WATER SUPPLY FOR SOUTH BLOOMING GROVE BUSINESS PARK

ENGINEER'S REPORT & TECHNICAL SPECIFICATIONS

VILLAGE OF SOUTH BLOOMING GROVE
ORANGE COUNTY, NEW YORK

PREPARED FOR:

-ROUTE 208 HOLDINGS, LLC
-VILLAGE OF SOUTH BLOOMING GROVE
-THE ORANGE COUNTY DEPARTMENT OF HEALTH

August 11, 2022

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1. INTRODUCTION

The purpose of this report is to accompany plans for the construction of approximately 208,000 SF of retail and office space for the referenced project in the Village of South Blooming Grove. The site is near the intersection of NYS Route 208 & Museum Village Road (as shown in Appendix A) and is identified as Tax Map Numbers 223-1-2 & 4. There is also a small parcel used for site access that is in the Town of Blooming Grove and identified as Tax Map Number 53-1-20. The site is located within the Office Research Industrial (ORI) Zone and while the project consistent with the zoning regulations for this district, a variance for building height and number of stories was granted by the Zoning Board of Appeals.

There are existing offices on the site that are currently served by one individual drilled well. The existing on-site well will be abandoned in accordance with AWWA A-100 requirements. There is also an on-site sewage pump station that discharges to an existing 12-inch PVC force main located on Museum Village Road which will be replaced. The proposed project will require 1,075 LF of 6-inch C900 PVC watermain, a 58,000-gallon water storage tank, and the construction of a booster pump station. These proposed water supply facilities will be owned and operated by Route 208 Holdings, LLC (the Project Applicant & Property Owner). The goal of this project is to provide adequate average daily working pressures and flows while also providing fire flow capacity for this non-transient, non-community water supply system.

2. WELL DEVELOPMENT & WATER STORAGE TANK

Well Development

Water supply well #3B was constructed in accordance with New York State Department of Health Appendix 5-B and 5-D and the pump tests were performed in conformance with New York State Department of Environmental Conservation (NYSDEC) "Recommended Pump Test Procedures for Water Supply Applications" as provided in Appendix 10 TOGS 3.2.1. The proposed well can produce 26 gpm as evidenced during the 72-hour pump test. The hydrogeologic report, well drilling log, pump test & water quality test results can be found in Appendix C. The well was drilled to a depth of 485'

below ground surface and 55-feet of 6” casing was installed. The well pump is a 60 GPM, 4" submersible 10 HP SS SR Sub-Turbine, Franklin Electric, submersible pump and will be set at elevation 271’ in the well.

Groundwater will be pumped into the proposed 58,000-gallon water storage tank prior to disinfection and distribution. The selected well pump is capable of pumping 37 gpm into the water storage tank to an elevation of 596.2 with 165’ of total dynamic head (TDH). The pump is therefore adequate to serve the needs of the proposed water system. Calculations for the well pump sizing can be found in Appendix B.

The proposed water supply design includes the following:

1. A submersible well pump capable of discharging the stabilized withdrawal rate from the well.
2. Variable Frequency Drive (VFD) booster pumps to regulate the pump speed and discharge rate to match the stabilized withdrawal rate.
3. Flow metering.
4. Raw and finished water sampling taps.
5. Flow and residual chlorine paced sodium hypochlorite feed system.
6. Chlorine contact with a minimum contact time to satisfy the CT calculation.
7. A stand-by generator plug and manual transfer switch will be provided at the well house. The operator will be able to use a portable generator to power the well when needed. A catalog cut for the proposed portable gas generator is included in Appendix E.

Water Quality

Review of the water quality laboratory test results indicate the samples meet all of the NYSDOH drinking water standards. The Langlier Index value for Well 3B was reported at -0.67. There no maximum contaminant level (MCL) established for Langlier Index, but the desired range is 0.5 to -0.5.

3. WATER DISTRIBUTION

The water distribution system and appurtenances have been designed in accordance with the requirements of the Village of South Blooming Grove, Ten State Standards and Part 5 of the New York State Sanitary Code. The proposed water main includes approximately 1,075 feet of 6-inch C900 PVC watermain as shown on the project plans with cast iron valves and fittings. Gate valves will be spaced a maximum of 800 feet, an air release valve is provided at the high point in the water main, and a hydrant has been proposed at the low point in the system as required. The proposed building will be sprinklered, so fire hydrants for firefighting purposes have not been proposed. All portions of the proposed water supply system will be located within the subject property.

The utility layout has resulted in crossings of the water main with storm drainage utility lines. The profiles shown on the accompanying plans show the minimum vertical separation distances required for the respective crossings. To the extent possible, the proposed water main is located with proper separation distances to these utility lines. A minimum horizontal separation distance of ten feet (10') has been provided between the proposed watermain and the proposed parallel utility lines and a minimum of 18-inches of vertical clearance where there are crossing.

4. FLOWS

Domestic:

Data regarding the projected water demand usage was obtained from the New York State Design Standards for Intermediate Sized Wastewater Treatment Systems dated March 5, 2014. The water demand calculation can be found in Appendix B of this report. There is a grocery store proposed on the first floor with offices located on the floors above. There is an average daily demand 7,480 gpd or 5.19 gpm, a maximum day demand of 14,960 gpd (2 times the average day demand), and a peak hourly demand of 20.78 gpm (4 times the average daily demand). These values incorporate a 20% water savings for modern plumbing fixtures.

Fire:

Fire flow requirements have been based on the National Fire Protection Agency (NFPA) 13 since both buildings will be sprinklered. A total fire flow of 457.2 gpm for a duration of 60 minutes was calculated and includes hose stream allowance. This yields a fire flow working volume of 27,432 gpd within the water storage tank. The fire flow calculation can be found in Appendix B of this report.

5. PROPOSED WATER MAIN HYDRAULICS

Average Daily and Peak Hourly Flow Analysis:

The friction loss calculations for the proposed water main can be found in Appendix B. The calculations utilized the approximate locations, dimensions, and elevations of all the components within water supply system as shown in project plans. A 6-inch C900 PVC watermain will provide adequate capacity for both fire and domestic flows. It should also be noted that the friction losses in a 6-inch C900 PVC water main associated with the peak hourly and fire flows are minimal. The proposed water main is adequately sized to provide domestic and fire flow capacity for the proposed project and includes exterior valves and interior backflow prevention as required.

6. PROPOSED WATER STORAGE TANK & BOOSTER STATION

Water Storage Tank:

It is proposed to construct a new water storage tank that is 22.38-feet in diameter and has a 21.2-foot height (nominal) and will provide 2.942 gallons of water storage per foot. The capacity of the tank will be 58,000 gallons with approximately 18-inches of freeboard and the tank base will be at elevation 575.5. The storage tank is a bolted glass-fused to steel tank with a concrete floor designed and constructed in accordance with AWWA 0103 (latest version). Tank details can be found on the project plans and capacity charts for the proposed tank are shown in Appendix C. The domestic working volume of the tank will be the top 5.08 feet of water (minus the freeboard) in the tank, or approximately 14,960 gallons which is equal to the maximum day demand. Utilizing this working volume will help maintain constant working pressures under average daily operating conditions within the system. The potable water supply will operate with a pump on elevation of 590.12 and a pump off elevation of 595.20. This average water

elevation in the tank combined with the booster pumping station and low friction losses of 6-inch C900 PVC pipe provides working pressures at or above 35 psi in all the locations within the site.

The water storage tank was also designed to provide the water volume required for a one (1) hour fire with a required flow rate of 457.2 gpm. This equates to a minimum required volume of 27,432 gallons. The fire flow volume is stored within the tank between elevation 580.79 and 590.12. The volume of the tank exceeds the maximum day demand requirements and the combined requirement for fire flow volume and average day demand.

The floor elevation of the tank will be 576.5 feet with an overflow elevation of 596.2 feet. The tank will have one 24" diameter side manway access and a 30" square access hatch in the roof. The overflow pipe from the tank will discharge to the ground surface and ultimately flow into the adjacent ACOE wetland.

The proposed operational controls are as follows:

1. The water level in the water storage tank will be operated with a submersible transducer in the tank. At the elevations noted on the design plans, the transducer will call via telemetry for the well pump to start and stop.
2. At the well house, the chlorinator pump will operate automatically based on chlorine residual. The chlorinator will also be interlocked and energized when the well pump starts.
3. Alarm conditions will be at the well house and will be transmitted by use of an automatic dialer. The alarms will include:
    a. Well pump failure
    b. Low water alarm in well casing
    c. Chlorinator pump failure
    d. High level alarm in the water storage tank
    e. Low level alarm in the water storage tank

Packaged Booster Pump Station:

Booster pumps are proposed on the discharge side of the water storage tank since the average working volume of the tank will be at an elevation slightly lower than the fourth floor of the proposed buildings. There is a static water elevation difference from the water storage tank to the fourth floor of the proposed buildings of 64.41 feet. There is a Total Dynamic Head of approximately 104.41 feet at a flow of 26 gpm. Calculations, pump curves and cut sheets can be found in Appendix B.

As shown on the accompanying plans, it is proposed to construct an above grade packaged BPS in the vicinity of the water storage tank at elevation 576.5 and a 2-inch PE pipe will connect the water storage tank to the BPS. The pumping station will be 9.67 feet wide, 24.875 feet long with an approximate interior height of 8 feet. Two FE Select 3VR-09-00stg, 2 HP, Vertical Multi Stage 3450 RPM pumps will be situated within the BPS. The use of each pump will be alternated on a daily basis. All of the mechanical appurtenances associated with the BPS are shown on the attached plans and Appendix E.

Auxiliary power will be provided to the BPS via one gas-fired generator set in a weatherproof sound attenuating enclosure with automatic transfer switch and engine protection alarms. The generator will tie into the natural gas main located within either the NYS Route 208 or Museum Village Road right of way.

Bypass pumping conditions have not been considered should the proposed 58,000-gallon tank be taken out of service since this is a commercial site plan with a simple water supply system. Valves will be installed on all three sides of the tee so the tank can be taken out of service and domestic water can still be provided to the lower floors of the proposed buildings. However, fire flow when the proposed water storage tank is out of service cannot be achieved.

7. DISINFECTION

Calculations were prepared for chlorine contact (CT) associated with the proposed well. The size and length of the pipe prior to arriving at the first user is adequate to provide CT for 4-log inactivation. The CT calculations and Chlorine Feed Pump design can be found in Appendix B.

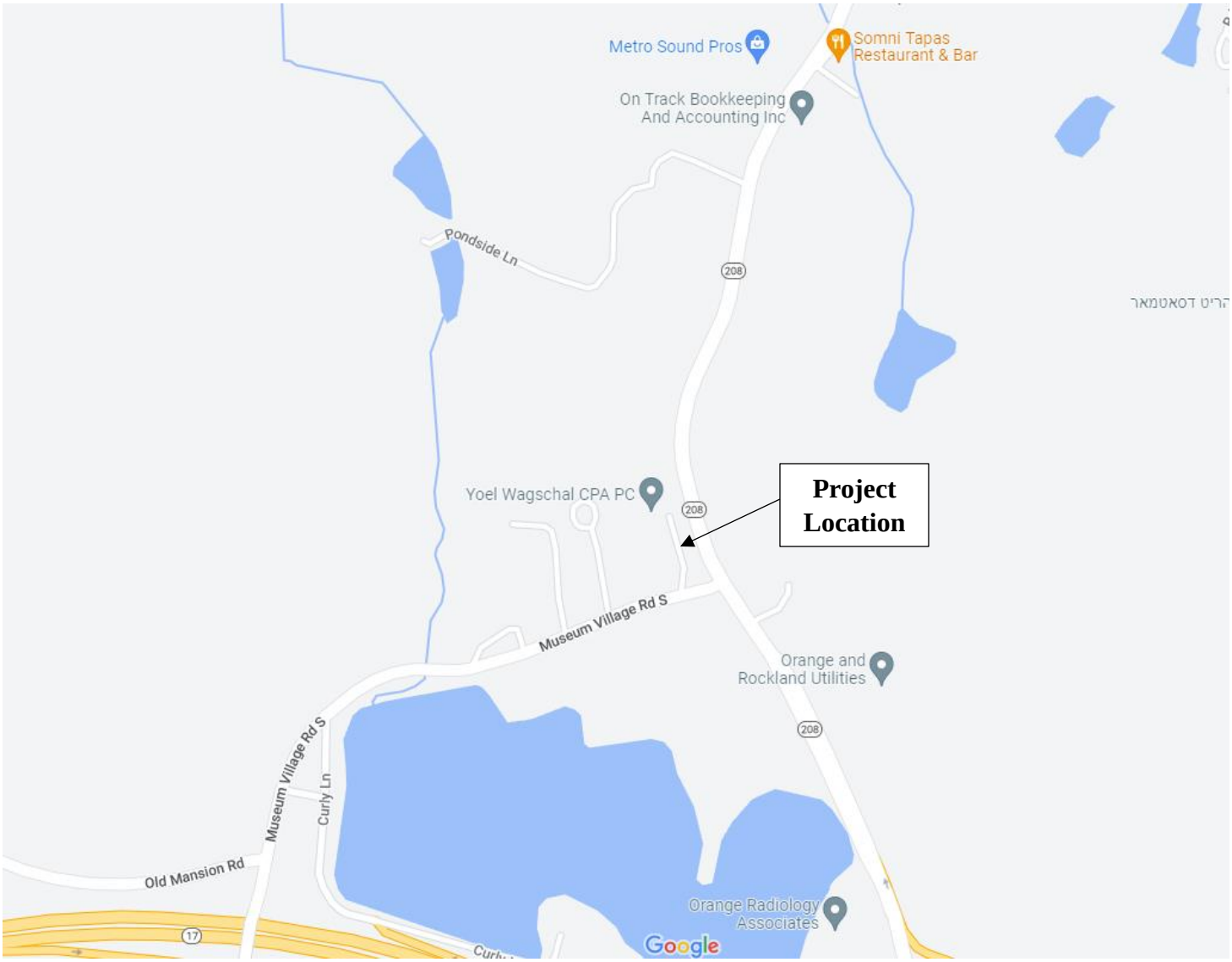
8. CONCLUSION

The proposed project will generate an average daily water demand of 7,480 gpd and a peak hourly flow of 20.78 gpm. The proposed well has a yield of 26 gpm which is adequate to supply water for the project under these varying conditions.

The required water booster pump station will be provided with a standby emergency generator to ensure operation during power outages. The 58,000 gallon water storage tank and BPS will also include an auto-dialer alarm system to promptly notify the project owner and operator if there are operation issues. The water storage tank will provide sufficient storage for both domestic and fire flow requirements.

Static and residual pressures have been calculated for the water distribution system which demonstrates that adequate pressures and flows will be provided at all points of the system.

APPENDIX A



LOCATION MAP

NOT TO SCALE

APPENDIX B

Water Demand Commercial Building

Per Empoyee (Offices)

# of Employees	Hydraulic Loading Rate (gpd/Employee)	Average Daily Flow (gpd)	Average Daily Flow (gpm)	Maximum Daily Flow (gpd)	Peak Hourly Flow (gpm)
450	15	6,750	4.69	13,500	18.75

Grocery Store 1st Floor Building #1

Building Gross Floor Area (SF)	Hydraulic Loading Rate (gpd/SF)	Average Daily Flow (gpd)	Average Daily Flow (gpm)	Maximum Daily Flow (gpd)	Peak Hourly Flow (gpm)
26,000	0.10	2,600	1.81	5,200	7.22
	Total =	**9,350**	**6.49**	**18,700**	**25.97**
	Less 20% Water Saving Fixtures=	**7,480**	**5.19**	**14,960**	**20.78**

SYSTEM HEAD CURVE CALCULATIONS

Flow (gpm)	Flow (cfs)	Velocity (ft/s)	Item	Diam. (in.)	K or C Value	Length (ft.)	h_f (ft/100 ft)	Hl (ft.)
			Static Head					161.6200
15	0.034	1.568	Bell Mouth Entrance	2	0.05			0.0019
15	0.034	1.568	Check Valve	2	3.5			0.1337
15	0.034	1.568	Straight Pipe	2	150	96	0.51	0.4896
15	0.034	1.568	90° Elbow	2	0.3			0.0115
						Total Dynamic Head (ft.) =		**162.26**

Flow (gpm)	Flow (cfs)	Velocity (ft/s)	Item	Diam. (in.)	K or C Value	Length (ft.)	h_f (ft/100 ft)	Hl (ft.)
			Static Head					161.6200
20	0.046	2.091	Bell Mouth Entrance	2	0.05			0.0034
20	0.046	2.091	Check Valve	2	3.5			0.2377
20	0.046	2.091	Straight Pipe	2	150	96	0.71	0.6816
20	0.046	2.091	90° Elbow	2	0.3			0.0204
						Total Dynamic Head (ft.) =		**162.56**

Flow (gpm)	Flow (cfs)	Velocity (ft/s)	Item	Diam. (in.)	K or C Value	Length (ft.)	h_f (ft/100 ft)	Hl (ft.)
			Static Head					161.6200
25	0.057	2.614	Bell Mouth Entrance	2	0.05			0.0053
25	0.057	2.614	Check Valve	2	3.5			0.3714
25	0.057	2.614	Straight Pipe	2	150	96	1.21	1.1616
25	0.057	2.614	90° Elbow	2	0.3			0.0318
						Total Dynamic Head (ft.) =		**163.19**

Flow (gpm)	Flow (cfs)	Velocity (ft/s)	Item	Diam. (in.)	K or C Value	Length (ft.)	h_f (ft/100 ft)	Hl (ft.)
			Static Head					161.6200
30	0.068	3.137	Bell Mouth Entrance	2	0.05			0.0076
30	0.068	3.137	Check Valve	2	3.5			0.5348
30	0.068	3.137	Straight Pipe	2	150	96	1.64	1.5744
30	0.068	3.137	90° Elbow	2	0.3			0.0458
						Total Dynamic Head (ft.) =		**163.78**

Flow (gpm)	Flow (cfs)	Velocity (ft/s)	Item	Diam. (in.)	K or C Value	Length (ft.)	h_f (ft/100 ft)	Hl (ft.)
			Static Head					161.6200
35	0.080	3.660	Bell Mouth Entrance	2	0.05			0.0104
35	0.080	3.660	Check Valve	2	3.5			0.7279
35	0.080	3.660	Straight Pipe	2	150	96	2.00	1.9200
35	0.080	3.660	90° Elbow	2	0.3			0.0624
						Total Dynamic Head (ft.) =		**164.34**

Flow (gpm)	Flow (cfs)	Velocity (ft/s)	Item	Diam. (in.)	K or C Value	Length (ft.)	h_f (ft/100 ft)	Hl (ft.)
			Static Head					161.6200
40	0.091	4.182	Bell Mouth Entrance	2	0.05			0.0136
40	0.091	4.182	Check Valve	2	3.5			0.9507
40	0.091	4.182	Straight Pipe	2	150	96	2.85	2.7360
40	0.091	4.182	90° Elbow	2	0.3			0.0815
						Total Dynamic Head (ft.) =		**165.40**

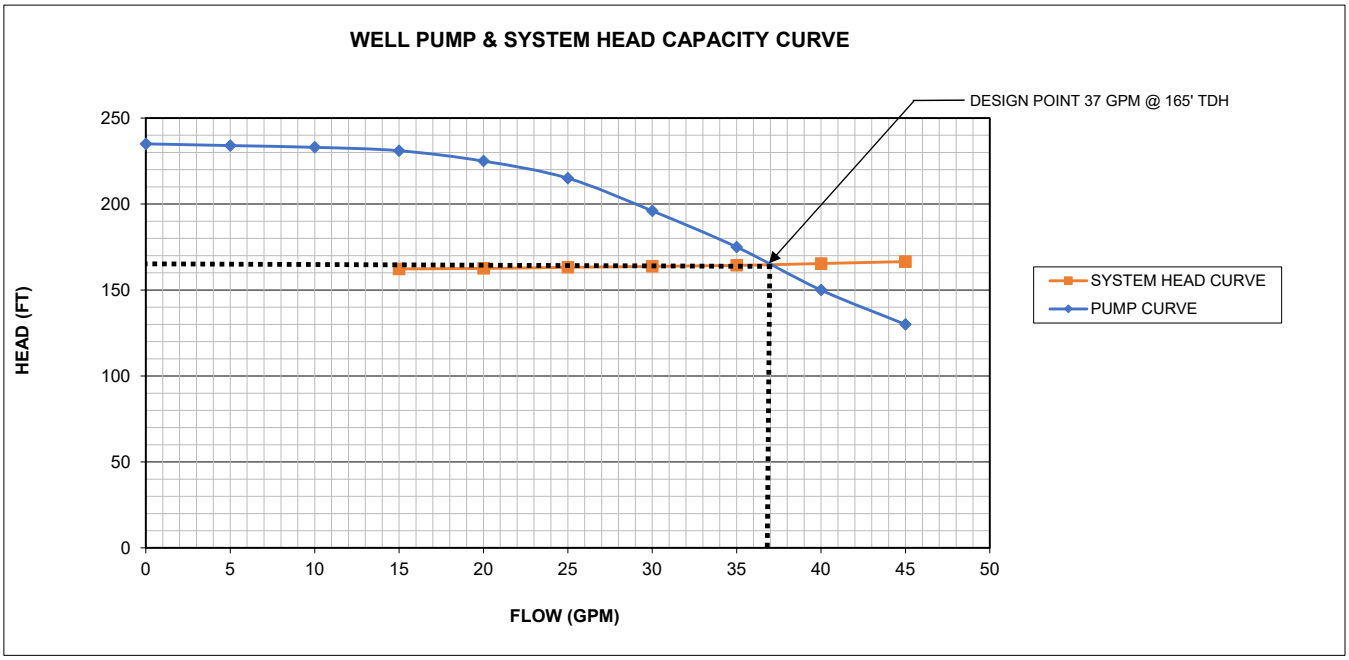
Flow (gpm)	Flow (cfs)	Velocity (ft/s)	Item	Diam. (in.)	K or C Value	Length (ft.)	h_f (ft/100 ft)	Hl (ft.)
			Static Head					161.6200
45	0.103	4.705	Bell Mouth Entrance	2	0.05			0.0172
45	0.103	4.705	Check Valve	2	3.5			1.2032
45	0.103	4.705	Straight Pipe	2	150	96	3.70	3.5520
45	0.103	4.705	90° Elbow	2	0.3			0.1031
						Total Dynamic Head (ft.) =		**166.50**

SYSTEM HEAD CURVE SUMMARY

TDH (ft.)	*GPM*
162.26	15
162.56	20
163.19	25
163.78	30
164.34	35
165.40	40
166.50	45

FE 4" Tri Seal High Capacity Pumps (2 HP)

HEAD (ft.)	*GPM*
235	0
234	5
233	10
231	15
225	20
215	25
196	30
175	35
150	40
130	45



Water Storage Tank & Booster Pumps

Water Demand=	5.19	gpm	Average Daily Flow
	20.78	gpm	Peak Hourly Flow for pump selection
Water Storage Tank			
FFE Bldg. #1=	600.00	ft.	
Bldg. #1 [4th Floor] Hgt.=	40.00	ft.	
Bldg. #1 [4th Floor] El.=	640.00		
20 psi residual Bldg. #1 [4th Fl.]=	46.14	ft.	Fire sprinkler flow presssure req.
Min. H_20 Pressure El. @ 20 psi=	686.14	ft.	[Use Booster Pumps]
Tank Diameter=	22.38	ft.	
Tank Height=	21.20	ft.	
Base Elevation=	576.50	ft.	
Tank Max. El.=	597.70	ft.	
Overflow=	596.20	ft.	[1.5' Freeboard]
Tank Volume=	2942.00	gal./ft.	
Tank Volume=	57957.40	gallons	
Domestic H20 Demand=	14960.00	gpd	[Domestic Working Volume]
Fire Flow=	27432.00	gpd	[NFPA 13 Sprinklered Building - See JPW Calcs.]
Domestic H20 Working Vol. Ht.=	5.08	ft.	
Domestic H20 Working Vol. El.=	591.12	ft.	
Fire Flow Working Vol. Ht.=	9.32	ft.	
Fire Flow Working Vol. El.=	581.79	ft.	
Booster Pumps Static Head			
FFE Bldg. #1=	600.00	ft.	
Tank's Low Domestic H_2O El.=	581.79	ft.	
El. Diff.=	18.21	ft.	
=	7.88	psi	
FFE Bldg. #1=	600.00	ft.	
Tank's High Domestic H_2O El.=	591.12	ft.	
El. Diff.=	8.88	ft.	
=	3.85	psi	
Min. Residual Pressure @ Curb=	35.00	psi	
=	15.15	ft.	
Highest Pumping Static Head=	42.88	psi	[35 psi net @ curb]
=	99.06	ft.	
Lowest Pumping Static Head=	38.85	psi	[35 psi net @ curb]
=	89.73	ft.	

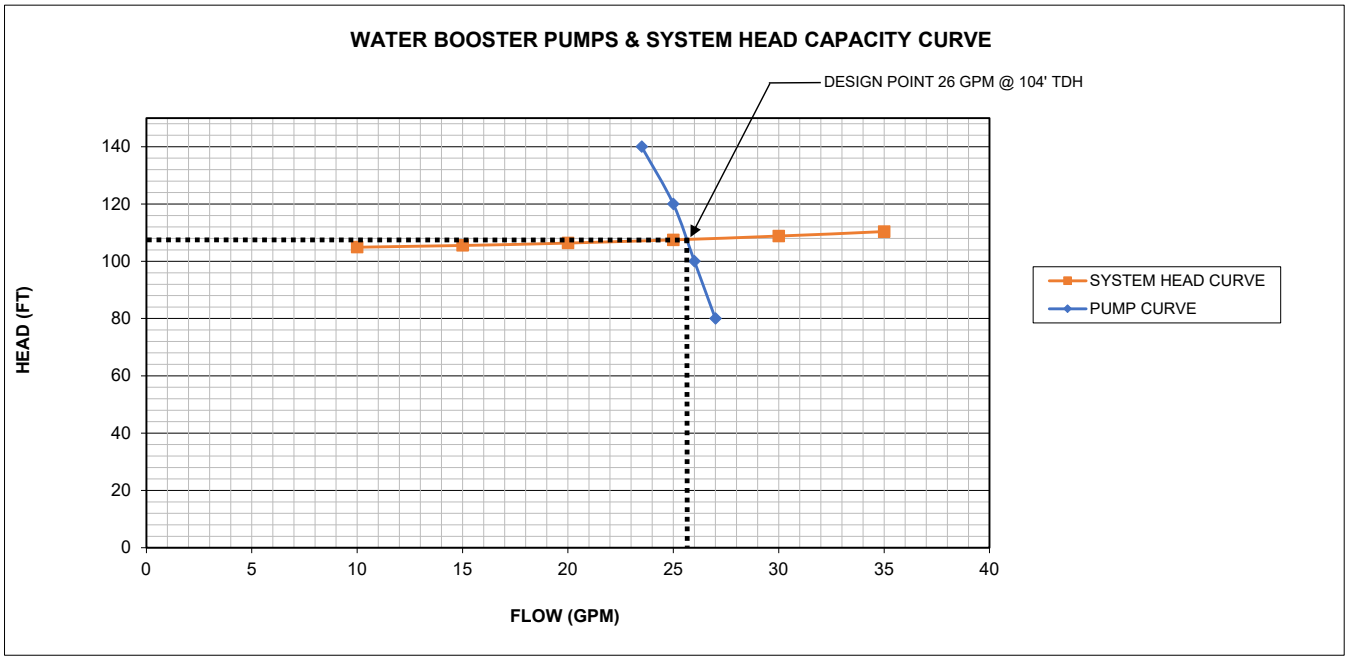
Res. Pressure Req. [4th Floor]=	20.00	psi	[Sprinkler Fire Flow Req.]
Height of Bldg. #1 =	40.00	ft.	
=	17.32	psi	
Residual Pressure @ 4th Fl. [Max]=	25.57	psi	OK
=	59.06	ft.	
Residual Pressure @ 4th Fl. [Min]=	21.53	psi	OK
=	49.73	ft.	

SYSTEM HEAD CURVE SUMMARY

TDH (ft.)	*GPM*
104.92	10
105.52	15
106.37	20
107.46	25
108.79	30
110.37	35

FE 3VR-09-00stg Multi-Speed (2HP)

HEAD (ft.)	*GPM*
140	23.5
120	25
100	26
80	27



CT Inactivation Using Distribution Pipe Only

Peak Flow, Q=	20.78	gpm	
Temp=	10	^{o}C	
Cl_2 Concentration=	0.2	mg/l	[Worst Case]
CT Req'd (Table 2A)=	6	mg/l * min.	
Pipe Baffling Factor=	1		
PH=	7-9		

$$\text{Min. Volume of Pipe} = \frac{\text{CT (mh/l) x Peak Flow (gpm)}}{\text{Concentration (mg/l) x Baffling Factor}}$$

Min. Req. Vol. of Pipe= 623.33 gallons

Length of Pipe Required for CT

Pipe Diameter=	6	inches	
Area of 6" Pipe=	28.26	in^2	
Area of 6" Pipe=	0.196	ft^2	
Vol. of 6" Pipe/LF=	1.47	gal./LF	
Length of Pipe Req.=	424.63	LF	
LF of Pipe Provided=	930	LF	[To Bldg. #1]

CT IS Adequate with the volume of the 6" C900 water line

Chlorine Feed Rate

[Check if Disinfection Will Occur within Districution Piping Before 1st User]

Well Flow (gpm) x Cl_2 residual (ppm) x $\frac{1,440}{125,000}$

Max. Well Flow=	21	gpm	
Avg. Well Flow=	5.19	gpm	
Cl_2 residual=	5	ppm	
NaClO Conc.=	125,000	ppm	[@ 12.5% Solution]
Cl_2 Feed Rate=	1.20	gpd	Maximum Flow
	0.050	gph	
Cl_2 Feed Rate=	0.30	gpd	Average Daily Flow
	0.012	gph	

Use a Grundfos DDA 7.5-16 CHEMICAL FEED PUMP

Max. Operating Pressure=	535.92	ft.
	232	psi
Max. Flow=	1.98	gph
Min. Flow=	2.5	ml/hr

Chlorine Feed Rate

[Check if Disinfection Will Occur within Districution Piping Before 1st User]

Well Flow (gpm) x Cl_2 residual (ppm) x $\frac{1,440}{125,000}$

Max. Well Flow=	21	gpm	
Avg. Well Flow=	5.19	gpm	
Cl_2 residual=	5	ppm	
NaClO Conc.=	125,000	ppm	[@ 12.5% Solution]
Cl_2 Feed Rate=	1.20	gpd	Maximum Flow
	0.050	gph	
Cl_2 Feed Rate=	0.30	gpd	Average Daily Flow
	0.012	gph	

Use a Grundfos DDA 7.5-16 CHEMICAL FEED PUMP

Max. Operating Pressure=	535.92	ft.
	232	psi
Max. Flow=	1.98	gph
Min. Flow=	2.5	ml/hr

APPENDIX C

72-HOUR PUMPING TEST REPORT

ROUTE 208 HOLDINGS LLC

SOUTH BLOOMING GROVE
BUSINESS PARK
VILLAGE OF SOUTH BLOOMING
GROVE, NY

PROJECT NO.: 31403128.000
DATE: MAY 2022

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This report was prepared by WSP USA (WSP) for the account of Route 208 Holdings LLC, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use that a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

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1.0 INTRODUCTION

WSP USA Inc., and related company Hydrogeologic, Architecture, Land Surveying, Landscape Architecture Services, P.C. (WSP), has prepared the following report with the results the 72-hour pumping test completed on the proposed water-supply well (Well 3B) that was drilled on the South Blooming Grove Business Park property on Route 208 in the Village of South Blooming Grove, New York (Figure 1). Well 3B was drilled by Northern Drilling Inc. in February 2022. A copy of the well completion report for Well 3B is provided in Appendix I. The well was constructed with 55 feet of 6-inch diameter casing and was drilled to a total depth of 485 feet. Well 3B is proposed to supply a non-transient, non-community water system and was, therefore, tested in accordance with the New York State Department of Health (NYSDOH) Sanitary Code Part 5, Subpart 5-1 Appendix 5-D requirements.

2.0 72-HOUR PUMPING TEST PROGRAM

The 72-hour pumping test program on Well 3B was conducted between March 21 through 24, 2022. During the pumping test program, water-level measurements were collected from Well 3B; two onsite bedrock monitoring wells, Wells 1 and 2; seven existing offsite wells located near the project site; and from a nested-pair of piezometers, PZ-1, installed near Well 3B. The locations of the wells and piezometer measured are shown on Figure 2. The hydrograph, 180-day drawdown projection graph and a summary table of water-level measurements collected from Well 3B are provided in Appendix II. The hydrographs and summary table of water-level measurements collected from the onsite and offsite monitoring wells measured during the test period are provided in Appendix III and the hydrograph and summary table of water-level measurements collected from the piezometer location are included in Appendix IV.

The water from Well 3B was discharged to waste during the pumping test. The discharge location is shown on Figure 2. The location was positioned downgradient of the onsite test well and bedrock monitoring wells to prevent artificial recharge of the groundwater during the test period.

Daily precipitation was measured on the project site and monitored at other nearby weather stations during the test period. The daily precipitation values from a nearby station have been overlain on the hydrographs for reference and the daily precipitation totals are also included on the table below.

TABLE 1: Daily Precipitation Totals

Date	Daily Precipitation (inches)
3/17/2022	0.26
3/18/2022	0
3/19/2022	0.26
3/20/2022	0
3/21/2022	0
3/22/2022	0
3/23/2022	0.07
3/24/2022	0.57
3/25/2022	0.08
3/26/2022	0.14
3/27/2022	0
3/28/2022	0

Water samples were collected from Well 3B at the end of the 72-hour pumping test for analysis for NYSDOH Sanitary Code Part 5, Subpart 5-1 parameters for non-transient, non-community public water-supply wells listed in Tables 8A, 8B, 8C, 8D, 9C, 9D and methyl tertiary-butyl ether (MTBE), turbidity, perfluorinated compounds perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), and 1,4-dioxane. Additionally, a MPA (microscopic particulate analysis), giardia and cryptosporidium sample was collected from Well 3B and the physical parameters of pH, temperature and conductivity were measured as part of a preliminary groundwater under the direct influence of surface water (GWUDI) assessment because there is a surface-water feature within 200 feet of the well. The laboratory reports for the Part 5 and MPA samples are included in Appendix V and graphs of the physical parameter measurements collected are included in Appendix VI.

2.1 Well 3B

The 72-hour pumping test on Well 3B was started at 9:47 on March 21, 2022. The static water level in Well 3B prior to the start of pumping was 5.44 ft btoc (feet below top of casing). Following the start-up of the pump in the well, the pumping rate was initially adjusted to 30 gpm (gallons per minute). As the test progressed, the pumping rate in Well 3B decreased to 26 gpm by 15:00 on March 21 where it remained for the duration of the test period.

The pump in Well 3B was shut down at 10:53 on March 24 after a total of 73 hours and 6 minutes of continuous pumping. The final water level in Well 3B at the end of the test was 134.92 ft btoc, for a total drawdown of 129.48 feet. The water-level change over the last 6 hours of pumping in Well 3B was 0.44 foot, which meets the stabilization criteria of less than 0.5 foot per 100 feet of available drawdown in the well. A 180-day water-level drawdown projection has been completed for Well 3B using the water-level data from the last 12 hours of the test period to assess the water level in the well after 180 days of continuous pumping. A copy of the 180-day water-level drawdown projection graph is included in Appendix II. Based on the projection, the water level in the well after 180 days of continuous pumping is 152.80 ft btoc which leaves approximately 332 feet of available drawdown in the well.

Water-level recovery in Well 3B was measured for four days following shut down of the test. The water level in the well reached 90% recovery to the pre-test level 7 hours and 45 minutes after the end of pumping.

3.0 OFFSITE MONITORING WELLS

Water-level measurements were collected from two onsite bedrock monitoring wells and seven offsite wells located near the South Blooming Grove Business Park property during the pumping test conducted on Well 3B. The well locations are shown on Figure 2 and the hydrographs and a summary table of the water-level measurements collected from the wells are provided in Appendix III. Initially, water-level monitoring equipment was installed in six offsite wells. However, during the test period the property owner at 9 Romeo Drive requested that his well be measured also. Therefore, manual water-level measurement collection at 9 Romeo Drive began on March 23, approximately 24 hours before the end of the pumping test on Well 3B.

The water-level drawdown measured in the monitoring well locations that is attributed to Well 3B pumping is provided in the table below.

TABLE 2: Monitoring Well Drawdown

Well Location	Drawdown Attributed to Well 3B Pumping (feet)
Onsite Well 1	22.1
Onsite Well 2	2.2
17 Romeo Drive	2.0
16 Museum Village Road	ND
7 Rieger Drive	ND
9 Romeo Drive	ND
Wills Pond Well 1	ND
Wills Pond Well 2	ND
Wills Pond Well 3	ND

ND - None discernible

Water-level drawdown that was attributed to pumping in Well 3B was measured in the onsite monitoring Wells 1 and 2 at 22.1 feet and 2.2 feet, respectively, and in one offsite well at 17 Romeo Drive at 2.0 feet. No discernible drawdown that was attributed to Well 3B pumping was measured in any of the other offsite wells.

For the well at 9 Romeo Drive, the water-level data that was collected was limited because a pressure transducer could not be installed because of the well configuration. However, the static water level that was measured on March 23 while Well 3B was pumping was very similar to the static water levels measured in the well on March 25, 28 and 29 after the pumping test on Well 3B had ended. If Well 3B had caused drawdown in the well at 9 Romeo Drive, a post-test recovery in the static water level in the offsite well would be evident. No recovery in the static water level occurred, therefore, the conclusion is that Well 3B did not cause discernible drawdown in this offsite well. The deeper water levels measured in the 9 Romeo Drive well on March 23 and 24 are likely associated with the pump in the well cycling on and off.

The small amount of drawdown that was measured in the one offsite well at 17 Romeo Drive occurred with Well 3B pumping continuously for 72+ hours at 26 gpm. The actual drawdown that may occur in this well when Well 3B is placed into service under normal operating conditions (cycling on and off during the day) will likely be much less and should not affect the use of this well in the future.

4.0 PIEZOMETER LOCATION

A nest-pair of piezometers was installed in the wetland near Well 3B. The piezometers were installed with one piezometer screen set shallow and the adjacent piezometer screen set deeper to assess potential water-level drawdown and/or changes in vertical head during the pumping test. There was no surface water present on the exterior of the piezometers throughout the data collection period. The hydrograph and summary table of the manual water-level measurements collected from the piezometers are included in Appendix IV.

In the shallow screened piezometer, a very slight declining trend was measured in the groundwater during the early part of the pumping test period. Following the rain event on March 23 and 24, the declining trend ended, and the water level began to rise slightly before pumping in Well 3B had ended. The slight declining trend followed by a slight recovery (overall change less than 0.1 foot) appears related to precipitation conditions and not pumping in Well 3B.

The water level in the deeper screened piezometer was generally level during the early portion of the pumping test, and then also began to rise slightly as a result of the rain event on March 23 and 24.

The vertical head direction was downward through the data collection period with shallow groundwater recharging the deeper groundwater at location PZ-1.

The water-level data collected from the nested-pair of piezometers at location PZ-1 during the test indicate no discernible drawdown effects that are attributed to Well 3B pumping.

5.0 WATER-QUALITY RESULTS

Water samples were collected from Well 3B at the end of the 72-hour test for analysis for NYSDOH Sanitary Code Part 5, Subpart 5-1 parameters for non-transient, non-community public water-supply wells listed in Tables 8A, 8B, 8C, 8D, 9C, 9D and MTBE, turbidity, PFOS and PFOA, and 1,4-dioxane. The laboratory reports for the Part 5 samples along with the MPA, giardia and cryptosporidium results are included in Appendix V.

The results from the Part 5 samples collected from Well 3B met all NYSDOH drinking standards. The results from the MPA sample collected reported a low risk for potential GWUDI and giardia and cryptosporidium were none detected. The Langlier Index value for Well 3B was reported at -0.67. There no maximum contaminant level (MCL) established for Langlier Index, but the desired range is 0.5 to -0.5. This corrosivity value should be considered as part of the water system design. There was a trace PFOS detection at 1.40J ng/L (nanograms per liter) which is below the MCL value of 10 ng/L. The detection was noted with a "J" flag because the detection was below the laboratory reporting limit.

Physical parameter measurements for pH, temperature and conductivity were collected from the discharge water from Well 3B and from the surface water in Satterly Creek upstream of the well discharge location. The graphs and tables of the measurements collected are included in Appendix VI. The conductivity values measured in Well 3B were consistently lower than the values measured in the surface water in Satterly Creek and no notable changes or correlation in the data between the surface water and the bedrock groundwater are evident. The temperature of the water in Well 3B was consistent throughout the data collection period and the temperature from the surface-water data showed daily oscillation and no correlation between the two data sets is evident. This data supports a low potential risk of GWUDI for Well 3B.

6.0 CONCLUSIONS

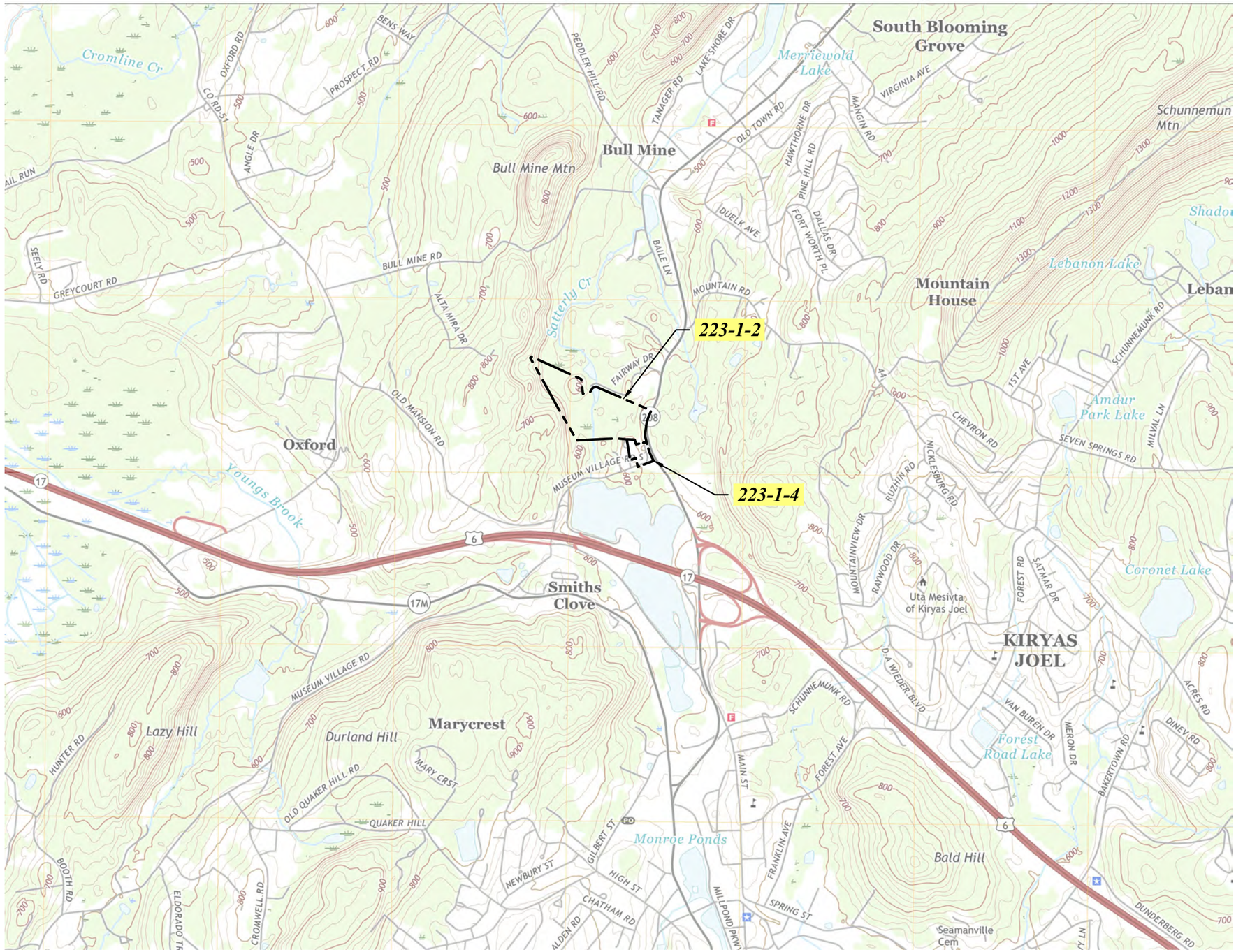
- The 72-hour pumping test conducted on Well 3B demonstrated stabilized yield and water-level drawdown at a pumping rate of 26 gpm. The static water level in Well 3B prior to the start of pumping was 5.44 ft btoc and the final pumping water level was 134.92 ft btoc, for a total drawdown of 129.48 feet
- A 180-day water-level drawdown projection was completed for Well 3B using the pumping test data. Based on the projection, the water level in the well after 180 days of continuous pumping is 152.80 ft btoc which leaves approximately 332 feet of available drawdown in the well.
- The water-level recovery in Well 3B achieved 90% recovery to the pre-test level 7 hours and 45 minutes after the end of pumping.
- Water-level measurements were collected from two onsite bedrock monitoring wells and seven offsite wells located near the South Blooming Grove Business Park property during the pumping test conducted on Well 3B. Water-level drawdown that was attributed to pumping in Well 3B was measured in the onsite monitoring Wells 1 and 2 at 22.1 feet and 2.2 feet, respectively, and in one offsite well at 17 Romeo Drive at 2.0 feet. No discernible drawdown that was attributed to Well 3B pumping was measured in any of the other offsite wells. The small amount of drawdown that was measured in the one offsite well at 17 Romeo Drive occurred with Well 3B pumping continuously for 72+ hours at 26 gpm. The actual drawdown that

may occur in this well when Well 3B is placed into service under normal operating conditions (cycling on and off during the day) will likely be much less and should not affect the use of this well in the future.

- A nested-pair of piezometers was installed in the wetland near Well 3B. The water-level data in the shallow and deeper screened piezometers showed slight variations as a result of precipitation conditions, and the vertical head direction was downward (shallow groundwater recharging deeper groundwater) throughout the data collection period. No discernible drawdown was measured in the piezometers that was attributed to Well 3B pumping during the test period.
- Water samples were collected from Well 3B at the end of the 72-hour test for analysis for NYSDOH Sanitary Code Part 5, Subpart 5-1 parameters for non-transient, non-community public water-supply wells listed in Tables 8A, 8B, 8C, 8D, 9C, 9D and MTBE, turbidity, PFOS and PFOA, and 1,4-dioxane. The results from the Part 5 samples collected from Well 3B met all NYSDOH drinking standards. The Langlier Index value for Well 3B was reported at -0.67. There no MCL established for Langlier Index, but the desired range is 0.5 to -0.5. This corrosivity value should be considered as part of the water system design. There was a trace PFOS detection at 1.40J ng/L which is below the MCL value of 10 ng/L. The detection was noted with a "J" flag because the detection was below the laboratory reporting limit.
- The results from the MPA sample collected from Well 3B reported a low risk for potential GWUDI and giardia and cryptosporidium were none detected. Physical parameter measurements for pH, temperature and conductivity were collected from the discharge water from Well 3B and from the surface water in Satterly Creek upstream of the well discharge location. The physical parameter measurements showed no correlation between the surface water and Well 3B during the test period. This data support a low potential risk of GWUDI for Well 3B.

cmm
May 24, 2022
H:\South Blooming Grove\2022\Pumping Test Report\72-Hour Test.docx

FIGURES



LEGEND

PROPERTY BOUNDARY

0 2000

SCALE IN FEET

B

SOURCE:
USGS TOPOGRAPHIC QUADRANGLE MONROE, NEW YORK (2019).

WSP USA, Inc. and related company
Hydrogeologic, Architecture, Land Surveying, Landscape Architecture, P.C. (WSP)
4 Research Drive
Suite 204
Shelton, Connecticut 06484
(203) 929-8555

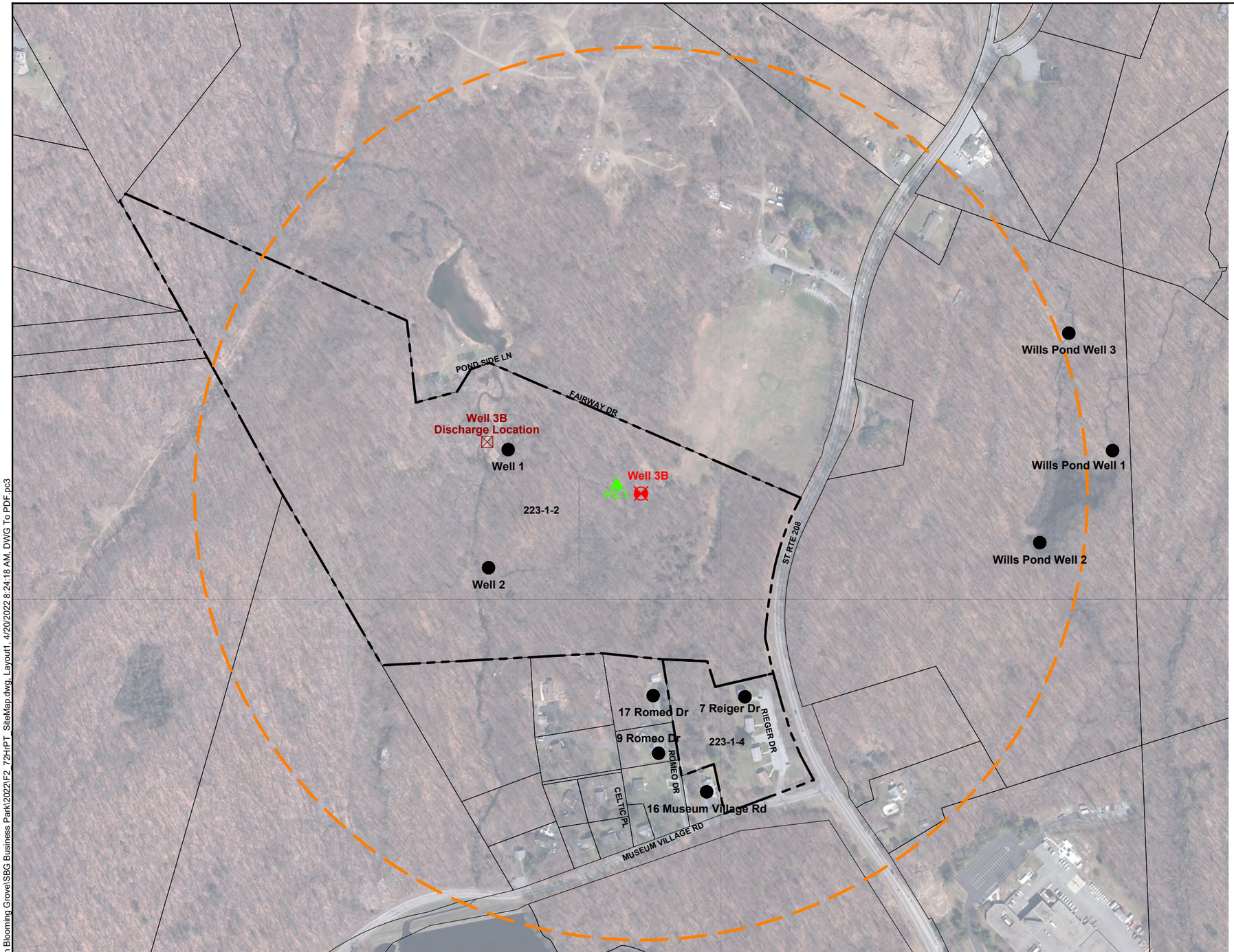
Drawn By:	RAC
Checked:	SS
Approved:	SS
DWG Date:	03/18/21

South Blooming Grove Business Park
South Blooming Grove, New York

SITE LOCATION MAP

FIGURE 1

O:\DWG\Village of South Blooming Grove\SBG Business Park\F1_USGS.dwg, Layout1, 3/18/2021 10:22:30 AM, DWG To PDF.pc3



LEGEND

- PROPERTY BOUNDARY
- 1,500-FOOT RADIUS
- PUMPING WELL LOCATION
- MONITORING WELL LOCATION
- PIEZOMETER LOCATION
- WELL DISCHARGE LOCATION

0 350

SCALE IN FEET

O:\DWG\Village of South Blooming Grove\SBG Business Park\2022\F2_72HrPT_SiteMap.dwg, Layout1, 4/20/2022 8:24:18 AM, DWG To PDF.pc3

B

WSP USA, Inc. and related company
Hydrogeologic, Architecture, Land Surveying, Landscape Architecture, P.C. (WSP)
4 Research Drive
Suite 204
Shelton, Connecticut 06484
(203) 929-8555

Drawn By:	RAC
Checked:	SS
Approved:	SS
DWG Date:	04/20/22

South Blooming Grove Business Park
South Blooming Grove, New York

SITE MAP - WELL 3B 72-HOUR PUMPING TEST

FIGURE 2

APPENDIX I

(1) COUNTY Orange

(2) TOWN Blooming Grove

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

WATER WELL COMPLETION REPORT

(3) DEC Well Number

(4) OWNER NAME: Route 208 Holdings LLC

(5) OWNER ADDRESS: 59 Montrose Ave #1 Brooklyn, NY 11206

(6) WELL ADDRESS (Also provide sketch or map, see instructions on reverse)
☐ Same as owner address — Rieder Drive Blooming Grove, NY

(7) LATITUDE/LONGITUDE AND METHOD USED
■ GPS ☐ Map 41° 21' 15" N 74° 11' 44" W

(8) TAX MAP NO. 223-1-2

(9) DEPTH OF WELL (Feet)

(10) DEPTH TO GROUNDWATER (Feet)

(11) DATE MEASURED

(12) FLOWING? ☐ Yes ■ No

CASINGS

(13) DIAMETER	10" in.	6" in.	in.	in.
(14) LENGTH	30' ft.	55' ft.	ft.	ft.

