

# ENGINEER'S REPORT

POTABLE WATER SYSTEM TO SERVE

**LEGOLAND New York**

TOWN OF GOSHEN  
ORANGE COUNTY, NEW YORK

Prepared By:

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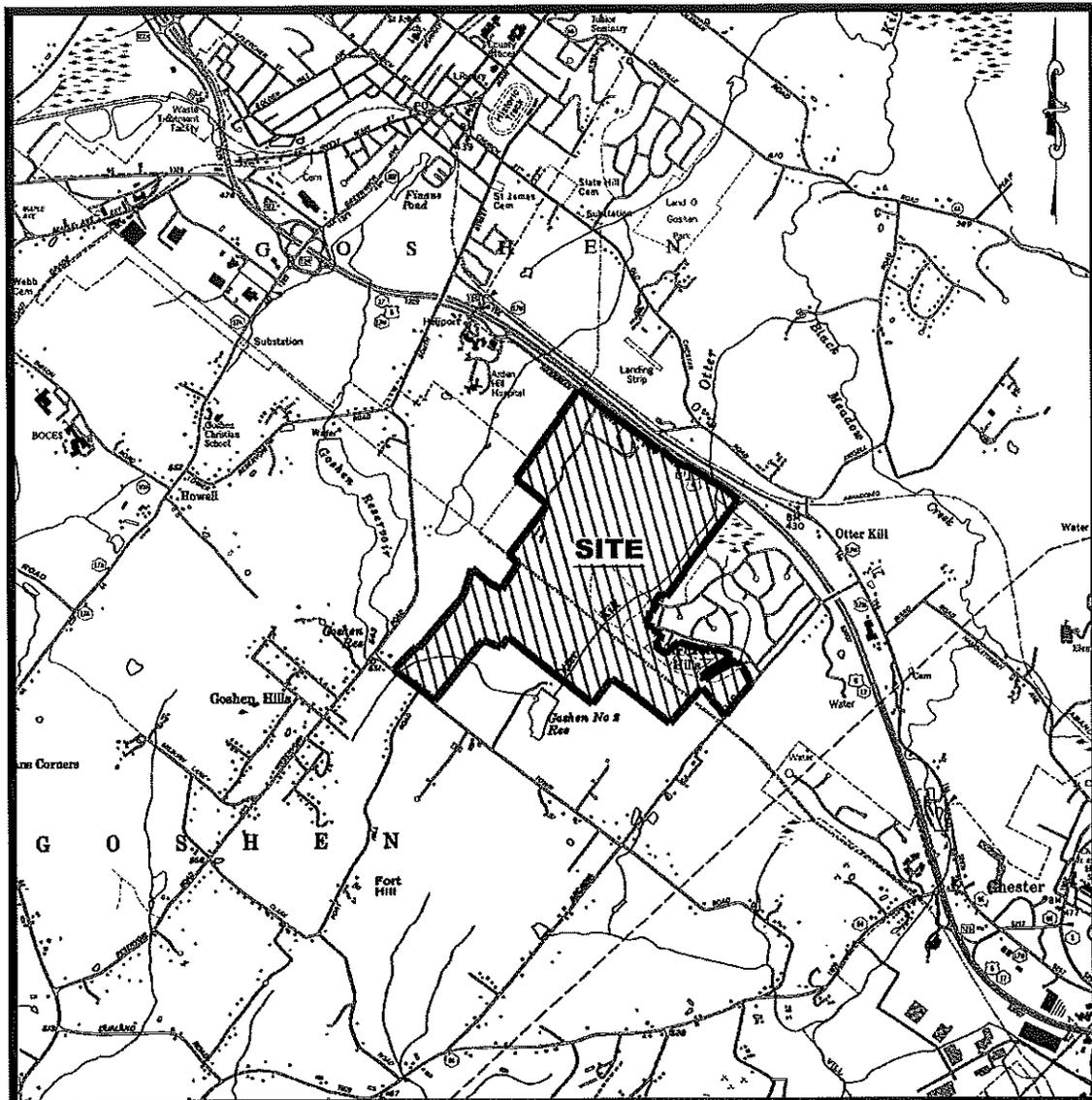


