Lake Hills Main Blvd. & Mass Grading

Lift Station Report

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Certificate of Authorization No. EB-0007723

Documents included herein which have been prepared by professionals other than Madden, Moorhead, and Stokes, Inc. are not covered under the above registered engineer's signature and seal

Appendices
A   Lift Station Design Calculations
B   Lift Station Pump Data

LIFT STATION ANALYSIS/FORCE MAIN

The proposed development Lake Hills Main Blvd & Mass Grading consists of a spine road for future development. The future development consists of +/-560 senior living homes. The project will have a gravity collection system, which will connect to 1 lift station. Lift Station 1 is in the center of the site along the spine road. Lift Station 1 is designed to serve the future senior living homes and the future commercial development part of the PUD plan. Lift Station 1 has an average daily flow is 98,700 GPD and the peak hourly flow is 274 GPM.

The force main tie-in location is an existing force main stub located along a maintenance road within the Silver Springs Mission Inn Parcel that connects to the Sewer & Water Plant Investments, LLC parcel. The force main is owned and maintained by the Central Lake Community Development District. The lift station calculations are in Appendix A. The force main velocity calculations are in Appendix A, showing the minimum velocity of 2ft/sec is achieved. A Hydromatic pump was picked for the Lift Station. The pump curve with operating condition noted is in Appendix B along with other pump information. Lift Station 1 operates at 302 GPM at70.1 feet TDH.

DEMAND SUMMARY AND CAPACITY ANALYSIS
Lift Station 1
ADF   Average Daily Flow: (558 units) x (150 GPD/unit) + (150,000sf) x (0.1GPD/sf)
                                = 98,700 GPD = 68.54 GPM
PHF   Peak Hourly Flow: ADF x 4 = 274.17 GPM

Gravity sewer capacity is given by $Q = (1.486/n)AR_h^{2/3}S^{1/2}$

Pipe Diameter		[1]Manning's Number, n	Area, A [SF]	[2]Hydraulic Radius, R_h	[3]Slope, S [FT/FT]	Pipe Capacity Flowing Full, Q		[4]Pipe Capacity at 75% Full [GPM]
[IN]	[FT]					[CFS]	[GPM]	
8	0.67	0.012	0.349	0.167	0.0028	0.69	310.9	255.2
10	0.83	0.012	0.545	0.208	0.0021	1.09	488.2	400.8
12	1.00	0.012	0.785	0.250	0.0017	1.59	714.2	586.4
15	1.25	0.012	1.227	0.313	0.0012	2.42	1,088.0	893.2

Notes:
(1) Manning's n is 0.013 for PVC pipes
(2) Hydraulic Radius, R = D/4 for full-flowing pipes
(3) Minimum constructed slopes
(4) Gravity sewers shall be designed at no more than 75% full at peak flow.
(5) Per Civil Engineering Reference Manual Appendix 19.C, when d/D = 0.75, then Q/Q_{full} = 0.82

APPENDIX A

Lift Station 1 Design Calculations

LIFT STATION CALCULATIONS

Lake Hills

Lift Station #1

Located near Sta. 62+00

DESIGN FLOW RATE CALCULATION:

Residential

Single Family	Units	GPD/unit
	563	150
Total (GPD) =		84450

Shopping Center	Units	GPD/unit
Grocery Store (SF)	50,800	0.0727
Grocery Store (SF)	10,500	0.16

Outparcel A

Conveince Store (SF)	5,000	0.16

Outparcel B

Restaurant (SEAT)	250	25

Outparcel C

General Retail (SF)	6,000	0.16

Outparcel D

General Retail (SF)	25,000	0.16
Total (GPD) =		17383

Town of Howie-in the-Hills

Water Treatment Pan	1	200
Total (GPD) =		200

Total average daily flow	102,033 gpd

Peak factor	4
Peak inflow	283.43 gpm

WET WELL DESIGN ELEVATIONS AND CONTROL LEVELS:

B	Wet well diameter	6 ft
T	Top of wet well	73.28 ft
P	Influent invert in	55.60 ft
J	High-level alarm	54.95 ft
L	Lag pump ON	54.45 ft
M	Lead pump ON	53.95 ft
	Storage depth	1.85 ft
N	Pumps OFF	52.10 ft
	Sump depth	2.00 ft
Z	Floor of wet well	50.10 ft
	Wet well depth	23.18 ft

WET WELL BUOYANCY CALCULATION:

Assumptions:
1. SHWT is at wet well top
2. Unit weight of water   62.4 pcf

3. Unit weight of concrete	150.0	pcf
4. Unit weight of submerged soil	57.6	pcf

Assume SHWT at wet well top.