(15) GROUT TYPE / SEALING: BEN SEAL

(16) GROUT / SEALING INTERVAL (Feet) From 0' To 55'

SCREENS

(17A) MAKE / (17B) MATERIAL		(18) SLOT SIZE	
(19) DIAMETER	in.	in.	in.	in.
(20) LENGTH	ft.	ft.	ft.	ft.

(21) DEPTH TO TOP OF SCREEN, FROM TOP OF CASING (Feet)

YIELD TEST

(22) DATE: 2/4/22

(23) DURATION OF TEST (Hours:Minutes): THR

(24) LIFT METHOD ☐ Pump ■ Air Lift ☐ Bailer

(25) STABILIZED DISCHARGE (GPM): 60 gpm

(26) STATIC LEVEL PRIOR TO TEST (Feet below top of casing)

(27) MAXIMUM DRAWDOWN (Stabilized) (Feet below top of casing)

(28) RECOVERY TIME (Hours:Minutes)

(29) Was the water produced during the test discharged away from immediate area? ■ Yes ☐ No

DRILLER INFORMATION

(30) METHOD OF DRILLING ☐ Rotary ☐ Cable Tool ☐ Other

(31) USE OF WATER: TEST WELL

(32) DATE DRILLING WORK STARTED: 2-1-22

(33) DATE DRILLING WORK COMPLETED: 2-4-22

(34) DATE REPORT COMPLETED: 2-2-22

(35) REGISTERED COMPANY NAME: Northern Drilling Inc

(36) DEC REGISTRATION NO.: NYRD 10777

(37) REGISTERED COMPANY ADDRESS: PO Box 27 Hankerman NY 10926

(38) CERTIFIED DRILLER (Print name): MARK TURNBULL

(39) CERTIFIED DRILLER INITIALS (ELECTRONIC SIGNATURE) *: Mark Turnbull

PUMP INSTALLATION

(40) PUMP INSTALLED? ☐ Yes ☐ No

(41) DATE

(42) TYPE

(43) MAKE

(44) MODEL

(45) MAXIMUM CAPACITY (GPM)

(46) PUMP INSTALLATION LEVEL (Feet below top of casing)

(47) DATE REPORT COMPLETED

(48) REGISTERED COMPANY NAME

(49) DEC REGISTRATION NO. NYRD

(50) REGISTERED COMPANY ADDRESS

(51) CERTIFIED PUMP INSTALLER (Print Name)

(52) CERTIFIED PUMP INSTALLER INITIALS (ELECTRONIC SIGNATURE)*

WELL LOG

DEPTH TO BEDROCK (Feet below land surface)

GROUND ELEVATION 590 (Feet above sea level)

TOP OF CASING 2' (Feet above (+) or below (-) land surface)

TOP OF WELL

DEPTH (Feet)	DESCRIPTION
10' Casing	Sandy Loam & Water Set 10"
30	
	Bedrock Set 6" Casing Sealed
55'	
6" Drive Shoe	
310'	Fractured 5 gpm
360	Fractured 40 gpm
485'	Increased to 60 gpm after development

BOTTOM OF HOLE

* I agree, and it is my intent, to electronically sign this Water Well Completion Report (WWCR) by typing my initials in this signature box and electronically submitting it to the New York State Department of Environmental Conservation. I understand that my electronic signature is the legal equivalent of having placed my handwritten signature on a WWCR. I understand and agree that by electronically signing this WWCR, I hereby affirm that: (1) I am certified to supervise water well drilling activities as defined by Environmental Conservation Law 15-1502; (2) this water well was constructed in accordance with water well standards promulgated by the New York State Department of Health; and (3) under the penalty of perjury the information provided in this WWCR is true, accurate and complete, and I understand that any false statement made herein is punishable as a Class A Misdemeanor under Penal Law §210.45. 02/2020

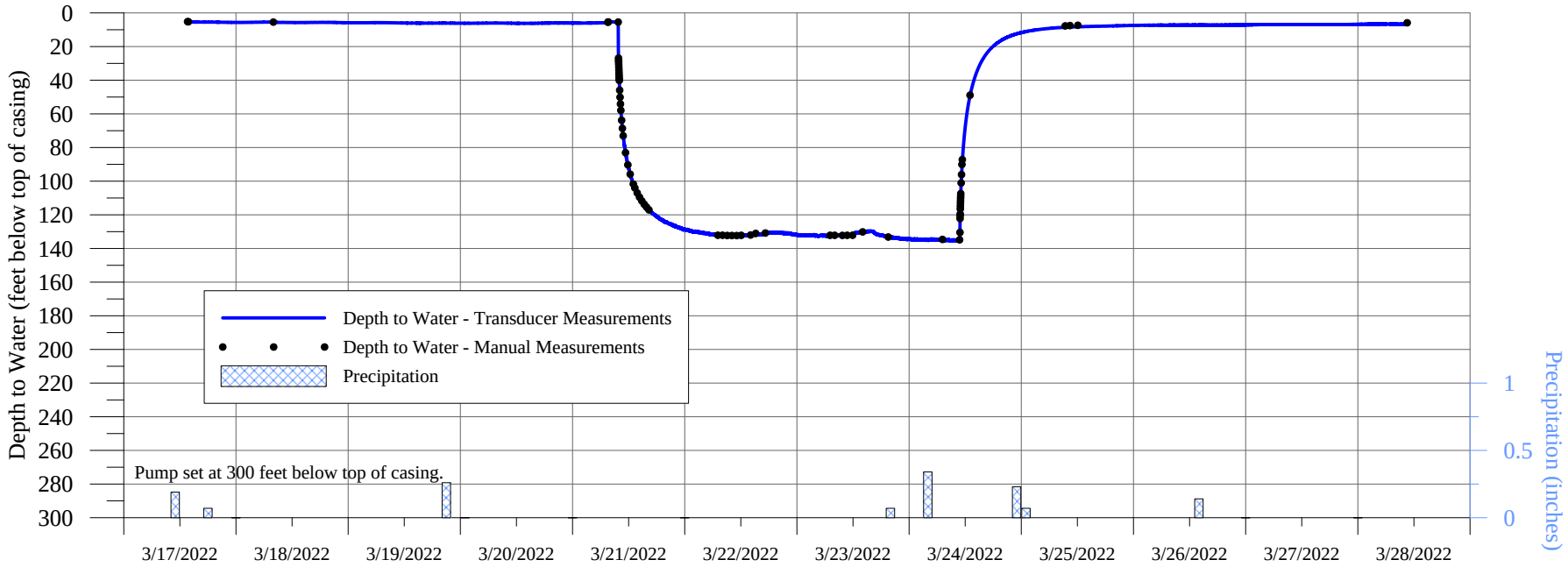
Provide a copy of this report to DEC and the well owner.

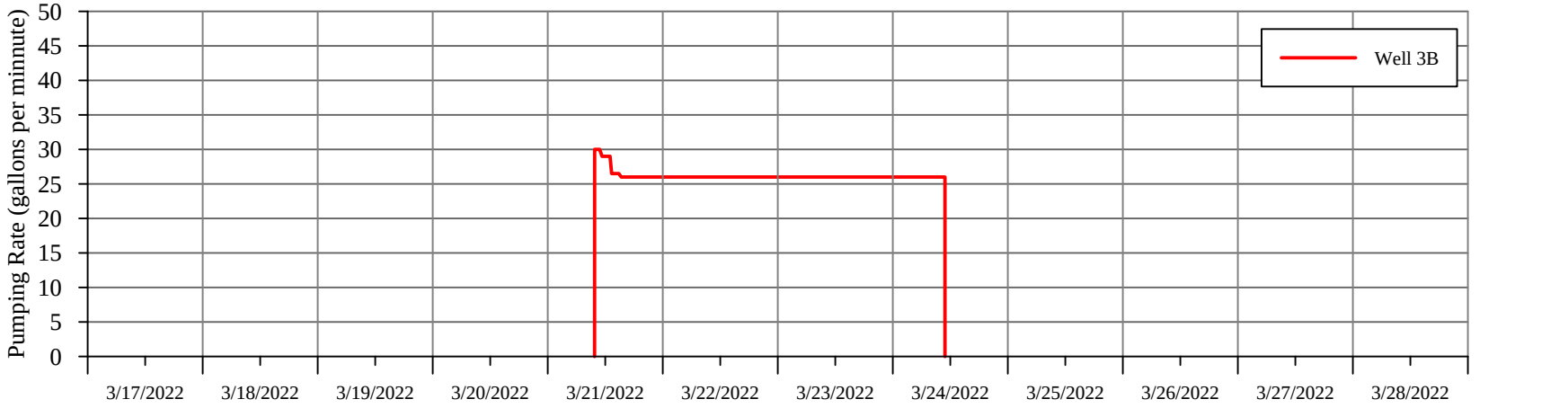
LOCATION SKETCH - Indicate north. Insert here or attach to this file.

APPENDIX II

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

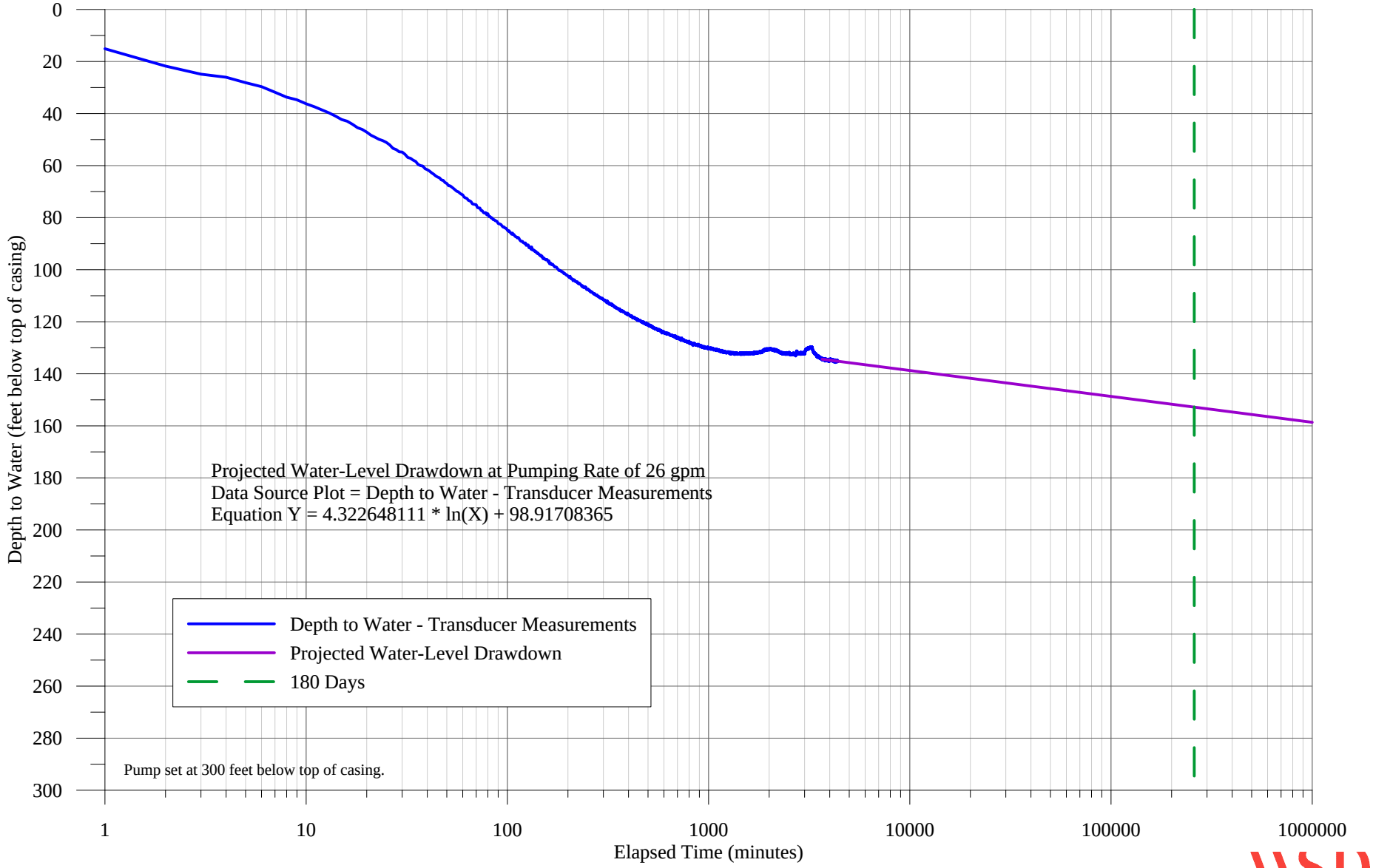
Hydrograph of Water-Level Measurements Collected from Pumping Well 3B During 72-Hour Pumping Test Conducted on Well 3B, March 2022





SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Graph of 180-Day Water-Level Drawdown Projection from Measurements Collected from Pumping Well 3B During 72-Hour Pumping Test Conducted on Well 3B, March 2022



SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Water-Level Measurements Collected from Pumping Well 3B
During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date	Time	Depth to Water (ft btoc)	Elapsed Time (minutes)	Drawdown (feet)	Comments
3/17/2022	14:00	5.38	--	--	Pressure transducer installed in Well 3B.
3/17/2022	15:00	5.42	--	--	
3/17/2022	16:00	5.44	--	--	
3/17/2022	17:00	5.45	--	--	
3/17/2022	18:00	5.44	--	--	
3/17/2022	19:00	5.47	--	--	
3/17/2022	20:00	5.49	--	--	
3/17/2022	21:00	5.55	--	--	
3/17/2022	22:00	5.59	--	--	
3/18/2022	0:00	5.66	--	--	
3/18/2022	1:00	5.67	--	--	
3/18/2022	2:00	5.65	--	--	
3/18/2022	3:00	5.60	--	--	
3/18/2022	4:00	5.55	--	--	
3/18/2022	5:00	5.52	--	--	
3/18/2022	6:00	5.47	--	--	
3/18/2022	7:00	5.47	--	--	
3/18/2022	8:00	5.47	--	--	
3/18/2022	9:00	5.65	--	--	
3/18/2022	10:00	5.65	--	--	
3/18/2022	11:00	5.67	--	--	
3/18/2022	12:00	5.72	--	--	
3/18/2022	13:00	5.72	--	--	
3/18/2022	14:00	5.73	--	--	
3/18/2022	15:00	5.70	--	--	
3/18/2022	16:00	5.68	--	--	
3/18/2022	17:00	5.65	--	--	
3/18/2022	18:00	5.63	--	--	
3/18/2022	19:00	5.62	--	--	
3/18/2022	20:00	5.64	--	--	
3/18/2022	21:00	5.66	--	--	
3/18/2022	22:00	5.73	--	--	
3/18/2022	23:00	5.78	--	--	
3/19/2022	0:00	5.81	--	--	
3/19/2022	1:00	5.83	--	--	
3/19/2022	2:00	5.84	--	--	
3/19/2022	3:00	5.82	--	--	
3/19/2022	4:00	5.83	--	--	
3/19/2022	5:00	5.79	--	--	
3/19/2022	6:00	5.76	--	--	
3/19/2022	7:00	5.76	--	--	
3/19/2022	8:00	5.80	--	--	
3/19/2022	9:00	5.82	--	--	
3/19/2022	10:00	5.88	--	--	
3/19/2022	11:00	5.94	--	--	
3/19/2022	12:00	6.01	--	--	
3/19/2022	13:00	6.05	--	--	
3/19/2022	14:00	6.07	--	--	
3/19/2022	15:00	6.08	--	--	
3/19/2022	16:00	6.08	--	--	
3/19/2022	17:00	6.07	--	--	
3/19/2022	18:00	6.07	--	--	
3/19/2022	19:00	6.05	--	--	
3/19/2022	20:00	6.05	--	--	
3/19/2022	21:00	6.05	--	--	
3/19/2022	22:00	6.07	--	--	

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Water-Level Measurements Collected from Pumping Well 3B
During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date	Time	Depth to Water (ft btoc)	Elapsed Time (minutes)	Drawdown (feet)	Comments
3/19/2022	23:00	6.09	--	--	
3/20/2022	0:00	6.14	--	--	
3/20/2022	1:00	6.15	--	--	
3/20/2022	2:00	6.14	--	--	
3/20/2022	3:00	6.11	--	--	
3/20/2022	4:00	6.09	--	--	
3/20/2022	5:00	6.07	--	--	
3/20/2022	6:00	6.02	--	--	
3/20/2022	7:00	6.01	--	--	
3/20/2022	8:00	6.03	--	--	
3/20/2022	9:00	6.03	--	--	
3/20/2022	10:00	6.07	--	--	
3/20/2022	11:00	6.12	--	--	
3/20/2022	12:00	6.16	--	--	
3/20/2022	13:00	6.18	--	--	
3/20/2022	14:00	6.20	--	--	
3/20/2022	15:00	6.18	--	--	
3/20/2022	16:00	6.16	--	--	
3/20/2022	17:00	6.10	--	--	
3/20/2022	18:00	6.06	--	--	
3/20/2022	19:00	6.00	--	--	
3/20/2022	20:00	5.96	--	--	
3/20/2022	21:00	5.97	--	--	
3/20/2022	22:00	5.97	--	--	
3/20/2022	23:00	6.00	--	--	
3/21/2022	0:00	6.04	--	--	
3/21/2022	1:00	6.04	--	--	
3/21/2022	2:00	6.02	--	--	
3/21/2022	3:00	6.01	--	--	
3/21/2022	4:00	6.06	--	--	
3/21/2022	5:00	5.95	--	--	
3/21/2022	6:00	5.90	--	--	
3/21/2022	7:00	5.86	--	--	
3/21/2022	8:00	5.36	--	--	
3/21/2022	9:00	5.37	--	--	
3/21/2022	9:46	5.44	--	--	
3/21/2022	9:47	15.10	1	9.66	Pump in Well 3B started.
3/21/2022	9:48	21.76	2	16.32	Pumping rate adjusted to 30 gpm.
3/21/2022	9:49	24.87	3	19.43	
3/21/2022	9:50	26.05	4	20.61	
3/21/2022	9:51	28.13	5	22.69	Pumping rate 30 gpm.
3/21/2022	9:52	29.67	6	24.23	
3/21/2022	9:53	31.82	7	26.38	
3/21/2022	9:54	33.71	8	28.27	
3/21/2022	9:55	34.72	9	29.28	
3/21/2022	9:56	36.25	10	30.81	Pumping rate 30 gpm.
3/21/2022	9:57	37.40	11	31.96	
3/21/2022	9:58	38.63	12	33.19	
3/21/2022	9:59	39.75	13	34.31	
3/21/2022	10:00	40.99	14	35.55	
3/21/2022	10:01	42.29	15	36.85	Pumping rate 30 gpm.
3/21/2022	10:06	47.14	20	41.70	
3/21/2022	10:11	51.06	25	45.62	Pumping rate 30 gpm.
3/21/2022	10:16	54.79	30	49.35	
3/21/2022	10:21	58.38	35	52.94	Pumping rate 30 gpm.
3/21/2022	10:26	61.58	40	56.14	

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Water-Level Measurements Collected from Pumping Well 3B
During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date	Time	Depth to Water (ft btoc)	Elapsed Time (minutes)	Drawdown (feet)	Comments
3/21/2022	10:31	64.40	45	58.96	Pumping rate 30 gpm.
3/21/2022	10:36	66.86	50	61.42	
3/21/2022	10:41	69.32	55	63.88	Pumping rate 30 gpm.
3/21/2022	10:46	71.25	60	65.81	
3/21/2022	11:00	77.22	74	71.78	Pumping rate 29 gpm.
3/21/2022	12:00	92.32	134	86.88	
3/21/2022	13:00	101.72	194	96.28	Pumping rate 26.5 gpm.
3/21/2022	14:00	107.84	254	102.40	
3/21/2022	15:00	112.75	314	107.31	Pumping rate 26 gpm.
3/21/2022	16:00	116.18	374	110.74	
3/21/2022	17:00	118.83	434	113.39	Pumping rate 26 gpm.
3/21/2022	18:00	121.24	494	115.80	
3/21/2022	19:00	122.69	554	117.25	Pumping rate 26 gpm.
3/21/2022	20:00	124.70	614	119.26	
3/21/2022	21:00	125.44	674	120.00	Pumping rate 26 gpm.
3/21/2022	22:00	126.73	734	121.29	
3/21/2022	23:00	128.11	794	122.67	Pumping rate 26 gpm.
3/22/2022	0:00	128.88	854	123.44	
3/22/2022	1:00	129.31	914	123.87	Pumping rate 26 gpm.
3/22/2022	2:00	130.15	974	124.71	
3/22/2022	3:00	130.48	1034	125.04	Pumping rate 26 gpm.
3/22/2022	4:00	131.01	1094	125.57	
3/22/2022	5:00	131.15	1154	125.71	Pumping rate 26 gpm.
3/22/2022	6:00	131.74	1214	126.30	
3/22/2022	7:00	132.01	1274	126.57	Pumping rate 26 gpm.
3/22/2022	8:00	132.07	1334	126.63	
3/22/2022	9:00	132.05	1394	126.61	Pumping rate 26 gpm.
3/22/2022	10:00	132.11	1454	126.67	
3/22/2022	11:00	132.20	1514	126.76	Pumping rate 26 gpm.
3/22/2022	12:00	131.94	1574	126.50	
3/22/2022	13:00	132.13	1634	126.69	Pumping rate 26 gpm.
3/22/2022	14:00	131.76	1694	126.32	
3/22/2022	15:00	131.62	1754	126.18	Pumping rate 26 gpm.
3/22/2022	16:00	131.29	1814	125.85	
3/22/2022	17:00	131.00	1874	125.56	Pumping rate 26 gpm.
3/22/2022	18:00	130.77	1934	125.33	
3/22/2022	19:00	130.64	1994	125.20	Pumping rate 26 gpm.
3/22/2022	20:00	130.67	2054	125.23	
3/22/2022	21:00	130.73	2114	125.29	Pumping rate 26 gpm.
3/22/2022	22:00	131.19	2174	125.75	
3/22/2022	23:00	131.15	2234	125.71	Pumping rate 26 gpm.
3/23/2022	0:00	132.11	2294	126.67	
3/23/2022	1:00	132.09	2354	126.65	Pumping rate 26 gpm.
3/23/2022	2:00	132.23	2414	126.79	
3/23/2022	3:00	132.21	2474	126.77	Pumping rate 26 gpm.
3/23/2022	4:00	132.39	2534	126.95	
3/23/2022	5:00	132.45	2594	127.01	Pumping rate 26 gpm.
3/23/2022	6:00	132.38	2654	126.94	
3/23/2022	7:00	132.35	2714	126.91	Pumping rate 26 gpm.
3/23/2022	8:00	131.74	2774	126.30	
3/23/2022	9:00	132.13	2834	126.69	Pumping rate 26 gpm.
3/23/2022	10:00	132.22	2894	126.78	
3/23/2022	11:00	132.17	2954	126.73	Pumping rate 26 gpm.
3/23/2022	12:00	131.86	3014	126.42	
3/23/2022	13:00	130.67	3074	125.23	Pumping rate 26 gpm.
3/23/2022	14:00	130.18	3134	124.74	

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Water-Level Measurements Collected from Pumping Well 3B During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date	Time	Depth to Water (ft btoc)	Elapsed Time (minutes)	Drawdown (feet)	Comments
3/23/2022	15:00	129.82	3194	124.38	Pumping rate 26 gpm.
3/23/2022	16:00	129.85	3254	124.41	
3/23/2022	17:00	131.44	3314	126.00	Pumping rate 26 gpm.
3/23/2022	18:00	132.01	3374	126.57	
3/23/2022	19:00	133.08	3434	127.64	Pumping rate 26 gpm.
3/23/2022	20:00	133.18	3494	127.74	
3/23/2022	21:00	133.39	3554	127.95	Pumping rate 26 gpm.
3/23/2022	22:00	133.89	3614	128.45	
3/23/2022	23:00	134.19	3674	128.75	Pumping rate 26 gpm.
3/24/2022	0:00	134.46	3734	129.02	
3/24/2022	1:00	134.34	3794	128.90	Pumping rate 26 gpm.
3/24/2022	2:00	134.85	3854	129.41	
3/24/2022	3:00	134.63	3914	129.19	Pumping rate 26 gpm.
3/24/2022	4:00	135.00	3974	129.56	
3/24/2022	4:52	134.48	4026	129.04	Six hours prior to end of pumping test period.
3/24/2022	5:00	134.63	4034	129.19	Pumping rate 26 gpm.
3/24/2022	6:00	135.05	4094	129.61	
3/24/2022	7:00	134.67	4154	129.23	Pumping rate 26 gpm.
3/24/2022	8:00	134.79	4214	129.35	
3/24/2022	9:00	135.27	4274	129.83	Pumping rate 26 gpm.
3/24/2022	10:00	135.24	4334	129.80	
3/24/2022	10:52	134.92	4386	129.48	Pumping rate 26 gpm.
3/24/2022	10:53	125.74	-1	120.30	Pump in Well 3B shut down.
3/24/2022	10:54	121.71	-2	116.27	
3/24/2022	10:55	119.68	-3	114.24	
3/24/2022	10:56	117.76	-4	112.32	
3/24/2022	10:57	115.99	-5	110.55	
3/24/2022	10:58	114.34	-6	108.90	
3/24/2022	10:59	112.76	-7	107.32	
3/24/2022	11:00	111.27	-8	105.83	
3/24/2022	11:01	109.89	-9	104.45	
3/24/2022	11:02	108.51	-10	103.07	
3/24/2022	11:03	107.21	-11	101.77	
3/24/2022	11:04	105.98	-12	100.54	
3/24/2022	11:05	104.76	-13	99.32	
3/24/2022	11:06	103.59	-14	98.15	
3/24/2022	11:07	102.49	-15	97.05	
3/24/2022	11:12	97.37	-20	91.93	
3/24/2022	11:17	92.88	-25	87.44	
3/24/2022	11:22	88.89	-30	83.45	
3/24/2022	11:27	85.28	-35	79.84	
3/24/2022	11:32	81.98	-40	76.54	
3/24/2022	11:37	78.99	-45	73.55	
3/24/2022	11:42	76.26	-50	70.82	
3/24/2022	11:47	73.69	-55	68.25	
3/24/2022	11:52	71.30	-60	65.86	
3/24/2022	12:00	67.77	-68	62.33	
3/24/2022	13:00	49.56	-128	44.12	
3/24/2022	14:00	38.77	-188	33.33	
3/24/2022	15:00	31.56	-248	26.12	
3/24/2022	16:00	26.43	-308	20.99	
3/24/2022	17:00	22.66	-368	17.22	
3/24/2022	18:00	19.79	-428	14.35	
3/24/2022	18:37	18.38	-465	12.94	Water level 90% recovered to pre-test level.
3/24/2022	19:00	17.52	-488	12.08	
3/24/2022	20:00	15.80	-548	10.36	

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Water-Level Measurements Collected from Pumping Well 3B
During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date	Time	Depth to Water (ft btoc)	Elapsed Time (minutes)	Drawdown (feet)	Comments
3/24/2022	21:00	14.47	-608	9.03	
3/24/2022	22:00	13.29	-668	7.85	
3/24/2022	23:00	12.42	-728	6.98	
3/25/2022	0:00	11.68	-788	6.24	
3/25/2022	1:00	11.14	-848	5.70	
3/25/2022	2:00	10.59	-908	5.15	
3/25/2022	3:00	10.17	-968	4.73	
3/25/2022	4:00	9.79	-1028	4.35	
3/25/2022	5:00	9.46	-1088	4.02	
3/25/2022	6:00	9.19	-1148	3.75	
3/25/2022	7:00	8.97	-1208	3.53	
3/25/2022	8:00	8.77	-1268	3.33	
3/25/2022	9:00	8.58	-1328	3.14	
3/25/2022	10:00	8.46	-1388	3.02	
3/25/2022	11:00	8.34	-1448	2.90	
3/25/2022	12:00	8.23	-1508	2.79	
3/25/2022	13:00	8.17	-1568	2.73	
3/25/2022	14:00	8.09	-1628	2.65	
3/25/2022	15:00	8.02	-1688	2.58	
3/25/2022	16:00	7.96	-1748	2.52	
3/25/2022	17:00	7.89	-1808	2.45	
3/25/2022	18:00	7.85	-1868	2.41	
3/25/2022	19:00	7.77	-1928	2.33	
3/25/2022	20:00	7.71	-1988	2.27	
3/25/2022	21:00	7.62	-2048	2.18	
3/25/2022	22:00	7.55	-2108	2.11	
3/25/2022	23:00	7.48	-2168	2.04	
3/26/2022	0:00	7.43	-2228	1.99	
3/26/2022	1:00	7.39	-2288	1.95	
3/26/2022	2:00	7.35	-2348	1.91	
3/26/2022	3:00	7.33	-2408	1.89	
3/26/2022	4:00	7.32	-2468	1.88	
3/26/2022	5:00	7.30	-2528	1.86	
3/26/2022	6:00	7.30	-2588	1.86	
3/26/2022	7:00	7.28	-2648	1.84	
3/26/2022	8:00	7.22	-2708	1.78	
3/26/2022	9:00	7.28	-2768	1.84	
3/26/2022	10:00	7.22	-2828	1.78	
3/26/2022	11:00	7.28	-2888	1.84	
3/26/2022	12:00	7.26	-2948	1.82	
3/26/2022	13:00	7.28	-3008	1.84	
3/26/2022	14:00	7.28	-3068	1.84	
3/26/2022	15:00	7.23	-3128	1.79	
3/26/2022	16:00	7.31	-3188	1.87	
3/26/2022	17:00	7.27	-3248	1.83	
3/26/2022	18:00	7.30	-3308	1.86	
3/26/2022	19:00	7.24	-3368	1.80	
3/26/2022	20:00	7.27	-3428	1.83	
3/26/2022	21:00	7.24	-3488	1.80	
3/26/2022	22:00	7.19	-3548	1.75	
3/26/2022	23:00	7.16	-3608	1.72	
3/27/2022	0:00	7.12	-3668	1.68	
3/27/2022	1:00	7.01	-3728	1.57	
3/27/2022	2:00	7.04	-3788	1.60	
3/27/2022	3:00	6.95	-3848	1.51	
3/27/2022	4:00	6.99	-3908	1.55	

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Water-Level Measurements Collected from Pumping Well 3B
During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date	Time	Depth to Water (ft btoc)	Elapsed Time (minutes)	Drawdown (feet)	Comments
3/27/2022	5:00	6.90	-3968	1.46	
3/27/2022	6:00	6.97	-4028	1.53	
3/27/2022	7:00	6.98	-4088	1.54	
3/27/2022	8:00	6.91	-4148	1.47	
3/27/2022	9:00	6.98	-4208	1.54	
3/27/2022	10:00	6.96	-4268	1.52	
3/27/2022	11:00	6.95	-4328	1.51	
3/27/2022	12:00	6.88	-4388	1.44	
3/27/2022	13:00	6.89	-4448	1.45	
3/27/2022	14:00	6.87	-4508	1.43	
3/27/2022	15:00	6.94	-4568	1.50	
3/27/2022	16:00	6.88	-4628	1.44	
3/27/2022	17:00	6.87	-4688	1.43	
3/27/2022	18:00	6.93	-4748	1.49	
3/27/2022	19:00	6.94	-4808	1.50	
3/27/2022	20:00	6.85	-4868	1.41	
3/27/2022	21:00	6.84	-4928	1.40	
3/27/2022	22:00	6.90	-4988	1.46	
3/27/2022	23:00	6.80	-5048	1.36	
3/28/2022	0:00	6.82	-5108	1.38	
3/28/2022	1:00	6.78	-5168	1.34	
3/28/2022	2:00	6.67	-5228	1.23	
3/28/2022	3:00	6.62	-5288	1.18	
3/28/2022	4:00	6.67	-5348	1.23	
3/28/2022	5:00	6.66	-5408	1.22	
3/28/2022	6:00	6.61	-5468	1.17	
3/28/2022	7:00	6.62	-5528	1.18	
3/28/2022	8:00	6.69	-5588	1.25	
3/28/2022	9:00	6.67	-5648	1.23	
3/28/2022	10:00	6.68	-5708	1.24	Pressure transducer removed from Well 3B.

ft btoc feet below top of casing

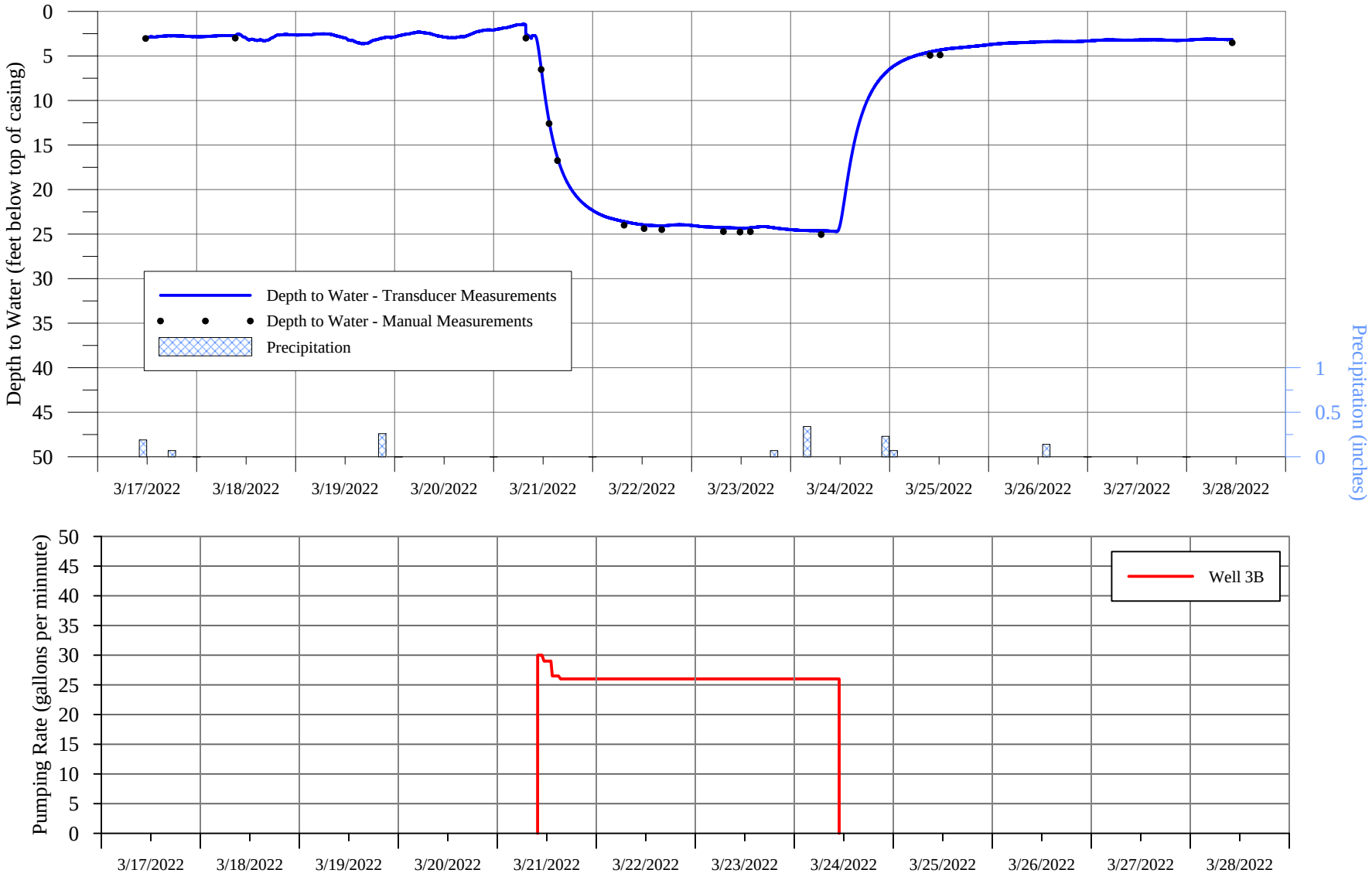
gpm gallons per minute

K:\Jobs\South Blooming Grove Business Park\72 Hour Pumping Test\Report\Well 3B WL table.doc

APPENDIX III

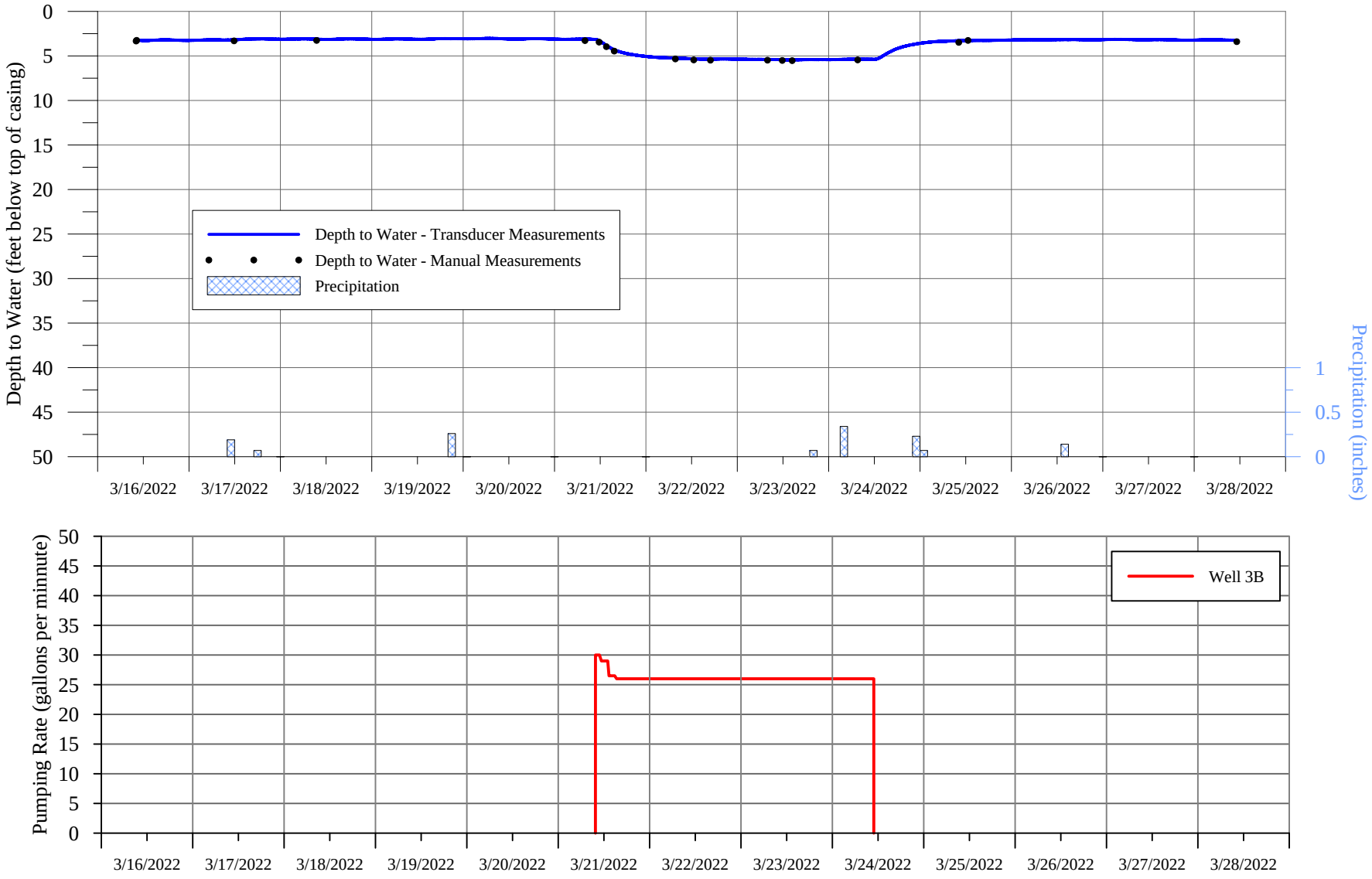
SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Hydrograph of Water-Level Measurements Collected from Onsite Well 1 During 72-Hour Pumping Test Conducted on Well 3B, March 2022



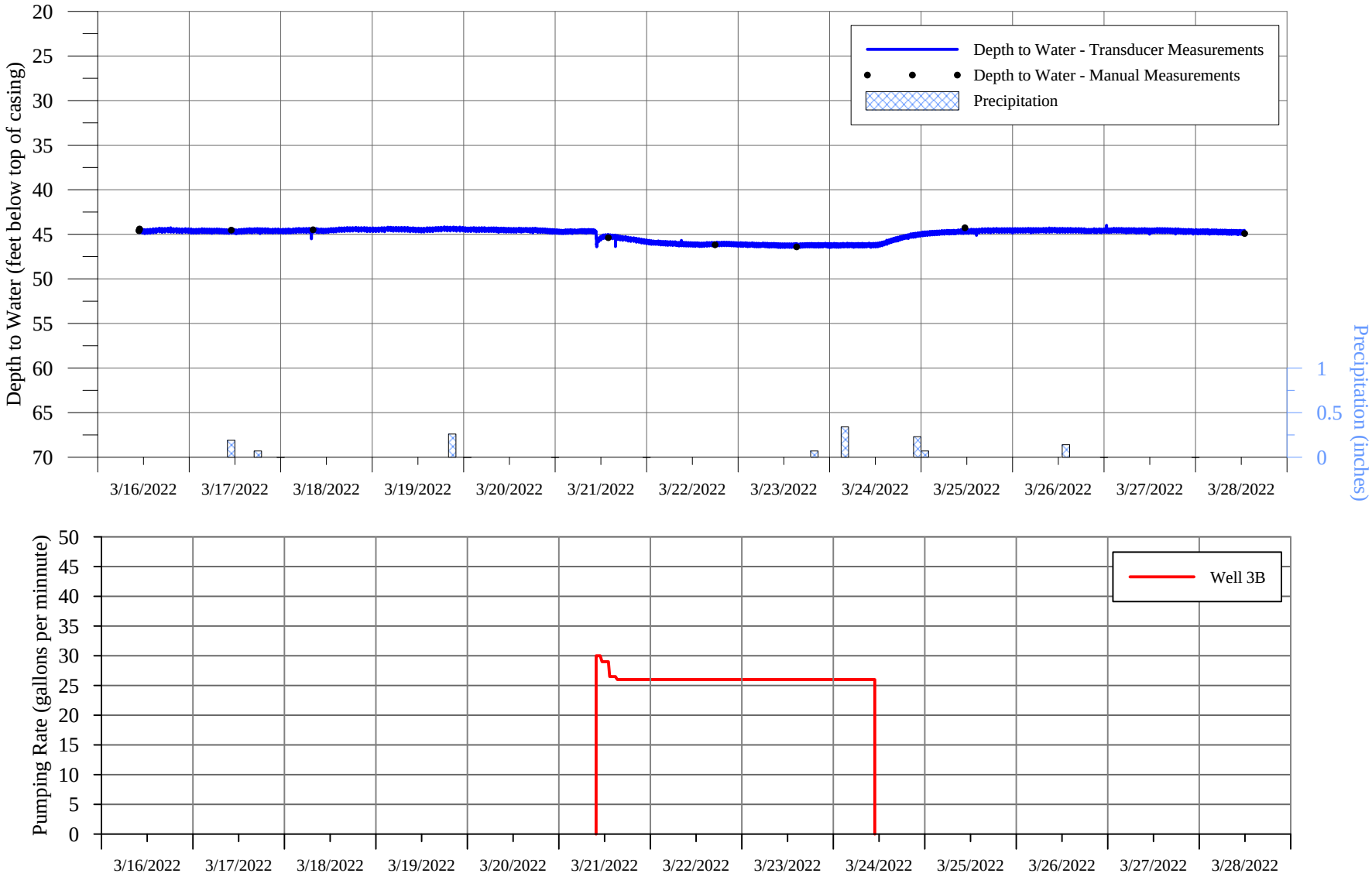
SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Hydrograph of Water-Level Measurements Collected from Onsite Well 2 During 72-Hour Pumping Test Conducted on Well 3B, March 2022



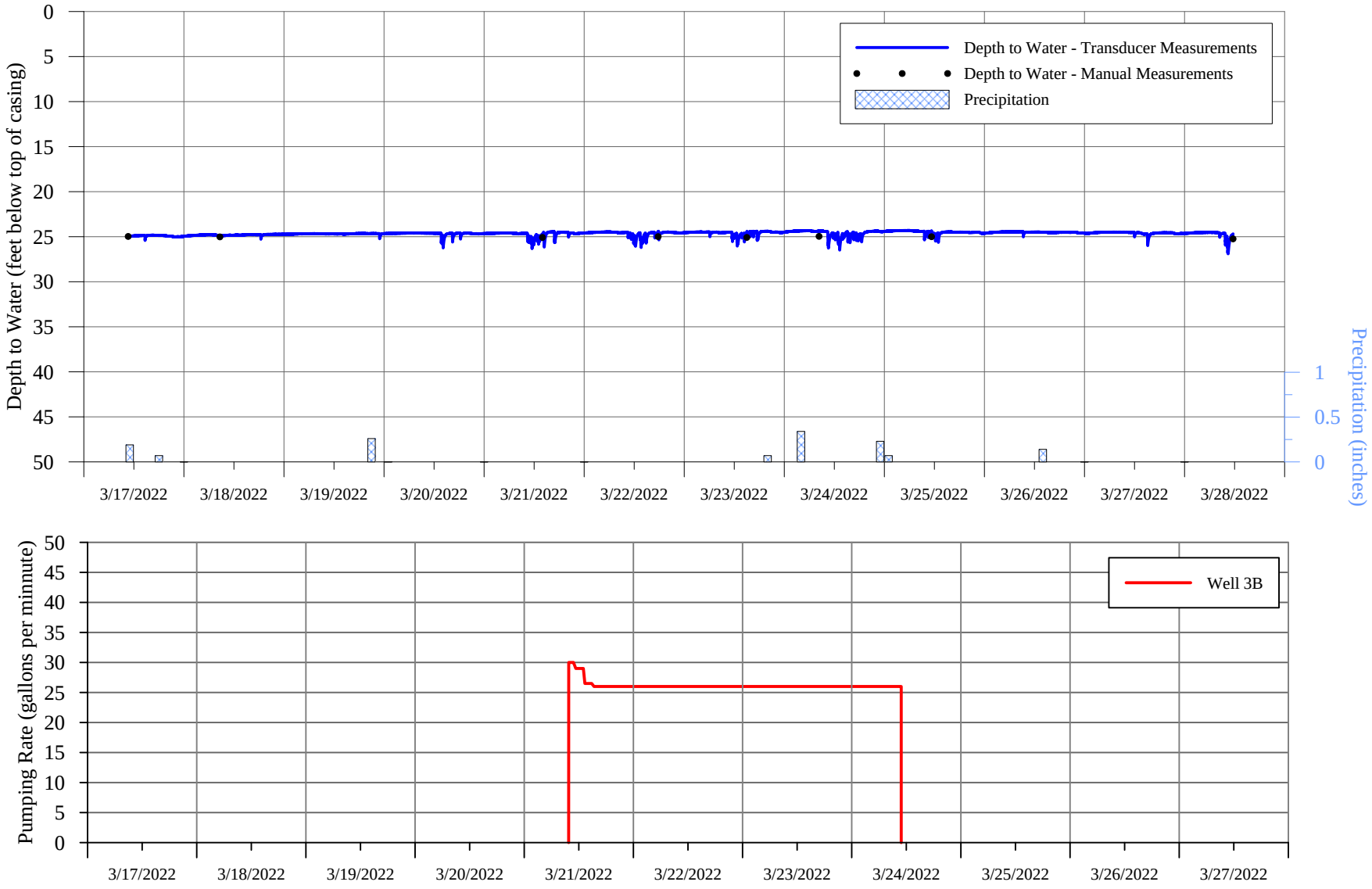
SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Hydrograph of Water-Level Measurements Collected from Well Located at 17 Romeo Drive During 72-Hour Pumping Test Conducted on Well 3B, March 2022



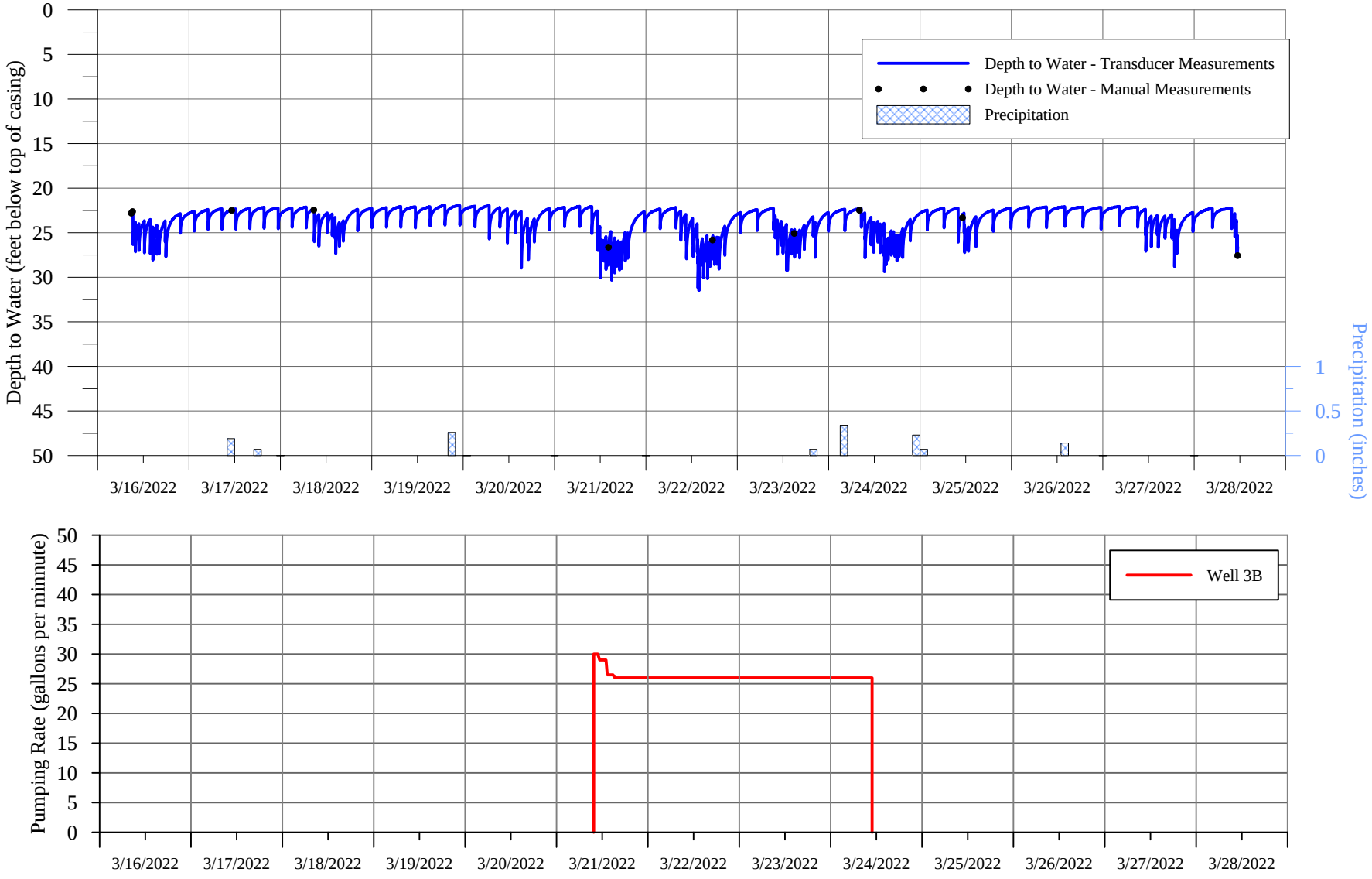
SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Hydrograph of Water-Level Measurements Collected from Well Located at 16 Museum Village Rd During 72-Hour Pumping Test Conducted on Well 3B, March 2022



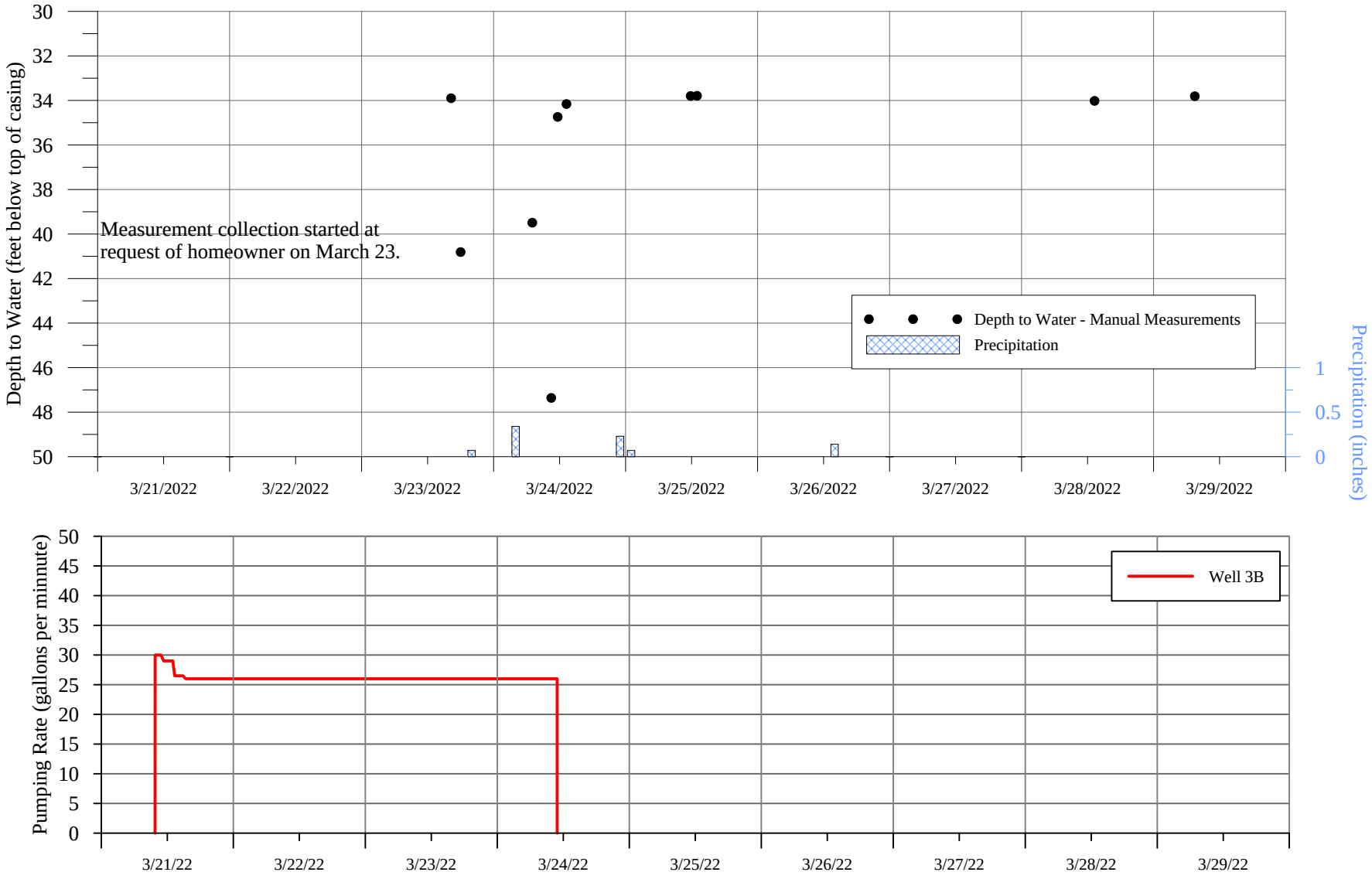
SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Hydrograph of Water-Level Measurements Collected from Well Located at 7 Rieger Drive During 72-Hour Pumping Test Conducted on Well 3B, March 2022