November 15, 2016  
Revised March 27, 2017  
Revised June 18, 2018

PROJECT OVERVIEW

Merlin Entertainments, as Project Sponsor, proposes to construct a theme park and resort on approximately 140 acres of a 522 acre site consisting of 15 total parcels located off Harriman Drive in the Town of Goshen. The Project Site is generally located south of NYS Route 17, at exit 125, on the east side of the Town of Goshen. The Project Site has street frontage on Harriman Drive and extends south of Conklingtown Road and as far east as Arcadia Road. See Project Location Map, Figure 1.

**FIGURE 1 - PROJECT LOCATION**



Source: NYSDOT Digital Raster Quadrangles for Goshen and Warwick

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The park, to be called LEGOLAND New York, will include rides and attractions, an aquarium, theaters, restaurants, a hotel and various Back of House facilities including offices and staff areas as well as associated parking and water, sanitary sewer and drainage facilities. Merlin Entertainments will own and operate the site. All onsite improvements and infrastructure will be owned and maintained by the property owner. All offsite sanitary facilities and infrastructure will be owned and maintained by the Village of Goshen. Based on similar-sized LEGOLAND parks, between 1.5 and 2.5 million annual visitors are anticipated to the site. Hours of Operation of the park in summer months will be from 10:00AM to 8:00PM, seven days a week. During non-peak season the park will be open from 10:00AM to 6:00PM on weekdays and 10:00AM to 8:00PM on weekends. The park will be closed from November through March. The hotel, offices and aquarium will be opened year round but with reduced staff and significantly reduced numbers of visitors. Operations at the park will include a 250-room hotel, 20,000 square foot aquarium, 81,000 square feet among five buildings in the Back of House area (including administration offices, maintenance warehouse, landscaping building and trash collection) and a theme park consisting of 26 rides and attractions, 2 theaters, 10 retail areas, and approximately 15 restaurants (including both dine-in, counter service and food kiosks) in eight themed areas.

Potable water supply for LEGOLAND New York will be provided by the Village of Goshen. The project would be an "Out of District" user of the Goshen Water District. Wastewater conveyance and treatment for LEGOLAND New York will be provided by the Village of Goshen. The project would be an "Out of District" user of the Goshen Sewer District.

**EXISTING WATER SUPPLY, STORAGE AND DISTRIBUTION**

The Village of Goshen water supply system consists of two surface water reservoirs and one well field and is permitted by the New York State Department of Environmental Conservation to take a combined amount of water up to 1.3 MGD. The Prospect Reservoir and Green Hill Reservoir are the main source of water supply for the Village of Goshen Water District. The Prospect Reservoir is located off of Lower Reservoir Road at the site of the Village Water Filtration Plant. The Prospect Reservoir is fed by surface runoff as well as the Green Hill Reservoir, located off of Conklingtown Road. The Crystal Run Village (CRV) Well Field is located on Stony Ford Road in the Town of Walkkill and contains two Village owned wells; Well#1 is approved for 275 gpm and Well #2 is approved for 300 gpm. The permitted taking from the aquifer is limited to 0.45 MGD with Well #1 and Well #2 alternately pumping. The Crystal Run Village (CRV) Well Field is controlled by the water level in the Prospect Reservoir water storage tank.

There are four (4) existing water storage tanks: a 500,000 gallon bolted steel reservoir located at the Filter Plant at Prospect Reservoir; a 300,000 gallon glass fused bolted steel reservoir located at Glen Arden; a 464,000 gallon glass fused bolted steel standpipe located on Bridle Court; and a 300,000 gallon welded steel standpipe located on Hilltop Drive. Both the Prospect Reservoir Tank and Glen Arden Tank, which are hydraulically connected, provide water storage capacity and distribution system operational pressure for the majority of the Village. The Hilltop Tank and Harness Estates Tank provide water storage for the Village high pressure zone in their respective areas. The booster pump stations for these zones are controlled by demand within the zones as well as system pressures

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controlled by the Prospect Reservoir and Glen Arden tanks. The booster pump stations for these zones are controlled by demand within the zones as well as system pressures controlled by the Prospect Reservoir and Glen Arden tanks. The overflow elevation for the Prospect Reservoir and Glen Arden tanks is 600 feet; typical operating water elevation in these tanks is between 595.0 feet and 599.0 feet.

