TECHNICAL MEMORANDUM

SUBJECT: Production Well MJ-PW1 Hydraulic Performance Evaluation, Middletown-Junction Property, Warren County, Ohio

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DATE: May 1, 2025

WELL EVALUATION SUMMARY

Terran Corporation, on behalf of Warren County Water & Sewer Dept. (WCW&SD), submits the following technical memorandum to document the installation and testing of production well MJ-PW01 for final approval by the Ohio Environmental Protection Agency, Southwest District Office (Ohio EPA, SWDO) for use as a Public Water System, Community Water Supply (PWS CWS) well. The production well was designed using the Ohio EPA "green book" as a guide to compliance with rules and procedures governing PWS CWS wells (i.e. Ohio EPA, 2023). Well development and testing was conducted following OAC 3745-9-09 methods and procedures.

WCW&SD submits for consideration the following facts concerning well MJ-PW1:

1) MJ-PW1 is a 16-inch diameter, 90-feet deep production well located near the northeast boundary of the Middletown-Junction property and adjacent to the Little Miami River which is the primary source water supply for the proposed Middletown-Junction Wellfield (Figure 1).
2) The ODNR well log (#3022157) is provided in Attachment #1.
3) MJ-PW1 location coordinates are: 39.3646852 degrees latitude; -84.2391888 degrees longitude.
4) MJ-PW1 was constructed with stainless steel, wire-wrapped screen consisting of 20-feet of 100 slot openings set from 70 to 90 feet below ground surface (ft. bgs). A #2 quartz sand filter pack was constructed around the screen from 60 feet to 90 feet. A 0.5 ft. thick bentonite pellet seal was placed over the filter pack and cement grout seal was tremie into the annular space from 59.5 ft. bgs to grade.
5) During the MJ-PW1 December 2024 24-hour constant rate test (CRT), a pumping rate of 1,691 gallons per minute (gpm) was sustained. WCW&SD is requesting an Ohio EPA approved permanent pump design rating of 1,100 gpm for this production well.
6) Analysis of the CRT data from the pumping and monitoring wells indicated the aquifer's transmissivity values range from 12,100 to 22,600 feet squared per day (ft.^{2}/day) and averages about 16,900 ft.^{2}/day. Calculated hydraulic conductivity values range from 185 to 318 feet/day (ft./day) and averages about 240 ft./day. Aquifer storativity values varied from 5.95×10^{-9} to 1.42×10^{-1} and averaged 1.57×10^{-2}. The range of storativity values are consistent with anticipated values for a semi-confined aquifer.

The production well's groundwater quality parameters meet Federal Maximum Contaminant Levels (MCLs) and Secondary MCLs (SMCLs) with the exception for the per- and polyfluoroalkyl substances (PFAS) constituent perfluorooctane sulfonate (PFOS) at 0.0166 µg/L (16.6 ng/l) (associated with the surface water quality of the Little Miami River), and the naturally-occurring metals of iron and manganese which are constituents routinely treated at the water treatment facility.

Cobbles and small boulders within the sand and gravel outwash at MJ-PW01.

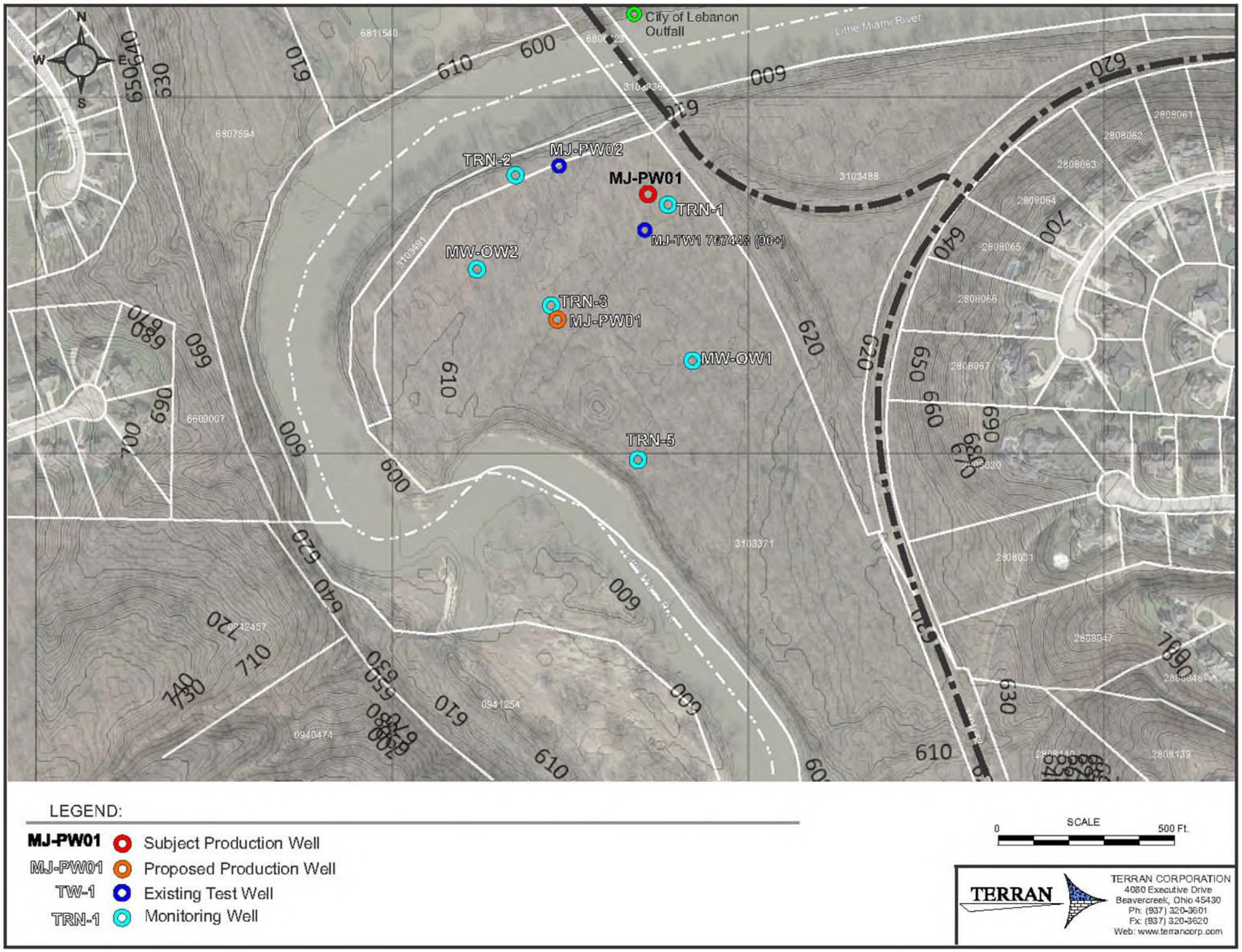


Figure 1. Location of production well MJ-PW1 and monitoring wells at the Middletown-Junction property.

Well Drilling and Construction Description

Drilling of MJ-PW1 was conducted during September 2024 with the installation of a 20-inch outer casing using a cable tool rig. National Water Services, LLC (NWS) mobilized a truck-mounted 28-L cable tool rig to the site in late August to set the 24-inch steel casing (Figure 2). The 20-inch casing was driven down and bailed to the bottom of the aquifer, a course sand and gravel outwash deposit (Figure 3), encountering bedrock at 90 feet. The proposed well screen and casing design (Attachment #1) was prepared by NWS based on samples of the formation collected on 5-foot intervals to characterize the aquifer's grain size distribution.

Figure 2. Production well MJ-PW1 under construction at the Middletown-Junction property, September 2024.

Figure 3. Course cobble outwash sand and gravel as found at MJ-PW1, September 2024.

Construction of MJ-PW1 was constructed during November 2024. MJ-PW1 was constructed with a 0.100-inch slot, 20-foot length of screen set from 70 to 90 ft. bgs. The 16-inch carbon steel casing sections, including exterior centralizers, were field welded (Figure 4). These were used to center the well inside the outer casing. The 24-inch casing was then pulled up using hydraulic jacks to expose the well screen and casing as the well was constructed.

A #2 quarry sand filter pack was constructed around the screen from 60 to 90 ft. bgs (Figure 5). A bentonite pellet seal, 0.5-feet in thickness, was constructed on top of the filter pack. The remainder of the casing annular space was grouted shut using Portland cement grout to seal the annular space from 59.5 ft. bgs to grade (Figure 6). MJ-PW1 was completed on November 26, 2024 in terms of its screen, casing, filter pack and annular sealing. The “as built” diagram of the well is provided in Figure 7. MJ-PW1 will be completed as a submersible pump operated well (Figure 7).

All the well’s final construction features, such as the pitless adaptor, submersible pump and supporting appurtenances will be installed according to WCW&SD plans at a later date when the well field is constructed under a separate contract and contractor. The proposed pump is an American-Marsh Pump capable of pumping 500 to 1,200 gpm under a total dynamic head pressure of 284 feet. A copy of the proposed pump performance data sheets is provided in Attachment #2 of this memorandum.

Figure 4. NWS installing MJ-PW1 well screen and casing on November 20, 2024.

Figure 5. No. 2 Parry sand pack being placed around the well screen, November 22, 2024.

Figure 6. NWS using tremie equipment to seal the annular space of well MJ-PW1 with cement grout, November 26, 2024.

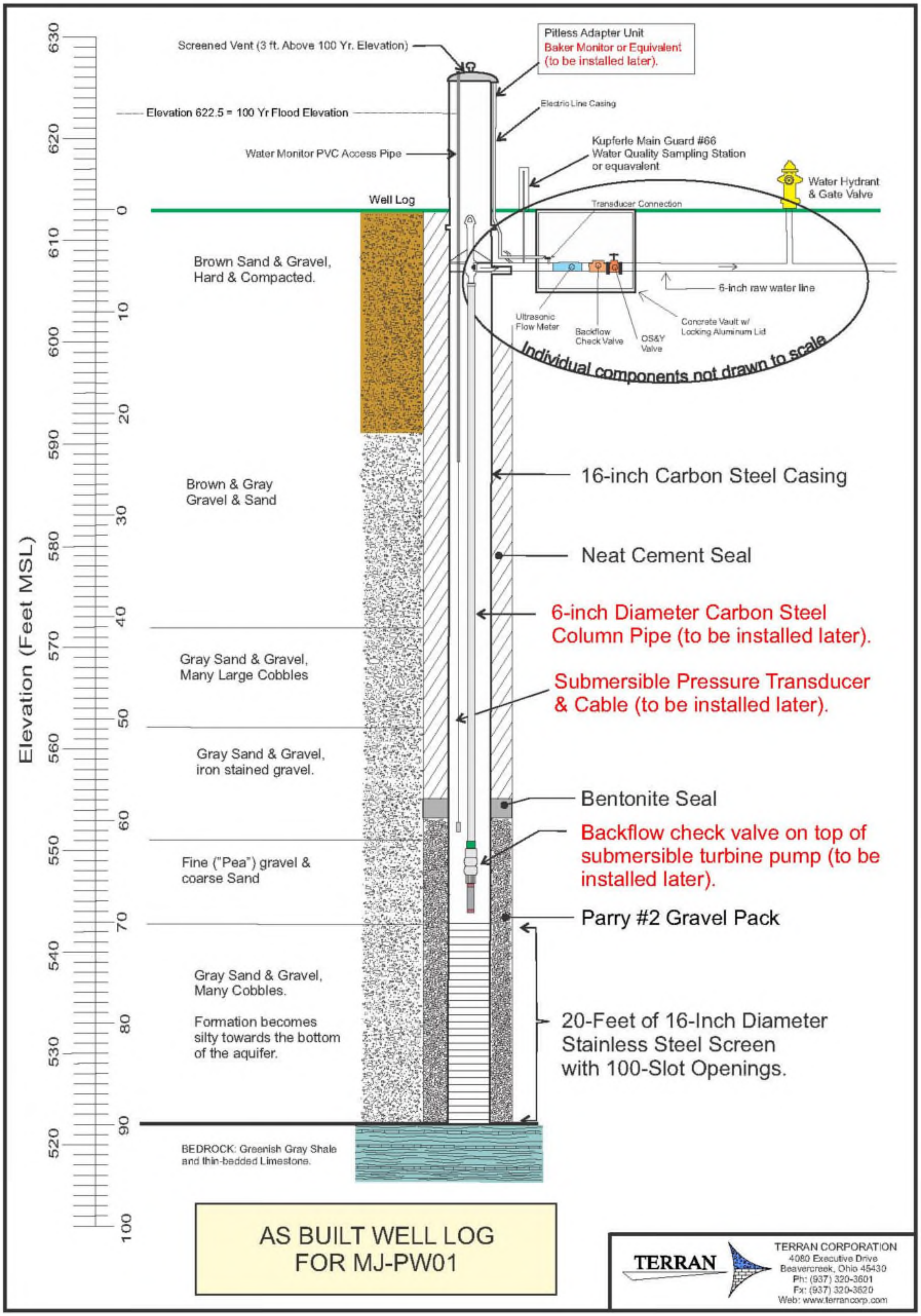


Figure 7. As built diagram for production well MJ-PW1.

Well Development

MJ-PW1 was developed in accordance with OAC 3745-9-09 to remove the native silt and sand of the filter pack. Development was conducted by repeated surging of the well screen while air-lift pumping the water at a rate of approximately 100 gpm to remove the formation fines (Figure 8). Development was conducted during December 2024 and effectively removed the silt and sand from around the screen. This was confirmed using a using a Rossum Sand Tester throughout the development process. After completion of development, subsequent measurements of sand accumulation in the tester from well discharge was hardly visible.

Figure 8. Well development of MJ-PW01 during November-December 2024.

Hydrogeologic Setting

The hydrogeologic setting of the subject area was characterized through the drilling of soil borings TRN-1 to TRN-7 with the installation of monitoring wells MJ-TRN1, MJ-TRN2, MJ-TRN3 and MJ-TRN5 (Terran Corp., 2022b). The site hydrogeology consists of stratified glacial outwash comprising a single buried valley aquifer (BVA) contained within a deeply incised bedrock valley (Figure 9). The BVA is primarily a semi-confined aquifer and MJ-PW1 is screened at the bottom of this aquifer at its location.

Depth to groundwater is shallow, ranging from approximately 16 to 24 ft. bgs as measured in the monitoring and test wells (Table 1). Water levels for monitoring wells MJ-TRN1, MJ-TRN2 and MJ-TRN3 located throughout the site (Figure 1) reflect the hydrodynamic activity at the Middletown-Junction property. Water levels in the three wells during March and April 2023 fluctuated on the order of 3 to 4 feet in response to high water events along the Little Miami River as measured at the U.S. Geological Survey (USGS) station 03242050 at South Lebanon (Figure 10).

Groundwater modeling of the Middletown-Junction property was conducted to evaluate the production potential of the proposed well field (Terran Corp., 2022a and 2023). The modeling results indicated a wellfield capable of producing 2.5 million gallons per day (MGD) is possible through three production wells, pumping between 550 to 600 gpm each. Based on the aquifer testing of the test wells at the property, the model was revised and determined that the aquifer has potential for 3.0 MGD production using two production wells (using the existing 16-inch test well as a backup well.

During the process for site approval, of the Middletown-Junction property, the Ohio EPA expressed concern regarding the City of Lebanon’s WWTP outfall occurring in proximity to the proposed well field. To address the concern, Terran conducted fate and transport (F&T) modeling of the outfall using chloride as the constituent of concern to evaluate potential long term impact to the well field under 3.0 MGD operation using wells MJ-PW1 and MJ-PW3 (Terran Corp., 2024a) and the existing test well TW-2 which is proposed for use at the well field as backup well MJ-PW2 (Terran Corp., 2024b). Results of the F&T modeling indicated the location of the outfall with respect to the well field and the surface flow of the Little Miami River and the silty nature of the Little Miami River’s bed will sufficiently protect the water quality of the Middletown-Junction well field.

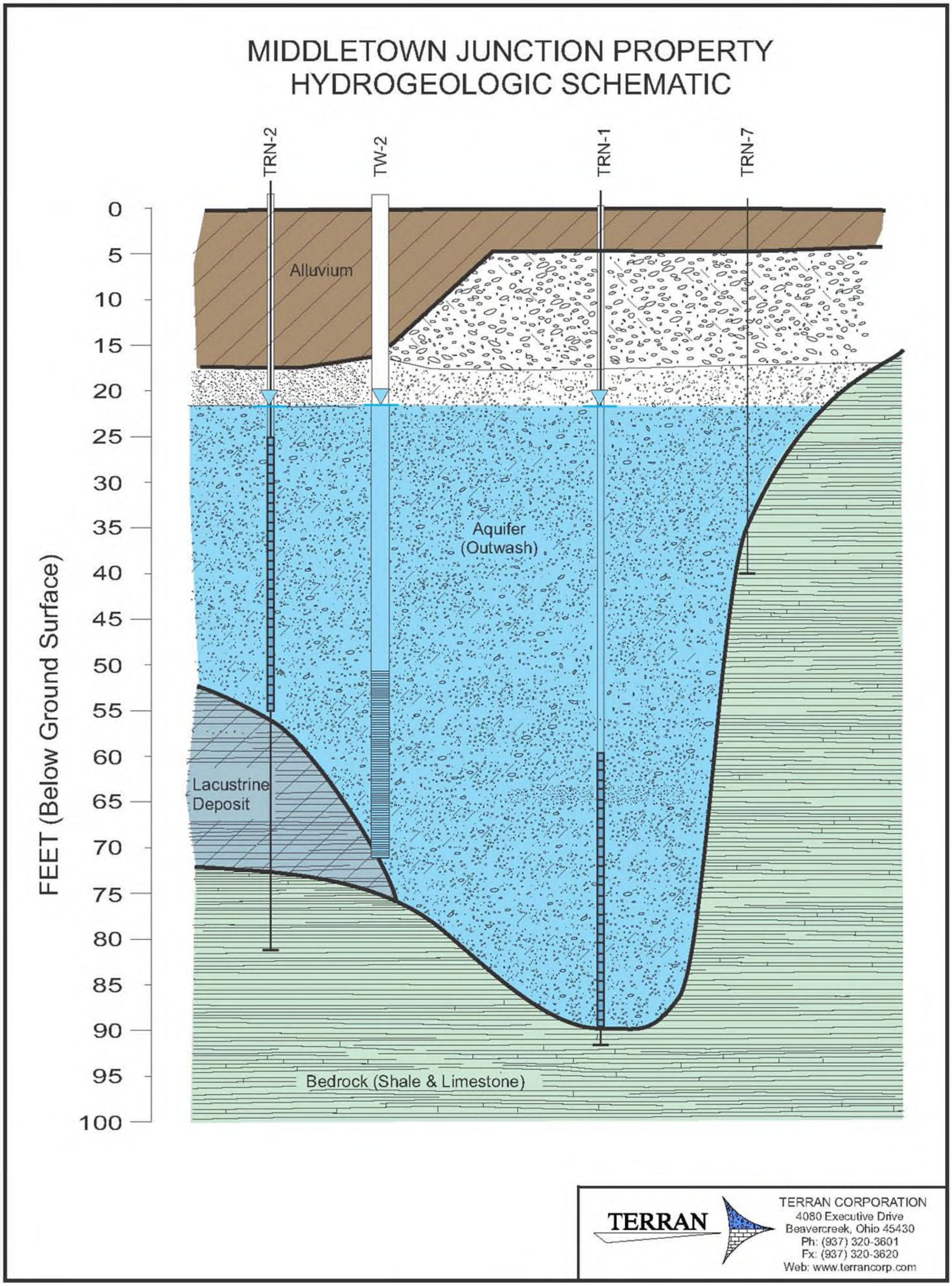


Figure 9. Conceptual hydrogeologic profile of buried valley aquifer at TW-2, Middletown-Junction property.

Table 1. Representative groundwater level measurements at the Middletown-Junction Property.

Date	TRN-1	TRN-2	TRN-3	TRN-5	OW-1	OW-2	TW-1	TW-2
	Depth to Groundwater (Feet below top-of-casing)							
11/14/2022	22.70	22.40	20.02	24.85	---	---	---	---
12/29/2022	22.91	22.65	20.22	---	25.45	---	22.36	19.25
1/4/2023	21.55	21.27	18.83	23.53	24.09	18.82	20.98	17.88
1/10/2023	21.63	21.39	18.99	23.81	24.20	18.97	21.13	18.09
1/11/2023	21.75	21.49	19.09	23.91	24.30	19.10	21.21	18.16
1/18/2023	21.28	21.01	18.59	23.42	23.79	18.60	20.76	17.64
1/27/2023	20.47	20.18	17.73	22.49	22.96	17.75	19.95	16.83
2/2/2023	20.59	20.33	17.93	22.78	23.15	17.94	20.09	16.98
3/1/2023	21.46	21.17	18.74	23.54	23.97	18.79	20.57	17.76
4/11/2023	19.04	18.82	16.48	21.60	21.67	16.44	18.23	15.41
4/12/2023	20.07	19.78	17.41	22.33	22.60	17.36	19.68	16.39
5/2/2023	21.30	21.04	18.61	23.31	23.84	18.61	20.48	17.67
5/18/2023	21.30	21.03	18.66	---	23.84	18.75	20.48	17.65
5/24/2023	21.87	21.62	19.19	24.06	24.44	19.25	21.34	17.94
6/1/2023	22.52	22.28	19.87	24.68	25.09	19.87	22.00	22.28
12/11/2024	22.40	22.43	20.00	24.80	25.22	-----	21.84	20.01
12/17/2024	22.58	22.03	19.59	24.22	24.81	19.58	21.44	18.61
2/25/2025	19.71	19.63	16.95	-----	-----	17.21	18.70	16.12
3/7/2025	20.99	20.75	18.34	23.20	23.55	18.32	20.15	17.40
3/14/2025	22.41	22.12	19.70	24.40	24.91	19.72	21.57	18.76
3/18/2025	19.43	19.20	17.12	21.47	21.67	16.77	19.43	15.84

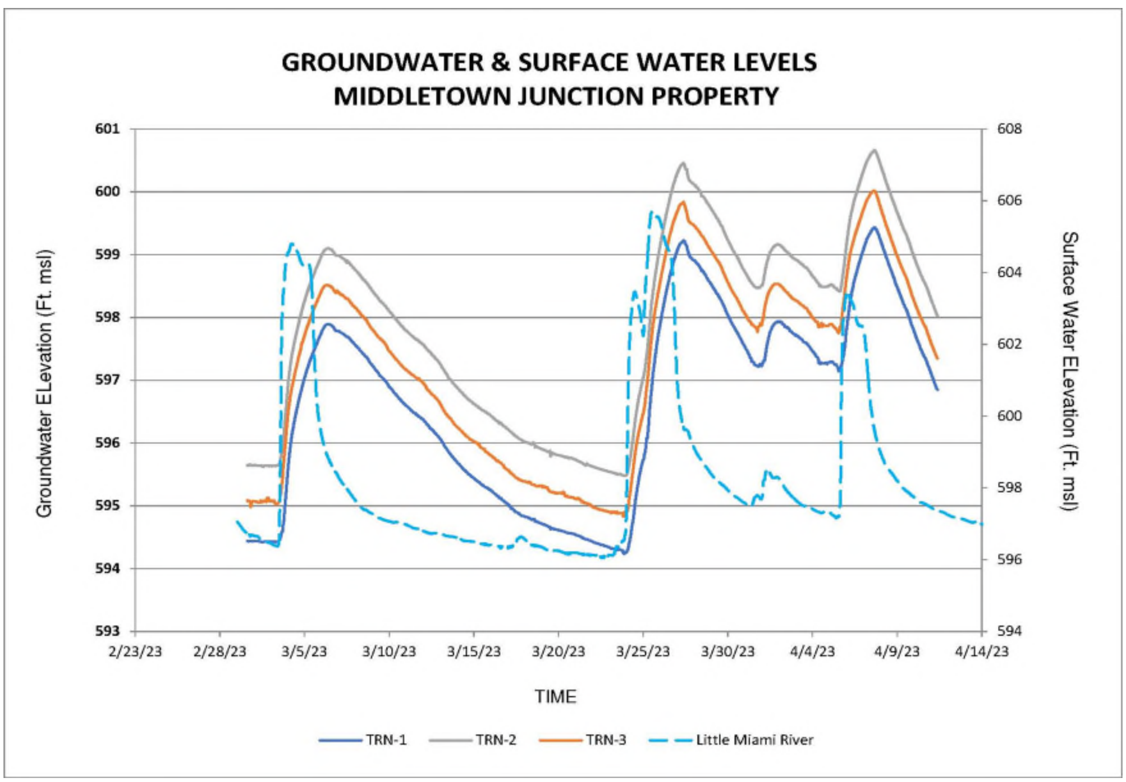


Figure 10. Groundwater level trends in monitoring wells TRN-1 to TRN-3 and Little Miami River stage elevations, March 1-April 11, 2023.

Well Testing

As required by OAC 3745-9-09(B), the aquifer and well performance at the MJ-PW1 wellsite were characterized through the conduct of a Step-Drawdown Test (SDT), a 24-hour Constant Rate Test (CRT) and a Recovery Test (RT). These tests were successfully completed from December 11-19, 2024. Test data was used for aquifer characterization to determine the sustainable yield and potential drawdown of the well at its rated design capacity. In addition to estimates of sustainable yield and drawdown, well test results were analyzed to determine representative values of key aquifer coefficients; transmissivity, hydraulic conductivity, storativity and diffusivity. These newly acquired well and aquifer parameters will be used to update the Middletown-Junction property conceptual, analytical and numerical groundwater models. The Ohio EPA required SDT and CRT field forms are provided in Attachment #3.

Step Drawdown Test (SDT) Description

The SDT of MJ-PW1 started at 09:00 hours on December 12, 2024. Four 120-minute-long steps were completed at pumping rates of 780, 1,066, 1,391 and 1,691 gpm. Conduct of MJ-PW1 SDT test used a submersible test pump and portable generator. At the wellhead, a 90-degree elbow, pressure gauge and controlling gate valve were installed to regulate discharge. Also installed at the pumping well were a transducer/datalogger and fixed electronic tape to monitor water levels manually and electronically (Figure 11).

Approximately 250 feet of 8-inch flexible discharge line extended away from MJ-PW1 to the north, directing the discharge water via overland flow into the Little Miami River. The pump discharge line was connected to a 10x7-inch orifice meter and manometer (Figure 12). Water levels in MJ-PW1 at the wellhead were monitored using both pressure transducer/datalogger and manual measurements. The transducer/data logger combination was programmed to record water level changes to a hundredth (0.01) of a foot every minute. A pressure transducer/datalogger was also installed on the discharge pipe manometer to record changes in discharge every minute (Figure 12).

Figure 13 graphically summarizes the drawdown measured in the pumping well as a function of SDT elapse time. These data are used to calculate the well performance parameters and aquifer hydraulic characteristics at and near the production well.

Figure 11. MJ-PW1 wellhead monitoring and flow control for SDT, CRT and RT.

Figure 12. SDT & CRT discharge pipe, orifice and manometer to measure discharge.

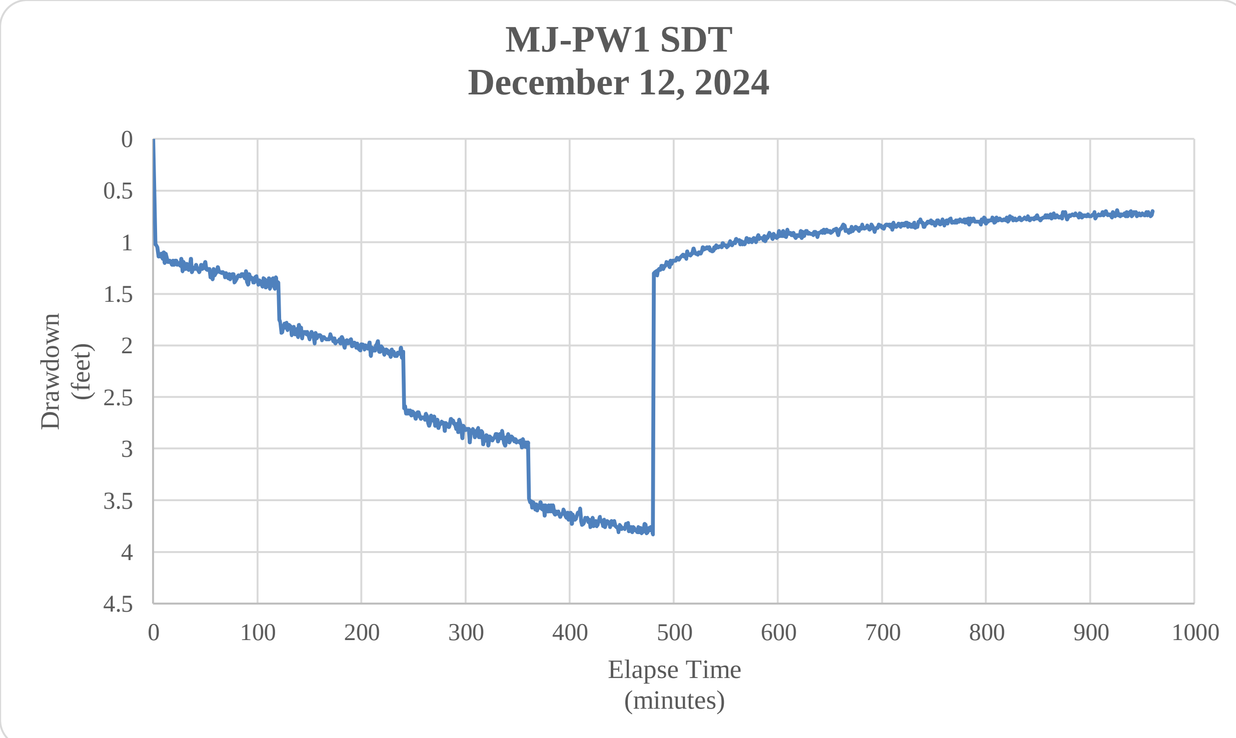


Figure 13. Graphical summary of drawdown vs. SDT elapse time at MJ-PW1.

The step test data was analyzed using various analytical techniques including those developed by Rorabaugh (1953), Kasenow (2001) and Bierschenk (1964). Analysis results are summarized in Figure 14. MJ-PW1 total in-well water level drawdown predictably decreases as pumping rates increase. This is graphically shown by the increase in the pumping well water level drawdown (Figure 14, 1st panel, dark blue line) as the discharge rate increased. Since all three of the SDT analysis methods provided virtually the same resulting total drawdown measured in the pumping well during the SDT, the various head loss components can be estimated with some certainty. This allows us to establish benchmark values for these individual head loss components of MJ-PW1 at its current condition as a newly constructed production well. For operation and maintenance, these benchmark values represent the baseline or near optimal conditions to compare future well performance tests of MJ-PW1.

About 27 percent of the total drawdown in MJ-PW1 is attributed to natural flow restrictions within the aquifer and through the well filter pack. This is graphically depicted as the red line in panels 2, 3 and 4 of Figure 14. Commonly described as aquifer loss or laminar well loss, this head loss component considers the rate at which laminar flow contributes to the pumped well total drawdown. Aquifer loss is calculated using the aquifer loss coefficient “B”. As determined from December 12, 2024 SDT, the benchmark B coefficient value for MJ-PW1 was measured to be 0.0014 ft./gpm.

Depending upon pumping rate, well loss or turbulent flow loss, as measured by the well loss coefficient “C”, causes about 11 to 18 percent of the total drawdown in MJ-PW1 (green line in panels 2, 3 and 4, Figure 14). In its current state as new construction, a production well benchmark C coefficient value for MJ-PW1 of $5.22E^{-07}$ ft./gpm^2 was determined from the SDT results. This qualitatively suggests the well was properly designed and developed (Walton, 1962; Bierschenk, 1964).

A third head loss component effecting total drawdown in a well is partial penetration of the well screen within the saturated aquifer. As shown by the light blue line in panels 2, 3 and 4 of Figure 14, partial penetration effects accounted for approximately 27 percent of the total drawdown in MJ-PW1. Only a portion of the aquifer was screened for this production well to minimize effects of well interference and maintain sufficient available drawdown during seasonal variations of groundwater piezometric levels.

From December 2024 SDT data, near-well aquifer transmissivity was estimated to be about 104,500 ft^2/day. Assuming an 83-foot aquifer thickness at MJ-PW1, a hydraulic conductivity value 1,190 ft./day was calculated using the near-well transmissivity estimates (Figure 14). These high T and K values assume no hydraulic recharge or barrier boundaries were encountered within the short duration SDT radius of influence. Boundary conditions effects on MJ-PW1 potential production will be discussed as part of the CRT data analysis.

A common technique to judge production well performance is to calculate the well’s specific capacity at various discharge rates. Figure 15 graphically summarizes the changes in specific capacity and drawdown observed at MJ-PW1 during December 2024 SDT.

Step Drawdown Test Analysis for Well MJ-PW1

Test Completed: December 12, 2024 (Terran & National Water Services)

Calculated Well-loss Coefficient Summary

Coefficient	B[2]	C[2]	n[2]	r_c[2]	L_p[3]
Method	(ft/gpm)	(ft/gpm^2)	(unitless)	(feet)	(percent)
Rorabaugh[1]	0.0006	2.842E-07	1.98	61.83	60
Rorabaugh	0.0014	5.147E-07	2.00	5.13	60
Kasenow	0.0014	5.292E-07	2.00	5.03	61
Bierschenk	0.0014	5.331E-07	2.00	5.16	60
Jacob	0.0014	5.126E-07	2.00	4.53	62
Average	*0.0014*	*5.224E-07*	*2.00*	*4.96*	*61*

[1] Rorabaugh with best fit n & corrected for partial penetration
[2] Average all values not corrected for partial penetration
[3] Calculated using highest SDT discharge

Calculated Well Drawdown Summary

Not corrected for partial penetration - All Methods

Field Measured Q_n (gpm)	Jacob s_{Tc} (feet)	Rorabaugh s_{Tc} (feet)	Kasenow s_{Tc} (feet)	Bierschenk s_{Tc} (feet)	Field Measured s_{Tm} (feet)
	Calculated total drawdown $s_{Tc} = BQ_n + CQ^n$				
780	1.41	1.39	1.39	1.39	1.39
1066	2.08	2.06	2.07	2.06	2.06
1391	2.95	2.93	2.94	2.93	2.94
1691	3.84	3.84	3.84	3.84	3.83

Corrected for partial penetration - Rorabaugh Method

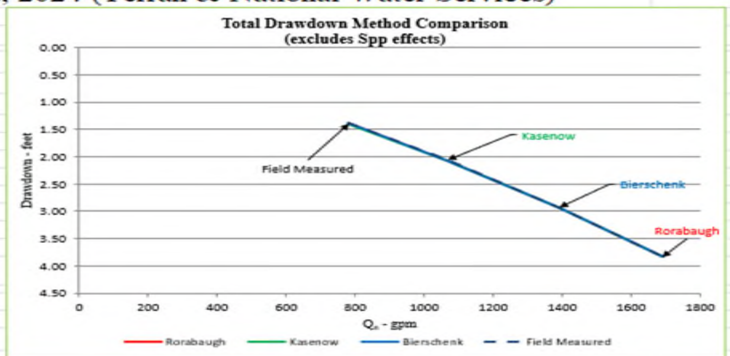
Coefficient	B	C	n	r_c	
	(ft/gpm)	(ft/gpm^2)	(unitless)	(feet)	
Field Measured	0.0006	2.842E-07	1.98	61.83	Field Measured
	Calculated $s_{Tc} = s_{pp} + s_a + s_w$				
Q_n (gpm)	s_{pp} (feet)	s_a (feet)	s_w (feet)	s_{Tc} (feet)	s_{Tm} (feet)
780	0.77	0.47	0.15	1.39	1.39
1066	1.15	0.64	0.28	2.06	2.06
1391	1.64	0.83	0.47	2.94	2.94
1691	2.13	1.01	0.69	3.83	3.83

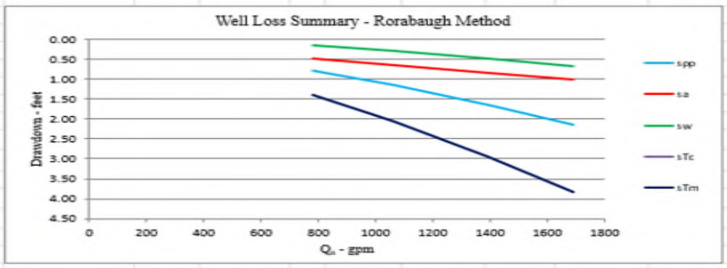
Corrected for partial penetration - Kasenow Method

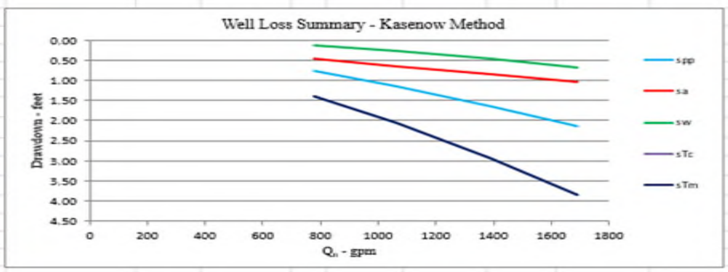
Coefficient	B	C	n	r_c	
	(ft/gpm)	(ft/gpm^2)	(unitless)	(feet)	
Field Measured	0.0006	2.346E-07	2.00	59.86	Field Measured
	Calculated $s_{Tc} = s_{pp} + s_a + s_w$				
Q_n (gpm)	s_{pp} (feet)	s_a (feet)	s_w (feet)	s_{Tc} (feet)	s_{Tm} (feet)
780	0.77	0.48	0.14	1.39	1.39
1066	1.15	0.65	0.27	2.06	2.06
1391	1.64	0.85	0.45	2.94	2.94
1691	2.13	1.03	0.67	3.83	3.83

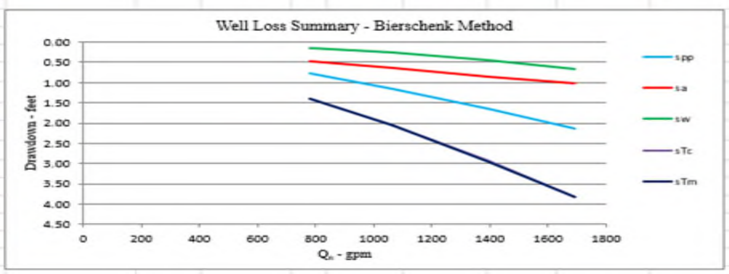
Corrected for partial penetration - Bierschenk Method

Coefficient	B	C	n	r_c	
	(ft/gpm)	(ft/gpm^2)	(unitless)	(feet)	
Field Measured	0.0006	2.363E-07	2.00	60.51	Field Measured
	Calculated $s_{Tc} = s_{pp} + s_a + s_w$				
Q_n (gpm)	s_{pp} (feet)	s_a (feet)	s_w (feet)	s_{Tc} (feet)	s_{Tm} (feet)
780	0.77	0.47	0.14	1.39	1.39
1066	1.15	0.65	0.27	2.06	2.06
1391	1.64	0.84	0.46	2.94	2.94
1691	2.13	1.02	0.68	3.83	3.83









Variables:

Q =	pumping rate	s_T =	total production well drawdown
T =	transmissivity	s_{Tm} =	total production well drawdown measured in the field
S =	storage coefficient	s_{Tc} =	calculated or modeled total production well drawdown
t =	pumping time	s_{pp} =	drawdown due to well screen partial penetration in aquifer
r_w =	pumping well radius	s_a =	drawdown due to aquifer loss during pumping
B =	aquifer loss coefficient	s_w =	drawdown due to well loss during pumping
C =	well loss coefficient	Ro =	radius of influence; distance to 0.01 ft drawdown
s_c =	specific capacity	r_c =	critical radius from well center into filter zone (turbulent/laminar flow)
Vs =	screen entrance velocity	Se =	estimated added head loss due to skin effect using Ro, r_w & r_c
r_e =	pumping well effective radius		
L_p =	laminar head loss ratio		
Se =	head loss due to skin effect		

CalcT Range	T ft^2/day	K ft/day	T gal/day ft	K gal/day/ft^2
Theis - s_{Tm}	98,821	1191	739,180	8,906
B&R - s_{pp}	374,705	4,515	2,802,790	33,769

Estimated Ro using B =	856	feet	
Sc using 4th step Q =	441.5	gpm/ft	
Vs using 4th step Q =	0.102	ft/sec	(goal < 0.10 ft/sec)
Estimated filter zone r_c using B	29.2	inches	
Estimated Se using B results	-2.01	feet	(goal Se <= 0 feet)

Walton/Sheahan Index Coefficient (C* - in ft/gpm^2) 5.27E-07

- $C^* < 2.5 \times 10^{-5}$ = properly designed & developed
- $2.5\times10^{-5} > C^* < 5\times10^{-5}$ = mild deterioration or clogging
- $5\times10^{-5} > C^* < 2\times10^{-4}$ = severe deterioration or clogging
- $C^* > 2\times10^{-4}$ = difficult to restore to original capacity

Bierschenk Development Factor (DF) = 0.04

- DF < 0.1 = very effective (excellent) development
- 0.1 > DF < 0.5 = effective (good) development
- 0.5 > DF < 1.0 = fairly effective (fair) development
- DF > 1.0 = poorly effective (poor) development

Notes: Minor adjustment needed in 1st step Q

Figure 14. Summary graphic of step-drawdown test analysis for MJ-PW1.

