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Savannah River Site

BSW Well Evaluation Report

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BSW Well Evaluation Report

Background

The BSW series wells are located in the Mixed Waste Management Facility and are part of the groundwater monitoring program at Savannah River Site. These wells have had persistent problems that prevent successful sampling that dates back to their installation. Only thirty-two of the fifty-three BSW wells were successfully sampled during 4th quarter, 2001. These problems were previously investigated by looking at field sampling logbooks from 4th quarter 2001 and other background information to try to identify causes for the high rate of sampling failure. Several possible causes were identified and reported in memorandum, SRT-EST-2002-00059. The memorandum recommended that an evaluation be performed on each well to identify problems and their causes and to correct them when possible. Environmental Restoration Division followed up on this recommendation and requested Savannah River Technology Center to perform an evaluation. This report includes the results of the evaluation performed on the BSW wells.

Method

The test method used for the BSW wells was basically the same as the method used during the BSE well evaluation with one exception. Instead of performing an initial test on each well with the existing sample tubing and one-way foot valve, new tubing and one-way valves were immediately installed in all of the BSW wells before testing began. This test modification was made because the new tubing proved to be far superior to the tubing currently being used, so no benefit could be expected by testing the original equipment again on the BSW wells.

Acceptable purge rate limits were established during the BSE well evaluation and were set at 0.06 gpm or higher which was considered a reasonable purge rate for the BSE and BSW well design. To put this purge rate into perspective, a purge rate of 0.06 gpm would take 16 minutes to purge one gallon. Turbidity levels of 15 NTU or less were considered acceptable as stated in the 3Q5 Manual.

Testing consisted of aggressive purging and monitoring flow rate and turbidity to determine each well's optimum operating parameters. Other notable characteristics unique to each well such as slow recharge rates, silt or sand present in purge water, or other significant characteristics were also recorded. Multiple well volumes were purged and turbidity and flow rates were measured at regular intervals. If the well operated within normal parameters, no additional work was required and the evaluation was considered complete for that well.

If purge rates were unacceptable or if the well did not produce any purge water at all, the sample tubing and the one-way foot valve were pulled out of the well and checked for damage and sediment deposits on the one-way foot valve. If this did not correct the problem, the well was tested to see if there was sufficient recharge. This was accomplished by pulling out the sample tubing immediately after a failed test and

lowering a water level tape into the well to observe the recharge rate. This proved to be a good method for determining whether the well was recharging quickly enough to maintain a steady purge rate. An average time of approximately 3 hours was spent on each of the fifty-three BSW wells and an average of thirteen gallons was purged from each well.

Turbidity was monitored at intervals of ten to fifteen minutes and recorded in the daily field records that are included as Appendix 1. If the turbidity showed a fast decline and looked like it would drop below 15 NTU in a reasonable time, the test would continue until the turbidity was within the range limit or began to level out. If the turbidity began to level out, indicating the turbidity would not reach 15 NTU within a reasonable time, the test would cease.

Results

Only seven of the fifty-three BSW wells produced both acceptable purge rates and turbidity as shown in Table 1. Thirty-three other BSW wells also had acceptable purge rates, but did not meet the turbidity requirements of <15 NTU and one well did not meet either criteria. Additionally, ten of the fifty-three BSW wells were determined to be either dry or the recharge rate was too slow to sustain a steady purge rate. And one well needed repairs that could not be performed during this evaluation preventing a final determination of its functionality.

Table 1: BSW Wells with Acceptable Turbidity and Flow Rates

well name and sample port #	water level (ft.)	well depth (ft.)	final turbidity (NTU)	purge rate (gpm)
BSW-01D-3	38	62	1	0.13
BSW-02D-3	23	54	9	0.14
BSW-03D-2	39	55	7	0.14
BSW-04D-2	48	63	9	0.09
BSW-05C-2	45	92	14	0.27
BSW-05C-3	45	111	14	0.27
BSW-08D-2	16	35	13	0.11

All but one of the BSW wells had acceptable purge rates of higher than 0.06 gpm excluding the ten dry/no recharge wells and the one well that needed repairs. A different type of HDPE sample tubing was purchased for the BSE and BSW well evaluation and proved to be very effective in improving purge rates so it was immediately installed in all of the BSW wells before well evaluation testing began. As with the BSE well, the new tubing made the most significant improvement in purge rates in the deeper BSW wells. Final sustainable purge rates for the BSW wells ranged from 0.27 gpm (four minutes to purge one gallon) to 0.05 gpm (twenty minutes to purge one gallon). Attachment 1 shows the evaluation purge rate results. Also included in Attachment 1 for comparison, are the original purge rates as recorded during the BSW well installation and development (WSRC-RP-2000-4137). The average purge rate for the BSW wells during this evaluation was 0.17 gpm compared to the original purge rates recorded during the original well development which averaged 0.07 gpm.

