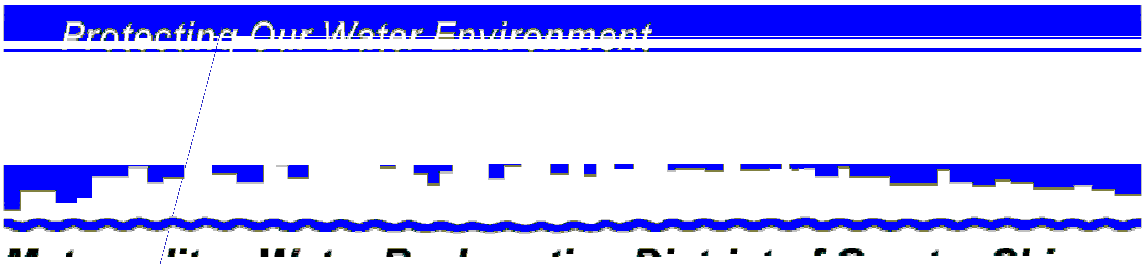

RESEARCH AND DEVELOPMENT DEPARTMENT

REPORT NO. 06-43

GROUNDWATER MONITORING REPORT

TUNNEL AND RESERVOIR PLAN
THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR
WATER QUALITY MONITORING WELLS
2005 ANNUAL REPORT

AUGUST 2006

LIST OF TABLES

LIST OF FIGURES

GROUNDWATER MONITORING REPORT
TUNNEL AND RESERVOIR PLAN

The January fill event began on January 12, 2005, resulting in storage of 1.49 billion gallons in the Reservoir. On February 14, 2005, with 4 to 6 feet of CSO water elevation in the Reservoir from the January 12, 2005, fill event, another diversion occurred. This event resulted in an additional 356 million gallons

TABLE 1: LIST OF PARAMETERS TO BE ANALYZED ACCORDING TO TABLE 2 FROM THE IEPA'S SCOPE OF WORK

Arsenic	Ammonia
Boron	Barium
Chloride	Cadmium
Copper	Chromium
Fecal Coliform	Cyanide
Iron	Fluoride
Lead	Manganese
Mercury	Nickel
Phenols	Silver
Sulfate	Temperature
Total Dissolved Solids	Nitrate

Biochemical Oxygen Demand (5-day and 21-day)