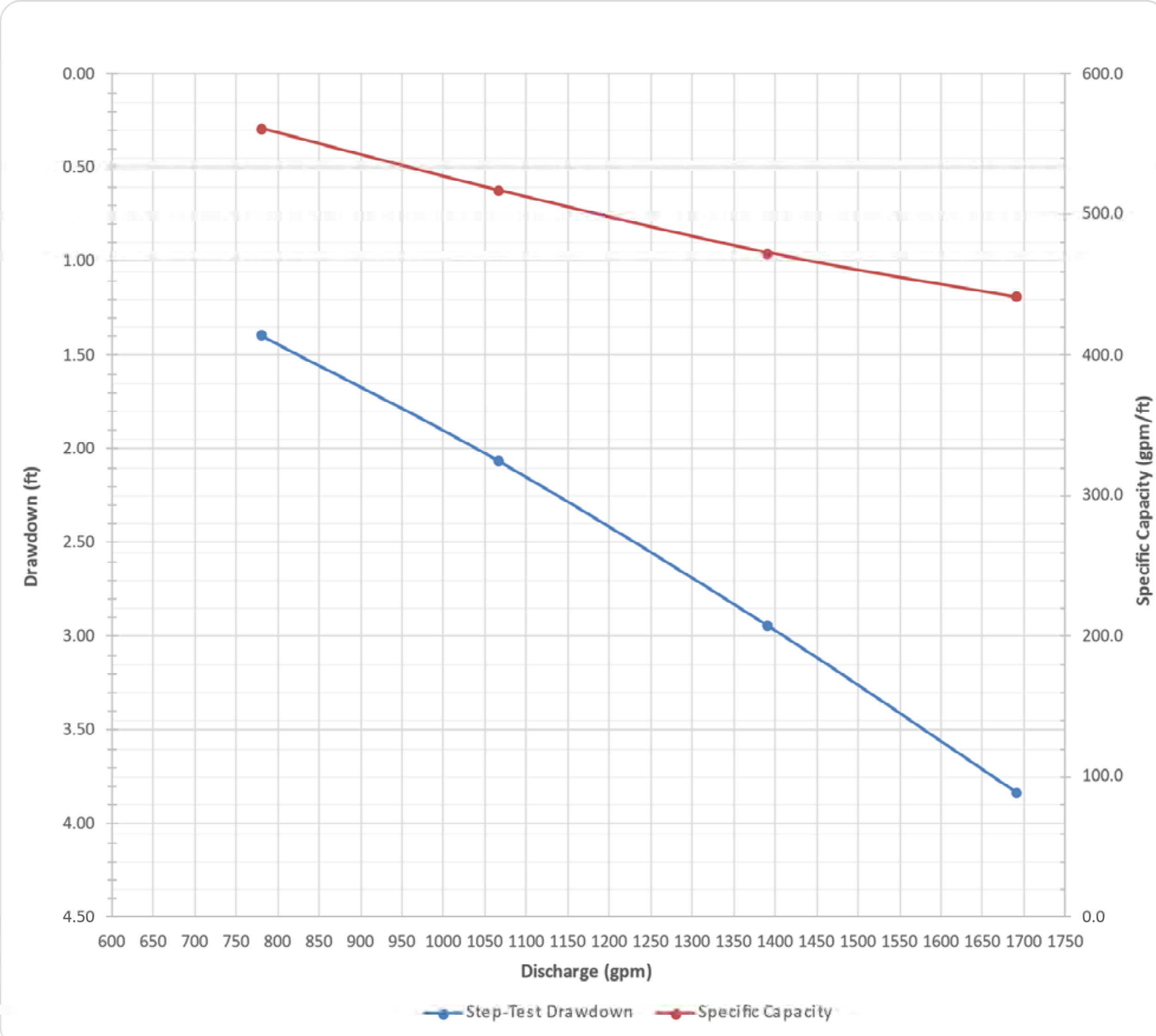


Figure 15. Changes in drawdown and specific capacity in MJ-PW1 during December 12, 2024 SDT.

Constant Rate Test Description

Beginning December 17th and concluding December 19, 2024, a 24-hour CRT and nominal 12-hour RT was completed by Terran and National Water Services at MJ-PW1. The pumping portion of the CRT began at 09:00 hours on December 17th and continued until December 18th at 09:40 hours. Discharge remained stable throughout the duration of the CRT, averaging 1,691 gpm. During the 1,480-minute pumping phase of the test, approximately 2.5 million gallons of water (2.5 MGD) were extracted.

Recording of water levels in the pumping and monitoring wells for the recovery phase of the CRT began immediately upon pumping ending on December 18th at 09:40 hours and continued until 10:00 hours on December 19th. The aquifer water levels recovered at MJ-PW1 to 90% of the pre-pumping static water level in about 3000 minutes (Figure 16). It is believed that MJ-PW1 90% recovery was obtained in about a one-day period but was masked by a regional decline in the Little Miami River water level. This could not be confirmed at the Middleton-Junction site since instrumentation installed to monitor river water level remained frozen before, during and after conduct of the CRT.

The same pump discharge line, orifice meter and manometer setup used to complete the SDT was utilized for the CRT (Figures 11 and 12). Water levels in MJ-PW1 at the wellhead were monitored using both pressure transducer/datalogger and manual measurements. The transducer/data logger combination was programmed to record water level changes to a hundredth (0.01) of a foot using a one-minute sampling schedule. A pressure transducer/datalogger was also installed on the discharge pipe manometer to record changes in discharge every minute (Figure 12).

Figure 16 graphically summarizes the drawdown and recovery measured in the pumping well as the function of CRT elapse time. Figure 17 is a corresponding graphical summary of discharge changes recorded at the manometer with elapse time. These data are used to calculate the well performance parameters and aquifer hydraulic characteristics at and near the production well.

In addition to collecting water level measurements manually and electronically at the pumping well, six additional locations were monitored using transducers and dataloggers: MJ-TW1, MJ-OW1, MJ-OW2, MJ-TRN1, MJ-TRN3, and MJ-TRN5. (Figure 1). Table 2 provides specific details of each monitoring location as it pertains to their use in the CRT analysis.

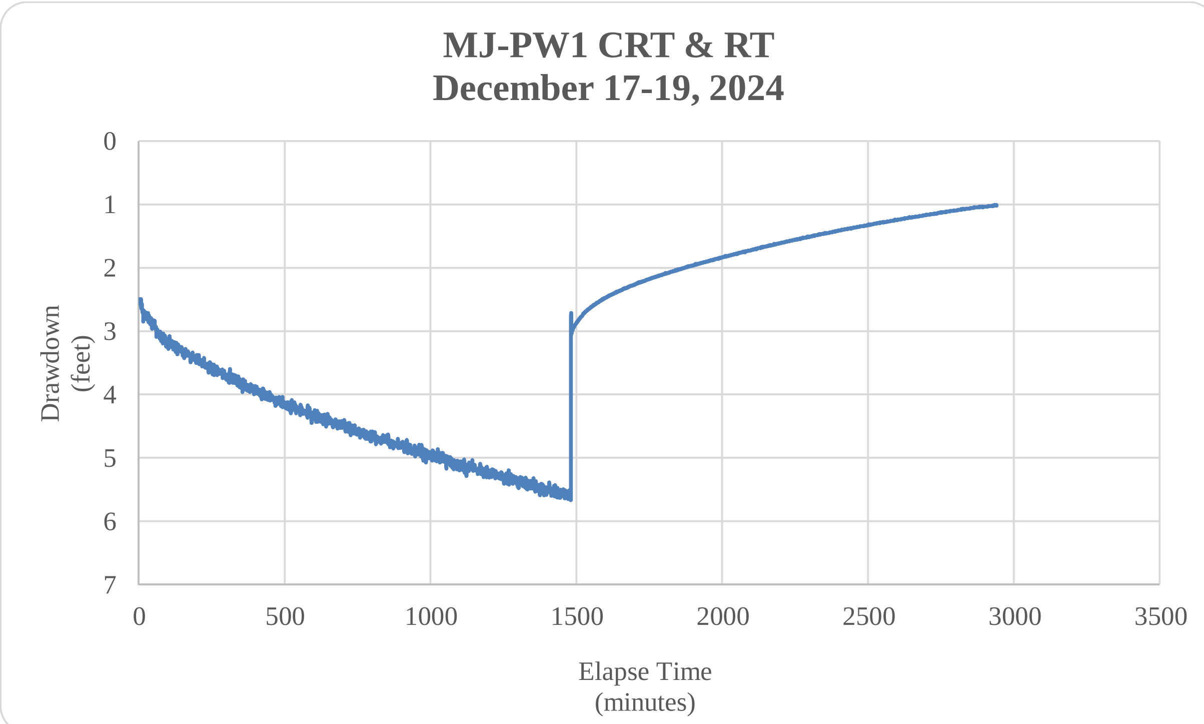


Figure 16. Graphical summary of drawdown and recovery vs. CRT elapse time at MJ-PW1.

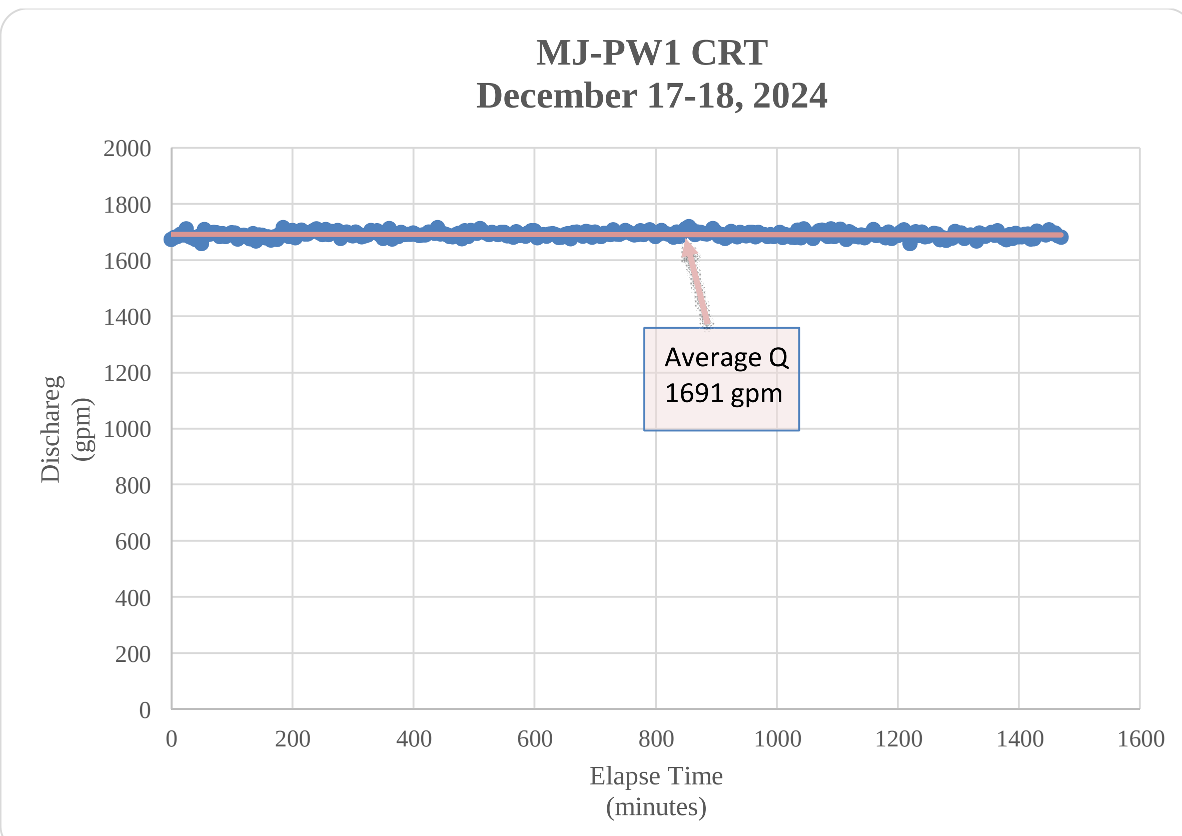


Figure 17. Graphical summary of discharge vs. elapse time during MJ-PW1 CRT pumping phase.

Table 2. Pumping and monitoring wells utilized in December 2024 MJ-PW1 SDT, CRT & RT.

Well ID	Location		Ground Elevation (ft MSL)	Casing Stickup (feet)	Meas. Pt. Elevation (ft MSL)	Screen Diameter (inches)	Screen Length (feet)	Distance to Pump Well (feet)
	Northing/Y (feet)	Easting/X (feet)						
MJ-PW1	501775	1476820	613	3.5	616	16	20	0
MJ-TW2	501809	1476503	610.2	2.2	612.4	16	20	322
MJ-TW1	501658	1476750	613.1	2.5	615.6	8	20	136
MJ-OW2	501531	1476298	611	3.5	613.81	2	15	592
MJ-OW1	501282	1476876	612.4	3	619.03	2	15	495
MJ-TRN1	501726	1476824	613	2.9	616.48	2	20	32
MJ-TRN3	501427	1476458	612.7	2.8	613.79	2	20	502
MJ-TRN5	500995	1476740	612	3.0	618.45	2	20	770

Note: Measuring point elevations are estimated for MJ-PW1.

Constant Rate Test Results

Transmissivity and storativity may be estimated using the change in drawdown as a function of the production well discharge with time and distance to an observation well. Many aquifer analysis techniques have been developed for the evaluation of time-drawdown data. For the MJ-PW1 CRT, several of these techniques were used to determine key aquifer coefficients. The computer program AQTESOLV™ was used to apply the analytical methods of Dougherty-Babu (1984), Theis (1935), Cooper-Jacob (1946), Papadopulos-Cooper (1967) and others to evaluate the CRT data. A representative analysis graph is shown in Figure 18 using the drawdown data from the pumping well and the 2-inch diameter observation well MJ-OW1 about 495 feet distal. Figure 19 shows residual drawdown curves of monitoring wells superimposed upon MJ-PW1 recovery data. Table 3 summarizes the transmissivity and storativity values calculated for the pumped and observation wells using applicable analytical models.

Analyses of water level data obtained during the CRT confirm the outwash aquifer in the study area behaves as a semi-confined hydrologic unit. In the vicinity of MJ-PW1, CRT drawdown water levels extend outward beyond monitoring well MJ-TW1. The predominate flow regime near the pumping well was bilinear. The induced flow regime at the remaining monitoring wells appeared to respond as linear moving to radial flow at test end. A representative apparent transmissivity value for the portion of the Middle-Junction property affected during the MJ-PW1 CRT would be ± 16,900 ft^2/day. Assuming the aquifer saturated thickness is 71 feet, a representative hydraulic conductivity would be ± 240 ft./day (Table 3).

A semi-logarithmic plot of MJ-PW1 drawdown during the December 2024 CRT is provided in Figure 20. This figure depicts, by way of a dramatic increase in the drawdown slope, the effects of barrier boundaries starting after about 100 minutes of pumping. The Moench analysis technique used in this analysis, referred to as Moench (Case 2) in the literature, only considers no flow boundaries in a "leaky", semi-confined aquifer.

Storativity is the measure of the volume of water retained in or released from storage in the aquifer, expressed as a function of surface area and change in head. The smaller the value for storativity, typically the more confined the aquifer. As shown in Table 3, once the cone of depressions extends beyond the immediate area of MJ-PW1, a representative calculated storage value from the constant rate aquifer test would be 0.0157 (1.6×10^{-2}).

Groundwater Production Potential at Middletown-Junction Property

The current groundwater conceptual site model of the Middletown-Junction property suggests the underlying aquifer consists of coarse outwash materials deposited in an erosional channel bounded by shale bedrock walls (Figure 9, Terran Corp., 2022a,b). This type of aquifer formation is commonly referred to as strip, channel or buried-valley aquifer. Groundwater flow in strip aquifers is strongly influenced by boundaries, usually resulting in an unexpectedly large drawdown of groundwater levels over large distances. When developing a wellfield in a strip aquifer, the underestimation of drawdowns can result in an overestimation of sustainable yields.

To determine representative values for transmissivity (T) and hydraulic conductivity (K) of the aquifer beneath the Middletown-Junction property, SDTs and CRTs were completed using MJ-TW1 and MJ-TW2 as pumping wells while measuring water level drawdown in all available monitoring wells. This work was completed to help optimize selected locations for installation of two new production wells, MJ-PW1 and MJ-PW3. Depending upon the pumping rate and duration of each test, the cone of depression may or may not encounter the aquifer boundaries. If no-flow or barrier boundaries are not reached during the pumping process of a test, the calculated T and K values will be higher and drawdown less than results for tests that are affected by boundaries.

We will use current and historical pumping tests at MJ-TW1 and MJ-TW2 to illustrate the effects of barrier boundaries. In 1993, a 2-hour SDT was completed at MJ-TW1 using 3-steps of 300, 600 and 715 gpm discharge rates. Calculated test results for T and K were 60,800 ft^2/day and 822 ft/day, respectively. This SDT was followed by a 2880-minute CRT pumping at 700 gpm. Data from this test resulted in a calculated T value of 51,500 ft^2/day and 757 ft./day for hydraulic conductivity. A 2023 CRT pumped MJ-TW1 at 222 gpm for 1,560 minutes. Results for T were 50,800 ft^2/day and 747 ft./day for K. It was noted that in the interpretation of these tests for pumping well drawdown, the cone of depression did not extend sufficiently far to encounter significant barrier boundaries.

The geometric mean for these MJ-TW1 pump tests results would be 54,200 ft^2/day for transmissivity and 775 ft./day for hydraulic conductivity. These aquifer coefficient values are used to estimate the theoretical water level drawdown in MJ-TW1 in absence of boundaries and if stressed at a higher pumping rate for a longer pumping duration. Using appropriate analytical equations, if MJ-TW1 could be pumped at 1,700 gpm for ten days, about 9.3 feet of drawdown in the pumping well would be realized.

For comparison, in 2023 a 3-hour SDT was completed at MJ-TW2 using 3-steps of 409, 557 and 730 gpm discharge rates. Calculated test results for T and K were 56,600 ft^2/day and 922 ft./day, respectively. Corrected for aquifer thickness, T and K values from the SDTs at MJ-TW1 and MJ-TW2 are very similar if not the same. Specific capacity for the MJ-TW1 SDT 3rd step was 268 gpd/ft compared to MJ-TW2 SDT 3rd step of 266 gpm/ft. This is to be expected since both wells are completed in the same strip aquifer spaced only 310 feet apart.

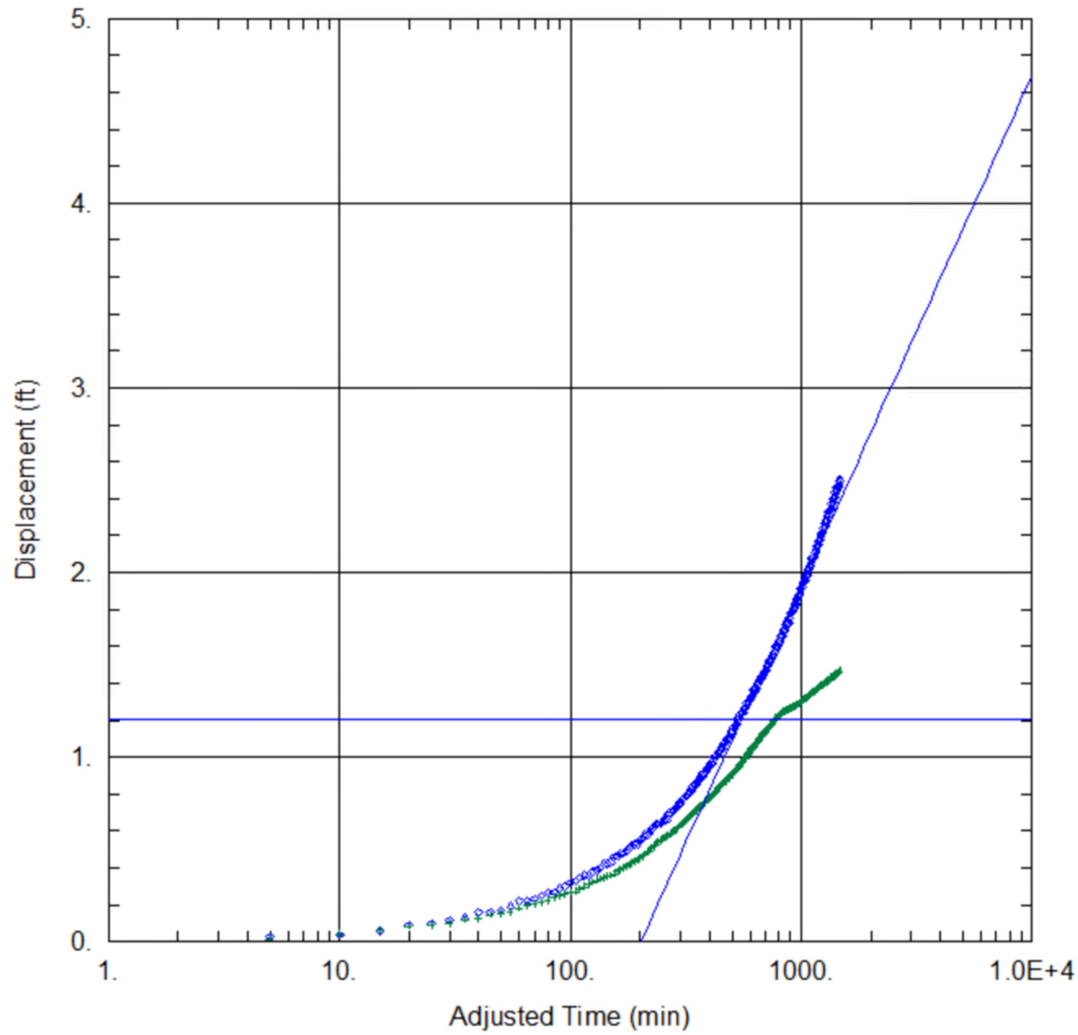
In 1994, a CRT using well MJ-TW2 pumping at 1,700 gpm for ten days was performed. The total drawdown in this test production well at the end of ten days pumping was 26 feet. The cause for the unusually large drawdown response appears to be barrier boundaries in a semi-confined aquifer. The 1994 CRT sufficiently stressed the aquifer over the ten-day period to reduce the effective transmissivity from 56,600 ft^2/day to 15,400 ft^2/day. Effective hydraulic conductivity was lowered from about 900 ft./day to 250 ft./day (Figures 21 and 22).

Completed SDT and CRT using MJ-TW2 provided ample stress to the aquifer to measure the effects of barrier boundaries on water level drawdowns in the pumping and monitoring wells. Figures 21 to 24 summarizes a portion of this data to determine representative T and K values throughout the well field when pumping stresses invoke barrier boundary effects.

Table 3. Calculated aquifer transmissivity and storativity values for MJ-PW1 and selected monitoring wells.

Pumping Well	Obs. Well	Test Type	Solution Method	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)[1]	Storativity (unitless)
MJ-PW1	MJ-PW1	Step-Drawdown	Theis	56,600	992	NA
MJ-PW1	MJ-PW1	Step-Drawdown	Bradbury & Rothschild	63,100	1107	NA
MJ-PW1	MJ-PW1	Step-Drawdown	Specific Capacity	64,700	1135	NA
			Geometeric Mean	***61,364***	***1076***	
MJ-PW1	MJ-PW1	Constant Rate	Cooper-Jacob	13,610	192	NA
MJ-PW1	MJ-PW1	Recovery	Theis (Recovery)	16,700	235	NA
			Geometeric Mean	***15,076***	***212***	
MJ-PW1	MJ-TRN1	Constant Rate	Hantush (Leaky)	17,090	241	2.17E-04
MJ-PW1	MJ-TRN1	Constant Rate	Cooper-Jacob	15,190	214	NA
MJ-PW1	MJ-TRN1	Constant Rate	Moench (Case 2)	15,450	218	1.42E-01
MJ-PW1	MJ-TRN1	Recovery	Theis (Recovery)	20,290	286	NA
			Geometeric Mean	***16,890***	***238***	***5.55E-03***
MJ-PW1	MJ-TW1	Constant Rate	Cooper-Jacob	14,520	206	2.30E-02
MJ-PW1	MJ-TW1	Constant Rate	Moench (Case 2)	18,320	258	5.00E-02
MJ-PW1	MJ-TW1	Constant Rate	Cooley-Case	15,400	217	2.20E-04
MJ-PW1	MJ-TW1	Recovery	Theis (Recovery)	22,040	310	NA
			Geometeric Mean	***17,334***	***245***	***6.32E-03***
MJ-PW1	MJ-TRN3	Constant Rate	Cooper-Jacob	16,600	234	2.80E-02
MJ-PW1	MJ-TRN3	Constant Rate	Hantush (Leaky)	16,030	226	3.77E-02
MJ-PW1	MJ-TRN3	Constant Rate	Moench (Case 2)	16,130	227	3.00E-02
MJ-PW1	MJ-TRN3	Recovery	Theis (Recovery)	19,080	269	NA
			Geometeric Mean	***16,917***	***238***	***3.16E-02***
MJ-PW1	MJ-TRN5	Constant Rate	Cooper-Jacob	19,980	281	1.02E-02
MJ-PW1	MJ-TRN5	Constant Rate	Moench (Case 2)	12,110	171	2.52E-02
MJ-PW1	MJ-TRN5	Constant Rate	Neuman	12,100	170	2.42E-02
MJ-PW1	MJ-TRN5	Recovery	Theis (Recovery)	22,060	311	NA
			Geometeric Mean	***15,942***	***225***	***1.84E-02***
MJ-PW1	MJ-OW1	Constant Rate	Cooper-Jacob	18,340	258	2.96E-02
MJ-PW1	MJ-OW1	Constant Rate	Neuman	15,990	225	3.29E-02
MJ-PW1	MJ-OW1	Constant Rate	Papadopulos-Cooper	17,530	247	3.53E-02
MJ-PW1	MJ-OW1	Recovery	Theis (Recovery)	22,580	318	NA
			Geometeric Mean	***18,458***	***260***	***3.25E-02***
MJ-PW1	MJ-OW2	Constant Rate	Cooper-Jacob	19,320	272	4.11E-09
MJ-PW1	MJ-OW2	Constant Rate	Papadopulos-Cooper	16,750	236	5.17E-09
MJ-PW1	MJ-OW2	Constant Rate	Dougherty-Babu	13,160	185	5.95E-09
MJ-PW1	MJ-OW2	Recovery	Theis (Recovery)	21,220	299	NA
			Geometeric Mean	***17,338***	***244***	***5.02E-09***

Notes: NA = Calculation method does not provide estimates of this variable; [1] Normalized hydraulic conductivity calculated using 71 feet as a saturated aquifer thickness



AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (Kz/Kr): 0.1037

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MJ-PW1	1476819.7	501774.6

Observation Wells

Well Name	X (ft)	Y (ft)
◦ MJ-OW1	1476876.2	501282.7

SOLUTION

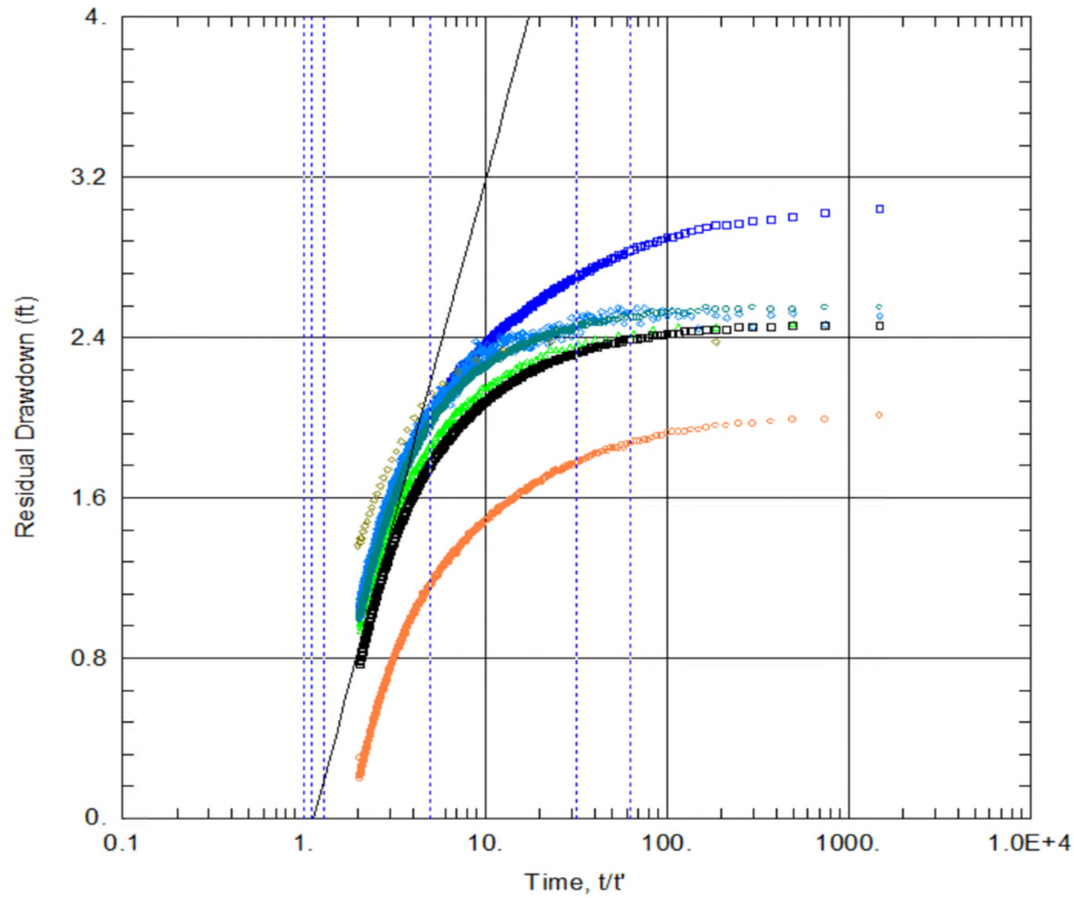
Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 2.156E+4 ft^2/day

S = 0.02766

Figure 18. Analysis hydrograph of drawdown in monitoring well MJ-OW1 for the December 2024 MJ-PW1 CRT.



AQUIFER DATA

Saturated Thickness: 90. ft

Anisotropy Ratio (Kz/Kr): 0.04089

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MJ-PW1	1476819.7	501774.6

Observation Wells

Well Name	X (ft)	Y (ft)
MJ-TW1	1476749.548	501657.899
MJ-PW1	1476819.7	501774.6
MJ-OW1	1476876	501282
MJ-TRN1	1476824	501726
MJ-OW2	147298	501531
MJ-TRN3	1476458	500995
MJ-TRN5	1476458	500995
MJ-PW2	1476820	501809

SOLUTION

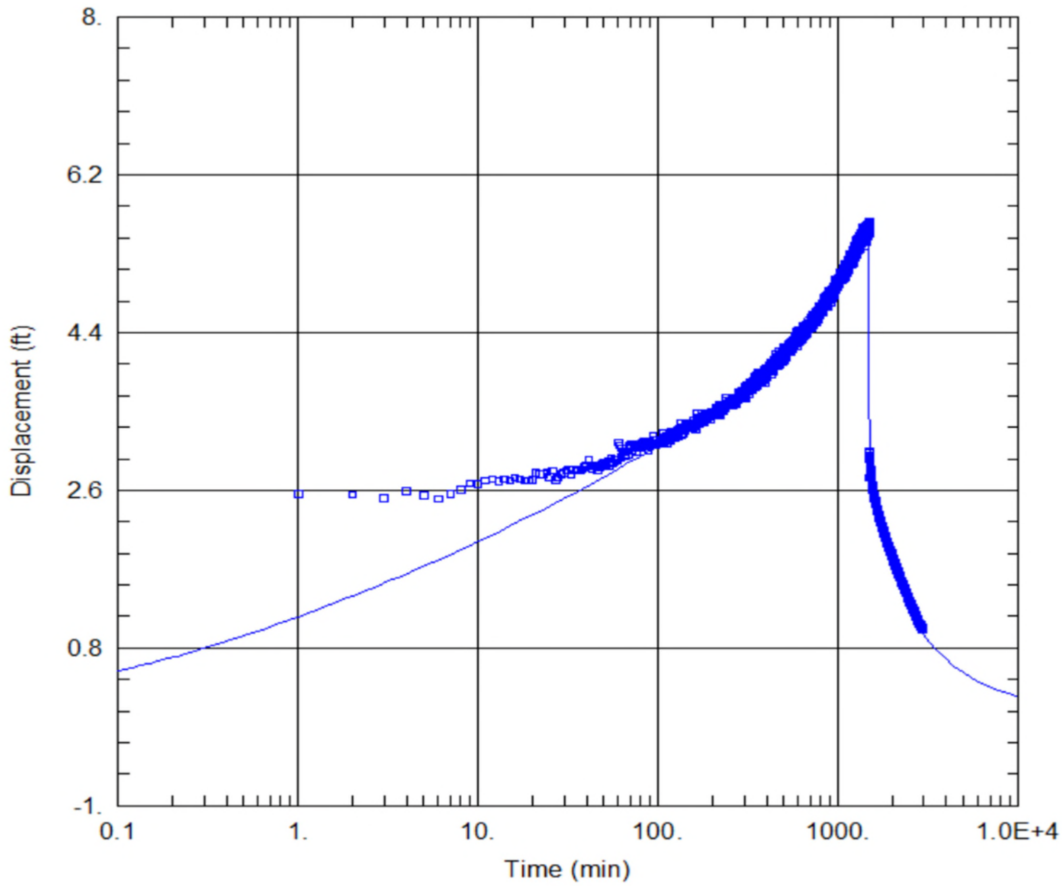
Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1.773E+4 ft^2/day

S/S' = 1.131

Figure 19. Composite residual recovery analysis of December 2024 MJ-PW1 CRT.



AQUIFER DATA

Saturated Thickness: 90. ft
Aquitard Thickness (b'): 3. ft
Anisotropy Ratio (Kz/Kr): 0.01336
Aquitard Thickness (b"): 5. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MJ-PW1	1476819.7	501774.6

Observation Wells

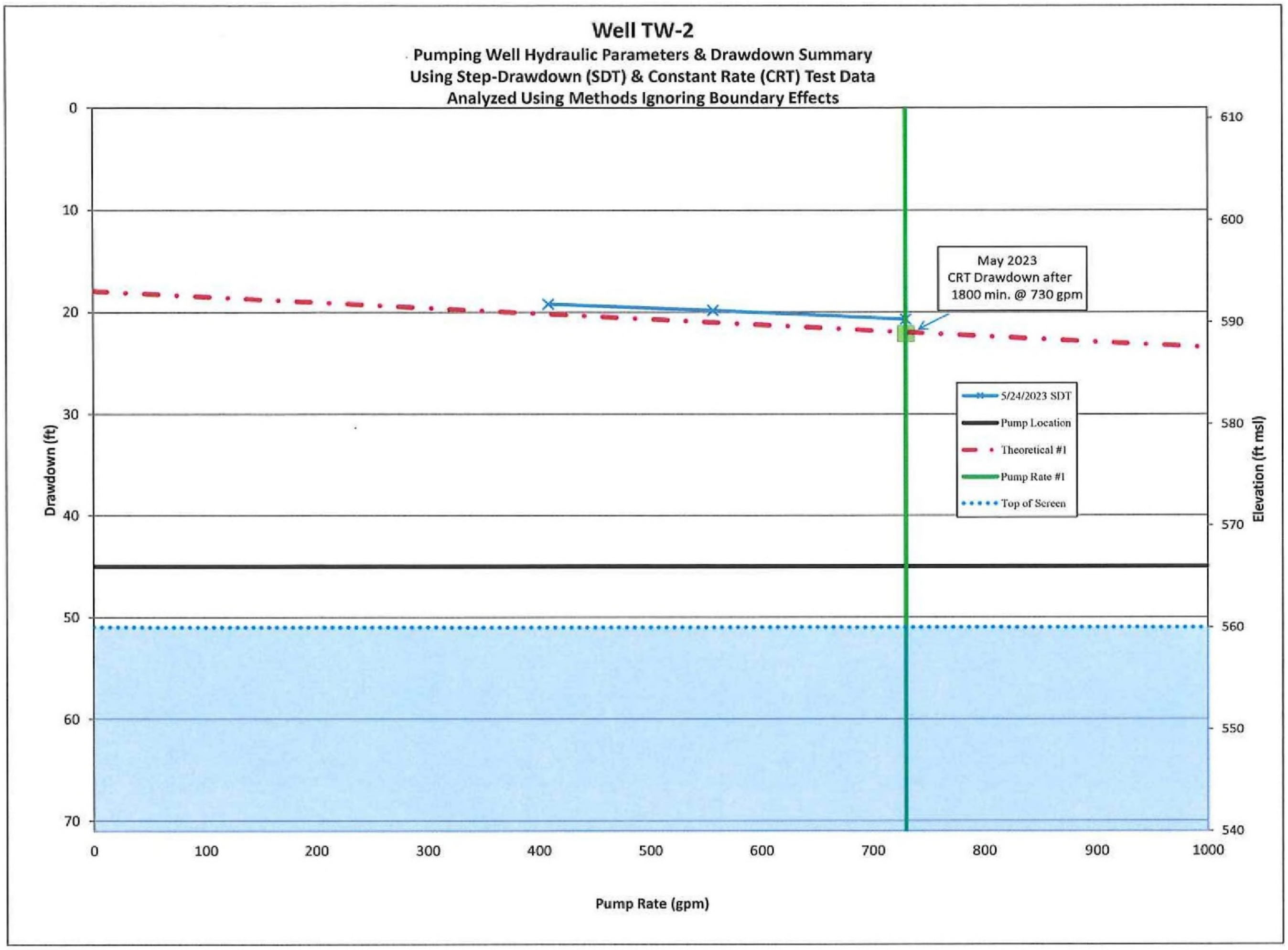
Well Name	X (ft)	Y (ft)
▫ MJ-PW1	1476819.7	501774.6

SOLUTION

Aquifer Model: Leaky
Solution Method: Moench (Case 2)

T = 1.664E+4 ft^2/day
1/B' = 0.04275 ft^{-1}
1/B" = 0. ft^{-1}
Sw = 0.001
r(c) = 0.67 ft
S = 0.2631
ß'/r = 0.07344 ft^{-1}
ß"/r = 0. ft^{-1}
r(w) = 10. ft

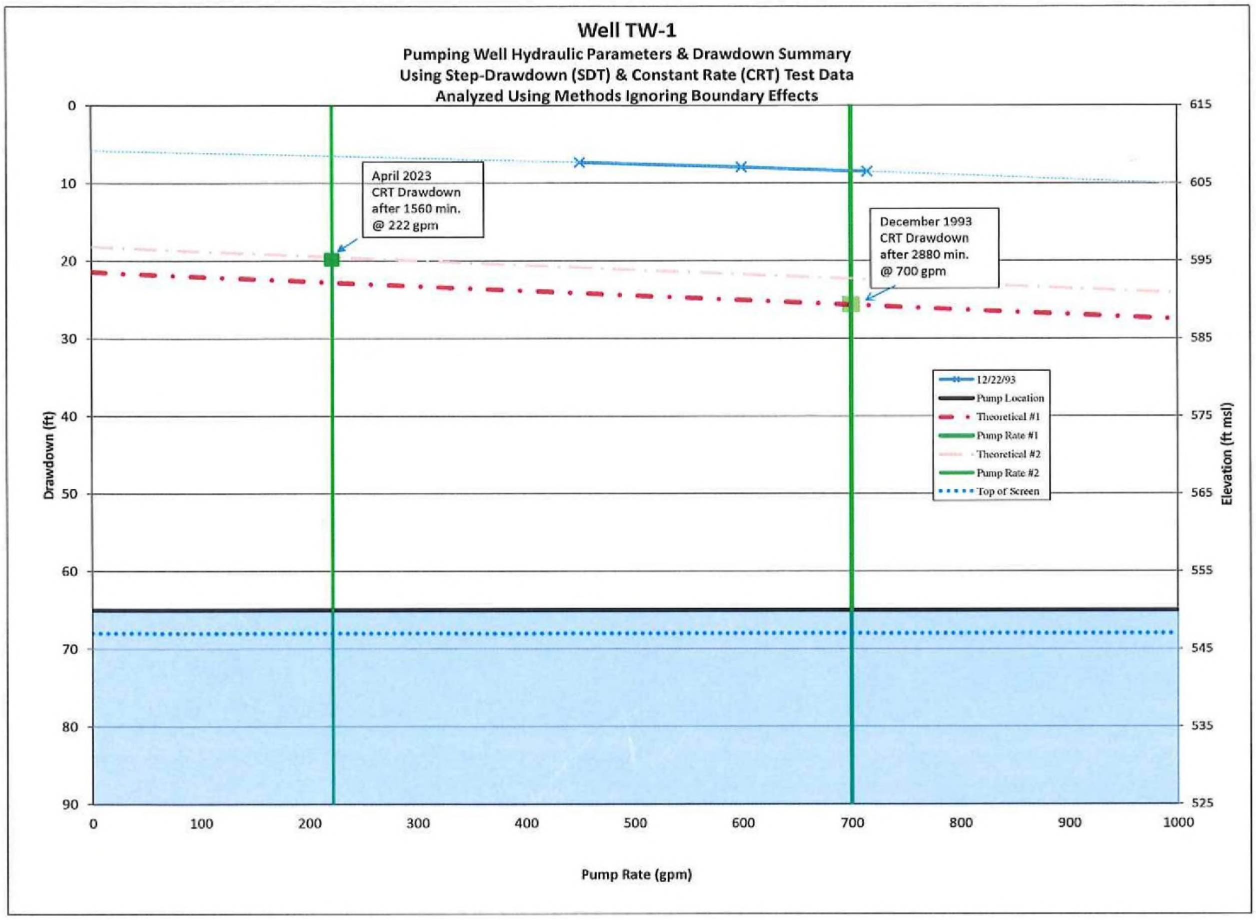
Figure 20. Semi-log drawdown plot used for Moench analysis of MJ-PW1.



