SANITARY SYSTEM CAPACITY ANALYSIS

ARIA & SUMMIT VILLAGE NORTH

Prepared for:

Aria LS LLC

Unity Reality LLC

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Olsson Project No. 019-0012

olsson

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1. INTRODUCTION

The Aria & Summit Village North development is located at the northwest corner of Northeast Douglas Street and Northwest Colbern Road in Lee's Summit, Missouri. The site will consist of approximately 108 acres (ac) of residential and commercial development. Olsson performed a capacity analysis on the city's existing sanitary sewer, pump station, and excess flow holding basin (EFHB), which are located downstream from the development. The purpose of the analysis was to estimate anticipated flows to determine the proposed development's impact on the existing sanitary system and to make recommendations for improvements, if necessary.

The proposed development has been split into three areas. Proposed Development Area 1 is approximately 43 ac and consists of 400 retirement housing units. Proposed Development Area 2 is approximately 24 ac and consists of 480 apartment housing units. Proposed Development Area 3 is approximately 41 ac and consists of a hotel (150 rooms), convenience store (4,000 square feet [sq. ft.]), retail and restaurants (53,600 sq. ft.), and senior apartment housing (400 units). Proposed Development Area 2 is currently in design and will be developed soon. Proposed Development Area 1 and Proposed Development Area 3 are anticipated to be developed in the more distant future.

2. BACKGROUND

The site is currently served by two,12-inch separate sanitary sewers, which run through the development and tie into the Lee's Summit Road Pump Station (LSRPS). A map showing the proposed development and existing sanitary sewer may be found in Exhibit 1 of Appendix A.

The sanitary sewer analysis for this site took three conditions into consideration:

- Existing Conditions – Estimated sanitary sewer design flow generated by land within the drainage basin that is currently developed.
- Proposed Conditions – Estimated sanitary sewer design flow generated by the existing conditions (above) as well as the additional flow generated by the proposed development. Exhibit 2 of Appendix A shows the anticipated drainage areas and flows for this condition.
- Ultimate Basin Build-out Conditions – Estimated sanitary sewer design flow generated by the entire drainage basin. Exhibit 3 of Appendix A shows the anticipated drainage areas for this condition.

The LSRPS and EFHB are located south of Proposed Development Area 1. LSRPS is a duplex pump station with a 12-inch force main that discharges to the Little Cedar watershed. The capacity of the downstream basin was not analyzed as part of this capacity analysis.

3. METHODOLOGY

3.1 Sanitary Sewer

Olsson estimated and modeled wastewater flows for the existing conditions of the sanitary sewer system. Geographic information system (GIS) data provided to Olsson by the City was used to identify currently developed areas located upstream of the development. The City of Lee's Summit's Design Criteria Section 6501.C.1 was used to assign flows to residential areas and non-residential areas greater than 100 acres (ac). Based on conversations with the City, the inflow rate (or k-factor) of 0.006 does not accurately describe existing conditions. An adjusted k-factor of 0.002 was used for all calculations. The flows were added into the sanitary sewer analysis (SSA) extension of AutoCAD Civil 3D to determine the hydraulic grade line (HGL) within the system. Modeling flows for existing developments provides an idea of the current capacity of the system. Table 1 shows the flow calculation of sanitary sewer flow for the existing conditions.

Table 1. Projected Sanitary Sewer Flow for Existing Conditions.

Existing Conditions – Current Basin Build-Out						
Existing Development Area	Area (ac)	Base Flow (gpd)	Peak Infiltration (gpd)	Peak Inflow (cfs*)	Design Flow Rate (MGD**)	Design Flow Rate (cfs*)
Area 4	74	111,000	37,000	0.52	0.49	0.76
Area 5	16	24,000	8,000	0.15	0.13	0.20
Area 6	92	138,000	46,000	0.62	0.58	0.91
					Total	1.86

* cfs = cubic feet per second; ** MGD = million gallons per day

Anticipated flows were then calculated for the proposed conditions. Design flows for the non-residential areas of the proposed development (areas 1 and 3) were estimated using the equivalent dwelling unit (EDU) method, as described in Section 6501.C.2 of the Design Criteria. Peak infiltration and inflow values were calculated using Section 6501.C.1 and the adjusted k-factor of 0.002. Design flows for the proposed residential area were found using the same method as the existing conditions (Section 6501.C.1). Table 2 shows the projected sanitary sewer flow calculation for the proposed development. A map of the proposed condition may be found in Exhibit 2 of Appendix A.

Table 2. Projected Sanitary Sewer Flow for Proposed Development.

Proposed Development Area 1				
	Value	EDU	Parameter	Total Base Flow (gpd)
Retirement Housing (Units)	400	0.4	per unit	48,000
			Total Area (ac)	43
			Peak Infiltration (gpd)	10,750
			Peak Inflow (cfs)	0.34
			Design Flow (mgd)	**0.28**
Proposed Development Area 2				
Residential Apartment Complex				
			Total Area (ac)	24
			Total Base Flow (gpd)	36,000
			Peak Infiltration (gpd)	12,000
			Peak Inflow (cfs)	0.21
			Design Flow (mgd)	**0.18**
Proposed Development Area 3				
	Value	EDU	Parameter	Total Flow (gpd)
Retirement Resort (Units)	200	0.4	per unit	24,000
Convenience Store (sq. ft.)	4,000	0.2	per 1,000 sq. ft.	240
Retail/Restaurants (sq. ft.)	53,600*	3.5	per 1,000 sq. ft.	56,280
Hotel (Rooms)	150	0.3	per room	13,500
			Total Base Flow (gpd)	94,020
			Total Area (ac)	41
			Peak Inflow (gpd)	10,250
			Peak Inflow (cfs)	0.33
			Design Flow (mgd)	**0.32**

*The value for retail/restaurant (sq. ft.) is the addition of all proposed commercial building footprints, excluding the convenience store, hotel, and retirement resort.

Much of the land within the drainage basin is currently undeveloped. The ultimate basin build-out condition predicts the impacts on the sanitary system when all land within the drainage basin is developed for residential or non-residential use. Please note this is not the condition that the proposed development will create. Rather, the ultimate basin build-out condition is the summation of the proposed development and full development of upstream areas. A map of the ultimate basin build-out areas can be found in Exhibit 3 of Appendix B. Table 3 details the wastewater flows assigned to each area with the ultimate basin build-out condition.

Table 3. Projected Sanitary Sewer Flow for Ultimate Basin Build-out Condition.

Ultimate Conditions – Ultimate Basin Build-Out						
Existing Development Area	Area (ac)	Base Flow (gpd)	Peak Infiltration (gpd)	Peak Inflow (cfs*)	Design Flow Rate (MGD**)	Design Flow Rate (cfs*)
Area 4	92	138,000	46,000	0.62	0.58	0.91
Area 5	114	171,000	57,000	0.74	0.70	1.09
Area 6	104	156,000	52,000	0.68	0.65	1.00
Area 7	73	109,500	36,500	0.52	0.48	0.75
					Total	3.75

* cfs = cubic feet per second; ** MGD = million gallons per day

3.2 Lee's Summit Road Pump Station and Excess Flow Holding Basin

A capacity analysis was also developed for the LSRPS and EFHB located downstream from the proposed development. Methodology for developing this capacity analysis was based on the Wastewater Excess Flow Holding Basin Facilities Design Criteria (Design Criteria Attachment 6501-3). Design criteria state that all EFHBs must be designed for peak excess flow from the sanitary sewer drainage area during a 50-year storm event. Peak excess flow from a 50-year event was estimated for three different conditions of the total drainage area (also used for sanitary sewer analysis): existing conditions, proposed conditions, and ultimate basin build-out conditions. Table 4 shows the design parameters used in the analysis for each condition.

Table 4. Excess Flow Holding Basin Sizing.

Design Parameter	Existing Conditions	Proposed Conditions	Ultimate Basin Build-out Conditions
Total Sewer Acreage (ac)	182	290	491
Peak Dry Weather Flow (MGD)	0.2	0.44	0.74
Peak Infiltration (MGD)	0.09	0.15	0.25
Time of Concentration (Tc) (min)	69	78	89
Rainfall Intensity (i_{50})	3.07	2.88	2.65
k value	0.002	0.002	0.002
Peak Inflow (MGD)	0.72	1.08	4.12
Total Peak Flow (MGD)	1.68	2.57	4.12
Total Rainfall (inches/hour)	3.53	3.73	3.91
Total Rainfall Entering System (million gallons (MG))	0.04	0.06	0.15
Inflow Hydrograph Duration (min)	694	764	864
Firm Capacity of LSRPS (gpm)*	1450	1450	1450

*Estimated based on As-Built Drawings w/ Pump Curve information provided by City.

4. ANALYSIS

4.1 Sanitary Sewer

Information for the existing sanitary sewer system was taken from the city's GIS maps. Boundaries for the existing conditions were determined using the current sanitary sewer layout and parcel maps. Boundaries for ultimate build-out of developed areas were determined using area contours. Manning's equation was used to determine current pipe flow capacities. Per the city's design criteria, the Manning's roughness coefficient used was 0.014 for polyvinyl chloride (PVC) pipe and 0.015 for ductile iron pipe (DIP).

For the model, Areas 1, 2, and 3 were tied in to the existing sanitary sewer at manhole (MH) #10-002, MH #10-007, and MH #10-010, respectively. Flows from Areas 4 and 5 were added at MH #10-001 just north of NE Douglas Street. Design flows for Area 6 were added to MH #10-011 just west of NE Douglas Street.

HGLs were calculated for each 12-inch sanitary sewer using a flow modeling extension in AutoCAD Civil 3D. Based on record drawings provided by city staff, MH #10-005 (Exhibit 1, Appendix A), has an overflow pipe that directs flow to the EFHB when water within the manhole has surcharged to an elevation of 903.00 feet. For the model, the HGL was assumed to have a tailwater elevation of 904.33 feet. This is equal to the pipe crown elevation of the 16-inch overflow pipe in MH #10-005.

Based on the City of Lee's Summit design guidelines, a sanitary sewer line is considered inadequate if the HGL elevation is higher than the crown of the pipe. The calculations and results of the analysis are included in pages 1 and 2 of Appendix B. The HGL for the north and south sanitary sewers under existing conditions, proposed conditions, and ultimate build-out basin conditions may be found in Appendix B.

4.2 Lee's Summit Road Pump Station and Excess Flow Holding Basin

Based on coordination with Xylem (the LSRPS pump manufacturer), the original LSRPS pumps were replaced in 2009. The pump curve for the pumps that were installed is provided in Appendix C. Record drawings for the pump station and force main were used to determine the theoretical system curve for the LSRPS force main. This was used in conjunction with the pump curve to determine that the firm capacity (design) of the pump station is 1,450 gallons per minute (gpm). The calculations used to determine the firm capacity are included in Appendix D of this report.