Only seven of the fifty-three BSW wells exhibited acceptable turbidity levels below 15 NTU. Twenty-one of the wells had turbidity values between 15 and 200 NTU, and fourteen wells had turbidity values >200 NTU as shown in Table 2. Attachment 2 shows the final turbidity results for each well after the evaluation was completed. During this evaluation the turbidity dropped during purging in most of the wells, but usually very slowly and as the turbidity dropped so did the rate of decrease. The daily field records (Appendix 1) show turbidity recorded at regular intervals during evaluation.

The high turbidity problem in the BSW wells dates back to the original installation and development at the time the BSW wells were installed in 2000. For example, after the BSW wells were installed and developed, only six of the BSW wells had a final turbidity of less than 15 NTU, one less then during this evaluation. The final turbidity results from the BSW well installation and development have been included as part of Attachment 2.

Table 2: Final Turbidity Results

# of BSW wells during evaluation	final turbidity
7	< 15 NTU
21	15 – 200 NTU
14	> 200
10	Dry wells/insufficient recharge
1	Repairs needed to complete evaluation
53	Total BSW wells

Ten of the BSW wells were either dry or the recharge rate was too slow to produce a steady purge rate as shown in Table 3. Seven of these wells are water table wells with very little water in them, which explains why they are not producing any purge water. Three are much deeper with plenty of water. These three wells may have clogged screens or they were installed in a very clayey formation that does not yield enough water. Eight of these ten BSW wells exhibited the same problems when they were installed as documented in the BSW well installation report.

Table 3: Dry or insufficient recharge

well name and sample port #	water level (ft.)	well depth (ft.)	water column height (ft.)	Comments from field evaluation
* BSW-02D-1	22	25	3	Tried pumping but no water to surface. Checked tubing and valve for damage. Checked water level and only 6 in. of water in well .Dry.
* BSW-03C-1	43	80	37	Installed new tubing and valve. Well is pumping dry. Recovery very slow. Checked recovery rate with water level tape to confirm.
* BSW-03C-2	45	98	53	Installed new tubing and valve. Well is pumping dry. Recovery very slow. Checked recovery rate with water level tape to confirm.
* BSW-03D-1	39	41	2	Did not replaced tubing or valve. Tried pumping but no water to surface. Checked water level and well has only 4 inches of water. Dry well.
* BSW-04D-1	47	49	2	Dry.
BSW-05D-1	40	43	3	Dry well. Installed new tubing. No water to surface. 5" of water in well.
BSW-06C-1	34	69	35	Installed new tubing. Low water level, very slow recovery rate.
* BSW-06D-1	31	31	0	Dry well as stated on well I.D. sign.
* BSW-06D-2	31	37	6	Installed new tubing. Very slow recovery.
* BSW-07D-1	37	42	5	Installed new tubing. No water to surface. 5 in. of water in well.

* Eight wells that were dry/insufficient recharge during original installation and development

Well BSW-5D-2 could not be tested because the sample port had fallen down into the well and could not be repaired. To repair this problem, the well cap has to be removed. This was not possible because the protective metal casing that surrounds the well was installed incorrectly and is blocking access to the cap. The protective casing will have to be shortened so the screws that remove the well head can be accessed.

Observations

All of the wells are now functioning at their optimum level with most of the problems corrected except for ten wells that are either dry or insufficient recharge, and one well that was not tested because of structural problem with the well casing (See Attachment 2 for complete BSW well evaluation results). The new tubing appears to solve many of the recurring problems as stated in the BSE Well Evaluation Report (WSRC-TR-2002-00222), especially slow purge rates that have been associated with the BSW wells. However, the high turbidity problem has not improved.

The turbidity problem dates back to the installation and development of the BSW wells in 2000. Even after purging an average of 54 gallons from each well during the development stage of the well installation, turbidity only dropped below 15 NTU in six wells. Over 100 gallons were purged out of several of the BSW wells and elevated turbidity levels still remained in these wells.

Recommendations

High turbidity is clearly the most significant problem associated with the BSW wells and cannot be corrected. The inorganic metals listed as Groundwater Protection Standard Constituents for the BSW wells should be considered for removal because of the negative impact high turbidity has on the accuracy of analytical results. Elevated metals, which are not representative of the groundwater, have been associated with high turbidity in other wells in the Mixed Waste Management facility as documented in memorandum SRT-EST-2001-0000163. This happens because a large percentage of the suspended matter in a water sample may contain adsorbed metals. If the particulates are not removed by filtering, the adsorbed metals will desorb from the surface when the water sample is acidified resulting in elevated metals not representative of the groundwater. Other possible approaches are:

1) Filter samples from these wells that are for metals analysis.
2) Based on previous metals results from these wells and previous work, SRT-EST-2001-0000163, establish a criteria below which you assume that values are the result of the turbidity problem.

