Attachment E – Groundwater Quality Study Report
(439 pages)

Data Reports (400+ pages)
in paper files

ENERGY NORTHWEST COLUMBIA GENERATING STATION
GROUND WATER QUALITY STUDY REPORT

INTRODUCTION

Special Condition S11.B of the Columbia Generating Station (CGS) National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA-002515-1 requires a groundwater quality study be conducted to assess effects of plant liquid discharges on the local groundwater, specifically discharges through NPDES Outfalls 002 and 003.[1] The study commenced with the development of a scope of work,[2] based on guidance established by the Department of Ecology,[3,4] that provided background information related to previous groundwater studies, a description of the two outfalls, an updated summary of the hydrogeology at the Columbia Generating Station site including an evaluation of the existing monitoring well network,[5] and a general outline of the proposed monitoring program. Specific details of the groundwater quality study were provided in the quality assurance project plan (QAPP),[6] or analogous sampling and analysis plan, that was submitted during the second year of the permit term. As required by permit special condition S11.B.3, monitoring commenced in July, 2008. The Department of Ecology performed an assessment of the groundwater quality study in October, 2008 and submitted a final report to Energy Northwest in August, 2009.[7] As a result of the review, minor modifications to sampling protocol were incorporated into the study in April and July, 2009. Per permit special condition S11.B.4, this report provides the results of two years of monitoring data associated with the groundwater quality study.

As stated in the QAPP, aspects of this groundwater quality study applicable to radiological monitoring, including sample collection/handling, QA/QC, analytical methods, and reporting were performed under procedures/protocols established for the Columbia Generating Station Radiological Environmental Monitoring Program.

CURRENT OUTFALL STATUS

Outfall 002

Liquid discharges from Outfall 002 are monitored per the current NPDES Permit Special Condition S2.A.2 on a bi-annual basis. Table 1 provides a summary of the 2008 to 2010 effluent data from the bi-annual analyses as well as data from additional sampling performed for NPDES permit renewal purposes. Daily discharge quantities for 2008 through July of 2010 are presented in Tables 2 – 4.

Outfall 003

Liquid discharges from Outfall 003 are monitored per the current NPDES Permit Special Condition S2.A.3. There have been no discharges from this outfall since October, 2003.

GROUNDWATER MONITORING RESULTS

A two year monitoring program was performed according to the sampling and analysis protocols described in the QAPP. Tests for bromide, potassium, total alkalinity, total phosphorus, and semi-volatile organic compounds were added in mid-2009 in response to recommendations included in the Department of Ecology review. Samples were collected once per calendar quarter from six monitoring wells (MW) associated with NPDES outfalls 002 and 003 as follows: July and October, 2008; January, April, July, and October; 2009 and January, June, and July of 2010. MW5 and MW6 represent the up-gradient and down-gradient wells for outfall 003, respectively. As discussed in the QAPP, MW3 is potentially influenced by infiltrating water from the cooling tower area thus, for this study, was used to assess impacts related to cooling tower (CT) operations. Being located along the same gradient as MW5 and MW6, results for MW3 will be primarily compared to MW5. MW5 is up-gradient of MW3 and outside the influence of CGS operations. At outfall 002, MW9 is the up-gradient well while MW7 and MW8 are down-gradient of this discharge. Results of field and laboratory analyses are summarized below.

Groundwater Elevations

Overall, the water table elevations decreased throughout the course of the study. Noted exceptions to this were increased water depths at wells associated with Outfall 002 in July, 2009 and June, 2010. These increases were attributed to large volume discharges associated with draining of the CGS condenser water boxes. Approximately 2.92 million gallons was released during the period of July 10 – 15, 2009 and approximately 9.51 million gallons was released to Outfall 002 from June 4 – 11, 2010. Groundwater depths at the monitoring wells associated with this study are presented in Table 5.

Field Parameters

For outfall 003, up-gradient MW5 recorded slightly higher pH values than the down-gradient MW6. The pH at MW3 was lower than both MW5 and MW6. The down-gradient wells at outfall 002 demonstrated slightly higher pH units than the up-gradient well. Conductivity was consistently lower at the up-gradient well for outfall 003. MW3 was considerably higher than both MW5 and MW6. The opposite was true at outfall 002, with the up-gradient well demonstrating

consistently higher conductivity than the two down-gradient wells. Field measurements of pH and conductivity are presented in Table 6.

Temperature measurements were consistently lower at the down-gradient well for outfall 003, although only slightly. There was no appreciable difference in temperature between the up-gradient and down-gradient wells at outfall 002. Dissolved oxygen was used as an indicator of well stabilization prior to sampling. Results for outfall 003 reveal that higher levels were consistently recorded at the up-gradient well. At outfall 002, dissolved oxygen levels were on average slightly higher at the down-gradient wells. Temperature and dissolved oxygen measurements are presented in Table 7.

Metals (Total Recoverable)

Unfiltered samples from the six groundwater monitoring wells were analyzed for 13 metals. Results for cadmium, lead, and silver in the six wells were basically non-detectable for the entire monitoring period as the majority of measurements were below the respective practical quantitation limit (PQL) for these parameters. Arsenic, manganese, selenium, iron, chromium, nickel, and mercury recorded at least one result with a concentration that was in excess of the respective water quality criterion. Copper, Barium, and zinc recorded detectable results but well below the respective water quality criterion.

The determination of trace metals in this study utilized methods and instrumentation associated with inductively coupled plasma mass spectrometry (ICP- MS). Results for arsenic, selenium, and manganese, indicating potential contamination and/or interference problems, led to the decision to have a select sample set analyzed by advanced inductively coupled plasma dynamic reaction cell mass spectrometry (ICP-DRC-MS) technology. Results indicate that selenium measurements were biased high by interferences, most likely from bromine and sulfur. Results for arsenic indicate that the two methods produced nearly identical results, although three monitoring quarters were affected by what appears to be laboratory analysis problems and are not included in the Table 8. Results for manganese indicate that the ICP-MS method may be slightly under-reporting concentrations for this metal.

For outfall 003, the up-gradient well recorded concentrations below the respective water quality criterion for all parameters during the entire monitoring period. Results reported for the down-gradient well indicate that mercury and selenium were slightly above the criterion for each of these parameters. General trends indicate that barium, iron, manganese, mercury, nickel, and zinc were higher in samples from the down-gradient well and that only arsenic and chromium recorded higher results at the up-gradient location. There was no significant difference between the up-gradient and down-gradient wells for copper.

MW3 had results for iron, manganese, and selenium above the respective criterion. Generally, results for barium, manganese, nickel, and zinc were higher at this location than at MW5. Iron was significantly higher than at MW5. Results for copper and mercury were similar to those reported for MW5 while chromium was slightly lower. Arsenic results were also lower than MW5 and similar to those reported for MW6.

