PUBLIC HEALTH DIVISION
Drinking Water Services
Kate Brown, Governor

Oregon Health Authority

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www.healthoregon.org/DWP

March 6, 2019

Ed Butts, PE
4B Engineering & Consulting, LLC
3700 River Road N
Suite 2
Keizer, OR 97303

Re: City of Monmouth (PWS ID#00537)
Cartridge Filtration Plant (PR#77-2017)
Final Approval

Dear Mr. Butts:

Thank you for your submittal to the Oregon Health Authority's Drinking Water Services (DWS) of plan review information for the filtration plant project for the City of Monmouth. On June 28, 2017, our office received a set of plans and a plan review fee of $3,300. An updated set of plans was provided to our office on July 7, 2017, which were conditionally approved for construction on August 18, 2017. As-builts were received at the time of the water system survey and plan review inspection, both of which were conducted on February 22, 2019.

Filtration Credit and Final Approval:
The filtration plant is granted Final Approval and the requirements in the Bilateral Compliance Agreement dated January 18, 2017 have been met. As part of this approval, the Harmsco cartridge filters are credited with 2.5-log removal for *Giardia* and 2.0-log credit removal for *Cryptosporidium*, provided the differential pressure does not exceed 25 psid across any one filter and flows do not exceed 800 gpm per filter (2,400 gpm total). Combined filter effluent turbidity and individual cartridge filter differential pressure is required to be monitored daily and reported to our office monthly. I strongly recommend that when needed, all the cartridge filters be changed out simultaneously.

Although Final Approval is granted for the newly constructed facilities, **pre-existing filter bypass piping was discovered following the site visit and will need to be removed**. This bypass will be more formally addressed in the water system survey report.

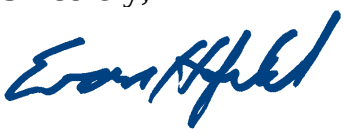
As part of this review, a tracer study was conducted for the 1.2 MG reservoir which demonstrated a total contact time of 85.4 minutes through a combination of pipeline and

storage at a flow rate of 1,550 gpm and a reservoir volume of 861,000 gallons. The tracer study results described above are acceptable with the following conditions: A contact time (T) of **85.4 minutes** can be used for the daily contact time (CT) calculations provided the reservoir volume does not drop below 861,000 gallons and the peak hourly demand flow leaving the contact reservoir does not increase over 10 percent of 1,550 gpm (i.e. cannot exceed 1,705 gpm). The CT parameters (chlorine residual, pH and temperature) must be measured daily from the first user sampling point at the end of the 6700' of 12" pipe to calculate CT required.

The lab sink at the treatment plant must be permanently posted as "non-potable" as it was agreed that there may be a risk of not having enough disinfection contact time at the treatment plant under all operating conditions.

More information on this project and tracer study is included on the following pages of this letter. This concludes the plan review process under PR#77-2017. Thank you for your cooperation during this process and if you have any questions or would like this information in an alternate format, please contact me at 971-673-0419 or via e-mail at evan.e.hofeld@state.or.us.

Sincerely,



Evan Hofeld, PE
Regional Engineer
Drinking Water Services

cc: Matt Johnson, City of Monmouth

Background and Project description:

City of Monmouth's Well #1 was determined to be under the influence of surface water and required surface water treatment in accordance with a Bilateral Compliance Agreement between the City of Monmouth and the Oregon Health Authority dated January 18, 2017. The project included installation of a cartridge filtration plant for surface water treatment and all four wells (wells #1, 2, 4 & 5) are filtered through the new system. The treatment installed included five (5) 10-micron VAF Model V-2000H screens ahead of three (3) Harmsco Muni-8-6FL-304 cartridge filter housings containing eight (8) Harmsco HC/170-LT2 cartridge filters per housing (800 gpm per housing), plumbed in parallel. the Harmsco cartridge filters are credited with 2.5-log removal for *Giardia* and 2.0-log credit removal for *Cryptosporidium*, provided the differential pressure does not exceed 25 psid across any one filter and flows do not exceed 800 gpm per filter (2,400 gpm total).