The ten wells that were dry or had insufficient recharge to maintain a steady purge should be removed from the sample list. No effort should be made to redevelop these wells since eight of the ten wells were also found to be dry or have an insufficient recharge during the original development as stated in the BSW well installation report. These ten wells can be utilized only for water level measurements in the future. In addition to these ten wells, BSW-04C-1 should be taken off the sample list because it did not have either acceptable purge rate or turbidity level and only should be used only for water level measurements.

Sample tubing should remain in the wells unless maintenance is required. Experience has shown that removing the sample tubing to take water level measurements is detrimental to sampling success. The action of retrieving and redeploying the sample tubing causes tubing failure and could cause increased turbidity. Therefore these wells can only be utilized for either sampling or water level measurements. The only way to successfully perform both functions is to measure the water level inside the sample tubing. This would only work if the one-way foot valve leaks enough to maintain static water level within the sample tubing. Currently there are no water level tapes small enough to deploy down the ¼ inch inside diameter of the sample tubing.

Repair work should be made to BSW-5D-2 so it can be tested to determine its functionality.

Two areas of work that remain to be completed which will be important to the future productivity of the BSE wells are more training for the samplers, written sampling guidelines and developing a maintenance program.

References

Noonkester, Jay, V. 2002, Investigating BSE and BSW Well Problems, SRT-EST-2002-00059.

Well Installation Report for the Burial Ground Southwest Plume Multi-level Groundwater Monitoring Wells, 2000, WSRC-RP-2000-4137.

Noonkester, Jay, V. 2002, BSE Well Evaluation Report, WSRC-TR-2002-00222.

Millings, Margaret, R. 2001, Evaluation of Physical and External Effects on Metal Trends in Monitoring Wells in the Southwest Plume at the MWMF, SRT-EST-2001-0000163.

Attachment 1: Flow Rates for the BSW Wells

well name and sample port #	water level (ft)	well depth (ft.)	BSW evaluation purge rate (gpm)	original well development (gpm)	water column height
BSW-05C-3	45	111	**0.27**	0.05	66
BSW-05C-2	45	92	**0.27**	0.09	47
BSW-01C-4	44	110	**0.25**	0.03	66
BSW-01C-3	43	102	**0.25**	0.05	59
BSW-05C-4	45	123	**0.25**	0.06	78
BSW-04C-2	50	112	**0.25**	0.08	62
BSW-07C-3	38	104	**0.25**	0.10	66
BSW-06C-2	34	80	**0.25**	0.12	46
BSW-08C-3	18	93	**0.25**	0.17	75
BSW-07C-1	36	78	**0.25**	0.18	42
BSW-07C-2	37	91	**0.25**	0.21	54
BSW-08C-2	18	72	**0.25**	0.21	54
BSW-01C-1	43	75	**0.22**	0.02	32
BSW-06C-4	34	106	**0.22**	0.11	72
BSW-06C-3	35	87	**0.22**	0.12	52
BSW-02C-3	28	105	**0.20**	0.07	77
BSW-02C-2	29	97	**0.20**	0.11	68
BSW-01C-2	43	85	**0.20**	0.15	42
BSW-03C-3	45	110	**0.17**	0.02	65
BSW-08D-3	16	41	**0.17**	0.29	25
BSW-03C-4	45	124	**0.14**	0.04	79
BSW-02D-3	23	54	**0.14**	0.08	31
BSW-05C-1	44	82	**0.14**	0.09	38
BSW-03D-2	39	55	**0.14**	0.09	16
BSW-08C-1	17	57	**0.14**	0.16	40
BSW-05D-3	41	62	**0.14**	0.20	21
BSW-04C-3	50	127	**0.14**	0.06	77
BSW-01D-2	38	49	**0.13**	0.11	11
BSW-01D-3	38	62	**0.13**	0.10	24
BSW-06D-3	31	46	**0.13**	0.14	15
BSW-07D-3	35	64	**0.13**	0.19	29
BSW-05D-2	42	53	**0.13**	0.32	11
BSW-07D-2	38	51	**0.12**	0.24	13
BSW-08C-4	19	106	**0.11**	0.08	87
BSW-08D-2	16	35	**0.11**	0.13	19
BSW-04D-3	49	69	**0.10**	0.15	20
BSW-07C-4	39	122	**0.10**	0.21	83
BSW-04D-2	48	63	**0.09**	0.15	15
BSW-02C-1	27	73	**0.08**	0.12	46
BSW-02D-2	22	31	**0.08**	0.13	9
BSW-08D-1	16	23	**0.08**	0.15	7
BSW-01D-1	38	41	**0.07**	0.11	3
BSW-04C-1	51	95	**0.05**	0.07	44
BSW-06D-1	31	31	**dry/slow recharge**	0.00	0

