



Dewberry®

Sanitary Sewer Lift Station Calculations

The Cascades – Phase 5

City of Groveland

(Job No.: 2SHC-J13)

Submitted To
City of Groveland

Prepared for:
Shea Homes Active Adult, LLC

Prepared by:
Dewberry

June 2015



Sanitary Sewer Lift Station Calculations

The Cascades – Phase 5

City of Groveland

Submitted To:
City of Groveland

Prepared For:
Shea Homes Active Adult, LLC

June 2015



The Cascades – Phase 5 Lift Station Summary

The project will include approximately five lift stations when built out. The network of lift stations and force mains was previously master planned. Lift stations #1 and #2 were built with Phase 1 of the project. Lift station #3 was built with Phase 3. Lift Stations #4 is currently being built with Phase 4.

Lift Station #5 will be built on the northeast portion of Phase 5 and will serve 348 units from Phase 5 and future Phase 6. 79 units from Phase 5 will contribute to Lift Station #4 and those lots were included in the calculations for the Phase 4 project. Please see Attachment A for the site layout showing the contributing units to the lift stations. Lift Station #5 will have a 6" forcemain that will connect to the existing 12" forcemain along Wilson Lake Parkway just south of Phase 4.

Lift Station #5 was previously permitted under FDEP Permit Number CS35-0241263-009. However, the permit has expired since and a new permit and calculations will be submitted to FDEP. Due to changes in the site layout and increase in lots contributing to the Lift Station #5, the calculations were revised for the new layout.

Attachment B shows the proposed operating condition for Lift Station #5. Attachment C includes the buoyancy calculations.



APPENDIX A

Site Layout



PHASE 5 = 348 LOTS TO LS#5



APPENDIX B

Lift Station Calculations

The Cascades

2SHC-J13

Lift Station # 5

DESIGN FLOW DETERMINATION

City of Groveland Requirement: ADF = 90 gallons/capita/day with 3.5 persons per connection = 315 gpd/unit

MDF = 4.0 * ADF

Peak Factor: 3.5 (flow 0.00 to 0.05 MGD-ADF), 3.0 (flow 0.05 to 0.25 MGD-ADF)

FLOW SOURCE

AVG DAILY FLOW (GPD)

	Units	Flow/Unit	
Single Family Units	348	315	<input type="text" value="109620"/> (see wastewater flow calculations)
TOTAL (gpd/gpm):		109620 /	76.13
POPULATION EQUIVALENT (000'S):			1.10
PEAKING FACTOR:			<input type="text" value="3.00"/>
PEAK FLOW (gpm):			228.4

TRIBUTARY FLOW FROM OTHER LIFT STATIONS

STATION NUMBER DESIGN FLOW (gpm)

TOTAL DESIGN INFLUENT = 228.4
DESIGN EFFLUENT = gpm

WETWELL SIZING CALCULATIONS

ENTER MINIMUM CYCLE TIME (min):
 DESIGN FLOW - ADF (gpm): 76.13
 MINIMUM WETWELL STORAGE (gal): 837.4
 MINIMUM PUMPING TIME AT 0 INFLOW (min): 4.53

WETWELL DIAMETER (ft):	4.00	6.00	8.00	10.00	
MIN. REQUIRED OPERATING RANGE (ft)	8.91	3.96	2.23	1.43	(must be between 2 ft and 4 ft)
WETWELL DIAMETER SELECTED:	<input type="text" value="6.00"/>				

BASIS: WETWELL VOLUME = CYCLE TIME * DESIGN FLOW / 4

DETERMINE CONTROL ELEVATIONS

TOP OF LIFT STATION		<input type="text" value="96.00"/> A
LOWEST GRAVITY INVERT ELEVATION:		<input type="text" value="82.25"/> B
HIGH LEVEL ALARM	0.50 /	81.75 C
LAG PUMP ON	0.50 /	81.25 D
LEAD PUMP ON	0.50 /	80.75 E
BOTH OFF (Operating Range from Selected Wetwell Diameter)	<input type="text" value="2.00"/> /	78.75 F
INSIDE BOTTOM / ELEVATION:	2.00 /	76.75 G