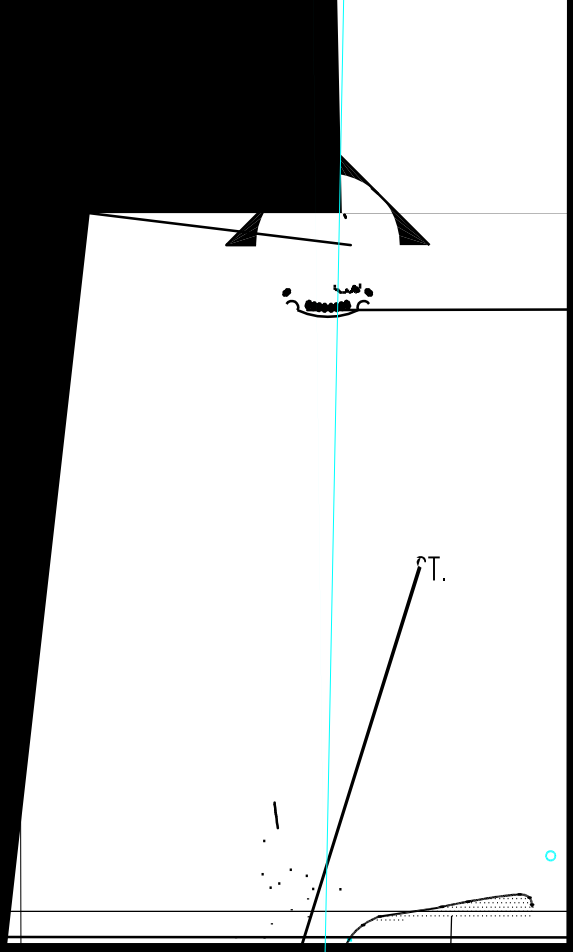

Table 2: PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN WATER QUALITY MONITORING WELL QT–1 DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Arsenic (mg/L)	Boron (mg/L)	Chloride (mg/L)	Copper (mg/L)	Fecal Coliform (cfu/100 mL)	Iron (mg/L)	Lead (mg/L)	Mercury (µg/L)	Phenols (µg/L)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Ammonia Nitrogen (mg/L)
1/20/05	<0.002	0.312	434	0.007	<1	35.237	<0.002	<0.05	3	372	1614	0.49
1/26/05	<0.002	0.309	429	0.014	<1	27.237	0.002	<0.05	<2	384	1642	0.48
2/2/05	<0.002	0.348	363	0.008	<1	4.538	<0.002	<0.05	<2	395	1138	0.39
2/10/05	<0.002	0.302	422	0.006	<1	25.734	<0.002	<0.05	4	400	1380	0.37
2/17/05	Well could not be sampled*											
2/25/05	<0.002	0.271	419	0.013	<1	26.340	0.006	<0.05	<2	400	1544	0.29
3/1/05	<0.002	0.322	442	0.010	<1	13.638	0.011	<0.05	2	466	1572	0.50
Revised 95% Upper Confidence Limit	0.003	NA	552	0.018	NA	47.612	0.015	0.15	NA	489	2279	NA
Excursion	No	NA	No	No	NA	No	No	No	NA	No	No	NA

Table 2 (Continued): PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN WATER QUALITY MONITORING WELL QT–1 DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Cyanide (mg/L)	Fluoride (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Silver (mg/L)	Temperature °C	Nitrate Nitrogen (mg/L)	BOD_5 (mg/L)	BOD_{21} (mg/L)
1/20/05	0.0711	<0.0004	<0.004	<0.003	0.24	0.0594	<0.002	<0.0008	11.2	0.005	<2	2
1/26/05	0.0701	<0.0004	<0.004	<0.003	0.20	0.0658	<0.002	<0.0008	11.1	0.006	<2	<2
2/2/05	0.0749	<0.0004	<0.004	<0.003	0.15	0.0280	<0.002	<0.0008	11.2	0.005	<2	2
2/10/05	0.0761	<0.0004	<0.004	<0.003	0.21	0.1100	<0.002	<0.0008	11.8	<0.005	4	3
2/17/05	Well could not be sampled*											
2/25/05	0.0740	<0.0004	<0.004	<0.003	0.27	0.0820	<0.002	<0.0008	12.1	0.007	<2	3
3/1/05	0.0693	0.0012	<0.004	<0.003	0.33	0.0286	<0.002	<0.0008	12.3	<0.005	<2	3
Revised 95% Upper Confidence	0.0963	0.0012	0.0048	0.002	0.57	0.1460	NA	**	NA	0.024	NA	NA

Table 3: PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN WATER QUALITY MONITORING WELL QT–2 DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

Table 3 (Continued): PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN WATER QUALITY MONITORING WELL QT–2 DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Cyanide (mg/L)	Fluoride (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Silver (mg/L)	Temperature °C	Nitrate Nitrogen (mg/L)	BOD_5 (mg/L)	BOD_{21} (mg/L)
1/20/05	0.0404	<0.0004	<0.004	<0.003	0.15	0.3478	0.038	<0.0008	13.1	0.216	<2	3
1/26/05	Well could not be sampled*											
2/2/05	0.0422	<0.0004	<0.004	<0.003	0.15	0.1906	0.023	<0.0008	12.5	0.014	<2	3
2/10/05	0.0509	<0.0004	<0.004	<0.003	0.15	0.0533	0.032	<0.0008	12.6	0.366	3	3
2/17/05	0.0524	<0.0004	<0.004	<0.003	0.12	0.0373	0.034	<0.0008	13.0	0.651	<2	3
2/25/05	0.0514	<0.0004	<0.004	<0.003	0.18	0.0435	0.028	<0.0008	13.4	1.195	<2	3
3/1/05	0.0497	0.0012	<0.004	<0.003	0.19	0.0317	0.037	<0.0008	13.2	2.570	<2	2
Revised 95% Upper Confidence Limit	0.0742	0.0012	0.007	0.002	0.35	0.0574	NA	0.0002	NA	4.416	NA	NA
Excursion	No	No	No	No	No	Yes	NA	No	NA	No	NA	NA

NA—not applicable.
No = concentration did not exceed 95 percent upper confidence limit; Yes = concentration exceeded 95 percent upper confidence limit.
*Unable to collect sample because snow blocked access to the well.