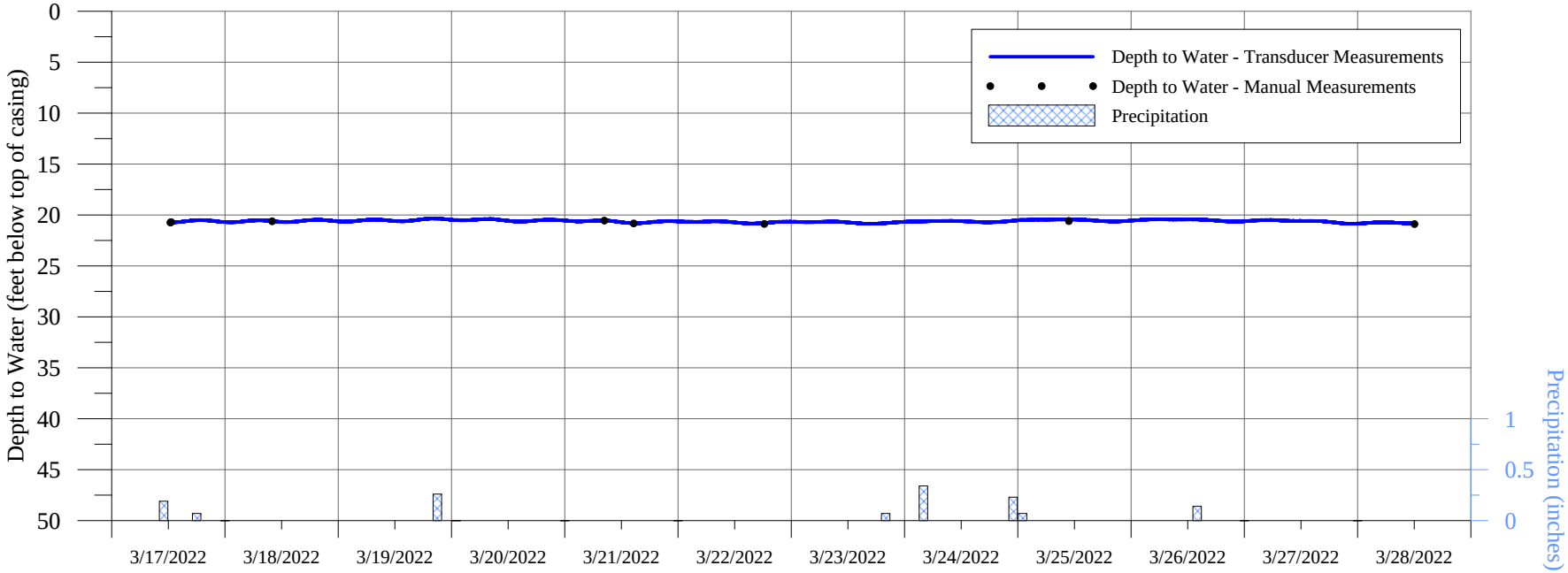
SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

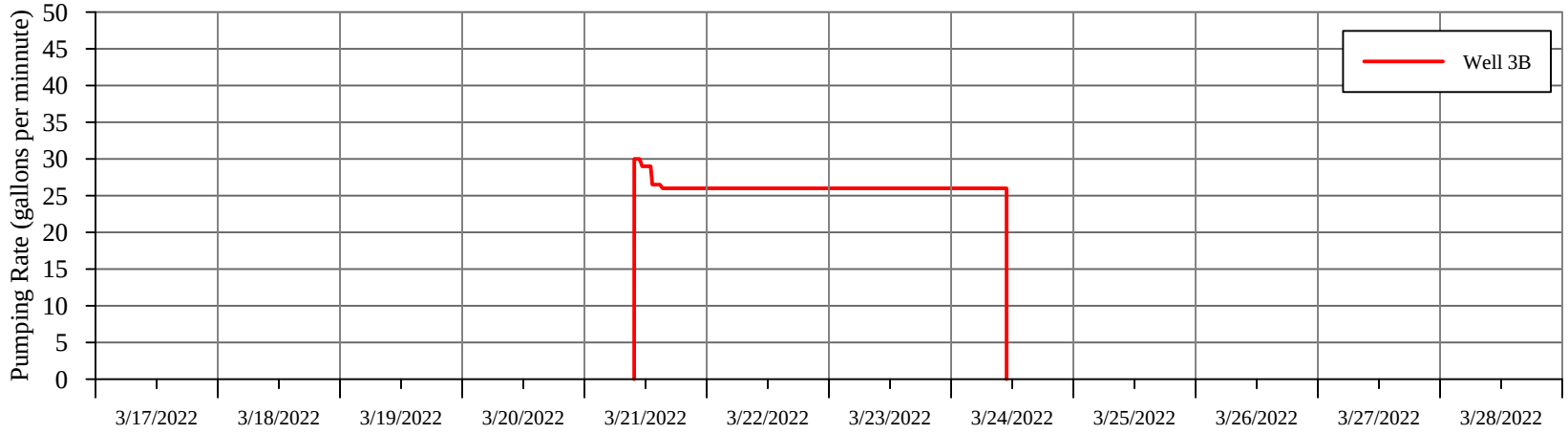
Hydrograph of Water-Level Measurements Collected from Well Located at 9 Romeo Drive During 72-Hour Pumping Test Conducted on Well 3B, March 2022



SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Hydrograph of Water-Level Measurements Collected from Wills Pond Well 1 During 72-Hour Pumping Test Conducted on Well 3B, March 2022





SOUTH BLOOMING GROVE BUSINESS PARK
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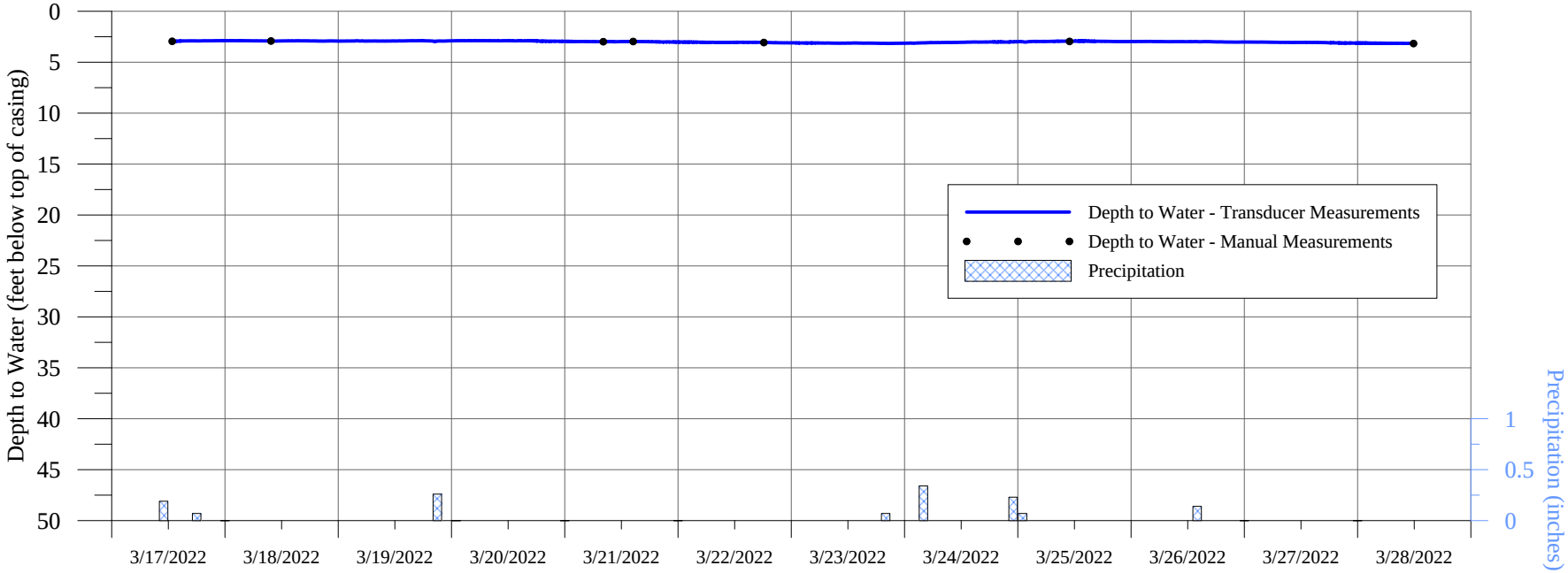
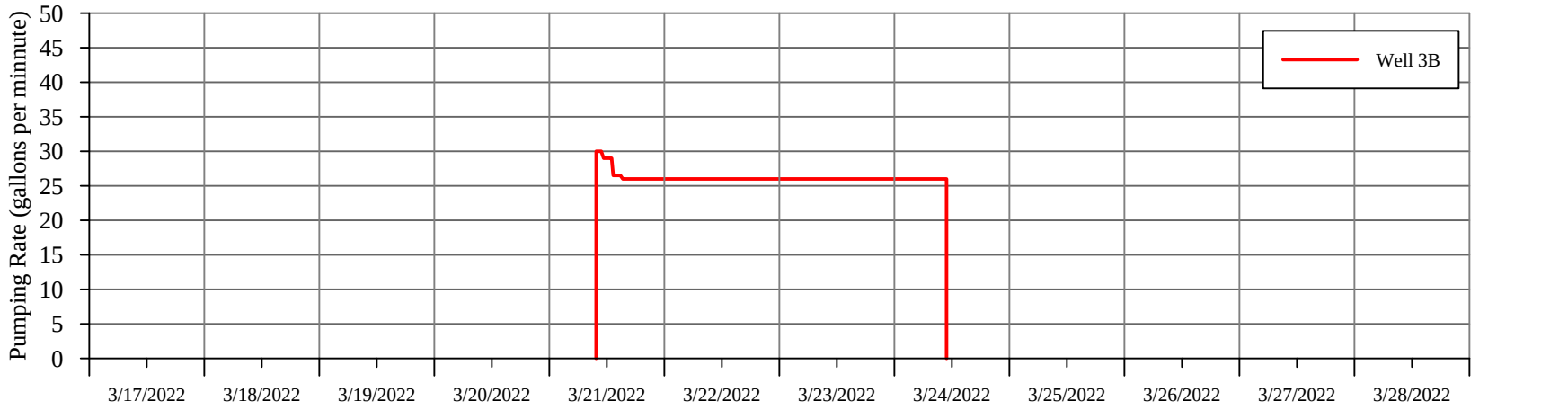
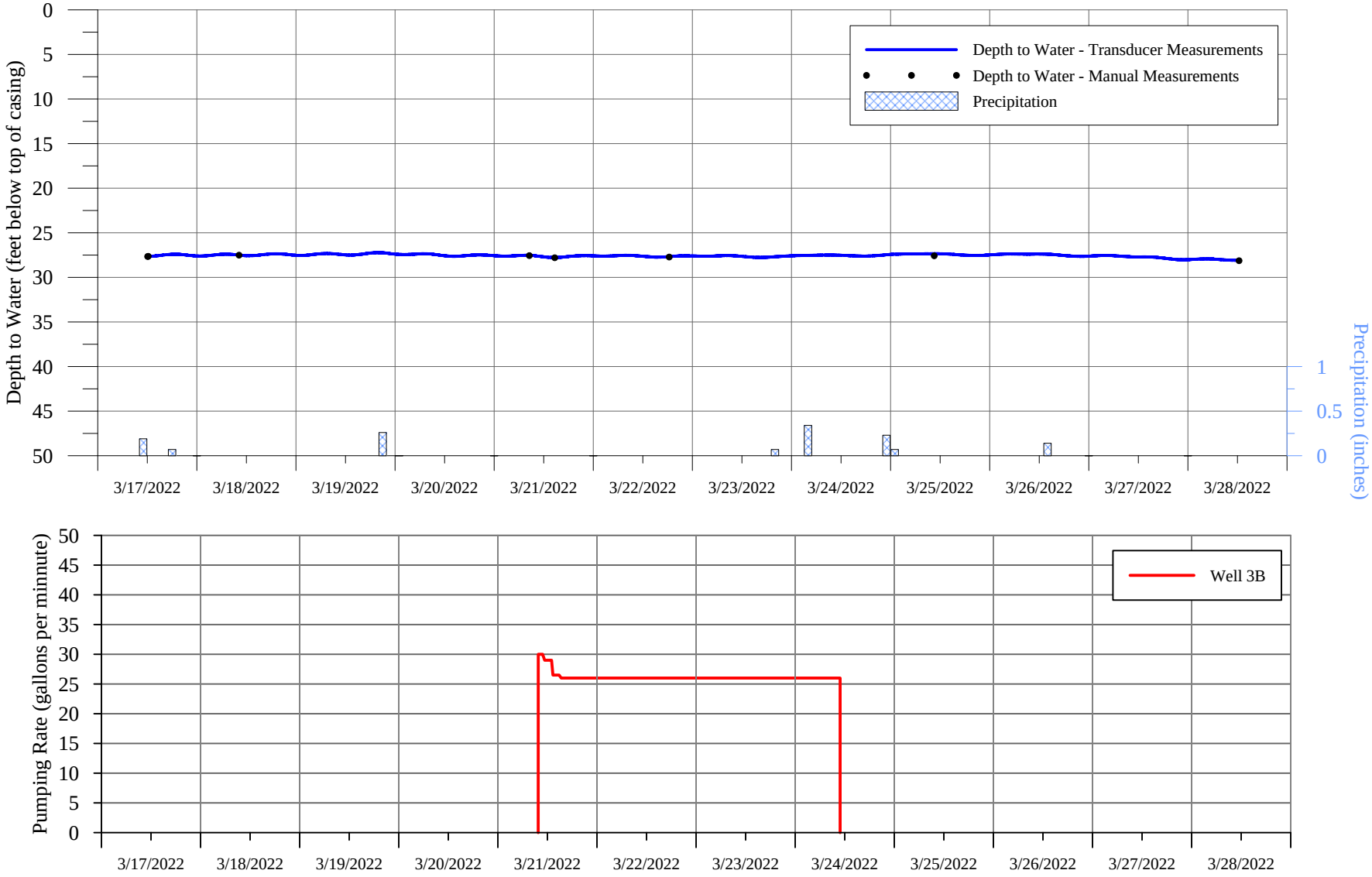
Hydrograph of Water-Level Measurements Collected from Wills pond Well 2 During 72-Hour Pumping Test Conducted on Well 3B, March 2022





SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Hydrograph of Water-Level Measurements Collected from Wills Pond Well 3 During 72-Hour Pumping Test Conducted on Well 3B, March 2022



SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Water-Level Measurements Collected from Monitoring Wells During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date/Time	Depth to Water (feet below top of casing)
Well 1	
3/17/2022 11:38	3.04
3/18/2022 9:22	3.00
3/21/2022 7:49	3.00
3/21/2022 11:32	6.52
3/21/2022 13:27	12.59
3/21/2022 15:29	16.75
3/22/2022 7:38	24.00
3/22/2022 12:29	24.38
3/22/2022 16:46	24.50
3/23/2022 7:43	24.72
3/23/2022 11:44	24.77
3/23/2022 14:15	24.73
3/24/2022 7:25	25.05
3/25/2022 9:49	4.93
3/25/2022 12:15	4.89
3/28/2022 11:04	3.52
Well 2	
3/16/2022 10:06	3.33
3/16/2022 10:15	3.25
3/17/2022 11:50	3.31
3/18/2022 9:31	3.26
3/21/2022 8:00	3.28
3/21/2022 11:42	3.45
3/21/2022 13:37	3.96
3/21/2022 15:41	4.46
3/22/2022 7:44	5.34
3/22/2022 12:34	5.45
3/22/2022 16:57	5.48
3/23/2022 7:56	5.48
3/23/2022 11:49	5.51
3/23/2022 14:25	5.53
3/24/2022 7:37	5.45
3/25/2022 10:10	3.48
3/25/2022 12:36	3.26
3/28/2022 11:11	3.40
17 Romeo Drive	
3/16/2022 10:48	44.60
3/16/2022 10:56	44.46
3/16/2022 10:58	44.40
3/17/2022 11:02	44.53
3/18/2022 8:29	44.49
3/21/2022 13:57	45.38
3/22/2022 17:57	46.18
3/23/2022 15:21	46.41
3/25/2022 11:30	44.27
3/28/2022 12:53	44.91
16 Museum Village Road	
3/17/2022 10:38	24.97
3/18/2022 8:38	25.02
3/21/2022 14:00	25.08
3/22/2022 17:45	24.99
3/23/2022 15:01	25.08

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

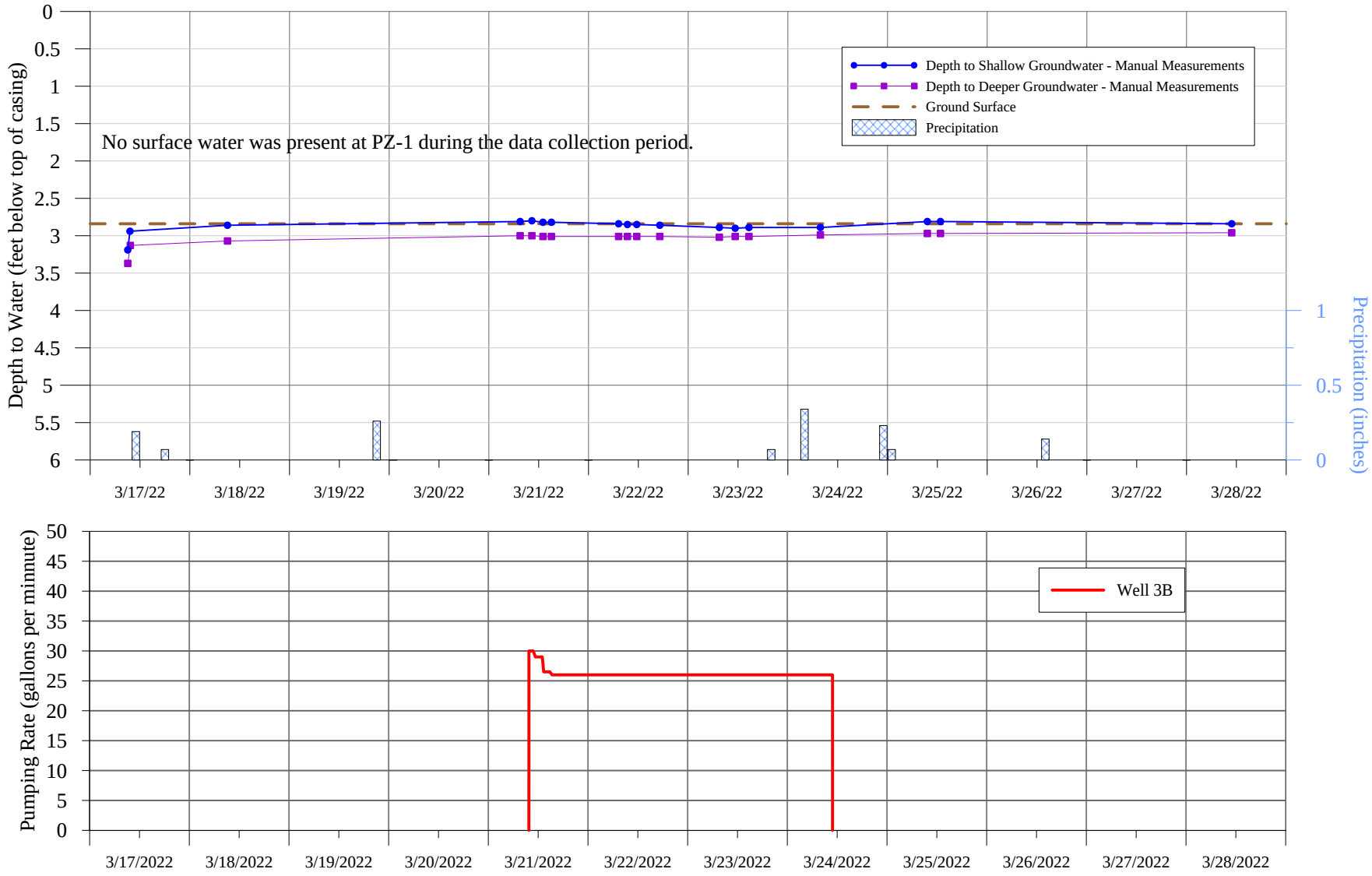
Summary of Water-Level Measurements Collected from Monitoring Wells During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date/Time	Depth to Water (feet below top of casing)
16 Museum Village Road (continued)	
3/24/2022 8:20	24.96
3/25/2022 11:19	25.00
3/28/2022 11:38	25.24
7 Rieger Drive	
3/16/2022 8:51	22.81
3/16/2022 9:11	22.63
3/17/2022 11:13	22.50
3/18/2022 8:46	22.45
3/21/2022 14:10	26.63
3/22/2022 17:29	25.82
3/23/2022 14:57	25.08
3/24/2022 8:04	22.48
3/25/2022 11:09	23.32
3/28/2022 11:24	27.57
9 Romeo Dr	
3/23/2022 16:16	33.90
3/23/2022 18:00	40.81
3/24/2022 7:02	39.49
3/24/2022 10:29	47.36
3/24/2022 11:39	34.74
3/24/2022 13:15	34.16
3/25/2022 11:50	33.80
3/25/2022 12:59	33.79
3/28/2022 13:16	34.02
3/29/2022 7:30	33.81
Well 1 (Wills Pond)	
3/17/2022 12:26	20.74
3/17/2022 12:36	20.70
3/18/2022 9:59	20.62
3/21/2022 8:23	20.55
3/21/2022 14:37	20.83
3/22/2022 18:17	20.88
3/25/2022 10:49	20.60
3/28/2022 12:03	20.89
Well 2 (Wills Pond)	
3/17/2022 12:49	2.95
3/18/2022 9:45	2.92
3/21/2022 8:10	2.99
3/21/2022 14:30	2.97
3/22/2022 18:11	3.07
3/25/2022 10:58	2.96
3/28/2022 11:51	3.17
Well 3 (Wills Pond)	
3/17/2022 12:05	27.66
3/17/2022 12:14	27.64
3/18/2022 10:13	27.51
3/21/2022 8:31	27.56
3/21/2022 14:40	27.80
3/22/2022 18:23	27.72
3/25/2022 10:34	27.58
3/28/2022 12:23	28.13

APPENDIX IV

SOUTH BLOOMING GROVE BUSINESS PARK
VILLAGE OF SOUTH BLOOMING GROVE, NEW YORK

Hydrograph of Water-Level Measurements Collected from Piezometer Location PZ-1 During 72-Hour Pumping Test Conducted on Well 3B, March 2022



SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Water-Level Measurements Collected from Piezometers During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date/Time	Depth to Water Shallow Piezometer (ft btoc)	Depth to Water Deeper Piezometer (ft btoc)	Depth to Water Deeper Piezometer Adjusted[1/] (ft btoc)	Gradient (Shallow - Deeper Water Level)	Vertical Head Direction
3/17/2022 9:03	3.19	2.33	3.37	-0.18	Down
3/17/2022 9:35	2.94	2.09	3.13	-0.19	Down
3/18/2022 9:04	2.86	2.03	3.07	-0.21	Down
3/21/2022 7:32	2.81	1.96	3.00	-0.19	Down
3/21/2022 10:22	2.80	1.96	3.00	-0.20	Down
3/21/2022 13:02	2.82	1.97	3.01	-0.19	Down
3/21/2022 15:04	2.82	1.97	3.01	-0.19	Down
3/22/2022 7:15	2.84	1.97	3.01	-0.17	Down
3/22/2022 9:22	2.85	1.97	3.01	-0.16	Down
3/22/2022 11:37	2.85	1.97	3.01	-0.16	Down
3/22/2022 17:10	2.86	1.97	3.01	-0.15	Down
3/23/2022 7:30	2.89	1.98	3.02	-0.13	Down
3/23/2022 11:19	2.90	1.97	3.01	-0.11	Down
3/23/2022 14:38	2.89	1.97	3.01	-0.12	Down
3/24/2022 7:50	2.89	1.95	2.99	-0.10	Down
3/25/2022 9:35	2.81	1.93	2.97	-0.16	Down
3/25/2022 12:45	2.81	1.93	2.97	-0.16	Down
3/28/2022 10:53	2.84	1.92	2.96	-0.12	Down

[1/] Water level adjusted to match casing height of shallow piezometer to assess vertical head.
ft btoc feet below top of casing

APPENDIX V

EnviroTest Laboratories Inc.

ANALYTICAL REPORT

Job Number: 420-219842-1

SDG Number: (V) South Blooming Grove

Job Description: WSP USA

For:
WSP USA
4 Research Drive
Shelton, CT 06464

Attention: Stacy Stieber

Debra Bayer
Customer Service Manager
dbayer@envirotestlaboratories.com
04/14/2022

EnviroTest Laboratories, LLC. Certifications and Approvals: NYSDOH 10142, NJDEP NY015, CTDOPH PH-0554

Job Narrative
420-J219842-1

Comments
No additional comments.

Receipt
All samples were received in good condition within temperature requirements.

GC/MS VOA
No analytical or quality issues were noted.

GC/MS Semi VOA
Method 525.2: The laboratory control standard (LCS) for this analytical batch did not meet the range of acceptable recoveries for the analytes indicated by an asterisk (*) on the results form and several analytes in the LCSD. These analytes were biased high in the LCS/LCSD and were not detected in the associated samples; therefore, the data have been reported with confidence of no false negatives.

No other analytical or quality issues were noted.

HAAS
No analytical or quality issues were noted.

Metals
No analytical or quality issues were noted.

General Chemistry
Method SM 4500 H+ B: The holding time for pH is 15 minutes, the samples were received outside of the holding time.

No other analytical or quality issues were noted.

Biology
No analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

METHOD SUMMARY

Client: WSP USA

Job Number: 420-219842-1
SDG Number: (V) South Blooming Grove

Description	Lab Location	Method	Preparation Method
Matrix: Water			
ICP Metals by 200.7	EnvTest	EPA 200.7 Rev 4.4	
200 Series Drinking Water Prep Determination Step	EnvTest		EPA 200.7/200.8
ICPMS Metals by 200.8	EnvTest	EPA 200.8 Rev.5.4	
200 Series Drinking Water Prep Determination Step	EnvTest		EPA 200.7/200.8
Total Metals Digestion for 200.8	EnvTest		EPA 200.8 Rev.5.4
Mercury in Water by CVAA	EnvTest	EPA 245.1 Rev.3.0	
Digestion for CVAA Mercury in Waters	EnvTest		EPA 245.1
Anions by Ion Chromatography	EnvTest	EPA 300.0 Rev. 2.1	
Anions by Ion Chromatography	EnvTest	EPA 300.0 Rev. 2.1	
EDB, DBCP, and 123TCP in Water by Microextraction and Gas Chromatography	EnvTest	EPA 504.1	
EDB, DBCP, and 123TCP in Water by Microextraction	EnvTest		EPA-DW 504.1
EPA 515 Chlorinated Acids		EPA 515	
Purgeable Organic Compounds in Water by GC/MS	EnvTest	EPA-DW 524.2	
Semivolatile Organic Compounds in Drinking Water by GCMS	EnvTest	EPA 525.2	
Determination of Semivolatile Organic Compounds in	EnvTest		EPA 525.2
EPA 531.1 Carbamate Pesticides in Drinki		EPA 531.1	
Organohalide Pesticides	EnvTest	EPA EPA 505	
505 Preparation	EnvTest		EPA EPA 505
Heterotropic Plate Count	EnvTest	IDEXX SIMPLATE	
Alkalinity, Titration Method	EnvTest	SM22 SM 2320B--2011	
Corrosivity LSI Calculation	EnvTest	SM20 SM 2330B-2016	
Hardness by Calculation	EnvTest	SM20 SM 2340B-97,-11	
Hardness Prep	EnvTest		ETL-STD HARD_Prep
pH	EnvTest	SM19 SM 4500 H+ B	
Total Coliform and Escherichia coli by Colilert - Presence/Absence	EnvTest	SMWW SM 9223	
Apparent Color	EnvTest	SM21 SM2120B-2011	
Turbidity	EnvTest	SM21 SM2130B-2011	
Odor, Threshold Test	EnvTest	SM20 SM2150B	
Total Dissolved Solids (Dried at 180 °C)	EnvTest	SM22 SM2540C-2015	
Cyanide, Total: Colorimetric Method	EnvTest	SM22 SM4500 CNE 2016	
Cyanide: Distillation	EnvTest		SM22 SM4500CNC-(-99)
Nitrite by Colormetric	EnvTest	SM22 SM4500 NO2 B-11	
General Sub Contract Method		Subcontract	
General Sub Contract Method	Alpha	Subcontract	

METHOD SUMMARY

Client: WSP USA

Job Number: 420-219842-1
SDG Number: (V) South Blooming Grove

Description	Lab Location	Method	Preparation Method

Lab References:

=

Alpha = Alpha Analytical, Inc.

EnvTest = EnviroTest

Method References:

EPA = US Environmental Protection Agency

EPA-DW = "Methods For The Determination Of Organic Compounds In Drinking Water", EPA/600/4-88/039, December 1988 And Its Supplements.

ETL-STD = EnviroTest Laboratories Standard Operating Procedure.

IDEXX =

SM19 = "Standard Methods For The Examination Of Water And Wastewater", 19Th Edition, 1995."

SM20 = "Standard Methods For The Examination Of Water And Wastewater", 20th Edition."

SM21 = "Standard Methods For The Examination Of Water And Wastewater", 21st Edition

SM22 = "Standard Methods for the Examination of Water and Wastewater", 22nd Edition

SMWW = "Standard Methods for the Examination of Water and Wastewater"

METHOD / ANALYST SUMMARY

Client: WSP USA

Job Number: 420-219842-1
SDG Number: (V) South Blooming Grove

Method	Analyst	Analyst ID
EPA-DW 524.2	Andersen, Eric C	ECA
EPA 525.2	Palentino, Gus J	GJP
EPA 504.1	Colby, Elizabeth	EC
EPA EPA 505	Atkinson, Emily	EA
EPA 200.7 Rev 4.4	Cusack, Renee	RC
EPA 200.8 Rev.5.4	Ratka, Angela	AR
EPA 245.1 Rev.3.0	Bracco, Olivia	OB
SM20 SM 2340B-97,-11	Cusack, Renee	RC
EPA 300.0 Rev. 2.1	Ratka, Angela	AR
IDEXX SIMPLATE	An, Chulwoo	CA
SM22 SM 2320B--2011	Canosa, Joseph	JC
SM20 SM 2330B-2016	Cusack, Renee	RC
SM19 SM 4500 H+ B	An, Chulwoo	CA
SMWW SM 9223	An, Chulwoo	CA
SM21 SM2120B-2011	An, Chulwoo	CA
SM21 SM2130B-2011	An, Chulwoo	CA
SM20 SM2150B	An, Chulwoo	CA
SM22 SM2540C-2015	Oates, Kobe	KO
SM22 SM4500 CNE 2016	Motley, Erika	EM
SM22 SM4500 NO2 B-11	Motley, Erika	EM

SAMPLE SUMMARY

Client: WSP USA

Job Number: 420-219842-1
SDG Number: (V) South Blooming Grove

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
420-219842-1	Well 3B	Drinking Water	03/24/2022 0920	03/24/2022 1213
420-219842-3	Field Blanks - Well 3B	Water	03/24/2022 0920	03/24/2022 1213

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

524.2 Purgeable Organic Compounds in Water by GC/MS

Method: 524.2
Preparation: N/A
Dilution: 1.0
Date Analyzed: 03/28/2022 1626
Date Prepared: N/A

Analysis Batch: 420-165391

Instrument ID: Agilent 6890 GC-MS
Lab File ID: X032813.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	RL	RL
1,1,1,2-Tetrachloroethane	<0.50		0.50	0.50
1,1,1-Trichloroethane	<0.50		0.50	0.50
1,1,2,2-Tetrachloroethane	<0.50		0.50	0.50
1,1,2-Trichloroethane	<0.50		0.50	0.50
1,1-Dichloroethane	<0.50		0.50	0.50
1,1-Dichloroethene	<0.50		0.50	0.50
1,1-Dichloropropene	<0.50		0.50	0.50
1,2,3-Trichlorobenzene	<0.50		0.50	0.50
1,2,3-Trichloropropane	<0.50		0.50	0.50
1,2,4-Trichlorobenzene	<0.50		0.50	0.50
1,2,4-Trimethylbenzene	<0.50		0.50	0.50
1,2-Dichloroethane	<0.50		0.50	0.50
1,2-Dichlorobenzene	<0.50		0.50	0.50
1,2-Dichloropropane	<0.50		0.50	0.50
1,3-Dichloropropane	<0.50		0.50	0.50
1,4-Dichlorobenzene	<0.50		0.50	0.50
2,2-Dichloropropane	<0.50		0.50	0.50
Benzene	<0.50		0.50	0.50
Bromobenzene	<0.50		0.50	0.50
Bromochloromethane	<0.50		0.50	0.50
Bromomethane	<0.50		0.50	0.50
n-Butylbenzene	<0.50		0.50	0.50
cis-1,2-Dichloroethene	<0.50		0.50	0.50
cis-1,3-Dichloropropene	<0.50		0.50	0.50
Carbon tetrachloride	<0.50		0.50	0.50
Chlorobenzene	<0.50		0.50	0.50
Chloroethane	<0.50		0.50	0.50
Chloromethane	<0.50		0.50	0.50
Dibromomethane	<0.50		0.50	0.50
Ethylbenzene	<0.50		0.50	0.50
Dichlorodifluoromethane	<0.50		0.50	0.50
Hexachlorobutadiene	<0.50		0.50	0.50
Isopropylbenzene	<0.50		0.50	0.50
p-Isopropyltoluene	<0.50		0.50	0.50
Methylene Chloride	<0.50		0.50	0.50
m-Xylene & p-Xylene	<1.0		1.0	1.0
Methyl tert-butyl ether	<0.50		0.50	0.50
o-Xylene	<0.50		0.50	0.50
Tetrachloroethene	<0.50		0.50	0.50
Toluene	<0.50		0.50	0.50
trans-1,2-Dichloroethene	<0.50		0.50	0.50
trans-1,3-Dichloropropene	<0.50		0.50	0.50
Trichloroethene	<0.50		0.50	0.50
tert-Butylbenzene	<0.50		0.50	0.50

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

524.2 Purgeable Organic Compounds in Water by GC/MS

Method: 524.2
Preparation: N/A
Dilution: 1.0
Date Analyzed: 03/28/2022 1626
Date Prepared: N/A

Analysis Batch: 420-165391

Instrument ID: Agilent 6890 GC-MS
Lab File ID: X032813.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	RL	RL
Trichlorofluoromethane	<0.50		0.50	0.50
Vinyl chloride	<0.50		0.50	0.50
Xylenes, Total	<1.5		1.5	1.5
Styrene	<0.50		0.50	0.50
sec-Butylbenzene	<0.50		0.50	0.50
1,3,5-Trimethylbenzene	<0.50		0.50	0.50
N-Propylbenzene	<0.50		0.50	0.50
1,3-Dichlorobenzene	<0.50		0.50	0.50
2-Chlorotoluene	<0.50		0.50	0.50
4-Chlorotoluene	<0.50		0.50	0.50

Surrogate	%Rec	Acceptance Limits
4-Bromofluorobenzene	98	71 - 120
Toluene-d8 (Surr)	104	79 - 121
1,2-Dichloroethane-d4 (Surr)	118	70 - 128

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

525.2 Semivolatile Organic Compounds in Drinking Water by GCMS

Method: 525.2
Preparation: 525.2
Dilution: 1.0
Date Analyzed: 03/28/2022 2324
Date Prepared: 03/28/2022 0956

Analysis Batch: 420-165559
Prep Batch: 420-165374

Instrument ID: Hewlett Packard 5890
Lab File ID: A0328014.D
Initial Weight/Volume: 1050 mL
Final Weight/Volume: 1.0 mL
Injection Volume:

Analyte	Result (ug/L)	Qualifier	MDL	MDL
Atrazine	<0.046		0.046	0.046
Benzo[a]pyrene	<0.019		0.019	0.019
Butachlor	<0.030	*	0.030	0.030
Bis(2-ethylhexyl) phthalate	<0.57		0.57	0.57
Di(2-ethylhexyl)adipate	<0.12	*	0.12	0.12
Metolachlor	<0.045		0.045	0.045
Metribuzin	<0.029		0.029	0.029
Propachlor	<0.019		0.019	0.019
Simazine	<0.055		0.055	0.055

Surrogate	%Rec	Acceptance Limits
2-Nitro-m-xylene	103	70 - 130
Perylene-d12	86	70 - 130
Triphenylphosphate	117	70 - 130

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

504.1 EDB, DBCP, and 123TCP in Water by Microextraction and Gas Chromatography

Method: 504.1
Preparation: 504.1
Dilution: 1.0
Date Analyzed: 03/26/2022 2252
Date Prepared: 03/25/2022 1534

Analysis Batch: 420-165563
Prep Batch: 420-165455

Instrument ID: None
Lab File ID: N/A
Initial Weight/Volume: 37.08 mL
Final Weight/Volume: 2 mL
Injection Volume:
Column ID: PRIMARY

Analyte	Result (ug/L)	Qualifier	MDL	RL
1,2-Dibromo-3-Chloropropane	<0.0047		0.0047	0.0094
1,2-Ethylene dibromide	<0.0047		0.0047	0.0094

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

EPA 505 Organohalide Pesticides

Method: EPA 505
Preparation: EPA 505
Dilution: 1.0
Date Analyzed: 03/26/2022 1646
Date Prepared: 03/25/2022 1533

Analysis Batch: 420-165490
Prep Batch: 420-165453

Instrument ID: None
Lab File ID: N/A
Initial Weight/Volume: 37.08 mL
Final Weight/Volume: 2 mL
Injection Volume:
Column ID: PRIMARY

Analyte	Result (ug/L)	Qualifier	RL	RL
Alachlor	<0.19		0.19	0.19
Aldrin	<0.047		0.047	0.047
Chlordane (technical)	<0.19		0.19	0.19
Dieldrin	<0.024		0.024	0.024
Endrin	<0.0094		0.0094	0.0094
gamma-BHC (Lindane)	<0.019		0.019	0.019
Heptachlor	<0.024		0.024	0.024
Heptachlor epoxide	<0.019		0.019	0.019
Hexachlorobenzene	<0.094		0.094	0.094
Hexachlorocyclopentadiene	<0.094		0.094	0.094
Methoxychlor	<0.094		0.094	0.094
Toxaphene	<0.94		0.94	0.94
Arochlor 1016 - Screen	<0.076		0.076	0.076
Arochlor 1221 - Screen	<19		19	19
Arochlor 1232 - Screen	<0.47		0.47	0.47
Arochlor 1242 - Screen	<0.28		0.28	0.28
Arochlor 1248 - Screen	<0.094		0.094	0.094
Arochlor 1254 - Screen	<0.094		0.094	0.094
Arochlor 1260 - Screen	<0.19		0.19	0.19

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

200.7 Rev 4.4 ICP Metals by 200.7

Method: 200.7 Rev 4.4
Preparation: 200.7/200.8
Dilution: 1.0
Date Analyzed: 03/30/2022 1819
Date Prepared: 03/25/2022 1445

Analysis Batch: 420-165520
Prep Batch: 420-165313

Instrument ID: Thermo ICP
Lab File ID: N/A
Initial Weight/Volume:
Final Weight/Volume:

Analyte	Result (ug/L)	Qualifier	RL	RL
Iron	<60		60	60
Manganese	<10		10	10
Sodium	20000		200	200
Zinc	21		20	20

200.8 Rev.5.4 ICPMS Metals by 200.8

Method: 200.8 Rev.5.4
Preparation: 200.7/200.8
Dilution: 1.0
Date Analyzed: 03/29/2022 1559
Date Prepared: 03/25/2022 1445

Analysis Batch: 420-165422
Prep Batch: 420-165313

Instrument ID: Perkin Elmer ELAN
Lab File ID: N/A
Initial Weight/Volume:
Final Weight/Volume:

Analyte	Result (ug/L)	Qualifier	RL	RL
Lead	<1.0		1.0	1.0
Silver	<1.0		1.0	1.0
Arsenic	<1.4		1.4	1.4
Beryllium	<0.30		0.30	0.30
Cadmium	<1.0		1.0	1.0
Chromium	<7.0		7.0	7.0
Copper	<10		10	10
Nickel	0.53		0.50	0.50
Antimony	<0.40		0.40	0.40
Thallium	<0.30		0.30	0.30
Barium	32		2.0	2.0
Selenium	<2.0		2.0	2.0

245.1 Rev.3.0 Mercury in Water by CVAA

Method: 245.1 Rev.3.0
Preparation: 245.1
Dilution: 1.0
Date Analyzed: 04/01/2022 1427
Date Prepared: 03/30/2022 1453

Analysis Batch: 420-165558
Prep Batch: 420-165470

Instrument ID: Perkin Elmer FIMS
Lab File ID: N/A
Initial Weight/Volume: 25 mL
Final Weight/Volume: 25 mL

Analyte	Result (ug/L)	Qualifier	RL	RL
Mercury	<0.20		0.20	0.20

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

SM 2340B-97,-11 Hardness by Calculation

Method: SM 2340B-97,-11
Preparation: N/A
Dilution: 1.0
Date Analyzed: 04/02/2022 1909
Date Prepared: N/A

Analysis Batch: 420-165575

Instrument ID: None
Lab File ID: N/A
Initial Weight/Volume:
Final Weight/Volume:

Analyte	Result (mg/L)	Qualifier	RL	RL
Calcium hardness as calcium carbonate	69		6.3	6.3
Total Hardness (as CaCO3)	120		17	17

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

Biology

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

Analyte	Result	Qual	Units	Dil	Method
Coliform, Total	Absent		CFU/100mL	1.0	SM 9223
Anly Batch:	Date Analyzed	03/24/2022 1651			
Escherichia coli	Absent		CFU/100mL	1.0	SM 9223
Anly Batch:	Date Analyzed	03/24/2022 1651			

Analyte	Result	Qual	Units	RL	RL	Dil	Method
Heterotrophic Plate Count	100		CFU/mL	2.0	2.0	1.0	SIMPLATE
Anly Batch:	Date Analyzed	03/24/2022 1600					

General Chemistry

Client: WSP USA

Job Number: 420-219842-1
Sdg Number: (V) South Blooming Grove

General Chemistry

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

Analyte	Result	Qual	Units	MDL	RL	Dil	Method
Nitrate as N	0.079	J	mg/L	0.030	0.25	1.0	300.0 Rev. 2.1
Anly Batch:	Date Analyzed 03/24/2022 1733						

Analyte	Result	Qual	Units	Dil	Method
Langelier Index	-0.67		NONE	1.0	SM 2330B-2016
Anly Batch:	Date Analyzed 04/06/2022 1702				

General Chemistry

Client Sample ID: **Well 3B**

Lab Sample ID: 420-219842-1
Client Matrix: Drinking Water

Date Sampled: 03/24/2022 0920
Date Received: 03/24/2022 1213

Analyte	Result	Qual	Units	RL	RL	Dil	Method
Alkalinity to pH 4.5 mg/l CaCO3	110		mg/L	5.0	5.0	1.0	SM 2320B--2011
Anly Batch:	Date Analyzed	03/31/2022 1700					
Total Dissolved Solids	230		mg/L	5.0	5.0	1.0	SM2540C-2015
Anly Batch:	Date Analyzed	03/28/2022 0855					
Sulfate	16		mg/L	5.0	5.0	1.0	300.0 Rev. 2.1
Anly Batch:	Date Analyzed	03/24/2022 1733					
Fluoride	0.99		mg/L	0.50	0.50	1.0	300.0 Rev. 2.1
Anly Batch:	Date Analyzed	03/24/2022 1733					
Chloride	34		mg/L	15	15	10	300.0 Rev. 2.1
Anly Batch:	Date Analyzed	04/06/2022 1351					
Cyanide, Total	<0.0050		mg/L	0.0050	0.0050	1.0	SM4500 CNE 201
Anly Batch:	Date Analyzed	03/31/2022 1541					
Prep Batch:	Date Prepared:	03/30/2022 1457					
Apparent Color	15		Pt-Co	5.0	5.0	1.0	SM2120B-2011
Anly Batch:	Date Analyzed	03/24/2022 1713					
pH@color measurement	7.2		SU	2.0	2.0	1.0	SM2120B-2011
Anly Batch:	Date Analyzed	03/24/2022 1713					
Turbidity	0.15		NTU	0.10	0.10	1.0	SM2130B-2011
Anly Batch:	Date Analyzed	03/24/2022 1716					
Odor	1.0		T.O.N.	1.0	1.0	1.0	SM2150B
Anly Batch:	Date Analyzed	03/24/2022 1720					
Temp @ Odor Measurement	60		Degrees C	5.0	5.0	1.0	SM2150B
Anly Batch:	Date Analyzed	03/24/2022 1720					
pH	7.24	H	SU	0.500	0.500	1.0	SM 4500 H+ B
Anly Batch:	Date Analyzed	03/24/2022 1715					
Temp @ pH Measurement	13.7		Degrees C	5.00	5.00	1.0	SM 4500 H+ B
Anly Batch:	Date Analyzed	03/24/2022 1715					
Nitrite as N	<0.010		mg/L	0.010	0.010	1.0	SM4500 NO2 B-11
Anly Batch:	Date Analyzed	03/25/2022 1008					

DATA REPORTING QUALIFIERS

Client: WSP USA

Job Number:
Sdg Number: (V) South Blooming Grove

Lab Section	Qualifier	Description
GC/MS Semi VOA		
	*	LCS or LCSD exceeds the control limits
General Chemistry		
	H	Sample was prepped or analyzed beyond the specified holding time
	J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

The following analytes are Not Part of the ELAP scope of accreditation:

Sulfur, Tungsten, Bicarbonate Alkalinity, 7 Day BOD 5210C, 28 Day BOD, Soluble BOD, Carbon Dioxide, Carbonate Alkalinity, CBOD Soluble, Chlorine, Cyanide (WAD), Ferrous Iron, Ferric Iron, Total Nitrogen, Total Organic Nitrogen, Dissolved Oxygen, pH, Solids (Fixed), Solids (Percent), Solids (Percent Moisture), Solids (Percent Volatile), Solids (Volatile Suspended), Temperature, TKN (Soluble), COD (Soluble), Total Inorganic Carbon, 2-Aminopyridine, 3-Picoline, 1-Methyl-2-pyrrilidinone, Aziridine, Dimethyl sulfoxide, 1-Chlorohexane, 1,2,4,5-Tetramethylbenzene, 4-Ethyl toluene, p-Diethylbenzene, Iron Bacteria, Salmonella, Sulfur Reducing Bacteria, & UOD (Ultimate Oxygen Demand).

The following analytes are Not Part of ELAP Potable Water scope of accreditation:

Ammonia (SM 4500NH3G), Biochemical Oxygen Demand (SM 5210B), Chemical Oxygen Demand (EPA 410.4), Dissolved Oxygen (SM 4500 O C), TKN (351.2), Phosphorus (365.3), Nitrate-Nitrite (353.2), Settable Solids (SM 2540F), Total Suspended Solids (SM 2540 C), m-Xylene & p-Xylene (502.2, 524), o-Xylene (502.2, 524), Sulfide (SM4500SD), Acenaphthene (525.2), Acenaphthylene (525.2), Fluoranthene (525.2), Fluorene (525.2), Phenanthrene (525.2), Anthracene (525.2), Pyrene (525.2), Benzo[a]anthracene (525.2), Benzo[b]fluoranthene (525.2), Benzo[g,h,i]perylene (525.2), Benzo[k]fluoranthene (525.2), Indeno[1,2,3-cd]pyrene (525.2), & Dibenz(a,h)anthracene (525.2). Pyridine

The following analytes are Not Part of ELAP Solid and Hazardous Waste scope of accreditation:

Ammonia (SM 4500NH3G), TKN (351.2), Phosphorus (365.3), 1,2-Dichloro-1,1,2-trifluoroethane (8260), & Chlorodifluoromethane (8260).

The following analytes are Not Part of ELAP Non Potable Water scope of accreditation:

Dissolved Organic Carbon (5310C), Mecoprop (8151A), MCPA (8151A).

Definitions and Glossary

Client: WSP USA

Job Number:

Sdg Number: (V) South Blooming Grove

Abbreviation	These commonly used abbreviations may or may not be present in this report.
%R	Percent Recovery
DL, RA, RE	Indicates a Dilution, Reanalysis or Reextraction.
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit - an estimate of the minimum amount of a substance that an analytical process can reliably detect. A MDL is analyte- and matrix-specific and may be laboratory-dependent.
ND	Not detected at the reporting limit (or MDL if shown).
QC	Quality Control
RL	Reporting Limit - the minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.
RPD	Relative Percent Difference - a measure of the relative difference between two points.

EnviroTest Laboratories, Inc.

CHAIN OF CUSTODY

REPORT# (Lab Use Only) 219842

Lab Name: EnviroTest Laboratories
Address & Phone: 315 Fullerton Avenue, Newburgh, New York 12550 845-562-0890

(1) South Blooming Grove

PROJECT REFERENCE: SBG Business Park	PROJECT NO.	PROJECT LOCATION: V. of
ENVIROTEST PROJECT MANAGER: Debra Bayer	P.O. NUMBER: 3140312	TOWN: Blooming Grove
CLIENT (SITE) PM: Stacy Stieber	CLIENT PHONE: 475-882-17	CLIENT FAX:
CLIENT NAME: WSP USA		
CLIENT ADDRESS: 4 Research Drive, Suite 301, Shelton, CT 06484		
COMPANY CONTRACTING THIS WORK (if applicable):		

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	D (Drinking Water) or W (Waste Water) Indicate	SOLID OR SEMISOLID	OTHER Specify	250ml Amber Unpres.	40ml Vials HCl/2Full Trip Blks	40ml Sodium Thio.	40ml Amber Pot Citrate/Sodium	Liter Amber HCl/Na2SO3	250ml Plastic Nitric Acid	60ml Amber Sod.Thio Powder	Liter Plastic	250ml Plastic Sodium Hyd.	125ml Plastic Sterile	Liter Plastic Nitric	40ml Vials Unpres.	REMARKS
3/24/22	930	Well 3B	G		D			1	3/2	5	2	2	1	2	4	1	2		2	Table 8B (Sb,As,Ba,Be,Cd,Cr,Cn,Hg,Ni
																				Se,Tl,F)
																				Table 8C (NO3,NO2)
																				Table 8D (Cl,Fe,Mn,Ag,Na,SO4,Zn,Odor,Color)
																				Table 9D 524.2 (POC,MTBE,Vinyl Chloride)
								Additional Bottles												Table 9C SOCs (504,505,515,525,531)
																				1,4-Dioxane, PFOA,PFOS, Asbestos
								1-Amber Liter Unpres.												Additional Tests (Total Coliform
								2-250ml Plastic Unpre. (NO AIR)												thru Zinc) Lead, Copper, Turb.
								2-250ml Amber Sodium Sulfite/Sodium Bisulfate												
								2-125ml PFAAs - Trizma												
								125ml PFAAs Full and 125ml PFAAs empty												
3/24/22	905	Field Blank PFAAs																		PFOA, PFOS Field Blank

420-219842-C-3
Field Blanks - Well 3B
Date Sampled: 3/24/2022
420-1884110

TURNAROUND TIME: NORMAL ✓ | QUICK | VERBAL

#OF COOLERS: 1

RELINQUISHED BY: (SIGNATURE)	COMPANY	DATE	TIME	RECEIVED BY: (SIGNATURE)	COMPANY	DATE	TIME
Eric Dreyer	WSP	3/24/22	12:13				
SAMPLED BY: (SIGNATURE) Eric Dreyer	WSP	3/24/22	09:20				
RELINQUISHED BY: (SIGNATURE)	COMPANY	DATE	TIME	RECEIVED BY: (SIGNATURE)	COMPANY	DATE	TIME

SUBCONTACT:Pace-SOC; PACE-Radon,Radio; IATL=Asbestos; Alpha=1,4-Dioxane, PFAS; Westchester=Propylene Glycol — Oberlander

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT YES / NO	Cooler Temp.:	LABORATORY REMARKS:
CH	3/24/22	12:13		0.1°C	ICE ✓ pH ___ CL2 ___ Reviewed by ___

LOGIN SAMPLE RECEIPT CHECK LIST

Client: WSP USA

Job Number: 420-219842-1
SDG Number: (V) South Blooming Grove

Login Number: **219842**

Question	T/F/NA	Comment
Samples were collected by ETL employee as per SOP-SAM-1	NA	
The cooler's custody seal, if present, is intact.	NA	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is recorded.	True	0.1C
Cooler Temp. is within method specified range.(0-4 C PW, 0-6 C NPW, or BAC <10 C	True	
If false, was sample received on ice within 6 hours of collection.	NA	
Based on above criteria cooler temperature is acceptable.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	

MICROBAC®

Microbac Laboratories, Inc. - Dayville

CERTIFICATE OF ANALYSIS

D2C2092

EnviroTest Labs

Debra Bayer
315 Fullerton AVE
Newburgh, NY 12550

Project Name: SOC Testing

Project / PO Number: 42002340 WSP USA
Received: 03/29/2022
Reported: 04/05/2022

Case Narrative

The temperature of sample(s) was 6.4 °C upon receipt at the laboratory. The accepted temperature range is >0 - ≤ 6 °C for chemistry analyses and >0 - ≤ 10 °C for microbiology analyses.