Disinfection Credit:

The tracer study completed by OAWU on April 26, 2017 for the 1.2 MG Permastore glass-fused-to-steel tank used for contact time. The tracer study demonstrated a total contact time of 85.4 minutes from the point of injection to the first user. was approved and documented in a letter from our office dated August 17, 2017. The conditions and results of the tracer study are summarized below:

Contact reservoir tracer study parameters:

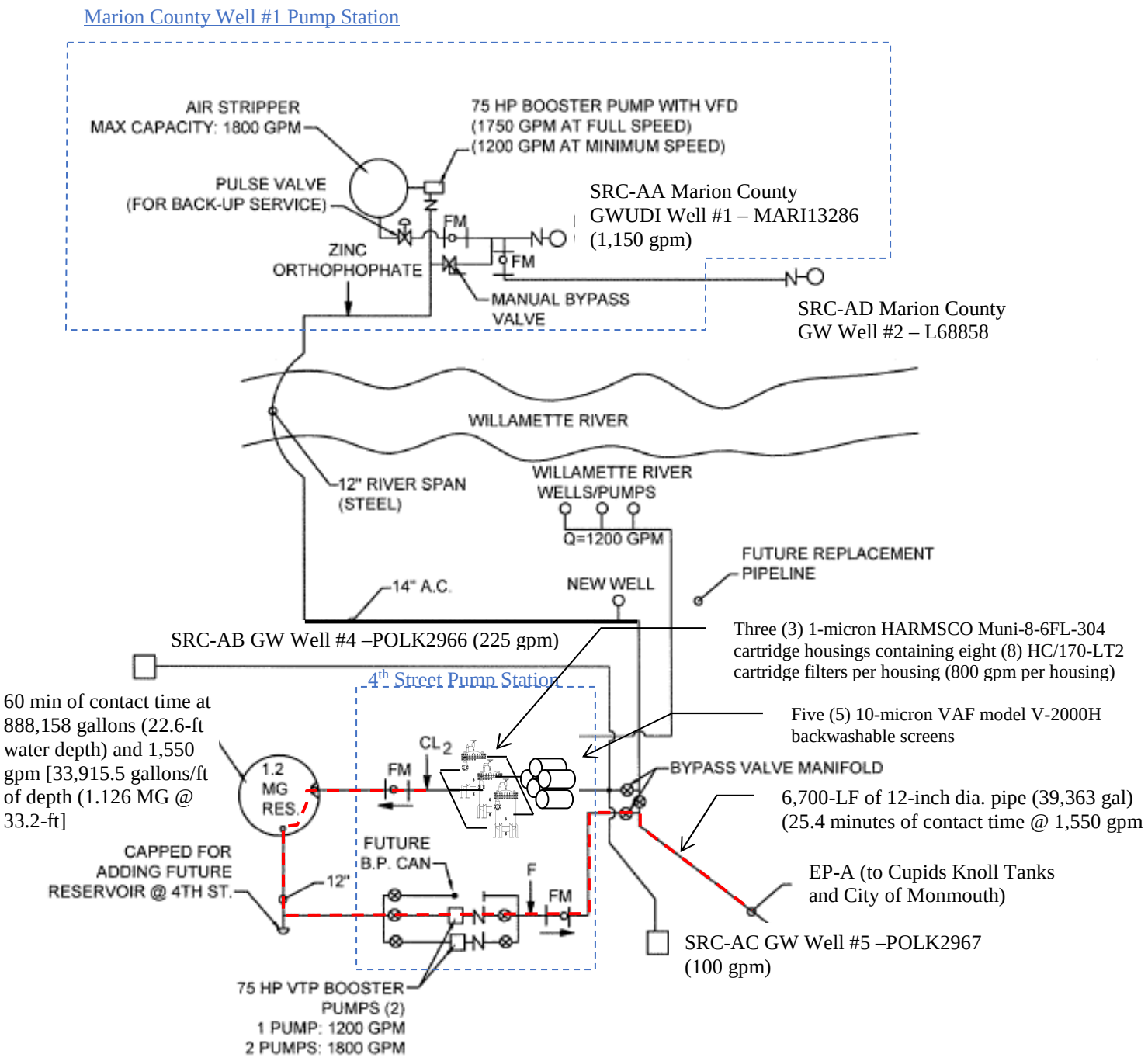
- Total tank volume: 1,250,000 gallons
- Tank volume used for tracer study (min) 861,000 gallons
- Peak Hourly Demand Flow 1,550 gpm
- Measured contact time (T) 60 minutes

(Measured contact time is based on a target chlorine residual of 0.74 mg/L measured at 60 minutes.)

Contact time in 12" pipe (from clearwell to first user)

- Pipe volume (length) 39,363 gallons (6,700 feet)
- Pump Rate 1,550 gpm
- Calculated contact time (T) 25.4 minutes

The tracer study results described above are acceptable with the following conditions: A contact time (T) of **85.4 minutes** can be used for the daily contact time (CT) calculations provided the reservoir volume does not drop below 861,000 gallons and the peak hourly demand flow leaving the contact reservoir does not increase over 10 percent of 1,550 gpm.