The water distribution system is a self-contained system comprised of approximately 31.5 miles of 4" through 16" cast iron, ductile iron and asbestos concrete water mains, approximately 244 fire hydrants and over 460 valves. There are two (2) water booster stations and two (2) pressure reducing stations.

According to data supplied by the Village, the existing water system serves approximately 5,500 people through approximately 1,750 service connections. The total amount of water produced in 2015 was 239,000,000 gallons. The total amount of water delivered to customers in 2015 was 226,000,000 gallons (average 619,178 gpd). A total of 13,000,000 gallons (approximately 5.5% of production) was unaccounted for and is attributed to flushing mains, fighting fires, filter backwashing, water main and service breaks and/or leaks. The average daily water treated from all sources in 2015 was 655,178 gallons per day and the highest single day demand was 888,400 gallons.

**ESTIMATED PROJECT WATER USAGE**

The water distribution system designed for LEGOLAND New York is based on the project's anticipated water usage of an annual average of 176,438 GPD with peak usage in July of approximately 255,394 GPD and off-peak usage in December of approximately 49,127 GPD. The anticipated water demand is based on recorded water usage at the LEGOLAND Windsor Resort, an existing seasonal park of similar size and scope. LEGOLAND Windsor is a 150-acre park with approximately 2.2 million visitors per year with two water attractions.

Comparison of the project's anticipated water usage of 255,394 GPD during peak season and an average of 49,127 GPD during off-peak season with the estimated wastewater generation of 130,689 GPD during peak season and an average of 26,025 GPD during the off peak season indicates that wastewater generation is approximately 58% of water usage. This non-typical variation in generation / usage is attributed to the nature of the theme park with two water attractions, ice/drinks preparation and landscaping maintenance.

As stated above, the Village of Goshen has a permitted combined water yield of 1.3 MGD with an average daily treated/distributed of 0.65 MGD, leaving an excess availability of approximately 0.65 MGD. Supporting water demand for LEGOLAND New York during the peak season with 0.25 MGD is well within the Village of Goshen's permitted water supply capability. The supply capability remains sufficient when the proposed peak demand of 0.25 MGD is considered along with the supply system's highest single day demand of 0.88 MGD which results in approximately 1.14 MGD.

WATER DISTRIBUTION

LEGOLAND New York's water distribution system will connect to the existing Village of Goshen water main in Harriman Drive. Approximately 6,100 feet of 12" ductile iron water main will be installed along Harriman Drive and into the project site, to an on-site water booster station. The water booster station will provide both domestic and fire suppression to support the park as well as maintain the water level in the water storage tank. Approximately 8,300 linear feet of 8" ductile iron will be installed through the site, predominately within the ring and service roads to provide water service to the various facilities in a closed system. Fire hydrants will be installed at all water main high points and at a maximum spacing of 600' along the length of the water mains. Domestic service will be provided to the various facilities through 3/4" to 2" Type K copper service lines with curb stops. Fire suppression systems will be provided by 4" or 6" ductile iron lines to the facilities, as appropriate, and include exterior valves and interior back flow prevention as required.

Approximately 2,500 feet of 8" ductile iron water main will be installed from the on-site water main to Arcadia Hills subdivision for use in the event of a water emergency. The on-site connection will be through a separate 12"x8" tee with an 8" valve in a normally closed (NC) position. A hydrant will be available at the closest point to the Arcadia Hills subdivision for an emergency connection and a valve and end cap provided for installation of a meter pit and water main extension in the event future extension / direct connection to the Arcadia Hills water distribution system is desired.