For outfall 002, the up-gradient and down-gradient wells produced results above the respective criterion for iron, manganese, and mercury. In addition, the down-gradient well recorded concentrations above the respective criterion for arsenic, chromium, nickel, and selenium. Generally, results for arsenic, barium, iron, and manganese determinations were higher at the down-gradient wells for the entire monitoring period. The admiralty brass main condenser contains approximately 0.05% arsenic, and is a potential contributor to the measured arsenic. Copper and zinc demonstrated higher concentrations at the down-gradient wells during the first three quarters but exhibited results similar to the up-gradient well for the remainder of the study. The trend for chromium was similar to the trend displayed by copper and zinc. Initially, nickel was higher at the down-gradient wells but for the last five quarters of the study reported results slightly higher at the up-gradient location. Mercury had reported concentrations consistently higher at the up-gradient well.

As discussed above, the results for selenium are likely biased high due to interferences, and results from ICP-DRC-MS analysis show that actual concentrations are well below the water quality criterion for this metal.

Total metals results are presented in Tables 8 through 12. Results comparing the two analytical technologies (ICP-MS and ICP-DRC-MS) used for arsenic, selenium, and manganese on select well samples and a circulating cooling water system sample are presented in Table 13.

Cations

Calcium, magnesium, potassium, and sodium measurements were higher in the down-gradient well as opposed to the up-gradient well for outfall 003. The reverse is true at outfall 002, where the concentrations for these four parameters are higher at the up-gradient location. MW3 reported higher concentrations for these four cations than both MW5 and MW6. Calcium and magnesium measurements are presented in Table 14. Potassium and sodium measurements are presented in Table 15.

Anions

Bromide concentrations are higher at the down-gradient locations than the associated up-gradient wells for each outfall. MW3 reported bromide levels higher than at MW5. Chloride concentrations at the up-gradient and down-

gradient wells associated with outfall 003, as well as samples from MW3, were nearly identical to one another. Chloride measurements reported higher concentrations at the up-gradient well associated with outfall 002 than the two down-gradient locations. Chloride concentrations were well below the water quality criterion at all locations. Fluoride concentrations were higher at the up-gradient well associated with outfall 003. The reverse is true at outfall 002, where the down-gradient locations reported consistently higher values than the up-gradient location. Results for well MW3 are below both MW5 and MW6. All results are well below the water quality criterion for this parameter. Nitrate measurements at both outfalls are higher at the up-gradient locations. Results for MW3 also report lower nitrate concentrations near the cooling towers than at MW5. All of the nitrate measurements associated with the up-gradient well at outfall 002 are above the water quality criterion. With the exception of the October, 2008 monitoring event, nitrite concentrations were non-detectable for all locations and periods. Sulfate concentrations are higher at the down-gradient well for outfall 003. The reverse is true at outfall 002, where the up-gradient well reported higher sulfate concentrations than the two down-gradient wells. MW3 reported sulfate concentrations higher than both MW5 and MW6 and similar to MW9. All the sulfate measurements are less than the water quality criterion. Anion results are presented in Tables 16 and 17.

Total Dissolved Solids, Total Alkalinity, and Total Phosphorus

For outfall 003, total dissolved solids (TDS) measurements were higher down-gradient than up-gradient. A reverse trend was evident at outfall 002, where the up-gradient location produced the higher readings. Measurements of samples from MW3 report significantly higher values than at both MW5 and MW6 and similar to MW9. Alkalinity displayed the same trends as TDS at both outfalls. MW3 results were higher than at all other locations. It should be noted that the bicarbonate fraction comprises the entire analytical spectrum for this parameter as carbonate alkalinity was non-detect. There was no significant difference between the total phosphorus measurements at the up-gradient and down-gradient wells associated with outfall 003. MW3 concentrations were similar to MW5 and MW6. The down-gradient wells at outfall 002 displayed higher total phosphorus measurements than the up-gradient well. Measurements for total dissolved solids, total alkalinity, and total phosphorus are presented in Table 18.

Volatile Organic Compounds (VOCs) and Semivolatile Organic Compounds (S-VOCs)

All monitoring wells were evaluated for organic compounds via VOC and S-VOC analyses. With the following exceptions, VOC's and S-VOC's were not detected in the monitoring wells. Chloroform was consistently detected in samples from both up-gradient and down-gradient wells associated with outfall 002, but not at concentrations greater than the water quality criterion. Bromoform and

dibromomethane were also detected at the down-gradient locations on two sampling dates. The two detectable results for dibromomethane were just above the PQL for this compound. The results for bromoform were above the water quality criterion for this parameter. Tetrachloroethene was detected in several samples from MW3 at concentrations just above the PQL. Bis 2 (ethylhexyl)phthalate was detected in samples from MW6, MW7, and MW8. It was also detected in samples from field and equipment blanks. One sample from MW6 collected in July, 2009 had a detectable concentration of Di-n-octylphthalate. Diethylphthalate, at just above the PQL, was detected in wells MW5 and MW9 during the October, 2009 sampling event. Measurements for chloroform, bromoform, and tetrachloroethene are presented in Table 19. (See Appendix A for VOC and S-VOC results).

CONCLUSIONS

The two year study appears to indicate that groundwater in the unconfined aquifer in the vicinity of CGS is influenced by plant operations related to the discharge of effluents through permitted outfalls and via infiltration from the large volume water systems, specifically the circulating cooling water system. Additionally, several of the chemical constituents measured in this study may be indicative of bulk water and potable water treatment practices and techniques.

Measurements for arsenic, chromium, iron, manganese, mercury, nickel, sodium, nitrate, total dissolved solids, and bromoform had reported concentrations from at least one sample that was in excess of the respective water quality criterion.

MW5, via its location, probably provides the best assessment of the local groundwater outside the influences of CGS and the 618-11 burial site. Measured concentrations of several parameters including conductivity, total dissolved solids, calcium, magnesium, potassium, sodium, bromide, sulfate, and total alkalinity were higher at MW3, located adjacent to the cooling towers, than at MW5. In addition, MW9, the up-gradient well at Outfall 002, consistently reported higher levels of these constituents as well. Infiltration of the groundwater may be occurring with a potential source being the circulating cooling water system. Increased levels of these same constituents are present in the circulating cooling water (CW), which is comprised of Columbia River water (typically operated at multiple cycles of concentration), and residuals from treatment chemical additives used to limit corrosion and scaling, adjust pH, and control biological growth (via halogenation) in the system. For comparison, a summary of analytical results of tests performed on samples collected from the CW system are presented in Table 20.

The presence of chloroform and bromoform, and potentially arsenic, in well samples associated with Outfall 002 are indicative of potable water treatment practices. The main condenser contains a small percentage of arsenic in the

admiralty brass alloy, and may be a potential contributor to the measured arsenic. In addition, the false positive tests for selenium (with a known interference from bromine), at several of the wells may also indicate the presence of potable water treatment chemicals.

