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July 26, 2017

City of La Center
Attn: Tony Cooper
305 NW Pacific Hwy
La Center, WA 98629

RE: Existing Sewer Conveyance Capacity Analysis

Dear Tony,

The Riverside Estates Subdivision and the Sunrise Terrace Subdivision have both been proposed to be constructed along Old Pacific Highway in the northwest corner of the City of La Center. Unfortunately, there is no existing sanitary service to this portion of the city. As a result, a sanitary pump station has been proposed in the southeast corner of the Riverside Estates Subdivision to provide the necessary service for both developments. Due to the size of both projects, it was prudent to verify the capacity of the impacted portion of the City of La Center's existing sanitary sewer conveyance system to ensure it is sized sufficiently to accommodate the increased flows. The following analysis and documentation is intended to confirm that the existing sanitary sewer conveyance system is sufficient to safely convey the additional sewer generated from both developments.

As part of this analysis, Romtec Utilities was contracted to complete a preliminary pump station design and size the proposed sanitary force main which will convey the effluent from the proposed pump station to the City of La Center's existing sanitary conveyance system. A basin analysis was previously completed to establish peak flow rates generated from the total buildout of the Riverside Estates Subdivision and the Sunrise Terrace Subdivision. These flows were provided to Romtec Utilities who used them to complete the preliminary pump station design. The preliminary design resulted in a 6' I.D. wet well structure and a 687 valve vault structure with 4" discharge piping, valves, and fittings. The pump station will use a 6" force main and will generate a total flow rate of 305 gpm. A spreadsheet depicting the design assumptions and friction losses, along with the conceptual plan and profile, has been included with this analysis.

As directed by city staff, the analysis of the sanitary sewer conveyance system was limited to the portion of the system that will be impacted by the increased flows generated from the proposed developments to the beginning of the new 18" gravity main recently installed by the City of La Center. As can be seen in the provided plan and profile, the force main will discharge into the existing sanitary manhole located at the north end of W E Avenue. This manhole is labeled as Manhole E18 on the City of La Center's Appendix B Collection System Map. After discharging into Manhole E18 the effluent will gravity flow south down W E Avenue through Manhole E17

into Manhole E16 located in the intersection of W E Avenue and W 7th Street. At this manhole flows are diverted east to Manholes E15 and E14. Manhole E14 is located in the intersection of W 7th Street and Pacific Highway. At Manhole E14 there is a considerable increase in flow which is generated from the majority of Basin E as delineated on the City's Collection System Map. The flow at Manhole E14 is then directed south down Pacific Highway through Manhole E12 into Manhole E7 which is the start of the new 18" gravity main. It should be noted that all of the conveyance pipes from Manhole E18 to E7 are 8".

