2004 Leakage Assessment of P01 Series Wells, Faro Mine

prepared for:
Deloitte and Touche Inc.
Interim Receiver, Faro Mine

prepared by:
Gartner Lee Limited

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Valerie Chort
Deloitte and Touche Inc.
Via email: vchort@deloitte.ca

Dear Ms. Chort:

Re: 40-692 2004 Leakage Assessment of P01 Series Wells, Faro Mine – Final Report

We are pleased to present you with an electronic copy of our report entitled "40-692 2004 Leakage Assessment of P01 Series Wells, Faro Mine." This document presents all the relevant data collected during the 2004 field season. The data and conclusions presented have been discussed and reviewed by all interested parties prior to finalizing the document.

Please do not hesitate to contact me at 633-6474 ext. 24, or Eric Denholm at 867-873-5808 ext. 22 should you have any questions.

Yours very truly,
GARTNER LEE LIMITED

(via e-mail)

Martin Guilbeault, M.Sc.
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MG:mg

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1. Executive Summary

Gartner Lee Limited completed the groundwater sampling and testing component of the 2004 Faro Mine Well Leakage Assessment Study from September 25 to October 1, 2004. Other sampling and testing consisting of single point packer testing and downhole video was performed in May and June of 2004 and results are discussed in this document. During the September 2004 field episode, geochemical profiles of field parameters (pH, specific conductance, temperature, ORP, DO) were recorded from the static water level to the bottom of the well in 20 wells. A discrete depth water sample was then collected from the screen interval of each well. Five of the water wells (P01-09 B,C,D and P01-07 D,E) were then sampled using inflatable single-point packer systems and one additional well (P01-07-C) was sampled after large volume continuous purging. Each of the five "packer tested" wells were initially purged by continuous pumping to remove as much groundwater as was feasible given time constraints. Field parameters were monitored during this purging and at least one sample was collected in wells P01-09 B,C,D and P01-07 C,D,E once purging was stopped. Single-point packers were then installed immediately above the screened intervals and inflated to isolate the screen and allow additional sampling and purging through the packer. The data suggest that wells P01-09 C/D are impacted by leakage and represent the most significant potential sources of impact to the aquifer. Inflatable packers were installed in these wells in September 2004 as a mitigation measure during the winter of 2004/2005 prior to possible decommissioning activitites in 2005.

2. Introduction

This draft report documents the field activities (geochemical profiling, discrete interval sampling, packer installation, purging and sampling) that were proposed in the work plan for continued leakage testing at the Faro Mine Site. The September 13, 2004 document entitled "Anvil Range: Recommendations and Proposed 2004 Workplan for Continued Leakage Testing at Rose Creek Tailings Facility (revised)," was developed and discussed in concert with Gartner Lee, Robertson GeoConsultants, the Interim Receiver, Environment Canada (Environmental Protection) and the Type II Projects Office. This document was prepared in order to summarize all relevant data from recent and past leakage testing and to provide an assessment of current conditions at the targeted wells. A draft report provided the necessary data for all interested parties to discuss future management actions. These recommendations are summarized in this report.

The specific objectives of the proposed September 2004 investigations were to:

1. Qualitatively assess geochemical conditions throughout the standing water in individual wells
2. Quantitatively determine the undisturbed groundwater chemistry within the well screens
3. Obtain a sample of groundwater which is most representative of in-situ conditions by minimizing possible leakage biases
4. Review historical chemistry data for each well to determine if there is any evidence of leakage effects and determine (if possible) the reliability of past data

Abnormally high temporal variability in water quality at location P01-09 prompted comparative sampling at location P01-09 by Environment Canada (EC) and Gartner Lee Limited (GLL) in 2003. Large variation in analytical results were again observed and some down-hole video and static water profiling was done by EC. Results suggested that leakage of tailings porewater into the wells may be occurring through some of the joints as outlined in a November 2003 memo by EC. Follow up work was initiated by GLL in early 2004 to examine the leakage issue specifically at P01-09. Assessment work was then extended to all P01 series wells in the fall of 2004.

3. Approach

In order to optimize the use of field equipment and minimize mobilization costs, this field program was conducted in conjunction with the fall routine well sampling episode. In order to minimize equipment set-up time, the packer testing field program was completed in separate phases which utilized multi-person field crews. Field work was conducted in the following manner:

1. Geochemical profiling of wells to determine in-situ well conditions
2. Depth discrete sampling of wells to obtain chemistry of groundwater within the well screen

3. Well purging to maximize flow rates and minimize possible effects from leakage
4. Installation of single-point inflatable packer to isolate the well screen sampling zone
5. Purging below the packer to provide localized flushing of well screen
6. Sampling below packer to eliminate bias from possible leakage from above the packer

In order to facilitate interpretation of the results, Table 1 provides a summary of testing activities that were performed by GLL during 2004 at each well.

Table 1. Summary of Testing Activities Performed at Each Well Location

Location	Date	Activity	Samples Collected (Original Sample ID)	Sample Description / Comments
P01-01-A	12-May-04	broken casing replaced (tubing is sandlocked in well)		
	Sept. 2004	tubing sandlocked in well (not sampled)		
P01-01-B	12-May-04	broken casing replaced (tubing is sandlocked in well)		
	June, 2004	monitor was rehabilitated by removing sand		
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01-01-B-34.5m	from discrete depth sampler
P01-02-A	June 15-22, 2004	well sampled (well is damaged)	P01-02A	conventional sample
	Sept. 2004	tubing is pinched and stuck in monitor due to a bulge in the casing.		
P01-02-B	June 15-22, 2004	well sampled	P01-02B	conventional sample
			P01-02B-D	replicate sample
	Sept. 2004	geochemical field parameter profiling of static water in well		
P01-03	June 15-22, 2004	well sampled	P01-03	conventional sample
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01-03-A-8.5m	from discrete depth sampler
P01-04-A	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01-04-A-33m	from discrete depth sampler
P01-04-B	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01-04-B-52m	from discrete depth sampler
P01-05-A	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01-05-A	
P01-05-B	June 15-22, 2004	conventional sampling	P01-05B-AP	after purging 3 well volumes
		down-hole camera used to examine joints in casing		
		leakage monitoring above packer by measuring the rise in water level above packer. The water level rise was 2.45m (4.9L) within 15h15min	P01-05B-TP	leakage water from top of packer
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01- 05-B 15	from discrete depth sampler
P01-06	June 15-22, 2004	conventional sampling	P01-06-AP	after purging 3 well volumes
		down-hole camera used to examine joints in casing		
		leakage monitoring above packer by measuring the rise in water level above packer. The water level rise was 1.97m (4.0L) within 16h22min	P01-06-TP	leakage water from top of packer

Table 1. Summary of Testing Activities Performed at Each Well Location

Location	Date	Activity	Samples Collected (Original Sample ID)	Sample Description / Comments
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01- 06-A 10.5m	from discrete depth sampler
P01-07-A	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01-07-A-17m	
P01-07-B	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01-07-B-22.7m	
P01-07-C	June 15-22, 2004	conventional sampling	P01-07C-AP	after purging 3 well volumes
			P01-07C-AP-R	(replicate) after 3 well volumes
		down-hole camera used to examine joints in casing		
		leakage monitoring above packer by measuring the rise in water level above packer. The water level rise was 4.9m (9.9L) within 101hrs	P01-07C-TP	leakage water from top of packer
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01- 07-C 26m	from discrete depth sampler
		large volume purging	P01-07- C-AFTER PURGE	after purging 352L from well with foot valve at screen (water always turbid and grey)
P01-07-D	June 15-22, 2004	conventional sampling	P01-07D - AP	after purging 3 well volumes
			P01-07D-AP- D	duplicate
		down-hole camera used to examine joints in casing		
		leakage monitoring above packer by measuring the rise in water level above packer. The water level rise was 0.4m (0.81L) within 98 hrs	P01-07D-TP	leakage water from top of packer
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01- 07-D-33m	from discrete depth sampler
		large volume purging prior to packer installation		purged a total of 408L from well with foot valve at screen
		installation of packer		
		purging and sampling below packer	BP-P01- 07-D	after purging 10L (3.3 well screen volumes) from below packer
P01-07-E	June 15-22, 2004	conventional sampling	P01-07E -AP	after purging 3 well volumes
		down-hole camera used to examine joints in casing		
		leakage monitoring above packer by measuring the rise in water level above packer. The water level rise was 0.02m (0.04L) within 16hrs30min	P01-07E-TP 9:00	leakage water from top of packer, packer was only installed to depth of 14m (only one joint below the water table)
		geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01- 07-E-33m	from discrete depth sampler

Table 1. Summary of Testing Activities Performed at Each Well Location

Location	Date	Activity	Samples Collected (Original Sample ID)	Sample Description / Comments
	Sept. 2004		DD-P01- 07-E-40m	from discrete depth sampler
		large volume purging prior to packer installation		purged a total of 210L from well with foot valve at screen
		installation of packer		
		purging and sampling below packer	BP-P01- 07-E	after purging 10L (3.3 well screen volumes) from below packer
			BP-P01- 07-E-R	after purging 10L (3.3 well screen volumes) from below packer
P01-08-A	Sept. 2004	tubing stuck/frozen? in well		
P01-08-B	June 15-22, 2004	well frozen		
	Sept. 2004	tubing stuck/frozen? in well		
P01-08-C	June 15-22, 2004	well frozen		
	Sept. 2004	tubing stuck/frozen? in well		
P01-08-D	Sept. 2004	tubing stuck/frozen? in well		
P01-09-A	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-PO1- 09-A-11m	from discrete depth sampler
			DD-PO1- 09-EB	from discrete depth sampler
P01-09-B	11-May-04	well rehabilitated by replacing riser pipe and casing		
		down-hole camera used to examine joints in casing		staining observed at most joints below the water table
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-PO1- 09-B- 15.5m	from discrete depth sampler
		large volume purging prior to packer installation		after purging 733L from well with foot valve at screen
		installation of packer		
		purging and sampling below packer	BP-P01-09-B	after purging 81L (26 well screen volumes) from below packer
	Nov. 2004	installation of long-term packer		
P01-09-C	11-May-04	down-hole camera used to examine joints in casing		staining observed at most joints below the water table
		conventional sampling	P01-09-C-GLL1	sample taken after purging 50L (dissolved metals only)
			P01-09-C-GLL2	sample taken after purging 150L (dissolved metals only)
		leakage monitoring above packer by measuring the rise in water level above packer. The water level rise was 6.02m (12.2L) within 13h53min	P01-09-C-GLL3	leakage water accumulated on top of packer
			P01-09-C-GLL3D	duplicate of leakage water on top of packer (dissolved metals only)
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-PO1- 09-C-21m	from discrete depth sampler
		large volume purging prior to packer installation	PO1- 09-C-AP	after purging 950L from well with foot valve at screen
		installation of packer		
		purging and sampling below packer	P01- 09-C- BP	after purging 66L (22 well screen

Table 1. Summary of Testing Activities Performed at Each Well Location

Location	Date	Activity	Samples Collected (Original Sample ID)	Sample Description / Comments
		bromide injection experiment and permanent installation of packer using nitrogen tank and regulator		
P01-09-D	11-May-04	down-hole camera used to examine joints in casing		staining observed at most joints below the water table
		well rehabilitated by retrieving stuck tubing		
		conventional sampling	P01-09-D-GLL4	sample taken after purging 150L
		leakage monitoring above packer by measuring the rise in water level above packer. The water level rise was 2.867m (5.8L) within 4h26min	P01-09-D-GLL5	leakage water accumulated on top of packer
			P01-09-D-GLL5R	duplicate of leakage water on top of packer (dissolved metals only)
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01- 09-D-20m	from discrete depth sampler
			DD-P01- 09-D-26m	from discrete depth sampler
		large volume purging prior to packer installation	P01- 09-D-AP	sample taken after purging 1026L with foot valve at screen
		installation of packer		
		purging and sampling below packer	P01- 09-D-BP- 12:04	after purging 33L (11 well screen volumes) from below packer
			P01- 09-D-BP- 14:49	after purging 66L (22 well screen
		bromide injection experiment and permanent installation of packer using nitrogen tank and regulator		
P01-10-A	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01-10A-14.5m	from discrete depth sampler
P01-10-B	June 15-22, 2004	conventional sampling	P01-10B-AP	after purging 3 well volumes
		down-hole camera used to examine joints in casing		
		leakage monitoring above packer by measuring the rise in water level above packer. The water level rise was 0.93m (1.9L) within 3hrs20min	P01-10B-P (TP) 14:00	leakage water from top of packer
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler	DD-P01- 10-B 20.5	from discrete depth sampler
P01-11	June 15-22, 2004		P01-11	conventional sample
	Sept. 2004	geochemical field parameter profiling of static water in well		
		discrete interval sampling using stainless steel sampler		
X21C-96	June 15-22, 2004	down-hole camera used to examine joints in casing		no visual staining observed at joints
	May, 2005	routine sampling	X21-C	evidence of tailings in well
X21B-96	June 15-22, 2004	down-hole camera used to examine joints in casing		no visual staining observed at joints

4. Field Methodology

4.1 Geochemical Profiling Using Multi-Probe

Waterra sampling tubing was removed from each well at least 3 weeks prior to the profiling to minimize disturbance of water within the well and allow stabilization of chemical conditions in the well. A detailed profile of field parameters (pH, ORP, Temperature, Dissolved Oxygen, TDS, Specific Conductance) was recorded on a YSI 560 MDS data-logger/multi-probe as the instrument was slowly lowered to the bottom of the well. The probe was allowed to stabilize prior to recording each measurement. The sampling interval was dependent on observed changes in parameters. At each well, sufficient sampling locations were chosen to adequately characterize the shape of the profiles. Profiling data are presented in Appendix B. Detailed field profiling of some wells was also done by Environment Canada in June of 2003. These data are presented and discussed in the following sections.

4.2 Groundwater Sampling

The groundwater samples collected for this 2004 leakage assessment study consisted of the following:

1. Conventional sampling of some wells (May and June)
2. Sampling of Leakage from above packer (May and June)
3. Discrete depth samples prior to testing (September)
4. Samples collected during/after large volume purging (September)
5. Samples collected during/after purging from below packer (September)

A different sampling method was used for each of the above samples. Conventional sampling was done either manually by agitating a tubing with a foot valve or mechanically (suction pump or hydrolift assisted) using standard HDPE tubing with foot valves. Sampling above the packer was done using tubing and foot valves (no purge). A stainless steel, discrete interval sampler was used to collect all depth discrete samples. Samples that were collected from the isolated packer zone were collected through ¼” OD HDPE tubing with a stainless steel Waterra SS-10 foot valve. These samples were collected either manually or with a peristaltic pump. A detailed description of each procedure is provided below.

4.3 Well purging

Once the static profile was recorded and a discrete interval sample was collected, full packer testing was performed at wells P01-09 B, C, D and P01-07 D, E. In order to purge as much water as practical from each well, a Waterra hydrolift pump and a Honda suction pump were attached to HDPE tubing with foot valves and wells were pumped for several hours resulting in purge volumes as much as 1000 L. In all cases, purge volumes were estimated from flow rates.

4.4 Depth discrete sampling

Once a detailed profile of field parameters was obtained from each well, an undisturbed water sample was collected from the screened interval using a stainless-steel, discrete interval sampler manufactured by Solinst Canada (model 425). A 450ml sample (maximum capacity of the sampler) was collected at each location. Due to limited volume, field parameters for each sample were not measured. However, static profiles of well water were recorded immediately prior to or within a few days prior to depth discrete sampling. All depth-discrete sampling results are presented in figures in the following section and field data is summarized in Appendix C. The sampler dimensions are 1.66 inches x 2ft OD. To ensure minimal disturbance of water within the 2" ID well, the sampler was lowered very slowly to the desired depth. The instrument sample port is located at the bottom of the canister. Prior to lowering the sampler down the well, it was pressurized with an air pump to prevent any water from above the sampling location to enter the sampler before the desired sampling depth. The sampler fills with water once the canister is depressurized.

4.5 Decontamination of Field Instruments and Sampling Equipment

The field probe used for obtaining static profiles of each well was decontaminated by wiping the cable dry as it was pulled up from the well and then rinsing with distilled water and drying. The cable and probe were stored in a clean cooler when not in use. The discrete depth sampler was decontaminated by using a four step cleaning process. Once the sample had been collected, the stainless steel instrument was disassembled and each part was rinsed with clean tap water from the town of Faro, then scrubbed in a solution of distilled water and Alconox ™, then immersed in distilled water and air dried. The steel cable and inflation tubing for the discrete depth sampler were also wiped clean as they were removed from the well. Clean tubing and new foot valves were used to purge each well prior to the installation of the packers. The packers were cleaned before use using the same procedure as that for the discrete depth sampler. A peristaltic pump was used for purging and sampling through the packer at location P01-09. Clean, new pump tubing was used for each sampling point.

4.6 Calibration of Field Instruments

Field probes were calibrated daily prior to the start of field activities using new pH and conductivity calibration solutions. Calibrations were performed according to GLL standard field protocols. The probe calibration was checked at the end of each field day or as much as practical depending on the progress of field activities.

4.7 Field Testing Logistics and Limitations

A list of problems and limitations were identified during the field study. These should be considered if future similar work is planned. The main issues include:

- Deformation of packers after and during use (some of the packers were slightly twisted or bent) causing problems during installation and removal
- Weak connections between sampling tubes and packers causing sampling tube to become loose when retrieving the packer after sampling
- Tangling, bending and kinking of the small diameter inflation line as packer was lowered and/or removed causing possible leaks in the tubing
- Packers getting stuck in well after use, the packer in P01-07-E has been left in the well because it was not possible to remove it without applying a force that might break the connection between the steel cable and the eye screw. The packer remained stuck in the well in February and May 2005 when GLL staff were on site.
- Field logistics associated with co-ordinating use of multi-parameter field probes to record relevant data during purging and sampling (multiple probes are needed to perform the purging and sampling concurrently at different locations)
- Less than optimal number field personnel for installing and sampling packers (3 persons required to properly manage the large coils of tubing, steel wire and inflation line while minimizing the possibility of contamination)
- Weather conditions (cold, wet, windy) making it very difficult to keep equipment clean on tailings
- Mechanical difficulties with:
    - Waterra Hydrolift pump
    - Gas generator used to run the hydrolift pump (failed during the field trip and had to be replaced)

5. Results and Discussion

A summary of all sampling and testing activities related to the 2004 leakage assessment is provided in Table 1. A complete set of testing was completed for P01-09 (B,C,D) and P01-07 (D,E). Complete testing was not performed on the remaining P01 series wells due to an overall slower progress than anticipated. Weather delays, mechanical difficulties and physical problems with equipment (packers getting stuck) and logistics associated with mobilizing equipment and personnel between testing locations were the main factors. Complete testing was performed on the wells of main concern (P01-09 and P01-07) and further testing was not deemed a priority given that an overall site data review was undertaken concurrently by Robertson GeoConsultants. Progress of the leakage sampling program was discussed with personnel from Environment Canada, Robertson GeoConsultants and DIAND Type II Sites present at the site during different phases of the work. The general agreement was that sufficient testing had been completed and data should be reviewed in a timely manner given the timelines for the overall site data compilation.

At the time of finalizing this report, several relevant observations were made by GLL while in the field. As part of follow up activities related to leakage assessment at the site, specific attention was paid to wells P01-10 and P01-08. Key observations from May 2005 are summarized and discussed in more detail in Appendix F. These included the following:

- Well P01-10B has tailings in the groundwater both during purging and sampling. The bottom few metres of sampling tubing gets clogged with fine sand / tailings when the well is sampled with the foot valve at the bottom.
- Well X21C has tailings in the groundwater during purging and sampling. This was also noted in 2004
- Well P01-08 (B specifically) is suspected to have been subjected to heaving due to freeze / thaw
- Well P01-07C has a significant amount of tailings during purging and sampling. This was also noted in Sept., 2004

All relevant data for conventional sampling have been included in the "time series" figures following the discussion for each well. The depth discrete samples collected in September 2004 are also included on these figures and it is important to note that these samples were collected using different methods than others shown on the figure. The time series figures include dissolved zinc and iron, sulphate and alkalinity. Where applicable, profiles of static water conditions (pH, T, specific conductance) are also included. In some cases, there is a significant difference (200 – 500 uS/cm) in the specific conductance between the two top sampling points. It has not been determined if this is a natural phenomenon or an artifact of measurement. Specific conductance values are lower when the probe/sensor is only partially submerged. This may have resulted in low readings for some of the measurements close to the surface. For wells where further packer testing and sampling was performed, plots of dissolved zinc and sulfate are included as well as the evolution of field parameters during purging, both pre and post packer installation. Analytical data and photographs from the down-hole camera are included in Appendix B, Appendix C, Appendix D and Appendix E. A summary of preliminary observations for each well is included in each section. To facilitate review, Table 2 provides a summary of maximum and minimum dissolved zinc and sulphate concentrations for selected wells. The following assessments have been made based on all data available up to October 25, 2004 and some observations made during the May 2005 routine groundwater sampling.

It should be noted that based on the findings of this study, there is the potential for all wells at the site, more specifically ones constructed through tailings, to allow leakage. Rates of leakage in most cases are extremely small and can not be quantified. Consequently, proper monitoring with particular attention to trends in water quality at all locations will ensure that any significant impact in water quality to the aquifer caused by future leakage will be mitigated.

During the April 2005 review of the draft report by the peer review working group, it was also established that well rehabilitation activities should not be attempted on any of the wells. It was clearly determined by GLL, EC and RG that any attempt to rehabilitate potentially leaking wells using a method of "completing a well with a well" would be problematic if not impossible and would jeopardize or eliminate the possibility of proper decommissioning at a later date. Therefore, the recommended actions for each well are based on the assumption that well rehabilitation is not an option at this site.

Table 2. Maximum and Minimum Concentrations of Dissolved Zinc (mg/L) and Total Sulfate (mg/L) in Selected Wells

	Max Zn	Date	Min Zn	Date	Max SO4	date	Min SO4	date
P01-01-A	< 0.01	2001 - 2004	< 0.01	2001 - 2004	580	6/2/2003	399	9/23/2002
P01-01-B	< 0.01	2001 - 2004	< 0.01	2001 - 2004	549	9/23/2002	289	9/10/2001
P01-02-A	0.014	Jun-03	< mdl		158	Sep-03	134	Sep-02
P01-02-B	<mdl		<mdl		130		116	
P01-03	0.014		<mdl		1290	Jun-04	769	Sep-01
P01-04-A	0.25	Jun-03	<mdl		460	Sep-04	191	
P01-04-B	<mdl		<mdl		50	Jun-03	30	Sep-01
P01-05-A	2.29	Sep-03	0.0065		1210	Sep-01	729	Sep-03
P01-05-B	<mdl		<mdl		814	Jun-03	600	Jun-02
P01-06	6.87	Sep-03	1.02	Sep-01	2610	Sep-01	1110	Jun-02
P01-07-A	0.24		<mdl		1080	Sep-04	349	Sep-01
P01-07-B	1.04	Sep-03	<mdl	Sep-01	1615	Sep-04	360	Sep-01
P01-07-C	0.23	Sep-03	<mdl		701	Sep-03	346	Jun-02
P01-07-D	0.0188	Sep-04	0.008	Sep-03	1070	Jun-03	433	Sep-01
P01-07-E	0.26	Jun-02	<mdl	Jun-02	1130	Sep-03	580	Sep-01
P01-08-A	5.17	Sep-03	0.006	Jun-03	261	Sep-02	200	Sep-02
P01-08-B	26.5	Sep-03	0.03	Jun-03	666	Sep-02	342	Sep-01
P01-08-C	0.73	Sep-01	0.04	Sep-02	724	Sep-02	410	Sep-02
P01-09-B			12.4	Sep-01			711	Sep-01
P01-09-C			5.56	Sep-04			390	Sep-04
P01-09-D			17.3	Sep-04			564	Sep-04
P01-10-A	0.58	Sep-03	0.0128	Sep-04	3070	Sep-04	298	Sep-01
P01-10-B	11	Sep-04	<mdl		596	Sep-04	94	Sep-01
P01-11	0.007	Jun-03	<mdl	Jun-02	863	Sep-04	573	Jun-02

5.1 P01-01 (downgradient of the cross-valley dam)

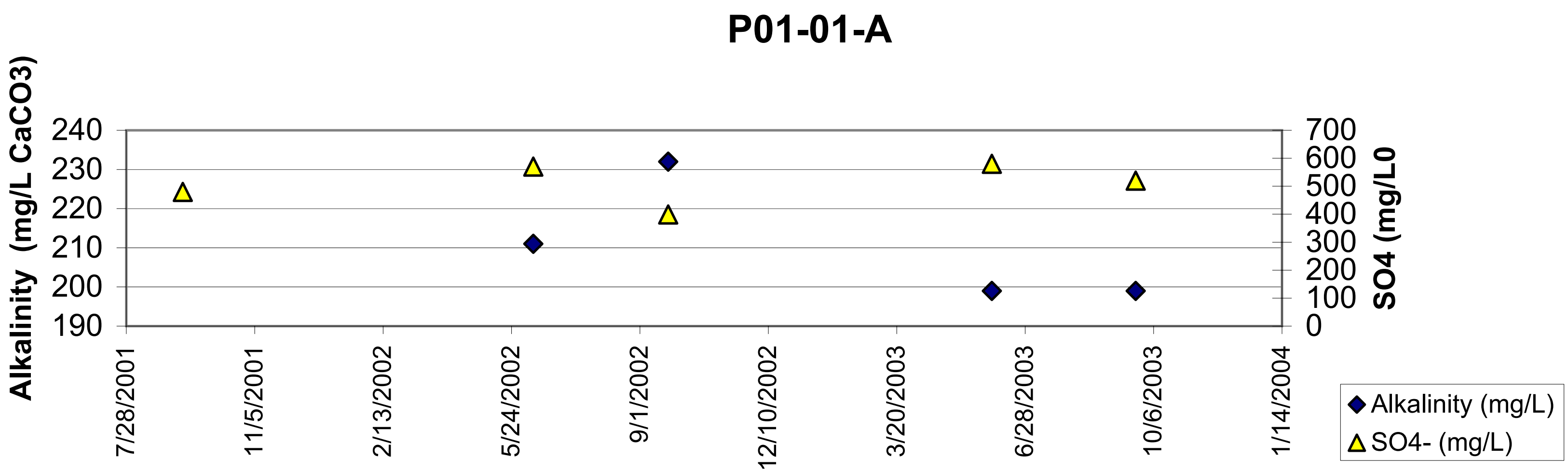
As indicated in Table 1, well P01-01-A was not sampled in 2004 because the surface casing was broken by snow removal equipment and the tubing is sand-locked in the well. Well P01-01-B was rehabilitated in June 2004 and included in the September 2004 sampling. Relevant data is presented in the following figures (Figure 1, Figure 2, Figure 3).

P01-01A

- There has never been a detectable concentration of dissolved zinc
- The time series shows no significant trend for sulfate

P01-01B

- Dissolved zinc has only been detected once (Sept/01)
- Concentrations of dissolved zinc and sulfate for the depth discrete sample (Sept/04) are within the same range as previous data
- The profile of field parameters does not suggest any evident leakage effects
- This well does not penetrate through tailings and therefore does not represent an immediate threat to water quality in the Rose Creek aquifer.
- This well should be sampled using conventional purging and sampling methods.
- Data collected thus far are likely representative of in-situ conditions at this location



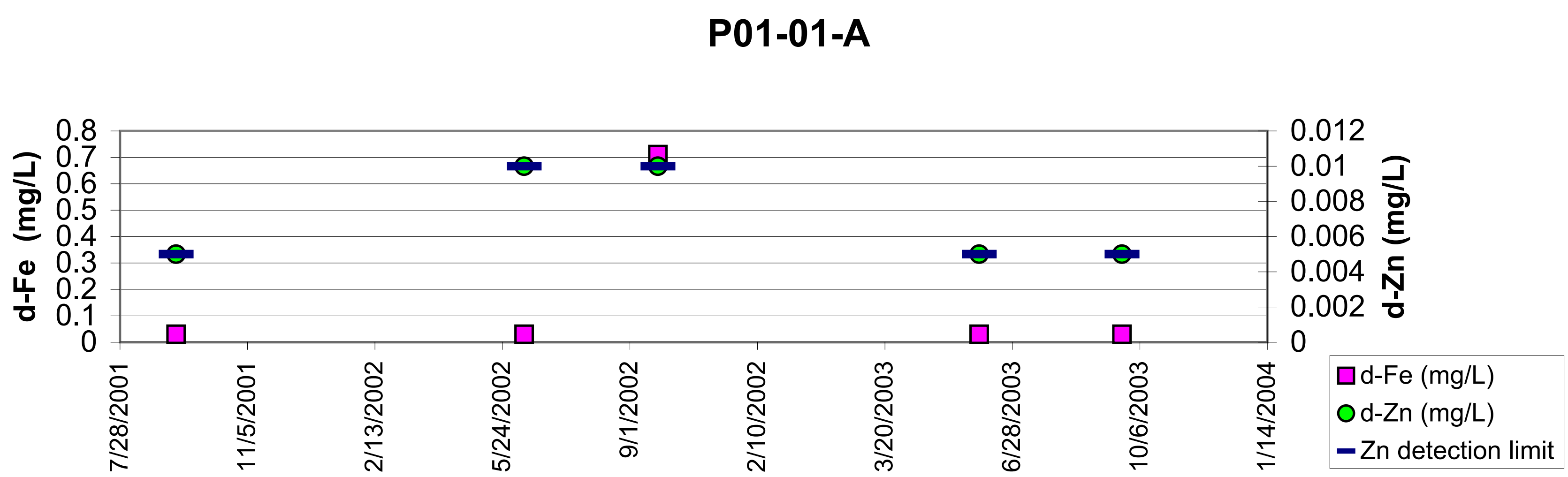
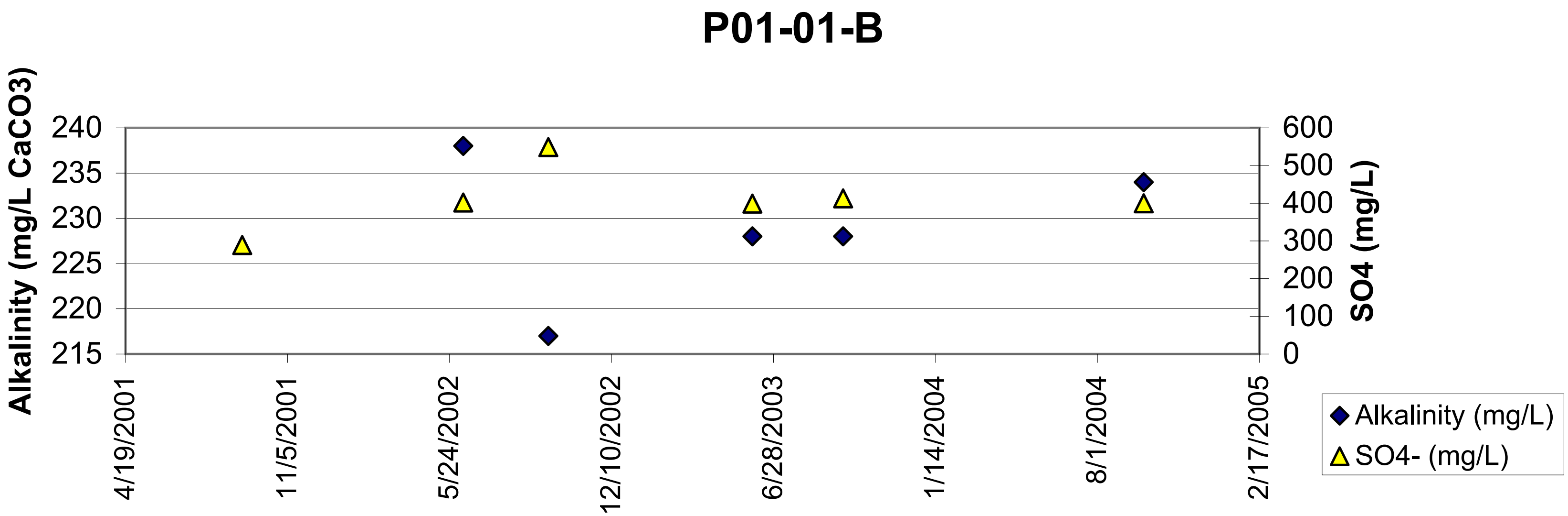


Figure 1. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-01-A



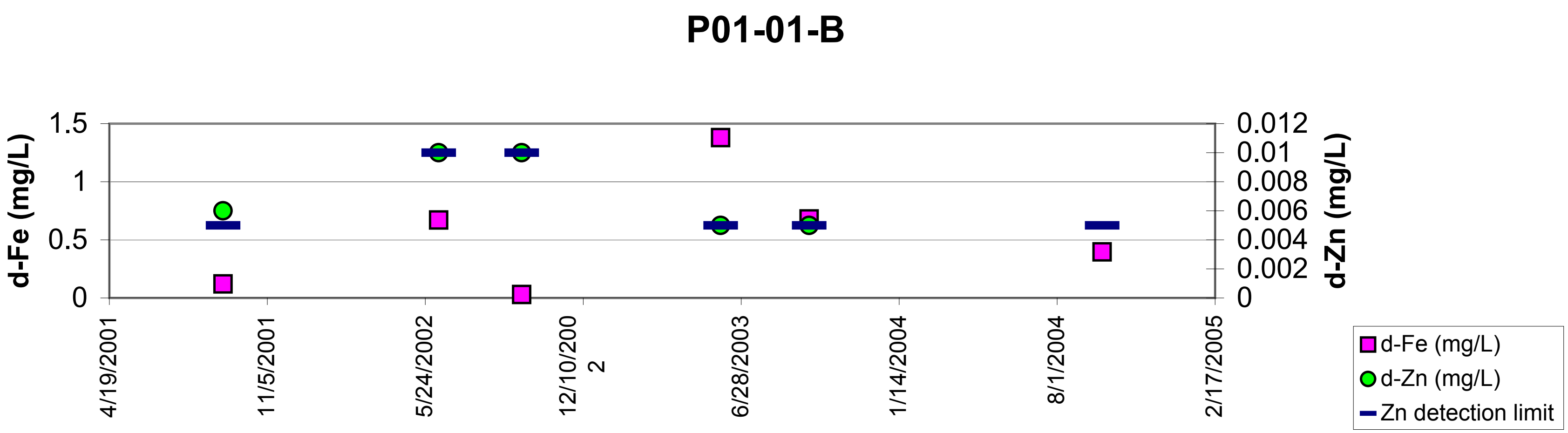


Figure 2. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-01-B (note: Sept 2004 data collected using a discrete depth sampler)

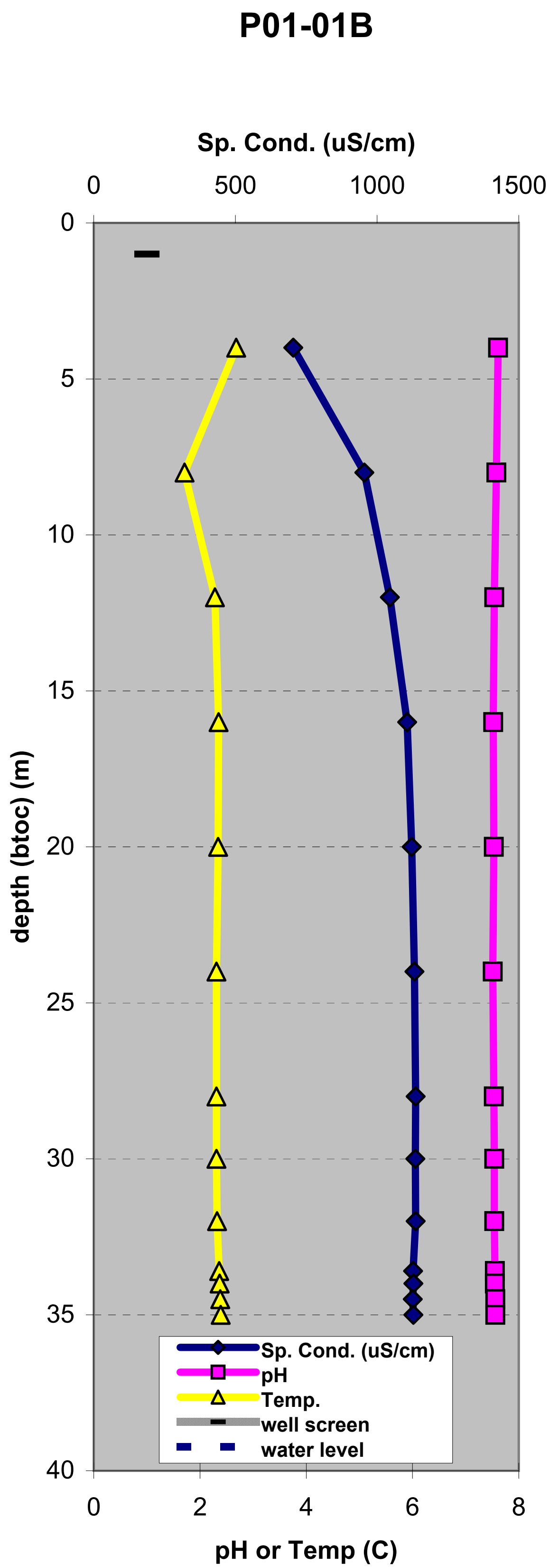


Figure 3. Geochemical (Field Parameter) profile of static water in well P01-01B

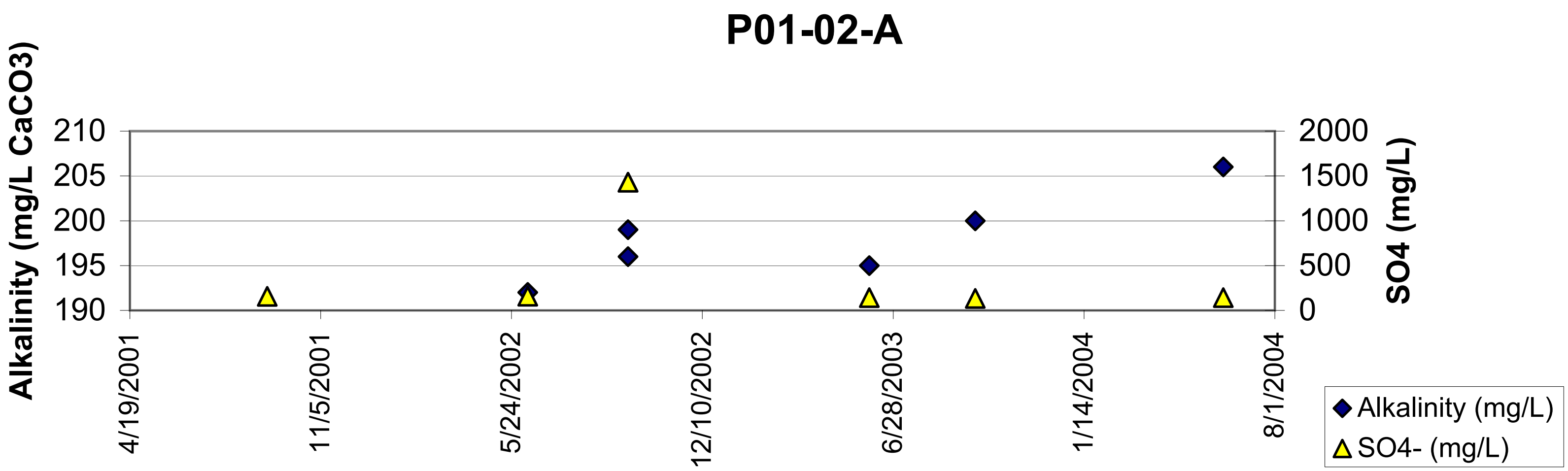
5.2 P01-02 (at the toe of Cross-Valley dam)

P01-02A

- Dissolved zinc has been detected only once (June/03)
- This well does not penetrate through tailings and therefore does not represent an immediate threat to water quality in the Rose Creek aquifer should it be susceptible to leakage.
- This well is often frozen
- The well currently has a bulge in the casing caused by freeze-thaw action acting on a well cap within the steel casing. This bulge has pinched the sampling tubing and therefore, until this well is rehabilitated, it is only possible to obtain samples through this tubing using small diameter tubing. Rehabilitation would consist of removing the protective steel casing which is cemented in the ground and subsequently replacing the PVC well casing.
- Data collected thus far are likely representative of in-situ conditions at this location
- One elevated value of sulfate (approx. 1200 mg/L) in 2002 was detected in this well. According to field records and chain of custody forms, this value is real and was replicated. The value seems higher than other historical values.

P01-02B

- This well is sometimes artesian and flowing (depending on water levels in the Cross Valley pond).
- Groundwater concentrations at this location are expected to be relatively uniform like they are at multi-level P03-09 also located downgradient of the dam.
- Data collected thus far are likely representative of in-situ conditions at this location
- This well is often frozen and therefore no depth-discrete sample was obtained from this well because it was frozen.



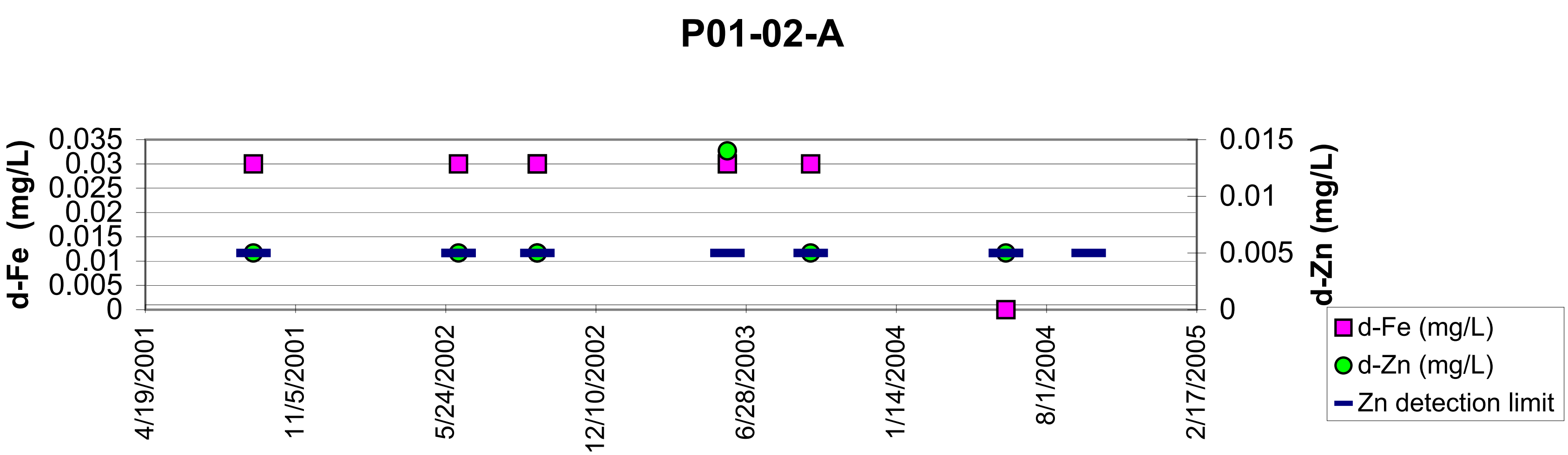
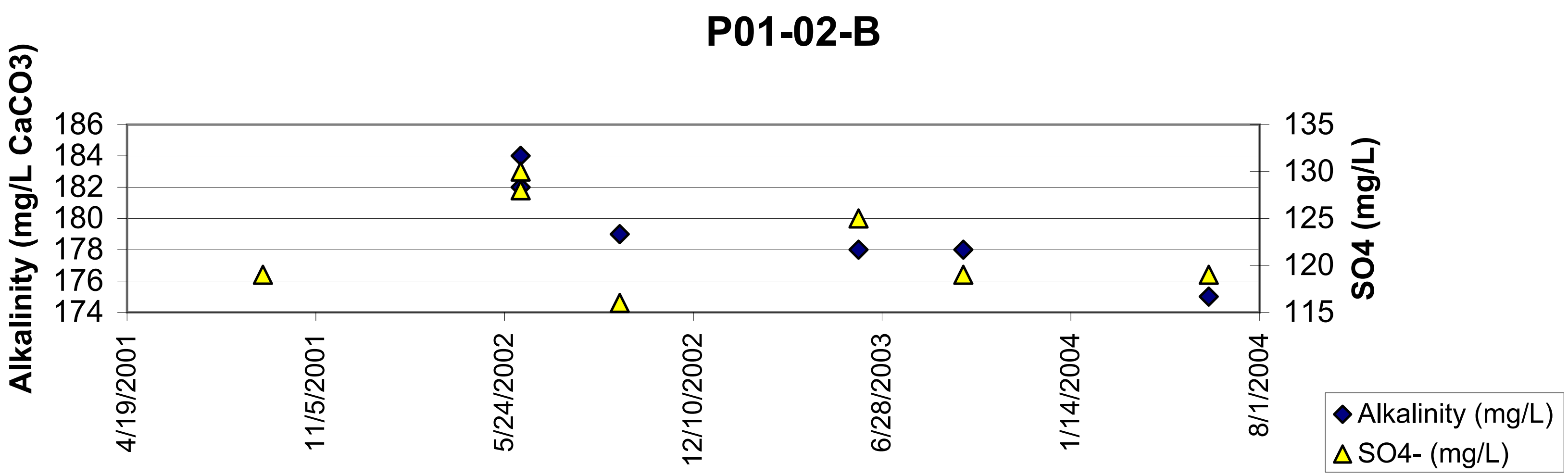


Figure 4. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-02-A



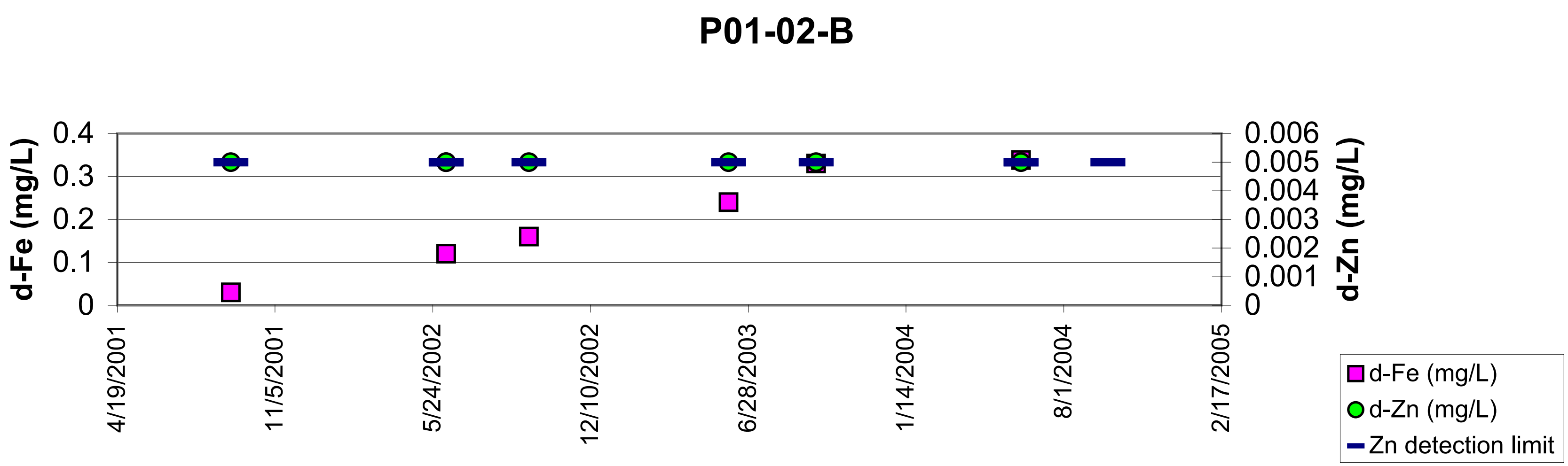


Figure 5. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-02-B

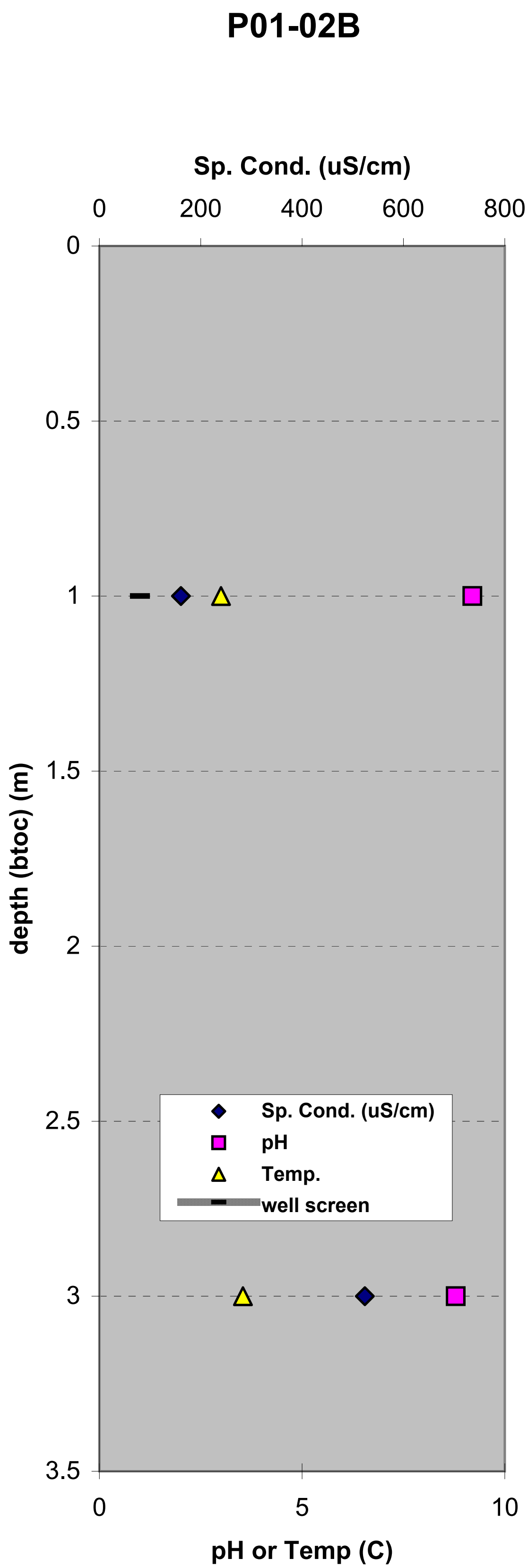
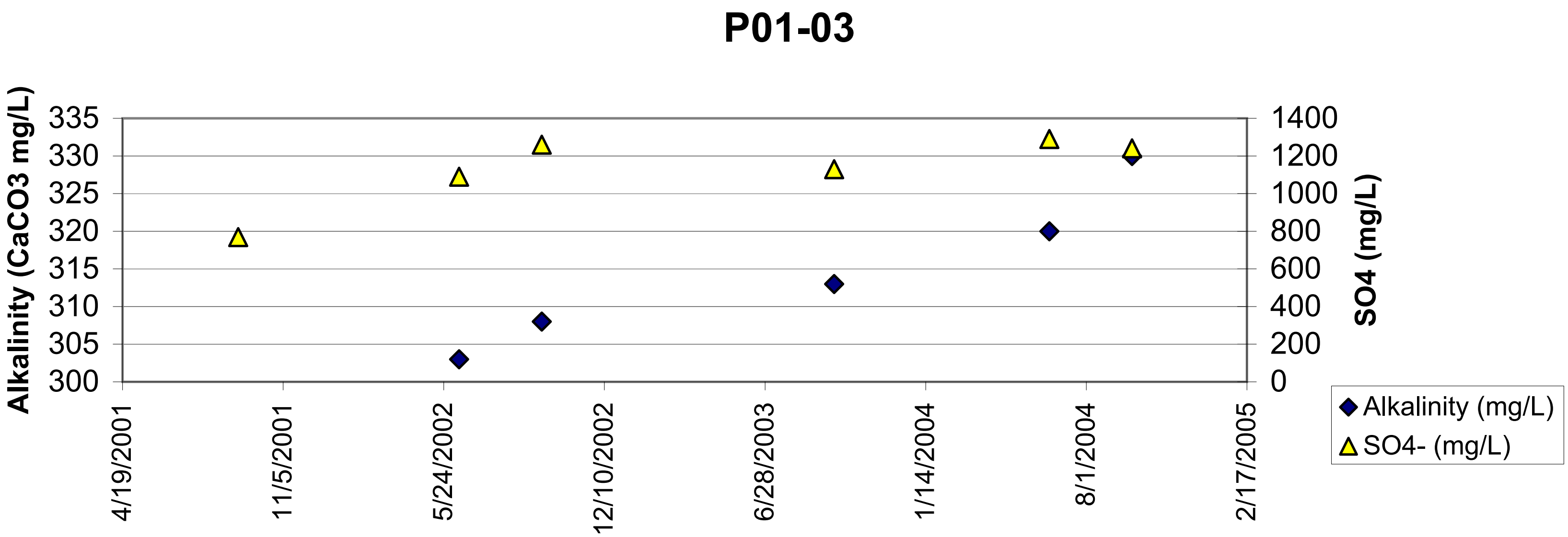