BLENDING CAPACITY FOR NITRATE EVENTS
WELL #4 = 225 GPM
WELL #5 = 100 GPM
NEW WELL = 125 GPM
450 GPM ≥ 350 GPM REQUIRED

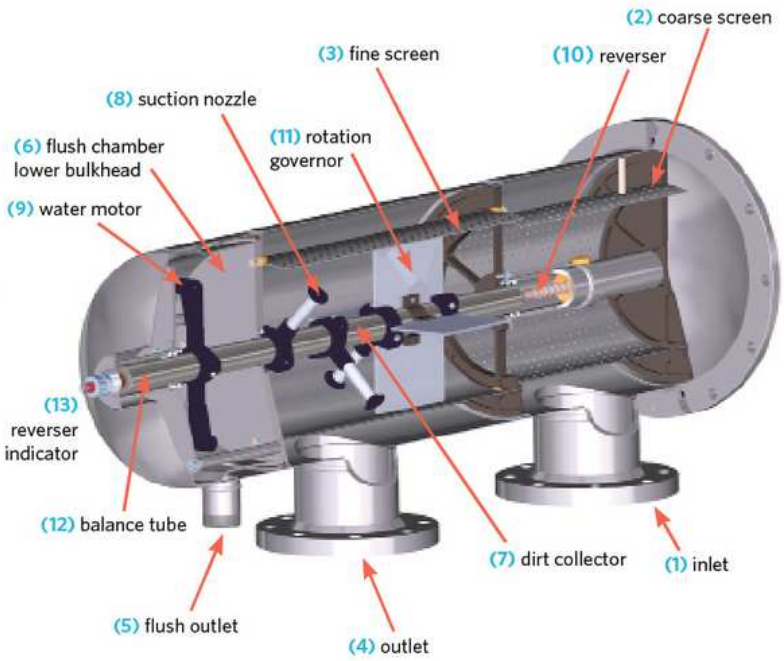
TOTAL AVAILABLE CAPACITY = 1150 GPM (MARION COUNTY) + 450 GPM (4TH STREET) = 1600 GPM

CITY OF MONMOUTH
SIMPLIFIED FLOW PATH

VAF V-2000H 10-micron screens

V-SERIES™ FILTER: HOW IT WORKS

Dirty water enters the filter through the inlet (1) and then passes through the coarse screen (2) from the outside in. It flows from the inside of the coarse screen to the inside of the fine screen and then passes through the fine screen (3) from the inside out. Dirt is collected on the inside surface of the fine screen. The clean filtered water then exits through the filter outlet (4) and on to the system.



As the dirt or cake builds up on the inside surface of the fine screen, the pressure drop across the screen increases. When the pressure drop (the DP or differential pressure) reaches a preset level of 0.5 bar (7 psi), the filter controller starts a flush cycle by opening a flush valve on the flush outlet (5). This flush valve exhausts the drive chamber to atmosphere at "0" psi.

The flush outlet is connected to the flush chamber which is separated from the filtration chamber by a lower bulkhead (6). However, the dirt collector (7) (a hollow pipe with suction nozzles) extends through the partition, thus providing a "path" from the suction nozzles (8) through the water motor (9), into the flush chamber and out the flush outlet to atmosphere. The pressure around the suction nozzle is the pressure inside the filter and as water flows through the "nozzle orifice," it drops to "0" psi when it leaves the flush outlet. This creates an aggressive "suction" at the suction nozzle opening. The suction nozzle clearance at the fine screen is very small so the extreme low pressure at the nozzle opening creates a vacuum causing backflow to pull the dirt from the fine screen.

The water motor has opposite facing jets near its ends. Water jetting out of these openings (coming from the suction nozzles) creates a reaction force (like a pin wheel) which rotates the motor and the dirt collector. As the dirt collector rotates, each suction nozzle cleans a band on the fine screen. As the dirt collector rotates, the reverser (10) (works like the level winder on a fishing reel) causes the water motor / dirt collector / suction nozzle assembly to move back and forth on a controlled path. This ensures proper overlap for 100% cleaning of the screen's inner surface.

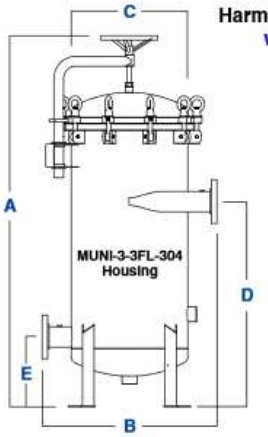
The rotation governor (11) helps control the rotation speed of the dirt collector assembly. The balance tube (12) helps balance the transverse pressure on the assembly. A magnet located on the end of the balance tube repels the reverser indicator (13) which provides visual indication of the dirt collector assembly movement. This indicates that that the entire cleaning system is operating properly during the rinse cycle.