Another indication of potential infiltration from CGS plant systems is the dilution of constituents related to Hanford Site operations, specifically the nitrate plume. Nitrate levels decreased down-gradient from MW5. The higher levels of mercury in samples from MW9 may be indicative of Hanford Site operations, as there does not appear to be a source for this parameter in CGS plant water systems.

Depth measurements at each well disclosed a general trend in declining water table elevations throughout the course of the study. Flushing of large volumes of effluent through Outfall 002, such as the June, 2010 event, greatly influenced the water table elevations in this area. A substantial increase in the depth of the groundwater was observed at both of the down-gradient wells. The up-gradient well had a substantial increase as well. In these cases, constituents associated with the discharge may migrate up-gradient into the area of MW9, thus negating somewhat the "control" designation of this well.

Findings of the hydrogeology study indicated that other wells in the vicinity of CGS do not show the higher concentrations for the aforementioned constituents that were observed at the monitoring wells associated with Outfall 002 and at MW3.[5] Additional findings from the hydrogeology study indicated that some local recharge to the aquifer appears to occur from plant operations and discharge effluents and that the water table elevations for most of the Hanford site, including the area in the vicinity of Columbia Generating Station, are declining.

The results of this study appear to corroborate the findings presented in the hydrogeology study.

RECOMMENDATIONS

Continue to monitor the groundwater on a quarterly basis following the protocol used in this study. Increase the monitoring of surface water discharges (via 24-hour composite sampling) at Outfall 002 from bi-annually to quarterly and include the same parameter list as used for testing the wells. Perform monthly "grab sampling" of Outfall 002 discharges and analyze for pH, conductivity, TDS, metals and anions.

Energy Northwest will evaluate the results obtained from the increased monitoring identified above. That evaluation will also consider the previous measurements that were in excess of their respective water quality criterion. The evaluation is expected to identify future actions.

REFERENCES

1. NPDES Permit No. WA-002515-1, issued by the Energy Facility Site Evaluation Council (EFSEC), May 25, 2006

2. *Energy Northwest Columbia Generating Station, Ground Water Quality Study Scope of Work*, Welch, R.E., Energy Northwest – Environmental Services, June 2007

3. *Implementation Guidance for the Ground Water Quality Standards*, Washington State Department of Ecology, Pub. No. 96-02, Revised October 2005

4. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies,* Washington State Department of Ecology, Pub. No. 04-03-030, July 2004

5. *Summary of Hydrogeology and Evaluation of Existing Groundwater Monitoring Wells for Outfalls 002 and 003 at the Columbia Generating Station*, Battelle, PNWD-3845, June 2007

6. *Energy Northwest Columbia Generating Station, Ground Water Quality Study Quality Assurance Project Plan*, Welch, R.E., Energy Northwest – Environmental Services, September 2007

7. *Columbia Generating Station NPDES Groundwater Study Review*, Washington State Department of Ecology, Pub. No. 09-10-064, April 2009

Table 1. NPDES Outfall 002 Effluent Water Quality

Date	BOD (mg/L)	COD (mg/L)	TOC (mg/L)	TSS (mg/L)	Ammonia (mg/L)	pH SU	Br (mg/L)	Fecal (c/100ml)	F (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	N, T.Org (mg/L)	O&G (mg/L)	T-P (mg/L)	SO4 (mg/L)	Al (mg/L)	Ba (mg/L)
5/6/2008*						7.44			0.12	0.34	0.25				31		
11/11/2008*						7.97			0.13	0.24	0.13				29		
4/29/2009*						7.23			0.11	0.56	0.054				30		
11/10/2009*						8.31			0.11	0.095	<0.03				11		
12/7/2009**		<10	1.2	<2	<0.03		<0.06		0.183	0.202	<0.03	0.28	<1	<0.1	25	0.031	0.065
5/4/2010*						7.32			0.074	3.8	<0.03				16		
10/20/2010**	<2							<1									

Date	Fe (mg/L)	Mg (mg/L)	Mn (mg/L)	Sn (mg/L)	Sb (mg/L)	As (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Pb (mg/L)	Hg (mg/L)	Ni (mg/L)	Se (mg/L)	Ag (mg/L)	Tl (mg/L)	Zn (mg/L)
5/6/2008*	0.45		0.017						0.0005	0.0068	0.0003		0.0041				0.024
11/11/2008*	0.23		0.017						0.0005	0.0081	0.0009		0.003				0.069
4/29/2009*	0.36		0.028						0.0005	0.017	<0.0002		0.004				0.12
11/10/2009*	0.49		0.022						0.0052	0.0095	0.0013		0.0027				0.027
12/7/2009**	0.059	11	0.0005	<0.001	<0.0006	0.02	<0.002	0.0002		0.0016	<0.0002	<0.0002	0.0031	0.0006	<0.0002	<0.0002	
5/4/2010*	0.18		0.016						0.0003	0.006	<0.0002		0.0034				0.032

* 24-hour composite results
** expanded parameter list for NPDES permit renewal purposes

Table 2. NPDES Outfall 002 daily flow data for 2008.

Day	Jan '08 (gal x 100)	Feb '08 (gal x 100)	Mar '08 (gal x 100)	Apr '08 (gal x 100)	May '08 (gal x 100)	Jun '08 (gal x 100)	Jul '08 (gal x 100)	Aug '08 (gal x 100)	Sep '08 (gal x 100)	Oct '08 (gal x 100)	Nov '08 (gal x 100)	Dec '08 (gal x 100)
1	1175	409	462	656	418	457	433	407	482	228	559	268
2	756	718	408	633	33	578	448	314	396	377	541	71
3	1109	448	192	314	222	1195	439	445	299	283	797	249
4	807	523	600	975	210	251	488	268	295	497	795	155
5	665	199	454	466	116	299	488	431	383	273	521	726
6	646	363	400	690	48	410	232	478	504	576	439	524
7	748	464	460	38	427	499	349	512	251	258	726	415
8	859	275	359	847	249	379	485	465	503	414	302	356
9	725	485	512	529	446	803	418	617	306	415	429	282
10	441	284	437	653	236	320	396	479	495	425	408	400
11	562	344	339	1861	400	533	360	476	615	292	563	303
12	461	178	598	253	386	335	434	496	510	291	516	459
13	501	177	415	295	77	526	490	347	519	475	215	522
14	601	295	125	597	182	504	384	453	355	430	477	512
15	411	279	34	215	253	409	414	483	572	272	261	763
16	555	101	234	314	146	445	186	481	362	420	397	679
17	291	443	156	54	446	477	291	396	531	169	299	656
18	199	284	412	32	264	536	354	410	278	439	370	497
19	220	434	211	1694	307	494	322	537	265	255	426	699
20	287	328	644	116	253	472	342	412	150	438	496	342
21	571	374	578	106	246	584	491	446	456	431	339	673
22	317	291	396	417	411	294	455	507	337	323	437	497
23	503	445	257	49	206	306	251	344	460	483	386	578
24	437	467	616	202	595	339	360	131	235	444	558	366
25	679	208	94	392	117	432	458	462	258	204	540	604
26	560	137	1505	353	288	581	351	370	396	567	497	582
27	740	143	1238	279	405	447	253	178	439	383	561	399
28	767	385	167	405	432	433	473	457	186	503	309	948
29	873	311	205	340	428	266	407	483	384	470	526	950
30	522		77	608	501	250	478	526	193	294	291	439
31	375		579		475		272	544		567		613
Total (gal x 100)	18363	9792	13164	14383	9223	13854	12002	13355	11415	11896	13981	15527
Max	1175	718	1505	1861	595	1195	491	617	615	576	797	950
Total (gal)	15,695,500											

Table 3. NPDES Outfall 002 daily flow data for 2009.

