-P-434	RF-J-201	693.65	688.30	RF-J-211	679.70	674.90	418.00	0.032	6.00	HDPE Pressure Pipe	8.14	0.37	4.58	420.16	13.58	684.52	61.40	688.77	675.18
RF-P-435	RF-J-211	679.70	674.90	RF-J-217	624.00	619.20	194.00	0.287	6.00	HDPE Pressure Pipe	19.72	0.48	4.30	420.16	45.48	2236.63	18.80	675.37	629.89
RF-P-436	RF-J-217	624.00	619.20	RF-J-212	618.65	611.61	82.60	0.092	6.00	HDPE Pressure Pipe	4.77	0.50	5.42	420.16	1.07	1208.80	34.80	629.89	628.81
RF-P-437	RF-J-212	618.65	611.61	RF-J-210	624.35	618.07	444.10	-0.015	6.00	HDPE Pressure Pipe	4.77	0.50	6.16	420.16	5.77	446.79	94.00	628.81	623.05
RF-P-438	RF-J-214	723.76	717.53	RF-J-204	723.70	717.42	74.20	0.001	6.00	HDPE Pressure Pipe	4.22	0.50	5.76	371.71	0.77	130.22	285.40	720.60	719.83
RF-P-439	RF-J-204	723.70	717.42	RF-J-215	719.40	715.80	343.30	0.005	6.00	HDPE Pressure Pipe	4.22	0.48	4.44	371.89	3.58	243.29	152.90	719.83	716.25
RF-P-440	RF-J-210	624.35	618.07	F 24 -2	625.00	619.83	185.60	-0.009	6.00	HDPE Pressure Pipe	4.77	0.48	5.22	420.16	2.75	329.28	127.60	623.05	620.30

*RF-P-419 TO RF-P-440 pressure network is modeled as gravity based on topographic profile

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS**TABLE 2- GRAVITY LATERAL SYSTEM, FLOW DATA**

Input Data						Output Data
Label	Start Node	Invert (Start) (ft)	Stop Node	Diameter (in)	Material	Flow (gpm)
RF-L-1	111 WD	751.82	RF-Tap-1	4.00	PVC	0.68
RF-L-2	401 WD	741.52	RF-Tap-2	4.00	PVC	0.68
RF-L-3	309 WD	744.55	RF-Tap-3	4.00	PVC	0.68
RF-L-4	307 WD	746.30	RF-MH-12	4.00	PVC	0.68
RF-L-5	305 WD	750.65	RF-Tap-4	4.00	PVC	0.68
RF-L-6	303 WD	751.00	RF-Tap-5	4.00	PVC	0.68
RF-L-7	211 WD	751.10	RF-Tap-6	4.00	PVC	0.68
RF-L-8	209 WD	751.62	RF-Tap-7	4.00	PVC	0.68
RF-L-9	205 WD	752.67	RF-Tap-8	4.00	PVC	0.68
RF-L-10	202 RR	750.10	RF-Tap-9	4.00	PVC	0.68
RF-L-11	200 RR	751.00	RF-Tap-10	4.00	PVC	0.68
RF-L-12	118 RR	751.00	RF-Tap-11	4.00	PVC	0.68
RF-L-13	209 RR	750.71	RF-Tap-12	4.00	PVC	0.68
RF-L-14	116 RR	751.00	RF-Tap-13	4.00	PVC	0.68
RF-L-15	114 RR	751.00	RF-Tap-14	4.00	PVC	0.68
RF-L-16	112 RR	750.08	RF-Tap-15	4.00	PVC	0.68
RF-L-17	211 RR	747.77	RF-Tap-16	4.00	PVC	0.68
RF-L-18	215 RR	742.19	RF-Tap-17	4.00	PVC	0.68
RF-L-19	217 RR	740.46	RF-Tap-18	4.00	PVC	0.68
RF-L-20	303 RR	734.93	RF-Tap-19	4.00	PVC	0.68
RF-L-21	207 RR	751.00	RF-Tap-20	4.00	PVC	0.68
RF-L-22	201 RR	748.63	RF-Tap-21	4.00	PVC	0.68
RF-L-23	107 RR	749.02	RF-Tap-22	4.00	PVC	0.68
RF-L-24	105 RR	754.41	RF-Tap-23	4.00	PVC	0.68
RF-L-25	100 WSD	746.04	RF-MH-13	4.00	PVC	0.68
RF-L-26	102 WSD	749.98	RF-Tap-24	4.00	PVC	0.68
RF-L-27	200 WSD	761.55	RF-MH-25	4.00	PVC	0.68
RF-L-28	202 WSD	765.75	RF-Tap-25	4.00	PVC	0.68
RF-L-29	204 WSD	772.30	RF-Tap-26	4.00	PVC	0.68
RF-L-30	301 WSD	781.78	RF-Tap-27	4.00	PVC	0.68
RF-L-31	207 WSD	782.76	RF-Tap-28	4.00	PVC	0.68
RF-L-32	213 WSD	790.78	RF-Tap-29	4.00	PVC	0.68
RF-L-33	203 WSD	772.75	RF-Tap-30	4.00	PVC	0.68
RF-L-34	201 WSD	767.98	RF-Tap-31	4.00	PVC	0.68
RF-L-35	109 WSD	762.38	RF-Tap-32	4.00	PVC	0.68
RF-L-36	107 WSD	761.00	RF-Tap-33	4.00	PVC	0.68
RF-L-37	103 WSD	753.93	RF-Tap-34	4.00	PVC	0.68

Input Data						Output Data
Label	Start Node	Invert (Start) (ft)	Stop Node	Diameter (in)	Material	Flow (gpm)
RF-L-38	204 WHD	814.54	RF-Tap-35	4.00	PVC	0.68
RF-L-39	208 WHD	806.78	RF-Tap-36	4.00	PVC	0.68
RF-L-40	300 MCD	800.90	RF-Tap-37	4.00	PVC	0.68
RF-L-41	308 WHD	801.92	RF-Tap-38	4.00	PVC	0.68
RF-L-43	302 WHD	797.83	RF-Tap-40	4.00	PVC	0.68
RF-L-44	304 WHD	791.28	RF-Tap-41	4.00	PVC	0.68
RF-L-45	200 MC	839.10	RF-Tap-42	4.00	PVC	0.68
RF-L-46	202 MC	843.21	RF-Tap-43	4.00	PVC	0.68
RF-L-47	204 MC	847.12	RF-Tap-44	4.00	PVC	0.68
RF-L-48	206 MC	853.46	RF-Tap-45	4.00	PVC	0.68
RF-L-49	208 MC	853.13	RF-Tap-46	4.00	PVC	0.68
RF-L-50	300 MC	851.47	RF-Tap-47	4.00	PVC	0.68
RF-L-51	302 MC	847.67	RF-Tap-48	4.00	PVC	0.68
RF-L-52	304 MC	800.86	RF-Tap-49	4.00	PVC	0.68
RF-L-53	306 MC	853.41	RF-Tap-50	4.00	PVC	0.68
RF-L-54	108 WHD	803.72	RF-Tap-51	4.00	PVC	0.68
RF-L-55	106 WHD	805.17	RF-Tap-52	4.00	PVC	0.68
RF-L-56	525 MC	879.14	RF-Tap-53	4.00	PVC	0.68
RF-L-57	355 MC	863.12	RF-Tap-54	4.00	PVC	0.68
RF-L-58	200 WHD	806.68	RF-Tap-55	4.00	PVC	0.68
RF-L-59	212 WHD	807.17	RF-Tap-56	4.00	PVC	0.68
RF-L-60	105 WSD	757.74	RF-Tap-57	4.00	PVC	0.68
RF-L-61	302 WD	756.54	RF-Tap-5	4.00	PVC	0.68
RF-L-62	210 WD	759.74	RF-Tap-58	4.00	PVC	0.68
RF-L-63	314 RR	741.00	RF-Tap-59	4.00	PVC	0.68
RF-L-64	312 RR	740.84	RF-Tap-19	4.00	PVC	0.68
RF-L-65	310 RR	741.51	RF-Tap-60	4.00	PVC	0.68
RF-L-66	308 RR	742.94	RF-Tap-61	4.00	PVC	0.68
RF-L-67	208 RR	744.13	RF-Tap-62	4.00	PVC	0.68
RF-L-68	301 RR	732.87	RF-Tap-60	4.00	PVC	0.68
RF-L-69	301 MC	823.55	RF-Tap-63	4.00	PVC	0.68
RF-L-70	200 WD	781.30	RF-Tap-8	4.00	PVC	0.68
RF-L-71	306 WHD	799.72	RF-Tap-64	4.00	PVC	0.68
RF-L-72	108 WSD	759.79	RF-Tap-32	4.00	PVC	0.68
RF-L-73	104 WSD	754.34	RF-Tap-57	4.00	PVC	0.68
RF-L-74	113 WD	753.78	RF-Tap-65	4.00	PVC	0.68

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS

TABLE 3- PRESSURE SYSTEM, FLOW DATA

	Below from min. limit
	Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-P-1	RF-J-26	756.39	AV-4	754.75	9.90	2.00	HDPE Pressure Pipe	0.17	2.61	25.54	0.17	758.02	757.85
RF-P-2	AV-4	754.75	RF-J-80	747.65	43.20	2.00	HDPE Pressure Pipe	0.16	2.61	25.54	0.76	757.85	757.09
RF-P-3	RF-J-61	754.20	RF-MH-29	754.90	297.60	4.00	HDPE Pressure Pipe	0.00	0.65	25.50	0.18	755.41	755.23
RF-P-31	100 WHD	783.95	RW-PMP-12	784.95	21.30	1.50	HDPE Pressure Pipe	-0.05	2.57	14.16	0.51	785.95	785.44
RF-P-32	RW-PMP-12	784.95	RF-J-121	790.45	55.80	1.50	HDPE Pressure Pipe	-0.10	2.57	14.16	1.33	794.35	793.02
RF-P-59	501 WLD	739.96	RW-PMP-26	740.96	12.10	1.50	HDPE Pressure Pipe	-0.08	2.51	13.80	0.28	741.96	741.68
RF-P-60	RW-PMP-26	740.96	RF-J-25	754.21	163.90	1.50	HDPE Pressure Pipe	-0.08	2.51	13.80	3.74	763.77	760.03
RF-P-70	RW-PMP-31	686.76	RF-J-20	693.25	347.60	1.50	HDPE Pressure Pipe	-0.02	2.13	11.74	5.88	768.45	762.57
RF-P-78	4010 BCR	769.75	RW-PMP-96	772.00	63.30	1.50	HDPE Pressure Pipe	-0.04	2.60	14.30	1.54	775.62	774.08
RF-P-85	4701 BCR	773.24	RW-PMP-102	773.24	18.30	1.50	HDPE Pressure Pipe	0.00	2.35	12.92	0.37	775.24	774.87
RF-P-86	RW-PMP-102	773.24	RF-J-38	798.00	228.50	1.50	HDPE Pressure Pipe	-0.11	2.35	12.92	4.61	825.53	820.92
RF-P-87	4615 BCR	762.80	RW-PMP-101	774.00	16.70	1.50	HDPE Pressure Pipe	-0.67	7.86	43.27	3.17	780.83	777.66
RF-P-88	RW-PMP-101	774.00	RF-J-40	791.80	191.50	1.50	HDPE Pressure Pipe	-0.09	7.86	43.27	36.25	856.92	820.67
RF-P-89	4407 BCR	744.00	RW-PMP-100	748.00	13.50	1.50	HDPE Pressure Pipe	-0.30	2.95	16.26	0.42	750.35	749.93
RF-P-90	RW-PMP-100	748.00	RF-J-44	785.00	534.60	1.50	HDPE Pressure Pipe	-0.07	2.95	16.26	16.51	827.26	810.76
RF-P-92	RF-J-11	752.70	RF-J-86	753.79	246.50	4.00	HDPE Pressure Pipe	0.00	0.65	25.50	0.15	755.61	755.47
RF-P-93	RF-J-86	753.79	RF-J-61	754.20	93.30	4.00	HDPE Pressure Pipe	0.00	0.65	25.50	0.06	755.47	755.41
RF-P-126	7 LBD	705.00	RW-PMP-53	708.00	56.90	1.50	HDPE Pressure Pipe	-0.05	2.31	12.70	1.11	709.73	708.62
RF-P-127	RW-PMP-53	708.00	RF-J-13	711.13	76.00	1.50	HDPE Pressure Pipe	-0.04	2.31	12.70	1.49	765.56	764.07
RF-P-136	102 MC	810.51	RW-PMP-58	811.00	15.50	1.50	HDPE Pressure Pipe	-0.03	2.50	13.77	0.35	812.51	812.16
RF-P-137	RW-PMP-58	811.00	RF-J-108	815.46	81.70	1.50	HDPE Pressure Pipe	-0.06	2.50	13.77	1.86	835.40	833.54
RF-P-165	101 BRT	702.75	RW-PMP-70	707.00	31.00	1.50	HDPE Pressure Pipe	-0.14	2.32	12.79	0.61	708.62	708.01
RF-P-166	RW-PMP-70	707.00	RF-J-19	706.70	58.30	1.50	HDPE Pressure Pipe	0.01	2.32	12.79	1.16	762.45	761.29
RF-P-175	RW-PMP-96	772.00	RF-J-53	759.85	71.00	1.50	HDPE Pressure Pipe	0.17	2.60	14.30	1.73	777.25	775.52
RF-P-178	4609 BCR	758.78	RW-PMP-72	758.00	104.10	1.50	HDPE Pressure Pipe	0.01	2.27	12.49	1.97	760.78	758.81
RF-P-179	RW-PMP-72	758.00	RF-J-41	794.10	237.60	1.50	HDPE Pressure Pipe	-0.15	2.27	12.49	4.51	821.51	817.00
RF-P-202	RF-J-5	803.80	RF-J-6	813.00	50.60	2.00	HDPE Pressure Pipe	-0.18	0.00	0.00	0.00	833.54	833.54
RF-P-203	RF-J-20	693.25	RF-J-21	711.00	121.70	2.00	HDPE Pressure Pipe	-0.15	1.20	11.74	0.51	762.57	762.07
RF-P-204	RF-J-21	711.00	RF-J-22	722.45	131.20	2.00	HDPE Pressure Pipe	-0.09	1.20	11.74	0.55	762.07	761.52
RF-P-205	RF-J-23	737.50	RF-J-24	745.00	216.80	2.00	HDPE Pressure Pipe	-0.04	1.20	11.74	0.90	761.20	760.30
RF-P-206	RF-J-24	745.00	RF-J-25	754.21	63.80	2.00	HDPE Pressure Pipe	-0.14	1.20	11.74	0.27	760.30	760.03
RF-P-207	RF-J-27	741.70	RF-J-28	737.45	103.30	2.00	HDPE Pressure Pipe	0.04	2.61	25.54	1.81	754.79	752.97
RF-P-208	RF-J-28	737.45	RF-J-29	738.20	190.60	2.00	HDPE Pressure Pipe	0.00	2.61	25.54	3.35	752.97	749.63
RF-P-215	RF-J-66	741.35	RF-J-15	746.05	63.90	2.00	HDPE Pressure Pipe	-0.07	1.31	12.79	0.31	756.45	756.14
RF-P-216	RF-J-67	739.40	RF-J-66	741.35	103.50	2.00	HDPE Pressure Pipe	-0.02	1.31	12.79	0.50	756.96	756.45
RF-P-217	RF-J-68	737.00	RF-J-67	739.40	133.60	2.00	HDPE Pressure Pipe	-0.02	1.31	12.79	0.65	757.61	756.96
RF-P-220	RF-J-71	722.30	RF-J-70	728.55	66.60	2.00	HDPE Pressure Pipe	-0.09	1.31	12.79	0.32	760.47	760.14

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS

TABLE 3- PRESSURE SYSTEM, FLOW DATA (CONTINUED)

 Below from min. limit
 Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-P-221	RF-J-72	716.50	RF-J-71	722.30	112.00	2.00	HDPE Pressure Pipe	-0.05	1.31	12.79	0.55	761.01	760.47
RF-P-222	RF-J-19	706.70	RF-J-72	716.50	57.60	2.00	HDPE Pressure Pipe	-0.17	1.31	12.79	0.28	761.29	761.01
RF-P-226	RF-J-76	751.21	RF-J-62	754.05	121.10	2.00	HDPE Pressure Pipe	-0.02	1.30	12.70	0.58	756.23	755.65
RF-P-227	RF-J-25	754.21	RF-J-26	756.39	114.40	2.00	HDPE Pressure Pipe	-0.02	2.61	25.54	2.01	760.03	758.02
RF-P-228	RF-J-29	738.20	RF-J-79	739.00	293.60	2.00	HDPE Pressure Pipe	0.00	2.61	25.54	5.16	749.63	744.47
RF-P-229	RF-J-79	739.00	RF-MH-13	743.00	74.30	2.00	HDPE Pressure Pipe	-0.05	2.61	25.54	1.30	744.47	743.17
RF-P-230	RF-J-80	747.65	RF-J-27	741.70	130.90	2.00	HDPE Pressure Pipe	0.05	2.61	25.54	2.30	757.09	754.79
RF-P-231	RF-J-117	791.00	RF-MH-23	791.10	80.70	2.00	HDPE Pressure Pipe	0.00	1.45	14.16	0.47	791.74	791.27
RF-P-232	RF-J-8	781.00	RF-J-121	790.45	21.00	2.00	HDPE Pressure Pipe	-0.45	0.00	0.00	0.00	793.02	793.02
RF-P-233	RF-J-121	790.45	RF-J-120	790.80	78.00	2.00	HDPE Pressure Pipe	0.00	1.45	14.16	0.46	793.02	792.56
RF-P-234	RF-J-120	790.80	RF-J-119	790.89	7.60	2.00	HDPE Pressure Pipe	-0.01	1.45	14.16	0.04	792.56	792.51
RF-P-235	RF-J-119	790.89	RF-J-118	790.95	8.10	2.00	HDPE Pressure Pipe	-0.01	1.45	14.16	0.05	792.51	792.46
RF-P-236	RF-J-118	790.95	RF-J-117	791.00	122.80	2.00	HDPE Pressure Pipe	0.00	1.45	14.16	0.72	792.46	791.74
RF-P-237	RF-J-22	722.45	RF-J-87	726.40	56.80	2.00	HDPE Pressure Pipe	-0.07	1.20	11.74	0.24	761.52	761.28
RF-P-238	RF-J-87	726.40	RF-J-23	737.50	20.80	2.00	HDPE Pressure Pipe	-0.54	1.20	11.74	0.09	761.28	761.20
RF-P-252	RF-J-101	747.16	RF-J-77	748.47	198.50	2.00	HDPE Pressure Pipe	-0.01	1.30	12.70	0.96	758.13	757.18
RF-P-253	RF-J-12	743.70	RF-J-102	744.94	187.60	2.00	HDPE Pressure Pipe	-0.01	1.30	12.70	0.90	760.67	759.76
RF-P-254	RF-J-102	744.94	RF-J-101	747.16	337.90	2.00	HDPE Pressure Pipe	-0.01	1.30	12.70	1.63	759.76	758.13
RF-P-255	RF-J-78	729.40	RF-J-103	733.31	58.90	2.00	HDPE Pressure Pipe	-0.07	1.30	12.70	0.28	761.70	761.42
RF-P-256	RF-J-103	733.31	RF-J-12	743.70	156.30	2.00	HDPE Pressure Pipe	-0.07	1.30	12.70	0.75	761.42	760.67
RF-P-257	RF-J-104	727.65	RF-J-78	729.40	47.00	2.00	HDPE Pressure Pipe	-0.04	1.30	12.70	0.23	761.93	761.70
RF-P-258	RF-J-105	723.58	RF-J-104	727.65	109.70	2.00	HDPE Pressure Pipe	-0.04	1.30	12.70	0.53	762.46	761.93
RF-P-259	RF-J-13	711.13	RF-J-106	716.77	151.70	2.00	HDPE Pressure Pipe	-0.04	1.30	12.70	0.73	764.07	763.34
RF-P-260	RF-J-106	716.77	RF-J-105	723.58	183.30	2.00	HDPE Pressure Pipe	-0.04	1.30	12.70	0.88	763.34	762.46
RF-P-261	RF-J-7	824.80	RF-J-107	826.23	43.00	2.00	HDPE Pressure Pipe	-0.03	1.41	13.77	0.24	832.97	832.73
RF-P-262	RF-J-6	813.00	RF-J-108	815.46	27.00	2.00	HDPE Pressure Pipe	-0.09	0.00	0.00	0.00	833.54	833.54
RF-P-263	RF-J-108	815.46	RF-J-109	821.69	68.10	2.00	HDPE Pressure Pipe	-0.09	1.41	13.77	0.38	833.54	833.16
RF-P-264	RF-J-109	821.69	RF-J-7	824.80	34.10	2.00	HDPE Pressure Pipe	-0.09	1.41	13.77	0.19	833.16	832.97
RF-P-265	RF-J-107	826.23	RF-J-110	829.10	86.50	2.00	HDPE Pressure Pipe	-0.03	1.41	13.77	0.48	832.73	832.25
RF-P-266	RF-J-110	829.10	RF-J-111	831.04	58.40	2.00	HDPE Pressure Pipe	-0.03	1.41	13.77	0.33	832.25	831.92
RF-P-267	RF-J-111	831.04	RF-MH-18	831.65	18.30	2.00	HDPE Pressure Pipe	-0.03	1.41	13.77	0.10	831.92	831.82
RF-P-270	RF-J-70	728.55	RF-J-114	732.25	167.50	2.00	HDPE Pressure Pipe	-0.02	1.31	12.79	0.82	760.14	759.32
RF-P-271	RF-J-114	732.25	RF-J-17	734.00	79.00	2.00	HDPE Pressure Pipe	-0.02	1.31	12.79	0.39	759.32	758.94
RF-P-272	RF-J-17	734.00	RF-J-115	735.08	97.70	2.00	HDPE Pressure Pipe	-0.01	1.31	12.79	0.48	758.94	758.46
RF-P-273	RF-J-115	735.08	RF-J-68	737.00	174.10	2.00	HDPE Pressure Pipe	-0.01	1.31	12.79	0.85	758.46	757.61
RF-P-274	RF-J-77	748.47	RF-J-122	749.56	77.90	2.00	HDPE Pressure Pipe	-0.01	1.30	12.70	0.38	757.18	756.80
RF-P-275	RF-J-122	749.56	RF-J-76	751.21	118.40	2.00	HDPE Pressure Pipe	-0.01	1.30	12.70	0.57	756.80	756.23
RF-P-278	RF-J-4	751.35	RF-J-3	756.75	34.20	2.00	HDPE Pressure Pipe	-0.16	10.14	99.24	7.42	775.11	767.69
RF-P-279	RF-J-10	757.45	RF-MH-10	755.30	99.70	3.00	HDPE Pressure Pipe	0.02	4.50	99.24	3.00	758.55	755.55
RF-P-280	RF-J-14	754.05	RF-J-11	752.70	151.60	3.00	HDPE Pressure Pipe	0.01	0.58	12.79	0.10	755.72	755.61
RF-P-283	RF-J-38	798.00	RF-J-39	794.90	193.50	3.00	HDPE Pressure Pipe	0.02	0.59	12.92	0.13	820.92	820.79
RF-P-284	RF-J-39	794.90	RF-J-40	791.80	165.30	3.00	HDPE Pressure Pipe	0.02	0.59	12.92	0.11	820.79	820.67
RF-P-285	RF-J-40	791.80	RF-J-41	794.10	349.90	3.00	HDPE Pressure Pipe	-0.01	2.55	56.19	3.67	820.67	817.00

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS

TABLE 3- PRESSURE SYSTEM, FLOW DATA (CONTINUED)