SYSTEM PRESSURES

Hydrant flow testing was conducted on the existing 6" and 8" water mains on South Street by representatives from Lanc and Tully, PC and the Village of Goshen on March 29, 2018. The results of the test are as follows:

Hydrant Location	Flow (GPM)	Static Pressure	Residual Pressure
Test Hydrant A – 6" 170 South St south of Harriman Dr (Flow)	520		
Test Hydrant A – 6" 156 South St south of Harriman Dr (Read)		54 psi	36 psi
Test Hydrant B – 8" 48 South St north of Harriman Dr (Flow)	530		
Test Hydrant B – 8" 74 South St north of Harriman Dr (Read)		57 psi	30 psi

As stated in the "Existing Water Supply, Storage and Distribution" discussion above, water system pressures in this area of the Village of Goshen are controlled by and dependent upon the water level in the Prospect Reservoir and Glen Arden Tanks with typical operating water elevation in these tanks between 595.0 feet and 599.0 feet.

Overall system pressure and flows for the LEGOLAND New York site have been calculated and are provided herein to support the water booster station selection. The overall system calculations conclude a static pressure range between 30.3 psi and 32.9 psi (based on the site water storage tank levels) at the site high point hydrant and residual pressures of 26.4 psi to 29.0 psi at 500 gpm. Flow available at the high point hydrant at the minimum required 20psi is calculated between

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approximately 844 gpm and 953 gpm. Static pressures at the low point of the overall site, which is at the booster station located in the Back of House area, demonstrate that a pressure reducing station would not be required with calculated a static pressure range between 76.7 psi and 79.9 psi.

WATER BOOSTER STATION

Static pressures at the water booster station have been calculated based on the typical Prospect Reservoir Tank operating water elevations and conclude a static pressure range of 127 feet to 131 feet. Based on the anticipated proposed storage tank operating water elevations and friction losses, the water booster station has been designed to pump 200 gpm at a total dynamic head of 92 feet. The pumps selected are two (2) Grundfos Model CR45-1 pumps connected to 10 HP, 3500 RPM motors rated for 204 GPM at 96' Head that will operate at 74.7% efficiency. Calculations for the overall water system to serve LEGOLAND New York, including the booster pump requirements are included in Appendix A. The Performance Curves for the selected pumps are contained in Appendix B.

The water booster station is a packaged AquaPak water booster pumping station with equipment factory installed on a welded steel base and enclosed in a modular steel insulated building manufactured by USEMCO, Inc., Tomah, Wisconsin. The water booster station will operate with a remote water tank level control with manually operated variable frequency drives (VFD). Factory installed equipment includes piping and valves to include 3" station inlet, 3" pump inlet isolation wafer butterfly valves, 3" pump discharge isolation wafer butterfly valves and wafer silent check valves, 3" magnetic flow meter, 3" station discharge outlet; NEMA 1 control panel for 460 volt 3 phase 3 wire incoming service with USEMCO H2Pro PLC type control; accessory items to include lighting, ventilation blowers, dehumidifiers and heaters; all internal wiring within the main chamber only. The booster station is also equipped with a Cummins 45 KW Natural Gas generator and auto transfer switch, factory installed and wired.

WATER STORAGE TANK

Water from the booster station will be pumped through the site to a 560,000 gallon (nominal) water storage tank. A minimum water level elevation of 621.0 feet is required in order to provide the minimum static working pressure of 20 psi at the high point of the site distribution system. The storage tank has been sized to provide for one-day storage of average daily demand (255,394 gallons – Peak Season) plus consideration of fire flow of 2,000 gpm for 1 hour (120,000 gallons). Due to dramatic water use variations between Peak Season (255,394 gpd) and Off-Season (49,127 gpd) operations, the ISO recommended fire flow storage of 2,000 gpm for two (2) hours has been reduced by half to minimize excessive water storage during off-peak season; fire flow requirements during peak season will be supplemented by the transmission main and water booster station.

