Lake Hills Main Blvd. & Mass Grading

Lift Station Report

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Date: 2025.02.10 14:26:01 -05'00'

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David A. Stokes, P.E. #66527
Certificate of Authorization No. EB-0007723

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 Flygt 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 at 61.1 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:

$Q, gpm = 448.83 \times (V, ft/s \times A, sf)$

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

NP 3153 HT 3~ 462

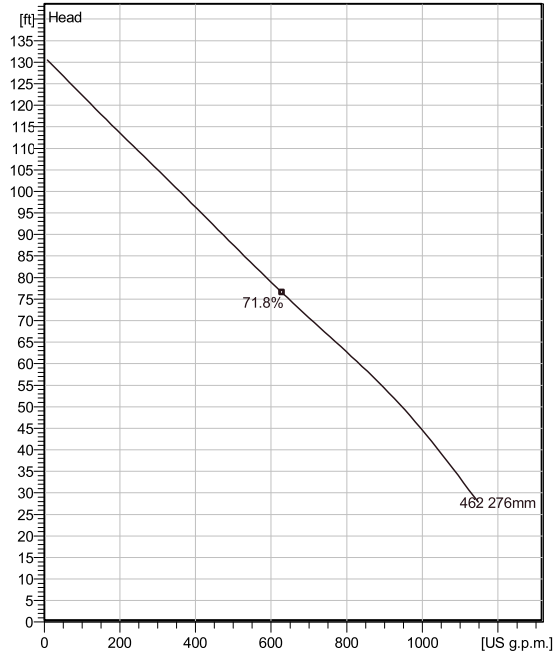Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT
a xylem brand

Technical specification

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.428 lb/ft³,1.6889E-5 ft²/s

Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3153.185 21-18-4AA-W
20hp

Installation type
P - Semi permanent, Wet

Impeller diameter
276 mm

Discharge diameter
4 inch

Pump information

Impeller diameter
276 mm

Discharge diameter
4 inch

Inlet diameter
150 mm

Maximum operating speed
1760 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Project	Xylect-20111063	Created by	
Block	0	Created on	10/28/2024
		Last update	10/28/2024

Program version
74.0 - 7/1/2024 (Build 136)

Data version
10/7/2024 8:08 A10P10

User group(s)
Xylem:USA - EXT

NP 3153 HT 3~ 462

Technical specification

Motor - General

Motor number N3153.185 21-18-4AA-W 20hp	**Phases** 3~	**Rated speed** 1760 rpm	**Rated power** 20 hp
ATEX approved No	**Number of poles** 4	**Rated current** 58 A	**Stator variant** 4
Frequency 60 Hz	**Rated voltage** 208 V	**Insulation class** H	**Type of Duty** S1
Version code 185			

Motor - Technical

Power factor - 1/1 Load 0.81	**Motor efficiency - 1/1 Load** 87.5 %	**Total moment of inertia** 2.38 lb ft²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.75	**Motor efficiency - 3/4 Load** 89.0 %	**Starting current, direct starting** 345 A	
Power factor - 1/2 Load 0.63	**Motor efficiency - 1/2 Load** 88.5 %	**Starting current, star-delta** 115 A	