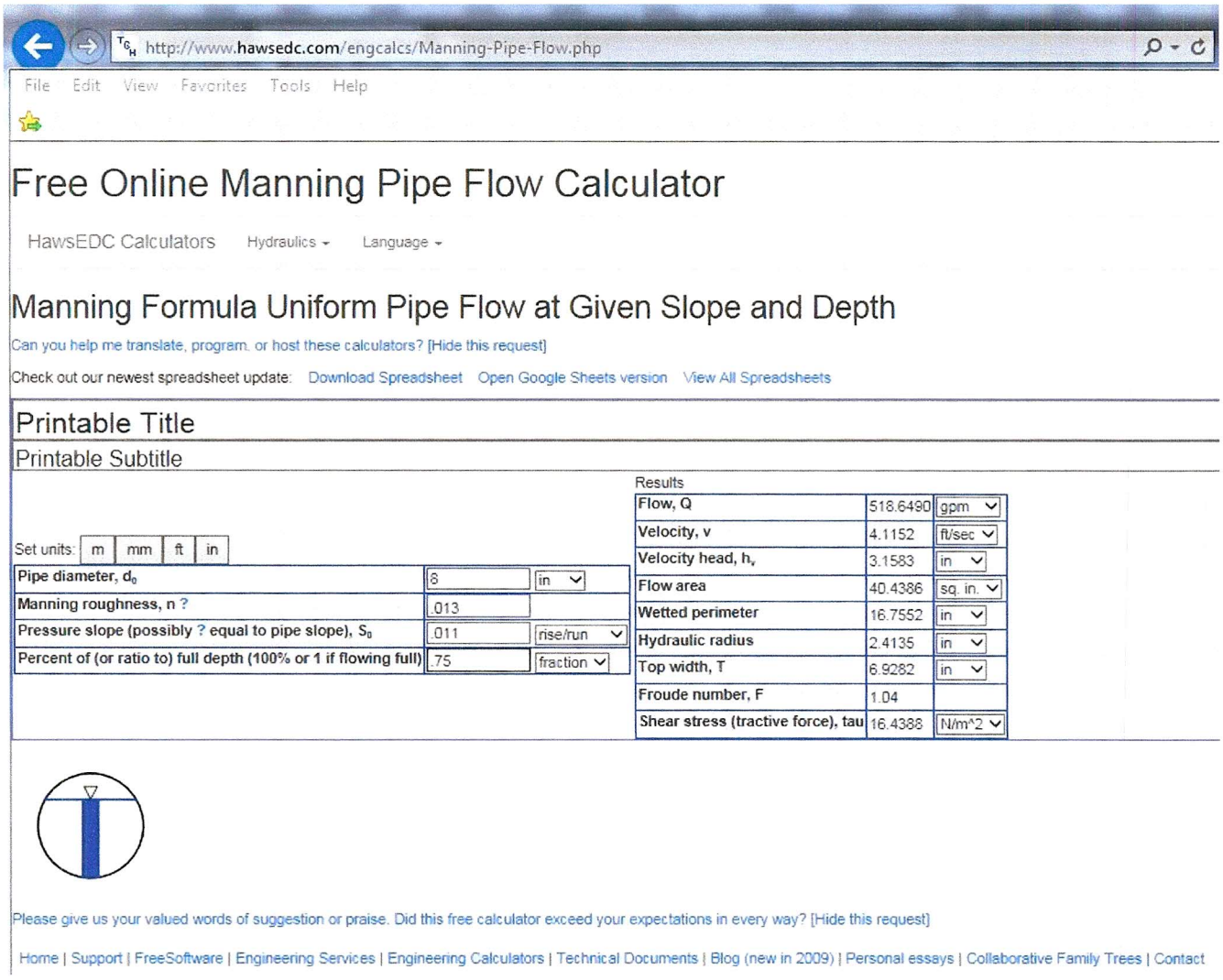
After determining which pipe sections would be impacted, anticipated flow rates were calculated for each section of pipe. These rates were established by utilizing the contributing flow spreadsheet provided by city staff to calculate the existing flows in the pipe and then adding the 305 gpm flows generated from the proposed pump station. The relevant portion of the spreadsheet used to calculate the existing flows has been included with this letter. After calculating the anticipated flows, it was determined, based on existing pipe slopes and contributing flows, that the pipes from Manholes E16 to E15 and Manholes E12 to E7 would be the confining sections of the conveyance system. Pipe slopes were calculated by having a surveyor establish locations and rim elevations of each manhole and obtain measurements from the rim to the inverts of the pipes. The rim elevations and the measure downs were then used to calculate the relative invert elevations. These elevations were then used to calculate the pipe slopes which were used to determine the flow capacity of the pipe.

Pipe capacities were calculated using Manning's Equation. These calculations were made assuming the pipes were flowing 75% full with a Manning's roughness coefficient of 0.013. Using an 8" diameter pipe with a slope of 1.1%, the 75% capacity of the pipe run from Manhole E16 to E15 is 518.65 gpm. This is greater than the 318.4 gpm anticipated flows through this pipe segment. The 75% capacity for the pipe run from Manhole E12 to E7 was calculated at 1,211 gpm using a 6.0% pipe slope. This is substantially greater than the 618.1 gpm anticipated for this pipe segment. Printouts verifying these calculations have been included as Figures 1 and 2 below. Table 1 below shows the comparison of the anticipated flows and the 75% capacity flows for the two relevant pipes.