Day	Jan '09 (gal x 100)	Feb '09 (gal x 100)	Mar '09 (gal x 100)	Apr '09 (gal x 100)	May '09 (gal x 100)	Jun '09 (gal x 100)	Jul '09 (gal x 100)	Aug '09 (gal x 100)	Sep '09 (gal x 100)	Oct '09 (gal x 100)	Nov '09 (gal x 100)	Dec '09 (gal x 100)
1	685	488	532	492	343	111	163	154	357	329	233	201
2	1179	282	737	371	364	205	341	277	235	314	456	252
3	439	513	595	427	135	269	303	203	134	423	66	126
4	785	498	627	459	641	807	299	138	212	218	58	323
5	672	564	572	445	1099	1020	331	214	274	504	362	171
6	579	518	392	20	1484	264	521	231	291	408	141	278
7	226	555	349	238	554	497	258	157	227	278	115	449
8	393	500	396	322	293	457	326	154	175	472	64	605
9	438	579	466	332	508	604	639	11	312	260	393	376
10	294	336	544	150	441	610	7409	166	140	547	59	249
11	400	547	465	247	274	527	3731	246	188	239	301	181
12	206	335	489	392	1085	351	1789	71	298	444	132	190
13	591	378	378	321	734	140	7677	173	157	283	211	419
14	385	271	462	341	673	339	6692	95	280	220	123	463
15	739	139	256	326	977	288	1872	218	190	154	284	707
16	606	347	613	273	332	206	284	33	244	188	280	539
17	621	330	481	336	284	741	289	151	264	49	242	219
18	501	299	255	150	455	348	277	125	241	26	316	531
19	450	582	396	315	729	576	173	83	189	304	180	713
20	424	650	520	240	557	356	302	310	131	254	232	443
21	496	317	444	328	853	492	274	200	214	212	189	417
22	328	717	483	418	893	149	169	183	289	31	309	308
23	557	1119	456	139	847	294	215	159	143	372	290	186
24	600	475	452	314	895	235	202	153	166	90	176	181
25	500	462	320	207	809	157	202	117	123	204	336	369
26	536	364	388	25	462	59	405	141	452	106	584	557
27	457	537	410	331	527	576	1143	193	156	221	658	399
28	870	496	415	490	442	308	193	171	486	243	137	179
29	547		457	514	592	120	387	262	337	409	179	331
30	780		436	481	757	362	153	152	188	177	436	223
31	553		282		357		226	197		374		324
Total (gal x 100)	16837	13198	14068	9444	19396	11468	37245	5138	7093	8353	7542	10909
Max	1179	1119	737	514	1484	1020	7677	310	486	547	658	713
Total (gal)	16,069,100											

Table 4. NPDES Outfall 002 daily flow data for 2010

Day	Jan '10 (gal x 100)	Feb '10 (gal x 100)	Mar '10 (gal x 100)	Apr '10 (gal x 100)	May '10 (gal x 100)	Jun '10 (gal x 100)	Jul '10 (gal x 100)
1	481	567	116	188	173	441	462
2	125	140	338	381	305	891	328
3	319	143	213	297	313	357	356
4	698	286	284	105	213	5346	316
5	575	188	145	860	362	15198	186
6	466	108	448	927	393	14608	365
7	203	276	287	678	540	14755	417
8	305	295	423	314	570	11377	505
9	336	406	387	131	336	9810	180
10	193	445	249	374	291	14625	329
11	298	556	226	75	376	9389	602
12	304	274	490	457	460	376	443
13	399	376	94	121	346	410	312
14	291	359	276	542	367	354	405
15	169	381	188	385	380	405	319
16	206	256	429	349	406	551	379
17	636	286	253	347	391	372	446
18	422	153	335	58	554	287	357
19	605	109	236	213	377	636	345
20	413	284	367	193	317	537	328
21	538	275	314	366	299	320	138
22	175	127	230	311	306	426	547
23	157	267	202	394	444	390	481
24	258	262	91	497	425	704	901
25	300	263	301	630	391	556	1631
26	314	598	509	393	519	457	165
27	229	420	931	499	539	469	102
28	64	239	479	174	570	420	366
29	322		488	343	267	517	105
30	343		461	416	472	312	287
31	625		212		484		466
Total (gal x 100)	10769	8339	10002	11018	12186	105296	12569
Max	698	598	931	927	570	15198	1631
Total (gal)	17,017,900						

Table 5. Depth of groundwater in CGS NPDES monitoring wells

Groundwater Depth (ft)

	CT Area	Outfall 003		Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9
10/24/2007						5.54
2/6/2008						5.65
4/23/2008						5.49
7/23/2008	4.00	7.43	4.41	2.69	3.04	5.31
10/22/2008	3.85	7.29	4.23	2.65	2.96	5.19
1/21/2009	3.89	7.29	4.26	2.72	3.12	5.30
4/27/2009	3.77	7.20	4.06	2.27	2.64	5.08
7/22-23/2009	3.75	7.15	4.11	3.28	3.64	5.77
10/27/2009	3.63	7.06	4.02	1.94	2.47	4.86
1/25/2010	3.51	6.92	3.91	2.14	2.54	4.85
6/14/2010	3.42	6.81	3.83	10.52	9.17	8.99
7/29/2010	3.46	6.84	3.86	2.98	3.28	5.47

Table 6. Summary of pH and Conductivity Measurements

pH (Std. Units)