Table 4: PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN WATER QUALITY MONITORING WELL QT–3 DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Arsenic (mg/L)	Boron (mg/L)	Chloride (mg/L)	Copper (mg/L)	Fecal Coliform (cfu/100 mL)	Iron (mg/L)	Lead (mg/L)	Mercury (µg/L)	Phenols (µg/L)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Ammonia Nitrogen (mg/L)
1/20/05	<0.002	0.262	178	0.009	<1	10.912	<0.002	<0.05	3	169	870	0.41

Table 4 (Continued): PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN WATER QUALITY MONITORING WELL QT–3 DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Cyanide (mg/L)	Fluoride (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Silver (mg/L)	Temperature °C	Nitrate Nitrogen (mg/L)	BOD_5 (mg/L)	BOD_{21} (mg/L)
1/20/05	0.0622	<0.0004	<0.004	<0.003	0.16	0.0798	<0.002	<0.0008	10.4	0.015	<2	2
1/26/05	Well could not be sampled*											
2/2/05	0.0714	<0.0004	<0.004	<0.003	0.14	0.1401	0.003	<0.0008	12.5	<0.005	2	4
2/10/05	0.0731	<0.0004	0.006	<0.003	0.15	0.1590	<0.002	<0.0008	12.6	0.015	<2	4
2/17/05	0.0710	<0.0004	<0.004	<0.003	0.08	0.1557	<0.002	<0.0008	13.1	0.046	<2	3
2/25/05	0.0741	<0.0004	<0.004	<0.003	0.16	0.1741	0.002	<0.0008	12.9	0.026	<2	3
3/1/05	0.0616	0.0005	<0.004	<0.003	0.16	0.1180	<0.002	<0.0008	11.0	<0.005	<2	3
Revised 95% Upper Confidence Limits	0.1000	0.0006	0.007	0.002	0.38	0.1793	NA	0.0196	NA	0.331	NA	NA
Excursion	No	No	No	No	No	No	NA	No	NA	No	NA	NA

NA—not applicable.

No = concentration did not exceed 95 percent upper confidence limit; Yes = concentration exceeded 95 percent upper confidence limit.

*Unable to collect sample because snow blocked access to the well.

**Background value was below detection limit, 95 percent upper confidence limit could not be determined.

Table 5: PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN WATER QUALITY MONITORING WELL QT–4 DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Arsenic (mg/L)	Boron (mg/L)	Chloride (mg/L)	Copper (mg/L)	Fecal Coliform (cfu/100 mL)	Iron (mg/L)	Lead (mg/L)	Mercury (µg/L)	Phenols (µg/L)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Ammonia Nitrogen (mg/L)
1/20/05	<0.002	0.420	437	0.014	<1	18.748	<0.002	<0.05	4	237	1402	0.43
1/26/05	Well could not be sampled*											
2/2/05	<0.002	0.445	430	0.007	<1	1.986	<0.002	<0.05	4	252	1479	0.47
2/10/05	<0.002	0.469	447	0.006	<1	2.220	0.002	<0.05	4	253	1420	0.50
2/17/05	<0.002	0.372	466	0.009	<1	19.352	<0.002	<0.05	<2	253	348	0.48
2/25/05	<0.002	0.371	464	0.015	<1	23.224	0.006	<0.05	<2	231	1434	0.32
3/1/05	<0.002	0.379	462	0.010	<1	13.638	0.011	<0.05	2	230	1572	0.40
Revised 95% Upper Confidence Limit	**	NA	611	0.073	NA	31.510	0.024	0.07	NA	300	1873	NA
Excursion	NA	NA	No	No	NA	No	No	No	NA	No	No	NA