	Below from min. limit
	Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-P-286	RF-J-41	794.10	RF-J-42	802.25	55.80	3.00	HDPE Pressure Pipe	-0.15	3.12	68.69	0.85	817.00	816.15
RF-P-287	RF-J-42	802.25	RF-J-43	804.25	144.00	3.00	HDPE Pressure Pipe	-0.01	3.12	68.69	2.19	816.15	813.96
RF-P-288	RF-J-43	804.25	RF-J-44	785.00	210.50	3.00	HDPE Pressure Pipe	0.09	3.12	68.69	3.20	813.96	810.76
RF-P-289	RF-J-45	794.00	RF-J-46	798.50	95.80	3.00	HDPE Pressure Pipe	-0.05	3.86	84.94	2.16	805.94	803.78
RF-P-290	RF-J-46	798.50	RF-J-47	789.85	264.90	3.00	HDPE Pressure Pipe	0.03	3.86	84.94	5.98	803.78	797.80
RF-P-291	RF-J-47	789.85	RF-J-48	787.90	155.00	3.00	HDPE Pressure Pipe	0.01	3.86	84.94	3.50	797.80	794.30
RF-P-292	RF-J-48	787.90	RF-J-49	784.35	128.60	3.00	HDPE Pressure Pipe	0.03	3.86	84.94	2.90	794.30	791.40
RF-P-293	RF-J-49	784.35	RF-J-50	776.50	365.80	3.00	HDPE Pressure Pipe	0.02	3.86	84.94	8.25	791.40	783.15
RF-P-294	RF-J-50	776.50	RF-J-51	770.65	200.70	3.00	HDPE Pressure Pipe	0.03	3.86	84.94	4.53	783.15	778.62
RF-P-298	RF-J-51	770.65	RF-J-60	769.45	101.10	3.00	HDPE Pressure Pipe	0.01	3.86	84.94	2.28	778.62	776.34
RF-P-300	RF-J-63	751.65	RF-J-14	754.05	201.70	3.00	HDPE Pressure Pipe	-0.01	0.58	12.79	0.14	755.85	755.72
RF-P-301	RF-J-64	750.00	RF-J-63	751.65	195.50	3.00	HDPE Pressure Pipe	-0.01	0.58	12.79	0.13	755.99	755.85
RF-P-302	RF-J-65	749.90	RF-J-64	750.00	97.50	3.00	HDPE Pressure Pipe	0.00	0.58	12.79	0.07	756.05	755.99
RF-P-303	RF-J-15	746.05	RF-J-65	749.90	133.50	3.00	HDPE Pressure Pipe	-0.03	0.58	12.79	0.09	756.14	756.05
RF-P-304	RF-J-62	754.05	RF-J-11	752.70	50.40	3.00	HDPE Pressure Pipe	0.03	0.58	12.70	0.03	755.65	755.61
RF-P-305	RF-J-9	759.80	RF-J-10	757.45	253.50	3.00	HDPE Pressure Pipe	0.01	4.50	99.24	7.63	766.18	758.55
RF-P-306	RF-J-44	785.00	RF-J-81	782.00	64.10	3.00	HDPE Pressure Pipe	0.05	3.86	84.94	1.45	810.76	809.31
RF-P-307	RF-J-81	782.00	RF-J-82	785.00	55.60	3.00	HDPE Pressure Pipe	-0.05	3.86	84.94	1.26	809.31	808.05
RF-P-308	RF-J-82	785.00	RF-J-45	794.00	93.90	3.00	HDPE Pressure Pipe	-0.10	3.86	84.94	2.12	808.05	805.94
RF-P-311	RF-J-52	765.55	RF-J-53	759.85	126.00	4.00	HDPE Pressure Pipe	0.05	2.17	84.94	0.70	776.22	775.52
RF-P-312	RF-J-3	756.75	RF-J-55	759.55	146.40	4.00	HDPE Pressure Pipe	-0.02	2.53	99.24	1.08	767.69	766.61
RF-P-313	RF-J-55	759.55	RF-J-9	759.80	58.30	4.00	HDPE Pressure Pipe	0.00	2.53	99.24	0.43	766.61	766.18
RF-P-314	RF-J-60	769.45	RF-J-52	765.55	21.10	4.00	HDPE Pressure Pipe	0.19	2.17	84.94	0.12	776.34	776.22
RF-P-318	RF-J-53	759.85	RF-J-54	756.65	153.60	6.00	HDPE Pressure Pipe	0.02	1.13	99.24	0.16	775.52	775.37
RF-P-322	RF-J-54	756.65	RF-J-112	754.58	96.60	6.00	HDPE Pressure Pipe	0.02	1.13	99.24	0.10	775.37	775.27
RF-P-323	RF-J-112	754.58	RF-J-4	751.35	150.50	6.00	HDPE Pressure Pipe	0.02	1.13	99.24	0.15	775.27	775.11
RF-P-400	Rocky River Lift Station	710.00	RW-PMP-103	710.00	23.80	4.00	HDPE Pressure Pipe	0.00	8.09	316.78	1.51	724.00	722.49
RF-P-401	RW-PMP-103	710.00	RF-J-225	725.00	27.30	4.00	HDPE Pressure Pipe	-0.55	8.09	316.78	1.51	755.13	753.62
RF-P-402	RF-J-225	725.00	RF-J-226	729.00	146.20	4.00	HDPE Pressure Pipe	-0.03	8.09	316.78	8.10	753.62	745.51
RF-P-403	RF-J-226	729.00	RF-J-206	730.00	273.90	4.00	HDPE Pressure Pipe	0.00	8.09	316.78	15.18	745.51	730.33
RF-P-404	RF-J-227	601.70	RF-J-228	632.80	314.00	3.00	HDPE Pressure Pipe	-0.10	0.55	12.16	0.19	676.32	676.12
RF-P-405	RF-J-228	632.80	RF-J-229	641.56	72.30	3.00	HDPE Pressure Pipe	-0.12	0.55	12.16	0.04	676.12	676.08
RF-P-406	RF-J-229	641.56	RF-J-230	657.75	132.80	3.00	HDPE Pressure Pipe	-0.12	0.55	12.16	0.08	676.08	676.00
RF-P-407	RF-J-230	657.75	RF-J-232	673.00	129.20	3.00	HDPE Pressure Pipe	-0.12	0.55	12.16	0.08	676.00	675.92
RF-P-408	RF-J-236	640.15	RF-J-231	655.35	181.80	3.00	HDPE Pressure Pipe	-0.08	1.19	26.16	0.46	675.60	675.14
RF-P-409	RF-J-231	655.35	RF-J-216	674.50	151.30	3.00	HDPE Pressure Pipe	-0.13	1.19	26.16	0.39	675.14	674.75
RF-P-410	RF-J-232	673.00	RF-J-233	667.58	177.80	3.00	HDPE Pressure Pipe	0.03	0.55	12.16	0.11	675.92	675.81
RF-P-411	RF-J-233	667.58	RF-J-234	660.42	68.50	3.00	HDPE Pressure Pipe	0.11	0.55	12.16	0.04	675.81	675.77
RF-P-412	RF-J-234	660.42	RF-J-235	652.00	82.20	3.00	HDPE Pressure Pipe	0.10	0.55	12.16	0.04	675.77	675.73
RF-P-413	702 WBD	605.05	RW-PMP-1	606.05	47.30	1.50	HDPE Pressure Pipe	-0.02	2.21	12.16	0.85	607.05	606.20
RF-P-414	RW-PMP-1	606.05	RF-J-227	601.70	66.30	1.50	HDPE Pressure Pipe	0.07	2.21	12.16	1.20	677.51	676.32
RF-P-415	804 CPD	661.13	RW-PMP-2	662.59	37.30	1.50	HDPE Pressure Pipe	-0.04	2.54	14.01	0.87	664.13	663.26
RF-P-416	RF-J-235	652.00	RF-J-237	643.00	87.80	3.00	HDPE Pressure Pipe	0.10	0.55	12.16	0.05	675.73	675.67
RF-P-417	RF-J-237	643.00	RF-J-236	640.15	28.90	3.00	HDPE Pressure Pipe	0.10	1.19	26.16	0.07	675.67	675.60
RF-P-418	RW-PMP-2	662.59	RF-J-237	643.00	89.40	1.50	HDPE Pressure Pipe	0.22	2.54	14.01	2.10	677.77	675.67

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS
TABLE 4 – PRESSURE JUNCTION, FLOW DATA

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
RF-J-3	761.95	756.75	767.69	5.00
RF-J-4	755.95	751.35	775.11	10.00
RF-J-5	806.75	803.80	833.54	13.00
RF-J-6	816.00	813.00	833.54	9.00
RF-J-7	827.80	824.80	832.97	4.00
RF-J-8	784.05	781.00	793.02	5.00
RF-J-9	764.00	759.80	766.18	3.00
RF-J-10	763.00	757.45	758.55	0.00
RF-J-11	756.60	752.70	755.61	1.00
RF-J-12	748.00	743.70	760.67	7.00
RF-J-13	715.50	711.13	764.07	23.00
RF-J-14	758.00	754.05	755.72	1.00
RF-J-15	751.90	746.05	756.14	4.00
RF-J-17	738.70	734.00	758.94	11.00
RF-J-19	712.30	706.70	761.29	24.00
RF-J-20	696.45	693.25	762.57	30.00
RF-J-21	714.00	711.00	762.07	22.00
RF-J-22	725.65	722.45	761.52	17.00
RF-J-23	742.00	737.50	761.20	10.00
RF-J-24	748.20	745.00	760.30	7.00
RF-J-25	757.00	754.21	760.03	3.00
RF-J-26	759.70	756.39	758.02	1.00
RF-J-27	743.90	741.70	754.79	6.00
RF-J-28	743.55	737.45	752.97	7.00
RF-J-29	744.30	738.20	749.63	5.00
RF-J-38	802.40	798.00	820.92	10.00
RF-J-39	800.00	794.90	820.79	11.00
RF-J-40	796.35	791.80	820.67	12.00
RF-J-41	800.70	794.10	817.00	10.00
RF-J-42	807.35	802.25	816.15	6.00
RF-J-43	809.50	804.25	813.96	4.00
RF-J-44	797.00	785.00	810.76	11.00
RF-J-45	802.00	794.00	805.94	5.00

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
RF-J-46	803.05	798.50	803.78	2.00
RF-J-47	795.45	789.85	797.80	3.00
RF-J-48	792.75	787.90	794.30	3.00
RF-J-49	789.15	784.35	791.40	3.00
RF-J-50	781.00	776.50	783.15	3.00
RF-J-51	776.10	770.65	778.62	3.00
RF-J-52	770.90	765.55	776.22	5.00
RF-J-53	765.35	759.85	775.52	7.00
RF-J-54	761.20	756.65	775.37	8.00
RF-J-55	765.00	759.55	766.61	3.00
RF-J-60	773.00	769.45	776.34	3.00
RF-J-61	757.65	754.20	755.41	1.00
RF-J-62	756.50	754.05	755.65	1.00
RF-J-63	755.90	751.65	755.85	2.00
RF-J-64	756.00	750.00	755.99	3.00
RF-J-65	754.45	749.90	756.05	3.00
RF-J-66	745.50	741.35	756.45	7.00
RF-J-67	744.85	739.40	756.96	8.00
RF-J-68	741.65	737.00	757.61	9.00
RF-J-70	732.65	728.55	760.14	14.00
RF-J-71	726.75	722.30	760.47	17.00
RF-J-72	721.00	716.50	761.01	19.00
RF-J-76	755.00	751.21	756.23	2.00
RF-J-77	753.10	748.47	757.18	4.00
RF-J-78	733.90	729.40	761.70	14.00
RF-J-79	745.20	739.00	744.47	2.00
RF-J-80	750.65	747.65	757.09	4.00
RF-J-81	786.85	782.00	809.31	12.00
RF-J-82	786.85	785.00	808.05	10.00
RF-J-86	757.36	753.79	755.47	1.00
RF-J-87	729.75	726.40	761.28	15.00
RF-J-101	751.70	747.16	758.13	5.00
RF-J-102	749.32	744.94	759.76	6.00

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
RF-J-103	737.76	733.31	761.42	12.00
RF-J-104	732.14	727.65	761.93	15.00
RF-J-105	728.03	723.58	762.46	17.00
RF-J-106	721.18	716.77	763.34	20.00
RF-J-107	829.43	826.23	832.73	3.00
RF-J-108	818.46	815.46	833.54	8.00
RF-J-109	824.69	821.69	833.16	5.00
RF-J-110	832.70	829.10	832.25	1.00
RF-J-111	834.91	831.04	831.92	0.00
RF-J-112	759.15	754.58	775.27	9.00
RF-J-114	736.76	732.25	759.32	12.00
RF-J-115	739.76	735.08	758.46	10.00
RF-J-117	793.75	791.00	791.74	0.00
RF-J-118	793.25	790.95	792.46	1.00
RF-J-119	793.95	790.89	792.51	1.00
RF-J-120	793.68	790.80	792.56	1.00
RF-J-121	793.60	790.45	793.02	1.00
RF-J-122	753.85	749.56	756.80	3.00
RF-J-225	727.00	725.00	753.62	12.00
RF-J-226	735.22	729.00	745.51	7.00
RF-J-227	607.35	601.70	676.32	32.00
RF-J-228	637.30	632.80	676.12	19.00
RF-J-229	646.10	641.56	676.08	15.00
RF-J-230	662.34	657.75	676.00	8.00
RF-J-231	659.40	655.35	675.14	9.00
RF-J-232	678.20	673.00	675.92	1.00
RF-J-233	676.00	667.58	675.81	4.00
RF-J-234	672.00	660.42	675.77	7.00
RF-J-235	656.00	652.00	675.73	10.00
RF-J-236	644.45	640.15	675.60	15.00
RF-J-237	647.31	643.00	675.67	14.00

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS
TABLE 5 – COLLECTION SYSTEM HYDRAULIC GRADE LINE (MANHOLE)

Input Data									Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Base Load (Local Sanitary) (gpm)	Population (Local Sanitary) (Capita)	Depth (Out) (ft)	Depth (In) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-J-201	693.65	688.30	419.17	420.16	0.99	1.00	0.47	0.47	1.80	688.77	688.77
RF-J-202	704.00	698.93	379.92	383.00	3.08	2.00	0.45	0.45	1.80	699.38	699.38
RF-J-203	719.15	711.94	374.37	382.84	8.47	5.00	0.45	0.45	1.80	712.39	712.39
RF-J-204	723.70	717.42	357.19	371.89	14.70	8.00	2.41	2.41	9.40	719.83	719.83
RF-J-205	725.55	720.26	328.52	360.83	32.31	11.00	6.27	6.27	24.60	726.53	726.53
RF-J-206	734.70	730.00	316.78	327.78	11.00	1.00	14.13	14.13	138.30	744.13	744.13
RF-J-207	729.75	724.40	333.28	349.78	16.50	2.00	6.34	6.34	24.80	730.74	730.74
RF-J-208	694.55	687.01	381.13	382.56	1.43	1.00	8.89	8.89	34.80	695.90	695.90
RF-J-209	685.35	680.95	378.51	382.53	4.03	3.00	13.23	13.23	51.80	694.18	694.18
RF-J-210	624.35	618.07	420.16	420.16	0.00	0.00	4.98	4.98	19.50	623.05	623.05
RF-J-211	679.70	674.90	420.16	420.16	0.00	0.00	0.47	0.47	1.80	675.37	675.37
RF-J-212	618.65	611.61	420.16	420.16	0.00	0.00	17.20	17.20	67.40	628.81	628.81
RF-J-213	723.60	718.69	354.23	371.71	17.48	7.00	2.58	2.58	10.10	721.27	721.27
RF-J-214	723.76	717.53	371.71	371.71	0.00	0.00	3.07	3.07	12.00	720.60	720.60
RF-J-215	719.40	715.80	374.86	382.60	7.74	4.00	0.45	0.45	1.80	716.25	716.25
RF-J-216	679.80	674.50	393.07	419.67	26.60	26.00	17.77	17.77	69.60	692.27	692.27
RF-J-217	624.00	619.20	420.16	420.16	0.00	0.00	10.69	10.69	41.90	629.89	629.89
RF-J-218	712.83	706.51	381.02	382.62	1.61	1.00	0.45	0.45	1.80	706.96	706.96
RF-J-219	731.81	726.73	327.78	338.78	11.00	1.00	5.29	5.29	20.70	732.02	732.02
RF-J-220	715.76	709.03	381.13	382.78	1.65	1.00	0.45	0.45	1.80	709.48	709.48
RF-J-221	700.90	695.02	379.69	382.61	2.93	2.00	2.96	2.96	11.60	697.98	697.98
RF-J-222	684.68	679.36	418.02	420.02	2.00	2.00	11.67	11.67	45.70	691.03	691.03
RF-MH-1	757.75	747.00	83.84	83.84	3.40	0.00	0.43	0.43	7.60	747.43	747.43
RF-MH-2	753.00	744.50	88.60	88.60	8.16	0.00	0.58	0.58	10.30	745.08	745.08
RF-MH-3	756.00	742.83	91.32	91.32	10.88	0.00	0.51	0.51	8.90	743.34	743.34
RF-MH-4	748.00	733.44	94.72	94.72	14.28	0.00	0.71	0.71	12.50	734.15	734.15
RF-MH-5	736.60	728.50	89.38	94.89	19.79	3.00	0.71	0.71	12.50	729.21	729.21
RF-MH-6	730.15	722.40	316.64	316.64	50.32	0.00	1.74	1.74	30.70	724.14	724.14
RF-MH-7	733.50	723.50	94.89	94.89	14.28	0.00	0.71	0.71	12.50	724.21	724.21
RF-MH-8	735.10	727.48	94.89	94.89	14.28	0.00	0.71	0.71	12.50	728.19	728.19
RF-MH-9	736.45	731.21	265.98	265.98	36.04	0.00	0.86	0.86	15.20	732.07	732.07
RF-MH-10	760.65	754.50	99.24	143.29	44.04	13.00	1.06	1.06	18.70	755.56	755.56
RF-MH-11	757.95	748.20	150.09	150.09	6.80	0.00	0.77	0.77	13.50	748.97	748.97
RF-MH-12	750.30	743.55	226.20	227.63	36.11	1.00	0.68	0.68	12.00	744.23	744.23
RF-MH-13	746.25	740.00	248.97	265.98	53.06	13.00	0.86	0.86	15.20	740.86	740.86
RF-MH-14	844.25	838.50	24.05	24.05	2.04	0.00	0.50	0.50	8.90	839.00	839.00
RF-MH-15	835.10	829.60	19.90	36.40	19.90	3.00	0.43	0.43	7.60	830.03	830.03

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS

TABLE 5 – COLLECTION SYSTEM HYDRAULIC GRADE LINE (MANHOLE) (CONTINUED)

Input Data									Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Base Load (Local Sanitary) (gpm)	Population (Local Sanitary) (Capita)	Depth (Out) (ft)	Depth (In) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-MH-16	839.95	827.60	51.30	65.98	22.84	5.00	0.38	0.38	6.60	827.98	827.98
RF-MH-17	842.00	830.10	48.81	48.81	2.04	0.00	1.05	1.05	18.50	831.15	831.15
RF-MH-18	835.60	831.15	14.45	47.45	33.68	4.00	0.88	0.88	15.60	832.03	832.03
RF-MH-19	815.00	809.00	66.66	66.66	8.84	0.00	0.58	0.58	10.20	809.58	809.58
RF-MH-20	796.85	783.00	104.84	115.18	31.42	5.00	0.58	0.58	10.30	783.58	783.58
RF-MH-21	791.15	784.00	2.04	24.05	24.05	3.00	0.46	0.46	8.20	784.46	784.46
RF-MH-22	811.00	804.65	0.00	0.00	0.00	0.00	0.35	0.35	6.20	805.00	805.00
RF-MH-23	795.70	790.75	15.52	48.52	34.36	5.00	0.50	0.50	2.00	791.25	791.25
RF-MH-24	797.15	789.00	34.51	49.16	16.69	4.00	0.50	0.50	2.00	789.50	789.50
RF-MH-25	768.55	761.70	117.90	117.90	23.80	0.00	0.54	0.54	9.50	762.24	762.24
RF-MH-26	886.45	882.10	1.36	23.37	23.37	3.00	0.35	0.35	6.20	882.45	882.45
RF-MH-27	847.90	842.95	23.37	23.37	1.36	0.00	0.65	0.65	11.50	843.60	843.60
RF-MH-28	865.00	861.35	23.37	23.37	1.36	0.00	0.75	0.75	13.30	862.10	862.10
RF-MH-29	758.20	754.90	25.50	80.44	54.95	27.00	0.70	0.70	12.30	755.60	755.60
RF-MH-30	760.00	756.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	756.75	756.75
RF-MH-31	903.50	899.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	899.50	899.50

*RF-J-201 TO RF-J-222 pressure network is modeled as gravity based on topographic profile

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS**TABLE 6 - PROPERTY CONNECTION DATA**

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (gpm)
111 WD	755.82	751.82	0.68
401 WD	745.52	741.52	0.68
309 WD	748.55	744.55	0.68
307 WD	750.30	746.30	0.68
305 WD	754.65	750.65	0.68
303 WD	755.00	751.00	0.68
211 WD	755.10	751.10	0.68
209 WD	755.62	751.62	0.68
205 WD	756.67	752.67	0.68
202 RR	754.10	750.10	0.68
200 RR	755.00	751.00	0.68
118 RR	755.00	751.00	0.68
209 RR	754.71	750.71	0.68
116 RR	755.00	751.00	0.68
114 RR	755.00	751.00	0.68
112 RR	754.08	750.08	0.68
211 RR	751.77	747.77	0.68
215 RR	746.19	742.19	0.68
217 RR	744.46	740.46	0.68
303 RR	739.93	734.93	0.68
207 RR	755.00	751.00	0.68
201 RR	752.63	748.63	0.68
107 RR	753.02	749.02	0.68
105 RR	758.41	754.41	0.68
100 WSD	750.04	746.04	0.68
102 WSD	753.98	749.98	0.68
200 WSD	765.55	761.55	0.68
202 WSD	769.75	765.75	0.68
204 WSD	776.30	772.30	0.68
301 WSD	785.78	781.78	0.68
207 WSD	786.76	782.76	0.68
213 WSD	794.78	790.78	0.68
203 WSD	776.75	772.75	0.68
201 WSD	771.98	767.98	0.68
109 WSD	766.38	762.38	0.68
107 WSD	765.00	761.00	0.68
103 WSD	757.93	753.93	0.68

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (gpm)
204 WHD	818.54	814.54	0.68
208 WHD	810.78	806.78	0.68
300 MCD	804.90	800.90	0.68
308 WHD	805.92	801.92	0.68
310 WHD	817.32	813.32	0.68
302 WHD	801.63	797.83	0.68
304 WHD	795.28	791.28	0.68
200 MC	843.10	839.10	0.68
202 MC	847.21	843.21	0.68
204 MC	851.12	847.12	0.68
206 MC	857.46	853.46	0.68
208 MC	857.13	853.13	0.68
300 MC	855.47	851.47	0.68
302 MC	851.67	847.67	0.68
304 MC	854.86	800.86	0.68
306 MC	857.41	853.41	0.68
108 WHD	807.72	803.72	0.68
106 WHD	809.17	805.17	0.68
525 MC	883.14	879.14	0.68
355 MC	867.12	863.12	0.68
200 WHD	810.68	806.68	0.68
212 WHD	811.17	807.17	0.68
105 WSD	761.74	757.74	0.68
302 WD	760.54	756.54	0.68
210 WD	763.74	759.74	0.68
314 RR	745.00	741.00	0.68
312 RR	744.84	740.84	0.68
310 RR	745.51	741.51	0.68
308 RR	746.94	742.94	0.68
208 RR	748.13	744.13	0.68
301 MC	827.55	823.55	0.68
200 WD	783.30	781.30	0.68
306 WHD	801.72	799.72	0.68
108 WSD	761.79	759.79	0.68
104 WSD	756.34	754.34	0.68
113 WD	755.78	753.78	0.68

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FOREST VIEW (F-24-2) DRIVE AREA MODEL RESULTS

TABLE 7 – TRANSITION RESULTS

Input Data					Output Data				
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Transition Length (ft)	Depth (Out) (ft)	Velocity (In) (ft/s)	Flow (Total Out) (gpm)	Velocity (Out) (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RF-T-1	760.00	754.50	5.00	0.76	2.51	144.65	2.51	755.26	755.26
RF-T-2	804.25	797.00	5.00	1.02	0.00	0.68	0.62	798.02	798.02
RF-T-3	798.00	786.00	5.00	1.15	1.82	51.20	1.87	787.15	787.15
RF-T-4	791.95	783.53	5.00	0.58	1.46	25.41	1.54	784.11	784.11
RF-T-5	792.85	785.00	5.00	1.03	0.27	2.04	0.80	786.03	786.03
RF-T-6	798.00	786.00	5.00	1.50	3.04	49.84	1.85	787.50	787.50
RF-T-7	797.75	788.35	5.00	0.80	0.35	49.84	1.85	789.15	789.15
RF-T-8	797.50	788.35	5.00	0.83	0.34	49.16	1.49	789.18	789.18
RF-T-9	796.00	790.00	5.00	0.87	1.58	48.52	1.58	790.87	790.87
RF-T-10	758.50	751.00	5.00	1.24	2.38	120.62	2.38	752.24	752.24
RF-T-11	796.58	789.92	5.00	0.73	1.85	49.20	1.85	790.65	790.65
RF-T-12	796.20	790.00	5.00	0.80	1.25	49.20	1.25	790.80	790.80
RF-T-13	758.90	749.91	5.00	1.66	2.53	147.37	2.53	751.57	751.57
RF-T-14	738.69	728.50	5.00	1.21	2.63	94.72	2.22	729.71	729.71
RF-T-15	740.65	729.50	5.00	0.71	3.51	94.72	2.22	730.21	730.21
RF-T-16	840.94	834.50	5.00	0.60	4.64	24.05	1.53	835.10	835.10
RF-T-17	836.29	829.50	5.00	0.85	4.40	24.05	1.53	830.35	830.35
RF-T-18	837.86	827.85	5.00	0.79	1.60	38.44	1.60	828.64	828.64
RF-T-19	840.46	829.14	5.00	0.51	3.35	49.49	1.85	829.65	829.65
RF-T-20	840.59	829.14	5.00	0.86	1.85	49.49	1.85	830.00	830.00
RF-T-21	841.69	829.75	5.00	0.48	1.06	49.49	1.06	830.23	830.23
RF-T-22	839.06	831.05	5.00	0.75	1.79	48.81	1.84	831.80	831.80

TABLE 8 – FLOW AT OUTFALL

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
F 24 -2	625.00	619.83	Free Outfall	620.30	5.17	420.16

