



United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Water Resources Division
230 Collins Road
Boise, Idaho 83702-4520

September 15, 1999

Paul Castelin
Idaho Department of Water Resources
1301 North Orchard Street
Boise, Idaho, 83706

Dear Mr. Castelin:

Enclosed are the results of our cooperative effort to monitor the effects of managed recharge on the ground-water systems in the Southwest Irrigation District. The enclosures include: location map of the recharge sites and monitoring sites, table of results of water quality monitoring at recharge sites, table of results of water quality monitoring at observation wells, table of recharge totals for each site, 1992 through June 1999, hydrographs of ground-water levels at each recharge site, hydrographs of observation wells located upgradient and downgradient of recharge activities, hydrographs of rates of recharge for each injection well and spreading basin at recharge site 5, tables of daily mean rates of recharge for each injection well and spreading basin at recharge site 5, and copies of the six Microscopic Particulate Analysis (MPA) samples collected at recharge sites 3 and 4.

Twenty samples of recharge water were collected at 7 sites for on site determinations of water temperature, specific conductance, pH, alkalinity, fecal coliform, and fecal streptococcus (see table 1). As in previous years, fecal coliform and fecal streptococcus bacteria were observed in all recharge waters at varying concentrations. Thirty-seven water samples from nine nearby domestic wells were also collected for determinations of the same parameters (see table 2). Again as in previous years the few bacteria that were observed in the domestic wells are not believed to be a result of recharge activities.

Recharge for the project through June 30, 1999 totaled 3,419 acre-feet. I have included the recharge totals for the Southwest Irrigation Project for 1992 through June 30, 1999 (see summary of recharge table). I have also included hydrographs of rates of recharge for each injection and/or recharge site for the spring 1999 recharge season. Additionally, I have included tables of daily mean rates of recharge for each injection wells and/or recharge site.

Aquifer response to recharge was measured continuously at eight observation wells located at the seven recharge sites. I have included a hydrograph for each well. The aquifer response to recharge has been positive. For example, spring water levels in the

limestone aquifer in the Cottonwood Critical Ground-Water Area have risen about 2 feet per year since 1994 (see hydrographs for wells 13S-21E-06DAD1 & 08BDD1). Springtime water levels in the rhyolite aquifer in the Artesian Critical Ground-Water Area near Dry Creek rose an average of about 15 feet per year between 1994 and 1996 (see hydrograph for well 11S-19E-03ADD1). Since 1996, the rise has been 3 feet per year. Additionally, I have included a hydrograph of water levels for well 11S-19E-17ABA1 which is completed in the rhyolite aquifer and located northwest and downgradient of recharge site 6. I have also included a hydrograph of water levels for 11S-20E-24DDD1, which is completed in the basalt aquifer and located east, and upgradient of recharge site 7.

Six MPA samples were collected during the study: four samples from recharge site 3, including one quality-control replica sample, and two samples from site 4 which also included one quality-control sample. Results of analyses of samples from site 3 indicate an increase in the occurrence of particles and in the MPA risk score with time, implying an increase in surface water influence at the site from March to April.

The operation of the Southwest Irrigation District's recharge project in 1999 has produced some valuable information in understanding the short and long term effects of using injection wells as a method of recharge in fractured-rock aquifers. The current program will end September 30, 1999. At that time all monitoring activities for the Southwest Irrigation District project will cease. The U. S. Geological Survey has a strong interest in continuing to collect the necessary information to understand the effects on ground-water systems that are being impacted by managed recharge. Therefore, I am seeking your help in putting together a meeting in the very near future to discuss the continuation of this important project.

If you have any questions or need additional information, please call me at (208) 387-1314 or Email me at hwyoung@usgs.gov.

Sincerely,

Bill

H.W. Young
Hydrologist

Enclosures

Copy to: Garr Wayment, SID
Galen Myers, SID
Randy Brown, SID
Grant Wyatt, SID
Bill Parsons, SID
Ronald Golus, BOR, Boise, ID

Summary of recharge 1992-1999

<u>SITE</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>SOURCE OF WATER</u>
(acre-feet for all years)									
1	0	177	0	593	1,140	1,140	864	1,010	Cottonwood Cr.
2	36	531	250	971	761	553	562	352	Cottonwood Cr.
3	0	0	139	740	971	1,038	190	508	Dry Creek
4	0	17	212	1,050	1,030	1,070	770	742	Dry Creek
5	0	141	34	226	269	277	302	288	Dry Creek
6	42	1,164	1,285	1,964	2,217	2,161	825	456	Murtaugh Lake
<u>7</u>	<u>0</u>	<u>0</u>	<u>103</u>	<u>930</u>	<u>483</u>	<u>1,445</u>	<u>46</u>	<u>63</u>	<u>Murtaugh Lake</u>
Totals	78	2,030	2,023	6,474	6,871	7,684	3,559	3,419a	