TOTAL DESIGN HEAD CALCULATION - Minor Losses Coefficient Determination

TYPE	COEFFICIENT	Maximum Design Condition				Run-Out Condition			
		DISCHARGE		On-Site FM		Off-Site FM		Off-Site City FM	
		NUMBER	K TOTAL	NUMBER	K TOTAL	NUMBER	K TOTAL	NUMBER	K TOTAL
1. BEND 90	0.30	2	0.60	0	0.00	2	0.60	0	0.00
2. BEND 45	0.23	1	0.23	9	2.07	2	0.46	0	0.00
3. CHECK VALVE	2.50	1	2.50	0	0.00	0	0.00	0	0.00
4. PLUG VALVE	0.90	1	0.90	0	0.00	0	0.00	0	0.00
5. TEE-BRANCH	1.80	0	0.00	1	1.80	0	0.00	0	0.00
6. TEE-STRAIGHT	0.60	0	0.00	0	0.00	0	0.00	0	0.00
7. REDUCER	0.25	0	0.00	0	0.00	0	0.00	0	0.00
8. OUTLET LOSS	1.00	0	0.00	0	0.00	0	0.00	0	0.00
9. Bend 22	0.12	0	0.00	0	0.00	0	0.00	0	0.00
10. WYE 45	0.23	0	0.00	0	0.00	0	0.00	0	0.00
11.	1.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTALS			4.23		3.87		1.06		0.00

HEAD LOSS DETERMINATION

PIPE:	DISCHARGE	On-Site FM	Off-Site FM	Off-Site FM #2
DESIGN FLOW (gpm):	185.0	185.0	1300.0	1300.0
DIAMETER (in):	<input type="text" value="4.00"/>	<input type="text" value="6.00"/>	<input type="text" value="12.00"/>	<input type="text" value="16.00"/>
VELOCITY (fps) <i>(must be between 2 and 5 fps)</i>	4.72	2.10	3.69	2.07
VELOCITY HEAD (ft):	0.35	0.07	0.21	0.07
MINOR LOSSES (ft):	1.47	0.26	0.22	0.00
PIPE LENGTH (ft):	<input type="text" value="30"/>	<input type="text" value="2850"/>	<input type="text" value="10200"/>	<input type="text" value="9600"/>
DESIGN "C" FACTOR:	120	130	130	130
FRICTION LOSS (ft):	0.816	9.29	41.88	9.71
TOTAL FRICTION LOSSES (ft):	11.83		Off-Site Friction Losses (ft)	51.82

DESIGN HEAD CALCULATION

DISCHARGE ELEVATION:	<input type="text" value="130.00"/> (Highest Point in FM)	Discharge Elev.:	130.00
PUMPS OFF ELEVATION:	78.75	Lead Pump On Ele	80.75
MAX. ELEVATION HEAD: (Discharge - Pumps off elev.)	51.25 feet	MIN. ELEV. HEAC	49.25 feet
FM TIE-IN HEAD: <input type="text" value="25.00"/> PSI	57.69 feet	STATIC HEAD:	49.25 feet
STATIC HEAD:	108.94 feet	FRICTION HEAD:	63.65 feet
TOTAL FRICTION LOSSES:	11.83 feet	TOTAL HEAD:	112.90 feet
--TOTAL DESIGN HEAD--	120.77 feet		