Figure 6. Geochemical (Field Parameter) profile of static water in well P01-02B

5.3 P01-03 (at the toe of Intermediate dam)

P01-03

- Well is not completed through tailings
- The profiles for temperature, pH and specific conductance do not suggest any anomalies attributable to leakage
- The depth discrete sample taken at the screen has similar water quality to the conventional sample collected in June 2004
- The time series data suggests an increasing trend in sulfate but no distinguishable trend for dissolved zinc.
- This well does not penetrate through tailings and therefore does not represent an immediate threat to water quality in the Rose Creek aquifer.
- This well should be sampled using conventional purging and sampling techniques.
- Data collected thus far are likely representative of in-situ conditions at this location



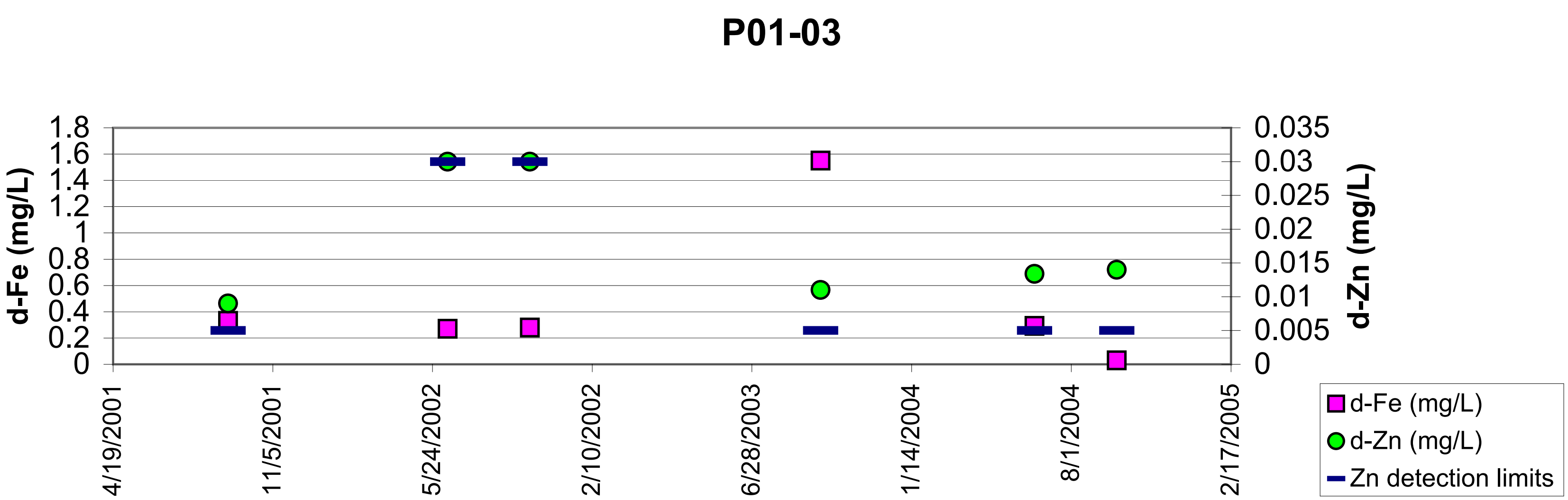


Figure 7. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-03

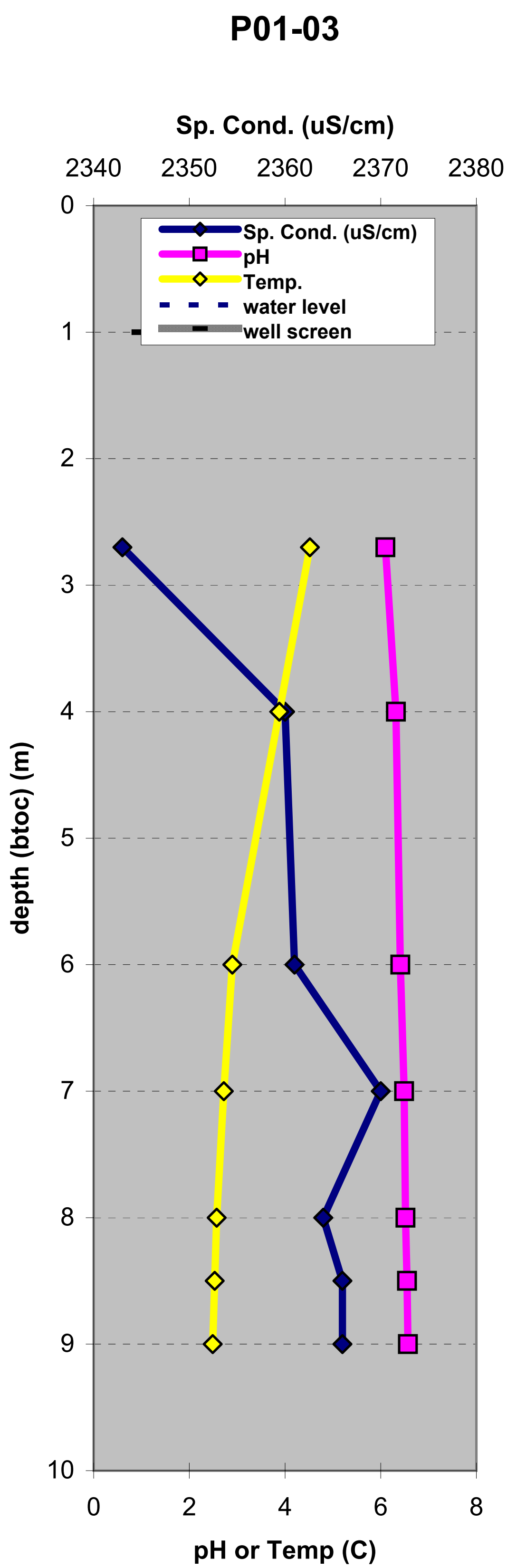


Figure 8. Geochemical (Field Parameter) profile of static water in well P01-03

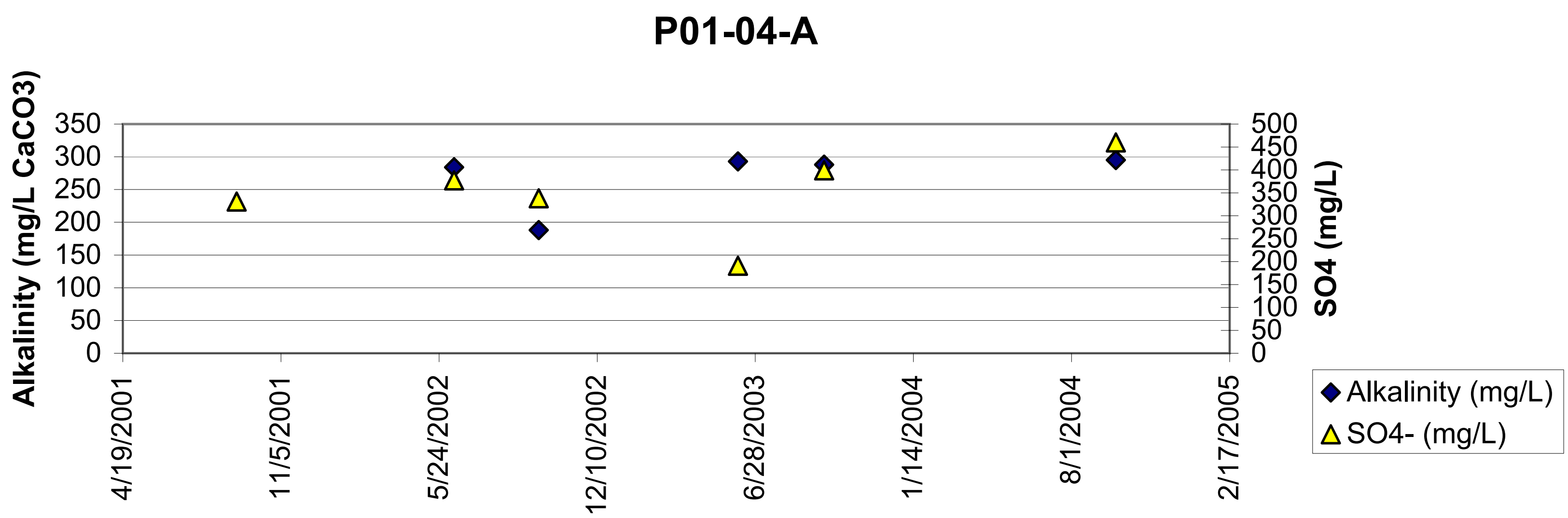
5.4 P01-04 (at toe of Intermediate Dam)

P01-04-A

- The field parameter profile does not provide any evidence of leakage
- Specific conductance, pH and temperature are relatively constant from top to bottom
- This well shows elevated zinc (0.25 mg/L) deep in the aquifer
- The depth discrete sample concentrations of dissolved zinc and sulfate are within the same range as previous sampling
- This well does not penetrate through tailings and therefore does not represent an immediate threat to water quality in the Rose Creek aquifer.
- This well should be sufficiently purged prior to sampling to overcome any possible leakage sample bias.
- Data collected thus far are likely representative of in-situ conditions at this location

P01-04B

- The field parameter profile does not provide any evidence of leakage
- Specific conductance, pH and temperature are relatively constant from top to bottom
- The field parameter profile is similar for both P01-04A and P01-04B
- Sulfate values in this deeper monitor (>50m bgs) are low (< 50mg/L)
- No detectable zinc concentrations have been observed in this monitor
- This well does not penetrate through tailings and therefore does not represent an immediate threat to water quality in the Rose Creek aquifer.
- This well should be sufficiently purged prior to sampling to overcome any possible leakage sample bias.
- Data collected thus far are likely representative of in-situ conditions at this location



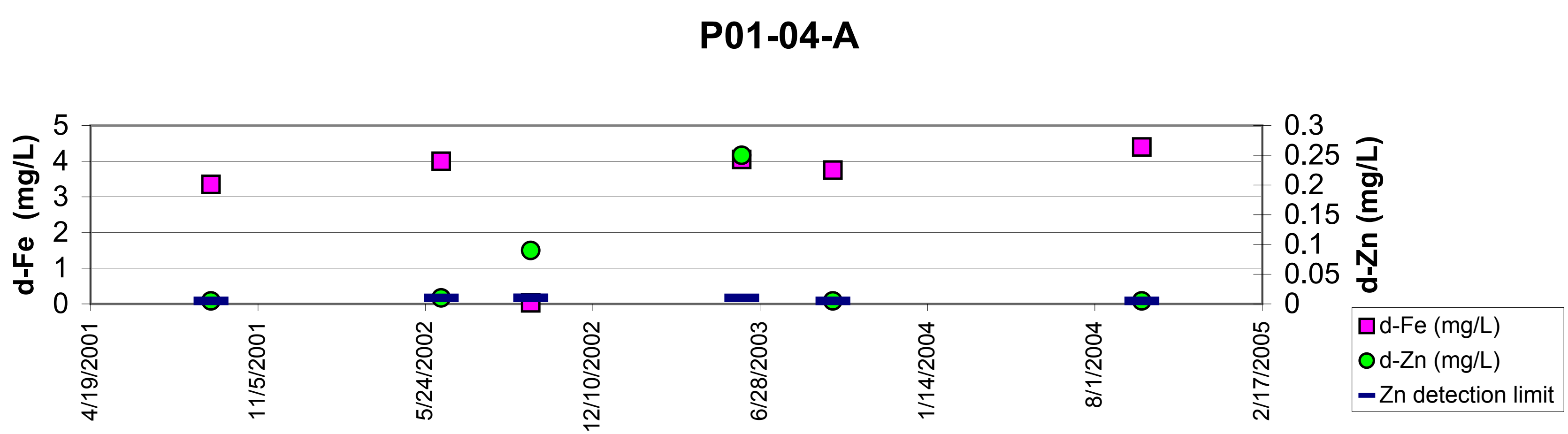
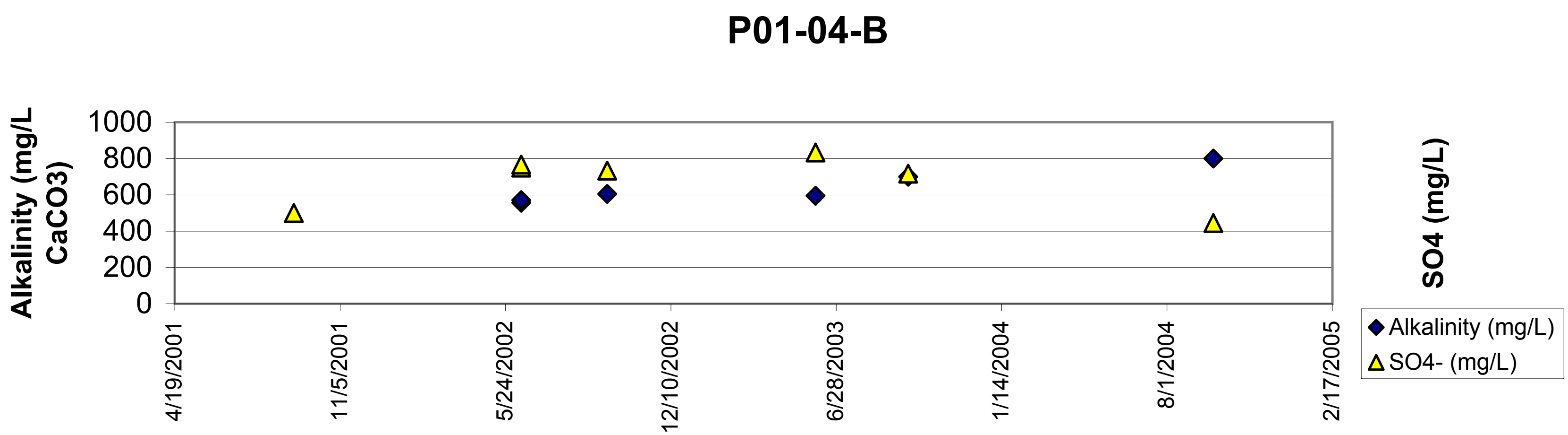


Figure 9. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-04-A



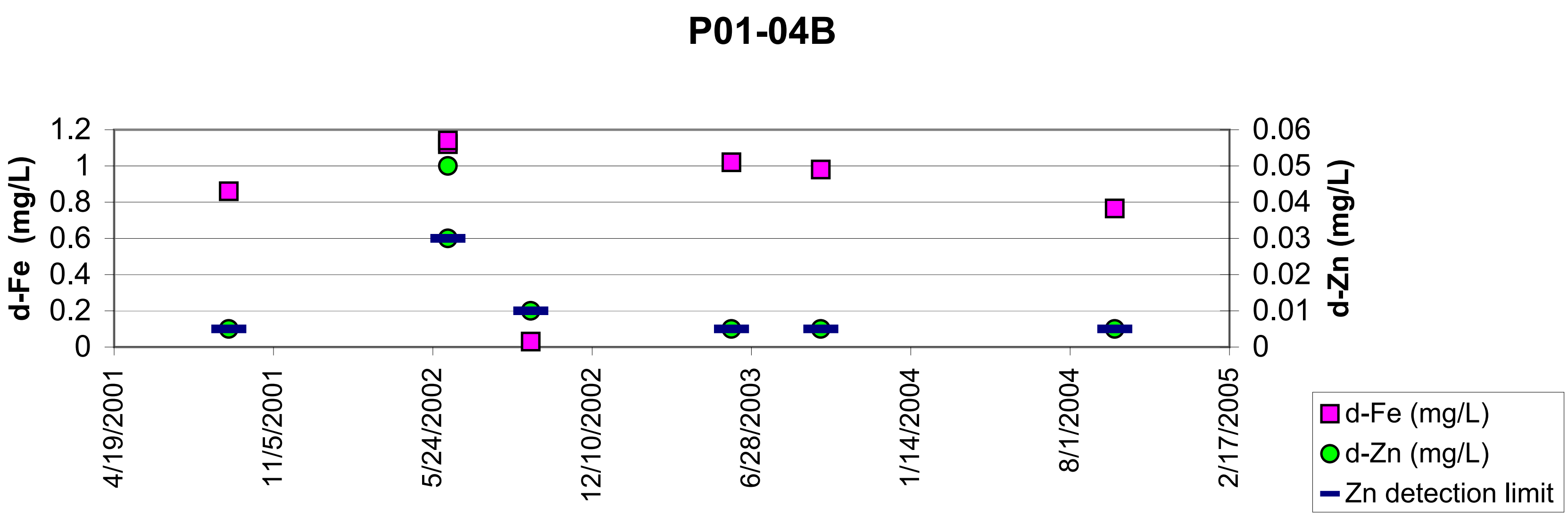


Figure 10. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-04-B

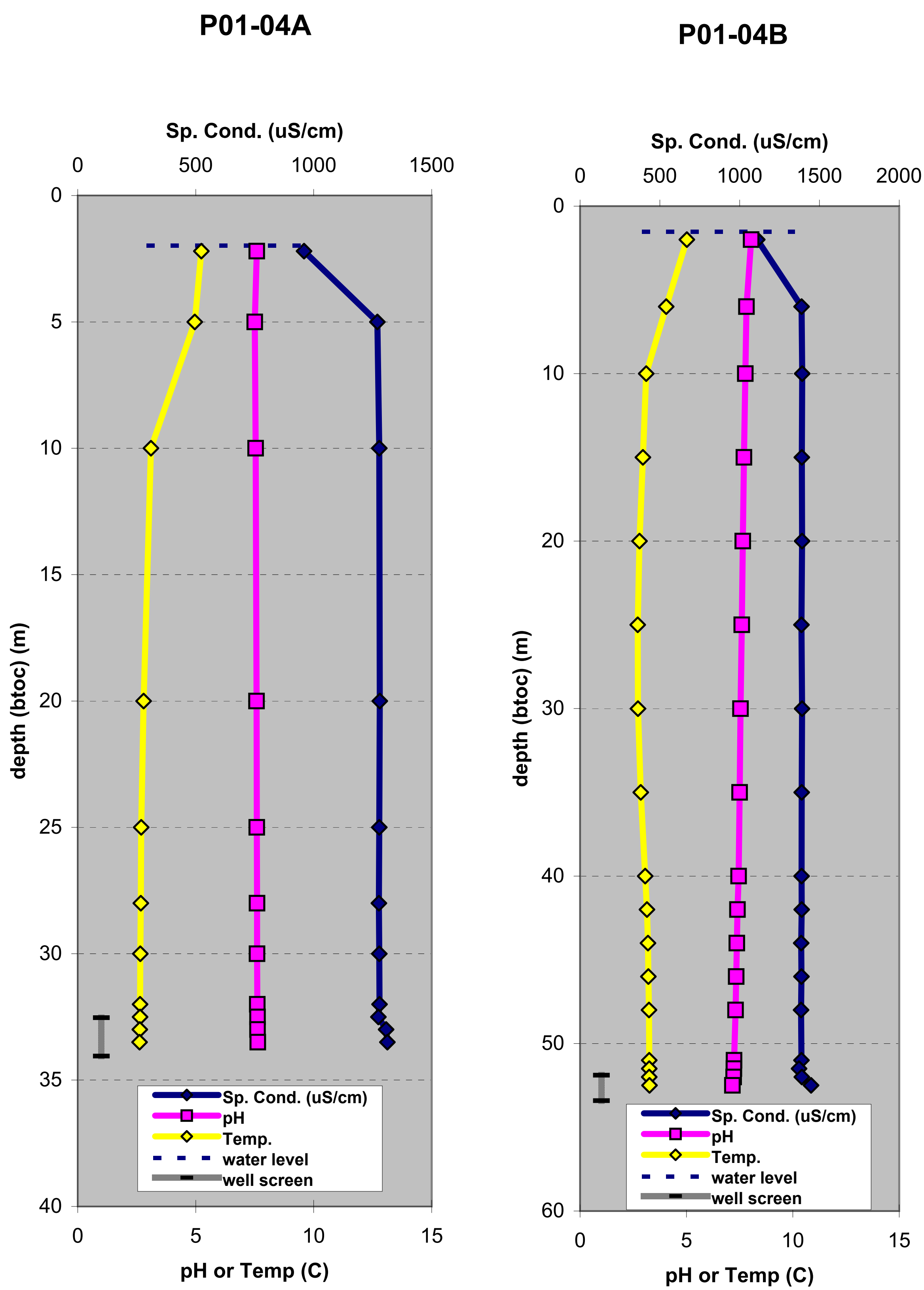


Figure 11. Geochemical (Field Parameter) profile of static water in wells P01-04A and P01-04B

5.5 P01-05 (on Intermediate Impoundment, near toe of Dam)

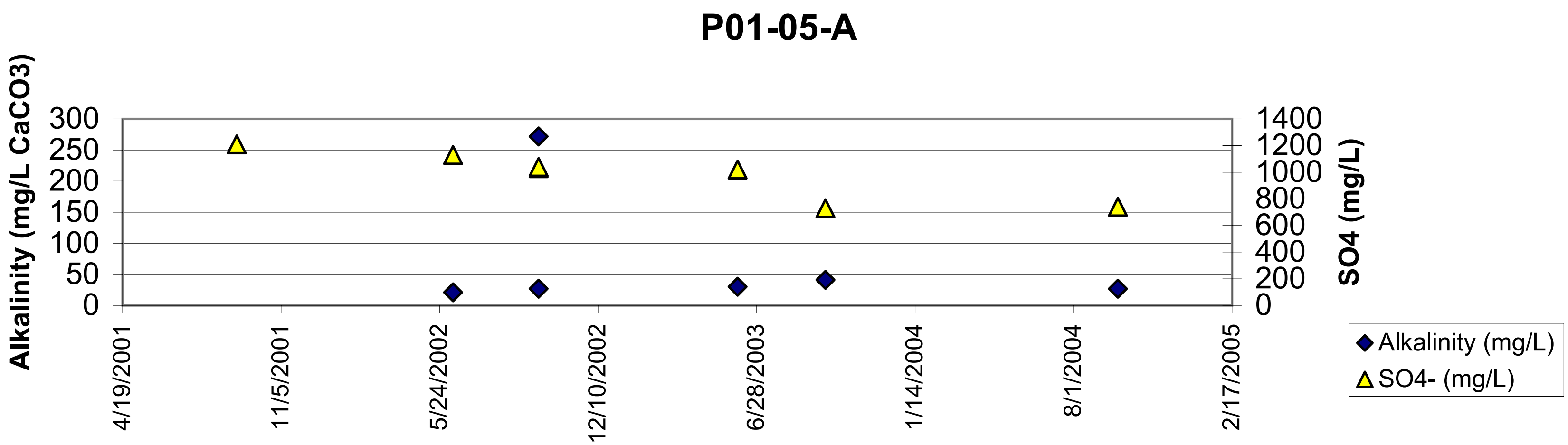
P01-05A

- There is a significant change in specific conductance across the screened interval
- This well is usually pumped dry when it is sampled (this could introduce bias from geochemical reactions as the well recharges)
- There is an anomalous value of elevated metals in September 2003 (could be sampling artifact or nature of sampling in tailings)
- There is an increasing trend in sulfate which is consistent with the depth discrete sample
- It is not possible to determine if any leakage is occurring at this location
- If recharge rates to the well are low, this implies that any leakage rates / flow out of the well would also be low, and therefore, any impact to the local groundwater system at this point, which is in the tailings, would only be very localized.
- Samples collected after purging the well dry may have more of an impact from leakage as contaminated water may leak through joints in the casing and accumulate in the well as it slowly recharges.
- This well should be monitored using a protocol (not yet developed) to ensure constant review of the data and allow for determination of leakage effects should it become problematic

P01-05B

- Both the Environment Canada and Gartner Lee field profiles show the same decreasing with depth trend for specific conductance.
- The shape of the September 2004 profile (diffusion type) suggests that leakage may be occurring
- The decreasing profile suggests that conditions at the well screen are different than higher in the well casing
- Leakage testing in May/June 2004 showed the possibility for leakage to accumulate above the packer through one exposed joint below the water table
- Water accumulating on top of the packer (presumably from leakage) had elevated sulfate and zinc compared to conventional samples and samples from below the packer suggesting leakage. However, there are uncertainties with interpretation of the leakage water chemistry (above packer) (Figure 16) as geochemical reactions occur as leakage water is exposed to oxygen as it flows into the evacuated well, down the casing and to the top of the packer
- Some dilution effect of leakage water mixing with the remaining water on top of the packer once most of it has been pumped should also be considered
- The depth discrete sample (Sept. '04) had elevated zinc (> 5mg/L)
- Down-hole camera video showed significant staining around joints in this well

- It is likely that possible leakage effects are significant at this location when sampling and therefore sampling should not be continued at this location and the well should be properly decommissioned
- This well should be monitored using a protocol (not yet developed) to ensure constant review of the data and allow for determination of leakage effects should it become problematic



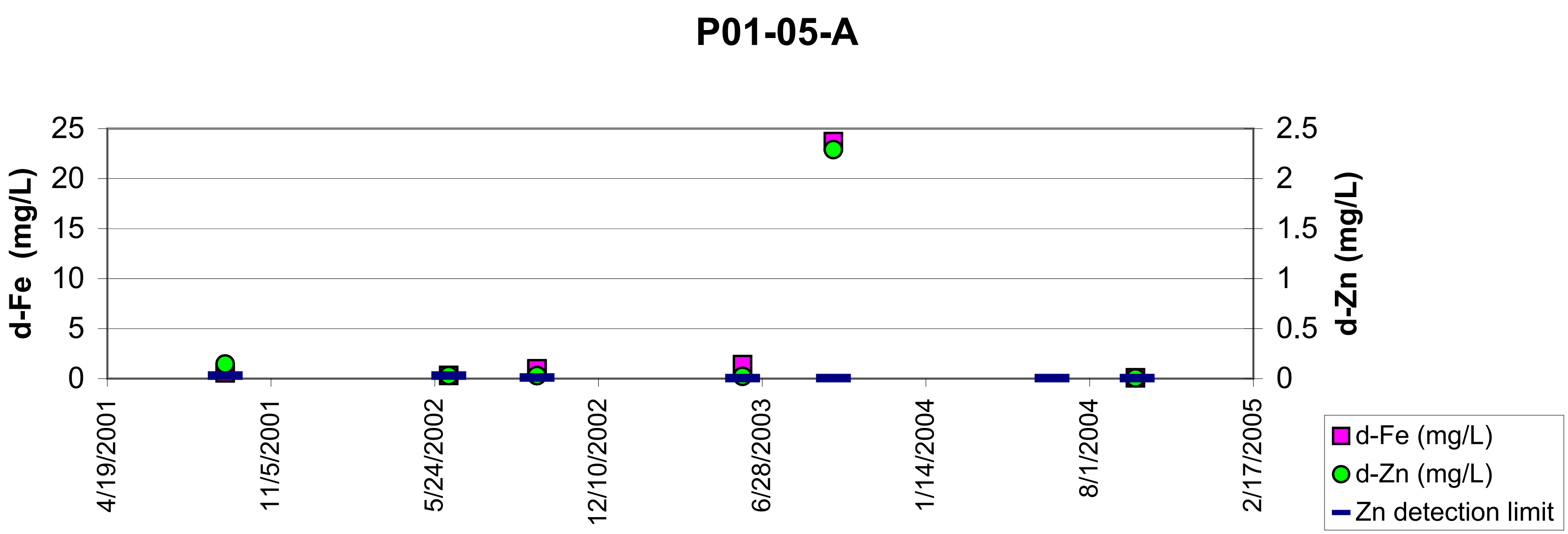
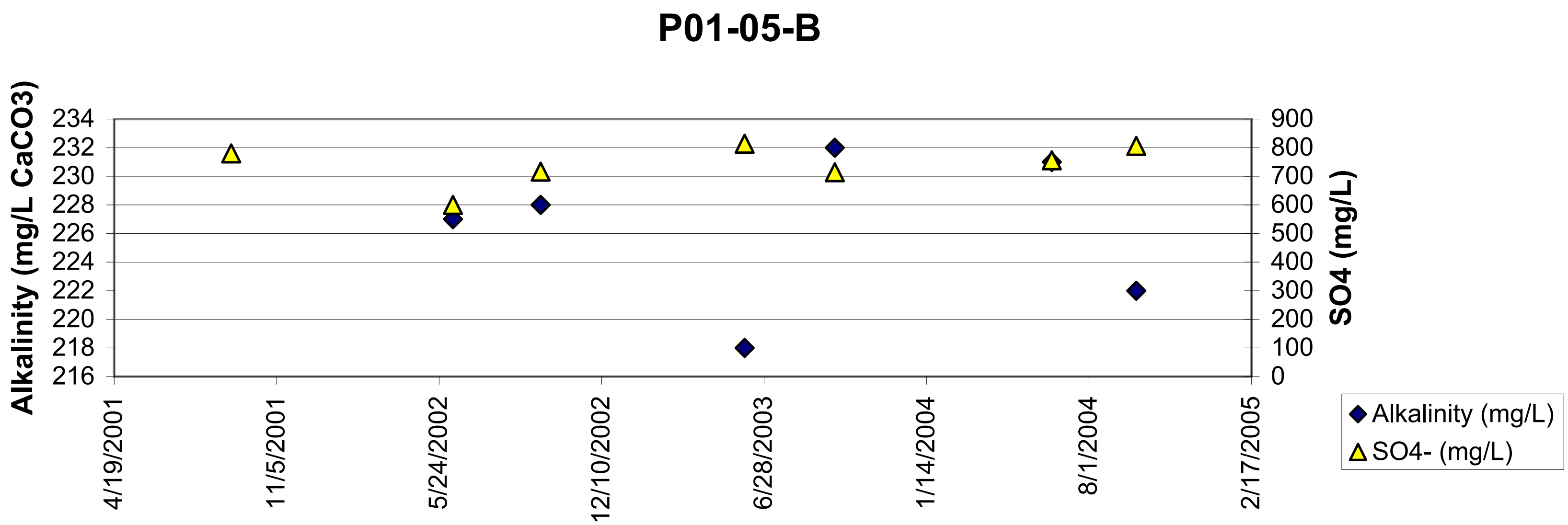


Figure 12. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-05-A



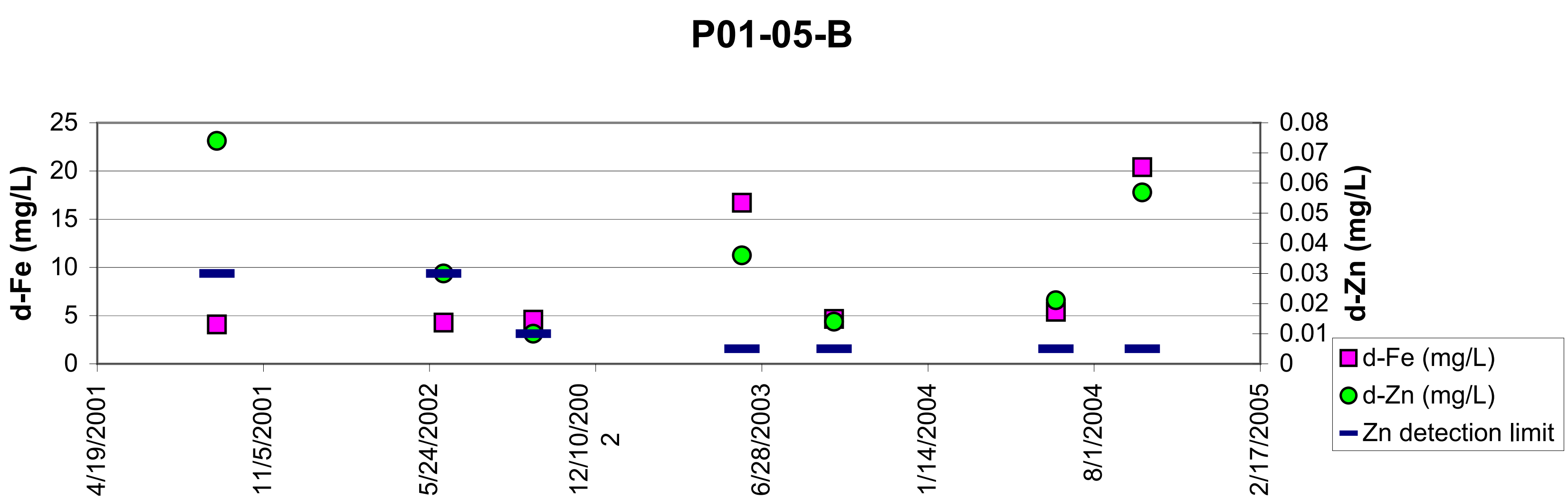


Figure 13. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-05-B

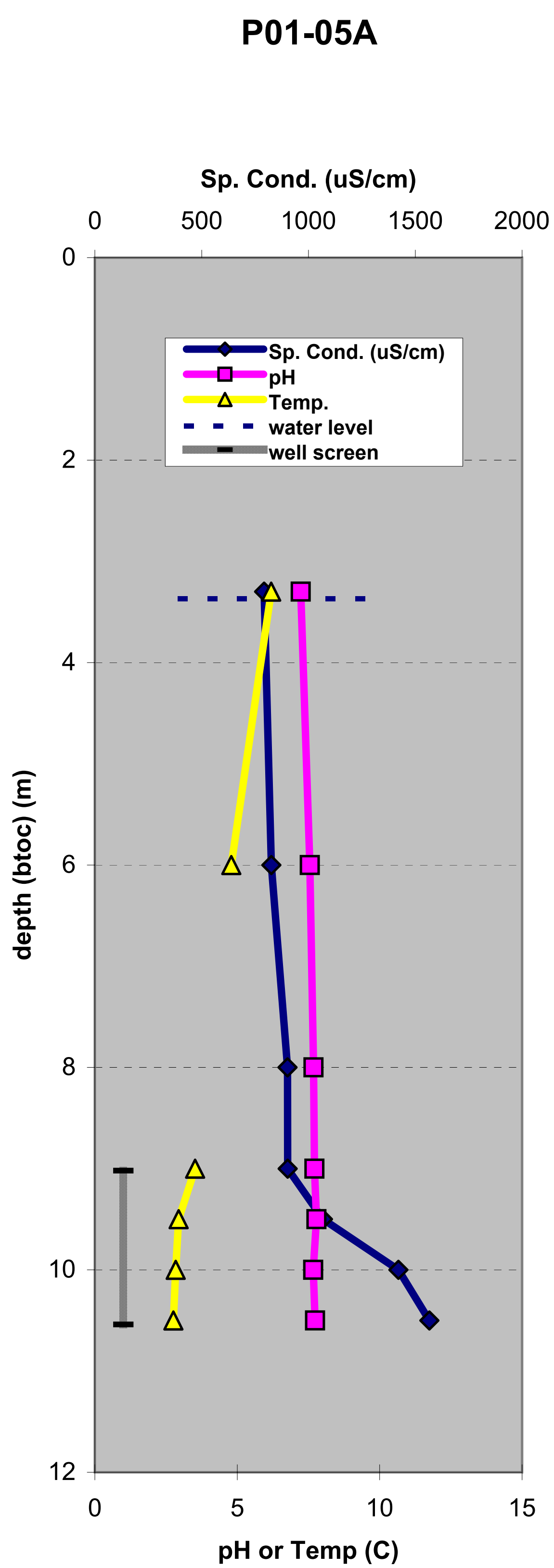
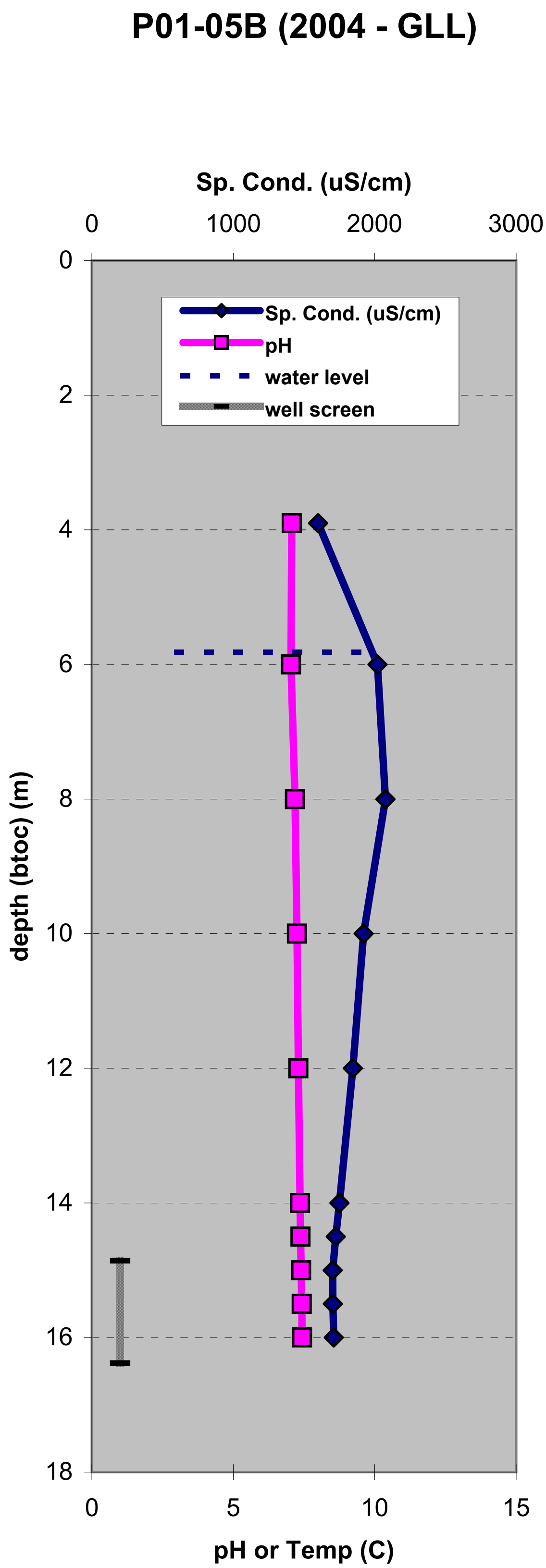


Figure 14. Geochemical (Field Parameter) profile of static water in well P01-05A



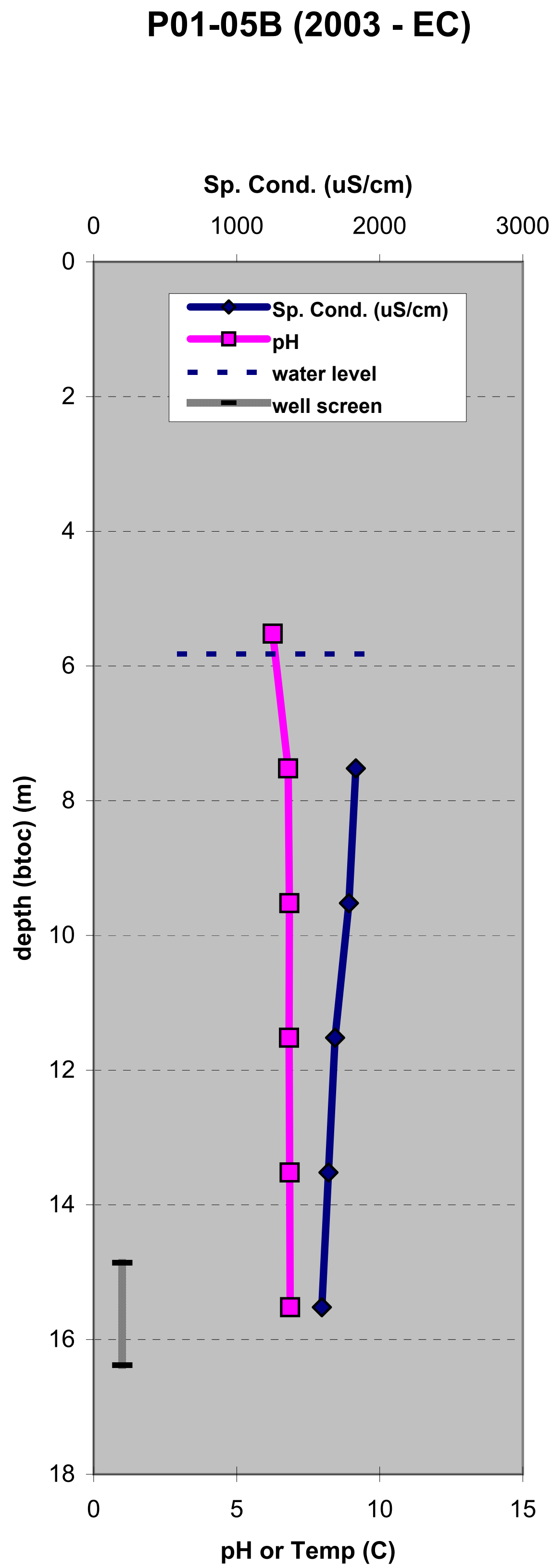
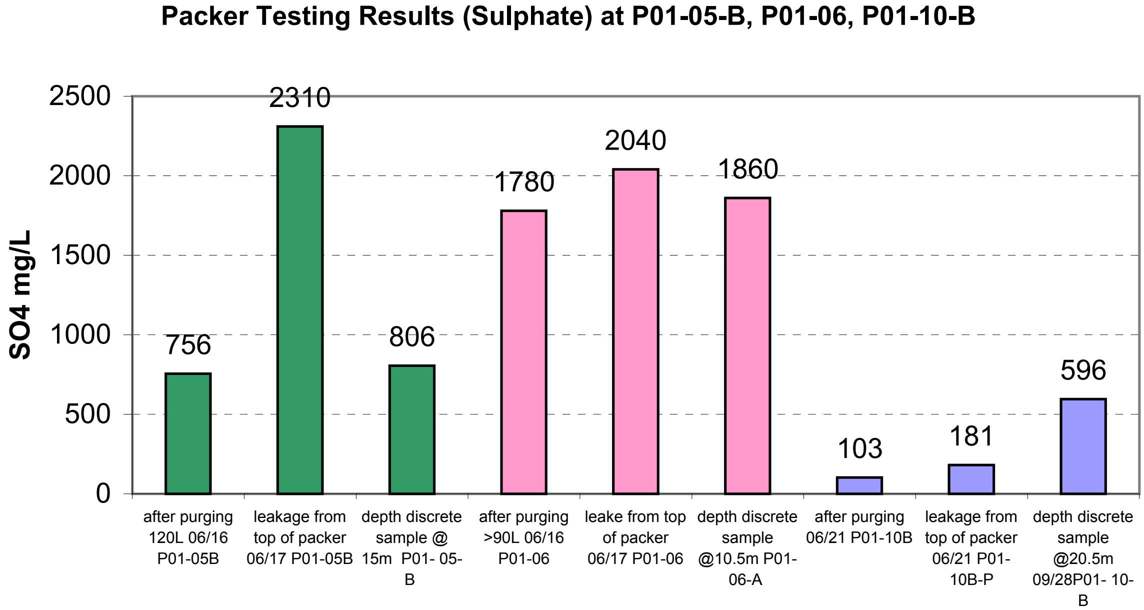
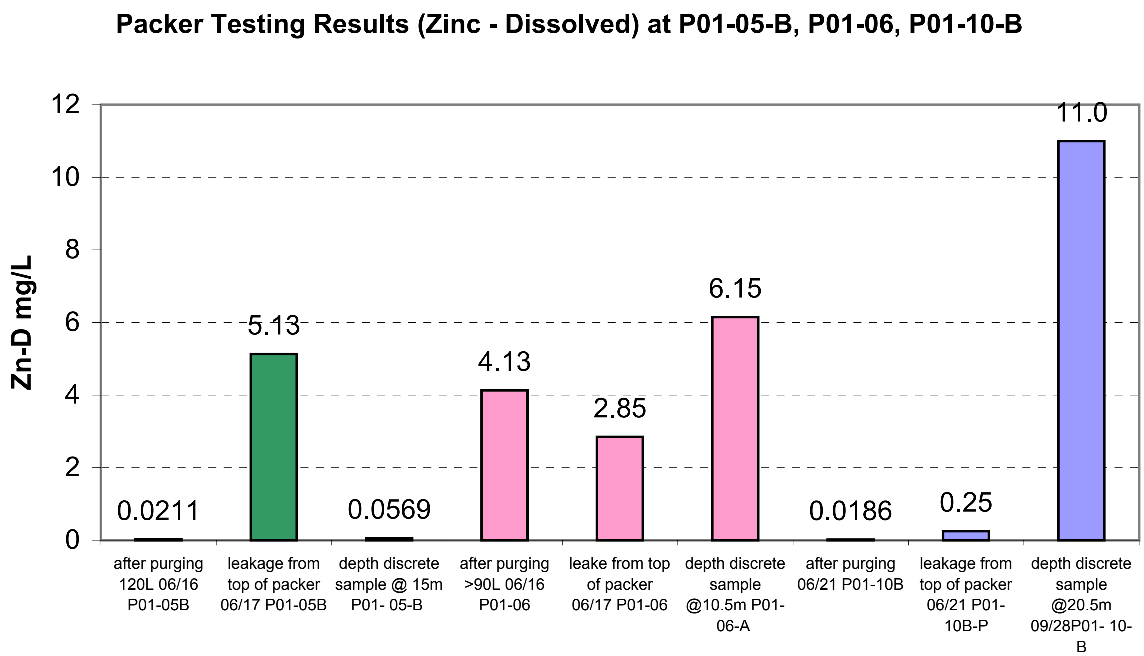


Figure 15. Geochemical (Field Parameter) profile of static water in well P01-05 by Gartner Lee Limited (GLL) and Environment Canada





METHOD (JUNE)
purged well for 3 well volumes and collected sample.
Placed packer down well and removed any water above packer
Left packer in well ~12 hrs (depending on well)
Collected sample from leakage water that collected on top of packer

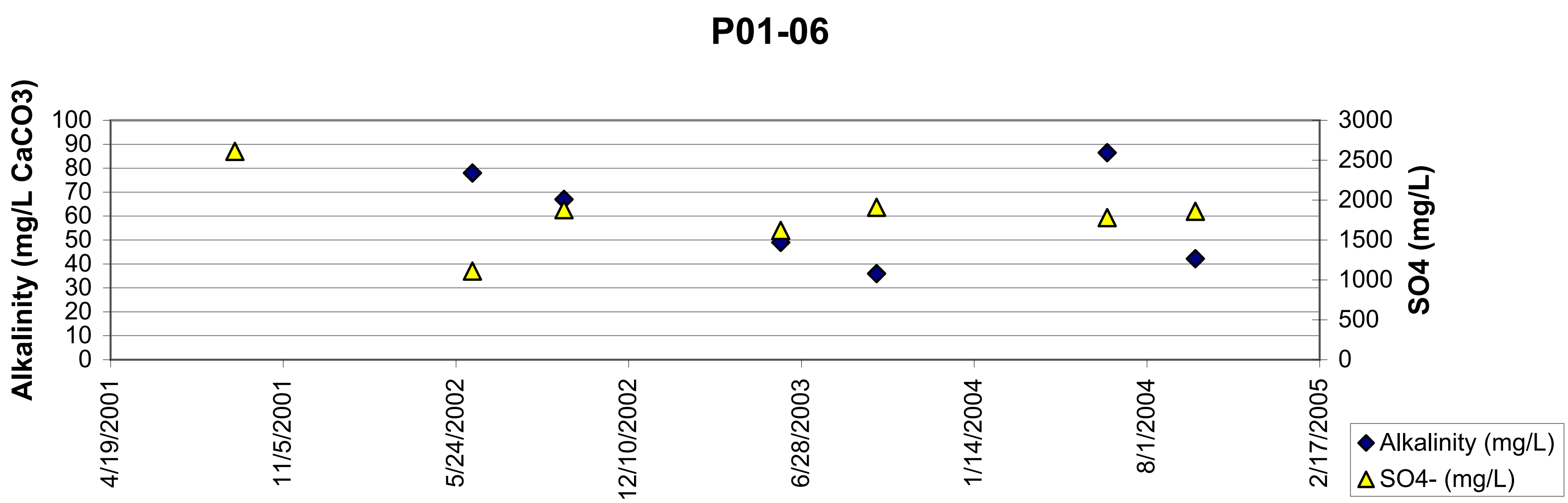
METHOD (SEPTEMBER)
took a depth discrete sample at well screen

Figure 16. Summary of Leakage Assessment Sampling Results for Wells P01-05-B, P01-06 and P01-10-B

5.6 P01-06 (Intermediate Impoundment, toe of Secondary Dam)

P01-06

- The slope of the field parameter profiles (EC and GLL) are similar for specific conductance
- The profiles do not show clear evidence of leakage effects
- Testing in May/June 2004 showed that there is potential for leakage to occur in this well
- Down-hole camera photos showed staining around joints below the water table
- There is an observed increasing trend in dissolved zinc concentrations in the well
- The increase is likely due to loading from upgradient of the well (either infiltration from tailings or infiltration of surface water or groundwater from X-24 (Faro Creek)) which is contaminated by rock dump seepage
- The iron concentrations are significantly more elevated (300-600 mg/L) at this location than most locations. Similar concentrations of dissolved iron (~300 mg/L) are observed at P03-06-05 located upgradient in the secondary impoundment
- The sodium concentrations in the top of packer leakage is similar to conventional sampling samples
- Sulfate and zinc concentrations in the top of packer leakage are within the range of conventional sampling
- The data collected so far seems representative of in-situ conditions, however, due to the transient nature of the leakage problem, future monitoring at this location should be stopped and the well should be properly decommissioned



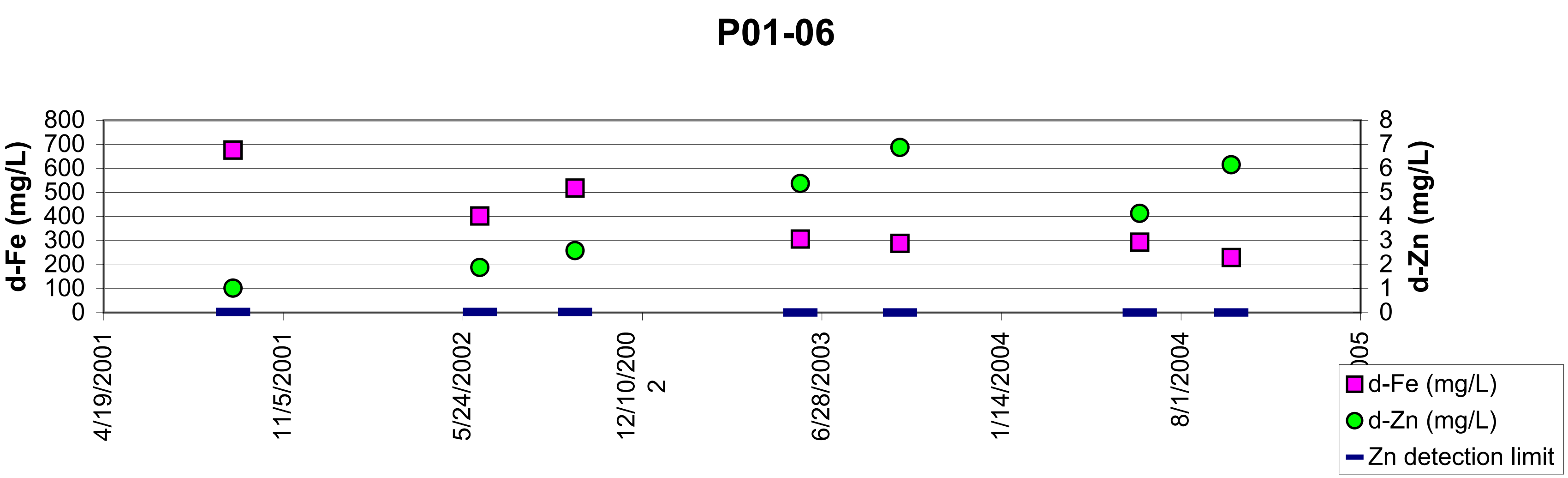
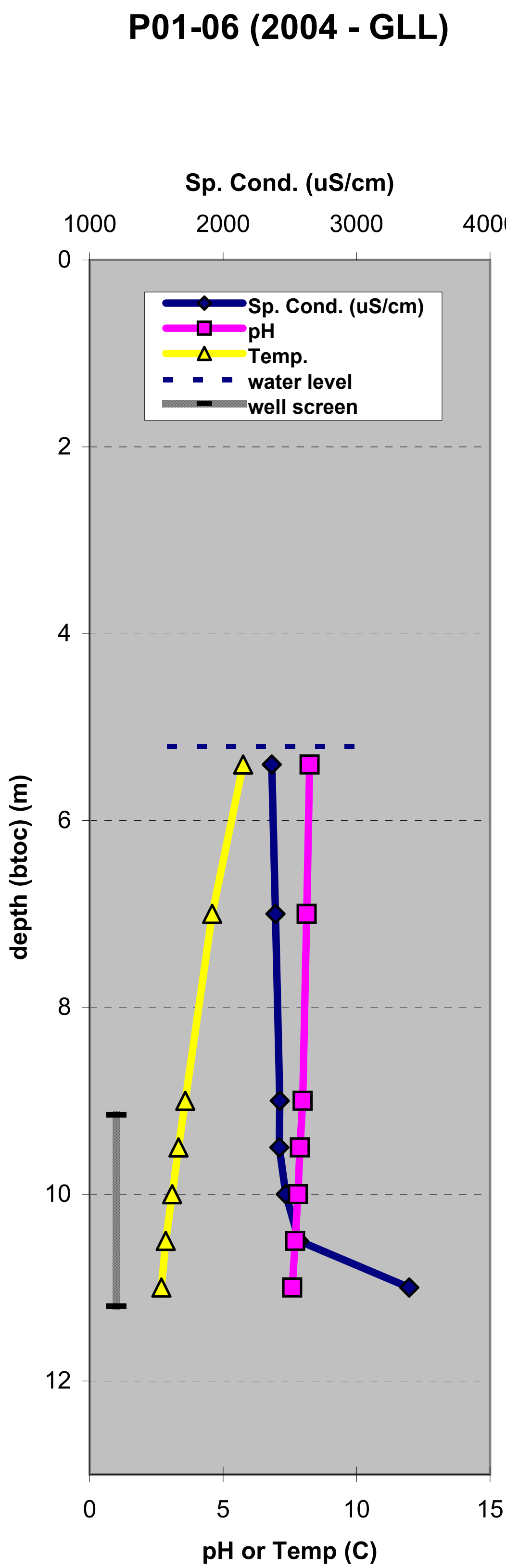


Figure 17. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-06



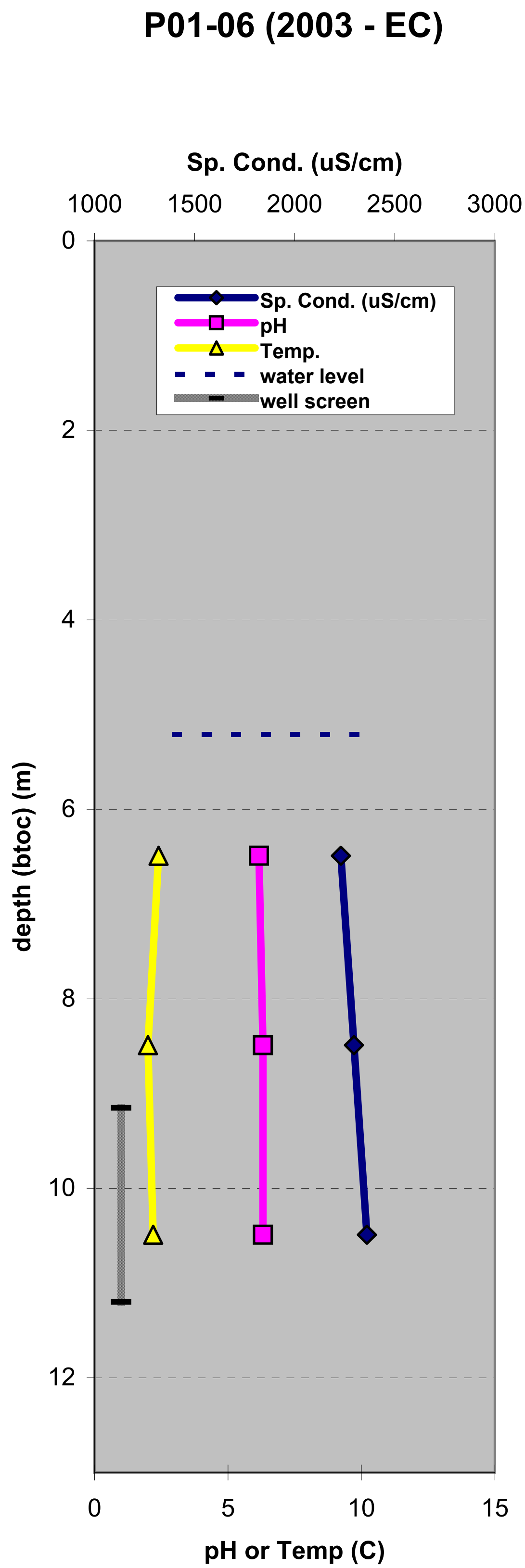


Figure 18. Geochemical (Field Parameter) profile of static water in well P01-06 by Gartner Lee Limited (GLL) and Environment Canada

5.7 P01-07 (near Secondary Impoundment Dam)

P01-07-A

- This well is completed in tailings
- The geochemical profile of field parameters does not suggest any clear evidence of leakage
- The depth discrete sample shows similar water quality to previous samples with a slightly elevated value of sulfate
- The multi-level well P03-04 is located within a few hundred meters downgradient and therefore provides information relevant to this location
- There exists some uncertainty about leakage in this well and therefore sampling of this well should be stopped and the well should be properly decommissioned

P01-07-B

- The geochemical profile of field parameters is similar in shape to that in well P01-07-A and does not suggest any clear evidence of leakage
- A field replicate (2001) shows significant field variability in sulfate concentrations
- The time series data does not suggest any clear trend in dissolved zinc and sulfate concentrations
- The depth discrete sample shows similar water quality to previous samples
- The multi-level well P03-04 is located within a few hundred meters downgradient and provides information relevant to this location at similar depths
- There exists some uncertainty about leakage in this well and therefore sampling of this well should be stopped and the well should be properly decommissioned

P01-07-C

- Leakage testing in May/June showed a significant accumulation of leakage water above the packer
- A down-hole video of the well revealed staining around some of the joints suggesting leakage
- The leakage water from the top of the packer had elevated sodium (320 mg/L)
- The static profiles do not show clear evidence of leakage and show uniform specific conductance throughout the entire water column (the top sample could be due to a partially submerged conductivity sensor)
- Sulfate at this location shows an increasing trend which is likely representative of actual trends in the aquifer
- Leakage water (from top of packer) did not have elevated zinc concentrations
- The sample taken after large volume purging shows concentrations of sulfate, dissolved zinc and sodium within a similar range to previous results
- The multi-level well P03-04 is located within a few hundred meters downgradient and provides information relevant to this location at similar depths

- There is a significant amount of tailings in the well during purging and sampling. Groundwater is immediately grey and turbid and remains throughout the entire purging and sampling.
- Tailings in the well suggest leakage and therefore sampling of this well should be stopped and the well should be properly decommissioned.