well name and sample port #	water level (ft)	well depth (ft.)	BSW evaluation purge rate (gpm)	Original well development (gpm)	water column height
BSW-07D-1	37	42	**dry/slow recharge**	0.00	5
BSW-06D-2	31	37	**dry/slow recharge**	0.00	6
BSW-04D-1	47	49	**dry/slow recharge**	0.00	2
BSW-02D-1	22	25	**dry/slow recharge**	0.00	3
BSW-03D-1	39	41	**dry/slow recharge**	0.00	2
BSW-03C-2	45	98	**dry/slow recharge**	0.01	53
BSW-03C-1	43	80	**dry/slow recharge**	0.01	37
BSW-06C-1	34	69	**dry/slow recharge**	0.06	35
BSW-05D-1	40	43	**dry/slow recharge**	0.07	3

Attachment 2: Final Results from the Evaluation

BSW Well Evaluation Results								Original Development Results	
well name and sample port #	**water level (ft.)**	**well depth (ft.)**	**final turbidity (NTU)**	**purge rate (gpm)**	**total amount purged (gal.)**	**well volume (gal.)**	**comments**	*turbidity (NTU)*	*purge rate gal/min*
BSW-01C-1	43	75	89	0.22	18.0	0.6	Installed new tubing and valve.	*413*	*0.02*
BSW-01C-2	43	85	>200	0.20	18.0	0.8	Installed new tubing and valve. Turbidity seemed stable and milky looking.	*>1000*	*0.15*
BSW-01C-3	43	102	>200	0.25	18.0	1.2	Installed new tubing and valve. Turbidity seemed stable and milky looking.	*480*	*0.05*
BSW-01C-4	44	110	52	0.25	24.0	1.3	Installed new tubing.	*54*	*0.03*
BSW-01D-1	38	41	103	0.07	6.0	0.1	Installed new tubing. Low well volume is the cause of slow purge rate.	*467*	*0.11*
BSW-01D-2	38	49	16	0.13	10.0	0.2	Installed new tubing.	*417*	*0.11*
BSW-01D-3	38	62	1	0.13	6.0	0.5	Installed new tubing.	*6*	*0.10*
BSW-02C-1	27	73	>200	0.08	5.0	1.0	Installed new tubing and valve	*>1000*	*0.12*
BSW-02C-2	29	97	80	0.20	12.0	1.4	Installed new tubing and valve.	*>1000*	*0.11*
BSW-02C-3	28	105	>200	0.20	20.0	0.9	Installed new tubing.	*225*	*0.07*
BSW-02D-1	22	25	-	-	-	-	Tried pumping but no water to surface. Checked tubing and valve for damage. Checked w.l. only 6 inches of water in well .Dry.	*>1000*	*0.00*
BSW-02D-2	22	31	>200	0.08	6.0	0.2	Installed new tubing and valve.	*>1000*	*0.13*
BSW-02D-3	23	54	9	0.14	4.0	0.6	Installed new tubing and valve. Well port was missing. Had to remove well head and retrieve and reset port.	*28*	*0.08*
BSW-03C-1	43	80	-	0.02	<1	0.7	Installed new tubing and valve. Well pumping dry. Recovery very slow. Checked recovery rate with w.l. tape to confirm.	*438*	*0.01*
BSW-03C-2	45	98	>200	0.02	1.0	1.0	Installed new tubing and valve. Well pumping dry. Recovery very slow. Checked recovery rate with w.l. tape to confirm.	*46*	*0.01*
BSW-03C-3	45	110	173	0.17	9.0	1.3	Installed new tubing and valve. Some very fine sand with first couple gallons of purge water.	*84*	*0.02*
BSW-03C-4	45	124	>200	0.14	10.0	1.6	Installed new tubing and valve. Very fine sand present in purge water.	*>1000*	*0.04*