Analytical Testing Parameters

Client Sample ID: Well 3B (420-219842-1)
Sample Matrix: Drinking Water
Lab Sample ID: D2C2092-01
Collected By: Customer
Collection Date: 03/24/2022 9:20

Herbicides by GC/ECD	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 515.3, Rv. 1 (1996)								
2,4-D	<0.100	0.100	ug/L	1		03/30/22 1325	03/30/22 2234	ALG
Dalapon	<1.00	1.00	ug/L	1		03/30/22 1325	03/30/22 2234	ALG
Dicamba [2C]	<0.100	0.100	ug/L	1		03/30/22 1325	03/30/22 2234	ALG
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	<0.200	0.200	ug/L	1		03/30/22 1325	03/30/22 2234	ALG
Pentachlorophenol	<0.0400	0.0400	ug/L	1		03/30/22 1325	03/30/22 2234	ALG
Picloram [2C]	<0.100	0.100	ug/L	1		03/30/22 1325	03/30/22 2234	ALG
2,4,5-TP (Silvex)	<0.200	0.200	ug/L	1		03/30/22 1325	03/30/22 2234	ALG
Surrogate: 2,4-Dichloropenylacetic acid	109	Limit: 70-130	% Rec	1		03/30/22 1325	03/30/22 2234	ALG
Surrogate: 2,4-Dichloropenylacetic acid [2C]	107	Limit: 70-130	% Rec	1		03/30/22 1325	03/30/22 2234	ALG

Herbicides by HPLC	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 531.2, Rv. 1 (2001)								
Aldicarb sulfoxide	<0.500	0.500	ug/L	1		04/01/22 0758	04/01/22 1803	RSD
Aldicarb sulfone	<0.800	0.800	ug/L	1		04/01/22 0758	04/01/22 1803	RSD
Oxamyl	<1.00	1.00	ug/L	1		04/01/22 0758	04/01/22 1803	RSD
Methomyl (Lannate)	<0.500	0.500	ug/L	1		04/01/22 0758	04/01/22 1803	RSD
3-Hydroxycarbofuran	<0.500	0.500	ug/L	1		04/01/22 0758	04/01/22 1803	RSD
Aldicarb (Temik)	<0.500	0.500	ug/L	1		04/01/22 0758	04/01/22 1803	RSD
Carbofuran (Furaden)	<0.900	0.900	ug/L	1		04/01/22 0758	04/01/22 1803	RSD
Carbaryl (Sevin)	<0.500	0.500	ug/L	1		04/01/22 0758	04/01/22 1803	RSD
Surrogate: 4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	105	Limit: 70-130	% Rec	1		04/01/22 0758	04/01/22 1803	RSD

Definitions

MCL: US EPA Maximum Contaminant Level
RL: Reporting Limit
ug/L: Micrograms per Liter

MICROBAC®

Microbac Laboratories, Inc. - Dayville

CERTIFICATE OF ANALYSIS

D2C2092

Project Requested Certification(s)

Microbac Laboratories, Inc. - Dayville
11549 New York State Department of Health

Report Comments

Samples were received in proper condition and the reported results conform to applicable accreditation standard unless otherwise noted.

The data and information on this, and other accompanying documents, represents only the sample(s) analyzed. This report is incomplete unless all pages indicated in the footnote are present and an authorized signature is included. ***The services were provided under and subject to Microbac's standard terms and conditions which can be located and reviewed at <https://www.microbac.com/standard-terms-conditions>.***

Reviewed and Approved By:

M Montgomery

Melisa L. Montgomery
Quality Assurance Officer
Reported: 04/05/2022 16:57

EnviroTest Laboratories
315 Fullerton Avenue
Newburgh, NY 12550
Phone (845) 562-0890 Fax (845) 562-0841

Ch

D 2 C 2 0 9 2
EnviroTest Labs

EnviroTest Laboratories Inc. NKR

Client Information (Sub Contract Lab)	Sampler:	COC No: 420-15225.1
Client Contact: Shipping/Receiving	Phone:	Page: Page 1 of 1
Company: Microbac Laboratories (CT)	dbayer@envirotestlaboratories.com	STL Job #: 420-219842-1
Address: 61 Louisa Viens Drive, ,	Due Date Requested: 4/7/2022	
City: Dayville	TAT Requested (days): Std TAT 3/25/22 RB	
State, Zip: CT, 06241		
Phone:	PO #:	
Email:	WO #:	
Project Name: WSP USA	Project #: 42002340	
Site:	SSOW#:	

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - Di Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

MS Splos 3/25/22

Special Instructions/Note:

Sample Identification Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUBCONTRACT/ 615 Chlorinated Acids	SUBCONTRACT/ 531.1 Carbamate Pesticides in DW	Total Number of containers
			Preservation Code:						
Well 3B (420-219842-1)	3/24/22	9:20	DW	Water			X	X	4

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:		Date:	Time:	Method of Shipment:		
Relinquished by: John Hern	Date/Time: 3/28/22 1055	Company: DTC	Received by: [illegible] 6.4°	Date/Time: 3/29/22 1115	Company	
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company	
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company	

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks:

Page 3 of 3

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client: EnviroTest Laboratories, Inc.
315 Fullerton Avenue
Newburgh NY 12550

Client: ENV127

Report Date: 3/31/2022
Report No.: 656898 - TEM Water
Project: WSP USA
Project No.: 42002340

TEM WATER SAMPLE ANALYSIS SUMMARY

Lab No.:7394510
Client No.:420-219842-1

Sampled: 3/24/22
Analyzed: 3/31/22
Location: Well 3B

Total Asbestos Concentration (MFL): <0.062
Asbestos Concentration Fibers > 10 µm (MFL): <0.062
Asbestos Types: None Detected

Please refer to the Preface of this report for further information regarding your analysis.

Date Received: 3/26/2022
Date Analyzed: 03/31/2022
Signature:
Analyst: Craig Liska

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client: EnviroTest Laboratories, Inc.
315 Fullerton Avenue
Newburgh NY 12550

Client: ENV127

Report Date: 3/31/2022
Report No.: 656898 - TEM Water
Project: WSP USA
Project No.: 42002340

Appendix to Analytical Report:

Customer Contact: Debra Bayer
Method: EPA Method For Determining Asbestos In Drinking Water, EPA Method 100.1

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service:customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Shirley Clark
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Air Cassettes
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by EPA Method For Determining Asbestos In Drinking Water, EPA Method 100.1
Accreditation:

- NYSDOH-ELAP No. 11021
- NJ DEP No. 03863
- PA DEP No. 68-03378

Minimum detection limit dependent upon turbidity of sample and volume filtered.

National Primary Drinking Water Regulations under EPA's Safe Drinking Water Act dictates maximum contaminant levels for asbestos at 7.0 million fibers per liter (MFL).

EPA and NYS-DOH regulations require segregation of overall fiber concentration, total asbestos concentration, and asbestos concentration of fibers > 10 µm in length.

All results are based on the samples as received at the lab.iATL assumes that appropriate sampling methods have been used and that the data upon which these results are based have been accurately supplied by the client.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a complete list with highlighted disclaimers pertinent to this project. For a full explanation of these and other

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	EnviroTest Laboratories, Inc.	Report Date:	3/31/2022
	315 Fullerton Avenue	Report No.:	656898 - TEM Water
	Newburgh NY 12550	Project:	WSP USA
		Project No.:	42002340
Client:	ENV127		

disclaimers, please inquire at customerservice@iatl.com.
(1)Note: Sample not analyzed.
(2)Note: Sample not analyzed at request of client.
(6)Note: Sample turbidity >1.0 NTU. Therefore MDL >> 0.1 MFL. Does not meet National Primary Drinking Water Standards.
(9)Note: Void - overloaded, unable to prep.

Samples received out of hold time (48 hours) must have UV/O3 treatment to assure sample viability.

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client: EnviroTest Laboratories, Inc.
315 Fullerton Avenue
Newburgh NY 12550

Client: ENV127

Report Date: 3/31/2022
Report No.: 656898 - TEM Water
Project: WSP USA
Project No.: 42002340

TEM WATER SAMPLE ANALYSIS DETAILS

Lab No.: 7394510
Client No.: 420-219842-1

Sampled: 3/24/22
Analyzed: 3/31/22
Location: Well 3B

Filter Type: MCE
Filter Size (mm²): 962
Pore Size (µm): 0.45

Volume Filtered (mL): 200
Grid Openings: 6
Opening Area (mm²): 0.013
Area Analyzed (mm²): 0.0780
Sensitivity (f/mm²): 12.8
Detection Limit (MFL): 0.062

Asbestos Fibers
Total Fibers > 0.5 µm: None Detected
Concentration (MFL): <0.062
Fibers > 10 µm: None Detected
Concentration (MFL): <0.062
Asbestos Type(s): None Detected

Non-Asbestos Fibers: None Detected
Concentration (MFL): <0.062
Fiber Types Identified: None Detected

Micrograph Number:
X-Ray Spectrum Number:

Please refer to the Preface of this report for further information regarding your analysis.

Date Received: 3/26/2022
Date Analyzed: 03/31/2022
Signature:
Analyst: Craig Liska

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client: EnviroTest Laboratories, Inc.
315 Fullerton Avenue
Newburgh NY 12550

Client: ENV127

Report Date: 3/31/2022
Report No.: 656898 - TEM Water
Project: WSP USA
Project No.: 42002340

ANALYTICAL REPORT

Lab Number:	L2215653
Client:	Envirotest Laboratories Inc. 315 Fullerton Avenue Newburgh, NY 12550
ATTN:	Debra Bayer
Phone:	(845) 562-0890
Project Name:	WSP USA
Project Number:	42002340
Report Date:	04/12/22

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), CT (PH-0141), DoD (L2474), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NJ (MA015), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-17-00150), USFWS (Permit #206964).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2215653-01	WELL 3B (420-219842-1)	DW	Not Specified	03/24/22 09:20	03/25/22
L2215653-02	FIELD BLANKS-WELL 3B (420-219842-2)	FIELD REAGENT BLANK	Not Specified	03/24/22 09:20	03/25/22

Project Name:	WSP USA	**Lab Number:**	L2215653
Project Number:	42002340	**Report Date:**	04/12/22

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Susan E O'Neil Susan O' Neil

Title: Technical Director/Representative Date: 04/12/22

ORGANICS

SEMIVOLATILES

Project Name: WSP USA
Lab Number: L2215653
Project Number: 42002340
Report Date: 04/12/22

SAMPLE RESULTS

Lab ID: L2215653-01
Client ID: WELL 3B (420-219842-1)
Sample Location: Not Specified

Date Collected: 03/24/22 09:20
Date Received: 03/25/22
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 120,522
Analytical Date: 04/05/22 01:45
Analyst: DB

Extraction Method: EPA 522
Extraction Date: 04/01/22 04:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.156	0.156	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	103		70-130

Project Name: WSP USA
Project Number: 42002340
Lab Number: L2215653
Report Date: 04/12/22

SAMPLE RESULTS

Lab ID: L2215653-01
Client ID: WELL 3B (420-219842-1)
Sample Location: Not Specified

Date Collected: 03/24/22 09:20
Date Received: 03/25/22
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 04/06/22 19:57
Analyst: AC

Extraction Method: EPA 537.1
Extraction Date: 04/05/22 16:45

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.79	0.598	1
Perfluorooctanesulfonic Acid (PFOS)	1.40	J	ng/l	1.79	0.598	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	100		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	91		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	92		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	90		70-130

Project Name: WSP USA
Project Number: 42002340
Lab Number: L2215653
Report Date: 04/12/22

SAMPLE RESULTS

Lab ID: L2215653-02
Client ID: FIELD BLANKS-WELL 3B (420-219842-2)
Sample Location: Not Specified

Sample Depth:
Matrix: Field Reagent Blank
Analytical Method: 133,537.1
Analytical Date: 04/06/22 20:06
Analyst: AC

Date Collected: 03/24/22 09:20
Date Received: 03/25/22
Field Prep: Not Specified

Extraction Method: EPA 537.1
Extraction Date: 04/05/22 16:45

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.80	0.601	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.80	0.601	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	104		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	94		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	98		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102		70-130

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 04/04/22 22:33
Analyst: DB

Extraction Method: EPA 522
Extraction Date: 04/01/22 04:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01 Batch: WG1622382-1					
1,4-Dioxane	ND		ug/l	0.150	0.150

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	103		70-130

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

Method Blank Analysis
Batch Quality Control

Analytical Method: 133,537.1
Analytical Date: 04/06/22 16:18
Analyst: AC

Extraction Method: EPA 537.1
Extraction Date: 04/05/22 15:34

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab for sample(s): 01-02 Batch: WG1623752-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	0.668
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	0.668

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	103		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	93		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	98		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	104		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: WSP USA

Project Number: 42002340

Lab Number: L2215653

Report Date: 04/12/22

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01 Batch: WG1622382-2 WG1622382-3								
1,4-Dioxane	85		82		70-130	4		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	96		89		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: WSP USA

Project Number: 42002340

Lab Number: L2215653

Report Date: 04/12/22

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1623752-2								
Perfluorooctanoic Acid (PFOA)	96		-		50-150	-		30
Perfluorooctanesulfonic Acid (PFOS)	93		-		50-150	-		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	97				70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	96				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	96				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	96				70-130

Matrix Spike Analysis
Batch Quality Control

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1623752-3 QC Sample: L2215637-01 Client ID: MS Sample												
Perfluorobutanesulfonic Acid (PFBS)	ND	1.58	1.36J	86		-	-		50-150	-		30
Perfluorohexanoic Acid (PFHxA)	ND	1.78	1.68J	94		-	-		50-150	-		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	1.78	1.25J	70		-	-		50-150	-		30
Perfluoroheptanoic Acid (PFHpA)	ND	1.78	1.64J	92		-	-		50-150	-		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	1.63	1.18J	72		-	-		50-150	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	1.69	1.71J	101		-	-		50-150	-		30
Perfluorooctanoic Acid (PFOA)	ND	1.78	1.82J	102		-	-		50-150	-		30
Perfluorononanoic Acid (PFNA)	ND	1.78	1.78J	100		-	-		50-150	-		30
Perfluorooctanesulfonic Acid (PFOS)	ND	1.66	1.57J	95		-	-		50-150	-		30
Perfluorodecanoic Acid (PFDA)	ND	1.78	1.82J	102		-	-		50-150	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	1.66	1.39J	83		-	-		50-150	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	1.78	1.54J	86		-	-		50-150	-		30
Perfluoroundecanoic Acid (PFUnA)	ND	1.78	1.61J	90		-	-		50-150	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	1.78	1.46J	82		-	-		50-150	-		30
Perfluorododecanoic Acid (PFDoA)	ND	1.78	1.57J	88		-	-		50-150	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	1.68	1.39J	82		-	-		50-150	-		30
Perfluorotridecanoic Acid (PFTrDA)	ND	1.78	1.43J	80		-	-		50-150	-		30
Perfluorotetradecanoic Acid (PFTA)	ND	1.78	1.25J	70		-	-		50-150	-		30

Matrix Spike Analysis

Batch Quality Control

Project Name: WSP USA

Project Number: 42002340

Lab Number: L2215653

Report Date: 04/12/22

Parameter	*Native Sample*	*MS Added*	*MS Found*	*MS %Recovery*	*Qual*	*MSD Found*	*MSD %Recovery*	*Qual*	*Recovery Limits*	*RPD*	*Qual*	*RPD Limits*
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1623752-3 QC Sample: L2215637-01 Client ID: MS Sample												

Surrogate	*MS % Recovery*	*MS Qualifier*	*MSD % Recovery*	*MSD Qualifier*	*Acceptance Criteria*
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	88				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	92				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	98				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	100				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1623752-4 QC Sample: L2215637-03 Client ID: DUP Sample						
Perfluorobutanesulfonic Acid (PFBS)	6.46	6.35	ng/l	2		30
Perfluorohexanoic Acid (PFHxA)	36.5	34.4	ng/l	6		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	ND	ng/l	NC		30
Perfluoroheptanoic Acid (PFHpA)	76.9	77.7	ng/l	1		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	0.596J	ng/l	NC		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	ND	ng/l	NC		30
Perfluorooctanoic Acid (PFOA)	154	153	ng/l	1		30
Perfluorononanoic Acid (PFNA)	9.24	9.19	ng/l	1		30
Perfluorooctanesulfonic Acid (PFOS)	0.723J	0.772J	ng/l	NC		30
Perfluorodecanoic Acid (PFDA)	ND	ND	ng/l	NC		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	ND	ng/l	NC		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	ND	ng/l	NC		30
Perfluoroundecanoic Acid (PFUnA)	ND	ND	ng/l	NC		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	ND	ng/l	NC		30
Perfluorododecanoic Acid (PFDoA)	ND	ND	ng/l	NC		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	ND	ng/l	NC		30
Perfluorotridecanoic Acid (PFTrDA)	ND	ND	ng/l	NC		30
Perfluorotetradecanoic Acid (PFTA)	ND	ND	ng/l	NC		30

Lab Duplicate Analysis
Batch Quality Control

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits

Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1623752-4 QC Sample: L2215637-03 Client ID: DUP Sample

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	102		96		70-130
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	88		83		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	95		100		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	95		94		70-130

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2215653-01A	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	3.4	Y	Absent		A2-14DIOXANE-522(28)
L2215653-01B	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	3.4	Y	Absent		A2-14DIOXANE-522(28)
L2215653-01C	Plastic 250ml Trizma preserved	B	NA		3.4	Y	Absent		A2-537.1-PFOA/PFOS(14)
L2215653-01D	Plastic 250ml Trizma preserved	B	NA		3.4	Y	Absent		A2-537.1-PFOA/PFOS(14)
L2215653-02A	Plastic 250ml Trizma preserved	B	NA		3.4	Y	Absent		A2-537.1-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name: WSP USA
Project Number: 42002340

Lab Number: L2215653
Report Date: 04/12/22

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
PERFLUOROALKYL CARBOXYLIC ACIDS (PFCAs)		
Perfluorooctadecanoic Acid	PFODA	16517-11-6
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5
Perfluorotetradecanoic Acid	PFTA	376-06-7
Perfluorotridecanoic Acid	PFTrDA	72629-94-8
Perfluorododecanoic Acid	PFDoA	307-55-1
Perfluoroundecanoic Acid	PFUnA	2058-94-8
Perfluorodecanoic Acid	PFDA	335-76-2
Perfluorononanoic Acid	PFNA	375-95-1
Perfluorooctanoic Acid	PFOA	335-67-1
Perfluoroheptanoic Acid	PFHpA	375-85-9
Perfluorohexanoic Acid	PFHxA	307-24-4
Perfluoropentanoic Acid	PFPeA	2706-90-3
Perfluorobutanoic Acid	PFBA	375-22-4
PERFLUOROALKYL SULFONIC ACIDS (PFSAs)		
Perfluorododecanesulfonic Acid	PFDoDS	79780-39-5
Perfluorodecanesulfonic Acid	PFDS	335-77-3
Perfluorononanesulfonic Acid	PFNS	68259-12-1
Perfluorooctanesulfonic Acid	PFOS	1763-23-1
Perfluoroheptanesulfonic Acid	PFHpS	375-92-8
Perfluorohexanesulfonic Acid	PFHxS	355-46-4
Perfluoropentanesulfonic Acid	PFPeS	2706-91-4
Perfluorobutanesulfonic Acid	PFBS	375-73-5
FLUOROTELOMERS		
1H,1H,2H,2H-Perfluorododecanesulfonic Acid	10:2FTS	120226-60-0
1H,1H,2H,2H-Perfluorodecanesulfonic Acid	8:2FTS	39108-34-4
1H,1H,2H,2H-Perfluorooctanesulfonic Acid	6:2FTS	27619-97-2
1H,1H,2H,2H-Perfluorohexanesulfonic Acid	4:2FTS	757124-72-4
PERFLUOROALKANE SULFONAMIDES (FASAs)		
Perfluorooctanesulfonamide	FOSA	754-91-6
N-Ethyl Perfluorooctane Sulfonamide	NEtFOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide	NMeFOSA	31506-32-8
PERFLUOROALKANE SULFONYL SUBSTANCES		
N-Ethyl Perfluorooctanesulfonamido Ethanol	NEtFOSE	1691-99-2
N-Methyl Perfluorooctanesulfonamido Ethanol	NMeFOSE	24448-09-7
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	NEtFOSAA	2991-50-6
N-Methyl Perfluorooctanesulfonamidoacetic Acid	NMeFOSAA	2355-31-9
PER- and POLYFLUOROALKYL ETHER CARBOXYLIC ACIDS		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid	HFPO-DA	13252-13-6
4,8-Dioxa-3h-Perfluorononanoic Acid	ADONA	919005-14-4
CHLORO-PERFLUOROALKYL SULFONIC ACIDS		
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1
PERFLUOROETHER SULFONIC ACIDS (PFESAs)		
Perfluoro(2-Ethoxyethane)Sulfonic Acid	PFEESA	113507-82-7
PERFLUOROETHER/POLYETHER CARBOXYLIC ACIDS (PFPCAs)		
Perfluoro-3-Methoxypropanoic Acid	PFMPA	377-73-1
Perfluoro-4-Methoxybutanoic Acid	PFMBA	863090-89-5
Nonafluoro-3,6-Dioxaheptanoic Acid	NFDHA	151772-58-6

Project Name:	WSP USA	**Lab Number:**	L2215653
Project Number:	42002340	**Report Date:**	04/12/22

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
NR	- No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: DU Report with 'J' Qualifiers

Project Name:	WSP USA	**Lab Number:**	L2215653
Project Number:	42002340	**Report Date:**	04/12/22

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

Report Format: DU Report with 'J' Qualifiers

Project Name:	WSP USA	**Lab Number:**	L2215653
Project Number:	42002340	**Report Date:**	04/12/22

Data Qualifiers

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Report Format: DU Report with 'J' Qualifiers

REFERENCES

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

133 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537.1, EPA/600/R-18/352. Version 1.0, November 2018.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N, **SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

EnviroTest Laboratories
315 Fullerton Avenue
Newburgh, NY 12550
Phone (845) 562-0890 Fax (845) 562-0841

3/26/22

Chain of Custody Record

L215653

EnviroTest Laboratories Inc.

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Bayer, Debra	Carrier Tracking No(s):	COC No: 420-15226.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: dbayer@envirotestlaboratories.com		Page: Page 1 of 1
Company: Alpha Analytical				STL Job #: 420-219842-1
Address: 8 Walkup Drive,	Due Date Requested: 4/5/2022			
City: Westborough	TAT Requested (days): Std TAT 3/25/22 B			
State, Zip: MA, 01581	PO #:			
Phone:	WO #:			
Email:	Project #: 42002340			
Project Name: WSP USA	SSOW#:			
Site:				

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)

Other:

NY Sites 3/25/22 B

Special Instructions/Note:

Sample Identification Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUBCONTRACT/ 1,4-Dioxane	SUBCONTRACT/ PFOA/PFOS	Total Number of containers
			Preservation Code:						
-01 Well 3B (420-219842-1)	3/24/22	9:20	DW	Water			X	X	4
-02 Field Blanks - Well 3B (420-219842-3)	3/24/22	9:20		Water				X	1

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Deliverable Requested: I, II, III, IV, Other (specify)

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

	Date/Time	Company		Date/Time	Company
Relinquished by: John Horn	3/25/22 1510	PACE	Received by: Paul Mazzella (AAC)	3/25/22 1310	Alpha
Relinquished by: Paul Mazzella (AAC)	3/25/22 1438	Alpha	Received by: Paul Mazzella	3/25/22 1645	AAC
Relinquished by: Paul Mazzella	3/25/22	AAC	Received by:		

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks: 3/25 2230

Ck 3/26/22 03:00 AAC 3/26/22 0515

3/26/22 0515 AAC

ANALYTICAL SERVICES, INC.
Microbiological Testing, Research and Consulting

130 Allen Brook Ln., PO Box 515, Williston, VT 05495 USA
1.800.723.4432 / 802.878.5138 Fax: 802.878.6765
www.analyticalservices.com

4/26/2022

Ron Bayer
EnviroTest Laboratories
315 Fullerton Ave
Newburgh, NY 12550

Subj.: ASI Report 68648

Dear Ron,

Enclosed please find the results of Microscopic Particulate Analysis (MPA) performed by Analytical Services, Inc. (ASI).

Sample(s) covered in this report were received at ASI on: 3/24/2022

This report contains the following number of pages (total): 3

This report concerns only the samples referenced herein. These results were generated under ASI's quality system, which is in accordance with the NELAC (TNI) standard. Deviations, if any, are noted.

Exceptions: Please note, the sample volume was less than the recommended minimum collection volume of 500 gallons and was analyzed as requested by the client.

Thank you for using ASI for your microbiological testing needs. If you have any questions, please contact us at 800-723-4432.

Sincerely,
ANALYTICAL SERVICES, INC. (ASI)

Harry D. Christman, Ph.D.
Technical Director

Microscopic Particulate Analysis (MPA)

Sample Information

Client	EnviroTest Laboratories	Volume Sampled (gal)	447.8
Site	SBG Business Park	Filter Color	Brown
Water Type	Raw/Well	Sediment Volume (mL)	0.5
Client Sample ID	Well 3B	Analysis Start	3/24/22 12:11
ASI Sample #	68648-01	Analysis End	4/25/22

MPA Data (data per 100 gal.)

Vol. Examined at 150x (gal.)	100	Detection Limit at 150X =	1.0
Vol. Examined at 300x (gal.)	NA	Detection Limit at 300X =	NA
Amorphous Debris	Uniform	Iron Bacteria	Present
Vegetative Debris w/ chlorophyll	ND	Crustaceans	ND
Veg. Debris w/o chlorophyll	ND	Crustacean Parts/Eggs	ND
Diatoms w/ chlorophyll (300X)	ND	Water Mites	ND
Diatoms w/o chlorophyll (300X)	ND	Gastrotrichs	ND
Other Algae (300X, see below)	ND	Tardigrades	ND
Coccidia (300x)	ND	Nematodes/N. Eggs	ND
Rotifiers / Rotifier Eggs	ND	Invertebrate Eggs	ND
Spores	ND	Annelids	ND
Pollen	ND	Amoeba	ND
Insects/Larvae	ND	Protozoa (300X, non-Crypto/Giardia)	ND

Cryptosporidium and Giardia Data

		RESULTS	
Volume Examined (gal.)	223.9	per Vol. Examined	Per 100gal
Cryptosporidium Oocysts:		0	<0.45
Giardia Cysts:		0	<0.45

MPA Risk Rating Score (per EPA Consensus Method)

Numerical Score	0	Risk Rating	Low

Other

Algae Observed	NA
Comments	NA

Methods: MPA - SOP based on EPA Consensus Method (EPA 910/9-92-029)
Cryptosporidium & Giardia - SOP based on purification, staining & exam procedures in EPA 1623/1623.1

Notes MPA Risk Rating Tables were developed by USEPA Region 10 from limited data; interpret with caution.
MPA Risk Rating Score - if less than 100 gallons was examined, interpret with caution.

Analytical Services, Inc.

Page ___ of ___

CHAIN OF CUSTODY RECORD

Ship to: Analytical Services, Inc., 130 Allen Brook Lane, Williston, VT 05495, Attn: Sample Management
Phone: 1-800-723-4432 or 802-878-5138 • Fax: 802-878-6765 *Web site: www.analyticalservices.com*

Submitted By: WSP, USA 4 Research Dr., Suite 204 Shelton, CT 06484 Phone: _____ Email: _____	Report To: WSP, USA 4 Research Dr., Suite 204 Shelton, CT 06484 Stacy Stieber Phone: _____ Email: stacy.stieber@wsp.com
Project Name: SBG Business Park Job Site: SBG, NY P.O. Number: 31403128.000	Invoice To: Chaya Oberlander Route 208 Holdings LLC 199 Lee Avenue PMB 103 Brooklyn, NY 11211 Phone: _____ Email: _____

Sample Identification*	Sample Collection			Sample Matrix (check one)						Analysis Requested	Lab Use Only
	Date (Start)	Time (Start)	Sampler Initials	Water - Raw	Water - Finished	Waste Water	Biosolids	Soil/Sediment	Other		Temp (°C)
Well 3B	3/22/22	3/23/22	EB	✓						EPA Staining Procedure for Giardia/Cryptosporidium	14.5°

*Sample ID should match ID written on the sample containers and data sheets. Sample ID will appear on the report for identification.

Relinquished By (signature)	Date/Time	Received By (signature)	Date/Time
Eric Grayson	3/23/22 17:05	[signature]	3/23/22 1705
		[signature]	3/24/22 1040

Field Comments:

Lab Comments: TEMP = 0.1C ON ICE

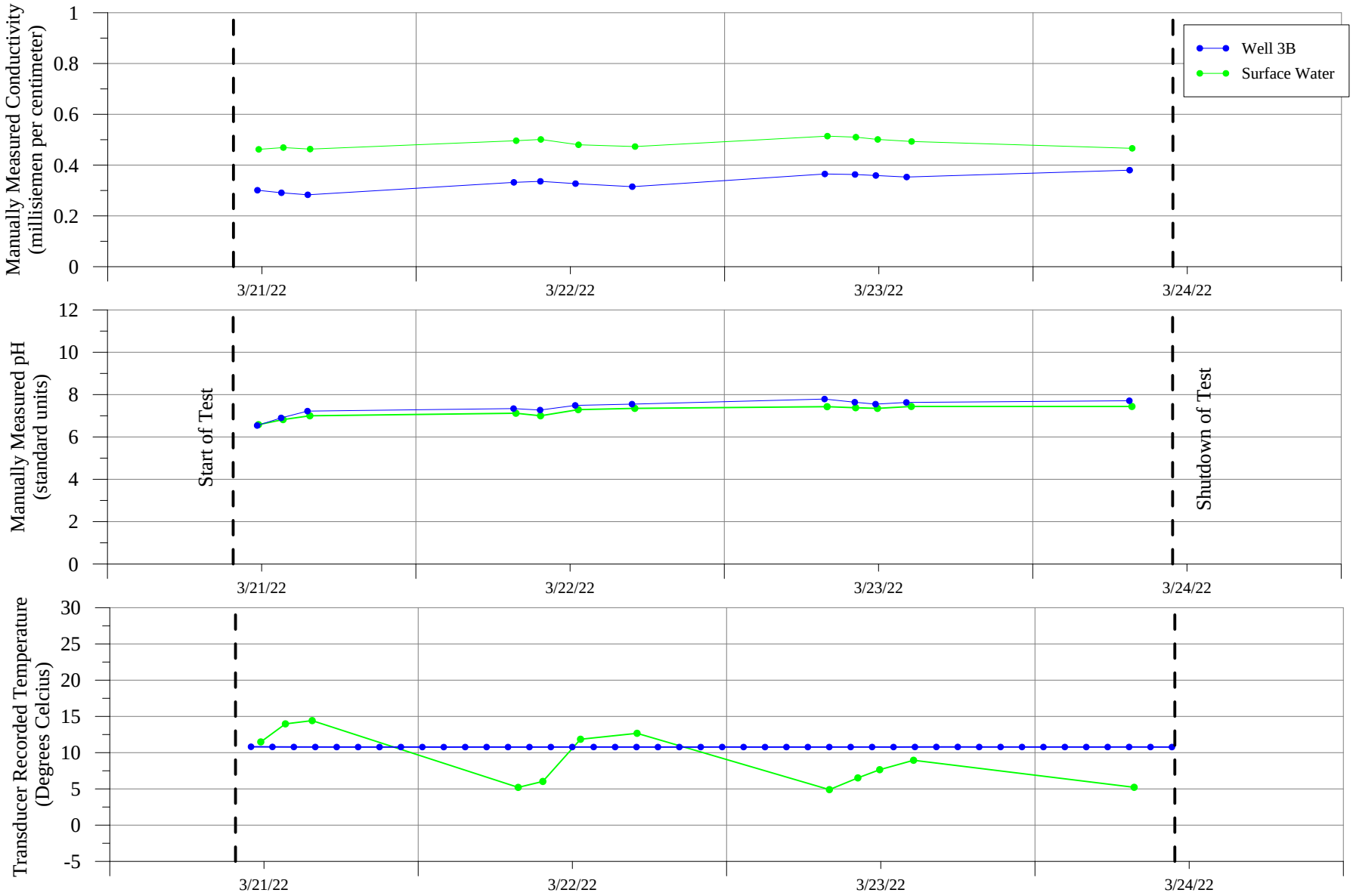
3/3

White – To accompany samples • Yellow – Sampler Copy

APPENDIX VI

SOUTH BLOOMING GROVE BUSINESS PARK
VILLAGE OF SOUTH BLOOMING GROVE, NEW YORK

Graphs of Physical Parameter Measurements Collected from Pumping Well 3B and Nearby Surface Water During 72 Hour Pumping Test Program Conducted on Well 3B, March 2022



SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Conductivity and pH Measurements Collected from Surface Water and Well 3B
During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date and Time	pH (S.U.)	Conductivity (mS/cm)
Surface Water in Satterly Creek		
3/21/2022 11:45	6.58	0.462
3/21/2022 13:40	6.82	0.469
3/21/2022 15:45	7.00	0.463
3/22/2022 7:47	7.12	0.496
3/22/2022 9:42	7.00	0.501
3/22/2022 12:38	7.29	0.480
3/22/2022 17:02	7.35	0.473
3/23/2022 8:00	7.43	0.514
3/23/2022 10:13	7.38	0.510
3/23/2022 11:55	7.35	0.501
3/23/2022 14:33	7.44	0.493
3/24/2022 7:43	7.44	0.466
Well 3B		
3/21/2022 11:39	6.54	0.301
3/21/2022 13:31	6.90	0.291
3/21/2022 15:34	7.22	0.283
3/22/2022 7:36	7.34	0.332
3/22/2022 9:40	7.27	0.336
3/22/2022 12:24	7.49	0.327
3/22/2022 16:49	7.55	0.315
3/23/2022 7:48	7.79	0.365
3/23/2022 10:09	7.64	0.363
3/23/2022 11:46	7.55	0.359
3/23/2022 14:10	7.63	0.353
3/24/2022 7:31	7.71	0.380

S.U. standard units
mS/cm milliSiemen per centimeter

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Temperature Measurements Collected from Well 3B and Nearby Surface Water During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date	Time	Manually Measured Temperature Surface Water (degrees Celsius)
3/21/2022	11:45	4.90
3/21/2022	13:40	11.48
3/21/2022	15:45	13.97
3/22/2022	7:47	14.42
3/22/2022	9:42	5.21
3/22/2022	12:38	6.03
3/22/2022	17:02	11.85
3/23/2022	8:00	12.67
3/23/2022	10:13	4.90
3/23/2022	11:55	6.52
3/23/2022	14:33	7.65
3/24/2022	7:43	8.95
Date	**Time**	**Pressure Transducer Measured Temperature Well 3B (degrees Celsius)**
3/21/2022	10:00	10.86
3/21/2022	11:00	10.81
3/21/2022	12:00	10.80
3/21/2022	13:00	10.78
3/21/2022	14:00	10.78
3/21/2022	15:00	10.78
3/21/2022	16:00	10.78
3/21/2022	17:00	10.77
3/21/2022	18:00	10.78
3/21/2022	19:00	10.77
3/21/2022	20:00	10.77
3/21/2022	21:00	10.77
3/21/2022	22:00	10.77
3/21/2022	23:00	10.77
3/22/2022	0:00	10.77
3/22/2022	1:00	10.77
3/22/2022	2:00	10.77
3/22/2022	3:00	10.77
3/22/2022	4:00	10.77
3/22/2022	5:00	10.77
3/22/2022	6:00	10.78
3/22/2022	7:00	10.77
3/22/2022	8:00	10.77
3/22/2022	9:00	10.77
3/22/2022	10:00	10.77
3/22/2022	11:00	10.78
3/22/2022	12:00	10.78
3/22/2022	13:00	10.78
3/22/2022	14:00	10.78
3/22/2022	15:00	10.78
3/22/2022	16:00	10.78
3/22/2022	17:00	10.77
3/22/2022	18:00	10.77
3/22/2022	19:00	10.77
3/22/2022	20:00	10.77
3/22/2022	21:00	10.77
3/22/2022	22:00	10.77
3/22/2022	23:00	10.77
3/23/2022	0:00	10.78
3/23/2022	1:00	10.77

SOUTH BLOOMING GROVE BUSINESS PARK
SOUTH BLOOMING GROVE, NEW YORK

Summary of Temperature Measurements Collected from Well 3B and Nearby Surface Water During 72-Hour Pumping Test Conducted on Well 3B, March 2022

Date	Time	Pressure Transducer Temperature Well 3B (degrees Celsius)
3/23/2022	2:00	10.77
3/23/2022	3:00	10.77
3/23/2022	4:00	10.78
3/23/2022	5:00	10.77
3/23/2022	6:00	10.77
3/23/2022	7:00	10.78
3/23/2022	8:00	10.78
3/23/2022	9:00	10.78
3/23/2022	10:00	10.78
3/23/2022	11:00	10.78
3/23/2022	12:00	10.77
3/23/2022	13:00	10.78
3/23/2022	14:00	10.78
3/23/2022	15:00	10.78
3/23/2022	16:00	10.78
3/23/2022	17:00	10.79
3/23/2022	18:00	10.79
3/23/2022	19:00	10.78
3/23/2022	20:00	10.78
3/23/2022	21:00	10.78
3/23/2022	22:00	10.78
3/23/2022	23:00	10.78
3/24/2022	0:00	10.78
3/24/2022	1:00	10.78
3/24/2022	2:00	10.78
3/24/2022	3:00	10.78
3/24/2022	4:00	10.78
3/24/2022	5:00	10.78
3/24/2022	6:00	10.78
3/24/2022	7:00	10.78
3/24/2022	8:00	10.78
3/24/2022	9:00	10.78
3/24/2022	10:00	10.78

APPENDIX D

SECTION 02623

POLYVINYL CHLORIDE (PVC) WATER MAIN PIPE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required, and install polyvinyl chloride (PVC) waterline, fittings, service connections and appurtenances as shown on the Drawings and as specified herein.

B. All water mains less than or equal to 12 inches in diameter shall be constructed of PVC, unless otherwise approved by the Engineer of the Village of South Blooming Grove.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. This standard references the documents listed below. They form a part of this standard to the extent specified herein. In any case of conflict, the requirements of this standard shall prevail. All references to AWWA & ASTM Standards shall be to the most recent revisions.

1. ASTM D1598 - Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.

2. ASTM D1599 - Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.

3. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

4. ASTM D2122 - Standard Method of Determining dimensions of Thermoplastic Pipe and Fittings.

5. ASTM D2152 - Standard Test Method for Degree of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion.

6. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).

7. ASTM D2412 - Standard Test Method for Determination of External Loading characteristics of Plastic Pipe by Parallel-Plate Loading.

8. ASTM D2774 - Recommended Practice for underground Installation of Thermoplastic Pressure Piping.

9. ASTM D2837 - Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

10. ASTM D3139 - Specifications for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

11. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

12. AWWA M23 - PVC Pipe - Design and Installation.

13. NSF 14 - Plastics Piping System Components and Related Materials.

14. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

15. AWWA C900/C905

16. ASTM D1785 / D2466 / D2564 / D2729 / D3034 / D3139 / D3212

17. Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C900/C905.

1.3 SUBMITTALS

A. Submit manufacturer's data and shop drawings for all pipe, valves, hydrants, system appurtenances, etc.

B. Shop drawings, catalog cuts, and manufacturer's literature for all pipe and pipe fittings, to include coatings and linings, material specifications, dimensions, tolerances, and all related data shall be submitted.

C. Manufacturer's certification that pipe supplied meets the required specifications shall be submitted.

D. Pipe manufacturers shall furnish Certificates of Compliance on pipe, with each load of pipe supplied. Immediately turn certificates over to Engineer. Materials delivered to the site without accompanying certificates will be subject to rejection.

E. Shop drawings showing proposed methods and procedures for connecting to existing pipelines shall be submitted to the Engineer for approval.

F. Shop drawings and catalog cuts for methods of anchoring pipe bends, if other than concrete reaction blocking, shall be submitted. If joint method is chosen, calculations indicating how many pipe joints will be anchored shall also be submitted.

G. The Contractor shall record the location and size of all services, taps, and corporations. Horizontal tie data for fittings and bends shall be submitted. An as-built survey will be provided by the Contractor for the location of the water main and all appurtenances.

H. Shop drawings and catalog cuts of adapters for the joining of pipes of different materials and for caps and plugs at ends of pipelines shall be submitted.

I. Submit to the Engineer within fourteen days after receipt of Notice-to-Proceed a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

J. Submit and shall comply with pipe manufacturer’s recommendations for handling, storing, and installing pipe and fittings.

1.4 QUALITY ASSURANCE

A. Qualifications: All of the PVC pipe and ductile iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. PVC pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of County or it shall be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner to prevent distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the County, is damaged beyond repair by the Contractor shall be removed from the site.

C. The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the County, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

1.6 PROTECTION OF WATER AND GAS LINES FROM STORM AND SANITARY SEWER

A. Parallel Water (or Gas) and Sewer Lines - potable water (or gas) lines and pipelines carrying sewage, shall not be installed any closer than 10 feet horizontally from one another. The distance shall be measured edge to edge.

B. Water (or Gas) and Sewer Line Crossings - Whenever water (or gas) and sewer lines must cross, the sewer must be situated below the water (or gas) line with at least an 18-inch clear, vertical separation between top of sewer line and bottom of water line. In no case shall a water (or gas) line pass under a sewer unless specifically approved by the Engineer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water (or gas) line joints. Where a water (or gas) line is approved to cross under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water (or gas) line.

C. Special Conditions - When it is not practical to maintain a ten-foot separation between sewer and water (or gas) lines, immediately notify the Engineer. If the Engineer concurs, he may order the reconstruction of the sewer pipe with a pressure pipe. Regardless, the sewer shall be installed with a vertical separation of at least 18-inch from the water (or gas) line. The sewer and water (or gas) lines shall be pressure tested for leakage in accordance with requirements in other sections.

A. Special Conditions - Crossing Lines - When it is impossible to obtain proper horizontal and vertical separation, immediately notify the Engineer. If the Engineer concurs, he shall order (1) the water (or gas) line raised, (2) one of the lines to be concrete encased, (3) the sewer to be constructed of materials and with joints that are equivalent to water main standards of construction and which shall be pressure tested to assure water tightness prior to backfilling or (4) other protective measures.

PART 2 PRODUCTS

2.1 WATER MAIN

A. Polyvinyl Chloride (PVC) Pipe

1. All 4-inch through 12-inch diameter PVC pipe shall be rated per AWWA, C900, DR18, Class 150. Water mains larger than 12 inches shall be constructed of Ductile Iron Pipe.

2. PVC pipe less than 4-inches in diameter shall be Schedule 80 with a pressure rating of 200 psi solvent welded, including blow-off assemblies. PVC pipe will be acceptable for pipe diameters of 12 inches or less.

3. The potable water mains shall be blue in color.

4. All pipe shall be manufactured in the United States.

B. Steel Encasement Pipe: Conform to ASTM Designation A252, Grade 2. Joints shall be welded completely around the pipe by a certified welder. Pipe shall meet all AASHTO standards and Florida DOT requirements.

C. Fittings:

1. PVC Pipe: Fittings shall be ductile iron mechanical joint, with a working pressure of 250 psi and conforming to AWWA Specifications C110 or C153. For pipe 8 inches and smaller, fittings shall be C900 PVC rated fittings.

2. PVC fittings for 2-inch and smaller diameter pipe shall be threaded or glued and shall be Schedule 80 and conform to the requirements of ASTM D-2464. Threaded joints shall be used only with Schedule 80 pipe or stronger. At threaded joints between PVC and metal pipes, the metal shall contain a threaded socket and the PVC threaded spigot end. A metal spigot shall not, under any circumstances be screwed into a PVC socket.

3. PVC fittings 4-inches and larger in diameter shall meet the requirements of applicable AWWA C900 and C905 specifications. Fittings shall be manufactured entirely of PVC meeting ASTM D1784, shall be formed by a thermal-form process and be of one-piece construction, able to withstand 755 psi quick burst pressure-tested in accordance with ASTM D1599 and withstand 500 psi for a minimum of 1,000 hours tested in accordance with ASTM D1598. Bells shall be gasketed push on type conforming to ASTM D3139 with gaskets conforming to ASTM F477. Fittings shall be as manufactured by the Harrington Corporation, or approved equal. Cement lined ductile iron fittings with mechanical or push on joints conforming to AWWA C153 or C110 may be approved as alternative when PVC pressure fittings of the required sizes are not available.

4. Tapping Sleeves: Sleeve shall be stainless steel, mechanical joint type, with working pressure

rating of 250 PSI, and conform to AWWA Standard C110.

5. All fittings shall be manufactured in the United States.

D. Joint Restraining Devices: Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support, and shall conform to the details shown on the drawings. Concrete thrust blocks may be utilized as additional restraint if as shown on the drawings.

1. Joint restraint devices for C-900, C905 PVC pipe used with ductile iron mechanical joint fittings shall be EBAA Iron Sales, Inc., Series 2000 PV, Uni-Flange 1300, Star Pipe Product, L.P., or approved equal.

2. Bell joint restraint devices for PVC push joint pipe shall be EBAA Iron Inc., Series 1600 for C-900 PVC pipe, Series 2800 for bell restraint on C-905 PVC pipe or Uni-Flange Series 1300, 1360 or 1390 or ROMAC Series 600, Star Pipe Products L.P., or approved equal.

3. C-900 or C-905 PVC fittings shall be restrained with EBAA Iron Inc., Series 2500 bell restraint for PVC fittings, Star Pipe Products, L.P., or an approved equal.

4. Bolts and nuts shall be Ductile Iron, T-Head type with hexagonal nuts. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface.

E. Joint Design: PVC pipe 4 inches in diameter or larger shall have provisions for expansion and contraction provided in the joints. All joints shall be designed for push-on make-up connections. Push-on joint may be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross section, similar and equal to John's Mannville ring-type and Ethyl Bell Ring or may be made with a separate twin gasketed coupling similar and equal to Certainteed Fluid-Type.

F. Valves: Provide two wrenches or keys for each size and type of valve operating nut. The valves shall be equal to the following:

1. Gate valves shall be iron body metal seated gate valves conforming to AWWA C500, latest edition, for potable water. Valves shall open left and shall have a non-rising stem with 2-inch square operating nut. Valves shall remain watertight under a test pressure of 200 psi. Valves shall be for buried service.

2. Acceptable manufacturer and model shall be U.S. Pipe and Foundry Company, 10" A-USP0 Resilient Wedge Gate Valves - M.J. x M.J., or approved equivalent.

3. Valve boxes shall be two (2) piece, sliding type adjustable, 5-1/4 inch shaft, cast iron boxes complete with lid as manufactured by Mueller Co. or equivalent. The upper section shall slide over the lower to give an adjustment of two feet in height with a minimum 6-inch lap. The lid shall be cast with the word "WATER". Box and lid shall be tar coated.

2.2 TAPPING SLEEVES AND VALVES

A. The tapping sleeve shall be equal to Mueller Model H-615, or approved equal. The tapping valve shall be of the same manufacturer as the sleeve, and both shall conform with the latest AWWA Designation C-500, latest edition. The Mueller, or approved equal,

sleeve and valve shall be designed for at least 200 psi working pressure. The valve shall be as specified under 2.1 F. The sleeve shall have mechanical joint connection to the existing main.

2.3 IDENTIFICATION

A. Pipe shall bear identification markings that will remain legible after normal handling, storage, and installation. Markings shall be applied in a manner that will not weaken or damage the pipe. Marking shall be applied at intervals of not more than 5 feet on the pipe. Marking on the pipe shall include the following:

1. Nominal size and OD base.

2. PVC

3. Dimension ration

4. AWWA pressure rating.

5. AWWA designation.

6. Manufacturer's name and trademark.

7. Manufacturer's production code, including day, month, year, shift, plant, and extruder of manufacturer.

8. All PVC water pipe shall be color-coded blue.

B. Location Detection Wire

1. Materials: Continuous, insulated 10-gauge copper wire (color to match pipe identification).

2. Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 18-inches above top of box (stored inside the 2-inch brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of 2 (two) 10-gauge wires shall be pulled along with the pipe.

PART 3 EXECUTION

3.1 WATER MAIN INSTALLATION

A. Polyvinyl Chloride (PVC) water pipe shall be installed in accordance with the manufacturer's recommendation, as shown on the drawings, and as specified herein.

B. The Contractor shall use care in handling, storage, and installation of pipe and fittings. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation and these specifications.

C. Pipe shall be laid to lines and grade shown on the drawings with bedding and backfill as shown on the drawings. Blocking under the pipe will not be permitted.

D. Bedding: Firm, dry and even bearing of suitable material.

E. Placement/Alignment:

1. Installation shall be in accordance with lines and grades shown on the Drawings. For pressure systems, deflection of joints shall not exceed 7.5% or as recommended by the manufacturer.

2. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

3. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.

4. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.

5. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the County to ensure absolute cleanliness inside the pipe. The color stripe and pipe text shall be viewed from the top of pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.

6. Locating Wire: Locating wire, for electronically locating pipe after it is buried, or installed by trenchless technology shall be attached along the length of and installed with the pipe. This is applicable to all sizes and types of pressure mains. At a minimum, the tracing wire is to be attached to the pipe with nylon wire ties. The wire itself shall be 10-gauge single strand solid core copper wire with non-metallic insulation. The insulation shall be color coded for the type of pipe being installed. Continuous continuity must be maintained in the wire along the entire length of the pipe run. Permanent splices must be made in the length of the wire using wire connectors approved for underground applications as listed in the uniform electric code handbook. The coiled wire shall extend to a minimum of 12-inches above the surface and be connected to a test station box at valve locations.

7. PVC Pressure Pipe Installation and Training: PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe", AWWA C605, and AWWA Manual M-23. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer. At no time shall the bell spigot end be allowed to go past the "insertion line" or "homing mark" for pressure pipe applications and homing mark shall be visible.

8. Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc making a square cut. The end shall be beveled with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. The insertion line on the spigot shall be

remarked to the same dimensions as the factory-marked spigot.

9. All Contractor pipe crews utilizing PVC pressure pipe shall be trained on an annual basis and attended by the manufacturer's representative of the respective approved Manufacturers in Appendix D "List of Approved Products." The training session will consist of proper handling, storage, installation, and compaction as well as requirements regarding PVC pipe and deflection. It is recommended that every person handling, installing or backfilling PVC pipe shall be properly trained.

F. JOINTS

1. Joint Placement:

a. Push on joints: Pipe shall be laid with the bell ends facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.

b. Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

3.2 SERVICE CONNECTIONS

A. For any service taps that are located within a paved area, a 2-inch cast iron body gate valve shall be used in lieu of a corporation stop.

B. Service connections shall be installed at the locations and in the manner shown on the Drawings.

C. Service clamps for PVC mains shall be full-circle bearing types.

D. Corporation stops and curb stops shall be fitted with a compression connection outlet with split-lock devices for polyethylene or copper pipe.

E. On curbed streets the exact location for each installed service shall be marked by etching or cutting a “W” in the concrete curb; where no curb exists or is planned, locations shall be adequately marked by a method approved by the Engineer and/or the Village of South Blooming Grove.

F. Service connection shall not be installed on pipelines 16 inches and larger unless extenuating conditions exist and said connection is approved by the Engineer and/or the Village of South Blooming Grove.

G. When practical, in new residential, commercial, or/and industrial subdivisions, the corporation stop shall be located at the intersecting property line or in the center of the lot.

1. Copper Pipe: Copper pipe for 3/4-inch to 1-inch service line installations shall be American manufactured, Type K, and conform to the requirements of ASTM designation B88. Brass compression couplings with screw-clamp fittings shall be used with copper pipe.

2. Polytubing: Polyethylene Tubing will be acceptable in sizes from 1-1/2 inches to 2 inches in diameter. Tubing for service lines shall be of a type approved by the National Sanitation Foundation for use in transmitting fluids for human consumption. The tubing shall be

designed for a minimum burst pressure of 630 psi for water at 23ºC, and shall be manufactured in accordance with the requirements of ASTM D2737 and shall be blue in color.

3.3 LINE STOP AND DOUBLE LINE STOP WITH TEMPORARY BY-PASS

A. Line stop shall be equal to Hydra-Stop or equal permitting the tapping of the existing water main and insertion of a removable expandable stopper within the water main temporarily interrupting flow to enable modification of the existing pipe i.e., adding fittings, specials and main line valves. Following installation of new appurtenances, the expandable stopper is readily removed and the tapping fitting blind flanged.

B. Double line stop with temporary by pass shall be equal to Hydra-Stop or equal permitting the uninterrupted flow of water by by-passing the flow through two installed tapping apparatus on the existing water main and an assembly of by-pass pipe, thereby isolating a convenient section of the existing main when the expandable stoppers are set in the main. The isolated section of existing pipe can be removed to enable the assembly of fittings, specials and main line valve within the existing main. Upon removal of the expandable stopper, flow will resume through the newly installed appurtenances. Temporary by-pass will be removed and the tapping fittings blind flanged.