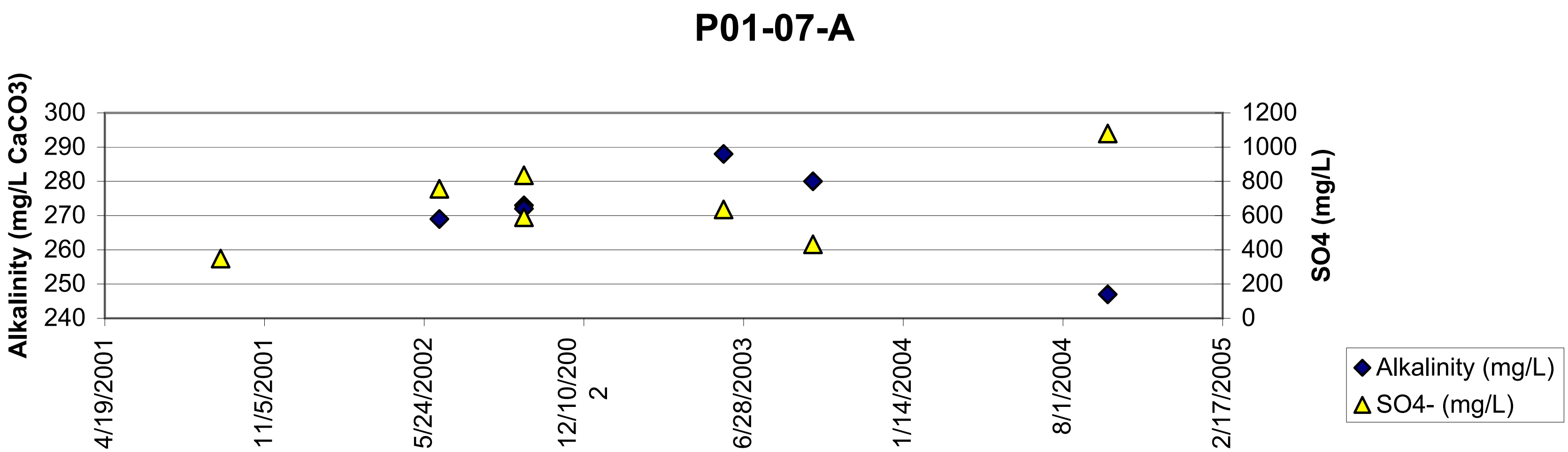
P01-07-D

- Sulfate at this location has an increasing trend
- The leakage water from the top of the packer had elevated sodium (320 mg/L)
- Packer testing in May/June showed that this well has the potential for leakage
- Depth discrete sample obtained from the screened interval has similar water chemistry than other samples collected previously
- The data does not suggest any significant adverse impact to the aquifer from this well
- The multi-level well P03-04 is located within a few hundred meters downgradient and provides information relevant to this location at similar depths
- There exists some uncertainty about leakage in this well and therefore this well should not be sampled in the future
- Due to the transient nature of the leakage problem, this well should not be sampled in the future and the well should be properly decommissioned.
- Data collected thus far from this well is likely representative of in-situ conditions
- This well should be monitored using a protocol to ensure constant review of the data and allow for determination of leakage effects should it become problematic

P01-07-E

- Sulfate has a similar increasing trend at this location to that at P01-07-D suggesting that both wells are monitoring the same trends in the aquifer.
- A down-hole video of the well revealed minimal staining around some of the joints suggesting that leakage may not occur or have a chemistry which is conducive to staining the well casing
- Both the GLL and EC profiles do not suggest clear evidence of leakage
- 2 depth discrete samples were collected (one at screen and one higher in the well casing). The concentration of dissolved zinc and sodium was similar for both samples but the deeper one had more elevated sulfate concentrations. This is consistent with the observed profile showing slightly more elevated specific conductance at depth.
- Leakage water on top of the packer had elevated dissolved zinc concentrations (4.9 mg/L) relative to conventional samples suggesting leakage.
- The data suggests that proper purging of the well seems to eliminate any effects of leakage
- It is likely that the data collected thus far is representative of conditions in the aquifer
- The multi-level well P03-04 is located within a few hundred meters downgradient and provides information relevant to this location at similar depths
- There exists some uncertainty about leakage in this well and therefore sampling of this well

- Due to the transient nature of the leakage problem, this well should not be sampled in the future and the well should be properly decommissioned.



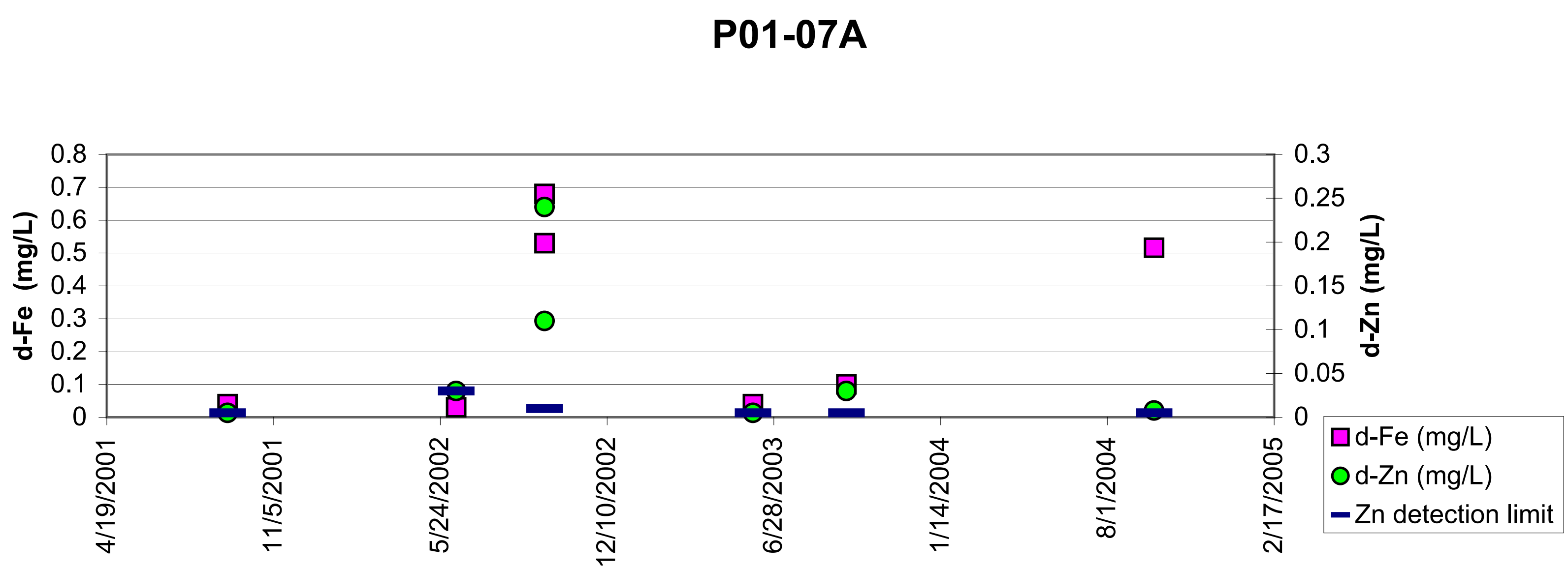
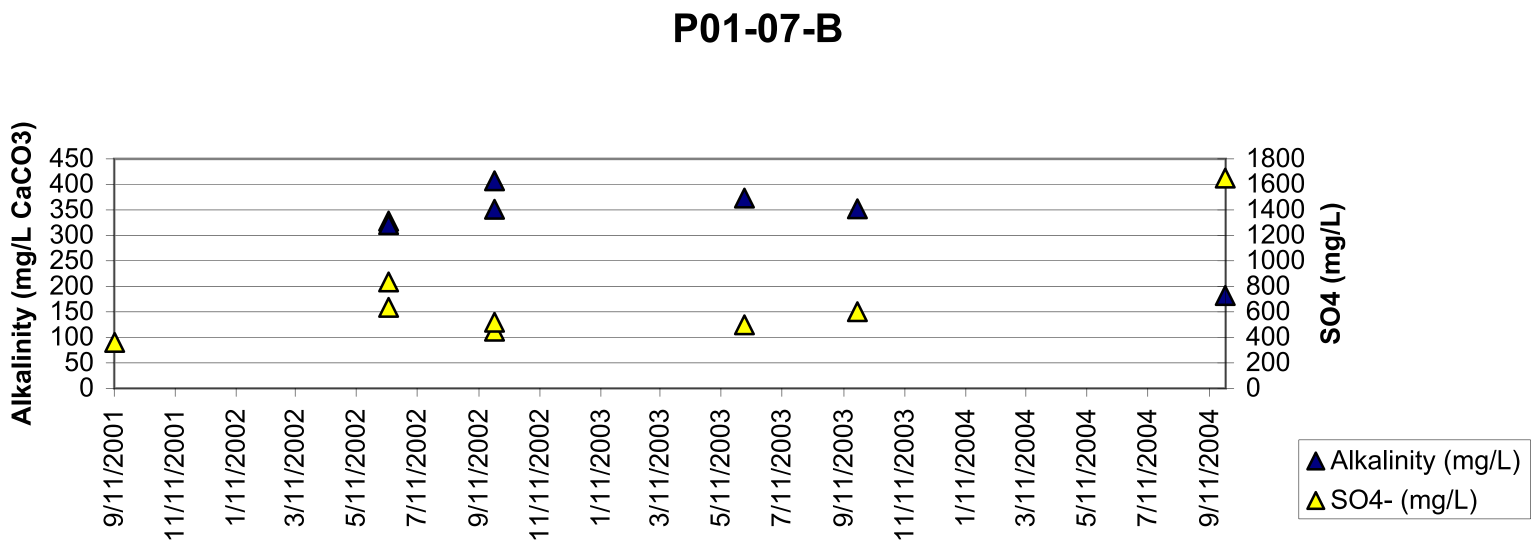


Figure 19. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-07-A



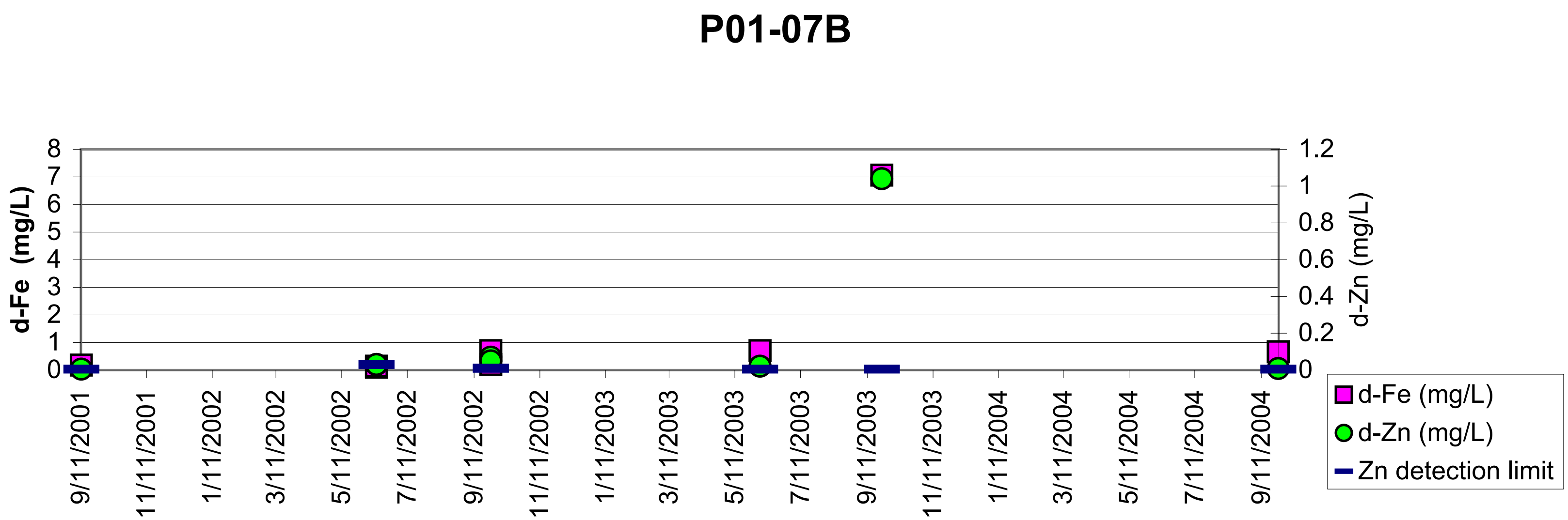
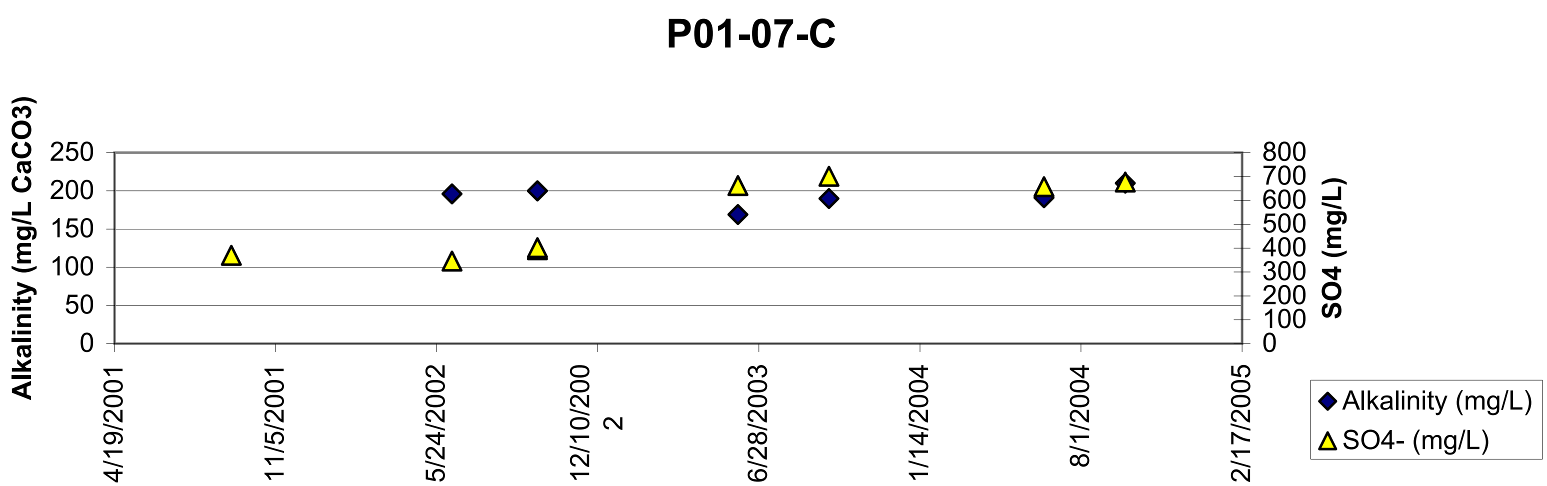


Figure 20. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-07-B



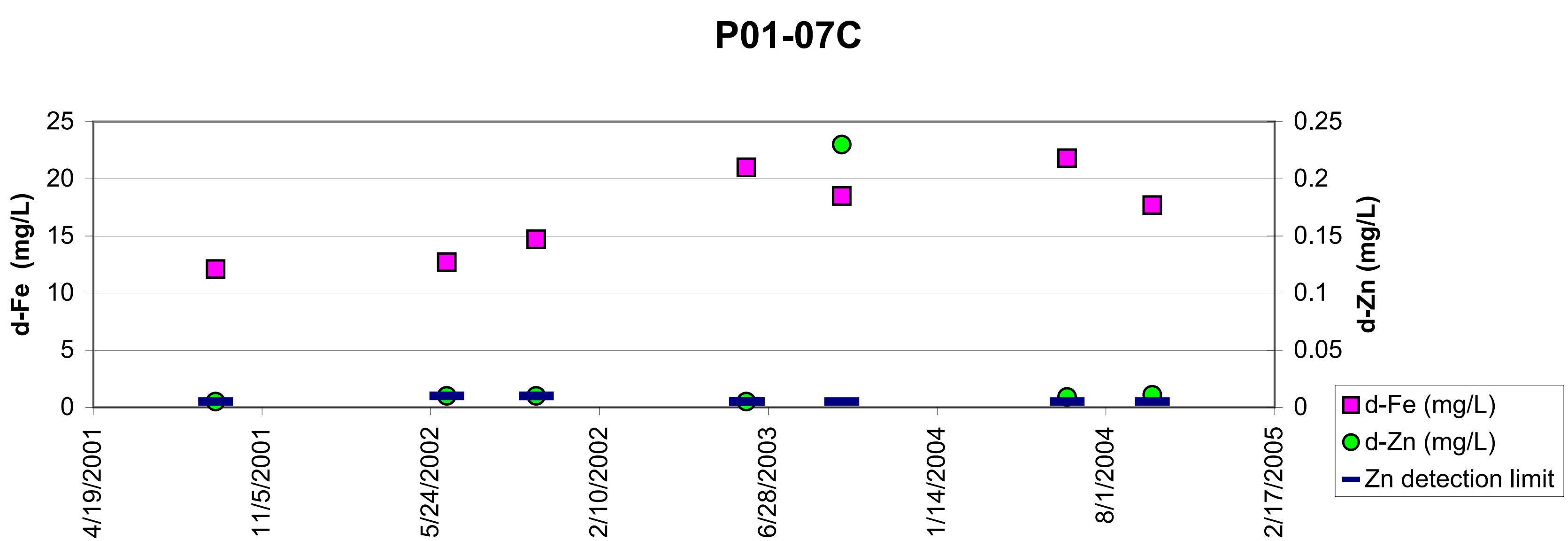
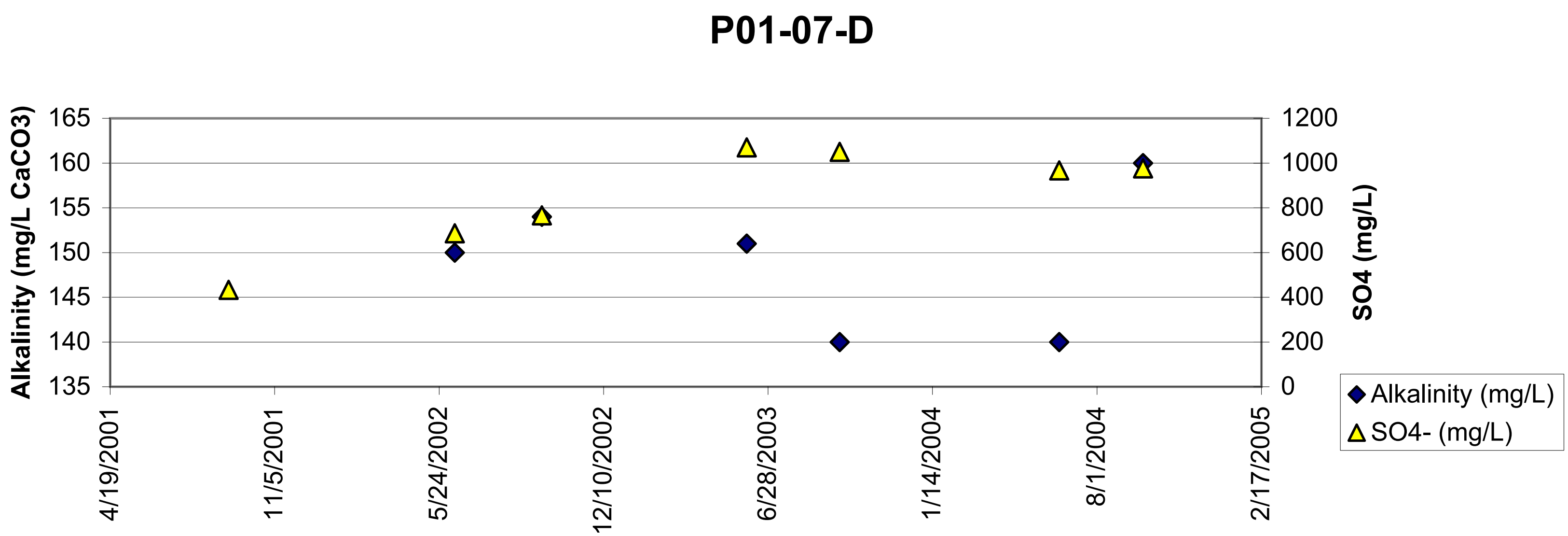


Figure 21. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-07-C



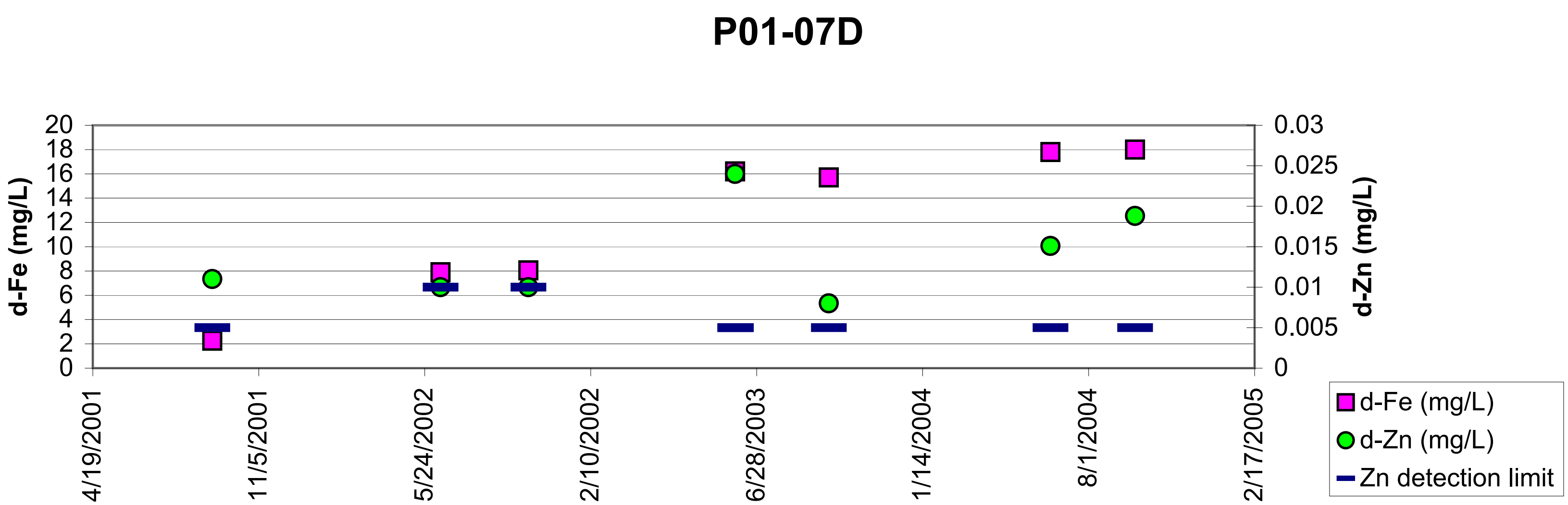
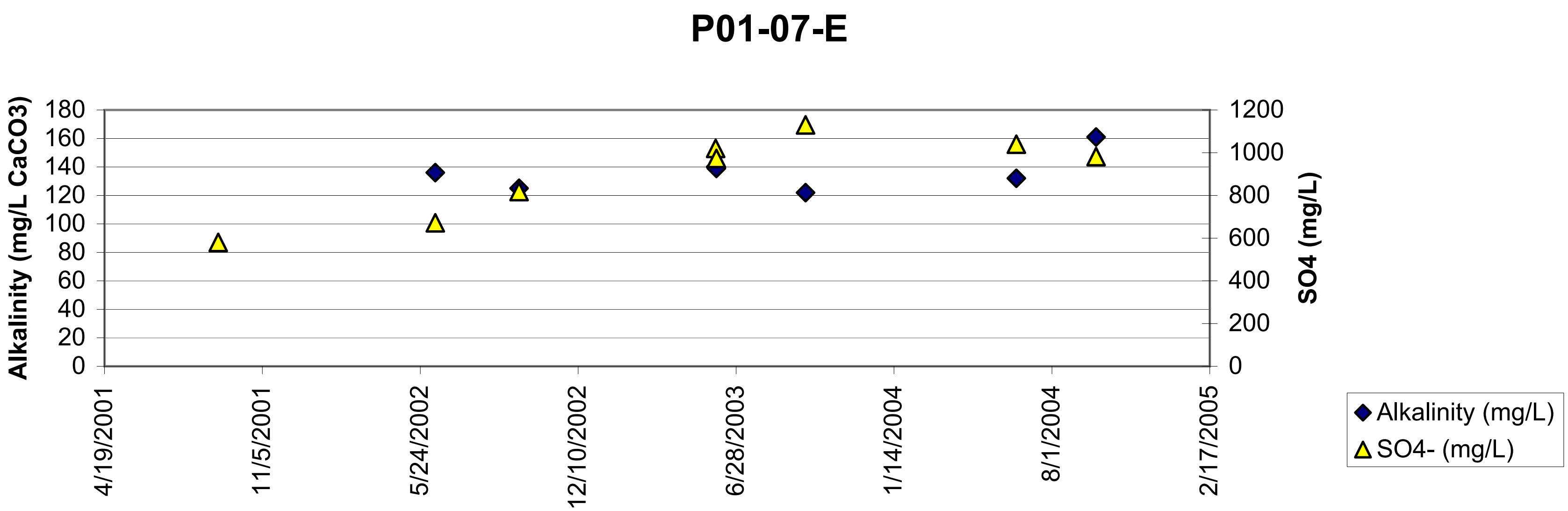


Figure 22. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-07-D



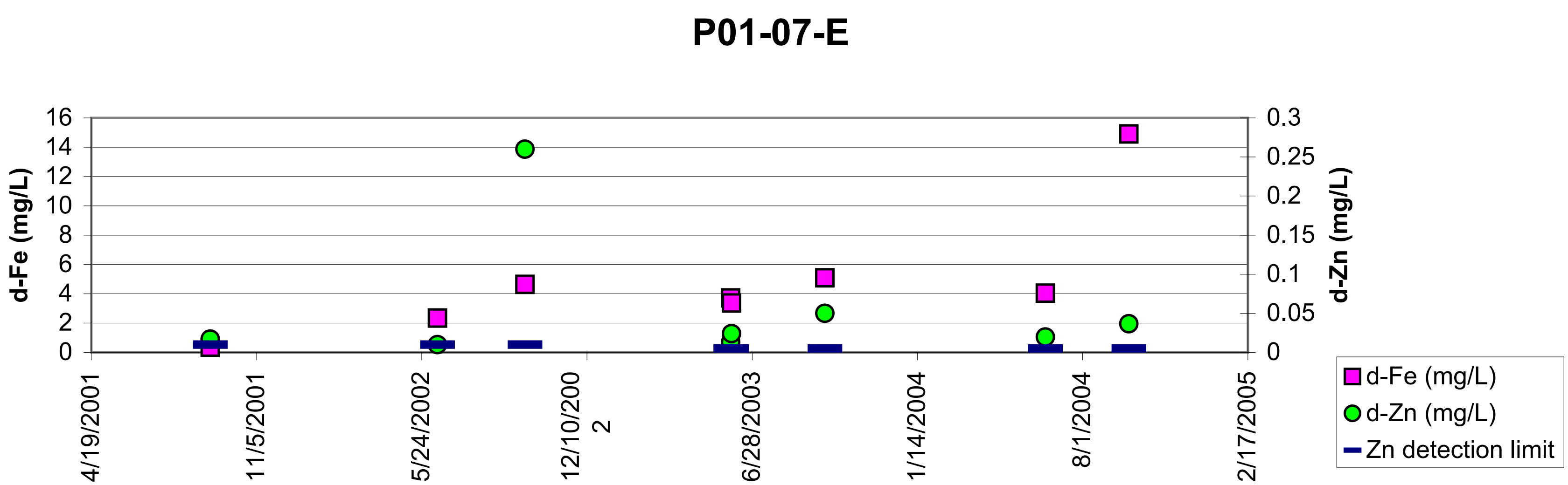


Figure 23. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-07-E

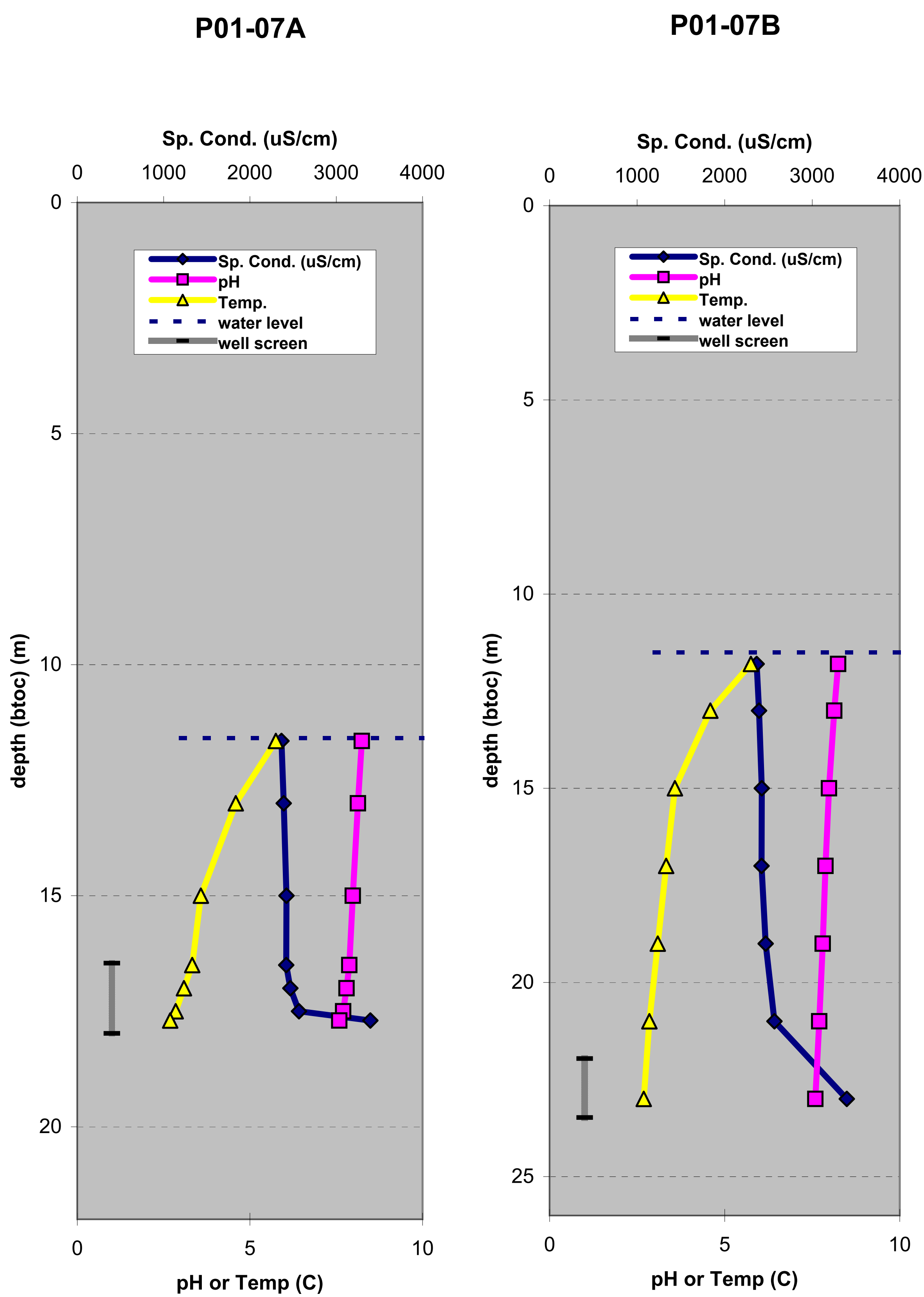


Figure 24. Geochemical (Field Parameter) profile of static water in wells P01-07A and P01-07B

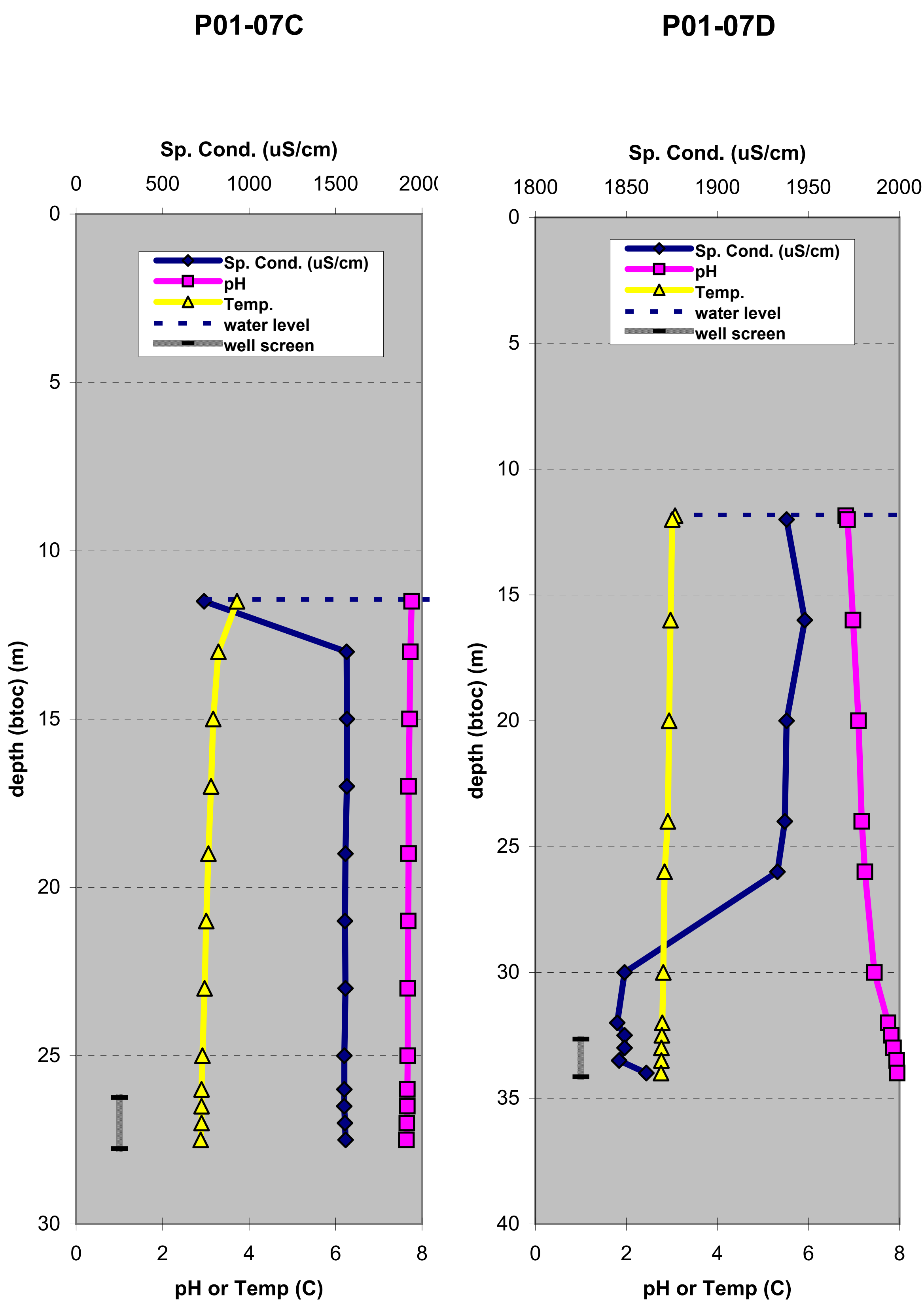


Figure 25. Geochemical (Field Parameter) profile of static water in wells P01-07C and P01-07D

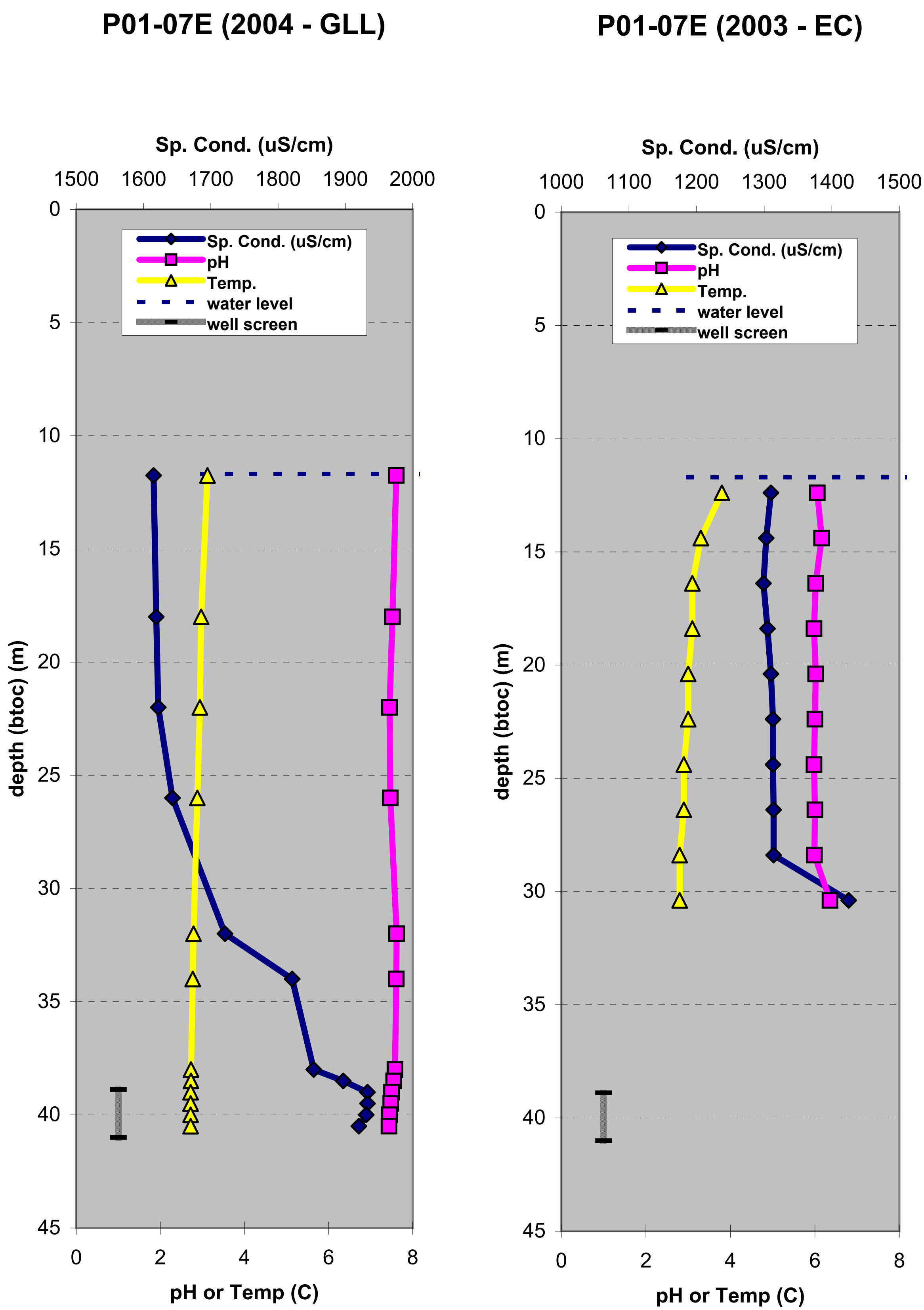
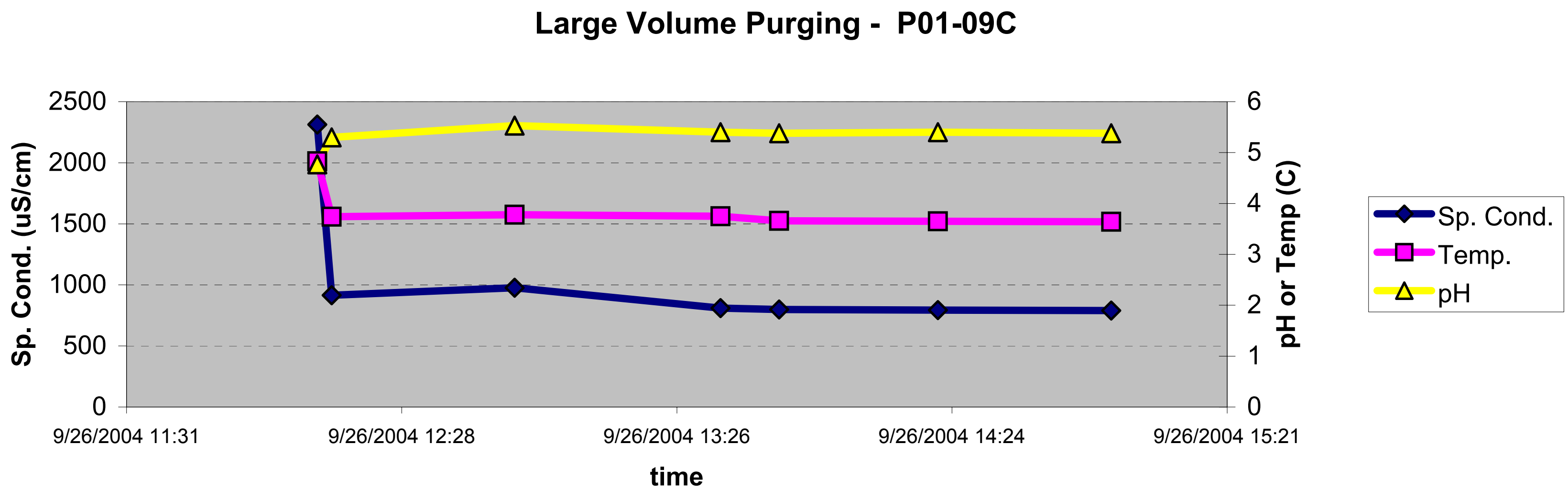


Figure 26. Geochemical (Field Parameter) profile of static water in well P01-07E
by Gartner Lee Limited (GLL) and Environment Canada