Preliminary - Draft

APPENDIX-C

REDBUD TRAIL AREA (F24-10) MODEL RESULTS

REDBUD TRAIL AREA (F24-10) MODEL RESULTS

TABLE 1- PRESSURE SYSTEM, FLOW DATA

Below from min. limit

Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RR-P-1	RR-J-3	657.65	RR-J-4	631.83	294.40	2.00	HDPE Pressure Pipe	0.088	4.00	39.15	11.40	809.56	798.16
RR-P-2	RR-J-5	682.20	RR-J-6	681.00	17.70	2.00	HDPE Pressure Pipe	0.068	1.16	11.36	0.07	758.55	758.48
RR-P-3	RR-J-4	631.83	RR-J-9	630.00	188.30	2.00	HDPE Pressure Pipe	0.010	4.00	39.15	7.29	798.16	790.87
RR-P-4	RR-J-11	640.25	RR-J-8	640.50	121.70	2.00	HDPE Pressure Pipe	-0.002	4.00	39.15	4.71	762.07	757.35
RR-P-5	RR-J-12	626.83	RR-J-10	628.90	53.20	2.00	HDPE Pressure Pipe	-0.039	4.00	39.15	2.06	780.83	778.77
RR-P-6	RR-J-14	622.00	RR-J-13	622.00	107.00	2.00	HDPE Pressure Pipe	0.000	5.16	50.51	6.64	737.97	731.33
RR-P-10	RR-J-21	672.00	F24-10	675.40	78.50	2.00	HDPE Pressure Pipe	-0.043	5.16	50.51	4.87	680.44	675.57
RR-P-12	RR-J-23	668.50	RR-J-21	672.00	67.00	2.00	HDPE Pressure Pipe	-0.052	5.16	50.51	4.16	684.60	680.44
RR-P-14	RR-J-25	666.00	RR-J-23	668.50	79.30	2.00	HDPE Pressure Pipe	-0.032	5.16	50.51	4.92	689.52	684.60
RR-P-17	RR-J-27	634.00	RR-J-25	666.00	512.20	2.00	HDPE Pressure Pipe	-0.062	5.16	50.51	31.80	721.31	689.52
RR-P-18	RR-J-13	622.00	RR-J-27	634.00	161.30	2.00	HDPE Pressure Pipe	-0.074	5.16	50.51	10.01	731.33	721.31
RR-P-19	RR-J-28	621.00	RR-J-14	622.00	23.20	2.00	HDPE Pressure Pipe	-0.043	5.16	50.51	1.44	739.41	737.97
RR-P-20	RR-J-8	640.50	RR-J-28	621.00	289.10	2.00	HDPE Pressure Pipe	0.067	5.16	50.51	17.95	757.35	739.41
RR-P-21	RR-J-29	634.83	RR-J-11	640.25	122.60	2.00	HDPE Pressure Pipe	-0.044	4.00	39.15	4.75	766.82	762.07
RR-P-22	RR-J-30	687.90	RR-J-3	657.65	51.80	2.00	HDPE Pressure Pipe	0.584	4.00	39.15	2.01	811.57	809.56
RR-P-23	RR-J-2	706.00	RR-J-31	704.95	182.00	2.00	HDPE Pressure Pipe	0.006	4.00	39.15	7.05	822.38	815.33
RR-P-24	RR-J-31	704.95	RR-J-30	687.90	97.20	2.00	HDPE Pressure Pipe	0.175	4.00	39.15	3.76	815.33	811.57
RR-P-25	RR-J-1	780.20	RR-J-32	744.50	77.60	2.00	HDPE Pressure Pipe	0.460	4.00	39.15	3.00	839.13	836.13
RR-P-26	RR-J-32	744.50	RR-J-2	706.00	354.90	2.00	HDPE Pressure Pipe	0.108	4.00	39.15	13.74	836.13	822.38
RR-P-27	RR-J-35	684.65	RR-J-5	682.20	101.40	2.00	HDPE Pressure Pipe	0.024	1.16	11.36	0.40	758.95	758.55
RR-P-28	RR-J-36	687.00	RR-J-35	684.65	69.60	2.00	HDPE Pressure Pipe	0.034	1.16	11.36	0.27	759.22	758.95
RR-P-29	1113 WLD	670.07	RR-PMP-1	671.07	43.80	1.50	HDPE Pressure Pipe	-0.023	2.06	11.36	0.70	672.07	671.37
RR-P-30	RR-PMP-1	671.07	RR-J-36	687.00	74.00	1.50	HDPE Pressure Pipe	-0.215	2.06	11.36	1.18	760.40	759.22

Preliminary - Draft

REDBUD TRAIL AREA (F24-10) MODEL RESULTS
TABLE 1- PRESSURE SYSTEM, FLOW DATA (CONTINUED)

	Below from min. limit
	Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RR-P-32	RR-J-10	628.90	RR-J-37	631.56	138.50	2.00	HDPE Pressure Pipe	-0.019	4.00	39.15	5.37	778.77	773.40
RR-P-33	RR-J-37	631.56	RR-J-29	634.83	170.10	2.00	HDPE Pressure Pipe	-0.019	4.00	39.15	6.59	773.40	766.82
RR-P-36	RR-J-9	630.00	RR-J-38	628.20	104.10	2.00	HDPE Pressure Pipe	0.017	4.00	39.15	4.03	790.87	786.84
RR-P-37	RR-J-38	628.20	RR-J-12	626.83	155.00	2.00	HDPE Pressure Pipe	0.009	4.00	39.15	6.00	786.84	780.83
RR-P-43	200 BT	762.14	RR-PMP-6	763.06	36.20	1.50	HDPE Pressure Pipe	-0.025	2.16	11.92	0.63	764.14	763.51
RR-P-44	RR-PMP-6	763.06	RR-J-1	780.20	72.70	1.50	HDPE Pressure Pipe	-0.236	2.16	11.92	1.26	840.40	839.13
RR-P-45	205 BT	791.68	RR-PMP-7	790.45	50.90	1.50	HDPE Pressure Pipe	0.024	2.35	12.94	1.03	793.68	792.65
RR-P-46	RR-PMP-7	790.45	RR-J-33	800.00	99.70	1.50	HDPE Pressure Pipe	-0.096	2.35	12.94	2.02	842.79	840.77
RR-P-50	RR-J-39	809.75	RR-J-33	800.00	134.10	2.00	HDPE Pressure Pipe	0.073	1.46	14.29	0.80	841.57	840.77
RR-P-54	RR-J-41	782.95	RR-J-1	780.20	13.40	2.00	HDPE Pressure Pipe	0.206	2.78	27.23	0.26	839.40	839.13
RR-P-55	RR-J-33	800.00	RR-J-41	782.95	69.40	2.00	HDPE Pressure Pipe	0.246	2.78	27.23	1.37	840.77	839.40
RR-P-56	RR-J-42	810.00	RR-J-39	809.75	12.40	2.00	HDPE Pressure Pipe	0.020	1.46	14.29	0.07	841.65	841.57
RR-P-57	RR-J-43	813.00	RR-J-42	810.00	64.70	2.00	HDPE Pressure Pipe	0.046	1.46	14.29	0.39	842.03	841.65
RR-P-58	RR-J-44	815.85	RR-J-43	813.00	42.00	2.00	HDPE Pressure Pipe	0.068	1.46	14.29	0.25	842.29	842.03
RR-P-59	RR-J-45	816.00	RR-J-44	815.85	16.00	2.00	HDPE Pressure Pipe	0.009	1.46	14.29	0.10	842.38	842.29
RR-P-60	RR-J-46	817.80	RR-J-45	816.00	25.80	2.00	HDPE Pressure Pipe	0.070	1.46	14.29	0.15	842.54	842.38
RR-P-61	RR-J-40	818.00	RR-J-46	817.80	39.70	2.00	HDPE Pressure Pipe	0.005	1.46	14.29	0.24	842.77	842.54
RR-P-62	RR-J-47	822.00	RR-J-40	818.00	36.70	2.00	HDPE Pressure Pipe	0.109	1.46	14.29	0.22	842.99	842.77
RR-P-63	RR-J-48	822.80	RR-J-47	822.00	28.00	2.00	HDPE Pressure Pipe	0.029	1.46	14.29	0.17	843.16	842.99
RR-P-64	RR-J-49	825.85	RR-J-48	822.80	31.00	2.00	HDPE Pressure Pipe	0.098	1.46	14.29	0.19	843.35	843.16
RR-P-65	RR-J-50	838.77	RR-J-49	825.85	247.20	2.00	HDPE Pressure Pipe	0.052	1.46	14.29	1.48	844.83	843.35

Preliminary - Draft

REDBUD TRAIL AREA (F24-10) MODEL RESULTS
TABLE 1- PRESSURE SYSTEM, FLOW DATA (CONTINUED)

	Below from min. limit
	Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RR-P-66	RR-J-51	842.85	RR-J-50	838.77	40.30	2.00	HDPE Pressure Pipe	0.101	1.46	14.29	0.24	845.07	844.83
RR-P-67	RR-J-52	843.50	RR-J-51	842.85	59.90	2.00	HDPE Pressure Pipe	0.011	1.46	14.29	0.36	845.43	845.07
RR-P-78	309 BT	842.80	RR-PMP-14	842.80	54.30	1.50	HDPE Pressure Pipe	0.000	2.59	14.29	1.32	844.80	843.48
RR-P-79	RR-PMP-14	842.80	RR-J-52	843.50	69.80	1.50	HDPE Pressure Pipe	-0.010	2.59	14.29	1.70	847.12	845.43
RR-P-83	RR-J-6	681.00	RR-J-57	665.81	101.10	2.00	HDPE Pressure Pipe	0.150	1.16	11.36	0.40	758.48	758.09
RR-P-86	RR-J-57	665.81	RR-J-58	659.24	43.70	2.00	HDPE Pressure Pipe	0.150	1.16	11.36	0.17	758.09	757.92
RR-P-87	RR-J-58	659.24	RR-J-7	651.00	54.90	2.00	HDPE Pressure Pipe	0.150	1.16	11.36	0.21	757.92	757.70
RR-P-89	RR-J-7	651.00	RR-J-59	643.93	60.10	2.00	HDPE Pressure Pipe	0.118	1.16	11.36	0.24	757.70	757.47
RR-P-90	RR-J-59	643.93	RR-J-8	640.50	29.10	2.00	HDPE Pressure Pipe	0.118	1.16	11.36	0.11	757.47	757.35

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REDBUD TRAIL AREA (F24-10) MODEL RESULTS
TABLE 2- PRESSURE JUNCTION, FLOW DATA

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
RR-J-1	785.50	780.20	839.13	25.00
RR-J-2	712.50	706.00	822.38	50.00
RR-J-3	661.80	657.65	809.56	66.00
RR-J-4	635.00	631.83	798.16	72.00
RR-J-5	686.50	682.20	758.55	33.00
RR-J-6	684.50	681.00	758.48	34.00
RR-J-7	655.00	651.00	757.70	46.00
RR-J-8	646.00	640.50	757.35	51.00
RR-J-9	632.25	630.00	790.87	70.00
RR-J-10	632.40	628.90	778.77	65.00
RR-J-11	643.80	640.25	762.07	53.00
RR-J-12	630.00	626.83	780.83	67.00
RR-J-13	626.50	622.00	731.33	47.00
RR-J-14	623.75	622.00	737.97	50.00
RR-J-21	679.00	672.00	680.44	4.00
RR-J-23	675.12	668.50	684.60	7.00
RR-J-25	670.25	666.00	689.52	10.00
RR-J-27	640.00	634.00	721.31	38.00
RR-J-28	625.50	621.00	739.41	51.00
RR-J-29	638.18	634.83	766.82	57.00
RR-J-30	692.75	687.90	811.57	54.00
RR-J-31	710.20	704.95	815.33	48.00
RR-J-32	747.45	744.50	836.13	40.00

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
RR-J-33	803.00	800.00	840.77	18.00
RR-J-35	689.85	684.65	758.95	32.00
RR-J-36	691.50	687.00	759.22	31.00
RR-J-37	634.99	631.56	773.40	61.00
RR-J-38	631.45	628.20	786.84	69.00
RR-J-39	814.00	809.75	841.57	14.00
RR-J-40	826.00	818.00	842.77	11.00
RR-J-41	787.00	782.95	839.40	24.00
RR-J-42	815.40	810.00	841.65	14.00
RR-J-43	817.00	813.00	842.03	13.00
RR-J-44	819.60	815.85	842.29	11.00
RR-J-45	821.40	816.00	842.38	11.00
RR-J-46	821.50	817.80	842.54	11.00
RR-J-47	826.50	822.00	842.99	9.00
RR-J-48	829.50	822.80	843.16	9.00
RR-J-49	829.85	825.85	843.35	8.00
RR-J-50	843.00	838.77	844.83	3.00
RR-J-51	847.00	842.85	845.07	1.00
RR-J-52	850.15	843.50	845.43	1.00
RR-J-57	669.56	665.81	758.09	40.00
RR-J-58	663.11	659.24	757.92	43.00
RR-J-59	648.94	643.93	757.47	49.00

Preliminary - Draft

REDBUD TRAIL AREA (F24-10) MODEL RESULTS
TABLE 3- OUTFALL, FLOW DATA

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
F24-10	683.80	675.40	Free Outfall	675.57	8.40	50.51

Preliminary - Draft

APPENDIX-D

RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

TABLE 1- GRAVITY SYSTEM, FLOW DATA

Below from min. limit

Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-CO-1	RW-MH-2	669.75	662.40	RW-MH-1	645.78	630.00	136.70	0.237	8.00	PVC	8.76	0.05	10.90	44.31	32.40	3990.09	1.10	662.45	630.05
RW-CO-2	RW-MH-7	619.74	614.75	RW-MH-6	620.95	613.95	297.80	0.003	8.00	PVC	0.49	0.67	5.33	77.10	0.05	355.13	21.70	615.65	615.60
RW-CO-3	RW-MH-8	627.95	621.97	RW-MH-7	619.74	614.75	127.40	0.057	8.00	PVC	5.96	0.38	4.82	76.42	6.41	1842.62	4.10	622.06	615.65
RW-CO-4	RW-MH-9	641.00	628.85	RW-MH-8	627.95	621.97	182.20	0.038	8.00	PVC	5.07	0.10	8.40	75.06	6.88	1480.00	5.10	628.95	622.07
RW-CO-5	RW-MH-1	645.78	629.60	RW-MH-9	641.00	628.85	99.90	0.008	8.00	PVC	2.72	0.15	13.50	75.06	0.75	618.64	12.10	629.76	629.01
RW-CO-6	RW-MH-10	649.55	630.30	RW-MH-1	645.78	629.60	239.10	0.003	8.00	PVC	1.46	0.14	17.05	30.76	0.67	372.02	8.30	630.43	629.76
RW-CO-7	RW-MH-11	646.50	631.25	RW-MH-10	649.55	630.30	310.40	0.003	8.00	PVC	1.48	0.13	16.58	30.08	0.95	381.00	7.90	631.38	630.43
RW-CO-8	RW-MH-12	639.00	632.25	RW-MH-11	646.50	631.25	359.00	0.003	8.00	PVC	1.40	0.12	10.33	28.04	1.00	362.12	7.70	632.37	631.38
RW-CO-9	RW-MH-13	642.55	634.50	RW-MH-12	639.00	632.25	190.50	0.012	8.00	PVC	2.40	0.10	6.73	26.00	2.21	790.05	3.30	634.58	632.37
RW-CO-10	RW-MH-14	643.55	635.90	RW-MH-13	642.55	634.50	136.30	0.010	8.00	PVC	2.27	0.08	7.18	26.00	1.40	732.69	3.50	635.98	634.58
RW-CO-11	RW-MH-15	644.00	636.55	RW-MH-14	643.55	635.90	171.80	0.004	8.00	PVC	1.44	0.10	6.88	20.56	0.65	427.21	4.80	636.65	636.00
RW-CO-12	RW-MH-16	651.80	637.12	RW-MH-15	644.00	636.55	177.80	0.003	8.00	PVC	1.34	0.10	10.40	19.88	0.57	390.73	5.10	637.22	636.65
RW-CO-13	RW-MH-18	653.45	646.20	RW-MH-14	643.55	635.85	319.30	0.032	8.00	PVC	2.17	0.08	6.81	4.76	10.24	1362.65	0.30	646.23	635.98
RW-CO-16	RW-T-4	638.80	634.80	RW-T-3	639.00	634.00	84.90	0.009	8.00	PVC	3.23	0.18	3.83	101.99	0.77	699.25	14.60	634.97	634.20
RW-CO-17	RW-T-5	639.30	635.00	RW-T-4	638.80	634.80	78.60	0.003	8.00	PVC	1.93	0.25	3.48	101.31	0.20	344.77	29.40	635.25	635.05
RW-CO-18	RW-MH-21	643.00	635.15	RW-T-5	639.30	635.00	26.80	0.006	8.00	PVC	2.62	0.22	5.41	99.95	0.10	528.37	18.90	635.35	635.25

Preliminary - Draft

RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

TABLE 1- GRAVITY SYSTEM, FLOW DATA (CONTINUED)

Below from min. limit

Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-CO-19	RW-T-6	645.33	636.00	RW-MH-21	643.00	635.15	189.90	0.004	8.00	PVC	2.40	0.21	7.92	99.94	0.85	467.86	21.40	636.21	635.36
RW-CO-20	RW-T-7	646.39	636.50	RW-T-6	645.33	636.00	86.30	0.006	8.00	PVC	2.64	0.20	8.94	97.90	0.48	537.76	18.20	636.69	636.21
RW-CO-21	RW-T-8	647.24	637.00	RW-T-7	646.39	636.50	69.60	0.007	8.00	PVC	2.86	0.19	9.40	97.22	0.49	603.86	16.10	637.18	636.69
RW-CO-22	RW-MH-22	647.50	637.40	RW-T-8	647.24	637.00	21.10	0.019	8.00	PVC	4.17	0.16	9.50	96.54	0.36	1019.57	9.50	637.54	637.18
RW-CO-23	RW-T-9	647.34	638.50	RW-MH-22	647.50	637.40	57.20	0.019	8.00	PVC	4.19	0.14	8.81	95.85	1.10	1028.08	9.30	638.64	637.54
RW-CO-24	RW-MH-19	645.85	639.75	RW-T-9	647.34	638.50	550.40	0.002	8.00	PVC	1.73	0.23	6.81	81.52	1.25	324.31	25.10	639.98	638.73
RW-CO-40	RW-T-22	651.74	638.00	RW-MH-16	651.80	637.12	34.20	0.026	8.00	PVC	2.99	0.08	13.54	19.88	0.84	1202.40	1.70	638.06	637.22
RW-CO-41	RW-MH-17	651.20	646.20	RW-T-22	651.74	638.00	297.20	0.028	8.00	PVC	2.10	0.04	8.70	5.44	8.17	1249.27	0.40	646.23	638.06
RW-CO-42	RW-T-24	679.40	673.50	RW-T-23	679.14	673.30	85.60	0.002	8.00	PVC	1.30	0.13	5.20	27.00	0.20	329.29	8.20	673.63	673.43
RW-CO-43	RW-MH-5	679.50	674.20	RW-T-24	679.40	673.50	33.30	0.021	8.00	PVC	3.01	0.10	4.93	27.00	0.64	1077.69	2.50	674.27	673.63
RW-CO-44	RW-T-23	679.14	673.30	RW-T-25	678.94	673.00	66.80	0.004	8.00	PVC	1.66	0.11	5.23	27.00	0.29	468.58	5.80	673.41	673.12
RW-CO-45	RW-T-25	678.94	673.00	RW-T-26	678.68	672.75	87.00	0.003	8.00	PVC	1.40	0.12	5.27	27.00	0.25	368.27	7.30	673.12	672.87
RW-CO-46	RW-T-27	678.32	672.50	RW-MH-4	678.25	672.30	23.80	0.008	8.00	PVC	2.13	0.11	5.22	27.68	0.16	658.00	4.20	672.59	672.43
RW-CO-47	RW-T-26	678.68	672.70	RW-T-27	678.32	672.50	119.10	0.002	8.00	PVC	1.15	0.14	5.23	27.68	0.20	275.55	10.00	672.84	672.64
RW-CO-48	RW-T-28	677.24	671.50	RW-MH-3	677.00	670.95	43.80	0.013	8.00	PVC	2.83	0.10	5.23	42.95	0.55	817.04	5.30	671.60	671.05
RW-CO-49	RW-MH-4	678.25	672.30	RW-T-28	677.24	671.80	187.10	0.003	8.00	PVC	1.39	0.13	5.03	29.04	0.50	354.10	8.20	672.43	671.93
RW-CO-50	RW-T-29	674.82	668.50	RW-MH-2	669.75	662.40	141.90	0.043	8.00	PVC	4.56	0.07	6.17	43.63	6.10	1587.14	2.70	668.57	662.47
RW-CO-51	RW-MH-3	677.00	670.95	RW-T-29	674.82	668.50	60.90	0.040	8.00	PVC	4.42	0.08	5.52	42.95	2.45	1531.98	2.80	671.03	668.58
RW-CO-52	RW-MH-6	620.95	613.95	stbank Lift Stat	629.00	613.44	119.70	0.004	8.00	PVC	0.84	0.67	10.61	132.10	0.05	455.51	29.00	615.60	615.55
RW-CO-53	RW-T-3	639.00	634.00	G23-M54	639.50	633.00	174.50	0.006	8.00	PVC	2.67	0.20	5.08	104.71	1.00	534.67	19.60	634.20	633.20

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RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

TABLE 2 – GRAVITY LATERAL SYSTEM, FLOW DATA

Input Data						Output Data
Label	Start Node	Invert (Start) (ft)	Stop Node	Diameter (in)	Material	Flow (gpm)
RW-L-2	3300.00	619.33	RW-Tap-2	4.00	PVC	55.00
RW-L-3	410 RWD	638.57	RW-Tap-3	4.00	PVC	0.68
RW-L-4	412 RWD	638.90	RW-Tap-4	4.00	PVC	0.68
RW-L-5	415 RWD	633.49	RW-Tap-5	4.00	PVC	0.68
RW-L-6	414 RWD	638.98	RW-Tap-6	4.00	PVC	0.68
RW-L-7	416 RWD	639.91	RW-Tap-7	4.00	PVC	0.68
RW-L-8	418 RWD	640.20	RW-Tap-8	4.00	PVC	0.68
RW-L-9	420 RWD	641.03	RW-Tap-9	4.00	PVC	0.68
RW-L-10	422 RWD	642.60	RW-Tap-10	4.00	PVC	0.68
RW-L-11	426 RWD	643.59	RW-Tap-11	4.00	PVC	0.68
RW-L-12	428 RWD	643.77	RW-Tap-12	4.00	PVC	0.68
RW-L-13	430 RWD	643.71	RW-MH-22	4.00	PVC	0.68
RW-L-14	434 RWD	644.29	RW-Tap-13	4.00	PVC	0.68
RW-L-15	438 RWD	644.68	RW-Tap-14	4.00	PVC	0.68
RW-L-16	440 RWD	645.01	RW-Tap-15	4.00	PVC	0.68
RW-L-17	442 RWD	644.26	RW-Tap-16	4.00	PVC	0.68
RW-L-18	423 RVD	635.63	RW-Tap-17	4.00	PVC	0.68
RW-L-19	432 RWD	644.37	RW-Tap-18	4.00	PVC	0.68
RW-L-34	5103 RD	631.48	RW-MH-8	4.00	PVC	0.68
RW-L-35	5105 RD	618.07	RW-Tap-33	4.00	PVC	0.68
RW-L-36	5100 RD	628.16	RW-MH-8	4.00	PVC	0.68
RW-L-37	5013 RD	652.43	RW-Tap-34	4.00	PVC	0.68
RW-L-38	5011 RD	647.73	RW-Tap-35	4.00	PVC	0.68
RW-L-39	5009 RD	647.90	RW-Tap-36	4.00	PVC	0.68
RW-L-40	5007 RD	645.49	RW-Tap-37	4.00	PVC	0.68
RW-L-41	5005 RD	644.06	RW-Tap-38	4.00	PVC	0.68
RW-L-42	5003 RD	642.92	RW-Tap-39	4.00	PVC	0.68

Input Data						Output Data
Label	Start Node	Invert (Start) (ft)	Stop Node	Diameter (in)	Material	Flow (gpm)
RW-L-43	5001 RD	641.00	RW-Tap-40	4.00	PVC	0.68
RW-L-44	5001 RWD	641.96	RW-Tap-41	4.00	PVC	0.68
RW-L-45	5008 JRD	651.07	RW-MH-17	4.00	PVC	0.68
RW-L-46	5007 JRD	652.36	RW-MH-17	4.00	PVC	0.68
RW-L-47	5006 JRD	648.43	RW-Tap-42	4.00	PVC	0.68
RW-L-48	5004 JRD	647.26	RW-Tap-43	4.00	PVC	0.68
RW-L-49	5005 JRD	648.68	RW-Tap-44	4.00	PVC	0.68
RW-L-50	5002 JRD	646.00	RW-Tap-45	4.00	PVC	0.68
RW-L-51	5003 JRD	646.59	RW-Tap-46	4.00	PVC	0.68
RW-L-52	5000 RWD	643.72	RW-Tap-47	4.00	PVC	0.68
RW-L-53	5002 GRD	647.47	RW-Tap-48	4.00	PVC	0.68
RW-L-54	5008 GRD	652.62	RW-Tap-49	4.00	PVC	0.68
RW-L-55	5006 GRD	650.54	RW-Tap-50	4.00	PVC	0.68
RW-L-56	5007 GRD	653.59	RW-MH-18	4.00	PVC	0.68
RW-L-57	5005 GRD	647.14	RW-Tap-51	4.00	PVC	0.68
RW-L-58	5003 GRD	644.87	RW-Tap-52	4.00	PVC	0.68
RW-L-59	5004 GRD	650.97	RW-Tap-53	4.00	PVC	0.68
RW-L-60	5001 RWD	644.10	RW-Tap-54	4.00	PVC	0.68
RW-L-61	2 NPR	663.93	RW-MH-2	4.00	PVC	0.68
RW-L-62	4 NPR	675.98	RW-Tap-55	4.00	PVC	0.68
RW-L-63	6 NPR	674.52	RW-Tap-56	4.00	PVC	0.68
RW-L-64	8 NPR	671.76	RW-Tap-57	4.00	PVC	0.68
RW-L-65	10 NPR	673.02	RW-Tap-58	4.00	PVC	0.68
RW-L-66	413 RWD	632.86	RW-Tap-59	4.00	PVC	0.68

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RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