Date	CT Area	Outfall 003		Outfall 002		
		Upgrd	Dwngrd	Dwngrd	Dwngrd	Upgrd
	MW 3	MW 5	MW 6	MW 7	MW 8	MW 9
10/24/2007						7.18
2/6/2008						6.70
4/23/2008						6.08
7/23/2008	6.73	7.27	7.17	7.31	7.25	7.19
10/22/2008	6.93	7.19	7.24	7.47	7.27	7.28
1/21/2009	6.59	7.27	7.08	7.27	7.14	7.11
4/27/2009	6.31	6.43	6.02	6.75	6.28	6.54
7/22-23/2009	6.85	7.64	7.32	7.70	7.46	7.03
10/27/2009	6.92	7.81	7.29	7.71	7.51	7.41
1/25/2010	6.92	7.89	7.42	7.83	7.61	7.63
6/14/2010	6.87	7.78	7.14	7.83	7.64	7.52
7/29/2010	6.73	7.69	7.15	7.43	7.49	7.40

Conductivity (µS/cm)

Date	CT Area	Outfall 003		Outfall 002		
		Upgrd	Dwngrd	Dwngrd	Dwngrd	Upgrd
	MW 3	MW 5	MW 6	MW 7	MW 8	MW 9
10/24/2007						1048
2/6/2008						1031
4/23/2008						1018
7/23/2008	1001	462	672	270	626	1008
10/22/2008	870	385	590	270	455	850
1/21/2009	1000	370	550	290	430	800
4/27/2009	991	458	664	252	632	934
7/22-23/2009	763	391	466	350	365	623
10/27/2009	729	333	476	332	403	608
1/25/2010	736	323	475	293	385	600
6/14/2010	724	316	458	270	294	626
7/29/2010	722	341	491	265	297	659

Table 7. Summary of Temperature and Dissolved Oxygen Measurements

Temperature (°C)

Date	CT Area	Outfall 003			Outfall 002		
	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9
10/24/2007						17.5
2/6/2008						17.9
4/23/2008						17.1
7/23/2008	20.4	20.4	19.8	23.1	18.6	18.6
10/22/2008	18.3	18.2	17.2	16.5	16.5	16.6
1/21/2009	17.0	16.9	16.0	15.5	15.5	16.0
4/27/2009	20.1	19.1	18.6	18.1	18.3	18.9
7/22-23/2009	21.5	22.7	19.0	17.9	17.6	19.7
10/27/2009	19.9	20.1	18.2	17.9	17.7	17.7
1/25/2010	18.7	18.6	18.1	17.1	16.4	18.0
6/14/2010	20.1	21.0	18.7	23.8	24.0	18.8
7/29/2010	19.9	20.1	18.7	19.7	20.4	18.8

Dissolved Oxygen (mg/L)

Date	CT Area	Outfall 003			Outfall 002		
	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9
10/24/2007						N/A
2/6/2008						N/A
4/23/2008						N/A
7/23/2008	N/A	N/A	N/A	N/A	N/A	N/A
10/22/2008	N/A	N/A	N/A	N/A	N/A	N/A
1/21/2009	N/A	N/A	N/A	N/A	N/A	N/A
4/27/2009	4.02	6.04	4.61	7.13	6.62	5.74
7/22-23/2009	4.06	6.81	5.73	8.56	8.73	6.83
10/27/2009	4.01	6.30	3.47	5.27	7.83	5.32
1/25/2010	4.23	6.21	3.97	6.35	7.34	6.12
6/14/2010	3.98	6.27	5.19	6.89	6.55	6.35
7/29/2010	4.27	6.83	3.81	6.71	6.32	6.88

Table 8. Summary of Arsenic, Barium, and Cadmium Measurements

Arsenic (µg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	4.0	4.9	3.6	12	10	4.4	10
10/22/2008	2.2	4.0	3.2	9.0	5.5	3.6	
1/21/2009	3.3	4.7**	3.6	13	6.8	4.4	
4/27/2009	2.3	4.9	3.8	10	6.5	4.0	
7/22-23/2009							
10/27/2009	2.2*	4.8*		11.9*	5.9*		
1/25/2010							
6/14/2010	2.3	4.6	2.8	42	25	4.3	
7/29/2010	2.2	4.7	3.0	22	9.4	4.1	

* from alternate method, see Table 13
** used duplicate sample result

Barium (µg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	100	48	91	72	230	61	1000
10/22/2008	62	40	79	48	65	46	
1/21/2009	91	93	91	180	79	52	
4/27/2009	67	44	87	31	80	43	
7/22-23/2009	66	48	89	70	64	46	
10/27/2009	69	49	94	56	70	44	
1/25/2010	60	35	73	40	53	36	
6/14/2010	66	40	77	42	32	44	
7/29/2010	62	40	75	43	27	40	

Cadmium (µg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	10
10/22/2008	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
1/21/2009	<0.2	0.3	<0.2	0.4	<0.2	<0.2	
4/27/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
7/22-23/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
10/27/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
1/25/2010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
6/14/2010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
7/29/2010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	

Table 9. Summary of Chromium, Copper, and iron Measurements

Chromium (µg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	16	5	4.4	34	30	5.5	50
10/22/2008	3.2	4.5	3.4	40	2.1	2.6	
1/21/2009	4.1	0.4	3.8	190	4.3	3.7	
4/27/2009	3.4	4.6	4.6	6.6	1.7	2.3	
7/22-23/2009	5.5	6.4	5.6	3.4	3.9	3.8	
10/27/2009	5.9	7.6	6.1	3.7	3.9	4.9	
1/25/2010	3.2	4.9	3.7	2.7	2.9	3.2	
6/14/2010	2.3	3.8	2.8	0.6	0.5	1.8	
7/29/2010	2.3	4.3	2.9	0.5	0.5	2	

Copper (µg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	5.8	0.4	0.8	7.7	21	2.7	1000
10/22/2008	1.0	0.3	0.5	3.5	0.9	1.5	
1/21/2009	1.6	2.7	0.4	26	1.9	1.6	
4/27/2009	0.5	<0.2	0.2	0.5	<0.2	1	
7/22-23/2009	0.8	0.5	0.7	3.2	0.8	1.5	
10/27/2009	2.3	0.5	1	1.3	0.8	1.9	
1/25/2010	0.8	0.4	1	1.1	1.3	1.5	
6/14/2010	0.9	0.6	0.8	2.2	2.4	1.4	
7/29/2010	0.7	0.3	0.5	1.2	1.2	1.3	

Iron (µg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	3200	87	260	5100	13000	840	300
10/22/2008	200	130	100	1700	310	190	
1/21/2009	350	50	150	12000	740	280	
4/27/2009	97	86	130	390	110	94	
7/22-23/2009	64	30	140	360	150	68	
10/27/2009	70	39	60	77	46	62	
1/25/2010	84	45	67	130	250	72	
6/14/2010	80	30	220	150	110	33	
7/29/2010	57	<7	74	58	18	42	

Table 10. Summary of Lead, Manganese, and Mercury Measurements

Lead (µg/L)