The storage tank proposed is a 48' diameter – 42' high (nominal) bolted glass-fused to steel tank with a concrete floor designed and constructed in accordance with AWWA D103 (latest version). The floor elevation of the tank will be 610.5 feet with an overflow elevation of 651.5 feet. The tank will be equipped with a pressure-actuated level indicating transmitter to detect the water level in the

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storage tank and transmit signals to the booster pump station controls. Preliminary water tank operating levels for peak season operation are anticipated to be between 645.0 feet (water booster station pumps on) and 651.0 (water booster station pumps off). Alarm conditions will be transmitted via modem/dialer to the park's owner and their water system operator. Calculations for the overall water system to serve LEGOLAND New York, including the water storage requirements and operating levels are included in Appendix A.

CONCLUSIONS

The proposed LEGOLAND New York will generate an additional water demand of water usage of an annual average of 176,438 GPD with peak usage in July of approximately 255,394 GPD and minimal usage in December of approximately 49,127 GPD. The Village of Goshen has a permitted combined water yield of 1.3 MGD with an average daily treated/distributed of 0.65 MGD, leaving an excess availability of approximately 0.65 MGD which is more than adequate to supply the park. The required water booster pump station will be provided with a standby emergency generator to ensure operation during power outages and will also include an auto-dialer alarm system to promptly notify the project owner and operator if the booster pump station is not operating properly. The water storage tank will provide sufficient storage for both domestic and fire suppression requirements. Static and residual pressures have been calculated for the distribution system which demonstrates that more than adequate pressures will be provided at all points of the system. Therefore, no adverse impacts on the Village of Goshen water supply system are anticipated.

LANC & TULLY, P.C.

  
John O'Rourke, P.E.



JOR/DMK/  
water sys.engrpt.doc

**APPENDIX A**  
**Calculations**

**LANC & TULLY, P.C.**

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 Tel (845) 294-3700  
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 www.lanctully.com

JOB LECOLLATTAN WATER SYSTEM

SHEET NO. 1 OF 3

CALCULATED BY SMK DATE 4-20-18

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

SCALE \_\_\_\_\_

WATER DEMAND: 255,394 GPD (MAX DEM PER SENSOR) = 177 GPM

WATER SYSTEM PRESSURE NEEDS:

HIGH POINT OF SITE WATER MAIN (HOTEL) EL =	575.0
20 PSI. REQUIRED = 20 x 2.307 = 46.1 FT OR 46 FT	+ 46.0
MINIMUM WATER EL FOR 20 PSI	<u>621.0</u>

WATER STORAGE TANK:

STORAGE REQUIRED = 255,394 GAL (MAX DEM PER SENSOR) + 120,000 (200 GPM / 1 HR \* FIRE) = 375,394 GAL.

48"  $\phi$  TANK (47.53' DIA) = 13,287 GAL / FT \* SUPPLEMENTED BY BOOSTER STATION / MAIN

375,394 GAL  $\div$  13,287 = 28.2 FT REQUIRED ABOVE EL 621.0

TANK FLOOR EL = 610.5

MIN. WATER EL = 621.0

A 10.5 FT + 28.2 FT = 38.7 FT MINIMUM TANK HEIGHT

TANK SELECTED: 48"  $\phi$  x 42' (AQUA) = 560,000 GAL (558,034 GAL)

FLOOR EL = 610.50 CAPACITY ABOVE EL 621.0 = 621.00

TANK HEIGHT = 42.17 651.50

652.67

- 1.17 FREEBOARD

651.50 OVERFLOW EL

A 30.5'

x 13,287 GAL / FT

CAPACITY ABOVE EL 621.0 = 405,253.5 GAL

WATER BOOSTER STATION:

OPERATING WATER LEVELS PROSPECT TANK 595.0  $\rightarrow$  599.0

WATER MAIN EL @ BOOSTER STATION 468.0 468.0

STATIC PRESSURES = A 127 FT A 131 FT

PROPOSED TANK FULL EL = 651.0

WATER MAIN EL @ BOOSTER = 468.0

A 183 FT

EXISTING STATIC PRESSURE + 127 FT

A 56 FT - STATIC HEAD

FRICTION LOSSES TO TANK FROM BOOSTER STATION

4100' - 8" + FITTINGS  $\approx$  4300' x 0.077 PSI / 100' x 0.54 (C140 MULT) = 1.6 PSI x 2.307 = 3.7'

LANC & TULLY, P.C.