SYSTEM HEAD CURVE GENERATION

SET INITIAL FLOW (gpm): 0.00
 SET INCREMENTAL FLOW (gpm): 10.00

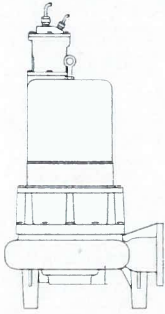
FLOW (gpm)	Maximum Design Condition					Run-Out Condition				
	DISCHARGE		On-Site FM		Head w/ 25.00 PSI AT FM	Off-Site FM		Off-Site FM #2		Head w/ 0 PSI AT FM
	FRICITION	MINOR	FRICITION	MINOR		FRICITION	MINOR	FRICITION	MINOR	
0.0	0.00	0.00	0.00	0.00	108.94	0.00	0.00	0.00	0.00	49.25
10.0	0.00	0.00	0.04	0.00	108.99	0.01	0.00	0.00	0.00	49.31
20.0	0.01	0.02	0.15	0.00	109.13	0.02	0.00	0.00	0.00	49.46
30.0	0.03	0.04	0.32	0.01	109.34	0.04	0.00	0.01	0.00	49.69
40.0	0.05	0.07	0.55	0.01	109.62	0.07	0.00	0.02	0.00	50.01
50.0	0.07	0.11	0.83	0.02	109.97	0.10	0.00	0.02	0.00	50.40
60.0	0.10	0.15	1.16	0.03	110.38	0.14	0.00	0.03	0.00	50.86
70.0	0.14	0.21	1.54	0.04	110.86	0.19	0.00	0.04	0.00	51.40
80.0	0.17	0.27	1.97	0.05	111.41	0.24	0.00	0.06	0.00	52.01
90.0	0.22	0.35	2.45	0.06	112.02	0.30	0.00	0.07	0.00	52.69
100.0	0.26	0.43	2.98	0.08	112.68	0.36	0.00	0.08	0.00	53.44
110.0	0.31	0.52	3.55	0.09	113.41	0.43	0.00	0.10	0.00	54.26
120.0	0.37	0.62	4.17	0.11	114.21	0.51	0.00	0.12	0.00	55.14
130.0	0.43	0.72	4.83	0.13	115.06	0.59	0.00	0.14	0.00	56.09
140.0	0.49	0.84	5.54	0.15	115.97	0.68	0.00	0.16	0.00	57.11
150.0	0.55	0.96	6.30	0.17	116.93	0.77	0.00	0.18	0.00	58.19
160.0	0.62	1.10	7.10	0.20	117.96	0.87	0.00	0.20	0.00	59.34
170.0	0.70	1.24	7.94	0.22	119.04	0.97	0.00	0.23	0.00	60.55
180.0	0.78	1.39	8.83	0.25	120.18	1.08	0.00	0.25	0.00	61.83
190.0	0.86	1.55	9.75	0.28	121.38	1.19	0.00	0.28	0.00	63.16
200.0	0.94	1.71	10.73	0.31	122.63	1.31	0.01	0.30	0.00	64.56
210.0	1.03	1.89	11.74	0.34	123.94	1.44	0.01	0.33	0.00	66.03
220.0	1.12	2.07	12.79	0.37	125.31	1.57	0.01	0.36	0.00	67.55
230.0	1.22	2.26	13.89	0.41	126.73	1.70	0.01	0.39	0.00	69.14
240.0	1.32	2.47	15.03	0.45	128.20	1.84	0.01	0.43	0.00	70.78
250.0	1.43	2.68	16.21	0.48	129.73	1.98	0.01	0.46	0.00	72.49
260.0	1.53	2.89	17.43	0.52	131.32	2.13	0.01	0.49	0.00	74.26
270.0	1.64	3.12	18.69	0.56	132.96	2.29	0.01	0.53	0.00	76.09
280.0	1.76	3.36	19.99	0.61	134.65	2.45	0.01	0.57	0.00	77.98
290.0	1.88	3.60	21.33	0.65	136.40	2.61	0.01	0.61	0.00	79.93
300.0	2.00	3.85	22.71	0.70	138.20	2.78	0.01	0.64	0.00	81.94
310.0	2.12	4.11	24.13	0.74	140.05	2.95	0.01	0.68	0.00	84.01
320.0	2.25	4.38	25.59	0.79	141.96	3.13	0.01	0.73	0.00	86.14
330.0	2.38	4.66	27.09	0.84	143.92	3.32	0.01	0.77	0.00	88.32
340.0	2.52	4.95	28.63	0.89	145.93	3.50	0.02	0.81	0.00	90.57
350.0	2.66	5.24	30.20	0.95	147.99	3.70	0.02	0.86	0.00	92.87
360.0	2.80	5.55	31.82	1.00	150.11	3.89	0.02	0.90	0.00	95.23