Wet well wall thickness	8.00	in
Bottom slab lip width	18.00	in
Bottom slab thickness	12.00	in
Volume of water displaced	1,062.92	cf
Total uplift force	66,326	lbs
Volume of concrete	407.52	cf
Weight of concrete	61,128	lbs
Volume of soil above lip	964.89	cf
Weight of soil above lip	55,578	lbs
Total resistance force	116,705	lbs
Factor of safety	1.8	

FUTURE FLOW CALCULATIONS:

Provided Wet Well Volume	391.31	gal
Capacity of 8" Force Main	1567	gpm
Used Capacity w/ Residential	302	gpm
Additional Capacity	**1265**	gpm
Additional Units Based on current Pump Operating condition	**28.00**	Units
Capacity of 8" Gravity Sewer main	394	gpm
Peak Flow of Residential	283	gpm
Additional Capacity	**111**	gpm

SYSTEM HEAD CURVE CALCULATION:

STATIC HEAD CALCULATION:

Pressure at tie-in location	25 psi
Elevation at tie-in location	83.00 ft
HGL at tie-in location	140.70 ft
Static head for pump	88.60 ft

SYSTEM HEAD CURVE CALCULATION:

Pipe Length	28 ft	7,700 ft
Pipe Inside Diameter	8.00 in	8.00 in
Pipe Area	0.349 sf	0.349 sf
Roughness C	130	130

Fittings:	K-Value	No.	Tot K	No.	Tot K
Discharge	1.0	1	1	1	1
90 Deg. Bend	0.6	2	1.2	0	0
45 Deg. Bend	0.4	0	0	20	8
Expansion	0.5	1	0.5	0	0
Gate Valve	0.4	1	0.4	15	6
Check Valve	2.5	1	2.5	0	0
Total K-Value			5.6		15.0

Q, gpm	V, fps	Friction Losses in Feet					TDH, ft
		Pipe	Fittings	Pipe	Fittings	Total	
270.0	1.7	0.05	0.26	12.43	0.69	13.42	102.02
280.0	1.8	0.05	0.28	13.29	0.74	14.36	102.96
290.0	1.9	0.05	0.30	14.18	0.80	15.33	103.93
300.0	1.9	0.05	0.32	15.10	0.85	16.33	104.93
310.0	2.0	0.06	0.34	16.05	0.91	17.36	105.96
320.0	2.0	0.06	0.36	17.02	0.97	18.41	107.01
330.0	2.1	0.07	0.39	18.01	1.03	19.50	108.10

CYCLE TIME CALCULATION:

Operating point flow	302.00 gpm
Wet well cross-section area	28.27 sf
Storage volume	391.31 gal
Pump on time	14.06 min
Pump off time	1.43 min
Cycle time	15.49 min
Maximum starts per hour	3.9

CHECK MINIMUM WET WELL STORAGE DEPTH:

$V = Q \times T / 4$, where:
  T = Minimum Cycle Time   5 min
  Q = Pumped Flow, gpm
  V = Required Wet Well Storage Volume, gallons
   ** assume both pumps are operating

Minimum volume	377.5 gal
Minimum storage depth	1.78 ft
Provided storage depth	1.85 ft, OK

CHECK MAXIMUM WET WELL STORAGE DEPTH:

Maximum filling time is 30 minutes under average conditions:

30 minutes of ADF	2056.25 gal
Maximum storage depth	9.72 ft
Provided storage depth	1.85 ft, OK

FORCE MAIN VELOCITY CALCULATIONS:

Q, gpm = 448.83 x (V, ft/s x A, sf)