Test Date	Test Analysis Type	Total Pumping Duration (minutes)	Highest Pumping Stress (gpm)	SDT Step Duration (minutes)	SDT Step Events (each)	Loss Coefficients: Aquifer B (ft/gpm)	Loss Coefficients: Well C (ft/gpm^2)	Near-Well Aquifer Parameters: T (gal/day/ft)	K (ft/d)	S (unitless)	S_y (unitless)	Comments
5/24/2023	SDT	180	730	60	3	0.0021	2.27E-06	423,000	992			B & C - four analysis methods; T & K by Theis; b=53 ft
5/24/2023	Spc. Cap.	180	730					399,600	937			Driscoll unconfined method; b=53 ft
5/25-26/2023	CRT	1800	730					380,000	958			Theis method; b=53 feet
5/25-26/2023	CRT	1800	730					376,500	950			Theis recovery method; b=53 ft.
5/25-26/2023	CRT	1800	730					383,000	966			Cooper-Jacob method; b=53 ft.
5/25-26/2023	Obs	1800	730					291,000	734		0.109	Jaeger method using TW-1; b=53 ft
5/25-26/2023	Obs	1800	730					311,800	787		0.118	Jaeger method using TRN-2; b=53 ft
5/25-26/2023	D-D	1800	730					363,500	917	0.002		Kasenow method of D-D using TW-1; b=53 ft
Existing data analysis representative well/aquifer coefficients:						**0.0021**	**2.27E-06**	**363,600**	**901**	**0.002**	**0.113**	

Notes:
- SDT are Step-Drawdown Tests
- Spc. Cap. are analyses techniques to calculated T & K values using Specific Capacity values
- CRT are Constant Rate Tests
- D-D are Distance Drawdown analyses methods
- Obs are Observation well analysis methods. The pumping well being evaluated was used as an observation well during a nearby well pump or aquifer test.
- due to the test data not meeting the analysis method assumptions or boundaries, these values are incorrect and should not be considered representative

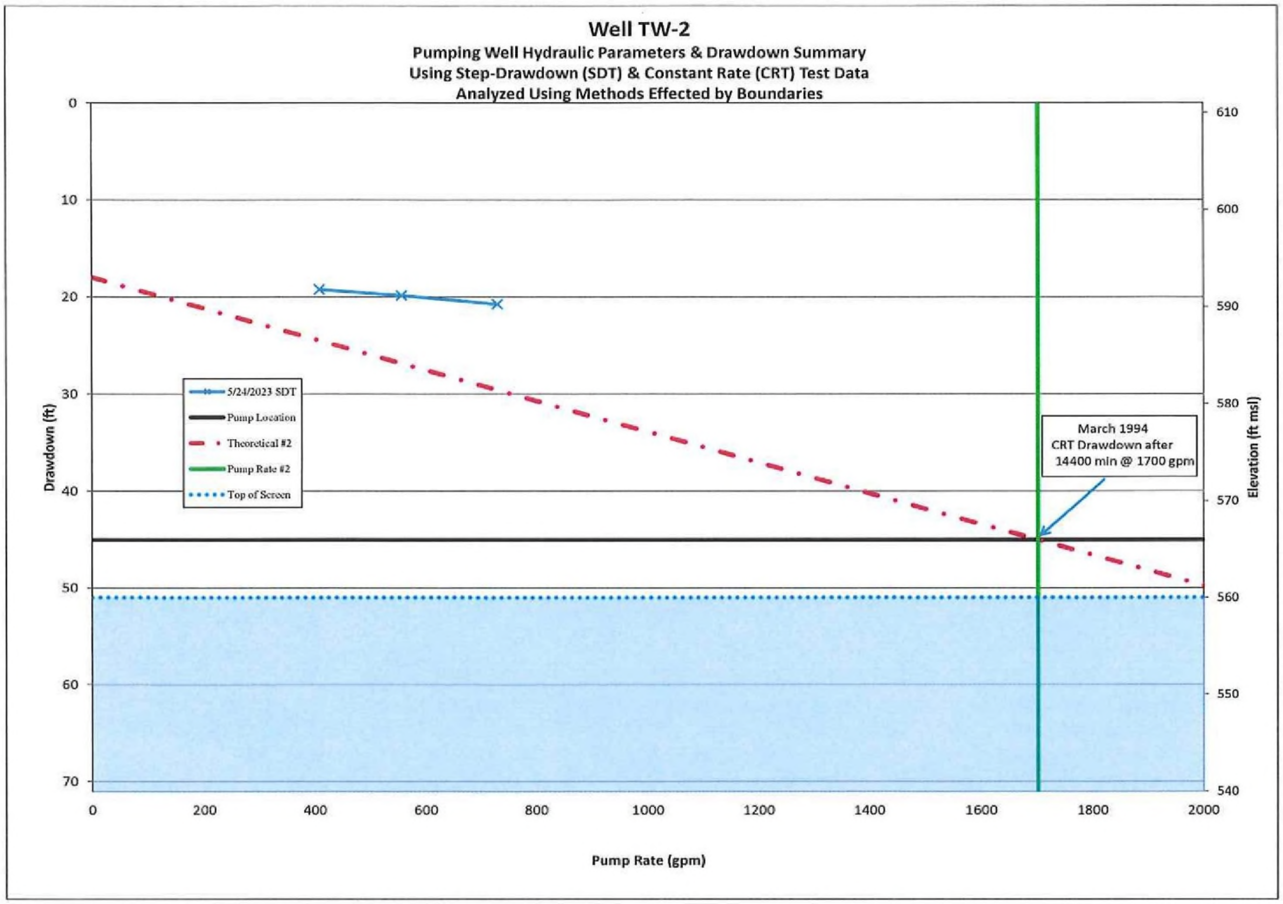
Figure 21. Summary graphic illustrates aquifer coefficients calculated for TW-2 ignoring boundaries.



Test Date	Test Analysis Type	Total Pumping Duration (minutes)	Highest Pumping Stress (gpm)	SDT Step Duration (minutes)	SDT Step Events (each)	Loss Coefficients: Aquifer B (ft/gpm)	Loss Coefficients: Well C (ft/gpm²)	Near-Well Aquifer Parameters: T (gal/day/ft)	K (ft/d)	S (unitless)	S_y (unitless)	Comments
12/22/1993	SDT	360	715	120	3	0.0025	1.77E-06	509,040	920			B & C - four analysis methods; T & K by Theis; b=68 ft
12/27-28/1993	CRT	2880	700					385,000	757			Theis method; b=68 feet
12/27-28/1993	CRT	2880	700					542,900	1067			Theis recovery method; b=68 ft.
12/27-28/1993	CRT	2880	700					477,200	938			Cooper-Jacob method; b=68 ft.
12/27-28/1993	Obs	2880	700					449,900	885	0.0015	0.278	Neuman method using MJ-P1 by CEC; b=68 ft
12/27-28/1993	Spc. Cap.	2880	700					283,600	722			GeoMean T & K from six unconfined methods; b=53 ft
4/11-12/2023	CRT	1560	222					380,000	747			Theis method; b=68 feet
4/11-12/2023	CRT	1560	222					514,200	923			Cooper-Jacob method; b=68 ft.
4/11-12/2023	Obs	1560	222					451,600	888			Theis recovery method using TRN-1; b=68 ft.
4/11-12/2023	Obs	1560	222					275,300	541			Cooper-Jacob method using TRN-1 & boundaries; b= 68 ft
4/11-12/2023	Obs	1560	222					493,200	969	0.0025	0.102	Tartakovsky-Neuman method using TRN-1; b=68 ft.
4/11-12/2023	Obs	1560	222					298,900	588	0.0020	0.162	Neuman method using TRN-1; b=68 ft.
4/11-12/2023	Spc. Cap.	1560	222					256,200	614			GeoMean T & K from six unconfined methods; b=56 ft
Existing data analysis representative well/aquifer coefficients:						**0.0025**	**1.77E-06**	**396,282**	**796**	**0.0020**	**0.166**	

Notes:
- SDT are Step-Drawdown Tests
- Spc. Cap. are analyses techniques to calculated T & K values using Specific Capacity values
- CRT are Constant Rate Tests
- D-D are Distance Drawdown analyses methods
- Obs are Observation well analysis methods. The pumping well being evaluated was used as an observation well during a nearby well pump or aquifer test.
- due to the test data not meeting the analysis method assumptions or boundaries, these values are incorrect and should not be considered representative

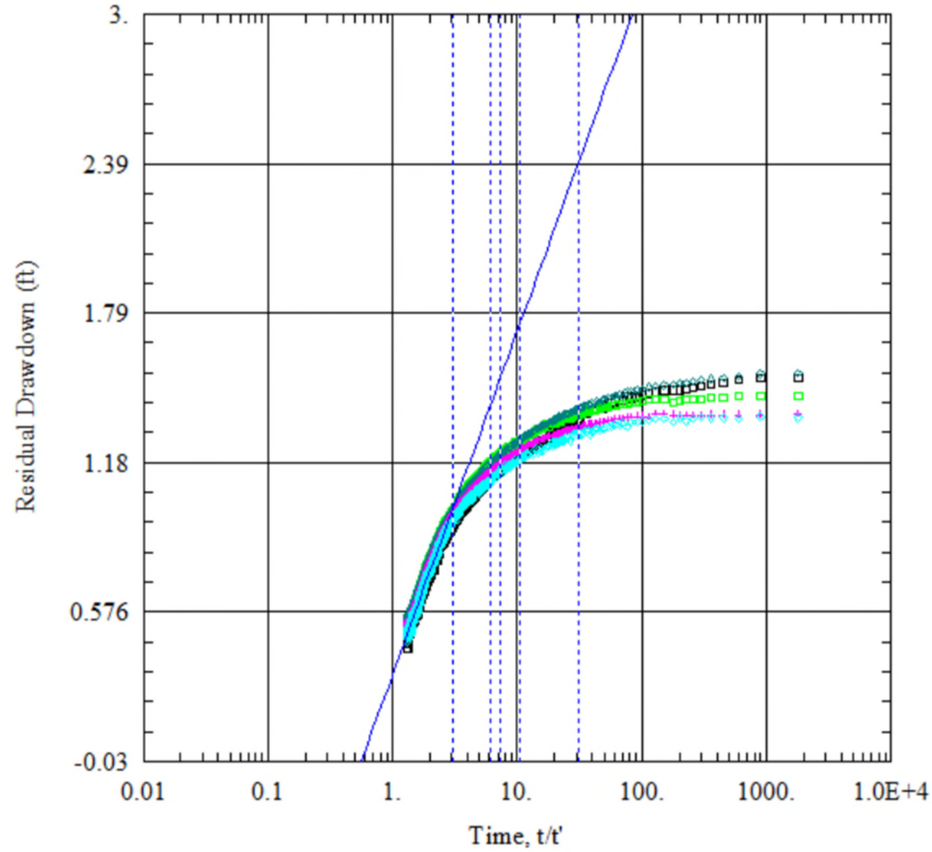
Figure 22. Summary graphic illustrating aquifer coefficients calculated for MJ-TW1 ignoring boundaries.



Test Date	Test Analysis Type	Total Pumping Duration (minutes)	Highest Pumping Stress (gpm)	SDT Step Duration (minutes)	SDT Step Events (each)	Loss Coefficients: Aquifer B (ft/gpm)	Loss Coefficients: Well C (ft/gpm^2)	Near-Well Aquifer Parameters: T (gal/day/ft)	K (ft/d)	S (unitless)	S_y (unitless)	Comments
4/18-28/1994	CRT	14400	1702					120,000	303			Theis method; b=53 feet
4/18-28/1994	Spc. Cap.	14400	1702					125,800	295			GeoMean T & K from six unconfined methods; b=53 ft
5/25-26/2023	Obs	1800	730					85,700	216	0.0005	0.114	Neuman/Agarwal unconfined method using TRN-1: b=53 ft.
5/25-26/2023	Obs	1800	730					80,500	203	0.0005	0.114	Tart/Neu/Agarwal unconfined method using TRN-1: b=53 ft.
5/25-26/2023	Obs	1800	730					89,800	226	0.0005	0.391	Neuman/Agarwal unconfined method using TRN-2: b=53 ft.
5/25-26/2023	Obs	1800	730					86,800	219	0.0005	0.392	Tart/Neu/Agarwal unconfined method using TRN-2: b=53 ft.
5/25-26/2023	Obs	1800	730					80,700	206	0.0005	0.14	Neuman/Agarwal unconfined method using TW-1: b=53 ft.
5/25-26/2023	Obs	1800	730					76,900	194	0.0005	0.141	Tart/Neu/Agarwal unconfined method using TW-1: b=53 ft.
5/25-26/2023	Obs	1800	730					123,900	313	0.0005	0.391	Neuman/Agarwal unconfined method using TRN-5: b=53 ft.
5/25-26/2023	Obs	1800	730					117,400	296	0.0004	0.03	Tart/Neu/Agarwal unconfined method using TRN-5: b=53 ft.
5/25-26/2023	Obs	1800	730					132,700	335		0.013	Cooper-Jacob method for TRN-5; b=53 ft.
5/25-26/2023	Obs	1800	730					119,600	302		0.049	Cooper-Jacob method for TRN-1; b=53 ft.
5/25-26/2023	Obs	1800	730					115,600	292		0.033	Cooper-Jacob method for TRN-3; b=53 ft.
Existing data analysis representative well/aquifer coefficients:								98,952	250	0.0005	0.100	

Notes:
- SDT are Step-Drawdown Tests
- Spc. Cap. are analyses techniques to calculated T & K values using Specific Capacity values
- CRT are Constant Rate Tests
- D-D are Distance Drawdown analyses methods
- Obs are Observation well analysis methods. The pumping well being evaluated was used as an observation well during a nearby well pump or aquifer test.
- due to the test data not meeting the analysis method assumptions or boundaries, these values are incorrect and should not be considered representative

Figure 202. Summary graphic illustrating aquifer coefficients calculated for MJ-TW2 that includes boundary effects.



WELL TEST ANALYSIS

AQUIFER DATA

Saturated Thickness: 57. ft

Anisotropy Ratio (Kz/Kr): 0.3831

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
TW-2	1476507	501851

Observation Wells

Well Name	X (ft)	Y (ft)
TW-2	1476507	501851
TW-1	1476749	501657
TRN-2	1476342	501796
TRN-3	1476473	501426
OW-2	1476266	501550

SOLUTION

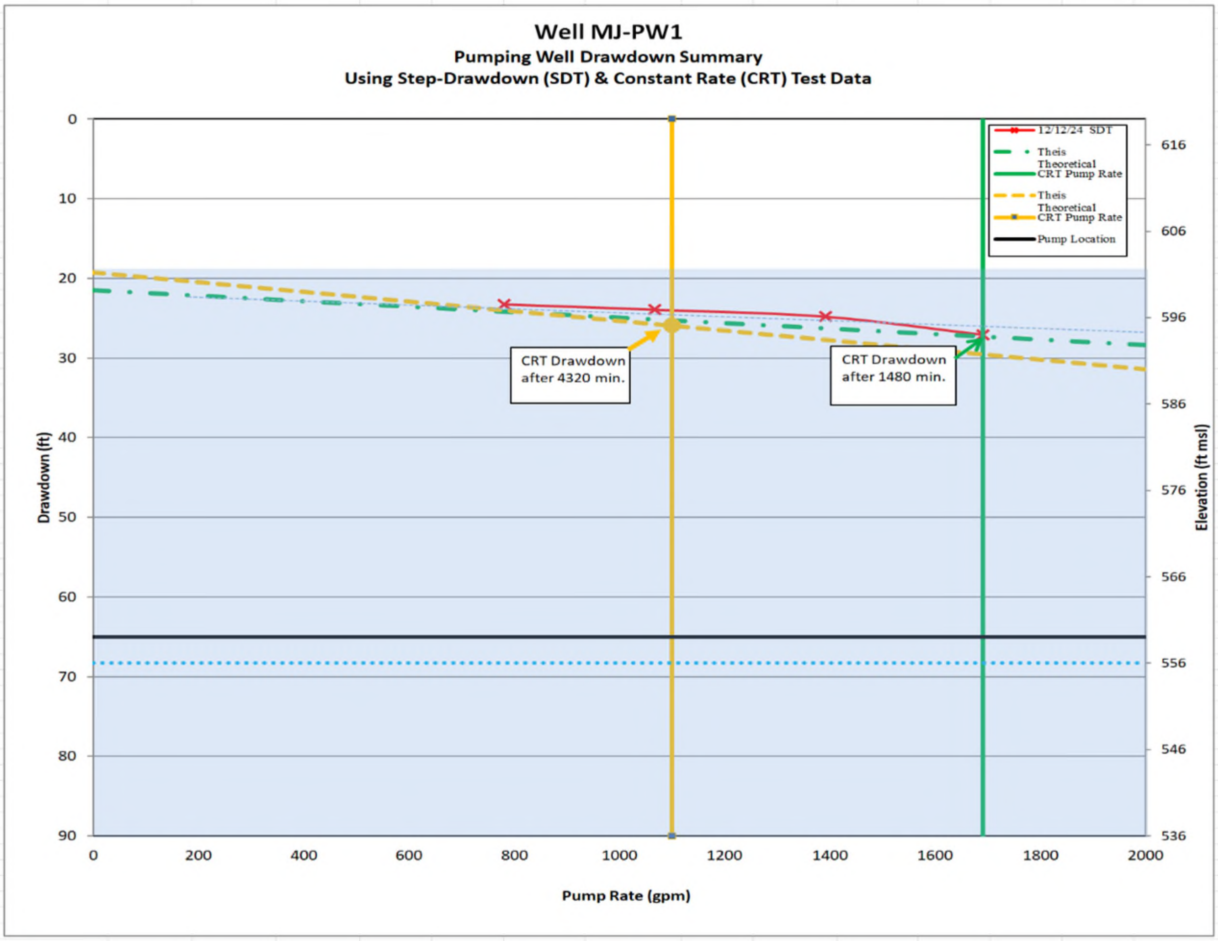
Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1.849E+4 ft^2/day

S/S' = 0.589

Figure 21. Monitoring well composite residual drawdown curves used in the MJ-TW2 2023 CRT analysis.



Test Date	Test Analysis Type	Total Pumping Duration (minutes)	SDT Step Duration (minutes)	SDT Step Events (each)	Loss Coefficients: Aquifer B (ft/gpm)	Loss Coefficients: Well C (ft/gpm^2)	Near-Well Aquifer Parameters: T (ft^2/day)	Near-Well Aquifer Parameters: K (ft/d)	Near-Well Aquifer Parameters: S/S_y (unitless)	Comments
12/12/2024	SDT	480	120	4	0.0014	5.22E-07	382,690	4610		Bradbury & Rothchild method; b=90 ft.; no boundaries
12/12/2024	SDT	480	120	4			73,530	1073		Theis method; b=68.5 ft.; leaky confined conditions
12/17-18/2025	CRT	1480					21,510	239		Cooper-Jacob method; b=90 ft.
12/17-18/2025	CRT	1480					22,730	253		Theis Recovery method; b=90 feet
12/17-18/2025	CRT	1480					17,580	248	0.035	Paired w/MJ-OW1, Hantush leaky ; r=495 ft.
12/17-18/2025	CRT	1480					14,820	209	0.011	Paired w/MJ-TW1, Moench (Case 2) method; r=136 ft.
12/17-18/2025	CRT	1480					15,080	212	0.028	Paired w/MJ-OW2, Cooley-Case method; r=592 ft.
12/17-18/2025	CRT	1480					12,160	171	0.025	Paired w/MJ-TRN5, Cooley-Case method; r=770 ft.
12/17-18/2025	CRT	1480					14,800	208	0.028	Paired w/MJ-OW2. Jaeger method (late time); r=592 ft.
12/17-18/2025	CRT	1480					15,000	211	0.024	Paired w/MJ-OW2, Goyal method (late time); r=592 ft.
Existing data analysis representative well/aquifer coefficients:					**0.0014**	**5.22E-07**	**16,710**	**219**	**0.025**	

Notes:
- SDT — are Step-Drawdown Tests
- Spc. Cap. — are analyses techniques to calculated T & K values using Specific Capacity values
- CRT — are Constant Rate Tests
- D-D — are Distance Draw-down analyses methods
- (shaded) — due to the test data not meeting the analysis method assumptions or boundaries, these values are incorrect and should not be considered representative

Figure 225. Summary graphic illustrating aquifer coefficients calculated for MJ-PW1 that includes boundary effects.

Groundwater Quality Results

A groundwater sample was collected from test well MJ-PW01 on December 18, 2024. The sample was collected at the conclusion of the 24-hour constant rate test from a metal sample port located off the pump casing. The lab results for a groundwater samples from test wells MJ-TW1 and MJ-TW2 are also provided for comparison purposes (Tables 4 and 5). A copy of the MJ-PW1 lab results is provided in Attachment #4 of this technical memorandum.

Groundwater samples from MJ-PW1 were analyzed for the water quality parameters of volatile organic compounds (VOCs), synthetic organic compounds (SOCs), total metals (Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Fe, Hg, Pb, Mg, Mn, Ni, Se, Ag, Na, Tl and Zn), fluoride, chloride, total dissolved solids (TDS), alkalinity, pH, sulfate, nitrate, nitrate, cyanide and Polyfluoroalkyl Substances (PFAS) (Tables 4 and 5).

The inorganic metal constituents reported for MJ-PW1 included barium (0.127 mg/L), calcium (114 mg/L), magnesium (28.2 mg/L), and sodium (28.0 mg/L). General chemistry parameters included total alkalinity (311 mg/L), chloride (52.1 mg/L), fluoride (0.24 mg/L), pH (8.1 s.u.), TDS (360 mg/L), nitrate (0.59 mg/L) and sulfate (39.5 mg/L) (Tables 4 and 5).

All the reported inorganic constituents are of a natural occurrence, commonly found in soil and groundwater. Of the reported inorganic levels in MJ-PW1, none of the common constituents have exceeded their respective U.S. EPA Maximum Contaminant Levels (MCLs); however, the constituents of iron and manganese did exceed their Secondary Maximum Contaminant Levels (SMCL) (Tables 4 and 5).

Organic constituents analyzed included VOCs, SOCs and PFAS constituents (Tables 4 and 5). No detectable concentrations of VOCs or SOCs were reported for MJ-PW1. The PFAS constituent of perfluorooctane sulfonate (PFOS) was reported at 0.0166 µg/L, exceeding the MCL of 0.004 µg/L. Two other PFAS constituents reported included Perfluorobutane sulfonate (PFBS) at 0.00256 µg/L and Perfluorooctanoic acid (PFOA) at 0.00302 µg/L; both PFAS constituents are reported at concentrations below federal action levels.

Two total coliform bacteria water samples were also collected, respectively at 9:00 and 9:30 a.m. at the conclusion of the MJ-PW1 24-hour CRT pump test; both sample results tested negative for total coliform (Tables 4 and 5).

Table 4. Summary of Analytical Results for Ground Water Samples from MJ-PW1 (and test wells MJ-TW1 and MJ-TW2 for comparison), Middletown-Junction Property, Ohio.

PARAMETER	MJ-TW1*	MJ-TW2	MJ-PW1	MCL	SMCL
Inorganic Parameters					
Alkalinity, total (as $CaCO_3$) (mg/l)	344	311	315	NA	NA
Antimony, total (mg/l)	ND	<0.005	<0.003	0.006	
Arsenic, total (mg/l)	ND	<0.010	<0.003	0.010	
Barium, total (mg/l)	0.216	0.127	0.202	2	
Beryllium, total (mg/l)	ND	<0.001	<0.001	0.004	
Cadmium, total (mg/l)	0.71	<0.002	<0.001	0.005	
Calcium, total (mg/l)	109	114	112		
Chloride (mg/l)	43.3	52.1	76.0		250
Chromium, total (mg/l)	ND	<0.005	<0.005	0.1	
Copper, total (mg/l)	ND	<0.005	0.009J	1.3	1.0
Cyanide, total (mg/l)	ND	<0.0050	<0.003	0.2	
Fluoride (mg/l)	ND	0.24	0.21	4	2
Iron, total (mg/l)	**2.44**	<0.2	**2.44**		0.3
Lead, total (mg/l)	ND	<0.005	0.0007J	0.015	
Magnesium, total (mg/l)	29.8	28.2	29.6		
Manganese, total (mg/l)	**0.365**	<0.100	**0.371**		0.05
Mercury, total (mg/l)	ND	NA	<0.0005	0.002	
Nickel, total (mg/l)	ND	<0.005	<0.010		
Nitrate-N as NO3-N (mg/l)	ND	0.59	<0.5	10	
Nitrite-N as NO2-N (mg/l)	ND	NA	0.01	1	
pH (s.u.)	7	8.1	7.1		6.5-8.5
Total Dissolved Solids (mg/l)	**529**	360	480		500
Selenium, total (mg/l)	ND	<0.010	<0.003	0.05	
Silver, total (mg/l)	ND	<0.002	<0.010		0.1
Sodium, total (mg/l)	20.7	28.0	24.3		
Sulfate (mg/l)	53.9	39.5	36.0		250
Thallium, total (mg/l)	ND	<0.050	<0.001	0.002	
Zinc, total (mg/l)	ND	<0.160	0.0192		5
Volatile Organic Chemicals (VOCs)					
Benzene (µg/l)	ND	<1.0	<0.5	5	
Bromobenzene (µg/l)	ND	<1.0	NA		
Bromochloromethane (µg/l)	ND	<1.0	NA		
Bromodichloromethane (µg/l)	ND	<1.0	NA		
Bromoform (µg/l)	ND	<1.0	NA		
Bromomethane (µg/l)	ND	<1.0	NA		
n-Butylbenzene (µg/l)	ND	<1.0	NA		
sec-Butylbenzene (µg/l)	ND	<1.0	NA		

** Sample results from Tetra Tech (2007)*

Table 4. Summary of Analytical Results for Ground Water Samples from MJ-PW1 (and test wells MJ-TW1 and MJ-TW2 for comparison), Middletown-Junction Property, Ohio.

PARAMETER	MJ-TW1	MJ-TW2	MJ-PW1	MCL	SMCL
Volatile Organic Chemicals (VOCs) (Continued)					
tert-Butylbenzene (µg/l)	ND	<1.0	NA		
Carbon Tetrachloride (µg/l)	ND	<1.0	<0.5	5	
Chlorobenzene (µg/l)	ND	<1.0	<0.5	100	
Chloroethane (µg/l)	ND	<1.0	NA		
Chloroform (µg/l)	ND	<1.0	NA		
Chloromethane (µg/l)	ND	<1.0	NA		
2-Chlorotoluene (µg/l)	ND	<1.0	NA		
4-Chlorotoluene (µg/l)	ND	<1.0	NA		
Dibromochloromethane (µg/l)	ND	<1.0	NA		
Dibromomethane (µg/l)	ND	<1.0	NA		
1,2-Dichlorobenzene (µg/l)	ND	<1.0	<0.5	600	
1,3-Dichlorobenzene (µg/l)	ND	<1.0	NA		
1,4-Dichlorobenzene (µg/l)	ND	<1.0	<0.5	75	
Dichlorodifluoromethane (µg/l)	ND	<1.0	NA		
1,1-Dichloroethane (µg/l)	ND	<1.0	NA		
1,2-Dichloroethane (µg/l)	ND	<1.0	<0.5	5	
1,1-Dichloroethene (µg/l)	ND	<1.0	<0.5	7	
cis-1,2-Dichloroethene (µg/l)	ND	<1.0	<0.5	70	
trans-1,2-Dichloroethene (µg/l)	ND	<1.0	<0.5	100	
Dichloromethane (methylene chloride) (µg/l)	0.94	<1.0	<0.5	5	
1,2-Dichloropropane (µg/l)	ND	<1.0	<0.5	5	
1,3-Dichloropropane (µg/l)	ND	<1.0	NA		
2,2-Dichloropropane (µg/l)	ND	<1.0	NA		
1,1-Dichloropropene (µg/l)	ND	<1.0	NA		
1,3-Dichloropropene (cis & trans) (µg/l)	ND	<1.0	NA		
1,2-Dibromo-3-chloropropane (µg/l)	ND	<5.0	NA		
1,2-Dibromoethane (EDB) (µg/l)	ND	<1.0	NA		
Ethylbenzene (µg/l)	ND	<1.0	<0.5	700	
Fluorotrichloromethane (µg/l)	ND	<1.0	NA		
Hexachlorobutadiene (µg/l)	ND	<1.0	NA		
Isopropylbenzene (µg/l)	ND	<1.0	NA		
p-Isopropyltoluene (µg/l)	ND	<1.0	NA		
Naphthalene (µg/l)	ND	<1.0	NA		
n-Propylbenzene (µg/l)	ND	<1.0	NA		
Styrene (µg/l)	ND	<1.0	<0.5	100	
1,1,1,2-Tetrachloroethane (µg/l)	ND	<1.0	NA		
1,1,2,2-Tetrachloroethane (µg/l)	ND	<1.0	NA		
Tetrachloroethene (µg/l)	ND	<1.0	<0.5	5	
Toluene (µg/l)	ND	<1.0	<0.5	1000	

Table 4. Summary of Analytical Results for Ground Water Samples from MJ-PW1 (and test wells MJ-TW1 and MJ-TW2 for comparison), Middletown-Junction Property, Ohio.

PARAMETER	MJ-TW1	MJ-TW2	MJ-PW1	MCL	SMCL
Volatile Organic Chemicals (VOCs) (Continued)					
1,2,3-Trichlorobenzene (µg/l)	ND	<1.0	NA		
1,2,4-Trichlorobenzene (µg/l)	ND	<1.0	<0.5	70	
1,1,1-Trichloroethane (µg/l)	ND	<1.0	<0.5	200	
1,1,2-Trichloroethane (µg/l)	ND	<1.0	<0.5	5	
Trichloroethylene (µg/l)	ND	<1.0	<0.5	5	
1,2,3-Trichloropropane (µg/l)	ND	<1.0	NA		
1,2,4-Trimethylbenzene (µg/l)	ND	<1.0	NA		
1,3,5-Trimethylbenzene (µg/l)	ND	<1.0	NA		
Vinyl Chloride (µg/l)	ND	<1.0	<0.5	2	
Xylenes, total (µg/l)	ND	<1.0	<0.5	10,000	

** Sample results from Tetra Tech (2007)*

Table 5. Summary of Analytical Results for Ground Water Samples from MJ-PW1 (and test wells MJ-TW1 and MJ-TW2 for comparison), Middletown-Junction Property, Ohio.

PARAMETER	MJ-TW1*	MJ-TW2	MJ-PW1	MCL	SMCL
Synthetic Organic Chemicals (SOCs)					
Alachlor (mg/l)	<0.000020	NA	<0.00020	0.002	
Atrazine (mg/l)	<0.000030	NA	<0.00030	0.003	
Simazine (mg/l)	<0.000040	NA	<0.00035	0.004	
Radiological Parameters					
Gross Alpha (pCi/L)	<3	NA	<3		
Gross Beta (pCi/L)	NA	NA	<4		
Radium-226 and Radium-228 (Combined)	3	NA	<1	*5 pCi/L*	
Uranium	NA	NA	NA	*30 pCi/L*	
Per and Polyfluoroalkyl Substances (PFAS)					
Perfluorooctanoic acid (PFOA) (µg/L)	NA	<0.0044	0.00302	0.004	
Perfluorooctane sulfonate (PFOS) (µg/l)	NA	**0.014**	**0.0166**	0.004	
Perfluorononanoic acid (PFNA) (µg/L)	NA	<0.0046	<0.00186	1.0*	
Perfluorobutane sulfonate (PFBS) (µg/L)	NA	<0.0044	0.00256		
Perfluorohexane sulfonate (PFHxS) (µg/L)	NA	<0.0044	<0.00186		
Hexafluoropropylene oxide dimer acid (HFPO-DA) (µg/L)	NA	<0.0023	<0.00186		
Biological Parameters					
Total Coliform	Negative	NA	Negative		
Fecal Coliform	Negative	NA	Negative		
Indicator Parameters					
Redox Potential (Eh)	NA	-206.1 mV	NA		
Dissolved Oxygen	NA	5.24 mg/L	NA		
Temperature	NA	14.62˚C	NA		
Specific Conductance	NA	820 µmhos/cm	NA		
pH (field)	NA	6.82 s.u.	NA		
Turbidity	NA	0.30 NTU	NA		

Note: Highlighted Results exceed either MCL or SMCL levels.

BDL – Below Detection Limit
MCL – Maximum Contaminant Level
SMCL – Secondary Maximum Contaminant Level
NTU – Nephelometric Turbidity Units* Hazard Index (Unitless)
** Sample results from Tetra Tech (2007)*

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ATTACHMENT #1

ODNR WELL LOG
Production Well MJ-PW01

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Geological Survey, 2045 Morse Road, Columbus, Ohio 43229-6605
Phone (614) 265-6576

Well Log Number: 3022157

Page 1 of 2 for this record.

WELL LOCATION

County: WARREN   Township: HAMILTON

Owner/Builder: WARREN CO. WATER & SEWER DISTRICT

Address of Well Location: 406 JUSTICE DR

City: LEBANON   Zip Code +4: 45036

Permit No.: ___ Section: ___ *and or* Lot No.: ___

Use of Well: MUNICIPAL

Coordinates of Well (Use only one of the below coordinate systems)

Latitude, Longitude Coordinates

Latitude: 39.364685   Longitude: -84.239189

Elevation of Well in feet: ___ +/- ___ ft.

Datum Plane: ☐ NAD27 ☐ NAD83   Elevation Source: DIGITAL MAP

Source of Coordinates: GPS

Well location written description:

Near the intersection of the Little Miami Scenic Bike Trail and the Lebanon Countryside Trail

Comments on water quality/quantity and well construction:

WELL TEST *

Pre-Pumping Static Level: 21.5 ft.   Date: 12/18/2024

Measured from: TOP OF CASING

Pumping test method: PUMPING

Test Rate: 1691 gpm   Duration of Test: 24 hrs.

Feet of Drawdown: 27 ft.   Sustainable Yield: ___ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No   Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump: ___   Capacity: ___ gpm

Pump set at: ___ ft.   Pitless Type: ___

Pump installed by: ___

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm: NATIONAL WATER SERVICES (DAYT)

Address: 3949 DAYTON PARK DR

City, State, Zip: DAYTON OH 45414

Signed: JOSH GAVIN (Filed Electronically)   Date: 4/30/2025

ODH Registration Number: 003318   Last Revised on: 5/1/2025

CONSTRUCTION DETAILS

Drilling Method: CABLE TOOL

BOREHOLE/CASING (Measured from ground surface)

1. Borehole Diameter: 24 inches   Depth: 90 ft.
   Casing Diameter: ___ in.   Length: ___ ft.   Thickness: ___ in.
2. Borehole Diameter: 16 inches   Depth: 90 ft.
   Casing Diameter: 16 in.   Length: 70 ft.   Thickness: 0.5 in.

Casing Height Above Ground: 3 ft.

Type: 1: ___ 2: STEEL

Joints: 1: ___ 2: WELDED

SCREEN

Diameter: 16 in.   Slot Size: 0.1 in.   Screen Length: 20 ft.

Type: CONTINUOUS WIRE WOUND   Material: STAINLESS STEEL

Set Between: 70 ft. and 90 ft.

GRAVEL PACK (Filter Pack)

Material/Size: #2   Vol/Wt. Used: 6,750 LBS

Method of Installation: POURED (GRAVITY)

Depth: Placed From: 60 ft. To: 90 ft.

GROUT

Material: NEAT CEMENT   Vol/Wt. Used: 11,165 LBS

Method of Installation: PUMPED WITH TREMIE PIPE

Depth: Placed From: 3 ft. To: 60 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BROWN	SANDY	SOIL	0	7
TAN	SILTY	SAND & GRAVEL	7	20
BROWN		SAND & GRAVEL	20	30
BROWN	PEA	GRAVEL	30	41
BROWN	LARGE	GRAVEL & BOULDERS	41	51
BROWN		SAND & GRAVEL	51	61
BROWN	PEA	GRAVEL & SAND	61	71
BROWN	COARSE	SAND & GRAVEL	71	81
GRAY	COBBLES	SAND & GRAVEL	81	85
GRAY	FINE	SAND/GRAVEL/BOULI	85	90
BLUE		SHALE	90	91
		WATER AT	22	90

Aquifer Type (Formation producing the most water.): SAND & GRAVEL

Date of Well Completion: 12/19/2024   Total Depth of Well: 90 ft.