All Pumps On Condition: 150.0 GPM at 118.0 Feet TDH

Velocity: 3.83 feet/sec

Maximum Run-Out Condition: 410.0 GPM at 105.0 Feet TDH

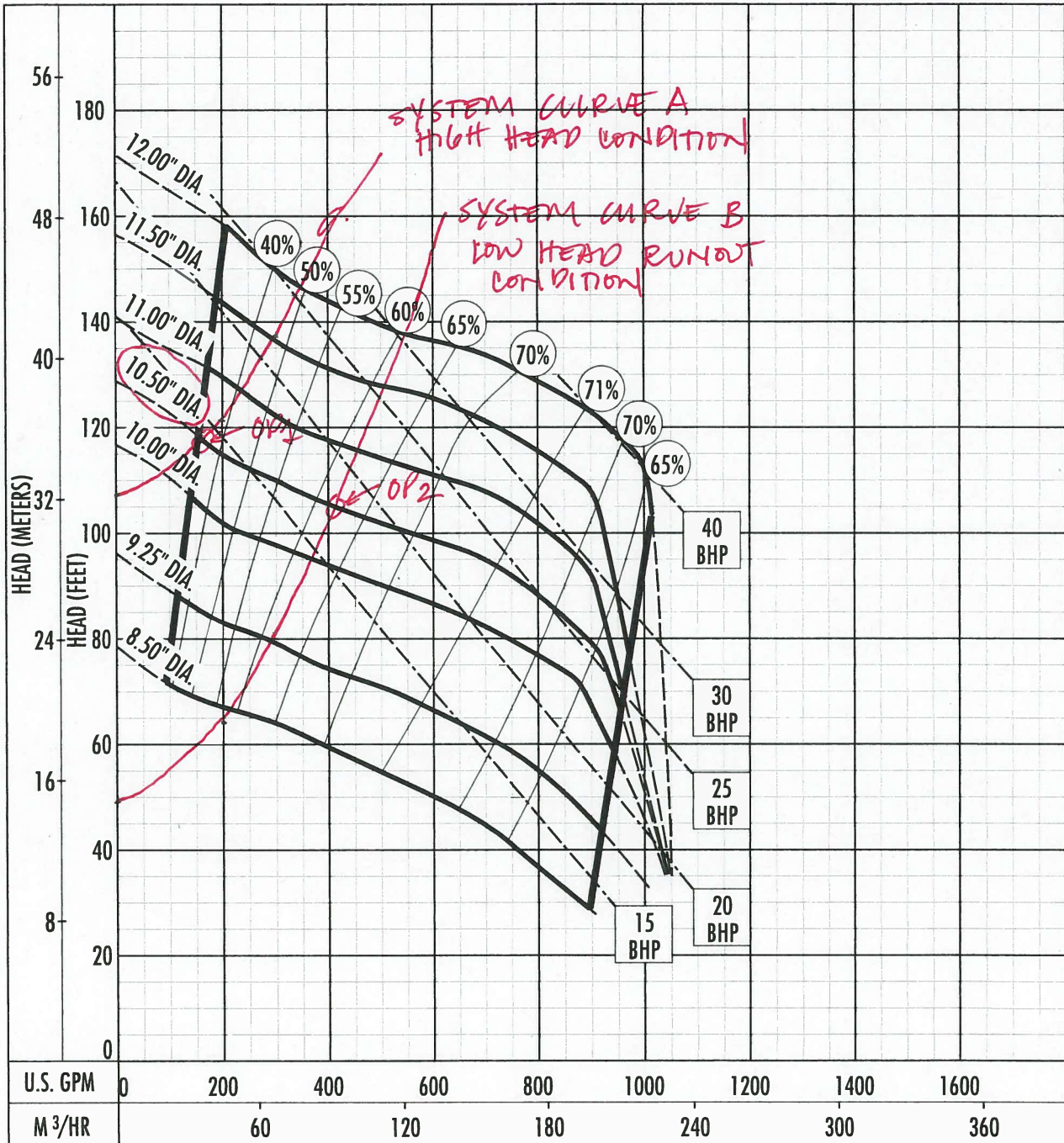
Velocity: 10.47 feet/sec



Performance Curve

S4K/S4KX

RPM: **1750** Discharge: **4"** Solids: **3"**



The curves reflect maximum performance characteristics without exceeding full load (Nameplate) horsepower. All pumps have a service factor of 1.2. Operation is recommended in the bounded area with operational point within the curve limit. Performance curves are based on actual tests with clear water at 70° F. and 1280 feet site elevation.



APPENDIX C

Buoyancy Calculations

CASCADES PH. 5

Lift Station

Prepared by Dewberry

Date: 06/30/15

By: JPP

FLOTATION CALCULATIONS-CONCRETE WET WELL/MANHOLE STRUCTURE

CONCRETE = 150.00 LBS/FT3
SATURATED SOIL = 120.00 LBS/FT3
WATER = 62.40 LBS/FT3

Design Assumptions:
- NO WATER IN WET WELL
- NEGLECT TOP SLAB WEIGHT
- NEGLECT SOIL FRICTION

NOTE: Spaces following the single arrow lines are to be input by the user.

CALCULATE BARREL WEIGHT

OUTSIDE DIAMETER (FEET) -----> 7.33
INSIDE DIAMETER (FEET) -----> 6.00
HEIGHT OF BARREL (FEET) -----> 19.25

WEIGHT OF BARREL (LBS) ----->>> 40,206.26

CALCULATE BOTTOM SLAB WEIGHT

DIAMETER (FEET) -----> 10.30
THICKNESS (FEET) -----> 1.00

WEIGHT OF BOTTOM SLAB (LBS) ----->>> 12,498.43

CALCULATE SOIL WEIGHT

DIAMETER OF BOTTOM SLAB (FEET) ----->>> 10.30
OUTSIDE DIAMETER OF BARREL (FEET) ----->>> 7.33
HEIGHT OF BARREL (FEET) ----->>> 20.50

WEIGHT OF SOIL (LBS) ----->>> 32,705.36

TOTAL WEIGHT ----->>> 85,410.05

CALCULATE WEIGHT OF WATER DISPLACED

OUTSIDE DIAMETER OF BARREL (FEET) ----->>> 7.33
HEIGHT OF BARREL (FEET) ----->>> 19.25
DIAMETER OF BOTTOM SLAB (FEET) ----->>> 10.30
THICKNESS OF BOTTOM SLAB (FEET) ----->>> 1.00

WEIGHT OF WATER DISPLACED (LBS) ----->>> 55,888.28

$$\text{SAFETY FACTOR} = \frac{85,410.05}{55,888.28} = \boxed{1.53}$$