Minimum velocity	2.0 ft/s
Minimum flow	313.3 gpm
Maximum velocity	10.0 ft/s
Maximum flow	1566.7 gpm
Actual flow	302.0 gpm
Actual velocity	1.93 ft/s

APPENDIX B

Lift Station 1 Pump Data

Item Number / Tags	: Default	Size	: 10M-SS
Service	:	Stages	: 4
Quantity	: 1	Based on curve number	: 10_TURB_2260_1800_SS Rev 180719
Quote number	:	Date last saved	: 14 Mar 2025 4:13 PM

Operating Conditions

Flow, rated	: 302.0 USgpm
Head, rated (requested)	: 70.51 ft
Head, rated (actual)	: 70.77 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available	: Ample
Site Supply Frequency	: 60 Hz

Performance

Speed criteria	: Synchronous
Speed	: 1185 rpm
Impeller dia.	: 6.52 in
Impeller diameter, maximum	: 7.06 in
Impeller diameter, minimum	: 6.00 in
Efficiency (bowl / pump)	: 79.36 / - %
NPSH required / margin required	: 4.49 / 0.00 ft
nq (imp. eye flow) / S (imp. eye flow)	: 42 / 131 Metric units
Minimum Continuous Stable Flow	: 185.0 USgpm
Head max.	: 92.06 ft
Head rise to shutoff (bowl / pump)	: 30.08 / - %
Flow, best eff. point (bowl / pump)	: 301.6 / - USgpm
Flow ratio, rated / BEP (bowl / pump)	: 100.12 / - %
Diameter ratio (rated / max)	: 92.35 %
Head ratio (rated dia / max dia)	: 81.70 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Water
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids size limit	: 0.68 in
Solids concentration, by volume	: 0.00 %
Temperature	: 68.00 deg F
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Vapor pressure, rated	: 0.34 psi.a

Material

Material selected	: Cast Iron bowl Std impeller

Pressure Data

|	
Maximum working pressure	: See the Additional Data page
Maximum allowable working pressure	: See the Additional Data page
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: See the Additional Data page

Driver & Power Data (@Max density)

Driver sizing specification	: Maximum power
Margin over specification	: 0.00 %
Service factor	: 1.00
Power, hydraulic	: 5.40 hp
Power (bowl / pump)	: 6.80 / - hp
Power, maximum	: 7.26 hp
Motor rating	: 7.50 hp / 5.59 kW

Bowl performance. Adjusted for construction and viscosity.
The duty point represents the head at the bowl.
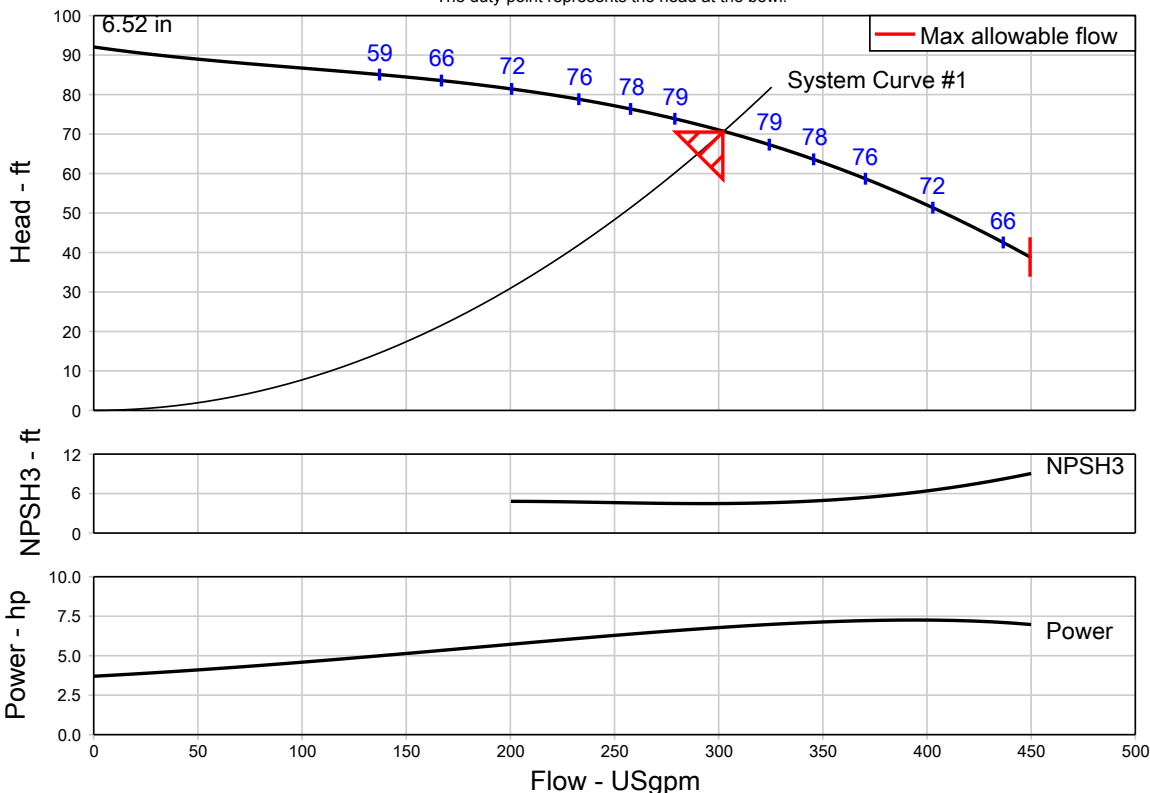
Item Number / Tags	: Default	Size	: 10M-SS
Service	:	Stages	: 4
Quantity	: 1	Speed	: 1185 rpm
Quote number	:	Frame size	:
		Date last saved	: 14 Mar 2025 4:13 PM