Table 1: Total Flows and 75% Pipe Capacity Comparison

PIPE SEGMENT ID	UP MH	DOWN MH	EXISTING FLOW	PEAK FLOW	PUMP STATION FLOW	TOTAL FLOW	75% PIPE CAPACITY
			(GPD)	(GPM)	(GPM)	(GPM)	(GPM)
Ia-75	**E-12**	**E-7**	82.9	313.1	305	618.1	1211.3
Ia-2	**E-16**	**E-15**	3.1	13.4	305	318.4	623.4

Figure 1: 75% Pipe Capacity for the Pipe Segment from Manhole E16 to E15



http://www.hawsedc.com/engcalcs/Manning-Pipe-Flow.php

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Free Online Manning Pipe Flow Calculator

HawsEDC Calculators Hydraulics Language

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Printable Title

Printable Subtitle

Set units: m | mm | ft | in

Pipe diameter, d_o	8	in
Manning roughness, n ?	.013	
Pressure slope (possibly ? equal to pipe slope), S_o	.011	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q	518.6490	gpm
Velocity, v	4.1152	ft/sec
Velocity head, h_v	3.1583	in
Flow area	40.4386	sq. in.
Wetted perimeter	16.7552	in
Hydraulic radius	2.4135	in
Top width, T	6.9282	in
Froude number, F	1.04	
Shear stress (tractive force), tau	16.4388	N/m^2

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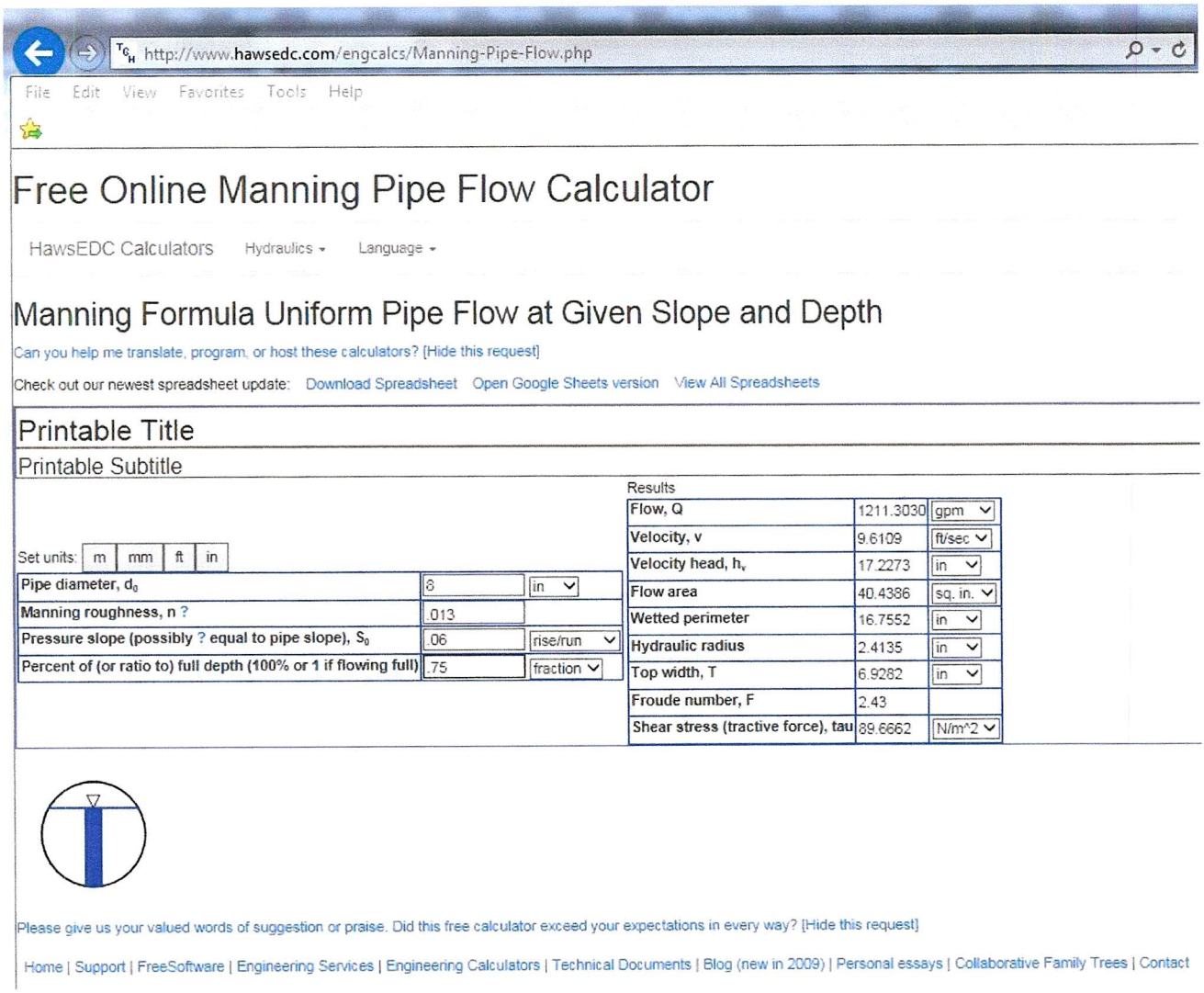
Figure 2: 75% Pipe Capacity for the Pipe Segment from Manhole E12 to E7