3.4 CONNECTION TO EXISTING PIPELINES

A. All service to remain to all residents continuously. Furnish engineer a schedule and shop drawings to connections.

B. Connect to existing pipelines in accordance with the Drawings, or as directed by the Engineer. Provide necessary adapters and specials required to make the connections.

C. Do work at such times and in such a manner as to cause a minimum of interruption to existing services. Services damaged by work under this Contract shall be repaired immediately at no additional cost to the Owner.

D. The tapping of existing main where indicated on the Plans shall be made without interruption of water service and under the working pressure. Tapping machine shall be used to tap the main through the tapping sleeve and valve. The completed tap shall be without leakage and any damage to mains shall be repaired by and at the expense of the Contractor.

E. The insertion valve into the existing main where indicated on the plans shall be made without interruption of water service and under the working pressure. Installation shall be as recommended by the manufacturer.

F. Line stop of the existing main to cut in fittings, valves etc., where indicate on the plans shall be made to temporarily interrupt the flow. Linestop installation shall be as recommended by the manufacturer.

G. Double line stop with temporary by-pass of the existing main where indicated on the plans to isolate a section of pipe to cut in fittings, valves, etc., continuous by-pass piping shall permit uninterrupted flow. Double linestop installation shall be as recommended by the manufacturer, by-pass piping shall be of equal size to the existing main.

3.5 SERVICE CONNECTIONS AND ENTRANCE SERVICE PIPING

A. Water Main Connection: Tap water main with size and in location as indicated on plans according

to the water department. All services encountered to be replaced to the curb and cost to be included in the unit price for commercial service.

B. Make connections, 2 inch and smaller, with drilling machine according to the following:

1. Install service clamps (saddle) if required, and corporation stops in size, quantity, and arrangement required and according to manufacturer's written instructions.

2. Install service clamps on pipe (1-1/2" and 2") to be tapped and drill through to cut pipe. Position outlets for corporation stops.

3. Install corporation stops into service clamps.

4. Use drilling machine compatible with service clamp and corporation stop. Drill hole in main. Remove drilling machine and connect water service piping.
5. Install copper service with gooseneck loop to corporation stop with bend fittings.

6. Install curb stop in service piping with head pointing up on firmly placed concrete brick pad and with cast-iron service box and lid.

C. Extend water service piping and connect to water supply source and building water piping systems at the curb stop in locations and pipe sizes indicated.

1. Terminate water service piping at the curb stop. Curb stop and curb boxes to be replaced.

2. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed at the curb stop. Curb stop and boxes to be replaced.

3. Detectable warning tape labeled (WATER) shall be installed one foot above the piping during backfilling operations.

4. Hydrostatic pressure test and disinfect service piping in conjunction with the watermain.

3.6 TESTING OF WATER LINES

A. Sufficient notice must be given to the head of the municipal water department of any testing so they can witness if desired.

B. The head of the municipal water department must review and accept the testing, hydrostatic and bacteriological, as adequate.

C. The Contractor shall conduct a pressure test of the water main after all appurtenances required in the work for the section to be tested are installed. The length of section to be tested shall be approved by the Engineer. Whenever conditions permit, as determined by the Engineer, the water main shall be tested before the trench is backfilled. The pressure test shall be witnessed by the Engineer or Project Representative.

D. Pressure testing the PVC water main shall be done in accordance with AWWA 605. Prior to the test, the Contractor shall submit the proposed testing methods and equipment, in writing, for the Engineer's approval. Testing equipment shall be approved by and calibrated to the satisfaction of the Engineer.

E. The section of pipe to be tested shall be filled with water of potable quality and all air shall be expelled from the pipe. The Contractor shall make all taps, as necessary, for releasing all of the air and for all test purposes as may be required. Taps may be installed during the laying of the water main.

F. For the pressure test, the Contractor shall raise the water pressure (based on the elevation at the lowest point in the section under test and corrected to the gauge location) to a minimum pressure of 150 pounds per square inch gauge for domestic water mains.

G. The required pressure shall be maintained for an uninterrupted period of two hours. Unless otherwise noted, the volume of water required to maintain the specified pressure as measured by the Engineer shall not exceed the limits determined by the following formula as defined in Section 4 of ANSI/AWWA C600, latest edition:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

in which L is the allowable leakage in gallons per hour; S is the length of water line tested; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge.

H. If a section should fail to pass the pressure test, the Contractor shall do everything necessary to locate, uncover, and replace any defective material or work to the satisfaction of the Engineer, at his own expense and without extension of time for completion of the Work. Repeated tests and repairs shall be made until the section passes the specified tests.

3.7 DISINFECTION OF WATER LINES

A. After a section of water main has been pressure tested and found acceptable, it shall be thoroughly flushed by the Contractor. Minimum flushing velocity shall be 2.5 feet per second.
Flows to produce a minimum velocity of 2.5 feet per second:

Pipe Size (Inches)	Flow (gpm)	Hydrant Openings @ 40 psi
4	100	one - 2-1/2"
6	220	one - 2-1/2"
8	390	one - 2-1/2"
10	610	one - 2-1/2"
12	880	one - 2-1/2"
16	1,570	one - 2-1/2"
18	1,980	two - 2-1/2"
24	3,530	one - 4-1/2"

B. Upon completion of flushing, the Contractor shall disinfect the main, services, valves, and hydrants with chlorine solution in accordance with the requirements of AWWA C651, latest edition, and in accordance with the New York State Department of Health using the continuous feed method. The strength of this solution shall be such that a residual of at least twenty-five (25) mg/l of chlorine shall be retained in the main after twenty-four (24) hours. The tablet method of chlorinating the water main, as described in AWWA C651, is not an acceptable method.

C. The interiors of all appurtenances and sections of water main that cannot be normally disinfected shall be swabbed by the Contractor to the satisfaction of the Engineer with a concentrated chlorine solution containing not less than 200 ppm of free chlorine before installation.

D. Disinfect all existing water lines, services, and appurtenances which were broken, damaged, contaminated, or suspected of being contaminated as a result of work done in conjunction with this project.

E. Following disinfection, all treated water shall be thoroughly flushed from the main (minimum flushing velocity 2.5 feet per second) and samples shall be taken and analyzed at the Contractor's expense. There is to be two consecutive days of sampling. Samples to be taken every 1200 feet of water main, every branch, and at the end of the line. The samples will be analyzed by a NYS Health Department approved laboratory and copies of the tests forwarded to the Engineer and Owner. The main shall not be placed in service until the water has been approved for service. Chlorinated water shall be properly disposed of or dechlorinated by the Contractor at his expense.

F. If the tests results are unsatisfactory, additional flushing shall be done by the Contractor or the main shall be re-chlorinated, or both until further testing indicates the results are satisfactory. All additional flushing and/or testing shall be at the Contractor's expense.

3.8 FIELD QUALITY CONTROL

A. In the presence of the Engineer, inspect each length of pipe and each structure delivered to the job for flaws, cracks, dimensional tolerance and compliance with the applicable specifications. Only pipes, fittings and structures accepted by the Engineer and so marked shall be installed in the work.

B. The Contractor shall inspect pipe joints and verify that they have been properly installed and made up, and free from sags, high spots, and excessive deflections.

3.9 DAMAGED FACILITIES

A. Any section of piping that is found defective in material, alignment, grade, joint, or otherwise, shall be corrected at no additional cost to the Owner.
B. In the event that dirt, debris, or any other foreign material has entered any portion of the piping or structures, flush the piping or structure with clean water. Continue the flushing process until the piping or structure is clean, as determined by Engineer.

C. Any damage done to existing utility mains their appurtenances as result of work under this contract shall be repaired or replaced by the Contractor to the satisfaction of the Engineer at no additional cost to the Owner.

END OF SECTION

SECTION 13000

FIRE WATER
GLASS FUSED TO STEEL BOLTED STORAGE TANK

PART 1 - GENERAL

1.1 SUMMARY

A. Under this section the manufacturers authorized tank dealer (MATD) shall furnish all required labor, materials and equipment for providing and erecting a Statewide Aquastore 58,000 gallon Glass-Fused-to-Steel Bolted Water Storage Tank(s) constructed of factory prefabricated glass-coated, bolt-together steel panels.

B. Each tank structure shall include a foundation, floor, free span dome and other accessory components as shown on the contract drawings and described herein. Note that painted, powder coat, stainless steel or galvanized bolt-together tanks are not acceptable.

C. All required tank materials and principal appurtenances shall be supplied by the tank manufacturer. Tank structures and appurtenances shall be new and not previously used.

D. A site and project specific foundation designed by the tank manufacturer with the applicable state PE stamp must be provided with the bid documents. No third party designs will be allowed. The tank manufacturer shall be solely responsible for the tank structural steel and foundation design.

E. Tanks shall be designed, manufactured and glass coated in the United States of America, by a tank manufacturer specializing in the production of glass-coated, bolt-together steel tank systems. All structural steel utilized in the tank structure shall be produced and glass coated in the United States of America.

F. Related Sections

1. None

1.2 REFERENCES

1. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
    1. American Society for Testing and Materials (ASTM)
    2. American Water Works (AWWA)
        a. Tank steel panel materials, design, fabrication and erection shall comply with AWWA D103-09 and addendum D103a-14 for bolted steel tanks, unless specified otherwise herein.
    3. American National Standards Institute (ANSI)
    4. NACE International (NACE)
    5. American Institute of Steel Construction (AISC)
    6. Occupational Safety and Health Administration (OSHA)
    7. Factory Mutual (FM)
        a. Certification of annual review of quality control procedures of the manufacturing plant by FM is required upon request.
    a. NFPA-22
    8. American Welding Society (AWS)
    9. International Organization for Standardization (ISO)
        a. The tank manufacturer’s quality assurance program shall be certified to comply with ISO 9001 standards.

10. International Building Codes (IBC)
    a. Tanks will be designed such that Seismic, Wind and Roof designs conform to the current state and local standards.

1.3 SUBMITTALS

A. Before executing any work in this section, the tank manufacturer shall submit for documentation, job specific structural calculations for tank and foundation, general arrangement drawings and specifications for the tank structure, foundation, joint sealant and all appurtenances. There shall be no deviation from the drawings and specifications, except upon written order from the engineer. Submittal documentation for the tank and foundation shall be sealed by the tank manufacturers Professional Engineer licensed and registered in the applicable state.

B. Product Data "catalog cuts" and spec sheets provided shall be marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

C. Submittals shall include certification that each applicable Section of AWWA D103-09 and addendum D103a-14 is met. Any exceptions taken shall be noted with full explanation given for the deviation. Provide a copy of this specification with a check mark next to each item where the proposed equipment does not adhere to the specification (with the bid), and provide information on the exception and how the proposed equipment would be brought into adherence with the item required.

D. All engineering costs which cause changes in design from the plans and specifications are to be borne entirely and unconditionally by the General Contractor. Approval by the Engineer of the shop drawings submitted by the General Contractor shall in no way relieve the General Contractor of full responsibility for the accuracy and completeness of the design and of the shop drawings.

E. A submittal substitution review deposit in the amount of $2,000, payable to the owner, shall be submitted, upon engineer request, with the request for review of any substitution deviations from the plans and specifications. The deposit will be used by the engineer at a rate of $150/hour to review such requests, regardless of whether the substitution is approved or rejected. The owner will return any unused funds to the petitioner within 45 days of approval of submittals.

F. Submit documentation certifying tank design and manufacture in the United States. Submit documentation certifying steel produced and glass coated in United States.

G. Copy of Builder Certification Program sponsored by the tank manufacturer certifying factory training and experience of the MATD building employees.

H. Documented qualifications of MATD building employees including their project construction foreman shall be submitted upon request, for review. MATD foreman shall have construction experience of at least five years in bolted glass fused to steel construction of the manufacturers tank being provided and at least (3) of that manufacturers specific glass fused to steel tank projects that are fully complete. Construction experience shall be for tanks of similar size and climate as to the one specified herein. Owner reserves the right to reject without penalty proposed foreman that does not meet the prior experience requirements.

I. The tank manufacturer shall provide a standard Operation and Maintenance Manual upon approval of the drawings and completion of the tank installation.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Tank manufacturers Professional Engineer experienced, licensed and registered in the applicable state is responsible to sign and seal documentation for tank manufacturers tank and foundation design. Evidence of professional liability insurance shall be provided ($1,000,000) policy.
2. The tank manufacturer shall be a specialist in the design and fabrication with a minimum of 15 years documented glass fused to steel tank manufacturing experience in the United States of projects in similar climates, sizes and applications. The tank manufacturer shall employ a staff of full time design engineers, and shall own and operate its steel fabrication and glass coating facilities.
3. The MATD shall have built, on its own, at least 15 of the specific manufacturers glass fused to steel tanks designed to AWWA D103and being provided that are equal or greater in size than the specified tank, operating satisfactorily in a similar application within the United States for a minimum of (10) ten years. The MATD shall provide with bid, the project name, location, application, size, capacity, contact information and year of supply/operation of their erected tank.
4. Manufacturers and MATD lacking the experience requirements listed in this section or elsewhere in the contract documents will NOT be considered without prior approval. Strict adherence to the standards of design, fabrication, erection, product quality, and long term performance established in this specification will be required by the engineer and owner.
5. Builders lacking the experience requirement will not be considered unless they provide a satisfactory 5 year 100% performance bond in lieu of evidence of experience and long term operation.

B. Source Limitations

1. Tank and dome in this Section shall be furnished and erected by a single MATD.
2. Tank and dome in this Section shall be manufactured and fabricated by a single source with all fabrication and engineering design done in house.

1.5 PACKAGING, DELIVERY AND HANDLING

A. All sheets that pass factory inspection and quality control checks shall be protected from damage prior to packaging for shipment.

B. Heavy paper or plastic foam sheets shall be placed between each panel to eliminate sheet-to-sheet abrasion during shipment.

C. Individual stacks of panels will be wrapped in heavy waterproof cover and steel banded to special wood pallets built to the roll-radius of the tank panels. Shipment from the factory shall be by truck, exclusively hauling the tank components. This procedure minimizes contact or movement of finished panels during shipment.

1.6 WARRANTY

A. If within a period of one (1) year from date of completion (or 14 months after delivery), the tank structure or any part thereof shall prove to be defective in material or workmanship upon examination by the manufacturer, the manufacturer will supply a replacement part, will repair, or allow a credit for same.

B. The warranty shall be further extended with the use of a Manufacturer supplied Cathodic Protection system as follows: the glass coated product zone surfaces, that portion of the

tank interior below the normal high elevation of the contained liquid will not corrode under normal and proper use, maintenance and operation during the period expiring on the earlier of (i) 60 months after liquid is first introduced into the tank or (ii) 62 months after shipment from the factory.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The tank will be supplied by Statewide Aquastore, Inc. located in East Syracuse, New York. Tank manufacturer will be CST Industries of DeKalb, IL or pre-approved alternate. No other manufacturer will be acceptable for the base bid. This requirement is intended to protect the owner so that no one bidder gains an unfair price advantage by quoting a lesser product that does not comply with the minimum performance and salient features set forth in these specifications.

B. All pre-approval requests must be made at least 10 business days prior to the specified bid date or they will not be considered. Only bids from tank manufacturers and MATD who have successfully prequalified will be considered. Bidders will be notified via addendum allowing or disallowing the pre-approval request. If bidder fails to pre-qualify and provide the documentation deemed necessary by the engineer to evaluate proposed alternate equipment, the proposed tank will be rejected.

C. The engineer is the sole authority for determining conformance to the specifications and whether to pre-quality a proposed supplier. Under no circumstances will they be required to prove that an alternate product is not equal to the specified equipment. The engineer's decision or judgment on these matters will be final, conclusive and binding.

D. Naming of a manufacturer does not relieve them from complying with the performance features, the salient features and any made in the USA requirements of the contract documents. The contract documents represent the minimum acceptable standards that will be allowed.

E. The Engineer's selection of factory applied glass-fused-to-steel bolt together tank construction for this project has been predicated upon specific criteria, construction methods, and an optimum coating resistance to internal and external tank corrosion. Deviations from the specified design, construction or coating details will not be permitted. To assure the greatest ease of availability of tank and appurtenant components, and/or spare parts, preference will be given to U.S. manufacturers.

F. The Engineer/owner reserves the right to evaluate all bids based on long term, 40-50 year operation, coating and maintenance costs. Values to be used in this evaluation will be at the discretion of the Engineer to determine which tank best fits the owner's needs. The Engineer will add such costs, dependent upon the type of tank offered, to the bidder's price to determine the effective low bid for purposes of making the award.

G. An authorized dealer of the tank manufacturer shall provide and install the tank. Sub-contracting of the tank erection by the MATD shall not be permitted. Building crews shall comply with the tank manufacturer's requirements for building practices and equipment used on the job.

H. In order to assure uniform quality and ease of maintenance and obtaining service or spare parts from as few places to the maximum extent possible, it is the intent of these specifications that equipment under this section, tank, foundation design, cathodic protection system and dome shall be supplied by a single manufacturer. The equipment manufacturer and MATD assume the responsibility for proper installation and functioning of equipment.

2.2 DESIGN REQUIREMENTS

A. Tank structures shall be vertical, cylindrical, flat bottom, glass coated, bolt together steel construction. Epoxy, powder coated, galvanized or stainless steel are not considered equal and will not be considered.

B. Tank shall be in 100% adherence to US, State and local codes, standards and requirements. No foreign designs or codes will be accepted.

C. The factory coated glass-fused-to-steel bolt together tank shall have a nominal diameter of 22.38 feet, with a nominal sidewall height (to roof eave) of 21.2’ feet.

D. Tank capacity shall be 58,000 gallons (usable, U.S. gallons) at 19.2 feet liquid depth. Design freeboard shall be 12 inches.

E. Finished floor elevation shall be set at Elev. 576.5

F. Loads to be considered in the tank and roof design shall include basic live, seismic and snow loads.

G. Specific Gravity 1.0 minimum.

H. Net allowable soil bearing capacity 4,000 PSF (per Geotechnical report)

I. Seismic Design

1. Design per IBC 2015. EN 15282 is not considered equal and will not be accepted.
2. Map Spectral Response
    a. S_s
    b. S_1
3. Importance Factor based on Category I. (I_E)
4. Site Class A.
5. Long Period Transition Period (T_L)

J. Snow Load

1. Ground Snow Load 20 PSF.
2. Importance Factor 0.8 (I_s)
3. Thermal Factor 1.0 (C_t)
4. Exposure Factor 0.7 (C_e)

K. Wind Load (AWWA D103-09/ASCE 7-10)

1. Basic Wind Speed 120 mph
2. Risk Category I
3. Exposure Category C

L. Frost Depth 5.0’

M. Load cases (include the self-weight of the structure in all of the following load combinations) shall be analyzed to determine the controlling stresses, as follows:

1. Normal operating conditions (full tank) with a full snow load.
2. Empty tank, no snow.
3. Wind, or earthquake, on empty tank, full snow.
4. Wind, or earthquake, on empty tank, snow on leeward side of dome.
5. Wind, or earthquake, on empty tank, no snow

N. Glass Fused to Steel Floor

1. The tank floor bottom shall be constructed of glass-coated steel panels as shown on contract drawings. The glass floor shall be installed on top of a compacted and base and ringwall or concrete floor slab as specified in the contract documents.
2. Glass-coated steel floor panels shall have the same milled glass, formulated with titanium dioxide, as the tank sidewalls to produce a finish interior surface with optimum toughness and resistance to conditions normally found in fire water storage tanks. The finished tank interior floor glass coating shall be white.
3. If a concrete floor slab is used it shall be constructed of reinforced concrete as specified in the contract documents and capable of supporting the full load of the tank. If fill is used, the fill under the floor shall be compacted and tested to a minimum of 95% of proctor.

O. Aluminum Geodesic Dome Roof

1. The tank roof shall be furnished and manufactured by CST Industries, the tank manufacturer. Roofs shall be designed to AWWA D108 and ADM – 2010 and be constructed of triangular aluminum panels as shown on contract drawings. Roofs shall be clear span and self-supporting. Center post supports are not permitted. Materials shall be AA6005A-T61, AA6061-T6 or AA3003-H16. All metal components of the aluminum dome structure shall be aluminum or 300 series stainless steel. Alternate aluminum dome manufacturers wishing to be considered must pre-qualify with the engineer in order to register as an acceptable alternate.
2. Connection forces shall be transferred through gusset plates connected to the top and bottom flanges of the beam struts. The connections shall be designed as moment connections; a minimum of four bolts shall be used to connect the gusset plate to each strut flange. The structural analysis shall be performed using non-linear, second order, stiffness analysis models in accordance with ADM 2010 Chapter C. Stability shall be provided for the structure as a whole and for each of its components. The available strengths of members and connections determined in accordance with Section C.3 shall equal or exceed the required strengths determined in accordance with Section C.2
3. No galvanized, aluminized, painted, or plated steel shall be used anywhere in the dome above the mounting bracket base plates. Dissimilar materials in the supporting structure shall be isolated from the aluminum dome by means of a composite elastomeric gasket. Designs that incorporate raised battens, overlapping panels and/or designs that incorporate fasteners which penetrate panels and attach to structural members are expressly prohibited.
4. Roof live loads and dead loads shall be carried by tank sidewalls, without additional support. A roof hatch, with a hinged gasket cover and locking hasp, shall be provided near the outside tank ladder.
5. Roofs are aluminum in color and shall be constructed of non-corrugated, triangular geodesic aluminum panels, which are sealed and firmly clamped in an interlocking manner within a fully triangulated aluminum space truss system of wide flange extrusions, thus forming a dome structure. Fabric type flashing is not allowed.
6. The dome shall be self-supporting from the periphery structure with horizontal thrust contained by an integral tension ring. The entire structure shall be designed a s a watertight system under all design loads and temperature conditions. The design shall include sealant to be completely encapsulated by applying it to the gusset covers inner circumference, beneath the gusset covers top closure plates.

7. The top surface of the batten bars must be completely flush with the triangular panel surfaces so that no ponding of water occurs at cover joints. Raised batten bars, overlapping panels, and/or panel attachment fasteners that penetrate panels are expressly prohibited.
8. The walkway and handrail, if supplied with the roof, shall be constructed of aluminum.
9. The roof manway opening shall be at least 30" square. The opening shall have a curb of at least 4" in height, and the cover shall have a downward overlap of at least 2". The manway shall be aluminum.
10. Dome Materials
    a. Triangulated dome frame struts: 6061-T6 aluminum or 6005A-T61.
    b. Structural frame gussets: 6061-T6 aluminum, 0.3125 inch nominal thickness.
    c. Triangular closure panels: .050 inch nominal thickness, 3003-H16 aluminum Sheet.
    d. Perimeter tension/compression ring: 6061-T6 aluminum or 6005A-T61.
    e. Fasteners: Fasteners shall be designed with a factor of safety of 2.34 on ultimate strength and 1.65 on yield strength. Threaded fasteners shall be 304 stainless steel.. Lockbolts shall be 7075-T73 aluminum, 304 or 305 stainless steel. Screws shall be aluminum or 300 series stainless steel.
    f. Sealant: Silicone by Pecora, General Electric Silpruf or equal and shall be resistant to ozone and UV. Sealer shall conform to Federal Specification TT-S-00230
    g. Gaskets: Silicone, General Electric SE-44/88 or equal. Gaskets shall conform to ZZ-R-765, Class 2, Grade 50 or equal. Neoprene may be substituted but only if shielded from UV light. Gaskets must be 1/8" thickness minimum.
    h. Anchor Fasteners: Series 300 stainless steel.
    i. Dormers, doors, and hatches: 6061-T6, 5086-H34 or 5052-H36 or 5052-H32 aluminum, 0.090inch nominal thickness.
    j. The tank supplier shall perform all manufacturing work described herein with mechanics skilled and experienced in the fabrication of aluminum dome roof structures. Fabrication shall be done in an ISO 9001 certified facility.
    k. All field work shall be completed by the MATD qualified erection crew. Sub-contracting of the roof manufacturing or erection is not allowed.
    l. Field re-fabrication of structural components or panels will not be accepted. Forcing of the structure to achieve fit-up during construction is expressly forbidden and not acceptable. Any indication of improper fit-up of parts shall be immediately reported to the fabricator.
    m. All sealant joints shall be tooled slightly concave after sealant is installed. Care shall be taken to keep sealant confined to the joint in a neat manner. Any sealant applied outside of the joint shall be removed so that the panels will be free from misplaced sealant. All gasket materials shall be continuous, splices will not be allowed.

2.3 MANUFACTURING PROCESS

A. Glass Coating

1. The glass coating system shall be in full accordance with the requirements of AWWA D103, latest revision. Coating frits shall be individually tested in accordance with PE1 Test T-2. (Citric acid at room temperature). The coating process shall employ equipment that evenly coats the sheet surface and all four exposed sheet edges

B. Surface Preparation

1. Following the de-coiling and shearing process, sheets shall be steel grit blasted on both sides to the equivalent of SSPC PC-10 (near white metal blast cleaning). Sandblasting and chemical pickling of steel sheets is not acceptable. The surface anchor pattern shall be not be less than 1.0 mils. (.0001inches). Sheets shall be evenly oiled on both sides to protect them from corrosion during fabrication.

C. Cleaning

1. After fabrication and prior to application of the coating system, all sheets shall be thoroughly cleaned by Coral COR Clene 16 caustic wash with 140°F hot water, then a two stage rinse followed immediately by hot air drying. Inspection of the sheets shall be made for traces of foreign matter, soil particles, grease or rust. Any such sheets shall be re-cleaned or grit-blasted to an acceptable level of quality.

D. Coating Application

1. Manufacturer shall maintain and use supplementary directional spray nozzles using an automated machine process to consistently coat the sheet edge profiles per PE 101 standard. The sheet edges shall be coated with the same vitreous enamel glass coating as the panel surface.
2. All sidewall sheets shall receive one coat of a catalytic nickel oxide glass pre-coat to both sides, followed by air-drying.
3. A second coat of milled cobalt blue glass shall be made to both sides of the sheets and then dried.
4. A third cover coat of milled titanium dioxide white glass shall then be applied to the inside of the sheet. This milled glass shall be formulated with 18% to 22% titanium dioxide to produce a finish interior surface with optimum toughness and resistance to conditions normally found in fire water storage tanks. This specific coating shall be Aquastore Vitrium. Any alternate three coat system must be submitted for approval and acceptance prior to bid.
5. The sheets shall then be fired at a minimum temperature of 1500 °F in strict accordance with ISO 9001 quality process control procedures, including firing time, furnace humidity, temperature control, etc.
6. The 4 continuous sheet edge enamel thickness shall be 5 mils.
7. The dry film interior coating thickness shall be 10-18 mils min. The dry film exterior coating thickness shall be 7-15 mils min. This is a three coating process.
8. The finished tank inside sidewall glass coating shall be white. Cobalt Blue finished interior color will not be accepted. The standard tank sidewall finished outside color shall be Cobalt Blue. (Munsell standard 7.5 PB 2/4.) Finished outside colors shall not vary noticeably among tank panels. Off color panels will be rejected; replacement panels of matching color shall be supplied by the tank manufacturer.

E. Sheet Edge Coating

1. Prior to sheet glassing all four (4) exposed rectangular continuous sheet edges, including starter sheets, for each specific sheet radii shall be mechanically rounded in profile resulting in an optimized radius and adhere to The Porcelain Enameling Institute's Technical Manual PEI-101.
2. The sheet surface next to the edge must remain flat, post process, to prevent 'bulging' to less than 0.030 inches (0.79mm) relative to the flat, while being rolled. All (4) exposed sheet edges will then be directionally sprayed by nozzles, using an automated machine process, and coated with the same vitreous enamel glass coating as the sheet surface.
3. Sheet edge encapsulation will have an enamel coating minimum DFT (dry film thickness) of 5 mils (127 microns). Coating adhesion shall be tested in accordance with ISO 28765 Class 2 or better. Sheet face and sheet edge must meet the same glass quality test. Rounded sheet edge encapsulation will not have exposed uncoated steel.
4. The process shall be equal in all respects to Edge Coat II by CST Industries. Sealer or glass overspray as edge coating shall not be an acceptable alternative and nozzle spray must be directionally oriented toward the edges to ensure consistency of coverage. . The coating shall have a tensile strength of 1500 psi.

2.4 SOURCE QUALITY CONTROL

A. The manufacturers quality system shall be ISO 9001 certified and refer to ISO (International Organization of Standardization) for the following testing and procedures.

B. Coated sheets shall be inspected for mil thickness using a calibrated magnetic induction type electronic dry film thickness gage with a valid calibration record. Test frequency shall be a minimum of every gage change and/or a minimum of every half hour.

C. Coated sheets shall be measured for color using an electronic colorimeter with a valid calibration record. Test frequency shall be a minimum of every gage change and/or a minimum of every half hour. The color must fall within the specified tolerance or it shall be rejected.

D. An electrical leak detection test shall be performed on the interior and exterior surface of each panel after fabrication. Inside wet sheet surfaces shall be inspected using a low voltage wet sponge holiday tester in accordance with ASTM D5162-91 Method A. The tester shall be used at a voltage of 67.5 volts (+/- 10 %) and set so the alarm is sounded if the electrical resistance of the glass coating falls below 125,000. The tester shall have a valid calibration record. The testing solution used to wet the sponge shall contain a low suds wetting agent added at a ratio of not more than ½ fluid oz. per gallon of water. Every sheet shall be 100% tested for holidays in the factory and any sheet with a discontinuity shall be rejected.

E. Adherence of the glass coating to the tank steel shall be tested in accordance with ISO standards. Any sheet that has poor adherence will be rejected. Coating adhesion shall be tested in accordance with ISO 28765 Class 2 or better. Sheet face and sheet edge must meet the same glass quality test.

F. Glass coating shall be tested for fishscale by placing the full size production sheets in an oven 400°F for one hour. The sheets will then be examined for signs of fishscale. Any sheet exhibiting fishscale shall be rejected and all sheets from that gage lot will be similarly tested. The minimum frequency of testing for this shall be five times per

month.

G. The tank manufacturer shall provide documentation upon request (prior to tank fabrication), of the above tests including mill reports and traceable documents to demonstrate the source of steel used in the manufacture of this project specific tank

2.5 MATERIALS

A. Plates and Sheets

1. Plates and sheets used in the construction of the tank shell, floor, or roof shall comply with the minimum standards of AWWA D103, latest edition and AWWA D103a-14 addendum. All steel shall be smelted and produced in the United States of America.
2. The annealing effect created from the glass coated firing process shall be considered in determining ultimate steel strength and yield strength of the steel used for calculations detailed in AWWA D103, Equations 5-4 and 5-5 and in accordance with the AWWA D103a-14 Addenda such that F_u and F_y shall be reduced by a factor of 0.7 from the published steel values. In no event shall a yield strength greater than 50,000 psi be utilized for such calculations detailed in AWWA D103 unless the tank manufacturer can substantiate the use of higher values because of a documented testing program.
3. The tank manufacturer shall have and provide for the Engineer's review, upon request, published ultimate tensile and yield strength values for the proposed steel. In addition, per AWWA D103a-14 the tank manufacturer shall have test results for the most recent two (2) year period to substantiate the use of Fu and Fy values used in the tank manufacturer's design calculations if the values exceed 70 percent of the published values.
4. Design requirements for mild strength steel shall be ASTM A-1011 Grade 30 with a maximum allowable tensile stress of 12,135 psi. High strength steel shall be ASTM A-1011 Grade 50 with a maximum allowable tensile stress of 21,167 psi.
5. When multiple vertical bolt line sheets and plates of ASTM A-1011 Grade 50 are used, the effective net section area shall not be taken as greater than 85% of the gross area. Multiple vertical bolt line sheets and plates shall be manufactured such that holes are staggered in the vertical bolt lines and that no two adjoining holes are in-line horizontally, except at the center of the sheet or plate
6. When Rolled Structural Shapes are used, the material shall conform to minimum standards of ASTM A36 or ASTM A992.
7. Minimum acceptable sheet thicknesses:
    a. Foundation
    b. Course 3
8. Chemical compositions for mild steel and high strength steel shall be stated in the submitted mill certifications. Raw steel for plates and sheets shall conform to the following composition requirements. These specifications refer to the design tensile strength after firing. The steel shall have the following chemical composition
    a. Carbon (Mild) 0.06% maximum
    b. Carbon (HSS) 0.10% maximum

c. Manganese 1.50% maximum
d. Phosphorus 0.04% maximum
e. Sulfur 0.05% maximum
f. Aluminum 0.08% maximum

9. Vertical tank seams shall be offset. Straight seam 4 corner joints are not acceptable.

B. Horizontal Web Stiffeners

1. Stiffeners shall be of the "web truss" design, with extended tail to create multiple layers of stiffener, permitting wind loads to be distributed around the tank. Stiffeners should be fabricated of steel with hot dipped galvanized or epoxy coating.. Rolled angle stiffeners shall not be permitted for intermediate horizontal wind stiffeners.
2. Maximum web stiffeners allowed is 2 at course 3. Additional stiffeners may be desired at the time of tank erection, if telecommunications equipment mounting will be required per contract documents.

C. Bolt Fasteners

1. Bolts used in tank lap joints shall be 1/2-13 UNC-2A rolled thread and shall meet the minimum requirements of AWWA D103. Bolt material shall be SAE J429 Grade 5 (1" bolt length) with a tensile strength of 74,000-psi minimum, and a proof load of 55,000-psi min. and an allowable shear stress with threads excluded from the shear plane of 18,163-psi min.
2. SAE J429 Grade 5/ASTM A325 (1-1/4" bolt length) and heat treated to a tensile strength of 120,000 psi min and a proof load of 85,000 psi min. and having an allowable shear stress with threads excluded from the shear plane of 29,454 psi min.
3. SAE J429 Grade 8/ASTM A490 (bolts greater than 1-1/4") and heat treated to a tensile strength of 150,000 psi min and a proof load of 120,000 psi min. and having an allowable shear stress with threads excluded from the shear plane of 36,818 psi min.
4. The bolt finish shall be zinc coated, mechanically deposited 2.0 mils minimum per ASTM B695.
5. The entire bolt head shall be encapsulated up to the splines on the shank with high impact polypropylene copolymer. Resin shall be stabilized with an ultraviolet light resistant material such that the color shall appear black. The bolt head encapsulation shall be certified to meet the ANSI/NSF Standard 61 for indirect additives.
6. All lap joint bolts shall be properly selected such that threaded portions will not be exposed in the "shear plane" between the sheets. In addition, bolt lengths shall be sized as to achieve a neat and uniform appearance. Excessive threads extending beyond the nut will not be permitted.
7. All lap joint bolts shall include a minimum of four (4) splines, .002 inches minimum on the underside of the bolt head at the shank in order to resist rotation during torque wrench application.

D. Sealants

1. The lap joint sealant shall be a one component, moisture cured, polyurethane compound. The sealant shall be manufactured by a United States supplier as

well as be suitable for contact with fire water and shall be certified to meet ANSI/NSF Additives Standard No. 61.

2. The sealant shall be used to seal lap joints, bolt connections and for sheet edge fillets. The sealant shall be CST Industries, Manus Bond 98 Sealer. The sealant should have a curing rate at 73°F and 50% RH and be tack free in 6 to 8 hours. Final cure time should be 10 to 12 days. Sealer shall be resistant up to 100-ppm chlorine concentration during disinfection. Neoprene gaskets and tape type sealer shall not be used.
3. The sealant shall cure to a rubber like consistency, have excellent adhesion to the glass coating, low shrinkage and be suitable for interior and exterior use.
4. Due to poor compatibility with chlorine, the sealant Sika 1A shall not be used on fire water storage tanks.

E. Roof Vent

1. A properly sized aluminum vent assembly in accordance with AWWA D103 shall be furnished and installed above the maximum water level. A curbed opening shall be provided at the apex of the dome. At maximum possible rate of water fill or withdrawal, the resulting interior pressure or vacuum will not exceed 0.5-inch water column.
2. Protection against birds and protection against ice plugging shall be provided. An insect screen shall be provided and designed to open should the screen become plugged by ice formation.
3. The vent shall be constructed of aluminum such that the hood can be unbolted and used as a secondary roof access.

F. Pipe Connections

1. Where pipe connections are shown to pass through tank panels, they shall be field located, saw cut, (acetylene torch cutting or welding is not permitted), and utilize an interior and exterior flange assembly. Tank shell reinforcing shall comply with AWWA D103 latest edition. CST Industries Manus Sealer shall be applied on any cut panel edges or bolt connections.
2. Overflow piping shall be irrigation grade seamless aluminum tubing. Twenty four mesh non corrodible screen shall be installed within the pipe.

G. Ladder Assemblies

1. An AWWA D103 and OSHA 1910 compliant external tank ladder shall be furnished and installed as shown on the contract drawings. Ladders shall be aluminum and utilize grooved, skid-resistant rungs.
2. Personal fall arrest system, safety cage and step-off platforms (as required by OSHA 1910 or customer submittal drawings) shall be fabricated of galvanized steel. Ladders shall be equipped with a hinged lockable entry device at the bottom of the ladder. Step off platform shall be at maximum intervals of every 30’.

H. Access Doors

1. Each tank shall be provided with one (2) 24-inch diameter bottom access door as shown on contract drawings per AWWA D103. The manhole opening shall be a minimum of 24 inches in diameter. The access door and tank shell reinforcing shall comply with AWWA D103 latest edition.
2. A davit to hold the cover plate is required.

I. Vortex Breaker

1. Each tank shall be provided with a vortex breaker at the outlet pipe connection according to NFA-22.

J. Tank Insulation

1. Installation of the tank insulation shall be by the tank erector. Workman shall be trained and experienced with this system. Tank erector will provide a list of similar tank insulation installations they have completed over the last three years. Final installation shall be completed prior to the advent of cold weather.
2. Insulation system shall have an R value of 10 minimum. Manufacturers – Global Therm or approved equal.
3. Shell Insulation will be a laminated panel of vertical standing seam design with a minimum insulation thickness of 1-1/2 inch consisting of foil-faced isocyanurate foam laminated to a metal outer sheathing. Outer sheathing shall be .024inch minimum thickness 3105H14 aluminum with a stucco embossed finish.
4. The shell insulation panels shall be secured to the tank with an internal grid of ¼ inch galvanized steel wire rope and stainless steel clips attached within the standing seam panel joints.
5. All standing seam joints shall be internally sealed with a flexible butyl caulk to provide a watertight joint. All flashing materials shall be with matching .024 thick stucco embossed aluminum sheet. All exposed caulking shall be premium grade silicone or polyurethane to prevent water penetration.
6. The aluminum exterior sheathing shall have a mill painted with a color selected by Owner or Owners representative from panel manufacturer's standard colors.

K. Roof Insulation - Knuckle Roof

1. Shall be 1-1/2 inch thick laminated panels of similar construction as the shell insulation panels. The outer sheathing shall be with matching .024 inch thick aluminum with a stucco embossed finish. The sheathing color shall match the shell sheathing.
2. The shell/roof juncture shall be made weather tight with a matching aluminum coping. All flashings and panel overlaps will be made weather tight and installed down weather to provide and promote positive water runoff.
3. Roof manway shall have a 4" aluminum extension bolted between the shell of the roof and the casting of the manway to allow the insulation to be installed as noted directly above in item A.

L. Penetrations

1. All manways, nozzles, support brackets, vents, ladders, and handrails shall have insulation cut tight against them and be sealed with polyurethane caulk or equal.
2. Field installation shall be in strict accordance with the manufacturers established procedures. Only trained and certified experienced tank construction personnel, employed by the tank supplier, will be allowed to install the insulation.
3. Work on the insulation shall not begin until the tank has been leak tested and accepted by the owner/engineer. Upon completion of the work all packaging material, extra jacketing, and insulation shall be removed from the owners property and properly disposed of by the contractor.

M. Liquid Level Controls

1. Indicator is to be of the gauge board style or design. The exterior gauge board is to be a (half travel) (full travel) model.
2. All tank interior components are to be fabricated of stainless steel including the float, guide wires, float cable and any fastening hardware including anchors.
3. The exterior gauge board is to be fabricated of galvanized steel with fully adhered vinyl facing containing graduations for level height indication. The numerical graduations are to be 1 foot increments.
4. A cast iron, with red powder coat finished target shall glide freely along the gauge board to indicate the level of water in the tank at any given time. The target shall be circular with an interior opening in the target to allow for an unobstructed view of the gauge board which would normally be hidden without such opening. Brackets used to attach the gauge board to the tank sidewall are to be stainless steel.
5. The float cable is to be carried through a 1.5 inch galvanized threaded pipe attached vertically to the roof of the tank with a proper flange. Two (2) A356 aluminum castings containing pulleys with stainless steel axles are to be supplied to create the required 90 degree transition bends from a vertical direction exiting the roof, to horizontal and again back downward vertically where an additional 1.5" galvanized threaded pipe is attached to the top of the gauge board with a 1.5" galvanized U-bolt.
6. Two (2) float guide wires (stainless steel) are to maintain vertical travel of the interior stainless steel float. The guide wires shall be attached to the roof of the tank via externally mounted spring tensioners and fixed to the floor of the tank. The springs in the tensioners are to be manufactured of stainless steel.
7. The manufacturer of the gauge board shall be Tank Products or equal.

N. Identification Plate

1. A manufacturer's nameplate shall list the tank serial number, tank diameter and height, maximum design capacity, intended storage use, and date of installation. The nameplate shall be affixed to the tank exterior sidewall at a location approximately 5' from grade elevation in a position of unobstructed view.

O. Cathodic Protection System

1. The tank manufacturer will provide a passive cathodic protection system designed specifically for the project tank, consisting of sacrificial anodes which provide protection for the portion of the structure immersed in liquid. The anodes are attached to the floor, and bolted through existing shell sheet bolt holes. Lead wires and buss bars are used to ensure continuity between anodes and all structure shell sheets.
2. The cathodic protection system shall be designed by a licensed professional engineer employed by the tank manufacturer. The system shall be designed to protect the tank.
3. The resistivity of the water to be stored in the tank will determine the type and number of anodes.

P. Plastic Encapsulated Cap

1. High density polyethylene co-polymer caps and sealant shall be used to cover the bolts, nuts and washers exposed on the exterior sidewall of the tank.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Employees of the MATD shall be experienced in the construction of the specified glass fused to steel tank and should be trained in a factory training program receiving builder certification by the tank manufacturer, and shall be employed full time by the authorized dealer.

B. Supervisory personnel of the erection crew shall identify themselves to responsible personnel of the Engineer or Inspector upon initially entering the job site. Only trained and certified personnel will be allowed on site.

C. Tank Foundation

1. The tank foundation shall be built in accordance with the contract drawings and/or approved shop drawings. Foundation shall be designed by the manufacturers licensed engineer and built by the MATD to safely sustain the structure and its live loads. Floor rebar shall be epoxy coated.

D. Glass Fused to Steel Floor

1. Glass-coated bolted steel floor panels shall be assembled over a 3 inch compacted sand base contained by a concrete ring wall. Alternately, if the panels are to be set on a concrete slab, a non-extruding and resilient bituminous type of filler may be used, meeting the requirements of ASTM D1751.

2. Tank footing design shall be based on the soil bearing capacity given by the engineer, as determined by geotechnical analysis performed by a licensed soils engineer. Copies of the soil report will be provided to the bidder prior to bid date by the Owner or Engineer

3. Plastic encapsulated nuts shall be used to cover the bolt threads exposed on the inside of the floor. The plastic encapsulation shall be Noryl GFN2-701S and NSF 61 compliant.

E. Tank Structure

1. Field erection of the glass-coated, bolted-steel structures and components shall be in strict accordance with the procedures established by the manufacturer and performed by MATD who is regularly engaged in erection of the manufacturers glass fused to steel tanks, using experienced factory-trained certified erectors fully employed by the Dealer.

2. Only specialized erection jacks and building equipment developed and supplied by the tank manufacturer shall be used to erect the tanks. Every sheet shall be 100% tested for interior holidays in the field.

3. Particular care shall be taken in handling and bolting of the glass-coated steel tank panels, appurtenances and members to avoid abrasion of the coating system. Prior to liquid test, all surface areas shall be visually inspected. Chips or scrapes in the glass coating shall be repaired per the tank manufacturer's recommended procedure.

4. An electrical coating leak test shall be performed during erection using a wet sponge nine-volt leak detection device. All electrical leak points found on the inside surface shall be repaired in accordance with manufacturers published touch-up procedures.

5. No backfill is to be placed against the tank sidewall without prior written approval of the tank manufacturer. Any backfill allowed shall be placed strictly in accordance with the instructions of the tank manufacturer.

3.2 FIELD TESTING

A. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling to its overflow elevation.

B. Any leaks disclosed by this test shall be corrected by the MATD in accordance with the manufacturer's recommendations.

C. Water required for testing following completion of tank erection will be furnished by the owner. Disposal of water, if required, following testing is by the Owner. Labor and equipment necessary for hydrostatic tank testing shall be included in the contract price of the tank.

3.3 FIRST YEAR INSPECTION

A. On or near the (1) year anniversary date of initial tank use (but not more than (14) months from date of delivery of tank materials to job site), the MATD shall make a visual inspection of the tank interior coating and appurtenances, tank exterior coating and appurtenances, and the immediate area surrounding the tank for evidence of leakage. A written summary of the inspection report will be filed with the tank owner and the tank manufacturer.

B. Water required for the inspection process will be furnished and disposed of by the Owner.

END OF SECTION

Revised 1-10-2020

SECTION 33123

WATER BOOSTER PUMP STATION

Above Ground Pumping Station with Modular Building

The contractor shall furnish and install a factory designed and assembled automatic water booster station with all necessary pumps, internal valves, piping, electrical controls and accessories as shown on the plans and specified herein.

The station shall be complete with all needed equipment factory installed on a fabricated steel base and enclosed in an insulated modular steel building. Station shall be as manufactured by USEMCO, Inc., Tomah, Wisconsin, and represented by Reiner Pump Systems, Inc., Stanhope, NJ, or approved equal. Proposed equal equipment must be submitted to the engineer at least 15 days prior to bid. Submittals must include data on all equipment included in the station along with a drawing showing the proposed station. Proposed equal equipment not submitted 15 days prior to the bid date will not be considered.

To insure total quality control, the complete unit will be designed, fabricated, assembled and tested in-house by the station manufacturer. The complete pump station will be UL listed under 'QCZJ - Packaged Pumping Systems'.

Constant Pressure with Variable Speed Motor

The booster pump station is to provide water service to a closed distribution system at a constant pressure. Two service pumps, each sized for the normal peak flow conditions, are provided. The pumps alternate at the end of each cycle and the back-up pump will also operate with the duty pump during periods of unusually high consumption. System pressure is controlled by varying the speed in direct ratio to the discharge pressure.

The centrifugal pumps and motors shall be suitable for operating under the following design conditions: (minimum suction pressure_____ PSI)

Pump No.	GPM	TDH	HP	RPM	EFF
1	_26__	_104_	_2__	_3560_	_50_
2	_26__	_104_	_2__	_3560_	_50_

The pump motors shall be of the type specified and shall be suitable for 460 volt, 3 phase, 60 hertz, 3 wire electrical service.

Equipment Base

The equipment chamber's common base shall be fabricated from a minimum 3/8" structural grade steel plate, reinforced with adequate sized steel channels to prevent deflection due to equipment weight and stresses imposed from lifting and setting of equipment.

Bolt on lifting eyes shall be placed about the perimeter of the equipment base to facilitate lifting and handling of the station. The lifting eyes shall be easily removable after the station has been set in place.

The steel plate and structural employed in the base shall meet or exceed the requirement of ASTM-A36.

12.4 Equipment Building

The booster pump station will be complete with a factory assembled modular building affixed to the steel equipment base supporting the booster pumps as shown on the plans. The completed booster station shall be one piece when delivered and require only off loading, installation on the prescribed foundation slab, pipe line hook up and electrical service to complete the installation. **Field erected buildings or buildings using steel C studs as wall framing members and C joists as roof trusses will not be acceptable.**

The polyurethane foam core shall be classified by Underwriters Laboratories as having flame spread of 25 or lower and smoke generation of less than 450 when tested in accordance with UL Standard 723 (ASTM Standard E-84).

All sidewall and ceiling panels shall consist of interior and exterior metal skins formed with steel dies and roll-forming equipment and checked with gauges for uniformity and accuracy. The panel shall be furnished with an embossed finish pressed into the galvanized steel panel. Polyurethane shall be foamed-in-place (poured, not frothed) and, when completely heat-cured, shall bond to the metal skins to form a rigid 4" thick insulated panel. Overall coefficient of heat transfer ("U" factor) shall be a minimum of .033 (R-30) for 4" thick walls. Wood reinforcement shall be placed inside the wall and ceiling panels where required to support the station equipment loads. Any wood reinforcement in a wall and ceiling panel shall be totally enclosed within the panel and cladded with the exterior and or interior metal skins. To ensure tight joints, panel edges must have foamed-in-place tongues and grooves with a flexible vinyl gasket also foamed-in-place on the interior and exterior of all tongue edges.

Panels shall be equipped with cam lock joining devices. The distance between locks shall not exceed 46". Each locking device shall consist of a cam-action, hooked locking arm placed in one panel, and a steel rod positioned in the adjoining panel, so that when the locking arm is rotated, the hook engages over the rod and draws the panel tightly together with cam action. The locking arms and steel rods shall be housed in individual steel pockets set into the panel. Press fit caps shall be provided to close lock wrench holes. A cam lock wrench shall be supplied with the building.

Exterior of building shall be a minimum of .018 (26 ga.) thick galvanized steel panel, protected by a spray and baked tan color polyester protective coating.

Interior of building shall be a minimum of .018" (26 ga.) thick galvanized steel panel, protected by a spray and baked white color polyester protective coating. The use of FRP (fiberglass reinforced plastic) sheeting attached to plywood sheets as an interior finish is not acceptable. FRP sheeting may be applied over the galvanized steel panel in chemical feed rooms only.

Hinged entrance door shall be a steel commercial type, insulated hollow core. Matching metal jambs shall be furnished to fit prefab panels without the use of any interior framing. Jamb members shall attach to panels with sheet metal screws. The door shall be supplied with weather-stripping and a wiper gasket. Entrance opening shall be a minimum 36" x 78" clear opening size. Hardware for doors shall be cylindrical lockset with satin stainless-steel finish. Each door shall have three tamper-proof pinned butt hinges. All doors for outdoor structures shall be supplied with a metal shield above the door to divert rain and snow from the door opening. An extruded aluminum sillplate shall be provided on outdoor buildings.

The ceiling panels shall be covered by a pitched truss roof with stone coated metal roofing shingles. The roof shall be a gable end type, 3:12 minimum pitch with 12" overhang on all sides. Roof peak is to run parallel to the station longest dimension. Mounting strips to be installed in modular building for mounting of the roof trusses. Trusses to be spaced on a maximum of 24" centers, covered with exterior grade plywood, 30# underlayment and covered with 26-gauge steel Tilcor CF shingles. The panels shall be as manufactured by McElroy metals.

Lifting Device

A spreader bar type lifting device, built to lift the modular building from each corner of deck structure without impinging the lifting chain/cables on the modular building sidewalls, shall be provided by the installing contractor.

Welding

All welding shall be in accordance with standard AWS practices, with proper fillet section and continuity to assure a sound, watertight structure. All welds shall be sound and free from embedded scale or slag, shall have tensile strength across the weld not less than that of the thinner of the connected sections, and shall be watertight. Butt welds shall be used for all welded joints in line pipe assemblies. Fillet welds shall be used for flange attachment in accordance with AWWA C207. All welds in contact with soil or water shall be tested with a dye penetrant to assure the watertight integrity of the weld system. All pipe and fittings shall be welded by welders certified for ASME type IX pipe welding.

Protective Coating

All mill scale, rust, weld flux and other foreign matter shall be removed from all steel surfaces by steel shotblasting to SSPC SP-10 specification for near-white blast cleaning. Surface irregularities shall be removed by grinding.

Steel and cast/ductile iron surfaces surfaces shall receive a minimum of two coats of hi-build epoxy coating. The coating material shall show excellent resistance to immersion in seawater as well as to splash or spillage of water, petroleum products, and salt solutions. The surfaces shall receive two coats a minimum of 3 mils each to a total of 6 mils dry.

Piping interior shall have a fusion bonded epoxy coating applied after shotblasting. The coating shall meet AWWA C-213 standards and be applied to a minimum thickness of 12 mils.

Paint touch-up kits shall be provided with the station for coating areas damaged in shipping.

The floor in all working areas within the station shall be protected with heavy neoprene matting.

Multi-Stage Centrifugal Pumps

The pump end shall be of the vertical multi-stage design with the motor mounted directly to the top of the pump. The pump models shall be furnished as shown on the plans and installed in accordance with the recommendations of the manufacturer.

The pump suction/discharge chamber, motor stool and pump shaft coupling shall be constructed of cast iron. The impellers, pump shaft, diffuser chambers, outer discharge sleeve, and impeller seal ring or seal ring retainers shall be constructed of stainless steel. The impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement. Intermediate and lower shaft bearings shall be tungsten carbide and ceramic. Pumps shall be equipped with a high temperature mechanical seal assembly with tungsten carbide seal faces mounted in stainless steel seal components.

The pump motor shall be sized to insure the pump is non-overloading when operating on the specified pump curve. The motor shall be of the horsepower, voltage, phase and cycle as shown on the drawings. Motor design shall be of the open drip proof with a NEMA C face design operating at a nominal 3500 RPM with a minimum service factor of 1.15. Lower motor bearings shall be adequately sized to insure long motor life.

SECTION 33123

WATER BOOSTER PUMP STATION

Pipe & Fittings

All internal transmission piping and fittings shall be of schedule 40 black, seamless steel pipe and will be manufactured in accordance with the dimensional tolerances and material specifications of the AWWA C-200-75 for steel pipe and steel butt-welded fittings.

All piping shall be sized as shown on the plans.