well name and sample port #	water level (FT)	well depth (ft.)	final turbidity (NTU)	purge rate (gpm)	total amount purged (gal.)	well volume (gal.)	comments	*turbidity (NTU)*	*purge rate gal/min*
BSW-03D-1	39	41	-	-	-	-	Did not replaced tubing or valve. Tried pumping but no water to surface. Checked w.l. and well has only 4 inches of water. Dry well.	-	*0.00*
BSW-03D-2	39	55	7	0.14	4.5	0.3	Did not replace tubing or valve.	*14*	*0.09*
BSW-04C-1	51	95	>200	0.05	8.0	0.9	Installed new tubing. Water has a gray-white color.	*>1000*	*0.07*
BSW-04C-2	50	112	31	0.25	24.0	1.2	Installed new tubing.	*430*	*0.08*
BSW-04C-3	50	127	>200	0.14	12.0	1.5	Installed new tubing. Water has gray tint.	*>1000*	*0.06*
BSW-04D-1	47	49	-	-	-	-	Dry	-	*0.00*
BSW-04D-2	48	63	9	0.09	5.0	0.3	Installed new tubing.	*270*	*0.15*
BSW-04D-3	49	69	30	0.10	10.0	0.4	Installed new tubing.	*114*	*0.15*
BSW-05C-1	44	82	28	0.14	12.0	0.8	Installed new tubing.	*42*	*0.09*
BSW-05C-2	45	92	14	0.27	15.0	1.2	Installed new tubing.	*13*	*0.09*
BSW-05C-3	45	111	14	0.27	12.0	1.3	Installed new tubing.	*0*	*0.05*
BSW-05C-4	45	123	25	0.25	18.0	1.6	Installed new tubing.	*4*	*0.06*
BSW-05D-1	40	43	-	-	-	-	Dry well. Installed new tubing. No water to surface. 5" of water in well.	*440*	*0.07*
BSW-05D-2	42	53	9	0.13	1.0	0.2	Installed new tubing. Pumped dry after 1.2 gal. purged. Very slow recovery. Sample port fallen down well head and can not be repaired without major work.	*110*	*0.32*
BSW-05D-3	41	62	44	0.14	6.0	0.4	Installed new tubing.	*24*	*0.20*
BSW-06C-1	34	69	190	-	2.0	-	Installed new tubing. Low water level, very slow recovery rate.	*408*	*0.06*
BSW-06C-2	34	80	56	0.25	20.0	0.9	Installed new tubing.	*114*	*0.12*
BSW-06C-3	35	87	72	0.22	6.0	1.0	Installed new tubing.	*286*	*0.12*
BSW-06C-4	34	106	31	0.22	6.0	1.4	Installed new tubing.	*29*	*0.11*
BSW-06D-1	31	31	-	-	-	-	Dry well as stated on well I.D. sign.	-	*0.00*
BSW-06D-2	31	37	165	0.03	3.0	0.1	Installed new tubing. Very slow recovery.	-	*0.00*
BSW-06D-3	31	46	>200	0.13	6.0	0.3	Installed new tubing. Turbidity going up.	*300*	*0.14*
BSW-07C-1	36	78	119	0.25	18.0	0.8	Installed new tubing.	*950*	*0.18*
BSW-07C-2	37	91	>200	0.25	33.0	1.1	Installed new tubing.	*710*	*0.21*
BSW-07C-3	38	104	65	0.25	16.0	1.3	Installed new tubing.	*975*	*0.10*
BSW-07C-4	39	122	161	0.10	6.5	1.7	Installed new tubing. Very fine suspended reddish material in water.	*62*	*0.21*
BSW-07D-1	37	42	-	-	-	0.1	Installed new tubing. No water to surface. 5" of water in well.	-	*0.00*

well name and sample port #	water level (FT)	well depth (ft.)	final turbidity (NTU)	purge rate (gpm)	total amount purged (gal.)	well volume (gal.)	comments	*turbidity (NTU)*	*purge rate gal/min*
BSW-07D-2	38	51	>200	0.12	6.0	0.3	Installed new tubing.	*302*	*0.24*
BSW-07D-3	35	64	20	0.13	9.0	0.6	Installed new tubing.	*48*	*0.19*
BSW-08C-1	17	57	>200	0.14	16.0	0.8	Installed new tubing.	*432*	*0.16*
BSW-08C-2		72	85	0.25	30.0	1.0	Installed new tubing.	*220*	*0.21*
BSW-08C-3	18	93	>200	0.25	10.0	1.5	Installed new tubing.	*>1000*	*0.17*
BSW-08C-4	19	106	>200	0.11	10.0	1.7	Installed new tubing.	*>1000*	*0.08*
BSW-08D-1	16	23	137	0.08	8.0	0.1	Installed new tubing.	*52*	*0.15*
BSW-08D-2	16	35	13	0.11	5.0	0.4	Installed new tubing.	*6*	*0.13*
BSW-08D-3	16	41	18	0.17	14.0	0.5	Installed new tubing.	*16*	*0.29*

Appendix 1: Daily Field Records

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well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments	Well Depth
BSW-03C 3	3-25-02	out of Range	6 min	2	1.3 gal			Istall new Tubing + Valve	110'
		"	6 min	1				Pumping very Good, getting some very	
		"	6 min	1				Fine Sand with the first 2 to 3 gal.	
		"	6 min	1					
		"	6 min	2					
		173.0	6 min	2					
BSW-03C 4	3-25-02	out of Range	7 min.	2	1.6 gal			Istall new Tubing + Valve	125'
		"	7 min.	2				Pumping very Good	
		"	7 min.	2				Pumping very very Fine Sand all the way	
		"	7 min.	2				up to 10 gal	
		"	7 min.	2					
BSW-03C 2	3-26-02	out of Range	50 min	1	[illegible] gal			Istall new Tubing + Valve, well Pumping	98'
								dry and Recovering very slow	
								I used the Water Level Tape to	
								Check to see how Fast it was	
								Recovering (Could be Clogged Screen)	
BSW-03C 1	3-26-02		50 min	48 oz	0.74 gal			Port 1+2 have Same problem.	80'
								Istalled new Tubing + Valve	
								Someone has broke the Lock hole	
								on this Well.	
								After well pumped dry I pulled	
								out the tubing to Find that the	
								Recovery is very slow	