HDR Inc. completed an engineering report in 2012 to assess storage capacity of the EFHB and to recommend improvements to reduce groundwater inflow into the basin. This report recommended improvements to reduce capacity of the EFHB from 1.25 million gallons (MG) to 0.67 MG. The total volume required for the EFHB for each condition described in Section 2 was compared to the total volume of the EFHB after recommended improvements.

The Lee's Summit design guidelines for EFHBs was used in this analysis to determine whether excess capacity is available within the EFHB with each condition.

5. RESULTS

5.1 Sanitary Sewer

The hydraulic analysis of the existing conditions indicates that the HGL is above the crown of the pipe in the segment from MH #10-003 to MH #10-005 on the north sanitary sewer and from MH #10-006 to MH #10-005 on the south sanitary sewer. The results for the existing conditions may be found in tables 1 and 4 on Page 1 of Appendix B. A profile of the existing conditions HGL for the north and south sanitary sewers may be found on pages 2 and 3, respectively, in Appendix B.

The hydraulic analysis of the proposed conditions indicates that the HGL is above the crown of the pipe in the segment from MH #10-003 to MH #10-005 on the north sanitary sewer and from MH #10-006 to MH #10-005 on the south sanitary sewer. The results for the proposed conditions may be found in tables 2 and 5 on Page 1 of Appendix B. A profile of the proposed conditions HGL for the north and south sewers may be found on pages 4 and 5, respectively, in Appendix B.

The hydraulic analysis of the ultimate basin build-out indicates that the HGL is above the crown of the pipe from MH#10-003 to MH#10-005 on the north sanitary sewer, and MH#006 to MH #10-005 for the south sanitary sewer. The results for the ultimate basin build-out conditions may be found in tables 3 and 6 of Appendix B. A profile of the ultimate basin build-out conditions HGL for the north and south sewers may be found on pages 6 and 7, respectively, in Appendix B.

5.2 Lee's Summit Road Pump Station and Excess Flow Holding Basin

The LSRPS and EFHB basin have adequate capacity to support the proposed development. Excess capacity is available in the EFHB for the existing, proposed, and ultimate basin build-out flow conditions.

Table 5 shows excess flow available within the EFHB for each condition. A hydrograph used to determine the required storage for Ultimate Conditions during a 50-year design storm event for the EFHB is provided in Appendix E. The total storage available is based on the proposed capacity after recommended improvements from the 2012 HDR report were made.

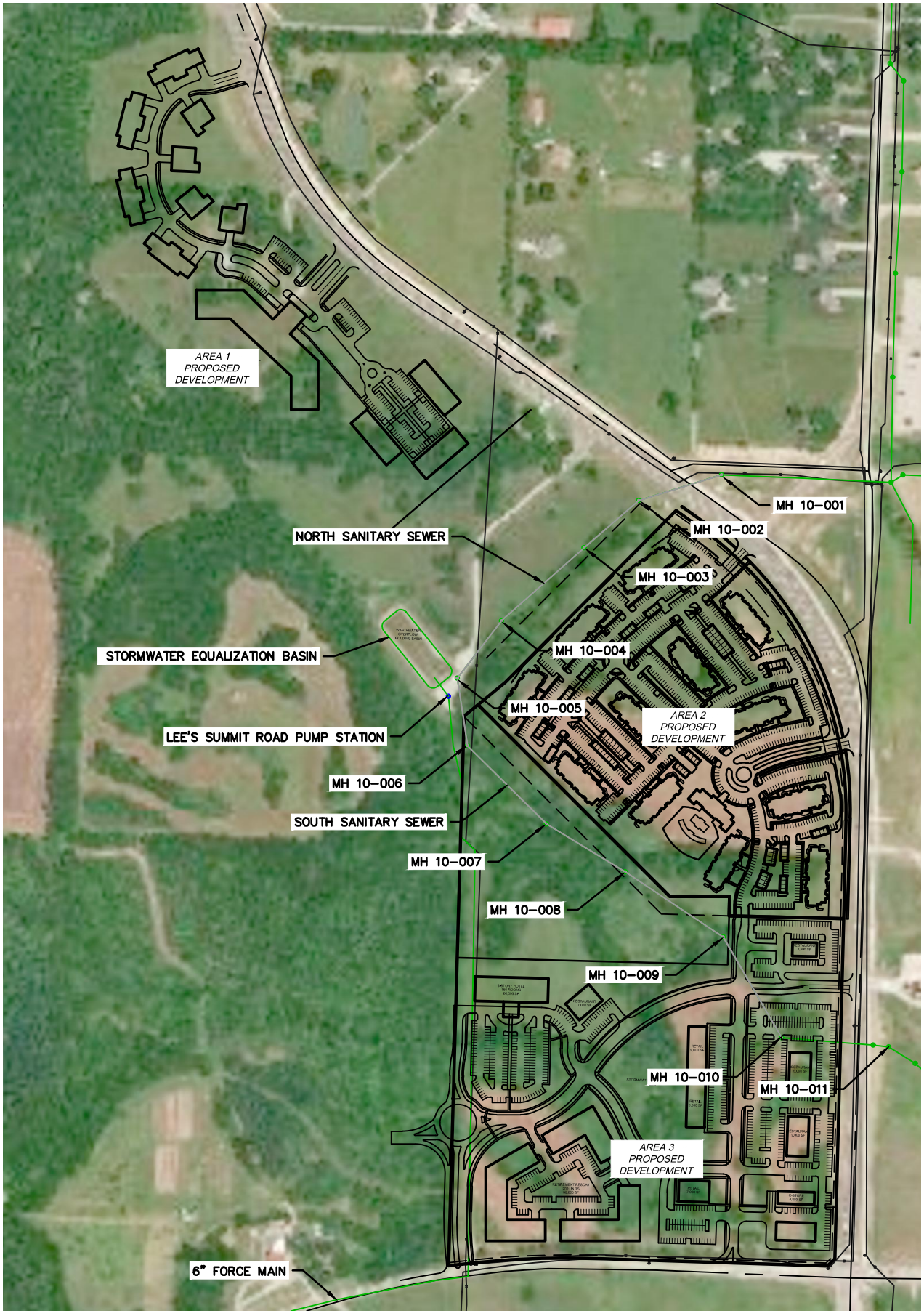
Table 5. Excess Flow Holding Basin Excess Capacity.

Parameter	Existing Conditions	Proposed Conditions	Ultimate Basin Build-out Condition
Total Storage Available (MG)	0.67	0.67	0.67
Total Storage Required (MG)	0.00	0.00	0.29
Excess Capacity Available (MG)	0.67	0.67	0.38

The excess capacity available for the equalization basin is dependent on the capacity of the LSRPS. Pumps will experience wear over time that can reduce pumping capabilities of the pump station. The current pumps have been in operation for 10 years, and the extent of pump wear is unknown. It is recommended that the actual performance of the LSRPS pumps be verified by the city. This can be done by “dead-heading” each pump to determine the pump output pressure with no water pumping. Dead-heading the pumps would help determine the extent of pump wear and would also help determine the actual pump output.

APPENDIX A

Subbasin Maps



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DATE: 3/11/2019			

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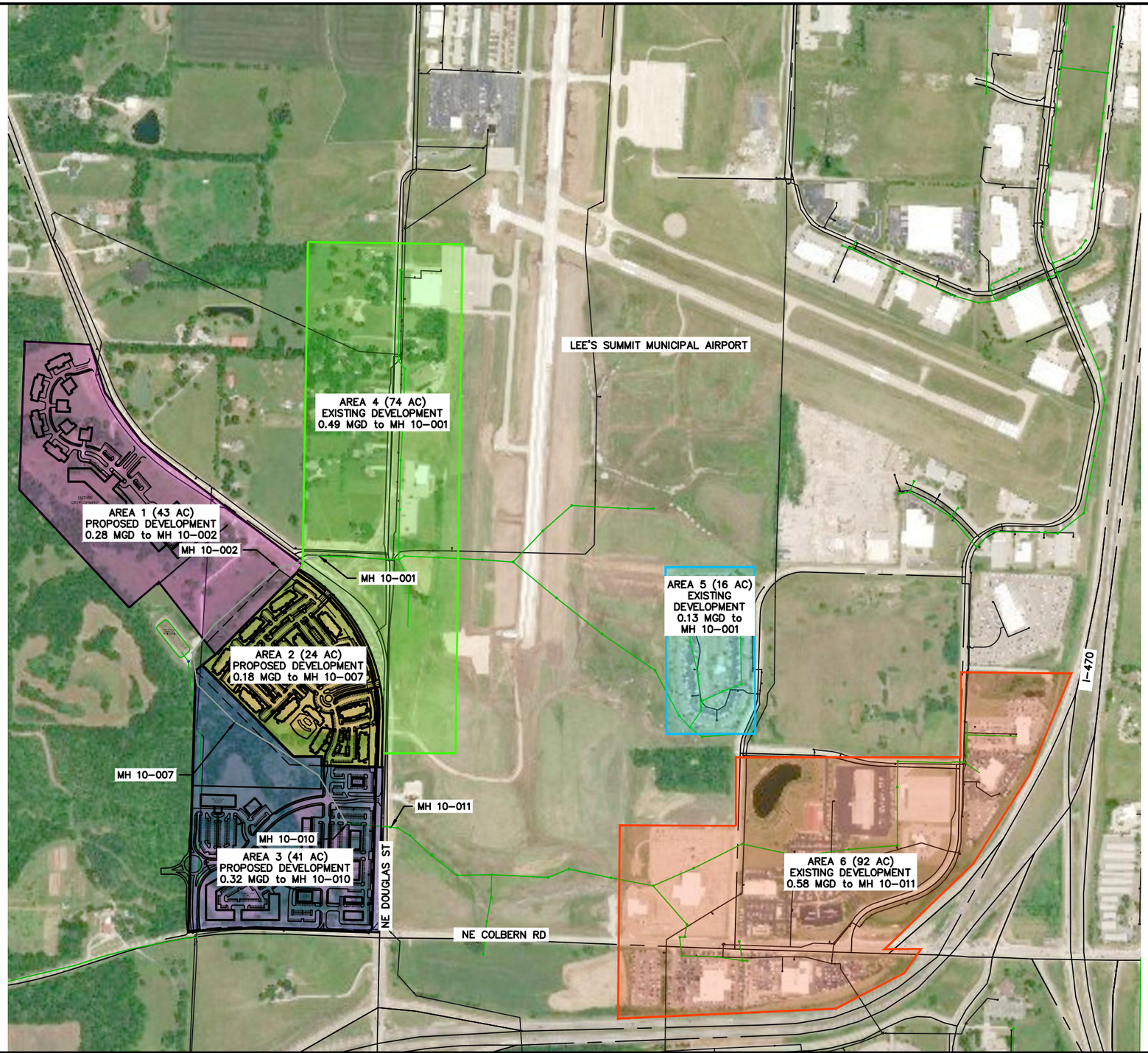