After a preset time, the flush valve closes and the flushing cycle is complete. Minimal water is used for each flush, and the filter continues to supply water to the system during the flush cycle.

Models

Model Number	Screen Area		Nominal Flow										Flush Line	Flush Volume 15 Seconds	
			25 micron		50 micron		100 micron		150 micron		200 micron				
	in^2	cm^2	gpm	m^3/hr	gpm	m^3/hr	gpm	m^3/hr	gpm	m^3/hr	gpm	m^3/hr	in	gal	liters
V-250	224	1445	134	30	181	41	276	63	320	73	360	82	1.5 NPT	8	30
V-500	448	2890	269	61	363	82	551	125	640	148	720	164	1.5 NPT	15	57
V-1000	867	5594	520	118	702	159	1066	242	1220	277	1410	320	2 NPT	15	57
V-1500	1300	8387	780	177	1053	239	1599	363	1850	420	2120	482	2 NPT	23	87
V-2000H	1696	10942	1018	231	1374	312	2086	474	2420	553	2780	632	2 NPT	33	125
V-3 VERT	1696	10942	1018	231	1374	312	2086	474	2420	553	2780	632	3 flange	33	125
V-3500	3060	19742	1836	417	2479	563	3764	855	3990	906	5010	1139	3 flange	44	167
V-8000	6784	43768	4072	924	5496	1248	8344	1896	9680	2212	11120	2528	3 flange (x4)	132	500

HARMSCO® MUNICIPAL Filtration Systems



Harmsco HURRICANE® Animation:
www.harmsco.com/z/100

NSF Certified to ANSI-NSF 61

Certified: NSF/ANSI Standard 61
Drinking Water System Components - Health Effects

MUNI-1-2FL-304 MUNI-3-3FL-304 MUNI-5-4FL-304 MUNI-8-6FL-304

Filter Model	A Filter Height	B Width	C Diameter	D Inlet	E Outlet	Pipe Size I/O NPS	Drain Size NPT	Floor Space	Service Height	Shipping Wt. (lbs.)
MUNI-1-2FL-304	48"	15-1/2"	11"	23-5/8"	9-3/4"	2" Flange	3/4"	1.6 ft²	77"	150
MUNI-3-3FL-304	64"	30"	20"	35-1/4"	12"	3" Flange	1-1/2"	4.5 ft²	98-1/2"	420
MUNI-5-4FL-304	74"	37-1/2"	30"	38"	14-1/8"	4" Flange	1-1/2"	8.5 ft²	98-1/2"	1,100
MUNI-8-6FL-304	84"	45-1/4"	35-3/8"	44-1/4"	20-1/2"	6" Flange	1-1/2"	14 ft²	104-1/2"	1,600

Design Recommendations

Pre-filtration is always recommended due to potential changes in environmental conditions. Turbidity must not exceed 1-NTU prior to final filtration stage (HC/170-LT2 cartridge). For more information please contact Harmsco Filtration Products.

Pre-Filtration

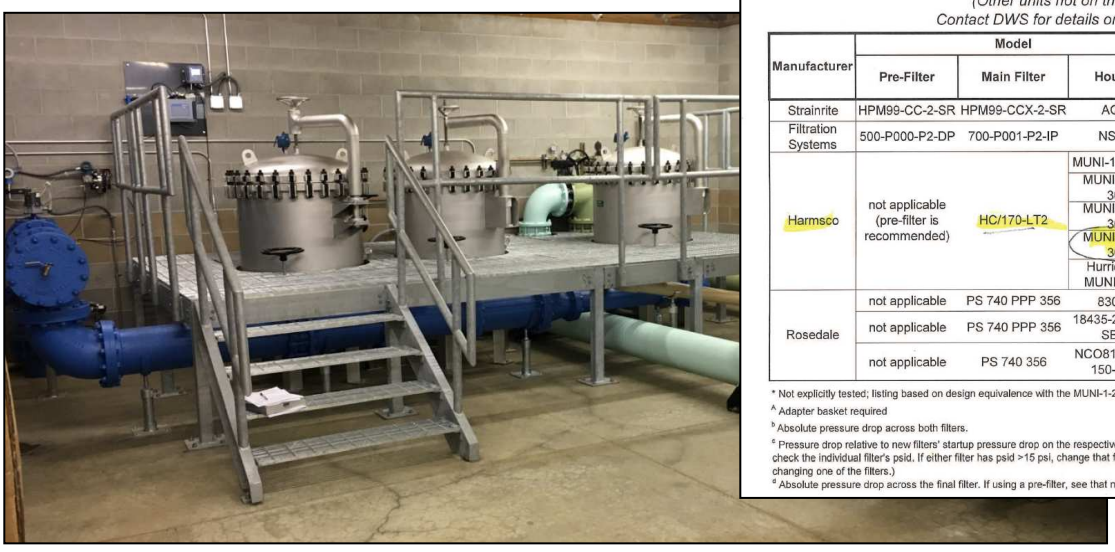
Filter Model	NO. of Cartridges	Pleated Media Area (sq.ft.)	Max Flow Rate (GPM)	Max Flow Rate (LPM)	Max Flow Rate (M³/HR)
MUNI-1-2FL-304	1	170	150	568	34
MUNI-3-3FL-304	3	510	450	1,703	102
MUNI-5-4FL-304	5	850	750	2,839	170
MUNI-8-6FL-304	8	1,360	1,200	4,542	272