TABLE 3 – PRESSURE SYSTEM, FLOW DATA

	Below from min. limit
	Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-P-1	RW-J-57	671.22	RW-MH-5	674.05	50.80	2.00	HDPE Pressure Pipe	-0.056	2.75	26.97	0.99	675.20	674.22
RW-P-2	RW-J-51	662.99	RW-J-57	671.22	146.30	2.00	HDPE Pressure Pipe	-0.056	1.31	12.84	0.72	675.92	675.20
RW-P-3	RW-J-56	658.61	RW-J-51	662.99	47.00	2.00	HDPE Pressure Pipe	-0.093	1.31	12.84	0.23	676.15	675.92
RW-P-4	RW-J-52	652.64	RW-J-56	658.61	118.40	2.00	HDPE Pressure Pipe	-0.050	1.31	12.84	0.58	676.74	676.15
RW-P-5	RW-J-55	652.54	RW-J-52	652.64	32.10	2.00	HDPE Pressure Pipe	-0.003	1.31	12.84	0.16	676.89	676.74
RW-P-6	RW-J-53	652.01	RW-J-55	652.54	56.30	2.00	HDPE Pressure Pipe	-0.009	1.31	12.84	0.28	677.17	676.89
RW-P-7	RW-J-54	651.98	RW-J-53	652.01	44.60	2.00	HDPE Pressure Pipe	-0.001	1.31	12.84	0.22	677.39	677.17
RW-P-8	RW-J-1	652.28	RW-J-54	651.98	25.70	2.00	HDPE Pressure Pipe	0.012	1.31	12.84	0.13	677.52	677.39
RW-P-24	RW-J-8	613.55	RW-J-26	614.63	299.80	4.00	HDPE Pressure Pipe	-0.004	1.99	78.12	1.43	652.85	651.42
RW-P-25	RW-J-26	614.63	RW-J-25	621.86	130.30	4.00	HDPE Pressure Pipe	-0.055	1.99	78.12	0.62	651.42	650.80
RW-P-26	RW-J-25	621.86	RW-J-24	628.90	178.30	4.00	HDPE Pressure Pipe	-0.039	1.99	78.12	0.85	650.80	649.95
RW-P-27	RW-J-24	628.90	RW-J-9	629.50	102.20	4.00	HDPE Pressure Pipe	-0.006	1.99	78.12	0.49	649.95	649.47
RW-P-28	RW-J-9	629.50	RW-J-10	630.15	236.40	4.00	HDPE Pressure Pipe	-0.003	1.99	78.12	1.12	649.47	648.34
RW-P-29	RW-J-10	630.15	RW-J-23	631.22	312.60	4.00	HDPE Pressure Pipe	-0.003	1.99	78.12	1.49	648.34	646.86
RW-P-30	RW-J-23	631.22	RW-J-22	632.25	323.40	4.00	HDPE Pressure Pipe	-0.003	1.99	78.12	1.54	646.86	645.32
RW-P-31	RW-J-22	632.25	RW-J-11	633.12	39.30	4.00	HDPE Pressure Pipe	-0.022	1.99	78.12	0.19	645.32	645.13
RW-P-32	RW-J-11	633.12	RW-J-12	634.43	191.80	4.00	HDPE Pressure Pipe	-0.007	1.99	78.12	0.91	645.13	644.22
RW-P-33	RW-J-12	634.43	RW-J-13	635.75	137.30	4.00	HDPE Pressure Pipe	-0.010	1.99	78.12	0.65	644.22	643.56
RW-P-34	RW-J-13	635.75	RW-J-14	636.00	67.90	4.00	HDPE Pressure Pipe	-0.004	1.99	78.12	0.32	643.56	643.24
RW-P-35	RW-J-14	636.00	RW-J-21	636.24	101.70	4.00	HDPE Pressure Pipe	-0.002	1.99	78.12	0.48	643.24	642.76
RW-P-36	RW-J-21	636.24	RW-J-20	637.50	178.60	4.00	HDPE Pressure Pipe	-0.007	1.99	78.12	0.85	642.76	641.91
RW-P-37	RW-J-20	637.50	RW-MH-19	639.65	404.50	4.00	HDPE Pressure Pipe	-0.005	1.99	78.12	1.92	641.91	639.98
RW-P-58	Westbank Lift Station	604.90	RW-PMP-66	605.00	30.00	4.00	HDPE Pressure Pipe	-0.003	1.99	78.12	0.14	615.55	615.41
RW-P-59	RW-PMP-66	605.00	RW-J-8	613.55	91.80	4.00	HDPE Pressure Pipe	-0.093	1.99	78.12	0.44	653.28	652.85
RW-P-102	RW-PMP-22	637.25	RW-T-9	638.20	70.90	1.50	HDPE Pressure Pipe	-0.013	2.60	14.33	1.73	640.06	638.33
RW-P-103	431 RWD	637.25	RW-PMP-22	637.25	49.70	1.50	HDPE Pressure Pipe	0.000	2.60	14.33	1.21	639.25	638.04
RW-P-158	RW-PMP-50	640.00	RW-T-22	637.93	78.40	1.50	HDPE Pressure Pipe	0.026	2.62	14.44	1.94	640.00	638.05
RW-P-159	5000 JRD	641.63	RW-PMP-50	640.00	55.20	1.50	HDPE Pressure Pipe	0.030	2.62	14.44	1.37	643.63	642.26
RW-P-172	RW-PMP-57	626.12	RW-J-1	652.28	93.10	1.50	HDPE Pressure Pipe	-0.281	2.33	12.84	1.86	679.38	677.52
RW-P-173	3313 GD	625.12	RW-PMP-57	626.12	36.50	1.50	HDPE Pressure Pipe	-0.027	2.33	12.84	0.73	627.12	626.39
RW-P-178	RW-PMP-60	666.60	RW-J-57	671.22	83.90	1.50	HDPE Pressure Pipe	-0.055	2.57	14.13	2.00	677.20	675.20
RW-P-179	15 NPR	666.60	RW-PMP-60	666.60	55.20	1.50	HDPE Pressure Pipe	0.000	2.57	14.13	1.31	668.60	667.29
RW-P-186	RW-PMP-64	655.63	RW-T-28	671.30	127.60	1.50	HDPE Pressure Pipe	-0.123	2.52	13.90	2.95	674.37	671.42
RW-P-187	5 NPR	655.63	RW-PMP-64	655.63	75.90	1.50	HDPE Pressure Pipe	0.000	2.52	13.90	1.75	657.63	655.88

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RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

TABLE 4 – PRESSURE JUNCTION, FLOW DATA

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
RW-J-1	656.28	652.28	677.52	11.00
RW-J-8	619.00	613.55	652.85	17.00
RW-J-9	645.75	629.50	649.47	9.00
RW-J-10	649.35	630.15	648.34	8.00
RW-J-11	639.00	633.12	645.13	5.00
RW-J-12	642.25	634.43	644.22	4.00
RW-J-13	645.40	635.75	643.56	3.00
RW-J-14	644.00	636.00	643.24	3.00
RW-J-20	643.00	637.50	641.91	2.00
RW-J-21	644.00	636.24	642.76	3.00
RW-J-22	641.50	632.25	645.32	6.00
RW-J-23	646.50	631.22	646.86	7.00
RW-J-24	641.00	628.90	649.95	9.00
RW-J-25	627.85	621.86	650.80	13.00
RW-J-26	619.65	614.63	651.42	16.00
RW-J-51	666.99	662.99	675.92	6.00
RW-J-52	656.64	652.64	676.74	10.00
RW-J-53	656.01	652.01	677.17	11.00
RW-J-54	655.98	651.98	677.39	11.00
RW-J-55	656.54	652.54	676.89	11.00
RW-J-56	662.61	658.61	676.15	8.00
RW-J-57	675.22	671.22	675.20	2.00

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RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

TABLE 5 – COLLECTION SYSTEM HYDRAULIC GRADE LINE

Input Data									Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Base Load (Local Sanitary) (gpm)	Population (Local Sanitary) (Capita)	Depth (In) (ft)	Depth (Out) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-MH-1	645.78	629.50	75.06	75.06	0.00	28396.80	0.25	0.25	4.50	629.76	629.76
RW-MH-2	669.75	662.25	44.30	44.31	1.00	4899.39	0.20	0.20	3.50	662.45	662.45
RW-MH-3	677.00	670.80	42.94	42.95	1.00	2941.26	0.23	0.23	4.00	671.03	671.03
RW-MH-4	678.25	672.00	29.03	29.04	5.00	2957.62	0.43	0.43	7.50	672.43	672.43
RW-MH-5	679.50	674.05	26.97	27.00	6.00	33.00	0.22	0.22	3.90	674.27	674.27
RW-MH-6	620.95	613.74	132.10	132.10	0.00	110534.40	1.86	1.86	32.80	615.60	615.60
RW-MH-7	619.74	614.63	77.10	77.10	0.00	31334.40	1.02	1.02	18.00	615.65	615.65
RW-MH-8	627.95	621.86	76.42	76.42	0.00	30355.20	0.20	0.20	3.50	622.06	622.06
RW-MH-9	641.00	628.70	75.06	75.06	0.00	28396.80	0.25	0.25	4.40	628.95	628.95
RW-MH-10	649.55	630.15	30.76	30.76	0.00	23500.80	0.28	0.28	4.90	630.43	630.43
RW-MH-11	646.50	631.11	30.08	30.08	0.00	22521.60	0.27	0.27	4.70	631.38	631.38
RW-MH-12	639.00	632.00	28.04	28.04	0.00	19584.00	0.37	0.37	6.60	632.37	632.37
RW-MH-13	642.55	634.43	26.00	26.00	0.00	16646.40	0.15	0.15	2.70	634.58	634.58
RW-MH-14	643.55	635.75	26.00	26.00	0.00	16646.40	0.23	0.23	4.10	635.98	635.98
RW-MH-15	644.00	636.24	20.56	20.56	0.00	8812.80	0.41	0.41	7.20	636.65	636.65
RW-MH-16	651.80	637.00	19.88	19.88	0.00	7833.60	0.22	0.22	3.90	637.22	637.22
RW-MH-17	651.20	646.00	5.44	5.44	0.00	7833.60	0.23	0.23	4.10	646.23	646.23
RW-MH-18	653.45	646.10	4.76	4.76	0.00	6854.40	0.13	0.13	2.20	646.23	646.23
RW-MH-19	645.85	639.65	81.52	81.52	0.00	4896.00	0.33	0.33	5.80	639.98	639.98
RW-MH-21	643.00	635.00	99.94	99.95	3.00	10787.70	0.35	0.35	6.10	635.35	635.35
RW-MH-22	647.50	637.00	96.53	96.54	3.00	5897.21	0.54	0.54	9.50	637.54	637.54

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RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

TABLE 6 – PROPERTY CONNECTION DATA

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (gpm)
410 RWD	642.57	638.57	0.68
412 RWD	642.90	638.90	0.68
414 RWD	642.98	638.98	0.68
416 RWD	643.91	639.91	0.68
418 RWD	644.20	640.20	0.68
420 RWD	645.03	641.03	0.68
422 RWD	646.60	642.60	0.68
426 RWD	647.59	643.59	0.68
428 RWD	647.77	643.77	0.68
430 RWD	647.71	643.71	0.68
432 RWD	648.37	644.37	0.68
434 RWD	648.29	644.29	0.68
438 RWD	648.68	644.68	0.68
440 RWD	649.01	645.01	0.68
442 RWD	648.26	644.26	0.68
413 RWD	636.86	632.86	0.68
415 RWD	637.49	633.49	0.68
423 RVD	639.63	635.63	0.68
5103 RD	635.48	631.48	0.68
5105 RD	622.07	618.07	0.68
5100 RD	632.16	628.16	0.68
5013 RD	656.43	652.43	0.68
5011 RD	651.73	647.73	0.68
5009 RD	651.90	647.90	0.68
5007 RD	649.49	645.49	0.68
5005 RD	648.06	644.06	0.68

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (gpm)
5003 RD	646.92	642.92	0.68
5001 RD	645.00	641.00	0.68
5001 RWD	645.96	641.96	0.68
5008 JRD	655.07	651.07	0.68
5007 JRD	656.36	652.36	0.68
5006 JRD	652.43	648.43	0.68
5004 JRD	651.26	647.26	0.68
5005 JRD	652.68	648.68	0.68
5002 JRD	650.00	646.00	0.68
5003 JRD	650.59	646.59	0.68
5001 RWD	648.10	644.10	0.68
5000 RWD	647.72	643.72	0.68
5002 GRD	651.47	647.47	0.68
5008 GRD	656.62	652.62	0.68
5007 GRD	657.59	653.59	0.68
5006 GRD	654.54	650.54	0.68
5005 GRD	651.14	647.14	0.68
5003 GRD	648.87	644.87	0.68
5004 GRD	654.97	650.97	0.68
2 NPR	667.93	663.93	0.68
4 NPR	679.98	675.98	0.68
6 NPR	678.52	674.52	0.68
8 NPR	675.76	671.76	0.68
10 NPR	677.02	673.02	0.68
3300.00	623.33	619.33	55.00

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RIDGEWOOD ROAD AREA (G23-M54) MODEL RESULTS

TABLE 7- TRANSITION TABLE

Input Data					Output Data				
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Transition Length (ft)	Depth (Out) (ft)	Velocity (In) (ft/s)	Flow (Total Out) (gpm)	Velocity (Out) (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-T-3	639.00	633.80	5.00	0.40	2.67	104.71	2.67	634.20	634.20
RW-T-4	638.80	634.50	5.00	0.47	1.92	101.99	3.23	634.97	634.97
RW-T-5	639.30	634.80	5.00	0.45	1.92	101.31	1.92	635.25	635.25
RW-T-6	645.33	635.90	5.00	0.31	2.35	99.94	2.40	636.21	636.21
RW-T-7	646.39	636.00	5.00	0.69	2.62	97.90	2.64	636.69	636.69
RW-T-8	647.24	636.50	5.00	0.68	2.86	97.22	2.86	637.18	637.18
RW-T-9	647.34	638.20	5.00	0.44	1.73	95.85	4.19	638.64	638.64
RW-T-22	651.74	637.93	5.00	0.13	0.82	19.88	2.98	638.06	638.06
RW-T-23	679.14	673.10	5.00	0.31	1.30	27.00	1.66	673.41	673.41
RW-T-24	679.40	673.30	5.00	0.33	1.30	27.00	1.30	673.63	673.63
RW-T-25	678.94	672.50	5.00	0.62	1.40	27.00	1.40	673.12	673.12
RW-T-26	678.68	672.40	5.00	0.44	1.15	27.68	1.15	672.84	672.84
RW-T-27	678.32	672.20	5.00	0.39	1.15	27.68	2.13	672.59	672.59
RW-T-28	677.24	671.30	5.00	0.30	1.39	42.95	2.83	671.60	671.60
RW-T-29	674.82	668.38	5.00	0.19	4.56	43.63	4.56	668.57	668.57

TABLE 8 – FLOW AT OUTFALL

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
G23-M54	639.50	633.00	Free Outfall	633.20	6.50	104.71

Preliminary - Draft

APPENDIX-E

RIDGEWOOD ROAD AREA (G23-69) MODEL RESULTS

RIDGEWOOD ROAD AREA (G23-69) MODEL RESULTS

TABLE 1 – GRAVITY SYSTEM, FLOW DATA

 Below from min. limit
 Above from max. limit

Input Data											Output Data								
Label	Start Node	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Stop Node	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Material	Velocity (ft/s)	Depth (Middle) (ft)	Cover (Average) (ft)	Flow (gpm)	Headloss (ft)	Capacity (Design) (gpm)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-CO-14	RW-T-1	649.40	645.03	RW-MH-20	649.50	644.70	10.70	0.031	8.00	PVC	3.89	0.09	3.92	39.43	0.30	1323.94	3.00	645.11	644.81
RW-CO-25	RW-MH-24	653.00	642.40	RW-T-10	652.06	642.00	123.70	0.003	8.00	PVC	1.68	0.15	9.67	43.54	0.40	392.49	11.10	642.55	642.15
RW-CO-26	G23-69	646.00	636.00	RW-T-12	646.18	636.40	18.40	0.022	8.00	PVC	3.65	0.09	9.22	49.67	0.40	1098.88	4.50	636.49	636.09
RW-CO-27	RW-T-13	647.18	637.00	RW-T-12	646.18	636.40	101.70	0.006	8.00	PVC	2.20	0.13	9.31	49.67	0.60	543.11	9.10	637.13	636.53
RW-CO-28	RW-T-14	648.80	638.50	RW-T-13	647.18	637.00	164.30	0.009	8.00	PVC	2.60	0.13	9.57	48.99	1.48	687.45	7.10	638.62	637.13
RW-CO-29	RW-MH-23	650.00	640.40	RW-T-15	649.81	639.50	19.10	0.047	8.00	PVC	4.78	0.08	9.29	45.59	0.88	1667.86	2.70	640.47	639.59
RW-CO-30	RW-T-16	649.57	639.00	RW-T-14	648.80	638.50	78.20	0.006	8.00	PVC	2.23	0.13	9.77	46.95	0.50	567.31	8.30	639.13	638.63
RW-CO-31	RW-T-15	649.81	639.50	RW-T-16	649.57	639.00	24.60	0.020	8.00	PVC	3.48	0.11	9.77	46.27	0.47	1057.99	4.40	639.59	639.13
RW-CO-32	RW-T-17	651.62	641.50	RW-MH-23	650.00	640.40	214.70	0.005	8.00	PVC	2.02	0.13	9.19	44.90	1.10	503.25	8.90	641.63	640.53
RW-CO-33	RW-T-10	652.06	642.00	RW-T-17	651.62	641.50	58.50	0.009	8.00	PVC	2.45	0.12	9.43	43.54	0.48	663.40	6.60	642.11	641.63
RW-CO-34	RW-T-18	652.51	642.80	RW-MH-24	653.00	642.40	54.10	0.007	8.00	PVC	2.30	0.13	9.49	42.86	0.37	613.67	7.00	642.92	642.55
RW-CO-35	RW-T-19	651.92	643.00	RW-T-18	652.51	642.80	66.40	0.003	8.00	PVC	1.62	0.15	8.65	42.18	0.20	377.69	11.20	643.15	642.95
RW-CO-36	RW-T-11	651.71	643.50	RW-T-19	651.92	643.00	22.90	0.022	8.00	PVC	3.47	0.12	7.90	41.50	0.44	1101.31	3.80	643.59	643.15
RW-CO-37	RW-T-20	651.34	643.80	RW-T-11	651.71	643.50	40.80	0.007	8.00	PVC	2.28	0.12	7.21	41.50	0.30	611.26	6.80	643.92	643.62
RW-CO-38	RW-T-21	650.21	644.00	RW-T-20	651.34	643.80	126.40	0.002	8.00	PVC	1.25	0.18	6.21	41.50	0.20	266.82	15.60	644.18	643.98
RW-CO-39	RW-MH-20	649.50	644.70	RW-T-21	650.21	644.00	78.70	0.009	8.00	PVC	2.44	0.14	4.84	40.82	0.63	677.75	6.00	644.81	644.18

Preliminary - Draft

RIDGEWOOD ROAD AREA (G23-69) MODEL RESULTS

TABLE 2- GRAVITY LATERAL SYSTEM, FLOW DATA

Input Data							Output Data		
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Diameter (in)	Material	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Flow (gpm)
RW-L-1	441 BLD	646.00	RW-Tap-1	644.93	4.00	PVC	119.20	0.01	0.68
RW-L-20	413 BLD	641.05	RW-Tap-19	636.81	4.00	PVC	108.60	0.04	0.68
RW-L-21	415 BLD	641.06	RW-Tap-20	637.41	4.00	PVC	115.00	0.03	0.68
RW-L-22	417 BLD	642.11	RW-Tap-21	638.11	4.00	PVC	118.20	0.03	0.68
RW-L-23	419 BLD	641.16	RW-Tap-22	638.88	4.00	PVC	127.50	0.02	0.68
RW-L-24	423 BLD	642.97	RW-Tap-23	640.22	4.00	PVC	111.90	0.03	0.68
RW-L-25	427 BLD	646.01	RW-Tap-24	641.08	4.00	PVC	119.20	0.04	0.68
RW-L-28	437 BLD	646.00	RW-Tap-27	644.30	4.00	PVC	123.20	0.01	0.68
RW-L-29	439 BLD	646.00	RW-Tap-28	644.66	4.00	PVC	117.50	0.01	0.68
RW-L-30	416 BLD	640.86	RW-Tap-29	638.19	4.00	PVC	99.90	0.03	0.68
RW-L-31	420 BLD	635.45	RW-Tap-30	639.58	4.00	PVC	120.70	-0.03	0.68
RW-L-32	424 BLD	642.24	RW-Tap-31	641.40	4.00	PVC	100.20	0.01	0.68
RW-L-33	428 BLD	645.22	RW-Tap-32	642.55	4.00	PVC	82.70	0.03	0.68

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RIDGEWOOD ROAD AREA (G23-69) MODEL RESULTS

TABLE 3 – PRESSURE SYSTEM, FLOW DATA

	Below from min. limit
	Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scaled) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-P-38	RW-J-37	645.20	RW-T-1	645.03	71.50	2.50	HDPE Pressure Pipe	0.002	2.58	39.43	0.95	646.18	645.24
RW-P-39	RW-J-38	645.30	RW-J-37	645.20	46.90	2.50	HDPE Pressure Pipe	0.002	2.58	39.43	0.62	646.80	646.18
RW-P-40	RW-J-15	645.50	RW-J-38	645.30	59.20	2.50	HDPE Pressure Pipe	0.003	2.58	39.43	0.78	647.59	646.80
RW-P-41	RW-J-16	640.74	RW-J-15	645.50	288.20	2.50	HDPE Pressure Pipe	-0.017	2.58	39.43	3.81	651.40	647.59
RW-P-42	RW-J-44	629.37	RW-J-16	640.74	138.70	2.50	HDPE Pressure Pipe	-0.082	2.58	39.43	1.84	653.24	651.40
RW-P-43	RW-J-45	622.69	RW-J-44	629.37	120.40	2.50	HDPE Pressure Pipe	-0.055	1.68	25.70	0.72	653.96	653.24
RW-P-44	RW-J-43	621.48	RW-J-45	622.69	23.10	2.50	HDPE Pressure Pipe	-0.052	1.68	25.70	0.14	654.10	653.96
RW-P-45	RW-J-17	618.31	RW-J-43	621.48	81.60	2.50	HDPE Pressure Pipe	-0.039	1.68	25.70	0.49	654.59	654.10
RW-P-46	RW-J-46	616.18	RW-J-17	618.31	158.90	2.50	HDPE Pressure Pipe	-0.013	1.68	25.70	0.95	655.54	654.59
RW-P-47	RW-J-18	616.01	RW-J-46	616.18	116.60	2.50	HDPE Pressure Pipe	-0.001	1.68	25.70	0.70	656.24	655.54
RW-P-48	RW-J-47	615.64	RW-J-18	616.01	23.60	2.50	HDPE Pressure Pipe	-0.016	1.68	25.70	0.14	656.38	656.24
RW-P-49	RW-J-42	614.51	RW-J-47	615.64	54.90	2.50	HDPE Pressure Pipe	-0.021	1.68	25.70	0.33	656.71	656.38
RW-P-50	RW-J-41	595.32	RW-J-42	614.51	178.20	2.50	HDPE Pressure Pipe	-0.108	0.81	12.43	0.28	656.99	656.71
RW-P-51	RW-J-48	588.47	RW-J-41	595.32	62.50	2.50	HDPE Pressure Pipe	-0.110	0.81	12.43	0.10	657.08	656.99
RW-P-52	RW-J-19	585.94	RW-J-48	588.47	22.60	2.50	HDPE Pressure Pipe	-0.112	0.81	12.43	0.04	657.12	657.08
RW-P-53	RW-J-40	579.25	RW-J-19	585.94	67.20	2.50	HDPE Pressure Pipe	-0.100	0.81	12.43	0.10	657.22	657.12
RW-P-54	RW-J-49	570.31	RW-J-40	579.25	99.50	2.50	HDPE Pressure Pipe	-0.090	0.81	12.43	0.16	657.38	657.22
RW-P-55	RW-J-39	575.82	RW-J-49	570.31	135.30	2.50	HDPE Pressure Pipe	0.041	0.81	12.43	0.21	657.59	657.38
RW-P-56	RW-J-50	579.83	RW-J-39	575.82	39.30	2.50	HDPE Pressure Pipe	0.102	0.81	12.43	0.06	657.65	657.59
RW-P-57	RW-J-50	579.83	RW-J-2	579.88	89.70	2.50	HDPE Pressure Pipe	-0.001	0.00	0.00	0.00	657.65	657.65
RW-P-138	RW-PMP-40	608.64	RW-J-42	614.51	212.70	1.50	HDPE Pressure Pipe	-0.028	2.41	13.28	4.51	661.22	656.71
RW-P-139	9 SCD	620.46	RW-PMP-40	608.64	54.30	1.50	HDPE Pressure Pipe	0.218	2.41	13.28	1.15	622.46	621.31
RW-P-142	RW-PMP-42	630.53	RW-J-44	629.37	119.00	1.50	HDPE Pressure Pipe	0.010	2.49	13.73	2.69	655.93	653.24
RW-P-143	1 SCD	630.52	RW-PMP-42	630.53	51.40	1.50	HDPE Pressure Pipe	0.000	2.49	13.73	1.16	632.52	631.36
RW-P-156	RW-PMP-49	594.15	RW-J-50	579.83	85.60	1.50	HDPE Pressure Pipe	0.167	2.26	12.43	1.61	659.26	657.65
RW-P-157	16 SCD	594.15	RW-PMP-49	594.15	72.90	1.50	HDPE Pressure Pipe	0.000	2.26	12.43	1.37	596.15	594.78

Preliminary - Draft

RIDGEWOOD ROAD AREA (G23-69) MODEL RESULTS

TABLE 4 – PRESSURE JUNCTION, FLOW DATA

Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
RW-J-2	583.88	579.88	657.65	34
RW-J-15	650.5	645.5	647.59	1
RW-J-16	644.74	640.74	651.4	5
RW-J-17	622.31	618.31	654.59	16
RW-J-18	620.01	616.01	656.24	17
RW-J-19	589.94	585.94	657.12	31
RW-J-37	650	645.2	646.18	0
RW-J-38	650	645.3	646.8	1
RW-J-39	579.82	575.82	657.59	35
RW-J-40	583.25	579.25	657.22	34
RW-J-41	599.32	595.32	656.99	27
RW-J-42	618.51	614.51	656.71	18
RW-J-43	625.48	621.48	654.1	14
RW-J-44	633.37	629.37	653.24	10
RW-J-45	626.69	622.69	653.96	14
RW-J-46	620.18	616.18	655.54	17
RW-J-47	619.64	615.64	656.38	18
RW-J-48	592.47	588.47	657.08	30
RW-J-49	574.31	570.31	657.38	38
RW-J-50	583.83	579.83	657.65	34