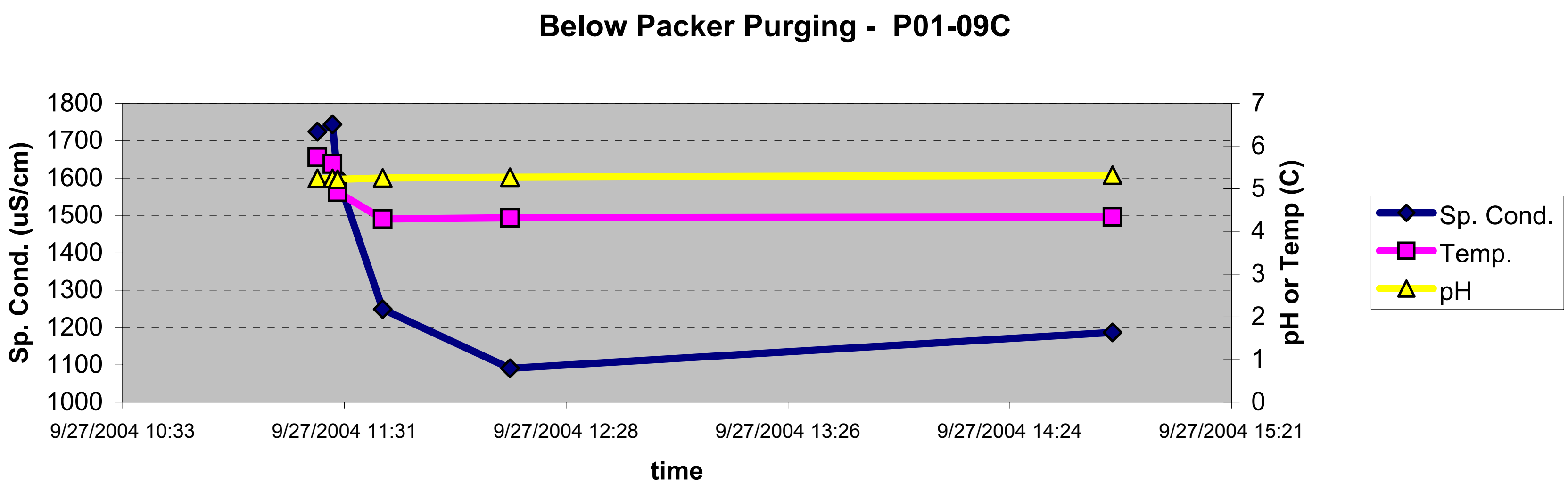


Figure 45. Evolution of Field Parameters During Purging for Well P01-09C

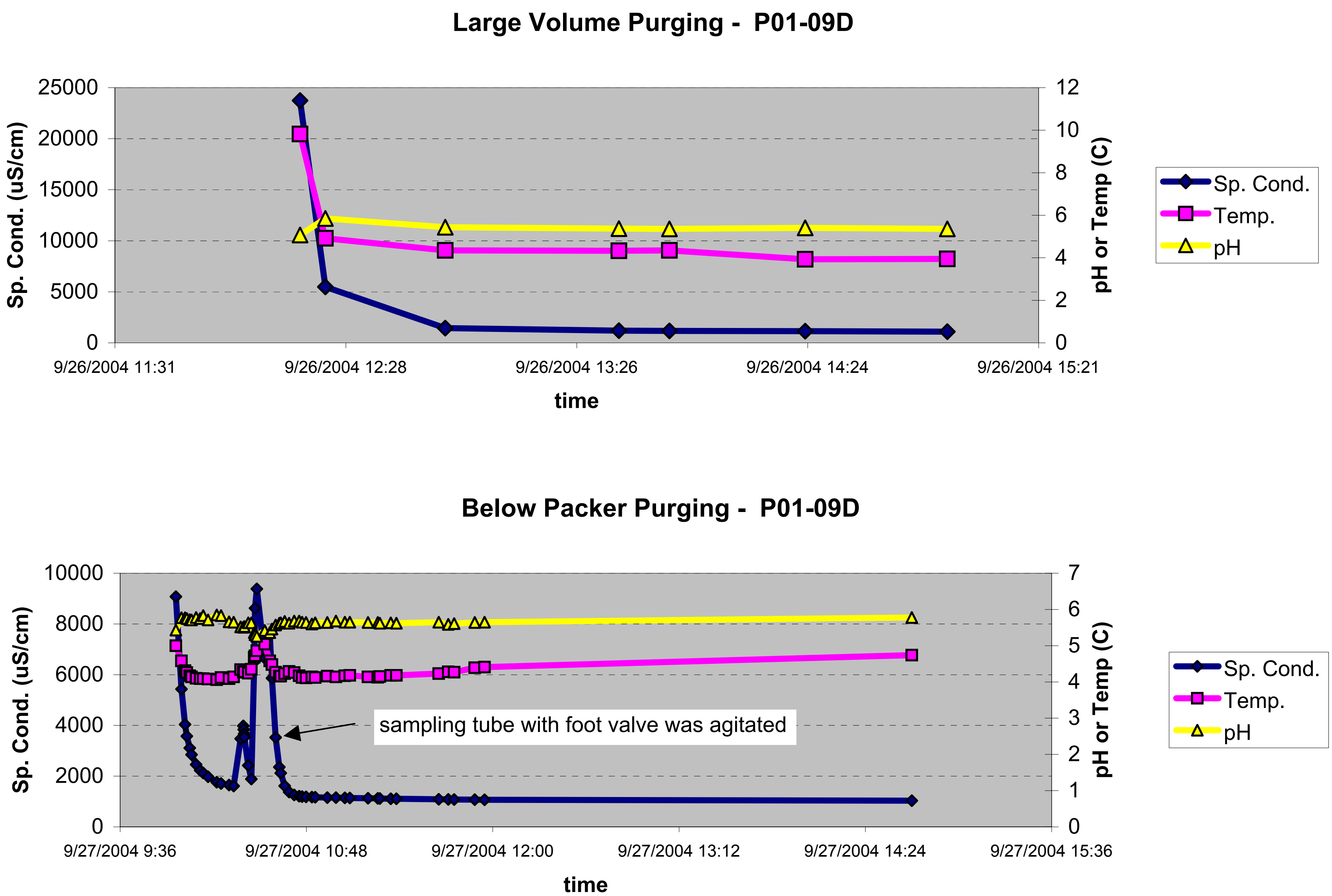
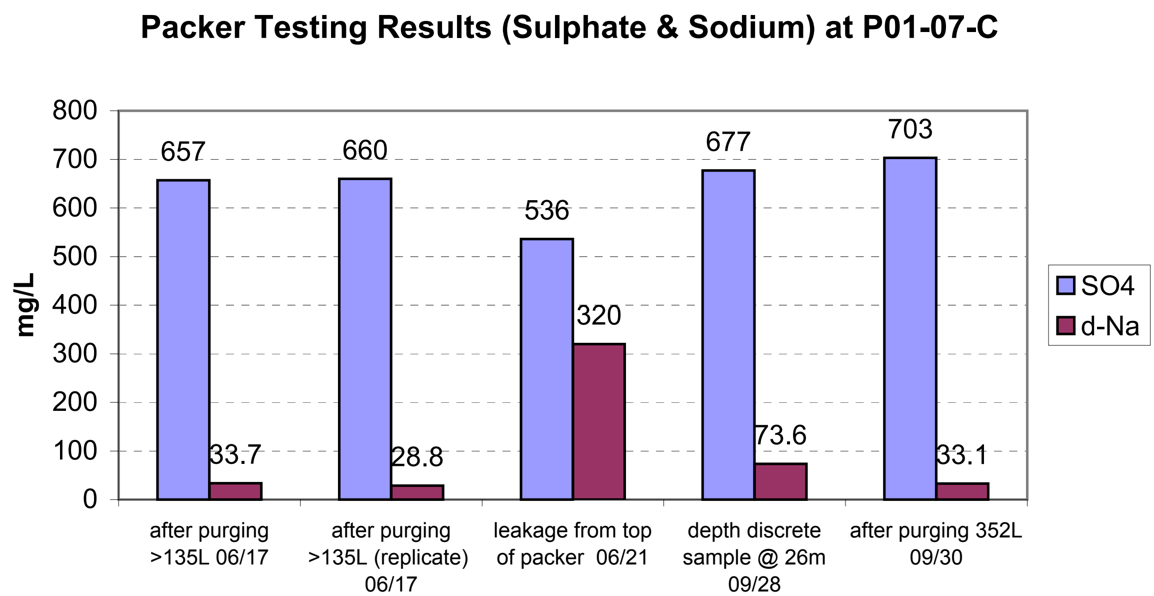
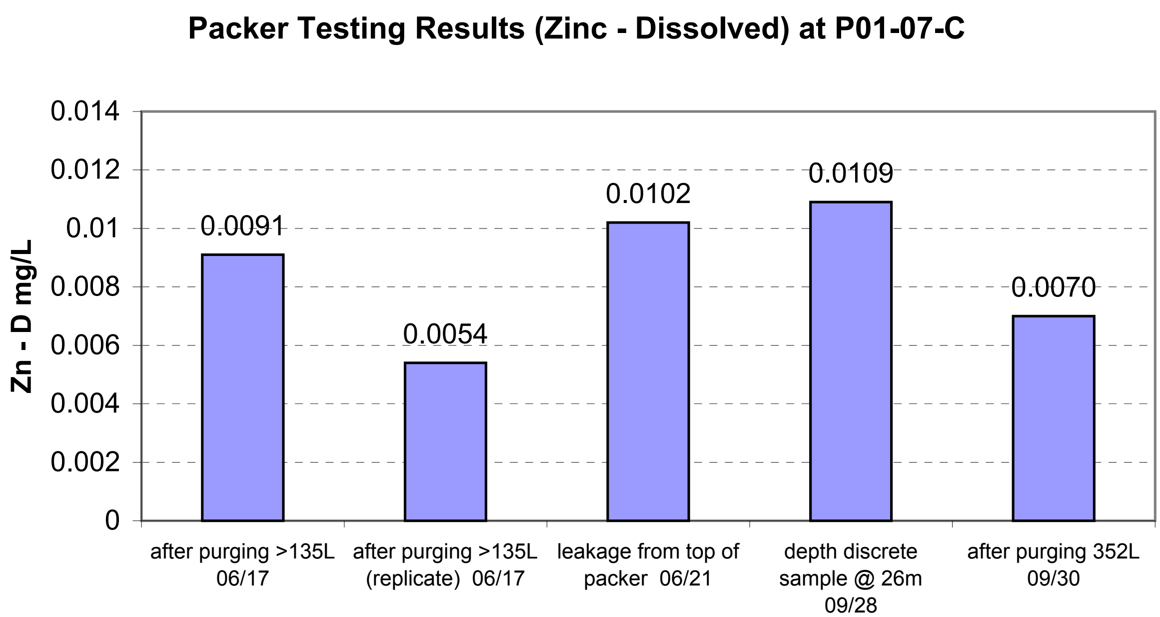


Figure 46. Evolution of Field Parameters During Purging for Well P01-09D

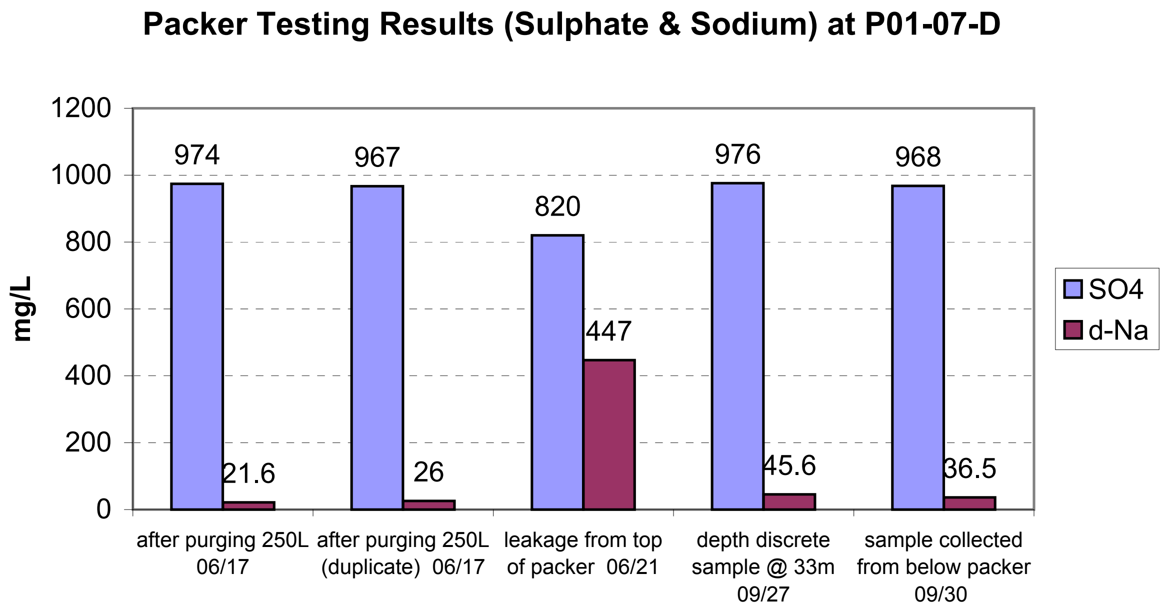


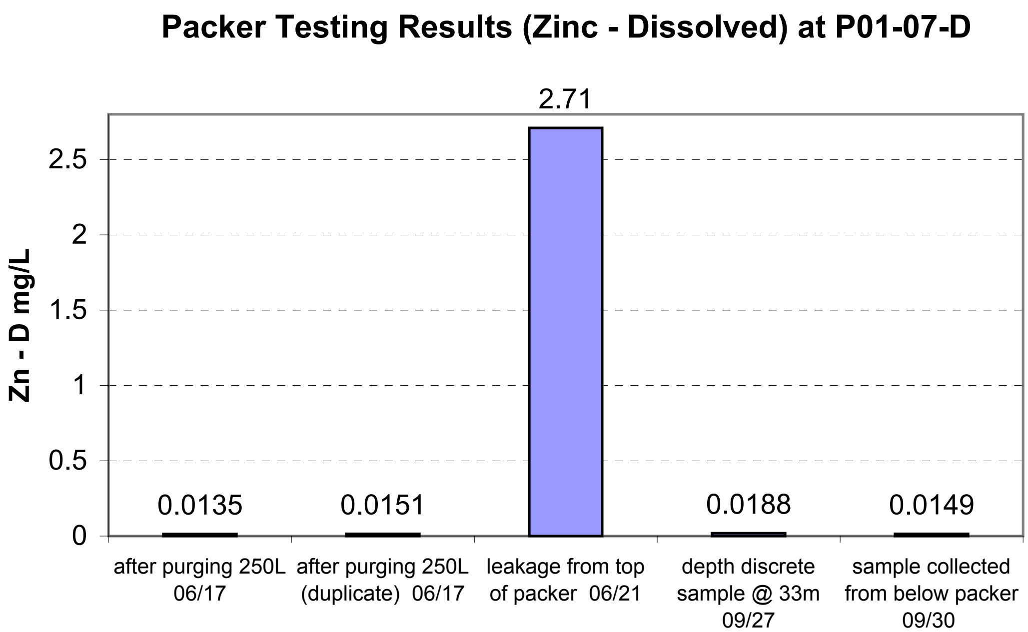


METHOD (JUNE)
purged well for 3 well volumes and collected sample.
Placed packer down well and removed any water above packer
Left packer in well 101 hrs total vol of leakage =9.9L
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample at well screen
purged 352L and collected sample

Figure 30. Summary of Leakage Assessment Sampling Results for Wells P01-07-C

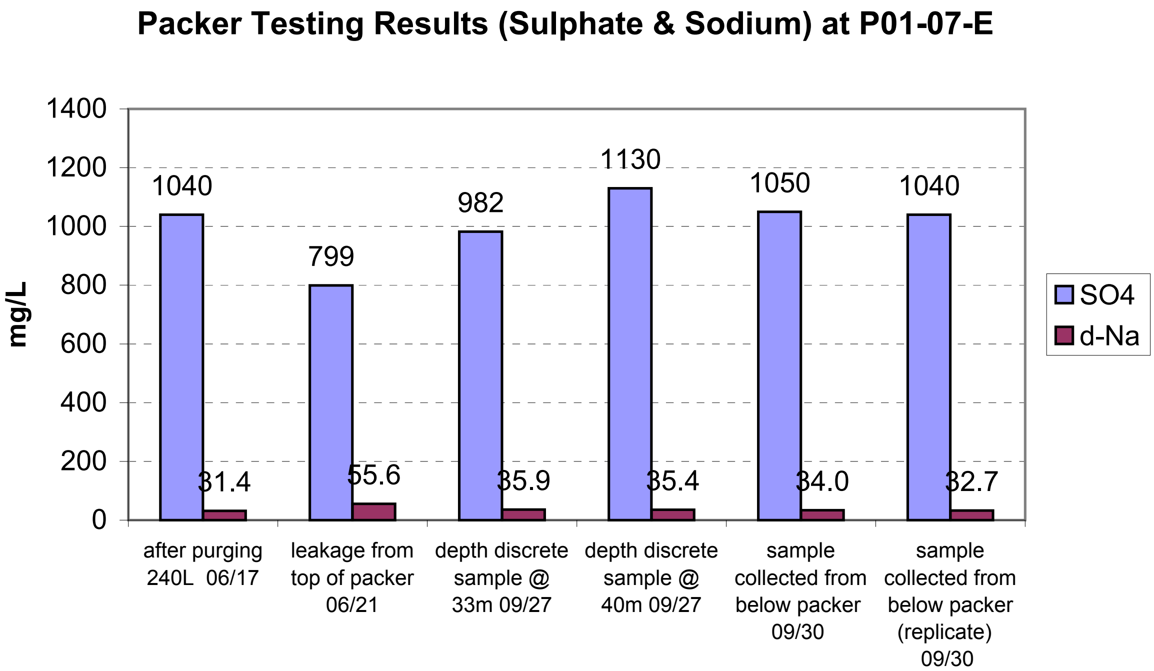


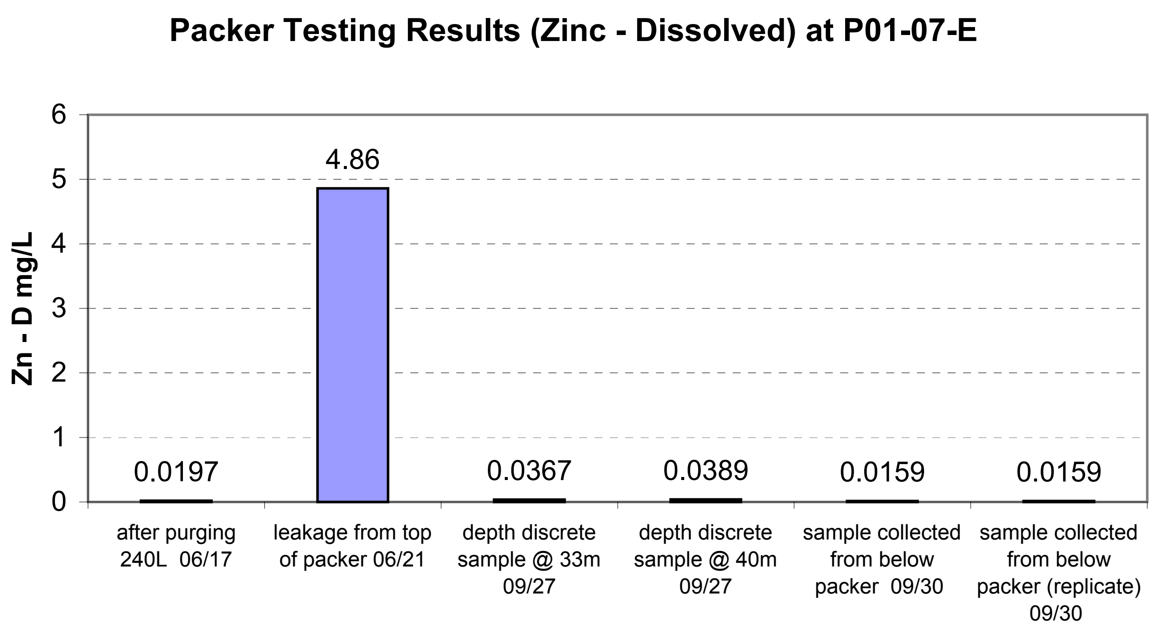


METHOD (JUNE)
purged well for 3 well volumes (250L) and collected sample.
Placed packer down well and removed any water above packer
Left packer in well 98 hrs total vol of leakage =0.8L
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample at well screen
purged 408L
placed packer down well and purged 10L from below the packer
collected a sample from below packer with packer still in place, sample tube was at top of packer

Figure 31. Summary of Leakage Assessment Sampling Results for Wells P01-07-D

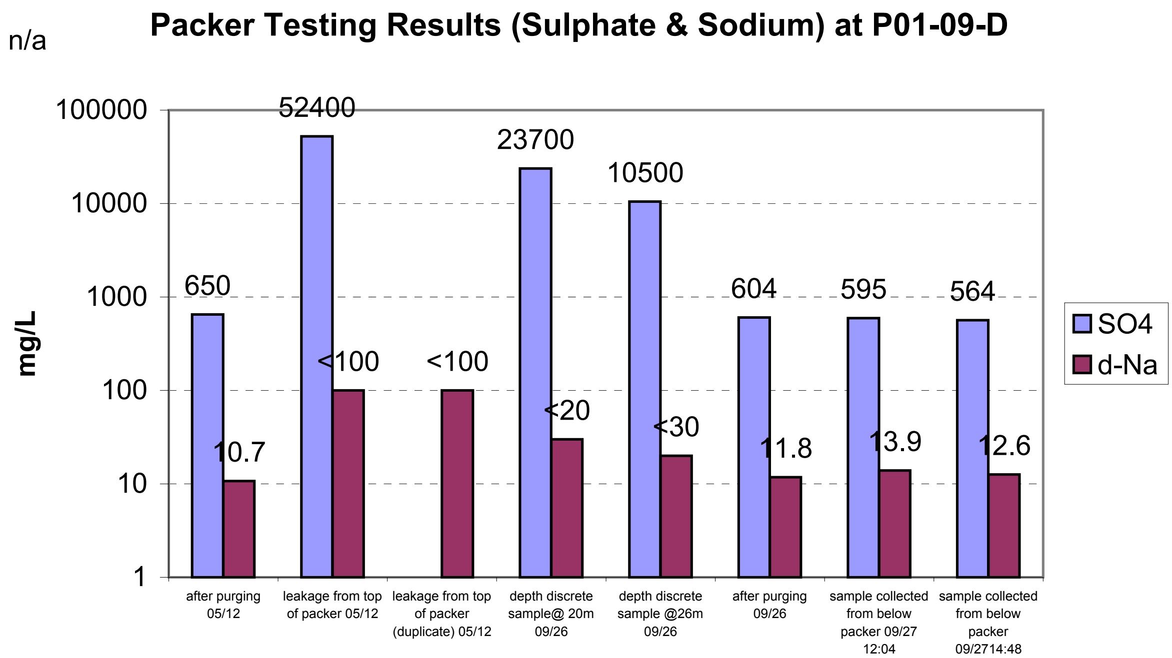


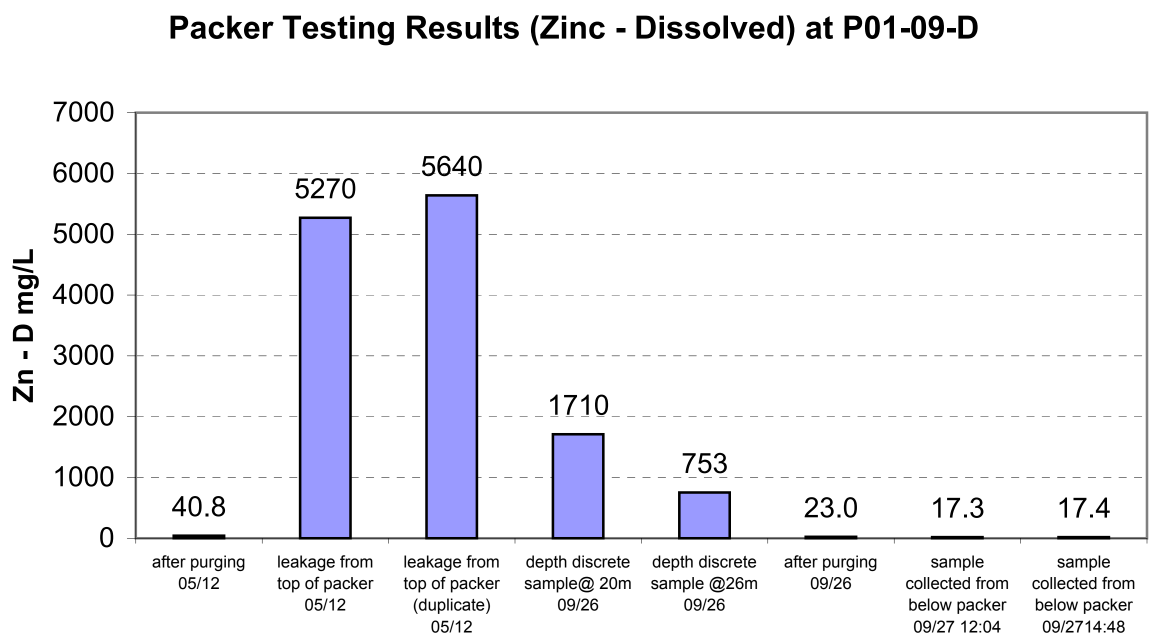


METHOD (JUNE)
purged well for 3 well volumes and collected sample.
Placed packer down well and removed any water above packer
Left packer in well 16hrs30mins total vol of leakage = 0.4L
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample at 33m and at well screen
purged 210L
placed packer down well and purged 10L
collected a sample from below packer with packer still in place, sample tube was at top of packer

Figure 32. Summary of Leakage Assessment Sampling Results for Wells P01-07-E

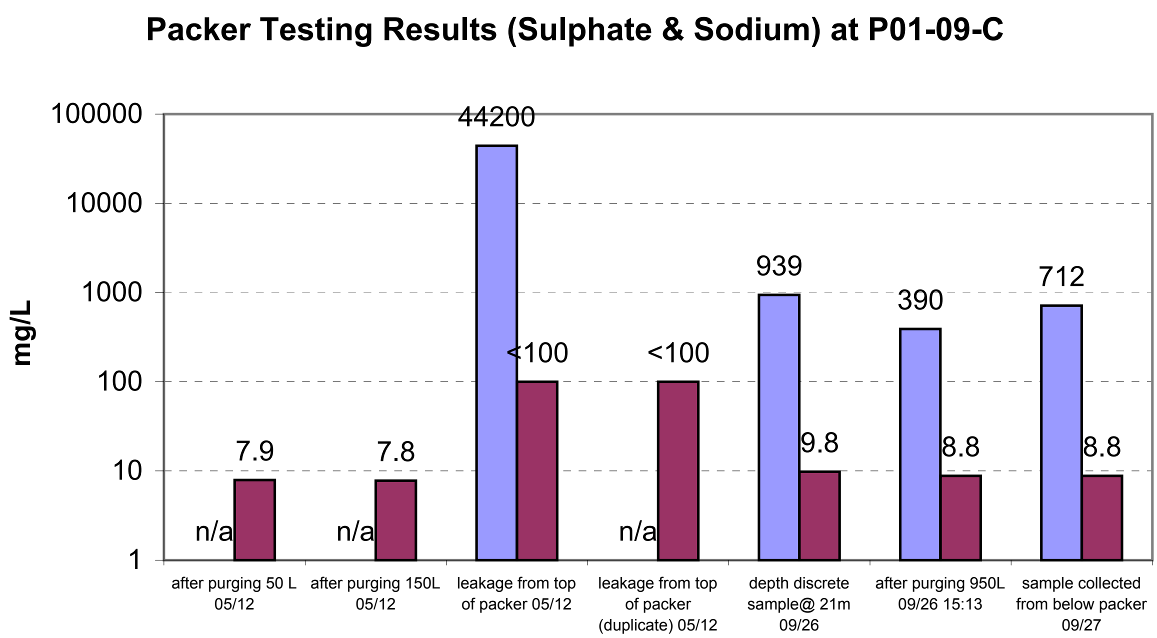


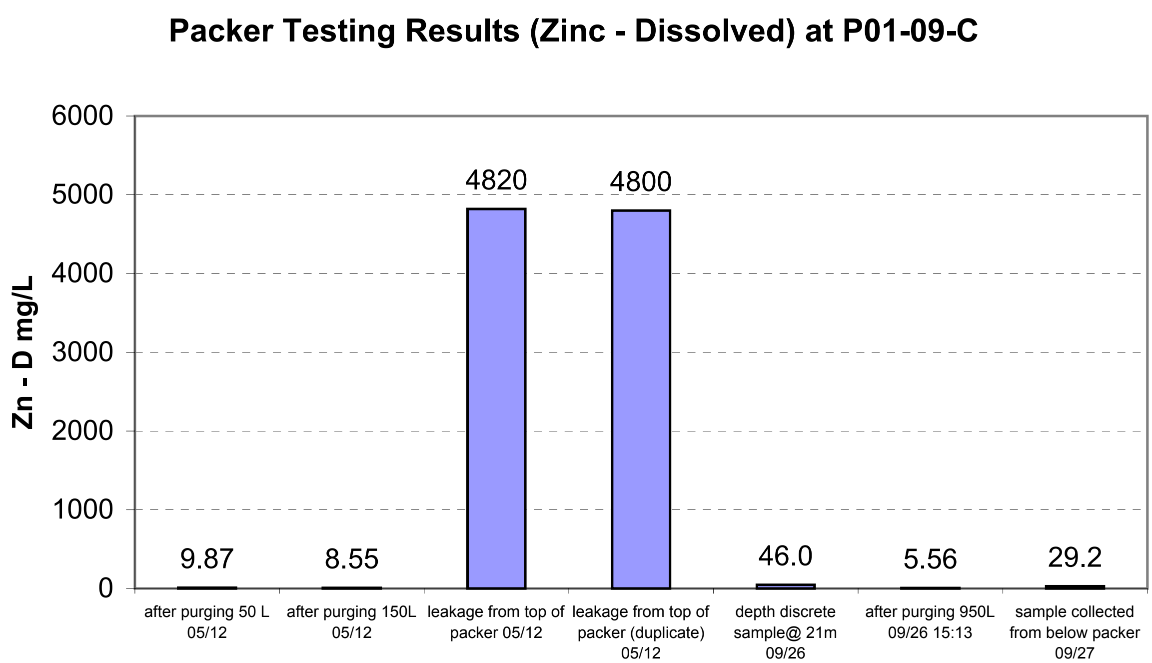


METHOD (MAY)
purged well for 3 well volumes(150L) and collected sample.
Placed packer down well and removed any water above packer
Left packer in well >12 hrs. (depending on well)
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample above and at well screen
purged 1026L and collected sample
placed packer down well and purged 33L
collected a sample from below packer with packer still in place, sample tube was at top of packer
continued purging for an additional 33 L and took second sample from below packer

Figure 48. Summary of Leakage Assessment Sampling Results for Wells P01-09-D

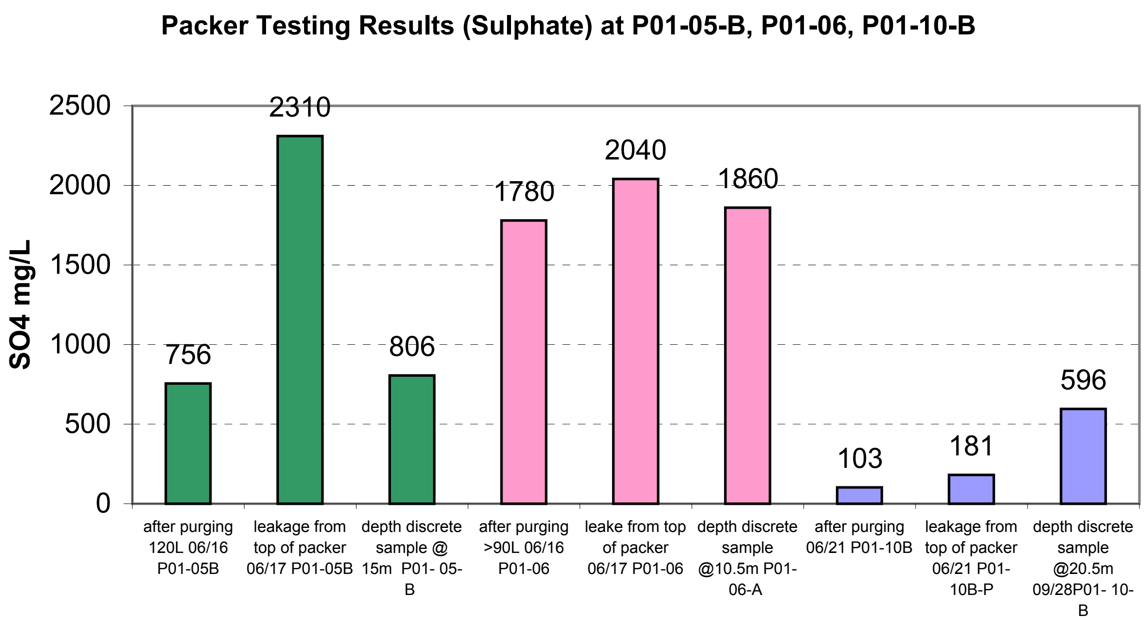


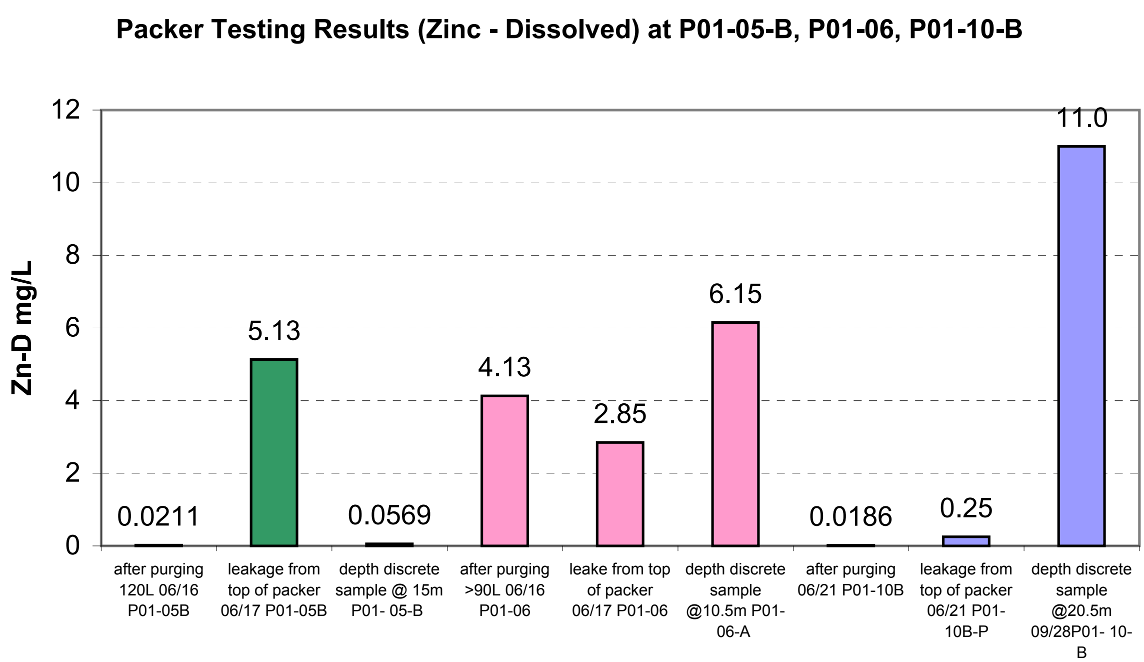


METHOD (MAY)
purged well for 3 well volumes and collected sample.
Placed packer down well and removed any water above packer
Left packer in well >12 hrs. (depending on well)
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample above and at well screen
purged 950Lvolumes and collected sample
placed packer down well and purged
collected sample from below back with packer in place, sample tube was at top of packer

Figure 49. Summary of Leakage Assessment Sampling Results for Wells P01-09-C

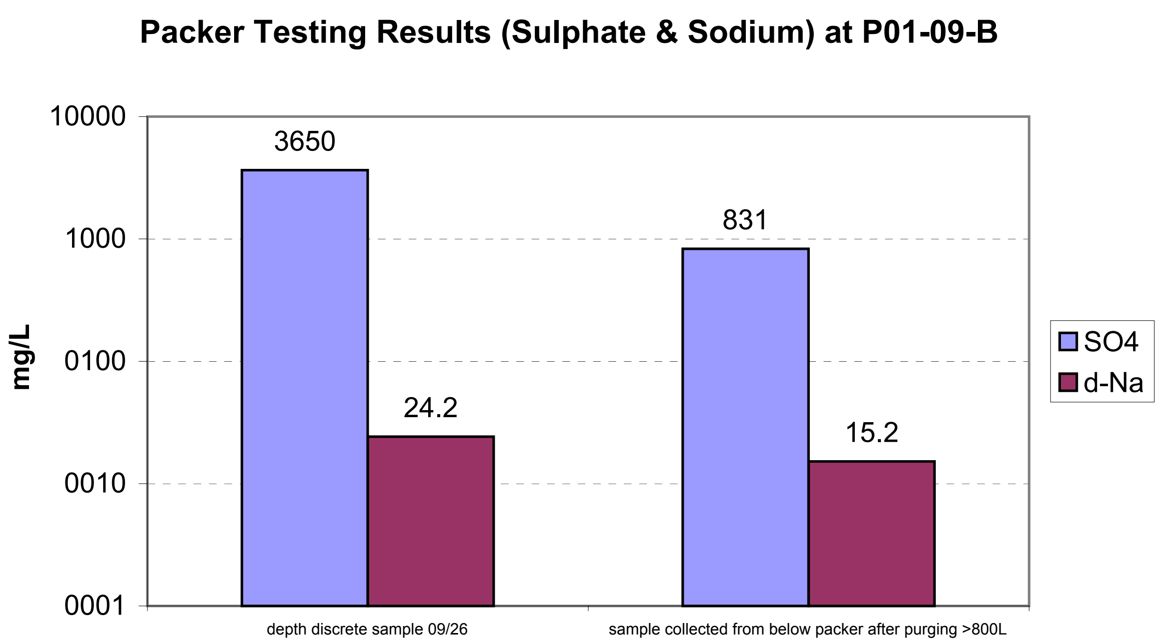


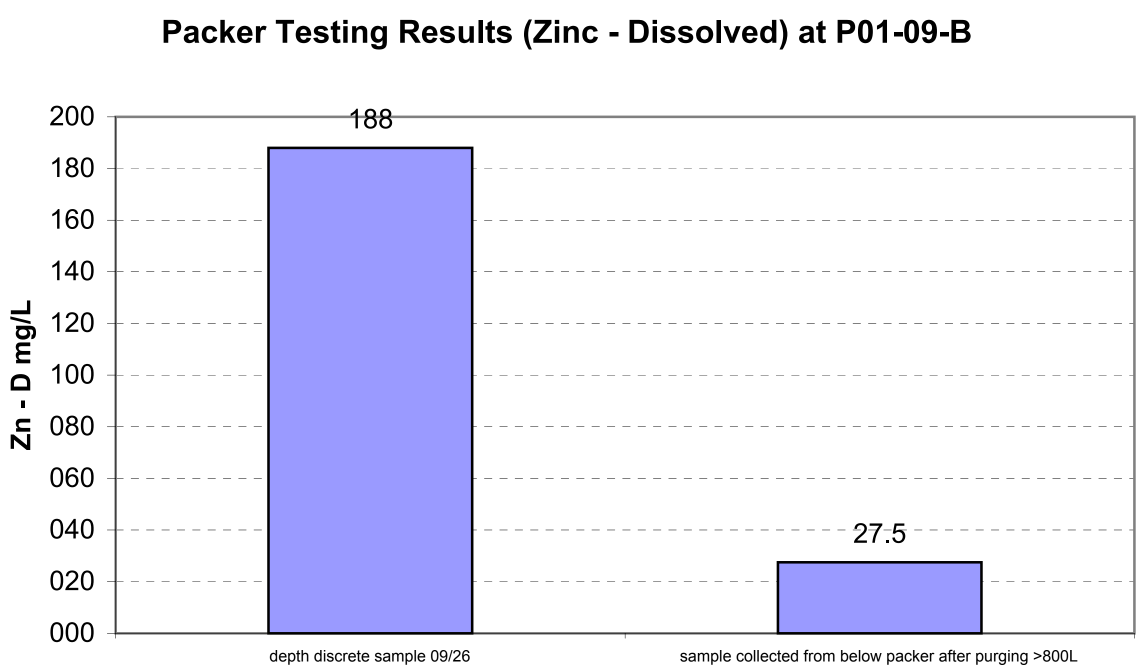


METHOD (JUNE)
purged well for 3 well volumes and collected sample.
Placed packer down well and removed any water above packer
Left packer in well ~12 hrs (depending on well)
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample at well screen

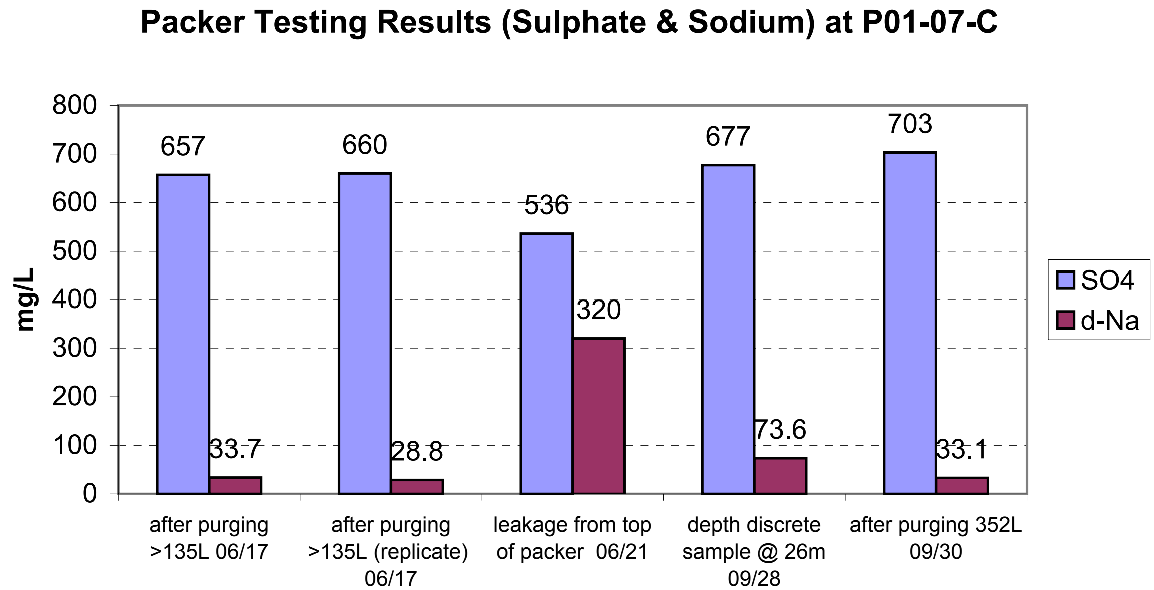
Figure 16. Summary of Leakage Assessment Sampling Results for Wells P01-05-B, P01-06 and P01-10-B

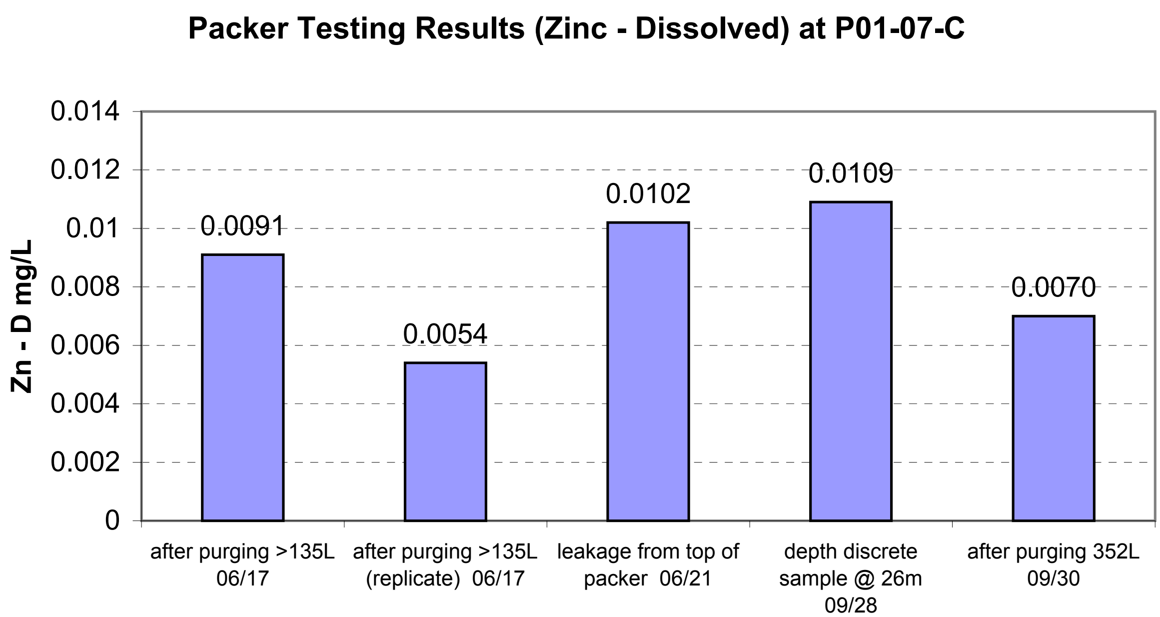




METHOD (SEPTEMBER)
took a depth discrete sample at well screen
purged 733L
placed packer down well and purged an additional 81L
collected a sample from below packer with packer still in
place, sample tube was at top of packer

Figure 47. Summary of Leakage Assessment Sampling Results for Wells P01-09-B

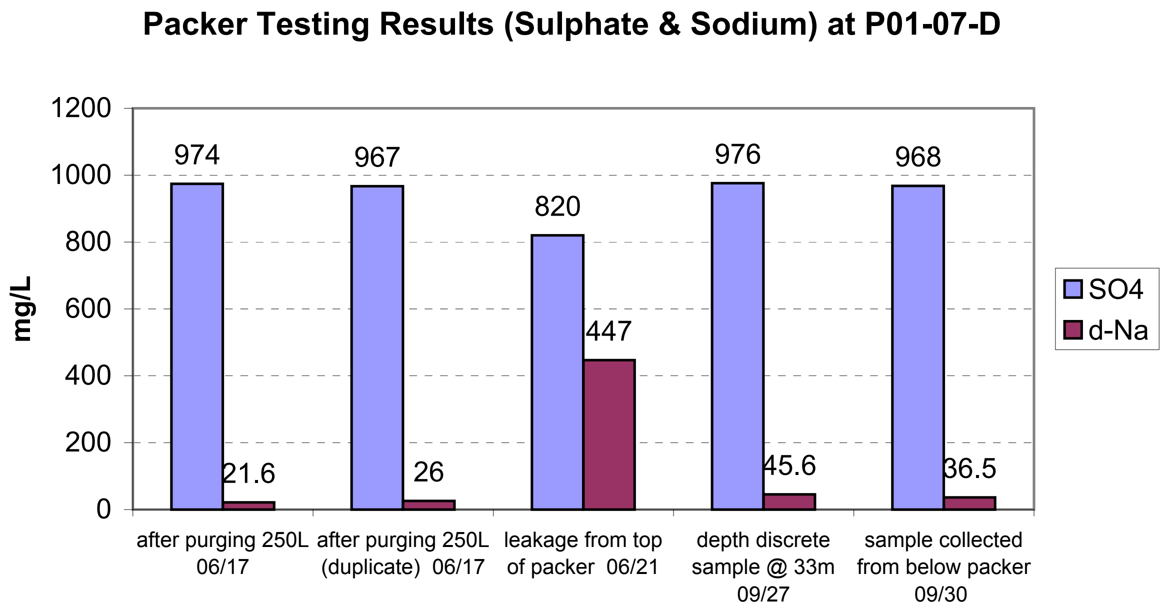


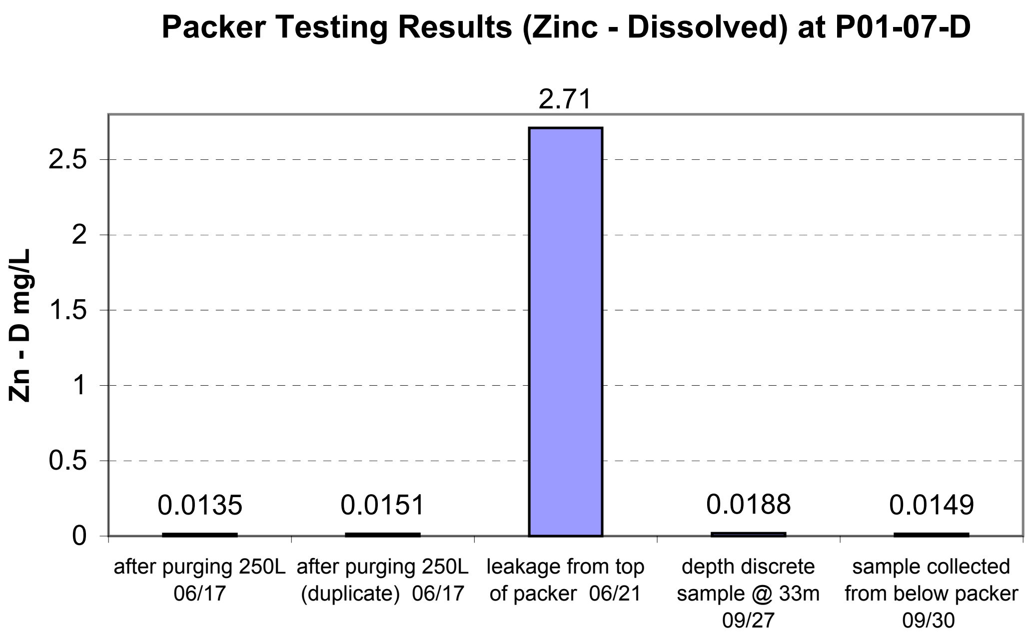


METHOD (JUNE)
purged well for 3 well volumes and collected sample.
Placed packer down well and removed any water above packer
Left packer in well 101 hrs total vol of leakage =9.9L
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample at well screen
purged 352L and collected sample

Figure 30. Summary of Leakage Assessment Sampling Results for Wells P01-07-C

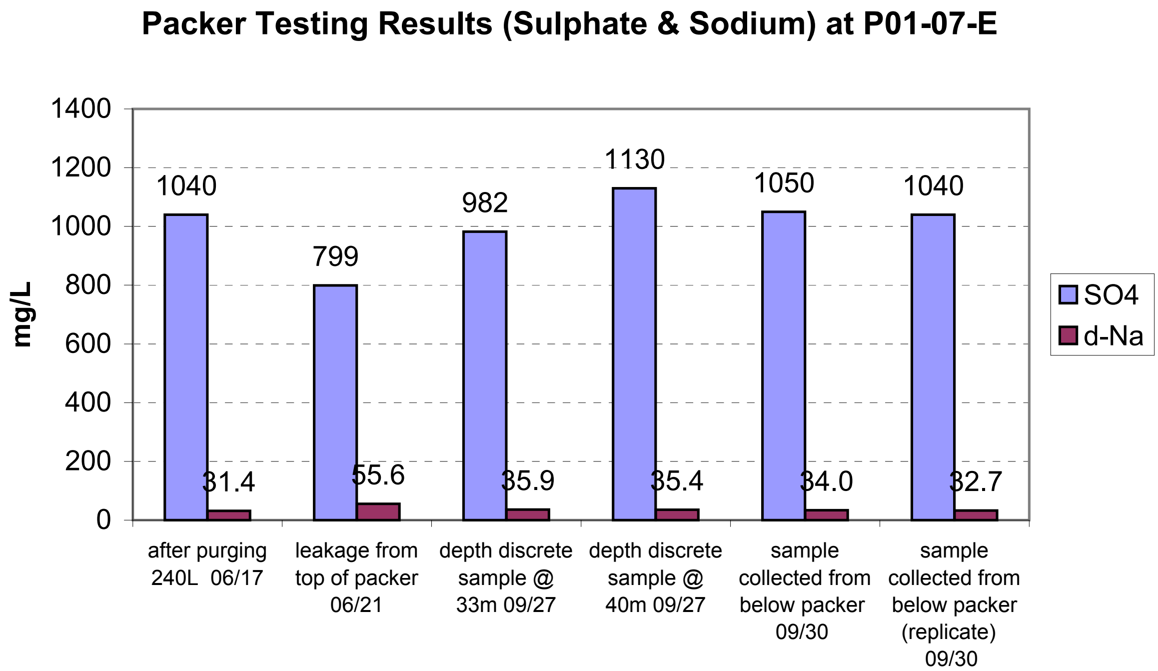


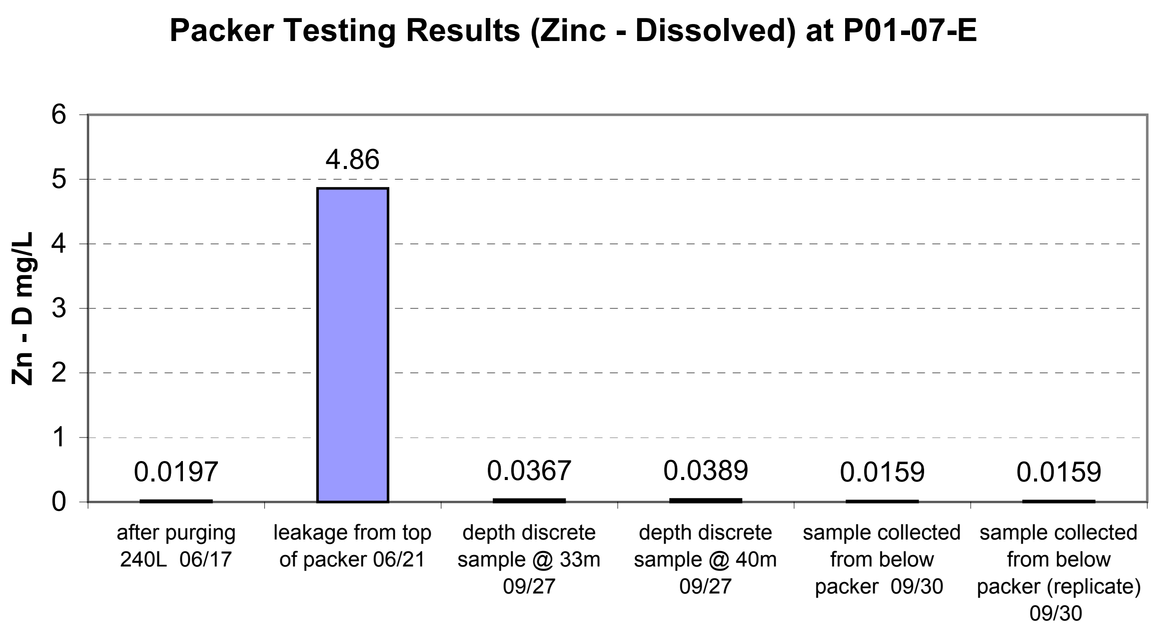


METHOD (JUNE)
purged well for 3 well volumes (250L) and collected sample.
Placed packer down well and removed any water above packer
Left packer in well 98 hrs total vol of leakage =0.8L
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample at well screen
purged 408L
placed packer down well and purged 10L from below the packer
collected a sample from below packer with packer still in place, sample tube was at top of packer

Figure 31. Summary of Leakage Assessment Sampling Results for Wells P01-07-D





METHOD (JUNE)
purged well for 3 well volumes and collected sample.
Placed packer down well and removed any water above packer
Left packer in well 16hrs30mins total vol of leakage = 0.4L
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample at 33m and at well screen
purged 210L
placed packer down well and purged 10L
collected a sample from below packer with packer still in place, sample tube was at top of packer

Figure 32. Summary of Leakage Assessment Sampling Results for Wells P01-07-E

5.8 P01-08

Observations from May 2005 of this well cluster are included in Appendix F.