Compression Couplings

Compression couplings, where shown on the drawings, shall consist of steel sleeves with compression gaskets and followers. Couplings will be bolted style for over 2" and threaded style for 2" and less.

Ball Valves

Ball valves shall be of the one-piece design with bronze body, bronze trim, TFE seat, threaded ends and lever operator. Valves shall be Nibco Model T-560-BR-Y-20 and shall be sized and installed as shown on the plans.

Silent Check Valves

Each pump discharge piping shall include a threaded style, non-slam check valve, sized as shown on the plans. The valve body shall be of cast iron construction, bronze plug, seat and guide bushings with stainless steel valve spring and seat retainer. The valve plug shall be guided at both ends by a center shaft integral with the valve plug. Alignment of the center shaft shall be provided through the usage of guide bushings. The check valve shall be designed to prevent water hammer by returning the valve plug to the seat before reversal of flow occurs.

Hydropneumatic Bladder Tank

A hydropneumatic tank with a replaceable bladder shall be supplied with the station. The tank shall be ASME coded and stamped. Internal bladder shall be heavy duty butyl rubber. Tank exterior shall be painted with red oxide primer and finish coat. Pressure rating shall be 125 PSI and volume of 53 gallons.

Pressure Gauges

Pressure gauges shall be provided to indicate suction and discharge pressure and shall be wall mounted on a steel plate as near to the pressure source as possible. The gauges shall have 4 1/2 inch minimum diameter faces with molded black phenolic case, turret type with snap ring face mounting. The gauge internal construction shall include phosphor bronze

bourdon tube with bronze movement. The gauges shall have 1/4" N.P.T. bottom connections, flexible sensing lines, bronze snubbers and needle valves.
Pressure gauge ranges shall be as follows:

Suction Pressure: _____ to _____ PSI.
Discharge Pressure: _____ to _____ PSI.

Electrical Control System

The electrical control system shall be assembled into a NEMA I enclosure fabricated of 14 gauge steel. Clear space shall be provided in front of the panel to adequately meet the requirement of Article 110-16 of the National Electrical Code in regard to working space.

The control panel shall be constructed in compliance with Underwriter's Laboratories Industrial Control Panels listing and follow-up service, utilizing UL listed recognized components where applicable. The control panel shall bear a UL 508 serialized label.

Properly sized, UL listed, molded case circuit breakers shall be provided for each pump motor and the lighting distribution interior.

Panel Mount Load Center

As part of the water booster control panel, an electrical distribution center consisting of thermal magnetic circuit breakers with a capacity of 15 amps, shall be provided for each branch circuit including the following:

Control
Dehumidifiers
Blowers
Heaters
Convenience Receptacle
Lighting

The circuit breakers shall indicate when the circuit is open and shall have means provided for manual switching. All breakers shall be labeled as to function with permanently attached phenolic nameplates.

Lighting Panel Transformer

A properly sized transformer shall be provided to supply 240/120 volt, single phase power for the lighting panel. The transformer shall be a 7.5 KVA, dry type, wall-mounted transformer UL listed for indoor use.

SECTION 33123

WATER BOOSTER PUMP STATION

Variable Frequency Drive

Quality Assurance

A. The manufacturer of the VFD shall be a certified ISO 9001 and ISO 14000 facility.
B. The VFD, including its internal electronic thermal overload protection circuit, shall be UL and cUL Listed in accordance to UL 508C - Power Conversion Equipment.
C. UL / cUL labels shall be attached on the outside of each VFD as verification.
D. The VFD shall be designed in accordance with NEMA, IEC, EN, UL and CSA standards.
E. The VFD manufacturer shall have 20 years of experience, minimum, in the design, construction and application of variable frequency drives.
F. The VFD manufacturer shall have an existing service organization.
G. The manufacturer of the VFD shall have the ability to design and manufacture insulated gate bipolar transistors (IGBT) to be incorporated into the construction of the VFD.
H. The manufacturer of the VFD shall have the ability to evaluate any component failure at their own analysis lab. The services available shall include x-ray magnification of components, complete electrical testing, and the ability to analyze failures within the components.

General Description

A. The VFD shall convert the input AC mains power to an adjustable frequency and adjustable voltage as defined in the following sections.
B. The input power section shall utilize a full wave 6-pulse bridge design incorporating diode rectifiers. The diode rectifiers shall convert AC line power of fixed voltage and frequency to fixed DC voltage. This power section shall be insensitive to phase sequence of the AC line voltage.
C. The DC bus shall have external connections for external braking and allow for customer common DC Bus for multiple drive regeneration.
D. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize insulated gate bipolar transistors (IGBT's).

Construction

A. The VFD shall be rated UL Type 1 and shall be UL Listed as a plenum rated VFD.
B. The VFD shall employ built-in RS-485 communication via an RJ45 connection or terminal block.
C. The VFD shall employ built-in Modbus-RTU communication via a terminal block connection.
D. The VFD shall employ a standard control panel with built-in parameter copy functionality.
E. The VFD shall utilize one (1) connector slots for internally mounting plug-in options.
F. The VFD shall employ a removable control terminal block.
G. The VFD shall employ sink/source selectable control logic.
H. The VFD shall employ modular cooling fans – no tools required to exchange (up to 75Hp).
I. The VFD shall include a standard DC link reactor for ratings 100Hp and above.

SECTION 33123

WATER BOOSTER PUMP STATION

Application Data

A. The VFD shall be sized to operate a Variable Torque load.
B. The speed range shall be from a minimum speed of 0.5 Hertz to a maximum speed of 400Hertz.

Environmental Ratings

A. The VFD shall be designed to operate in the following Ambient Temperature range: Non-freezing.
    a) Variable Torque and Constant Torque loads: –10C to +50C (14 to 122F).
B. The storage temperature shall be –20C to +65C (-4 to 149F), non-condensing. Applicable for short periods, such as during transit.
C. The maximum relative humidity shall be 90% at 50C (122F), non-condensing.
D. The VFD shall be rated to operate at altitudes less than or equal to 1000m (3280ft). For altitudes above 1000m (3280ft):
    a) Sizes up to 75Hp: Reduce the rated output current (Amperes) by 3% for every 500m (1640ft), up to 2500m (8200ft) maximum (91% of rated).
    b) Sizes 100Hp and larger: Reduce the rated output current (Amperes) by 2% for every 500m (1640ft), up to 3000m (9842ft) maximum (92% of rated).
    c) Consult factory for higher altitudes.
E. The VFD shall be designed according to IEC 60068-2-6 to resist vibration.

VFD Ratings

A. The VFD shall be designed for operation with the following input voltages.
    a) FR-F720, 1Hp to 75Hp: 170-242Vac 50HZ, 170-264Vac 60Hz, 200-240Vac (+10%/-15%).
    b) FR-F740, 1Hp to 800Hp: 323-528Vac 50/60Hz, 380-480Vac (+10%/-15%).
B. The speed range shall be from a minimum of 0.5 Hz to a maximum of 400Hz, adjustable by increments of 0.01Hz. Operation above 60Hz shall require programming changes to avoid over speeding the application.
C. The input voltage frequency range shall be 47.5 to 63 Hz.
D. The displacement power factor shall not be less than 0.93 with optional DC line reactor at 100% load factor. (DC reactor included as standard for VFD's 100HP and above.)
E. The efficiency of the VFD at 100% speed and load shall not be less than 95%.
F. The VFD shall conform to the European Union ElectroMagnetic Compatibility directive, CE labeled. The VFD shall meet product standard EN61800-3 for Second (2^{nd}) Environmental.
G. Frequency precision shall not be less than:
    a) Using analog input: Within +/- 0.2% of maximum output frequency. (25C +/-10C)
    b) Using digital input: Within +/- 0.01% of set output frequency.
H. The Over-current capacity shall be:
    a) Variable torque (LD): 120% for 1 min or 150% for 3sec, at 50C (continuous).
    b) Variable torque (SLD): 110% for 1 min or 120% for 3sec, at 40C (continuous).
I. The VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency.

J. The Speed Control Range shall be:
   a) 20:1 while running between 3 and 60 Hz.

Protection

A. The VFD shall be UL 508C Listed for use on distribution systems with 65kArms available fault current, based upon the UL short-circuit test.
B. Upon power-up and before operational control is allowed to begin, the VFD shall check for valid operation of memory, pre-charge circuit, fan operation, and option board communication.
C. The VFD shall be protected against short circuits between the output phases & ground and the logic & analog outputs.
D. Once operational, monitoring shall continually take place and an abnormality will result in an alarm.
E. The following Circuit protection shall be allowed:
   a) The VFD shall be rated for use with the appropriate UL class fuse.
   b) Alternately, circuit breakers may be used, provided that they are listed or certified by an accredited electrical testing laboratory such as Underwriters Laboratories.
F. For a fault condition other than an internal fault, an auto restart function shall provide up to 10 programmable restart attempts. The programmable time delay before each restart shall range from 0 to 10 seconds.
G. The deceleration ramp of the VFD shall be programmable for normal and fault conditions. Stop modes shall include: dc injection braking, controlled deceleration to stop and coast to stop.
H. Upon loss of the analog speed reference signal:
   a) The VFD shall follow the programmed deceleration ramp to a controlled stop.
   b) Hold the VFD speed based upon the last good value and trigger a warning alarm.
I. The VFD shall have solid state I^2t protection that is evaluated in accordance with UL 508C. The minimum adjustment range shall be from 0 to 150% of the current output of the VFD.
J. The VFD shall include Metal Oxide Varistors (MOVs) wired to the incoming AC terminals.
K. STOP key on the keypad shall be functional at all time, drive mode insensitive.
L. The VFD shall be insensitive to input power phase sequence.
M. The VFD shall include 3 skip frequency ranges that can each be programmed with a selectable bandwidth of the user's choice. The skip frequencies shall allow independent programming for back-to-back or overlap.
N. The output frequency shall be parameter setting enabled to fold back when the motor is overloaded.
O. The VFD shall monitor the main circuit capacitors, control circuit capacitor, in-rush suppression circuit, and cooling fan and shall provide a pre-alarm so that maintenance can be scheduled.
P. The VFD shall include an output timer function so that peripheral equipment maintenance can be scheduled.
Q. The VFD shall include parameter selectable input and output phase loss protection.
R. The VFD basic insulation level shall be tested based upon ANSI/IEEE C62.41-1999.

Adjustments and Configurations

A. The VFD shall be factory pre-set to operate most common applications.
B. Choice of four (4) types of acceleration and deceleration patterns shall be available: linear, S-curve shaped – two types, and backlash compensated.
C. The acceleration and deceleration ramps shall be individually adjustable from 0.00 to 3600 seconds.
D. The volts per hertz ratios shall be user selectable.
E. The VFD shall store the last eight (8) alarm faults and data at time of fault. The data shall include output frequency, output current, output voltage and VFD operation time at fault occurrence.
F. The VFD shall have user programmable DC injection braking to stop the motor's rotation. DC injection braking voltage is adjustable between 0 to 30% and up to 10 seconds of continuous operation.
G. Cooling fan control shall be selectable: Operates continuously during run operation, and dependent upon temperature at stop.
H. The VFD shall have adjustable accel/decel ramp profiles.
I. The VFD shall have the ability to start into a reverse rotating motor (anti-windmill) and achieve the set speed.
J. The VFD shall have two (2) different selectable settings for accel/decel times, torque boost, base frequency, stall prevention frequency and current, and output frequency detection functions.
K. The VFD shall have coast to stop functionality by parameter setting.
L. The VFD shall automatically compute the motor's slip compensation.
M. The VFD shall be able to limit motor rotation to only one direction.
N. The VFD shall have two (2) output current detection functions which are able to trigger individual alarms.
    a) Zero current detection level.
    b) High output current detection.
O. The VFD shall include two (2) parameters for user entry. (Unit or machine number, install date).

Operational Features

A. The VFD shall allow the motor to be switched in sequence to line power when operating at the base frequency.
B. The VFD shall be able to start into a rotating motor (any speed or direction) and accelerate (decelerate) to set speed without tripping or component loss.
C. There shall be a regenerative avoidance function to minimize the effect of opposite rotation of another fan within the same duct.
D. The VFD shall allow for automatic optimization of the VFD output, during accel/decal and constant speed, characteristic based upon the application and load.
E. The VFD shall incorporate PID control for process controls such as flow rate, air volume, or pressure.
    a) The VFD shall include programmable PID shutoff for energy savings in low speed region. (PID sleep)
    b) The VFD shall include the capability to monitor values of PID setpoint, process value, and deviation.

c) The VFD shall include PID forward/reverse operation switchover by external signal.

F. The VFD shall allow for controlled deceleration to stop following an input power loss.
G. The VFD shall included automatic pump sequencing, which will allow the VFD to sequence up to 4 pumps across the line without additional controllers or software.
H. The VFD shall contain three (3) skip frequency ranges that can be programmed within a selectable range of 0-400Hz with a minimum bandwidth of 0.01Hz. Each skip range shall be independently programmable.
I. The VFD shall be able to perform bi-direction rotation following a –10 to +10Vdc input.
J. The VFD shall be able to run for at set hold time at the start frequency to smooth motor start.
K. Communication options include:
   a) RS-485 (standard).
   b) Modbus RTU.
   c) LonWorks™
   d) CC-Link
   e) Profibus DP
   f) *Device*Net™
   g) Metasys-N2
L. The VFD output signals shall be able to be utilized in lieu of a remote output terminal of a programmable logic controller when the VFD is being controlled via RS 485 or network.

Operator Interface

A. Six (6) key Control Panel, with setting dial, shall be mounted on each drive and shall be removable & interchangeable regardless of the Hp rating. The customer control shall include the following functionality.
   a) Furnished with each VFD as standard.
   b) Batch parameter read, copy and verification functionality.
   c) Four (4) digit numerical display.
   d) Standard RS-485 communication through a RJ 45 port.
   e) Allows direct access for parameter changes.
   f) Includes an electronic parameter write disable feature.
   g) Stores/displays last four (4) alarm faults and data at time of fault. The data shall include output frequency, output current, output voltage and VFD operation time at fault occurrence.
   h) Forward, Reverse and Stop keys command normal starting and stopping as programmed when the VFD is in keypad control mode.
   i) Display of I/O and output terminal ON/OFF states.
   j) STOP key is functional at all time, drive mode insensitive.
   k) Can be mounted at a distance of 20 meters from the VFD.

B. Twenty-four (24) key parameter unit shall be available as an optional accessory and shall be removable & interchangeable regardless of the Hp rating. The customer control shall include the following functionality.
   a) Batch parameter read, copy and verification functionality.
   b) Standard RS-485 communication through a RJ 45 port.
   c) Alpha numeric LCD display.

- 4 Lines x 16 characters.
- Adjustable LCD contrast.

d) Includes a parameter write disable feature.
e) Stores last eight (8) alarm faults and operation data (frequency, voltage, current, and VFD run time) at time of fault occurrence.
f) Forward, Reverse and Stop keys command normal starting and stopping as programmed when the VFD is in keypad control mode.
g) STOP key is functional at all time, drive mode insensitive.
h) Can be mounted at a distance of 20 meters from the VFD.
i) Eight (8) languages available selectable among English, Japanese, German, French, Spanish, Italian, Swedish and Finnish.
j) Allows direct access for parameter changes individually, by function set and by user selected groups. Parameters can be listed by definition, factory default setting, or user changed values.
k) Calibration of frequency meter or bias/gain settings.
l) Arrow keys shall provide the ability to scroll through menus and screen, select or activate functions or change the value of a selected parameter.
m) HELP functionality shall include the following:
    1) Monitoring of data: Running frequency, motor current, output voltage, set frequency, running speed (RPM), DC bus voltage, over-current load %, peak output current, peak dc bus voltage, input & output power used (kW), input and output signal state (ON or OFF).
    2) Stores/displays last eight (8) alarm faults and data at time of fault. The data shall include output frequency, output current, output voltage and VFD operation time at fault occurrence.
    3) Troubleshooting hints shall reference alarm definitions in plain English and point to applicable parameter settings.
    4) Display of installed options and software version shall be available.

C. Computer interface via RS-485 option
a) An optional VFD Software program shall be available which supports serial communication between a PC and network of 1 to 32 variable frequency drives (VFD's) through the Parameter Unit ports.
Capabilities include:
- Edit drive parameters, transfer settings to and from the drive, and save them to disk
- Monitoring of I/O, analog outputs, and VFD status using a variety of available displays
- Diagnostics
- Help screens that include detailed parameter descriptions
- Access to parameters grouped by function (for example, all parameters related to accel / decel, braking, or options).

SECTION 33123

WATER BOOSTER PUMP STATION

Control

A. The control power for the digital inputs and outputs shall be 24Vdc, selectable to sink or source. Optional 120Vac control power for the digital inputs and outputs shall be available.
B. All logic connections shall be furnished on a removable terminal strip.
C. External devices shall be able to be connected to the terminal strip for starting/stopping the VFD, speed control and indicating operation status.
D. Speed command input shall be by means of:
   a) Keypad.
   b) Analog input.
   c) Serial communications.
   d) Floating point input shall accept a three-wire input
   e) There shall be three (3) parameter assignable analog inputs.
   a) The selection consists of the following configurations: 0-5Vdc, 0-10Vdc, 4-20mA dc, -5 to +5 Vdc, and –10 to +10 Vdc.
   b) Two (2) terminals shall be selectable for either voltage or current reference input.
   c) Combinations of the above speed references can be selected and be switched via remote terminal.
F. There shall be twelve (12) logic inputs that are parameter assignable.
   a) The selection consists of PTC, 15 preset speeds (up to four inputs), second functions, jog, current input selection, auto restart, external thermal relay, PID control, Advanced PID control to allow motor sequencing, PU to external switch-over.
   b) Optional 3-digit BCD or 12-bit binary input terminals (3) shall be available as relay contact or open collector signals.
G. Output signals shall consist of:
   a. Five (5) open collector outputs shall be available, which are parameter assignable and are optically isolated.
      1) Can be selected for positive or negative logic.
      2) The selection of assignments shall consist of: Running, Up to speed, Power failure/Under-voltage, Overload, Output frequency detection (first & second), Electronic over-current pre-alarm, PU mode, Inverter ready, Zero current detection, PID upper limit, PID lower limit, PID reverse rotation output, Commercial power supply switch over (MC1-MC3), Fan fault, Fin (heatsink) overheat pre-alarm, Power savings, Minor and Major fault outputs as standard selections.
      3) The VFD's output terminals shall allow control through network commands.
      4) Optional relay output contact signals (3) shall be available and selectable.
      5) Optional digital outputs (5) shall be available and selectable through open collector terminals.
   b. Pulse or Analog output signal shall be selectable in the form of either:
      1) Analog output signal, 4-20mAdc.
      2) Analog output signal, 0-10Vdc
   c. Two (2) Form (C) relay outputs with selectable Normally Open or Normally Closed alarm outputs shall be available.
      1) Alarm terminals shall be individually parameter assignable.

Braking

A. The VFD shall provide terminals for adding an external braking unit to allow for dissipation of excessive electrical energy from the motor.
B. The following shall be available:
   a) DC dynamic braking – Including adjustable operation frequency, time and voltage.
   b) External line regeneration.
   c) Can be used for common bus systems for multiple drive regeneration.

Drive Operation

With the H-O-A switch in the "HAND" position, the drive shall be controlled by the manual speed potentiometer on the drive door.

With the H-O-A switch in "AUTOMATIC", the drive shall start from the automatic pump controller and its speed shall be controlled by a 4-20mA signal from this controller.

With the H-O-A switch in the "OFF" position, the run circuit will be open and the VFD will not operate.

H2PrO **™ Programmable Logic Controller - Variable Speed**

The **H2PrO ™** control system described hereinafter is a system as manufactured by USEMCO Inc., Tomah, Wisconsin. The naming of a manufacturer of equipment in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment, but is to establish a standard of excellence for the material used, and to indicate a principle of operation desired.

System Coordination And Single Source Responsibility

The equipment provided shall be a completely integrated microprocessor based automatic control and monitoring system consisting of the required controller, power equipment, motor starters, pressure/flow and alarm monitoring equipment in a factory wired and tested assembly. The automatic control and alarm/monitoring system components shall be standard, catalogued, stocked products of the system supplier to assure one source responsibility, immediately available spare/replacement parts, proper system interconnections and reliable long term operation.

SECTION 33123

WATER BOOSTER PUMP STATION

USEMCO H2pro ™ Pump Controller

The control system shall utilize standard "off the shelf" equipment. Job specific, "one-of-a-kind" customized software and hardware components will not be accepted. A standard system is defined, as one, which has published literature, is available at time of bid, with fully tested hardware and software, such that no development must be done beyond system configuration.

The equipment shall be protected from transient voltages and surges induced into the signal lines. The contractor shall provide a permanent earth ground connection to the panel ground lug in order to insure proper operation of transient protectors.

A microprocessor-based automatic pump and alarm control system shall be provided for each booster pumping station incorporating an industrial-grade, 16-bit CMOS microcomputer and associated elements suitable for achieving performance as hereinafter described. The controller will incorporate the following:

-Internal diagnostics.
-Real time clock calendar.
-Floating-point math.
-Battery back up.
-Non-proprietary RTU communication.
-(4) PID loops.

The system shall incorporate UL 508 Industrial Control Panel approved elements as required of all components of these project panels and be furnished with all necessary hardware and software to accomplish level-responsive pump and alarm operation with software specifically suited to this project.

All of the discrete I/O circuitry of the computer-based system shall be built to the IEEE 472 (1974) Surge Withstand Capability Standards. The automatic pump and alarm control system computer shall be the standard product of the control system manufacturer and specifically suited for this type of industrial control panel service. All job connections shall be a UL recognized clamp type barriered screw terminals accepting up to two AWG 14 conductors per terminal.

The variable speed drive equipment shall be programmed to respond to variations in the discharge pressure and/or flow in a manner wherein the hydraulic requirement will be accommodated in the pumping program using simple menu-related operator interface routines.

Upon power-up, the Controller shall go through a timing routing, which allows the analog signal and display to stabilize before any control, or alarm outputs are enabled. After the

stabilization period, the control circuits of the Controller shall be sequentially enabled on a time-step arrangement.

In addition to the time delay upon power-up, the differential-level control circuits shall each be forced to an off condition upon power up so that a pressure and/or flow excursion will need to go past their turn-on elevation for them to operate.

An alternator shall operate the pumps in a First-on/First-off (FOFO) sequence and can be configured to sequence the pumps every start, every 24 hours, on the lowest run time or manually.

The alternator shall be capable of accepting pump failure and/or advance inputs and shall automatically transfer to the next pump sequence when failure condition is sensed.

The alternator shall provide automatic transposing of the operating sequence of the control relays for the pumps on successive starts. The FOFO alternator sequencing shall operate such that the next load turned on is always the one that has had the longest opportunity to rest since its last operation.

It is the specific intention of this functional requirement that a standard programmable logic controller will be employed with features as herein described and be a fully integrated assembly. That is, the furnishing of similar functions using a proprietary controller with custom software, a multiplicity of set points, modules or extensive relay-timer logic to accomplish control sequences, etc., is specifically precluded by this specification and will not be acceptable.

Microprocessor based, programmable controller and operator interface shall provide all of the above controls and operations.

The automatic pump and alarm control shall employ a backlit LCD operator interface having a 320 x 240 pixel eight color display with touch screen. The operator interface shall be IEC standard IP65F rated. The display also must support bar graphs or analog meters for wetwell levels, VFD #1, #2, #3 speed indication. Operator interface must support screen scrolling and three levels of password protection. The interface must support a printer port.

A Configuration and Operations Manual will be included for the pump controller. The Manual shall include the following information as a minimum:

-How to view and change between the various displays.
-How to configure the controller.
-How to display alarms.
-How to display statuses.
-Analog control set point adjustment.
-Analog alarm set point adjustment.

-How to view and reset pump run times.
-How to view and reset pump start counters.
-Security Password usage.
-An example of programming values.
-Adjustment of the real-time calendar/clock.
-A listing of values programmed at the factory.
-A worksheet for entering the values programmed in the field.

The intent of the specification is that a standard controller be provided, with standard documentation. A custom written Description of Operation is not acceptable.

Controller Configuration

The pump controller operates via a discharge pressure transmitter and shall be capable of being configured at the factory or jobsite to perform operating functions as described below. All configurations are password protected and shall be provided as a minimum as follows:

-Duplex Pump operation.
-Flow Sensor (4-20mA or Pulse Input).
-Suction Transmitter and Pressure Switch.
-Clock hours (0-23) and minutes (0-59).
-Calendar day of week (0-6 for Monday - Sunday).
-Minimum 1 Pump Speed.
-Minimum 2 Pump Speed.
-Maximum 1 Pump Speed.
-Maximum 2 Pump Speed.
-Discharge transducer rating (5-300 PSI).
-Alternate service pumps every 24 hours.
-Suction transducer rating (5-150 PSI).
-Flow meter rating (5-6999 GPM).
-Sequence pumps via set points based on pressure.

The pump controller will include the field adjustable delay timers. All timer settings are password protected and shall be provided as follows:

-Pump 1 start fail delay (0-99 seconds).
-Pump 2 start fail delay (0-99 seconds).
-Lead pump start delay (0-99 seconds).
-Lag pump start delay (0-99 seconds).
-Lead pump stop delay (0-99 seconds).
-Lag pump stop delay (0-99 seconds).
-Minimum Lead pump run time (0-5 minutes).
-Minimum Lag pump run time (0-5 minutes).

-Delay between calls (0.1-9.9 minutes).
-Low suction on delay (0-5 minutes).
-Low suction reset (0-5 minutes).

The pump controller will include the field adjustable set points. Set points are password protected and provided as follows:

-Lead pump start pressure.
-Lead pump stop pressure.
-Lag pump start pressure. *
-Lag pump stop pressure.
-High-pressure alarm set point.
-Low-pressure alarm set point.
-Low suction pressure alarm.
-Low suction alarm reset.

Controller Test

A password-protected screen will be included to simulate the discharge and suction pressure and the flow rate. For each of these, the Up and Down arrows are used to select automatic increment, automatic decrement, or hold the reading. When the test screen is displayed, the simulate mode is turned on or off by pressing the 'Toggle On/Off' button. If none of the simulate controls are changed by the operator for a period of ten minutes, the simulate mode will be automatically turned off and normal operation will resume.

Sequence Selection

The controller will allow the operator to select an alternating sequence for the normal service pumps. Depending upon the configuration of the controller, it will allow alternating or fixed sequence of duplex or triplex systems.

Alarm Messages

In the event of an alarm condition the operator interface will display an alarm message. Press the 'Alarm Ack' button to acknowledge the alarm and 'Alarm Reset' button to clear the alarm. The following list of alarms shall be provided:

FLOW AND SUCTION SWITCH OVERLAP message occurs when both a suction pressure switch and no flow switch has been factory configured for the system. Since the devices use the same digital input, one of the devices must be disabled.
SETPOINT OVERLAP CHECK THE SETTINGS message occurs when the controller has detected inconsistencies in the on and off set points between the service pump and third pump configured.

COMMUNICATION FAULT WITH REMOTE STATION message occurs when the remote discharge sensor configuration is enabled and the controller detects a communication problem.

LOW SUCTION ALARM message occurs when either the suction pressure switch goes active or the suction pressure falls below the low suction pressure set point for the alarm delay period. When this alarm occurs, the pumps will be turned off during the low suction condition (one factory configuration allows a high capacity pump to continue to run in spite of the low suction condition). This event will also activate the assigned low suction alarm telemetry contact.

HIGH DISCHARGE ALARM FLOW IS XXXX message occurs when the discharge pressure reaches the high discharge pressure alarm set point. At the time of the fault, the flow rate is saved and displayed on the alarm screen. This flow rate will be applicable when the flow control configuration is enabled. The pumps will be disabled, and will resume operation when the discharge pressure falls to the jockey or lead pump start set point (one factory configuration allows a high capacity pump to continue to run in spite of the high discharge condition). This event will also activate the assigned high discharge alarm telemetry contact.

LOW DISCHARGE ALARM message occurs when the discharge pressure falls below the low pressure alarm set point.

PUMP 1 FAULT ALARM message occurs when the assigned pump 1 fault digital input goes active. This event will also activate the assigned normal service pump fail telemetry contact.

PUMP 1 START FAIL ALARM message occurs when the assigned pump 1 run signal does not go active with the activation of the associated pump call relay. This event will also activate the assigned normal service pump fail telemetry contact.

PUMP 2 FAULT ALARM message occurs when the assigned pump 2 fault digital input goes active. This event will also activate the assigned normal service pump fail telemetry contact.

PUMP 2 START FAIL ALARM message occurs when the assigned pump 2 run signal does not go active with the activation of the associated pump call relay. This event will also activate the assigned normal service pump fail telemetry contact.

PUMP 3 FAULT ALARM message occurs when the assigned pump 3 fault digital input goes active. This event will also activate the assigned pump 3 fail telemetry contact.

PUMP 3 START FAIL ALARM message occurs when the assigned pump 3 run signal does not go active with the activation of the associated pump call relay. This event will also activate the assigned pump 3 fail telemetry contact.

Telemetry

Provide the following contacts for future telemetry:

-Low Suction/No Flow.
-Pumps Failure.
-High Discharge Pressure.
-Common Alarm.

Shop Drawings

A complete set of drawings shall be supplied to insure successful installation and operation of the control system. The shop drawings shall consist of all of the following:

-Sufficient detail to evaluate compliance with these specifications.
-A detailed component list including manufacturer and catalog number.
-A custom-wiring diagram for this specific application to facilitate and insure accurate field connections to the control panel by electrical installation personnel.
-A description of operation for the control system.
-An enclosure dimension print.

Low Suction Pressure Cutout

A pressure switch shall be provided to shut down the pumps in the event of an operator determined low suction pressure. The pressure switch shall be the snap action type rated for 5 amps at 240 VAC and have an adjustable differential. Switch shall be mounted on the control panel.

Pressure Transmitter

Variable capacitance transmitters shall be provided for station inlet and discharge pressure. The transmitter shall provide a 4-20 mA signal to the programmable controller. The transmitter shall have adjustments for zero and span. The housing shall be welded 17-4 PH stainless steel and have the following performance specifications at a minimum: accuracy of ± 0.13% FS at constant temperature; non-repeatability 0.02% FS; ambient operating temperature -40°F to 260°F; EMI/RFI effect <1.0% FS @ 10 V/M.

Wiring

All wiring shall comply with the National Electric Code and applicable state and local codes. Wiring shall be completely factory installed except for the power lines that run to the control panel continuously from the external disconnect switch.

All wiring within the equipment chamber and outside the control panel shall be run in PVC rigid conduit except for the liquidtight metallic flexible conduit to connect the pump motors.

Accessory items such as the sump pump, dehumidifier, etc. with approved manufacturer's rubber cord may be plugged into polarized grounded outlets.

It shall be the responsibility of the local electrical contractor to furnish and install correctly sized service wires from the service pole outside the equipment chamber to the control panel. It shall also be the responsibility of the electrical contractor to furnish and install, if required, any exterior disconnects or switching mechanisms.

Lights

The equipment chamber shall be well lighted by 5 dual, 40 watt, rapid start fluorescent light fixtures with guards installed within the equipment chamber. An automatic and manual light switch shall be provided and shall be conveniently located at the top of the entrance tube.

Chlorination System

Space, and piping connections, shall be provided for a chlorination system to inject sodium hypochlorite solution. The system shall include two metering pumps with manually adjustable speed and stroke length to set the proportional feed rate. The pump shall be interlocked with the main pumps so that it will run when either pump is running. Pump shall be capable of supplying 15 gallons per day at a pressure of 125 PSI. Pump shall be LMI model A or equal. Also included shall be a bleed-four function valve, required piping and valves and injection nozzle. A 30 gallon polyethylene tank storage shall also be provided.

Generator

A natural gas driven generator shall be supplied for standby power. Generator shall be capable of continuous operation at 30 KW at 50°C. The output shall be 460 volts, 3 wire, 3 phase, and 60 Hz. Engine shall be 6 cylinder, 4 cycle and liquid cooled. Generator shall include the following: battery charger, coolant heater. A 70 amp automatic transfer switch shall be included with the generator. The generator shall be provided in a level 1 sound attenuated weatherproof enclosure.

Dehumidifiers

Packaged dehumidifier assemblies with hermetically sealed Freon refrigeration type compressor, expansion coil, fan and condenser coil shall be furnished to maintain the relative humidity of the air to prevent condensation on the walls. The dehumidifier shall be

controlled automatically by an adjustable humidistat located on the dehumidifier. A low-temperature thermostat shall be provided for the dehumidifier.

The dehumidifier shall be housed in a heavy steel enclosure and shall be floor mounted. The condensate shall be drained to the station drain.

The dehumidifier shall have a capacity of 24 pints per 24 hours at 80 degrees F and 60% relative humidity. The dehumidifier performance shall be as certified by the Association of Home Appliance Manufacturers.

Ventilation Systems

Ventilating systems shall be provided to maintain a fresh air system in the equipment chamber and chemical feed room. The exhaust blower shall be sized and rated to change the equipment chamber air 6 times per hour. The blower shall be of the centrifugal, squirrel cage design with statically balanced wheel to assure quiet performance and maximum air delivery. The blower shall be thermostatically controlled and shall also be provided with a automatic and a manual switch located near the door.

Heaters

The equipment chamber and chemical feed room shall be provided with a 3000-watt electric heater suitable for 240 volt, single-phase service. The heater shall be of the fan-forced, with fan delay, and complete with an integral, automatic, snap action thermostat. Fan motor is to be totally enclosed and impedance protected. The heater shall be wall mounted, with an 18-gauge steel grille surface-mounting frame. Heater shall be hard wired into the station electrical system.

Inspection and Test

Prior to assembly, all station components shall be inspected for quality and tested for proper function and freedom from defects. Upon completion, the station shall be connected to a test tank and an operational test performed under simulated field conditions while a final inspection is conducted. Any deficiencies or irregularities shall be corrected at the factory. Automatic controls shall be adjusted to approximate job requirements.

Initial Operation

After the job installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the

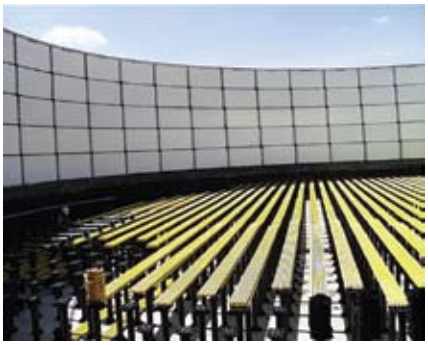
pump station and to instruct the owner's operating personnel in the operation and maintenance of the equipment. Four (4) copies of O and M manuals will be supplied to the owner prior to initial operation.

Guarantee

The manufacturer of the pump station shall guarantee for a period of one year from the date station is placed into operation or eighteen months from date of shipment, whichever occurs first, that the entire station and all equipment therein shall be free from defects in design, materials and workmanship. In the event a component fails or is proven defective during the guarantee period, the manufacturer will provide a replacement part without cost, upon return of the defective part. Normal use items, such as grease, light bulbs, mechanical seals, packing and belts are excluded.

APPENDIX E

Glass Fused-To-Steel Water Storage Tanks



STATEWIDE
AQUASTORE, Inc.

Topics

Introduction

The configuration and selection of a water storage tank is often something that needs to be done in the early stages of a project design. In order to apply for and secure funding that may be available, timing of construction and overall project costs will all play a factor in the determination. Because many municipalities have a single source of water storage, the tank design plays a critical role in meeting the current and future needs of the community and project.

Review of community demands for current and anticipated water supply, site conditions, pressure requirements, long term maintenance, ease of access and overall costs are only some of the critical details essential to the ultimate selection of the tank configuration.

There are three types of liquid storage tanks available that are considered for municipal water storage applications: Glass coated bolted steel, welded painted steel and concrete.

Tanks utilized in potable water systems are designed to AWWA (American Water Works Assoc.) standards. Tanks used in wastewater or landfill applications are designed to AISC (American Institute of Steel Construction) and fire storage tanks are typically designed to NFPA (National Fire Protection Association) standards.

The first edition of AWWA D100 for painted steel tanks was issued in 1941. The standard for bolted glass fused-to-steel AWWA D103 was issued 39 years later in 1980. Six years later AWWA issued the first edition for wire wound pre-stressed concrete tanks in 1986.

Manufacture & Erection

Application & History - Glass fused-to-steel tanks are used for a variety of liquid storage applications. Potable Water, Wastewater, Equalization, Sludge, Landfill Leachate, Brine, Trickling Filters, Sequential Batch Reactors (SBR), Frac Storage, Aerobic and Anerobic Digesters are just some of the many applications that can benefit from the use of this type of tank.

The process of fusing glass to steel has been in existence for well over 100 years and began in the beer brewing industry. In the late 1800's, the technology was used in the United States and in the 1940's the technology was applied to agriculture by A.O. Smith Harvestore Products, Inc. storing silage and manure. These types of tanks are known as Harvestores and Slurrystores respectively. There are tens of thousands of these structures dotting the countryside on local farms.

In the early 1970's, glass coated bolted steel tanks were recognized for their superior coating and quality and were introduced into the liquid storage market, where they dominate today.

Design & Configurations – Glass coated bolted steel tanks are used in a variety of configurations from

Manufacture & Erection (cont'd)

standpipes, reservoirs and most recently Composite Elevated (CET) designs. Standpipes are tanks where pressure is required to properly feed the system and the water is elevated in a tall column to achieve this. The tank height is larger than the tank diameter. The elevation of the water is accomplished by storing the required "water on top of water". Standpipe height usually does not exceed 140'.

Reservoirs are the most common configuration used in water storage. With this design, the tank diameter is larger than the tank is tall and these tanks can be used with a pumping system or by gravity. The diameter of these tanks can reach 250' with capacities up to 6 million gallons.

The CET design is used in applications similar to a standpipe, in that height is used to achieve the head pressure needed to properly operate the system. The CET column is constructed with jump form technology resulting in a hollow concrete pedestal on which the tank is then constructed. There is an enormous amount of structural rebar and steel embedded in the concrete with walls that can exceed 10" thick and a top cap of about 4' thick concrete.

The concrete pedestal interior offers plenty of space for pump stations, municipal maintenance equipment, office space and other uses. There are theoretically no height limitations for CET's and capacities are up to 1.5 million gallons.

The roof of glass bolted tanks varies depending upon the diameter, snow loads and other factors. They can be the same glass fused-to-steel material (Knuckle Design) as the tank or a free-span aluminum geodesic dome, consisting of panels mounted on a rigid structural frame (Geodesic Design).

The tank floors are usually constructed with a monolithic concrete pour or they can be glass fused-to-steel panels depending upon site and design conditions.

Advanced Technology – The unique manufacturing process of this equipment and advanced technology is what sets these tanks apart from typical painted steel or concrete structures. The tanks are constructed exclusively of United States materials and all of the manufacturing is completed in a U.S. plant (CST) in DeKalb, Illinois. CST Industries has the largest glass fused-to-steel tank manufacturing facility in the world. All critical manufacturing is completed in an ISO-9001 certified controlled environment. The high level of quality control ensures an exceptionally manufactured product. The uncontrolled variables, that exist for field manufactured products such as painted steel, and concrete tanks, are eliminated with the factory manufacturing. Adverse weather, extreme temperatures, worker experience & environmental conditions that are proven to have a significant effect to onsite manufactured products, have minimal effect on the glassing process. In addition, the tanks are easily erected year around as the manufacturing itself is completed in the factory and only the assembly of the components is required in the field.

Coating – Essentially all storage tanks have a coating. The coatings' available today consist of either concrete, paint or glass. The impermeability and unique features of the glass offer numerous advantages over the other choices.

The glass coating process begins with a glass frit that is mixed with other minerals and water to create a liquid slurry. This glass slurry is then robotically sprayed

at precise amounts and thicknesses onto previously cut and rolled, punched, grit blasted and cleaned steel panels. The panels are then run through a furnace at 1500° F. This high heat melts the silica glass slip into the surface of the grit blasted steel. This completes the mechanical bond as well as the chemical bond between the steel and the silica glass. Different coatings that are

Manufacture & Erection (cont'd)

available for other tanks rely on a mechanical bond of the coating to the underlying material. In addition to the mechanical bond, the glass fusing process also provides a chemical bond of the materials. This chemical bond strength is many times the holding strength of the conventional mechanical bond and prevents any undercutting of the coating which can allow spreading of corrosion on the primary steel material. This benefit can best be explained by imagining a scratch on an automobile. Because that coating has only a mechanical bond, if the steel is exposed, corrosion will begin to occur. Left untreated this corrosion will expand and creep beneath the surrounding painted surface and compromise the remaining coating. This is often witnessed with raised bubbles, spreading rust and weakened substrate. The chemical bond of the glass fused-to-steel coating prevents this spreading of corrosion in the event the coating was compromised.

Tank Erection – Erection of the glass fused-to-steel tank in the field encompasses a unique jacking system. Once the starter sheet (bottom ring) is either embedded into the concrete foundation or constructed utilizing a glass coated bolted steel floor design, the top ring of the tank is constructed on the jacks. The roof of the tank is then erected and the ring and roof are jacked up. Each additional ring is then assembled below the top ring by bolting the sheets together and applying a specially manufactured urethane sealant between the seams. All construction is completed at ground level ensuring a safe, fast and efficient

building environment. Tanks are normally completed within a week or two which saves significant costs to the owner if prevailing wages for onsite labor are being used. Additionally, the manufacturer requires that all building crews be factory trained and certified in the erection process, ensuring the same quality control in the field. Only fully trained erectors are used for the construction of these tanks.

Advantages

Maintenance Costs - There are numerous advantages of a glass fused-to-steel liquid storage tank when compared to either a painted steel or concrete tank design. One of the most powerful economic advantages is the fact that the glass coating never requires repainting, it is permanent. The dollars saved from not having to repaint a painted tank or repair aged concrete can be funneled to other projects in a municipality.

Flexibility - The bolted design and erection of this product yields flexibility that no other tank can offer. Because manufacturing is completed in a factory, large staging areas needed when a product is manufactured on site are eliminated. The erection of the tank can typically be completed with a cleared area of roughly 6 – 10' around the tank diameter. This reduced site clearing and leveling can save thousands of dollars on the overall project beyond the price of the tank itself. The panels themselves can be hand carried and assembled in tight locations when required, allowing this tank to be installed in many locations that would be impossible for other tank types. Additionally, a panel can easily be replaced in the event extra manways, nozzles or other components are req'd. Unlike a concrete or welded tank that would need to be torn down if the structure were compromised, this type of tank structure can essentially be considered permanent since any compromised panels can always be replaced.

Sustained Beauty – Another benefit of the glass fused-to-steel coating is the sustained appearance. Because the glass will not chalk, fade or discolor, a community can expect the appearance of

Advantages (cont'd)

their tank to remain for years into the future. While painted tank coatings erode, rust and fade away over time, the glass coating will continue to hold its curb appeal. Unlike concrete tanks that require an exterior coating to prolong the concrete appearance and require the reapplication of the coating over time, to prevent the dark unsightly stains of concrete, the glass coating will hold up to the elements.

Glass fused-to-steel tanks are often placed in areas, where long term visual appearance is desired.

Expandable – Another unique and significant feature of the glass fused-to-steel bolted tank design is the ability for the tanks to be vertically expanded. If a community or industry experiences growth and additional capacity is necessary, the tanks unique jacking process allows the end user to gain this capacity both quickly and cost effectively. The factory certified tank erection crew simply unbolts the bottom ring from the original starter sheet, jacks the tank up and adds the number of rings necessary to achieve the new capacity.

Tank expansions can typically be completed in less than a week and at a substantial savings over having to purchase a new tank to gain the additional capacity. If the possibility of future expansion exists for any community or industry it is recommended that this be considered in the initial project design, so that adequate concrete and rebar can be placed in the tank foundation to support any additional future loading. Because of the superior glass coating, when these tanks are expanded, there is no difference in appearance between the original panels and the new panels. Several communities across the country have had their tanks expanded after 25 years of service with no detectable difference in appearance.

Ancillary Items – The bolted design allows for the easy and simple installation of additional nozzles or penetrations into the tank at any time and eliminates the difficulty this can encounter with other tank designs. Insulation, baffles, special walkways, stairs, platforms and internal equipment can easily be installed if the project design requires it.

Disadvantages

Shapes - The specialized manufacturing process of fusing the glass coating to the high strength steel requires that the steel sheets are capable of being run through a furnace. Steel sheet sizes are limited as a result of this process. As a result, the only design available is a cylinder. Odd shapes are difficult to achieve with this type of construction. If odd shapes are required then welded joints must be considered.

Capacities - AWWA limits the maximum sheet thickness for bolted steel tank designs. This creates a hydrostatic loading limitation on the capacity of the tank structure. This sheet thickness restriction means that typical bolted glass-fused-to-steel tanks are only available in sizes up to approximately 6,000,000 gallons.

Other tank types should be considered for greater capacities.

Other Considerations

Bullet Holes - Because the vast majority of these tanks are found in rural areas instead of major urban areas, some communities are concerned with the possibility of the product being damaged by bullet holes. While it is possible for a bullet to penetrate the high strength steel, the probability of this happening is rare.

While still an uncommon occurrence, if the impact from a bullet were to damage the tank it would typically result in the glass coating being chipped. One could expect the chip itself to be about the size of a coin.

Because the chemical bonding of the coating to the steel will prevent any undercutting of the coating, the simple remedy for this would be to essentially cover the spot with a light layer of sealer. If the impact were significant enough to create any damage to the interior tank coating, the cathodic

Other Considerations (con't)

protection system inside of the tank would protect the steel until any touch-up is performed. If, somehow a bullet did actually penetrate the steel sheets, the repair however, would simply be to ream out the hole and insert a structural bolt. Overall any potential bullet damage to a glass fused-to-steel tank should be considered minimal at worse and should be far easier to repair or address than the potential of having to repaint an epoxy painted tank or to have the windings exposed and structure weakened after shotcrete is shattered from an impact on a concrete structure.

Ice – Unheated structures with little or no turnover have the potential of freezing if exposed to prolonged severe freezing temperatures. The principles of heat transfer ultimately apply to all tank construction materials.

In a typical municipal application, the system, by virtue of its operation, provides adequate turnover. If not, this requirement needs to be addressed in the design of any system to ensure that this does not occur. There are numerous solutions available for low turnover, in the event of prolonged extreme low temperature periods. One should seek the advice of their design engineer and tank manufacturer.

Manufacturing Improvements

Edge Coating - Continuing Research and Development of glass coating technology and product performance has yielded significant improvements in glass Fused-to-Steel storage tanks since the product was first introduced in the late 1940's for dry and liquid storage. One of those improvements has been the development of sheet Edge Coating. Prior to this process, the high surface tension of the sharp edges, prevented the glass from adequately adhering to the steel edges.

Edge Coating machine is part of the current manufacturing process.

The sheet edges were filleted with sealer and this became a potential future maintenance issue. As the tanks aged, it could become necessary to clean and reseal the sheet edges for protection against any future corrosion.

Rounded sheet edges with glass coating.

With the goal of making the storage tanks as maintenance free as possible, in the 1990's, AO Smith, developed the Edge Coat process. The sheet edges are now mechanically beveled after shearing, creating a beveled edge surface. The edges are then arc sprayed with a stainless steel. In the final stage, glass slurry encapsulates the steel sheet edges.

Sealer - Additional improvements were made to the sealer used in the erection of the tanks. The sealer was upgraded for enhanced UV exposure and 200 ppm chlorine resistance. The sealer is manufactured exclusively by Manus, Inc. for CST Industries. This improvement has extended the life of the sealer and adds to the minimal maintenance design of the tanks.

Specially formulated UV resistant Polyurethane sealer

Protective Caps - A high impact polypropylene

Exposed Nut/Washer combination prior to protective caps

Manufacturing Improvements (con't)

copolymer protective cap is available to cover the exterior nut - washer combination on the tank of the bolted design. This ultraviolet resin material is ANSI/NSF approved and was added to control the oxidation of the bolt – nut that were previously exposed to the elements and could begin to show signs of streaking on the tank sheets. Although this streaking was capable of being cleaned, it was another potential maintenance issue that the manufacturer wanted to remove.

Maintenance

It is wise to have an inspection procedure instituted as part of the regular maintenance program for all tanks.

AWWA recommends that all potable water storage tanks be inspected every 3 to 5 years. Every system should have a periodic inspection program to ensure that the system is working properly. As with anything, the sooner an issue is addressed, the less chance it has to develop into a catastrophic event.

Scheduled inspections help to ensure that no vandalism or structural concerns have arisen.

No configuration of liquid storage tank should be installed and left to sit alone, without some type of inspection procedure in place This way any serious problems can be avoided.

"Neglecting maintenance is the most common cause of structural failure in a storage tank"… This statement applies to ANY type of storage tank.

Glass fused-to-steel tanks have very limited long term maintenance costs. Aside from periodic inspections and powerwashing, the only maintenance item is the periodic replacement of the sacrificial anodes used in the cathodic protection system. The sacrificial anode cathodic protection system is designed specifically for each individual system.

A water sample is taken and the resistivity/conductivity of the water, area of exposed steel surfaces and many additional factors determine the exact number of anodes required to maintain the system for about ten years. Once the anodes have been depleted, they will need to be replaced. This can be accomplished easily when the tank is empty during a scheduled inspection or with the use of a diver.

The National Association of Corrosion Engineers states that as a result of the billions of dollars spent annually on failing infrastructure, that any structure that could benefit from the use of cathodic protection, should use it. Essentially, if there is any steel or rebar associated with a storage tank, cathodic protection should be considered to extend the life of the structure.

Historically, glass fused-to-steel tanks require the least amount of maintenance and associated costs, over the lifetime of the structure, than either painted steel or concrete structures.

Conclusion

Overall, glass fused-to-steel tanks should be considered as a solution to a municipalities or industries liquid storage needs.

The impermeability and chemical resistance of the glass coating means these tanks are well suited for wastewater, landfill and other aggressive industrial applications.

Initial construction costs, anticipated life and long term maintenance costs are all significant factors relative to the various tank designs and materials available today. The long term maintenance costs and life cycle during a tank evaluation all need to be considered when selecting the appropriate product for a specific project.

A properly maintained and inspected glass fused-to-steel tank should be expected to have as long a life, if not longer, than the painted steel or concrete type structures but for much less in maintenance costs. Contact us for further details.

Because project financing can vary depending on several factors, a complete analysis of initial costs and, lower maintenance should help a community decide which type of product is best suited for their needs.