TABLE 5- COLLECTION SYSTEM HYDRAULIC GRADE LINE

Input Data									Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (gpm)	Flow (Total Out) (gpm)	Base Load (Local Sanitary) (gpm)	Population (Local Sanitary) (Capita)	Depth (Out) (ft)	Depth (In) (ft)	Volume (gal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-MH-20	649.50	644.56	40.79	40.82	40.82	12.00	0.25	0.25	4.40	644.81	644.81
RW-MH-23	650.00	640.10	45.58	45.59	45.59	7.00	0.37	0.37	6.60	640.47	640.47
RW-MH-24	653.00	642.20	43.53	43.54	43.54	5.00	0.35	0.35	6.10	642.55	642.55

Preliminary - Draft

RIDGEWOOD ROAD AREA (G23-69) MODEL RESULTS

TABLE 6 – PROPERTY CONNECTION DATA

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (gpm)
413 BLD	645.05	641.05	0.68
415 BLD	645.06	641.06	0.68
417 BLD	646.11	642.11	0.68
419 BLD	645.16	641.16	0.68
423 BLD	646.97	642.97	0.68
427 BLD	650.01	646.01	0.68
437 BLD	650.00	646.00	0.68
439 BLD	650.00	646.00	0.68
441 BLD	650.00	646.00	0.68
416 BLD	644.86	640.86	0.68
420 BLD	639.45	635.45	0.68
424 BLD	646.24	642.24	0.68
428 BLD	649.22	645.22	0.68

TABLE 7 – TRANSITION RESULTS

Input Data					Output Data				
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Transition Length (ft)	Depth (Out) (ft)	Velocity (In) (ft/s)	Flow (Total Out) (gpm)	Velocity (Out) (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-T-1	649.40	645.03	5.00	0.08	3.89	39.43	3.89	645.11	645.11
RW-T-10	652.06	641.78	5.00	0.34	1.68	43.54	2.45	642.11	642.11
RW-T-11	651.71	643.16	5.00	0.43	2.28	41.50	3.47	643.59	643.59
RW-T-12	646.18	636.10	5.00	0.39	2.20	49.67	3.65	636.49	636.49
RW-T-13	647.18	636.80	5.00	0.33	2.17	49.67	2.20	637.13	637.13
RW-T-14	648.80	638.20	5.00	0.42	2.23	48.99	2.60	638.62	638.62
RW-T-15	649.81	639.00	5.00	0.59	3.43	46.27	3.48	639.59	639.59
RW-T-16	649.57	638.80	5.00	0.33	2.20	46.95	2.23	639.13	639.13
RW-T-17	651.62	641.30	5.00	0.33	2.02	44.90	2.02	641.63	641.63
RW-T-18	652.51	642.50	5.00	0.42	1.62	42.86	2.30	642.92	642.92
RW-T-19	651.92	642.90	5.00	0.25	1.59	42.18	1.62	643.15	643.15
RW-T-20	651.34	643.30	5.00	0.62	1.25	41.50	2.28	643.92	643.92
RW-T-21	650.21	643.67	5.00	0.51	1.25	41.50	1.25	644.18	644.18

Preliminary - Draft

RIDGEWOOD ROAD AREA (G23-69) MODEL RESULTS

TABLE 8 – FLOW AT OUTFALL

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
G23-69	646.00	636.00	Free Outfall	636.09	10.00	49.67

Preliminary - Draft

APPENDIX-F

RIDGEWOOD ROAD AREA (G23-M50) MODEL RESULTS

RIDGEWOOD ROAD AREA (G23-M50) MODEL RESULTS

TABLE 1 – PRESSURE SYSTEM, FLOW DATA

	Below from min. limit
	Above from max. limit

Input Data								Output Data					
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (Scale d) (ft)	Diameter (in)	Material	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Flow (gpm)	Headloss (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
RW-P-9	RW-J-3	573.18	RW-J-30	572.76	14.20	2.00	HDPE Pressure Pipe	0.029	1.43	14.03	0.08	597.79	597.70
RW-P-10	RW-J-30	572.76	RW-J-31	570.80	31.60	2.00	HDPE Pressure Pipe	0.062	1.43	14.03	0.18	597.70	597.52
RW-P-11	RW-J-31	570.80	RW-J-4	565.90	89.40	2.00	HDPE Pressure Pipe	0.055	1.43	14.03	0.52	597.52	597.00
RW-P-12	RW-J-27	568.46	RW-J-4	565.90	31.00	2.00	HDPE Pressure Pipe	0.083	1.36	13.29	0.16	597.16	597.00
RW-P-13	RW-J-29	572.18	RW-J-27	568.46	65.30	2.00	HDPE Pressure Pipe	0.057	1.36	13.29	0.34	597.51	597.16
RW-P-14	RW-J-28	572.64	RW-J-29	572.18	57.30	2.00	HDPE Pressure Pipe	0.008	1.36	13.29	0.30	597.81	597.51
RW-P-15	RW-J-5	571.23	RW-J-28	572.64	31.70	2.00	HDPE Pressure Pipe	-0.044	1.36	13.29	0.17	597.97	597.81
RW-P-16	RW-J-4	565.90	RW-J-34	565.04	83.90	2.00	HDPE Pressure Pipe	0.010	2.79	27.32	1.67	597.00	595.33
RW-P-17	RW-J-34	565.04	RW-J-32	568.49	67.70	2.00	HDPE Pressure Pipe	-0.051	2.79	27.32	1.35	595.33	593.99
RW-P-18	RW-J-32	568.49	RW-J-33	574.12	145.60	2.00	HDPE Pressure Pipe	-0.039	2.79	27.32	2.90	593.99	591.09
RW-P-19	RW-J-33	574.12	RW-J-6	565.22	169.10	2.00	HDPE Pressure Pipe	0.053	2.79	27.32	3.37	591.09	587.72
RW-P-20	RW-J-6	565.22	G23-M50	578.21	226.50	2.00	HDPE Pressure Pipe	-0.057	4.14	40.51	9.35	587.72	578.38
RW-P-21	RW-J-36	565.25	RW-J-6	565.22	35.60	2.00	HDPE Pressure Pipe	0.001	1.35	13.19	0.18	587.91	587.72
RW-P-22	RW-J-35	566.66	RW-J-36	565.25	58.60	2.00	HDPE Pressure Pipe	0.024	1.35	13.19	0.30	588.21	587.91
RW-P-23	RW-J-7	566.15	RW-J-35	566.66	34.10	2.00	HDPE Pressure Pipe	-0.015	1.35	13.19	0.18	588.38	588.21
RW-P-60	RW-PMP-1	559.15	RW-J-5	571.23	58.00	1.50	HDPE Pressure Pipe	-0.208	2.41	13.29	1.23	599.21	597.97
RW-P-61	14 SSD	558.15	RW-PMP-1	559.15	17.80	1.50	HDPE Pressure Pipe	-0.056	2.41	13.29	0.38	560.15	559.77
RW-P-68	RW-PMP-5	584.78	RW-J-3	573.18	69.90	1.50	HDPE Pressure Pipe	0.166	2.55	14.03	1.64	599.43	597.79
RW-P-69	17 SSD	584.68	RW-PMP-5	584.78	33.30	1.50	HDPE Pressure Pipe	-0.003	2.55	14.03	0.78	586.68	585.90
RW-P-82	6 SSD	545.23	RW-PMP-12	546.23	21.00	1.50	HDPE Pressure Pipe	-0.048	2.39	13.19	0.44	547.23	546.79
RW-P-83	RW-PMP-12	546.23	RW-J-7	566.15	49.60	1.50	HDPE Pressure Pipe	-0.402	2.39	13.19	1.04	589.42	588.38

Preliminary - Draft

RIDGEWOOD ROAD AREA (G23-M50) MODEL RESULTS

TABLE 2 – PRESSURE JUNCTION, FLOW DATA

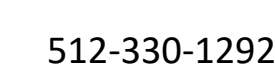
Label	Elevation (Ground) (ft)	Elevation (ft)	Hydraulic Grade (ft)	Pressure (Maximum) (psi)
RW-J-3	577.18	573.18	597.79	11.00
RW-J-4	569.90	565.90	597.00	13.00
RW-J-5	575.23	571.23	597.97	12.00
RW-J-6	569.22	565.22	587.72	10.00
RW-J-7	570.15	566.15	588.38	10.00
RW-J-27	572.46	568.46	597.16	12.00
RW-J-28	576.64	572.64	597.81	11.00
RW-J-29	576.18	572.18	597.51	11.00
RW-J-30	576.76	572.76	597.70	11.00
RW-J-31	574.80	570.80	597.52	12.00
RW-J-32	572.49	568.49	593.99	11.00
RW-J-33	578.12	574.12	591.09	7.00
RW-J-34	569.04	565.04	595.33	13.00
RW-J-35	570.66	566.66	588.21	9.00
RW-J-36	569.25	565.25	587.91	10.00

TABLE 3- FLOW AT OUTFALL

Input Data				Output Data		
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Depth (Structure) (ft)	Flow (Total Out) (gpm)
G23-M50	582.21	578.21	Free Outfall	578.38	4.00	40.51

Preliminary - Draft

EXHIBITS



FLOW ARROW		
PROPERTY CONNECTION		LOT NO.
WETWELL		LOT NO.
PUMP		PMP-1
MANHOLE		MH-1
PRESSURE JUNCTION		J-1
TRANSITION		T-1
TAP		Tap-1
OUTFALL/ LIFT STATION		O-1

WEST LAKE HILLS CITY LIMITS

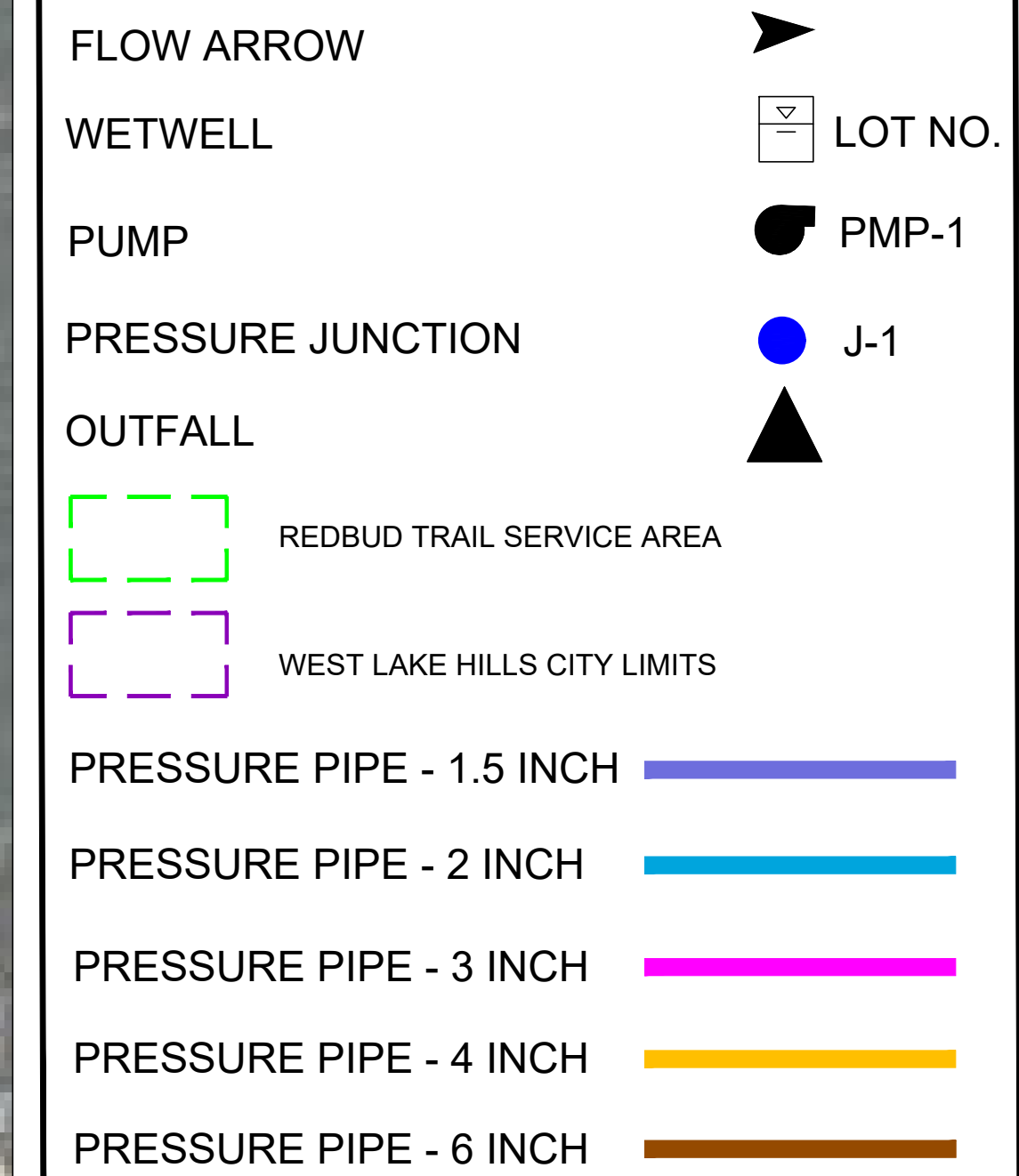
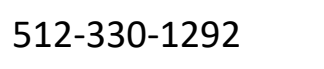
EXHIBIT- 2

**REDBUD FOREST VIEW, SOUTH
(F24-2) SEWER SHED THAT
FLOWS TO ROCKY RIVER LIFT
STATION**

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Page 143 of 143

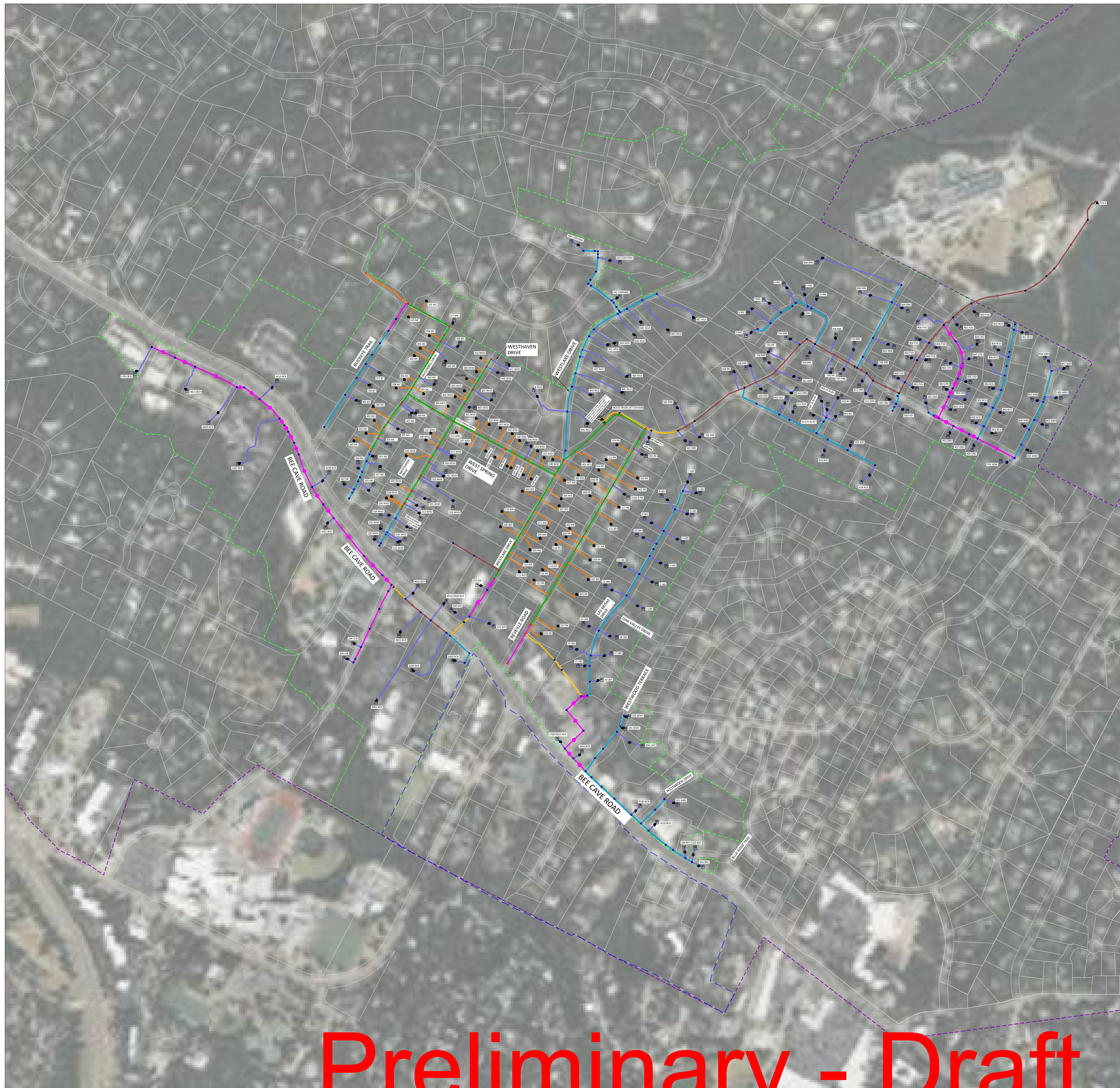
Preliminary - Draft

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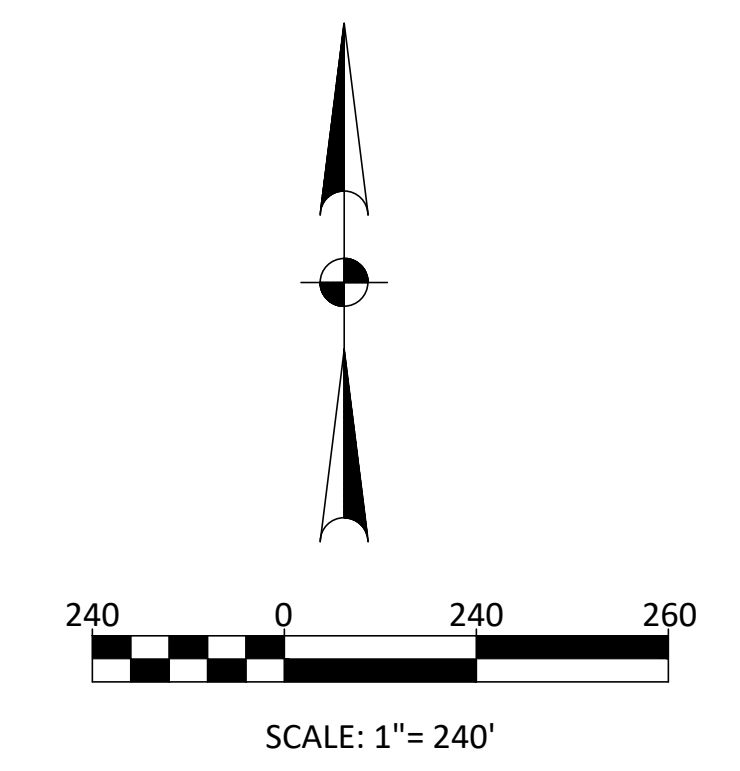
**REDBUD FOREST VIEW, NORTH
(F24-2) ROCKY RIVER LIFT
STATION FORCE MAIN AND
CONTRIBUTING SEWERSHED**

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Preliminary - Draft



Walter P. Moore and Associates, Inc.
401 South 1st Street, Suite 600
Austin, Texas 78704
512-330-1292



LEGEND

FLOW ARROW		
PROPERTY CONNECTION		LOT NO.
WETWELL		LOT NO.
PUMP		PMP-1
MANHOLE		MH-1
PRESSURE JUNCTION		J-1
TRANSITION		T-1
TAP		Tap-1
OUTFALL		O-1

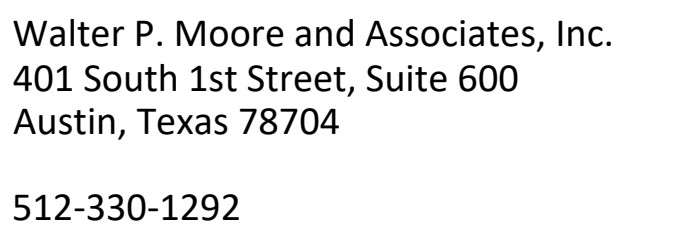
	REDBUD TRAIL SERVICE AREA
	SANDERLING TRAIL SERVICE AREA
	WEST LAKE HILLS CITY LIMITS
PRESSURE PIPE - 1.5 INCH	
PRESSURE PIPE - 2 INCH	
PRESSURE PIPE - 3 INCH	
PRESSURE PIPE - 4 INCH	
PRESSURE PIPE - 6 INCH	
GRAVITY PIPE - 4 INCH	
GRAVITY PIPE - 8 INCH	

West Lake Hills WasteWater Model

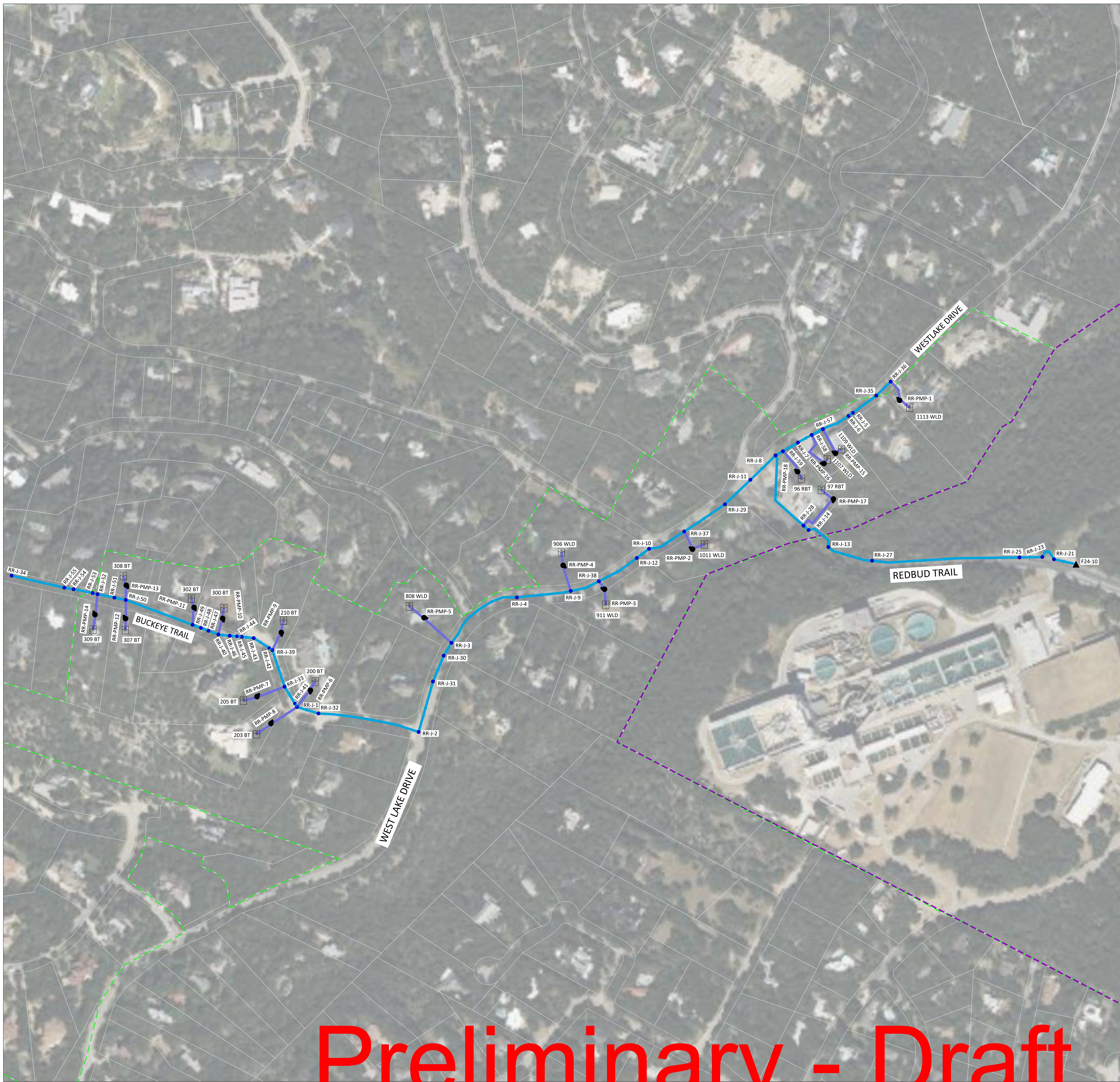
[illegible]

EXHIBIT-4

REDBUD FOREST VIEW, NORTH
& SOUTH SEWER SHED (F24-2)



FLOW ARROW		
WETWELL		LOT NO.
PUMP		PMP-1
PRESSURE JUNCTION		J-1
OUTFALL		O-1
	REDBUD TRAIL SERVICE AREA	
	WEST LAKE HILLS CITY LIMITS	
PRESSURE PIPE - 1.5 INCH		
PRESSURE PIPE - 2 INCH		



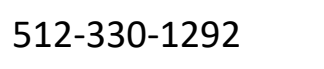
West Lake Hills WasteWater Model

[illegible]

EXHIBIT- 5

**REDBUD TRAIL (F24-10) SEWER
SHED**

Preliminary - Draft



LEGEND

FLOW ARROW		
PROPERTY CONNECTION		LOT NO.
WETWELL		LOT NO.
PUMP		PMP-1
MANHOLE		MH-1
TRANSITION		T-1
TAP		Tap-1
PRESSURE JUNCTION		J-1
OUTFALL		O-1