Final Stage

Filter Model	NO. of Cartridges	Pleated Media Area (sq.ft.)	Max Flow Rate (GPM)	Max Flow Rate (LPM)	Max Flow Rate (M³/HR)
MUNI-1-2FL-304	1	120	100	378	23
MUNI-3-3FL-304	3	360	300	1,135	68
MUNI-5-4FL-304	5	600	500	1,892	113
MUNI-8-6FL-304	8	960	800	3,028	181

Filter Specifications

- 304L or 316L stainless steel, electropolished
- Built to ASME design standards (not code stamped)
- Standpipe - 304L or 316L stainless steel
- Inlet/Outlet - flanged connections
- NSF 61 Listed Ball Valves (2) - 316 stainless steel
- O-ring housing seal, swing bolt closure
- NSF 61 Listed Pressure Gauges (2) - 316 stainless steel
- Pressure - 150 psi (10 bar) max.
- Temperature* - up to 140˚F (60˚C) with standard cartridges



Alternative Treatment Technology Units Meeting Challenge Study Criteria
CARTRIDGE & BAG FILTERS: Oregon Administrative Rule 333-061-0050(4)(c)(J)
Oregon Health Authority, Drinking Water Services (DWS)

(Other units not on this list may meet the criteria.
Contact DWS for details on verfications for units not listed.)

Manufacturer	Model: Pre-Filter	Model: Main Filter	Model: Housing	Log_{10} Removal Credit: *Crypto.*	*Giardia*	Virus	Maximum Flow/Module (gpm)	Maximum Pressure Drop (psi @ 20°C)
Strainrite	HPM99-CC-2-SR	HPM99-CCX-2-SR	AQ2-2	2.0	2.0	0	20	25[b]
Filtration Systems	500-P000-P2-DP	700-P001-P2-IP	NS-122	2.0	2.0	0	15	15[c]
Harmsco	not applicable (pre-filter is recommended)	HC/170-LT2	MUNI-1-2FL-304	2.0	2.5	0	100	25[d]
			MUNI-3-3FL-304*	2.0	2.5	0	300	25[d]
			MUNI-5-4FL-304*	2.0	2.5	0	500	25[d]
			MUNI-8-6FL-304*	2.0	2.5	0	800	25[d]
			Hurricane™ MUNI 90 MP	2.0	2.5	0	65	30[d]
Rosedale	not applicable	PS 740 PPP 356	830-2P[A]	2.0	2.0	0	10	15[d]
	not applicable	PS 740 PPP 356	18435-2F-1-150-SB700	2.0	2.0	0	80	31[d]
	not applicable	PS 740 356	NCO8135-2P-1-150-S-700	2.0	2.0	0	80	31[d]

* Not explicitly tested; listing based on design equivalence with the MUNI-1-2FL-304.

[A] Adapter basket required

[b] Absolute pressure drop across both filters.

[c] Pressure drop relative to new filters' startup pressure drop on the respective filters (pre- or final). For example, if the psid across both filters exceeds 15 psi, check the individual filter's psid. If either filter has psid >15 psi, change that filter. (This does not imply the total psid across both filters should be 30 psi before changing one of the filters.)

[d] Absolute pressure drop across the final filter. If using a pre-filter, see that manufacturer's specifications for that device.

Permastore Glass-Fused-To-Steel 1.2 MG tank (tank model #7640 SR) – Manuf. 8-23-10.

- Nominal Capacity = 1,238,016 gallons (4,686.4 m^3)
- Nominal Height = 36.84-ft (11.23 m)
- Diameter = 75.64-ft (23.055 m)
- Base Area = 4,472.4-ft^2 (417.5 m^2)

Nominal Capacity / Nominal Height = 33,605 gallons/ft of depth