After completing the downstream sanitary sewer conveyance analysis we feel that the existing system has more than sufficient capacity to safely convey the additional sanitary effluent from the proposed pump station for the Riverside Estates and Highland Terrace Subdivisions. If you have any questions please feel free to call me at (360) 431-9988.

Sincerely,
Precision Land Services, Inc.

Tim Wines

Tim Wines, PE

APPENDIX A

Flow Calculations for Existing Sanitary Mainline

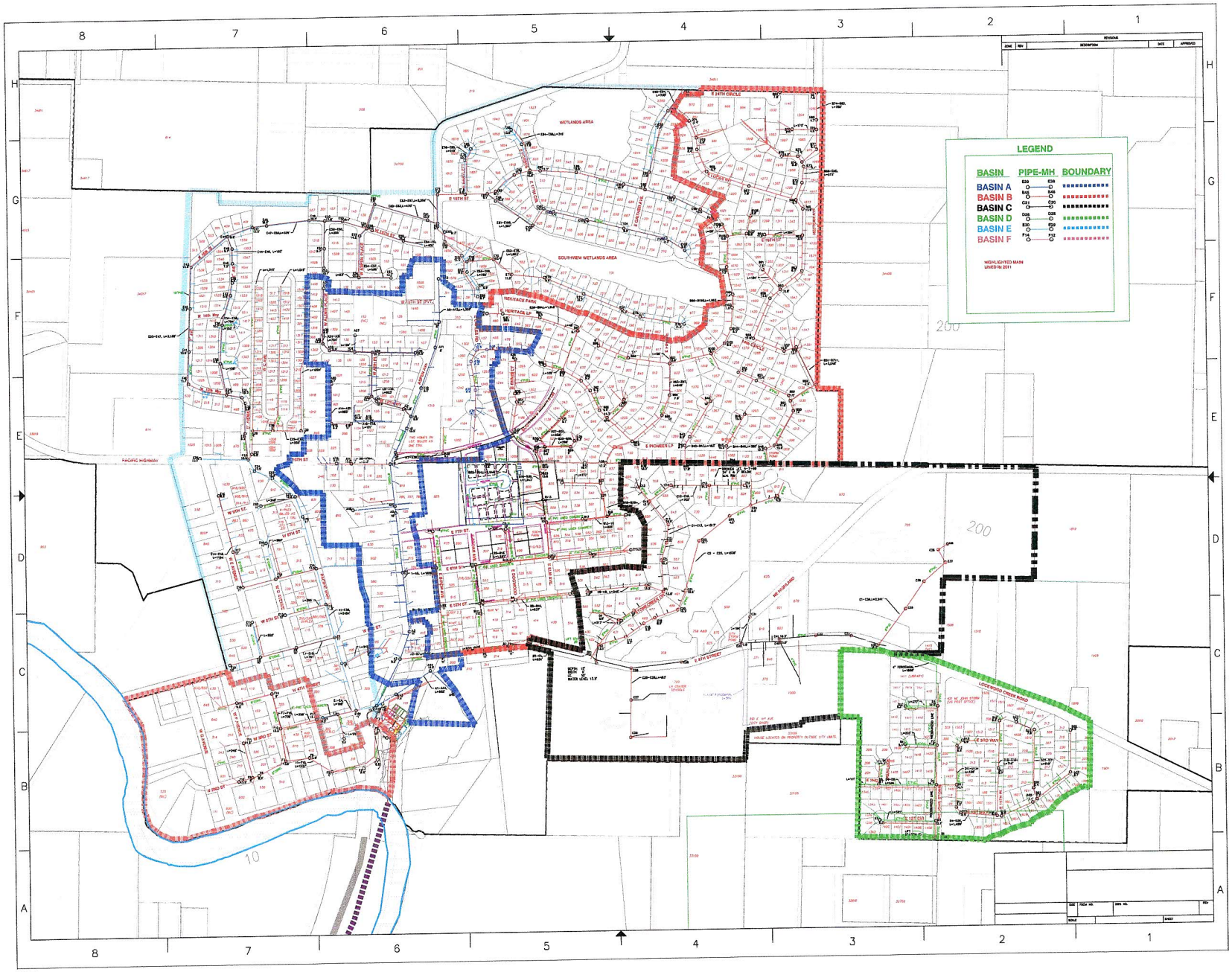
Table A-1 - Sanitary Sewer Collection System Flows