 REDBUD TRAIL SERVICE AREA

WEST LAKE HILLS CITY LIMITS

PRESSURE PIPE - 1.5 INCH

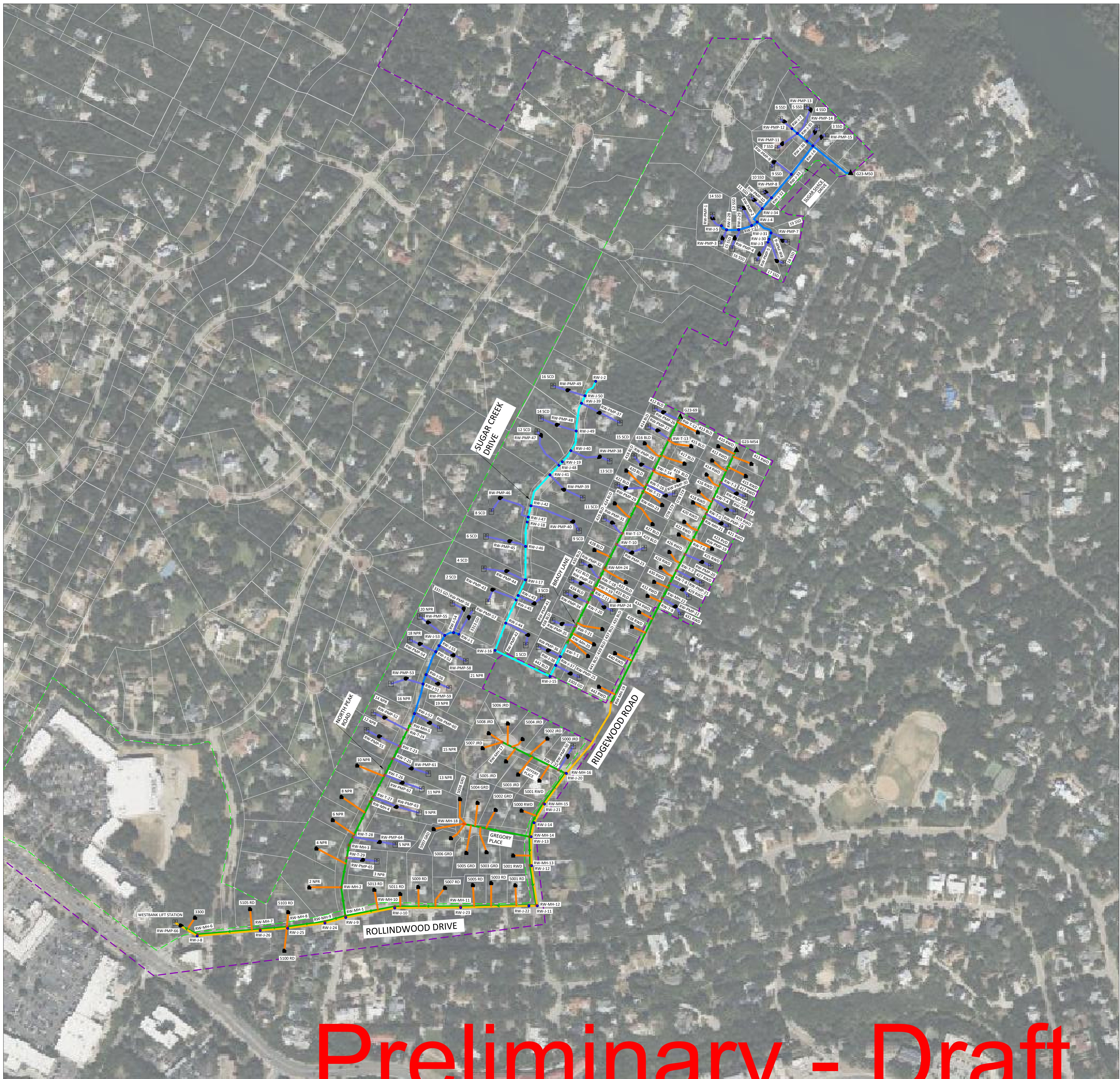
PRESSURE PIPE - 2 INCH

PRESSURE PIPE - 3 INCH

PRESSURE PIPE - 4 INCH

GRAVITY PIPE - 4 INCH

GRAVITY PIPE - 8 INCH 



West Lake Hills WasteWater Model

[illegible]

PROJECT NO.	DESIGNED BY	REVIEWED BY	DRAWN BY
C02-23004-03	RR	NS	PR
ORIGINAL ISSUE			DATE
			16-12-2024

EXHIBIT- 6

REDBUD RIDGEWOOD
(G23-M54, G23-69,G23-M50)
SEWER SHED

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DRAFT REPORT ON

CITY OF WEST LAKE HILLS, TEXAS

HULL CIRCLE AREA

EXISTING SANITARY SEWER NETWORK HYDRAULIC ANALYSIS



Prepared for
City of West Lake Hills
911 Westlake Drive
West Lake Hills, TX 78746

Prepared by
Walter P. Moore and Associates, Inc.
401 S 1st Street, Suite 600 Austin TX 78704

Preliminary - Draft

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10. CONCLUSION	12

APPENDICES

APPENDIX A OUTFALL PROFILES

APPENDIX B HULL CIRCLE AREA MODEL RESULTS FOR PEAK CONDITION

EXHIBITS

EXHIBIT 1 HULL CIRCLE LAS ALTOS LIFT STATION CONTRIBUTING SEWERSHED

1. LIST OF ABBREVIATIONS**REPORT ABBREVIATIONS****COA:** City Of Austin**EGL:** Energy Grade Line**Ft:** Feet**Ft/s:** Feet per Second**PSI:** Pounds per Square Inch**GPM:** Gallons per Minute**HDPE:** High Density Polyethylene**HGL:** Hydraulic Grade Line**LUE:** Living Unit Equivalent**PVC:** Poly Vinyl Chloride**WLH:** West Lake Hills**MODEL ELEMENTS ABBREVIATIONS****CO** – Conduit- gravity sewer main**J** – Junction- low pressure system junction**L** – Lateral- service line from residential or commercial property to sewer main**MH** - Manhole**P** – Pressure- low pressure wastewater main**T** – Transition- transition from low pressure to gravity system**Tap** – lateral connection to sewer main**STREET ABBREVIATIONS****WLD-** Westlake Drive**HCD-** Hull circle Drive**HC-** Hidden Cove**WCH-** Wildcat Hollow**TMD-** Terrace Mtn. Drive

2. DEFINITIONS

Capacity:

The maximum capacity of the gravity interceptor.

Depth:

Depth of flow in a gravity sewer main.

Discharge Point:

Point where the City of West Lake Hills collection system discharges to the City of Austin's collection system.

EGL (Energy Grade Line):

A line that represents the total energy head (pressure head, elevation head, and velocity head) in a fluid system, always above the HGL by the velocity head amount.

Flow/Capacity:

A pipe flowing at its maximum capacity (Ratio of the pipe's current capacity and the maximum capacity) would have with a value of one.

Headloss:

Headloss is the reduction in head, or pressure, that occurs as fluid flows through a pipe or other hydraulic system due to friction, turbulence, or other factors.

HGL (Hydraulic Grade Line):

A line representing the pressure head and elevation head in a fluid system, indicating the height to which water would rise in piezometer tubes along a pipeline.

LUE (Living Unit Equivalent):

A term commonly used in engineering, planning, and utility design to standardize the measurement of water demand or wastewater generation. It represents the average flow of one residential unit (typically a single-family home) for water or wastewater services. For the purposes of this study, 245 gpd was used per LUE.

3. INTRODUCTION

The City of West Lake Hills (WLH) wastewater collection system is a combination of gravity and low-pressure systems. The WLH collection system discharges to the City of Austin (COA) collection system through several different entry points. Each of these entry points, and the system as whole, has defined average and peak flow limitations defined in an agreement between the COA and WLHs. This report describes the analysis of Hull Circle trail service area sanitary sewer shed for peak loading based on the conditions defined in the above referenced agreement.

HULL CIRCLE AREA

The Hull Circle Trail service area is situated in the northeast corner of WLHs and consists of a pressure system primarily serving residential properties. The system discharges into the LAS Altos lift station along Westlake Drive. Since this entry point is unmetered, peak flows are calculated by applying a 4.0 multiplier to the average flows for each property.

The model was designed to represent the current conditions of the collection system. Hull Circle was added after the original COA Agreement, without increasing the overall average or peak flows for WLHs. However, it introduced an additional entry point with a peak flow limit of 49 gpm. To ensure a safety margin within the 49-gpm peak flow limit, it is recommended to restrict connections to a maximum of 48 single-family units.

4. OBJECTIVES

The main objectives of this study are

- To develop a wastewater model for the City of Westlake Hills to monitor the system's capacity for existing conditions, proposed redevelopment, and contractual agreement limits with the COA.
- To develop accurate GIS files of the collection system to assist with the City's asset management program.
- To develop an understanding of the maximum capacity of the existing collection system under peak flow conditions.
- To develop various scenarios, including sub-basins transfers, to get the maximum capacity out of the existing systems lift stations and interceptors while maintaining contractual limits at discharge points.
- To use future flow meter data to calibrate the current model and define actual operational conditions.

5. DATA COLLECTION

Existing site plan and utility plan information was collected from the City of West Lake Hills. The AutoCAD background files were geolocated with respect to NAD 83 Texas coordinate system and the analysis was performed in Central Zone projection, TX83. Information collected by WPM includes:

- West Lake Hills Wastewater Collection System Map dated February 7, 2023
- GIS mapping data from the City of West Lake's website
- Record drawings for wastewater infrastructure
- COA Annual Wastewater connection and flow summary spreadsheet
- Elevation Data from LIDAR
- Pump information, from WLH design standards. (pump curve data, wet well size, pump cycle times based on wastewater generation)
- Probability data for low pressure systems was provided by Bentley, correlating the number of connected grinder pump connections with the maximum number of grinder pumps operating simultaneously.

5.1 HULL CIRCLE RECORD DRAWINGS

- Westlake Drive, Hull circle drive, Hidden cove drive - "0249 - WLH Hull Circle - As-Builts"
- Los Altos Lift station details - "Los Altos S-1976-0093"
- Wildcat Hollow Drive - "Sewer As-Builts - Wildcat - DSS - 05.23.23"

6 DESIGN CRITERIA

6.1 DESIGN CRITERIA FOR SANITARY NETWORK:

- **Average Flow:** Residential 245 gpd per LUE
Commercial 175 gpd per LUE
(Robert E. Lee Wastewater study by PBS&J, Refer section 7 for more details)
- **Maximum Peak Flow limitation:** 49 gpm
(City of Austin, Texas - Peak flow limitation at Capital of Texas trail entry point)
- **Minimum flow velocity:** 2 ft/s
- **Maximum flow velocity:** 10 ft/s
- **Minimum pipe cover:** 4 ft
(City of Austin, Texas – Utilities Criteria Manual, Section 2)
- **Maximum cover:** 15 ft
- **Minimum slope:** 0.335% (8-inch diameter)
(Texas Commission on Environmental Quality, Chapter 217 – Design Criteria for Domestic Wastewater Systems)

- **Pump Information:**

Type A – E-One Gator Grinder pump unit, single core

- 9 to 15 gpm at 138 to 0 feet of total head
- Utilized for all single family residential

Type B – E-One dual core pump unit

- 9 to 15 gpm at 138 to 0 feet of total head
- Utilized for non-residential with average daily flows up to 3,000 gpd
- Utilized for average daily flows up to 20,000 gpd

Add pump detail for
Myers WGL 20H as
well.

(West Lake Hills- Wastewater flow modelling and calculations, - II. Low Pressure System Pump Units)

6.2 REFERENCE MANUALS AND SOFTWARE

- City of Austin, Texas – Utilities Criteria Manual, Section 2
- City of Westlake Hills– Engineering Standards, Article 5: Wastewater Facilities
- Bentley E-ONE Grinder setup
- Sewer GEMS CONNECT Edition Update, Bentley Systems
- Autodesk Civil 3D
- ArcGIS Desktop

6.3 DESIGN ASSUMPTIONS

- Peak flow calculations were determined by applying a 4.0 multiplier to average wastewater flows for each property
- Elevations for wastewater lines without as -built drawings was assumed to have a depth of 4 feet. Ground elevations were taken from LIDAR
- E-one grinder pump design guide was followed for low pressure systems flow operations
- COA Annual Wastewater connection and flow summary spreadsheet utilized for modelling the existing wastewater collection system and to determine average and peak flow calculations
- WaterCAD Model (by KFA) was utilized for low pressure main modelling and for pump curves.
- Maximum peak flows capped at 90% pipe capacity
- Grinder pump wet wells-3 feet in diameter and 5 feet deep
- Pressure system laterals - 1.5-inch diameter HDPE pipe

7 METHODOLOGY

The hydraulic modelling software **SEWERGEMS** was used to create the existing wastewater collection system model to understand the system's existing capacity and limitations which can be utilized to forecast future demands or operational scenarios. Parameters used for the model development are included below.

Calculation method/ Equation used in software are:

- **Manning's Equation:**

$$V = \frac{k}{n} R^{2/3} S^{1/2}$$

Where,

V = mean velocity (m/s, ft/s)

k = 1.49 for U.S. customary units, 1.00 for SI units

n = Manning's roughness value

- **Hazen – Williams Equation:**

$$V = kCR^{0.63} S^{0.54}$$

Where,

V = mean velocity (m/s, ft/s)

k = 1.32 for U.S. customary units, or 0.85 for SI units

C = Hazen-Williams's roughness coefficient (unitless)

R = hydraulic radius (m, ft)

S = friction slope (m/m, ft/ft).

- **Energy Equation:**

$$\frac{p_1}{\gamma} + z_1 + \frac{V_1^2}{2g} + H_G = \frac{p_2}{\gamma} + z_2 + \frac{V_2^2}{2g} + H_L$$

Where,

p = pressure (N/m², lb/ft²)

γ = specific weight of the fluid (N/m³, lb/ft³)

z = elevation above a datum (m, ft)

V = fluid velocity (m/s, ft/s)

g = gravitational acceleration (m/s², ft/s²)

HG = head gain, such as from a pump (m, ft)

HL = combined head loss (m, ft).

E-One Extreme Flow Probability Method

The E-One Extreme Flow Probability Method was utilised for modelling grinder pumps, allowing for the estimation of extreme flows necessary for the design and analysis of the sewer system. This method predicts the maximum number of grinder pumps expected to operate simultaneously, based on the number of grinder pumps connected to the system.

The table below, provided by Bentley, provides the probability if the maximum number of pumps operating simultaneously based on the total number of grinder pump connections.

Check space

Table 3 MAXIMUM NUMBER OF GRINDER PUMP CORES OPERATING DAILY	
Number of Grinder Pump Cores Connected	Maximum Daily Number of Grinder Pump Cores Operating Simultaneously
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15
345-377	16
378-410	17
411-443	18
444-476	19
477-509	20
510-542	21
543-575	22
576-608	23
609-641	24
642-674	25
675-707	26
708-740	27
741-773	28
774-806	29
807-839	30
840-872	31
873-905	32
906-938	33
939-971	34
972-1,004	35

* Table 3, sourced from Page 14 of the Low-Pressure Sewer System using E/One Grinder Pumps Manual, has been utilized for reference, if 4 to 9 grinder pumps are connected to the system, then 3 is the maximum number of grinder pumps that are operating simultaneously.

7.1 MODELLING METHODOLOGY

- This sewer shed is low pressure system located at the northeast of Westlake Hills (WLH) that extends to the Las Altos lift station.
- The model includes a total 35 pumps, consisting of the following types:
 - E-One grinder simplex pumps- 34 pumps,
 - Myers WGL 20 H- 1 pump (201 lot- large residential development)
- Based on Bentley's E-One Extreme Flow Probability Method (reference section 7.0- Methodology) for peak conditions. 6 grinder pumps were modelled as pumping simultaneously during peak flow conditions.
- With 35 grinder pumps, the probability of a maximum of 6 grinder pumps are operating simultaneously was determined.
- A total of 35 Living Unit Equivalents (LUEs) make up this basin.

8 MODEL FLOW CALCULATIONS

The WLH system utilizes data from the Robert E. Lee Wastewater Study prepared by PBS&J for determining average flow per Living Unit Equivalent (LUE) and for diurnal curves for various land use types. The land use types utilized include residential, office, commercial, and school, each with their own diurnal curve. An average daily wastewater flow of 245 gpd per LUE is used for residential properties based on the Robert E. Lee Study. To calculate LUEs for non-residential properties WLH applies a 7/5 weekday adjustment factor, therefore the LUE conversions are as follows:

- 1 Residential LUE = 245 gpd = 7,350 gallons/month
- 1 Non-Residential LUE = 245 gpd x 5/7 = 175 gpd = 5,250 gallons/month

In determining/modelling the peak flows for each entry point to the COA system, we converted the gallons per month flows into gallons per minute for each type of sanitary connection.

TABLE 1 - WASTEWATER LOAD CALCULATIONS FOR RESIDENTIAL CONNECTIONS

Property Connection	Address	Current LUEs	Avg. Flows (gpm)	Peak Flows (gpm)
3	Hull Circle	1	0.17	0.68
2	Hull Circle	1	0.17	0.68
5	Hull Circle	1	0.17	0.68
6	Hull Circle	1	0.17	0.68
10	Hull Circle	1	0.17	0.68
11	Hull Circle	1	0.17	0.68
16	Hull Circle	1	0.17	0.68
23	Hull Circle	1	0.17	0.68
27	Hull Circle	1	0.17	0.68
20	Hull Circle	1	0.17	0.68
9	Hull Circle	1	0.17	0.68
4	Hull Circle	1	0.17	0.68
21	Hull Circle	1	0.17	0.68
22	Hull Circle	1	0.17	0.68
1	Hull Circle	1	0.17	0.68
19	Hull Circle	1	0.17	0.68
29	Hull Circle	1	0.17	0.68
18	Hull Circle	1	0.17	0.68
2	Hidden Cove	1	0.17	0.68
1	Hidden Cove	1	0.17	0.68
1603	Westlake Drive	1	0.17	0.68
1613	Westlake Drive	1	0.17	0.68
1628	Westlake Drive	1	0.17	0.68
1618	Westlake Drive	1	0.17	0.68
1611	Westlake Drive	1	0.17	0.68
1700	Westlake Drive	1	0.17	0.68
1509	Westlake Drive	1	0.17	0.68
1616	Westlake Drive	1	0.17	0.68
1506	Westlake Drive	1	0.17	0.68
1627	Westlake Drive	1	0.17	0.68
1624	Westlake Drive	1	0.17	0.68
1626	Westlake Drive	1	0.17	0.68
1615	Westlake Drive	1	0.17	0.68
1515	Harbor View	1	0.17	0.68

9. RESULTS SUMMARY

Pressurized System - As per Appendix-B, Table 1, the main gravity systems peak load analysis results show maximum velocities of **7.83 Ft/s**, respectively which is within the minimum (3 Ft/s) and maximum (10 Ft/s) limits per COA design standards.

~~System Capacity - As per Appendix-B, Table 1, Hydraulic Gradient Line (HGL) determined by invert elevation and depth of flow indicates that the maximum flows within the system do not exceed the pipe capacity at any point within the system.~~

As per Appendix-B, Table 3, the peak flow at the discharge point is recorded as **76.64 gpm**, which exceeds the agreement limitation of 49 gpm as per COA agreement.

Velocity

COA

10 CONCLUSION

Utilizing Bentley's SewerGEMS software, a model of the Hull circle area collection system was created and validated. The model was analysed for peak loading scenarios, and it was determined as current system compromising hydraulics that could not damage to the system. According to the analysis, the peak combined flow for the Hull Circle service area is 76.64 gpm, which exceeds the agreement limitation of 48 gpm. We are in process of modelling the additional from wildcat hollow extension drive. Scenarios modelling is in progress to assess the current and future potential for increasing the capacity of the system.

The model can also be utilized to develop various operational scenarios to address proposed development within the sewer shed.



City of West Lake Hills City Council

AGENDA REPORT

Meeting Date:	February 5, 2025	Item Number:	5
Department:	Building & Development Services		
Prepared By:	Jennifer C. Bills, Director of Building & Development	Cost / Budget:	n/a
Exhibits:	See Attach	Source of Funds:	Street Maintenance Fund

Subject

Receive a presentation and discuss findings and recommendations regarding completed, ongoing and proposed street and drainage projects within the City of West Lake Hills.

Recommendation

Review proposed project list and provide direction on future projects for FY25.

Discussion

In 2021, the West Lake Hills voters approved the street maintenance sales tax collection. The work proposed for this years is a mix of street repaving projects identified in the pavement condition study and street drainage improvements, identified in the [2016-2017 Drainage Master Plan](#) study. For the fiscal year 2023-2024, the projects were determined in 2023, using the studies as the starting point. The engineering team with Walter P. Moore designed the drainage improvements, the specifications for the different levels of street paving treatments and the sections of streets where the treatments would be applied.

Street Treatment Types

For street repair, there are six main treatment types to consider.

1. Full Depth Repair

- **Cost:** High
- **Length of Use:** 20-30 years
- **Time to Install:** Several weeks to months (depending on project size)
- **Description:** This involves repairing the pavement down to the base material, removing deteriorated sections, and applying new pavement. It is the most durable solution but also the most expensive and time-consuming.

2. Mill and Overlay

- **Cost:** Medium to High
- **Length of Use:** 10-15 years
- **Time to Install:** Several days
- **Description:** This process includes grinding up the existing asphalt and base material before removing and applying a new pavement layer. It is more cost-effective than full-depth repair but has a shorter lifespan.
- **Considerations:** Best used when the road base has not been damaged/compromised. For narrow streets, the lanes cannot be done one at a time, so the entire road will be closed during repair. With a new layer of asphalt, this also allows the use of “micromilling/microgrooving” of sections with steep slopes or curves to add traction to these areas.

3. Concrete Repair

- **Cost:** Medium to High
- **Length of Use:** 15-25 years
- **Time to Install:** Several weeks
- **Description:** This involves replacing sections of concrete in areas subjected to heavy loads or for streets with extreme slope. It provides long-lasting durability but requires more time and expense than asphalt treatments.
- **Considerations:** Typically used at high volume intersections where there will be a lot of vehicle stopping or standing.

4. Surface Preservation (chip seal or liquid seal coat)

- **Cost:** Low to Medium
- **Length of Use:** 5-10 years
- **Time to Install:** A few days to a week
- **Description:** Asphalt overlay or seal coat is applied as a thin protective layer, including asphalt emulsion, to extend pavement life. It is a cost-effective maintenance option but does not offer structural reinforcement.
- **Considerations:**
 - Chip seal is applying a coat of oil/tar to the existing pavement and placing gravel onto the surface. While the application process is relatively, quick, there is a period of time while the gravel adheres that vehicles can track the tar and the gravel is loose. Additionally, on roads with bar ditches, the excess gravel will migrate into the ditch.
 - Liquid seal coat is an application that, after doing crack sealing, a thin layer of an asphalt emulsion is sprayed onto the surface. This is best applied when the temperatures are over 85 degrees, or higher for very shaded streets, for the shortest drying time. This process requires two coats, so at minimum each street must be closed for two days during application.

5. Crack Seal

- **Cost:** Low
- **Length of Use:** 3-5 years
- **Time to Install:** A few hours to a day
- **Description:** Adhesive sealant is placed into pavement cracks to prevent moisture infiltration and slow deterioration. It is a quick, inexpensive preventative measure.
- **Considerations:** This is used on a road in good condition to keep it from deteriorating. Any cracks in the pavement allow water infiltration that damages the asphalt and will long term damage the road base.

6. Drainage/Curbs

- **Cost:** Medium
- **Length of Use:** 10-20 years
- **Time to Install:** Several days to weeks
- **Description:** This involves grading, fixing inlets and adding concrete curbs (ribbon or stand up) to manage water flow and prevent pavement degradation. It enhances roadway longevity but does not directly improve surface integrity.
- **Considerations:** For very narrow roads, or at curves, ribbon curbs provide stability on the edge of the pavement to keep the street from “unraveling” overtime due to driving street or edge drainage. In some locations, drainage improvements, either swales/ditches or curb/gutter may be appropriate when the drainage is creating unsafe driving conditions or causing damage to the street surface/base.

With all these considerations, the choice of treatment should be based on budget, expected lifespan, traffic volume, and the urgency of repairs.

FY24 Projects

Work began on the FY24 projects in October 2024 and is 50% complete. For this cycle, the projects included the street pavement treatments of crack seal, surface preservation (liquid seal coat), mill & overlay and sections of full depth repair (potholes) (Attachment 2). Other work included adding ribbon curbs at select locations, drainage improvements, and limited curb repair/replacement. All crack seal, drainage and full depth repairs have been completed, and the mill & overlay is currently underway, with completion tentatively scheduled for February 2025 (Attachment 1). For the liquid seal coat, the contractors did the first coat (of two) on November 12, but due to the temperature and the shaded nature of the streets, there were concerns about the drying time needed for the best outcome. The second coat on Live Oak Ridge and the two coat treatment for Madrone Rd, Parkwood Ct. and Rocky River Cv. are tentatively scheduled for March 2025.

FY25 Proposed Projects

Staff and consultants with Walter P. Moore have created the proposed list for the FY25 Proposed Projects (Attachment 3 & 4). With these projects, staff are recommending crack sealing and mill & overlay as the only surface treatments used, due to the concerns with seal coat listed above. The list also includes some ribbon curb and micromilling in select locations. Due to the weather delays and temperature issues experienced this year, staff is recommending future road work to be scheduled between the beginning of June to end of August.

The drainage project on North Peak was previously included in the FY24 projects but was pulled for additional study. The project scope included putting in a swale (ditch) with a concrete flume on the east side of the road, to drain ponding water from the west side, as well as keep the street drainage from running down the driveways on the east side. Both sides of the right-of-way have private improvement (planters, landscaping, parking pads), so staff and engineering are looking at other options. The surveyors have provided additional information regarding underground utilities under pavements on the street.

The preliminary options in order of escalating cost:

- No drainage, only mill & overlay street
- Add drainage feature to the west side of the road to address ponding (would not address street drainage going to driveways)
- Keep project as designed
- Place underground storm sewer under the street

Next Steps

City Council to approve a task order for design of projects.