Table 5 (Continued): PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN WATER QUALITY MONITORING WELL QT–4 DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Cyanide (mg/L)	Fluoride (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Silver (mg/L)	Temperature °C	Nitrate Nitrogen (mg/L)	BOD_5 (mg/L)	BOD_{21} (mg/L)
1/20/05	0.1071	0.0004	0.007	<0.003	0.18	0.1307	<0.002	<0.0008	12.8	<0.005	<2	4
1/26/05	Well could not be sampled*											
2/2/05	0.1027	<0.0004	<0.004	<0.003	0.16	0.0414	<0.002	<0.0008	12.6	<0.005	<2	2
2/10/05	0.1097	0.0006	<0.004	<0.003	0.18	0.0408	<0.002	<0.0008	11.8	0.007	<2	2
2/17/05	0.1044	<0.0004	<0.004	0.003	0.11	0.1711	<0.002	<0.0008	11.9	0.013	<2	2
2/25/05	0.1086	<0.0004	<0.004	<0.003	0.19	0.2197	<0.002	<0.0008	12.0	0.028	<2	2
3/1/05	0.0629	<0.0004	<0.004	<0.003	0.17	0.0783	<0.002	<0.0008	12.9	<0.005	<2	3
Revised 95% Upper Confidence Limit	0.1576	0.0009	0.074	0.002	0.37	0.2332	NA	0.0043	NA	0.262	NA	NA
Excursion	No	No	No	Yes	No	No	NA	No	NA	No	NA	NA

NA—not applicable.

No = concentration did not exceed 95 percent upper confidence limit; Yes = concentration exceeded 95 percent upper confidence limit.

*Unable to collect sample because snow blocked access to the well.

**Background value was below detection limit, 95 percent upper confidence limit could not be determined.

Table 6: PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN THORNTON TRANSITIONAL RESERVOIR DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Arsenic (mg/L)	Boron (mg/L)	Chloride (mg/L)	Copper (mg/L)	Fecal Coliform (cfu/100 mL)	Iron (mg/L)	Lead (mg/L)	Mercury (µg/L)	Phenols (µg/L)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Ammonia Nitrogen (mg/L)
1/15/05	<0.002	0.070	93	0.014	3400	3.728	0.004	<0.05	18	40	306	0.19
1/20/05	<0.002	0.058	82	0.015	90	3.769	0.004	<0.05	14	40	370	0.32
1/26/08	0.004	0.068	92	0.020	<100	2.632	0.002	<0.05	11	41	389	0.53
2/3/05	Reservoir could not be sampled*											
2/10/05	<0.002	0.072	95	0.027	<100	1.724	0.004	<0.05	14	42	312	0.33
2/15/05	<0.002	0.069	101	0.014	<10	1.549	0.005	<0.05	9	46	366	0.46
2/23/05	<0.002	0.077	107	0.012	9	1.634	0.007	<0.05	5	52	1470	0.21
3/1/05	Reservoir could not be sampled**											

Table 6 (Continued): PARAMETERS FROM TABLE 2 OF IEPA'S SOW IN THORNTON TRANSITIONAL RESERVOIR DURING THE JANUARY 12 AND FEBRUARY 14, 2005, FILL EVENTS

	Table 2 (SOW) Parameters											
Date	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Cyanide (mg/L)	Fluoride (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Silver (mg/L)	Temperature °C	Nitrate Nitrogen (mg/L)	BOD_5 (mg/L)	BOD_{21} (mg/L)
1/15/05	0.0333	0.0007	0.005	0.003	0.16	0.0607	0.005	0.0033	5.3	1.002	2	7
1/20/05	0.0354	0.0004	0.005	<0.003	0.26	0.0531	0.016	<0.0008	5.2	0.970	5	7
1/26/08	0.0290	0.0005	0.004	<0.003	0.19	0.0313	0.004	<0.0008	4.1	1.094	3	5
2/3/05	Reservoir could not be sampled*											
2/10/05	0.0254	<0.0004	<0.004	<0.003	0.15	0.0276	0.004	<0.0008	4.4	<0.005	4	7
2/15/05	0.0252	<0.0004	<0.004	0.004	0.17	0.0438	0.004	<0.0008	4.2	1.018	18	24
2/23/05	0.0266	0.0005	<0.004	<0.003	0.18	0.0436	0.004	<0.0008	4.2	1.072	3	5
3/1/05	Reservoir could not be sampled**											

*Unable to collect sample because reservoir surface was covered with ice.

**Unable to collect sample because reservoir was dry.