PROJECT NO: 019-0012	UNITY VILLAGE SANITARY SEWER ANALYSIS PROPOSED DEVELOPMENT CONDITIONS	EXHIBIT
DRAWN BY: MRD		2
DATE: 5/6/2019		

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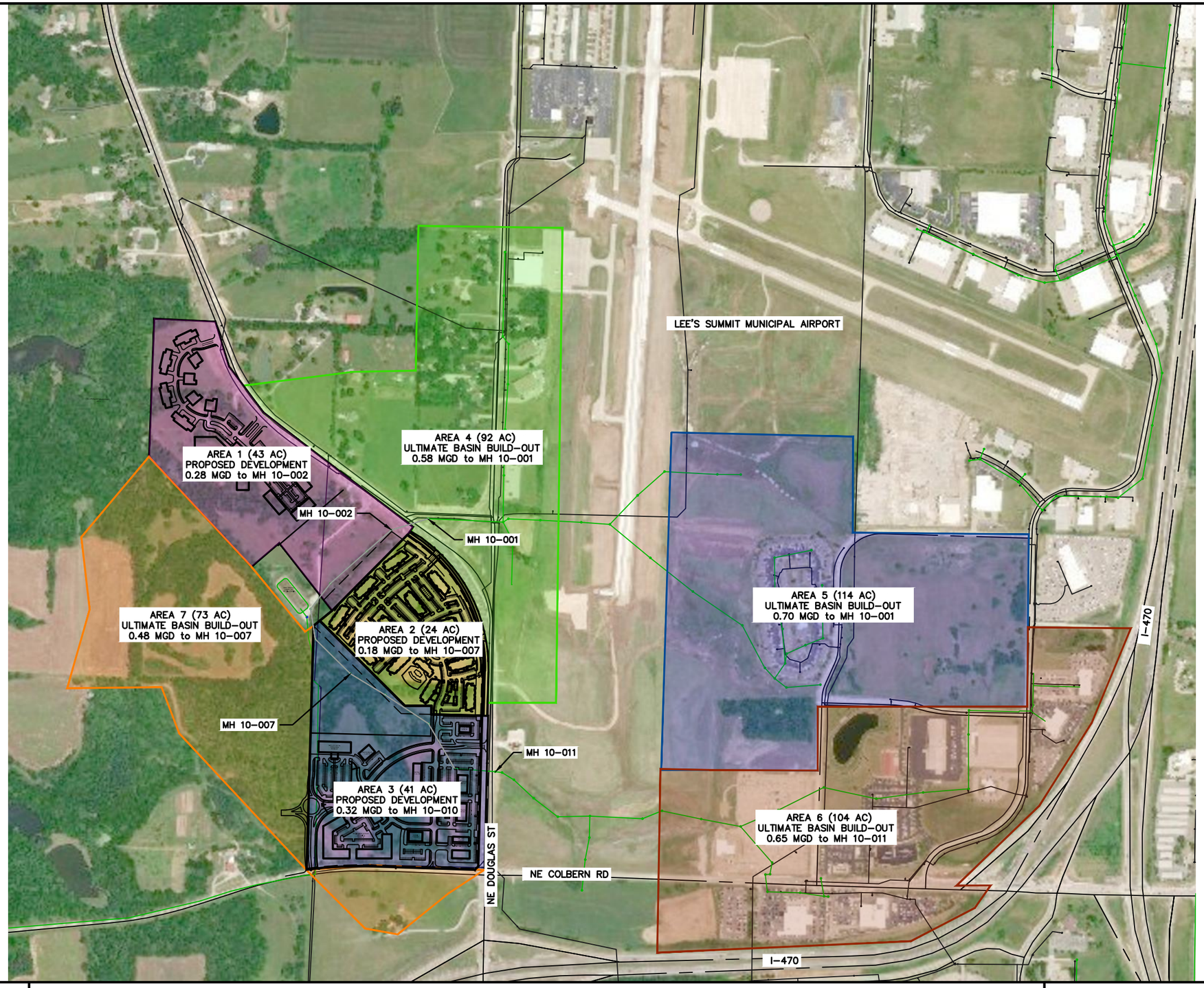

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DRAWN BY: MRD		1301 Burlington Street North Kansas City, MO 64116 TEL 816.361.1177 FAX 816.361.1888	3
DATE: 5/6/2019			

APPENDIX B

Sanitary Sewer Analysis Calculations and Hydraulic Grade Line

Table 1 - North Sanitary Sewer Flow - Existing Conditions

US MH	DS MH	Pipe No.	Design Flow Rate (MGD)	Cumulative Design Flow Rate (MGD)	Cumulative Design Flow Rate (cfs)	US Invert	DS Invert	US MH Rim Elev.	Slope (%)	Pipe Diam. (in)	Pipe Length (ft)	Pipe Capacity (cfs)	Pipe Capacity (MGD)	Percent Pipe Capacity	HGL Elev.	Crown
MH 10-005	LS Road PS			0.61	0.95			908.00		12						
MH 10-004	MH 10-005	P-45140	0	0.61	0.95	896.87	894.18	908.00	1.00%	12	268.47	3.572	2.30	26.6%	904.53	897.87
MH 10-003	MH 10-004	P-45139	0	0.61	0.95	903.93	898.97	912.00	1.37%	12	361.42	4.180	2.70	22.7%	904.81	904.93
MH 10-002	MH 10-003	P-45104	0	0.61	0.95	907.82	904.03	917.00	1.60%	12	236.48	4.518	2.91	21.0%	908.23	908.82
MH 10-001	MH 10-002	P-45103	0.61	0.61	0.95	911.48	908.32	921.00	1.11%	12	284.75	3.759	2.43	25.3%		

Table 2 - North Sanitary Sewer Flow - Proposed Conditions

US MH	DS MH	Pipe No.	Design Flow Rate (MGD)	Cumulative Design Flow Rate (MGD)	Cumulative Design Flow Rate (cfs)	US Invert	DS Invert	US MH Rim Elev.	Slope (%)	Pipe Diam. (in)	Pipe Length (ft)	Pipe Capacity (cfs)	Pipe Capacity (MGD)	Percent Pipe Capacity	HGL Elev.	Crown
MH 10-005	LS Road PS		0	0.89	1.38			908.00		12						
MH 10-004	MH 10-005	P-45140	0	0.89	1.38	896.87	894.18	908.00	1.00%	12	268.47	3.572	2.30	38.7%	904.74	897.87
MH 10-003	MH 10-004	P-45139	0	0.89	1.38	903.93	898.97	912.00	1.37%	12	361.42	4.180	2.70	33.1%	905.38	904.93
MH 10-002	MH 10-003	P-45104	0.28	0.89	1.38	907.82	904.03	917.00	1.60%	12	236.48	4.518	2.91	30.6%	908.32	908.82
MH 10-001	MH 10-002	P-45103	0.61	0.61	0.95	911.48	908.32	921.00	1.11%	12	284.75	3.759	2.43	25.3%		

Table 3 - North Sanitary Sewer Flow - Ultimate Basin Build-Out

US MH	DS MH	Pipe No.	Design Flow Rate (MGD)	Cumulative Design Flow Rate (MGD)	Cumulative Design Flow Rate (cfs)	US Invert	DS Invert	US MH Rim Elev.	Slope (%)	Pipe Diam. (in)	Pipe Length (ft)	Pipe Capacity (cfs)	Pipe Capacity (MGD)	Percent Pipe Capacity	HGL Elev.	Crown
MH 10-005	LS Road PS		0	1.57	2.43			908.00		12						
MH 10-004	MH 10-005	P-45140	0	1.57	2.43	896.87	894.18	908.00	1.00%	12	268.47	3.572	2.30	68.0%	905.61	897.87
MH 10-003	MH 10-004	P-45139	0	1.57	2.43	903.93	898.97	912.00	1.37%	12	361.42	4.180	2.70	58.1%	907.59	904.93
MH 10-002	MH 10-003	P-45104	0.28	1.57	2.43	907.82	904.03	917.00	1.60%	12	236.48	4.518	2.91	53.8%	908.79	908.82
MH 10-001	MH 10-002	P-45103	1.29	1.29	2.00	911.48	908.32	921.00	1.11%	12	284.75	3.759	2.43	53.1%		

Table 4 - South Sanitary Sewer Flow - Existing Conditions

US MH	DS MH	Pipe No.	Design Flow Rate (MGD)	Cumulative Design Flow Rate (MGD)	Cumulative Design Flow Rate (cfs)	US Invert	DS Invert	US MH Rim Elev.	Slope (%)	Pipe Diam. (in)	Pipe Length (ft)	Pipe Capacity (cfs)	Pipe Capacity (MGD)	Percent Pipe Capacity	HGL Elev.	Crown
MH 10-005	LS Road PS		0	0.58	0.91					12						
MH 10-006	MH 10-005	P-45141	0	0.58	0.91	902.75	896.68	909.00	3.04%	12	199.4	6.227	4.02	14.6%	903.28	903.75
MH 10-007	MH 10-006	P-45142	0	0.58	0.91	910.92	903.05	917.50	2.05%	12	384.0	5.109	3.30	17.7%	911.32	911.92
MH 10-008	MH 10-007	P-45143	0	0.58	0.91	922.97	911.02	931.00	3.98%	12	300.0	7.122	4.59	12.7%	923.37	923.97
MH 10-009	MH 10-008	P-45144	0	0.58	0.91	926.78	923.07	935.00	0.97%	12	381.0	3.521	2.27	25.7%	927.18	927.78
MH 10-010	MH 10-009	P-45145	0	0.58	0.91	931.85	926.98	940.50	1.28%	12	380.3	4.038	2.61	22.4%	932.25	932.85
MH 10-011	MH 10-010	P-45146	0.58	0.58	0.91	940.00	931.95	949.29	2.67%	12	301.0	5.836	3.77	15.5%		