NP 3153 HT 3~ 462

Performance curve

Duty point

Flow	Head
302 US g.p.m.	105 ft

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.428 lb/ft³,1.6889E-5 ft²/s
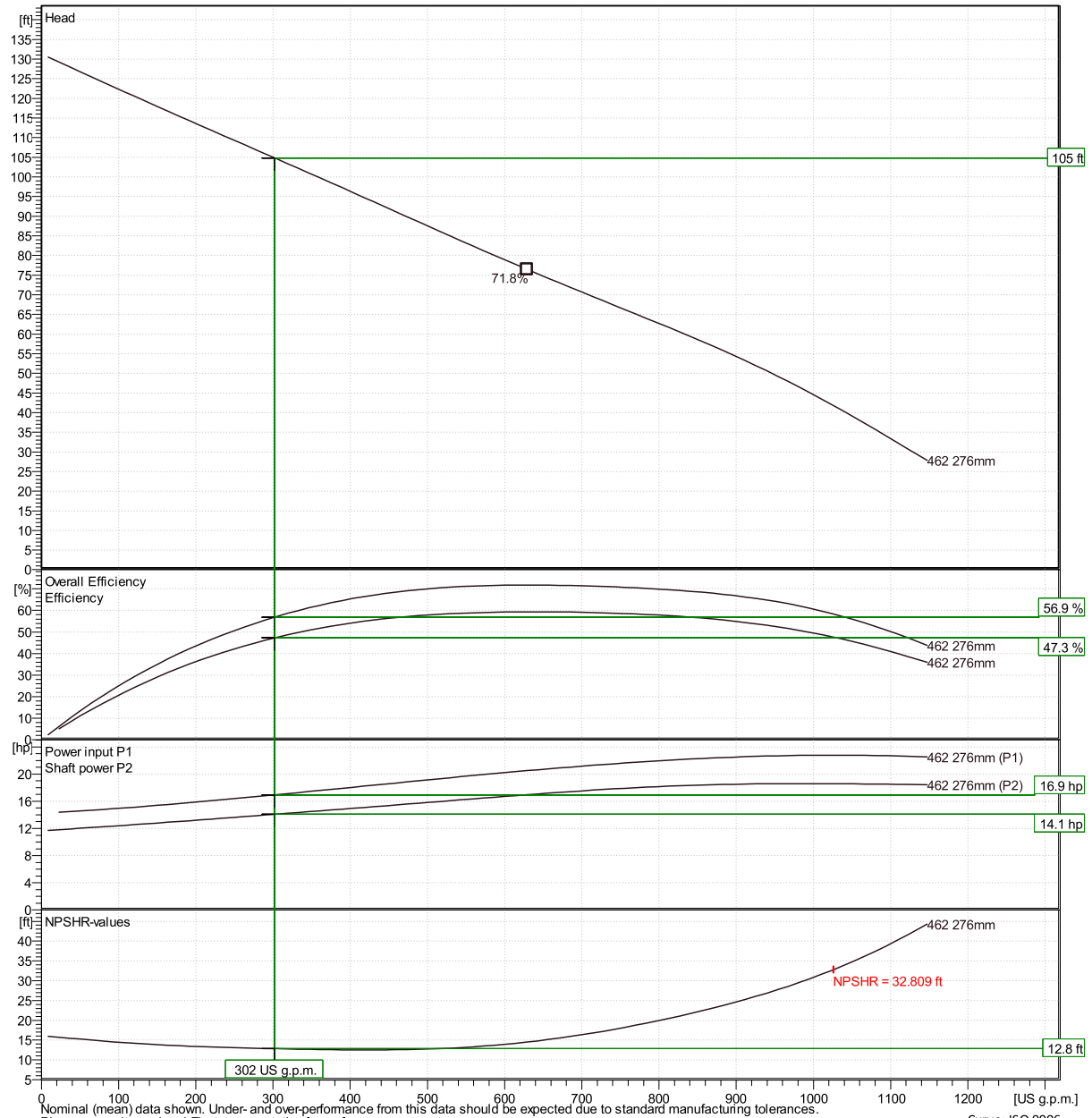
Head [ft]
- 105 ft
- 71.8%
- 462 276mm

Overall Efficiency / Efficiency [%]
- 56.9 %
- 47.3 %
- 462 276mm
- 462 276mm

Power input P1 / Shaft power P2 [hp]
- 462 276mm (P1)
- 462 276mm (P2)
- 16.9 hp
- 14.1 hp

NPSHR-values [ft]
- 462 276mm
- NPSHR = 32.809 ft
- 12.8 ft
- 302 US g.p.m.

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

Xylect-20111063

0

Created on   10/28/2024   Last update   10/28/2024

NP 3153 HT 3~ 462

Duty Analysis

FLYGT
a **xylem** brand

Curves according to: Water, pure [100%] ; 39.2°F; 62.428lb/ft³; 1.6889E-5ft²/s

105 ft

71.8%

462 276mm

302 US g.p.m.

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	302	105	14.1	302	105	14.1	56.9 %	697	12.8

Project		Created by	
Block	Xylect-20111063	Created on	10/28/2024	Last update	10/28/2024

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User group(s)
Xylem:USA - EXT

