ATTACHMENT H

BOREHOLE STORAGE VOLUME CALCULATIONS

PROCEDURE FOR CALCULATING WELL BORE STORAGE VOLUME

The following well specifications are needed to accurately determine the Well Bore Storage Volume (WBSV) and ultimately, the volume of water to be purged from the well during well development.

Total Depth (TD) of well: _____

Depth to Water (DTW) in the well: _____

Nominal Diameter of Casing/Screen: _____

Diameter of Borehole: _____

Depth to Top of Filter Pack: _____

Pore Volume of Filter Pack: _____
(assume a porosity of 25% if unknown)

Calculate the WBSV using the following mathematical formula:

$$\text{WBSV (gallons)} = \pi(r_1)^2h_1 + 0.25\,(\pi(r_2)^2h_2 - \pi(r_1)^2h_2)$$

Where: π (pi) = 3.1416
r_1 = radius of well casing/screen
h_1 = TD minus DTW
r_2 = radius of borehole
h_2 = TD minus Depth to Top of Filter Pack
0.25 = assumed porosity of Filter Pack
r_1, h_1, r_2, h_2 units = inches

Example:

TD = 50 feet
DTW = 30 feet
Nominal Diameter of Casing/Screen = 2 inches
Diameter of Borehole = 8 inches
Depth to Top of Filter Pack = 35 feet
Porosity (assumed) = 25%

$$\text{WBSV (gallons)} = \pi(r_1)^2h_1 + 0.25\,(\pi(r_2)^2h_2 - \pi(r_1)^2h_2)$$

$$\begin{aligned}
\text{WBSV} &= 3.1416\,(1'')^2(240'') + .025[3.1416(4'')^2(180'') - 3.1416(1'')^2(180'')] \\
&= 753.984 + .025[9047.808 - 565.488] \\
&= 753.984 + .025[8482.32] \\
&= 2874.564\ \text{in}^3\ /\ 1728\ \text{in}^3/\text{ft}^3 \\
&= 1.644\ \text{ft}^3 \times 7.4809\ \text{gallons/ft}^3 \\
&= 12.45\ \text{gallons}
\end{aligned}$$

Where: $\text{ft}^3 = 1728\ \text{in}^3$ and $\text{ft}^3 = 7.4809$ gallons

VOLUME OF WATER IN CASING OR HOLE

Diameter of Casing or Hole (in)	Gallons per foot of Depth	Cubic Feet per Foot of Depth	Liters per Meter of Depth	Cubic Meters per Meter of Depth
1	0.041	0.006	0.509	0.509×10^{-3}
1 1/2	0.092	0.012	1.142	1.142×10^{-3}
2	0.163	0.022	2.024	2.024×10^{-3}
2 1/2	0.255	0.034	3.167	3.167×10^{-3}
3	0.367	0.049	4.558	4.558×10^{-3}
3 1/2	0.500	0.067	6.209	6.209×10^{-3}
4	0.653	0.087	8.110	8.110×10^{-3}
4 1/2	0.083	0.110	10.26	10.26×10^{-3}
5	1.020	0.136	12.67	12.67×10^{-3}
5 1/2	1.234	0.165	15.33	15.33×10^{-3}
6	1.469	0.196	18.24	18.24×10^{-3}
7	2.000	0.267	24.84	24.84×10^{-3}
8	2.611	0.349	32.43	32.43×10^{-3}
9	3.305	0.442	41.04	41.04×10^{-3}
10	4.080	0.545	50.67	50.67×10^{-3}
11	4.937	0.660	61.31	61.31×10^{-3}
12	5.875	0.785	72.96	72.96×10^{-3}
14	8.000	1.069	99.35	99.35×10^{-3}
16	10.440	1.396	129.65	129.65×10^{-3}
18	13.220	1.767	164.18	164.18×10^{-3}
20	16.320	2.182	202.68	202.68×10^{-3}
22	19.750	2.640	245.28	245.28×10^{-3}
24	23.500	3.142	291.85	291.85×10^{-3}
26	27.580	3.687	342.52	342.52×10^{-3}
28	32.000	4.276	397.41	397.41×10^{-3}
30	36.720	4.909	456.02	456.02×10^{-3}
32	41.780	5.585	518.87	518.87×10^{-3}
34	47.160	6.305	585.68	585.68×10^{-3}
36	52.880	7.069	656.72	656.72×10^{-3}

1 Gallon = 3.785 Liters
1 Meter = 3.281 Feet
1 Gallon Water Weighs 8.33 lbs. = 3.785 Kilograms
1 Liter Water Weighs 1 Kilogram = 2.205 lbs.
1 Gallon per foot of depth = 12.419 liters per foot of depth
1 Gallon per meter of depth = 12.419×10^{-3} cubic meters per meter of depth