P01-08-A

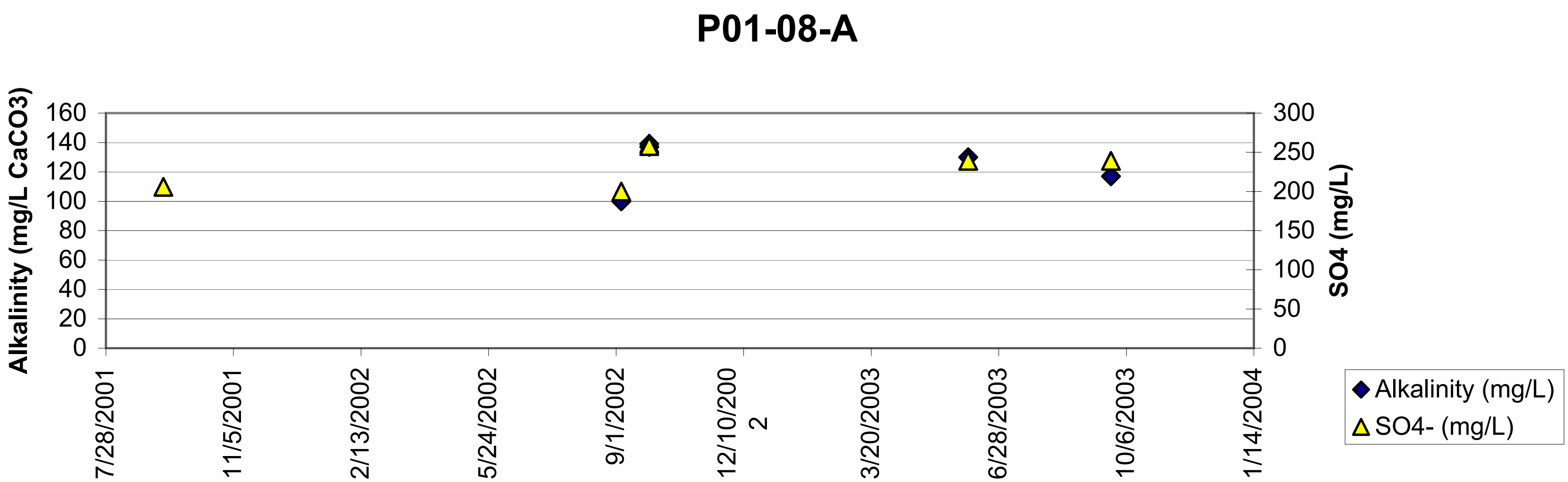
- This well currently has sampling tubing stuck or frozen in it. It is possible to use another sampling tubing to obtain samples from the well. This well was noted to be frozen in Sept. 2004 and was sampled in May 2005.
- It is extremely difficult to test wells that are screened in tailings.
- The option to decommission this well should be examined more closely.

P01-08-B

- Under current conditions, any impact from leakage would be minimal based on the metals and sulfate concentration observed in the data.
- Dissolved zinc concentrations of approx. 25mg/L were observed in 2003 suggesting impact from leakage.
- EC noted in 2004 that tailings were observed in the well during sampling in 2004.
- Groundwater also had the characteristic odour of tailings porewater.
- The condition of both the steel casing and the well casing suggest that the well may be affected by heaving of tailings sediments.
- There is currently a tubing which is stuck in the well. It does not seem to extend to the bottom of the well and it can only be lifted approx. 1-2 ft before it gets stuck.
- The elevated zinc concentrations and observation of tailings in the well by EC in 2004 suggest that this well may be affected by leakage and therefore should be decommissioned.

P01-08C

- Sampling tubing is stuck or frozen in this well in May 2005.
- This well has always been problematic to sample as it is often frozen and has tubing stuck in it.
- This well is not located in an area of great interest and has been problematic and therefore could be decommissioned



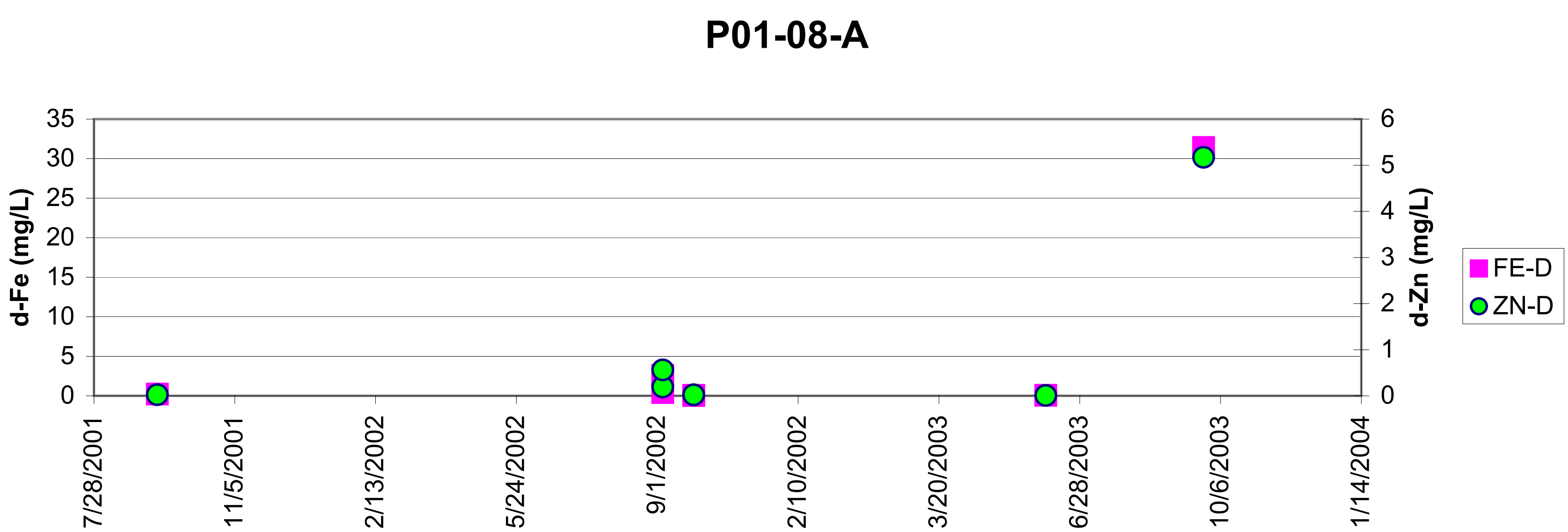
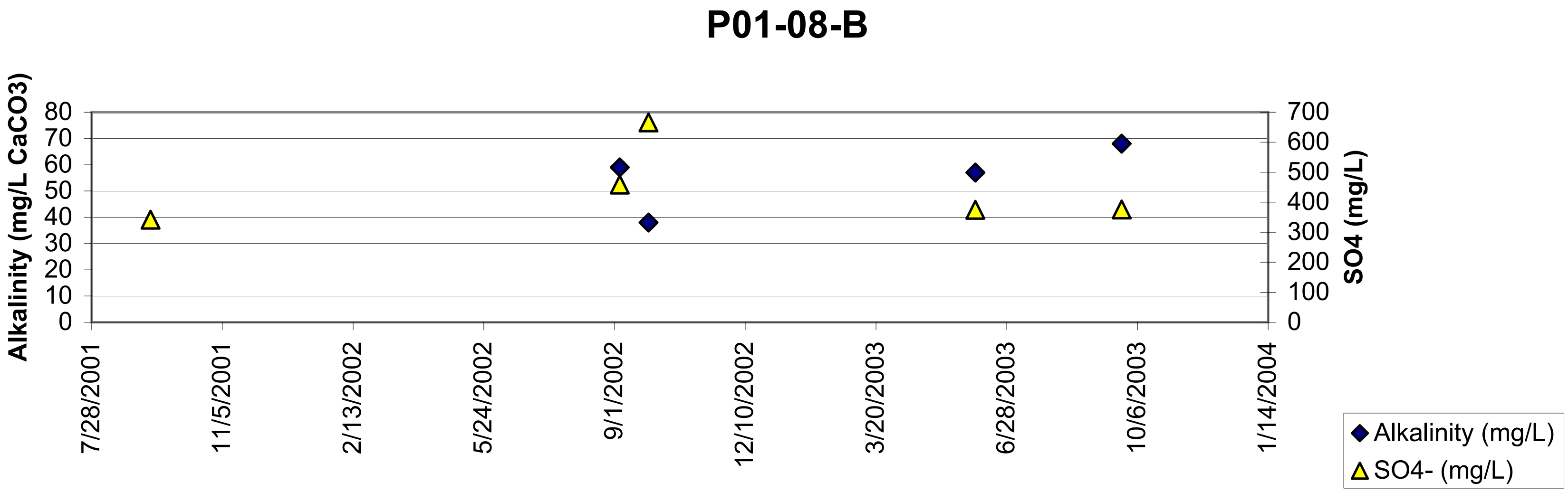


Figure 33. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-08-A



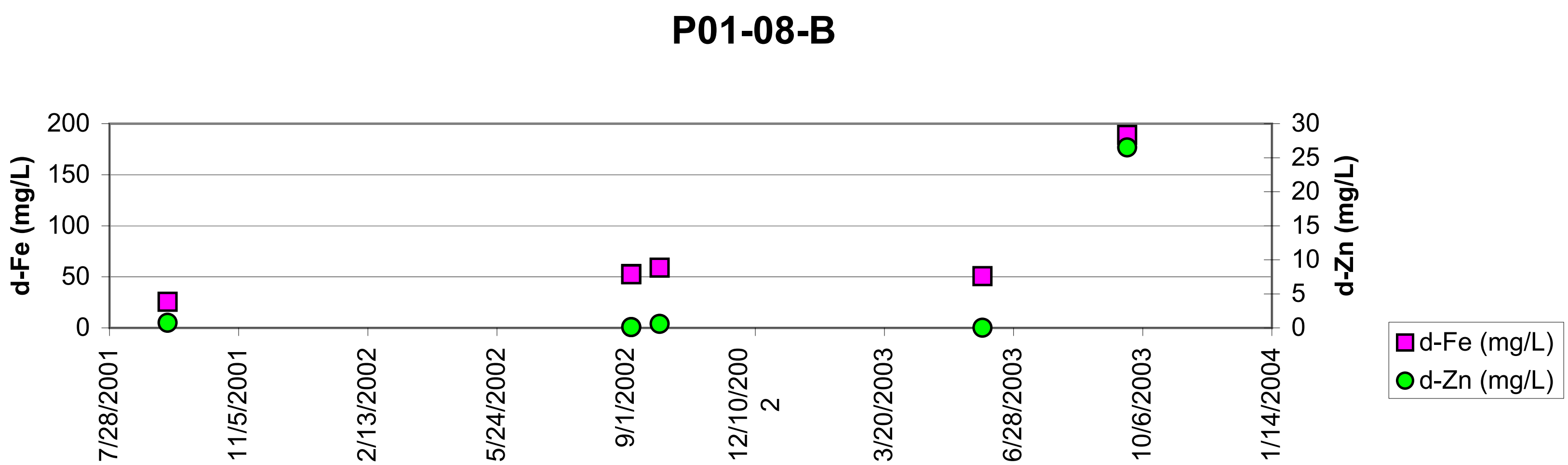
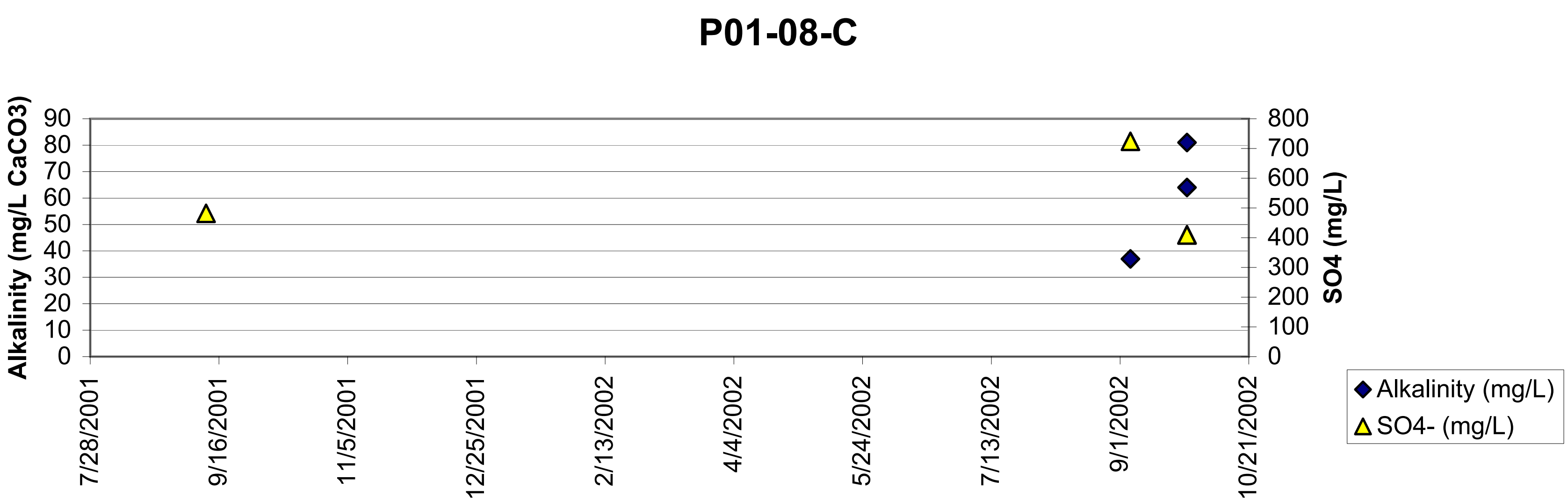


Figure 34. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-08-B



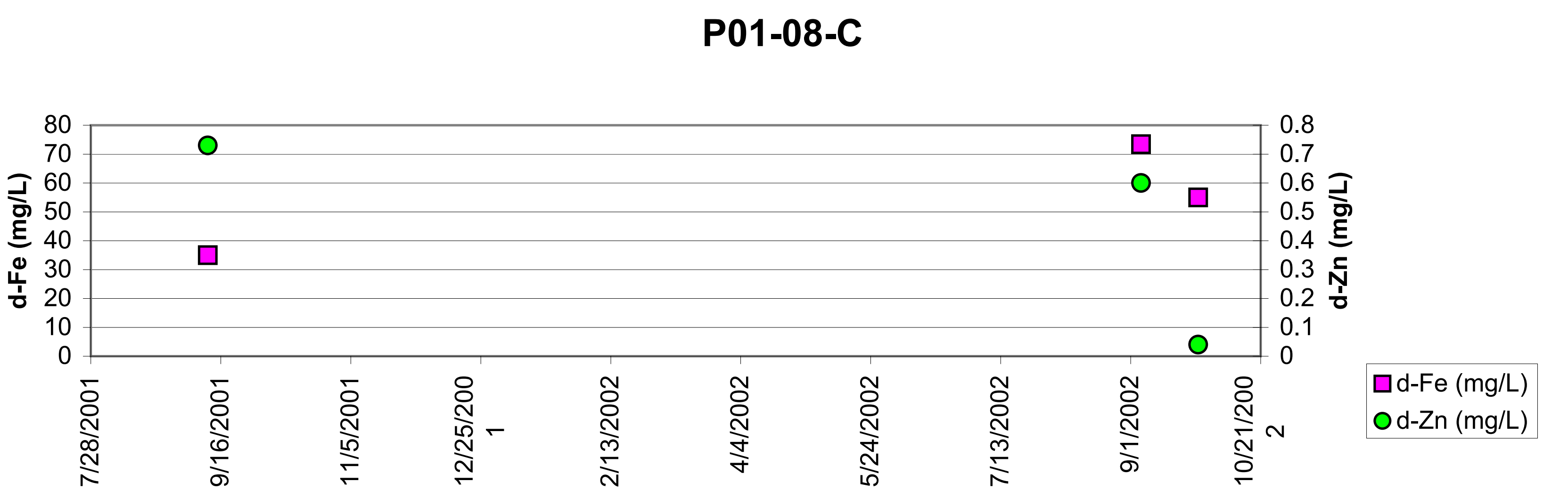


Figure 35. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-08-C

5.9 P01-09

P01-09-A

- This well has provided the worst water quality anywhere at the site
- The depth discrete sample shows similar water quality to that obtained by conventional sampling
- Sodium concentrations in this well are relatively low (<80 mg/L)
- The profile does not provide any clear indication of leakage
- A significant rising trend in sulphate is observed here
- There was a sharp increase in sulphate over the summer of 2002 and a corresponding rise in dissolved zinc over the winter of 2001/2002 which could be indicative of leakage
- Leakage effects would be very difficult if not impossible to detect in this well due to the extremely elevated dissolved metals and sulphate concentrations
- The data provided so far is likely representative of water chemistry at this location, however, if leakage is occurring in this well, it may be impossible to determine the exact depth from which the poor quality water is coming from (i.e. mostly from screen or from leaky joints higher in tailings?)
- Three multi-level wells (P03-01, P03-02 and P03-03) are located within a few hundred meters of this well and therefore provide data for this location
- Although not a priority because it is screened in the tailings, the well should eventually be properly decommissioned
- No further sampling of this well should be conducted

P01-09-B

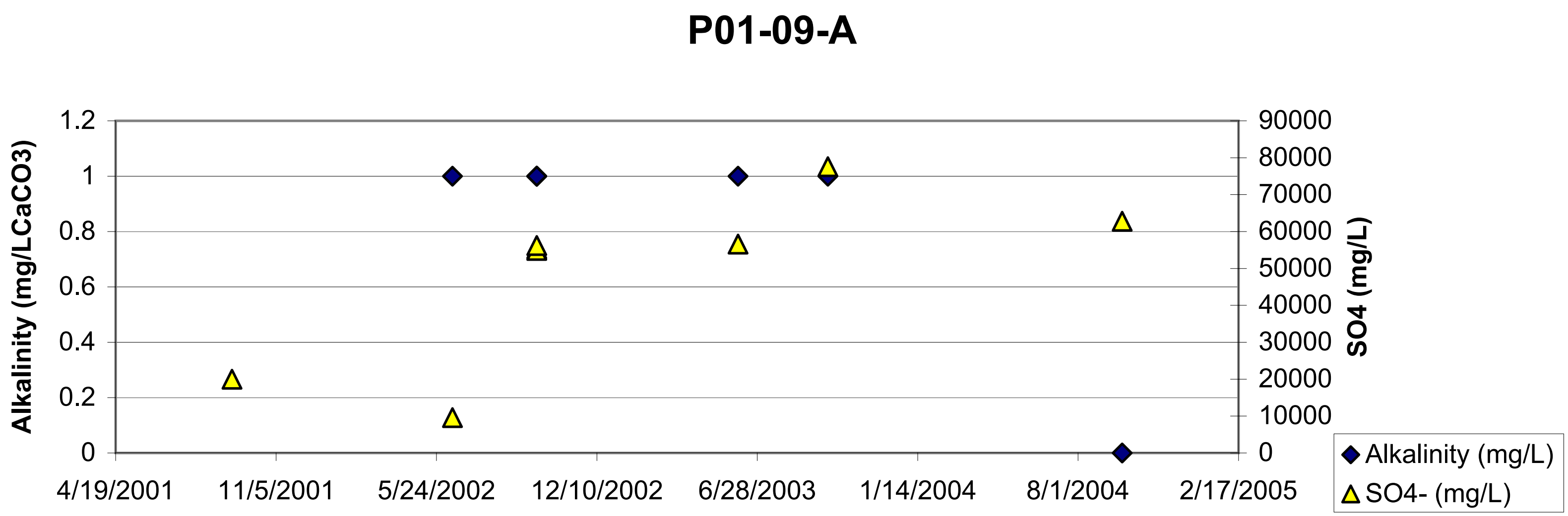
- Both the 2004 (GLL) and 2003 (EC) geochemical field parameter profiles clearly show impact from leakage at this location
- There currently seems to be impact from leakage that affects sampling
- Large volume purging seems to only minimize the effects of leakage but clearly does not eliminate them
- The decrease in specific conductance during purging both prior to and after packer installation indicates some flushing of contaminated water from the formation around the well screen
- However, it is likely that all data from this well has been impacted from leakage since the well was installed
- No further sampling or testing of the well should be done and the well should be properly decommissioned

P01-09-C

- Both the 2004 (GLL) and 2003 (EC) geochemical field parameter profiles provide clear evidence of impact from leakage at this location
- The depth discrete sample collected in this well prior to purging provides clear evidence that leakage has impacted the well
- The decrease in specific conductance during purging both prior to and after packer installation indicates some flushing of contaminated water from the formation around the well screen
- The sample obtained below the packer after purging has significantly reduced concentrations of sulfate and dissolved zinc relative to all other samples collected previously
- No further sampling or testing of the well should be done and the well should be properly decommissioned

P01-09-D

- Both the 2004 (GLL) and 2003 (EC) geochemical field parameter profiles provide clear evidence of impact from leakage at this location
- The depth discrete samples collected in this well show clear evidence of leakage, with elevated dissolved metals and sulfate concentration within the well casing and slightly lower concentrations within the well screen where flushing and mixing with aquifer water is occurring.
- The decrease in specific conductance during purging both prior to and after packer installation indicates some flushing of contaminated water from the formation around the well screen
- The sample obtained below the packer after purging have significantly reduced concentrations of sulfate and dissolved zinc relative to all other samples collected previously
- No further sampling or testing of the well should be done and the well should be properly decommissioned



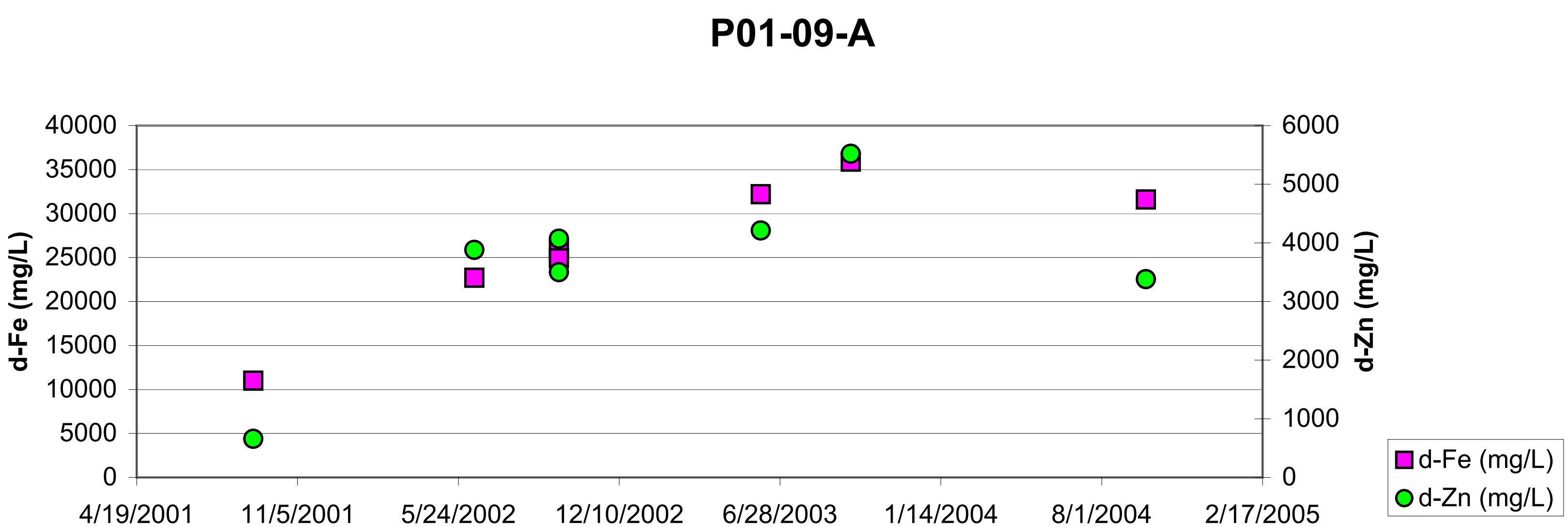
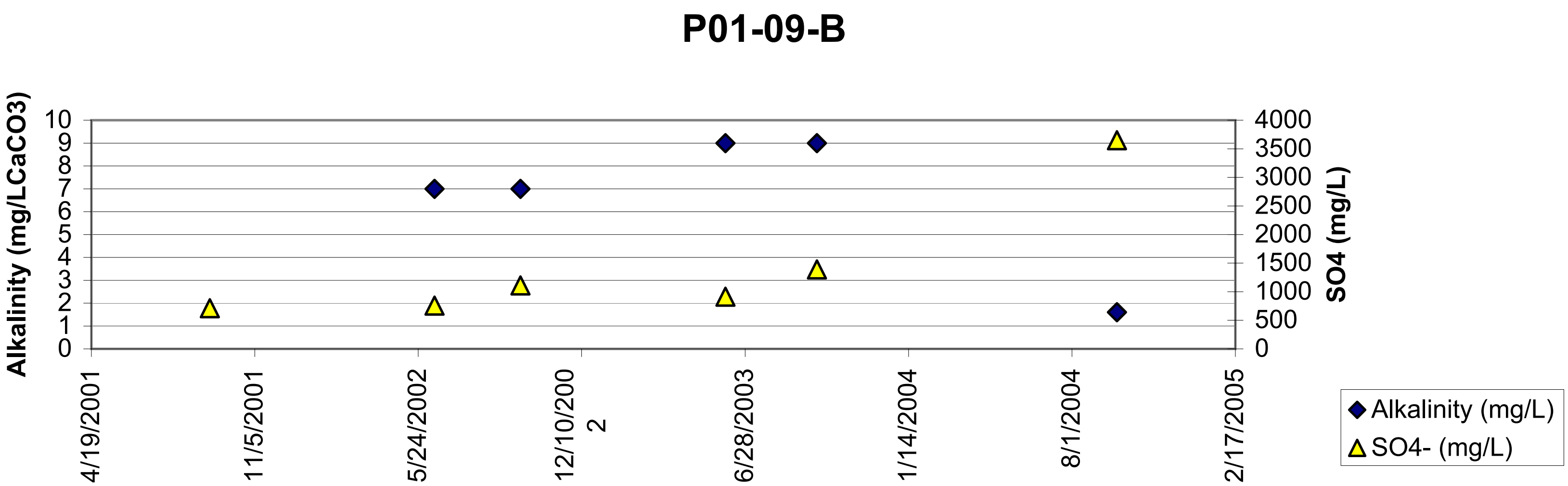


Figure 36. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-09-A



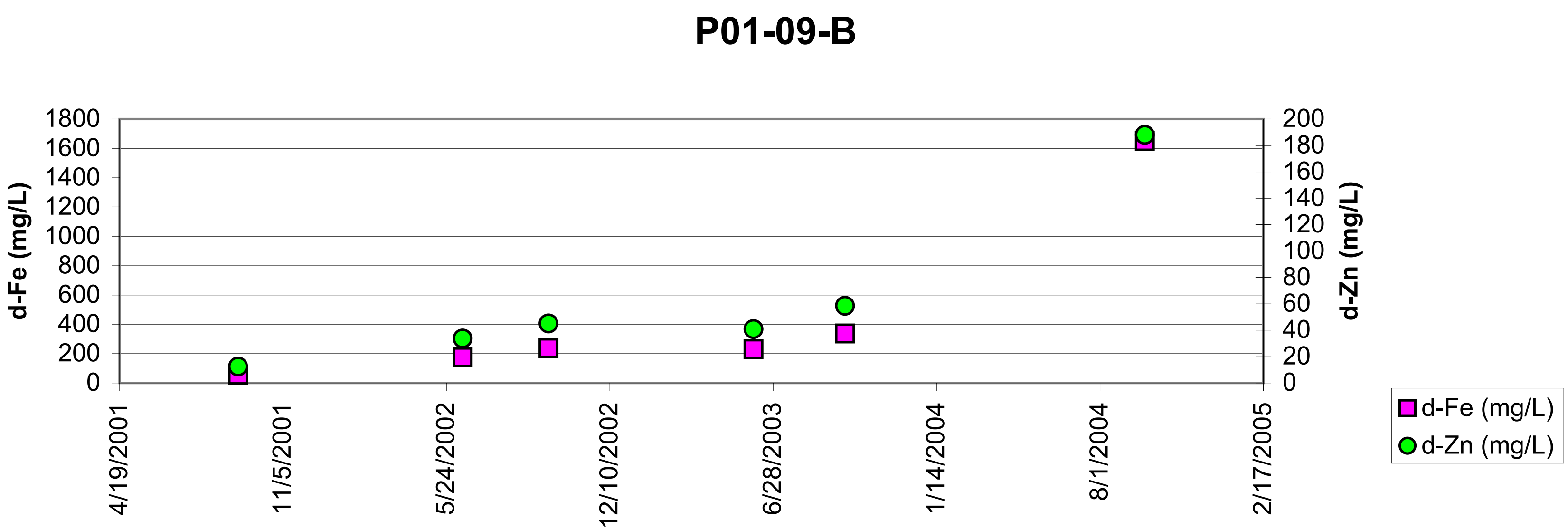
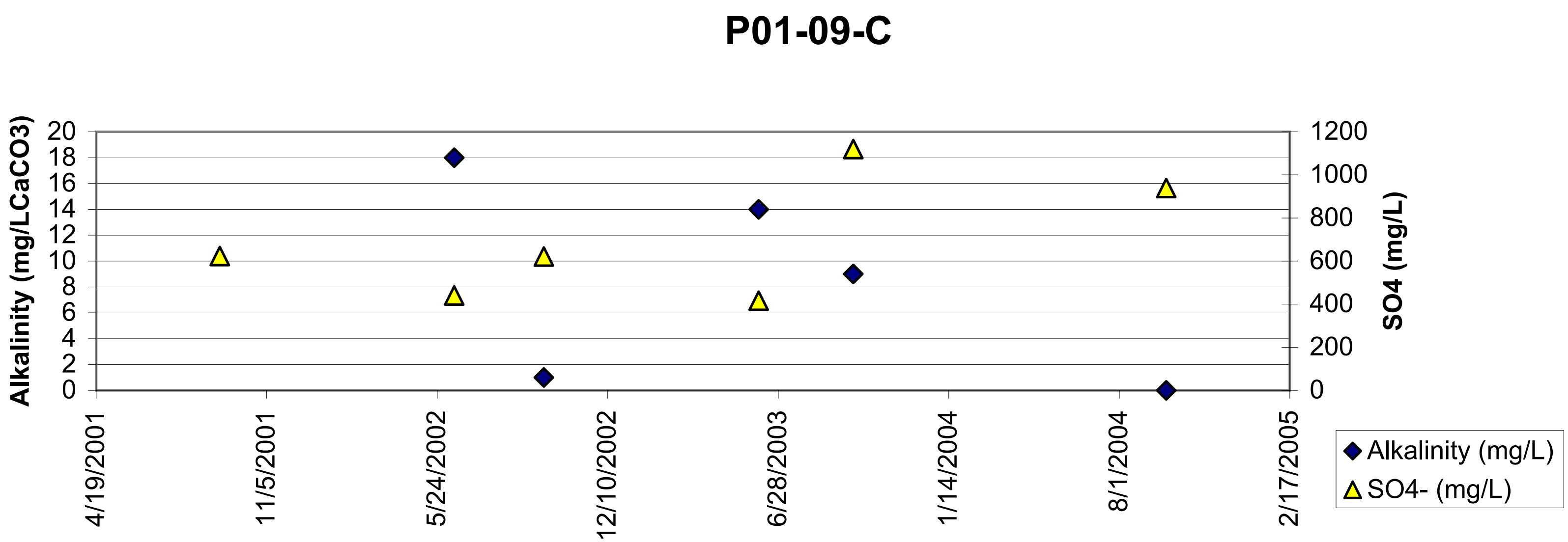


Figure 37. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-09-B



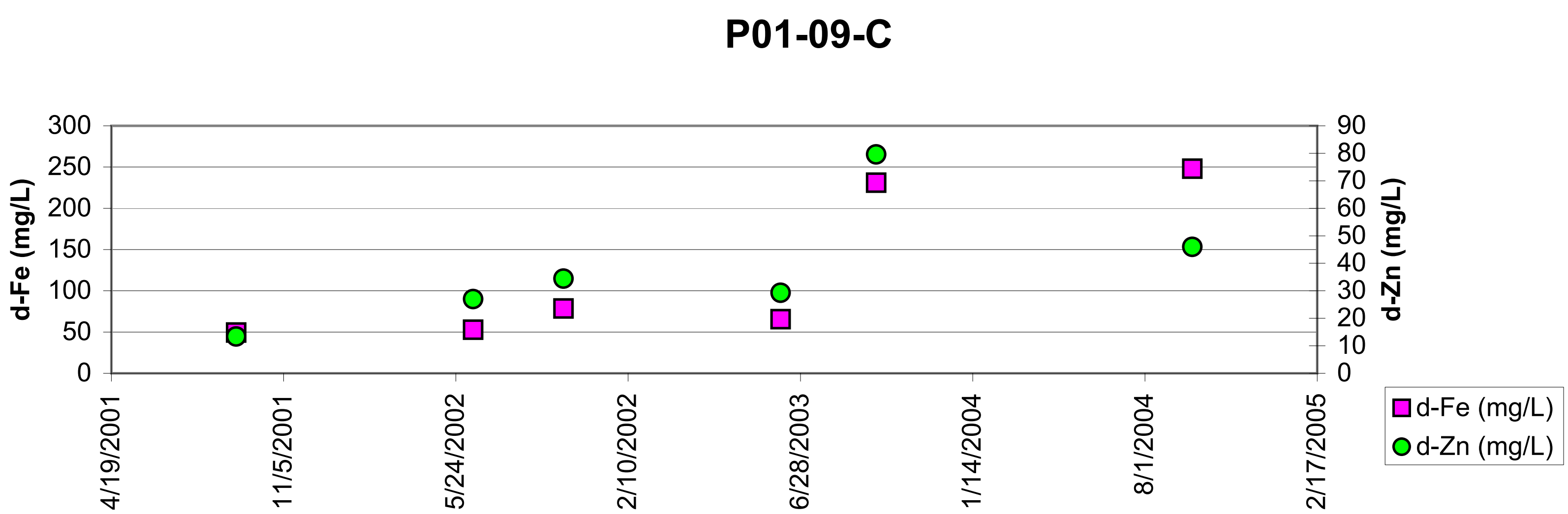
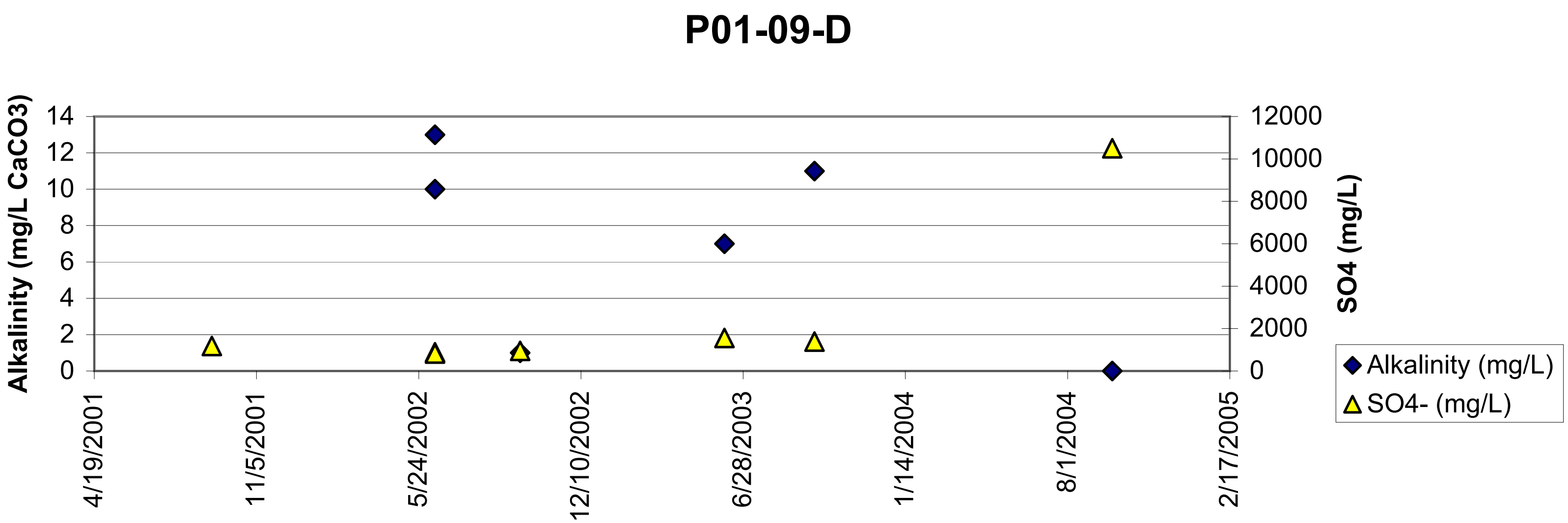


Figure 38. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-09-C



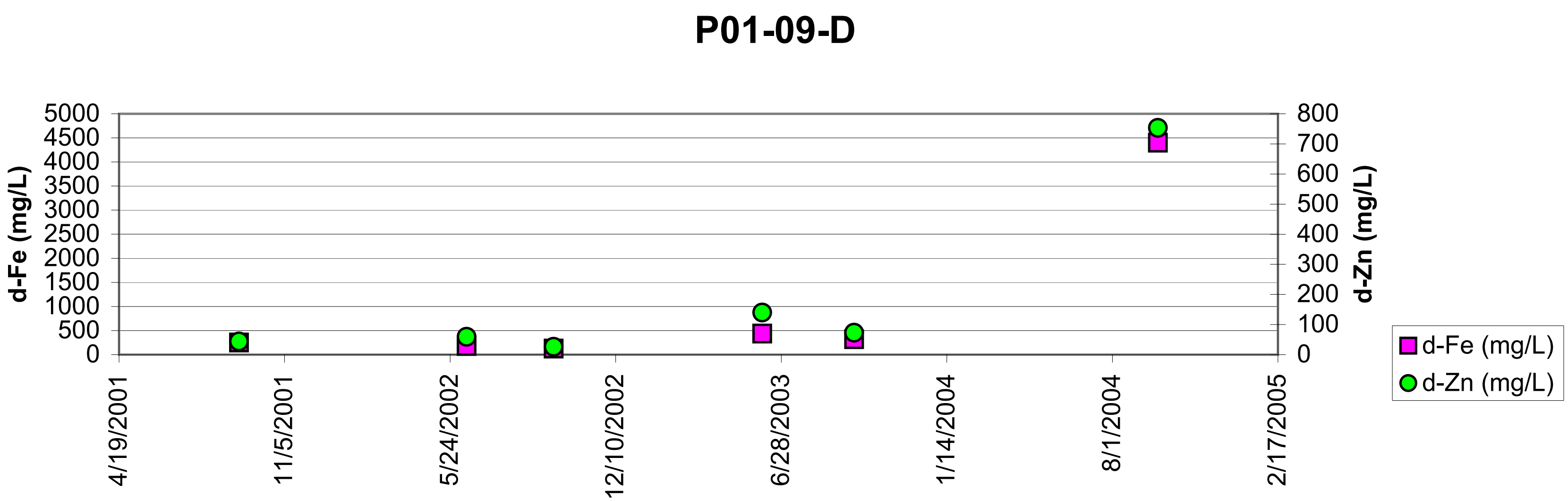


Figure 39. Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-09-D

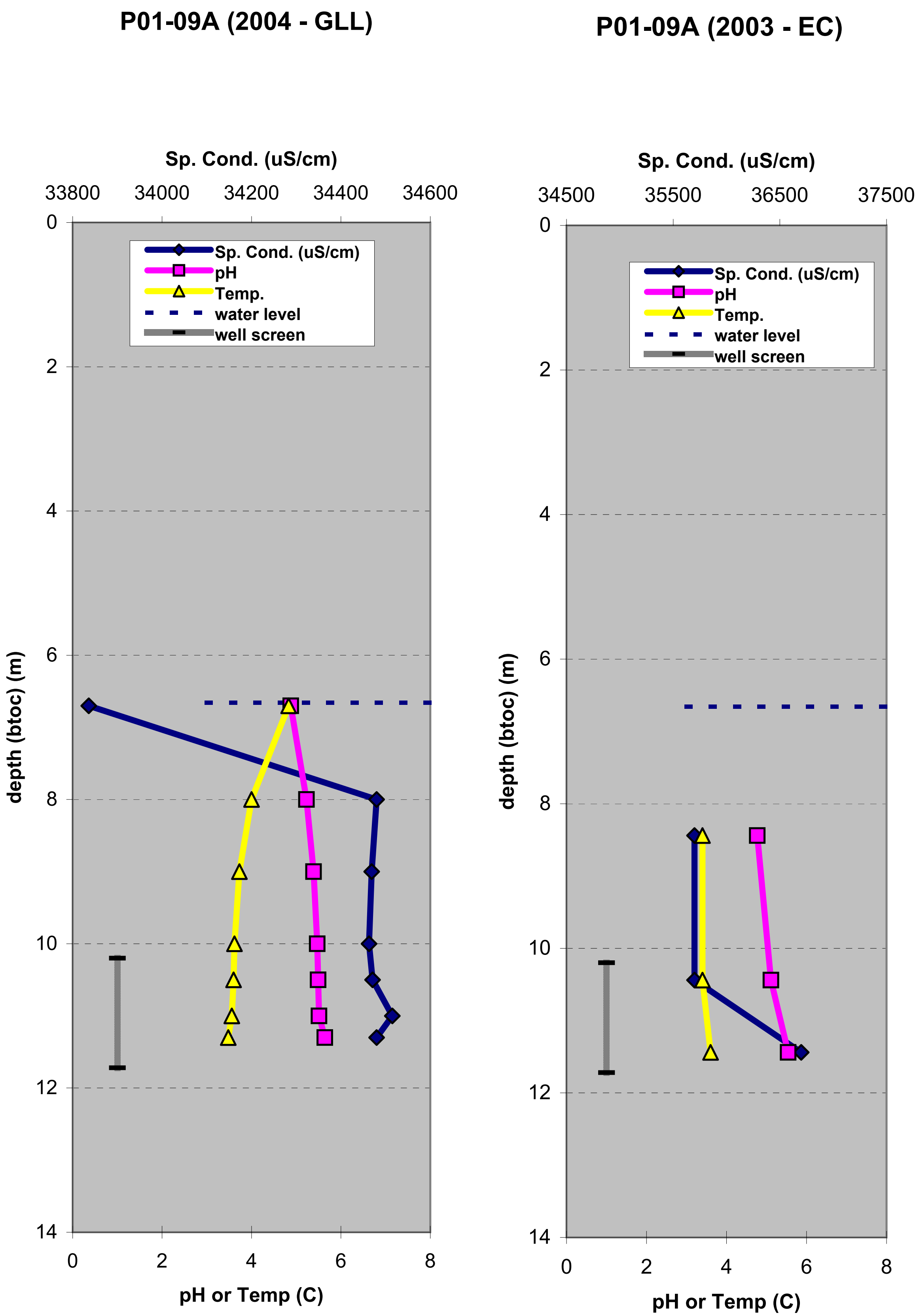
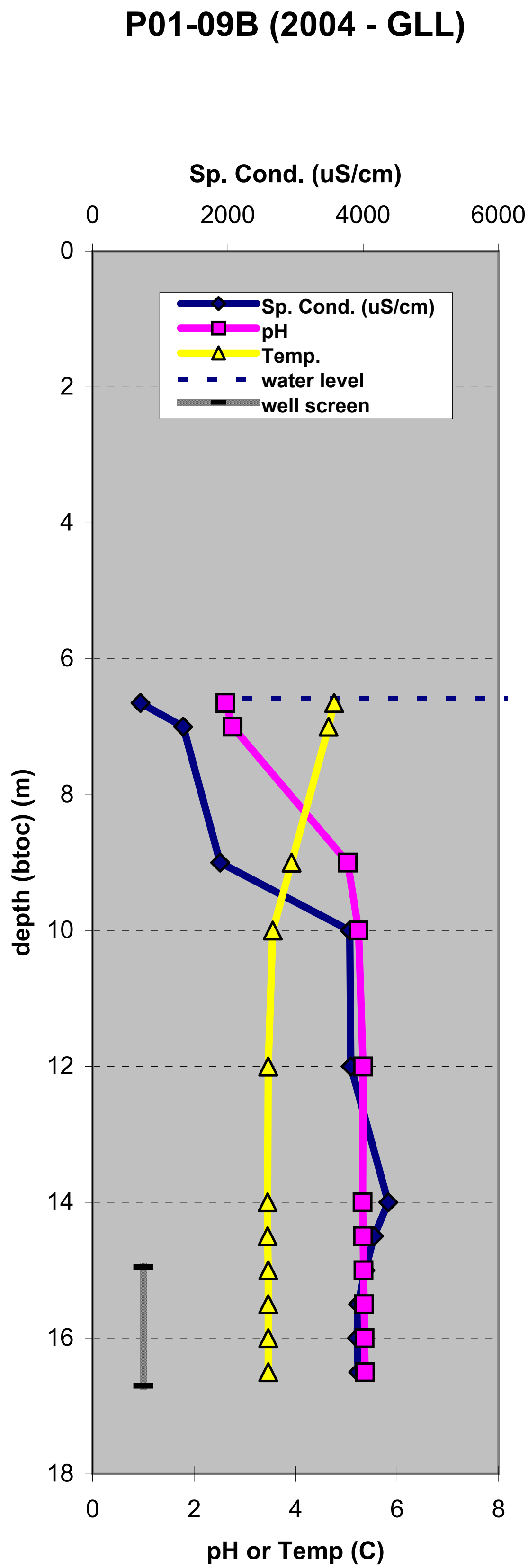


Figure 40. Geochemical (Field Parameter) profile of static water in wells P01-09A by Gartner Lee Limited (GLL) and Environment Canada



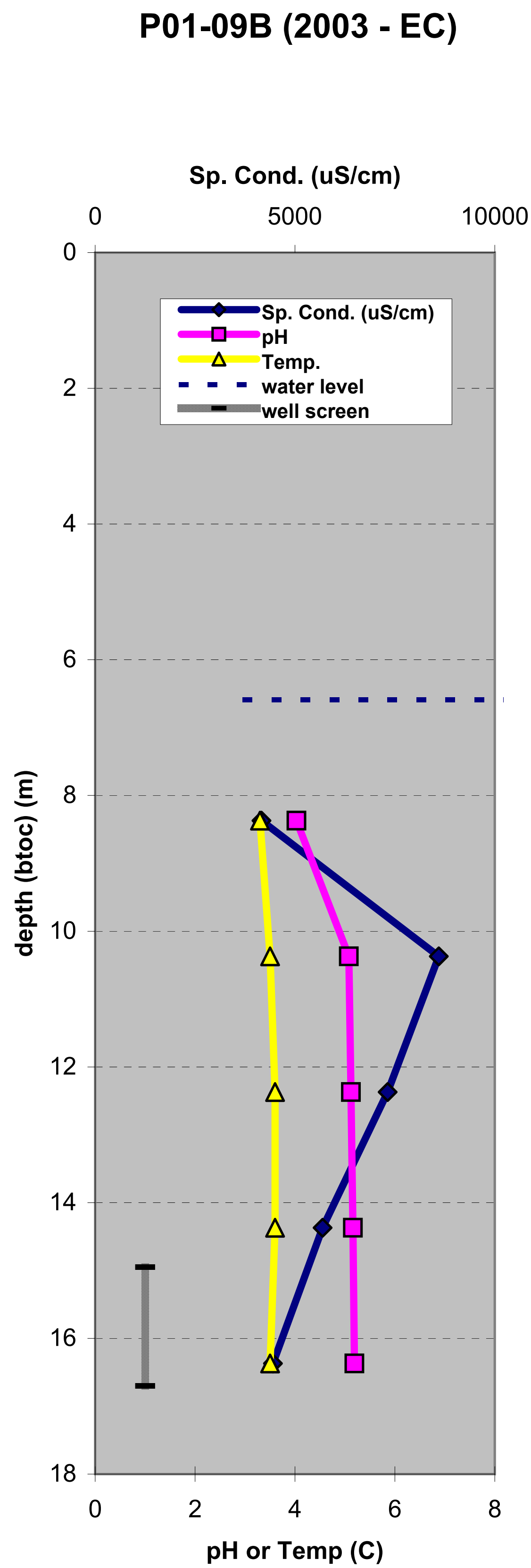


Figure 41. Geochemical (Field Parameter) profile of static water in wells P01-09B (EC)

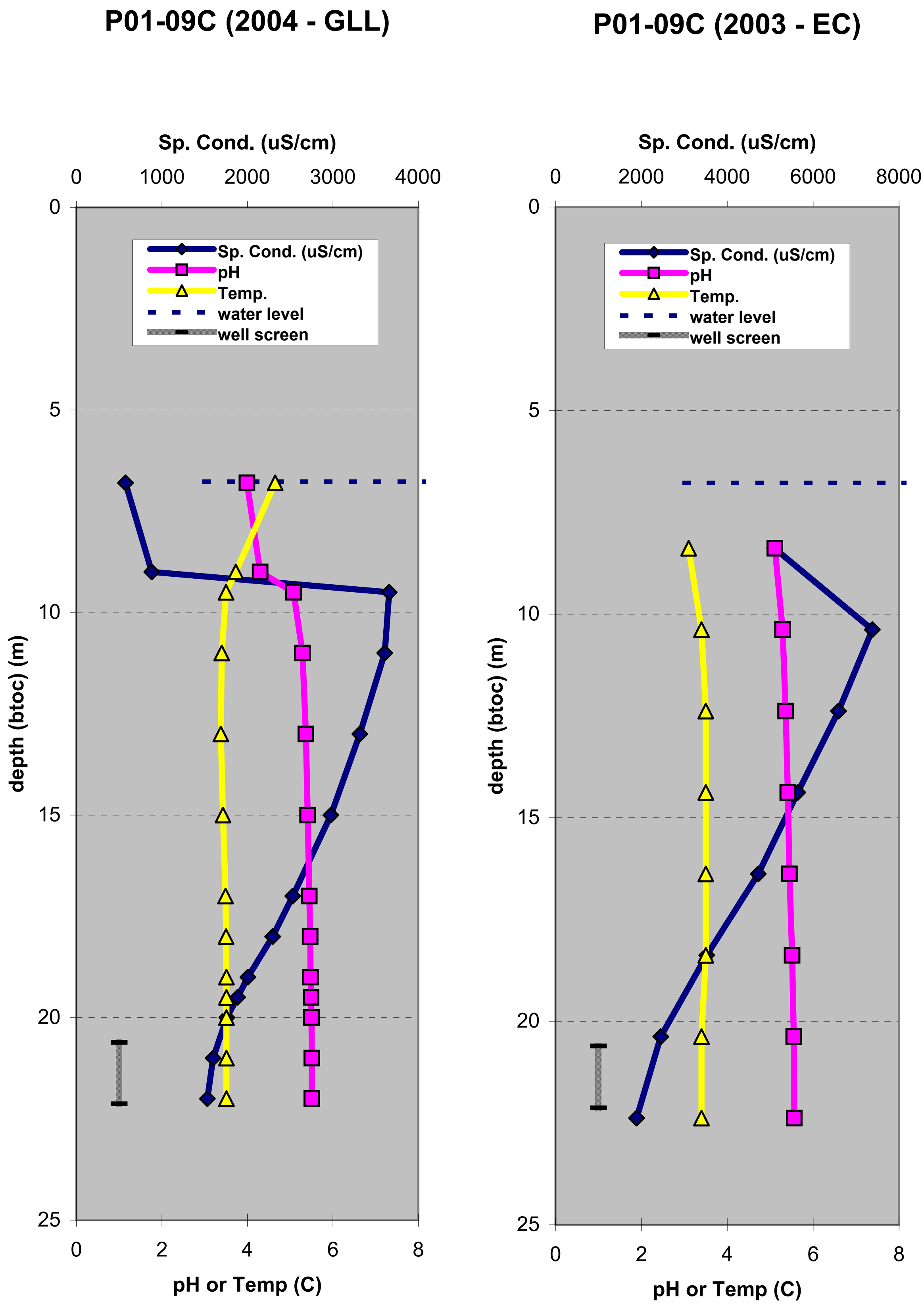
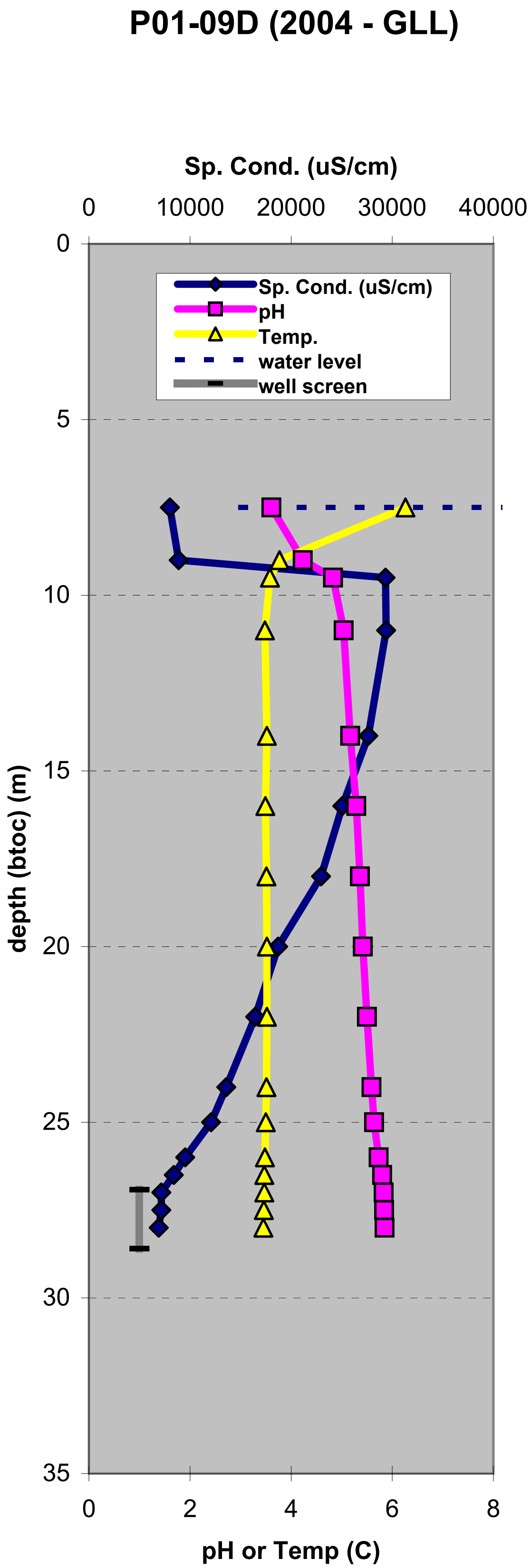