Performance Data

Head, maximum diameter, rated flow	: 86.62 ft
Head, minimum diameter, rated flow	: 56.49 ft
Head max.	: 92.06 ft
Efficiency adjustment factor, total	: 1.00
Power adjustment, total	: 0.00 hp
Head adjustment factor, total	: 1.00
Flow adjustment factor, total	: 1.00
NPSH3 adjustment factor, total	: 1.00
NPSH margin dictated by pump supplier	: 0.00 ft
NPSH margin dictated by user	: 0.00 ft
NPSH margin used (added to 'required' values)	: 0.00 ft

Mechanical Limits

Torque, rated power, rated speed	: 0.57 hp/100 rpm
Torque, maximum power, rated speed	: 0.61 hp/100 rpm
Torque, driver power, full load speed	: 0.64 hp/100 rpm
Torque, driver power, rated speed	: 0.63 hp/100 rpm
Torque, pump shaft limit	: 13.25 hp/100 rpm
Radial load, worst case	: -
Radial load limit	: -
Impeller peripheral speed, rated	: -
Impeller peripheral speed limit	: -

Stage, Speed and Solids Limits

Stages, maximum	: 10
Stages, minimum	: 1
Pump speed limit, maximum	: 1800 rpm
Pump speed limit, minimum	: 901 rpm
Curve speed limit, maximum	: 1900 rpm
Curve speed limit, minimum	: 901 rpm
Variable speed limit, maximum	: -
Variable speed limit, minimum	: 450 rpm
Solids size limit	: 0.68 in

Typical Driver Data

Driver speed, full load	: 1170 rpm
Driver speed, rated load	: 1173 rpm
Driver efficiency, 100% load	: 90.20 %
Driver efficiency, 75% load	: 90.90 %
Driver efficiency, 50% load	: 90.60 %

Various Performance Data

	Flow (USgpm)	Head (ft)	Efficiency (%)	NPSH3 (ft)	Power (hp)
Shutoff, rated	0.00	92.06	-	-	3.70
Shutoff, maximum	0.00	107.9	-	-	4.70
Minimum Continuous Stable Flow	185.0	82.48	69.46	4.79	5.55
Rated flow, minimum	302.0	56.49	78.14	-	5.51
Rated flow, maximum	302.0	86.62	80.10	-	8.24
BEP flow, rated	301.6	70.83	79.36	4.49	6.80
120% rated flow, rated	362.4	60.34	76.75	5.21	7.19
End of curve, rated	450.0	38.71	63.07	9.05	6.97
End of curve, minimum	413.7	32.65	61.70	7.01	5.53
End of curve, maximum	486.7	45.89	64.64	11.79	8.72
Maximum value, rated	-	92.06	79.36	-	7.26
Maximum value, maximum	-	-	80.31	-	9.15