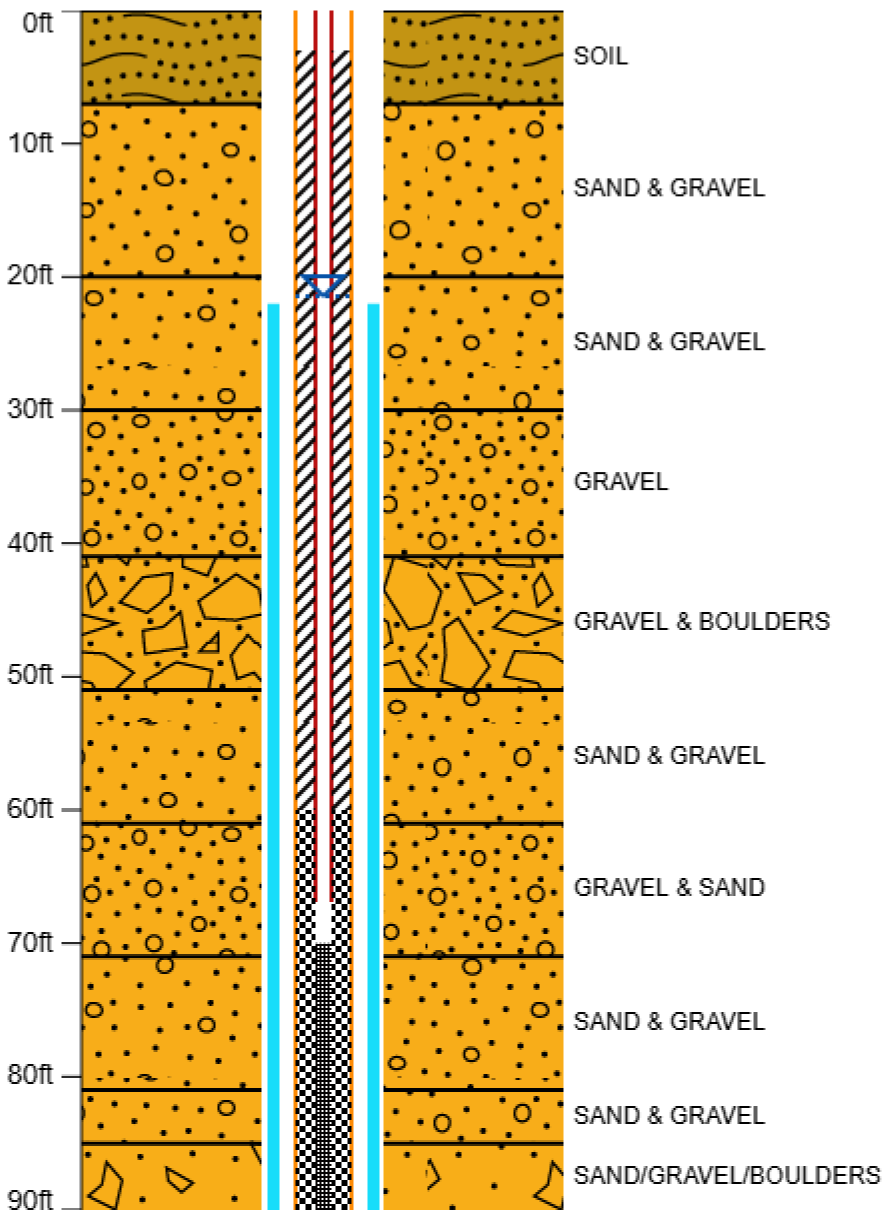
Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number
3022157



String: 1
Borehole Depth: 90 ft.
Borehole Diameter: 16 in.
Casing Length: 70 ft.
Casing Diameter: 16 in.

Borehole
Casing
Gravel
Grout
Screen
Water At
Static Water Level

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

SUBMITTAL FORM

To: Terran Corporation Attn: Kelly Smith 4080 Executive Drive Beavercreek, OH 45430 (937) 320-3601	**Originator:** National Water Services, LLC Donnie Williams P.O. Box 230 Paoli, IN 47454 (812) 723-2108
Engineers Contract No.:	**Project Name:** Warren County Water & Sewer Department Middletown Junction Production Well Drilling
NWS Project No.: 8666	**Submittal #: WAR-001**
_X__ **For Approval** ______ **For Information**	______ **Resubmittal** __X__ **As Specified** _____ **Exception**

Qty.	Drawing / Specification Section Reference	Description of Item
	Spec Section 33.21.00 Water Supply Wells	Recommended Well Design

Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

Contractor: National Water Services, LLC

Submitted By: *Donnie Williams* **Date:** 9/11/2024

Senior Estimator

Work may proceed	**Revise and resubmit -** Work may proceed Subject to Incorporation of changes indicated.	**Revise and resubmit -** Work may not proceed	**Review not required -** Work may proceed

(Please mark the box below the appropriate review and add any applicable notes in space provided below.)

Notes:

Proceed as proposed.

Submittal Reviewed By: Kelly C Smith Terran Corp. **Date:** 9/12/2024

Owner

Warren County Water & Sewer Department

Contact Person

City/State

Lebanon, OH

Phone Number

Date

9/11/2024

Well Location

Middletown Junction

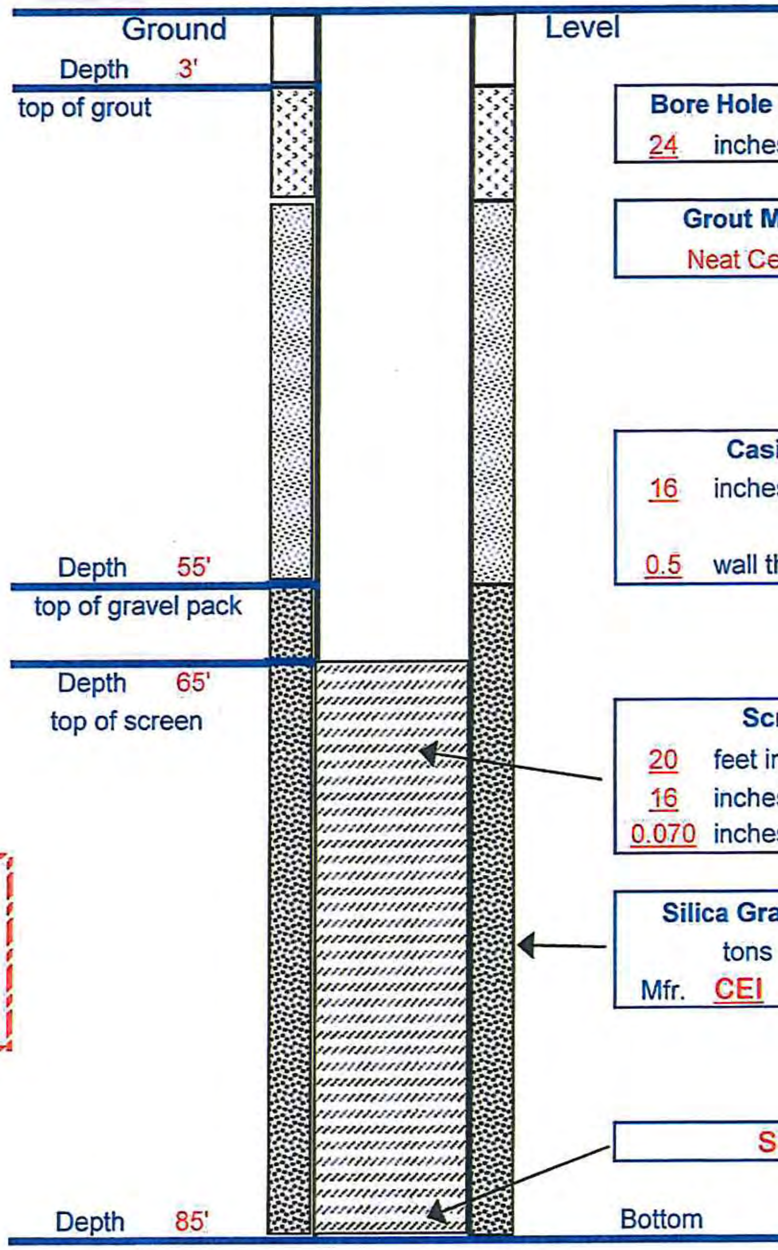
Well Number

PW-3

Not to Scale

Please note that all depths measured from ground level are not to scale.

Casing extends 2' above ground level.



Bore Hole Diameter
24 inches

Grout Material
Neat Cemeent

Casing
16 inches diameter
0.5 wall thickness

Screen
20 feet in length
16 inches diameter
0.070 inches slot size

Silica Gravel Wall
tons Size # 4
Mfr. CEI

SS Plate

Static Level	
Type of Rig	Cable Tool
Driller	Grant Herron
Date Completed	
Pumped G.P.M. at feet pumping level after hours	
Special Notes	

FIELD BORING LOG

Date 8/30/2024
County
Project Warren Co. 2-Production Wells
Phone No.
Location

Township
Job# #8666
Boring No. PW-3
Foreman Grant Heron

Drilling Methods: HSA ______ CFA______ ROTARY ______ ROCK CORING __ CABLE TOOL __XX-

DEPTH, FT		DESCRIPTION	Type	Sample		
FROM	TO			Depth, FT	Recovery	SPT Blows N/6"
0	2	Sandy soil brown				
2	18	Sand & gravel tan 1"--3" gravel cobbles				
18	25	Brown sand & gravel, gravel !"--2", 3"-4" cobbles				
25	29	Brown sand & gravel, gravel !"--2", 3"-4" cobbles				
29	31	Uniform gravel 1" w/sand. Bailed below casing, lost all water to static level.				
31	35	Course brown gravel, little to no sand--some cobbles				
35	40	Large clean gravel/cobbles				
40	45	Large brown clean gravel, Mainly 1"--2" gravel				
45	50	Large brown gravel/cobbles 4"--6" cobbles				
50	58	Large cobbles 4'--6", boulders-large gravel; Hard to bail, had to bust up to bail out.				
58	60	Large gravel to pea gravel, getting sandier				
60	65	Large sand & gravel w/cobbles				
65	70	Boulders up to 12" diameter, large gravel, Had to drill up to get to bail				
70	80	Large boulders w/fine sand, between--some cobbles ; most boulders 8"--12" diameter, cable broke				
80	84	Large gravel, fine, loose shale, sands mixed				

WATER LEVEL OBSERVATIONS

DURING DRILLING

AT COMPLETION

AFTER ______ HRS ______
AFTER ______ HRS ______
AFTER ______ HRS ______

NOTES: 24"

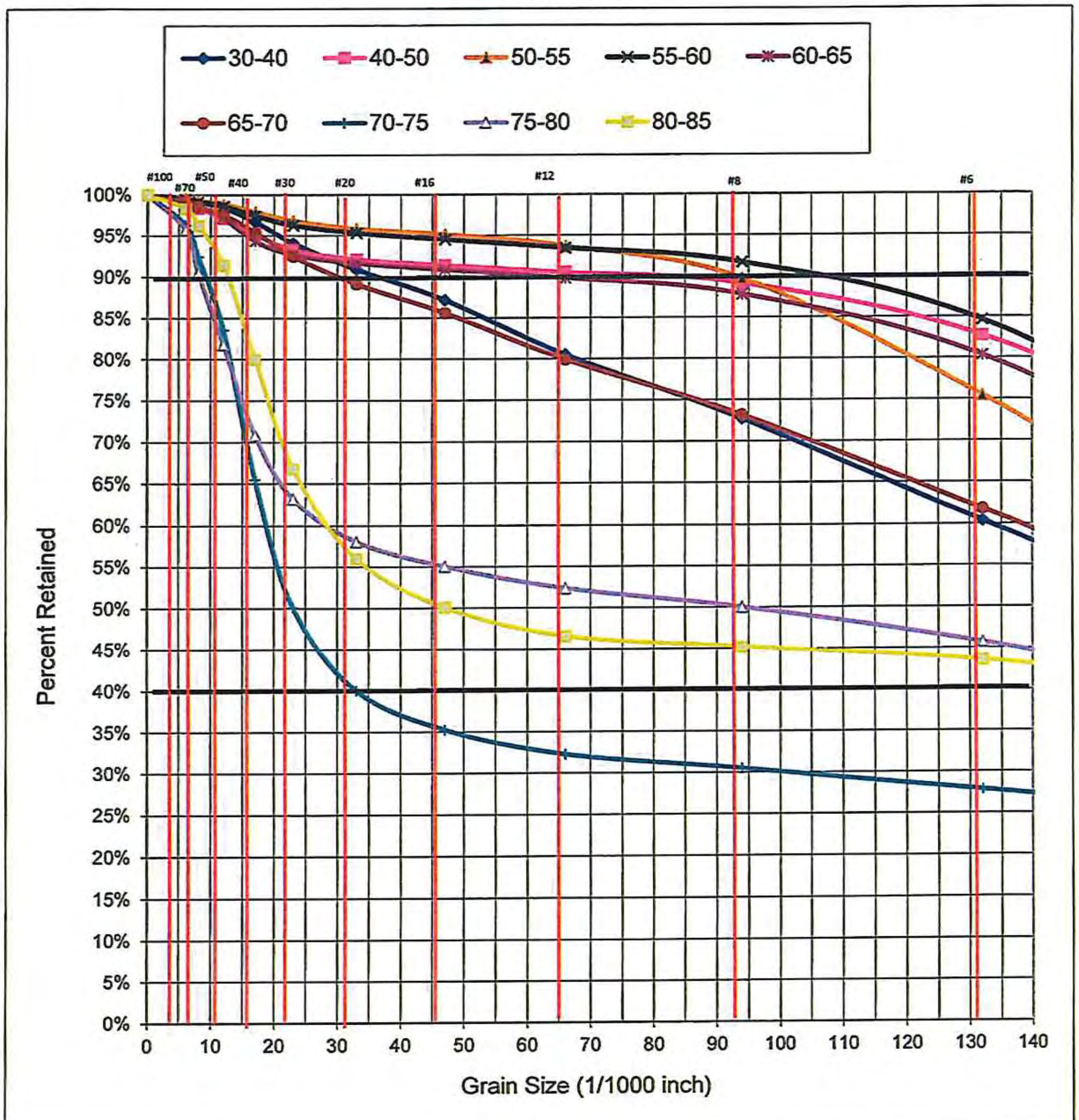
PIEZOMETER INSTALLED
______ YES ______ NO
DEPTH ______ CASING ______

Grount: ______ Grount Depth: ______
Installation: ______ No. Bags: ______
GPM: ______

Johnson Screens
651-636-3900

Johnson Screens

SAND ANALYSIS



Job Name Middletown Jct. Prod Well
Location Warren County, OH
Driller National Water Services, LLC

Sample ID Middletown Jct. Prod Well
Analyzed by: Duvall, Steven
Date: 9/11/2024

Casing ϕ 16 in
Screen ϕ 16 in

Desired Yield 1,000 GPM
SWL (ft) N/A ft

Recommended Slot Size: 70 slot (0.070") screen from 65' to 85' bgs.
Recommended Gravel Pack: CEI #4

Based exclusively on the samples provided by the contractor, a sieve analysis graph and suggested screen slot size is provided as requested. Since numerous construction considerations and site circumstances influence successful well completion, Johnson Screens assumes no responsibility for final well performance nor awareness of local regulations pertaining to well installations.

Prepared by:Meyer, Wayne

Send Samples to 1950 Old Highway 8, New Brighton, MN 55112

9/11/2024

Johnson Screens

WELL SCREEN SUBMITTAL DATA

CLIENT: NWS
PROJECT: Middletown Junction - High Flow 100 Construction

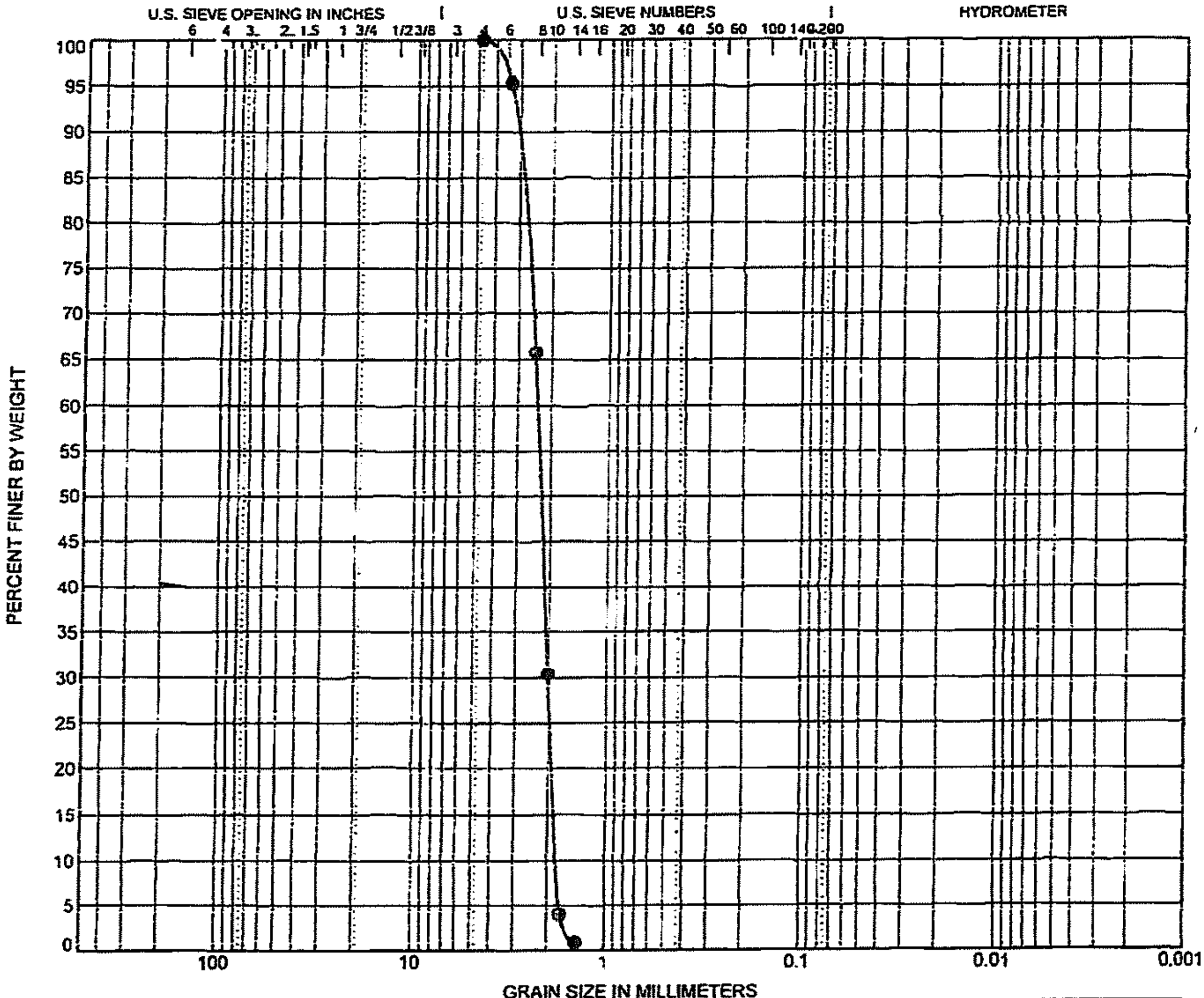
Material	304 Stainless			
Nom Size	16	PS	*410*	*mm*
Top x Bottom Fitting Configuration	WR x WR W/PB			
Estimated Total Well Depth	85	ft	*26*	*meters*
Estimated Feet of Screen	20	ft	*6*	*meters*
Design Slot Size	0.070	in	*1.8*	*mm*
Approx. Outside Diameter	16.06	in	*408*	*mm*
Screen Barrel Inside Diameter	15.39	in	*391*	*mm*
Approx. Clear ID at Fittings	15.06	in	*382*	*mm*
Approx. Weight Per Ft	17	lbs	*8*	*kg*
Wire Width	0.071	in	*1.8*	*mm*
Wire Height	0.177	in	*4.5*	*mm*
Calc. Collapse Strength *	27	PSI	*2*	*kg/sq.cm*
Open Area	49.6%			
Intake Area	300	sq.in./ft	*6,361*	*sq.cm./meter*
Transmitting Capacity-at 0.1 ft/sec	93	gpm/ft	*19*	*lps/meter*
Support Rod Diam	0.152	in	*3.9*	*mm*
No Rods	70			
Cross Sectional Rod Area	1.61	sq.in.	*10.39*	*sq.cm.*
Design Yield Strength	30,000	PSI	*2,109*	*kg/sq.cm*
Calc.Tensile Strength *	41,100	lbs	*18,600*	*kg*
Max.Recomended Hang Wt. *	20,500	lbs	*9,300*	*kg*
Column Load *	38,100	lbs	*17,300*	*kg*

* A broad range of site conditions and completion methods can impact the physical strength requirements (collapse, tensile, hang weight and column strengths) for a successful screen installation. Consult a Johnson Screens technical representative with questions regarding the parameters presented above as they may relate to your specific site requirements. Final design parameters should be reviewed and confirmed by the customer and his third-party consultants.

Prepared by Waterwell Sales
Subject to Aqseptence Group Inc
Standard Terms and Conditions.
www.johnsonscreens.com/water-wells

REPORT NO. 012

GRAIN SIZE DISTRIBUTION TEST REPORT



% +3"	%Gravel	%Sand	%Silt	%Clay
0.0	72.0			

LL	PI	D90	D60	D50	D30	D15	D10	Cc	Cu
		3.175	2.36	2.243	2.026	1.84	1.781	0.98	1.32

REMARKS	USCS	AASHTO

PROJECT NUMBER A13042

PROJECT NAME

LOCATION #4 well Pack

DATE 5/14/13

MATERIAL DESCRIPTION

1.0-2.0 sand

Solar Testing Laboratories
1125 Valley Belt Road
Brooklyn Heights, Ohio 44313
Telephone: 216-741-7007

CURVE # ____

Nominal Pipe Size		Outside Diameter (Inch)	Nominal Wall Thickness Schedule (Inch)																
NPS	DN	OD	SCH 5s	SCH l0s	SCH 10	SCH 20	SCH 30	SCH 40s	SCH STD	SCH 40	SCH 60	SCH 80s	SCH XS	SCH 80	SCH 100	SCH 120	SCH 140	SCH 160	SCH XXS
1/8	6	0.405		1.240				0.068	0.068	0.068		0.095	0.095	0.095					
1/4	8	0.540		1.650				0.088	0.088	0.088		0.119	0.119	0.119					
3/8	10	0.675		1.650				0.091	0.091	0.091		0.126	0.126	0.126					
1/2	15	0.840	0.065	2.110				0.109	0.109	0.109		0.147	0.147	0.147				0.188	0.294
3/4	20	1.050	0.065	2.110				0.113	0.113	0.113		0.154	0.154	0.154				0.219	0.308
1	25	1.315	0.065	2.770				0.133	0.133	0.133		0.179	0.179	0.179				0.250	0.358
1 1/4	32	1.660	0.065	2.770				0.140	0.140	0.140		0.191	0.191	0.191				0.250	0.382
1 1/2	40	1.900	0.065	2.770				0.145	0.145	0.145		0.200	0.200	0.200				0.281	0.400
2	50	2.375	0.065	2.770				0.154	0.154	0.154		0.218	0.218	0.218				0.344	0.436
2 1/2	65	2.875	0.083	3.050				0.203	0.203	0.203		0.276	0.276	0.276				0.375	0.552
3	80	3.500	0.083	3.050				0.216	0.216	0.216		0.300	0.300	0.300				0.438	0.600
3 1/2	90	4.000	0.083	3.050				0.226	0.226	0.226		0.318	0.318	0.318					
4	100	4.500	0.083	3.050				0.237	0.237	0.237		0.337	0.337	0.337		0.438		0.531	0.674
5	125	5.563	0.109	3.400				0.258	0.258	0.258		0.375	0.375	0.375		0.500		0.625	0.750
6	150	6.625	0.109	3.400				0.280	0.280	0.280		0.432	0.432	0.432		0.562		0.719	0.864
8	200	8.625	0.109	3.760		0.250	0.277	0.322	0.322	0.322	0.406	0.500	0.500	0.500	0.594	0.719	0.812	0.906	0.875
10	250	10.750	0.134	4.190		0.250	0.307	0.365	0.365	0.365	0.500	0.500	0.500	0.594	0.719	0.844	1.000	1.125	1.000
12	300	12.750	0.156	4.570		0.250	0.330	0.375	0.375	0.406	0.562	0.500	0.500	0.688	0.844	1.000	1.125	1.312	1.000
14	350	14.000	0.156	4.780	0.250	0.312	0.375		0.375	0.438	0.594		0.500	0.750	0.938	1.094	1.250	1.406	
16	400	16.000	0.165	4.780	0.250	0.312	0.375		0.375	0.500	0.656		0.500	0.844	1.031	1.219	1.438	1.594	
18	450	18.000	0.165	4.780	0.250	0.312	0.438		0.375	0.562	0.750		0.500	0.938	1.156	1.375	1.562	1.781	
20	500	20.000	0.188	5.540	0.250	0.375	0.500		0.375	0.594	0.812		0.500	1.031	1.281	1.500	1.750	1.969	
22		22.000	0.188	5.540	0.250	0.375	0.500		0.375		0.875		0.500	1.125	1.375	1.625	1.875	2.125	
24	600	24.000	0.218	6.350	0.250	0.375	0.562		0.375	0.688	0.969		0.500	1.219	1.531	1.812	2.062	2.344	
26		26.000			0.312	0.500	0.000		0.375				0.500						
28	700	28.000			0.312	0.500	0.625		0.375				0.500						
30		30.000	0.250	7.920	0.312	0.500	0.625		0.375				0.500						
32	800	32.000			0.312	0.500	0.625		0.375	0.688			0.500						
34		34.000			0.312	0.500	0.625		0.375	0.688			0.500						
36	900	36.000			0.312	0.500	0.625		0.375	0.750			0.500						
38		38.000							0.375				0.500						
40	1000	40.000						0.375											
42		42.000							0.375				0.500						
44	1100	44.000							0.375				0.500						
46		46.000							0.375				0.500						
48	1200	48.000							0.375			0.500							

ATTACHMENT #2

MW-PW01 SUBMERSIBLE PUMP PERFORMANCE SHOP DRAWINGS DOCUMENTS

Pump Performance Datasheet

American-Marsh Pumps Quotation System 24.4.1

Item number	: 001
Service	:
Quantity	: 1
Quote number	: 2447099
Size	: 12GC
Stages	: 4
Based on curve number	: 12GC
Basic model number	: -
Date last saved	: 27 Jan 2025 10:13 AM

Operating Conditions

Flow, rated	: 1,200.0 USgpm
Differential head / pressure, rated (requested)	: 282.0 ft
Differential head / pressure, rated (actual)	: 284.0 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available, rated	: Ample
Site Supply Frequency	: 60 Hz

Performance

Speed criteria	: Synchronous
Speed, rated	: 1750 rpm
Impeller diameter, rated	: 9.38 in
Impeller diameter, maximum	: 9.50 in
Impeller diameter, minimum	: 8.75 in
Efficiency (bowl / pump)	: 83.03 / 81.10 %
PEI (CL)	: -
NPSH required / margin required	: 16.65 / 0.50 ft
Ns (total flow) / Nss (imp. eye flow)	: 2,199 / 7,657 US Units
MCSF	: 640.5 USgpm
Head, maximum, rated diameter	: 347.0 ft
Head rise to shutoff (bowl / pump)	: 23.03 / 25.72 %
Flow, best eff. point (bowl / pump)	: 1,082.9 / 1,057.5 USgpm
Flow ratio, rated / BEP (bowl / pump)	: 110.82 / 113.47 %
Diameter ratio (rated / max)	: 98.68 %
Head ratio (rated dia / max dia)	: 96.63 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

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

Material

Material selected	: Cast iron - Standard

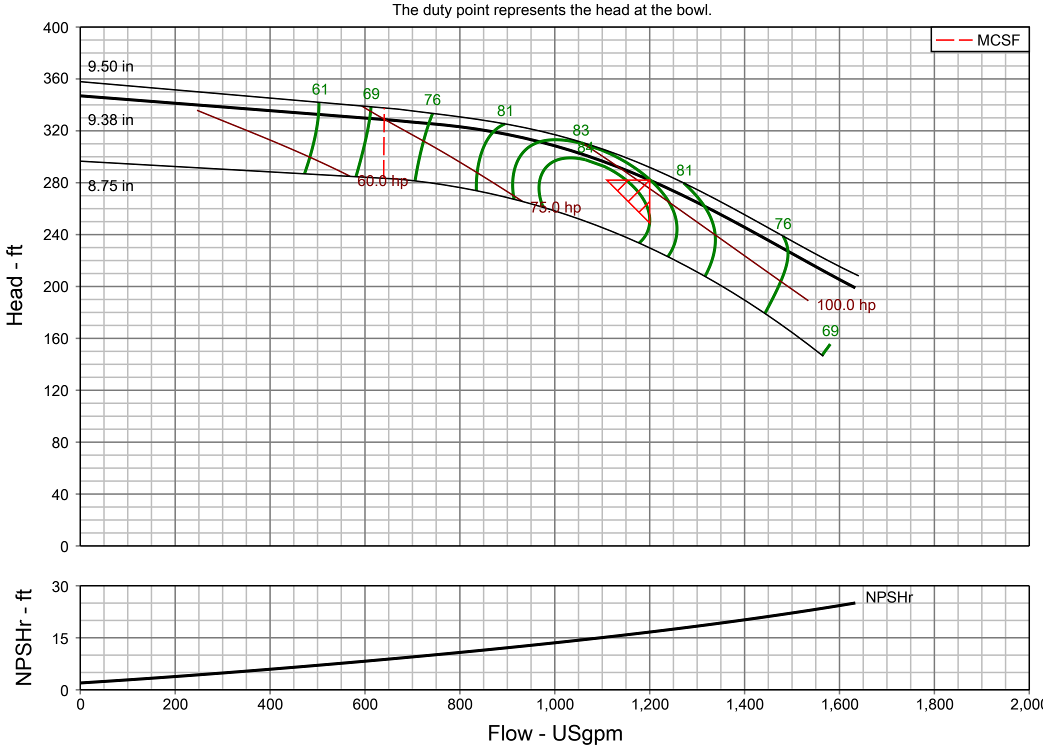
Pressure Data

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

Driver & Power Data (@Max density)

Driver sizing specification	: Maximum power
Margin over specification	: 0.00 %
Service factor	: 1.15
Power, hydraulic	: 85.43 hp
Power (bowl / pump)	: 103 / 103 hp
Power, maximum, rated diameter	: 116 hp
Minimum recommended motor rating	: 125 hp / 93.21 kW

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



Item number	: 001	Size	: 12GC
Service	:	Stages	: 4
Quantity	: 1	Speed, rated	: 1750 rpm
Quote number	: 2447099	Intellicode	:
		Date last saved	: 27 Jan 2025 10:13 AM

Performance Data

Head, maximum diameter, rated flow	: 291.8 ft
Head, minimum diameter, rated flow	: 229.8 ft
Head, maximum, rated diameter	: 347.0 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
NPSHR adjustment factor, total	: 1.00
User applied performance adjustment comments	:
NPSH margin dictated by pump supplier	: 0.50 ft
NPSH margin dictated by user	: 0.00 ft
NPSH margin used (added to 'required' values)	: 0.50 ft

Mechanical Limits

Torque, rated power, rated speed	: 5.89 hp/100 rpm
Torque, maximum power, rated speed	: 6.61 hp/100 rpm
Torque, driver power, full load speed	: 7.00 hp/100 rpm
Torque, driver power, rated speed	: 7.00 hp/100 rpm
Torque, pump shaft limit	: 18.14 hp/100 rpm
Radial load, worst case	: -
Radial load limit	: -
Impeller peripheral speed, rated	: -
Impeller peripheral speed limit	: -

Stage, Speed and Solids Limits

Stages, maximum	: 20
Stages, minimum	: 1
Pump speed limit, maximum	: 3000 rpm
Pump speed limit, minimum	: 800 rpm
Curve speed limit, maximum	: 3000 rpm
Curve speed limit, minimum	: 300 rpm
Variable speed limit, maximum	: -
Variable speed limit, minimum	: 100 rpm
Solids diameter limit	: 0.63 in

Energy Indexes

Bare pump model number	: 12GC
Basic model number	: -
PEI CL/VL	: - / -
ER CL/VL	: - / -

Typical Driver Data

Driver speed, full load	: 1785 rpm
Driver speed, rated load	: 1788 rpm
Driver efficiency, 100% load	: N/A
Driver efficiency, 75% load	: N/A
Driver efficiency, 50% load	: N/A

Various Performance Data	Flow (USgpm)	Head (ft)	Efficiency (%)	NPSHr (ft)	Power (hp)
Shutoff, rated	0.00	347.0	-	-	55.22
Shutoff, maximum	0.00	357.9	-	-	56.92
MCSF	640.5	328.7	70.93	8.74	74.92
Rated flow, minimum	1,200.0	229.8	83.69	-	83.18
Rated flow, maximum	1,200.0	291.8	82.10	-	108
BEP flow, rated	1,082.9	298.9	83.78	14.79	97.53
120% rated flow, rated	1,440.0	237.6	77.64	20.95	111
End of curve, rated	1,633.4	198.9	70.99	25.03	116
End of curve, minimum	1,566.1	146.2	68.83	0.00	83.98
End of curve, maximum	1,640.6	208.1	71.52	25.20	121
Maximum value, rated	-	347.0	83.78	-	116
Maximum value, maximum	-	-	82.91	-	121

System differential pressure	@ Density, rated	@ Density, max
Differential pressure, rated flow, rated (psi)	122.0	122.0
Differential pressure, shutoff, rated (psi)	150.2	150.2
Differential pressure, shutoff, maximum (psi)	154.9	154.9

Discharge pressure	@ Suction pressure, rated	@ Suction pressure, max	@ Suction pressure, rated	@ Suction pressure, max
Discharge pressure, rated flow, rated (psi.g)	122.0	122.0	122.0	122.0
Discharge pressure, shutoff, rated (psi.g)	150.2	150.2	150.2	150.2
Discharge pressure, shutoff, maximum (psi.g)	154.9	154.9	154.9	154.9

Ratios

Maximum flow / rated flow, rated	: 136.12 %	Head rated diameter / head minimum diameter, rated flow	: 122.74 %

Head and Power Losses

Friction loss rate, column	: 8.76 %
Friction loss, column	: 1.75 ft
Friction loss, discharge head	: 3.46 ft
Friction loss, can/barrel	: -
Friction loss, suction bell and strainer	: 0.00 ft
Friction loss, bowl/column adaptor	: 0.82 ft
Friction loss, total	: 6.03 ft
Power loss, lineshaft bearings	: -
Power loss, thrust bearing	: 0.20 hp
Power loss, total	: 0.20 hp

Bowl vs. Pump Performance

Head (bowl / pump)	: 282.0 ft / 276.0 ft
Efficiency (bowl / pump)	: 83.03 % / 81.10 %
Power (bowl / pump)	: 103 hp / 103 hp
NPSH required at first stage impeller eye	: 16.65 ft

Weights and Down Thrust

Weight, lineshaft	: -
Weight, bowl assembly rotating element	: 97.88 lb
Thrust factor	: 5.10 lb/ft
Thrust, hydraulic (rated / max)	: 1,435.8 / 1,766.5 lbf
Thrust, bowl shaft end (rated / max)	: 0.00 / 0.00 lbf
Thrust, shaft step (rated / max)	: 0.00 / 0.00 lbf
Thrust, stuffing box sleeve (rated / max)	: - / -
Thrust, total (rated / max)	: 1,533.7 / 1,864.4 lbf
Thrust Limit	: -

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

Pressure Data	Maximum working pressure (psi.g)	Maximum allowable working pressure (psi.g)	Hydrostatic test pressure (psi.g)
Bowl	150.2	246.0	369.0
Column	150.2	1,200.0	-
Discharge head	150.2	275.0	-
Can/Barrel	-	-	-

Torque Limits

Torque, lineshaft limit	: -

Dimensions

Minimum clearance below suction bell lip/case	: 0.00 in
Minimum well diameter	: 0.00 in
Suction nozzle centerline height	: -
Bowl assembly length, first stage	: 24.06 in
Bowl assembly length, upper stage	: 11.00 in
Bowl assembly length, total	: 57.06 in
Suction bearing hub length	: 0.00 in
Strainer length	: 0.00 in
Bowl to column adaptor length	: 0.00 in
Discharge head stick-down	: 0.28 in
Submersible motor adaptor length	: 17.00 in
Submersible motor length	: -
Column length	: 20.00 ft
Total pump length	: 26.20 ft
Can / barrel length	: -
Stuffing box sleeve diameter	: -
Suction bell diameter	: -
Minimum submergence to prevent vortexing	: 28.00 in
Actual submergence (based on LLL)	: 314 in
Discharge head height	: 26.00 in
Discharge nozzle centerline height	: 9.00 in
Min distance discharge nozzle centerline to suction bell	: 0.00
Lineshaft length	: -
Bowl shaft diameter	: 1.69 in
Bowl diameter, outside	: 11.75 in
Bowl diameter, exit	: 9.58 in
Column diameter, inside	: 6.07 in
Column internal obstruction diameter	: -
Can/barrel diameter, inside	: -
Can/barrel obstruction diameter	

NPSH

NPSH at bowl (available / required)	: Ample / 16.65 ft
NPSH at low liquid level (available / required)	: Ample / -
NPSH at suction flange (available / required)	: - / -

Liquid Velocities

Column liquid velocity	: 13.30 ft/s
Discharge head liquid velocity	: 13.62 ft/s
Can liquid velocity	: -
Suction nozzle liquid velocity	: -

Additional Design Conditions

NSF/ANSI/CAN 61 & 372 Certification Required	: NO	Pump Length Definition	: Column length (Setting)
		Length Value	: 20.00 ft
Pump Design	: Submersible	Well Inside Diameter	: in
Impeller Type	: Enclosed Impeller	Pumping Level (From Bottom of Head to Liquid)	: ft
Driver Type	: Submersible Motor		
Head Measurement Location	: Top of bowl	NPSH Measurement Location	: Bowl

Bowl Options

Impeller Fastener	: Collet	Bowl Suction Connection Size	: Submersible
Bowl Shaft Material	: 416ss	Bowl Suction Type	: Submersible
Bolting	: Standard Bolting	Submersible Motor Adaptor Size	: 8" Motor Bracket
Bowl Discharge Type	: Threaded		

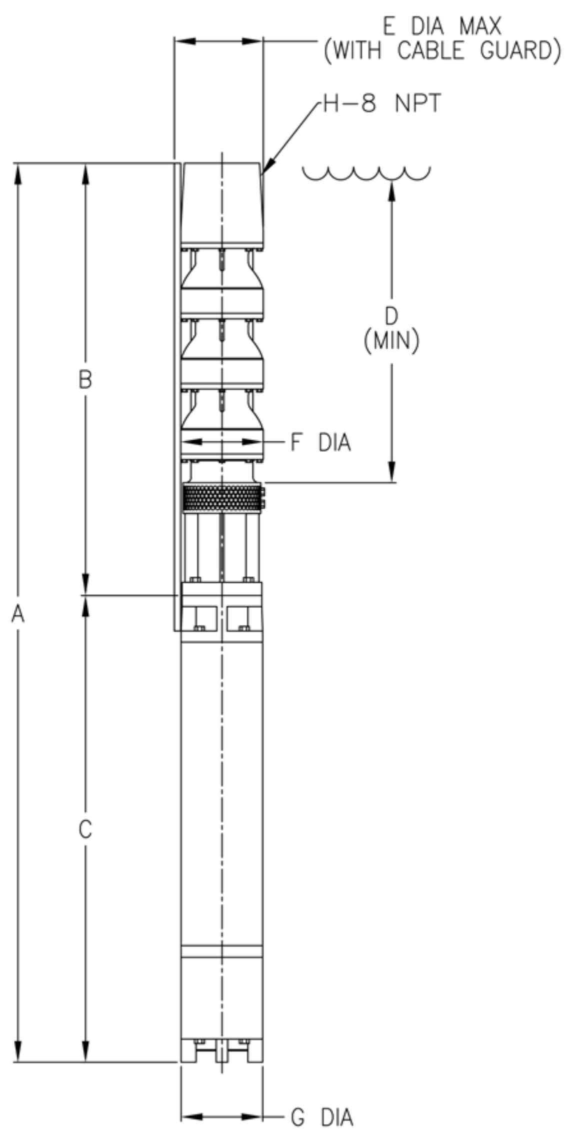
Column Options

Column Diameter	: 6 inch	Column Type	: Threaded

Discharge Head Options

Discharge Head Type	: Fabricated Steel	Discharge Head Flange Rating	: Class 150
Larger Head Diameter Required	: No	Discharge Head Column Connection	: Threaded
Discharge Head Size	: 6" Discharge		

GENERAL ARRANGEMENT DRAWINGS



DISCHARGE HEAD

Not Required

FOUNDATION PLATE

Not Required

STRAINER DETAIL

Not Required

All Dimensions Are In inches ± 0.38 in
Not For Construction Unless Certified By Engineering
Drawings Represent General Construction

A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
73.06	74.06	-1.00	28.00	11.44	11.25	-1	6"	---	---	---	---	---	---	---

S	H2	H3	H4	H5	F1	F2	F3	F4	P1	P2	P3	P4	S1	S2
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Vertical Turbine Pump			
480 SERIES VT			
Submersible Pump			
GENERAL DATA			
FLOW	1,200.0 USgpm	HEAD	282.0 ft
LIQUID	Water	SG	1.000 SG
LIQUID TEMP	68.00 deg F	VISCOSITY	1.00 cP
PUMP DATA			
BOWL MODEL	12GC	STAGES	4
BOWL SFT DIA	1.69 in	LINESHAFT DIA	---
IMPELLER CONN. TYPE	Collet	COLUMN SIZE	6.00 in
COLUMN CONN. TYPE	Threaded	COL WALL / COL SCH	0.28 in
TOTAL RATED THRUST	1,533.7 lbf		
MECHANICAL SEAL DATA			
MFGR	---	TYPE	-
SIZE	-	API CODE	-
PUMP MATERIAL DATA			
BOWL	Cast Iron	IMPELLER	Standard
BOWL WR	None	IMP WR	None
BOWL SHAFT	416 SS	LINESHAFT	-
STRAINER	300 SS	COL PIPE	Steel
DISCHARGE HEAD	Steel	COL CPLG	Steel
MOTOR DATA			
MFR.	Clarke	FRAME	-
HP	118	RPM	1750
PHASE	Three	VOLTS	230V or 460V
CYCLES	60	ROTATION	-
TYPE	Solid Shaft	ENCLOSURE	-
WEIGHTS			
EST. PUMP WT.	635.0 lb	EST. MOTOR WT.	-1.00 lb

CERTIFICATION CONTENT	
CUSTOMER	National Water Service
SERVICE	-
ITEM NUMBER	001
P.O. NUMBER	-
QUOTE NO.	2447099
DATE	-
CERTIFIED FOR	-
CERTIFIED BY	-

WARNING

DO NOT OPERATE THIS MACHINE WITH OUT PROTECTIVE GUARD IN PLACE. ANY OPERATION OF THIS MACHINE WITHOUTPROTECTIVE GUARD CAN RESULT IN SEVERE BODILY INJURY

Vertical Turbine - 12GC - 4 Stage

PLEUGER

Submersible Motors
Ranges 6" - 16"

60 Hz

Highest Reliability & Durability
Energy Efficiencies up to 95%

PLEUGER. Reliable. Always.