Date	CT Area MW 3	Outfall 003 Upgrd MW 5	Outfall 003 Dwngrd MW 6	Outfall 002 Dwngrd MW 7	Outfall 002 Dwngrd MW 8	Outfall 002 Upgrd MW 9	Reg. Limit
7/23/2008	2.8	<0.2	<0.2	2.5	8.9	0.5	50
10/22/2008	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
1/21/2009	<0.2	<0.2	<0.2	6.5	<0.2	<0.2	
4/27/2009	<0.2	<0.2	2.8	<0.2	<0.2	<0.2	
7/22-23/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
10/27/2009	0.4	0.4	0.4	0.4	0.4	0.2	
1/25/2010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
6/14/2010	<0.2	<0.2	0.2	<0.2	<0.2	0.3	
7/29/2010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	

Manganese (µg/L)

Date	CT Area MW 3	Outfall 003 Upgrd MW 5	Outfall 003 Dwngrd MW 6	Outfall 002 Dwngrd MW 7	Outfall 002 Dwngrd MW 8	Outfall 002 Upgrd MW 9	Reg. Limit
7/23/2008	150	0.5	10	140	490	64	50
10/22/2008	5	1.6	0.5	44	8.6	7.8	
1/21/2009	21	6.6	7.4	450	49	21	
4/27/2009	0.8	0.2	2.5	10	1.8	1.5	
7/22-23/2009	1.1	<0.2	5.2	14	6.2	2.5	
10/27/2009	1.3	0.3	1.1	1.5	0.7	1.3	
1/25/2010	1.2	0.7	3.8	4.3	10	5.4	
6/14/2010	1.4	0.5	12	6.5	6.2	0.2	
7/29/2010	1.4	0.2	5.4	2.3	1.7	2.1	

Mercury (µg/L)

Date	CT Area MW 3	Outfall 003 Upgrd MW 5	Outfall 003 Dwngrd MW 6	Outfall 002 Dwngrd MW 7	Outfall 002 Dwngrd MW 8	Outfall 002 Upgrd MW 9	Reg. Limit
7/23/2008	<0.2	<0.2	0.5	0.8	0.7	1.4	2
10/22/2008	<0.2	<0.2	0.4	0.9	0.3	1.3	
1/21/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
4/27/2009	<0.2	<0.2	1	0.5	0.3	1.8	
7/22-23/2009	0.8	<0.2	1.1	1.1	1.8	2.8	
10/27/2009	0.5	0.5	2.7	2.1	3.1	6.4	
1/25/2010	<0.2	<0.2	0.6	0.5	0.3	2.3	
6/14/2010	<0.2	0.6	0.9	0.2	3.1	4.4	
7/29/2010	<0.2	<0.2	0.4	0.5	0.7	1.7	

Table 11. Summary of Nickel, Selenium, and Silver Measurements

Nickel (µg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	20	2.4	5.1	30	35	8.8	100
10/22/2008	6.1	2.2	4.0	70	4.4	5.5	
1/21/2009	44	15	22	180	23	28	
4/27/2009	8.2	2.5	5.5	7.5	5.7	5.9	
7/22-23/2009	7.4	5.1	8.4	7.5	7.8	8.4	
10/27/2009	7.3	2.8	4.7	3.8	4.6	5.6	
1/25/2010	5.0	1.8	3.1	3.0	4.6	3.9	
6/14/2010	9.0	2.9	5.3	2.8	3.1	6.4	
7/29/2010	4.9	1.9	3.5	2.0	2.0	3.7	

***Selenium (µg/L)**

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	11	3.7	7.9	<0.6	1.5	5.6	10
10/22/2008	8.8	3	6.8	<0.6	2	4.4	
1/21/2009	27	<0.6	10	<0.6	2.6	8.3	
4/27/2009	7.8	3.4	6.7	<0.6	1.6	4.4	
7/22-23/2009	8.5	4.1	8.3	41	5.1	4	
10/27/2009	13	3.3	11	43	28	5.4	
1/25/2010	8.1	4	6.8	5.6	23	4.3	
6/14/2010	13	4.3	9.8	36	50	7.9	
7/29/2010	9	4.1	8.6	26	37	4.9	

* Probable interference, results likely non-detect - see Table 13 and results discussion

Silver (µg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	<0.2	<0.2	<0.2	0.6	0.8	<0.2	50
10/22/2008	<0.2	<0.2	<0.2	0.6	<0.2	<0.2	
1/21/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
4/27/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
7/22-23/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
10/27/2009	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
1/25/2010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
6/14/2010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
7/29/2010	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	

Table 12. Summary of Zinc Measurements

Zinc (µg/L)

Date	CT Area MW 3	Outfall 003 Upgrd MW 5	Outfall 003 Dwngrd MW 6	Outfall 002 Dwngrd MW 7	Outfall 002 Dwngrd MW 8	Outfall 002 Upgrd MW 9	Reg. Limit
7/23/2008	11	<0.2	2.7	13	38	4.1	5000
10/22/2008	1.6	0.9	1.3	5.4	2.7	2	
1/21/2009	5	51*	3.4	35	3.7	2.6	
4/27/2009	<0.2	<0.2	<0.2	<0.2	<0.2	3.1	
7/22-23/2009	1.8	1.4	2.4	3.5	1.9	1.9	
10/27/2009	3.3	3.1	3.4	2.6	3	4.4	
1/25/2010	5.1	1.7	2.2	1.8	2.5	2.5	
6/14/2010	0.6	0.4	1.0	0.4	0.5	0.5	
7/29/2010	0.7	0.3	0.7	0.9	0.3	0.8	

* dupl = 3.6

Table 13. Summary of Analytical Method Comparison for potential Interference for Arsenic, Selenium, and Manganese

Arsenic (µg/L)

Date	Outfall 003						Outfall 002						Plant	
	MW 3		MW 5		MW 6		MW 7		MW 8		MW 9		CW	
	Analytical Method													
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
10/27/2009	21	2.22	24.0	4.77	NA	NA	32	11.9	26	5.91	NA	NA		
6/14/2010	2.3	2.65	4.6	5.76	2.8	3.64	42	51.7	25	29.5	4.3	4.82		
7/29/2010	2.2	2.84	4.7	4.96	3.0	3.41	22	25.8	9.4	9.96	4.1	4.86	8.1	8.92

Selenium (µg/L)

Date	Outfall 003						Outfall 002						Plant	
	MW 3		MW 5		MW 6		MW 7		MW 8		MW 9		CW	
	Analytical Method													
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
10/27/2009	13	2.38	3.3	3.52			43	0.661	28	0.811				
6/14/2010	13	1.2	4.1	2.6	9.8	2.2	36	<1.1	50	<1.1	7.9	<1.1		
7/29/2010	9.0	1.73	4.1	2.53	8.6	1.98	26	<0.59	37	<0.59	4.9	<0.59	190	1.81

Manganese (µg/L)