System differential pressure

	@ Density, rated	@ Density, max
Differential pressure, rated flow, rated (psi)	30.63	30.63
Differential pressure, shutoff, rated (psi)	39.84	39.84
Differential pressure, shutoff, maximum (psi)	46.72	46.72

Discharge pressure

	@ Suction pressure, rated	@ Suction pressure, max	@ Suction pressure, rated	@ Suction pressure, max
Discharge pressure, rated flow, rated (psi.g)	30.63	30.63	30.63	30.63
Discharge pressure, shutoff, rated (psi.g)	39.84	39.84	39.84	39.84
Discharge pressure, shutoff, maximum (psi.g)	46.72	46.72	46.72	46.72

Ratios

Maximum flow / rated flow, rated	: 148.83 %	Head rated diameter / head minimum diameter, rated flow	: 125.27 %

Head and Power Losses

Friction loss rate, column	: -
Friction loss, column	: -
Friction loss, discharge head	: -
Friction loss, can/barrel	: -
Friction loss, suction bell and strainer	: 0.00 ft
Friction loss, bowl/column adaptor	: -
Friction loss, total	: -
Power loss, lineshaft bearings	: -
Power loss, thrust bearing	: -
Power loss, total	: -

Bowl vs. Pump Performance

Head (bowl / pump)	: 70.51 ft / -
Efficiency (bowl / pump)	: 79.36 % / -
Power (bowl / pump)	: 6.80 hp / -
NPSH required at first stage impeller eye	: 4.49 ft

Weights and Down Thrust

Weight, lineshaft	: -
Weight, bowl assembly rotating element	: 63.20 lb
Thrust factor	: 3.81 lb/ft
Thrust, hydraulic (rated / max)	: 268.5 / 350.5 lbf
Thrust, bowl shaft end (rated / max)	: 0.00 / 0.00 lbf
Thrust, shaft step (rated / max)	: - / -
Thrust, stuffing box sleeve (rated / max)	: - / -
Thrust, total (rated / max)	: 331.7 / 413.7 lbf
Thrust bearing capacity	: -

* Rated thrust @ rated head, density, and suction pressure where applicable
* Max thrust @ max head, density, and suction pressure where applicable

Pressure Data

	Maximum working pressure (psi.g)	Maximum allowable working pressure (psi.g)	Hydrostatic test pressure (psi.g)
Bowl	39.84	475.0	712.5
Column	-	-	-
Discharge head	-	-	-
Can/Barrel	-	-	-

Torque Limits

Torque, lineshaft limit	: -

Dimensions

Minimum clearance below suction bell lip/case	: 7.00 in
Minimum well diameter	: 9.75 in
Suction nozzle centerline height	: -
Suction to first stage impeller centerline	: -
Bowl assembly length, first stage	: 12.21 in
Bowl assembly length, upper stage	: 8.25 in
Bowl assembly length, total	: 36.96 in
Suction bearing hub length	: 4.93 in
Strainer length	: 0.00 in
Bowl to column adaptor length	: -
Discharge head stick-down	: -
Submersible motor adaptor length	: -
Submersible motor length	: -
Column length	: -
Total pump length	: -
Can / barrel length	: -
Stuffing box sleeve diameter	: -
Suction bell diameter	: 9.50 in
Minimum submergence to prevent vortexing	: 33.00 in
Discharge head height	: -
Discharge nozzle centerline height	: -
Min distance discharge nozzle centerline to suction bell	: 0.00
Lineshaft length	: -
Bowl shaft diameter	: 1.44 in
Bowl diameter, outside	: 9.63 in
Bowl diameter, exit	: 6.92 in
Column diameter, inside	: -
Column internal obstruction diameter	: -
Can/barrel diameter, inside	: -
Can/barrel obstruction diameter	