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JOB LEGGALIA WATER SYSTEM

SHEET NO. 2 OF 3

CALCULATED BY MK DATE 4-20-18

CHECKED BY DATE

SCALE

EXISTING HYDRAULIC #156 SOUTH ST. (6" MAIN) FLOW TEST @ 520 GPM

STATIC: 54 PSI RES. VAL: 36 PSI FL: 18 PSI @ 520 GPM

FRICITION LOSSES EXISTING MAIN TO BOOSTER STATION @ 250 GPM (CONSERVATIVE FOR 200 GPM DEMAND)

795' 6" EXISTING MAIN @ 0.40 PSI / 100 = 3.18 PSI

30' PR. 8" + FITTINGS ≈ 100' @ 0.09 PSI / 100 = 0.09 PSI

6080' PR 12" @ 0.01 PSI / 100 = 0.61 PSI

EXISTING FL @ 250 GPM (GRAPH) = 10.00 PSI

13.88 PSI ≈ 14 PSI x 2.307 = 32.3 FT

TOTAL DYNAMIC HEAD FOR BOOSTER STATION:

56 FT - STATIC

36 FT - FRICTION LOSSES (3.7' TO TANK + 32.3 FROM EXISTING)

92 FT TDH @ 200 GPM

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JOB LEGOLAND WATER SYSTEM

SHEET NO. 3 OF 3

CALCULATED BY SMK DATE 4-20-18

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

SCALE \_\_\_\_\_

OVERALL SYSTEM PRESSURES, FLOWS (COMPLETE WATER SYSTEM ONLINE) CONTROLLED BY WATER STORAGE TANK

TANK OPERATING LEVELS: (PRELIMINARY)

Low Level (Booster on) EL: 645.0 Tank Full (Pumps off) Level EL: 651.0

Site H.P. Hydrant (Hotel) W.A. EL: 575.0

<u>Δ 70.0'</u>	<u>Δ 76.0'</u>
x <u>0.43351</u>	x <u>0.43351</u>

Static Pressures at H.P. Hydrant 30.3 psi (Low) 32.9 psi (High)  
 Based on Tank Water Levels

FRICTION LOSSES TANK TO H.P. HYDRANT @ 500 GPM

676' - 8" DI + FITTINGS @ 800' @ 0.36 psi/100' x 0.54 (Circ) = 1.56 psi  
220' - 6" DI + FITTINGS @ 300' @ 1.45 psi/100' x 0.54 (Circ) = 2.35 psi  
3.91 psi

HP Hydrant Low Static: 30.3 psi High Static: 32.9  
 Fr @ 500 GPM 3.9 psi 3.9 psi

Residual Pressures: 26.4 psi (Low) 29.0 psi (High)

$$Q_h @ 20psi = 500 \left( \frac{30.3 - 20}{30.3 - 26.4} \right)^{0.54} = 500 \left( \frac{32.9 - 20}{32.9 - 29.0} \right)^{0.54}$$

Q<sub>h</sub> @ 20psi = 844.7 GPM (Low) Q<sub>h</sub> @ 20psi = 953.9 GPM (High)

STATIC PRESSURES AT LOW POINT OF SITE (Water Booster Station)