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Pump Performance Datasheet

Company Name	
Company contact number	
Quote Number	1151740
Project name	Default

Model/Order No.	3VR-09-00stg-2HP Vertical Multi-Stage
Stages	9
Quantity of pumps in parallel	1
Based on curve number	3VR-9
Saved Date	30 Jun 2022 3:36 AM

Operating Conditions

Flow, rated	: 21.00 USgpm
Head, rated (requested)	: 143.0 ft
Head, rated (actual)	: 185.3 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available	: Ample
Site Supply Frequency	: 60 Hz

Performance

Speed criteria	: Synchronous
Speed	: 3450 rpm
Impeller dia.	: 3VR-9
Impeller diameter, maximum	: 3VR-9
Impeller diameter, minimum	: 3VR-9
Efficiency	: 52.50 %
NPSH required / margin required	: 8.37 / 0.00 ft
Ns (imp. eye flow) / Nss (imp. eye flow)	: 1,196 / 3,512 US Units
MCSF	: 7.48 USgpm
Head max.	: 324.4 ft
Head rise to shutoff	: 75.07 %
Flow, best eff. point	: 16.70 USgpm
Flow ratio, rated / BEP	: 125.73 %
Diameter ratio (rated / max)	: 100.00 %
Head ratio (rated dia / max dia)	: 100.00 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 0.97 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Water
Additional liquid description	:
Solids diameter, max	: 0.00 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

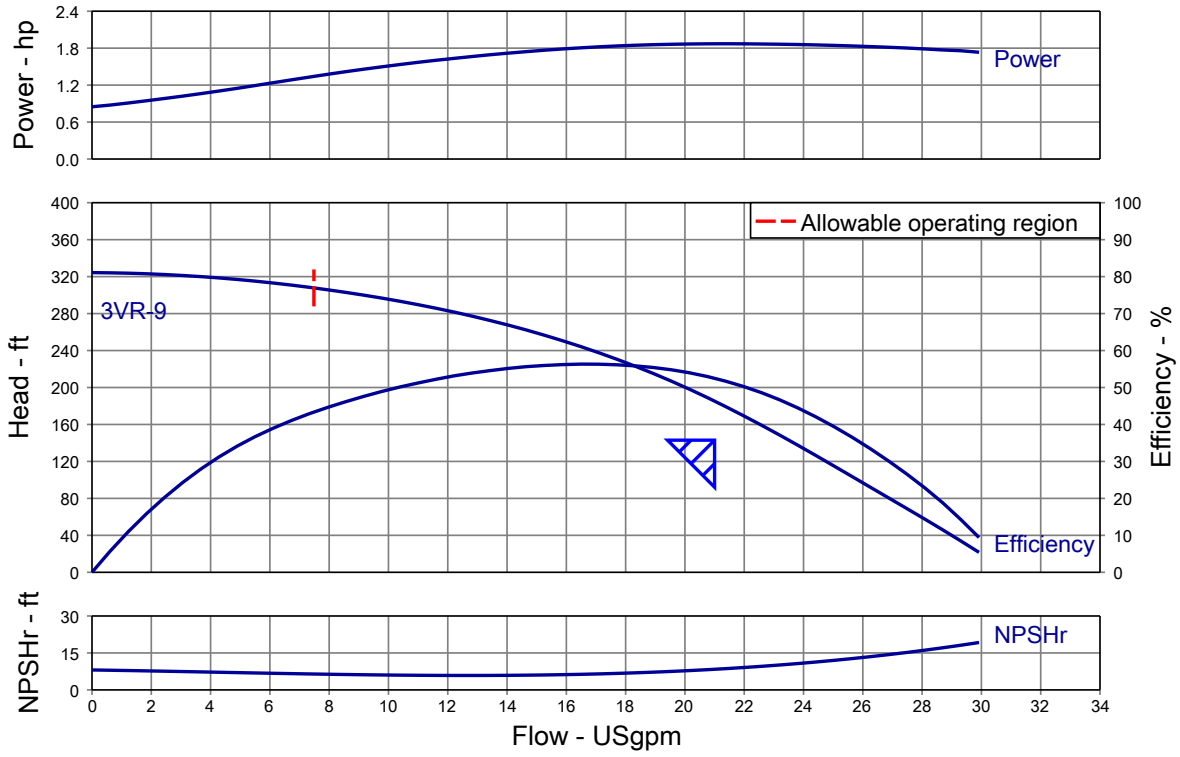
Material selected	: 316SS / 316SS

Pressure Data

Shut off pressure	: 140.4 psi.g
Maximum allowable working pressure	: N/A
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: N/A

Driver & Power Data (@Max density)

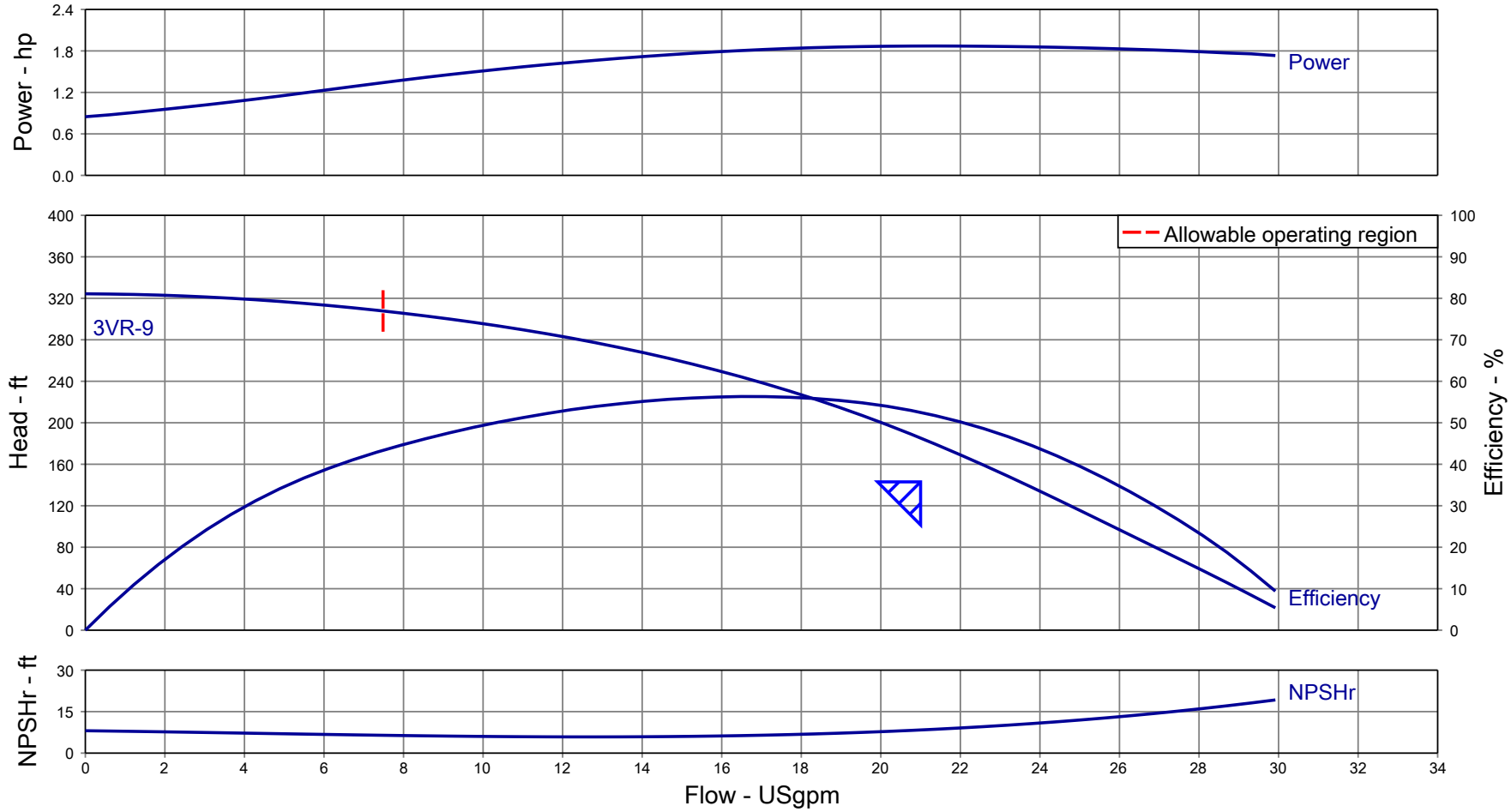
Driver sizing specification	: Rated power
Margin over specification	: 0.00 %
Service factor	: 1.00
Power, hydraulic	: 0.98 hp
Power, rated	: 1.87 hp
Power, maximum	: 1.87 hp
Motor rating	: 2.00 hp / 1.49 kW



Pump Performance Curve

Company Name	
Company contact number	

Quote Number	1151740
Quote Date	10 Jun 2021
Project name	Default



Description	: 3VR-09-00stg-2HP Vertical Multi-Stage
Stages	: 9
Flow, rated	: 21.00 USgpm
Head, rated	: 143.0 ft

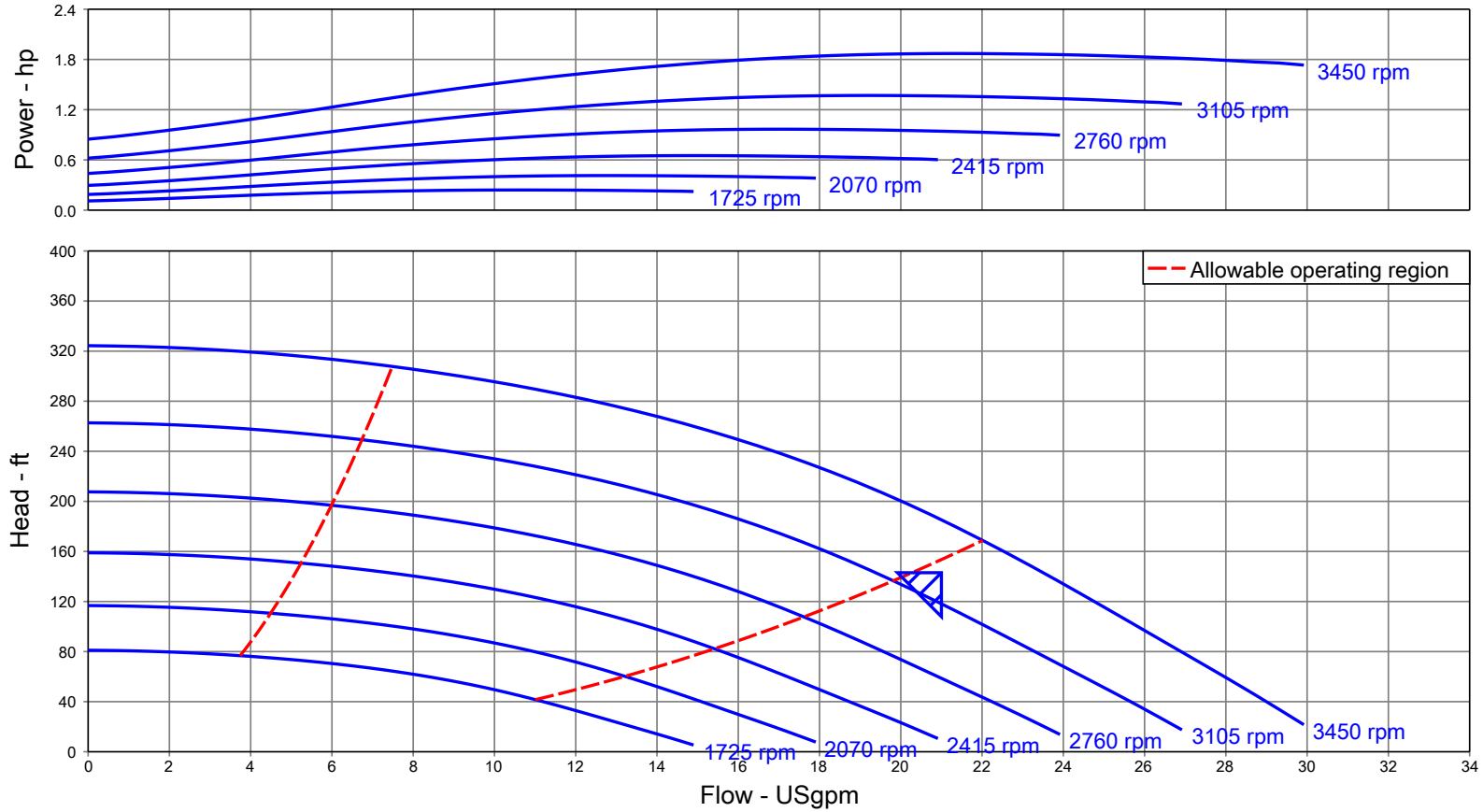
Speed	: 3450 rpm
Based on curve number	: 3VR-9
Efficiency	: 52.50 %
Power, rated	: 1.87 hp

NPSH required	: 8.37 ft
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 0.97 / 1.00
Saved Date	: 30 Jun 2022 3:36 AM

Multi-Speed Performance Curve

Company Name	
Company contact number	

Quote Number	1151740
Quote Date	10 Jun 2021
Project name	Default



Description	: 3VR-09-00stg-2HP Vertical Multi-Stage
Stages	: 9
Flow, rated	: 21.00 USgpm
Head, rated	: 143.0 ft

Speed	: 3450 rpm
Based on curve number	: 3VR-9
Efficiency	: 52.50 %
Power, rated	: 1.87 hp
Impeller dia.	: 0.02 in

NPSH required	: 8.37 ft
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 0.97 / 1.00
Saved Date	: 30 Jun 2022 3:36 AM

Pump Performance - Additional Data

Company Name	
Company contact number	
Quote Number	1151740
Project name	Default

Model/Order No.	3VR-09-00stg-2HP Vertical Multi-Stage
Stages	9
Quantity of pumps in parallel	1
Based on curve number	3VR-9
Saved Date	30 Jun 2022 3:36 AM

Performance Data	
Head, maximum diameter, rated flow	: 185.3 ft
Head, minimum diameter, rated flow	: 185.3 ft
Head max.	: 324.4 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
Flow adjustment factor, efficiency only (shift BEP)	: 1.00
Flow adjustment factor, end-of-curve only, total	: 1.00
MCSF adjustment factor	: 1.00
NPSHR adjustment factor, total	: 1.00
User applied performance adjustment comments	:
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

Stage, Speed and Solids Limits	
Stages, maximum	: 9
Stages, minimum	: 9
Pump speed limit, maximum	: 3600 rpm
Pump speed limit, minimum	: 1800 rpm
Curve speed limit, maximum	: 3600 rpm
Curve speed limit, minimum	: 1200 rpm
Variable speed limit, maximum	: -
Variable speed limit, minimum	: 800 rpm
Solids size limit	: 0.00 in
Typical Driver Data	
Driver speed, full load	: 3450 rpm
Driver speed, rated load	: 3460 rpm
Driver efficiency, 100% load	: 84.00 %
Driver efficiency, 75% load	: 83.20 %
Driver efficiency, 50% load	: 79.90 %

Mechanical Limits	
Torque, rated power, rated speed	: 0.05 hp/100 rpm
Torque, maximum power, rated speed	: 0.05 hp/100 rpm
Torque, driver power, full load speed	: 0.06 hp/100 rpm
Torque, driver power, rated speed	: 0.06 hp/100 rpm
Torque, pump shaft limit	: -
Radial load, worst case	: -
Radial load limit	: -
Impeller peripheral speed, rated	: -
Impeller peripheral speed limit	: -

Various Performance Data	**Flow (USgpm)**	**Head (ft)**	**Efficiency (%)**	**NPSHr (ft)**	**Power (hp)**
Shutoff, rated	0.00	324.4	-	-	0.85
Shutoff, maximum	0.00	324.4	-	-	0.85
MCSF	7.48	307.8	43.36	6.45	1.34
Rated flow, minimum	21.00	185.3	52.50	-	1.87
Rated flow, maximum	21.00	185.3	52.50	-	1.87
BEP flow, rated	16.70	242.0	56.34	6.38	1.81
120% rated flow, rated	25.20	111.8	38.62	12.19	1.84
End of curve, rated	29.92	21.60	9.41	19.23	1.73
End of curve, minimum	29.92	21.60	9.41	19.23	1.73
End of curve, maximum	29.92	21.60	9.41	19.23	1.73
Maximum value, rated	-	324.4	56.34	-	1.87
Maximum value, maximum	-	-	56.34	-	1.87

System differential pressure	**@ Density, rated**	**@ Density, max**
Differential pressure, rated flow, rated (psi)	80.18	80.18
Differential pressure, shutoff, rated (psi)	140.4	140.4
Differential pressure, shutoff, maximum (psi)	140.4	140.4

Discharge pressure	**@ Suction pressure, rated**	**@ Suction pressure, max**	**@ Suction pressure, rated**	**@ Suction pressure, max**
Discharge pressure, rated flow, rated (psi.g)	80.18	80.18	80.18	80.18
Discharge pressure, shutoff, rated (psi.g)	140.4	140.4	140.4	140.4
Discharge pressure, shutoff, maximum (psi.g)	140.4	140.4	140.4	140.4

Ratios			
Maximum flow / rated flow, rated	: 104.83 %	Head rated diameter / head minimum diameter, rated flow	: 100.00 %

INTERNAL PRICE SHEET			
Company name		Size / Stages	3VR-09-00stg-2HP Vertical Multi-Stage / 9
		Pump speed	3450 rpm
Line item number	001	Quote No.	1151740
Project name	Default	Date Last Saved	10 Jun 2021

Totals			
Total Extended Net	$ 5,493.00	Estimated Lead Time	5 days
Pump Total	$ 0.00		

Pump & Motor

Qty	Description	Order No.	List Price	Multiplier	Net Price	Margin	Unit Sell Price	Extended Sell Price
1	Pump Selected: 3VR-9stg-2HP Vertical Multistage - 3VR0900NF1A-E6E3	3VR0900NF1A-E6E3	$ 4,139.00	1.000	$ 4,139.00	0.00 %	$ 4,139.00	$ 4,139.00
	Motor : 2 HP / 230/460V / 3 Phase / 56C Motor Frame							

Pump

Qty	Description	Order No.	List Price	Multiplier	Net Price	Margin	Unit Sell Price	Extended Sell Price
	Configured System							
	Product Material (Pump Body / Top Plate): 316SS / 316SS							
	Connection Type: ANSI - DIN, Round, Type F - 1.25" (375PSI max allowable working pressure)							
	Seal Type: 1 - GraphitexSiCx3166SSxEPDM							
	Motor Flange: NEMA							
	Companion Flange							
	Stainless steel companion flange kits available for your pump size							
	Lead Time: Consult Factory							

Motor

Qty	Description	Order No.	List Price	Multiplier	Net Price	Margin	Unit Sell Price	Extended Sell Price
	Pump End or Complete Unit: Complete Unit							
	Efficiency: Premium							
	Hertz: 60 Hertz							
	Enclosure Type: TEFC							
	Phase/Voltage: 3 phase, 230/460v							
	Lead Time: Typically 5 business days							

Drive/Control

Qty	Description	Order No.	List Price	Multiplier	Net Price	Margin	Unit Sell Price	Extended Sell Price
	Control Type: Starter							
	Product: Smartstart Pump Starter							
	NEMA Enclosure Rating: NEMA 3R							
	Disconnect: No							

INTERNAL PRICE SHEET			
Project name	Default	Quote No.	1151740
Line item number	001	Date Last Saved	10 Jun 2021

Drive/Control

Qty	Description	Order No.	List Price	Multiplier	Net Price	Margin	Unit Sell Price	Extended Sell Price
	Incoming Phase: 3							
	Voltage: 230V							
1	Starter: SSP-3-SSP3E-30S - 1-32 Amps - N3R SSP, 1-32A, w/ EOL, No Disc	SSP3E-30S	$ 1,354.00	1.000	$ 1,354.00	0.00 %	$ 1,354.00	$ 1,354.00
	Lead Time: RFQ							

QUOTATION

Quote Information	
Quote No.	1151740
Quote Date	10 Jun 2021
Project name	Default
Est. Leadtime ARO	5 days

/ / /

Chris Reiner, Chris Reiner (creiner@reinerpump.com-franklin)

Customer Information	
To	
Street Address	
City/State/Zip	/ /
Phone No.	

Totals	
Total Extended Net	$ 5,493.00
Pump Total	$ 0.00
Pump & Motor Total	$ 4,139.00
Motor Total	$ 0.00
Drive/Control Total	$ 1,354.00

Pump & Motor

Order No.	Qty	Description	Unit Price	Extended Sell Price
3VR0900NF1A-E6E3	1	**Pump End Construction** Pump Selected: 3VR-9stg-2HP Vertical Multistage - 3VR0900NF1A-E6E3	$ 4,139.00	$ 4,139.00
		Motor Specifications Motor : 2 HP / 230/460V / 3 Phase / 56C Motor Frame		
Pump & Motor Total				$ 4,139.00

Pump

Order No.	Qty	Description	Unit Price	Extended Sell Price
	1	*Configured System* **Pump End Construction** Product Material (Pump Body / Top Plate): 316SS / 316SS		
		Connection Type: ANSI - DIN, Round, Type F - 1.25" (375PSI max allowable working pressure)		
		Seal Type: 1 - GraphitexSiCx3166SSxEPDM		
		Motor Flange: NEMA		
		Companion Flange Stainless steel companion flange kits available for your pump size		
		Lead Time: Consult Factory		
Pump Total				$ 0.00

Motor

Order No.	Qty	Description	Unit Price	Extended Sell Price
		Motor Specifications Pump End or Complete Unit: Complete Unit		
		Efficiency: Premium		
		Hertz: 60 Hertz		
		Enclosure Type: TEFC		
		Phase/Voltage: 3 phase, 230/460v		
		Lead Time: Typically 5 business days		
Motor Total				$ 0.00

QUOTATION

Quote Information	
Quote No.	1151740
Quote Date	10 Jun 2021
Project name	Default
Est. Leadtime ARO	5 days

Totals	
Total Extended Net	$ 5,493.00
Pump Total	$ 0.00
Pump & Motor Total	$ 4,139.00
Motor Total	$ 0.00
Drive/Control Total	$ 1,354.00

Motor

Order No.	Qty	Description	Unit Price	Extended Sell Price

Drive/Control

Order No.	Qty	Description	Unit Price	Extended Sell Price
		Drive & Controls Control Type: Starter		
		Product: Smartstart Pump Starter		
		NEMA Enclosure Rating: NEMA 3R		
		Disconnect: No		
		Incoming Phase: 3		
		Voltage: 230V		
SSP3E-30S	1	Starter: SSP-3-SSP3E-30S - 1-32 Amps - N3R SSP, 1-32A, w/ EOL, No Disc	$ 1,354.00	$ 1,354.00
		Lead Time: RFQ		
Drive/Control Total				$ 1,354.00

QUOTATION

Quote Information	
Quote No.	1151740
Quote Date	10 Jun 2021
Project name	Default
Est. Leadtime ARO	5 days

/ / /

Chris Reiner, Chris Reiner (creiner@reinerpump.com-franklin)

Customer Information	
To	
Street Address	
City/State/Zip	/ /
Phone No.	

Pump & Motor		
Order No.	Qty	Description
1 3VR0900NF1A-E6E3	 1	**Pump End Construction** Pump Selected: 3VR-9stg-2HP Vertical Multistage - 3VR0900NF1A-E6E3
		Motor Specifications Motor : 2 HP / 230/460V / 3 Phase / 56C Motor Frame

Pump		
Order No.	Qty	Description
	1	*Configured System* **Pump End Construction** Product Material (Pump Body / Top Plate): 316SS / 316SS
		Connection Type: ANSI - DIN, Round, Type F - 1.25" (375PSI max allowable working pressure)
		Seal Type: 1 - GraphitexSiCx3166SSxEPDM
		Motor Flange: NEMA
		Companion Flange Stainless steel companion flange kits available for your pump size
		Lead Time: Consult Factory

Motor		
Order No.	Qty	Description
1		**Motor Specifications** Pump End or Complete Unit: Complete Unit
		Efficiency: Premium
		Hertz: 60 Hertz
		Enclosure Type: TEFC
		Phase/Voltage: 3 phase, 230/460v
		Lead Time: Typically 5 business days

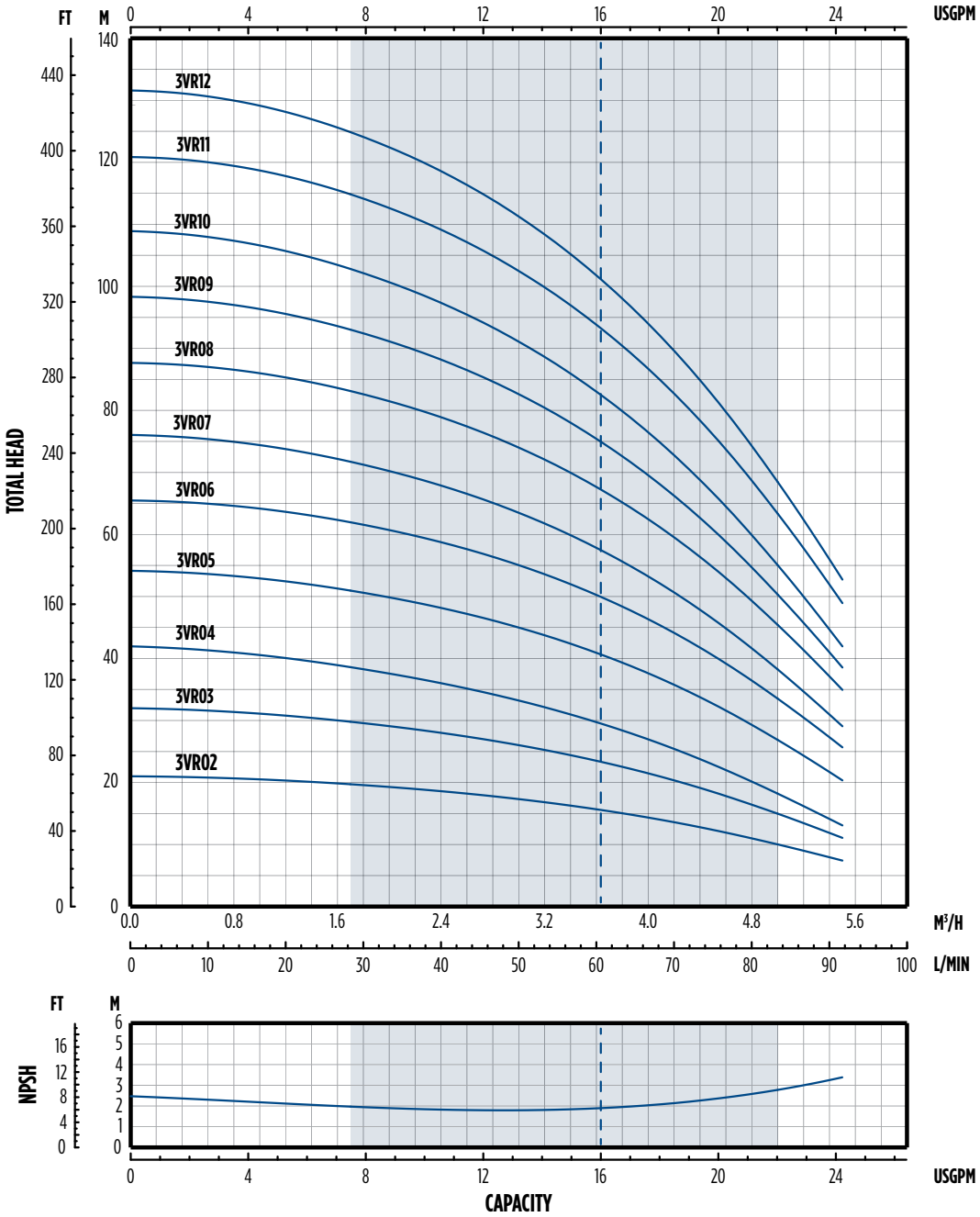
QUOTATION

Quote Information	
Quote No.	1151740
Quote Date	10 Jun 2021
Project name	Default
Est. Leadtime ARO	5 days

Drive/Control		
Order No.	Qty	Description
1		**Drive & Controls** Control Type: Starter
		Product: Smartstart Pump Starter
		NEMA Enclosure Rating: NEMA 3R
		Disconnect: No
		Incoming Phase: 3
		Voltage: 230V
SSP3E-30S	1	Starter: SSP-3-SSP3E-30S - 1-32 Amps - N3R SSP, 1-32A, w/ EOL, No Disc
		Lead Time: RFQ

VR SERIES - 3 VR

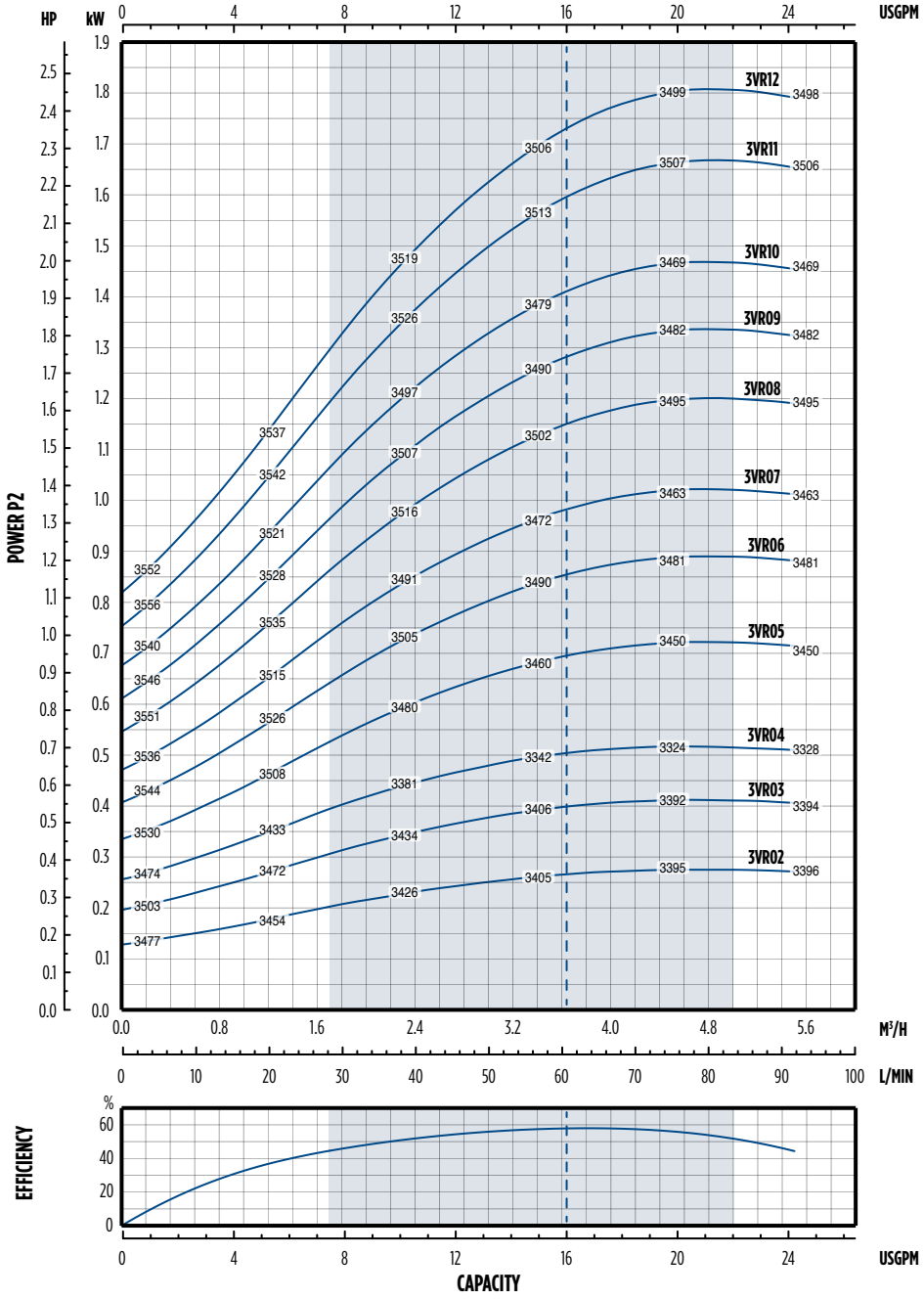
PERFORMANCE: 2-POLE



Note: Specifications subject to change without prior notice. Hydraulic characteristics are according to ISO standard 9906, Annex A.

VR SERIES - 3 VR

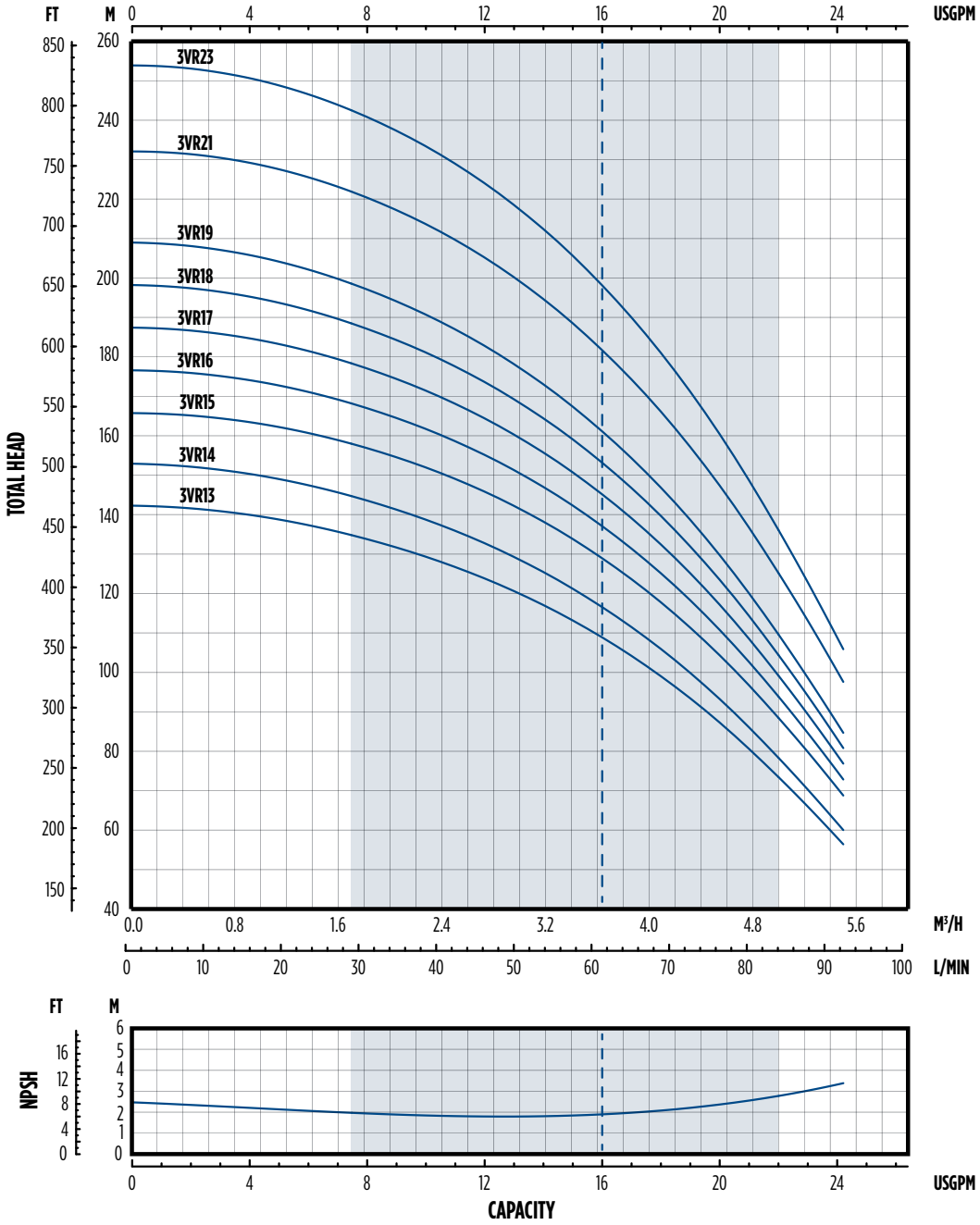
POWER CURVE: 2-POLE



Note: Specifications subject to change without prior notice.

VR SERIES - 3 VR

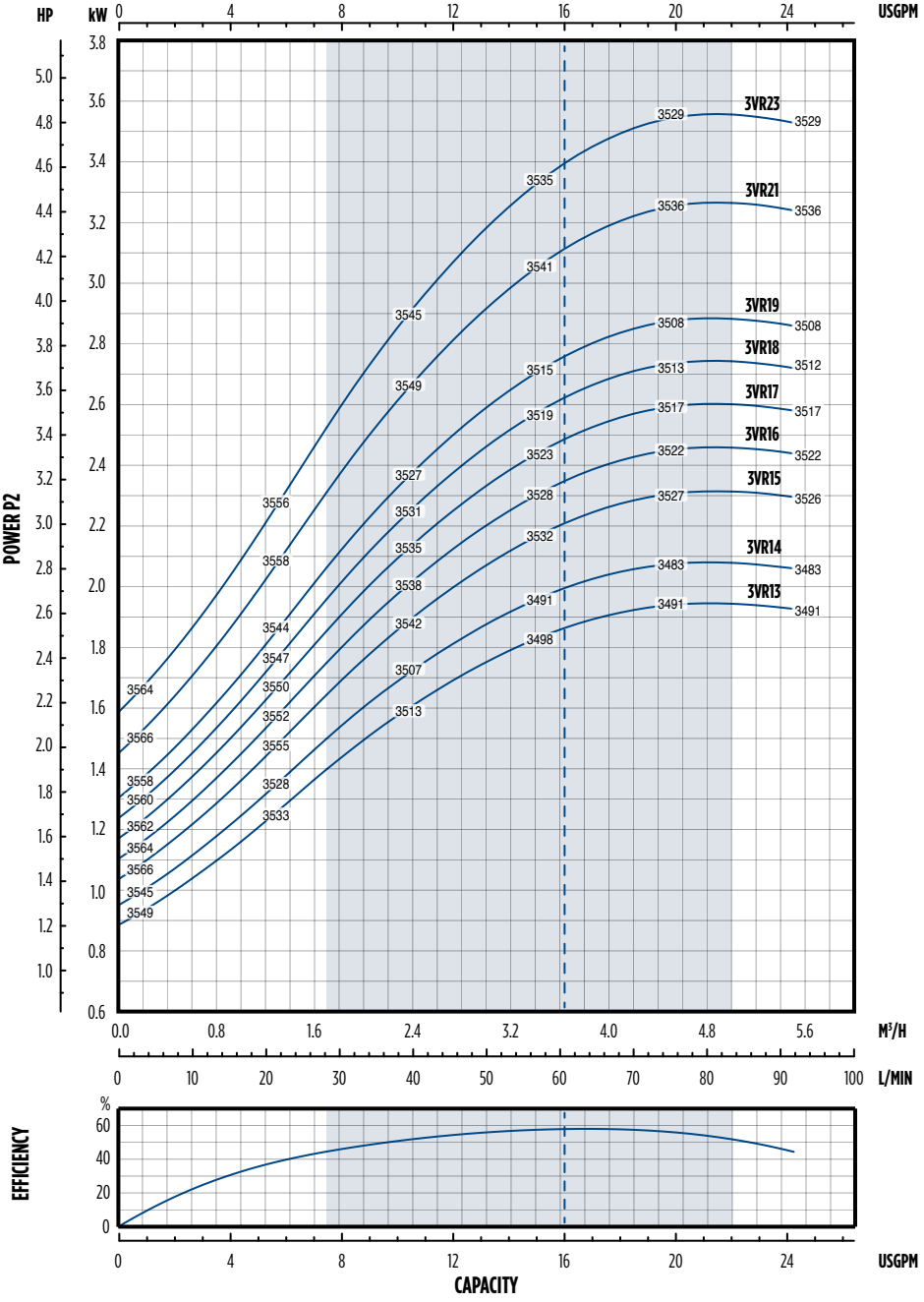
PERFORMANCE: 2-POLE



Note: Specifications subject to change without prior notice. Hydraulic characteristics are according to ISO standard 9906, Annex A.

VR SERIES - 3 VR

POWER CURVE: 2-POLE

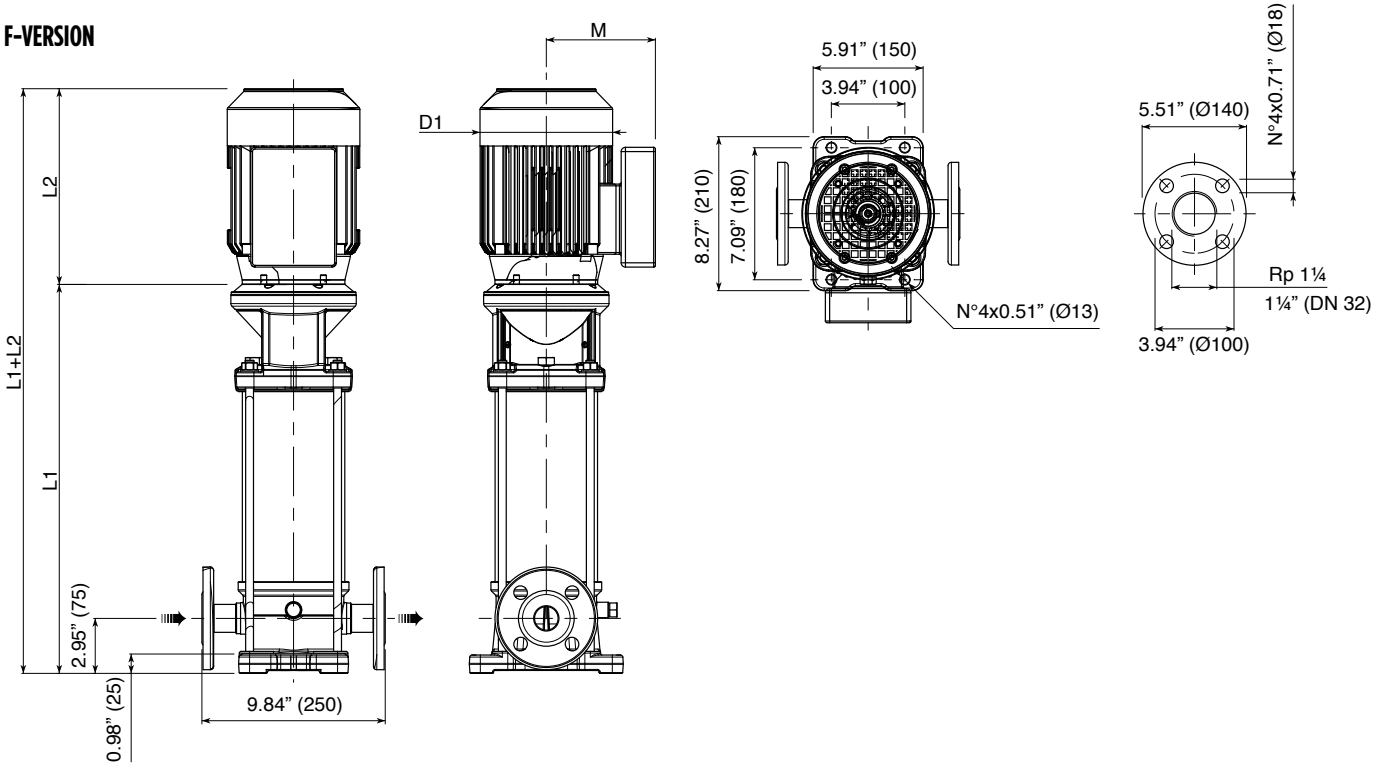


Note: Specifications subject to change without prior notice.

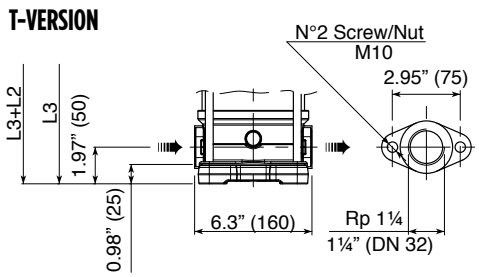
VR SERIES - 3 VR

DIMENSIONS: 2-POLE

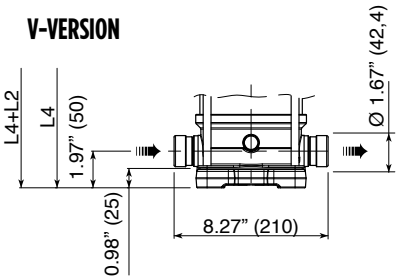
F-VERSION



T-VERSION



V-VERSION



F-Version: Round flanges on body type PN25; pump is supplied without counter-flanges (optional accessories, including bolts and joints).
T-Version: Oval flanges on body type PN16; pump is supplied without threaded oval counter-flanges (optional accessories, including bolts and joints).
V-Version: Grooved or rapid connection fitted pump casing is supplied without the collars (optional accessories).

VR SERIES - 3 VR

DIMENSIONS: 2-POLE

Model	No Stages	2-Pole Motor Rating			PEA Only Height (in)		
		Power		NEMA Frame Size	L1 "F" Fitted	L3 "T" Fitted	L4 "V" Fitted
		HP	kW				
3VR0200	2	0.50	0.37	56C	12.30	11.32	11.32
3VR0300	3	0.75	0.55	56C	13.19	12.20	12.20
3VR0400	4	0.75	0.55	56C	14.07	13.09	13.09
3VR0500	5	1.00	0.75	56C	14.96	13.98	13.98
3VR0600	6	1.50	1.10	56C	15.85	14.86	14.86
3VR0700	7	1.50	1.10	56C	16.73	15.75	15.75
3VR0800	8	1.50	1.10	56C	18.01	17.03	17.03
3VR0900	9	2.00	1.50	56C	18.90	17.91	17.91
3VR1000	10	2.00	1.50	56C	19.78	18.80	18.80
3VR1100	11	2.00	1.50	56C	20.67	19.69	19.69
3VR1200	12	3.00	2.20	56C	21.56	20.57	20.57
3VR1300	13	3.00	2.20	56C	22.44	21.46	21.46
3VR1400	14	3.00	2.20	56C	23.33	22.34	22.34
3VR1500	15	3.00	2.20	56C	24.21	N.A.	23.23
3VR1600	16	3.00	2.20	56C	25.49	N.A.	24.51
3VR1700	17	3.00	2.20	56C	26.38	N.A.	25.39
3VR1800	18	5.00	3.70	182-4TC	27.26	N.A.	26.28
3VR1900	19	5.00	3.70	182-4TC	28.15	N.A.	27.17
3VR2100	21	5.00	3.70	182-4TC	29.92	N.A.	28.94
3VR2300	23	5.00	3.70	182-4TC	31.69	N.A.	30.71

Model	No Stages	3600 RPM, 2-Pole Motor Dimensions (in)											
		L2 Height				D1 Diameter				M (max)			
		1Ø ODP	3Ø ODP	1Ø TEFC	3Ø TEFC	1Ø ODP	3Ø ODP	1Ø TEFC	3Ø TEFC	1Ø ODP	3Ø ODP	1Ø TEFC	3Ø TEFC
3VR0200	2	9.79	9.16	9.29	9.29	6.19	6.19	6.19	6.19	5.06	5.06	5.18	5.19
3VR0300	3	11.98	9.16	9.91	9.29	6.19	6.19	6.19	6.19	5.06	5.06	5.19	5.19
3VR0400	4	11.98	9.16	9.91	9.29	6.19	6.19	6.19	6.19	5.06	5.06	5.19	5.19
3VR0500	5	10.00	9.78	10.19	10.17	7.01	6.19	7.19	7.19	5.62	5.06	5.74	5.23
3VR0600	6	12.04	10.17	11.19	10.17	7.01	7.19	7.19	7.19	5.62	5.62	5.72	5.23
3VR0700	7	12.04	10.17	11.19	10.17	7.01	7.19	7.19	7.19	5.62	5.62	5.72	5.23
3VR0800	8	12.04	10.17	11.19	10.17	7.01	7.19	7.19	7.19	5.62	5.62	5.72	5.23
3VR0900	9	13.41	11.22	11.18	11.17	7.01	7.19	7.19	7.19	5.62	5.62	5.72	5.23
3VR1000	10	13.41	11.22	11.18	11.17	7.01	7.19	7.19	7.19	5.62	5.62	5.72	5.23
3VR1100	11	13.41	11.22	11.18	11.17	7.01	7.19	7.19	7.19	5.62	5.62	5.72	5.23
3VR1200	12	N.A.	11.18	12.06	12.04	N.A.	7.19	7.19	7.19	N.A.	5.62	5.79	5.74
3VR1300	13	N.A.	11.18	12.06	12.04	N.A.	7.19	7.19	7.19	N.A.	5.62	5.79	5.74
3VR1400	14	N.A.	11.18	12.06	12.04	N.A.	7.19	7.19	7.19	N.A.	5.62	5.79	5.74
3VR1500	15	N.A.	11.18	12.06	12.04	N.A.	7.19	7.19	7.19	N.A.	5.62	5.79	5.74
3VR1600	16	N.A.	11.18	12.06	12.04	N.A.	7.19	7.19	7.19	N.A.	5.62	5.79	5.74
3VR1700	17	N.A.	11.18	12.06	12.04	N.A.	7.19	7.19	7.19	N.A.	5.62	5.79	5.74
3VR1800	18	N.A.	10.75	15.18	13.68	N.A.	8.88	8.60	8.60	N.A.	6.75	6.87	6.87
3VR1900	19	N.A.	10.75	15.18	13.68	N.A.	8.88	8.60	8.60	N.A.	6.75	6.87	6.87
3VR2100	21	N.A.	10.75	15.18	13.68	N.A.	8.88	8.60	8.60	N.A.	6.75	6.87	6.87
3VR2300	23	N.A.	10.75	15.18	13.68	N.A.	8.88	8.60	8.60	N.A.	6.75	6.87	6.87

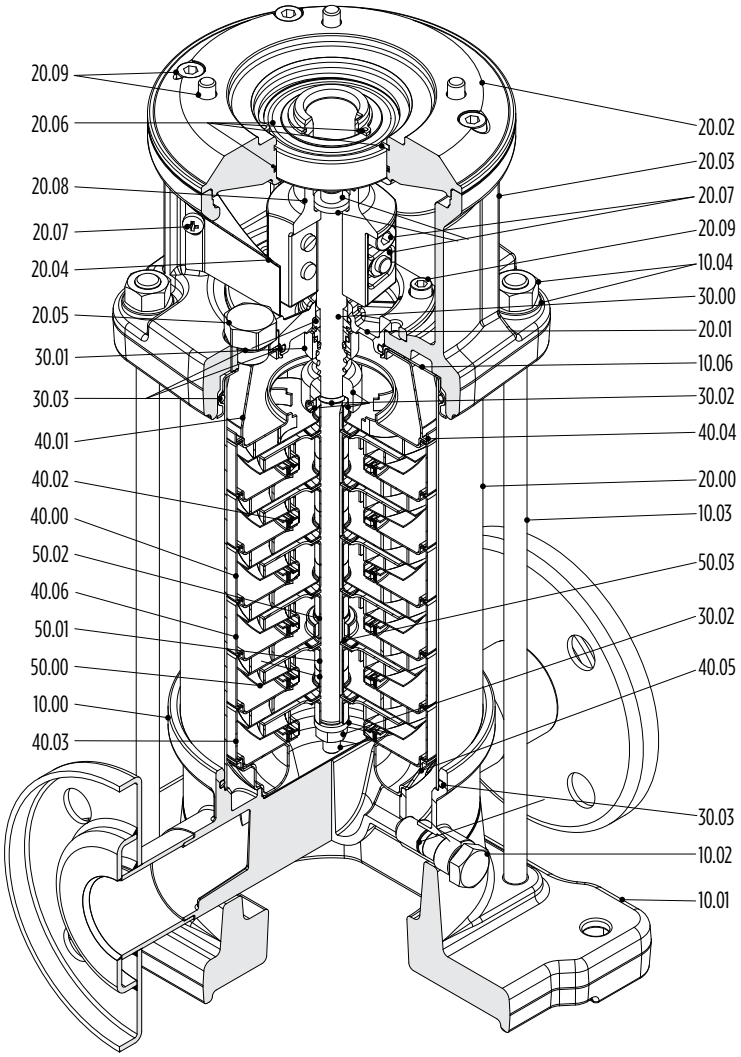
VR SERIES - MATERIALS

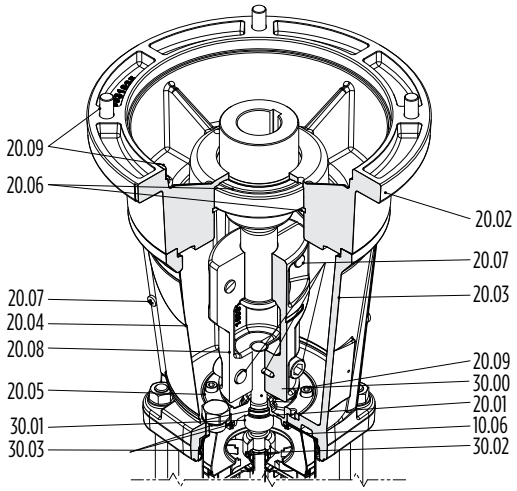
1-3-6-10 VR

Ref. No.	Part Description	Material		
		Type	N - 316SS version	
			ASTM/AISI	DIN / EN
10.00	Pump casing	Stainless Steel	CF 8M / AISI 316	1.4408
10.02	Filling and draining plug	Stainless Steel	AISI 316	1.4401
20.00	Outer Case	Stainless Steel	AISI 316	1.4401
20.01	Mechanical seal housing	Stainless Steel	AISI 316	1.4401
20.05	Filling plugs	Stainless Steel	AISI 316	1.4401
30.00	Pump shaft	Stainless Steel	AISI 316	1.4401
30.01	Kit Mechanical seal	Silicon Carbide SiC, Graphite, EPDM, Stainless Steel	-	-
30.02	Mechanical seal fastening kt	Stainless Steel	AISI 316	1.4401
30.03	Kit O-rings	EPDM	-	-
40.00	Stage housing and diffuser	Stainless Steel	AISI 316	1.4401
40.01	Stage centering outlet	Stainless Steel	AISI 316	1.4401
40.02	Floating neck ring	PPS	-	-
40.03	Initial stage housing	Stainless Steel	AISI 316	1.4401
40.04	Last stage with diffuser	Stainless Steel	AISI 316	1.4401
40.05	Stage centering inlet	Stainless Steel	AISI 316	1.4401
40.06	Stage housing and diffuser with bearing	Stainless Steel, Tungsten Carbide WC	AISI 316	1.4401
50.00	Impeller	Stainless Steel	AISI 316	1.4401
50.01	Impeller Spacer	Stainless Steel	AISI 316	1.4401
50.02	Intermediary sleeve	Tungsten Carbide WC	-	-
50.03	Intermediary sleeve spacer	Stainless Steel	AISI 316	1.4401

VR SERIES - MAIN COMPONENTS

1-3-6-10 VR





Ref. No.	Description
10.00	Pump Casing
10.01	Pump Fixing Plate
10.02	Filling and Draining Plug
10.03	Tie Bolt
10.04	Kit Nuts and Washers
10.06	Upper Flange
20.00	Outer Case
20.01	Mechanical Seal Housing
20.02	Motor Flange
20.03	Motor Bracket
20.04	Coupling Guard
20.05	Filling Plugs
20.06	Circlips and Bearings, and O-ring
20.07	Coupling Fasteners
20.08	Coupling
20.09	Kit Motor Screws

Ref. No.	Description
30.00	Pump Shaft
30.01	Kit Mechanical Seal
30.02	Mechanical Seal Fastening Kit
30.03	Kit O-rings
40.00	Stage Housing and Diffuser
40.01	Stage Centering Outlet
40.02	Floating Neck Ring
40.03	Initial Stage Housing
40.04	Last Stage with Diffuser
40.05	Stage Centering Inlet
40.06	Stage Housing and Diffuser with Bearing
50.00	Impeller
50.01	Impeller Spacer
50.02	Intermediary Sleeve
50.03	Intermediary Sleeve Spacer

PRODUCT CATALOG

FPS

VR SERIES

VERTICAL MULTI-STAGE PUMPS

franklinwater.com

Franklin Electric

VR SERIES VERTICAL MULTI-STAGE PUMPS – 60HZ

STANDARD FEATURES & BENEFITS - ALL MODELS

- All 316 SS wetted components for superior durability, efficiency, and performance over a wide variety of applications (except G version of 30-45-65-95VR with CI casing and upper flange standard)
- Rugged NEMA motor mounting with oversized thrust bearing ensures long operating life in the toughest jobs (special, heavy-duty motor bearing not required)
- Silicon carbide/graphite/EPDM/SS mechanical seal for superior sealing
- Removeable stainless steel seal plate with jack screw taps provided for ease of service
- In-line suction and discharge connections with round ANSI flanges fit widest range of applications and provide for convenient, compact installation with a small footprint
- NEMA standard motors; ODP & TEFC enclosures, 1 & 3 phase voltages available with all 3-phase motors of premium efficiency design and inverter duty rated

GENERAL PUMP SPECIFICATIONS

- Flow range: 5 to 500 GPM (20 to 2,000 L/Min)
- Head range: Up to 750 feet (230 M)
- 230 psi (16 bar) max working pressure for oval flange connection models (1-20VR)
  360 psi (25 bar) max working pressure for round flange & grooved connection equipped models
  460 psi (32 bar) max working pressure for round flange 30 & 45VR models only
- Liquid Temp: +14 ˚F (-10 ˚C) to +248 ˚F (+120 ˚C)
- Clockwise rotation (looking at the pump from the top down)
- Round ANSI flange standard; optional oval flange & grooved connections available through 20VR
- 3600 & 1800 RPM performance available
- Optional seals: Silicon carbide & Tungsten carbide
- Optional elastomer: FKM