NP 3153 HT 3~ 462

VFD Curve

FLYGT
a **xylem** brand

Curves according to: Water, pure , 39.2 °F , 62.428 lb/ft³ , 1.6889E-5 ft²/s
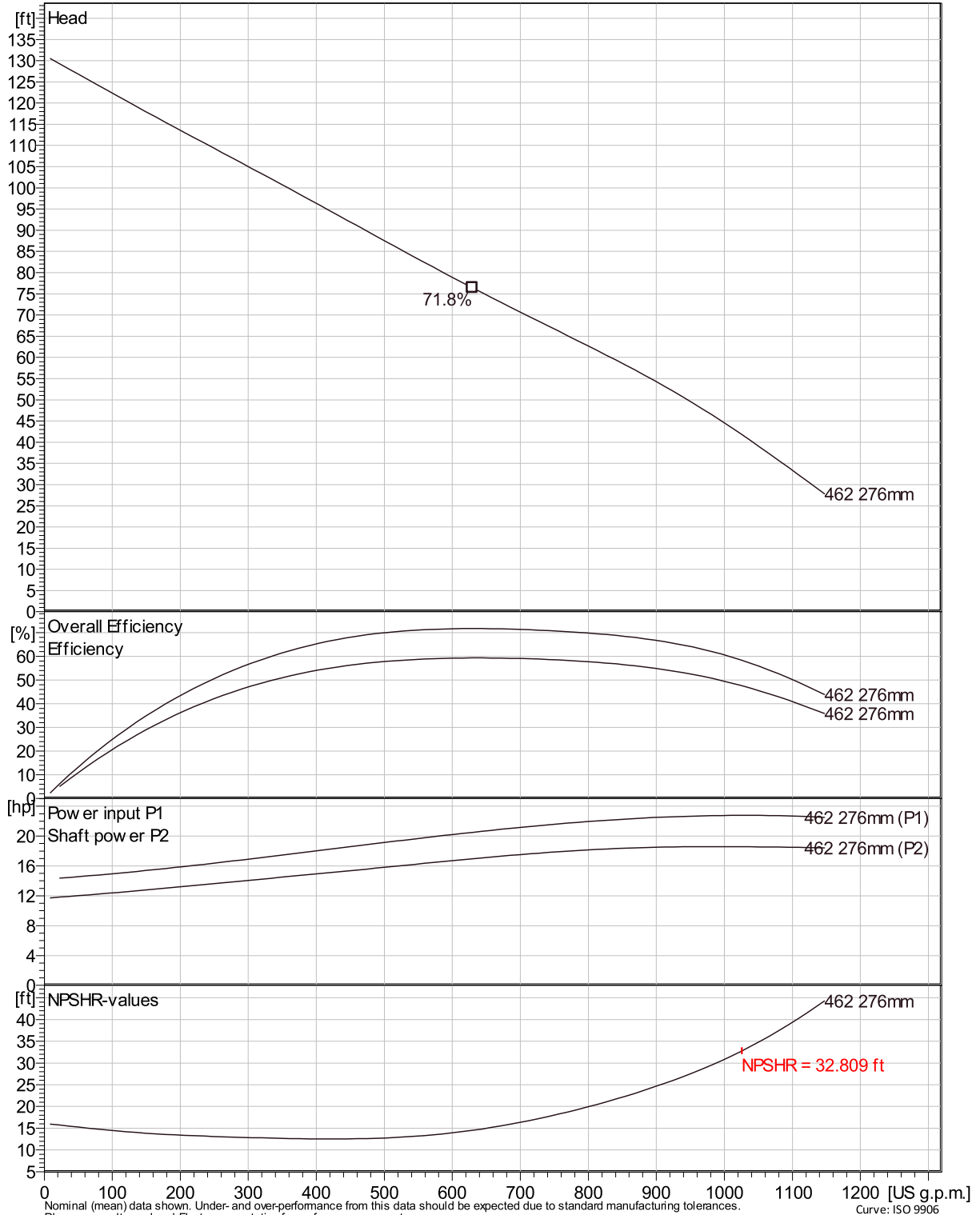
Head [ft]

71.8%

462 276mm

Overall Efficiency [%]
Efficiency

462 276mm
462 276mm

Power input P1 [hp]
Shaft power P2

462 276mm (P1)
462 276mm (P2)

NPSHR-values [ft]

462 276mm

NPSHR = 32.809 ft

[US g.p.m.]