NPSH

NPSH at bowl (available / required)	: Ample / 4.49 ft
NPSH at low liquid level (available / required)	: - / -
NPSH at suction flange (available / required)	: - / -

Liquid Velocities

Column liquid velocity	: -
Discharge head liquid velocity	: -
Can liquid velocity	: -
Suction nozzle liquid velocity	: -

Potable water

Is this for potable water service?	:

Product line options

Pump type	:	NPSHa measured at : Bowl
Head measured at	:	

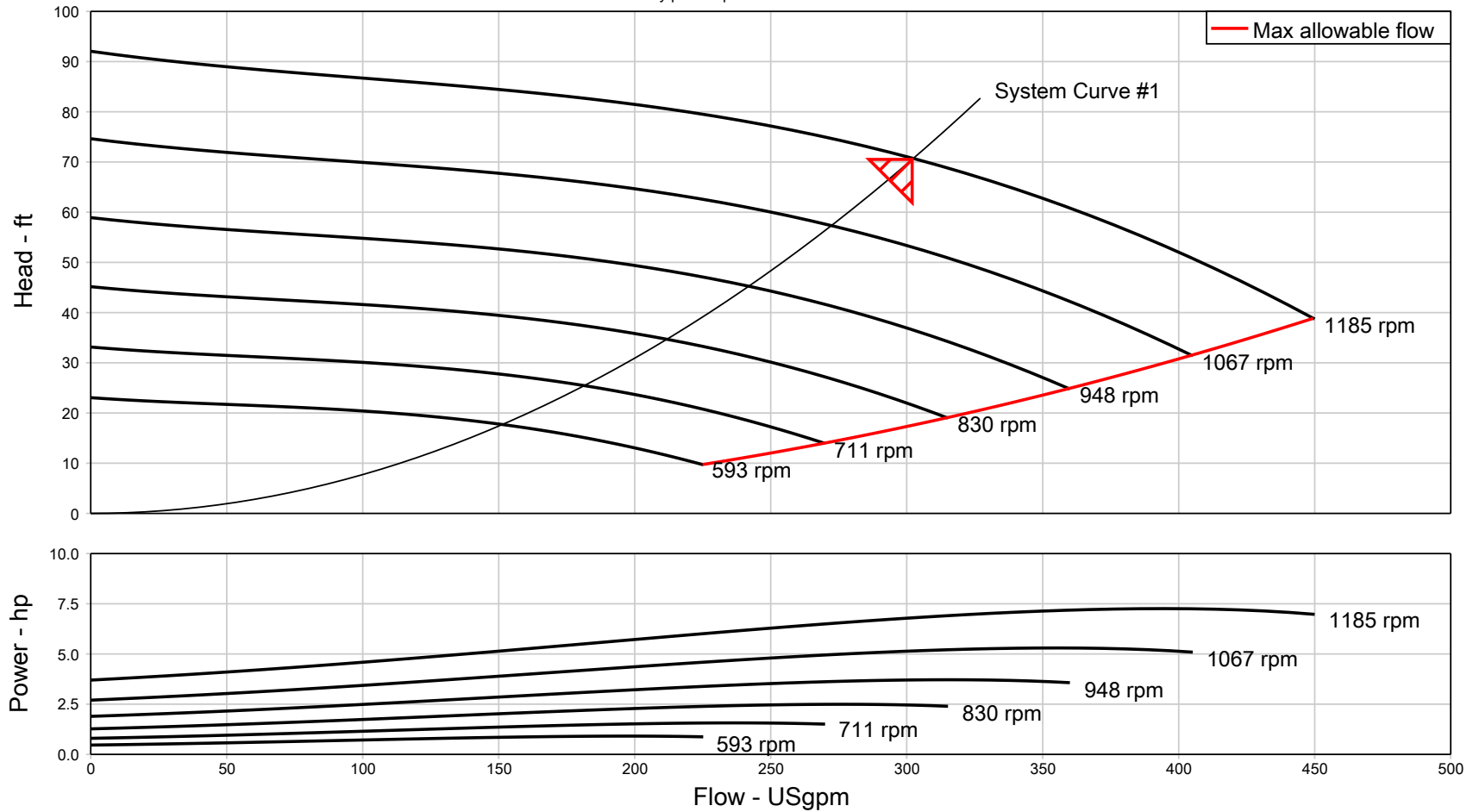## Product line options - additional

Pump Shaft Material	: Standard	Suction type : Bell
Bowl to column conn.	: Discharge case threaded	Suction strainer : None

Bowl performance. Adjusted for construction and viscosity.
The duty point represents the head at the bowl.