well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments	well Depth
BSW-03D #2	3-26-02	4.4	7 min	2.5	0.3 gal			Did Not Replaced Tubing & Valve well pumping very good	55'
		7.0	7 min	2					
BSW-03D #1	3-26-02							Did not Replaced Tubing & Valve Tried pumping but no water Surface. Pulled out Tubing and checked water Level not only 4" of water in well	41'
BSW-03D #1	3-27-02							Tried pumping no water surface Pulled out Tubing and Checked water Level, it was less than 6" at water from bottom of well. Water Level is Posted at 22.97' Did not Replace Tubing.	25'
BSW-02D #2	3-27-02	Out of Range	12 min	2	0.2 gal			Install New Tubing & Valve pumping good	
		11	12 min.	2					
		11	12 min	2					
BSW-02D #3		29.5	7 min	2	0.6 gal			Install New Tubing & Valve Well Port was missing. had to Take well head off and Reseat port back into Rubber head. Pumping Good	
		14.0	7 min	1					
		9.0	7 min	1					

well name and port #	date/time	turbidity NTU	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-32C #1	4-10-02	>200	12 min/1gal.		1 gal	10 sec.		Installed new Tubing & Valve
		>200	" "					Pumping Good
		>200	" "	5 gal.			60 min.	
BSW-32C #2	4-10-02	>200	7 min/1gal	3	1.4 gal	10 sec.		Installed new Tubing & Valve
		152	" "	3				Pumping very Good
		130	" "	1				
		104	" "	1				
		94	5 min/1gal	1				
		85	5 min/1gal	1				
		80	" "	2			60 min	

Purge 11

well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-01C-1	5-9-02	>200	7.5 min	2	0.64 gal.			Installed new Tubing,
		>200	6 min	2				turbidity is not droping
		155.9	5 min	2				very much in the last gals
		130.0	5 min	2				pumped
		108	5 min	2				
		97	5 min	2				
		90	4.5 min	2				
		89	4.5 min	2				
BSW-01C-2	5-9-02	>200	5 min	3	0.84 gal.			Installed new Tubing,
		>200	5 min	3				after pumping up to 18 gal
		>200	5 min	3				the water seem to be at
		>200	5 min	3				the same Rate as far as
		>200	5 min	3				the Turbidity. Some what Clear
		>200	5 min	3				
BSW-01C-3	5-9-02	>200	4 min	3	1.18 gal			Istalled new Tubing
		>200	4 min	3				the clearness of the water
		>200	4 min	3				seems to Remain the same
		>200	4 min	3				in the last 10 gal's Just
		>200	4 min	3				a little milky looking
		>200	4 min	3				
BSW-01C-4	5-17-02	>200	4.5 min	3	1.3 gal			Istalled new Tubing
		>200	4 min	3				pumping very good
		140.0	4 min	3				
		106	4 min	3				
		89	4 min	3				
		75	4 min	3				
		65	4 min	3				
		52	4 min	3				

well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-01D-1	5-17-02	>200	17 min	1 gal.	0.06 gal.			Installed new Tubing because of the low water Level this is about the best Flow Rate we can get, or Low well Volume
		>200	15 min	1 "				
		153	15 min	1 "				
		115	15 min	1 "				
		105	15 min	1 "				
		103	15 min	1 "				
BSW-01D-2	5-20-02	79	7.5 MIN	2 gal.	0.24 gal.			Istalled new Tubing Pumping Very Good
		28	7.5 min	2 gal				
		18	7.5 min	2 gal.				
		16	7.5 min	2 gal.				
		16	7.5 min	2 gal.				
BSW-01D-3	5-20-02	2	7.0 min	2 gal.	0.48 gal.			Istalled new Tubing Started out pumping clear And remain doing so Good Flow
		1	7.0 min	2 gal.				
		1	7.5 min	1 gal.				
		1	8.0 min	1 gal.				
BSW-02C-3	5-20-02	>200	5 min	2 gal.	1.5 gal.			Istalled new Tubing Good flow Rate
		>200	5 min	4 gal.				
		>200	5 min	3 gal.				
		>200	5 min	3 gal.				
		>200	5 min	6 gal.				
		>200	5 min	2 gal.				
BSW-04C-1	5-21-02	>200	23 min	4 gal.	0.9 gal.			Istalled new Tubing Water has a gray-white 100K
		>200	20 min	2 gal				
		>200	20 min	2 gal				