Table 5 - South Sanitary Sewer Flow - Proposed Conditions

US MH	DS MH	Pipe No.	Design Flow Rate (MGD)	Cumulative Design Flow Rate (gpd)	Cumulative Design Flow Rate (cfs)	US Invert	DS Invert	US MH Rim Elev.	Slope (%)	Pipe Diam. (in)	Pipe Length (ft)	Pipe Capacity (cfs)	Pipe Capacity (gpd)	Percent Pipe Capacity (%)	HGL Elev.	Crown
MH 10-005	LS Road PS		0	1.08	1.68					12						
MH 10-006	MH 10-005	P-45141	0	1.08	1.68	902.75	896.68	909.00	3.04%	12	199.4	6.227	4.02	26.9%	903.47	903.75
MH 10-007	MH 10-006	P-45142	0.18	1.08	1.68	910.92	903.05	917.50	2.05%	12	384.0	5.109	3.30	32.8%	911.45	911.92
MH 10-008	MH 10-007	P-45143	0	0.90	1.39	922.97	911.02	931.00	3.98%	12	300.0	7.122	4.59	19.6%	923.45	923.97
MH 10-009	MH 10-008	P-45144	0	0.90	1.39	926.78	923.07	935.00	0.97%	12	381.0	3.521	2.27	39.6%	927.26	927.78
MH 10-010	MH 10-009	P-45145	0.32	0.90	1.39	931.85	926.98	940.50	1.28%	12	380.3	4.038	2.61	34.5%	932.33	932.85
MH 10-011	MH 10-010	P-45146	0.58	0.58	0.91	940.00	931.95	949.29	2.67%	12	301.0	5.836	3.77	15.5%		

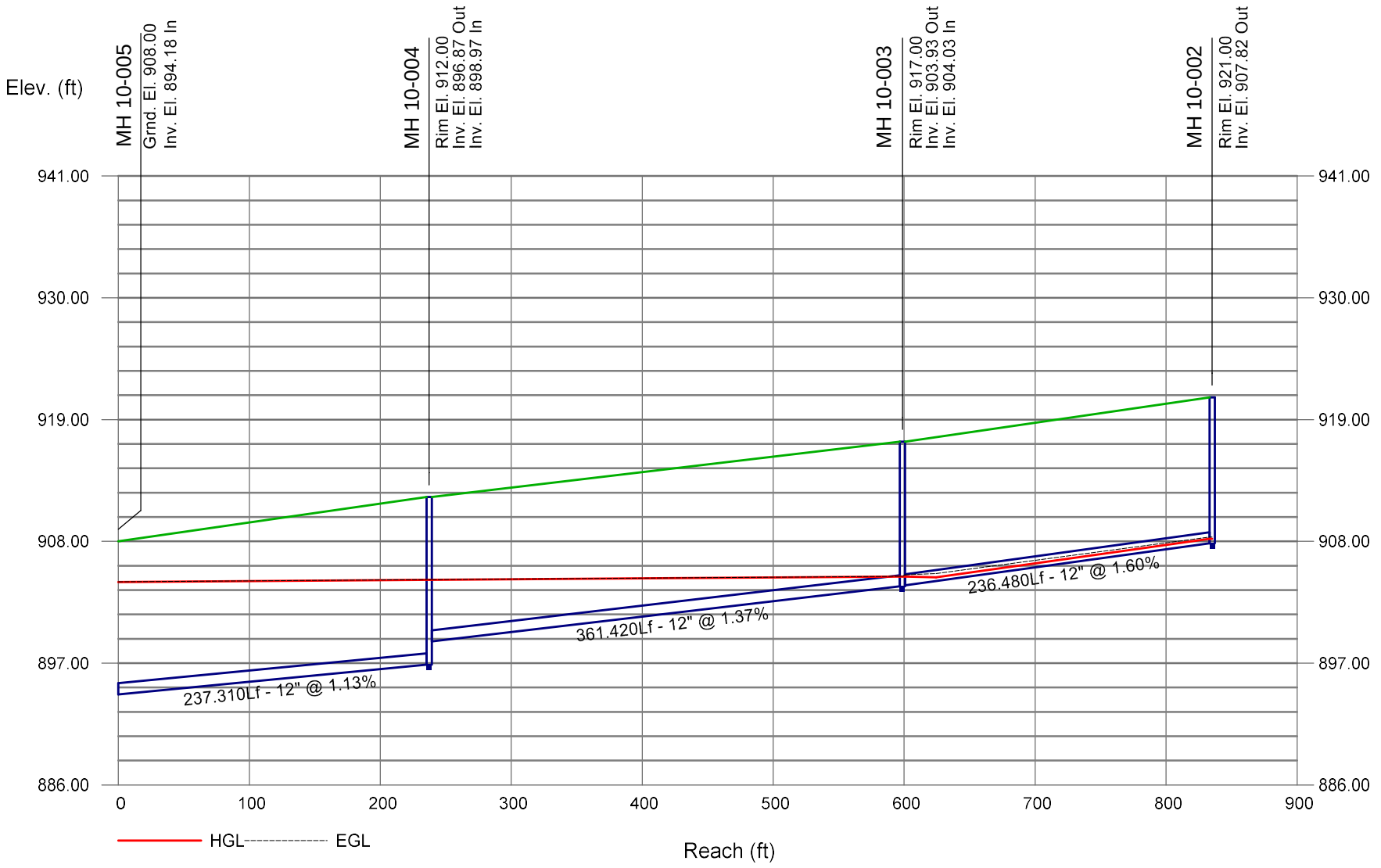
=HGL above crown

Table 6 - South Sanitary Sewer Flow - Ultimate Basin Build-Out

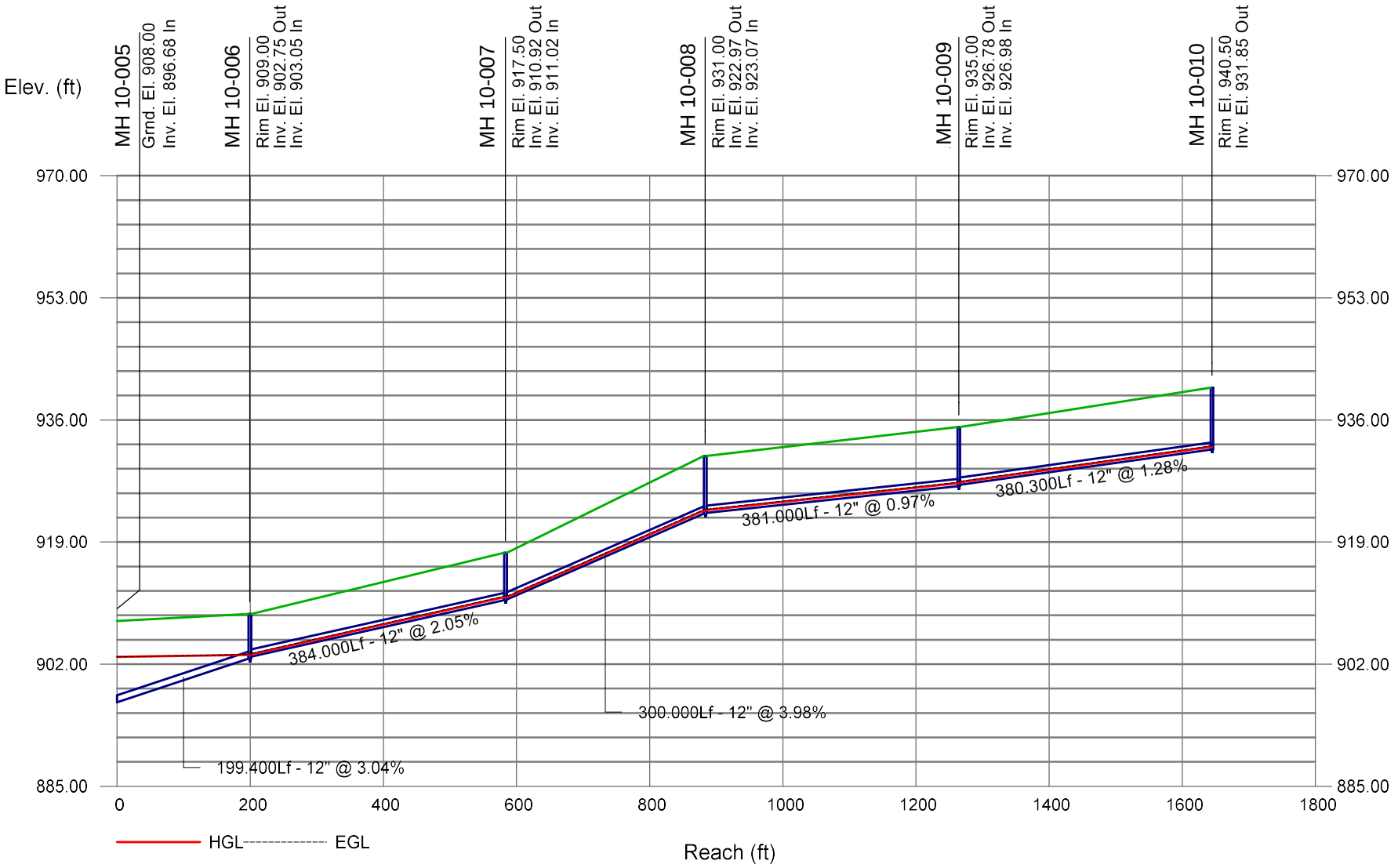
US MH	DS MH	Pipe No.	Design Flow Rate (MGD)	Cumulative Design Flow Rate (MGD)	Cumulative Design Flow Rate (cfs)	US Invert	DS Invert	US MH Rim Elev.	Slope (%)	Pipe Diam. (in)	Pipe Length (ft)	Pipe Capacity (cfs)	Pipe Capacity (MGD)	Percent Pipe Capacity (%)	HGL Elev.	Crown
MH 10-005	LS Road PS		0	1.63	2.52					12						
MH 10-006	MH 10-005	P-45141	0	1.63	2.52	902.75	896.68	909.00	3.04%	12	199.4	6.227	4.02	40.5%	904.16	903.75
MH 10-007	MH 10-006	P-45142	0.66	1.63	2.52	910.92	903.05	917.50	2.05%	12	384.0	5.109	3.30	49.3%	911.60	911.92
MH 10-008	MH 10-007	P-45143	0	0.96	1.49	922.97	911.02	931.00	3.98%	12	300.0	7.122	4.59	20.9%	923.49	923.97
MH 10-009	MH 10-008	P-45144	0	0.96	1.49	926.78	923.07	935.00	0.97%	12	381.0	3.521	2.27	42.3%	927.30	927.78
MH 10-010	MH 10-009	P-45145	0.32	0.96	1.49	931.85	926.98	940.50	1.28%	12	380.3	4.038	2.61	36.9%	923.37	932.85
MH 10-011	MH 10-010	P-45146	0.65	0.65	1.00	940.00	931.95	949.29	2.67%	12	301.0	5.836	3.77	17.2%		