Date	Outfall 003						Outfall 002						Plant	
	MW 3		MW 5		MW 6		MW 7		MW 8		MW 9		CW	
	Analytical Method													
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
10/27/2009	1.3	3.77	0.3	1.75			1.5	6.7	0.7	3.81				
6/14/2010	1.4	4.8	0.5	3.3	12	30.8	6.5	9.9	6.2	8.2	0.2	1.8		
7/29/2010	1.4	2.09	0.2	0.45	5.4	6.56	2.3	12.9	1.7	3.16	2.1	6.32	31	36.6

Analytical method 1 = ICP-MS
Analytical method 2 = ICP-DRC-MS

Table 14. Summary of Calcium and Magnesium Measurements

Calcium (mg/L)

Date	CT Area	Outfall 003		Outfall 002			Reg. Limit
	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	
10/24/2007						130	
2/6/2008						150	
4/23/2008						120	
7/23/2008	130	51	93	42	100	120	NA
10/22/2008	150	49	97	52	90	130	
1/21/2009	180	47	80	54	73	110	
4/27/2009	130	47	87	38	91	100	
7/22-23/2009	140	53	91	68	74	110	
10/27/2009	150	53	140	70	93	110	
1/25/2010	120	38	69	45	63	78	
6/14/2010	140	43	77	38	39	95	
7/29/2010	120	42	76	38	41	87	

Magnesium (mg/L)

Date	CT Area	Outfall 003		Outfall 002			Reg. Limit
	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	
10/24/2007						35	
2/6/2008						46	
4/23/2008						32	
7/23/2008	33	15	22	9.6	25	30	NA
10/22/2008	34	15	24	12	19	30	
1/21/2009	42	16	22	15	18	31	
4/27/2009	32	15	22	8.4	21	27	
7/22-23/2009	32	16	23	16	17	29	
10/27/2009	33	16	32	15	23	27	
1/25/2010	27	12	17	9.7	13	21	
6/14/2010	33	13	18	7.8	9.8	24	
7/29/2010	28	13	19	8.9	10	23	

Table 15. Summary of Potassium and Sodium Measurements

Potassium (mg/L)

Date	CT Area	Outfall 003		Outfall 002			Reg. Limit
	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	
7/23/2008							NA
10/22/2008							
1/21/2009							
4/27/2009	10	6.3	7.9	3.5	6.5	8.3	
7/22-23/2009	11	7.2	8.4	8.6	6.2	9.3	
10/27/2009	11	7.8	8.5	6.6	6.6	8.9	
1/25/2010	8.4	5.2	6.2	4.2	4.7	6.9	
6/14/2010	9.7	6.1	6.8	8.1	6.9	8.1	
7/29/2010	9.4	6.1	6.9	6.6	6.0	7.5	

Sodium (mg/L)

Date	CT Area	Outfall 003		Outfall 002			Reg. Limit
	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	
10/24/2007						55	
2/6/2008						59	
4/23/2008						52	
7/23/2008	46	20	27	7.6	21	49	Reccom = 20
10/22/2008	49	21	29	7.9	18	50	
1/21/2009	46	15	27	9.2	17	48	
4/27/2009	44	20	27	6.7	18	48	
7/22-23/2009	43	22	28	17	20	52	
10/27/2009	42	21	27	14	19	49	
1/25/2010	33	16	20	9.6	13	39	
6/14/2010	39	17	21	11	13	46	
7/29/2010	35	18	22	11	14	44	

Table 16. Summary of Bromide, Chloride, and Fluoride Measurements

Bromide (mg/L)

Date	CT Area MW 3	Outfall 003 Upgrd MW 5	Outfall 003 Dwngrd MW 6	Outfall 002 Dwngrd MW 7	Outfall 002 Dwngrd MW 8	Outfall 002 Upgrd MW 9	Reg. Limit
7/23/2008							NA
10/22/2008							
1/21/2009							
4/27/2009	1.1	0.093	0.66	0.07	0.15	0.56	
7/22-23/2009	1.1	0.11	0.74	6.2	0.64	0.56	
10/27/2009							
1/25/2010	1.3	0.077	0.9	0.95	6.2	0.66	
6/14/2010							
7/29/2010	0.61	<0.06	0.6	5.1	6.8	<0.06	

Chloride (mg/L)

Date	CT Area MW 3	Outfall 003 Upgrd MW 5	Outfall 003 Dwngrd MW 6	Outfall 002 Dwngrd MW 7	Outfall 002 Dwngrd MW 8	Outfall 002 Upgrd MW 9	Reg. Limit
10/24/2007						29	
2/6/2008						27	
4/23/2008						26	
7/23/2008	12	13	13	3.5	21	25	250
10/22/2008	13	13	14	9	20	25	
1/21/2009	16	14	14	7.3	19	25	
4/27/2009	14	14	14	5.6	28	24	
7/22-23/2009	13	14	14	10	11	25	
10/27/2009	15	15	15	9.1	11	22	
1/25/2010	16	16	15	8.2	11	22	
6/14/2010	15	14	15	7.8	9.9	21	
7/29/2010	16	16	16	9.6	12	22	

Fluoride (mg/L)

Date	CT Area MW 3	Outfall 003 Upgrd MW 5	Outfall 003 Dwngrd MW 6	Outfall 002 Dwngrd MW 7	Outfall 002 Dwngrd MW 8	Outfall 002 Upgrd MW 9	Reg. Limit
7/23/2008	0.05	0.23	0.15	0.15	0.14	0.09	4
10/22/2008	0.05	0.23	0.14	0.13	0.14	0.08	
1/21/2009	0.09	0.30	0.19	0.15	0.19	0.09	
4/27/2009	0.04	0.25	0.17	0.15	0.15	0.10	
7/22-23/2009	0.04	0.26	0.16	0.22	0.20	0.07	
10/27/2009	0.06	0.26	0.16	0.17	0.15	0.13	
1/25/2010	0.09	0.27	0.19	0.19	0.19	0.15	
6/14/2010	0.08	0.29	0.20	0.30	0.30	0.15	
7/29/2010	0.09	0.30	0.20	0.25	0.33	0.14	

Table 17. Summary of Nitrate, Nitrite, and Sulfate Measurements

Nitrate (as N) (mg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	4.3	7.7	6	0.26	0.22	23	10
10/22/2008	4.2	7.3	5.9	0.24	0.32	22	
1/21/2009	3.9	7.5	6.2	0.15	0.13	21	
4/27/2009	4.6	7.3	6.2	0.19	0.12	19	
7/22-23/2009	4.4	7.2	5.8	0.13	0.69	17	
10/27/2009	4.7	7.3	4.7	0.078	0.8	16	
1/25/2010	4.9	8.3	6.3	0.46	0.3	18	
6/14/2010	5.3	7.8	5.7	0.2	0.57	22	
7/29/2010	5.8	9.3	6.4	0.27	0.32	23	