APPLICATIONS

Water Supply and Pressure Boosting

- Pressure boosting in buildings
- Booster stations
- Pump packages

Water treatment

- Filtration systems
- Reverse osmosis systems

Light Industry

- Commercial washers
- Firefighting systems
- Machine coolant recirculation
- Car wash systems

Irrigation and Agriculture

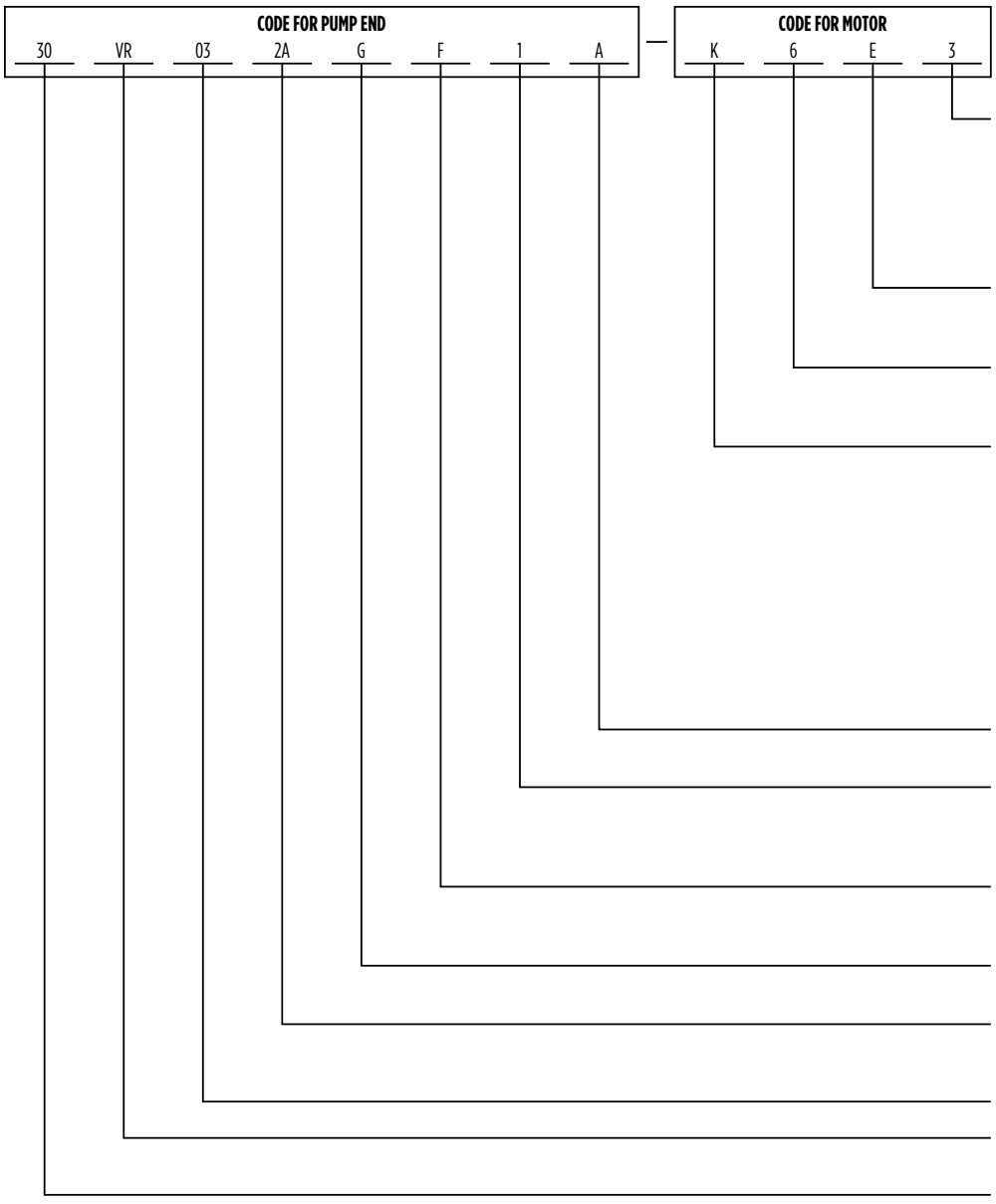
- Drip irrigation
- Sprinkler irrigation

Heating, Ventilation, and Air Conditioning (HVAC)

- Cooling towers
- Temperature control
- Refrigeration
- Heating systems
- Boiler feed
- Water recirculation

VR SERIES

MODEL NOMENCLATURE



Voltage (Phase)

1 = 115/230 (1-Phase)	2 = 230 only (1-Phase)
3 = 230/460 (3-Phase)	4 = 460 only (3-Phase)
5 = 575 only (3-Phase)	6 = 220 (1-Phase)
7 = 220 (3-Phase)	8 = 380/415 (3-Phase)
9 = 415 (3-Phase)	A = 190/380 (3-Phase)
B = 230/400 (3-Phase)	C = 400/690 (3-Phase)

Efficiency (Enclosure)

D = Premium (ODP)	E = Premium (TEFC)
X = Premium (X-Proof)	

Speed (Hz)

5 = 3000 RPM (50 Hz)	6 = 3600 RPM (60 Hz)
7 = 1500 RPM (50 Hz)	8 = 1800 RPM (60 Hz)

Frame (Kw)

A = 56C 0.5 HP (0.37 Kw)	B = 56C 0.75 HP (0.55 Kw)
C = 56C 1 HP (0.75 Kw)	D = 56C 1.5 HP (1.1 Kw)
E = 56C 2 HP (1.5 Kw)	F = 56C 3 HP (2.2 Kw)
U = 180TC 3 HP (2.2 Kw)	G = 180TC 5 HP (3.7 Kw)
V = 180TC 7.5 HP (5.5 Kw)	H = 210TC 7.5 HP (5.5 Kw)
J = 210TC 10 HP (7.5 Kw)	W = 210TC 15 HP (11 Kw)
K = 250TC 15 HP (11 Kw)	L = 250TC 20 HP (15 Kw)
X = 250TC 25 HP (18.5 Kw)	M = 280TSC 25 HP (18.5 Kw)
N = 280TSC 30 HP (22 Kw)	Z = 280TSC 40 HP (30 Kw)
P = 320TSC 40 HP (30 Kw)	R = 320TSC 50 HP (37 Kw)
S = 360TSC 60 HP (45 Kw)	T = 360TSC 75 HP (55 Kw)

Motor Type

A = NEMA	B = IEC

Seal Type

1 = Graphite/SiC EPDM	2 = SiC/SiC EPDM
3 = SiC/SiC FKM	4 = Graphite/SiC FKM
5 = WC/WC EPDM	6 = WC/WC FKM

Connection Type

F = Round Flange	T = Oval Flange
V = Grooved	

Casing/Hydraulics

G = CI/316SS	N = 316SS/316SS

Impeller Trim

0 = No Trim	1A = 1 Stage
2A = 2 Stages	

Total Number of Stages (always 2 Characters)

Series & Speed

VR = VR Series (2-Pole)	VRL = VRL Series (4-Pole)

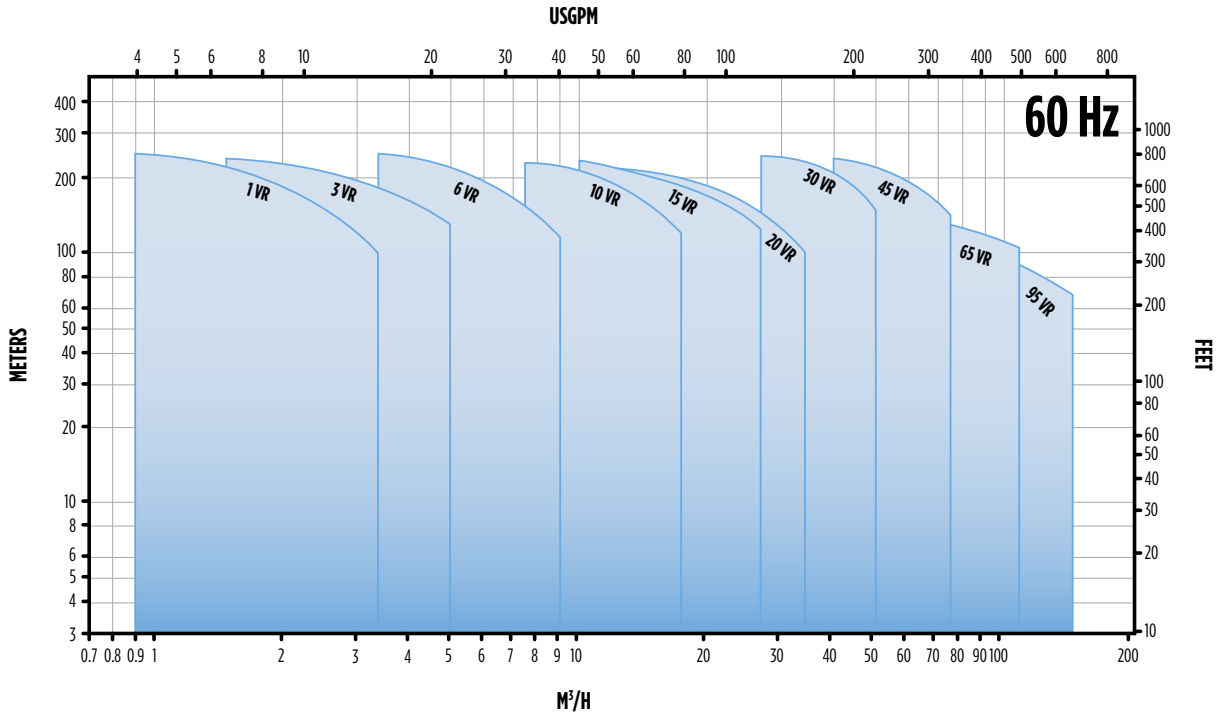
BEP Flow (60Hz-2P)

1 = 10 GPM	3 = 16 GPM
6 = 32 GPM	10 = 60 GPM
15 = 90 GPM	20 = 110 GPM
30 = 160 GPM	45 = 240 GPM
65 = 360 GPM	95 = 450 GPM

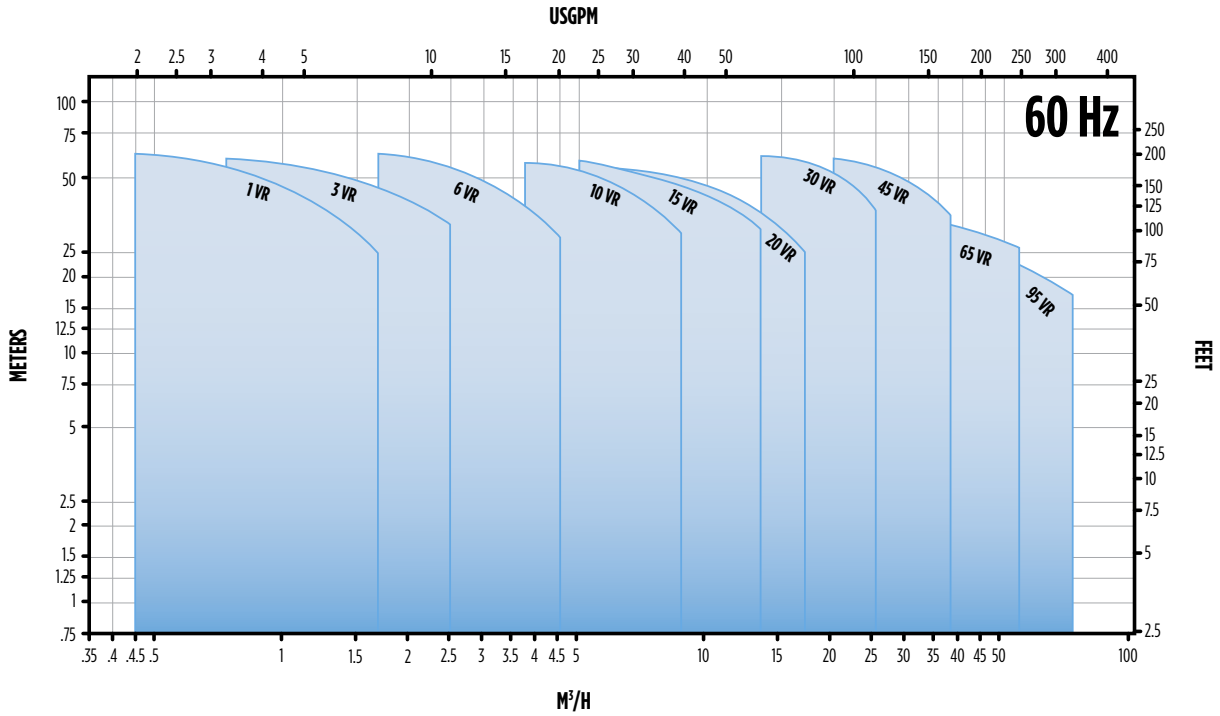
**Note: Nominal flow will be half of aboce at 4-pole (1800 RPM) operation*

VR SERIES

FAMILY CURVE - 2-POLE



FAMILY CURVE - 4-POLE



SUBMERSIBLE PUMPS

4" TRI-SEAL HIGH CAPACITY PUMPS

FEATURES

- Four performance ranges: 35, 45, 60, and 90 gpm
- 2" NPT discharge, with and without an internal stainless steel wafer-style check valve
- Stainless steel discharge head and motor bracket
- High flow hydraulic staging allows for maximum pump output, exceeds all energy efficiency standards, and provides increased product longevity
- Ceramic shaft sleeve and rubber discharge bearing eliminates sand wear
- Intermediate bearing for increased shaft stability when pump lengths dictate on high horse, high performance constructions
- Impeller eye and hub seals for improved performance and efficiency
- Stainless steel hex pump shaft, shell, and shaft coupling
- High capacity upthrust assembly for protection during start-up and operation (35, 45, 60, and 90 gpm models)
- Designed for optimal performance when powered by Franklin's corrosion-resistant 4" submersible motors

CSA CERTIFIED
PUMP END ONLY

C SA US 151236

NSF/ANSI 61
Drinking Water

MODEL NO. EXPLANATION

Example: 60FH10S4-PE

- 60 = gpm
- FH = Franklin Electric Brand
- 10 = 10 hp
- S = Stainless
- 4 = 4" Submersible
- PE = Pump End

Franklin Electric

SUBMERSIBLE PUMPS

4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

ORDER INFORMATION — 35-90 GPM PUMP ENDS

1 - 10 HP 4" High Capacity Pump Ends									
GPM	HP	Stages	Model	Order No.	Check Valve in 2" NPT Discharge	Basic Model	PEI_{CL} Number	Dimensions (in) Pump End Only	Wt. (lbs)
35	1	5	35FH1S4-PE	93653505	No	35S4	0.83	11.9	8
	1.5	7	35FH15S4-PE	93653507				14.5	9
	2	9	35FH2S4-PE	93653509				17	10
	3	12	35FH3S4-PE	93653512				20.9	11
	5	20	35FH5S4-PE	93653520				22.2	16
	7.5	29	35FH7S4-PE	93653529				44.5	23
	10	38	35FH10S4-PE	93653538				58.5	29
	1	5	35FH1S4-PECV	93663505	Yes			14.1	9
	1.5	7	35FH15S4-PECV	93663507				16.7	10
	2	9	35FH2S4-PECV	93663509				19.2	11
	3	12	35FH3S4-PECV	93663512				23	12
	5	20	35FH5S4-PECV	93663520				35.5	17
	7.5	29	35FH7S4-PECV	93663529				47	24
	10	38	35FH10S4-PECV	93663538				60.7	30
45	1.5	5	45FH15S4-PE	93654505	No	45S4	0.89	14.2	8
	2	7	45FH2S4-PE	93654507				17.6	9
	3	10	45FH3S4-PE	93654510				22.8	10
	5	16	45FH5S4-PE	93654516				35.3	14
	7.5	23	45FH7S4-PE	93654523				47.4	22
	10	31	45FH10S4-PE	93654531				63.3	28
	1.5	5	45FH15S4-PECV	93664505	Yes			16.3	9
	2	7	45FH2S4-PECV	93664507				19.8	10
	3	10	45FH3S4-PECV	93664510				25	11
	5	16	45FH5S4-PECV	93664516				37.4	15
	7.5	23	45FH7S4-PECV	93664523				49.5	23
	10	31	45FH10S4-PECV	93664531				65.5	29
60	2	7	60FH2S4-PE	93656007	No	60S4	0.94	23.5	10
	3	10	60FH3S4-PE	93656010				33.3	12
	5	16	60FH5S4-PE	93656016				48.8	18
	7.5	23	60FH7S4-PE	93656023				68.8	25
	10	30	60FH10S4-PE	93656030				86.9	31
	2	7	60FH2S4-PECV	93666007	Yes			25.7	11
	3	10	60FH3S4-PECV	93666010				35.4	13
	5	16	60FH5S4-PECV	93666016				50.9	19
	7.5	23	60FH7S4-PECV	93666023				71	26
	10	30	60FH10S4-PECV	93666030				89	32
90	2	6	90FH2S4-PE	93659006	No	90S4	0.92	23.4	10
	3	8	90FH3S4-PE	93659008				31.4	12
	5	13	90FH5S4-PE	93659013				46.3	17
	7.5	19	90FH7S4-PE	93659019				66.2	23
	10	25	90FH10S4-PE	93659025				84.2	29
	2	6	90FH2S4-PECV	93669006	Yes			25.6	11
	3	8	90FH3S4-PECV	93669008				33.6	13
	5	13	90FH5S4-PECV	93669013				48.5	18
	7.5	19	90FH7S4-PECV	93669019				68.4	24
	10	25	90FH10S4-PECV	93669025				86.3	30

NOTES: Maximum diameter across cable guard is 3.90" on all models.

ORDER INFORMATION — 35-90 GPM PUMP & MOTOR

1 - 1.5 HP Single-Phase Units (2-Wire PMA)									
GPM	HP	Stages	Volts	Model	Order No.	Check Valve in 2" NPT Discharge	Basic Model	PEI_{CL} Number	Wt. (lbs)
35	1	5	230	35FH1S4-2W230	93673505	No	35S4	0.83	32
	1.5	7		35FH15S4-2W230	93673507				40
	1	5		35FH1S4-2W230-CV	93693505	Yes			33
	1.5	7		35FH15S4-2W230-CV	93693507				41
45	1.5	5		45FH15S4-2W230	93674505	No	45S4	0.89	40
	1.5	5		45FH15S4-2W230-CV	93694505	Yes			41

1 - 1.5 HP Single-Phase Units (3-Wire PMA)									
35	1	5	230	35FH1S4-3W230	93703505	No	35S4	0.83	32
	1.5	7		35FH15S4-3W230	93703507				40
	1	5		35FH1S4-3W230-CV	93713505	Yes			33
	1.5	7		35FH15S4-3W230-CV	93713507				41
45	1.5	5		45FH15S4-3W230	93704505	No	45S4	0.89	40
	1.5	5		45FH15S4-3W230-CV	93714505	Yes			41

SUBMERSIBLE PUMPS

4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

MODEL CROSS REFERENCE — DOE COMPLIANT VS ORIGINAL FPS PUMP ENDS

1 - 10 HP 4" High Capacity Pump Ends					
GPM	Check Valve in 2" NPT Discharge	Tri-Seal High Capacity, DOE PEI_{CL} Rated		Original FPS (Discontinued, replaced by Tri-Seal High Capacity)	
		Model	Order No.	Model	Order No.
35	No	35FH1S4-PE	93653505	35FA1S4-PE	93613506
		35FH15S4-PE	93653507	35FA15S4-PE	93613508
		35FH2S4-PE	93653509	35FA2S4-PE	93613510
		35FH3S4-PE	93653512	35FA3S4-PE	93613514
		35FH5S4-PE	93653520	35FA5S4-PE	93613522
		35FH7S4-PE	93653529	35FA7S4-PE	93613534
		35FH10S4-PE	93653538	35FA10S4-PE	93613542
	Yes	35FH1S4-PECV	93663505	35FA1S4-PE W/ Check Valve	90653506
		35FH15S4-PECV	93663507	35FA15S4-PE W/ Check Valve	90653508
		35FH2S4-PECV	93663509	35FA2S4-PE W/ Check Valve	90653510
		35FH3S4-PECV	93663512	35FA3S4-PE W/ Check Valve	90653514
		35FH5S4-PECV	93663520	35FA5S4-PE W/ Check Valve	90653522
		35FH7S4-PECV	93663529	35FA7S4-PE W/ Check Valve	90653534
		35FH10S4-PECV	93663538	35FA10S4-PE W/ Check Valve	90653542
45	No	45FH15S4-PE	93654505	45FA15S4-PE	93614506
		45FH2S4-PE	93654507	45FA2S4-PE	93614508
		45FH3S4-PE	93654510	45FA3S4-PE	93614511
		45FH5S4-PE	93654516	45FA5S4-PE	93614518
		45FH7S4-PE	93654523	45FA7S4-PE	93614526
		45FH10S4-PE	93654531	45FA10S4-PE	93614531
	Yes	45FH15S4-PECV	93664505	45FA15S4-PE W/ Check Valve	90654506
		45FH2S4-PECV	93664507	45FA2S4-PE W/ Check Valve	90654508
		45FH3S4-PECV	93664510	45FA3S4-PE W/ Check Valve	90654511
		45FH5S4-PECV	93664516	45FA5S4-PE W/ Check Valve	90654518
		45FH7S4-PECV	93664523	45FA7S4-PE W/ Check Valve	90654526
		45FH10S4-PECV	93664531	45FA10S4-PE W/ Check Valve	90654531
60	No	60FH2S4-PE	93656007	60FA2S4-PE	93616006
		60FH3S4-PE	93656010	60FA3S4-PE	93616008
		60FH5S4-PE	93656016	60FA5S4-PE	93616013
		60FH7S4-PE	93656023	60FA7S4-PE	93616017
		60FH10S4-PE	93656030	60FA10S4-PE	93616024
	Yes	60FH2S4-PECV	93666007	60FA2S4-PE W/ Check Valve	90656006
		60FH3S4-PECV	93666010	60FA3S4-PE W/ Check Valve	90656008
		60FH5S4-PECV	93666016	60FA5S4-PE W/ Check Valve	90656013
		60FH7S4-PECV	93666023	60FA7S4-PE W/ Check Valve	90656017
		60FH10S4-PECV	93666030	60FA10S4-PE W/ Check Valve	90656024
90	No	90FH2S4-PE	93659006	90FA2S4-PE	93619005
		90FH3S4-PE	93659008	90FA3S4-PE	93619007
		90FH5S4-PE	93659013	90FA5S4-PE	93619012
		90FH7S4-PE	93659019	90FA7S4-PE	93619019
		90FH10S4-PE	93659025	90FA10S4-PE	93619020
	Yes	90FH2S4-PECV	93669006	90FA2S4-PE W/ Check Valve	90659005
		90FH3S4-PECV	93669008	90FA3S4-PE W/ Check Valve	90659007
		90FH5S4-PECV	93669013	90FA5S4-PE W/ Check Valve	90659012
		90FH7S4-PECV	93669019	90FA7S4-PE W/ Check Valve	90659019
		90FH10S4-PECV	93669025	90FA10S4-PE W/ Check Valve	90659020

MODEL CROSS REFERENCE — DOE COMPLIANT VS ORIGINAL FPS PUMP & MOTOR

1 - 1.5 HP Single-Phase Units (2-Wire PMA)					
GPM	Check Valve in 2" NPT Discharge	Tri-Seal High Capacity, DOE PEI_{CL} Rated		Original FPS (Discontinued, replaced by Tri-Seal High Capacity)	
		Model	Order No.	Model	Order No.
35	No	35FH1S4-2W230	93673505	35FA1S4-2W230	93613606
		35FH15S4-2W230	93673507	35FA15S4-2W230	93613608
	Yes	35FH1S4-2W230-CV	93693505	35FA1S4-2W230 W/ CV	90653606
		35FH15S4-2W230-CV	93693507	35FA15S4-2W230 W/ CV	90653608
45	No	45FH15S4-2W230	93674505	45FA15S4-2W230	93614606
	Yes	45FH15S4-2W230-CV	93694505	45FA15S4-2W230 W/ CV	90654606
1 - 1.5 HP Single-Phase Units (3-Wire PMA)					
35	No	35FH1S4-3W230	93703505	35FA1S4-3W230	93613706
		35FH15S4-3W230	93703507	35FA15S4-3W230	93613708
	Yes	35FH1S4-3W230-CV	93713505	35FA1S4-3W230 W/ CV	90653706
		35FH15S4-3W230-CV	93713507	35FA15S4-3W230 W/ CV	90653708
45	No	45FH15S4-3W230	93704505	45FA15S4-3W230	93614706
	Yes	45FH15S4-3W230-CV	93714505	45FA15S4-3W230 W/ CV	90654706

SUBMERSIBLE PUMPS

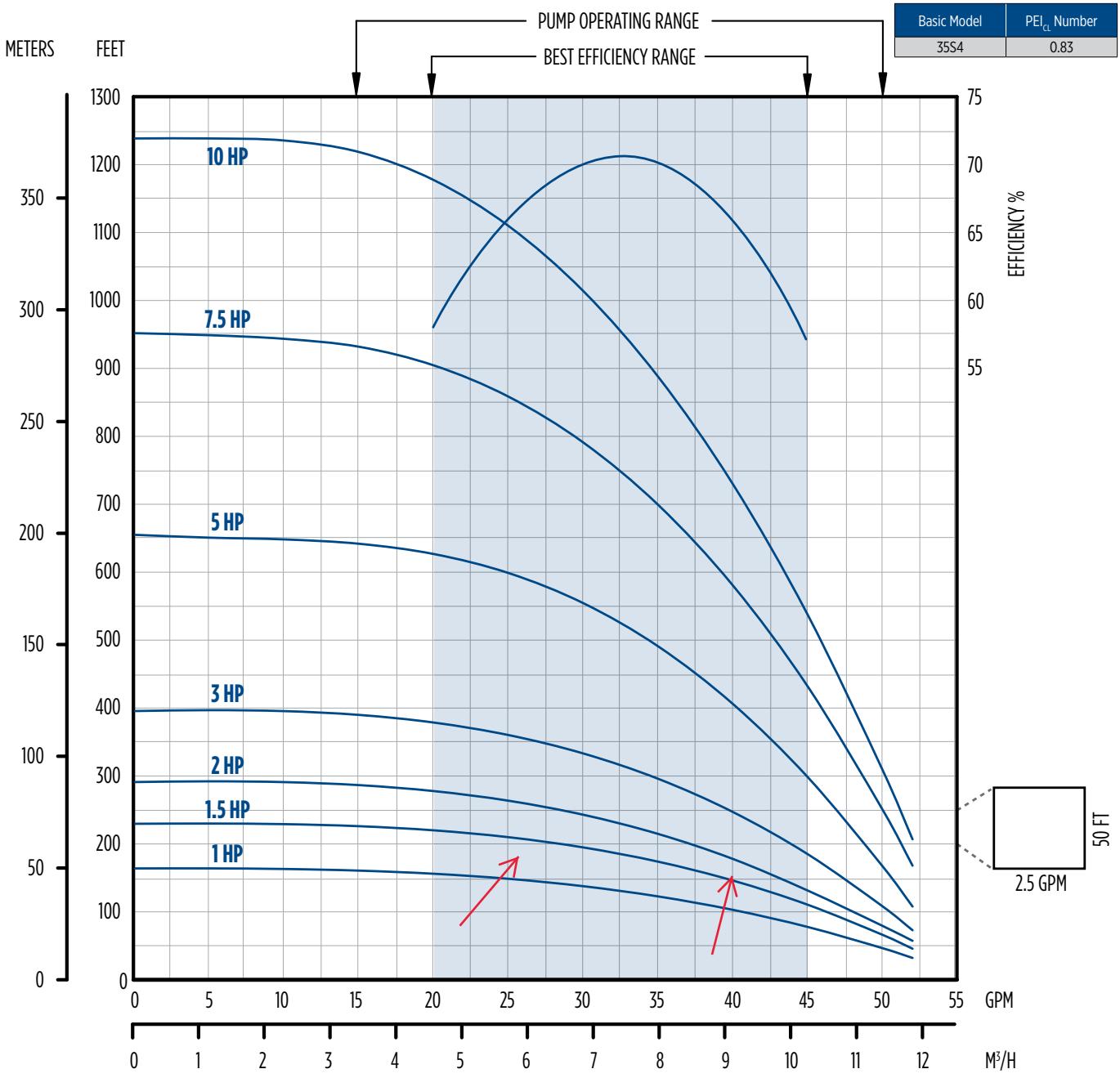
4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

PERFORMANCE

35 GPM

Basic Model	PEI_{CL} Number
35S4	0.83



SUBMERSIBLE PUMPS

4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

PERFORMANCE

35 GPM

HP	PSI	Depth to Pumping Water Level (Lift) in Feet. Shaded Areas Indicate Most Efficient Performance.																		
		0	20	40	60	80	100	120	140	160	180	200	240	280	320	360	400	440	480	Shut-Off (ft)
1	0					44	40	35	28											161
	10				44	39	34	27												
	20			43	39	33	25													
	30		42	38	32	23														
	40	42	37	31																
	50	36	30																	
	60	29																		
	70																			
	80																			
Shut-off PSI		70	61	52	44	35	26	18	9											
1.5	0							43	41	37	33	28								230
	10					46	43	40	37	32	27									
	20				45	43	40	36	32	26										
	30			45	42	39	35	31	24											
	40		44	42	39	35	30	23												
	50	44	41	38	34	29	21													
	60	41	37	33	28															
	70	37	33	27																
	80	32	26																	
Shut-off PSI		100	91	82	74	65	56	48	39	30	22	13								
2	0								44	42	40	37	30							300
	10							44	42	39	36	33	25							
	20					46	43	41	39	36	33	29								
	30				45	43	41	38	35	32	28	23								
	40			45	43	40	38	35	32	27	22									
	50		45	42	40	37	34	31	27	20										
	60	44	42	40	37	34	30	26												
	70	42	39	37	33	30	25													
	80	39	36	33	29	24														
Shut-off PSI		130	121	113	104	95	87	78	69	61	52	43	26							
3	0										45	44	40	37	32	25				400
	10									45	43	42	38	34	28					
	20								45	43	42	40	36	31	23					
	30							44	43	41	40	38	33	27						
	40						44	43	41	39	37	35	30							
	50				45	44	42	41	39	37	35	32	26							
	60			45	44	42	41	39	37	34	32	29								
	70		45	44	42	40	38	36	34	31	28	24								
	80	45	43	42	40	38	36	34	31	28	23									
Shut-off PSI		173	165	156	147	139	130	121	113	104	95	87	69	52	35	17				

HP	PSI	120	140	160	180	200	240	280	320	360	400	440	480	500	550	600	650	700	750	800	Shut-Off (ft)
5	0								44	42	40	38	36	34	30	24					650
	10							45	43	41	39	37	34	32	28	20					
	20							44	42	40	38	35	32	30	25						
	30						45	43	41	39	36	33	30	28	21						
	40					45	44	42	40	37	35	32	28	25							
	50				45	44	42	41	38	36	33	29	25	22							
	60			45	44	43	41	39	37	34	31	27	21								
	70		45	44	43	42	40	38	35	32	29	24									
	80	45	44	43	42	41	39	37	34	30	26										
Shut-off PSI		229	221	212	203	195	177	160	143	126	108	91	74	65	43	22					

HP	PSI	240	280	320	360	400	440	480	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	Shut-Off (ft)
7.5	0						45	43	43	41	39	37	35	32	29	25	20						950
	10						44	43	42	40	38	36	34	31	28	23							
	20					45	43	42	41	39	37	35	33	30	26	21							
	30				45	44	43	41	40	38	36	34	31	28	24								
	40			46	44	43	42	40	40	38	35	33	30	26	21								
	50			45	44	42	41	39	39	37	34	31	28	24									
	60		45	44	43	42	40	39	38	35	33	30	26	22									
	70		45	43	42	41	39	38	37	34	32	28	24										
	80	45	44	43	41	40	38	37	36	33	30	27	22										
Shut-off PSI		307	290	273	255	238	221	203	195	173	152	130	108	87	65	43	22						
10	0									45	43	42	41	39	38	36	35	33	31	28	25	22	1250
	10								45	44	43	42	40	39	37	35	34	32	29	27	24	20	
	20							45	45	44	42	41	40	38	36	35	33	31	28	26	22		
	30							45	44	43	42	40	39	37	36	34	32	30	27	24	20		
	40						45	44	44	42	41	40	38	37	35	33	31	28	26	22			
	50					46	45	44	43	42	40	39	37	36	34	32	30	27	24	21			
	60				46	45	44	43	42	41	40	38	37	35	33	31	29	26	23				
	70				45	44	43	42	42	41	39	38	36	34	32	30	28	25	21				
	80			46	45	44	43	42	41	40	38	37	35	33	31	29	26	23					
Shut-off PSI				403	385	368	351	333	325	303	281	260	238	216	195	173	152	130	108	87	65	43	

NOTES: Performance shown does not include friction loss in the drop pipe. All performance data is based on rated motor nameplate voltage. Performance shown is based on a pump without check valve.

SUBMERSIBLE PUMPS

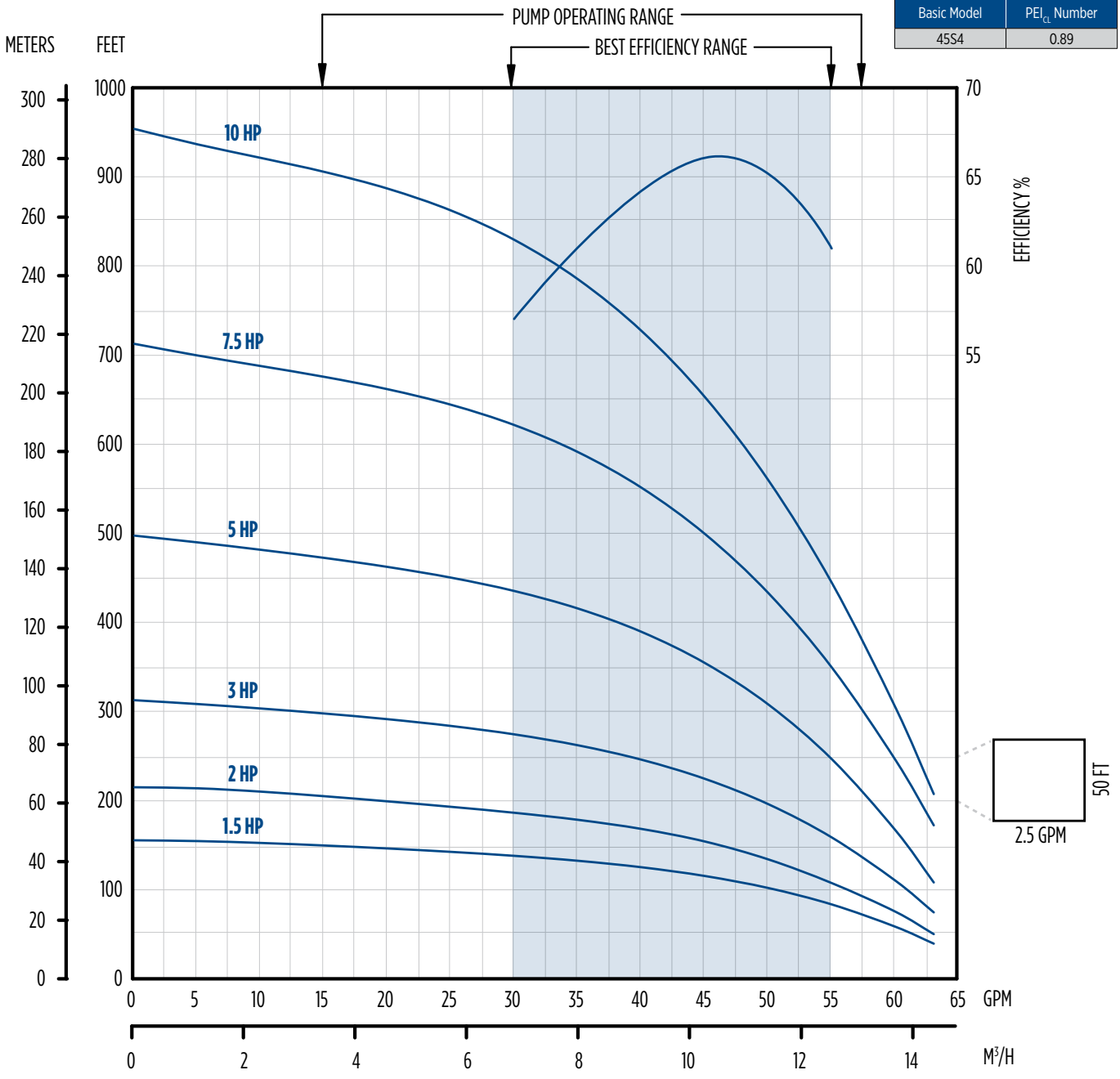
4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

PERFORMANCE

45 GPM

Basic Model	PEI_{CL} Number
45S4	0.89



SUBMERSIBLE PUMPS

4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

PERFORMANCE

45 GPM

HP	PSI	Depth to Pumping Water Level (Lift) in Feet. Shaded Areas Indicate Most Efficient Performance.																			
		0	20	40	60	80	100	120	140	160	180	200	240	280	320	360	400	440	480	500	Shut-Off (ft)
1.5	0					55	50	43													156
	10				54	49	41														
	20			54	48	39															
	30		53	47	38																
	40	52	46	36																	
	50	44	33																		
	60	30																			
Shut-off PSI		68	59	50	42	33	24	16													
2	0							52	48	43	35										216
	10						52	47	42	33											
	20				55	51	47	41	31												
	30			54	51	46	39	29													
	40		54	50	45	38															
	50	53	49	44	37																
	60	48	43	35																	
	70	42	34																		
	80	32																			
Shut-off PSI		94	85	76	68	59	50	42	33	24	16										
3	0									54	52	49	41								312
	10								54	51	48	45	35								
	20							54	51	48	44	40									
	30						53	50	47	44	39	32									
	40				55	53	50	47	43	38	31										
	50			55	52	50	46	42	37												
	60		55	52	49	46	42	36													
	70	54	52	49	45	41	35														
	80	51	48	44	40	34															
Shut-off PSI		135	126	118	109	100	92	83	74	66	57	48	31								
5	0												55	52	48	44	38				500
	10												53	50	46	41	33				
	20											55	51	48	43	37					
	30									56	54	53	49	45	40	32					
	40								56	54	53	51	47	42	36						
	50							55	54	52	51	49	45	39	30						
	60						55	54	52	50	49	46	42	34							
	70					55	53	52	50	48	46	44	38								
	80					53	52	50	48	46	43	41	33								
Shut-off PSI						182	173	165	156	147	139	130	113	95	78	61	43				

HP	PSI	160	180	200	240	280	320	360	400	440	480	500	550	600	650	700	750	800	850	900	Shut-Off (ft)
7.5	0							54	52	49	46	45	40	34							707
	10						55	53	50	48	44	43	37	30							
	20						54	52	49	46	42	40	34								
	30					55	53	50	47	44	40	38	30								
	40				56	54	51	48	45	42	37	35									
	50				54	52	50	47	43	39	34	31									
	60			55	53	51	48	45	41	37	30										
	70		55	54	52	49	46	43	39	33											
	80	55	54	53	50	48	44	41	36												
Shut-off PSI		237	228	219	202	185	168	150	133	116	98	90	68	46							
10	0									55	53	53	50	48	45	42	38	33			950
	10								56	54	52	52	49	47	44	40	36	31			
	20								55	53	51	51	48	45	42	38	34				
	30							56	54	52	50	49	47	44	40	36	31				
	40							55	53	51	49	48	46	42	39	34					
	50						55	54	52	50	48	47	44	41	37	31					
	60					56	54	53	51	49	47	46	43	39	34						
	70					55	53	52	50	48	46	44	41	37	32						
	80				56	54	52	51	49	47	44	43	39	35							
Shut-off PSI					307	290	273	255	238	221	203	195	173	152	130	108	87	65			

NOTES: Performance shown does not include friction loss in the drop pipe. All performance data is based on rated motor nameplate voltage. Performances for former XP models are the same as 45 gpm models. Performance shown is based on a pump without check valve.

SUBMERSIBLE PUMPS

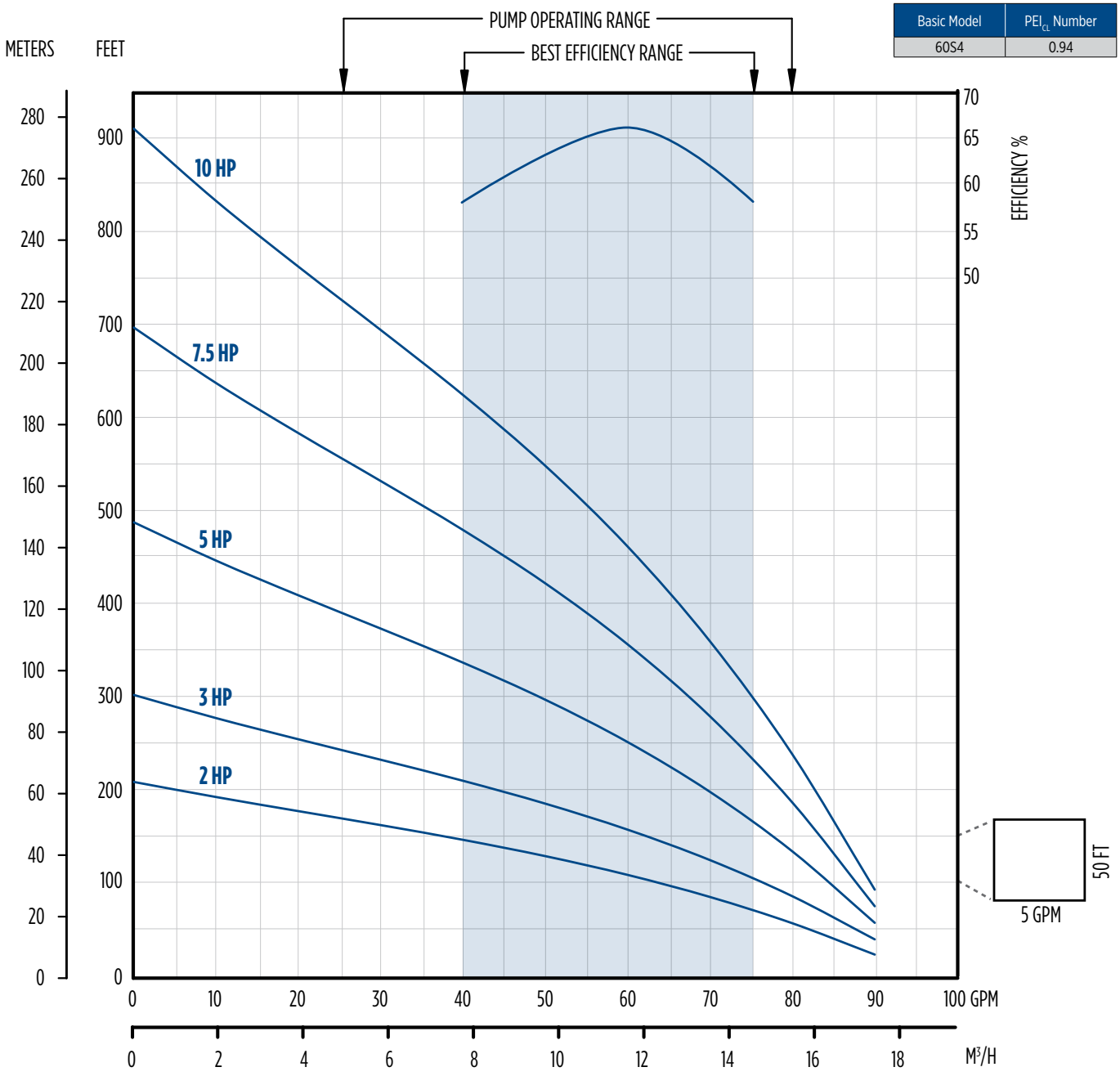
4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

PERFORMANCE

60 GPM

Basic Model	PEI_{CL} Number
60S4	0.94



SUBMERSIBLE PUMPS

4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

PERFORMANCE — 60 GPM

HP	PSI	Depth to Pumping Water Level (Lift) in Feet. Shaded Areas Indicate Most Efficient Performance.																		
		0	20	40	60	80	100	120	140	160	180	200	240	280	320	360	400	440	480	Shut-Off (ft)
2	0				79	72	64	55	45											206
	10			78	71	63	54	43												
	20		77	70	62	52	41													
	30	76	69	60	51															
	40	68	59	49																
	50	57	47																	
	60	45																		
Shut-off PSI		89	81	72	63	55	46	37	29											
3	0					82	77	71	66	59	52	44								300
	10				81	76	71	65	58	51	43									
	20			80	75	70	64	57	50	42										
	30		79	74	69	63	56	49	40											
	40	79	74	68	62	55	47	39												
	50	73	67	61	54	46	38	29												
	60	66	60	53	45															
	70	59	52	44																
	80	50	42																	
Shut-off PSI		130	121	113	104	95	87	78	69	61	52	43								
5	0							82	79	76	73	70	62	54	44					485
	10						82	79	76	73	69	66	58	49						
	20					81	78	75	72	69	65	61	53	43						
	30				81	78	75	72	68	64	60	56	47							
	40			80	77	74	71	68	64	60	56	51	41							
	50		80	77	74	71	67	63	59	55	50	45								
	60	79	76	73	70	66	63	59	54	50	45	40								
	70	76	73	69	66	62	58	54	49	44	39									
	80	72	69	65	61	57	53	48	43											
Shut-off PSI		210	201	193	184	175	167	158	149	141	132	123	106	89	71					
7.5	0										81	79	75	70	65	60	54	47	40	700
	10									80	78	76	72	67	62	56	50	43		
	20								80	78	76	74	69	64	59	53	46			
	30							80	78	76	74	71	66	61	55	49	42			
	40						80	78	75	73	71	69	63	58	52	45				
	50				81	79	77	75	73	71	68	66	60	54	48	41				
	60			81	79	77	75	72	70	68	65	63	57	51	44					
	70		81	79	77	74	72	70	67	65	62	59	53	47	40					
	80	80	78	76	74	72	69	67	64	62	59	56	50	43						
Shut-off PSI		303	294	286	277	268	260	251	242	234	225	216	199	182	165	147	130	113	95	

HP	PSI	40	60	80	100	120	140	160	180	200	240	280	320	360	400	440	480	500	550	600	Shut-Off (ft)
10	0										80	77	74	70	66	62	58	56	50	43	905
	10									81	78	75	72	68	64	60	55	53	47	40	
	20								81	79	76	73	69	66	62	57	53	50	44		
	30							81	79	78	74	71	67	63	59	55	50	47	41		
	40						81	79	77	76	72	69	65	61	57	52	47	44			
	50					80	79	77	76	74	70	67	63	58	54	49	44	41			
	60				80	79	77	75	74	72	68	64	60	56	51	46	41				
	70		81	80	78	77	75	73	72	70	66	62	58	53	48	43					
	80	81	80	78	76	75	73	71	70	68	64	60	55	50	45	40					
Shut-off PSI		374	366	357	348	340	331	323	314	305	288	271	253	236	219	201	184	175	154	132	

NOTES: Performance shown does not include friction loss in the drop pipe. All performance data is based on rated motor nameplate voltage. Performances for former XP models are the same as 45 gpm models. Performance shown is based on a pump without check valve.

SUBMERSIBLE PUMPS

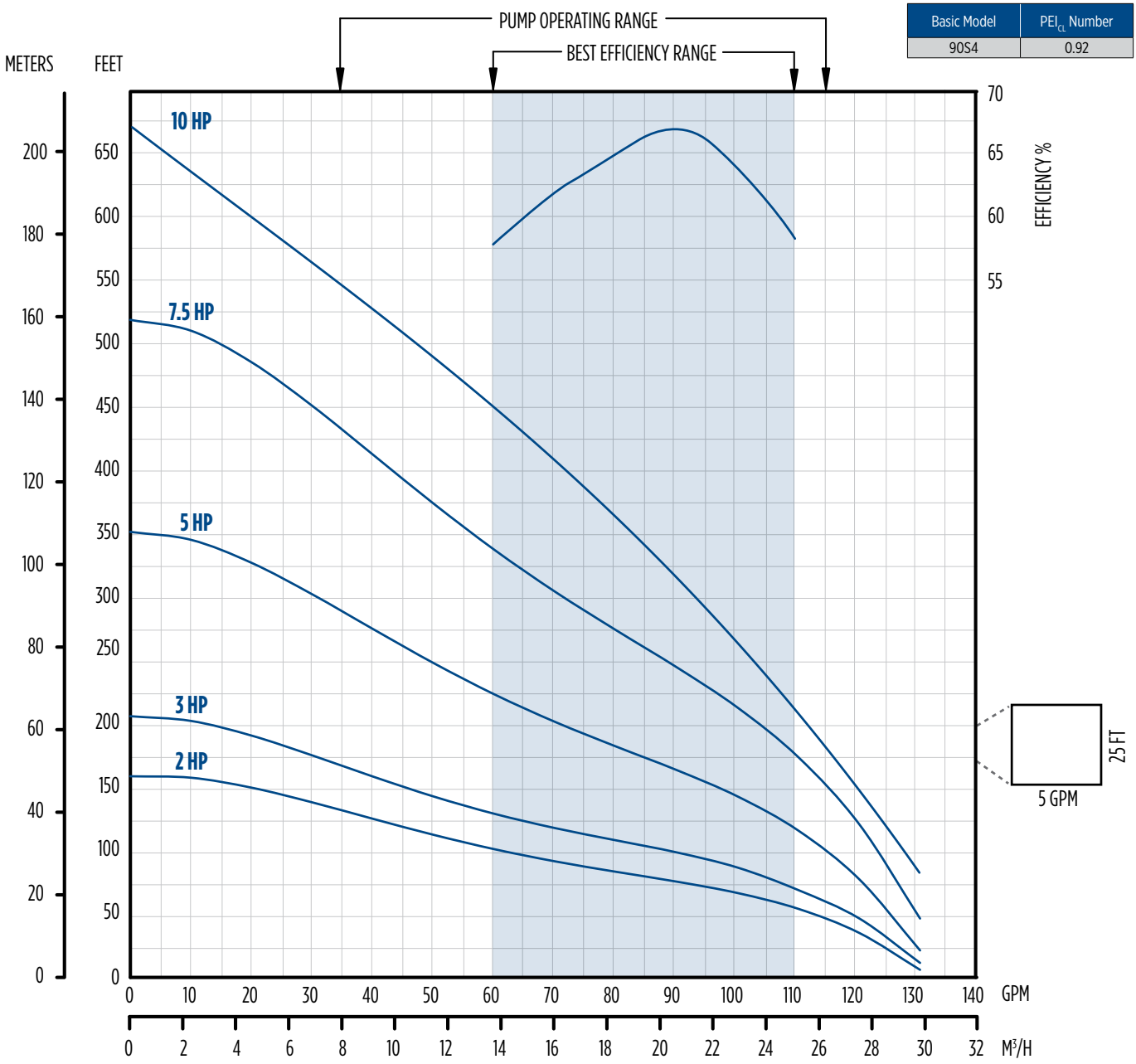
4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

PERFORMANCE

90 GPM

Basic Model	PEI_{CL} Number
90S4	0.92



SUBMERSIBLE PUMPS

4" TRI-SEAL HIGH CAPACITY PUMPS

Franklin Electric

PERFORMANCE — 90 GPM

HP	PSI	Depth to Pumping Water Level (Lift) in Feet. Shaded Areas Indicate Most Efficient Performance.																	
		0	20	40	60	80	100	120	140	160	180	200	240	280	320	360	400	440	Shut-Off (ft)
2	0				104	89													170
	10			102	86	67													
	20		100	83	64														
	30	97	80	60															
	40	77																	
Shut-off PSI		74	65	56	48	39													
3	0					103	90	76											220
	10				101	88	73												
	20		110	99	86	71													
	30	109	97	84	68														
	40	95	81	65															
	50	79	63																
	60	60																	
Shut-off PSI		95	87	78	69	61	52	43											
5	0							106	99	92	84	76							365
	10						105	98	91	83	74	65							
	20				110	104	97	90	82	73	64								
	30			109	103	96	88	80	72	62									
	40		108	102	95	87	79	70	61										
	50	107	101	94	86	78	69	60											
	60	100	92	85	76	67													
	70	91	83	75	66														
	80	82	74	65															
Shut-off PSI		158	149	141	132	123	115	106	97	89	80	71							
7.5	0									111	106	101	91	81	69				535
	10								110	105	101	96	85	74	62				
	20							109	105	100	95	90	79	68					
	30						108	104	99	94	89	84	73	60					
	40					108	103	98	93	88	83	77	66						
	50				107	102	98	93	87	82	76	71							
	60		111	106	102	97	92	87	81	76	70	64							
	70	110	106	101	96	91	86	80	75	69	63								
	80	105	100	95	90	85	79	74	68	62									
Shut-off PSI		232	223	214	206	197	188	180	171	162	154	145	128	110	93				
10	0											112	105	98	90	82	74	65	680
	10										112	108	101	93	86	77	69	60	
	20									111	108	104	97	89	81	73	64		
	30							114	111	107	104	100	92	84	76	68	59		
	40						114	110	107	103	99	95	88	80	71	62			
	50					113	110	106	102	99	95	91	83	75	66				
	60				113	109	106	102	98	94	90	86	78	70	61				
	70			112	109	105	101	98	94	90	86	82	73	65					
	80		112	108	104	101	97	93	89	85	81	77	69	60					
Shut-off PSI		294	286	277	268	260	251	242	234	225	216	208	190	173	156	139	121	104	

NOTES: Performance shown does not include friction loss in the drop pipe. All performance data is based on rated motor nameplate voltage. Performance shown is based on a pump without check valve.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