6.52 in

— Max allowable flow

System Curve #1

Head - ft

59 66 72 76 78 79 79 78 76 72 66

NPSH3 - ft

NPSH3

Power - hp

Power

Flow - USgpm
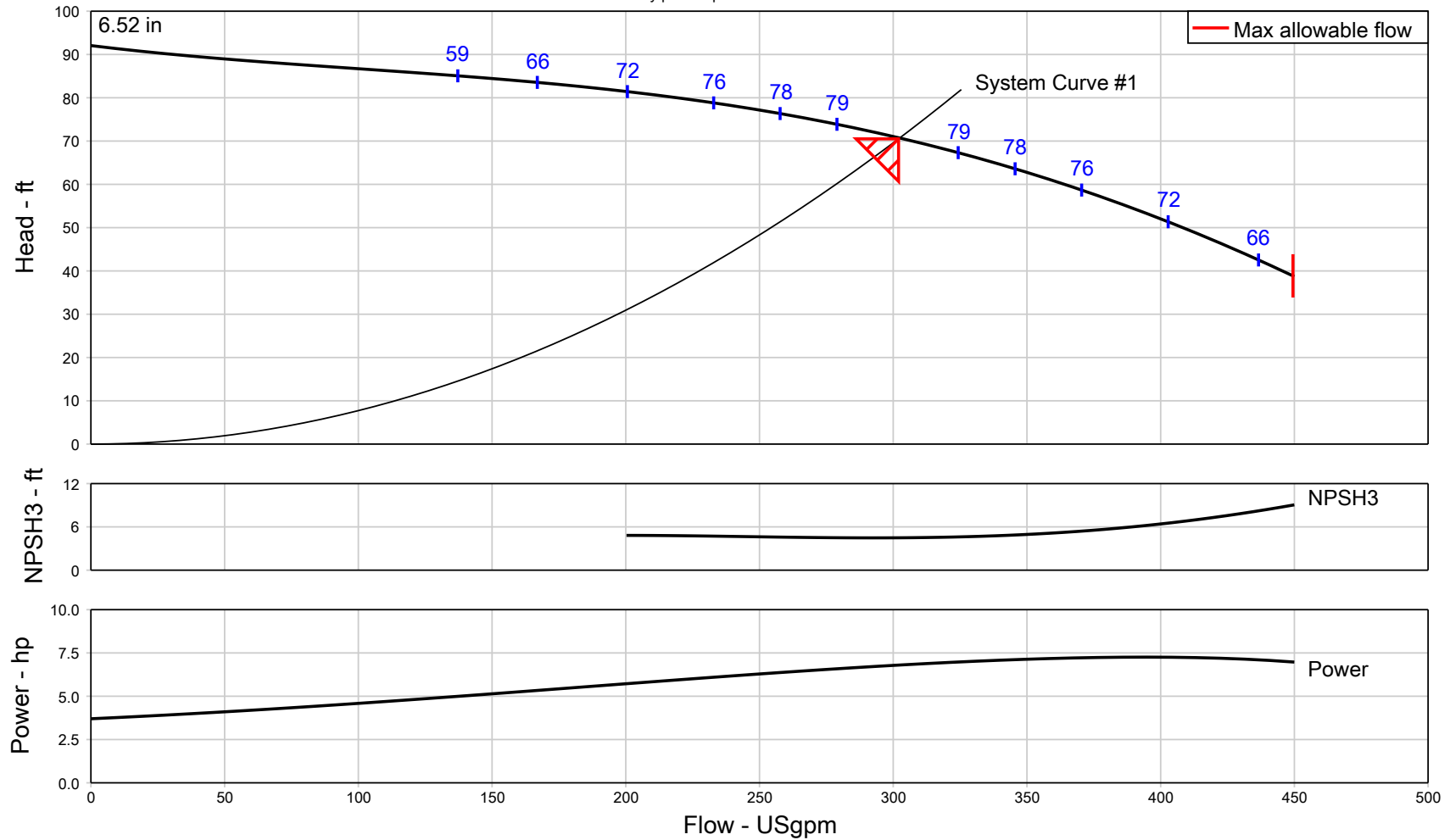
Item Number / Tags	: Default	Size	: 10M-SS	Flow, rated	: 302.0 USgpm
Service	:	Stages	: 4	Head, rated	: 70.51 ft
Quantity	: 1	Speed	: 1185 rpm	NPSH required	: 4.49 ft
Quote number	:	Based on curve number	: 10_TURB_2260_1800_SS	Fluid density	: 1.000 / 1.000 SG
Date last saved	: 14 Mar 2025 4:13 PM		Rev 180719	Viscosity	: 1.00 cP
		Efficiency (bowl / pump)	: 79.36 %	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
		Power (bowl / pump)	: 6.80 / - hp		