=HGL above crown

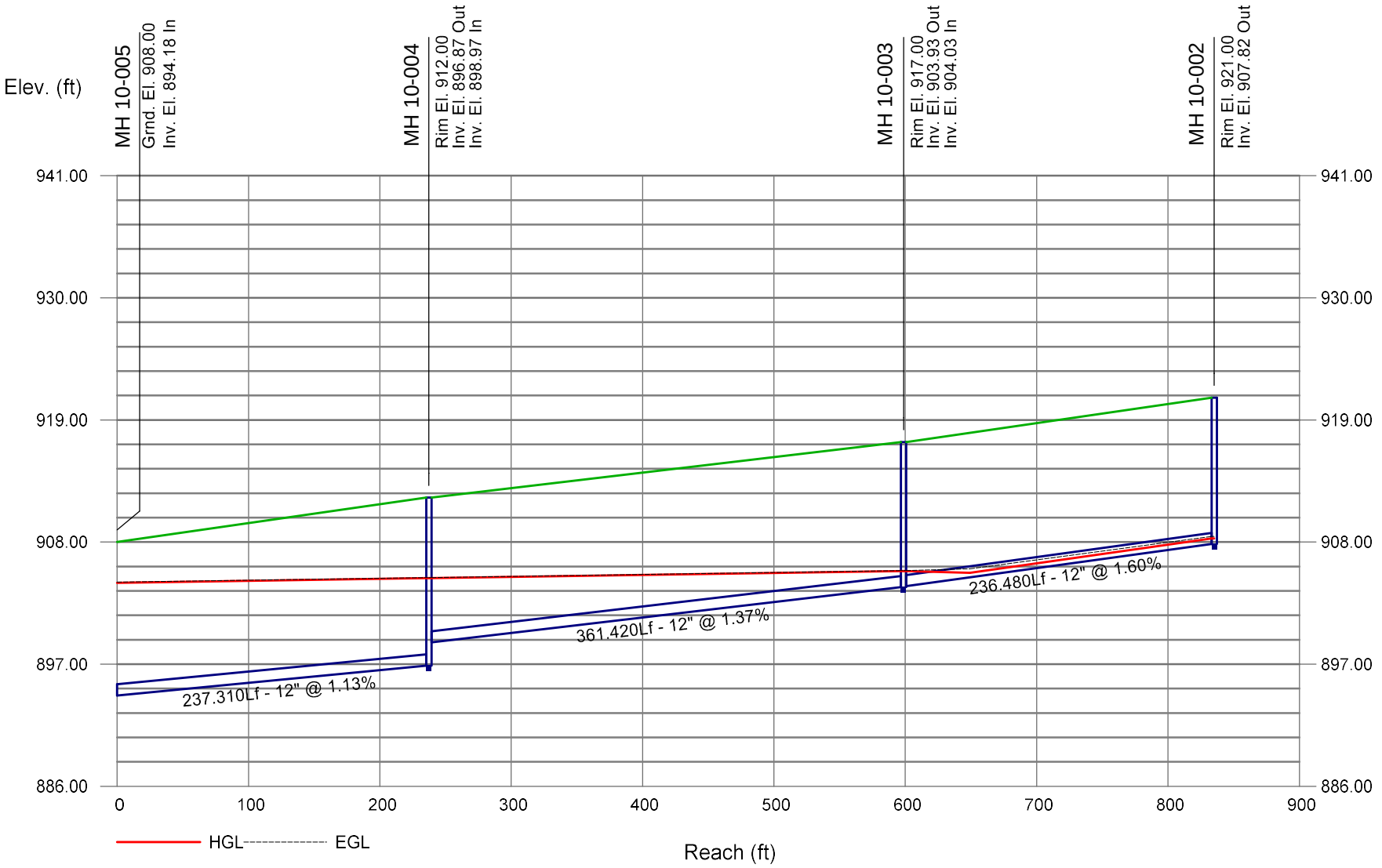
12" North Sanitary Sewer Existing Conditions HGL



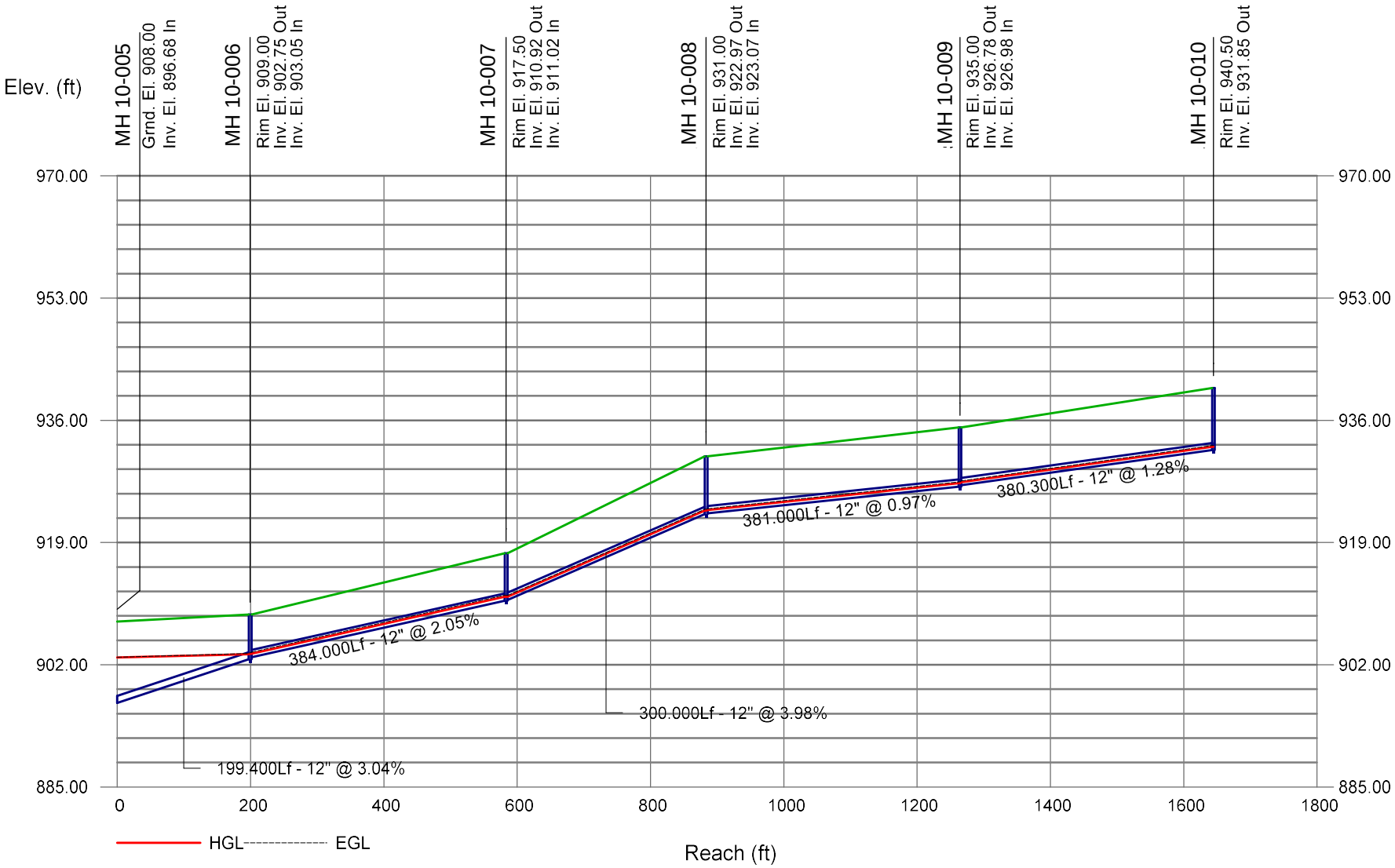
12" South Sanitary Sewer Existing Conditions HGL



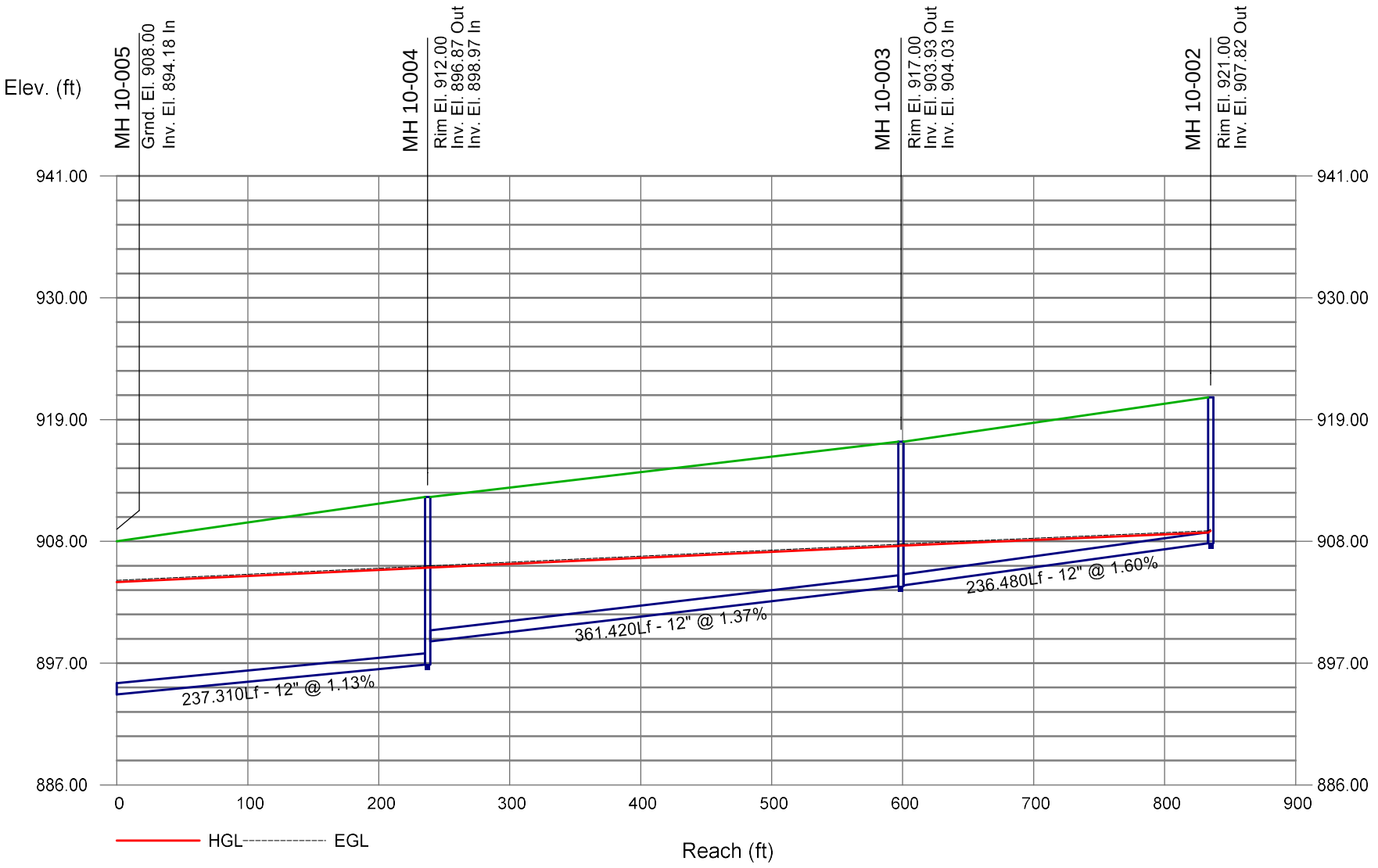
12" North Sanitary Sewer Proposed Conditions HGL