Figure 42. Geochemical (Field Parameter) profile of static water in wells P01-09C



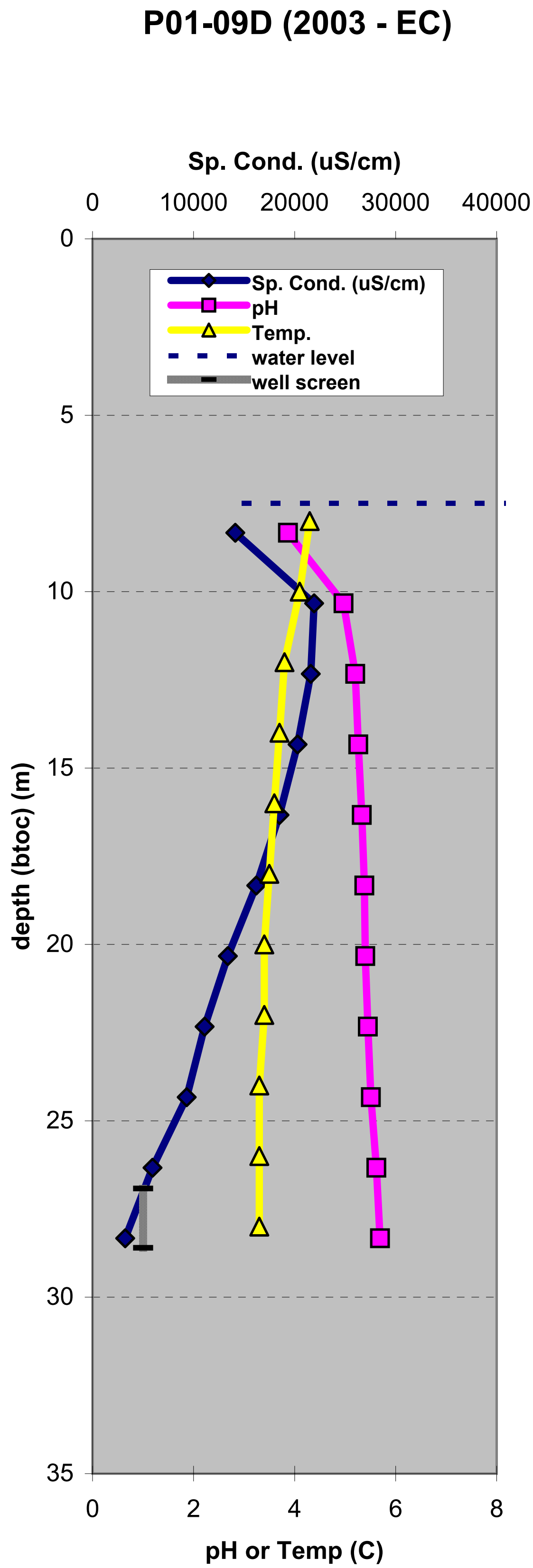
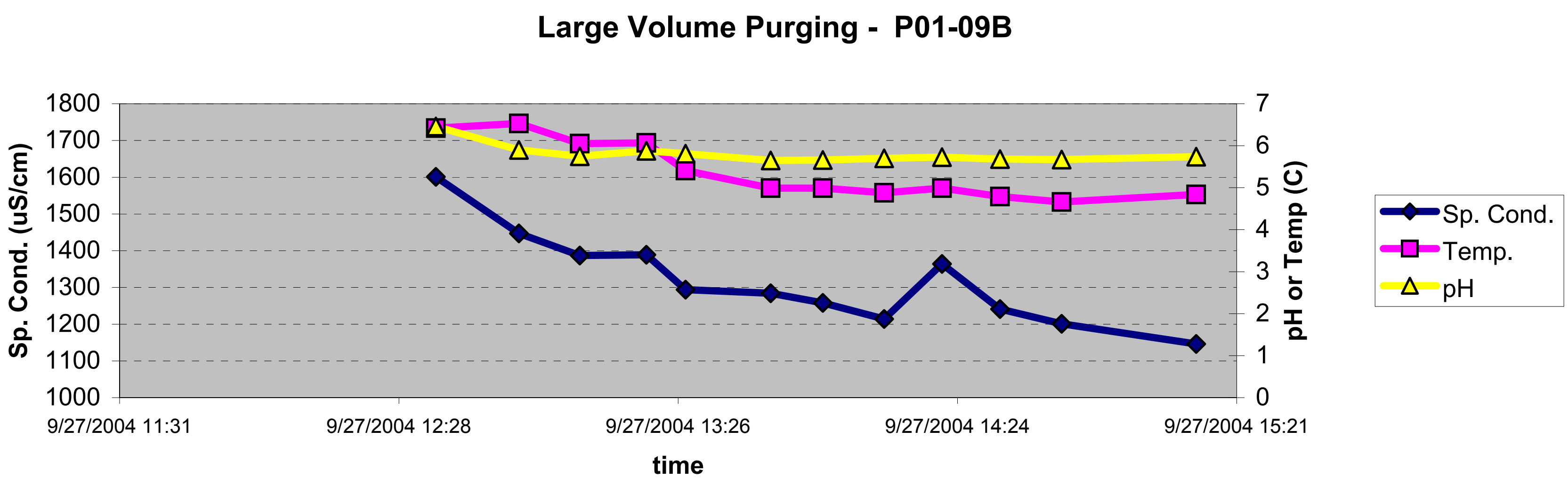


Figure 43. Geochemical (Field Parameter) profile of static water in wells P01-09D



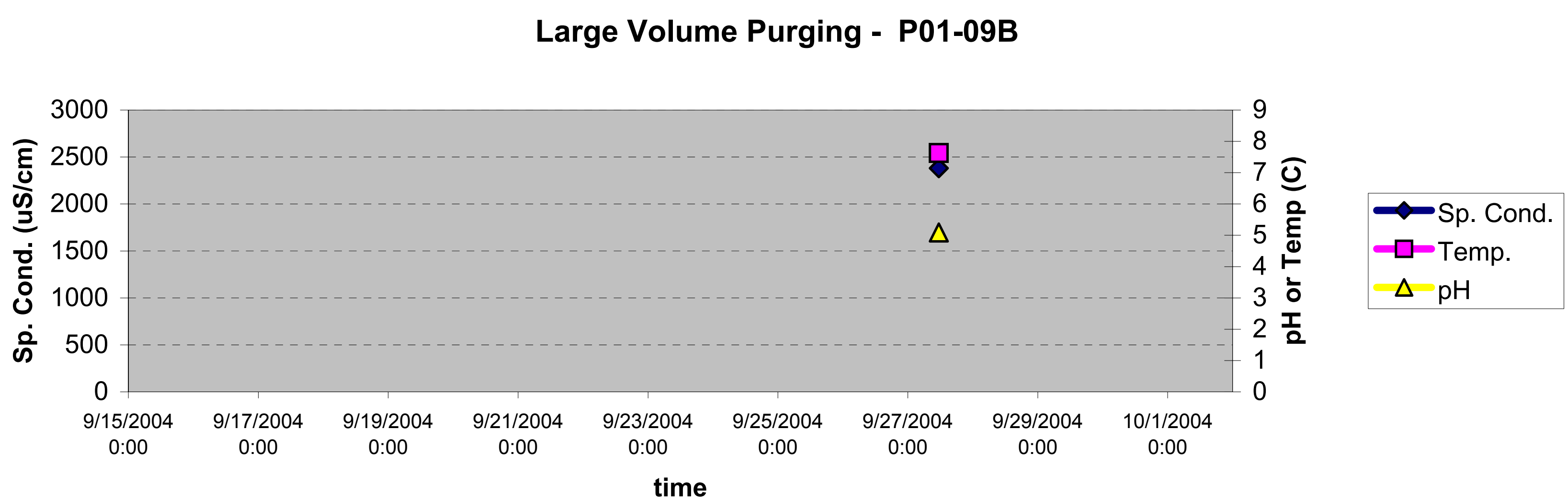
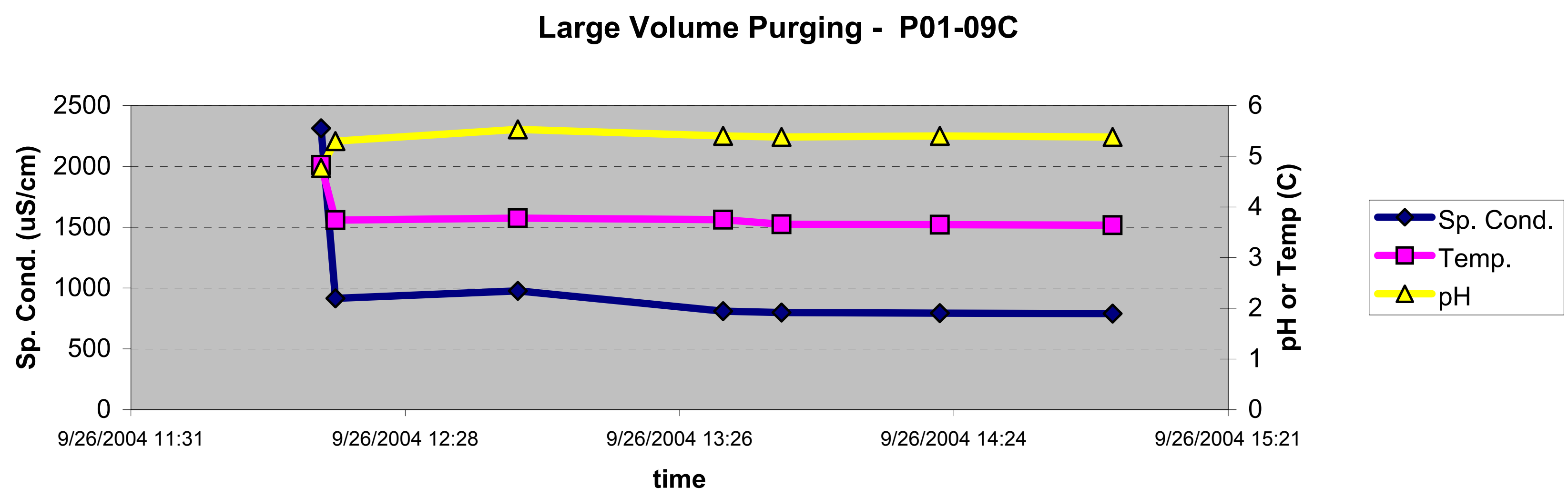


Figure 44. Evolution of Field Parameters During Purging for Well P01-09B



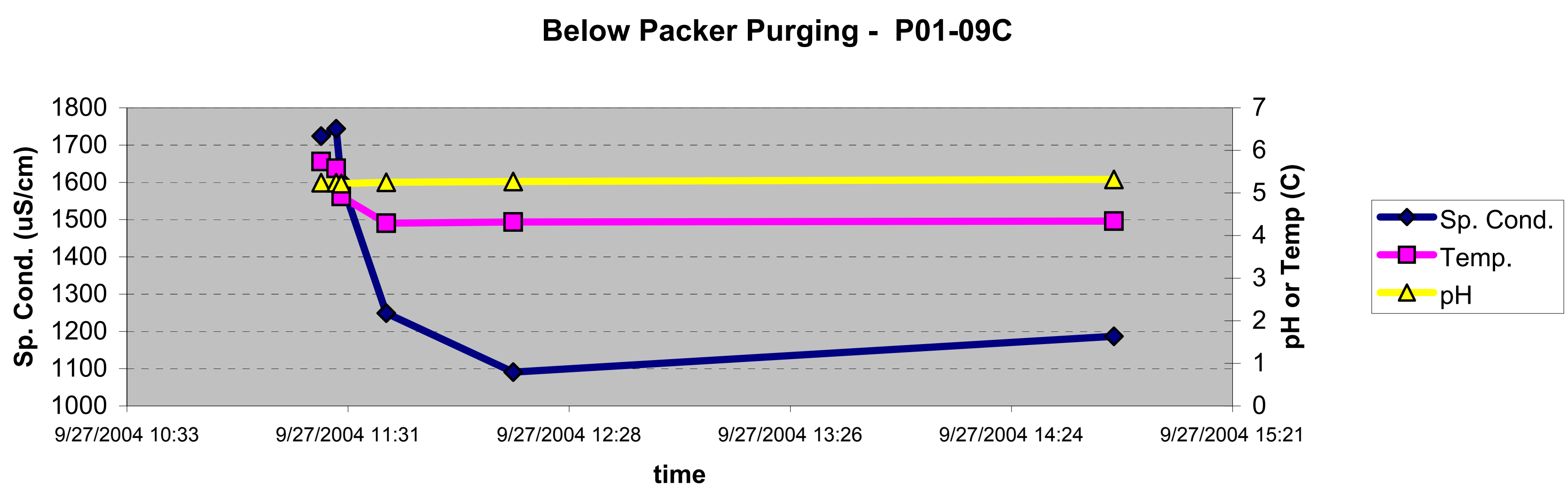
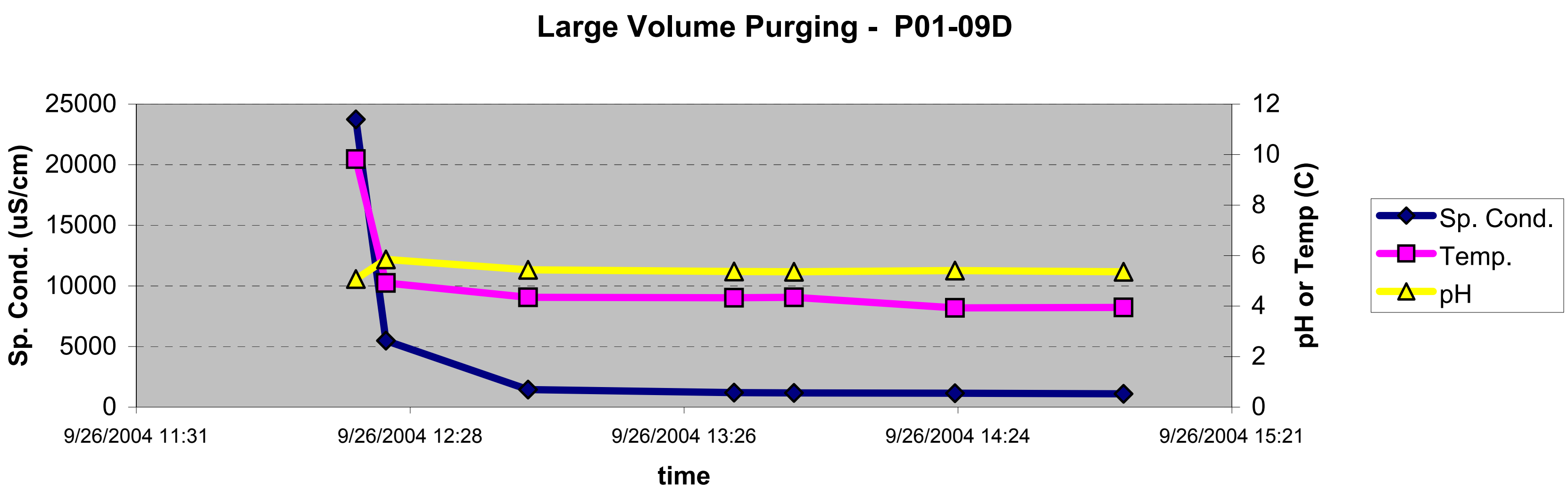


Figure 45. Evolution of Field Parameters During Purging for Well P01-09C



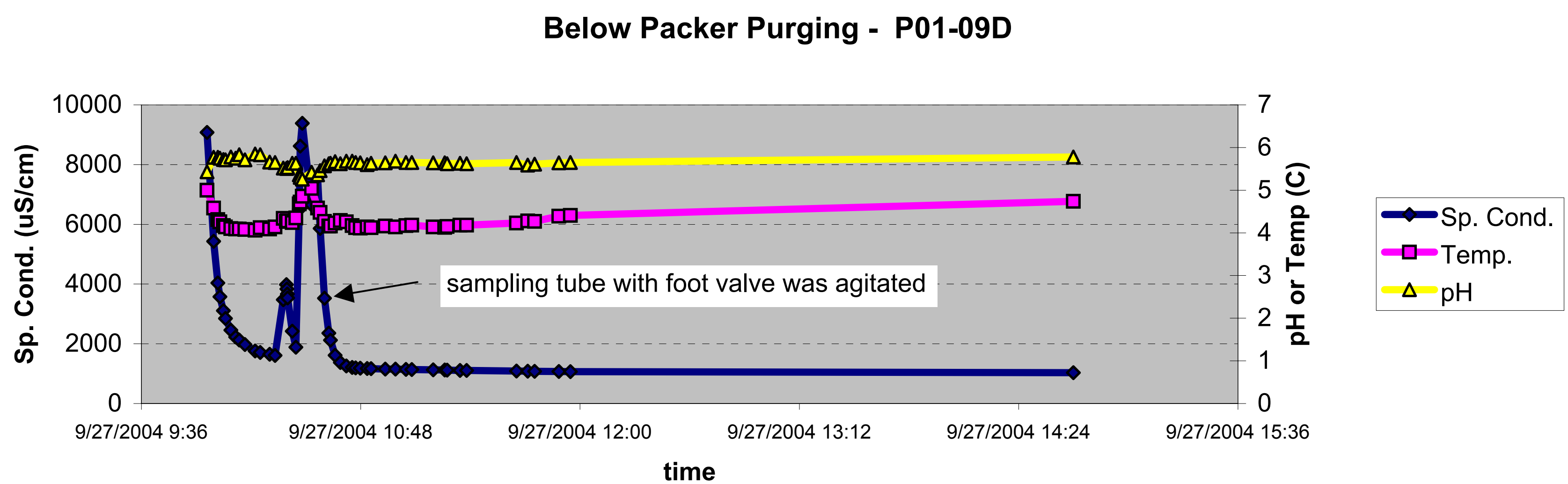
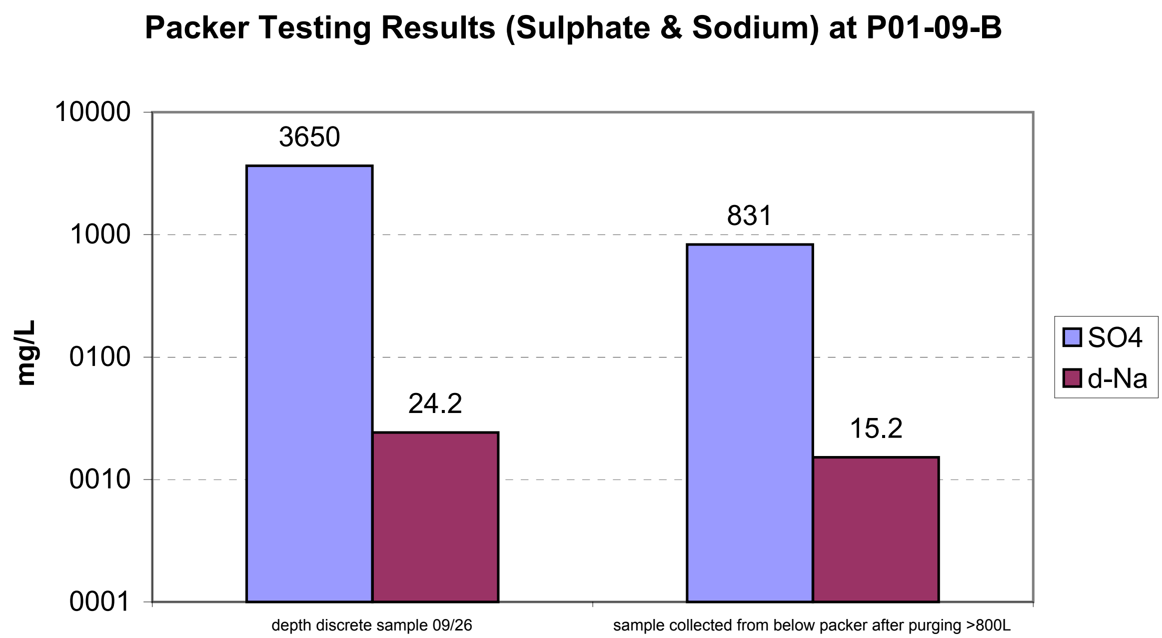
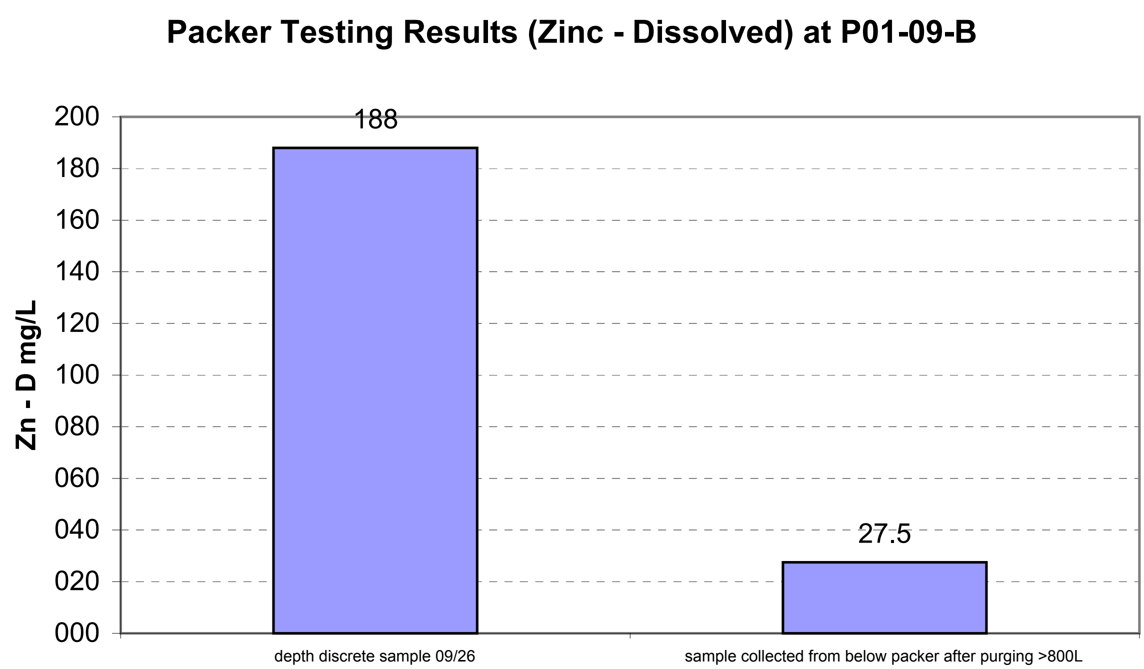


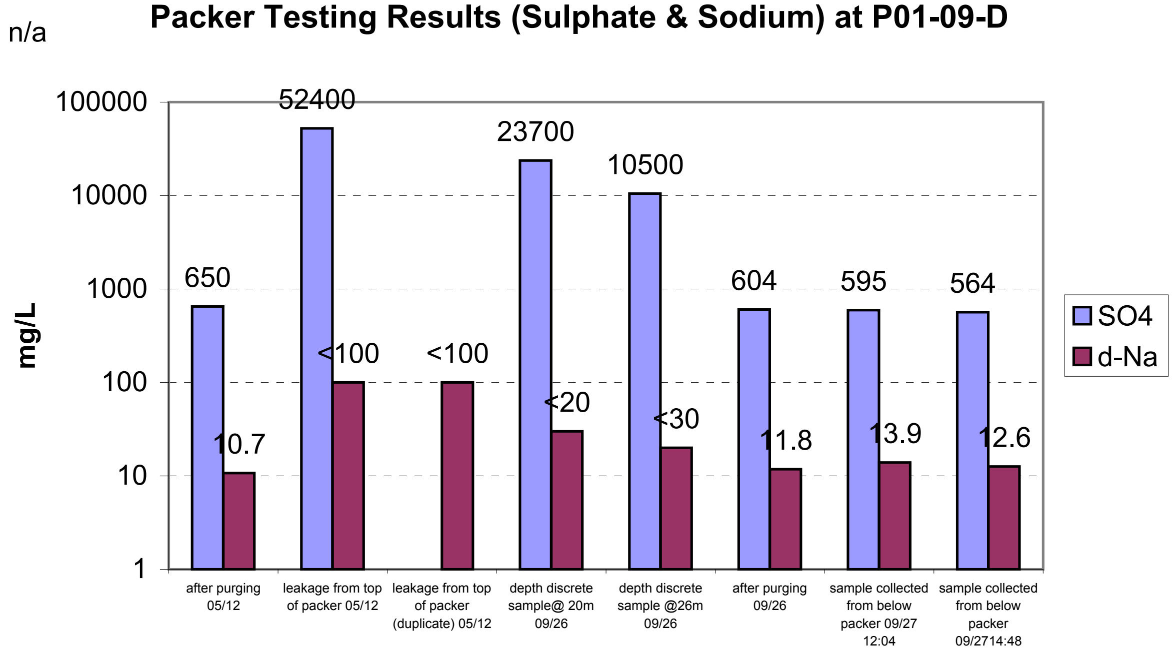
Figure 46. Evolution of Field Parameters During Purging for Well P01-09D

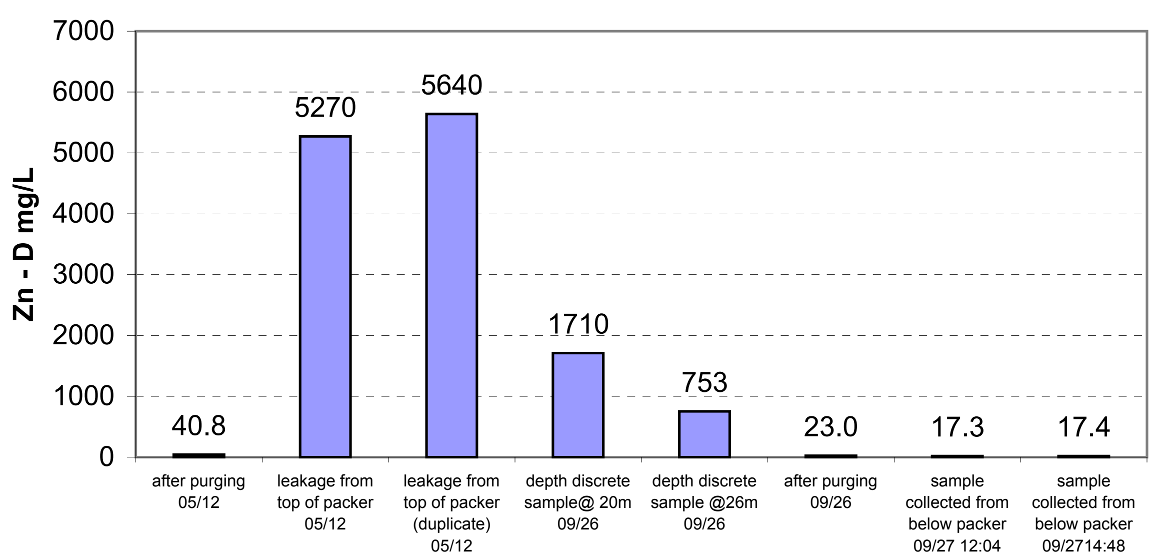




METHOD (SEPTEMBER)
took a depth discrete sample at well screen
purged 733L
placed packer down well and purged an additional 81L
collected a sample from below packer with packer still in
place, sample tube was at top of packer

Figure 47. Summary of Leakage Assessment Sampling Results for Wells P01-09-B

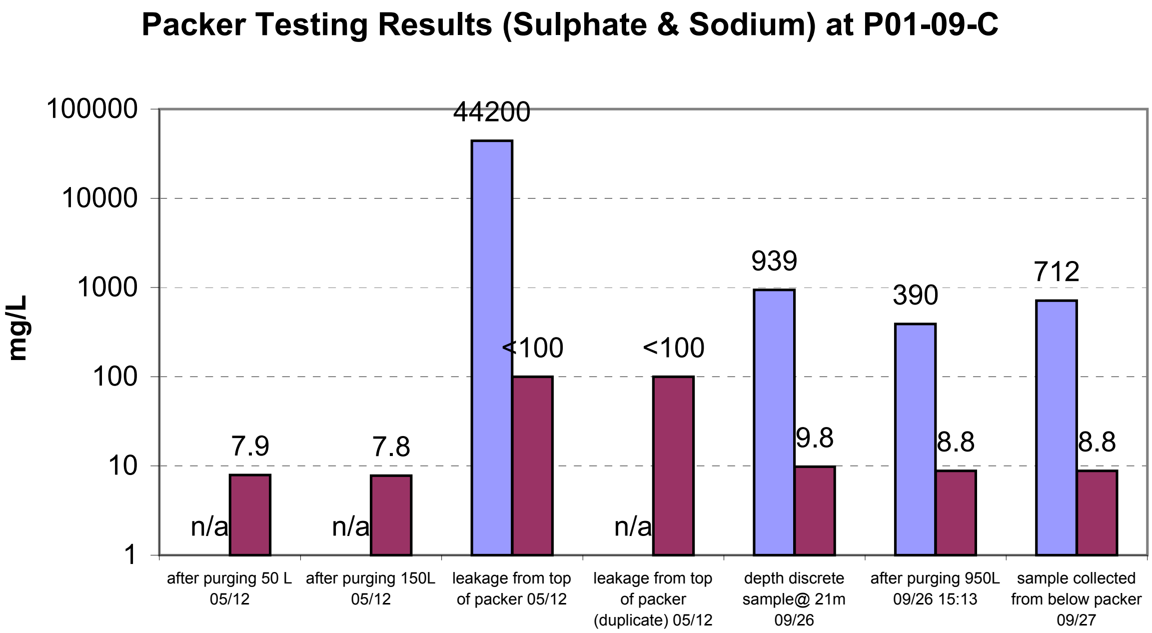


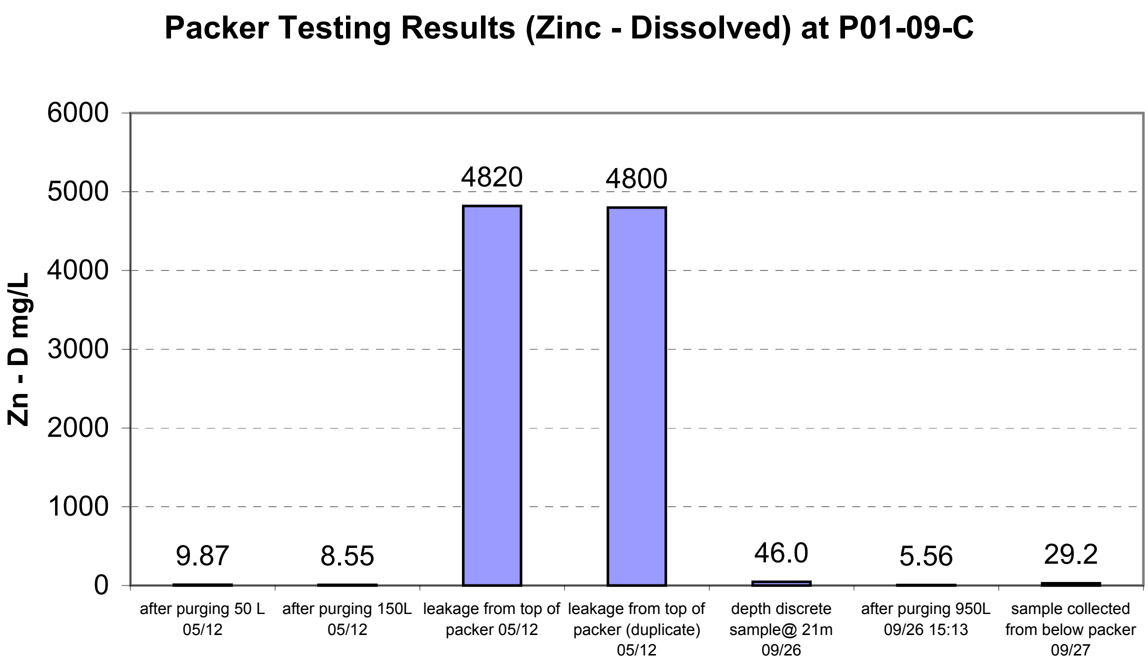


METHOD (MAY)
purged well for 3 well volumes(150L) and collected sample.
Placed packer down well and removed any water above packer
Left packer in well >12 hrs. (depending on well)
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample above and at well screen
purged 1026L and collected sample
placed packer down well and purged 33L
collected a sample from below packer with packer still in place, sample tube was at top of packer
continued purging for an additional 33 L and took second sample from below packer

Figure 48. Summary of Leakage Assessment Sampling Results for Wells P01-09-D





METHOD (MAY)
purged well for 3 well volumes and collected sample.
Placed packer down well and removed any water above packer
Left packer in well >12 hrs. (depending on well)
Collected sample from leakage water that collected on top of packer

METHOD (SEPTEMBER)
took a depth discrete sample above and at well screen
purged 950Lvolumes and collected sample
placed packer down well and purged
collected sample from below back with packer in place, sample tube was at top of packer

Figure 49. Summary of Leakage Assessment Sampling Results for Wells P01-09-C

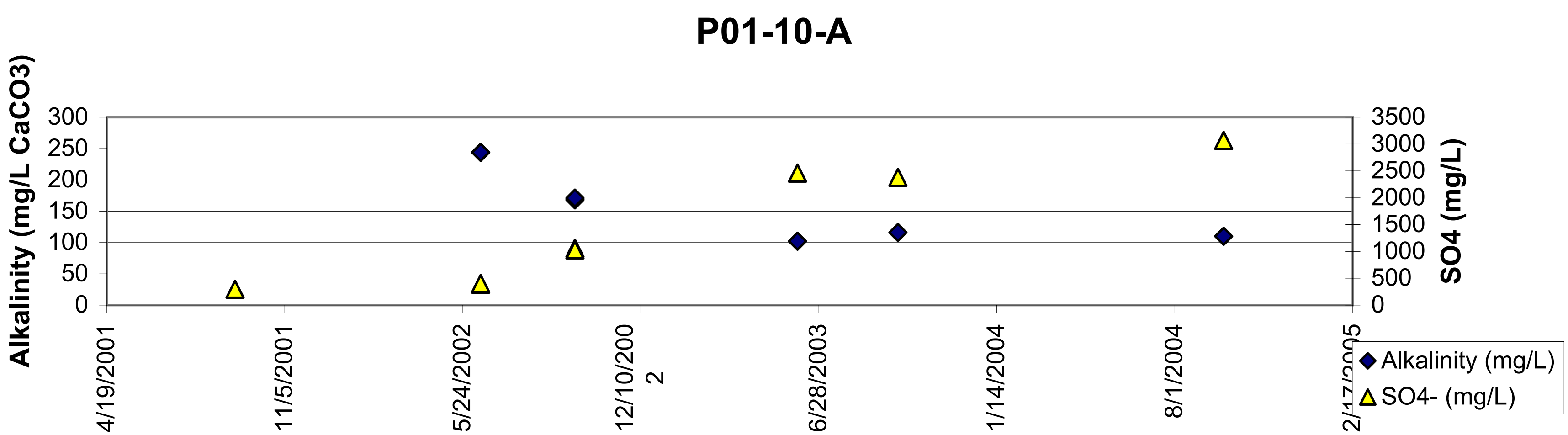
5.10 P01-10

P01-10-A

- Well is screened in the tailings
- The well is usually pumped dry prior to sampling
- Dissolved zinc concentrations in the depth discrete sample are within the typical range of previous measurements
- Sulphate concentrations in the depth discrete sample are higher than previous samples
- The field parameter profile may indicate that leakage is occurring (increasing specific conductance)
- There exists some uncertainty about leakage in this well.
- This well is not located in an area of worst tailings porewater quality.
- Wells screened in tailings are very difficult to test and therefore sampling of this well should be stopped and the well should be properly decommissioned.

P01-10-B

- The depth discrete sample taken at the screen had elevated zinc (11 mg/L) and sulfate (596 mg/L) which are significantly higher than previous samples. This suggests leakage because these concentrations are greater than expected natural variations in the aquifer
- The static profiles show an increase in specific conductance within a few meters of the water table, again suggesting leakage may be occurring
- It was confirmed in May 2005 that tailings are present in the well during purging and sampling.
- This well should not be sampled in the future and should be properly decommissioned



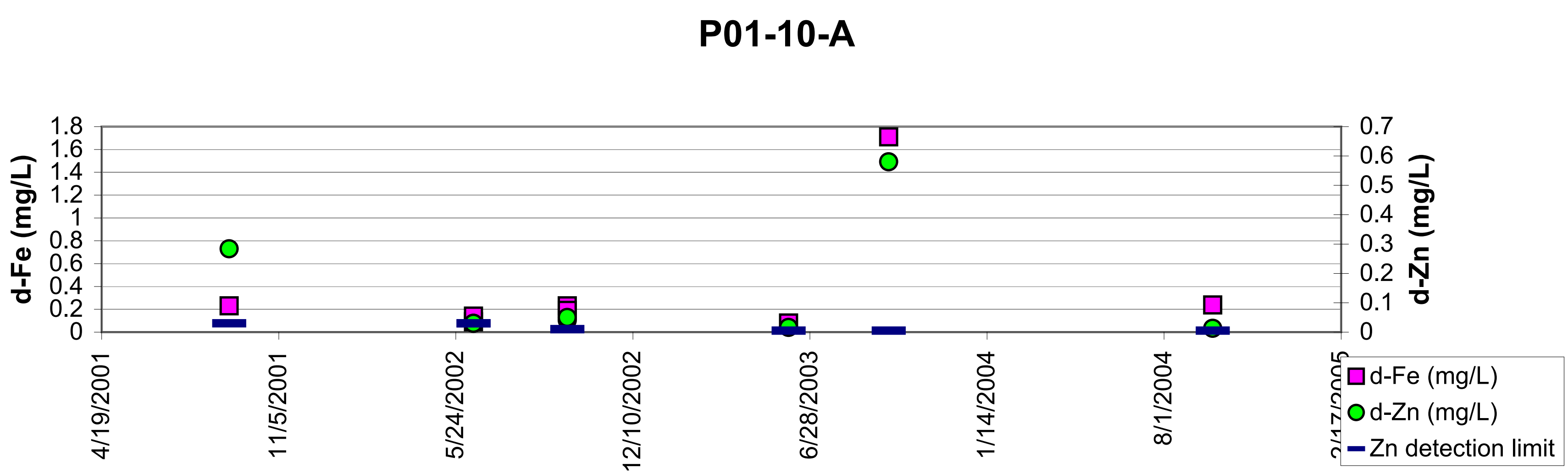
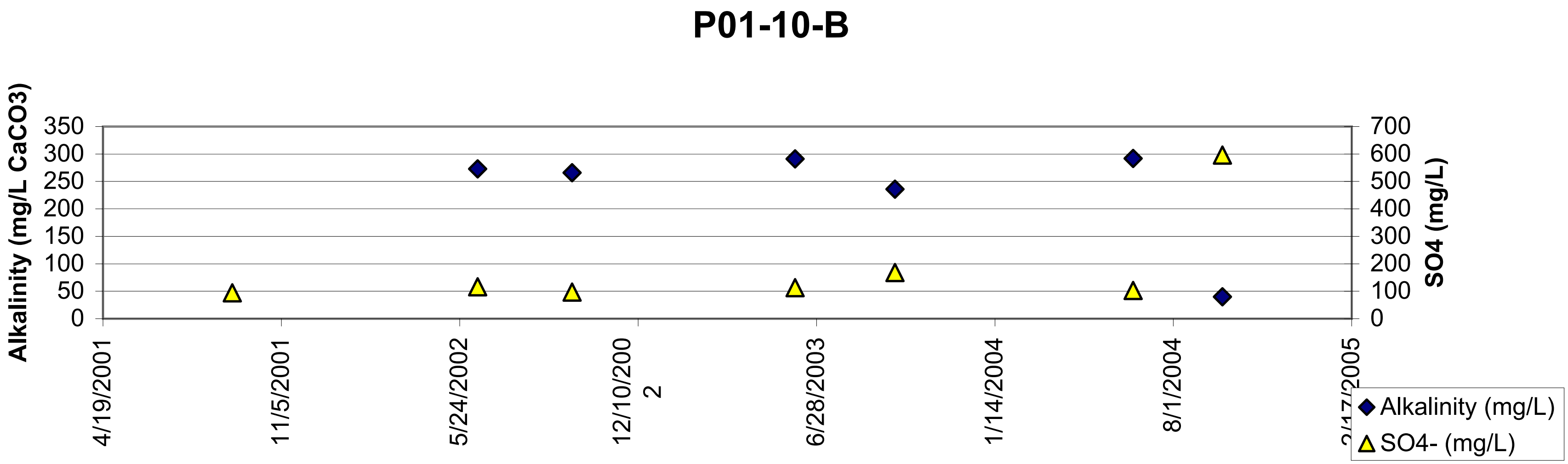


Figure 50 . Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-10-A



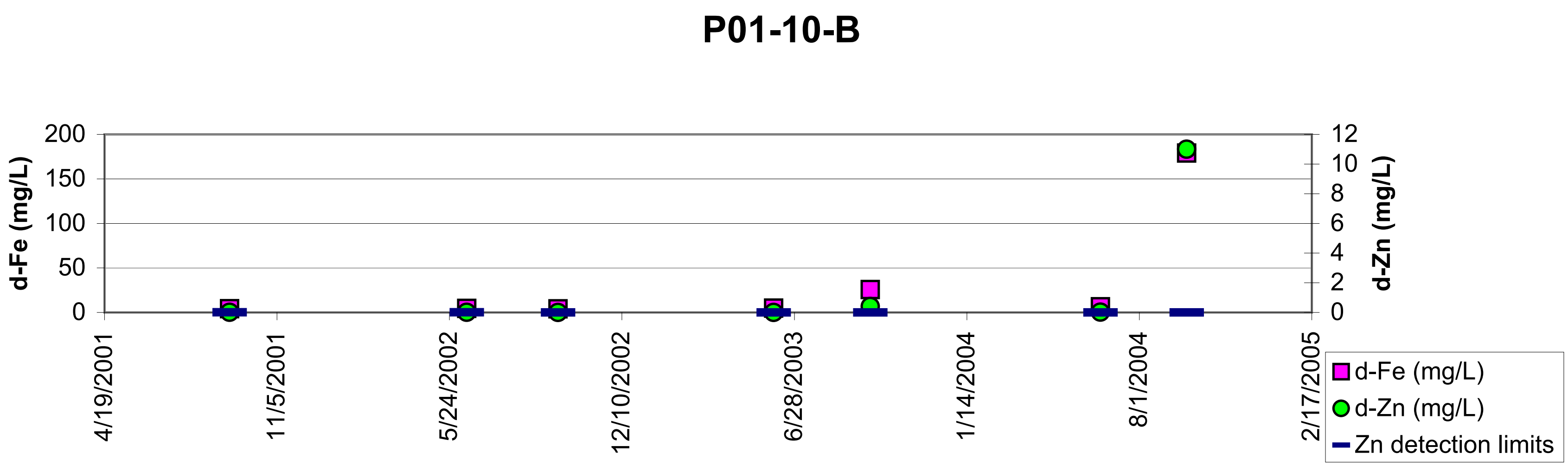


Figure 51 . Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-10-B

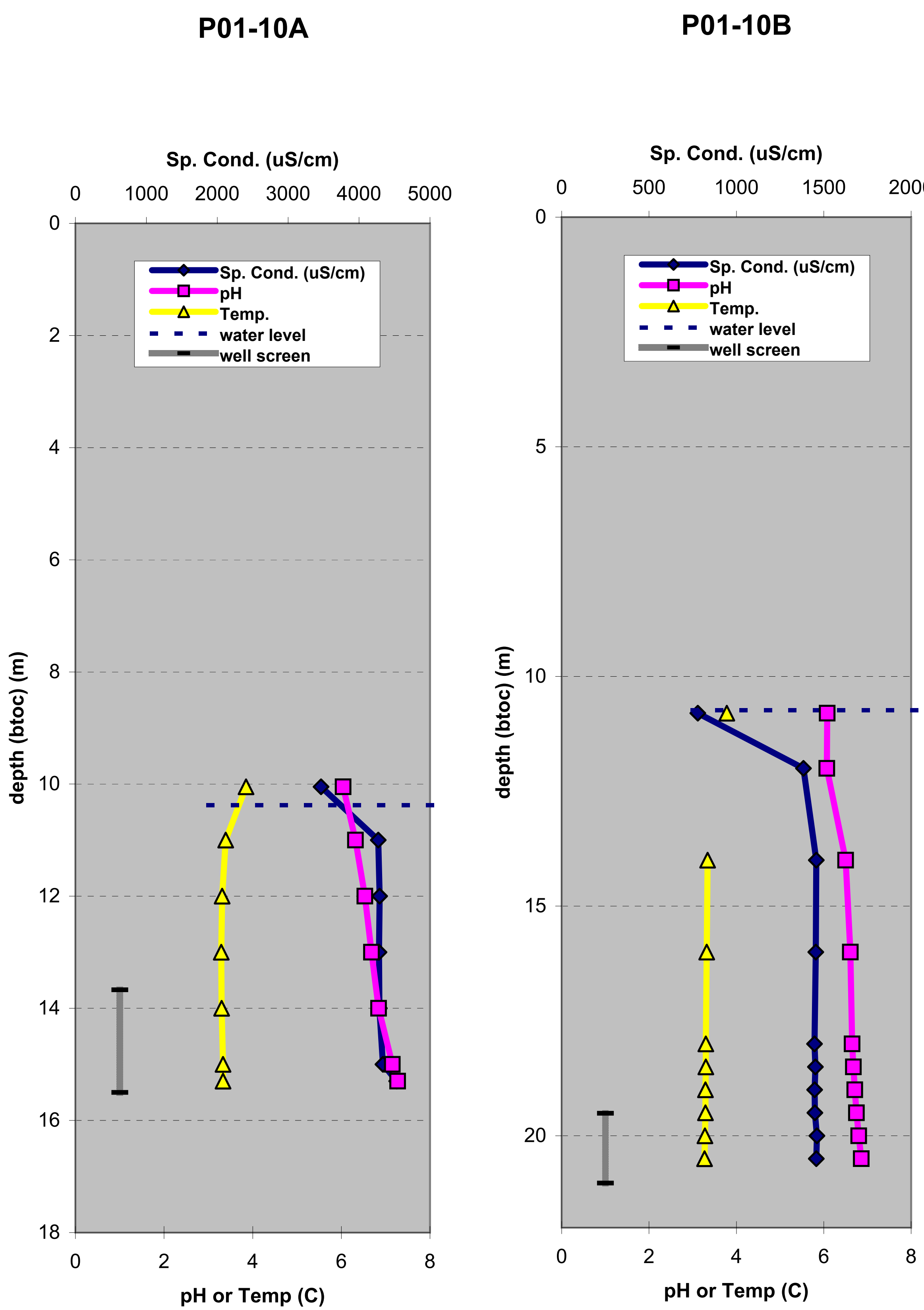
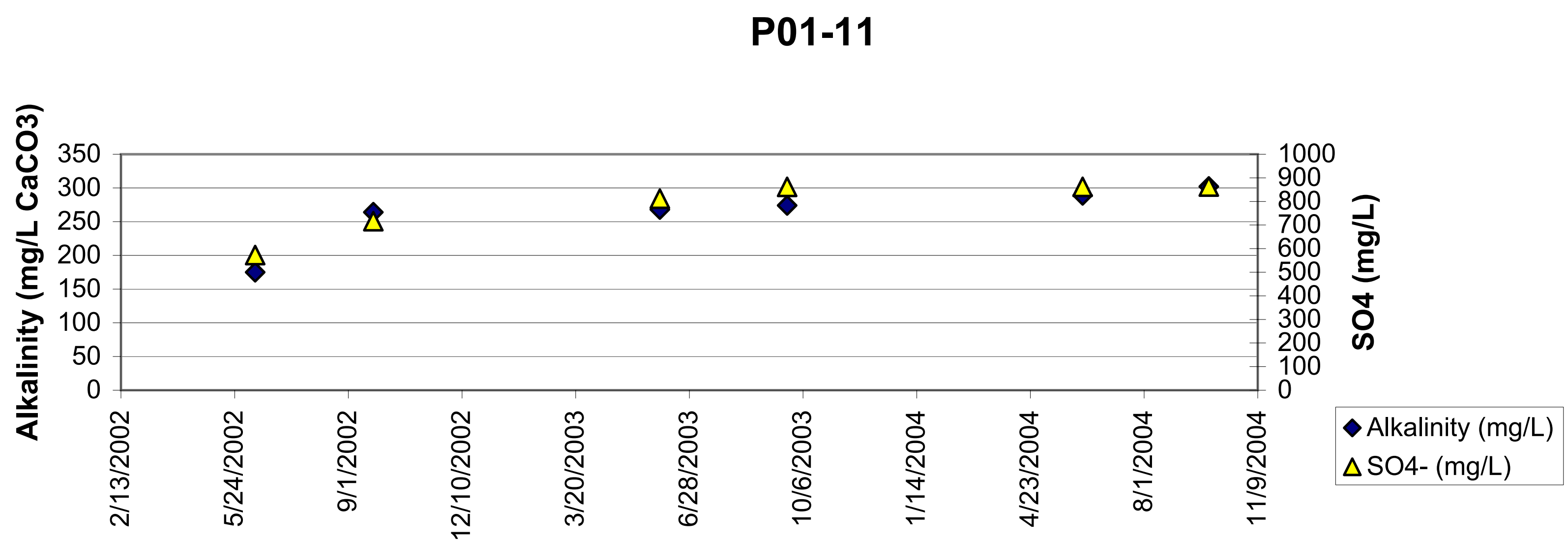


Figure 52 & 53. Geochemical (Field Parameter) profile of static water in wells P01-10A and P01-10B

5.11 P01-11

P01-11

- The temperature profile from this well suggests that leakage may be occurring
- This well is not screened through tailings and therefore does not constitute an immediate risk to groundwater quality in the deeper aquifer
- The depth discrete sample showed similar chemistry to samples collected using conventional methods



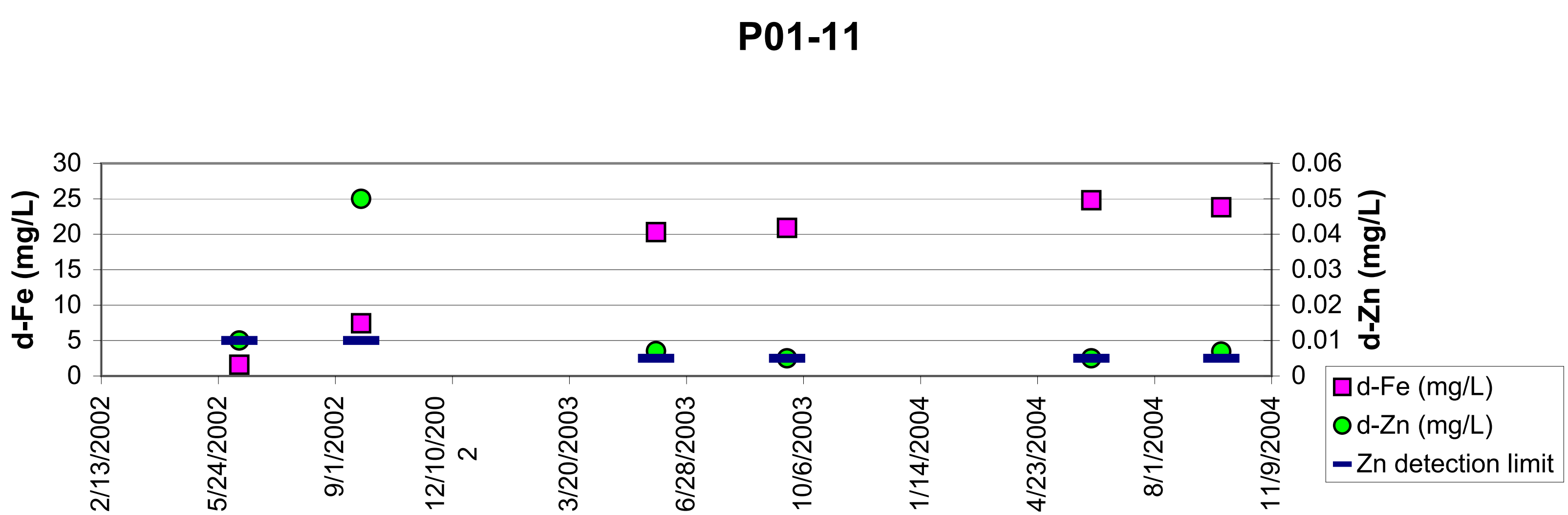


Figure 54 . Time series of dissolved Iron (Fe) Zinc (Zn) Sulphate (SO4) and Alkalinity for well P01-11

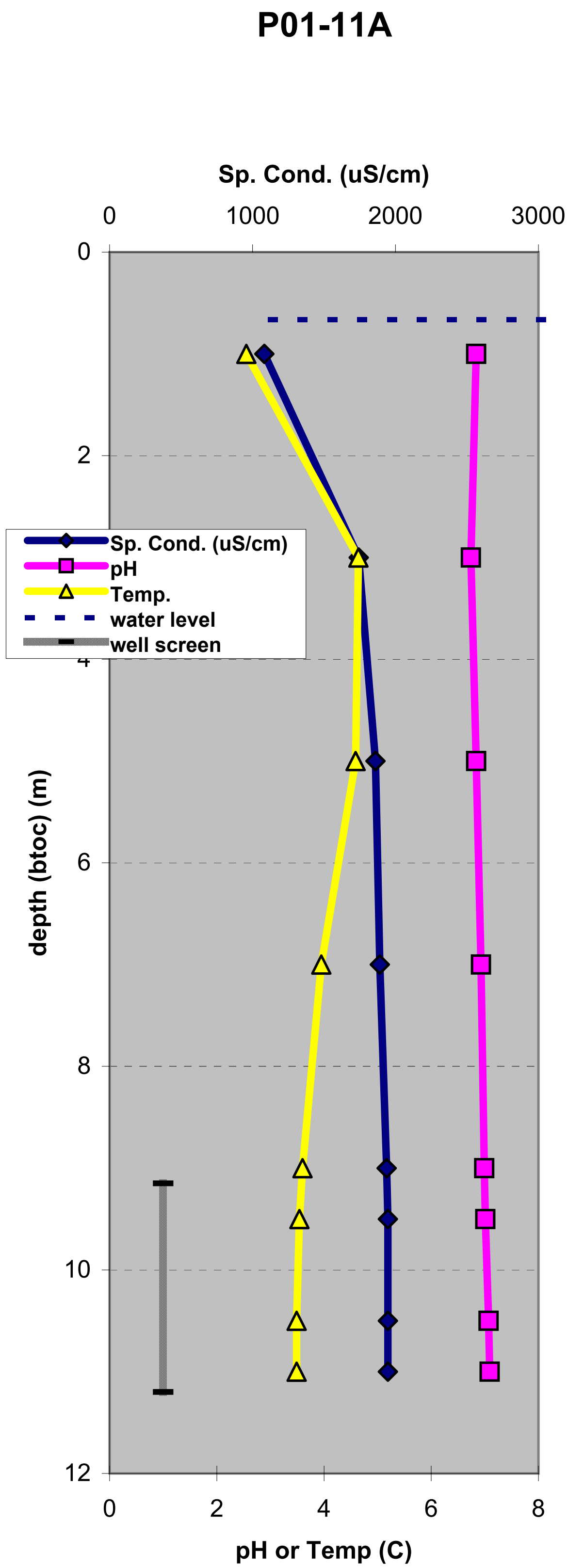


Figure 55. Geochemical (Field Parameter) profile of static water in well P01-11A

6. Concurrent Work

As suggested by Gartner Lee and Environment Canada, a solution of bromide salt was injected through the packer sampling tube at location P01-09D. The goal of this work was to provide a tracer for groundwater movement and aquifer properties at that location and confirm whether elevated concentrations of dissolved metals and sulphate detected at P03-03 could be due to leakage from wells at P01-09. The experiment was designed by Environment Canada and conducted immediately following packer testing of the well. A large volume of bromide solution was injected as a pulse by gravity feeding from tanks at surface. A more detailed description of the injection and associated background sampling should be obtained from Environment Canada. Any subsequent monitoring at location P03-03 where the bromide slug could potentially be detected should include analysis for bromide (Br-).