Nitrite (as N) (mg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	<0.03	<0.03	<0.03	<0.03	0.64	<0.03	1
10/22/2008	0.22	0.26	0.23	0.17	0.3	0.53	
1/21/2009	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
4/27/2009	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
7/22-23/2009	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
10/27/2009	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
1/25/2010	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
6/14/2010	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
7/29/2010	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	

Sulfate (mg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
10/24/2007						200	
2/6/2008						210	
4/23/2008						170	
7/23/2008	130	52	95	15	45	170	250
10/22/2008	130	49	92	15	42	160	
1/21/2009	210	50	87	16	39	150	
4/27/2009	120	50	100	14	43	140	
7/22-23/2009	120	50	93	110	60	130	
10/27/2009	120	53	100	94	110	130	
1/25/2010	140	56	100	37	120	140	
6/14/2010	110	51	97	49	51	150	
7/29/2010	130	59	120	54	58	160	

Table 18. Summary of Total Dissolved Solids, Total Alkalinity, and Total Phosphorus Measurements

Total Dissolved Solids (mg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008	670	300	440	160	<5	680	500
10/22/2008	650	300	440	200	360	700	
1/21/2009	830	280	430	210	340	650	
4/27/2009	700	350	520	180	430	680	
7/22-23/2009	620	310	440	350	340	600	
10/27/2009	730	370	510	320	440	620	
1/25/2010	720	310	460	270	390	580	
6/14/2010	680	290	460	240	250	630	
7/29/2010	670	340	470	230	260	620	

Total Alkalinity (mg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008							NA
10/22/2008							
1/21/2009							
4/27/2009							
7/22-23/2009							
10/27/2009	390	120	210	120	170	210	
1/25/2010	430	130	210	180	160	220	
6/14/2010	440	130	220	100	110	200	
7/29/2010	420	130	210	120	130	210	

Total Phosphorus (as P) (mg/L)

	CT Area	Outfall 003			Outfall 002		
Date	MW 3	Upgrd MW 5	Dwngrd MW 6	Dwngrd MW 7	Dwngrd MW 8	Upgrd MW 9	Reg. Limit
7/23/2008							NA
10/22/2008							
1/21/2009							
4/27/2009							
7/22-23/2009	<0.1	<0.1	0.12	0.91	<0.1	<0.1	
10/27/2009	0.17	<0.1	0.17	0.73	0.14	0.18	
1/25/2010	0.13	0.14	0.14	0.39	0.19	0.13	
6/14/2010	<0.1	<0.1	<0.1	0.74	0.32	<0.1	
7/29/2010	<0.1	<0.1	<0.1	0.46	0.2	<0.1	

Table 19. Summary of Chloroform,Bromoform,and Tetrachloroethne measurements

Chloroform (µg/l)

	CT Area	Outfall 003		Outfall 002			
		Upgrd	Dwngrd	Dwngrd	Dwngrd	Upgrd	
Date	MW 3	MW 5	MW 6	MW 7	MW 8	MW 9	Reg. Limit
7/23/2008	ND	ND	ND	1.88	4.27	1.00	7
10/22/2008	ND	ND	ND	5.39	2.65	1.03	
1/21/2009	ND	ND	ND	6.12	1.78	0.84	
4/27/2009	ND	ND	ND	4.30	1.40	0.83	
7/22-23/2009	ND	ND	ND	ND	1.22	1.09	
10/27/2009	ND	ND	ND	1.31	0.85	1.07	
1/25/2010	ND	ND	ND	2.99	0.76	0.77	
6/14/2010	ND	ND	ND	ND	ND	1.14	
7/29/2010	ND	ND	ND	ND	ND	0.89	

Bromoform (µg/l)

	CT Area	Outfall 003		Outfall 002			
		Upgrd	Dwngrd	Dwngrd	Dwngrd	Upgrd	
Date	MW 3	MW 5	MW 6	MW 7	MW 8	MW 9	Reg. Limit
7/23/2008	ND	ND	ND	ND	ND	ND	5
10/22/2008	ND	ND	ND	ND	ND	ND	
1/21/2009	ND	ND	ND	ND	ND	ND	
4/27/2009	ND	ND	ND	ND	ND	ND	
7/22-23/2009	ND	ND	ND	5.17	ND	ND	
10/27/2009	ND	ND	ND	ND	ND	ND	
1/25/2010	ND	ND	ND	ND	ND	ND	
6/14/2010	ND	ND	ND	14.8	23.7	ND	
7/29/2010	ND	ND	ND	ND	ND	ND	

Tetrachloroethene (µg/l)

	CT Area	Outfall 003		Outfall 002			
		Upgrd	Dwngrd	Dwngrd	Dwngrd	Upgrd	
Date	MW 3	MW 5	MW 6	MW 7	MW 8	MW 9	Reg. Limit
7/23/2008	ND	ND	ND	ND	ND	ND	0.8
10/22/2008	ND	ND	ND	ND	ND	ND	
1/21/2009	ND	ND	ND	ND	ND	ND	
4/27/2009	0.52	ND	ND	ND	ND	ND	
7/22-23/2009	0.56	ND	ND	ND	ND	ND	
10/27/2009	0.55	ND	ND	ND	ND	ND	
1/25/2010	0.53	ND	ND	ND	ND	ND	
6/14/2010	0.57	ND	ND	ND	ND	ND	
7/29/2010	0.50	ND	ND	ND	ND	ND	

Table 20. Circulating Cooling Water System Water Quality

Date	Cond (µS/cm)	TDS (mg/L)	TSS (mg/L)	Ammonia (mg/L)	Cl (mg/L)	F (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	T-P (mg/L)
7/8/2009	640	500	5.2	0.046	14	0.26	0.14	<0.03	7.1
10/13/2009	1200	930	14	0.16	26	0.32	0.051	<0.03	5.6
1/13/2010	1400	1000	9.2	0.039	21	0.54	1.6	<0.03	2.7
6/1/2010	720	510	5.4	0.054	17	0.33	0.38	<0.03	2.8
7/6/2010	1400	1200	9.4	0.13	48	0.66	0.57	<0.03	3.0

Date	T. Alk. (mg/L)	SO4 (mg/L)	Fe (mg/L)	Mg (mg/L)	Mn (mg/L)	Cr (mg/L)	Cu (mg/L)	Pb (mg/L)	Zn (mg/L)
7/8/2009	170	150	0.11	24	0.017	0.0014	0.027	<0.0002	0.025
10/13/2009	140	440	0.41	48	0.04	0.0024	0.047	0.0045	0.036
1/13/2010	110	800	0.3	53	0.02	0.0023	0.026	0.0008	0.041
6/1/2010	150	200	0.19	21	0.015	0.0008	<0.0002	<0.0002	<0.0002
7/6/2010	110	610	0.35	43	0.031	0.0021	0.032	0.0002	0.026