(a) 1999 totals through June 30, 1999

Table 4. Mean daily rates of injection for gaging station 13088412, Dry Creek injection site 3 near Artesian City, 12S-20E-6BAC2, 1994 through June 1997—Continued

	January 1997–June 1997							
Day	Jan	Feb	Mar	Apr	May	June		
1	.00	2.6	.17	.00	2.8	.00		
2	.00	2.6	.00	.00	2.7	.00		
3	.00	2.6	.00	.00	2.7	.00		
4	.00	2.7	.00	.00	2.7	.00		
5	.00	2.5	.00	.00	2.7	.00		
6	.00	1.5	.00	.00	2.7	.00		
7	.00	2.7	.00	.43	2.7	.00		
8	.77	2.6	.00	.00	2.7	.00		
9	2.2	2.5	.00	1.6	.98	.00		
10	2.2	2.5	.04	2.4	.00	.00		
11	2.2	2.4	.00	2.6	.00	.00		
12	2.1	2.1	.00	2.7	.00	1.7		
13	2.2	.00	.00	2.6	.00	2.6		
14	2.4	.00	.00	2.6	.00	2.5		
15	2.6	.00	.00	2.6	.00	2.3		
16	2.7	.00	.00	2.1	.00	2.3		
17	2.7	.00	.00	2.0	.00	1.4		
18	2.7	1.3	1.2	2.5	.00	.00		
19	1.8	2.3	2.0	2.5	.00	.00		
20	2.6	2.4	.00	2.5	.00	.00		
21	2.7	2.4	.00	2.6	.00	.00		
22	2.5	.98	.00	2.7	.00	.00		
23	2.7	.00	.00	2.8	.00	.00		
24	1.9	.00	.03	2.9	.00	.00		
25	.52	.00	.00	3.0	.00	.00		
26	.00	.84	.00	2.9	.00	.00		
27	.61	.00	.00	2.9	.00	.00		
28	2.2	.38	.00	2.9	.00	.00		
29	2.4	—	.00	2.8	.00	.00		
30	2.4	—	.00	2.8	.00	.00		
31	2.5	—	.00	—	.01	—		
TOTAL	49.60	39.90	3.44	57.43	22.69	12.80		
MEAN	1.60	1.43	.11	1.91	.73	.43		
MAX	2.7	2.7	2.0	3.0	2.8	2.6		
MIN	.00	.00	.00	.00	.00	.00		
AC-FT	98	79	6.8	114	45	25		
CAL YR 1997 to date:	TOTAL	185.86	MAX	3.0	MIN	.00	AC-FT	368

Table 7. Mean daily rates of recharge for gaging station 13088415, Parshall flume at infiltration pond site 5, near Artesian City, January 1993 through June 1997—Continued

Day	January 1997–June 1997					
	Jan	Feb	Mar	Apr	May	June
1	.07	.72	.00	.06	1.0	.00
2	.03	.62	.82	.00	.92	.00
3	.06	.57	.76	.00	.66	.28
4	.43	1.3	.56	.18	1.5	.39
5	.14	1.7	.52	1.5	1.7	.45
6	.00	.78	.45	.04	1.8	.94
7	.94	.21	.43	.86	1.8	1.1
8	1.9	.10	.66	2.2	1.2	2.6
9	3.0	.00	.94	2.0	.70	.83
10	2.4	.00	.81	1.3	1.4	.37
11	1.7	.00	.09	1.2	.84	.92
12	1.3	.00	.00	.80	1.3	1.6
13	1.3	.07	.00	.52	1.6	1.7
14	1.3	1.3	.00	.39	1.0	.30
15	.23	1.1	.00	.36	1.8	1.0
16	.49	.96	.00	.32	1.9	.69
17	.08	.95	.09	.26	3.0	.00
18	.02	.53	1.7	.22	1.0	.00
19	.02	.13	3.4	.20	.76	.00
20	.02	.02	2.2	.82	.94	.00
21	.00	.00	.82	1.7	.83	.00
22	.00	.04	.00	1.7	3.2	.00
23	.00	.28	.00	1.7	2.6	.00
24	.60	.11	.00	1.6	2.2	.00
25	2.1	.05	.00	1.3	1.9	.00
26	2.1	.02	.15	1.2	1.9	.00
27	.12	.04	.37	1.4	1.9	.00
28	.86	.00	.30	1.2	1.7	.00
29	1.3	—	.21	1.5	1.7	.00
30	.86	—	.18	2.0	1.5	.06
31	.74	—	.15	—	.50	—
TOTAL	24.11	11.60	15.61	28.53	46.75	13.23
MEAN	.78	.41	.50	.95	1.51	.44
MAX	3.0	1.7	3.4	2.2	3.2	2.6
MIN	.00	.00	.00	.00	.50	.00
AC-FT	48	23	31	57	93	26
CAL YR 1997 to date:						
	TOTAL	139.83	MAX	3.4	MIN	.00
					AC-FT	278