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

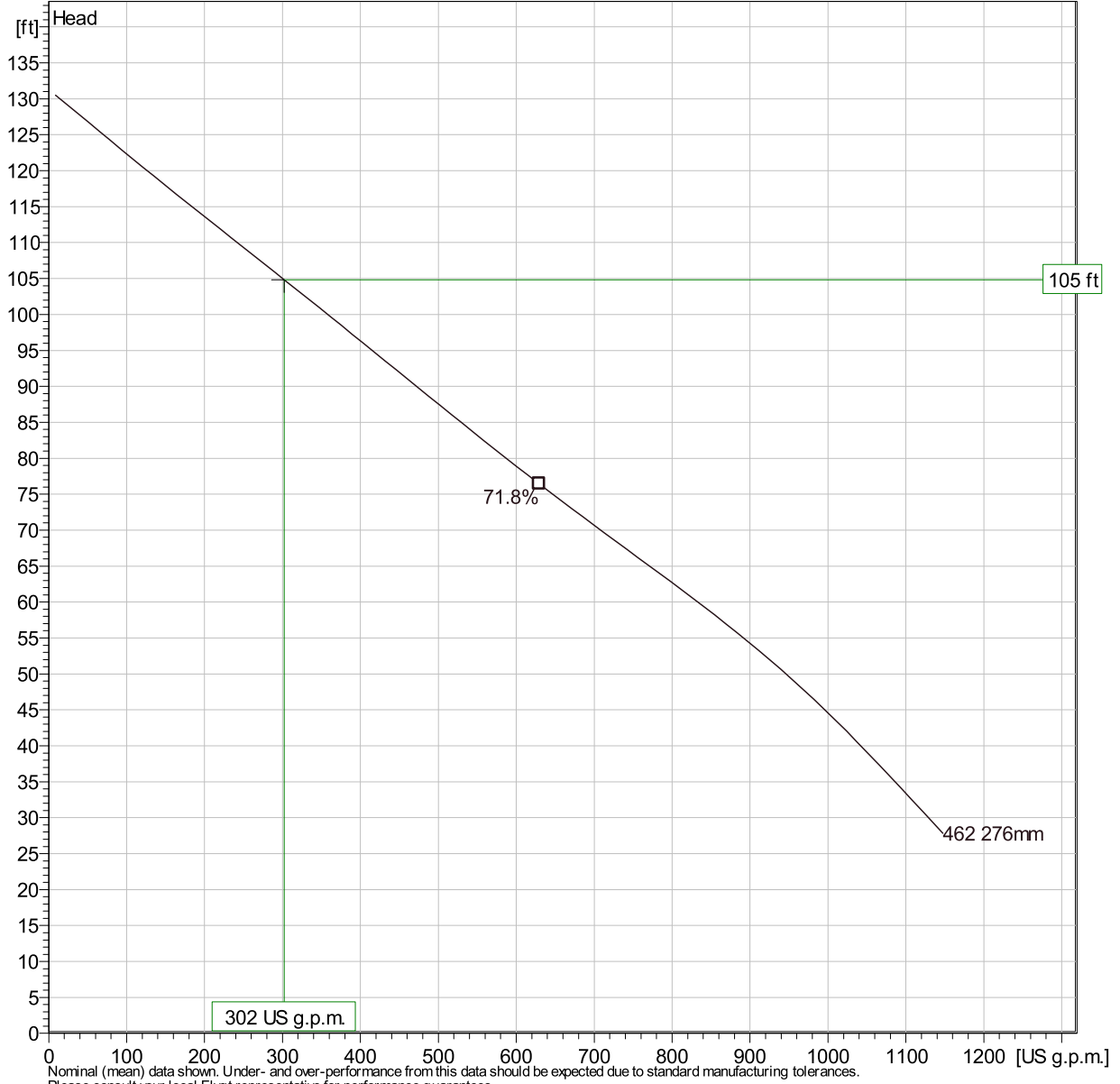| Project	Xylect-20111063	Created by	
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NP 3153 HT 3~ 462