well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-04C-2	5-21-02	131	4 min.	3 gal.	1.2 gal.			Installed new Tubing good flow Rate
		85	4.25 min.	3 gal.				
		59	4 min	3 gal.				
		46	4 min.	3 gal.				
		39	4 min.	3 gal.				
		35	4 min.	3 gal.				
		33	4 min.	3 gal.				
		31	4 min.	3 gal				
#								
BSW-04C-3	5-21-02	>200	7.25 min.	3 gal.	1.5 gal.			Installed new Tubing, Water is gray in Color
		>200	7.25 min.	3 gal.				
		>200	7.25 min.	3 gal.				
		>200	7.25 min.	3 gal.				
#								
BSW-04D-1	5-22-02	—	Dry	—	0.04 gal			Installed new Tubing "pumped well 2" from the bottom of the well and NO water surface"
#								
BSW-04D-2	5-22-02	18	11 min.	2 gal.	0.3 gal.			Installed new Tubing
		13	11 min.	1 gal.				
		10	11 min.	1 gal.				
		9	11 min.	1 gal.				
#								
BSW-04D-3	5-22-02	196	10 min.	1 gal.	0.4 gal.			Installed new Tubing
		87	10 min.	1 gal.				
		51	10 min.	1 gal.				
		37	10 min.	1 gal.				
		30	10 min	1 gal.				
		27	10 min.	2 gal.				
		29	10 min	2 gal.				
		30	10 min	2 gal.				

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well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-5D-1 #	5-22-02		Dry		0.02 gal			Installed new Tubing
								NO water to Surface <5' water
BSW-5D-2 #	5-22-02	9	8 min.	1 gal.	0.22 gal			Installed new Tubing
								pumps Dry after 1.2 gal.
								Takes 15 to 20 min to get
								a Small amount of Recovery.
								Well was Reinstalled because
								Tubing went all the way
								down to 64', Try pumping
								again and NO water Surface
								sample port fallen below
								Top of well head and
								Can not be repaired
								without major work.

well name and port #	date/time	turbidity NTU	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-8D-1	5-23-02	>200	20.5 min.	1 gal.	0.14 gal			Installed new Tubing
		155	15 min.	1 gal.				Good flow but over the
		138	15 min.	1 gal.				turbidity sat to 125 it started
		127	14 min.	1 gal.				[illegible] up. Tubing seem
		123	13 min.	1 gal.				to be slight inside the screen
		128	13 min.	1 gal.				Dust from tubing going
		137	13 min.	1 gal.				the high turbidity
BSW-8D-2	5-23-02	15	9 min.	2 gal.	0.38 gal			Installed new Tubing
		13	9 min.	2 gal.				Good Flow
		13	9 min.	1 gal.				
BSW-8D-3	5-23-02	51	6 min.	3 gal.	0.50 gal			Installed new Tubing
		32	6 min.	2 gal.				Good Flow
		26	6 min.	2 gal.				
		24	6 min.	3 gal.				
		22	6 min.	3 gal.				
		20	6 min.	2 gal.				
		18	6 min.	3 gal.				
BSW-8D-1	5-23-02	>200	7 min.	2 gal.	0.80 gal.			Installed new Tubing
	>200	7 min.	2 gal.					Good flow
	>200	7 min.	3 gal.					
	>200	7 min.	3 gal.					
	>200	7 min.	2 gal.					
	>200	7 min.	2 gal.					
	>200	7 min.	1.5 gal.					

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well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-08C-2	5-28-02	>200	4 min.	3 gal.	1.0 gal.			Installed new Tubing
		184	4 min.	3 gal.				good flow
		154	4 min.	3 gal.				
		143	4 min.	3 gal.				
		132	4 min.	3 gal.				
		115	4 min.	3 gal.				
		111	4 min.	3 gal.				
		100	4 min.	3 gal.				
		98	4 min.	3 gal.				
		85	4 min.	3 gal.				
BSW-08C-3 #	5-28-02	>200	4 min.	3 gal.	1.5 gal.			Installed new Tubing
		>200	4 min.	3 gal.				good Flow
		>200	4 min.	4 gal.				
BSW-08C-4 #	5-28-02	>200	7.5 min.	2 gal.	1.7 gal.			Installed new Tubing
		>200	9 min	4 gal				slow Flow
		>200	9 min	4 gal.				
[redacted] #								
BSW-07C-3	5-28-02	>200	4 min.	3 gal.	1.3 gal.			Installed new Tubing
		>200	4 min.	3 gal				good Flow
		58	4 min.	4 gal				
		83	4 min.	2 gal.				
		70	4 min.	2 gal				
		65	4 min.	2 gal				
BSW-07C-2 #	5-28-02	>200	4 min.	3 gal	1.1 gal.			Installed new Tubing
		>200	4 min.	3 gal				good Flow
		>200	4 min.	3 gal.				