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About PLEUGER

PLEUGER is an international manufacturer and supplier of submersible motors, pumps, thrusters and plunger pumps and related services with headquarters in Hamburg, Germany. Renowned worldwide across the energy, mining, water, industrial processing and the oil & gas industries for absolute reliability and outstanding longevity, our products are designed, engineered and manufactured to solve some of the toughest applications in the most challenging and harshest environments. With over 90 years experience we are experts in electric submersible motors and pumps for various applications in the Water and General Industry, including Mining and Oil & Gas market sector. With German engineering know-how and many years of industry experience, PLEUGER meets the demands of customers worldwide for performance, durability, energy efficiency and total cost of ownership.

PLEUGER CRAFTSMANSHIP

PLEUGER stands for true craftsmanship, combining vision, precision and attention to detail.

From our unique manufacturing processes for stators, to our unrivalled winding capabilities for submersible motors, each element is part of our journey to absolute perfection.

Nothing is more important to us than the reliability and durability of our products.

DESIGN & ENGINEERING

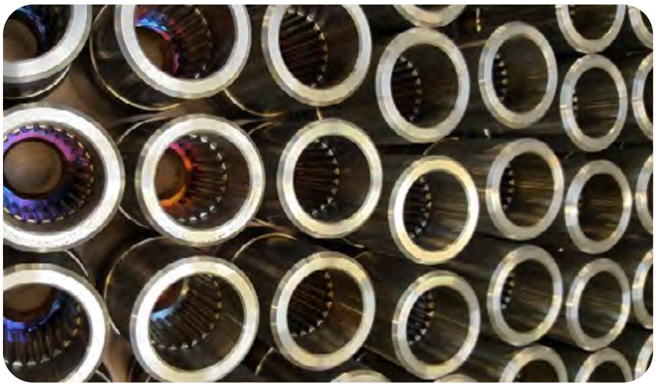
PLEUGER believes in total reliability and the very best quality. We achieve this through precision design and engineering. Proven throughout our decades of experience in consulting, engineering and manufacturing for the most demanding applications around the world.

We offer you the best fit for your submersible pump solution. Engineered for performance. Built to last.

TECHNOLOGIES

Our design engineers, production engineers and data analysts are always investigating how new technologies, materials and approaches can enhance what we do, to maximise performance and reliability and minimize energy consumption.

PLEUGER submersible pump units keep critical systems running across the world in energy, drinking water, industrial processes, dewatering and geothermal heating applications.



PLEUGER SUBMERSIBLE PUMPS

Best-in-class submersible pumps built for reliability and performance.

PLEUGER Submersible Motors — Made in Germany

As a manufacturer of world-class submersible motors, every PLEUGER product is designed, engineered and manufactured to the highest standards for efficiency, corrosion protection, and an extended power range.

NSF

Made in Germany

Standard Motors

- 6" to 50"
- Induction motor, Asynchronous motor
- Power output: 5.5 kW to 5 MW (7.4 HP to 6,705 HP)
- Operating speed: 200 to 3600 rpm – 2,4,6,8 pole designs
- 200 V to 6.6 kV / 50 and 60 Hz

PMM Motors

- 6" to 8"
- Synchronous motor
- Power output: 4.0 to 165 kW (5.36 to 221 HP), 200 kW (268 HP) on request
- Operating speed: 2100 to 3600 rpm (max 3800 rpm) 4 pole design
- Driven by Variable Frequency Drive (VFD)
- VFD input voltage 400 to 500 V / 70 and 120 Hz

Key Features

- Water-filled motors as standard
- Oil-filled motors on request
- Rewindable
- Operating temperatures: -20°C to +50°C / -4°F to +122°F, on request -30°C to +85°C / +22°F to +185°F
- Suitable for VFD operation

Significant savings in energy costs

High-performance pumps with increased efficiency of up to 85% (average η opt > 83%) available

International Design Standards

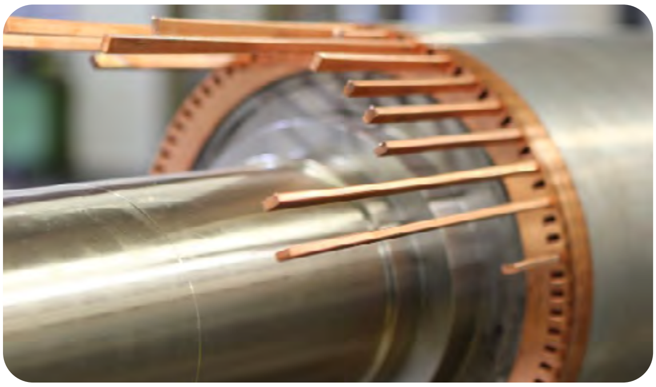
Design Standards: ANSI / ASTM / DIN / ISO / Hydraulic Institute / CE / API 610

Hydraulic Standards: ANSI/HI / EN ISO / API610 / NFPA20

Electrical Standards: NEMA / IEC / IEEE

Certifications: DNV GL / ABS / CSA / ATEX/ NSF61

Approvals: ISO 9001



PLEUGER PMM Motors

Our engineers and analysts are always investigating how new technologies, materials and approaches can enhance what we do, to maximise performance and reliability and minimize energy consumption.

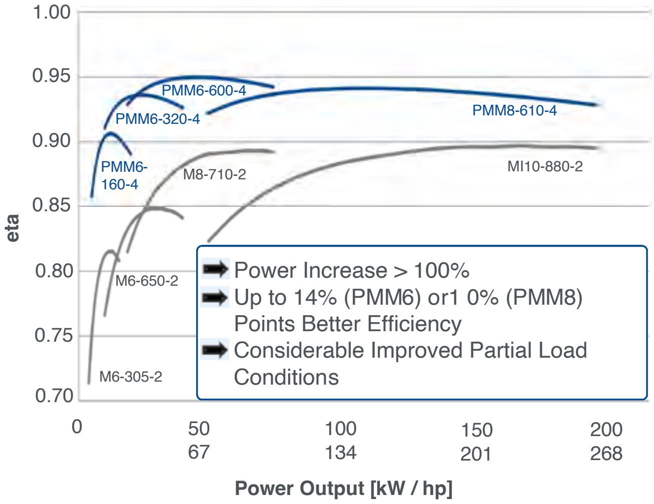
PLEUGER PMM motors are rewindable, synchronous electric motors with significant Increase of Motor Efficiency (up to 95%) and Power Output.

Available from 4 kW (5.4 HP) to 165 kW (to 221 HP), 200 kW (268 HP) on request with efficiencies up to 94%

- Designed to minimize life cycle costs
- Design based on the reliable PLEUGER asynchronous / induction motor
- Operated via variable frequency drive (VFD) ensures most efficient operation
- PLEUGER offers the complete system of pump, motor and VFD

Features and Benefits

- Up to 14 percent points better efficiency than asynchronous motors
- Increased power output of more than 100%, motors allow smaller unit sizes with reduced installation costs
- Wide efficiency curves drastically reduce number of motor sizes and simplify storage
- No special VFD required; standard VFDs from various manufacturers can be used
- No sinus filter or du/dt filter required, reduce investment and energy cost



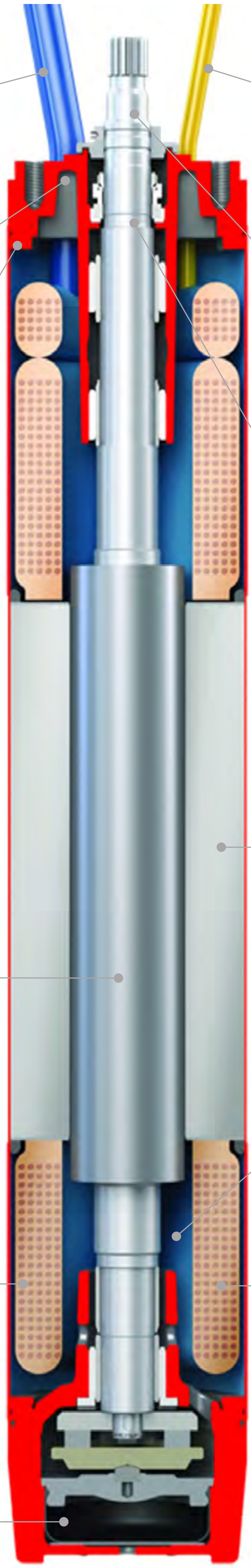
PLEUGER PMM Motors

Designed for increased performance and reduced life-cycle costs.

Motor Type	Power Output * kW (HP)	Current * A	Efficiency * %	Cos Phi *	Length, L mm (inch)	Diameter, D mm (inch)	Weight kg (lb)	Maximum Permissible Thrust kN (lbf) Down	Up
PMM6-160-4	4.0 (5.4)	8.2	87.0%	0.995	696 (27.40)	144 (5.669)	46 (101)	27.5 (6100)	6 (1350)
	5.5 (7.4)	11.0	89.0%	0.990					
	9.2 (12.3)	17.9	91.0%	0.975					
	11.0 (14.3)	21.5	91.5%	0.965					
	13.0 (17.4)	25.5	91.0%	0.955					
	15.0 (20.1)	29.0	91.0%	0.940					
PMM6-320-4	15.0 (20.1)	28.5	92.5%	0.990	856 (33.70)	144 (5.669)	64 (141)	27.5 (6100)	6 (1350)
	18.5 (24.8)	35.0	93.0%	0.985					
	22.0 (29.5)	41.5	93.5%	0.975					
	26.0 (34.9)	48.5	93.5%	0.970					
	30.0 (40.2)	57.0	93.0%	0.960					
	33.0 (44.3)	63.0	93.0%	0.950					
	37.0 (49.6)	71.0	92.5%	0.935					
	40.0 (53.6)	77.0	92.5%	0.925					
PMM6-600-4	40.0 (53.6)	79.0	94.5%	0.980	1136 (44.72)	144 (5.669)	101 (223)	27.5 (6100)	6 (1350)
	46.0 (61.7)	92.0	94.5%	0.970					
	50.0 (67.1)	100.0	94.5%	0.965					
	55.0 (73.8)	110.0	94.5%	0.960					
	60.0 (80.5)	121.0	94.5%	0.950					
	68.0 (91.2)	137.0	94.5%	0.935					
	75.0 (100.6)	153.0	94.0%	0.920					
PMM8-610-4	75.0 (100.6)	140.0	93.5%	0.985	1438 (56.61)	186 (7.323)	179 (395)	40.0 (9000)***	12.5 (2800)
	83.0 (111.3)	153.0	94.0%	0.985					
	90.0 (120.7)	166.0	94.0%	0.985					
	110.0 (147.5)	205.0	94.0%	0.975					
	140.0 (187.7)	260.0	94.0%	0.960					
	165.0 (221.0)	285.0	93.0%	0.940					
	**								

* at 120 Hz and 3600 rpm, max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, at Service Factor 1.0
** up to 200.0 (268) on request, *** max downthrust capacity 80KN/17,985 lbf on request

PLEUGER Standard and PMM Motors



Flat- or round cable

Space-saving cable design. Certified for drinking water applications.

NEMA or IEC flange connection

Universal connector to standard hydraulics.

Motor housing

Cast housing designed for reliability, corrosion resistance, strength and durability.

Induction Motor: Squirrel Cage Rotor for Asynchronous Motor
or
Permanent Magnet Motor: Rotor equipped with Permanent Magnets for Synchronous Motor

- Up to 14 % points higher motor efficiency compared to asynchronous motors, through reduction in copper loss
- Hermetically sealed rotor ensures protection of magnets against corrosion and mechanical damage
- Up to 200 kW (268 HP) available

Rewindable winding

Ease of maintenance and cost saving. PE or PE2 insulation.

PE2+PA insulation for optimized winding lifetime.

Breather diaphragm

Liquid pressure compensation to extend the service life of the mechanical seal and O-ring.

Signal Cable (Optional)

Used with temperature sensor PT100
For monitoring motor temperature.

Motor Shaft End

Standard duplex stainless steel for best combination of corrosion resistance, mechanical strength and stiffness. Special materials available upon request.

Mechanical Seal

High-grade SIC/SIC/Viton® as standard ensures wear resistance and ultra-low maintenance requirements.

Stator Tube

Standard 316 stainless steel construction for excellent corrosion resistance over the service life. Special materials available on request.

Motor Filling

Prefilled and tested with water/glycol mixture, or potable water on request.

Thrust Bearing

Heavy-duty, custom polymer to ensure ultra-low maintenance and maximum reliability

Thrust Bearings

PLEUGER motors are equipped with heavy duty motor axial thrust bearings made of high-performance polymers for highest axial thrust loads ensuring extraordinary lifetime and reliability.

- Developed by PLEUGER Industries
- Benchmark in submersible motor technology
- In operation since 2013
- Custom Polymer Material
- Heavy-duty design, up to 300kN axial thrust
- Ensures extraordinary lifetime of motor

Advantages

- Tilting pads made of proprietary synthetic material
- Rotating runner made of Stainless Steel
- Increase of lifetime
- Maintenance free
- Allowed axial thrust increased by 100% (up to 300kN)
- Lower absorbed power by 20%

- Increased wear resistance by using new polymers
- Improved dry run capabilities
- Increased water hammer resistance
- Lower starting torque
- Bi-directional operation
- High temperature resistance
- No contamination based on carbon wear

VPI

ROTOR MANUFACTURE - VACUUM PRESSURE IMPREGNATION (VPI)

The manufacture of our rotors includes a vacuum pressure impregnation process that ensures complete penetration of the epoxy into the micro laminations which are used to build up the layers of the rotor.

The VPI process results in a far stronger and more durable construction than traditional processes, allowing for final milling and honing to ensure the perfect rotor balance.

Due to the vacuum, air and moisture between the rotor laminations are extracted and replaced by liquid epoxy resin.

This prevents the occurrence of harmful:

- imbalance due to air pockets during operation of the motor
- corrosion between the rotor blades

The subsequent heat treatment of the rotor solidifies the already impregnated rotor pack into a solid block, which further increases the stiffness of the complete rotor.

Consequently, the bending of the rotor and thus the bending moment in the radial bearings are reduced, which leads to a longer service life of the bearings and thus of the motor.

COOLING CIRCUIT

Efficient Motor Cooling

- internal cooling system manufactured with a highly efficient cooling impeller
- Customized impeller for each motor size
- The design ensures sufficient thermal motor reserves and minimizes energy losses
- Re-windable / water filled
- Sealed winding wire (PE, PE+PA, etc.)

Cooling and lubrication options:

- Water-Glycol Mixture (standard)
- Drinking Water
- Pure Glycol
- Oil

Glycol plus additives prevent corrosion and serve as anti freeze, as well as being environmentally safe.

Pleuger Submersible Motor range for Low Voltages SF 1.0

	Model	Power Output	Voltage	Frequency	Speed	Current	Thrust Capacity max.		Length	Power Factor			Efficiency			Standard motor leads		
	d.o.l.	HP[3]	V[4] - 3Ph	Hz	RPM	A	Down(lbf)[5]	Up (lbf)	inches	1/1	3/4	1/2	1/1	3/4	1/2	No. of leads shape	Length ft	Cross section mm²
6" Motors	M6-160-2	8.5	460	60	3440	13.3	2800	1350	21.81	0.810	0.765	0.670	0.745	0.755	0.730	1Fl	9.8	4x2,5
	M6-200-2	11.5	460	60	3430	16.8	2800	1350	23.39	0.830	0.790	0.705	0.765	0.780	0.765	1Fl	9.8	4x2,5
	M6-240-2	15	460	60	3430	21	2800	1350	24.96	0.830	0.790	0.700	0.800	0.810	0.790	1Fl	9.8	4x2,5
	M6-270-2	17.5	460	60	3425	24	2800	1350	26.14	0.835	0.795	0.715	0.810	0.820	0.805	1Fl	9.8	4x2,5
	M6-305-2	21	460	60	3420	29	2800	1350	27.52	0.845	0.810	0.730	0.800	0.815	0.805	1Fl	9.8	4x2,5 [1]
	M6-340-2	24	460	60	3420	33	2800	1350	28.90	0.845	0.810	0.725	0.810	0.825	0.815	1Fl	9.8	4x2,5 [1]
	M6-400-2	29.5	460	60	3415	39.5	2800	1350	31.26	0.855	0.820	0.735	0.815	0.830	0.820	1Fl	9.8	4x4 [1]
	M6-460-2	35	460	60	3430	47	6100	1350	34.49	0.840	0.800	0.710	0.830	0.840	0.825	1Fl	9.8	4x6
	M6-530-2	41.5	460	60	3425	55	6100	1350	37.24	0.850	0.810	0.725	0.830	0.845	0.835	1Fl	9.8	4x6 [1]
	M6-600-2	48.5	460	60	3425	63	6100	1350	40.00	0.850	0.810	0.720	0.840	0.850	0.840	1Fl	9.8	4x10
	M6-650-2	53.5	460	60	3415	70	6100	1350	41.97	0.860	0.825	0.745	0.835	0.850	0.840	1Fl	9.8	4x10 [1]
	M6-720-2	60.5	460	60	3415	78	6100	1350	44.72	0.860	0.825	0.740	0.840	0.850	0.845	1Fl	9.8	4x10 [1]
8" Motors	M8-330-2	53.5	460	60	3470	70	17985	2800	40.87	0.855	0.840	0.790	0.840	0.850	0.835	1Fl	16.4	4x10 [1]
	M8-410-2	64.5	460	60	3485	83	17985	2800	44.02	0.855	0.840	0.785	0.850	0.855	0.835	1Fl	23.0	4x16
	M8-480-2	74	460	60	3490	92	17985	2800	46.77	0.870	0.845	0.785	0.865	0.865	0.840	1Fl	23.0	4x16 [1]
	M8-530-2	80.5	460	60	3485	102	17985	2800	48.74	0.860	0.850	0.795	0.860	0.865	0.845	1Fl	23.0	4x16 [1]
	M8-580-2	88.5	460	60	3490	111	17985	2800	50.71	0.875	0.855	0.800	0.855	0.860	0.845	1Fl	23.0	4x16 [1]
	M8-650-2	94	460	60	3495	116	17985	2800	53.46	0.875	0.855	0.805	0.865	0.860	0.845	1Rd	23.0	4x25
	M8-710-2	107	460	60	3490	133	17985	2800	55.83	0.850	0.835	0.780	0.885	0.890	0.885	1Rd	23.0	4x25 [1]
	M8-820-2	121	460	60	3490	149	17985	2800	60.16	0.855	0.845	0.795	0.885	0.890	0.885	4Rd	23.0	1x16P [1]
	M8-930-2	134	460	60	3495	165	17985	2800	64.49	0.850	0.835	0.785	0.895	0.895	0.885	4Rd	23.0	1x25P
	M8-990-2	142	460	60	3500	175	17985	2800	66.85	0.850	0.830	0.775	0.895	0.895	0.885	4Rd	23.0	1x25P
	M8-135-4	6.5	460	60	1750	10.5	17985	2800	33.19	0.765	0.685	0.565	0.750	0.750	0.720	1Fl	23.0	4x2.5
	M8-170-4	9	460	60	1755	14.3	17985	2800	34.57	0.745	0.665	0.540	0.780	0.775	0.740	1Fl	23.0	4x2.5
	M8-210-4	12	460	60	1755	18.8	17985	2800	36.14	0.750	0.675	0.555	0.800	0.800	0.775	1Fl	23.0	4x2.5
	M8-280-4	18	460	60	1750	26.5	17985	2800	38.90	0.800	0.730	0.615	0.795	0.805	0.790	1Fl	23.0	4x2.5
	M8-340-4	24	460	60	1750	35	17985	2800	41.26	0.790	0.720	0.605	0.815	0.820	0.805	1Fl	23.0	4x4
	M8-420-4	29.5	460	60	1745	41	17985	2800	44.41	0.810	0.750	0.645	0.830	0.840	0.825	1Fl	23.0	4x4 [1]
	M8-520-4	35	460	60	1750	48.5	17985	2800	48.35	0.800	0.740	0.630	0.840	0.845	0.835	1Fl	23.0	4x6
	M8-700-4	49.5	460	60	1745	69	17985	2800	55.43	0.820	0.765	0.655	0.820	0.835	0.825	1Fl	23.0	4x10 [1]
	M8-870-4	60	460	60	1750	84	17985	2800	62.13	0.795	0.735	0.620	0.850	0.850	0.835	1Fl	23.0	4x16
	M8-1050-4	72.5	460	60	1750	101	17985	2800	73.15	0.785	0.720	0.600	0.855	0.855	0.840	1Fl	23.0	4x16 [1]
10" Motors	MI10-420-2	121	460	60	3465	156	17985	5000	53.27	0.830	0.800	0.720	0.875	0.885	0.875	4Rd	23.0	1x25P
	MI10-490-2	141	460	60	3470	179	17985	5000	56.02	0.835	0.800	0.720	0.880	0.885	0.875	4Rd	23.0	1x25P [1]
	MI10-600-2	177	460	60	3465	220	17985	5000	60.35	0.850	0.820	0.745	0.880	0.890	0.880	4Rd	23.0	1x35P [1]
	MI10-740-2	221	460	60	3470	275	17985	5000	65.87	0.845	0.810	0.730	0.890	0.895	0.885	4Rd	23.0	1x50P [1,2]
	MI10-880-2	268	460	60	3470	330	17985	5000	71.38	0.845	0.805	0.725	0.895	0.895	0.885	3/4Rd	32.8	1x25PII [1]
	MI10-960-2	295	460	60	3460	360	17985	5000	74.53	0.860	0.835	0.765	0.890	0.895	0.890	3/4Rd	32.8	1x25PII [1]
	MI10-1070-2	322	460	60	3465	395	17985	5000	78.86	0.860	0.830	0.760	0.890	0.895	0.885	3/4Rd	32.8	1x25PII [1]
	MI10-1200-2	355	460	60	3475	435	17985	5000	83.98	0.855	0.820	0.745	0.895	0.895	0.890	3/4Rd	32.8	1x35PII [1]
	MI10-420-4	50	460	60	1750	66	17985	5000	53.27	0.805	0.765	0.685	0.870	0.875	0.860	1Fl	23.0	4x10
	MI10-420-4	72	460	60	1740	98	17985	5000	53.27	0.805	0.770	0.680	0.860	0.870	0.865	1Fl	23.0	4x16 [1]
	MI10-490-4	88	460	60	1735	118	17985	5000	56.02	0.810	0.780	0.695	0.865	0.875	0.875	4Rd	23.0	1x16P
	MI10-600-4	115	460	60	1730	154	17985	5000	60.35	0.815	0.785	0.705	0.860	0.875	0.875	4Rd	23.0	1x25P
	MI10-740-4	145	460	60	1730	193	17985	5000	65.87	0.810	0.775	0.690	0.865	0.880	0.880	4Rd	23.0	1x25P [1]
	MI10-880-4	177	460	60	1735	235	17985	5000	71.38	0.810	0.780	0.695	0.870	0.880	0.880	4Rd	23.0	1x35P [1]
	MI10-960-4	193	460	60	1735	255	17985	5000	74.53	0.810	0.775	0.695	0.875	0.885	0.885	4Rd	23.0	1x35P [1]
	MI10-1070-4	212	460	60	1735	280	17985	5000	78.86	0.810	0.775	0.690	0.870	0.880	0.880	4Rd	23.0	1x50P [1,2]
	MI10-1200-4	241	460	60	1735	320	17985	5000	83.98	0.805	0.770	0.685	0.880	0.890	0.885	4Rd	23.0	1x50P [1,2]
12"[6]	VNI12-65-2	248	460	60	3495	300	26977	5000	67.48	0.875	0.860	0.815	0.885	0.880	0.860	2Rd	32.8	3/4x25II [1]
	VNI12-75-2	288	460	60	3495	345	26977	5000	71.42	0.880	0.870	0.830	0.885	0.880	0.860	2Rd	32.8	3/4x35II [1]
	VNI12-90-2	322	460	60	3505	385	26977	5000	77.32	0.880	0.860	0.810	0.885	0.880	0.855	2Rd	32.8	3/4x50II [1]
	VNI12-65-4	168	460	60	1720	215	26977	5000	67.48	0.825	0.805	0.745	0.875	0.885	0.880	1Rd	32.8	4x50 [1]
	VNI12-75-4	201	460	60	1720	260	26977	5000	71.42	0.825	0.810	0.750	0.875	0.885	0.885	2Rd	32.8	3/4x25II [1]
	VNI12-90-4	248	460	60	1720	320	26977	5000	77.32	0.825	0.810	0.755	0.880	0.890	0.885	2Rd	32.8	3/4x35II [1]
	VNI12-100-4	275	460	60	1720	350	26977	5000	81.26	0.830	0.810	0.755	0.880	0.890	0.885	2Rd	32.8	3/4x35II [1]
	VNI12-110-4	308	460	60	1720	400	26977	5000	85.20	0.825	0.805	0.740	0.880	0.890	0.885	2Rd	32.8	3/4x50II [1]
	VNI12-120-4	350	460	60	1715	450	26977	5000	89.13	0.830	0.815	0.750	0.870	0.885	0.885	2Rd	32.8	3/4x50II [1]
14"[6]	VNI14-50-2	288	460	60	3500	355	33721	9000	71.81	0.850	0.850	0.810	0.895	0.890	0.870	2Rd	32.8	3/4x35II [1]
	VNI14-60-2	322	460	60	3515	395	33721	9000	75.75	0.850	0.835	0.780	0.895	0.890	0.865	2Rd	32.8	3/4x50II [1]
	VNI14-50-4	177	460	60	1730	230	33721	9000	71.81	0.810	0.790	0.720	0.880	0.885	0.875	1Rd	32.8	4x70
	VNI14-60-4	214	460	60	1730	280	33721	9000	75.75	0.820	0.800	0.735	0.880	0.885	0.875	1Rd	32.8	4x70 [1]
	VNI14-70-4	241	460	60	1730	310	33721	9000	79.09	0.820	0.795	0.735	0.885	0.885	0.875	2Rd	32.8	3/4x35II [1]
	VNI14-80-4	275	460	60	1730	355	33721	9000	83.62	0.820	0.800	0.730	0.885	0.890	0.875	2Rd	32.8	3/4x35II [1]
	VNI14-90-4	308	460	60	1735	400	33721	9000	87.56	0.820	0.795	0.725	0.885	0.890	0.875	2Rd	32.8	3/4x50II [1]
	VNI14-100-4	335	460	60	1735	430	33721	9000	91.50	0.820	0.795	0.725	0.890	0.890	0.875	2Rd	32.8	3/4x50II [1]
16"[6]	MI16-65-4	322	460	60	1725	425	33721	9000	78.11	0.800	0.790	0.735	0.890	0.900	0.895	2Rd	32.8	3/4x50II [1]

1) Cable must be submerged, 2) PE conductor outside the motor, 3) max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, 4) +14/-6%, other voltages up to 1000V on request, 5) max. value for thrust bearing only, motor values see pages "motor measures & specifications", 6) higher power output on request

Pleuger Submersible Motor range for Low Voltages SF 1.15

	Model d.o.l.	Power Output HP[3]	Voltage V[4] - 3Ph	Frequency Hz	Speed RPM	Current A	Thrust Capacity max. Down(lbf)[5]	Thrust Capacity max. Up (lbf)	Length inches	Power Factor 1/1	Power Factor 3/4	Power Factor 1/2	Efficiency 1/1	Efficiency 3/4	Efficiency 1/2	Standard motor leads No. of leads shape	Standard motor leads Length ft	Standard motor leads Cross section mm²
6" Motors	M6-160-2	7.5	460	60	3470	11.6	2800	1350	21.81	0.790	0.730	0.630	0.755	0.750	0.715	1Fl	9.8	4x2,5
	M6-200-2	10	460	60	3460	14.9	2800	1350	23.39	0.815	0.770	0.670	0.775	0.780	0.750	1Fl	9.8	4x2,5
	M6-240-2	12.5	460	60	3460	18.3	2800	1350	24.96	0.810	0.760	0.665	0.805	0.805	0.780	1Fl	9.8	4x2,5
	M6-270-2	15	460	60	3450	21.5	2800	1350	26.14	0.820	0.775	0.685	0.815	0.820	0.795	1Fl	9.8	4x2,5
	M6-305-2	18	460	60	3450	25	2800	1350	27.52	0.830	0.785	0.695	0.810	0.815	0.795	1Fl	9.8	4x2,5 [1]
	M6-340-2	21	460	60	3450	28.5	2800	1350	28.90	0.830	0.785	0.690	0.820	0.825	0.805	1Fl	9.8	4x2,5 [1]
	M6-400-2	25.5	460	60	3450	34.5	2800	1350	31.26	0.840	0.795	0.700	0.825	0.830	0.815	1Fl	9.8	4x4 [1]
	M6-460-2	30.5	460	60	3460	41	6100	1350	34.49	0.820	0.770	0.670	0.835	0.840	0.815	1Fl	9.8	4x6
	M6-530-2	36	460	60	3450	48.5	6100	1350	37.24	0.830	0.785	0.685	0.840	0.840	0.825	1Fl	9.8	4x6 [1]
	M6-600-2	42	460	60	3450	56	6100	1350	40.00	0.830	0.785	0.685	0.845	0.850	0.830	1Fl	9.8	4x10
	M6-650-2	47	460	60	3440	62	6100	1350	41.97	0.845	0.805	0.715	0.845	0.850	0.835	1Fl	9.8	4x10 [1]
	M6-720-2	52.5	460	60	3445	69	6100	1350	44.72	0.845	0.800	0.705	0.845	0.850	0.835	1Fl	9.8	4x10 [1]
8" Motors	M8-330-2	46.5	460	60	3495	61	17985	2800	40.87	0.855	0.830	0.765	0.845	0.845	0.825	1Fl	16.4	4x10 [1]
	M8-410-2	55.5	460	60	3505	72	17985	2800	44.02	0.850	0.825	0.760	0.855	0.850	0.825	1Fl	23.0	4x16
	M8-480-2	64.5	460	60	3505	81	17985	2800	46.77	0.860	0.830	0.760	0.865	0.860	0.830	1Fl	23.0	4x16 [1]
	M8-530-2	70	460	60	3505	89	17985	2800	48.74	0.855	0.835	0.770	0.860	0.860	0.830	1Fl	23.0	4x16 [1]
	M8-580-2	77	460	60	3505	98	17985	2800	50.71	0.865	0.840	0.775	0.855	0.860	0.835	1Fl	23.0	4x16 [1]
	M8-650-2	82	460	60	3510	102	17985	2800	53.46	0.870	0.840	0.780	0.865	0.860	0.835	1Rd	23.0	4x25
	M8-710-2	94	460	60	3505	117	17985	2800	55.83	0.845	0.820	0.760	0.890	0.890	0.880	1Rd	23.0	4x25 [1]
	M8-820-2	105	460	60	3505	129	17985	2800	60.16	0.850	0.830	0.775	0.890	0.890	0.880	4Rd	23.0	1x16P [1]
	M8-930-2	117	460	60	3510	144	17985	2800	64.49	0.845	0.820	0.760	0.895	0.895	0.880	4Rd	23.0	1x25P
	M8-990-2	123	460	60	3515	153	17985	2800	66.85	0.840	0.815	0.745	0.900	0.895	0.880	4Rd	23.0	1x25P
	M8-135-4	5.5	460	60	1760	9.3	17985	2800	33.19	0.715	0.630	0.510	0.755	0.740	0.695	1Fl	23.0	4x2.5
	M8-170-4	7.5	460	60	1765	12.7	17985	2800	34.57	0.695	0.610	0.485	0.780	0.765	0.720	1Fl	23.0	4x2.5
	M8-210-4	10.5	460	60	1760	17.3	17985	2800	36.14	0.725	0.640	0.520	0.800	0.795	0.755	1Fl	23.0	4x2.5
	M8-280-4	15.5	460	60	1755	23.5	17985	2800	38.90	0.765	0.690	0.565	0.805	0.800	0.775	1Fl	23.0	4x2.5
	M8-340-4	21	460	60	1755	31.5	17985	2800	41.26	0.755	0.680	0.560	0.820	0.820	0.795	1Fl	23.0	4x4
	M8-420-4	25.5	460	60	1755	36.5	17985	2800	44.41	0.780	0.715	0.600	0.835	0.835	0.815	1Fl	23.0	4x4 [1]
	M8-520-4	30	460	60	1755	43.5	17985	2800	48.35	0.770	0.705	0.585	0.845	0.845	0.825	1Fl	23.0	4x6
	M8-700-4	43	460	60	1755	61	17985	2800	55.43	0.795	0.730	0.610	0.830	0.835	0.815	1Fl	23.0	4x10 [1]
	M8-870-4	52.5	460	60	1755	75	17985	2800	62.13	0.770	0.695	0.575	0.850	0.850	0.825	1Fl	23.0	4x16
	M8-1050-4	63	460	60	1760	91	17985	2800	73.15	0.755	0.680	0.560	0.855	0.855	0.830	1Fl	23.0	4x16 [1]
10" Motors	MI10-420-2	105	460	60	3485	136	17985	5000	53.27	0.820	0.775	0.680	0.880	0.880	0.865	4Rd	23.0	1x25P
	MI10-490-2	122	460	60	3490	157	17985	5000	56.02	0.820	0.775	0.680	0.885	0.885	0.865	4Rd	23.0	1x25P [1]
	MI10-600-2	154	460	60	3485	194	17985	5000	60.35	0.840	0.800	0.715	0.885	0.890	0.875	4Rd	23.0	1x35P [1]
	MI10-740-2	192	460	60	3490	240	17985	5000	65.87	0.830	0.785	0.695	0.895	0.890	0.875	4Rd	23.0	1x50P [1,2]
	MI10-880-2	233	460	60	3490	295	17985	5000	71.38	0.830	0.780	0.685	0.895	0.895	0.880	3/4Rd	32.8	1x25PII [1]
	MI10-960-2	256	460	60	3480	315	17985	5000	74.53	0.850	0.815	0.735	0.895	0.895	0.880	3/4Rd	32.8	1x25PII [1]
	MI10-1070-2	280	460	60	3485	345	17985	5000	78.86	0.850	0.810	0.730	0.895	0.895	0.880	3/4Rd	32.8	1x25PII [1]
	MI10-1200-2	308	460	60	3490	385	17985	5000	83.98	0.840	0.795	0.710	0.895	0.895	0.880	3/4Rd	32.8	1x35PII [1]
	MI10-420-4	43	460	60	1760	58	17985	5000	53.27	0.790	0.740	0.645	0.875	0.870	0.850	1Fl	23.0	4x10
	MI10-420-4	63	460	60	1750	86	17985	5000	53.27	0.790	0.740	0.640	0.865	0.870	0.860	1Fl	23.0	4x16 [1]
	MI10-490-4	76.5	460	60	1745	103	17985	5000	56.02	0.795	0.755	0.660	0.875	0.880	0.870	4Rd	23.0	1x16P
	MI10-600-4	100	460	60	1740	135	17985	5000	60.35	0.805	0.760	0.670	0.865	0.875	0.870	4Rd	23.0	1x25P
	MI10-740-4	126	460	60	1745	169	17985	5000	65.87	0.800	0.750	0.655	0.875	0.880	0.875	4Rd	23.0	1x25P [1]
	MI10-880-4	154	460	60	1745	205	17985	5000	71.38	0.800	0.755	0.660	0.875	0.885	0.875	4Rd	23.0	1x35P [1]
	MI10-960-4	168	460	60	1745	225	17985	5000	74.53	0.800	0.750	0.660	0.880	0.890	0.880	4Rd	23.0	1x35P [1]
	MI10-1070-4	184	460	60	1745	245	17985	5000	78.86	0.800	0.750	0.650	0.875	0.885	0.875	4Rd	23.0	1x50P [1,2]
	MI10-1200-4	210	460	60	1745	280	17985	5000	83.98	0.795	0.745	0.645	0.885	0.890	0.880	4Rd	23.0	1x50P [1,2]
12"[6]	VNI12-65-2	216	460	60	3510	260	26977	5000	67.48	0.870	0.845	0.790	0.885	0.875	0.845	2Rd	32.8	3/4x25II [1]
	VNI12-75-2	250	460	60	3510	305	26977	5000	71.42	0.875	0.860	0.805	0.885	0.875	0.850	2Rd	32.8	3/4x35II [1]
	VNI12-90-2	280	460	60	3520	340	26977	5000	77.32	0.870	0.850	0.790	0.885	0.875	0.840	2Rd	32.8	3/4x50II [1]
	VNI12-65-4	146	460	60	1735	190	26977	5000	67.48	0.820	0.790	0.715	0.880	0.885	0.875	1Rd	32.8	4x50 [1]
	VNI12-75-4	175	460	60	1735	225	26977	5000	71.42	0.820	0.790	0.720	0.885	0.890	0.880	2Rd	32.8	3/4x25II [1]
	VNI12-90-4	216	460	60	1730	275	26977	5000	77.32	0.825	0.795	0.730	0.885	0.890	0.880	2Rd	32.8	3/4x35II [1]
	VNI12-100-4	239	460	60	1730	305	26977	5000	81.26	0.825	0.795	0.725	0.885	0.890	0.880	2Rd	32.8	3/4x35II [1]
	VNI12-110-4	268	460	60	1735	345	26977	5000	85.20	0.820	0.785	0.710	0.890	0.890	0.880	2Rd	32.8	3/4x50II [1]
	VNI12-120-4	303	460	60	1730	390	26977	5000	89.13	0.825	0.795	0.720	0.880	0.885	0.880	2Rd	32.8	3/4x50II [1]
14"[6]	VNI14-50-2	250	460	60	3515	305	33721	9000	71.81	0.855	0.840	0.790	0.895	0.885	0.860	2Rd	32.8	3/4x35II [1]
	VNI14-60-2	280	460	60	3530	350	33721	9000	75.75	0.845	0.820	0.755	0.895	0.885	0.855	2Rd	32.8	3/4x50II [1]
	VNI14-50-4	154	460	60	1740	205	33721	9000	71.81	0.805	0.770	0.690	0.885	0.885	0.865	1Rd	32.8	4x70
	VNI14-60-4	186	460	60	1740	240	33721	9000	75.75	0.815	0.780	0.705	0.885	0.885	0.865	1Rd	32.8	4x70 [1]
	VNI14-70-4	210	460	60	1740	275	33721	9000	79.09	0.810	0.780	0.705	0.885	0.885	0.870	2Rd	32.8	3/4x35II [1]
	VNI14-80-4	239	460	60	1745	310	33721	9000	83.62	0.815	0.780	0.700	0.890	0.885	0.870	2Rd	32.8	3/4x35II [1]
	VNI14-90-4	268	460	60	1745	350	33721	9000	87.56	0.810	0.775	0.695	0.890	0.885	0.870	2Rd	32.8	3/4x50II [1]
	VNI14-100-4	291	460	60	1745	380	33721	9000	91.50	0.810	0.770	0.680	0.890	0.885	0.870	2Rd	32.8	3/4x50II [1]
16"[6]	MI16-65-4	280	460	60	1735	365	33721	9000	78.11	0.800	0.775	0.700	0.895	0.900	0.890	2Rd	32.8	3/4x50II [1]