Table 5. Mean daily rates of injection for gaging station 130884125, Dry Creek injection site 3 near Artesian City, 12S-20E-6BBD3, January 1994 through June 1997—Continued

Day	January 1997–June 1997					
	Jan	Feb	Mar	Apr	May	June
1	.00	3.6	.21	.00	3.5	.00
2	.00	4.5	.00	.00	3.5	.00
3	.00	4.8	.00	.00	3.3	.00
4	.00	5.3	.00	.00	3.5	.00
5	.00	5.9	.00	.00	3.5	.00
6	.00	5.8	.00	.00	3.5	.00
7	.00	5.5	.00	1.4	3.5	.00
8	.67	4.8	.00	4.6	3.4	.00
9	1.7	3.1	.00	2.6	1.3	.00
10	1.6	1.8	.77	2.1	.00	.00
11	1.4	1.1	1.5	4.8	.00	.00
12	1.2	.75	1.3	5.3	.00	3.8
13	1.5	1.8	1.4	5.2	.00	6.3
14	2.6	3.0	1.3	5.2	.00	5.4
15	4.1	3.4	1.3	5.2	.00	3.5
16	5.2	3.5	1.4	5.2	.00	3.7
17	5.4	3.6	1.6	5.2	.00	1.3
18	5.5	2.6	1.5	5.2	.00	.00
19	5.4	1.5	1.5	5.1	.00	.00
20	4.6	1.7	3.3	5.1	.00	.00
21	4.3	1.7	4.3	5.6	.00	.00
22	4.1	1.7	3.4	5.4	.00	.00
23	3.7	2.9	3.6	4.2	.00	.00
24	1.2	2.8	2.9	4.1	.00	.00
25	1.3	2.3	.00	3.9	.00	.00
26	1.9	1.6	.00	3.8	.00	.00
27	1.6	1.6	.00	3.7	.00	.00
28	1.3	.51	.00	3.6	.00	.00
29	1.7	—	.00	3.6	.00	.00
30	2.1	—	.00	3.5	.00	.00
31	2.4	—	.00	—	.00	—
TOTAL	66.47	83.16	31.28	103.60	29.00	24.00
MEAN	2.14	2.97	1.01	3.45	.94	.80
MAX	5.5	5.9	4.3	5.6	3.5	6.3
MIN	.00	.51	.00	.00	.00	.00
AC-FT	132	165	62	205	58	48
CAL YR 1997 to date:	TOTAL	337.51	MAX 6.3	MIN .00	AC-FT 669	

Table 6. Mean daily rates of injection for gaging station 13088405, Dry Creek injection site 4 near Artesian City, 12S-19E-2ADC2, January 1994 through June 1997—Continued