well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-05C-1	5-29-02	46	8.5 min.	2 gal	0.8 gal			Installed new Tubing, very good pump
		34	7 min.	2 gal.				
		25	7 min.	2 gal.				
		27	7 min.	2 gal.				
		28	7 min.	2 gal.				
		28	7 min	2 gal.				
#								
BSW-07C-2	5-29-02	>200	4 min.	3 gal.	1.1 gal.			Installed new Tubing, good Flow
		>200	4 min.	3 gal.				
		>200	4 min.	3 gal.				
		>200	4 min.	3 gal.				
		>200	4 min.	3 gal.				
		>200	4 min.	3 gal.				
		>200	4 min.	3 gal.				
		>200	4 min.	3 gal.				
#								
BSW-07C-1	5-29-02	>200	4 min.	3 gal.	0.8 gal.			Installed new Tubing, good flow
		179	4 min.	3 gal.				
		147	4 min.	3 gal.				
		139	4 min.	3 gal.				
		130	4 min	3 gal.				
		119	4 min	3 gal.				
#								
BSW-05C-2	5-29-02	31	3.75 min	3 gal.				Installed new Tubing, very good flow
		23	3.75 min.	3 gal				
		20	3.75 min.	3 gal.				
		18	3.75 min.	3 gal.				
		14	3.75 min.	3 gal.				

well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW7C-4	5/28/1045	>200	7 min-3"well cap		1.7			Very Turbid. reddish Tint To
	1116	>200	1Liter/1min.75%					suspended material. No Sand
	1130	170	=10min/gal					present in purge water
	1150	161		6.5				Pumped until 1150
#								
BSW-05C-3	5-29-02	20	3.75 min.	3 gal.	1.3 gal.			Installed new Tubing
		28	3.75 min	3 gal.				Very Good Flow
		20	3.75 min.	3 gal.				
		14	3.75 min	3 gal.				
#								
BSW-07D-1	5-30-02		No water Surface 0.1gal					Installed new Tubing
								Water Level was less than
								5", unable to pump. No
								water to Surface.
#								Well Volume is 0.1 gal ?
BSW-07D-2	5-30-02	>200	8.5 min.	3 gal.	0.3 gal.			Installed new Tubing
		>200	8.5 m.n.	3 gal.				Stop pumping per Jay Request
								but Good Flow
#								
BSW-07D-3	5-30-02	30	8 min.	3gal.	0.6 gal			Installed new Tubing
		26	8 min.	3gal.				good flow
		20	8 min.	3 gal.				
#								
BSW-05C-4	5-30-02	170	4 min.	3 gal.	1.6 gal			Installed new Tubing
		95	4 min.	3 gal.				Very Good Flow
		48	4 min.	3 gal.				
		46	4 min.	3 gal.				
		30	4 min.	3 gal.				
		25	4 min.	3 gal				

well name and port #	date/time	turbidity NTU)	flow rate (mpg)	number of gal. purged	well volume	time for water to surface	total time purged	Comments
BSW-05D-3	5-30-02	131	7 min.	3 gal.	0.4 gal.			Installed new Tubing
		77	7 min.	3 gal.				Good Flow
		55	7 min.	3 gal.				
		44	7 min	3 gal.				
#								
BSW-06C-3	5-31-02	>200	4.5 min.	3 gal.	1.0 gal			Installed new Tubing
		104	4.5 min.	3 gal.				good flow
		92	4.5 min.	3 gal.				
		72	4.5 min.	3 gal.				
#								
BSW-06C-4	5-31-02	52	4.5 min.	3 gal.	1.4 gal.			Installed new Tubing
		38	4.5 min.	3 gal				good flow
		36	4.5 min	3 gal.				
		31	4.5 min.	3 gal				
#								
BSW-06D-3	5-31-02	112	8 min.	3 gal.	0.3 gal.			Installed new Tubing
		134	8 min.	3 gal.				good flow but Turbidity going
		>200	8 min.	3 gal.				back up.
#								
BSW-06D-2	6-3-02	165	30 min	3 gal	0.1 gal.			Installed new Tubing
								Very Slow Recovery
#								
BSW-06D-1	6-3-02	This	well	said on	the	Sign	that	its Dry and Capped up. (no Tubing installed)
BSW-06G-2	6-3-02	62	4 min.	10 gal.	0.9 gal			Installed new Tubing
		56	4 min.	10 gal				Very Good flow
BSW-06C-1	6-3-02	190	?	2 gal.				Installed new Tubing. Low water Level and well seem to be pumping Dry with slow Recovery