VFD Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.428lb/ft³; 1.6889E-5ft²/s
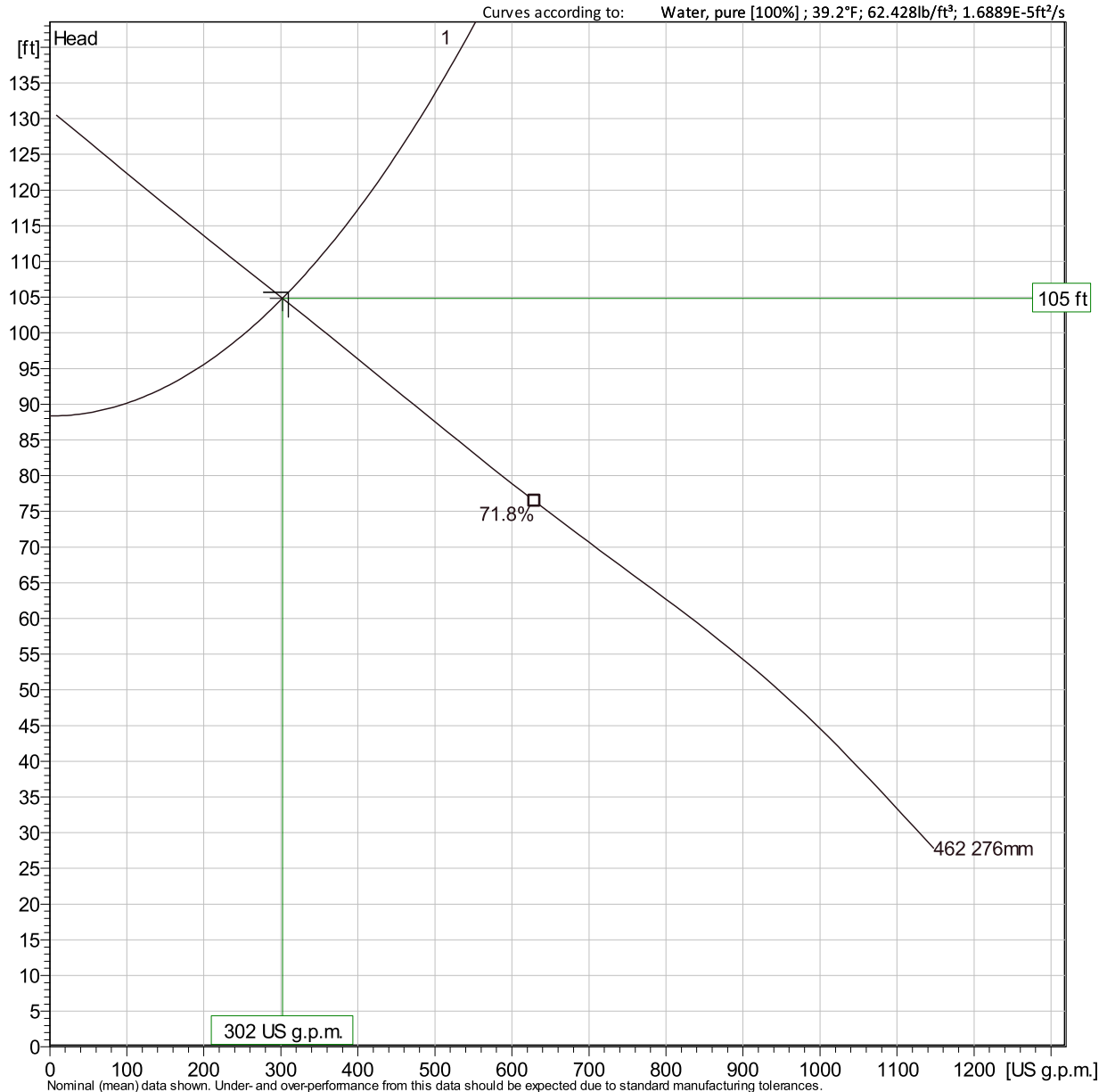
FLYGT
a **xylem** brand