Attachments

Attachment 1 – FY24 Project List

Attachment 2 – FY24 Project Map

Attachment 3 – FY25 Proposed Project List

Attachment 4 – FY25 Proposed Project Map

Other Information

[2021 Street Maintenance Sales Tax Website](#)

[2016 - 2017 Drainage Master Plan](#)

FY24 STREET MAINTENANCE PROJECTS				
	STREET NAME	LIMITS (FROM - TO)	REHABILITATION	STATUS
	CANYON CREEK	BASIN LDG - END	CS	COMPLETED
	CIRCLE RIDGE DR	LITTLE BEND RD - REDBUD TRL	CS	COMPLETED
	CORTONA CV	CORTONA DR - END	CS	COMPLETED
	CORTONA DR	CARRARA - END	CS	COMPLETED
	LITTLE BEND RD	REDBUD TRL - CIRCLE RIDGE DR	CS	COMPLETED
	MC CONNELL DR	BEE CAVE RD - END	CS	COMPLETED
	SKYLINE DR	NOB HILL CIR - WESTLAKE DR	CS	COMPLETED
	WEST SPRING DR	MC CONNELL - WESTLAKE DR	CS	COMPLETED
	BENT TREE CT	HILLCREST CT - END	M&O, CURB, & DRAINAGE	DRAINAGE COMPLETED, TENT. FEB. 2025
	WESTLAKE DRIVE	SKYLINE DR - CITY LIMIT (BRIDGE)	M&O, CS, MICROGROOVE	M&O COMPLETED
	HARBOR VIEW DR	WILDCAT HOLLOW - END	M&O + RIBBON CURB (1/2 st)	RIBBON CURB COMPLETE, M&O TENT. FEB. 2025
	BASIN LEDGE E	BASIN LEDGE - END	M&O + RIBBON CURB (1/2 st)	RIBBON CURB COMPLETED, M&O TENT. FEB. 2025
	ALLEGRO LN	YAUPON VALLEY - END	M&O + RIBBON CURB	RIBBON CURB COMPLETED, M&O TENT. FEB. 2025
	OLD STONEHEDGE	REDBUD TRL - BUTLER CV	M&O	TENT. FEB. 2025
	CEDAR PARK DR	OAK RIDGE DR - FOREST VIEW DR	M&O	TENT. FEB. 2025
	CANYON VIEW	TERRACE MTN - END	M&O	TENT. FEB. 2025
	ROCKY RIVER ROAD	REVEILLE RD - END	M&O	TENT. FEB. 2025
	BUTLER CV	OLD STONEHEDGE - END	M&O	TENT. FEB. 2025
	HULL CIR	WESTLAKE DR - WESTLAKE DR	M&O	TENT. FEB. 2025
	SUGAR CREEK DR	GENTRY DR - END	M&O	TENT. FEB. 2025
	LOMA LINDA	TERRACE MTN - END	M&O	TENT. FEB. 2025
	LIVE OAK RIDGE RD	REDBUD TRL - LIVE OAK CIRCLE	LIQUID ROAD	1 COAT COMPLETED, MARCH 2025
	MADRONE RD	YAUPON VALLEY - END	LIQUID ROAD	MARCH 2025
	PARKWOOD CT	LAS LOMAS DR - END	LIQUID ROAD	MARCH 2025
	ROCKY RIVER CV	ROCKY RIVER RD - END	LIQUID ROAD	MARCH 2025
DRAINAGE ONLY				
	LAS LOMAS & ROLLINGWOOD DR	WESTBANK MARKET - ROLLINGWOOD DR & LAS LOMAS INTERSECTION		COMPLETED

CS = CRACK SEAL

M&O = MILL & OVERLAY



WELCOME

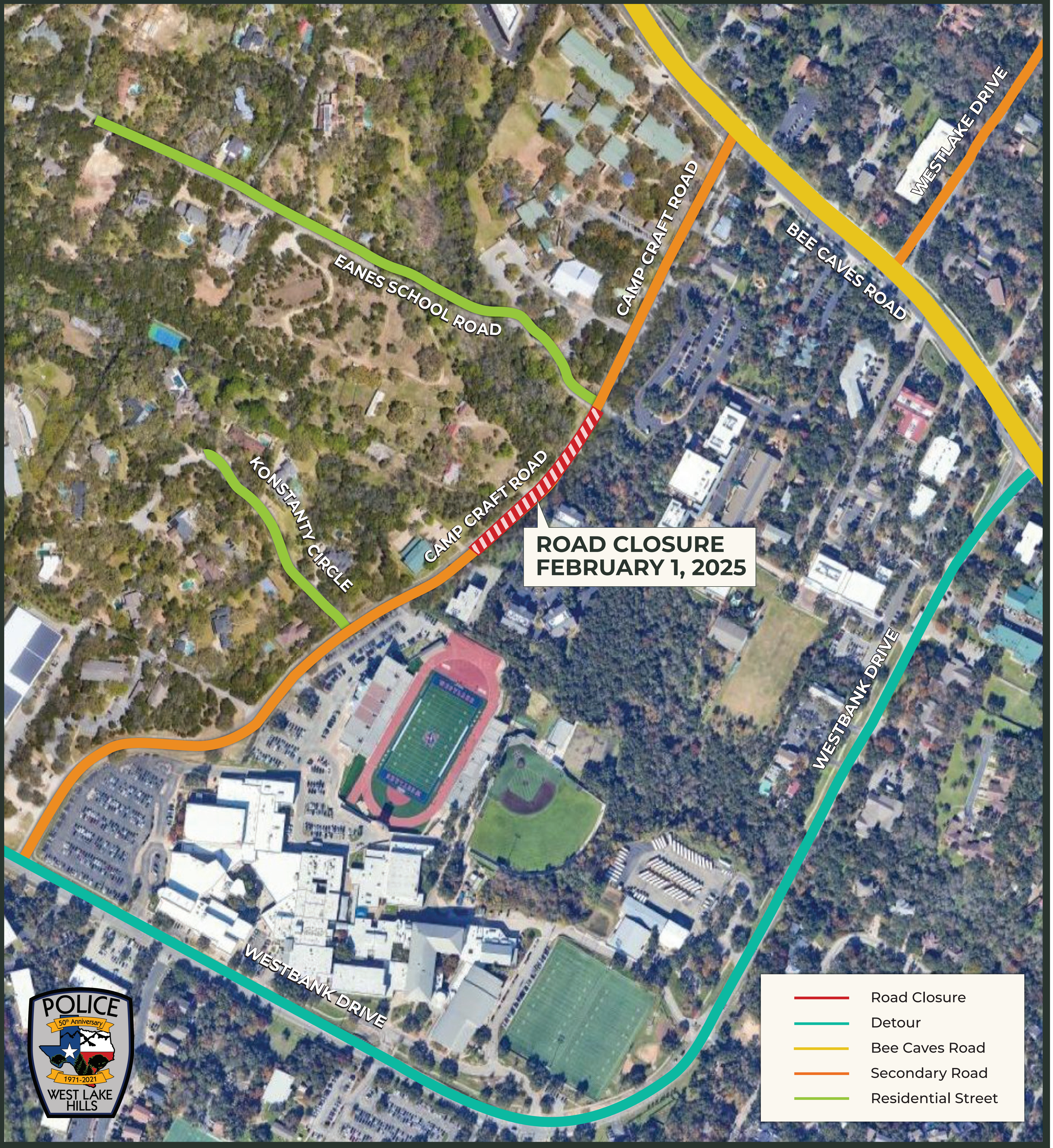
OPEN HOUSE

WEST LAKE HILLS
JANUARY 9, 2025





CAMP CRAFT ROAD CLOSURE



CONTACT US

 bonds@westlakehills.gov  (512) 327-3628





CURRENT ROADWAY PROJECT MAP



1 EANES CREEK/CAMP CRAFT ROAD

- Eanes School Road completion date: January 25, 2025
- Camp Craft Road completion date: July 31, 2025

2 WESTLAKE DRIVE

- Completed 2024

3 LAUREL VALLEY ROAD

- Completed 2024

4 YAUPON VALLEY ROAD

- Completed 2024

5 REDBUD TRAIL

- Completed 2024





WEST LAKE HILLS BOND PACKAGE

Proposition B, approved by voters on the November 2, 2021 ballot, allocates **\$11.8 million** to fund essential roadway repairs and drainage improvements for the following areas:

2 WESTLAKE DRIVE

Replacement of the Little Bee Creek crossing at Westlake Drive with larger culverts, including 645 feet of ditch improvements along Laurel Valley Road to the west, 1,335 feet of ditch improvements along Westlake Drive, and 450 feet of ditch improvements along Redbud Trail, both east and west of Westlake Drive.

4 YAUPON VALLEY ROAD

Various drainage ditch improvements on the western end of Yaupon Valley Road, including the installation of culverts and reinforced concrete pipes from Juniper Road to Madrone Road.

1 EANES CREEK/CAMP CRAFT ROAD

Replacement of Eanes Creek crossings at Camp Craft Road and Eanes School Road with improved culverts; raising Camp Craft Road by approximately 9 feet and Eanes School Road by approximately 2 feet.

3 LAUREL VALLEY ROAD

Replacement of four culvert sites from Westlake Drive west to Yaupon Valley at two intersecting points: Ledgeway and a tributary of Little Bee Creek. Little Bee Creek crosses Laurel Valley at three locations, while the tributary to Little Bee Creek crosses at another. The project also includes 840 feet of ditch improvements from Double Fork Road to Ledgeway.

5 REDBUD TRAIL

6,500 feet of drainage ditch improvements, replacement of two culverts, and construction of a retaining wall along the northern right-of-way to grade the ditch. This also includes securing a 25-foot drainage easement from the proposed cross culvert to Little Bee Creek.

The road and drainage projects were designed by an engineering firm under a contract with the City, utilizing a 2017 city-wide drainage study. This study applied a weighted ranking system that prioritized high risks to public safety, infrastructure damage, and recurring high maintenance costs.

The road and drainage studies were updated in 2018, leading the City's engineering firm to develop a comprehensive multi-year plan based on current roadway conditions and vehicular traffic volumes.



CAMP CRAFT ROAD PROJECT

These upgrades are designed to provide safer and more reliable road conditions for the community, particularly during heavy rainfall events.

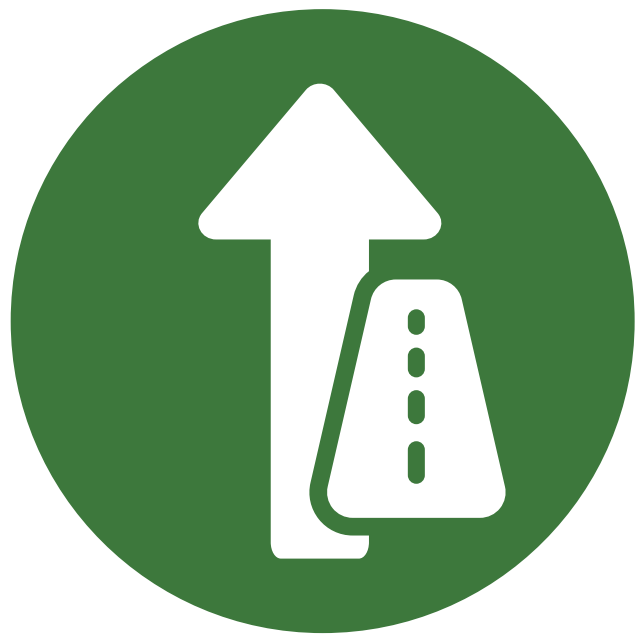
IMPROVEMENTS INCLUDE:



Replacement of Eanes Creek crossings at both Camp Craft Road and Eanes School Road



Improve drainage to reduce flood risks by relocating waterlines and installing future wastewater lines



Camp Craft Road will be raised by approximately 9 feet
Eanes School Road will be elevated by about 2 feet



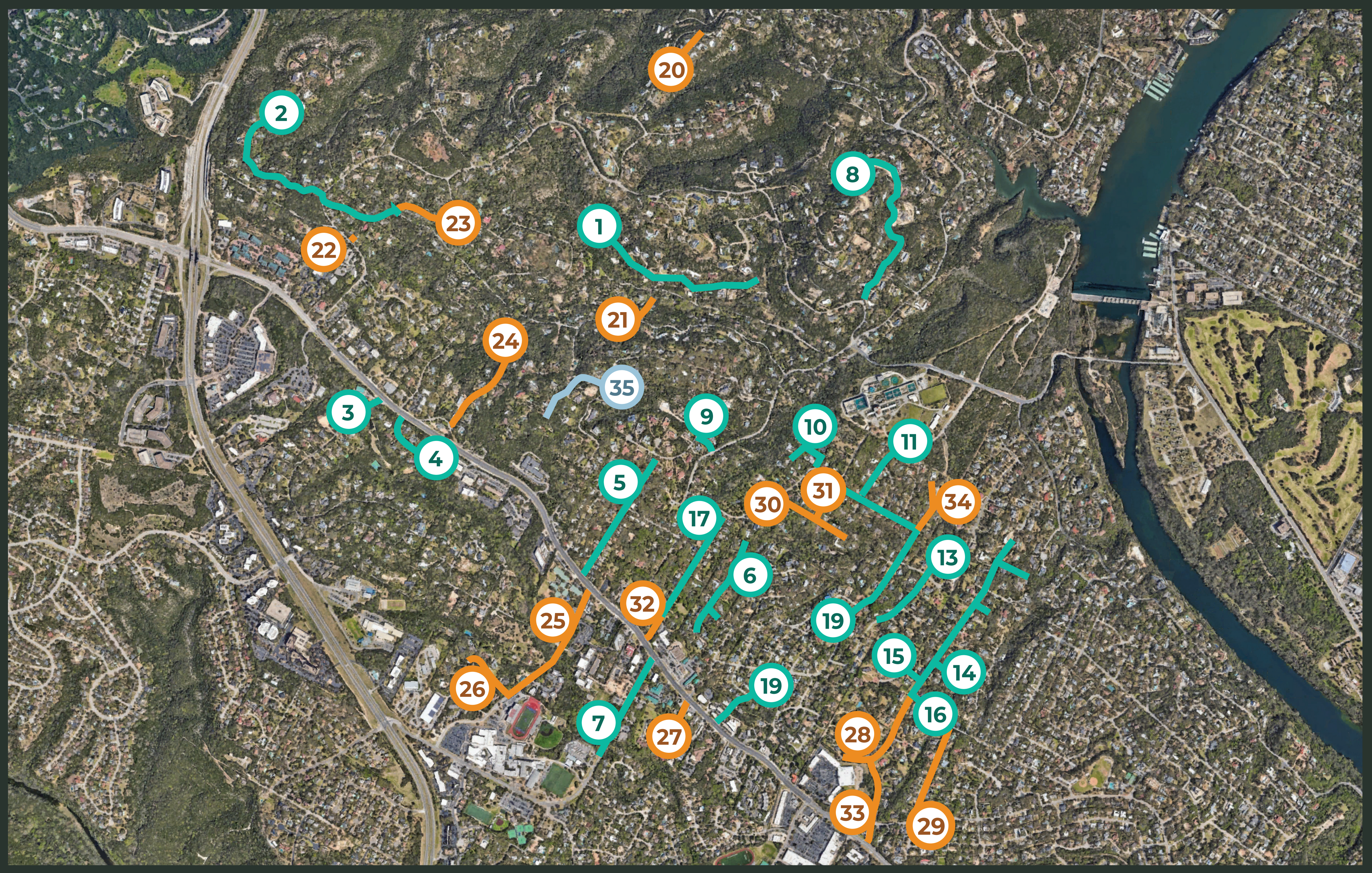
Repaving of Camp Craft Road and Eanes School Road

Preconstruction work on the road will begin in January, and the road will be closed Feb. 1. The road is expected to reopen no later than July 31.





STREET MAINTENANCE PROJECTS 2025



CRACK SEAL

- 1 LEDGEWAY E
END - END
- 2 YAUPON VALLEY RD
DOUBLE BEND BACK RD - END
- 3 SUNDOWN PKWY
BEE CAVES RD - CITY LIMIT
- 4 WOOD TRL
BEE CAVES RD - END
- 5 WESTHAVEN DR
BEE CAVES RD - END
- 6 LAS BRISAS DR
- 7 WESTBANK DR
BEE CAVES RD - CITY LIMITS
- 8 WILD CAT HOLLOW
RED BUD TRL - END
- 9 CARRARA
CORTONA DR - WESTLAKE
- 10 ROCKY RIVER CV
ROCKY RIVER RD - END
- 11 FOREST VIEW DR
OAK RIDGE DR - CITY LIMIT
- 12 OAK RIDGE DR

- 13 BULIAN LN
CITY LIMITS - END
- 14 MANOR RIDGE CT
- 15 HILLCREST CT
- 16 WOODVIEW CT
- 17 REVEILLE RD
BEE CAVES RD - ROCKY RIVER RD
- 18 LAS LOMAS DR
ROLLINGWOOD DR - TBD
- 19 WESTBROOK DR.
BEE CAVES DR - END

MILL AND OVERLAY

- 20 CALITHEA RD
TERRACE MOUNTAIN DR - END
- 21 DOUBLE FORK RD
265 FEET AT SOUTHWEST END
- 22 WASHINGTON CUTOFF
REDBUD TRL - YAUPON VALLEY RD
- 23 DOUBLE BEND BACK RD
YAUPON VALLEY RD - END
- 24 SWIFTCURRENT TRL
BEE CAVES RD - END

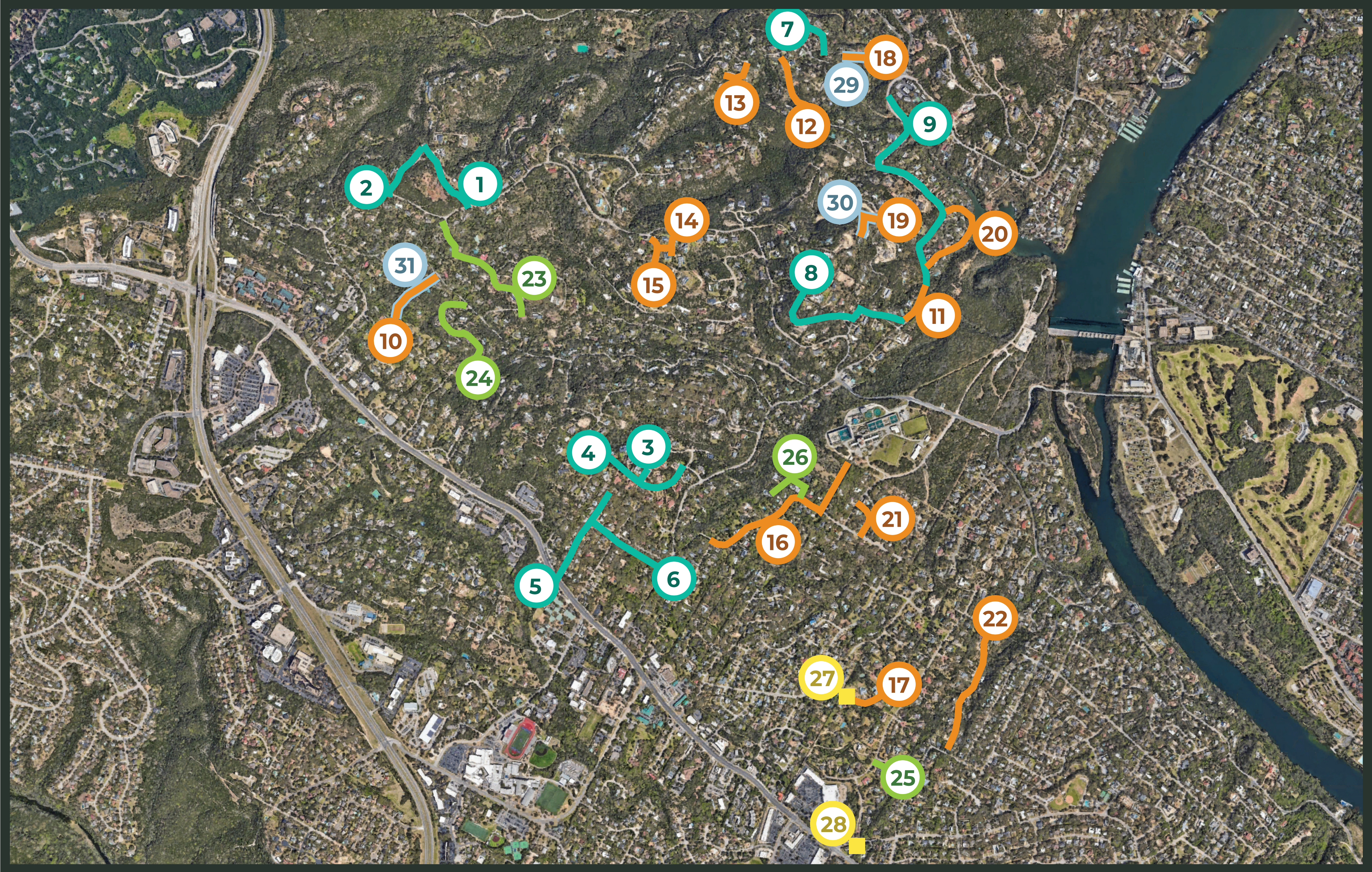
- 25 CAMP CRAFT RD
BEE CAVES RD - KONSTANTY CIR
- 26 KONSTANTY CIR
CAMP CRAFT RD - END
- 27 BEAVER TRL
BEE CAVES RD - R910
- 28 LAS LOMAS CT
ROLLINGWOOD DR - END
- 29 NORTH PEAK RD
ROLLINGWOOD DR - GENTRY
- 30 ROCKY LEDGE RD
ROCKY RIVER RD - END
- 31 BUENA VISTA CIR:
ROCKY LEDGE RD - END
- 32 REVEILLE RD
BEE CAVES RD - ROCKY RIVER RD
- 33 LAS LOMAS DR
ROLLINGWOOD DR - TBD
- 34 WESTBROOK DR.
BEE CAVES DR - END

RIBBON CURB

- 35 SPILLER LN
BUCKEYE TRL - R406



STREET MAINTENANCE PROJECTS 2024



CRACK SEAL

- 1 CIRCLE RIDGE DR:
LITTLE BEND RD - REDBUD TRL
- 2 LITTLE BEND RD:
RED BUD TRL - CIRCLE RIDGE DR
- 3 CORTONA CV:
CORTONA DR - END
- 4 CORTONA DR:
CARRARA - END
- 5 MCCONNELL DR:
BEE CAVE RD - END
- 6 W SPRING DR:
MCCONNELL DR - WESTLAKE DR
- 7 CANYON CREEK:
BASIN LEDGE - END
- 8 SKYLINE DR:
REDBUD TRAIL - NOB HILL CIR
- 9 WESTLAKE DR:
HARBOR VIEW DR - CITY LIMIT (BRIDGE)

MILL AND OVERLAY

- 10 ALLEGRO LN:
YAUPON VALLEY-END
- 11 WESTLAKE DR:
HARBOR VIEW DR - CITY LIMIT (BRIDGE)

- 12 LOMA LINDA:
TERRACE MTN - END
- 13 CANYON VIEW:
TERRACE MTN - END
- 14 BUTLER CV:
OLD STONEHEDGE - END
- 15 OLD STONEHEDGE:
REDBUD TR - LIMERICK LN
- 16 ROCKY RIVER RD:
REVEILLE RD - END
- 17 BENT TREE:
HILLCREST CT - END
- 18 BASIN LEDGE E:
BASIN LEDGE - END
- 19 HARBOR VIEW DR:
WILDCAT HOLLOW - END
- 20 HULL CIRCLE:
WESTLAKE DR - END
- 21 CEDAR PARK DR:
FOREST VIEW DR -
OAK RIDGE DR
- 22 SUGAR CREEK DR:
GENTRY DR - END

SURFACE PRESERVATION

- 23 LIVE OAK RIDGE RD:
RED BUD TRL - LIVE OAK CIRCLE
- 24 MADRONE RD:
YAUPON VALLEY RD - END
- 25 PARKWOOD CT:
LAS LOHMAS DR - END
- 26 ROCKY RIVER CV:
ROCKY RIVER - END

DRAINAGE IMPROVEMENT

- 27 BENT TREE:
HILLCREST CT - END
- 28 ROLLINGWOOD DR & LAS LOMAS
DRAINAGE IMPROVEMENT

RIBBON CURB

- 29 BASIN LEDGE E:
BASIN LEDGE - END
- 30 HARBOR VIEW DR:
WILDCAT HOLLOW - END
- 31 ALLEGRO LN:
YAUPON VALLEY-END



CAMP CRAFT ROAD

History and current conditions of Camp Craft Road:

The Drainage Master Planning process, initiated in 2015, identified this project as the city's top priority due to critical safety issues, recurring maintenance needs, and restricted access caused by roadway flooding.

If left in its current state, the city would face significant challenges, including the temporary closure of the road for repairs, such as replacing the undersized culverts and repaving. However, these measures would not address the core drainage problems, meaning periodic road closures due to flooding would persist.

Additionally, moderate rainfall events would continue to render the road impassable, further underscoring the need for a comprehensive solution. Reconstruction work is also necessary to restore the road to its condition before the partial demolition earlier this year.

Solutions and Benefits:

By moving the project forward, the roadway will be raised approximately 9 feet, significantly reducing the frequency of water overtopping the road. This enhancement will greatly improve safety, ensure better connectivity for schools, residents, and commercial properties, and lower long-term maintenance costs by addressing roadway degradation.

The construction includes durable drainage infrastructure with an expected lifespan of at least 25 years, minimizing future replacement needs. Additionally, the road is projected to remain free of repaving requirements for at least 10 years, ensuring lasting improvements to the area's infrastructure and accessibility.