Day	1996											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	—	.00	.14	e6.0	e5.3	3.9	.00	—	—	—	—	—
2	—	.00	2.5	5.7	e5.2	4.1	.00	—	—	—	—	—
3	—	.00	.00	5.5	5.1	3.6	.08	—	—	—	—	—
4	—	.00	3.0	5.3	5.1	4.1	.00	—	—	—	—	—
5	—	.00	5.7	5.2	5.0	4.1	.11	—	—	—	—	—
6	—	.00	5.7	e5.1	4.9	4.0	.01	—	—	—	—	—
7	—	.00	5.6	e5.1	4.7	3.9	.17	—	—	—	—	—
8	—	.00	5.6	e5.2	4.6	3.9	.00	—	—	—	—	—
9	—	.00	5.6	e5.3	4.6	3.8	.00	—	—	—	—	—
10	—	.00	5.4	5.1	4.3	3.8	.00	—	—	—	—	—
11	—	.00	5.2	4.9	4.1	3.2	.00	—	—	—	—	—
12	—	.00	4.9	4.7	3.9	.68	.00	—	—	—	—	—
13	—	.00	4.8	4.8	4.4	.25	.00	—	—	—	—	—
14	—	.00	4.6	4.7	4.6	.00	.00	—	—	—	—	—
15	—	.56	4.5	4.6	4.3	.00	.00	—	—	—	—	—
16	—	4.1	2.5	4.6	4.1	.00	.00	—	—	—	—	—
17	—	5.8	4.4	4.7	4.0	.18	.00	—	—	—	—	—
18	—	5.5	4.4	5.1	3.9	.68	.00	—	—	—	—	—
19	—	5.9	4.3	5.0	3.9	.20	.00	—	—	—	—	—
20	—	5.7	4.3	4.7	3.9	.00	.00	—	—	—	—	—
21	—	5.7	4.2	4.7	4.2	.00	.00	—	—	—	—	—
22	—	5.8	4.2	4.6	4.5	.00	.00	—	—	—	—	—
23	—	5.2	4.2	4.7	4.6	.00	.00	—	—	—	—	—
24	—	6.0	4.1	4.5	4.4	.00	.00	—	—	—	—	—
25	—	6.0	4.1	5.0	4.2	.00	.00	—	—	—	—	—
26	—	3.0	4.1	4.9	4.1	.63	.00	—	—	—	—	—
27	—	.00	e4.1	4.8	4.1	.33	.00	—	—	—	—	—
28	—	.00	3.9	4.7	4.0	.15	.00	—	—	—	—	—
29	—	.00	4.0	4.7	3.9	.73	.00	—	—	—	—	—
30	—	—	e4.1	e5.4	3.8	.28	.00	—	—	—	—	—
31	—	—	e4.0	—	2.6	—	.00	—	—	—	—	—
TOTAL	—	59.26	128.14	149.3	134.3	46.51	0.37	—	—	—	—	—
MEAN	—	2.04	4.13	4.98	4.33	1.55	.012	—	—	—	—	—
MAX	—	6.0	5.7	6.0	5.3	4.1	.17	—	—	—	—	—
MIN	—	.00	.00	4.5	2.6	.00	.00	—	—	—	—	—
AC-FT	—	118	254	296	266	92	.7	—	—	—	—	—
CAL YR 1996:	TOTAL	517.88	MEAN	2.44	MAX	6.0	MIN	.00	AC-FT	1027		

Table 6. Mean daily rates of injection for gaging station 13088405, Dry Creek injection site 4 near Artesian City , 12S-19E-2ADC2, January 1994 through June 1997—Continued

Day	January 1997–June 1997					
	Jan	Feb	Mar	Apr	May	June
1	3.8	.00	.85	4.2	5.5	5.1
2	5.7	.00	1.2	5.6	5.5	1.2
3	6.0	2.0	.81	6.8	5.5	.00
4	6.1	6.3	.63	6.6	5.4	.00
5	6.5	6.3	.66	6.5	5.4	.00
6	5.6	6.5	.86	6.4	4.0	.00
7	6.5	6.6	.76	6.4	4.5	.00
8	3.8	6.4	.84	6.3	4.9	.00
9	3.8	6.4	.88	6.2	4.8	.00
10	5.8	6.4	1.0	6.2	4.8	.00
11	5.8	7.2	1.1	6.2	4.7	.00
12	.15	6.3	1.2	6.1	4.6	.00
13	.00	3.6	1.2	6.4	4.2	.00
14	.00	.01	1.2	6.1	4.2	.00
15	.00	.00	1.2	6.0	4.6	.00
16	.00	.00	1.2	5.9	2.0	.00
17	.00	.00	1.2	5.7	2.6	.00
18	.00	.00	1.2	5.5	2.7	.00
19	.00	.00	1.0	5.3	.97	.00
20	.00	.00	6.4	5.3	3.4	.00
21	.00	.00	6.6	5.3	5.3	.00
22	.00	.88	6.6	5.3	5.1	.00
23	.00	1.9	6.3	5.1	5.0	.00
24	.00	.69	5.8	5.4	5.1	.00
25	.00	.75	5.8	5.7	5.1	.00
26	.00	1.2	5.7	5.7	5.1	.00
27	.00	1.2	5.5	5.5	5.1	.00
28	.00	.79	5.5	5.6	3.2	.00
29	.00	—	5.5	5.5	3.2	.00
30	.00	—	5.4	5.5	3.9	.00
31	.00	—	5.3	—	5.3	—
TOTAL	59.55	71.42	89.39	174.3	135.67	6.30
MEAN	1.92	2.55	2.88	5.81	4.38	.21
MAX	6.5	7.2	6.6	6.8	5.5	5.1
MIN	.00	.00	.63	4.2	.97	.00
AC-FT	118	142	177	346	269	12
CAL YR 1997 to date:	TOTAL	536.63	MAX 7.2	MIN .00	AC-FT	1060