Bowl performance. Adjusted for construction and viscosity.
The duty point represents the head at the bowl.

Item Number / Tags	: Default	Size	: 10M-SS	Flow, rated	: 302.0 USgpm
Service	:	Stages	: 4	Head, rated	: 70.51 ft
Quantity	: 1	Efficiency (bowl / pump)	: 79.36 %	Speed	: 1185 rpm
Quote number	:	Power (bowl / pump)	: 6.80 / - hp	Impeller dia.	: 6.52 in
Based on curve number	: 10_TURB_2260_1800_SS Rev 180719	NPSH required	: 4.49 ft	Fluid density	: 1.000 / 1.000 SG
Date last saved	: 14 Mar 2025 4:13 PM	Site Supply Frequency	: 60 Hz	Viscosity	: 1.00 cP
		Nominal speed	: 1170 rpm	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

Item Number / Tags	: Default	Quantity	: 1	Size	: 10M-SS
Service	:	Quote number	:	Stages	: 4
		Date last saved	: 14 Mar 2025 4:13 PM	Speed	: 1185 rpm

Load Profiles and Energy Costs

Expected pump life: 20 years

	Load Profile #1	Load Profile #2	Load Profile #3	Load Profile #4	Load Profile #5	Total
Flow: (USgpm)	302.0	-	-	-	-	-
Operation: (hours per year)	8,760	-	-	-	-	8,760
Energy cost, present value ($ per kWh)	0.1	-	-	-	-	-
Speed (rpm)	1185	-	-	-	-	-
Head (ft)	70.77	-	-	-	-	-
Efficiency (%)	79.36	-	-	-	-	-
Power, rated (hp)	6.80	-	-	-	-	-
Motor efficiency (%)	100.00	-	-	-	-	-
Drive/gear efficiency (%)	100.00	-	-	-	-	-
System curve		-	-	-	-	-
Energy, total (kWh)	888,279.1	-	-	-	-	888,279.1
Energy cost, per year	$ 4,441.40	-	-	-	-	$ 4,441.40
Energy cost, total present value	$ 66,613.73	-	-	-	-	$ 66,613.73

Life Cycle Cost Calculation

Additional Annual Costs

Routine maintenance cost	:	0.00
Repair cost	:	0.00
Operating cost	:	0.00
Downtime cost	:	0.00
Environmental cost	:	0.00
Other annual costs	:	0.00
Total, present value	:	$ 0.00

Additional One-time Costs, Year 0

Initial investment cost	:	0.00
Installation and commissioning cost	:	0.00
Other one-time costs, year 0	:	0.00

Additional One-time Costs, Year 20

Decommissioning cost	:	0.00
Other one-time costs, year 20	:	0.00
Total, present value	:	$ 0.00

Interest and Inflation Rates

Interest rate, %	:	6.00
Inflation rate, %	:	3.00

Total Net Present Value Costs

Total energy cost	:	$ 66,613.73
Total additional annual cost	:	$ 0.00
Total additional one-time cost	:	$ 0.00
Total life cycle cost	:	$ 66,613.73