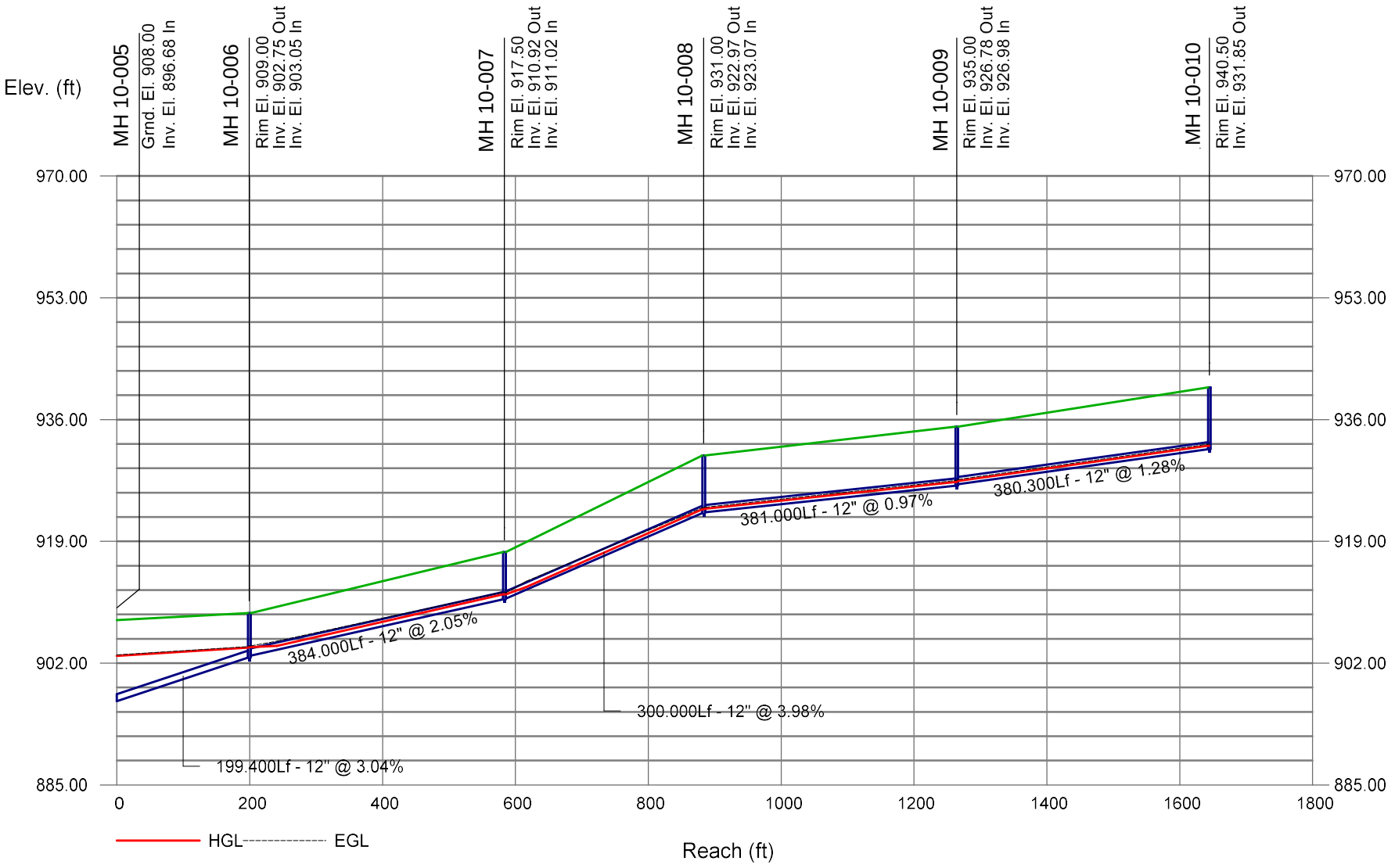
12" South Sanitary Sewer Proposed Conditions HGL



12" North Sanitary Sewer Ultimate Conditions HGL



12" South Sanitary Sewer Ultimate Conditions HGL

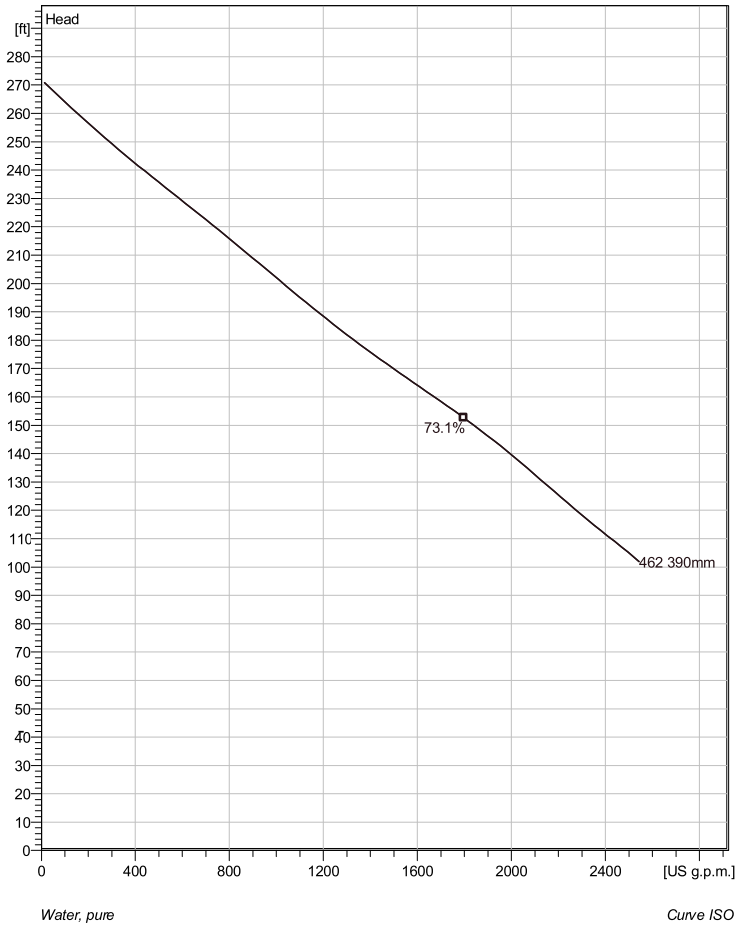


APPENDIX C

Lee’s Summit Road Pump Station Cut Sheet

NP 3301 HT 3~ 462

Technical specification



Water, pure *Curve ISO*

Note: Picture might not correspond to the current configuration.

General

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

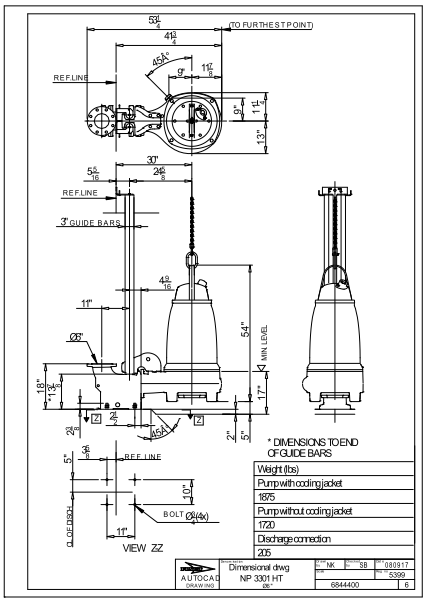
Impeller material	Grey cast iron
Discharge Flange Diameter	5 7/8 inch
Suction Flange Diameter	5 7/8 inch
Impeller diameter	390 mm
Number of blades	2

Motor

Motor #	N3301.180 35-29-4AA-W 105hp Standard
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	105 hp
Rated current	125 A
Starting current	560 A
Rated speed	1780 rpm
Power factor	
1/1 Load	0.84
3/4 Load	0.81
1/2 Load	0.72
Motor efficiency	
1/1 Load	93.0 %
3/4 Load	94.5 %
1/2 Load	95.0 %