It was reported by EC in early 2005 that bromide had been detected in well P03-03 suggesting that the slug of bromide from location P01-09 had reached well P03-03 within 6 months. More information should be obtained from EC Whitehorse.

7. Mitigation Measures

In order to mitigate possible impacts to the aquifer from leakage at location P01-09-D and P01-09-C, a single-point packer was installed and inflated in each well. The sampling tube was attached to each packer to allow sampling in the spring after contaminated water will have flushed from the area surrounding the well screen. Due to their proximity, the packers in both wells were attached to a pressurized gas source at ground surface. A pressure regulator maintains pressure at approximately 65 psi. The internal pressure of the tank and packer inflation lines are checked periodically by site personnel.

8. Conclusions and Recommendations

Table 3 provides a summary of findings and recommended actions for each well. The following is a list of recommendations for immediate action and for the upcoming 2005 season:

P01-01-A

- Well should be rehabilitated if possible by removing the "sandlocked" tubing or a multi-level monitor should be installed to replace this well

P01-01-B

- This well should be monitored using conventional sampling methods

P01-02-A

- Well should be rehabilitated if possible to remove the bulge in the well casing and remove the "pinched" tubing in the well. The well can still be sampled with minimal purge volume using small diameter tubing and foot valve.

P01-02-B

- This well should be monitored using conventional sampling methods

P01-03

- This well does not penetrate through tailings and therefore does not represent an immediate threat from leakage to water quality in the Rose Creek aquifer.
- This well should be sufficiently purged prior to sampling to overcome any possible leakage sample bias.

P01-04-A, B

- This well does not penetrate through tailings and therefore does not represent an immediate threat from leakage to water quality in the Rose Creek aquifer.
- This well should be sufficiently purged prior to sampling to overcome any possible leakage sample bias.

P01-05 A

- This well should be monitored using a protocol (not yet developed) to ensure constant review of the data and allow for determination of leakage effects should it become problematic

P01-05-B

- This well should be monitored using a protocol (not yet developed) to ensure constant review of the data and allow for determination of leakage effects should it become problematic

P01-06

- No further sampling of this well should occur
- Well should be properly decommissioned

P01-07-A, B, E

- No further sampling of these wells should occur
- Wells should be properly decommissioned
- The packer which is "stuck" in well P01-07-E should be either removed if possible or abandoned in the well during decommissioning

P01-07-C, D

- These wells should be monitored using a protocol (not yet developed) to ensure constant review of the data and allow for determination of leakage effects should it become problematic

P01-08-A,

- More information needs to be collected from this well to determine future action

P01-08-B, C

- These wells have tubing stuck or frozen in them and have been problematic to sample
- Although a frozen condition may currently be desirable to prevent any leakage, the wells should be properly decommissioned

P01-09-A, B, C, D

- The pressure should be monitored in the compressed gas tanks to ensure that packers in wells C and D remain inflated
- A packer should be immediately installed in well B using a similar long-term set-up as wells C and D
- All of these wells should be properly decommissioned early in the Spring of 2005 once the packers are removed
- Data from wells P01-09 wells screened in the aquifer should not be used to make any interpretations of overall site conditions within the aquifer
- Data from multi-level well screens at P03-03 which are screened in the aquifer are likely impacted by leakage upgradient at P01-09 and should only be used to assess this impact. These points are likely representative of very localized in-situ conditions at that location and should not be extrapolated to other locations.

P01-10 A, B

- Sampling of both wells should not be continued
- Both wells should be properly decommissioned in the spring of 2005

P01-11

- The well presently yields reliable data and does not pose an immediate threat to water quality in the underlying aquifer because it is not constructed through the tailings.
- This well should be continued to be monitored by using adequate purging

Other Older wells (not regularly sampled)

- All other wells at the site which are deemed not useful should be properly decommissioned as soon as possible to prevent the possibility of these acting as conduits for leakage

Bromide Monitoring

- In order to maximize the chance of detecting the bromide slug at location P03-03, selected points in the aquifer at this location should be sampled for bromide whenever other sampling is performed at the site (i.e. during routine, AMP and other sampling)

Sampling Protocol for Specific wells

A protocol should be developed to ensure that samples from specific wells identified as "sample with protocol" be constantly examined to determine if leakage effects may become significant in the future. This would likely involve collection of a depth-discrete sample from the screen interval followed by collection of a sample using conventional techniques. A series of key parameters should be identified as indicator parameters to establish a baseline for comparison of future data and future conditions at the wells.

Table 3. Summary of Status and Recommendations for Each Well Location. Note: recommendations follow from discussions with review group

Well ID	status in May. 2005	location	screen location	Installed through/in tailings?	bottom of screen depth (m)	Did down-hole video provide evidence of staining on joints below the water table	Did packer testing confirm the possibility of leakage?	Does static well profile suggest leakage?	Does discrete depth sampling suggest leakage?	Well Leakage under static conditions	Leakage Impact to Aquifer	Data reliability	Recommended action	Summary of Recommended Action: keep monitoring	develop sampling protocol and keep monitoring	Decommission in 2005	acquire more information	rationale
footnote			C				A			B								
P01-01-A	tubing sandlocked in well	downgradient of Cross-Valley Dam	A	NO	19.8	NT	NT	NT	NT	NT	NO	GOOD	Well should be rehabillitated to remove sandlocked tubing and should be used for conventional monitoring.	x				Well is located in a useful location and provides useful data. Well is not constructed through the tailings.
P01-01-B		downgradient of Cross-Valley Dam	A	NO	33.78	NT	NT	NO	NO	not significant	NO	GOOD	continue monitoring using proper purging methods	x				Well is located in a useful location and provides useful data. Well is not constructed through the tailings.
P01-02-A	tubing stuck and "pinched" in well due to bulge in casing	toe of Cross-Valley Dam	A	NO	12.54	NT	NT	NT	NT	not significant	NO	GOOD	Well can be sampled through pinched tubing. Well should be rehabillitated by removing steel protective casing and replacing bulged section of well casing. Proper drainage should be provided	x				Well is located in a useful location and provides useful data. Well is not constructed through the tailings.
P01-02-B		toe of Cross-Valley Dam	A	NO	26.88	NT	NT	undetermined	NO	not significant	NO	GOOD	continue monitoring using proper purging methods	x				Well is located in a useful location and provides useful data. Well is not constructed through the tailings.
P01-03		toe of Intermediate Dam	A	NO	7.78	NT	NT	NO	NO	not significant	NO	GOOD	continue monitoring using proper purging methods	x				Well is located in a useful location and provides useful data. Well is not constructed through the tailings.
P01-04-A		toe of Intermediate Dam	A	NO	32.53	NT	NT	NO	NO	not significant	NO	GOOD	continue monitoring using proper purging methods	x				Well is located in a useful location and provides useful data. Well is not constructed through the tailings.
P01-04-B		toe of Intermediate Dam	A	NO	51.89	NT	NT	NO	NO	not significant	NO	GOOD	continue monitoring using proper purging methods	x				Well is located in a useful location and provides useful data. Well is not constructed through the tailings.
P01-05-A	Well is usually pumped dry / slow recharge	intermediate impoundment	T	YES	9.02	NT	NT	undetermined	NO	not significant	NO	good estimate of tailings porewater chemistry	Consider decommissioning or keep monitoring with an established protocol		X			the well is sometimes pumped dry when sampling which would exacerbate any leakage effects. The well is screened in tailings and testing of wells in this environment is difficult. However, the well is in a location where there is little or no other data, impact to aquifer is minimal and this well could be decommissioned at a later date.
P01-05-B	Tailings are evident in well during purging/sampling	intermediate impoundment	A	YES	14.86	YES	YES	YES	NO	undetermined	NOT SIGNIFICANT	MODERATE	Consider decommissioning or keep monitoring with an established protocol		x			Well is located in a useful location and may provide useful data if it is used for monitoring an upgradient tracer injection. However, it is known to be impacted by leakage. Conditions at this location may get worse and therefore it may be targetted for decomissioning in the future.
P01-06		intermediate impoundment	A	YES	9.15	NOT SIGNIFICANT	YES	undetermined	undetermined	undetermined	NOT SIGNIFICANT	MODERATE	discontinue monitoring at this location and decommission well			x		Well is in a good location to monitor improvement due to seepage interception at X23 and could be replaced by a new "multi-level" well if deemed necessary.
P01-07-A		intermediate dam	T	YES	16.46	NT	NT	NO	undetermined	undetermined	NO	GOOD	discontinue monitoring at this location and decommission well			X		Wells screened in tailings are difficult to test and well rehabillitation is not an option. Leakage may become significant in the future and multi-level well P03-04 provides information a short distance down-gradient
P01-07-B		intermediate dam	T	YES	21.96	NT	NT	NO	undetermined	not significant	NO	GOOD	discontinue monitoring at this location and decommission well			X		Wells screened in tailings are difficult to test and well rehabillitation is not an option. Leakage may become significant in the future and multi-level well P03-04 provides information a short distance down-gradient
P01-07-C	significant tailings in well during sampling / purging	intermediate dam	A	YES	26.24	YES	YES	NO	undetermined	not significant	NO	GOOD	keep monitoring with protocol and consider decommissioning at a later date		x			There is currently lots of tailings within this well. Leakage may have significant impact in the future and well P03-04 is located downgradient and monitors over the same depth interval. However, this well could be used for tracer injection or monitoring in the future. This well could be monitored with a protocol and perhaps decommissioned at a later date.
P01-07-D		intermediate dam	A	YES	32.65	YES	YES	NO	NO	not significant	NO	GOOD	keep monitoring with protocol and consider decommissioning at a later date		x			Well is in a good location. It could be useful for tracer injections or monitoring for aquifer physical characteristics. Seems to be detecting a real signal of sulphate moving through aquifer.
P01-07-E	packer stuck in well above well screen	intermediate dam	A	YES	38.89	NOT SIGNIFICANT	NOT SIGNIFICANT	NO	NO	not significant	NO	GOOD	discontinue monitoring at this location and decommission well			x		This well provides similar information as P01-07D, it also has a packer stuck in it
P01-08-A	has one tubing stuck in it but also has useable sampling tubing	original impoundment	A	YES	14.02	NT	NT	NT	NT	undetermined	NT	not determined	More information needs to be collected to evaluate conditions at this location				x	There is currently tubing stuck in this well. It has been sampled in 2005 using another tubing. These results should be examined and further testing should be done to determine whether to decommission this well or not
P01-08-B	surface steel casing appears to have heaved and it is very loose. Sampling tubing is stuck in well (can be pulled up	original impoundment	A	YES	24.1	NT	NT	NT	NT	undetermined	NT	not determined	decommission well in 2005. However will need to remove stuck tubing			x		Well had elevated zinc, lead and iron in 2003 (not sampled in 2004). Tubing could be stuck in well due to a "sandlock" caused by sediments / tailings falling into the well. Condition of well and steel casing suggests possible heaving of casing which may have pulled joints apart. E. Canada also reported tailings in sample in 2004
P01-08-C	has tubing stuck or frozen in well	original impoundment	A	YES	28.8	NT	NT	NT	NT	undetermined	NT	not determined	decommission well in 2005. However will need to remove stuck tubing			x		This well has always been problematic to sample. It currently has sampling tubing stuck in the well that may require significant work to remove if possible. The well is not located in an area of great interest and has not been useful thus far.
P01-09-A		secondary impoundment	T	YES	10.2	NT	NT	NO	NO	undetermined	NT	good estimate of tailings porewater chemistry	decommission well in 2005			x		leakage is likely occurring, significant and other wells such as P03-01 / P03-02 and P03-03 are located close by. Not possible to determine where recharge water would be coming from (i.e. leaky joints or well screen).
P01-09-B	2004) for mitigation measures	secondary impoundment	A	YES	14.95	YES	YES	YES	YES	SIGNIFICANT	YES	BAD / not reliable	decommission well in 2005			x		leakage has been conclusively determined in this well
P01-09-C	packer installed (Sept. 2004) for mitigation	secondary impoundment	A	YES	20.61	YES	YES	YES	YES	SIGNIFICANT	YES	BAD / not reliable	decommission well in 2005			x		leakage has been conclusively determined in this well
P01-09-D	packer installed (Sept. 2004) for mitigation	secondary impoundment	A	YES	26.92	YES	YES	YES	YES	SIGNIFICANT	YES	BAD / not reliable	decommission well in 2005			x		leakage has been conclusively determined in this well
P01-10-A		original impoundment	T	YES	13.67	NT	NT	YES	undetermined	undetermined	NO	good estimate of tailings porewater chemistry	discontinue monitoring at this location and decommission well			x		the well is usually pumped dry when sampling which would exacerbate any leakage effects. Wells in tailings are difficult to test. It is not located in an area of "worst" tailings porewater quality.
P01-10-B	tailings in well during sampling / purging	original impoundment	A	YES	19.51	YES	YES	YES	YES	YES	undetermined	QUESTIONABLE	discontinue monitoring at this location and decommission well			x		Impact under current conditions seems minimal, however, tailings are observed in the well during sampling and often clog sampling tube clearly suggesting leakage
P01-11		toe of Cross-Valley Dam	A	NO	9.15	NT	NT	undetermined	NO	NO	NO	GOOD	continue monitoring using proper purging methods	x				Well is located in a useful location and provides useful data. Well is not constructed through the tailings.

possibility of leakage tested by inserting packer in well, evacuating water from above packer and monitoring water level rise over time
NT = not tested
A = packer testing performed in May/June 2004 where single point packer was installed in well and water was evacuated from above packer. The water level rise was then monitored.
B = Overall leakage assessment based on whether leakage is evident during static conditions

9. Acknowledgements

Gartner Lee would like to thank the following individuals for facilitating access to the site, assisting during the field episode and providing useful information: Deloitte & Touche Inc. (in their capacity as Interim Receiver for Anvil Range Mining Corporation), Anvil Range Mining Corporation (Interim Receivership) Care and Maintenance Personnel, DIAND/YTG Type II Mines Project Office, Environment Canada, Environmental Protection Branch.

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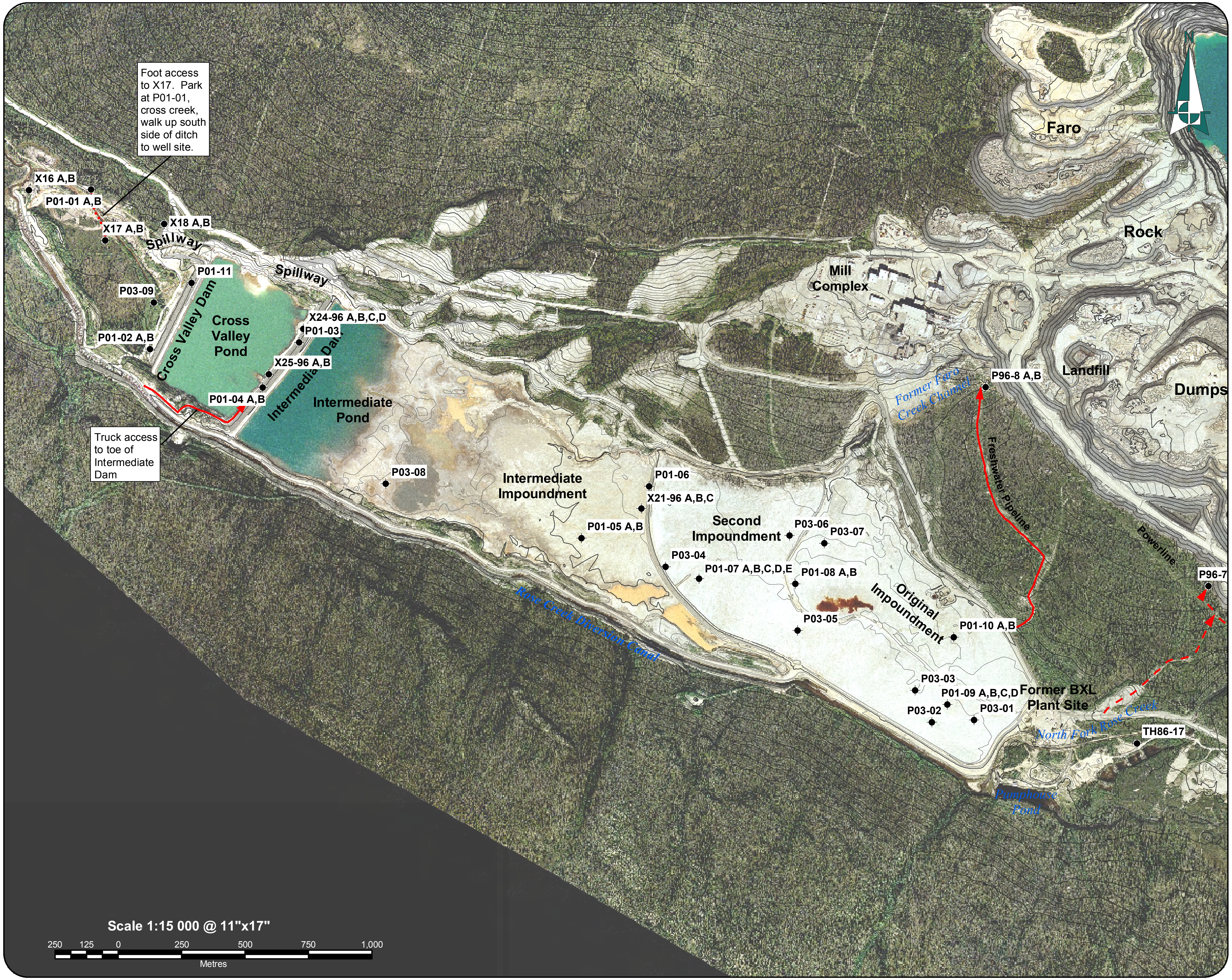
Hydrogeologist

Emma McKennirey, B.Sc., EIT
Junior Environmental Scientist

Appendices

Appendix A

Map of Well Locations in Rose Creek Tailings Impoundment



Legend

- Groundwater Monitoring Location
- Index Contours (5m)
- Intermediate Contours (1m)

Well Access Routes

- Foot
- ATV
- Truck

DATA SOURCES AND DISCLAIMERS:

Basemap: Orthoshop, Calgary, AB, November 2003. Prepared for SRK Consulting. Based on August 2003 aerial photography .

Projection: UTM Zone 8 NAD27

Created By: AS

Reviewed By: FP

Date Issued: June 15, 2004

Project Number: 23576

File Name: Faro_groundwater_sampling_plan_figures.mxd

Revision: 1.1

Deloitte & Touche Inc.
Faro Leakage Assessment

Down Valley and Tailings Impound Area
Faro, Yukon

Gartner Lee

Figure No.

Appendix B

Summary of Geochemical Profile Data and Packer Testing Purging Data

Summary of Geochemical Profile Data

Monitor	DateTime M/D/Y	Temp C	SpCond uS/cm	Cond uS/cm	TDS g/L	DO % %	DO Conc mg/L	pH	ORP mV	depth b.t.o.c. (m)
P01-01B	9/27/2004 10:41	2.68	704	404	0.457	34	4.61	7.61	42	4
	9/27/2004 10:43	1.71	955	530	0.621	10.6	1.47	7.58	-4	8
	9/27/2004 10:44	2.28	1045	592	0.679	3.9	0.54	7.54	-15	12
	9/27/2004 10:45	2.35	1106	628	0.719	2	0.28	7.52	-15	16
	9/27/2004 10:47	2.34	1122	636	0.729	1.4	0.19	7.53	-17	20
	9/27/2004 10:48	2.31	1132	641	0.735	1.2	0.17	7.51	-23	24
	9/27/2004 10:50	2.31	1136	644	0.739	1	0.14	7.53	-28	28
	9/27/2004 10:51	2.31	1135	643	0.738	0.9	0.13	7.54	-30	30
	9/27/2004 10:52	2.32	1136	644	0.738	0.9	0.12	7.54	-31	32
	9/27/2004 10:53	2.36	1127	640	0.733	0.8	0.11	7.55	-33	33.6
	9/27/2004 10:53	2.37	1128	640	0.733	0.8	0.11	7.55	-35	34
	9/27/2004 10:54	2.38	1126	639	0.732	0.8	0.11	7.56	-37	34.5
	9/27/2004 10:55	2.39	1128	641	0.733	0.8	0.11	7.56	-37	35
P01-02B		3	161					9.2		1
	9/26/2004 14:02	3.54	524	309	0.341	17.1	2.27	8.79	31	3
P01-03	9/27/2004 9:30	4.52	2343	1427	1.523	24	3.09	6.1	164	2.7
	9/27/2004 9:32	3.88	2360	1408	1.534	4.2	0.55	6.32	151	4
	9/27/2004 9:33	2.9	2361	1365	1.535	2.5	0.33	6.41	146	6
	9/27/2004 9:35	2.72	2370	1362	1.54	2.3	0.31	6.49	141	7
	9/27/2004 9:36	2.57	2364	1352	1.537	2.4	0.33	6.52	139	8
	9/27/2004 9:36	2.53	2366	1350	1.538	2.5	0.34	6.55	137	8.5
	9/27/2004 9:37	2.49	2366	1349	1.538	2.5	0.34	6.57	136	9
P01-04A	9/26/2004 17:26	5.24	959	597	0.623	49.3	6.24	7.59	-58	2.2
	9/26/2004 17:28	4.96	1270	784	0.826	11.2	1.42	7.5	-94	5
	9/26/2004 17:30	3.1	1278	743	0.831	2	0.27	7.54	-114	10
	9/26/2004 17:34	2.79	1280	737	0.832	1.2	0.16	7.58	-127	20
	9/26/2004 17:36	2.69	1278	734	0.831	1	0.14	7.59	-131	25
	9/26/2004 17:37	2.67	1276	732	0.83	1	0.14	7.6	-133	28
	9/26/2004 17:38	2.65	1278	732	0.83	1	0.14	7.6	-134	30
	9/26/2004 17:40	2.64	1279	733	0.831	1	0.14	7.61	-136	32
	9/26/2004 17:40	2.64	1274	730	0.828	1	0.13	7.62	-136	32.5
	9/26/2004 17:41	2.63	1307	749	0.85	1	0.13	7.62	-137	33
	9/26/2004 17:42	2.62	1312	752	0.853	1	0.13	7.63	-138	33.5
	9/26/2004 17:42	2.62	1313	752	0.854	1	0.13	7.63	-139	34

Summary of Geochemical Profile Data

Monitor	DateTime M/D/Y	Temp C	SpCond uS/cm	Cond uS/cm	TDS g/L	DO % %	DO Conc mg/L	pH	ORP mV	depth b.t.o.c. (m)
P01-04B	9/26/2004 16:35	5.02	1110	687	0.722	74.6	9.49	8.04	-97	2
	9/26/2004 16:38	4.05	1388	833	0.902	5.1	0.66	7.82	-127	6
	9/26/2004 16:39	3.11	1392	810	0.905	4.8	0.65	7.77	-131	10
	9/26/2004 16:40	2.95	1390	805	0.904	6	0.81	7.7	-134	15
	9/26/2004 16:42	2.79	1391	801	0.904	6.4	0.86	7.65	-136	20
	9/26/2004 16:43	2.71	1387	797	0.902	6.3	0.85	7.6	-137	25
	9/26/2004 16:45	2.72	1391	799	0.904	6.1	0.83	7.54	-138	30
	9/26/2004 16:46	2.85	1389	801	0.903	6.1	0.82	7.5	-139	35
	9/26/2004 16:48	3.06	1388	807	0.902	6	0.8	7.45	-139	40
	9/26/2004 16:49	3.14	1389	809	0.903	5.9	0.78	7.4	-140	42
	9/26/2004 16:51	3.19	1386	809	0.901	5.8	0.77	7.37	-140	44
	9/26/2004 16:52	3.21	1387	810	0.901	5.7	0.76	7.34	-140	46
	9/26/2004 16:54	3.24	1385	809	0.9	5.6	0.75	7.31	-140	48
	9/26/2004 16:58	3.25	1387	811	0.901	5.2	0.69	7.24	-142	51
	9/26/2004 16:59	3.25	1372	802	0.892	5	0.66	7.23	-142	51.5
	9/26/2004 17:00	3.25	1390	813	0.904	4.9	0.65	7.22	-142	52
	9/26/2004 17:02	3.26	1448	846	0.941	5	0.66	7.16	-141	52.5
P01-05A	9/26/2004 12:25	6.19	792	508	0.515	67.4	8.33	7.23	2	3.3
	9/26/2004 12:26	4.79	826	507	0.537	16.3	2.09	7.55	-182	6
			902					7.68		8
	9/26/2004 12:27	3.52	903	533	0.587	4.3	0.56	7.71	-229	9
	9/26/2004 12:29	2.94	1068	618	0.695	1.5	0.21	7.78	-248	9.5
	9/26/2004 12:30	2.84	1421	820	0.924	1.3	0.17	7.67	-241	10
	9/26/2004 12:31	2.76	1566	901	1.018	1.1	0.15	7.73	-239	10.5
P01-05B	9/26/04 11:54		1600					7.07		3.9
	9/27/04 11:55		2019					7.04		6
	9/28/04 11:56		2076					7.18		8
	9/29/04 11:57		1921					7.25		10
	9/30/04 11:58		1845					7.3		12
	10/1/04 12:00		1751					7.36		14
	10/2/04 12:00		1725					7.38		14.5
	10/3/04 12:01		1703					7.4		15
	10/4/04 12:02		1704					7.42		15.5
	10/5/04 12:03		1710					7.43		16
	9/26/2004 11:02	5.75	2365	1495	1.537	40.6	5.05	8.24	-20	5.4

Summary of Geochemical Profile Data

Monitor	DateTime M/D/Y	Temp C	SpCond uS/cm	Cond uS/cm	TDS g/L	DO % %	DO Conc mg/L	pH	ORP mV	depth b.t.o.c. (m)
P01-06	9/26/2004 11:03	4.59	2392	1459	1.555	8.8	1.12	8.13	-56	7
	9/26/2004 11:04	3.58	2424	1432	1.576	1.2	0.16	7.98	-66	9
	9/26/2004 11:05	3.33	2421	1419	1.574	0	0.01	7.88	-70	9.5
	9/26/2004 11:05	3.09	2469	1436	1.605	-0.3	-0.04	7.8	-73	10
	9/26/2004 11:06	2.85	2569	1482	1.67	-0.3	-0.04	7.7	-75	10.5
	9/26/2004 11:07	2.69	3395	1949	2.207	-0.3	-0.04	7.59	-80	11
P01-07A	9/26/2004 11:02	5.75	2365	1495	1.537	40.6	5.05	8.24	-20	11.65
	9/26/2004 11:03	4.59	2392	1459	1.555	8.8	1.12	8.13	-56	13
	9/26/2004 11:04	3.58	2424	1432	1.576	1.2	0.16	7.98	-66	15
	9/26/2004 11:05	3.33	2421	1419	1.574	0	0.01	7.88	-70	16.5
	9/26/2004 11:05	3.09	2469	1436	1.605	-0.3	-0.04	7.8	-73	17
	9/26/2004 11:06	2.85	2569	1482	1.67	-0.3	-0.04	7.7	-75	17.5
	9/26/2004 11:07	2.69	3395	1949	2.207	-0.3	-0.04	7.59	-80	17.7
P01-07B	9/26/2004 11:02	5.75	2365	1495	1.537	40.6	5.05	8.24	-20	11.8
	9/26/2004 11:03	4.59	2392	1459	1.555	8.8	1.12	8.13	-56	13
	9/26/2004 11:04	3.58	2424	1432	1.576	1.2	0.16	7.98	-66	15
	9/26/2004 11:05	3.33	2421	1419	1.574	0	0.01	7.88	-70	17
	9/26/2004 11:05	3.09	2469	1436	1.605	-0.3	-0.04	7.8	-73	19
	9/26/2004 11:06	2.85	2569	1482	1.67	-0.3	-0.04	7.7	-75	21
	9/26/2004 11:07	2.69	3395	1949	2.207	-0.3	-0.04	7.59	-80	23
P01-07C	9/25/2004 16:32	3.72	740	439	0.481	10.6	1.4	7.76	21	11.5
	9/25/2004 16:33	3.29	1564	915	1.016	6.1	0.81	7.73	-44	13
	9/25/2004 16:34	3.17	1566	913	1.018	2.5	0.34	7.71	-69	15
	9/25/2004 16:35	3.12	1565	911	1.017	1.8	0.24	7.69	-76	17
	9/25/2004 16:36	3.06	1557	904	1.012	1.3	0.17	7.69	-82	19
	9/25/2004 16:38	3.01	1554	901	1.01	1	0.13	7.68	-86	21
	9/25/2004 16:39	2.97	1557	902	1.012	1	0.13	7.67	-89	23
	9/25/2004 16:39	2.92	1551	897	1.008	0.8	0.11	7.67	-90	25
	9/25/2004 16:40	2.9	1551	897	1.008	0.7	0.09	7.66	-91	26
	9/25/2004 16:40	2.9	1550	896	1.007	0.7	0.09	7.66	-92	26.5
	9/25/2004 16:41	2.9	1554	898	1.01	0.6	0.08	7.65	-93	27
	9/25/2004 16:42	2.88	1558	900	1.013	0.6	0.08	7.64	-94	27.5
	9/26/2004 15:36	3.07				35.3	4.74	6.82	-121	11.85
	9/26/2004 15:37	3.01	1938	1124	1.26	11	1.47	6.86	-171	12
	9/26/2004 15:38	2.97	1948	1129	1.266	0.4	0.05	6.98	-222	16

Summary of Geochemical Profile Data

Monitor	DateTime M/D/Y	Temp C	SpCond uS/cm	Cond uS/cm	TDS g/L	DO % %	DO Conc mg/L	pH	ORP mV	depth b.t.o.c. (m)
P01-07D	9/26/2004 15:40	2.94	1938	1122	1.26	-0.4	-0.06	7.1	-247	20
	9/26/2004 15:42	2.91	1937	1120	1.259	-0.6	-0.07	7.17	-260	24
	9/26/2004 15:43	2.84	1933	1115	1.256	-0.7	-0.09	7.24	-268	26
	9/26/2004 15:45	2.81	1849	1066	1.202	0.4	0.06	7.45	-257	30
	9/26/2004 15:46	2.79	1845	1062	1.199	0.8	0.11	7.75	-237	32
	9/26/2004 15:47	2.78	1849	1064	1.202	0.9	0.12	7.82	-232	32.5
	9/26/2004 15:48	2.77	1849	1064	1.202	1	0.13	7.87	-230	33
	9/26/2004 15:48	2.77	1846	1062	1.2	1	0.14	7.94	-224	33.5
	9/26/2004 15:49	2.76	1861	1071	1.21	1.1	0.14	7.95	-218	34
P01-07E	9/26/2004 15:00	3.12	1615	940	1.05	8.7	1.16	7.61	118	11.75
	9/26/2004 15:02	2.97	1619	938	1.052	2.6	0.35	7.52	83	18
	9/26/2004 15:04	2.94	1622	938	1.054	2.5	0.33	7.45	66	22
	9/26/2004 15:05	2.88	1643	949	1.068	2.6	0.35	7.47	14	26
	9/26/2004 15:07	2.79	1721	991	1.118	2.3	0.31	7.62	-14	32
	9/26/2004 15:08	2.77	1821	1048	1.183	2.1	0.29	7.61	-16	34
	9/26/2004 15:10	2.73	1853	1065	1.205	1.9	0.26	7.58	-15	38
	9/26/2004 15:11	2.73	1897	1090	1.233	1.8	0.25	7.55	-7	38.5
	9/26/2004 15:12	2.72	1933	1110	1.256	1.9	0.26	7.5	6	39
	9/26/2004 15:13	2.72	1933	1111	1.257	1.9	0.26	7.48	10	39.5
	9/26/2004 15:14	2.72	1931	1109	1.255	2	0.26	7.45	13	40
	9/26/2004 15:14	2.72	1920	1103	1.248	2	0.27	7.44	13	40.5
P01-09A	9/25/2004 14:31	4.83	33836	20804	21.99	10.6	1.18	4.88	103	6.7
	9/25/2004 14:32	4	34480	20651	22.41	3.8	0.43	5.23	48	8
	9/25/2004 14:33	3.73	34469	20467	22.4	1.7	0.19	5.39	21	9
	9/25/2004 14:33	3.62	34463	20387	22.4	0.9	0.1	5.47	6	10
	9/25/2004 14:34	3.6	34471	20383	22.41	0.3	0.03	5.49	-3	10.5
	9/25/2004 14:35	3.56	34515	20382	22.43	0	0	5.51	-10	11
	9/25/2004 14:35	3.48	34480	20305	22.41	-0.2	-0.02	5.64	-23	11.3
P01-09B	9/25/2004 14:12	4.76	707	434	0.46	14.8	1.89	2.62	491	6.65
	9/25/2004 14:12	4.65	1340	819	0.871	11.6	1.49	2.76	434	7
	9/25/2004 14:14	3.92	1885	1126	1.225	3.8	0.5	5.03	150	9
	9/25/2004 14:15	3.55	3800	2243	2.47	2	0.27	5.24	117	10
	9/25/2004 14:16	3.46	3816	2246	2.48	1.3	0.17	5.33	103	12
	9/25/2004 14:17	3.45	4369	2571	2.84	1	0.13	5.32	101	14
	9/25/2004 14:17	3.45	4160	2448	2.704	0.9	0.12	5.33	100	14.5

Summary of Geochemical Profile Data

Monitor	DateTime M/D/Y	Temp C	SpCond uS/cm	Cond uS/cm	TDS g/L	DO % %	DO Conc mg/L	pH	ORP mV	depth b.t.o.c. (m)
	9/25/2004 14:18	3.46	4031	2372	2.62	0.8	0.11	5.34	99	15
	9/25/2004 14:19	3.46	3924	2309	2.551	0.7	0.1	5.35	98	15.5
	9/25/2004 14:19	3.46	3908	2300	2.54	0.7	0.09	5.36	97	16
	9/25/2004 14:20	3.46	3926	2311	2.552	0.6	0.08	5.37	95	16.5
	9/25/2004 13:38	4.65	575	351	0.373	9.8	1.26	3.99	234	6.8
	9/25/2004 13:40	3.73	882	524	0.573	5.5	0.73	4.3	233	9
	9/25/2004 13:41	3.5	3659	2157	2.379	2.8	0.37	5.08	112	9.5
	9/25/2004 13:42	3.4	3607	2119	2.345	1.3	0.17	5.29	88	11
	9/25/2004 13:43	3.38	3316	1947	2.156	0.6	0.08	5.37	79	13
	9/25/2004 13:44	3.43	2977	1751	1.935	0.2	0.03	5.41	76	15
P01-09C	9/25/2004 13:45	3.49	2532	1492	1.646	0	0	5.45	74	17
	9/25/2004 13:46	3.5	2295	1352	1.492	0	-0.01	5.47	73	18
	9/25/2004 13:47	3.51	2006	1182	1.304	-0.1	-0.01	5.48	74	19
	9/25/2004 13:48	3.51	1886	1112	1.226	-0.1	-0.01	5.49	75	19.5
	9/25/2004 13:49	3.51	1759	1037	1.143	0	-0.01	5.5	76	20
	9/25/2004 13:49	3.51	1599	943	1.04	-0.1	-0.01	5.51	76	21
	9/25/2004 13:50	3.51	1532	903	0.996	-0.1	-0.01	5.51	77	22
	9/25/2004 12:54	6.26	8007	5141	5.205	5.4	0.64	3.61	204	7.5
	9/25/2004 12:57	3.77	8873	5276	5.768	1.4	0.18	4.23	162	9
	9/25/2004 12:59	3.58	29339	17337	19.07	-1.2	-0.14	4.83	62	9.5
	9/25/2004 13:01	3.48	29391	17308	19.1	-1.8	-0.21	5.04	37	11
	9/25/2004 13:03	3.52	27631	16295	17.96	-1.9	-0.22	5.17	28	14
	9/25/2004 13:08	3.49	25062	14766	16.29	-1.5	-0.19	5.29	22	16
	9/25/2004 13:10	3.51	22952	13532	14.92	-1.5	-0.18	5.36	20	18
	9/25/2004 13:12	3.52	18708	11033	12.16	-1.4	-0.17	5.42	19	20
P01-09D	9/25/2004 13:13	3.52	16446	9698	10.69	-1.3	-0.16	5.5	16	22
	9/25/2004 13:15	3.51	13581	8007	8.827	-1.2	-0.15	5.59	8	24
	9/25/2004 13:16	3.5	12079	7119	7.852	-1.2	-0.15	5.64	4	25
	9/25/2004 13:17	3.48	9529	5612	6.194	-1.1	-0.14	5.73	-1	26
	9/25/2004 13:18	3.47	8390	4940	5.453	-1.1	-0.14	5.8	-4	26.5
	9/25/2004 13:19	3.47	7160	4215	4.654	-1	-0.14	5.83	-6	27
	9/25/2004 13:20	3.46	7154	4211	4.65	-1	-0.13	5.84	-6	27.5
	9/25/2004 13:20	3.45	6910	4066	4.491	-1.1	-0.14	5.85	-7	28
	9/25/2004 15:41	3.85	3463	2064	2.251	12.8	1.66	6.04	8	10.05
	9/25/2004 15:42	3.39	4271	2508	2.776	5.4	0.7	6.32	-85	11

Summary of Geochemical Profile Data

Monitor	DateTime M/D/Y	Temp C	SpCond uS/cm	Cond uS/cm	TDS g/L	DO % %	DO Conc mg/L	pH	ORP mV	depth b.t.o.c. (m)
P01-10A	9/25/2004 15:42	3.31	4290	2513	2.789	2.6	0.35	6.53	-138	12
	9/25/2004 15:43	3.29	4281	2506	2.783	1.3	0.18	6.68	-160	13
	9/25/2004 15:44	3.3	4286	2510	2.786	0.6	0.08	6.84	-174	14
	9/25/2004 15:45	3.33	4336	2542	2.819	-0.1	-0.02	7.15	-191	15
	9/25/2004 15:46	3.33	4530	2655	2.945	-0.2	-0.03	7.27	-197	15.3
P01-10B	9/25/2004 15:17	3.78	779	463	0.506	7.8	1.02	6.08	29	10.8
			1384					6.07		12
	9/25/2004 15:20	3.34	1457	854	0.947	0.8	0.11	6.5	-109	14
	9/25/2004 15:21	3.32	1454	852	0.945	0.2	0.03	6.61	-132	16
	9/25/2004 15:22	3.3	1447	847	0.941	0.1	0.01	6.65	-139	18
	9/25/2004 15:22	3.3	1452	850	0.943	0	0	6.68	-144	18.5
	9/25/2004 15:23	3.29	1448	848	0.941	-0.1	-0.01	6.71	-148	19
	9/25/2004 15:23	3.29	1449	848	0.942	-0.1	-0.02	6.75	-153	19.5
	9/25/2004 15:24	3.28	1461	855	0.95	-0.2	-0.03	6.8	-158	20
	9/25/2004 15:25	3.27	1457	852	0.947	-0.2	-0.03	6.86	-164	20.5
P01-11A	9/27/2004 10:09	2.55	1082	618	0.703	62.9	8.54	6.84	168	1
	9/27/2004 10:11	4.64	1743	1065	1.133	28.6	3.66	6.74	23	3
	9/27/2004 10:12	4.59	1860	1135	1.209	7.5	0.96	6.84	-63	5
	9/27/2004 10:13	3.95	1890	1130	1.229	2.8	0.37	6.93	-96	7
	9/27/2004 10:14	3.6	1938	1146	1.26	1.7	0.22	6.99	-102	9
	9/27/2004 10:15	3.54	1947	1149	1.266	1.4	0.19	7.01	-102	9.5
	9/27/2004 10:17	3.49	1947	1147	1.266	1.1	0.15	7.07	-105	10.5
	9/27/2004 10:17	3.49	1947	1147	1.266	1.1	0.14	7.09	-107	11

Appendix C

Summary of Analytical Results from Leakage Assessment Sampling

Summary of 2004 Leakage Assessment Sampling Results

Faro Mine, 2004

Sample ID	DD-P01- 01-B	DD-P01- 03-A	DD-P01- 04-A	DD-P01- 04- B	DD-P01- 05-A 10	P01-05B-AP	P01-05B-TP	DD-P01- 05-B	DD-P01- 06-A	P01-06-AP
Date Sampled	9/30/2004	9/28/2004	9/30/2004	9/30/2004	9/28/2004	6/22/2004	6/22/2004	9/28/2004	9/28/2004	6/22/2004
Sample port depth (m btoc)	34.50	8.5	33.00	52.00				15	10.5	
Physical Tests										
Conductivity (uS/cm)	1120	2320	1290	1400	1460	1600	3160	1620	2560	2680
Hardness CaCO3	576	1330	632	635	299	765	1330	747	1220	1180
pH	8.35	7.27	8.05	7.64	7.61	7.55	5.1	7.51	5.94	6.36
Dissolved Anions										
Acidity (to pH 8.3) CaCO3	<1.0	27.0	6.2	30.2	3.0			13.9	279	
Alkalinity-Total CaCO3	234	330	295	800	27.0	231	11	222	42.2	86.5
Bromide Br										
Chloride Cl										
Fluoride F										
Sulphate SO4	400	1240	460	26.7	740	756	2310	806	1860	1780
Nutrients										
Nitrate Nitrogen N										
Nitrite Nitrogen N										
Dissolved Metals										
Aluminum D-Al	<0.020	<0.10	<0.050	<0.10	<0.020	<0.050	<0.20	<0.050	<0.10	<0.10
Antimony D-Sb	<0.0010	<0.0050	<0.0025	<0.0050	0.0011	<0.0025	<0.010	<0.0025	<0.0050	<0.0050
Arsenic D-As	0.0026	<0.010	<0.0050	<0.010	<0.0020	<0.0050	<0.020	0.0080	0.011	0.016
Barium D-Ba	0.087	<0.020	0.029	0.527	<0.020	0.026	<0.040	0.029	0.027	0.029
Beryllium D-Be	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050
Boron D-B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10
Cadmium D-Cd	<0.00010	0.00121	<0.00025	<0.00050	<0.00010	<0.00025	<0.0010	<0.00025	<0.00050	<0.00050
Calcium D-Ca	170	393	200	154	85.5	237	110	229	333	316
Chromium D-Cr	<0.0010	<0.0050	<0.0025	<0.0050	<0.0010	<0.0025	<0.010	<0.0025	<0.0050	<0.0050
Cobalt D-Co	<0.0010	0.0411	<0.0025	<0.0050	0.0015	0.0073	0.227	0.0051	0.336	0.177
Copper D-Cu	<0.0020	<0.010	<0.0050	<0.010	<0.0020	<0.0050	<0.020	<0.0050	<0.010	<0.010
Iron D-Fe	0.396	0.030	4.40	0.765	0.081	5.39	1170	20.4	229	293
Lead D-Pb	<0.0020	<0.010	<0.0050	<0.010	<0.0020	0.0218	<0.020	<0.0050	<0.010	<0.010
Lithium D-Li	<0.050	<0.050	<0.050	0.185	<0.050	<0.050	<0.10	<0.050	<0.050	<0.050
Magnesium D-Mg	36.7	85.4	32.2	60.8	20.9	42	256	42.1	94.7	93.7
Manganese D-Mn	0.629	33.9	0.974	0.274	0.108	17.7	69.7	16.5	28.0	33.6
Mercury D-Hg	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum D-Mo	<0.0020	<0.010	<0.0050	<0.010	0.0145	<0.0050	<0.020	<0.0050	<0.010	<0.010
Nickel D-Ni	<0.010	0.064	<0.025	<0.050	<0.010	<0.025	0.71	<0.025	0.185	0.083
Selenium D-Se	<0.0020	<0.010	<0.0050	<0.010	<0.0020	<0.0050	<0.020	<0.0050	<0.010	<0.010
Silver D-Ag	<0.00010	<0.00050	<0.00025	<0.00050	<0.00010	<0.00025	<0.0010	<0.00025	<0.00050	<0.00050
Sodium D-Na	24.2	42.3	42.2	76.4	177	59	76.8	61.7	42.6	41.6
Thallium D-Tl	<0.00040	<0.0020	<0.0010	<0.0020	<0.00040	<0.0010	<0.0040	<0.0010	<0.0020	<0.0020
Titanium D-Ti	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10	<0.050	<0.050	<0.050
Uranium D-U	0.00562	0.0058	0.0029	<0.0020	<0.00040	0.0048	<0.0040	0.0054	0.0052	0.0065
Vanadium D-V	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.060	<0.030	<0.030	<0.030
Zinc D-Zn	<0.0050	0.0140	<0.0050	<0.0050	0.0065	0.0211	5.13	0.0569	6.15	4.13

Footnotes:

Results are expressed as milligrams per litre except where noted.

>= Less than the detection limit indicated.

Summary of 2004 Leakage Assessment Sampling Results

Faro Mine, 2004

Sample ID	P01-06-TP	DD-P01- 07-A	DD-P01- 07-B	P01-07- C-AFTER PURGE	DD-P01- 07-C	P01-07C-AP	P01-07C-AP-R	P01-07C-TP	DD-P01- 07-D	BP-P01- 07-D
Date Sampled	6/22/2004	9/28/2004	9/28/2004	9/30/2004	9/28/2004	6/22/2004	6/22/2004	6/22/2004	9/27/2004	9/30/2004
Sample port depth (m btoc)		17	22.7		26.00				33.00	
Physical Tests										
Conductivity (uS/cm)	2920	2460	3240	1490	1500	1390	1410	1600	1750	1800
Hardness CaCO3	1440	248	466	751	636	688	577	119	987	879
pH	6.14	7.73	7.60	7.47	7.65	7.47	7.46	8.17	7.47	7.14
Dissolved Anions										
Acidity (to pH 8.3) CaCO3		6.7	7.2	18.0	11.2					26.5
Alkalinity-Total CaCO3	70.1	247	182	190	210	191	189	272	160	155
Bromide Br										
Chloride Cl										
Fluoride F										
Sulphate SO4	2040	1080	1650	703	677	657	660	536	976	968
Nutrients										
Nitrate Nitrogen N										
Nitrite Nitrogen N										
Dissolved Metals										
Aluminum D-Al	<0.10	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10	<0.050	<0.10	<0.10
Antimony D-Sb	<0.0050	<0.0025	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0025	<0.0050	<0.0050
Arsenic D-As	<0.010	<0.0050	<0.010	0.016	<0.010	0.013	0.014	<0.0050	<0.010	<0.010
Barium D-Ba	<0.020	<0.020	<0.020	0.117	0.130	0.123	0.101	<0.020	0.096	0.080
Beryllium D-Be	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0051	<0.0050
Boron D-B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium D-Cd	<0.00050	<0.00025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00025	<0.00050	<0.00050
Calcium D-Ca	354	49.6	58.7	224	191	208	174	34	282	252
Chromium D-Cr	<0.0050	<0.0025	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0025	<0.0050	<0.0050
Cobalt D-Co	0.032	0.0027	<0.0050	0.0106	<0.0050	0.0102	0.0097	0.019	0.0240	0.0293
Copper D-Cu	<0.010	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.010	<0.010
Iron D-Fe	336	0.516	0.661	21.9	17.7	21.8	18.4	0.626	18.0	16.9
Lead D-Pb	<0.010	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.010	<0.010
Lithium D-Li	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Magnesium D-Mg	135	30.1	77.5	46.8	38.6	41.1	34.8	8.29	68.9	60.8
Manganese D-Mn	35.7	0.074	0.096	33.6	27.0	30.7	25.8	3	49.7	46.7
Mercury D-Hg	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum D-Mo	<0.010	0.0187	<0.010	<0.010	<0.010	<0.010	<0.010	0.106	<0.010	<0.010
Nickel D-Ni	0.071	<0.025	<0.050	<0.050	<0.050	<0.050	<0.050	<0.025	<0.050	<0.050
Selenium D-Se	<0.010	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.010	<0.010
Silver D-Ag	<0.00050	<0.00025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00025	<0.00050	<0.00050
Sodium D-Na	43.7	430	518	33.1	73.6	33.7	28.8	320	45.6	36.5
Thallium D-Tl	<0.0020	<0.0010	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0010	<0.0020	<0.0020
Titanium D-Ti	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Uranium D-U	0.0055	<0.0010	<0.0020	0.0076	0.0067	0.0066	0.0063	0.0019	0.0061	0.0057
Vanadium D-V	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Zinc D-Zn	2.85	0.0077	0.0088	0.0070	0.0109	0.0091	0.0054	0.0102	0.0188	0.0149

Footnotes:
Results are expressed as milligrams per litre except where noted.
>= Less than the detection limit indicated.