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	60 Hz	302	105	14.1	302	105	14.1	56.9 %	697	12.8
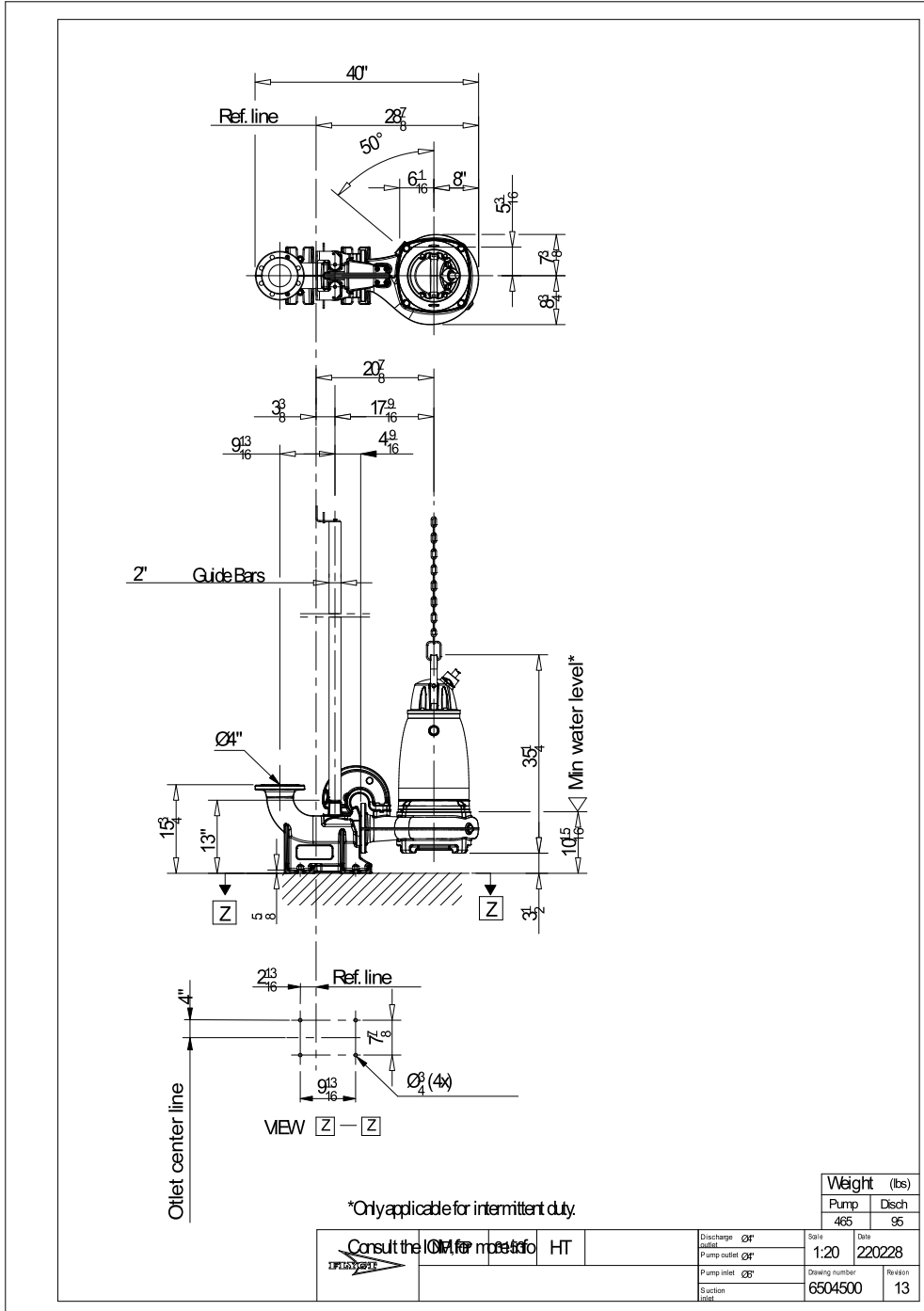
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Created by	
Created on	10/28/2024

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Program version
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User group(s)
Xylem:USA - EXT

40"

Ref. line

$28\frac{7}{8}$

50°

$6\frac{1}{16}$ 8"

$5\frac{1}{16}$

$7\frac{3}{8}$

$8\frac{1}{4}$

$20\frac{7}{8}$

$3\frac{3}{8}$ $17\frac{9}{16}$

$9\frac{13}{16}$ $4\frac{9}{16}$

2" Guide Bars

Ø4"

Min water level*

$35\frac{3}{4}$

$15\frac{3}{4}$

13"

$10\frac{15}{16}$

$5\frac{5}{8}$

$3\frac{1}{2}$

Z Z

$2\frac{13}{16}$ Ref. line

4"

$7\frac{7}{8}$

Ottlet center line

$9\frac{13}{16}$ $Ø\frac{8}{4}$ (4x)

VIEW Z — Z

*Only applicable for intermittent duty.

Consult the IOM for more info.

HT

Weight	(lbs)	
Pump	Disch	
465	95	

Discharge outlet	Ø4"	Scale 1:20	Date 220228
Pump outlet	Ø4"		
Pump inlet	Ø6"	Drawing number 6504500	Revision 13
Suction inlet			

Project	Xylect-20111063	Created by	
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