1) Cable must be submerged, 2) PE conductor outside the motor, 3) max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, 4) +14/-6%, other voltages up to 1000V on request, 5) max. value for thrust bearing only, motor values see pages "motor measures & specifications", 6) higher power output on request

Pleuger Submersible Motor range for Medium Voltages SF 1.0

	Model d.o.l.	Power Output HP[2)]	Voltage V[3)] - 3Ph	Frequency Hz	Speed RPM	Current A	Thrust Capacity max. Down(lbf)[4)]	Thrust Capacity max. Up (lbf)	Length inches	Power Factor 1/1	Power Factor 3/4	Power Factor 1/2	Efficiency 1/1	Efficiency 3/4	Efficiency 1/2	Standard motor leads: No. of leads shape	Length ft	Cross section mm²
14" Motors - 2300V	VNI14-60-4	115	2300	60	1755	33	33721	9000	75.75	0.775	0.720	0.615	0.855	0.845	0.815	3Rd	39.37	1x16
	VNI14-70-4	173	2300	60	1740	47	33721	9000	79.09	0.800	0.755	0.665	0.865	0.865	0.845	3Rd	39.37	1x16
	VNI14-80-4	230	2300	60	1730	61	33721	9000	83.62	0.815	0.780	0.710	0.870	0.875	0.860	3Rd	39.37	1x16
	VNI14-90-4	288	2300	60	1725	76	33721	9000	87.56	0.810	0.780	0.705	0.870	0.880	0.865	3Rd	39.37	1x16
	VNI14-100-4	316	2300	60	1730	84	33721	9000	91.50	0.805	0.775	0.695	0.875	0.880	0.870	3Rd	39.37	1x16
	VNI14-110-4	345	2300	60	1730	81	33721	9000	95.43	0.810	0.775	0.700	0.880	0.885	0.870	3Rd	39.37	1x16
	VNI14-120-4	403	2300	60	1725	106	33721	9000	99.37	0.805	0.775	0.700	0.880	0.885	0.875	3Rd	39.37	1x16
16" Motors - 4160V	MI16-120-4	230	4160	60	1760	34	33721	9000	99.76	0.810	0.765	0.680	0.860	0.845	0.815	3Rd	39.37	1x16
	MI16-130-4	288	4160	60	1760	42	33721	9000	103.70	0.810	0.765	0.680	0.870	0.860	0.830	3Rd	39.37	1x16
	MI16-145-4	403	4160	60	1760	60	33721	9000	109.61	0.785	0.730	0.630	0.880	0.875	0.845	3Rd	39.37	1x16
	MI16-165-4	575	4160	60	1750	84	33721	9000	117.48	0.795	0.745	0.645	0.890	0.885	0.865	3Rd	39.37	1x16
	MI16-185-4	690	4160	60	1745	99	33721	9000	125.35	0.810	0.770	0.685	0.890	0.890	0.875	3Rd	39.37	1x16

1) Cable must be submerged, 2) max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, 3) +10/-10%, other voltages up to 1000V on request
4) max. value for thrust bearing only, motor values see pages "motor measures & specifications"

Pleuger Submersible Motor range for Medium Voltages SF 1.15

	Model d.o.l.	Power Output HP[2)]	Voltage V[3)] - 3Ph	Frequency Hz	Speed RPM	Current A	Thrust Capacity max. Down(lbf)[4)]	Thrust Capacity max. Up (lbf)	Length inches	Power Factor 1/1	Power Factor 3/4	Power Factor 1/2	Efficiency 1/1	Efficiency 3/4	Efficiency 1/2	Standard motor leads: No. of leads shape	Length ft	Cross section mm²
14" Motors - 2300V	VNI14-60-4	100	2300	60	1760	30	33721	9000	75.75	0.750	0.685	0.575	0.850	0.840	0.800	3Rd	39.37	1x16
	VNI14-70-4	150	2300	60	1750	42	33721	9000	79.09	0.780	0.730	0.630	0.865	0.860	0.835	3Rd	39.37	1x16
	VNI14-80-4	200	2300	60	1740	54	33721	9000	83,62	0.800	0.760	0.675	0.870	0.870	0.850	3Rd	39.37	1x16
	VNI14-90-4	250	2300	60	1740	67	33721	9000	87.56	0.800	0.760	0.670	0.875	0.875	0.860	3Rd	39.37	1x16
	VNI14-100-4	275	2300	60	1740	74	33721	9000	91.50	0.795	0.750	0.665	0.880	0.880	0.860	3Rd	39.37	1x16
	VNI14-110-4	300	2300	60	1740	80	33721	9000	95.43	0.795	0.755	0.665	0.885	0.880	0.865	3Rd	39.37	1x16
	VNI14-120-4	350	2300	60	1740	93	33721	9000	99.37	0.795	0.755	0.670	0.885	0.885	0.870	3Rd	39.37	1x16
16" Motors - 4160V	MI16-120-4	200	4160	60	1765	31	33721	9000	99.76	0.790	0.735	0.645	0.855	0.835	0.800	3Rd	39.37	1x16
	MI16-130-4	250	4160	60	1765	38	33721	9000	103.70	0.790	0.735	0.645	0.865	0.850	0.815	3Rd	39.37	1x16
	MI16-145-4	350	4160	60	1765	54	33721	9000	109.61	0.760	0.700	0.590	0.880	0.865	0.835	3Rd	39.37	1x16
	MI16-165-4	500	4160	60	1760	76	33721	9000	117.48	0.770	0.710	0.605	0.890	0.880	0.855	3Rd	39.37	1x16
	MI16-185-4	600	4160	60	1755	88	33721	9000	125.35	0.795	0.745	0.645	0.890	0.885	0.865	3Rd	39.37	1x16

1) Cable must be submerged, 2) max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, 3) +10/-10%, other voltages up to 1000V on request
4) max. value for thrust bearing only, motor values see pages "motor measures & specifications"

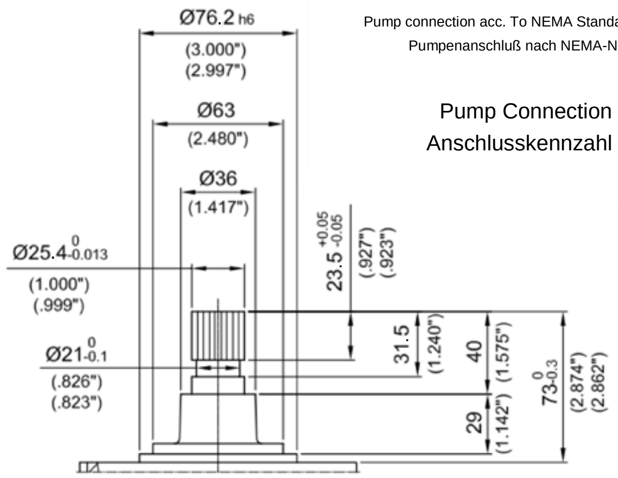
PLEUGER	Submersible motor Unterwassermotor	3626/0 09.18
	M6 – 2 Pol.	Zeichnungs-Nr.: Drawing-No.: 893 5-3/4

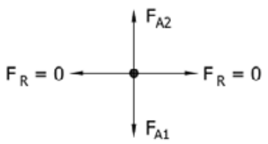
Pump connection acc. To NEMA Standards
Pumpenanschluß nach NEMA-Norm

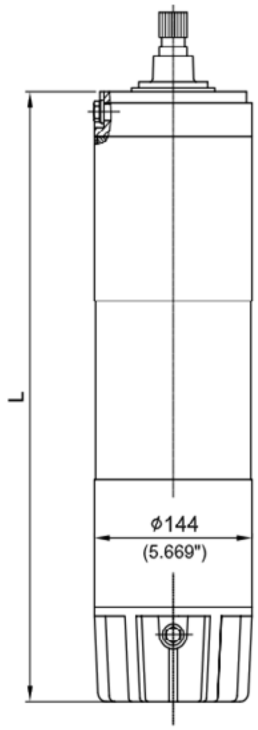
Pump Connection 38
Anschlusskennzahl 38

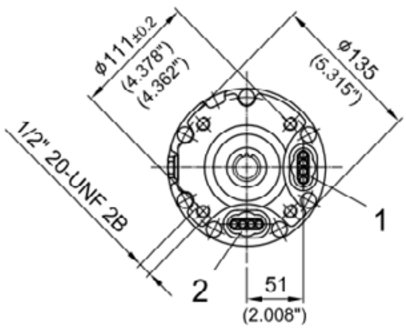
Spline data:	**Daten der Verzahnung:**
ANSI B92.1	ANSI B92.1
15 teeth	15 Zähne
30° pressure angle	30° Eingriffswinkel

Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm









Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity max. Max. Axialkraft				Series No. Baustufe
					F_{A1}		F_{A2}		
	mm	inch	kg	lb	kN	lbf	kN	lbf	
M6-160-2	554	21.81	38	84	12.5	2800	6	1350	3
M6-200-2	594	23.39	42	93	12.5	2800	6	1350	
M6-240-2	634	24.96	46	102	12.5	2800	6	1350	
M6-270-2	664	26.14	49	109	12.5	2800	6	1350	
M6-305-2	699	27.52	53	117	12.5	2800	6	1350	
M6-340-2	734	28.90	57	126	12.5	2800	6	1350	
M6-400-2	794	31.26	64	142	12.5	2800	6	1350	
M6-460-2	876	34.49	71	157	27.5	6100	6	1350	4
M6-530-2	946	37.24	79	175	27.5	6100	6	1350	
M6-600-2	1016	40.00	87	192	27.5	6100	6	1350	
M6-650-2	1066	41.97	93	206	27.5	6100	6	1350	
M6-720-2	1136	44.72	100	221	27.5	6100	6	1350	

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity
Ma. Axialkraft in Richtung Motor

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungs-querschnitt	Motor Leads Herausführbare Stromzuführungsleitungen							
	Single / Einfachleitung				Double / Doppelleitung			
	Flat / Flach							
	No. of cores / Anzahl der Adern							
mm²	3x		4x		3x		4x	
2,5	●	●	⊖	●	⊖	●	●	⊖
4	●	●	⊖	●	⊖	●	●	⊖
6 2)	●	●	●	⊖	●	●	●	●
10 2)	●	●		⊖	●	●		●
16 2)	●	●						
Position of leads Lage d. Leitungsdurchführung	1	2	1	2	1	2	1	2

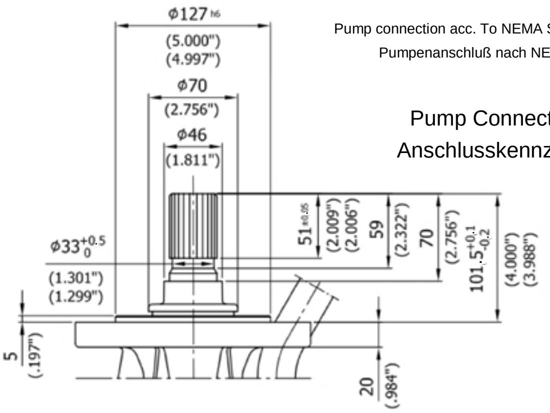
2) For installation into 6"-well please check O.D. of pumping unit
Bei Einbau in 6"-Brunnen, bitte den max. Aggregatdurchmesser beachten

⊖ Standard cable / Standardleitung
● Special cable / Sonderleitung

Max. cable dimensions **Max. Leitungsabmessungen**	
Position	1 + 2
Round / Rund	Ø22
Flat / Flach	17 x 36,5

M8 – 2 Pol.

Zeichnungs-Nr.:
Drawing-No.: 894 5-4

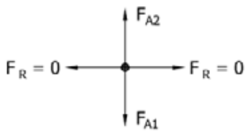


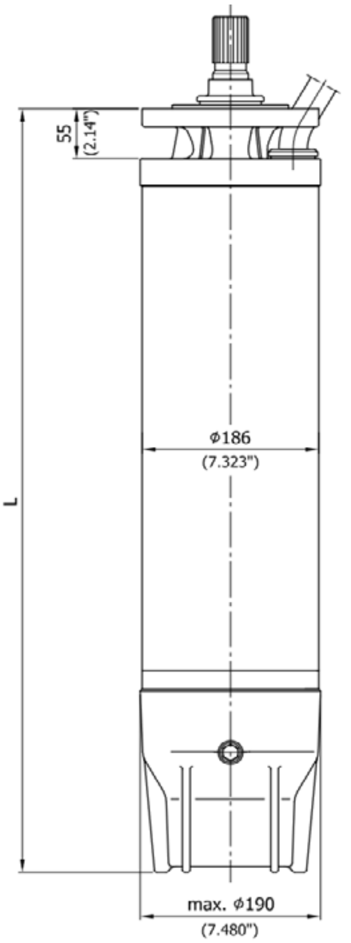
Pump connection acc. To NEMA Standards
Pumpenanschluß nach NEMA-Norm

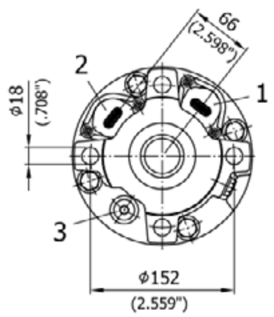
Pump Connection 39
Anschlusskennzahl 39

Spline data:	**Daten der Verzahnung:**
ANSI B92.1	ANSI B92.1
23 teeth	23 Zähne
30° pressure angle	30° Eingriffswinkel

Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm







Motor type / Motortyp	L (mm)	L (inch)	Weight / Gewicht 1) (kg)	Weight / Gewicht 1) (lb)	Thrust capacity / Axialkraft F_{A1} (kN)	F_{A1} (lbf)	F_{A2} (kN)	F_{A2} (lbf)
M8-330-2	1038	40.87	126	278	40	9000	12.5	2800
M8-410-2	1118	44.02	139	307	40	9000	12.5	2800
M8-480-2	1188	46.77	154	340	40	9000	12.5	2800
M8-530-2	1238	48.74	163	360	40	9000	12.5	2800
M8-580-2	1288	50.71	172	380	40	9000	12.5	2800
M8-650-2	1358	53.46	185	408	40	9000	12.5	2800
M8-710-2	1418	55.83	196	433	40	9000	12.5	2800
M8-820-2	1528	60.16	216	477	40	9000	12.5	2800
M8-930-2	1638	64.49	237	523	40	9000	12.5	2800
M8-990-2	1698	66.85	247	545	40	9000	12.5	2800

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (80 kN/17,985 lbf on request)
Ma. Axialkraft in Richtung Motor (80 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

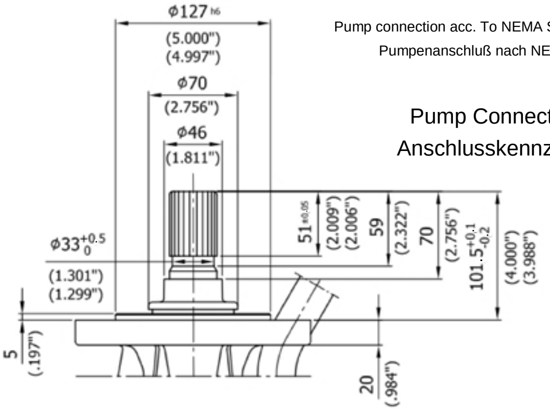
Cross Section / Leitungsquerschnitt	Motor Leads / Herausführbare Stromzuführungsleitungen													
	Single / Einfachleitung						Double / Doppelleitung							
	Round Rund		Flat Flach		1 Whip 1 Peitsche 2)		Round Rund			Flat Flach		2 Whips 2 Peitschen 2)		
	No. of cores / Anzahl der Adern													
mm²	1x3	1x4	1x3	1x4	1x3	1x4	2x3	1x3 1x4	2x4	2x3	1x3 1x4	2x3	1x3 1x4	2x4
2,5	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
4	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	●	●	●		●	●	●	●						
Position of leads / Lage d. Leitungsdurchführung	1	1	1	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

2) Three or four single core round cables, vulcanized (whip)
Mehrere 1-Adr. Rundleitungen mit gemeinsamer Vulkanisation im Bereich der Kabeldurchführung

● Special cable / Sonderleitung

Max. cable dimensions / Max. Leitungsabmessungen			
Position	1	2	3
Round / Rund	Ø42	Ø42	Ø21
Flat / Flach	17 x 44 19 x 40	17 x 44 19 x 40	-

PLEUGER	Submersible motor Unterwassermotor	3631/0 09.18
	M8 – 4 Pol.	Zeichnungs-Nr.: Drawing-No.: 894 5-4

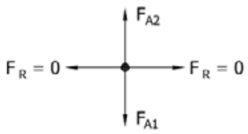


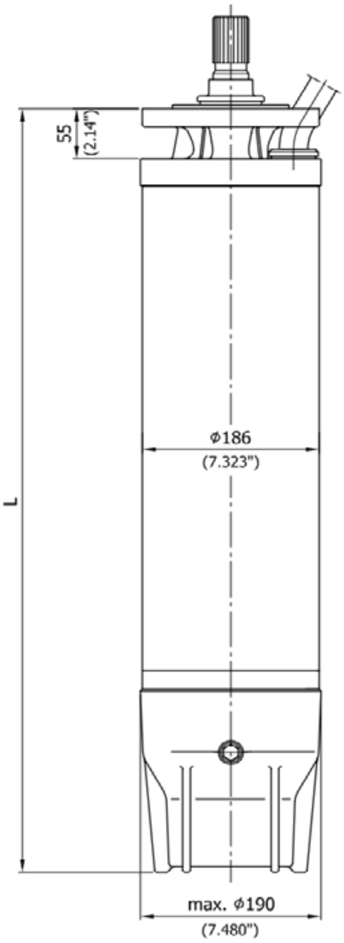
Pump connection acc. To NEMA Standards
Pumpenanschluß nach NEMA-Norm

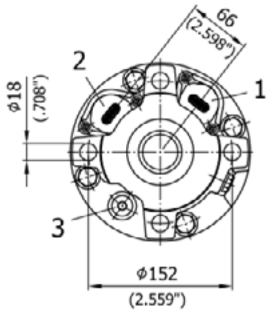
Pump Connection 39
Anschlusskennzahl 39

Spline data:	**Daten der Verzahnung:**
ANSI B92.1	ANSI B92.1
23 teeth	23 Zähne
30° pressure angle	30° Eingriffswinkel

Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm







Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
M8-135-4	843	33.19	87	192	40	9000	12.5	2800
M8-170-4	878	34.57	94	208	40	9000	12.5	2800
M8-210-4	918	36.14	102	225	40	9000	12.5	2800
M8-280-4	988	38.90	113	250	40	9000	12.5	2800
M8-340-4	1048	41.26	127	280	40	9000	12.5	2800
M8-420-4	1128	44.41	143	216	40	9000	12.5	2800
M8-520-4	1228	48.35	165	364	40	9000	12.5	2800
M8-700-4	1408	55.43	205	452	40	9000	12.5	2800
M8-870-4	1578	62.13	245	541	40	9000	12.5	2800
M8-1050-4	1758	69.21	275	607	40	9000	12.5	2800

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (80 kN/17,985 lbf on request)
Ma. Axialkraft in Richtung Motor (80 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungsquerschnitt	Motor Leads Herausführbare Stromzuführungsleitungen													
	Single / Einfachleitung						Double / Doppelleitung							
	Round Rund		Flat Flach		1 Whip 1 Peitsche 2)		Round Rund			Flat Flach		2 Whips 2 Peitschen 2)		
	No. of cores / Anzahl der Adern													
mm²	1x3	1x4	1x3	1x4	1x3	1x4	2x3	1x3 1x4	2x4	2x3	1x3 1x4	2x3	1x3 1x4	2x4
2,5	✔	✔					✔	✔	✔					
4	✔	✔	✔	✔			✔	✔	✔	✔	✔			
6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	●	●	●		●	●	●	●						
Position of leads Lage d. Leitungsdurchführung	1	1	1	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

2) Three or four single core round cables, vulcanized (whip)
Mehrere 1-Adr. Rundleitungen mit gemeinsamer Vulkanisation im Bereich der Kabeldurchführung

● Special cable / Sonderleitung

Max. cable dimensions / Max. Leitungsabmessungen			
Position	1	2	3
Round / Rund	Ø42	Ø42	Ø21
Flat / Flach	17 x 44 19 x 40	17 x 44 19 x 40	-

PLEUGER

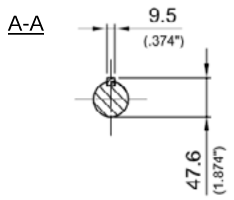
Unterwassermotor
Submersible motor

3628/0
09.18

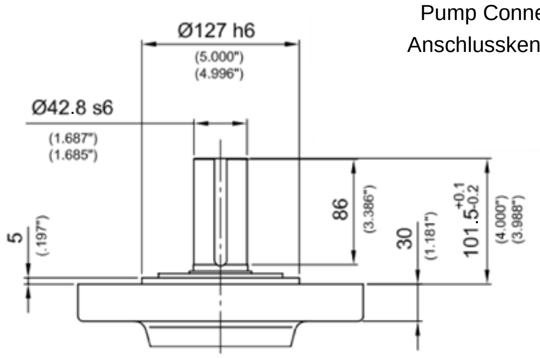
MI10 – 2 Pol.

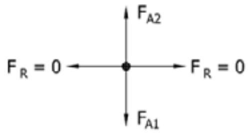
Zeichnungs-Nr.: / Drawing-No.: 877 5-3

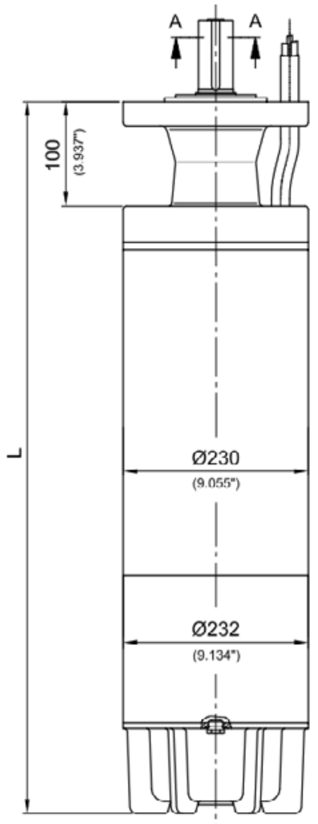
Pump Connection 43
Anschlusskennzahl 43



Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm







Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
MI10-420-2	1353	53.27	231	510	50	11250	22.5	5000
MI10-490-2	1423	56.02	249	549	50	11250	22.5	5000
MI10-600-2	1533	60.35	276	609	50	11250	22.5	5000
MI10-740-2	1673	65.87	312	688	50	11250	22.5	5000
MI10-880-2	1813	71.38	347	766	50	11250	22.5	5000
MI10-960-2	1893	74.53	367	810	50	11250	22.5	5000
MI10-1070-2	2003	78.86	395	871	50	11250	22.5	5000
MI10-1200-2	2133	83.98	428	944	50	11250	22.5	5000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

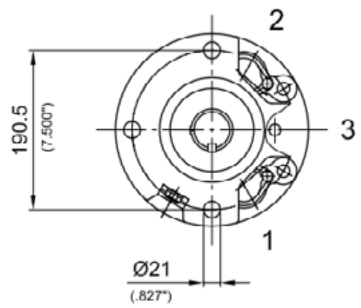
F_{A1} Max. downthrust capacity (80 kN/17,985 lbf on request)
Ma. Axialkraft in Richtung Motor (80 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungsquerschnitt	Motor Leads Herausführbare Stromzuführungsleitungen													
	Single / Einfachleitung						Double / Doppelleitung							
	Round Rund		Flat Flach		1 Whip 1 Peitsche 2)		Round Rund			Flat Flach		2 Whips 2 Peitschen 2)		
	No. of cores / Anzahl der Adern													
mm²	1x3	1x4	1x3	1x4	1x3	1x4	2x3	1x3 1x4	2x4	2x3	1x3 1x4	2x3	1x3 1x4	2x4
2,5	✔	✔	✔				✔	✔	✔	✔	✔			
4	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔	✔	✔
35	✔	✔			✔	✔	✔	✔	✔			✔	✔	✔
50	✔				✔	●	✔					✔	●	
Position of leads Lage d. Leitungsdurchführung	1	1	1	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

2) Three or four single core round cables, vulcanized (whip)
Mehrere 1-Adr. Rundleitungen mit gemeinsamer Vulkanisation im Bereich der Kabeldurchführung

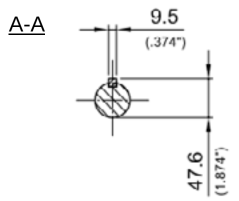
● Special cable / Sonderleitung



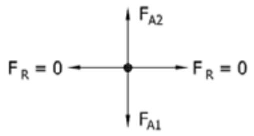
Max. cable dimensions / Max. Leitungsabmessungen			
Position	1	2	3
Round / Rund	Ø42	Ø42	Ø15
Flat / Flach	17 x 44 19 x 40	17 x 44 19 x 40	-

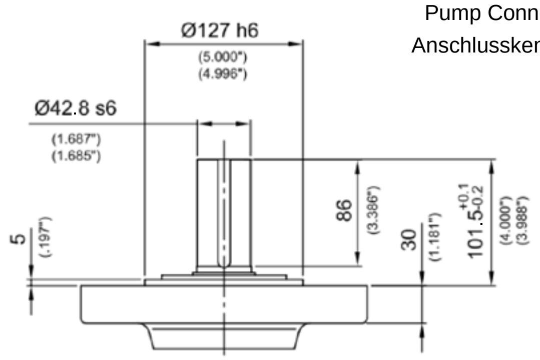
PLEUGER	Submersible motor Unterwassermotor	3629/0 09.18
	MI10 – 4 Pol.	Zeichnungs-Nr.: Drawing-No.: 877 5-3

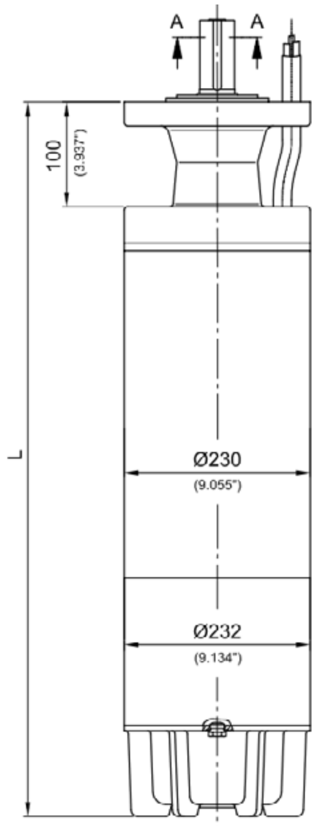
Pump Connection 43
Anschlusskennzahl 43

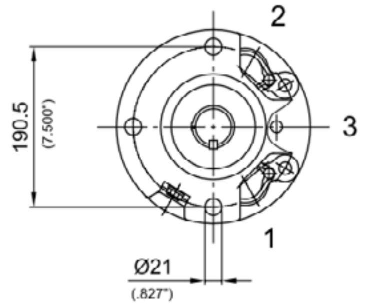


Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm









Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
MI10-420-4	1353	53.27	231	510	50	11250	22.5	5000
MI10-490-4	1423	56.02	249	549	50	11250	22.5	5000
MI10-600-4	1533	60.35	276	609	50	11250	22.5	5000
MI10-740-4	1673	65.87	312	688	50	11250	22.5	5000
MI10-880-4	1813	71.38	347	766	50	11250	22.5	5000
MI10-960-4	1893	74.53	367	810	50	11250	22.5	5000
MI10-1070-4	2003	78.86	395	871	50	11250	22.5	5000
MI10-1200-4	2133	83.98	428	944	50	11250	22.5	5000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (80 kN/17,985 lbf on request)
Ma. Axialkraft in Richtung Motor (80 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungsquerschnitt	Motor Leads Herausführbare Stromzuführungsleitungen													
	Single / Einfachleitung						Double / Doppelleitung							
	Round Rund		Flat Flach		1 Whip 1 Peitsche 2)		Round Rund		Flat Flach		2 Whips 2 Peitschen 2)			
	No. of cores / Anzahl der Adern													
mm²	1x3	1x4	1x3	1x4	1x3	1x4	2x3	1x3 1x4	2x4	2x3	1x3 1x4	2x3	1x3 1x4	2x4
2,5	✔	✔	✔	✔			✔	✔	✔	✔	✔			
4	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔	✔	✔
35	✔	✔			✔	✔	✔	✔	✔			✔	✔	✔
50	✔				✔	●	✔					✔	●	
Position of leads Lage d. Leitungsdurchführung	1	1	1	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

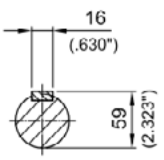
2) Three or four single core round cables, vulcanized (whip)
Mehrere 1-Adr. Rundleitungen mit gemeinsamer Vulkanisation im Bereich der Kabeldurchführung

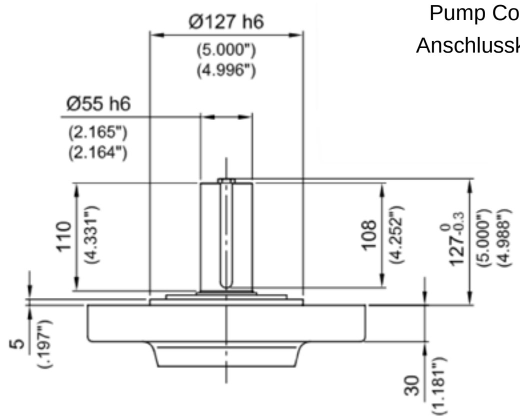
● Special cable / Sonderleitung

Max. cable dimensions / Max. Leitungsabmessungen			
Position	1	2	3
Round / Rund	Ø42	Ø42	Ø15
Flat / Flach	17 x 44 19 x 40	17 x 44 19 x 40	-

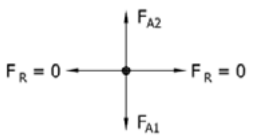
PLEUGER	**Submersible motor** **Unterwassermotor**	**3509/0** 09.18
	# VNI12 – 2 Pol.	Zeichnungs-Nr.: Drawing-No.: 878 5-2

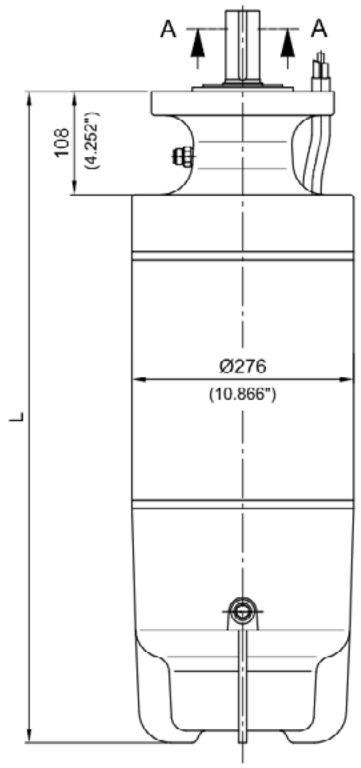
Pump Connection 41
Anschlusskennzahl 41





Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm





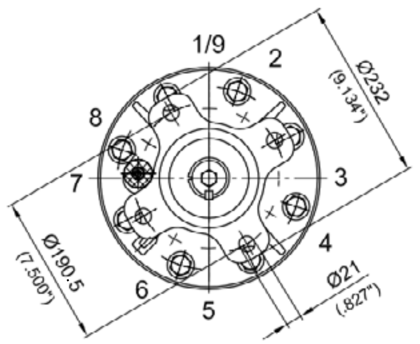
Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft F_{A1}		Thrust capacity Axialkraft F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
VNI12-65-2	1714	67.48	475	1048	60	13500	22.5	5000
VNI12-75-2	1814	71.42	525	1158	60	13500	22.5	5000
VNI12-90-2	1964	77.32	600	1323	60	13500	22.5	5000
VNI12-100-2	2064	81.26	650	1434	60	13500	22.5	5000
VNI12-110-2	2164	85.20	700	1544	60	13500	22.5	5000
VNI12-120-2	2264	89.13	750	1654	60	13500	22.5	5000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (120 kN/26,977 lbf on request)
Ma. Axialkraft in Richtung Motor (120 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

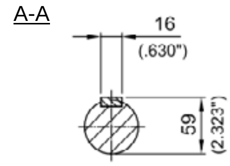
Cross Section Leitungs-querschnitt	**Motor Leads** **Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔			✔		✔	✔	✔	✔	✔
95						✔	✔			
Position of leads Lage der Leitungsdurchführung	1/9	1/9	1,5 / 9,10	1,5 / 9,10	1,5 / 9,10	1,2,4	1…4	1…6	1…6, 8	1…8

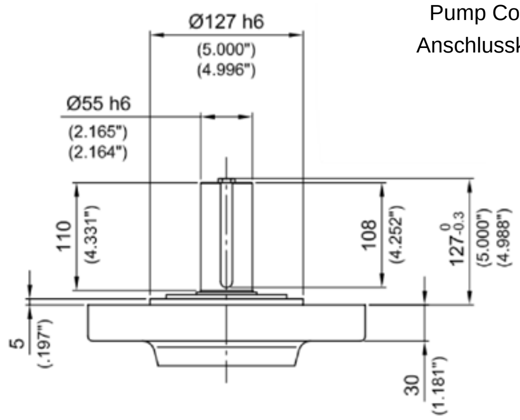


Max. cable dimensions / Max. Leitungsabmessungen										
Position	1	2	3	4	5	6	7	8	9	10
Round / Rund	ø40	ø26	ø40	ø26	ø26	ø26	ø26	ø26	ø45	ø45

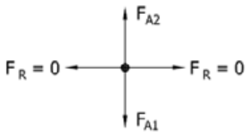
PLEUGER	Submersible motor Unterwassermotor	3510/0 09.18
	VNI12 – 4 Pol.	Zeichnungs-Nr.: Drawing-No.: 878 5-2

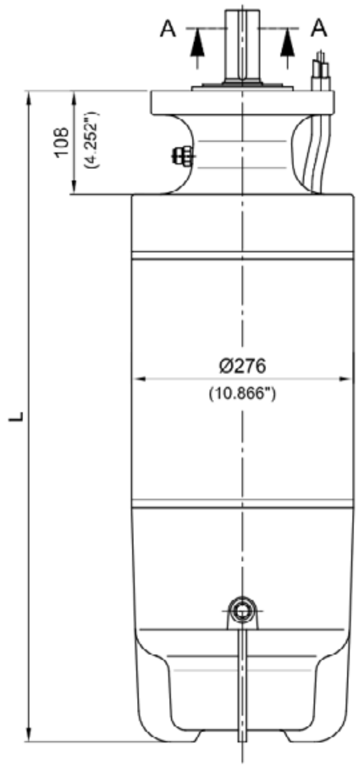
Pump Connection 41
Anschlusskennzahl 41





Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm





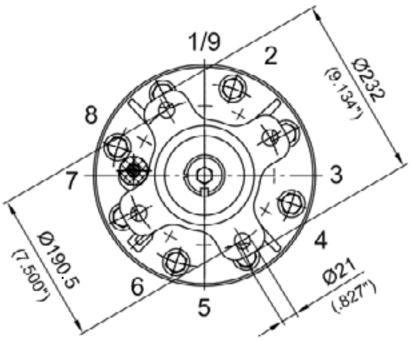
Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
VNI12-65-4	1714	67.48	475	1048	60	13500	22.5	5000
VNI12-75-4	1814	71.42	525	1158	60	13500	22.5	5000
VNI12-90-4	1964	77.32	600	1323	60	13500	22.5	5000
VNI12-100-4	2064	81.26	650	1434	60	13500	22.5	5000
VNI12-110-4	2164	85.20	700	1544	60	13500	22.5	5000
VNI12-120-4	2264	89.13	750	1654	60	13500	22.5	5000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (120 kN/26,977 lbf on request)
Ma. Axialkraft in Richtung Motor (120 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

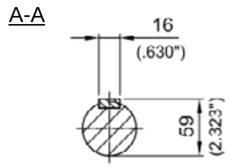
Cross Section Leitungs-querschnitt	Motor Leads Herausführbare Stromzuführungsleitungen									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔			✔		✔	✔	✔	✔	✔
95						✔	✔			
Position of leads Lage der Leitungsdurchführung	1/9	1/9	1 ,5 / 9 ,10	1 ,5 / 9 ,10	1 ,5 / 9 ,10	1,2,4	1…4	1…6	1…6, 8	1…8



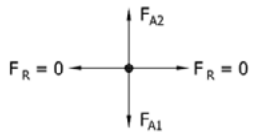
Max. cable dimensions / Max. Leitungsabmessungen										
Position	1	2	3	4	5	6	7	8	9	10
Round / Rund	ø40	ø26	ø40	ø26	ø26	ø26	ø26	ø26	ø45	ø45

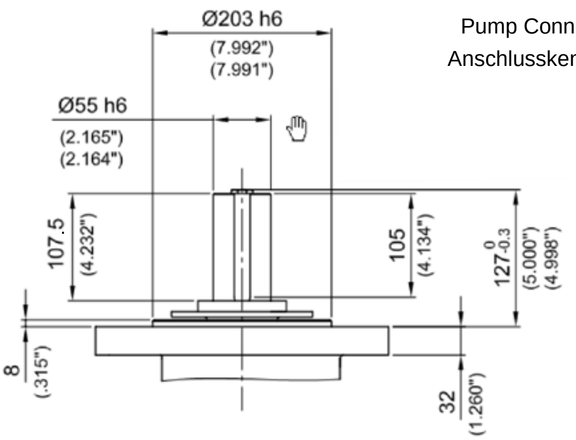
PLEUGER	Submersible motor Unterwassermotor	3607/0 09.18
	VNI14 – 2 Pol.	Zeichnungs-Nr.: Drawing-No.: 879 5-3