MAINLINE E with Riverside Estates and Highland Terrace										
PIPE SEGMENT ID	UP MH	DOWN MH	CONTRIBUTING ERU	TOTAL ERU	TOTAL PERSONS PER 1000	PEAK FACTOR	EXISTING FLOW (GPD)	PEAK FLOW (GPM)	PUMP STATION FLOW (GPM)	TOTAL FLOW (GPM)
la-75	**E-12**	**E-7**	9	402	1.085	3.8	82.9	313.1	305	618.1
la-73	**E-20**	**E-14**	349	393	1.061	3.8	81.1	306.7	305	611.7
la-74	**E-14**	**E-12**	23	44	0.119	4.2	9.1	38.3	305	343.3
la-3	**E-15**	**E-14**	6	21	0.057	4.3	4.3	18.6	305	323.6
la-2	**E-16**	**E-15**	4	15	0.041	4.3	3.1	13.4	305	318.4
la-1	**E-17**	**E-16**	4	11	0.030	4.4	2.3	9.9	305	314.9
la-4	**E-18**	**E-17**	7	7	0.019	4.4	1.4	6.3	305	311.3

* Highlighted rows indicate pipe segments analysed for conveyance capacity.

APPENDIX B

City of La Center's Appendix B Collection System Map


LEGEND
BASIN
PIPE-MH
BOUNDARY
BASIN A
BASIN B
BASIN C
BASIN D
BASIN E
BASIN F
HIGHLIGHTED MAIN LINED IN 2011
WETLANDS AREA
SOUTHVIEW WETLANDS AREA
E 24TH CIRCLE
E 18TH ST
E 16TH ST
E 12TH ST
E 8TH ST
E 6TH ST
E 5TH ST
E 4TH ST
E 3RD ST
E PIONEER LP
HERITAGE LP
PACIFIC HIGHWAY
LOCHWOOD CREEK ROAD
200
10

APPENDIX C

Romtec Utilities Preliminary Pump Station Design

ROMTEC UTILITIES

SYSTEM PIPING

JOB NAME: Riverside Estates (4in Wet Well Piping) **DATE:** 6/15/17

ELEVATIONS:

FM Discharge:	178.54
Lead Start:	123.85
Lead Stop:	121.33
Total Flow:	305 gpm
Duty Pumps:	1
Total Pumps:	2

	New Pipe Water @ Start	Old Pipe Water @ Stop	
Pump Flow:	305.0	305.0	
Static Head:	54.69	57.21	ft
TDH:	77.2	84.9	ft
Est. Efficiency:	50%		
Est. HP:	11.9	13.1	HP

PIPE MATERIAL AND SIZE

	Wet Well	Valve Vault	Meter Vault	FM1	FM2	FM3
Length:	12	20		2600		
Material:	Ductile Iron	Ductile Iron		PVC		
Class:	Class 53	Class 53		C900 DR18		
Nom. ID:	4"	4"		6"		
True ID:	4.160	4.160		6.080		
New C:	130	130		150		
Old C:	110	110		130		
Section GPM:	305.0	305.0		305.0		
V (ft/s):	7.20	7.20		3.37		

PIPE FITTINGS

	Wet Well	Valve Vault	Meter Vault	FM1	FM2	FM3
Disch Ell:	1					
45 Ell:				5		
90 Ell:	1	1		1		
Tee:		3				
Valve:		2				
Check:		1				
Outlet:				1		
Other (K=.5):						
Total K	0.8	5.6	0.0	2.1	0.0	0.0

FRICTION LOSSES

	Wet Well	Valve Vault	Meter Vault	FM1	FM2	FM3
Major Loss_New:	0.59	0.98		15.39		
Major Loss_Old:	0.80	1.33		20.06		
Minor Loss:	0.64	4.51		0.36		

Total Friction Loss New: 22.47 Total Friction Loss Old: 27.71