Configuration

Installation: P - Semi permanent, Wet



Project	Project ID	Created by	Created on	Last update
			1/16/2019	

NP 3301 HT 3~ 462

Performance curve

Pump

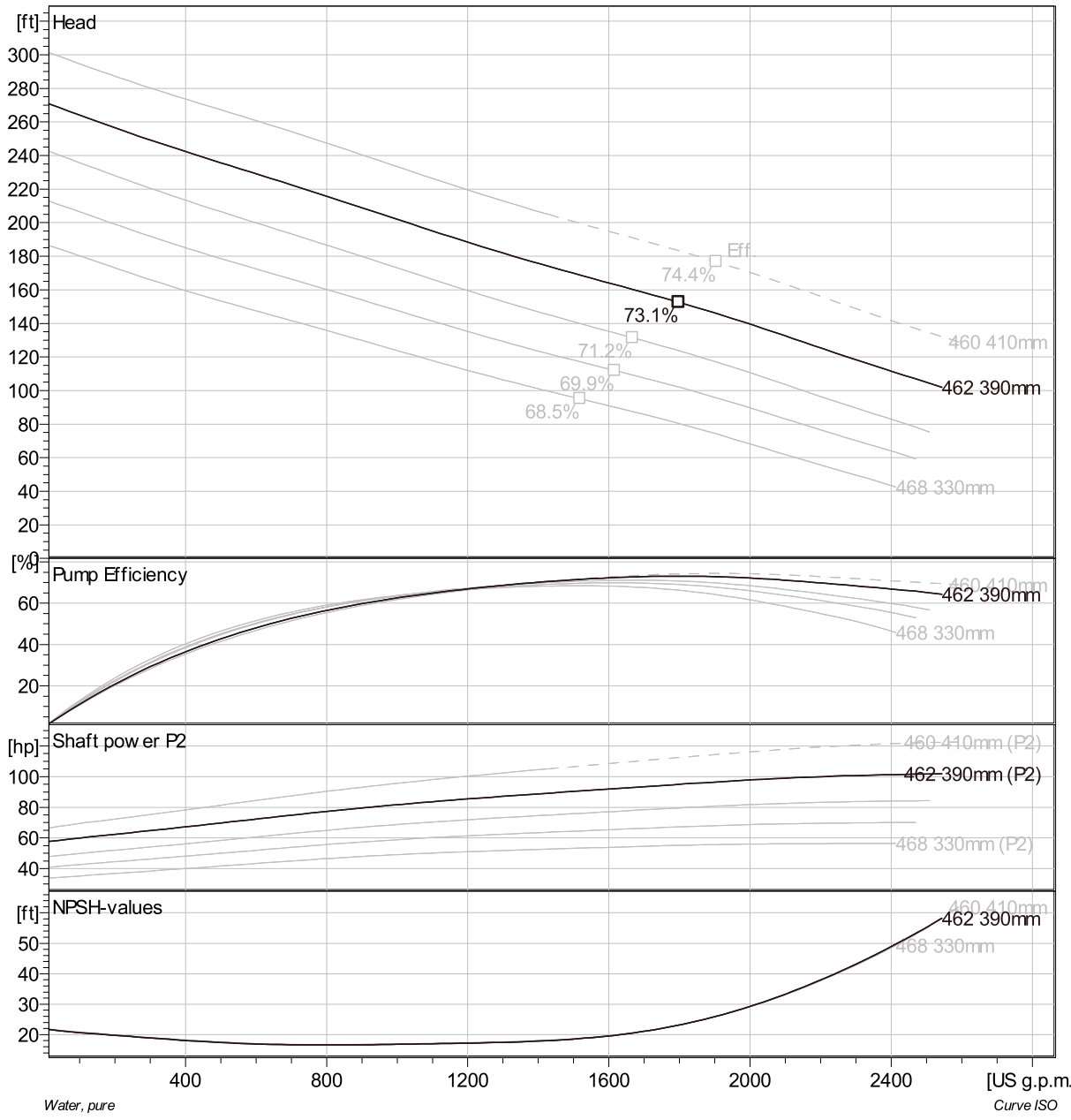
Discharge Flange Diameter	5 7/8 inch
Suction Flange Diameter	150 mm
Impeller diameter	15 3/8"
Number of blades	2

Motor

Motor #	N3301.180 35-29-4AA-W 105hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	105 hp
Rated current	125 A
Starting current	560 A
Rated speed	1780 rpm

Power factor	
1/1 Load	0.84
3/4 Load	0.81
1/2 Load	0.72

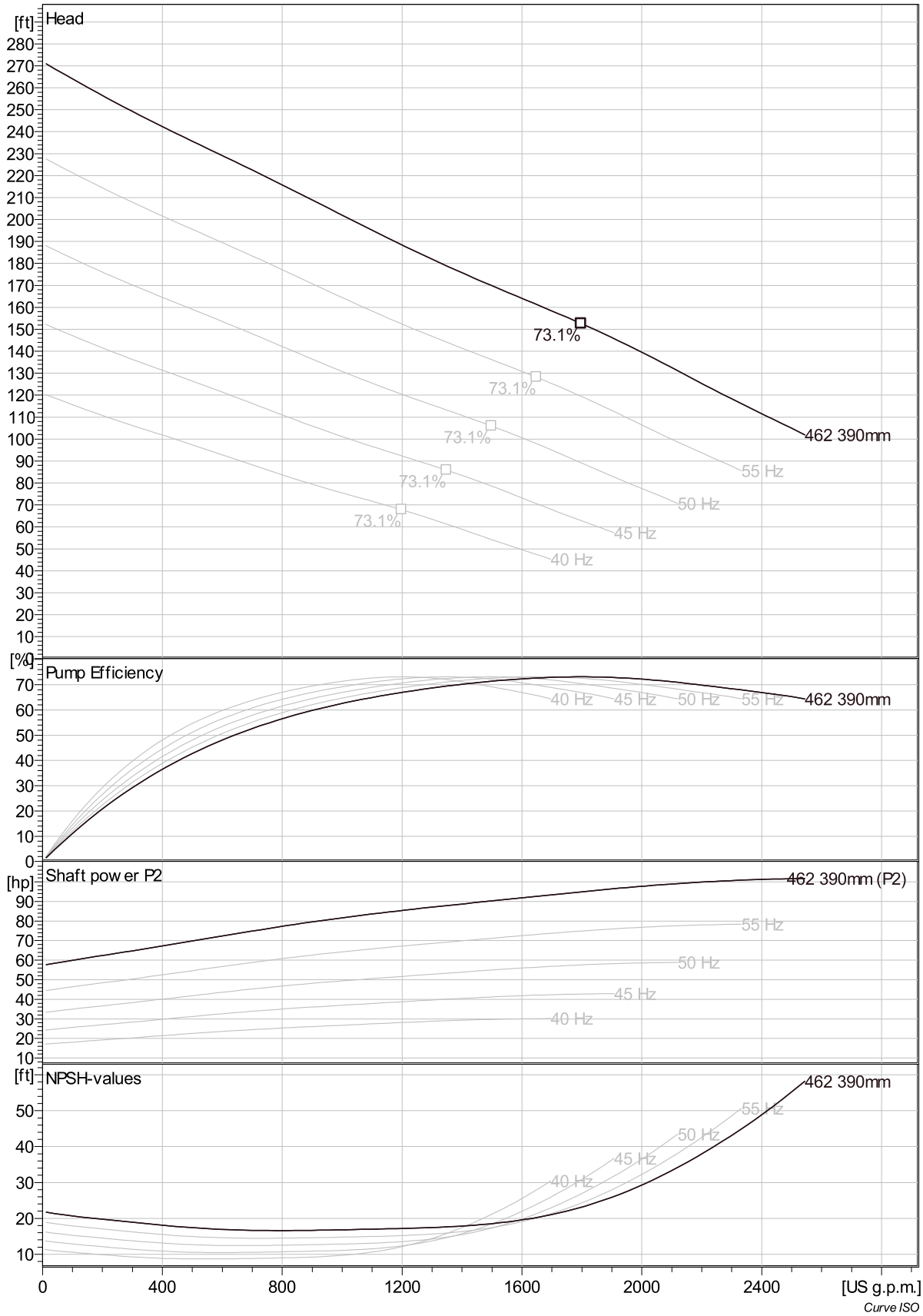
Motor efficiency	
1/1 Load	93.0 %
3/4 Load	94.5 %
1/2 Load	95.0 %



Project	Project ID	Created by	Created on	Last update
			1/16/2019	

NP 3301 HT 3~ 462

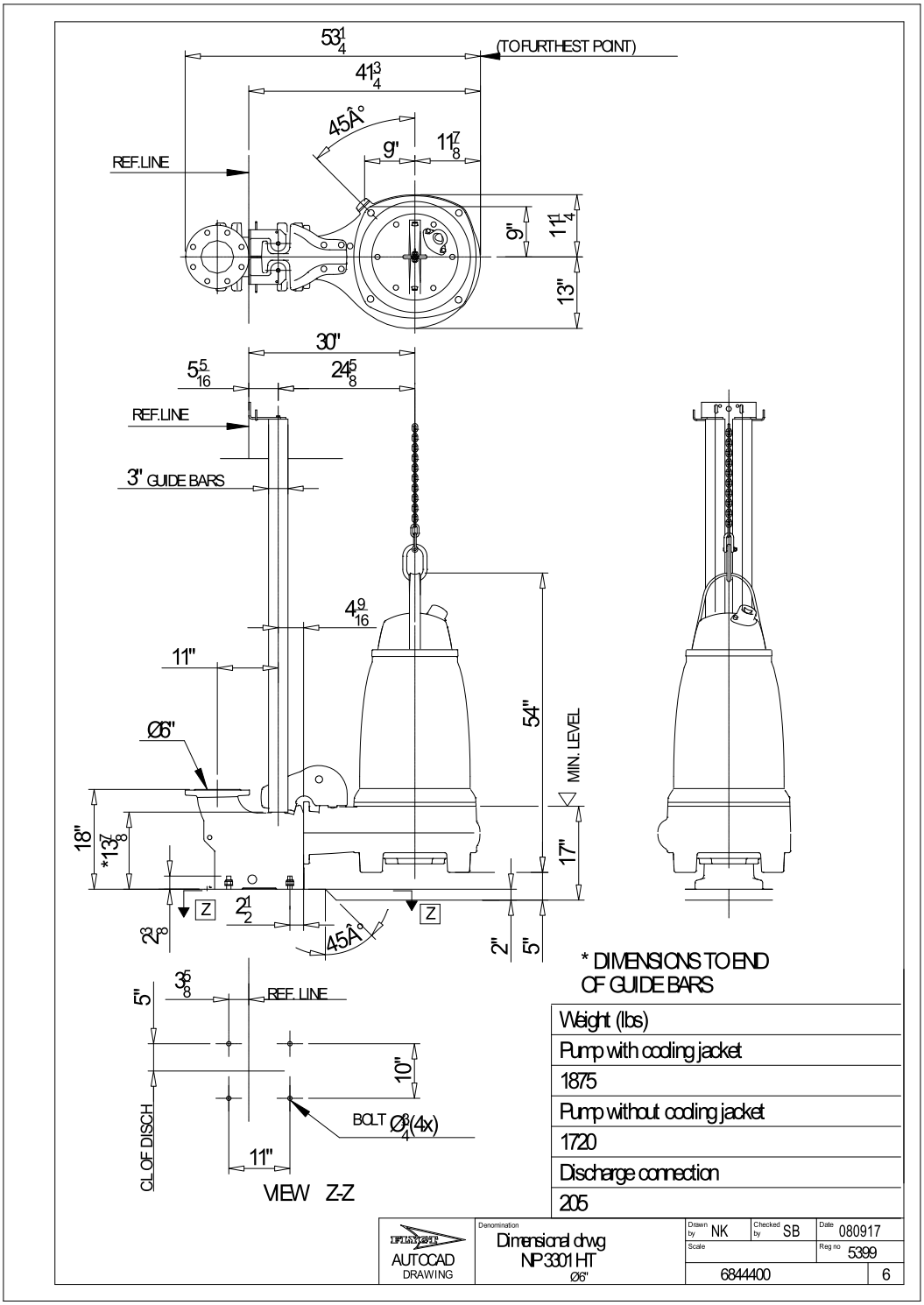
VFD Curve



Project	Project ID	Created by	Created on	Last update
			1/16/2019	

NP 3301 HT 3~ 462

Dimensional drawing



Project	Project ID	Created by	Created on	Last update
			1/16/2019	

APPENDIX D

Lee’s Summit Road Pump Station Capacity Calculation

olsson

Client: City of Lee's Summit
Project Name: Unity Village Apartments
Project Number: 019-0012
Description: Lee's Summit Road PS
Date: 3/18/2019
By: MRD