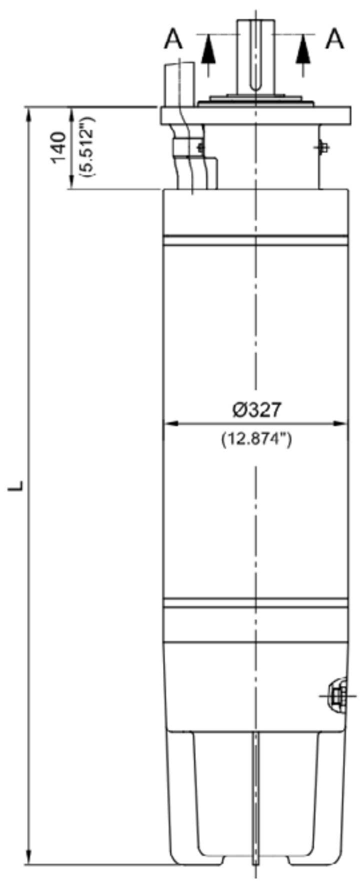
Pump Connection 40
Anschlusskennzahl 40

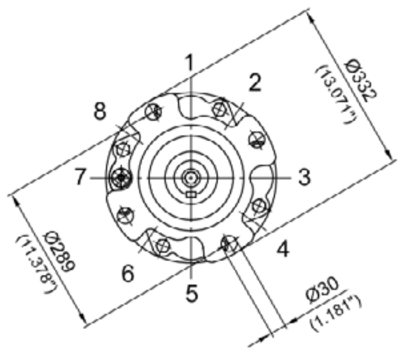


Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm









Motor type Motortyp	L mm	L inch	Weight / Gewicht 1) kg	Weight / Gewicht 1) lb	Thrust capacity / Axialkraft F_{A1} kN	F_{A1} lbf	F_{A2} kN	F_{A2} lbf
VNI14-50-2	1824	71.81	590	1301	75	17000	40	9000
VNI14-60-2	1924	75.75	650	1334	75	17000	40	9000
VNI14-70-2	2024	79.09	710	1566	75	17000	40	9000
VNI14-80-2	2124	83.62	770	1698	75	17000	40	9000
VNI14-90-2	2224	87.56	830	1830	75	17000	40	9000
VNI14-100-2	2324	91.50	890	1963	75	17000	40	9000
VNI14-110-2	2424	95.43	950	2095	75	17000	40	9000
VNI14-120-2	2524	99.37	1010	2227	75	17000	40	9000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (150 kN/33,721 lbf on request)
Ma. Axialkraft in Richtung Motor (150 kN auf Anfrage)

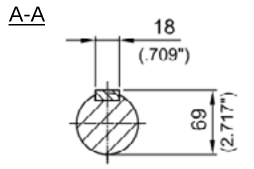
F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungs-querschnitt	**Motor Leads / Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
95						✔	✔	✔	✔	✔
120						✔	✔	✔	✔	✔
Position of leads Lage der Leitungsdurchführung	1	1	1 ,5	1 ,5	1 ,5	1,3,5	1, 3 5, 7	2…4 6…8	2…8	1…8

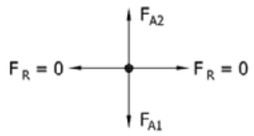
Max. cable dimensions / Max. Leitungsabmessungen								
Position	1	2	3	4	5	6	7	8
Round / Rund	ø51	ø26	ø45	ø26	ø51	ø26	ø45	ø26

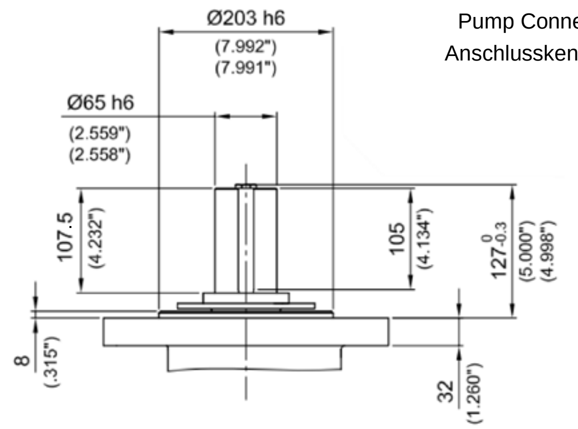
PLEUGER	Submersible motor Unterwassermotor	3608/0 09.18
	VNI14 – 4 Pol.	Zeichnungs-Nr.: Drawing-No.: 879 5-3

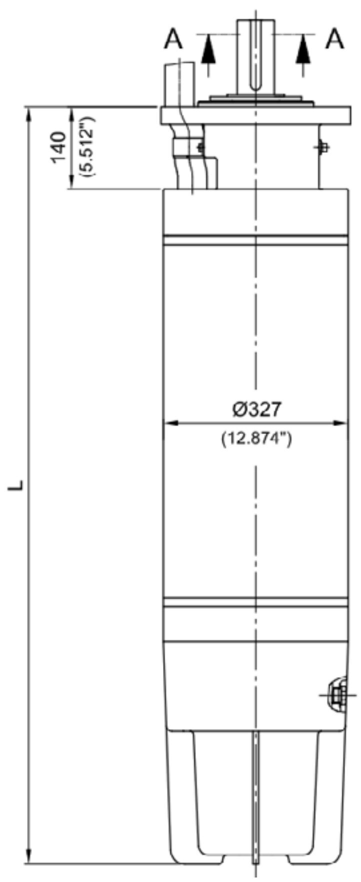
Pump Connection 42
Anschlusskennzahl 42



Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm







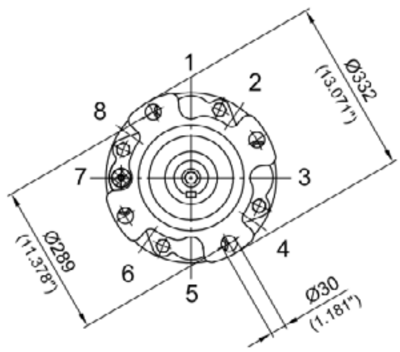
Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
VNI14-50-4	1824	71.81	590	1301	75	17000	40	9000
VNI14-60-4	1924	75.75	650	1334	75	17000	40	9000
VNI14-70-4	2024	79.09	710	1566	75	17000	40	9000
VNI14-80-4	2124	83.62	770	1698	75	17000	40	9000
VNI14-90-4	2224	87.56	830	1830	75	17000	40	9000
VNI14-100-4	2324	91.50	890	1963	75	17000	40	9000
VNI14-110-4	2424	95.43	950	2095	75	17000	40	9000
VNI14-120-4	2524	99.37	1010	2227	75	17000	40	9000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (150 kN/33,721 lbf on request)
Ma. Axialkraft in Richtung Motor (150 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

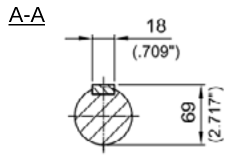
Cross Section Leitungs-querschnitt	**Motor Leads Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
95						✔	✔	✔	✔	✔
120						✔	✔	✔	✔	✔
Position of leads Lage der Leitungsdurchführung	1	1	1, 5	1, 5	1, 5	1,3,5	1, 3 5, 7	2…4 6…8	2…8	1…8



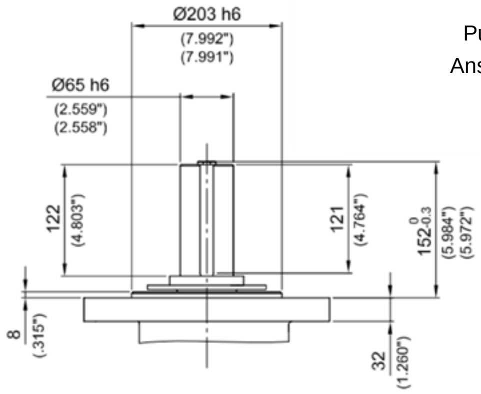
Max. cable dimensions / Max. Leitungsabmessungen								
Position	1	2	3	4	5	6	7	8
Round / Rund	ø51	ø26	ø45	ø26	ø51	ø26	ø45	ø26

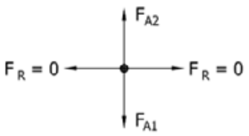
PLEUGER	Submersible motor Unterwassermotor	3613/0 09.18
	MI16 – 4 Pol.	Zeichnungs-Nr.: Drawing-No.: 881 5-2

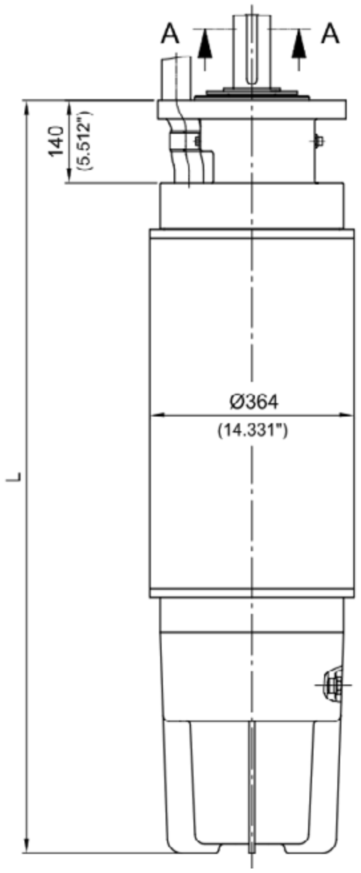
Pump Connection 47
Anschlusskennzahl 47

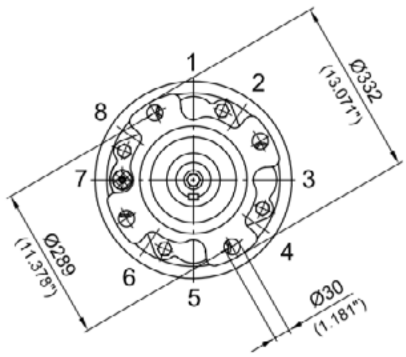


Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm









Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
MI16-65-4	1984	78.11	860	1896	75	17000	40	9000
MI16-75-4	2084	82.05	925	2040	75	17000	40	9000
MI16-85-4	2184	85.98	990	2183	75	17000	40	9000
MI16-95-4	2284	89.92	1055	2326	75	17000	40	9000
MI16-110-4	2434	95.83	1150	2536	75	17000	40	9000
MI16-120-4	2534	99.76	1215	2679	75	17000	40	9000
MI16-130-4	2634	103.7	1280	2822	75	17000	40	9000
MI16-145-4	2784	109.61	1375	3032	75	17000	40	9000
MI16-165-4	2984	117.48	1505	3318	75	17000	40	9000
MI16-185-4	3184	125.35	1635	3605	75	17000	40	9000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (150 kN/33,721 lbf on request)
Ma. Axialkraft in Richtung Motor (150 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungs-querschnitt	**Motor Leads Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
95						✔	✔	✔	✔	✔
120						✔	✔	✔	✔	✔
150						●	●			
Position of leads Lage der Leitungsdurchführung	1	1	1, 5	1, 5	1, 5	1,3,5	1, 3 5, 7	2…4 6…8	2…8	1…8

● Special cable / Sonderleitung

Max. cable dimensions / Max. Leitungsabmessungen								
Position	1	2	3	4	5	6	7	8
Round / Rund	ø51	ø26	ø45	ø26	ø51	ø26	ø45	ø26

PLEUGER Motor Sensors

PLEUGER pump sensors provide the operator real-time monitoring and data for key areas of pump performance

TEMPERATURE SENSORS
Plug-in 3 wire sensor Pt100 Sub Temp

Detects temperature for real-time feedback with 3x1.5 mm^3 EPR cable

- The purpose of the measurement is to protect the motor
- Measures the temperature of the motor fill. The measurement is based on the change in resistance which is proportional to the change in temperature
- Plug-in sensor intended to be installed in PLEUGER submersible motor with an applicable interface (seal)

FEATURES

- Simple plug-in installation
- Compact, single piece design
- Retrofittable
- Flexible, water resistant cable

VIBRATION SENSORS
Vibration Sensor PI-100 Sub Accelerometer (one axes)

PI-300 Sub Accelerometer (three axes X,Y,Z)

- Sub Accelerometer detects the incorrect operating conditions of rotating components (e.g. impeller)
- Side entry for easy access
- Waterproof
- Resistant to oil

CONDUCTIVITY SENSORS
Motor fill monitoring sensor PI-100 Sub Con

- Detects an incorrect or contaminated fill of the PLEUGER motor
- System consists of the sensor, a cable and the monitoring controller. The sensor measures the conductivity of the motor fill and its temperature.
- Plug-in sensor intended to be installed in PLEUGER motor with an applicable interface (adapter and seal).

FEATURES

- Plug-in installation
- Waterproof
- Dual function
- For PLEUGER Motors M8 to MI40
- Alternative Solution for Header Tank

PLEUGER Motors for Special Applications

Hot water motor

Designed for hot water applications such as District heating and Geothermal energy

- District heating and Geothermal
- All-weather greenhouse energy
- Cooling water and process pumps
- Thermal spas

Features

- 270 kW (362 HP) up to 85°C (185°F) water temperature
- Motor sizes 6″ to 12″
- Starting method DOL, Star-Delta (on request)
- Different cooling solutions available

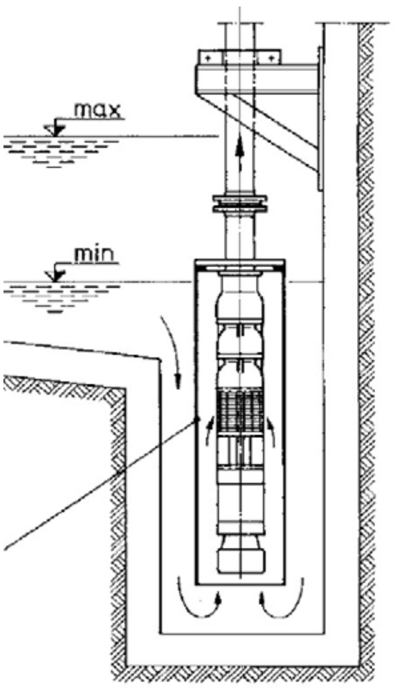
Examples of PLEUGER Submersible Motors for customized applications

- MI10-600-4 , 10″, 600 mm stator length, 4-pole design
- MIP16-130-6 Polder construction, 1300 mm stator length
- PMM6-320-4 Permanent Magnet Motor, 320 mm stator length (6″ and 8″ PMM)
- MIT19-130-2 Tandem configuration – two identical MI19-130-2 working together
- VNI22-200-4
- MOE8-410-2 Oil-filled motor
- MHA8-410-2 Filling liquid temperature ϑ > 90 °C or 194 °F
- MK6-460-2 Oil (petroleum) cavern installation

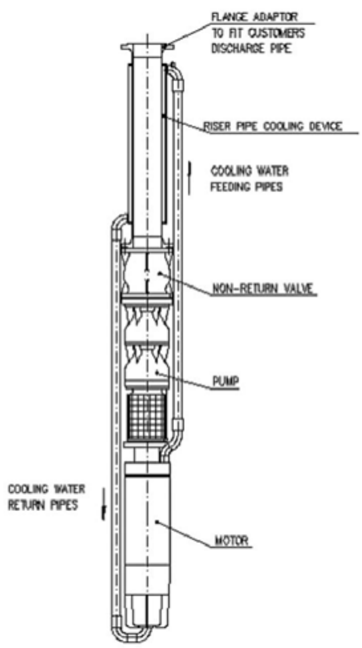
External Cooling Systems

Customized Cooling Systems for individual cooling requirements

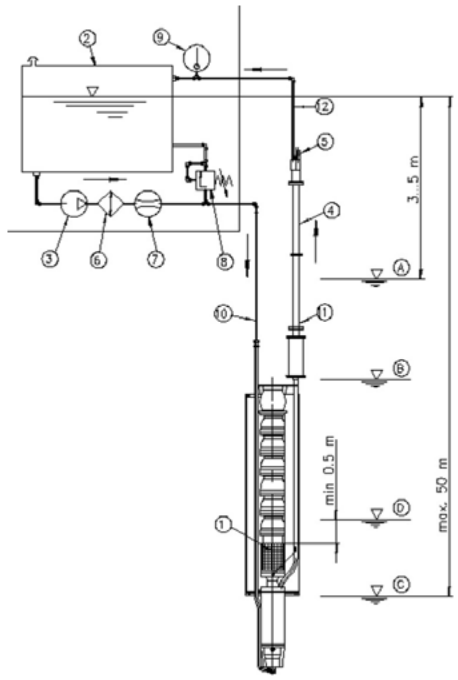
- Simple plug-in installation
- Compact, single piece design
- Retrofittable
- Flexible, water resistant cable



Cooling Shroud



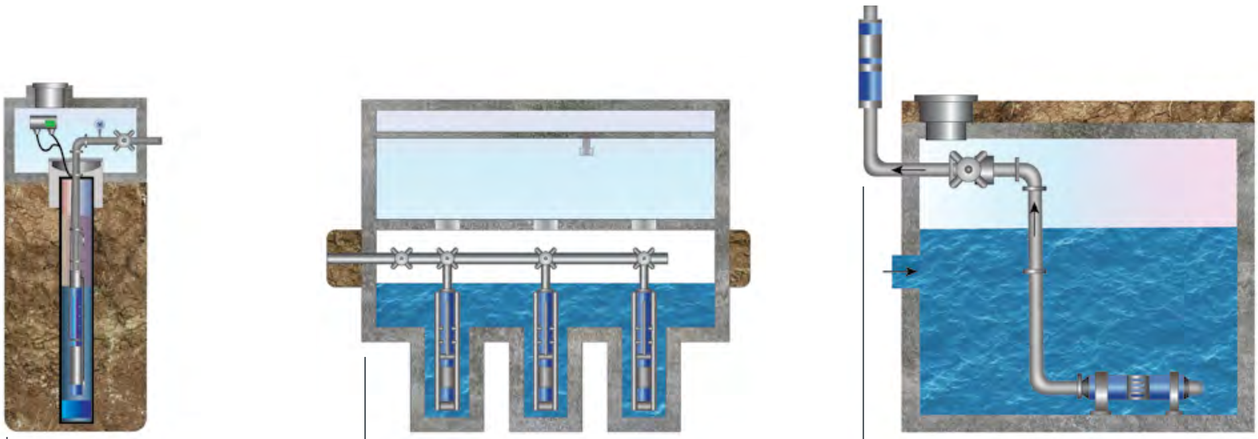
Riser Pipe Cooler



External Cooling Device

Pump installation options

With various installation options, PLEUGER's pump units are the ideal solution for almost any application in the water industry.



Vertical (e.g. bore well installation)

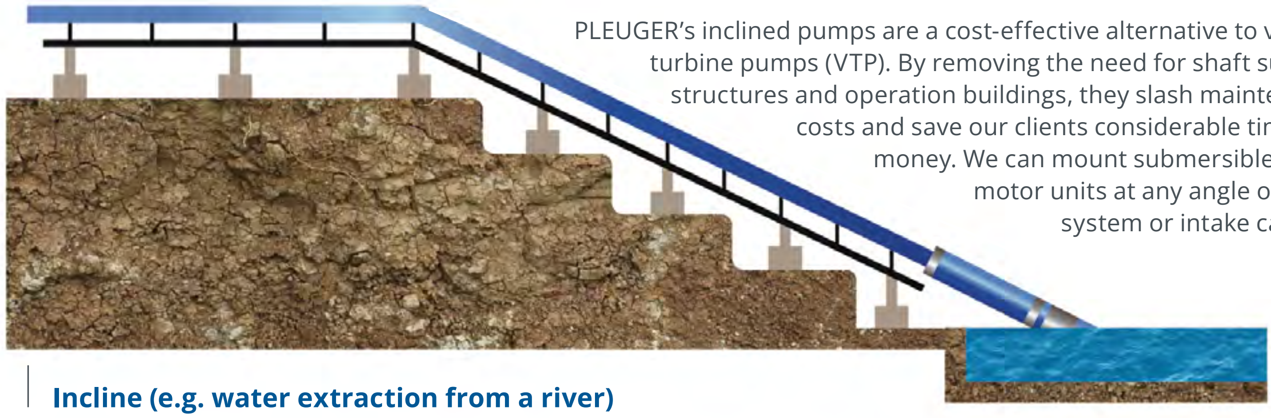
Parallel

Booster pump in pipeline

Horizontal (e.g. bottom of tank)

Inclined pumps for processing and cooling water applications

PLEUGER's inclined pumps are a cost-effective alternative to vertical turbine pumps (VTP). By removing the need for shaft support structures and operation buildings, they slash maintenance costs and save our clients considerable time and money. We can mount submersible pump motor units at any angle on a rail system or intake caisson.



Incline (e.g. water extraction from a river)

WORLDWIDE SALES, SERVICE AND SUPPORT

THE RELIABILITY EXPERTS

PLEUGER designs, manufactures and services submersible motors, pumps, thrusters and plunger pumps. Renowned worldwide for absolute reliability and outstanding longevity throughout the energy, mining, water, industrial processing and oil & gas industries.

Our products perform in some of the most challenging and harshest of environments. PLEUGER engineers find solutions to some of the toughest challenges and are trusted across the globe as the reliability experts.

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PLEUGER

www.pleugerindustries.com

Made in Germany

ATTACHMENT #3

MW-PW01 AQUIFER TESTING
FIELD DATA SHEETS

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

DNR 7811.93

Page No. 1

Owner ______ Address ______

Location of well on property ______

County ______ Township ______

Date ______ (Test Started / / Test Ended) ODNR Log# ______ Other Well ID TRN-1

Company Conducting Test ______ Individual Making Measurements ______

Type of Test ______ Distance From Pumping Well ______

Measuring Equipment Used ______

Static Water Level (S_0) ______ Measuring Point ______ Elevation Above Ground ______

Pumping Water Level (ft.) ______ Depth of Pump (ft.) ______

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12-24	0828	—	~~22.40~~ 22.95			Static
	0901		23.15			
	0902		23.27			
	0903		23.30			
	0904		23.33			
	0905		23.35			
	0910		23.35			
	0915		23.36			
	0920		23.37			
	0925		23.41			
	0930		23.42			
	0940		23.45			
	0950		23.48			
	1000		23.50			
	10:20		23.53			
	10:40		23.57			
	11:00		23.64			
	11:01		23.73			
	11:02		23.76			
	11:03		23.76			
	11:04		23.76			
	11:05		23.76			
	11:10		23.77			
	11:15		23.78			
	11:20		23.80			
	11:25		23.81			
	11:30		23.82			
	11:40		23.85			
	11:50		23.88			

DNR 7811.93

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

Page No. 2

Owner .... Address ....

Location of well on property ....

County .... Township ....

Date .... / .... ODNR Log# .... Other Well ID TRU-1
(Test Started / Test Ended)

Company Conducting Test .... Individual Making Measurements ....

Type of Test .... Distance From Pumping Well ....

Measuring Equipment Used ....

Static Water Level (S_0) .... Measuring Point .... Elevation Above Ground ....

Pumping Water Level (ft.) .... Depth of Pump (ft.) ....

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12-24	12:00		23.90			
	12:20		23.94			
	12:40		23.92			
	13:00		24.02			Change in Q
	13:01		24.14			
	13:02		24.16			
	13:03		24.16			
	13:04		24.16			
	13:05		24.17			
	13:10		24.19			
	13:15		24.20			
	13:20		24.22			
	13:25		24.24			
	13:30		24.25			
	13:40		24.27			
	13:50		24.29			
	14:00		24.34			
	14:20		24.39			
	14:40		24.44			
	15:00		24.55			Change in Q
	15:01		24.61			
	15:02		24.62			
	15:03		24.62			
	15:04		24.62			
	15:05		24.62			
	15:10		24.64			
	15:15		24.66			
	15:20		24.69			
	15:25		24.70			

DNR 7811.93

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

Page No. 3

Owner ______ Address ______
Location of well on property ______
County ______ Township ______
Date ______ / ______ ODNR Log# ______ Other Well ID TRN-1
(Test Started / Test Ended)
Company Conducting Test ______ Individual Making Measurements ______
Type of Test ______ Distance From Pumping Well ______
Measuring Equipment Used ______
Static Water Level (S_0) ______ Measuring Point ______ Elevation Above Ground ______
Pumping Water Level (ft.) ______ Depth of Pump (ft.) ______

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12/12/24	15:30		24.71			
	15:40		24.74			
	15:50		24.77			
	16:00		24.80			
	16:20		24.83			
	16:40		24.88			
	17:00		24.90			Pump Off
	17:01		24.31			
	17:02		24.24			
	17:03		24.2			
	17:04		24.2			
	17:05		24.19			
	17:06		24.18			
	17:07		24.17			
	17:08		24.16			
	17:09		24.14			
	17:10		24.13			
12/13/24	09:10		23.52			W.L. = 23.26 (from top of well casing)

Owner *Warren County* Well ID *TRN-2* Date *12-12-24* Page No. *1*

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level $(S - S_0)$	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0805		22.43			Static
	1042		22.64			
	1244		22.84			
	1446		23.09			
	1627		23.34			
12-13	0847		22.99			

Owner Warren County Well ID TRN-3 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0812		20.01			Static
	1036		20.21			
	1238		20.39			
	1439		20.66			
	1619		20.88			
12-13	0854		20.57			

Owner Warren County Well ID TRN-5 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level (S - S_0)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0817		24.81			Static
	1031		24.88			
	1232		24.99			
	1433		25.11			
	1612		25.25			
12-13	0859		25.27			

Owner Warren County Well ID OCO-1 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0823		25.23			Static
	1025		25.39			
	1226		25.58			
	1428		25.82			
	1606		26.04			
12-13	0904		25.75			

Owner Warren County Well ID OW-2 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0809		20.00			Static
	1038		20.15			
	1240		20.31			
	1442		20.52			
	1622		20.71			
12-13	0851		20.56			

Owner Warren County Well ID TW-1 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0831		21.83			Static
	1049		22.25			
	1251		22.57			
	1451		22.93			
	1632		23.28			
12-13	0916		22.39			

Owner Warren County Well ID TW-2 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0803		19.01			Static
	1044		19.16			
	1246		19.49			
	1448		19.76			
	1629		20.03			
12-13	0845		19.56			

DNR 7811.93

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

Page No. 1

Owner .... Address ....

Location of well on property ....

County .... Township ....

Date .... (Test Started / Test Ended) ODNR Log# .... Other Well ID TRN-1

Company Conducting Test .... Individual Making Measurements ....

Type of Test .... Distance From Pumping Well ....

Measuring Equipment Used ....

Static Water Level (S_0) .... Measuring Point .... Elevation Above Ground ....

Pumping Water Level (ft.) .... Depth of Pump (ft.) ....

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12-24	0828	—	~~22.40~~ 22.95			Static
	0901		23.15			
	0902		23.27			
	0903		23.30			
	0904		23.33			
	0905		23.35			
	0910		23.35			
	0915		23.36			
	0920		23.38			
	0925		23.41			
	0930		23.42			
	0940		23.45			
	0950		23.48			
	1000		23.50			
	10:20		23.55			
	10:40		23.57			
	11:00		23.64			
	11:01		23.73			
	11:02		23.76			
	11:03		23.76			
	11:04		23.76			
	11:05		23.76			
	11:10		23.77			
	11:15		23.78			
	11:20		23.80			
	11:25		23.81			
	11:30		23.82			
	11:40		23.85			
	11:50		23.88			

DNR 7811.93

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

Owner .... Address ....

Location of well on property ....

County .... Township ....

Date .... / .... ODNR Log# .... Other Well ID TW-1
(Test Started / Test Ended)

Company Conducting Test .... Individual Making Measurements ....

Type of Test .... Distance From Pumping Well ....

Measuring Equipment Used ....

Static Water Level (S_0) .... Measuring Point .... Elevation Above Ground ....

Pumping Water Level (ft.) .... Depth of Pump (ft.) ....

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12-24	12:00		23.90			
	12:20		23.94			
	12:40		23.92			
	13:00		24.02			Change in Q
	13:01		24.14			
	13:02		24.16			
	13:03		24.16			
	13:04		24.16			
	13:05		24.17			
	13:10		24.19			
	13:15		24.20			
	13:20		24.22			
	13:25		24.24			
	13:30		24.25			
	13:40		24.27			
	13:50		24.29			
	14:00		24.34			
	14:20		24.39			
	14:40		24.44			
	15:00		24.55			Change in Q
	15:01		24.61			
	15:02		24.62			
	15:03		24.62			
	15:04		24.62			
	15:05		24.62			
	15:10		24.64			
	15:15		24.66			
	15:20		24.69			
	15:25		24.70			

DNR 7811.93

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

Owner .... Address ....

Location of well on property ....

County .... Township ....

Date .... (Test Started / Test Ended) ODNR Log# .... Other Well ID TRN-1

Company Conducting Test .... Individual Making Measurements ....

Type of Test .... Distance From Pumping Well ....

Measuring Equipment Used ....

Static Water Level (S_0) .... Measuring Point .... Elevation Above Ground ....

Pumping Water Level (ft.) .... Depth of Pump (ft.) ....

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12/12/24	15:30		24.71			
	15:40		24.74			
	15:50		24.77			
	16:00		24.80			
	16:20		24.83			
	16:40		24.87			
	17:00		24.95			Pump Off
	17:01		24.31			
	17:02		24.24			
	17:03		24.2			
	17:04		24.2			
	17:05		24.19			
	17:06		24.18			
	17:07		24.17			
	17:08		24.16			
	17:09		24.14			
	17:10		24.13			
12/13/24	09:10		23.52			W.L. = 23.24 (From top of well casing)
12/17/24	08:34		22.58			
	11:10		23.99			
12/18/24	08:47		26.33			
12/19/24	09:43		23.64			

Owner Warren County Well ID TRN-2 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0805		22.43			Static
	1042		22.64			
	1244		22.84			
	1446		23.09			
	1627		23.34			
12-13	0847		22.99			
12-17-24	0805		22.03			
	1044		22.38			
12-18-24	0815		24.62			
12-19-24	0913		23.07			

Owner Warren County Well ID TRN-3 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0812		20.01			Static
	1036		20.21			
	1238		20.39			
	1439		20.66			
	1619		20.88			
12-13	0854		20.57			
12-17-24	0811		19.59			
	1050		19.95			
12-18-24	0823		22.12			
12-19-24	0920		20.63			

Owner Warren County Well ID TRN-5 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0817		24.81			Static
	1031		24.88			
	1232		24.99			
	1433		25.11			
	1612		25.25			
12-13	0859		25.27			
12-17-24	0819		24.22			
	1057		24.33			
12-18-24	0831		25.99			
12-19-24	0929		25.05			

Owner Warren County Well ID OCO-1 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0823		25.23			Static
	1025		25.39			
	1226		25.58			
	1428		25.82			
	1606		26.04			
12-13	0904		25.75			
12-17-24	0826		24.81			
	1104		25.19			
12-18-24	0839		27.27			
12-19-24	0937		25.78			

Owner Warren County Well ID OW-2 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0809		20.00			Static
	1038		20.15			
	1240		20.31			
	1442		20.52			
	1622		20.71			
12-13	0851		20.56			
12-17-24	0808		19.58			
	1047		19.81			
12-18-24	0819		21.93			
12-19-24	0914		20.62			

Owner Warren County Well ID TW-1 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0831		21.83			Static
	1049		22.25			
	1251		22.57			
	1451		22.93			
	1632		23.28			
12-13	0916		22.39			
12-17-24	0838		21.44			
	1113		22.37			
12-18-24	0851		24.64			
12-19-24	0948		22.47			

Owner Warren County Well ID TW-2 Date 12-12-24 Page No. 1

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-12	0803		19.01			Static
	1044		19.16			
	1246		19.49			
	1448		19.76			
	1629		20.03			
12-13	0845		19.56			
12-17-24	0802		18.61			
	1042		19.04			
12-18-24	0812		21.32			
12-19-24	0910		19.67			

TEP-DRAWDOWN TEST - PRODUCTION WELL # MJ-PW1

FIELD DATA FORM

Test date: 12-12-24

Well Information

Date drilled:______ Borehole diameter:______(inches) Borehole depth:______ft BLS
Casing ID diameter:______(inches) Casing material & thickness:______ Casing length:______ ft BLS
Screen ID diameter:______(inches) Screen material & slot size:______ Screen length:______ ft BLS
Screen Type:______ Screen fittings:______ Total well depth:______ ft BLS

Pump Information

Pump type:______ Pump diameter:______ Pump stages:______
Pump column -type/diameter:______ Check valve-type/material:______
Pump intake level:______ft BLS
Motor type:______ Motor horsepower:______ Motor length:______
Motor voltage:______ Phase:______ Service factor:______ Full-load amps:______

Step-Test Setup

Water discharged to: Riverbank Discharge distance from PW:______ (feet)
Orifice size: 7 (inches) Discharge pipe diameter: 10 (inches)
Static water level from top of access port: 21.84 (feet) Date/time: 12-12-24/0850
Contractor performing test:______
Measurements made by:______

STEP #1						
Notes	Time (hr:min)	Elapse Time (minutes)	Depth to Water (feet)	Line Pressure (psi)	Orifice Reading (inches)	Pumping Rate (gpm)
Static Water Level	08:~~34~~ 30	-5	~~21.85~~ 21.84			
Pump On - Shut In HD	09:00	0				
Valve Open	09:01	1	22.35	100		
	09:02	2	22.86			
	09:03	3	22.92			
	09:04	4	22.85			
Step #1 Motor	09:05	5	22.96		13.5	750
Amp Readings	09:10	10	22.99			
L_1 =	09:15	15	23.00			
L_2 =	09:20	20	23.01	80		
L_3 =	09:25	25	23.04			
	09:30	30	23.03	82		
	09:40	40	23.05		14.0	767
	09:50	50	23.07			
	10:00	60	23.08			
	10:20	80	23.14	82	14.0	767
	10:40	100	23.20			
	11:00	120	23.21			

STEP-DRAWDOWN TEST - PRODUCTION WELL MJ-PW1

Test date: 12-12-24

STEP #2						
Notes	**Time (hr:min)**	**Elapse Time (minutes)**	**Depth to Water (feet)**	**Line Pressure (psi)**	**Orifice Reading (inches)**	**Pumping Rate (gpm)**
Change Pump Rate	1100	0	23.21			
	11:01	1	23.54			
	11:02	2	23.67			
	11:03	3	23.67			
	11:04	4	23.69	73	27	1066
Step #2 Motor	11:05	5	23.65			
Amp Readings	11:10	10	23.64			
L_1 =	11:15	15	23.66			
L_2 =	11:20	20	23.69			
L_3 =	11:25	25	23.71			
	11:30	30	23.72	72	27	1066
	11:40	40	23.73			
	11:50	50	23.76			
	12:00	60	23.79			
	12:20	80	23.82			
	12:40	100	23.82	72	27	1066
	13:00	120	23.90			

STEP #3						
Change Pump Rate	13:00	0	23.90			
	13:01	1	24.41			
	13:02	2	24.45	[illegible]	46	1391
	13:03	3	24.48			
	13:04	4	24.47			
Step # 3 Motor	13:05	5	24.47			
Amp Readings	13:10	10	24.49			
L_1 =	13:15	15	24.52			
L_2 =	13:20	20	24.53			
L_3 =	13:25	25	24.54			
	13:30	30	24.56			
	13:40	40	24.58	63	45.5	
	13:50	50	24.62			
	14:00	60	24.64			
	14:20	80	24.68	63		
	14:40	100	24.73		45.5	
	15:00	120	24.77			

STEP-DRAWDOWN TEST - PRODUCTION WELL MJ-PW1

Test date: 12-12-24

STEP #4 Notes	Time (hr:min)	Elapse Time (minutes)	Depth to Water (feet)	Line Pressure (psi)	Orifice Reading (inches)	Pumping Rate (gpm)
Change Pump Rate	15:00	0	24.77			
	15:01	1	25.39			
	15:02	2	25.36	~~60~~	68	1691
	15:03	3	25.38			
	15:04	4	25.40			
Step #4 Motor	15:05	5	25.39			
Amp Readings	15:10	10	25.38			
L_1 =	15:15	15	25.41	58		
L_2 =	15:20	20	25.42		67.5	1685
L_3 =	15:25	25	25.43			
	15:30	30	25.45			
	15:40	40	25.48			
	15:50	50	25.51			
	16:00	60	25.52			
	16:20	80	25.56	58	68	Frozen mano tube
	16:40	100	25.58			
	17:00	120	25.63			
Recovery						
Pump Off	17:00	0	25.43			
	17:01	1	23.15			
	17:02	2	23.13			
	17:03	3	23.12			
	17:04	4	23.11			
	17:05	5	23.08			
	17:06	6	23.08			
	17:07	7	23.07			
	17:08	8	23.07			
	17:09	9	23.06			
	17:10	10	23.05			
	17:20	20	23.02			
		30				
		40				
		50				
		60				

Comments & Additional Notes:

2

PUMPING TEST RECORD
ODNR-Division of Water
Water Resources Section

Owner Warren Co Address

County Township

Date 12/17/24 (Test Started) / (Test Ended) ODNR Log# Other Well ID MJ-PW1

Company Conducting Test Individual Making Measurements

Type of Test CRT Distance From Pumping Well @ PW1

Measuring Equipment Used

Static Water Level (S_0) 21.47 Measuring Point TOC Elevation Above Ground

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
12-17-24	0900	0	21.47			Start @ 0900
	0901	1	24.03			
	0902	2	24.01			
	0903	3	24.01			
	0904	4	24.03			
	0905	5	24.03		1653	Orifice = 65"
	0906	6	24.03			
	0907	7	24.11		1691	orifice = 68"
	0908	8	24.13			
	0909	9	24.15			
	0910	10	24.15			
	0911	11	24.15			
	0912	12	24.17			
	0913	13	24.19			
	0914	14	24.19			
	0915	15	24.20		1691	orifice = 68"
	0920	20	24.23			
	0925	25	24.25			
	0930	30	24.28			
	0935	35	24.35			
	0940	40	24.34			
	0945	45	24.37			orifice = 67-68"
	0950	50	24.40			
	0955	55	24.42			
	1000	60 (1hr)	24.59		1666	orifice = 66" bumped open valve to 68.5"
	1030	90	24.61			
	11:00	120 (2hr)	24.73		1691	Orifice 68"
	11:30	150	24.82			
	12:00	180 (3hr)	24.90			orifice 68" checked [illegible] Gauge
		240 (4hr)				

DNR 7811.93

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

Page No. 2

Owner Waltons Co. Address

Location of well on property

County Township

Date 12/17/24 (Test Started) / (Test Ended) ODNR Log# NA Other Well ID MJT PW1

Company Conducting Test Individual Making Measurements

Type of Test CRT Distance From Pumping Well

Measuring Equipment Used

Static Water Level (S_0) Measuring Point Elevation Above Ground

Pumping Water Level (ft.) Depth of Pump (ft.)