CAMP CRAFT ROAD

Feasibility of Accelerated Construction:

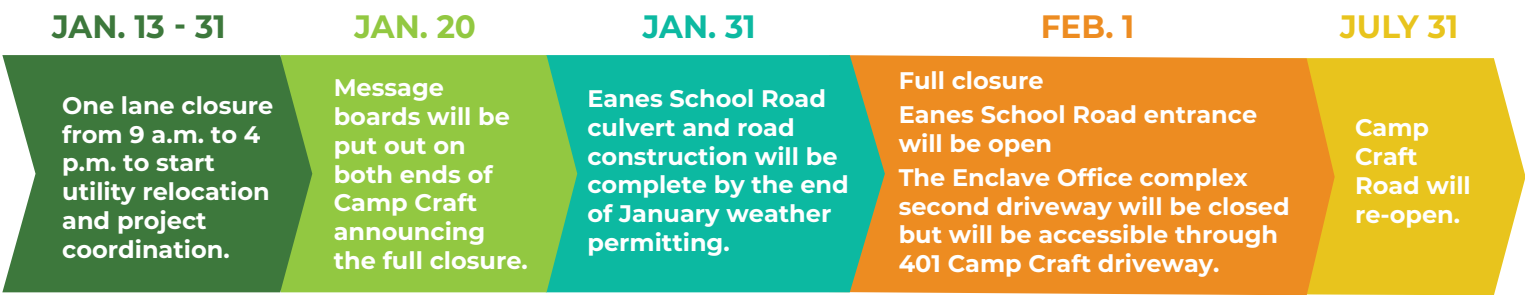
Could the project be completed over the summer using 24-hour shifts?

Staff, engineering consultants, and the contractor evaluated this option but found it unfeasible. The limited work area, the time required for materials to cure between steps, and the logistical challenges of material delivery outside standard hours would prevent the project from being completed within the summer time frame.

Could the project be split into two summer phases?

Dividing the project into two phases was also deemed impractical. The scope of work, including water line relocation, soil compaction, culvert installation, and road construction, does not allow for a natural halfway point where the road could safely reopen for the intervening 8 months. While minor work could be completed in 2–4 weeks, remobilizing the following summer would negate most of the time savings.

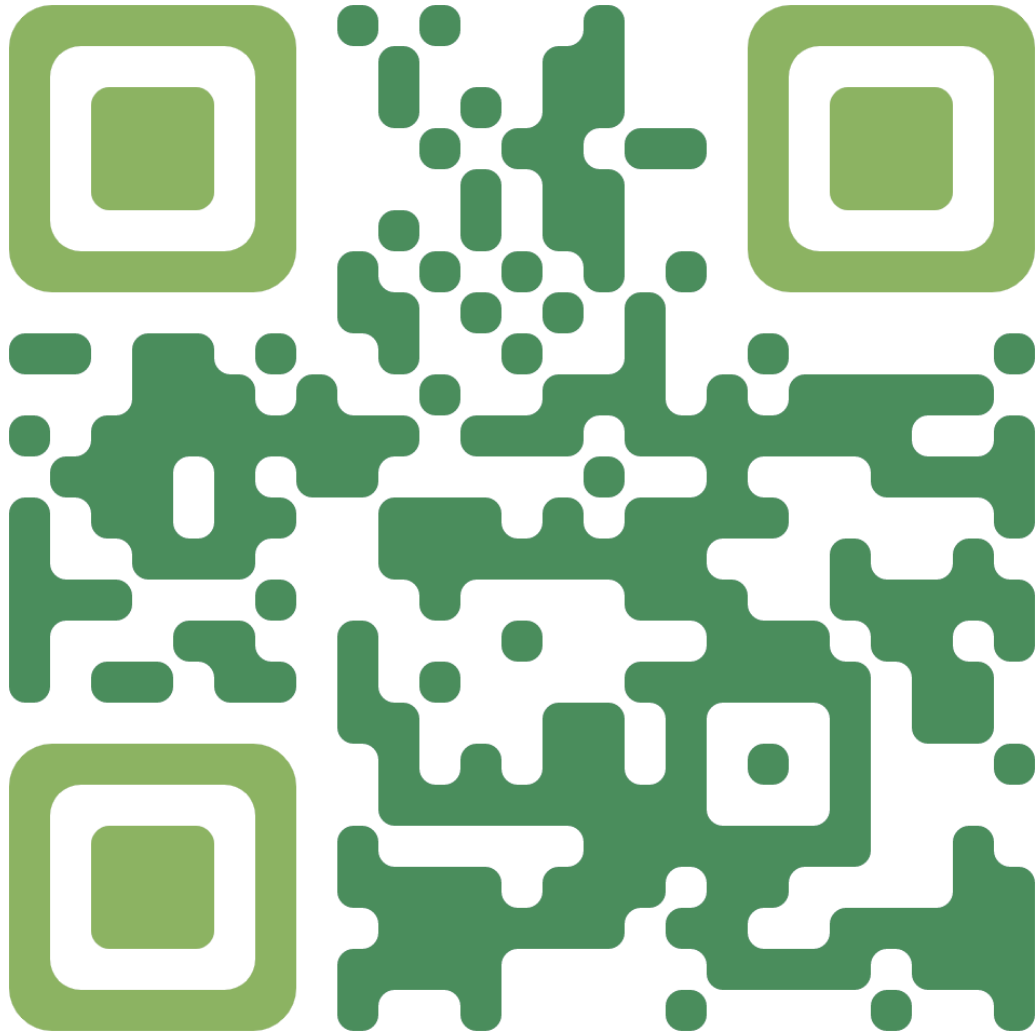
What to Expect Moving Forward:



Contact for project info will remain bonds@westlakehills.gov and city hall main line 512-327-3628

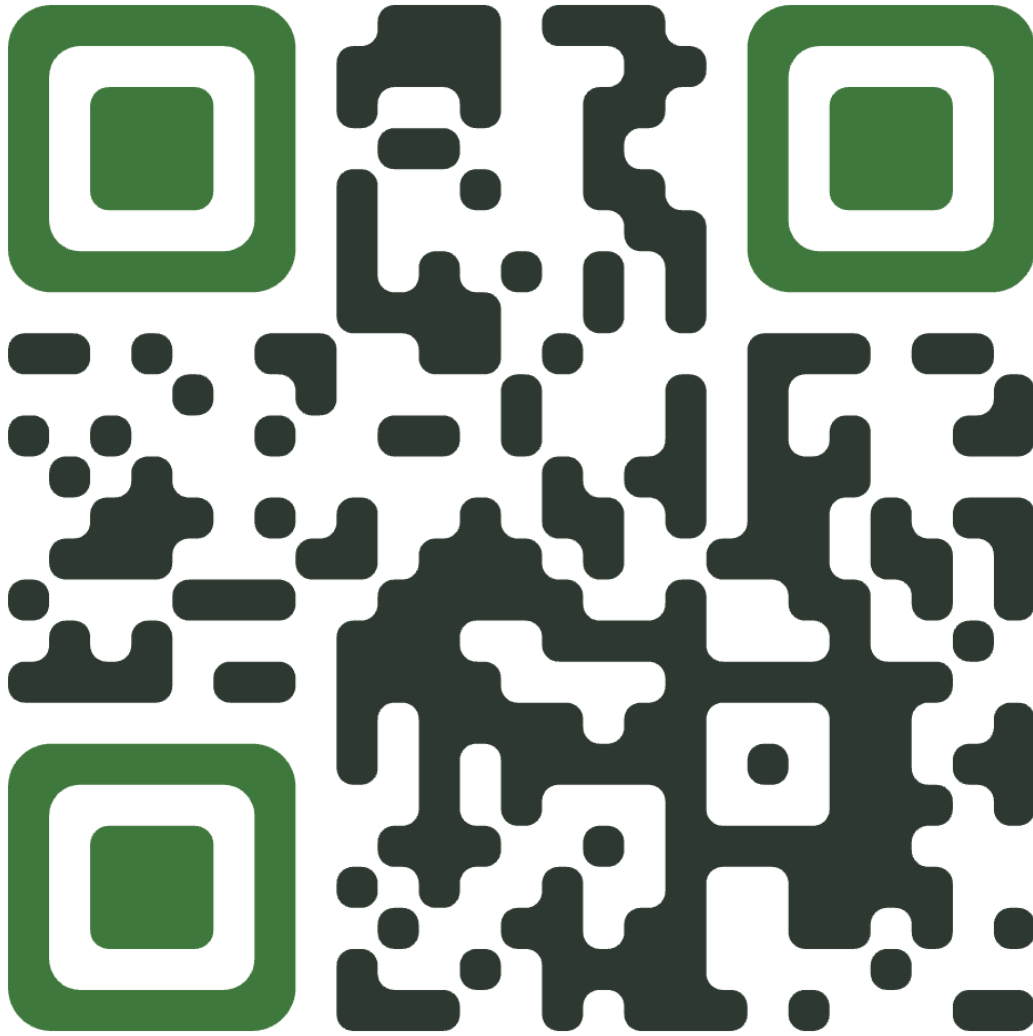


SIGN UP FOR PROJECT UPDATES





OPEN HOUSE INFORMATION



FY25 WLH STREET REHABILITATIONS & DRAINAGE IMPROVEMENTS

	STREET NAME	LIMITS (FROM - TO)	REHABILITATION	AREA (SY)	ESTIMATED COST
1	WILD CAT HOLLOW	SKYLINE DR - END	CS	5778	\$ 6,413.33
2	CARRARA	CORTONA DR - WESTLAKE DR	CS	703	\$ 780.08
3	LAS BRISAS ST	END - END	CS	4833	\$ 5,365.00
4	OAK RIDGE DR	ROCKY RIVER RD - WESTBROOK DR	CS	3927	\$ 4,358.60
5	REVEILLE RD	BEE CAVE RD - 310' FROM BEE CAVE RD	M&O + P1	758	\$ 18,792.89
5	REVEILLE RD	310' FROM BEE CAVE RD - END	CS	4591	\$ 5,095.64
6	FOREST VIEW DR	OAK RIDGE DR - CITY LIMIT	CS	2933	\$ 3,256.00
7	WOOD TRL	BEE CAVE RD - END	CS	1380	\$ 1,531.80
8	SUNDOWN PKWY	BEE CAVE RD - CITY LIMITS (4 SECTIONS)	CS	1227	\$ 1,361.60
9	WOODVIEW CT	LAS LOMAS DR - END	CS	311	\$ 345.33
10	MANOR RIDGE CT	LAS LOMAS DR - END	CS	187	\$ 207.20
11	CRESTWOOD CT	LAS LOMAS DR - END	CS	124	\$ 138.13
12	RIDGEMONT CT	LAS LOMAS DR - END	CS	202	\$ 224.47
13	HILLCREST CT	LAS LOMAS DR - END	CS	1742	\$ 1,933.87
14	WESTBANK DR	BEE CAVE RD - CITY LIMITS	CS	5000	\$ 5,550.00
15	YAUPON VALLEY RD	DOUBLE BEND BACK RD - W. END	CS	8111	\$ 9,003.33
16	WESTHAVEN DR	BEE CAVE RD - END	CS	4560	\$ 5,061.60
17	LEDGEWAY E	END - END	CS	560	\$ 4,301.60
18	LEDGEWAY W	LEDGEWAY - END	CS	3111	\$ 23,897.78
19	LEDGEWAY	LAUREL VALLEY RD - LEDGWAY E / LEDGEWAY W	CS	342	\$ 2,628.76
20	BULIAN LN	CITY LIMITS - END	CS	2430	\$ 2,697.30
21	LAS LOMAS DR	ROLLINGWOOD - LAS LOMAS CT	M&O + P1	2239	\$ 55,524.44
21	LAS LOMAS DR	LAS LOMAS CT - WOODVIEW CT	M&O	3178	\$ 75,631.11
21	LAS LOMAS DR	WOODVIEW CT - END	CS	7000	\$ 7,770.00
22	WESTBROOK DR	BEE CAVE RD - R103	CS	1618	\$ 1,795.73
22	WESTBROOK DR	R614 - OAK RIDGE DR	CS	4622	\$ 5,130.67
22	WESTBROOK DR	OAK RIDGE DR - END	M&O	1921	\$ 45,722.44
23	* NORTH PEAK RD	ROLLINGWOOD DR - GENTRY	M&O	3420	\$ 81,392.03
24	WASHINGTON CUTOFF	REDBUD TRL - YAUPON VALLEY RD	M&O	67	\$ 1,586.67
25	CAMP CRAFT RD	BEE CAVE RD - KONSTANTY CIR	M&O	4333	\$ 103,133.33
26	LAS LOMAS CT	ROLLINGWOOD DR - END	M&O	1444	\$ 34,377.78
27	BEAVER TRL	BEE CAVE RD - R910	M&O + P1	778	\$ 19,288.89
28	BUENA VISTA CIR	ROCKY LEDGE RD - END	M&O + P1	767	\$ 19,013.33
29	ROCKY LEDGE RD	ROCKY LEDGE RD - END	M&O + P1	2080	\$ 51,584.00
30	KONSTANTY CIR	CAMP CRAFT RD - END	M&O + P1	2667	\$ 66,133.33
32	DOUBLE FORK RD	SOUTHWEST END OF ROAD - 265' FROM S.W. END	M&O + P1	412	\$ 10,223.11
32	DOUBLE FORK RD	LAUREL VALLEY RD - S.E. END	CS	824	\$ 915.13
33	DOUBLE BEND BACK RD	YAUPON VALLEY RD - END	M&O + P2 + RIBBON CURB	1107	\$ 35,929.78
34	OLD BEE CAVE RD	BEE CAVE RD - SWIFTCURRENT TRL	CS	1320	\$ 1,465.20
35	SWIFTCURRENT TRL	OLD BEE CAVE RD - END	M&O + MICROGROOVE	3820	\$ 94,736.00
36	CALITHEA RD	TERRACE MOUNTAIN DR - END	M&O + MICROGROOVE	731	\$ 22,936.00
37	SPILLER LN	BUCKEYE TRL - R406	CS + RIBBON CURB	1571	\$ 10,324.44

(R = RESIDENCE)

TOTAL STREET REHABILITATION COST \$ 847,600

TOTAL STREET REHABILITATION COST + 30% CONTINGENCY \$ 1,101,900

CS = CRACK SEAL
M&O = MILL & OVERLAY
P = PATCH, # OF PATCHES

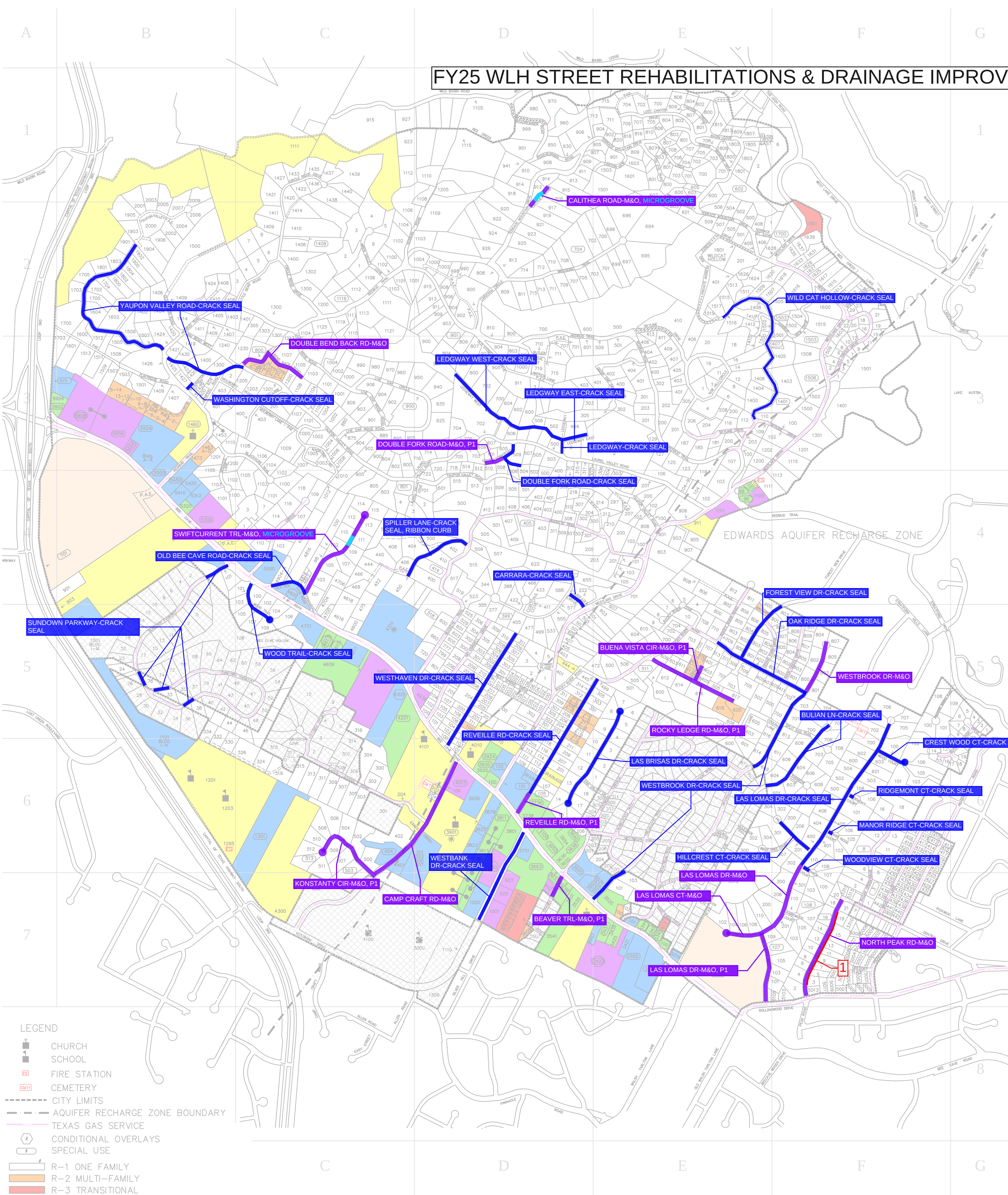
Preliminary Draft

1) 30% CONTINGENCY ACCOUNTS FOR MOBILIZATION COST & MISCELLANEOUS ITEMS (ESC, MOBILIZATION, CLEARING & GRUBBING, TRAFFIC STRIPING/REFLECTORS, MANHOLE/SPEEDBUMP/MAILBOX/STRUCTURE ADJUSTMENTS, ETC.)

2) * (ASTERIK) INDICATES STREETS WITH BOTH: STREET REHABILITATIONS AND DRAINAGE IMPROVEMENTS

FY25 WLH STREET REHABILITATIONS & DRAINAGE IMPROVEMENTS

- CRACK SEAL
- MILL & OVERLAY
- MICROGROOVE (FRICTION)
- DRAINAGE



- LEGEND
- CHURCH
 - SCHOOL
 - FIRE STATION
 - CEMETERY
 - CITY LIMITS
 - AQUIFER RECHARGE ZONE BOUNDARY
 - TEXAS GAS SERVICE
 - CONDITIONAL OVERLAYS
 - SPECIAL USE
 - R-1 ONE FAMILY
 - R-2 MULTI-FAMILY
 - R-3 TRANSITIONAL
 - O OFFICE
 - B-1 BUSINESS 1
 - B-2 BUSINESS 2
 - B-3 BUSINESS 3
 - GUI GOVERNMENT, UTILITY, INSTITUTIONAL
 - PDD PLANNED DEVELOPMENT DISTRICT
 - P.A.E. PRIVATE ACCESS EASEMENT
 - NOT A THROUGH ROAD
 - EXTRATERRITORIAL JURISDICTION
 - UNIFIED DEVELOPMENT AGREEMENT
 - UNPAVED ROAD

NOTE: EDWARDS AQUIFER RECHARGE ZONE BOUNDARY AS DEPICTED HEREON WAS DERIVED FROM 1"=200' SCALE MAPS PROVIDED BY THE TEXAS NATURAL RESOURCES CONSERVATION COMMISSION, AND SHOULD BE CONSIDERED APPROXIMATE ONLY. THE ACCURACY OF THE BOUNDARY DEPICTED ON TRIMAP MAPS VERSUS THE DEPICTION HEREON IS ESTIMATED TO BE PLUS OR MINUS 250 FEET.

THIS PRODUCT IS FOR INFORMATIONAL PURPOSES AND MAY NOT HAVE BEEN PREPARED FOR OR BE SUITABLE FOR LEGAL ENGINEERING, OR SURVEYING PURPOSES. IT DOES NOT REPRESENT AN ON-THE-GROUND SURVEY AND REPRESENTS ONLY THE APPROXIMATE RELATIVE LOCATION OF PROPERTY BOUNDARIES.

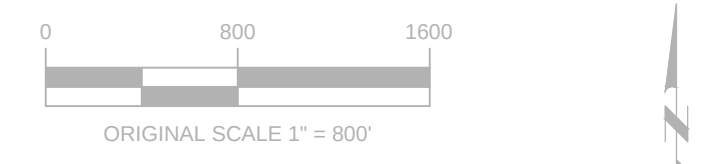
BAKER-AICKLEN & ASSOCIATES, INC.
Engineers • Surveyors • GIS • Planning
507 WEST LIBERTY AVENUE
ROUNDTOP, TX 79664
(512) 244-9520

City of West Lake Hills Street Index

Street Name	WLH Grid
Allegro Lane	C3
Basin Ledge	E1
Basin Ledge East (2 & 6)	E1
Beaver Trail (910 Only)	D7
Bee Cave Road (3300-6000)	A3,B3,B4,C4,C5,D6,D7,E7
Bent Tree Court	E6,F6
Big Bend	B3
Blackacre Trail (PAE)	B3,C3,C4
Blue Ridge Trail (100,101,200)	E6,E7
Bluff Park Circle	C4
Brady Lane (412-442)	F6,F7
Buckeye Trail	C5,D5,D4,E4
Buena Vista Circle	E5
Bullian Lane (601 & Up)	E7,E6,F6,F5
Butler Cove	D3
Calithea Road	D1,D2
Camp Craft Road	C7,C6,D6
Canyon Creek	E1
Canyon View	E1
Capital of Tx Hwy (515-1301)	B1,B2,A1,A3,A4,A5,B5,B6,B7,C7
Caravan Circle	D2
Carrara	D4,D5
Cedar Oak Drive (PAE)	E3
Cedar Park Drive	E5,F5
Circle Ridge Drive	C1,C2
Coquina Lane (PAE)	E6,E5,F5
Cortona Cove	D4,D5
Cortona Drive	D4,D5
Crest Wood Court	F6
Doe Trail (3612 & up PAE)	D7
Double Bend Back Road	C3
Double Fork Road	D3
Downie Place (PAE)	D5
Eanes School Road (317 & up PAE & exclude 301)	C6
Flintridge Road (1507 & up PAE)	A2,B2,B3
Forest View Drive (701-903)	E5,F5
Gentry Drive (3303, 3313, & 3315)	F7
Gregory Place	F7
Harbor View Drive	E3,E2,F2,F3
Hidden Cove (PAE)	F2
Hillcrest Court	F6
Hull Circle Drive	F3,F2
Jeffery Place	F7
Juniper Road	B3
Kennan Road (1106 & up PAE)	C2,D2
Konstantly Circle	C7,C6
Las Brisas Drive	D6,E6,E5
Las Lomas Court	E7
Las Lomas Drive	E7,F7,F6,F5
Laurel Valley Road	C4,D4,D3,E3,E4
Laurelwood Trail (204 only)	E6
Ledgeway East	D3
Ledgeway West	D3
Limerick Lane (PAE)	D3
Little Bend Road	C2
Live Oak Circle	C3,D3
Live Oak Ridge	C2,C3
Loma Linda	E1
Lost Canyon	E1
Madrone Road	C3,C4
Manor Ridge Court	F6
McConnell Drive	D5
Mulberry Road	B3,C3
Nob Hill Circle	E3
North Peak Road	F7
Oak Ridge Drive	E5,F5
Oak Valley	D6,E6
Old Bee Cave Road	C4,C5
Old Stable Lane	B4,C4
Old Stonehedge	D3
Old Wagon Road (1407 & up PAE)	B2
Ox Eye Trail	E1
Parkwood Court	F7
Rainbow Cove	F6
Redbud Cove	B3
Redbud Trail	B4,B3,B2,C2,D2,D3,E3,E4
Reveille Road	D6,D5,E5
Ridgemont Court	F6
Ridgewood Road (410-442,413-431 & exclude 411)	F7
Roadrunner Road	D1
Rock Creek Drive	F5
Rocky Ledge Road	E5
Rocky River Cove	E5
Rocky River Road	D5,E5,E4
Rollingwood Drive	F7
Skyline Drive	E2,E3,F3
Spiller Lane (440 & up PAE)	C4,C5
Split Rail Trail	F5,F6
Sprague Lane (PAE)	B4,B3
Spurlock Valley	E1,E2
Stratford Reserve Place	F5
Sugar Creek Drive	F7,F6
Sugar Shack Drive	F6,G6,G5
Sundown Parkway (only 101)	B4,B5,C5
Swiftcurrent Trail	C4
Terrace Mountain Cove #1	E2
Terrace Mountain Drive	D2,D1,E1,E2
Washington Cut Off	B3
Westbank Drive (911,923,925,950,1000,1001 & 4300)	D7,D6
Westbrook Drive (101,103,609 & up)	D6,E6,F6,F5,E7
Westhaven Drive	D6,D5
Westlake Drive (100-1801)	C6,C5,D5,D4,E3,E2
Westspring Drive	D5
Westwood Terrace (201,203,205,206)	D6,E6,E5
Wild Basin Ledge (923,1111 & 1115)	E1
Wild Basin South	E1
Wildcat Hollow (1521 & up PAE)	E3,F3,F2,E2
Windsong Trail	D2
Wood Trail	C4,C5
Woodview Court	F6,F7
Wren Valley Cove (PAE)	C2
Yaupon Valley Road	B2,B3,C3,C4,D4,E4

City of West Lake Hills
Address Map

Last Revised July 2014



1 Area of Interest: 149**Location: North Peak Road****AOI Category: Roadway Cross Drainage**

North Peak Road generally slopes from west to east with the lots on the west side lying on a local high point. The lack of roadside swales is causing ponding in the front yards of the properties on the east side of the roadway. In addition, the driveways do not provide conveyance causing the water to flow down the driveways.