Pump Station Information

Floor Elevation	882.7	
LWL Elevation	886.7	
HWL Elevation	893.7	
Pump CL Elevation	883.7	
Discharge Elevation	985.0	
Static Head	98.3	ft
Design Flow	2.1	MGD
	1450	GPM
# of Pumps On	1	
Pump Design Flow	1450	GPM
Well Layout		
Station Diameter	0.0	ft
Length	14.0	ft
Width	12.0	ft
Wet Well		
Storage	1256.6	gallons per foot
Storage	8796.5	gallons
Additional Storage		
Influent Pipe Diameter	0	inches
Surcharge Depth	0	inches
Length	0	ft
Storage	0.0	gallons
Total Storage	8796.5	gallons

LS Cycle Times (@ 1/2 of single pump influent flow)		
On Time	12.1	minutes
Off Time	12.1	minutes
Total Cycle Time	24.3	minutes

Pump Suction Information

Pump Suction Information		
Atmospheric Press.@ Sea Level	33.96	Feet
Atmospheric Press. Correction	1.20	Feet
Atmospheric Press. @ Site	32.76	Feet
Vapor Pressure of Liquid	0.815	Feet
Safety Factor	3	Feet
Static Lift	3.00	Feet (+ Flooded)

Dia (in)	Description	K or L (ft)	#	Total K
Minor Losses				
6	plug valve	1	0	0.0
6	90 Deg. Elbow	0.3	2	0.6
6	45 Deg. Elbow	0.2	1	0.2
6	22.5 Deg. Elbow	0.1	0	0.0
6	Misc. Fittings	1	0	0.0
6	Check Valve	2.5	0	0.0
6	Entrance Losses	1	1	1.0
			Total	1.8
		HLm @ Design =		0.46
Pump Suction Pipe				
6	Pipe Length	0	C1=	100
			C2=	120
		HL @ Design =		0.00
		TDSL @ Design =		-2.54

Net Deductions from Available At. Press.	1.27	Feet
NSPH Available	31.49	Feet

Lift Station Piping Information

Single Pump Discharge Pipe

Dia (in)	Description	K or L (ft)	#	Total K
Minor Losses				
6	plug valve	1	1	1.0
6	90 Deg. Elbow	0.3	2	0.6
6	45 Deg. Elbow	0.2		0.0
6	22.5 Deg. Elbow	0.1	0	0.0
6	Misc. Fittings	1	0	0.0
6	Check Valve	2.5	1	2.5
			Total	4.1
Pump Discharge Pipe				
6	Pipe Length	5.0	C1=	100
			C2=	120

Header

Dia (in)	Description	K or L (ft)	#	Total K
Minor Losses				
8	plug valve	1		0.0
8	90 Deg. Elbow	0.3	1	0.3
8	45 Deg. Elbow	0.2		0.0
8	22.5 Deg. Elbow	0.1		0.0
8	Misc. Fittings	1	0	0.0
8	Check Valve	2.5	0	0.0
			Total	0.3
Pump Discharge Pipe				
8	Pipe Length	10	C1=	100
			C2=	120

Force Main Piping Information

Dia (in)	Description	K or L (ft)	#	Total K
Minor Losses				
12	plug valve	1	0	0.0
12	90 Deg. Elbow	0.3	2	0.6
12	45 Deg. Elbow	0.2	2	0.4
12	22.5 Deg. Elbow	0.1	5	0.5
12	Misc. Fittings	1	5	5.0
12	Check Valve	2.5	0	0.0
12	Exit Losses	0.5	1	0.5
			Total	7.0
Pump Discharge Pipe				
12	Pipe Length	6533	C1=	100
			C2=	120

Client: City of Lee's Summit
Project Name: Unity Village Apartments
Project Number: 019-0012
Description: Lee's Summit Road PS
Date: 3/18/2019
By: MRD

PROPOSED PUMP

Design Point

Flow	1450	GPM (Total)
Flow	1450	GPM (per Pump)
TDH	172	Feet
NPSH Required	12	Feet
NPSH Excess	19.49	Feet (Must be Positive)

Pump Data

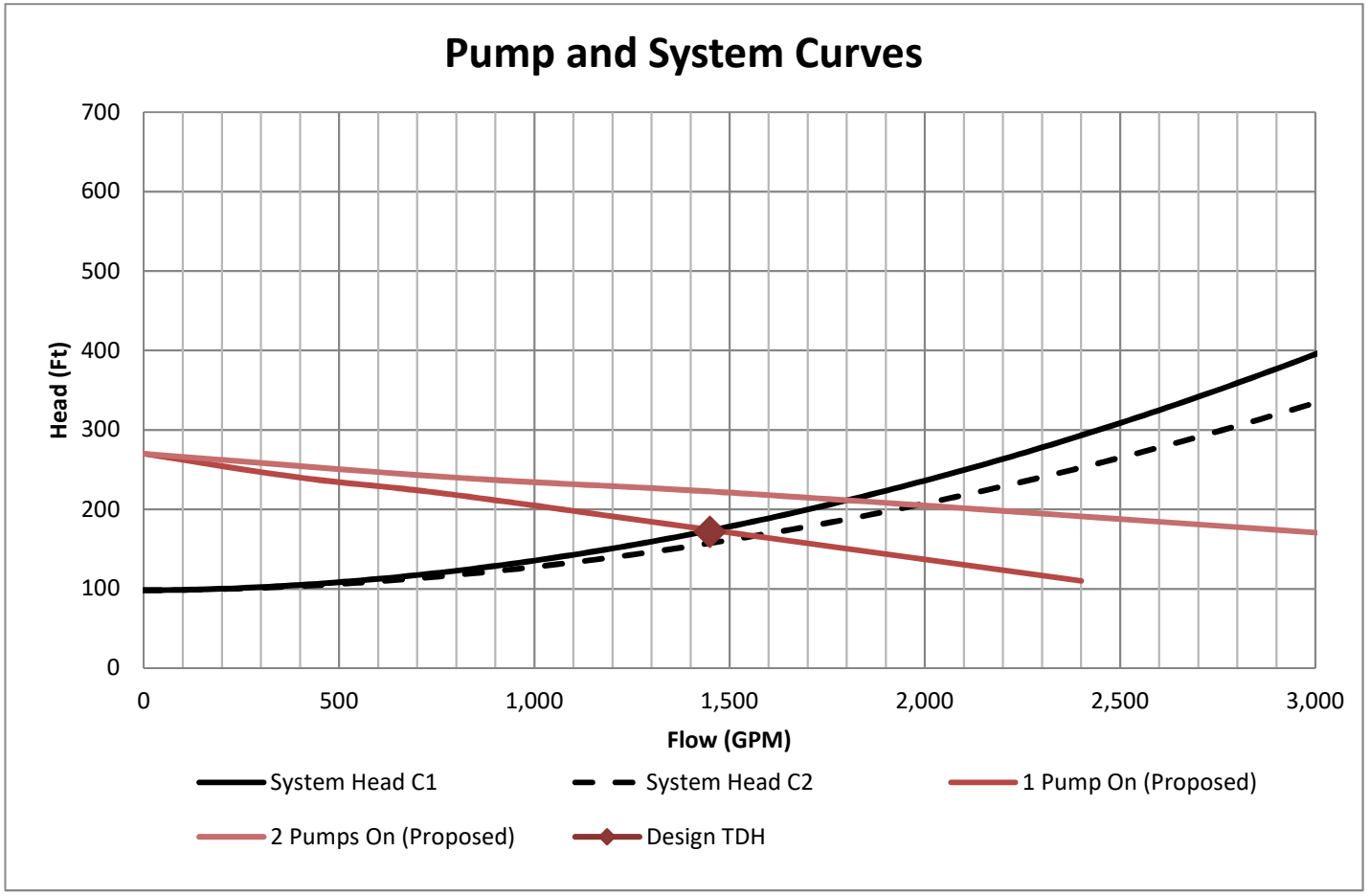
Flow gpm	Pump 1 & 2 TDH (ft)
0	270
400	240
800	218
1600	164
2400	110

Pump Curve Data

Flow (GPM) 1 Pump Running	Flow (GPM) 2 pumps Running
0	0
400	800
800	1600
1600	3200
2400	4800

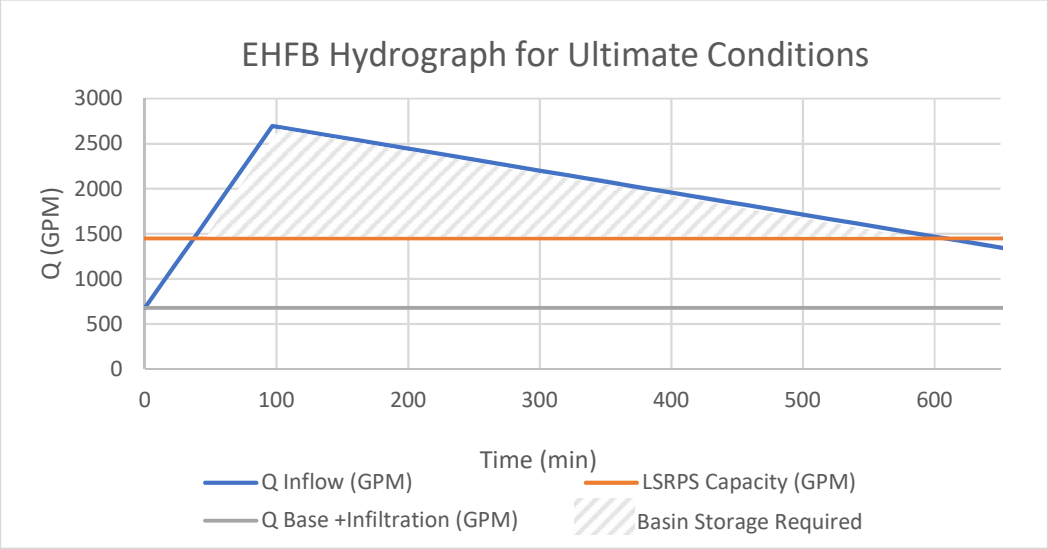
olsson

Client: City of Lee's Summit
Project Name: Unity Village Apartments
Project Number: 019-0012
Description: Lee's Summit Road PS
Date: 3/18/2019



APPENDIX E

EFHB Hydrograph for Ultimate Conditions


EHFB Hydrograph for Ultimate Conditions
3000
2500
2000
1500
1000
500
0
Q (GPM)
0
100
200
300
400
500
600
Time (min)
Q Inflow (GPM)
LSRPS Capacity (GPM)
Q Base +Infiltration (GPM)
Basin Storage Required

SANITARY SEWER CAPACITY ANALYSIS
ARIA & SUMMIT VILLAGE NORTH

May 2019

Olsson Project No. 019-0012