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
	12:30	24.99				
	1:00	25.09				Checked orifice 69"
	1:30	25.16				
	2:00	25.25				Checked orifice 69"
	2:30	25.31				
	3:00	25.37				
	3:30	25.43				Checked 69"
	4:00	25.58				Fuel at 77%
	500	25.63				
	6:00	25.71				
	7:00	25.90				
	8:00	26.05				
	900	26.17				
	1000	26.23				Checked at 69"
	11:00	Missed				
	12:00	26.31				
12/18/24	1:00am	26.46				
	2:00	26.54				
	3:00	26.61				
	4:00	26.70				
	5:00	26.78				
	6:00	26.83				
	7:00	26.94				Fuel @ 39%, Checked orifice 68"-69"
	8:00	27.00				OR = 68"
	8:30	27.01				
	9:02	27.04				
	9:30	27.06				
	9:37	27.12				
	9:40					Shutdown pump

Pull CRT to Recovery

12/18/24

0940 Stop	Start Recovery
0941	24.59'
0942	24.51'
0943	24.49'
0944	24.48'
0945	24.48'
0946	24.46'
0947	24.44'
0948	24.45'
0949	24.43'
0950	24.42'
0951	24.42'
0952	24.39'
0953	24.38'
0954	24.41'
0955	24.37'
0956	24.36'
0957	24.37'
0958	24.35'
0959	24.34'
1000	24.35'

12/19/24 09:45 22.55'

ATTACHMENT #4

GROUNDWATER LAB RESULTS

MASI LABORATORIES

7940 Memorial Drive Plain City, Ohio 43064 (614) 873-4654

Date: January 06, 2025

National Water Services LLC (1384)
Attn: Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

RE: Certificate of Analysis for Project - Private Drinking Water

The following report contains analytical results for samples submitted on the chain of custody dated December 18, 2024.

I have reviewed the validity of the analytical data generated. All data is reported in accordance to our laboratory QA/QC plan. Any exceptions are noted in the Case Narrative or with qualifiers in the report.

If you have any questions or need additional documentation, please contact our Office.

Sincerely,

Cheryl Rex

Cheryl Rex
MASI Laboratories
QA/QC Officer
cheryl@masilabs.com
(614) 873-4654

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877
Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number:
Date Received: 12/18/24 16:57
Ohio EPA Analyzed Date: 1/6/25 12:38

Sampler Name: Josh Gavin
Sample Date/Time: 12/18/24 09:30
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren Country Middletown Junction Well Field PW-1

PWSID: Facility ID: -
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165985
Lab Sample # : 4L02626-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
EPA 200.8 Rev. 5.4									
Antimony, Total	<3.0	ug/L		3.0	3.0	12/18/24 09:30	12/24/24 12:38	SLB	EPA 200.8 Rev. 5.4
Selenium, Total	<3.0	ug/L		3.0	3.0	12/18/24 09:30	12/24/24 12:38	SLB	EPA 200.8 Rev. 5.4
Thallium, Total	<1.0	ug/L		1.0	1.0	12/18/24 09:30	12/24/24 12:38	SLB	EPA 200.8 Rev. 5.4

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Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number:
Date Received: 12/18/24 16:57
Ohio EPA Analyzed Date: 1/6/25 12:38

Sampler Name: Josh Gavin
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Sample Monitoring Point:
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Sample Tap/Address: Spigot Warren Country Middletown Junction Well Field PW-1

PWSID: Facility ID: -
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165985
Lab Sample # : 4L02626-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Wet Chemistry Analysis									
Alkalinity, Total	**315**	mg/L CaCO3		4.00		12/23/24 18:00	12/23/24 18:00	JAC	SM 2320 B 2011
Chloride	**76.0**	mg/L		50.0	50.0	12/20/24 13:18	12/20/24 13:18	JOL	SM 4500Cl B 2011
Cyanide, Free	ND	mg/l (as free Cn)		0.003	0.0007	12/30/24 14:04	12/30/24 14:04	DCP	OIA-1677DW
Fluoride	**0.21**	mg/L		0.20	0.05	12/30/24 16:06	12/30/24 16:06	DCP	SM 4500 F C 2011
Nitrate-Nitrite	ND	mg/L		0.50	0.19	12/19/24 09:50	12/19/24 13:56	JOL	EPA 353.2 Rev 2.0
Nitrate as Nitrate-Nitrite	ND	mg/L		0.500	0.185	12/19/24 09:50	12/19/24 13:56	JOL	EPA 353.2 Rev 2.0
Nitrite	**0.01**	mg/L	**J**	0.10	0.01	12/19/24 08:20	12/19/24 10:40	JOL	EPA 353.2 Rev 2.0
pH (su)	**7.1**	-	**HOLD**			12/18/24 15:00	12/18/24 15:00	MMM	SM 4500H B 2011
Temperature (Centigrade)	**13.6**	-	**HOLD**			12/18/24 15:00	12/18/24 15:00	MMM	SM 4500H B 2011
Total Dissolved Solids/Total Filterable Residue	**480**	mg/L		10.0	4.0	12/20/24 18:20	12/20/24 18:20	JAC	SM 2540 C 2015
Sulfate	**36.0**	mg/L		20.0	4.1	12/23/24 12:00	12/23/24 12:00	JAC	SM 4500 SO42 E 2011
Metals Analysis									
Arsenic, Total	ND	ug/L		3	0.9	01/02/25 11:40	01/02/25 12:30	KRM	SM 3113 B 2010
Barium, Total	**202**	ug/L		25.0	0.5	12/26/24 14:08	12/26/24 14:08	CJS	EPA 200.7 1994
Beryllium, Total	ND	ug/L		1.0	0.06	12/26/24 14:08	12/26/24 14:08	CJS	EPA 200.7 1994
Cadmium, Total	ND	ug/L		1.0	0.2	12/26/24 14:08	12/26/24 14:08	CJS	EPA 200.7 1994
Calcium, Total	**112**	mg/L		2.0	0.09	12/19/24 13:33	12/19/24 13:33	CJS	EPA 200.7 1994
Chromium, Total	ND	ug/L		5.0	0.8	12/26/24 14:08	12/26/24 14:08	CJS	EPA 200.7 1994
Copper, Total	**9**	ug/L	**J**	50	1	12/26/24 14:08	12/26/24 14:08	CJS	EPA 200.7 1994
Iron, Total	**2440**	ug/L		800	8	12/27/24 09:43	12/27/24 09:43	KRM	EPA 200.7 1994
Lead, Total	**0.7**	ug/L	**J**	5.0	0.3	12/20/24 15:49	12/20/24 17:46	KRM	SM 3113 B 2010

MASI LABORATORIES

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Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number:
Date Received: 12/18/24 16:57
Ohio EPA Analyzed Date: 1/6/25 12:38

Sampler Name: Josh Gavin
Sample Date/Time: 12/18/24 09:30
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren Country Middletown Junction Well Field PW-1

PWSID: Facility ID: -
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165985 (Continued)

Lab Sample # : 4L02626-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Metals Analysis (Continued)									
Magnesium, Total	**29.6**	mg/L		5.0	0.04	12/19/24 13:33	12/19/24 13:33	CJS	EPA 200.7 1994
Manganese, Total	**371**	ug/L		20	0.6	12/26/24 18:23	12/26/24 18:23	KRM	EPA 200.7 1994
Mercury, Total	ND	ug/L		0.5	0.1	12/30/24 14:49	12/31/24 14:40	KRM	EPA 245.1 1994
Nickel, Total	ND	ug/L		10.0	1.2	12/26/24 14:08	12/26/24 14:08	CJS	EPA 200.7 1994
Silver, Total	ND	ug/L		10.0	0.6	12/31/24 09:48	12/31/24 09:48	CJS	EPA 200.7 1994
Sodium, Total	**24.3**	mg/L		5.0	0.2	12/19/24 13:33	12/19/24 13:33	CJS	EPA 200.7 1994
Zinc, Total	**19.2**	ug/L		10.0	0.9	12/26/24 14:08	12/26/24 14:08	CJS	EPA 200.7 1994
Volatile Organic Chemicals (VOC)									
1,1,1-Trichloroethane	ND	ug/L		0.5	0.09	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
1,1,2-Trichloroethane	ND	ug/L		0.5	0.07	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
1,1-Dichloroethene	ND	ug/L		0.5	0.09	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
1,2,4-Trichlorobenzene	ND	ug/L		0.5	0.1	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
1,2-Dichlorobenzene	ND	ug/L		0.5	0.03	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
1,2-Dichloroethane	ND	ug/L		0.5	0.05	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
1,2-Dichloropropane	ND	ug/L		0.5	0.08	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
1,4-Dichlorobenzene	ND	ug/L		0.5	0.07	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Benzene	ND	ug/L		0.5	0.06	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Carbon Tetrachloride	ND	ug/L		0.5	0.08	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Chlorobenzene	ND	ug/L		0.5	0.04	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
cis-1,2-Dichloroethene	ND	ug/L		0.5	0.04	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Ethylbenzene	ND	ug/L		0.5	0.05	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Methylene Chloride	ND	ug/L		0.5	0.05	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Styrene	ND	ug/L		0.5	0.07	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Tetrachloroethene	ND	ug/L		0.5	0.07	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2

MASI LABORATORIES

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877
Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number:
Date Received: 12/18/24 16:57
Ohio EPA Analyzed Date: 1/6/25 12:38

Sampler Name: Josh Gavin
Sample Date/Time: 12/18/24 09:30
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren Country Middletown Junction Well Field PW-1

PWSID: Facility ID: -
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165985 (Continued)
Lab Sample # : 4L02626-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Volatile Organic Chemicals (VOC) (Continued)									
Toluene	ND	ug/L		0.5	0.05	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
trans-1,2-Dichloroethene	ND	ug/L		0.5	0.1	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Trichloroethene	ND	ug/L		0.5	0.08	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Vinyl Chloride	ND	ug/L		0.5	0.1	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Total Xylenes	ND	ug/L		1.5	0.2	12/21/24 01:43	12/21/24 01:43	DTS	EPA Method 524.2
Surrogate: 4-Bromofluorobenzene			*87%*			*70-130*			*EPA Method 524.2*
Surrogate: 1,2-Dichlorobenzene-d4			*83%*			*70-130*			*EPA Method 524.2*
Synthetic Organic Compounds (SOC) Group 1									
Alachlor	ND	ug/L		0.20	0.07	12/20/24 11:58	12/24/24 01:09	MEM	EPA Method 525.2
Atrazine	ND	ug/L		0.30	0.07	12/20/24 11:58	12/24/24 01:09	MEM	EPA Method 525.2
Simazine	ND	ug/L		0.35	0.06	12/20/24 11:58	12/24/24 01:09	MEM	EPA Method 525.2
Surrogate: 1,3-Dimethyl-2-nitrobenzene			*104%*			*70-130*			*EPA Method 525.2*
Surrogate: Triphenylphosphate			*110%*			*70-130*			*EPA Method 525.2*
Surrogate: Perylene-d12			*99%*			*70-130*			*EPA Method 525.2*

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877

Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number:
Date Received: 12/18/24 16:57
Ohio EPA Analyzed Date: 1/6/25 12:38

Notes and Definitions

Item	Definition
HOLD	Exceeds Recommended Holding Time
J	Analyte was positively identified, the associated numerical value is estimated.
mg/kg Dry	Sample results reported on a dry weight basis
ug/L	ppb/Part per Billion
mg/L	ppm/Part per Million
ng/L	ppt/Part per Trillion
ND	Analyte NOT DETECTED at or above the method detection limit (MDL)
!	Analyte is at or above the Maximum Contaminate Level
MDL	Method Detection Limit
CFU	Colony Forming Units
MPN	Most Probable Number
NTU	Nephelometric Turbidity Unit
pCi/L	Picocuries per liter
SVI	Sludge Volume Index
%	Percent
GPD	Gallons per Day
su	Standard Units
RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was matrix spiked or duplicated.

Notes:
1. Calculated analytes are based on raw data and may not reflect the rounding of the individual compounds.
2. Samples are analyzed using the information received on the request sheet and may not be analyzed when the parameters fall outside required guidelines.

MASI ®
ENVIRONMENTAL
LABORATORIES
7940 Memorial Drive
Plain City, OH 43064
614-873-4654

New We[ll ... Sh]eet

Analysis Request ... [T]itle: 165985

** See reverse ... [sig]n *:

4L02626-01/03
AR # 165985
Received: 12/18/2024
Matrix: Potable

Client #: 1384 Client Name: National Water Services County: ______ P.O.# ______

Sampler Name: Josh Gavin SMP ID : ______ Sample Type/Class: ( ) New Well/Special

Sample Tap: Spigot Date Collected: 12/18/24 (MM/DD/YY) Time Collected: 09:30 am (hh:mm am/pm)

Tap Address: Warren County Middletown Junction Well Field (PW-1)

( ) Public Sample ( ) PWS ID #: ______ ( ) Facility ID #: ______ Private

( ) (New Well Trans) Transient Noncommunity

( ) (New Well Nontrans) Nontransient-Noncommunity + PFAS

(X) (New Well Comm) Community Water Systems + PFAS

Work Order
4L0
2630-01/02
(Office Use Only)

Microbiological Tests

	Time Collected
(X) 140 Total Coliform #1	09:00 am (hh:mm am/pm)
(X) 140 Total Coliform #2	09:30 am (hh:mm am/pm)

Office Use Only:
9.2
FD
1700

Route	
Office/Lab	[signature]

COOLER:

REVISED 2-15-23 DN

Summit Environmental Technologies, Inc.
3310 Win St.
Cuyahoga Falls, Ohio 44223
TEL: (330) 253-8211 FAX: (330) 253-4489
Website: http://www.settek.com

January 02, 2025

Jane McIntire
MASI Environmental Services
7940 Memorial Dr.
Plain City, OH 43064
TEL: (614) 873-4654
FAX: (614) 873-3809

RE: 4L02626

Order No.: 24121610

Dear Jane McIntire:

Summit Environmental Technologies, Inc. received 2 sample(s) on 12/20/2024 for the analyses presented in the following report.

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

Quality control data is within laboratory defined or method specified acceptance limits except where noted.

If you have any questions regarding these tests results, please feel free to call the laboratory.

Sincerely,

Brian J. Fackelman
Project Manager, LIMS Administrator
3310 Win St.
Cuyahoga Falls, Ohio 44223

Arkansas 88-0735, California 2943, Colorado, Connecticut PH-0108, Florida NELAC E87688, Idaho OH00923, Illinois 200061, Indiana C-OH-13, ISO/IEC 17025:2017 119125 L22-544, Kansas E-10347, Kentucky (Underground Storage Tank) 3, Kentucky 90146, Maryland 339, Michigan 9988, Minnesota 1780279, Nevada OH009232020-1, New Hampshire 2996, New Jersey OH006, New York 11777, North Carolina 39705 and 631, North Dakota R-201, Ohio DW, Ohio VAP CL0052, Oklahoma 2019-155, Oregon OH200001, Pennsylvania 68-01335, Rhode Island LA000317, South Carolina 92016001, Texas T104704466-19-16, Utah OH009232020-12, Virginia VELAP 10381, West Virginia 9957C

Summit Environmental Technologies, Inc.
3310 Win St.
Cuyahoga Falls, Ohio 44223
TEL: (330) 253-8211 FAX: (330) 253-4489
Website: http://www.settek.com

Case Narrative

WO#: **24121610**
Date: **1/2/2025**

CLIENT: MASI Environmental Services
Project: 4L02626

WorkOrder Narrative:
24121610: This report in its entirety consists of the following documents: Cover Letter, Case Narrative, Analytical Results, QC Summary Report, Applicable Accreditation Information, Chain-of-Custody, Cooler Receipt Form, and other applicable forms as necessary. All documents contain the Summit Environmental Technologies, Inc., Work Order Number assigned to this report.

Summit Environmental Technologies, Inc., holds the accreditations/certifications listed at the bottom of the cover letter that may or may not pertain to this report. Please refer to the "Accreditation Program Analytes Report" for accredited analytes list.

All results for Solid Samples are reported on an "as received" or "wet weight" basis unless indicated as "dry weight" using the "-dry" designation on the reporting units.

This report is believed to meet all of the requirements of the accrediting agency, where applicable. Any comments or problems with the analytical events associated with this report are noted below.

WorkOrder Comments:
24121610: Data is not for compliance per the chain of custody; data is for private use.
State required accreditation not specified; results may not be reported as certified data

Analytical Sequence Sample Notes:
24121610-001A, 002A SVOC-EPA537_DW(537): Sample exhibited potential low biased due to LCS/LCSD results, sample results confirmed via re-analysis

SUMMIT ENVIRONMENTAL TECHNOLOGIES, INC
Analytical Laboratories

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Workorder Sample Summary

WO#: **24121610**

02-Jan-25

CLIENT: MASI Environmental Services

Project: 4L02626

Lab SampleID	Client Sample ID	Tag No	Date Collected	Date Received	Matrix
24121610-001	4L02626-01		12/18/2024 9:30:00 AM	12/20/2024 2:15:00 PM	Drinking Water
24121610-001	4L02626-01		12/18/2024 9:30:00 AM	12/20/2024 2:15:00 PM	Drinking Water
24121610-002	4L02626-03 FRB		12/18/2024 9:30:00 AM	12/20/2024 2:15:00 PM	Drinking Water

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Analytical Report

(consolidated)

WO#: **24121610**

Date Reported: **1/2/2025**

CLIENT: MASI Environmental Services
Collection Date: 12/18/2024 9:30:00 AM
Project: 4L02626
Lab ID: 24121610-001
Matrix: DRINKING WATER
Client Sample ID: 4L02626-01

Analyses	Result	RL	Qual	Units	Uncertainty	DF	Date Analyzed
GROSS ALPHA / GROSS BETA RADIOACTIVITY (EPA 900.0)					**E900.0**	**E900**	Analyst: **DHF**
ALPHA, Gross	ND	3.00		pCi/L	± 2.04	1	12/23/2024 4:54:00 PM
BETA, Gross	ND	4.00		pCi/L	± 1.19	1	12/23/2024 4:54:00 PM
RADIUM-228 (904.0)					**E904.0**	**E903-904**	Analyst: **DHF**
Radium-228	ND	1.00		pCi/L	± 0.450	1	12/30/2024 2:20:00 PM
Yield	1.00					1	12/30/2024 2:20:00 PM

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
W	Sample container temperature is out of limit as specified at testcode		

Original

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Analytical Report

(consolidated)

WO#: **24121610**

Date Reported: **1/2/2025**

CLIENT: MASI Environmental Services
Collection Date: 12/18/2024 9:30:00 AM
Project: 4L02626
Lab ID: 24121610-001
Matrix: DRINKING WATER
Client Sample ID: 4L02626-01

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
PFAS BY EPA 537.1				**E537.1**	**E537.1**	Analyst: **AEH**
PERFLUORINATED ALKYL ACIDS (EPA 537.1)						
PFBS	0.00256	0.00186		µg/L	1	12/27/2024 1:46:00 AM
PFHxS	ND	0.00186		µg/L	1	12/27/2024 1:46:00 AM
PFOA	0.00302	0.00186		µg/L	1	12/27/2024 1:46:00 AM
PFOS	0.0166	0.00186		µg/L	1	12/27/2024 1:46:00 AM
PFNA	ND	0.00186		µg/L	1	12/27/2024 1:46:00 AM
HFPO-DA	ND	0.00186		µg/L	1	12/27/2024 1:46:00 AM
Surr: 13C2-PFDA	92.3	70 - 130		%Rec	1	12/27/2024 1:46:00 AM
Surr: 13C2-PFHxA	90.5	70 - 130		%Rec	1	12/27/2024 1:46:00 AM
Surr: 13C3-HFPO-DA	82.7	70 - 130		%Rec	1	12/27/2024 1:46:00 AM

Qualifiers:

H	Holding times for preparation or analysis exceeded
ND	Not Detected
R	RPD outside accepted recovery limits
W	Sample container temperature is out of limit as specified at testcode
M	Manual Integration used to determine area response
PL	Permit Limit
RL	Reporting Detection Limit

Original

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Analytical Report

(consolidated)

WO#: **24121610**

Date Reported: **1/2/2025**

CLIENT: MASI Environmental Services
Collection Date: 12/18/2024 9:30:00 AM

Project: 4L02626

Lab ID: 24121610-002
Matrix: DRINKING WATER

Client Sample ID: 4L02626-03 FRB

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
PFAS BY EPA 537.1				**E537.1**	**E537.1**	Analyst: **AEH**
PERFLUORINATED ALKYL ACIDS (EPA 537.1)						
PFBS	ND	0.00195		µg/L	1	12/27/2024 2:02:00 AM
PFHxS	ND	0.00195		µg/L	1	12/27/2024 2:02:00 AM
PFOA	ND	0.00195		µg/L	1	12/27/2024 2:02:00 AM
PFOS	ND	0.00195		µg/L	1	12/27/2024 2:02:00 AM
PFNA	ND	0.00195		µg/L	1	12/27/2024 2:02:00 AM
HFPO-DA	ND	0.00195		µg/L	1	12/27/2024 2:02:00 AM
Surr: 13C2-PFDA	110	70 - 130		%Rec	1	12/27/2024 2:02:00 AM
Surr: 13C2-PFHxA	104	70 - 130		%Rec	1	12/27/2024 2:02:00 AM
Surr: 13C3-HFPO-DA	91.5	70 - 130		%Rec	1	12/27/2024 2:02:00 AM

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
W	Sample container temperature is out of limit as specified at testcode		

Original

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QC SUMMARY REPORT

WO#: **24121610**
02-Jan-25

Client: MASI Environmental Services
Project: 4L02626 **BatchID:** 81083

Sample ID: **LCSD-81083** SampType: **LCSD** TestCode: **SVOC-EPA53** Units: **µg/L** Prep Date: **12/20/2024** RunNo: **200612**
Client ID: **BatchQC** Batch ID: **81083** TestNo: **E537.1** **E537.1** Analysis Date: **12/27/2024** SeqNo: **5395252**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
PFBS	0.0278	0.00200	0.03540	0	78.6	70	130	0.02746	1.37	20	
PFHxS	0.0308	0.00200	0.03650	0	84.3	70	130	0.02946	4.40	20	
PFOA	0.0358	0.00200	0.04000	0	89.5	70	130	0.03334	7.12	20	
PFOS	0.0323	0.00200	0.03704	0	87.3	70	130	0.03075	5.05	20	
PFNA	0.0370	0.00200	0.04000	0	92.4	70	130	0.03442	7.16	20	
HFPO-DA	0.0330	0.00200	0.04000	0	82.5	70	130	0.03010	9.21	20	
Surr: 13C2-PFDA	0.0417		0.04000		104	70	130		0	20	
Surr: 13C2-PFHxA	0.0439		0.04000		110	70	130		0	20	
Surr: 13C3-HFPO-DA	0.0387		0.04000		96.7	70	130		0	20	
Surr: NETFOSAA-d5	0.174		0.1600		109	70	130		0	20	

Sample ID: **MB-81083** SampType: **MBLK** TestCode: **SVOC-EPA53** Units: **µg/L** Prep Date: **12/20/2024** RunNo: **200612**
Client ID: **BatchQC** Batch ID: **81083** TestNo: **E537.1** **E537.1** Analysis Date: **12/27/2024** SeqNo: **5395256**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
PFBS	ND	0.00200									
PFHxS	ND	0.00200									
PFOA	ND	0.00200									
PFOS	ND	0.00200									
PFNA	ND	0.00200									
HFPO-DA	ND	0.00200									
Surr: 13C2-PFDA	0.0437		0.04000		109	70	130				

Qualifiers:
H Holding times for preparation or analysis exceeded
PL Permit Limit
S Spike Recovery outside accepted recovery limits
M Manual Integration used to determine area response
R RPD outside accepted recovery limits
W Sample container temperature is out of limit as specified at testcode
ND Not Detected
RL Reporting Detection Limit

Original

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QC SUMMARY REPORT

WO#: **24121610**

02-Jan-25

Client: MASI Environmental Services

Project: 4L02626 **BatchID:** 81083

Sample ID: **MB-81083** SampType: **MBLK** TestCode: **SVOC-EPA53** Units: **µg/L** Prep Date: **12/20/2024** RunNo: **200612**
Client ID: **BatchQC** Batch ID: **81083** TestNo: **E537.1** **E537.1** Analysis Date: **12/27/2024** SeqNo: **5395256**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: 13C2-PFHxA	0.0391		0.04000		97.8	70	130				
Surr: 13C3-HFPO-DA	0.0378		0.04000		94.6	70	130				
Surr: NETFOSAA-d5	0.173		0.1600		108	70	130				

Sample ID: **LCS-81083** SampType: **LCS** TestCode: **SVOC-EPA53** Units: **µg/L** Prep Date: **12/20/2024** RunNo: **200612**
Client ID: **BatchQC** Batch ID: **81083** TestNo: **E537.1** **E537.1** Analysis Date: **12/27/2024** SeqNo: **5395257**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
PFBS	0.0275	0.00200	0.03540	0	77.6	70	130				
PFHxS	0.0295	0.00200	0.03650	0	80.7	70	130				
PFOA	0.0333	0.00200	0.04000	0	83.4	70	130				
PFOS	0.0307	0.00200	0.03704	0	83.0	70	130				
PFNA	0.0344	0.00200	0.04000	0	86.1	70	130				
HFPO-DA	0.0301	0.00200	0.04000	0	75.2	70	130				
Surr: 13C2-PFDA	0.0378		0.04000		94.4	70	130				
Surr: 13C2-PFHxA	0.0401		0.04000		100	70	130				
Surr: 13C3-HFPO-DA	0.0358		0.04000		89.4	70	130				
Surr: NETFOSAA-d5	0.168		0.1600		105	70	130				

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits	W	Sample container temperature is out of limit as specified at testcode		

Original

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QC SUMMARY REPORT

WO#: **24121610**

02-Jan-25

Client: MASI Environmental Services

Project: 4L02626 **BatchID:** **81112**

Sample ID: **MB-81112** SampType: **MBLK** TestCode: **AlphaBeta_D** Units: **pCi/L** Prep Date: **12/22/2024** RunNo: **199384**

Client ID: **BatchQC** Batch ID: **81112** TestNo: **E900.0** **E900** Analysis Date: **12/23/2024** SeqNo: **5389095**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
ALPHA, Gross	ND	3.00									
BETA, Gross	ND	4.00									

Sample ID: **LCS-81112** SampType: **LCS** TestCode: **AlphaBeta_D** Units: **pCi/L** Prep Date: **12/22/2024** RunNo: **199384**

Client ID: **BatchQC** Batch ID: **81112** TestNo: **E900.0** **E900** Analysis Date: **12/23/2024** SeqNo: **5389096**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
ALPHA, Gross	13.8	3.00	15.00	0	92.2	70	130				
BETA, Gross	18.3	4.00	20.00	0	91.6	70	130				

Sample ID: **RLC-81112** SampType: **RLC** TestCode: **AlphaBeta_D** Units: **pCi/L** Prep Date: **12/22/2024** RunNo: **199384**

Client ID: **BatchQC** Batch ID: **81112** TestNo: **E900.0** **E900** Analysis Date: **12/23/2024** SeqNo: **5389098**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
ALPHA, Gross	ND	3.00	3.000	0	93.3	50	150				
BETA, Gross	4.09	4.00	4.000	0	102	50	150				

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits	W	Sample container temperature is out of limit as specified at testcode		

Original

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QC SUMMARY REPORT

WO#: **24121610**

02-Jan-25

Client: MASI Environmental Services

Project: 4L02626

BatchID: **81129**

Sample ID: **MB-81129** SampType: **MBLK** TestCode: **Radium-228_** Units: **pCi/L** Prep Date: **12/23/2024** RunNo: **200636**

Client ID: **BatchQC** Batch ID: **81129** TestNo: **E904.0** **E903-904** Analysis Date: **12/30/2024** SeqNo: **5396064**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Radium-228	ND	1.00		0	0						
Yield	1.00			0	0						

Sample ID: **LCS-81129** SampType: **LCS** TestCode: **Radium-228_** Units: **pCi/L** Prep Date: **12/23/2024** RunNo: **200636**

Client ID: **BatchQC** Batch ID: **81129** TestNo: **E904.0** **E903-904** Analysis Date: **12/30/2024** SeqNo: **5396065**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Radium-228	3.38	1.00	5.000	0	67.6	50	130				QLR
Yield	1.00			0	0						

Sample ID: **LCSD-81129** SampType: **LCSD** TestCode: **Radium-228_** Units: **pCi/L** Prep Date: **12/23/2024** RunNo: **200636**

Client ID: **BatchQC** Batch ID: **81129** TestNo: **E904.0** **E903-904** Analysis Date: **12/30/2024** SeqNo: **5396066**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Radium-228	4.55	1.00	5.000	0	91.0	50	130	3.380	29.5	20	R
Yield	1.00			0	0			1.000	0		

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits	W	Sample container temperature is out of limit as specified at testcode		

Original

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QC SUMMARY REPORT

WO#: **24121610**

02-Jan-25

Client: MASI Environmental Services

Project: 4L02626 **BatchID:** 81129

Sample ID: **RLC-81129**	SampType: **RLC**	TestCode: **Radium-228_**	Units: **pCi/L**	Prep Date: **12/23/2024**	RunNo: **200636**
Client ID: **BatchQC**	Batch ID: **81129**	TestNo: **E904.0**	**E903-904**	Analysis Date: **12/30/2024**	SeqNo: **5396068**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Radium-228	ND	1.00	1.000	0	79.0	50	150				
Yield	1.00			0	0						

Sample ID: **RLCD-81129**	SampType: **RLC**	TestCode: **Radium-228_**	Units: **pCi/L**	Prep Date: **12/23/2024**	RunNo: **200636**
Client ID: **BatchQC**	Batch ID: **81129**	TestNo: **E904.0**	**E903-904**	Analysis Date: **12/30/2024**	SeqNo: **5396069**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Radium-228	1.46	1.00	1.000	0	146	50	150				
Yield	1.00			0	0						

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits	W	Sample container temperature is out of limit as specified at testcode		

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Qualifiers and Acronyms

WO#: **24121610**
Date: **1/2/2025**

These commonly used Qualifiers and Acronyms may or may not be present in this report.

Qualifiers

U	The compound was analyzed for but was not detected above the MDL.
J	The reported value is greater than the Method Detection Limit but less than the Reporting Limit.
H	The hold time for sample preparation and/or analysis was exceeded. Not Clean Water Act compliant.
D	The result is reported from a dilution.
E	The result exceeded the linear range of the calibration or is estimated due to interference.
MC	The result is below the Minimum Compound Limit.
*****	The result exceeds the Regulatory Limit or Maximum Contamination Limit.
m	Manual integration was used to determine the area response.
d	Manual integration in which peak was deleted
N	The result is presumptive based on a Mass Spectral library search assuming a 1:1 response.
P	The second column confirmation exceeded 25% difference.
C	The result has been confirmed by GC/MS.
X	The result was not confirmed when GC/MS Analysis was performed.
B	The analyte was detected in the Method Blank at a concentration greater than the RL.
MB+	The analyte was detected in the Method Blank at a concentration greater than the MDL.
G	The ICB or CCB contained reportable amounts of analyte.
QC-/+	The CCV recovery failed low (-) or high (+).
R/QDR	The RPD was outside of accepted recovery limits.
QL-/+	The LCS or LCSD recovery failed low (-) or high (+).
QLR	The LCS/LCSD RPD was outside of accepted recovery limits.
QM-/+	The MS or MSD recovery failed low (-) or high (+).
QMR	The MS/MSD RPD was outside of accepted recovery limits.
QV-/+	The ICV recovery failed low (-) or high (+).
S	The spike result was outside of accepted recovery limits.
W	Samples were received outside temperature limits (0° – 6° C). Not Clean Water Act compliant.
Z	Deviation; A deviation from the method was performed; Please refer to the Case Narrative for additional information

Acronyms

ND	Not Detected	**RL**	Reporting Limit
QC	Quality Control	**MDL**	Method Detection Limit
MB	Method Blank	**LOD**	Level of Detection
LCS	Laboratory Control Sample	**LOQ**	Level of Quantitation
LCSD	Laboratory Control Sample Duplicate	**PQL**	Practical Quantitation Limit
QCS	Quality Control Sample	**CRQL**	Contract Required Quantitation Limit
DUP	Duplicate	**PL**	Permit Limit
MS	Matrix Spike	**RegLvl**	Regulatory Limit
MSD	Matrix Spike Duplicate	**MCL**	Maximum Contamination Limit
RPD	Relative Percent Different	**MinCL**	Minimum Compound Limit
ICV	Initial Calibration Verification	**RA**	Reanalysis
ICB	Initial Calibration Blank	**RE**	Reextraction
CCV	Continuing Calibration Verification	**TIC**	Tentatively Identified Compound
CCB	Continuing Calibration Blank	**RT**	Retention Time
RLC	Reporting Limit Check	**CF**	Calibration Factor

This list of Qualifiers and Acronyms reflects the most commonly utilized Qualifiers and Acronyms for reporting. Please refer to the Analytical Notes in the Case Narrative for any Qualifiers or Acronyms that do not appear in this list or for additional information regarding the use of these Qualifiers on reported data.

24121610

MASI LABORATORIES ©

SUBCONTRACT ORDER

Sending Laboratory:

Mobile Analytical Services, Inc.
7940 Memorial Dr
Plain City, OH 43064
Phone: 614-873-4654

Project Manager: Audrey Cooper

Subcontracted Laboratory:

Summit Environmental Technologies (5626)
3310 Win Street
Cuyahoga Falls, OH 44223
Phone: (330) 253-8211

Work Order: 4L02626

Analysis	Expires	Method	Comments Private
Sample ID: 4L02626-01 ***Potable***	***Sampled: 12/18/2024 09:30***		
PFOA/PFOS M537 Regulated List	01/01/2025 09:30		
Radium-228	06/16/2025 09:30		
Gross Beta	06/16/2025 09:30		
Gross Alpha	06/16/2025 09:30		
Containers Supplied: 1 cubetainer, 2 PFAS bottles		cpm 27	pH 1
Sample ID: 4L02626-03 ***Potable***	***Sampled: 12/18/2024 09:30***		
PFOA/PFOS M537 Regulated List Field Blank	01/01/2025 09:30		
Containers Supplied: 1 container			

Summit courier 5.0-0.0=5.0

Released By [signature] Date 12/19/24 Received By [signature] 12/20/24 Date 1415

7940 Memorial Drive Plain City, Ohio 43064 (614) 873-4654

Summit Environmental Technologies, Inc.
3310 Win St.
Cuyahoga Falls, Ohio 44223
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Website: http://www.settek.com

Sample Log-In Check List

Client Name: MAS-OH-43017   Work Order Number: 24121610   RcptNo: 1

Logged by:	Spencer M. Hartwell	12/20/2024 2:15:00 PM
Completed By:	Tegan A. Richards	12/21/2024 11:52:48 AM
Reviewed By:	Holly Florea	12/23/2024 9:24:47 AM

Chain of Custody

1. Is Chain of Custody complete? — Yes [ ] No [x] Not Present [ ]
2. How was the sample delivered? — Summit

Log In

3. Coolers are present? — Yes [x] No [ ] NA [ ]
4. Shipping container/cooler in good condition? — Yes [x] No [ ]
   Custody seals intact on shipping container/cooler? — Yes [ ] No [ ] Not Present [x]
   No. Seal Date: Signed By:
5. Was an attempt made to cool the samples? — Yes [x] No [ ] NA [ ]
6. Were all samples received at a temperature of >0° C to 6.0°C — Yes [x] No [ ] NA [ ]
7. Sample(s) in proper container(s)? — Yes [x] No [ ]
8. Sufficient sample volume for indicated test(s)? — Yes [x] No [ ]
9. Are samples (except VOA and ONG) properly preserved? — Yes [x] No [ ]
10. Was preservative added to bottles? — Yes [ ] No [x] NA [ ]
11. Is the headspace in the VOA vials less than 1/4 inch or 6 mm? — Yes [ ] No [ ] No VOA Vials [x]
12. Were any sample containers received broken? — Yes [ ] No [x]
13. Does paperwork match bottle labels? — Yes [x] No [ ]
    (Note discrepancies on chain of custody)
14. Are matrices correctly identified on Chain of Custody? — Yes [x] No [ ]
15. Is it clear what analyses were requested? — Yes [x] No [ ]
16. Were all holding times able to be met? — Yes [x] No [ ]
    (If no, notify customer for authorization.)

Special Handling (if applicable)

17. Was client notified of all discrepancies with this order? — Yes [ ] No [ ] NA [x]

Person Notified:		Date:	
By Whom:		Via:	[ ] eMail [ ] Phone [ ] Fax [ ] In Person
Regarding:			
Client Instructions:			

18. Additional remarks:

    Project information (Address/state), preservation, and number of containers not recorded on COC.

Cooler Information

Cooler No	Temp ºC	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	5.0	Good	Not Present			

7940 Memorial Drive   Plain City, Ohio 43064   (614) 873-4654

Date: December 20, 2024

National Water Services LLC (1384)
Attn: Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

RE: Certificate of Analysis for Project - Private Drinking Water

The following report contains analytical results for samples submitted on the chain of custody dated December 18, 2024.

I have reviewed the validity of the analytical data generated. All data is reported in accordance to our laboratory QA/QC plan. Any exceptions are noted in the Case Narrative or with qualifiers in the report.

If you have any questions or need additional documentation, please contact our Office.

Sincerely,

Cheryl Rex
MASI Laboratories
QA/QC Officer
cheryl@masilabs.com
(614) 873-4654

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877

Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number:
Date Received: 12/18/24 17:04
Ohio EPA Analyzed Date: 12/20/24 12:49

Sampler Name: Josh Gavin
Sample Date/Time: 12/18/24 09:00
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren County Middletown Junction Well Field PW1

PWSID: Facility ID:
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165985

Lab Sample # : 4L02630-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Microbiology									
Total Coliform	Absence	/ 100 ml		N/A	N/A	12/18/24 17:06	12/19/24 11:06	EFMG	SM 9223 B

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877

Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number:
Date Received: 12/18/24 17:04
Ohio EPA Analyzed Date: 12/20/24 12:49

Sampler Name: Josh Gavin
Sample Date/Time: 12/18/24 09:30
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren County Middletown Junction Well Field PW1

PWSID: Facility ID:
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165985

Lab Sample # : 4L02630-02 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Microbiology									
Total Coliform	Absence	/ 100 ml		N/A	N/A	12/18/24 17:06	12/19/24 11:06	EFMG	SM 9223 B

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877

Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number:
Date Received: 12/18/24 17:04
Ohio EPA Analyzed Date: 12/20/24 12:49

Notes and Definitions

Item	Definition
mg/kg Dry	Sample results reported on a dry weight basis
ug/L	ppb/Part per Billion
mg/L	ppm/Part per Million
ng/L	ppt/Part per Trillion
ND	Analyte NOT DETECTED at or above the method detection limit (MDL)
!	Analyte is at or above the Maximum Contaminate Level
MDL	Method Detection Limit
CFU	Colony Forming Units
MPN	Most Probable Number
NTU	Nephelometric Turbidity Unit
pCi/L	Picocuries per liter
SVI	Sludge Volume Index
%	Percent
GPD	Gallons per Day
su	Standard Units

Notes:
1. Calculated analytes are based on raw data and may not reflect the rounding of the individual compounds.
2. Samples are analyzed using the information received on the request sheet and may not be analyzed when the parameters fall outside required guidelines.

MASI ®
ENVIRONMENTAL LABORATORIES
7940 Memorial Drive
Plain City, OH 43064
614-873-4654

New We[ll] ...[Sh]eet

Analysis Request

** See reverse

4L02626-01/03
AR # 165985
Received: 12/18/2024
Matrix: Potable

[Ti]tle: 165985

[...]n *:

Client #: 1384 Client Name: National Water Services County: ______ P.O.#______

Sampler Name: Josh Gavin SMP ID :______ Sample Type/Class: ( ) New Well/Special

Sample Tap: Spigot Date Collected: 12/18/24 (MM/DD/YY) Time Collected: 09:30 am (hh:mm am/pm)

Tap Address: Warren County Middletown Junction Well Field (PW-1)

( ) Public Sample ( ) PWS ID #: ______ ( ) Facility ID #: ______ Private

( ) (New Well Trans) Transient Noncommunity

( ) (New Well Nontrans) Nontransient-Noncommunity + PFAS

(X) (New Well Comm) Community Water Systems + PFAS

Work Order
4L0
2630-01/02
(Office Use Only)

Microbiological Tests

	Time Collected
(X) 140 Total Coliform #1	09:00 am hh:mm am/pm
(X) 140 Total Coliform #2	09:30 am hh:mm am/pm

Office Use Only:
9.2
FD
1700

Route	
Office/Lab	[signature]

COOLER

REVISED 2-15-23 DN