Summary of 2004 Leakage Assessment Sampling Results

Faro Mine, 2004

Sample ID	P01-07D-AP- D	P01-07D - AP	P01-07D-TP	DD-P01- 07-E	DD-P01- 07-E	BP-P01- 07-E	BP-P01- 07-E-R	P01-07E -AP	P01-07E-TP 9:00	DD-PO1- 09-A
Date Sampled	6/22/2004	6/22/2004	6/22/2004	9/27/2004	9/27/2004	9/30/2004	9/30/2004	6/22/2004	6/22/2004	9/26/2004
Sample port depth (m btoc)				33.00	40.00					11.00
Physical Tests										
Conductivity (uS/cm)	1740	1740	2170	1730	1860	1880	1890	1720	1580	32100
Hardness CaCO3	739	910	145	980	1020	952	951	908	836	3170
pH	7.05	7.09	7.64	7.42	7.35	7.22	7.19	7.13	7.2	3.17
Dissolved Anions										
Acidity (to pH 8.3) CaCO3						25.1	27.8			
Alkalinity-Total CaCO3	136	140	333	161	133	135	132	132	188	<1.0
Bromide Br										<50
Chloride Cl										<500
Fluoride F										23
Sulphate SO4	974	967	820	982	1130	1050	1040	1040	799	62800
Nutrients										
Nitrate Nitrogen N										<100
Nitrite Nitrogen N										<100
Dissolved Metals										
Aluminum D-Al	<0.10	<0.10	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<10
Antimony D-Sb	<0.0050	<0.0050	<0.0025	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.50
Arsenic D-As	<0.010	<0.010	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<1.0
Barium D-Ba	0.058	0.07	<0.020	0.092	0.033	0.025	0.025	0.023	0.083	<0.80
Beryllium D-Be	<0.0050	<0.0050	<0.0050	0.0104	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.20
Boron D-B	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<4.0
Cadmium D-Cd	<0.00050	<0.00050	<0.00025	<0.00050	0.00113	0.00102	0.00115	0.00155	<0.00050	<0.050
Calcium D-Ca	217	268	46.3	281	297	277	277	269	243	490
Chromium D-Cr	<0.0050	<0.0050	<0.0025	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.50
Cobalt D-Co	0.035	0.0428	0.035	0.0261	0.0457	0.0481	0.0493	0.0765	0.0199	<0.50
Copper D-Cu	<0.010	<0.010	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<1.0
Iron D-Fe	14.5	17.8	4.91	14.9	7.53	6.79	6.75	4.04	4.1	31600
Lead D-Pb	<0.010	<0.010	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<1.0
Lithium D-Li	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<2.0
Magnesium D-Mg	47.9	58.4	7.1	67.8	67.9	63.4	63.3	57.6	55.5	472
Manganese D-Mn	41.8	51.6	4.11	49.6	53.4	51.8	51.6	46.6	38.4	184
Mercury D-Hg	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00047
Molybdenum D-Mo	<0.010	<0.010	0.186	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<1.0
Nickel D-Ni	<0.050	<0.050	0.295	<0.050	<0.050	<0.050	<0.050	0.084	0.091	<5.0
Selenium D-Se	<0.010	<0.010	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<1.0
Silver D-Ag	<0.00050	<0.00050	<0.00025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.050
Sodium D-Na	21.6	26	447	35.9	35.4	34.0	32.7	31.4	55.6	<80
Thallium D-Tl	<0.0020	<0.0020	<0.0010	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.20
Titanium D-Ti	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<2.0
Uranium D-U	0.0035	0.0042	0.0031	0.0064	0.0035	0.0036	0.0035	0.0029	0.0068	<0.20
Vanadium D-V	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<1.2
Zinc D-Zn	0.0135	0.0151	2.71	0.0367	0.0389	0.0159	0.0159	0.0197	4.86	3380

Footnotes:

Results are expressed as milligrams per litre except where noted.

>= Less than the detection limit indicated.

Summary of 2004 Leakage Assessment Sampling Results

Faro Mine, 2004

Sample ID	**DD-PO1- 09-EB**	**DD-PO1- 09-B**	**BP-P01- 09-B 18:20**	**DD-PO1- 09-C**	**PO1- 09-C-AP**	**P01- 09-C- BP**	**P01-09- C - AP (50 L)**	**P01-09- C - AP (150L)**	**P01-09- C - TP**
Date Sampled	9/26/2004	9/26/2004	9/28/2004	9/26/2004	9/26/2004	9/26/2004	5/12/2004	5/12/2004	5/12/2004
Sample port depth (m btoc)		15.50		21.00					
Physical Tests									
Conductivity (uS/cm)	2.9	4220	1330	1530	762	1160			34200
Hardness CaCO3	<0.66	550	324	319	290	315	163	160	4130
pH	5.35	3.86	5.97	3.56	6.23	6.01			3.18
Dissolved Anions									
Acidity (to pH 8.3) CaCO3			446						
Alkalinity-Total CaCO3	<1.0	1.6	15.1	<1.0	14.6	12.5			<1.0
Bromide Br		<25	<2.5	<5.0	<0.50	<1.2			
Chloride Cl		<250	<25	<50	<5.0	<12			
Fluoride F		<10	3.0	<2.0	<0.20	<0.50			
Sulphate SO4	<0.50	3650	831	939	390	712			44200
Nutrients									
Nitrate Nitrogen N		<50	<5.0	<10	<1.0	<2.5			
Nitrite Nitrogen N		<50	<5.0	<10	<1.0	<2.5			
Dissolved Metals									
Aluminum D-Al	<0.010	<0.50	<0.10	<0.050	0.103	<0.050			
Antimony D-Sb	<0.00050	<0.025	<0.0050	<0.0025	<0.0025	<0.0025			
Arsenic D-As	<0.0010	<0.050	<0.010	<0.0050	<0.0050	<0.0050			
Barium D-Ba	<0.020	<0.040	<0.020	0.037	0.030	0.032			
Beryllium D-Be	<0.0050	0.012	<0.0050	<0.0050	<0.0050	<0.0050			
Boron D-B	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10			
Cadmium D-Cd	<0.000050	0.0088	0.00327	0.00237	0.00240	0.00226			
Calcium D-Ca	<0.10	141	93.1	90.7	87.2	92.0	47.6	46.9	427
Chromium D-Cr	<0.0020	<0.025	<0.0050	<0.0025	<0.0025	<0.0025			
Cobalt D-Co	<0.00050	0.276	0.187	0.210	0.210	0.220	0.105	0.101	<0.50
Copper D-Cu	<0.0010	<0.050	<0.010	<0.0050	<0.0050	<0.0050			
Iron D-Fe	<0.030	1650	201	248	34.0	165	36.3	31.8	25000
Lead D-Pb	<0.0010	<0.050	<0.010	<0.0050	<0.0050	<0.0050			
Lithium D-Li	<0.050	<0.10	<0.050	0.058	<0.050	0.056			
Magnesium D-Mg	<0.10	47.9	22.3	22.5	17.5	20.8	10.6	10.3	743
Manganese D-Mn	<0.010	44.7	25.9	18.1	16.0	17.5	9.14	9.01	249
Mercury D-Hg	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00122
Molybdenum D-Mo	<0.0010	<0.050	<0.010	<0.0050	<0.0050	<0.0050			
Nickel D-Ni	<0.0050	0.40	0.207	0.238	0.226	0.244			
Selenium D-Se	<0.0010	<0.050	<0.010	<0.0050	<0.0050	<0.0050			
Silver D-Ag	<0.000050	<0.0025	<0.00050	<0.00025	<0.00025	<0.00025			
Sodium D-Na	<2.0	24.2	15.2	9.8	8.8	8.8	7.9	7.8	<100
Thallium D-Tl	<0.00020	<0.010	<0.0020	<0.0010	<0.0010	<0.0010			
Titanium D-Ti	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050			
Uranium D-U	<0.00020	<0.010	<0.0020	<0.0010	<0.0010	<0.0010			
Vanadium D-V	<0.030	<0.060	<0.030	<0.030	<0.030	<0.030			
Zinc D-Zn	<0.0050	188	27.5	46.0	5.56	29.2	9.87	8.55	4820

Footnotes:
Results are expressed as milligrams per litre except where noted.
>= Less than the detection limit indicated.

Summary of 2004 Leakage Assessment Sampling Results

Faro Mine, 2004

Sample ID	P01-09- C - TP - D	DD-P01- 09-D	DD-P01- 09-D-20m	P01- 09-D-AP	P01- 09-D-BP- 12:04	P01- 09-D-BP- 14:49	P01-09- D - AP	P01-09- D - TP	P01-09- D - TP-R
Date Sampled	5/12/2004	9/26/2004	9/26/2004	9/26/2004	9/27/2004	9/27/2004	5/12/2004	5/12/2004	5/12/2004
Sample port depth (m btoc)		26.00							
Physical Tests									
Conductivity (uS/cm)		9260	17800	1060	1020	1000	1140	36000	
Hardness CaCO3	4150	983	1530	259	367	318	257	3810	4070
pH		3.37	3.18	5.37	6.40	6.09	6.09	3.18	
Dissolved Anions									
Acidity (to pH 8.3) CaCO3									
Alkalinity-Total CaCO3		<1.0	<1.0	8.6	27.5	22.0	19.1	<1.0	
Bromide Br		<25	<50		<1.2				
Chloride Cl		<250	<500		<12				
Fluoride F		<10	<20		<0.50				
Sulphate SO4		10500	23700	604	595	564	650	52400	
Nutrients									
Nitrate Nitrogen N		<50	<100		<2.5				
Nitrite Nitrogen N		<50	<100		<2.5				
Dissolved Metals									
Aluminum D-Al		<1.0	<5.0	<0.050	<0.050	<0.050			
Antimony D-Sb		<0.050	<0.25	<0.0025	<0.0025	<0.0025			
Arsenic D-As		<0.10	<0.50	<0.0050	<0.0050	<0.0050			
Barium D-Ba		<0.20	<0.30	<0.020	0.021	<0.020			
Beryllium D-Be		<0.050	<0.075	<0.0050	<0.0050	<0.0050			
Boron D-B		<1.0	1.8	<0.10	<0.10	<0.10			
Cadmium D-Cd		<0.0050	<0.025	0.00109	0.00198	0.00188			
Calcium D-Ca	431	203	243	73.0	108	92.8	71.3	410	432
Chromium D-Cr		<0.050	<0.25	<0.0025	<0.0025	<0.0025			
Cobalt D-Co	<0.50	0.114	<0.25	0.0941	0.0985	0.103	0.0505	<0.50	<0.50
Copper D-Cu		<0.10	<0.50	<0.0050	<0.0050	<0.0050			
Iron D-Fe	25000	4400	11500	159	106	110	196	26700	28800
Lead D-Pb		<0.10	<0.50	<0.0050	<0.0050	<0.0050			
Lithium D-Li		<0.50	<0.75	<0.050	<0.050	<0.050			
Magnesium D-Mg	746	116	225	18.6	23.6	21.0	19.1	678	727
Manganese D-Mn	250	62.0	93.3	14.4	24.0	20.0	15.6	241	256
Mercury D-Hg	0.00129	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00107	0.00102
Molybdenum D-Mo		<0.10	<0.50	<0.0050	<0.0050	<0.0050			
Nickel D-Ni		<0.50	<2.5	0.106	0.136	0.134			
Selenium D-Se		<0.10	<0.50	<0.0050	<0.0050	<0.0050			
Silver D-Ag		<0.0050	<0.025	<0.00025	<0.00025	<0.00025			
Sodium D-Na	<100	<20	<30	11.8	13.9	12.6	10.7	<100	<100
Thallium D-Tl		<0.020	<0.10	<0.0010	<0.0010	<0.0010			
Titanium D-Ti		<0.50	<0.75	<0.050	<0.050	<0.050			
Uranium D-U		<0.020	<0.10	<0.0010	<0.0010	<0.0010			
Vanadium D-V		<0.30	<0.45	<0.030	<0.030	<0.030			
Zinc D-Zn	4800	753	1710	23.0	17.3	17.4	40.8	5270	5640

Footnotes:

Results are expressed as milligrams per litre except where noted.

>= Less than the detection limit indicated.

Appendix D

Summary of Time Series Data (2001 – 2004) for Selected Parameters in P01 Series Wells

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-01A																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1140			0.002	0.03	51.7	32	0.001	8	7.83	480	0.005	3.73	0.03	0.005
6/10/2002	211	1212		1230	0.002	0.03	44.6	27	0.001	6.5	7.75	570	0.01	3.59	0.03	0.01
9/23/2002	232		1080	1080	0.002	0.71	35	26	0.001	8.08	8.08	399	0.01		0.03	0.01
6/2/2003	199		1156	1190	0.002	0.03	42	23	0.001	7.3	8.05	580	0.005	3.14	0.03	0.005
9/22/2003	199		1285	1250	0.005	0.03	44	25	0.003	7.14	7.96	520	0.005	3.27	0.03	0.005

P01-01B																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		981			0.002	0.12	32.8	28	0.001	7.8	7.81	289	0.006	3.98	0.03	0.005
6/10/2002	238	1018		1040	0.002	0.67	34.6	26	0.001	6.5	7.77	402	0.01	3.74	0.03	0.01
9/23/2002	217		1240	1240	0.002	0.03	42.4	25	0.001	7.99	7.99	549	0.01		0.03	0.01
6/2/2003	228		1040	1070	0.002	1.38	34.7	23	0.001	6.7	8.09	399	0.005	3.28	0.03	0.005
9/22/2003	228		1132	1090	0.002	0.68	36	26	0.001	7.14	8.1	413	0.005	3.43	0.03	0.005
9/27/2004	234		1128	1120	<0.0020	0.396	36.7	24.2	<0.0020	7.56	8.35	400	0.005	3.913	0.03	0.005

P01-02A																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		591			0.001	0.03	23.4	23	0.0005	7.9	7.84	156	0.005	1.54	0.03	0.005
6/10/2002	192	614		625	0.001	0.03	23.6	18	0.0005	7.6	8.09	158	0.005	1.72	0.03	0.005
9/23/2002	199		629	629	0.001	0.03	20.4	13	0.0005	8.1	8.1	1430	0.005		0.03	0.005
9/23/2002	196		625	625	0.001	0.03	22.1	14	0.0005	8.1	8.1	1430	0.005		0.03	0.005
6/3/2003	195		608	599	0.001	0.03	22.8	14	0.0005	7.1	8.11	143	0.014		0.03	0.005
9/22/2003	200		624	611	0.001	0.03	21.3	12	0.0005	7.69	8.23	134	0.005		0.03	0.005
6/8/2004	206		557	620	<0.0010	<0.030	20.5	11.7	<0.0010	6.95	8	142	0.005		0.03	0.005

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-02B																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		554			0.001	0.03	27.5	22	0.0005	8	7.99	119	0.005	0	0.03	0.005
6/10/2002	184			556	0.001	0.12	26.3	19	0.0005		8.07	130	0.005		0.03	0.005
6/10/2002	182	544		554	0.001	0.12	25.7	19	0.0005	7.9	8.17	128	0.005	0.17	0.03	0.005
9/23/2002	179		561	561	0.001	0.16	24.4	18	0.0005	8.17	8.17	116	0.005		0.03	0.005
6/3/2003	178		557	541	0.001	0.24	25.9	16	0.0005	6.8	8.13	125	0.005	1.57	0.03	0.005
9/22/2003	178		564	548	0.001	0.33	26.1	16	0.0006	7.63	8.12	119	0.005	1.07	0.03	0.005
6/8/2004	175			530	0.001	0.338	23.4	14	0.001		8.1	119	0.005		0.03	0.005
6/8/2004	175		497	530	<0.0010	0.338	23.4	14	<0.0010	6.98	8.1	119	0.005		0.03	0.005
9/26/2004			524							8.79				0.342	0.03	0.005

P01-03 toe of Intermediate Dam, N. side, 9.2m																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1573			0.005	0.33	61.3	39	0.003	7.5	6.98	769	0.009	1.58	0.03	0.005
6/12/2002	303	1913		1950	0.005	0.27	68.7	44	0.003	7.5	7.21	1090	0.03	2.39	0.03	0.03
9/23/2002	308		1870	1870	0.005	0.28	61.3	37	0.003	6.92	6.92	1260	0.03		0.03	0.03
9/22/2003	313		2138	2170	0.01	1.55	81.9	41	0.005	6.55	7.91	1130	0.011		0.03	0.005
6/16/2004	320		2346	2360	<0.010	0.292	79.4	40.6	<0.010	5.67	7.39	1290	0.0134	1.88	0.03	0.005
9/27/2004	330		2366	2320	<0.010	0.03	85.4	42.3	<0.010	6.57	7.27	1240	0.014	2.611	0.03	0.005

P01-04A toe of Intermediate Dam, S. side, 33.2m																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1055			0.002	3.35	29.6	44	0.001	7.8	7.77	331	0.005	0.78	0.03	0.005
6/12/2002	284	1137		1120	0.002	4	29.1	44	0.001	8	7.66	377	0.01	1.67	0.03	0.01
9/27/2002	188			1020	0.002	0.03	51.8	6	0.001		7.73	338	0.09		0.03	0.01
9/27/2002			1020							7.73					0.03	0.01
6/6/2003	293		1197	1090	0.005	4.05	28.3	41	0.003	6.8	7.81	191	0.25	0.98	0.03	0.01
9/23/2003	288		1206	1150	0.005	3.75	28.3	40	0.003	7.08	8.03	399	0.005		0.03	0.005
9/26/2004	295		1313	1290	<0.0050	4.4	32.2	42.2	<0.0050	7.63	8.05	460	0.005	1.975	0.03	0.005

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-04B toe of Intermediate dam, S. side, 52.5m

	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1045			0.002	0.86	45.5	69	0.001	7.5	8.11	30	0.005	0.43	0.03	0.005
6/12/2002	557			1080	0.005	1.12	43.3	65	0.003		7.84	45	0.03		0.03	0.03
6/12/2002	571	1063		1100	0.01	1.14	44.2	67	0.005	7.1	7.92	46	0.05	1.29	0.03	0.03
9/24/2002	605		1030	1030	0.002	0.03	42.9	60	0.001	7.49	7.49	44	0.01		0.03	0.01
6/3/2003	595		1160	1140	0.002	1.02	50.6	72	0.001	6.5	7.84	50	0.005	0.57	0.03	0.005
9/23/2003	700		1177	1190	0.005	0.98	51	65	0.003	6.29	8.06	43	0.005	1.23	0.03	0.005
9/26/2004	800		1448	1400	<0.010	0.765	60.8	76.4	<0.010	7.16	7.64	26.7	0.005	1.539	0.03	0.005

P01-05A Intermediate Impoundment (tailings), 10.5m

	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1948			0.005	0.57	45.2	173	0.045	8	7.32	1210	0.145	2.9	0.03	0.03
6/10/2002	21			1940	0.005	0.31	43.3	211	0.005		7.51	1130	0.03		0.03	0.03
6/12/2002										8.2				3.25	0.03	0.03
9/26/2002	27		1890	1890	0.005	0.85	43.1	198	0.02	7.4	7.4	1030	0.03		0.03	0.03
9/26/2002	272		1900	1900	0.005	0.97	42.8	200	0.016	7.45	7.45	1040	0.03		0.03	0.03
6/4/2003	30		1015	1720	0.005	1.39	48.2	206	0.008	6.1	7.25	1020	0.023	2.93	0.03	0.005
9/23/2003	41		1187	1420	0.112	23.7	35.4	147	3.66	7.7	7.28	729	2.29	2.94	0.03	0.005
9/26/2004	27		1566	1460	<0.0020	0.081	20.9	177	<0.0020	7.73	7.61	740	0.0065	3.37	0.03	0.005

P01-05B Intermediate Impoundment, 15.6m

	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1475			0.002	4.09	35.3	47	0.032	7.8	7.22	780	0.074	3.24	0.03	0.03
6/10/2002	227			1550	0.005	4.27	42.4	66	0.006		7.78	600	0.03		0.03	0.03
9/26/2002	228		1520	1520	0.002	4.57	42	61	0.002	7.82	7.82	716	0.01		0.03	0.01
6/4/2003	218		1629	1530	0.005	16.7	44.7	59	0.003	6.7	7.94	814	0.036	3.28	0.03	0.005
9/23/2003	232		1541	1530	0.005	4.65	36.9	50	0.007	6.9	8.01	714	0.014	3.26	0.03	0.005
6/16/2004	231		1590	1600	<0.0050	5.39	42	59	0.0218	6	7.55	756	0.0211	3.32	0.03	0.005
9/28/2004	222			1620	<0.0050	20.4	42.1	61.7	<0.0050		7.51	806	0.0569		0.03	0.005

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-06 toe of Second Dam, 10.5m

	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		3189			-0.005	676	281	39	0.005	7.1	6.02	2610	1.02	4.75	0.03	0.03
6/12/2002	78			2270	-0.005	402	119	39	-0.003	6.2	6.1	1110	1.88	5.09	0.03	0.03
9/26/2002	67		2770	2770	-0.005	518	111	38	0.003	5.83	5.83	1880	2.58		0.03	0.03
6/4/2003	49		2640	2270	-0.005	306	91.4	39	-0.003	6.4	5.67	1620	5.37	4.77	0.03	0.005
9/23/2003	36		2501	2600	-0.01	288	92.6	36	0.007	6.29	5.88	1910	6.87	4.71	0.03	0.005
6/16/2004	86.5		2674	2680	<0.010	293	93.7	41.6	<0.010	5.62	6.36	1780	4.13	4.83	0.03	0.005
9/26/2004	42.2		3395	2560	<0.010	229	94.7	42.6	<0.010	7.59	5.94	1860	6.15	5.21	0.03	0.005

P01-07A Second Impoundment (tailings), 18.0m

	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/11/2001		1154			0.002	0.04	1.1	267	0.011	9.5	9.13	349	0.005	11.57	0.03	0.005
6/12/2002	269			1810	0.005	0.03	2.2	421	0.007	9.1	8.32	756	0.03	11.59	0.03	0.03
9/26/2002	273		2080	2080	0.007	0.53	3.3	432	0.091	8.24	8.24	835	0.24		0.03	0.01
9/26/2002	272		1770	1770	0.005	0.68	3.4	436	0.116	9.02	9.02	590	0.11		0.03	0.01
6/3/2003	288		1748	1710	0.005	0.04	2.3	368	0.004	9.6	9.06	636	0.005	11.12	0.03	0.005
9/23/2003	280		1332	1530	0.005	0.1	1.6	310	0.016	9.7	8.6	432	0.03	10.94	0.03	0.005
9/26/2004	247		3395	2460	<0.0050	0.516	30.1	430	<0.0050	7.59	7.73	1080	0.0077	11.585	0.03	0.005

P01-07B Second Impoundment (tailings), 23.3m

	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/11/2001		1508			0.005	0.18	1.2	363	0.286	9.7	9.78	360	0.005	11.35	0.03	0.005
6/12/2002	328			1920	0.005	0.1	23.9	384	0.049		7.99	635	0.03		0.03	0.03
6/12/2002	321			1890	0.005	0.14	23.6	367	0.027	7	7.75	835	0.03	11.48	0.03	0.03
9/26/2002	351		1600	1600	0.006	0.7	19.2	338	0.081	8.34	8.34	448	0.07		0.03	0.01
9/26/2002	407		1730	1730	0.005	0.2	18.8	332	0.014	7.91	7.91	519	0.05		0.03	0.01
6/3/2003	373		1589	1680	0.005	0.7	27.2	354	0.006	8.2	8.26	498	0.021	11.11	0.03	0.005
9/24/2003	352		1686	1690	0.029	7.06	22.8	336	0.809	6.98	7.82	601	1.04	11.04	0.03	0.005
9/26/2004	182		3395	3240	<0.010	0.661	77.5	518	<0.010	7.59	7.6	1650	0.0088	11.505	0.03	0.005

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-07C Second Impoundment, 27.7m																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/11/2001		992			0.002	12.1	26.5	40	0.007	7.6	7.45	370	0.005	11.27	0.03	0.005
6/12/2002	196			896	0.002	12.7	27	37	0.006	6.5	7.71	346	0.01	11.38	0.03	0.01
9/26/2002	200		1030	1030						7.72	7.72	393			0.03	0.01
9/26/2002	200	1040	1040	1040	0.002	14.7	30.9	38	0.004	7.47	7.47	402	0.01		0.03	0.01
6/2/2003	169			1180	0.01	21	42.6	36	0.005		7.54	662	0.005		0.03	0.005
6/3/2003			1348							6.8				10.98	0.03	0.005
9/23/2003	190		1401	1380	0.009	18.5	37.5	33	0.199	6.83	7.96	701	0.23	10.98	0.03	0.005
6/16/2004	191		1482	1390	<0.010	21.8	41.1	33.7	<0.010	7.03	7.47	657	0.0091	11.315	0.03	0.005
9/25/2004	210		1558	1500	<0.010	17.7	38.6	73.6	<0.010	7.64	7.65	677	0.0109	11.45	0.03	0.005

P01-07D Second Impoundment, 34.1m																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1013			0.002	2.26	39.3	30	0.001	6.9	7.21	433	0.011	11.64	0.03	0.005
6/12/2002	150			1220	0.002	7.89	39.2	29	0.001	7.1	7.85	686	0.01	11.74	0.03	0.01
9/26/2002	154		1420	1420	0.002	8.05	37.3	28	0.001	7.15	7.15	766	0.01		0.03	0.01
6/2/2003	151			1750	0.01	16.2	66.5	30	0.005		7.07	1070	0.024		0.03	0.005
6/3/2003			1822							6.5				11.3	0.03	0.005
9/23/2003	140		1716	1840	0.01	15.7	65.5	36	0.005	6.45	7.77	1050	0.008	11.3	0.03	0.005
6/16/2004	140		1759	1740	<0.010	17.8	58.4	26	<0.010	5.87	7.09	967	0.0151	11.682	0.03	0.005
9/26/2004	160		1861	1750	<0.010	18	68.9	45.6	<0.010	7.95	7.47	976	0.0188	11.815	0.03	0.005

P01-07E Second Impoundment, 40.2m																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1188			0.002	0.36	36.5	30	0.001	6.9	7.09	580	0.017	11.5	0.03	0.01
6/12/2002	136			1240	0.002	2.34	41	35	0.001	7.2	6.7	672	0.01	11.62	0.03	0.01
9/26/2002	125		1490	1490	0.002	4.64	44	35	0.001	7.25	7.25	818	0.26		0.03	0.01
6/2/2003	140			1650	0.01	3.71	59	36	0.005		7.02	1020	0.013		0.03	0.005
6/3/2003	139		1734	1680	0.005	3.37	56.2	36	0.003	6.4	7.49	973	0.024	11.41	0.03	0.005
9/24/2003	122		1806	1830	0.02	5.09	67.9	35	0.02	6.06	7.7	1130	0.05	11.18	0.03	0.005
6/17/2004	132		1664	1720	<0.010	4.04	57.6	31.4	<0.010	6.57	7.13	1040	0.0197	11.575	0.03	0.005
9/26/2004	161		1920	1730	<0.010	14.9	67.8	35.9	<0.010	7.44	7.42	982	0.0367	11.698	0.03	0.005

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-08A Original Impoundment (tailings), 15.1m														
	ALK-T	SPECIFIC COND	SPECIFIC CONDUCT(F)	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters
9/11/2001		660			0.002	0.22	6.6	90	0.01	7.3	7.66	206	0.024	11.77
9/5/2002					0.001	0.4	4.3	120	0.0461				0.189	
9/5/2002	100			642	0.009	2.58	4.5	121	0.326		6.88	200	0.561	
9/27/2002	137		882	882	0.002	0.03	1.4	185	0.018	8.01	8.01	261	0.02	
9/27/2002	139		857	857	0.002	0.03	1.3	179	0.005	8.05	8.05	258	0.02	
6/4/2003	130		757	1100	0.002	0.05	1.2	165	0.011	7.4	7.87	239	0.006	12.27
9/24/2003	117		764	763	0.142	31.4	2.8	152	5.24	7.72	7.64	239	5.17	12.25

P01-08B Original Impoundment, 25.6m														
	ALK-T	SPECIFIC COND	SPECIFIC CONDUCT(F)	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters
9/11/2001		935			0.002	25.5	23.2	32	0.008	6.9	7.21	342	0.742	13.05
9/5/2002					0.002	52.8	26.6	18	0.013				0.12	
9/5/2002	59			931	0.002	52.4	26	18	0.018		6.5	459	0.11	
9/27/2002	38		1210	1210	0.002	59	35.9	15	0.001	6.07	6.07	666	0.6	
6/4/2003	57		920	788	0.002	50.6	22.7	15	0.008	6.5	8.53	375	0.03	12.34
9/24/2003	68		897	801	0.521	189	28.9	14	26.4	6.92	7.23	376	26.5	12.34

P01-08C Original Impoundment, 29.7m														
	ALK-T	SPECIFIC COND	SPECIFIC CONDUCT(F)	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters
9/11/2001		972			0.005	35	28.4	15	-0.0005	6.7	6.34	482	0.73	13.48
9/5/2002	37			1210	-0.002	73.4	38.8	14	-0.001		6.16	724	0.6	
9/27/2002	64		890	890						6.63	6.63	410		
9/27/2002	81	900	900	900	-0.002	55	25.5	17	0.007	6.91	6.91	409	0.04	

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-09ASecond Impoundment(tailings) upstream 11.2m														
	ALK-T	SPECIFIC COND	SPECIFIC CONDUCT(F)	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters
9/11/2001		4710			0.02	11000	571	155	0.3	7.1	3.68	20000	658	5.95
6/13/2002	1			29900	0.5	22700	505	100	3	5.6	3.39	9580	3880	6.45
9/26/2002	1		31000	31000						3.2	3.2	55300		
9/26/2002	1		30000	30000	0.5	25900	501	50	0.5	3.27	3.27	54900	3500	
9/26/2002	1	30300	30300	30300	0.5	24900	497	50	0.6	3.34	3.34	56200	4070	
6/4/2003	1		35040	826	1	32200	571	200	0.5	5.9	7.32	56600	4210	6.06
9/24/2003	1		18100	35900	1	35900	633	100	1.6	5.9	3.34	77600	5520	5.95
9/25/2004	<1.0		34480	32100	<1.0	31600	472	<80	<1.0	5.64	3.17	62800	3380	6.66

P01-09B Second Impoundment upstream, 16.0m														
	ALK-T	SPECIFIC COND	SPECIFIC CONDUCT(F)	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters
9/11/2001		1220			-0.002	55.6	34.7	19	0.016	6.4	3.74	711	12.4	6.55
6/13/2002	7	1472		1130	-0.01	175	21.4	15	0.007	5.8	4.94	757	33.7	6.46
9/26/2002	7		1640	1640	-0.01	238	27.9	18	-0.005	5.27	5.27	1110	45.1	
6/4/2003	9		1506	1360	-0.01	231	20.5	16	-0.005	5.4	5.26	913	40.8	6.12
9/24/2003	9		1832	1910	-0.02	337	34.4	20	0.01	5.25	5.46	1390	58.5	6.37
9/25/2004	1.6		3926	4220	<0.050	1650	47.9	24.2	<0.050	5.37	3.86	3650	188	6.59

P01-09C Second Impoundment upstream, 21.2m														
	ALK-T	SPECIFIC COND	SPECIFIC CONDUCT(F)	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters
9/11/2001		1097			0.008	49.4	31.9	17	0.002	6.9	6.15	623	13.4	6.62
6/13/2002	18			793	0.01	52.8	18.7	9	0.005	4.2	6	440	27	6.5
9/26/2002	1		1010	1010	0.01	78.6	21.8	10	0.005	4.05	4.05	621	34.4	
6/5/2003	14		833	781	0.01	65.5	15.1	9	0.005	5.7	5.97	416	29.3	6.23
9/24/2003	9		1628	1590	0.02	231	29.7	11	0.02	5.5	5.67	1120	79.6	6.55
9/25/2004	<1.0		1532	1530	<0.0050	248	22.5	9.8	<0.0050	5.51	3.56	939	46	6.77

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-09D Second Impoundment, upstream, 27.9m														
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL
		COND	CONDUCT(F)											
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters
9/11/2001		1640			0.021	252	48.9	16	0.005	6	4.47	1180	43.7	6.95
6/13/2002	13			1220							5.62	884		
6/13/2002	10			1270	0.02	179	28.4	13	0.01	4.9	5.46	821	59.5	6.78
9/26/2002	1		1470	1470	0.01	127	33.7	18	0.005	4.5	4.5	950	26.1	
6/5/2003	7		1913	1840	0.05	437	36.9	13	0.03	5.5	5.51	1560	140	6.67
9/24/2003	11		1926	1950	0.02	320	42.2	18	0.01	5.41	5.6	1390	73.1	7.06
9/25/2004	<1.0		6910	9260	<0.10	4400	116	<20	<0.10	5.85	3.37	10500	753	7.5

P01-10AOriginal Impoundment(tailings)upstream14.9m																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/10/2001		1097			0.018	0.23	5.1	305	0.047	8	8.52	298	0.284	9.71	0.03	0.03
6/13/2002	244			1210	0.005	0.09	11.2	274	0.107		8.95	389	0.03		0.03	0.03
6/13/2002	244	1271		1200	0.005	0.14	11.4	281	0.099	9.5	9.03	402	0.03	9.71	0.03	0.03
9/27/2002	168		2260	2260	0.005	0.23	86.4	345	0.086	8.31	8.31	1060	0.04		0.03	0.01
9/27/2002	171		2200	2200	0.005	0.19	82.2	329	0.095	8.2	8.2	1030	0.05		0.03	0.01
6/4/2003	102		4055	3780	0.01	0.08	355	402	0.055	8.4	7.96	2460	0.016	9.52	0.03	0.005
9/25/2003	116		3701	3720	0.02	1.71	344	363	0.216	7.15	7.98	2380	0.58	9.23	0.03	0.005
9/25/2004	110		4530	4230	<0.010	0.238	471	308	<0.010	7.27	7.79	3070	0.0128	10.38	0.03	0.005

Summary of Time Series Data (2001 - 2004) for Selected Parameters in P01 Series Wells

P01-10B Original Impoundment, upstream, 21.2m																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
9/11/2001		643			0.001	4.19	11.8	54	0.0016	7.6	8.06	94	0.009	10.48	0.03	0.01
6/13/2002	273	668		632	0.002	4.5	12.5	51	0.001	6.4	7.83	116	0.01	10.38	0.03	0.01
9/27/2002	266		674	674	0.001	4.06	11.8	44	0.0005	7.85	7.85	97	0.005		0.03	0.005
6/4/2003	291		733	681	0.002	4.92	14	45	0.001	6.9	8.05	113	0.005	10.03	0.03	0.005
9/24/2003	236		781	712	0.006	25.7	22	47	0.131	7.02	7.84	168	0.404	10.07	0.03	0.005
6/17/2004	292		770	696	<0.0020	6.28	14.3	52.2	<0.0020	7.5	7.81	103	0.0186	10.246	0.03	0.005
9/25/2004	39.8		1457	1070	<0.0050	179	42.3	46.1	<0.0050	6.86	5.54	596	11	10.735	0.03	0.005

P01-11 toe of Cross Valley Dam N. side, 10.6m																
	ALK-T	SPECIFIC	SPECIFIC	COND-L	CU-D	FE-D	MG-D	NA-D	PB-D	PH-F	PH-L	SO4-T	ZN-D	SWL	Detection Limits	
		COND	CONDUCT(F)												Fe	Zn
DATE	mg/L	µS/cm	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	pH unit	pH unit	mg/L	mg/L	meters		
6/11/2002	175	1048		1180	0.002	1.59	33.7	36	0.001	6.9	7.91	573	0.01	0.65	0.03	0.01
9/23/2002	264		1600	1600	0.005	7.43	49.8	53	0.008	7.98	7.98	716	0.05		0.03	0.01
6/2/2003	268			1580	0.005	20.3	49.6	43	0.003		7.33	812	0.007		0.03	0.005
9/22/2003	274		1782	1770	0.005	20.9	52.6	45	0.003	7.16	7.86	862	0.005	0.07	0.03	0.005
6/8/2004	289			1830	0.005	24.8	60	47.9	0.005		7.76	862	0.005		0.03	0.005
9/27/2004	302		1947	1890	<0.0050	23.8	57.9	45.3	<0.0050	7.09	7.78	863	0.0069	0.665	0.03	0.005

Appendix E

Photographs from Down-Hole Camera

Well Location and Casing Joint Depth: P01-05B @ 2.5m

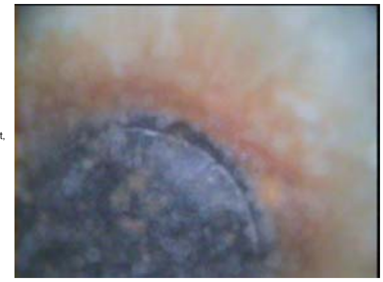
Field Observations:

Slight iron staining around joint, however relatively clean casing walls. Joint below water table.

Well Location and Casing Joint Depth: P01-05B @ 6.5m

Field Observations:

Iron staining above the joint, black staining below the joint. Joint below water table.



Well Location and Casing Joint Depth: P01-05B @ 9.5m

Field Observations:

Black staining below joint. Joint below water table.

Well Location and Casing Joint Depth: P01-05B @ 11.5m

Field Observations:

Not as black as other joints

Well Location and Casing Joint Depth: P01-05B @ 14.7m

Field Observations:

Black staining on screen

Well Location and Casing Joint Depth: P01-06

Field Obersvations:

Water fairly clear, no other obvious joints, iron staining

Well Location and Casing Joint Depth: P01-07C @ 2.6m

Well Location and Casing Joint Depth: P01-07C @ 5.5m

Field Observations:

Leakage apparent

Well Location and Casing Joint Depth: P01-07C @ 5.5(b)m

Well Location and Casing Joint Depth: P01-07C @ 11.5m

Field Observations:

Black staining below joint

Well Location and Casing Joint Depth: P01-07C @ 14.5m

Field Observations:

sides of tube very black, following 3 joints all resemble this one with black staining both above and below joint. Screen appears white with patchy black staining - murky image

Well Location and Casing Joint Depth: P01-07D @ 2.9m

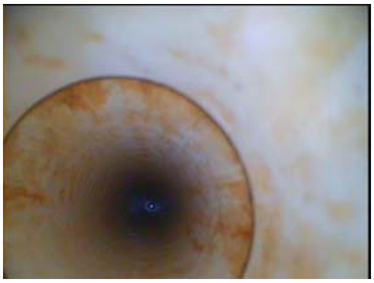
Field Observations:

Clean joint

Well Location and Casing Joint Depth: P01-07D @ 9m

Field Observations:

Splotchy iron staining along walls



Well Location and Casing Joint Depth: P01-07D @ 12m

Field Observations:

Black staining on lower side of joint

Well Location and Casing Joint Depth: P01-07D @ 15m

Field Observations:

Resembles something like a double joint,

Well Location and Casing Joint Depth: P01-07D @ 17.8m

Field Observations:

Zebra-like black and white striping on walls, another "double joint"

Well Location and Casing Joint Depth: P01-07D @ 20.6m

Field Observations:

Black walls with white stripes

Well Location and Casing Joint Depth: P01-07D @ 23.6m

Well Location and Casing Joint Depth: P01-07D @ 26.6m

Well Location and Casing Joint Depth: P01-07E @ 3m

Well Location and Casing Joint Depth: P01-07E @ 6m

Field Observations:

Iron stain running down drain

Well Location and Casing Joint Depth: P01-07E @ 12m

Well Location and Casing Joint Depth: P01-07E @ 15m

Well Location and Casing Joint Depth: P01-07E @ ~15m

Field Observations:

Air bubbles appeared from bottom of the well intermittently

Well Location and Casing Joint Depth: P01-10B @ 2.3m

Well Location and Casing Joint Depth: P01-10B @ 5.3m

Well Location and Casing Joint Depth: P01-10B @ 11.3m

Well Location and Casing Joint Depth: P01-101B @ 14.3m

Field Observations:

Black stain - leakage likely

Well Location and Casing Joint Depth: X21B-96 @ 3.3m

Well Location and Casing Joint Depth: X21B-96 @ 6.3m

Field Observations:

Some brown/iron colouring on sides

Well Location and Casing Joint Depth: X21B-96 @ 12.5m

Well Location and Casing Joint Depth: X21B-96 @ 13.9m

Field Observations;

well screen

Well Location and Casing Joint Depth: X21C-96 @ 0.5m

Well Location and Casing Joint Depth: X21C-96 @ 10.6m

Appendix F

Relevant Observations from May 2005

Gartner Lee Limited

memorandum

to: Valerie Chort (D&T)
from: Martin Guilbeault
date: May 30, 2005
ref: 40-692
re: **Follow-up Observations related to leakage assessment of P01 series wells and Other relevant Observations**

Gartner Lee Limited personnel were on site at the Faro mine from May 2nd to May 12th to perform the spring 2005 groundwater sampling. During this time, several wells were targeted for a more detailed visual investigation as discussed during a conference call between the GLL and the working group on April 12th. Wells which are discussed in this memo include P01-08A and P01-10B. In addition, some relevant observations were noted for wells X21C and P01-07C.

Well P01-08

The aim was to determine more specifically the condition of well P01-08A. It has been established that wells P01-08B and P01-08C should be decommissioned due to possible leakage effects. This is discussed in more detail in the "2004 Draft Leakage Assessment of P01 Series Wells" report. Some important observations regarding the condition of wells at location P01-08 were noted. These offer a plausible explanation to factors contributing to a compromise in well joint integrity and consequently possible leakage through well joints at some locations.

The current conditions of wells P01-08 as observed on May 11, 2005 were as follows:

P01-08A: There is no granular fill in the annular space between the well and protective steel casing. The well has two lengths of sampling tubing (one can be used while the other is stuck). The well does not appear to be frozen.

P01-08C: There is no granular fill in the annular space between the well and protective steel casing. Sampling tubing is stuck within the well.

P01-08B: The annular space between the well casing and the outer protective steel casing is filled with a granular material (likely sand). The PVC well casing is within a few inches of the top of steel casing. Sampling tubing is stuck in P01-08B. It is possible to move the sampling tubing up and down approximately 1 to 2 ft only before it gets stuck. It seems that perhaps the foot valve is catching on something (i.e. a cracked casing?) within the well.

Both the protective steel casing and the PVC well casing at P01-08B specifically is currently noticeably higher than the other wells at this location (P01-08A, P01-08C and one older well). It appears that the steel well casing may have heaved at this location and both the well casing and steel casing are tilted and held loosely in position (see attached photos). It is possible that tailings around the well might have settled somewhat since the well was installed. However, all three wells are located where tailings are higher than the surrounding area and appear to have heaved (see attached photos). Furthermore, there is evidence all over the tailings impoundment, more specifically in the original impoundment, of the effect of differential settling / heaving of tailings. The casings for wells P01-08A and C are not as high out of the ground. The steel casing at P01-08B, and consequently the PVC well casing can be moved back and forth manually. There is also a sampling tubing which is stuck (depth unknown) down the casing. As noted above, this tubing can be pulled up approximately 1 ft only before it jams.

The protective steel casing at P01-08B has also been filled with what appears to be silica sand or perhaps a mixture of sand and bentonite. This fill extends to within a few inches from the top of the PVC well casing (see attached photos). Furthermore, the PVC casing extends to within 5.5 cm from the top of the steel casing, suggesting that if the steel casing has indeed heaved up more than 5cm, it is likely that the PVC well has also heaved, resulting in stretching of the threaded well material and perhaps forcing apart of the joints. It is possible that friction between the fill in the casing and the well has acted to "sandlock" or anchor the well casing to the steel casing.

Relative Elevations of well casings at P01-08 (as of May 11, 2005).

In order to compare the current conditions at wells at P01-08, a rough survey of relative elevations of the wells was performed using a measuring tape and a level made by filling tubing with water and extending it between the wells to obtain a relative reference mark.

This information is summarized in table 1 along with well construction details available from the database. These should be verified to determine if they are from the original survey following well construction of if these values have been changed subsequent to other field measurements. Nevertheless, there appears to be a difference between both sets of values. These calculations suggest a net differential movement of the top of casing of approximately 10cm for P01-08B relative to both P01-08A and P01-08C. It is not possible to determine the net movement of these wells without a site survey relative to a known benchmark.

Also attached are photos of other older wells at the site not included in the routine sampling (depth, well ID, construction details not determined). These photos suggest that movement of tailings likely due to frost heave cycles appears to have shifted the steel casing and perhaps the well casings since the time they were installed.

<u>Well X21C</u>

As mentioned in the "Anvil Range Mine, 2004 Groundwater Sampling Field Summary Report (p.8)"it was observed in 2004 that there appeared to be tailings in well X21C during sampling. Field staff also noted that the sampling tubing needed to be replaced because the bottom few meters of tubing and the foot valve were clogged with what appeared to be tailings. The foot valve was brought back to the GLL office and the presence of tailings was confirmed. As recommended in the "Anvil Range Mine, 2004 Groundwater Sampling Field Summary Report (p.8)", it was conclusively determined on May 10th 2005 during routine sampling that well X21C does contain significant amounts of tailings material. Purge water from this well was immediately dark grey and remained extremely turbid with tailings during the entire purging process. Tailings material (dark grey with metallic appearance) settled to the bottom of the purge bucket. Wells at location X21 are installed in the same borehole in a cluster of three wells. The annular space between the wells and steel casing is filled with what appears to be granular material (see attached photos). Wells X21 B and C are standard 2" diameter monitoring wells while X21A is a smaller 1" diameter well. The current wells details were noted and are included in table 1. ***The presence of tailings in well X21C (not screened in tailings) has been confirmed and therefore decommissioning should be considered.***

Well P01-07C

The presence of tailings in well P01-07C (not screened in tailings) has been confirmed and therefore it should be decommissioned.

P01-10B

As a follow up to leakage assessment work performed in 2004 and as suggested by the working group after review of the draft report, well P01-10B, more information was collected from well P01-10B. Specifically, this included determining whether or not there were tailings in the well during sampling as reported by Environment Canada (EC) following review of the draft report. EC noted the presence of tailings in well P01-10B (not screened within the tailings) during sampling on May 12, 2004. EC further noted that significant amount of tailings remained in the purge water following purging of approximately 78L (three well volumes). GLL sampled this well on May 11, 2005. The well was purged by agitating a foot valve at the bottom of the well and attempting to retrieve material from the bottom of the well. The bottom 5m of tubing clogged with what appeared to be a mixture of fine sand and tailings (see attached photo). New tubing was then used to complete purging and collect a sample. Tailings were evident in the bottom of the purge bucket (which was cleaned prior to start of purging), especially after the dark grey sediments were allowed to dry. ***The presence of tailings in well P01-10B (not screened in tailings) has been confirmed and therefore it should be decommissioned.***

Recommendations:

- do a relative survey where possible of the elevation of different wells within a cluster. These might include:
  P01-09 (A,B,C/D) P01-07 (A, B, C, D/E) P01-08 (A, B, C) (done) P01-10 (A, B)

- A more complete site survey for the elevation of all wells should be done to determine current conditions.

- do a site reconnaissance of all wells to identify all old wells which should also potentially be decommissioned

- consider decommissioning older wells that are no longer in use throughout the site, specifically on the tailings impoundment

- review current elevation data (survey data) to find old coordinates, some might have been changed due to the fact that the wells are sometimes surveyed (stickup measured) when the wells are sampled (also the total depth is measured)

- obtain photographs of the wells and installation if they are available to piece together a visual historical record

- Well P01-10B was noted to have tailings in it and should be decommissioned.

- well X21C should be considered for decommissioning due to the presence of significant amount of tailings in the well.

I trust that this information and the observations noted herein will be useful for your future plans at the site. This memo will be appended to the final leakage assessment report as it contains information that pertains directly to P01 series wells.

Please do not hesitate to contact me at 867-633-6474 ext. 24 should you have any questions.

Regards,
(via e-mail)

Martin Guilbeault, M.Sc, P.Eng
Hydrogeologist

Table 1. Faro Mine, relative site well survey data of wells at P01-08 and X21

	current data from EQwin database				as measured on May 11, 2005			
Well ID	**elevation of ground (m)**	**Well stickup (m) ***	**elevation of t.o.c. (m) ****	**relative t.o.c. elevation (m) *****	**stickup of steel casing (m) ***	**stickup of well casing (m)**	**stickup of steel casing (above well) (m)**	**relative well toc elevation *******
P01-08A	1063.70	0.39	1064.09	0.00	0.59	0.435	0.155	0
P01-08B	1063.74	0.76	1064.49	**0.41**	1.03	0.975	0.055	**0.525**
P01-08C	1063.75	0.67	1064.42	0.33	0.74	0.675	0.065	0.34
X21A	1051.40	0.69	1052.09	0.00	0.79	0.625	0.165	0
X21B	1051.40	0.74	1052.14	0.05	0.79	0.675	0.115	0.05
X21C	1051.40	0.81	1052.21	0.12	0.79	0.765	0.025	0.14

* from ground surface to top of well casing

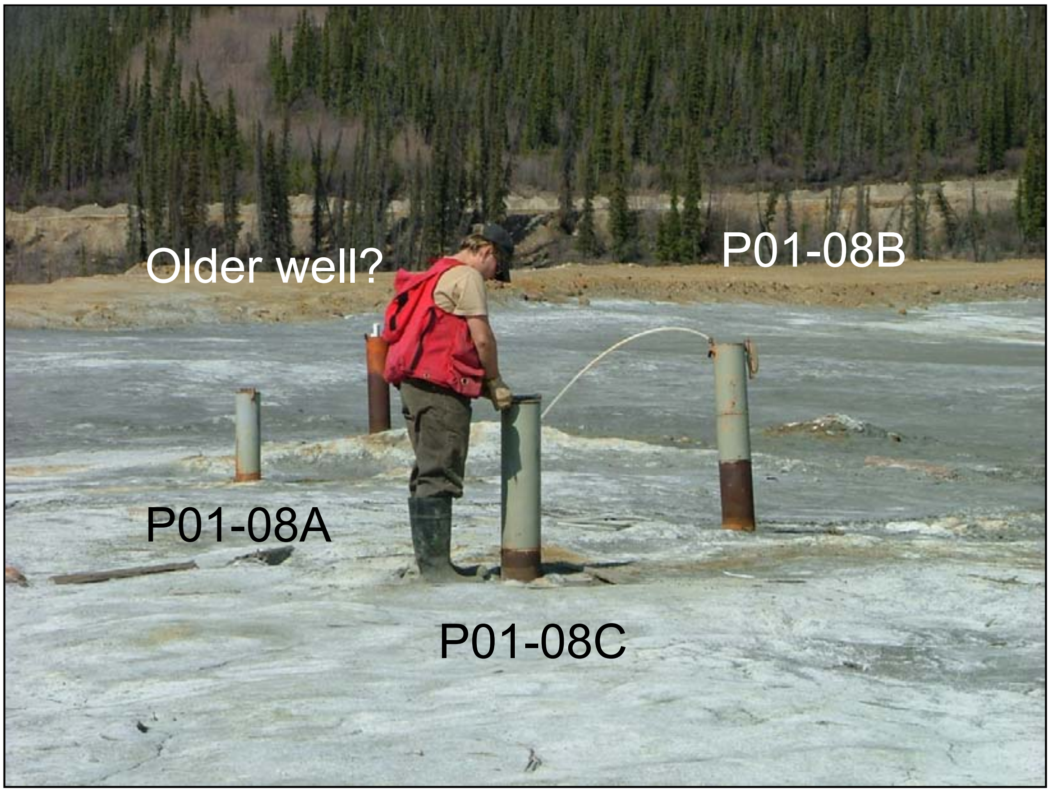
** calculated from ground and stickup

*** assuming P01-08A or X21A as "zero" reference

**** actual values as measured on May 11, 2005

Tailings from well P01-10B

Well P01-08B (well casing appears to have heaved and is loose)



Well cluster P01-08 in area of higher tailings

Well P01-08B (annular space filled with sand and sampling tubing stuck in well.)

Old wells near P01-07. Casing and/or well appear to have heaved.

Well Cluster X21. Annular space is filled with sand