Tank Low Level: 645.0 Tank High Level: 651.0

Booster W.A. EL: 468.0 468.0

<u>Δ 177'</u>	<u>Δ 183'</u>
x <u>0.43351</u>	x <u>0.43351</u>

76.7 psi Low Static 79.3 psi High Static

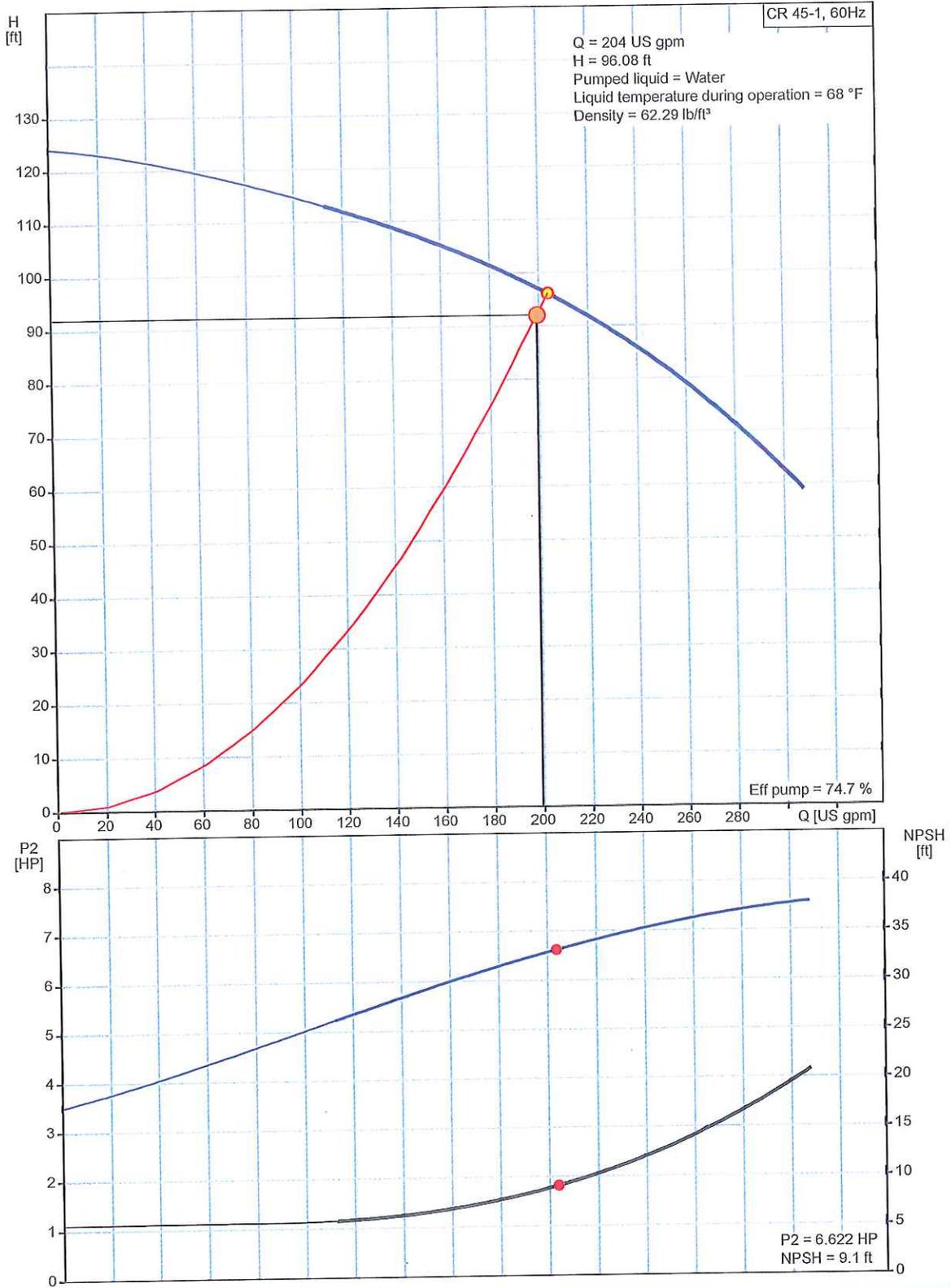
**APPENDIX B**  
**Pump Performance Datasheets**



Company name:  
Created by:  
Phone:

Date: 4/24/2018

### 97775260 CR 45-1 60 Hz



## 97775260 CR 45-1 60 Hz

