2007 ANNUAL REPORT

GROUNDWATER EXTRACTION SYSTEM AND GROUNDWATER MONITORING DATA EVALUATION

Simplot Plant Area

Eastern Michaud Flats Superfund Site

24 March 2008

NEWFIELDS

2500 55th Street, Suite 200
Boulder, CO 80301

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EXECUTIVE SUMMARY

This report provides an evaluation of the test groundwater extraction system operation and of groundwater data collected in 2007 in, and downgradient of, the Simplot Plant Area of the Eastern Michaud Flats Superfund Site.

The groundwater extraction system is being designed and implemented in accordance with a Remedial Design/Remedial Action Consent Decree (EPA, 2002). This is occurring in a phased approach that includes the operation of a test groundwater extraction system to provide data to support design of the final system, scheduled to be submitted in 2008. The test extraction system was initially started up in June 2004 and was fully functional by October 2004. Ongoing groundwater monitoring, performed in quarterly events in February/March, May, July/August and November/December 2007, provides data to assess effects of the test extraction system on downgradient groundwater conditions. Field work to fill remaining data gaps necessary to support final design of the groundwater extraction system is ongoing. This “Phase 2” work included installation of additional test extraction wells that were brought online in January 2008.

The test extraction system was operated throughout the year. It was shut down for approximately three weeks in late May/early June when the entire Don Plant facility was taken offline for routine maintenance (“turnaround”). Performance of individual wells was generally consistent with previous years and degradation of well performance was not observed. It is estimated that the test extraction system, along with the facility production well SWP-4, removed approximately 27 percent of the arsenic mass flux in groundwater downgradient of the source areas. The system is also estimated to have removed an average of 1,000 pounds per day of Orthophosphate (as Total Phosphorus) in 2007.

Groundwater from the test extraction system is used as makeup water in the Phosphoric Acid Plant portion of the Don Plant. The Don Plant water balance is complex and is integral to successful facility operation. Flows are continuously measured at key points within the process as part of routine operation. Flows from the test extraction system are relatively small compared to other inputs; 270 gallons per minute from the extraction system on average in 2007 compared to approximately 4,000 gallons per minute from the facility production wells. Since 2002, the average flow from the extraction wells has increased from less than fifty to the range of 300 gallons per minute. A corresponding decrease in fresh water consumption in the Phosphoric Acid Plant has occurred. This is expected because addition of test extraction groundwater to the reclaim cooling system has reduced the demand for fresh water input. The overall water flow to the gypsum stack has not been affected.

Assessment of groundwater data collected and other evaluations performed in 2007 identified the following key conclusions:

- o Constituent concentrations in East Plant Lower Zone groundwater downgradient of the test extraction system decreased significantly in 2005 and remained at those levels in 2006 and 2007. This appears to be a direct effect of the extraction system. Arsenic, Sulfate and Orthophosphate (as Total Phosphorus) concentrations all decreased in a similar manner. This provides evidence that phosphorus desorption/dissolution effects are not significant and that Orthophosphate (as Total Phosphorus) concentrations in groundwater will decline on a similar timeframe as Arsenic concentrations downgradient of the extraction system.

- o A source, or sources, of Arsenic and Orthophosphate (as Total Phosphorus) to Upper Zone groundwater is present in the Phosphoric Acid Plant area. A detailed evaluation is ongoing including weekly sampling of key groundwater wells and an aggressive source identification/control program. The key findings are:

  - o In the past, secondary containment structures have occasionally become compromised, allowing liquid process materials from the Phosphoric Acid Plant to escape and migrate into the subsurface. Routine inspection and maintenance of in-plant production areas allow such problems to be located and mitigated rapidly.

  - o Constituent concentrations in the Upper Zone groundwater have been elevated as a result of Phosphoric Acid Plant releases. The Upper Zone has a relatively thin saturated thickness, high hydraulic conductivity and reacts quickly to source inputs.

  - o Impacts are limited to Upper Zone groundwater. Downward migration is limited by presence of the American Falls Lake Bed (ALFB). Beyond AFLB, upward gradient keeps migration in groundwater in the upper portion of the saturated zone as transport proceeds to the river.

  - o Down gradient data indicate that the mass in the release is not sufficient to result in large increases in groundwater concentrations

  - o Once sources are controlled, concentrations reduce to levels consistent with gypsum stack impacts. Secondary sources (i.e., desorption/dissolution of phosphorus from aquifer solids) are not significant.

The Central Plant Area is being investigated as part of the Phase 2 Data Gap investigation. In addition, Simplot has implemented an aggressive inspection/maintenance program to address potential current and future source areas. Existing information indicates that the best action for the elevated concentrations of plant affected groundwater in the Central Plant Area is to control sources within and around the Phosphoric Acid Plant. The findings of this program, along with Phase 2 field data, will be used to support the decision of whether additional groundwater extraction wells are appropriate for this area. This evaluation will be documented in detail in the draft Final Groundwater Extraction System Remedial Design Report, to be submitted in 2008.

- Constituent concentrations in Batiste Spring and the Spring at Batiste were variable in 2007. Arsenic concentrations generally increased in the Spring at Batiste Road (0.006 mg/L in the first quarter, 0.020 mg/L in the fourth quarter) and decreased at Batiste Spring (0.03 mg/L to 0.016 mg/L from first to fourth quarters). This likely reflects small changes in the location of the plume caused by regional groundwater/surface water effects. Orthophosphate (as Total Phosphorus) concentrations showed the same trends.

- Constituent concentrations in Central Plant Lower Zone groundwater downgradient of production well SWP-4 are at or near regional groundwater levels, indicating that SWP-4 effectively captures all gypsum stack-affected groundwater in the area.

- Concentrations of constituents in West Plant groundwater in the target extraction areas have been relatively stable. Overall the estimated mass flux of constituents in the West Plant Area are considerably lower than the East Plant Area.

The evaluations provided in this report will be expanded and integrated with other Site data (including the findings of the ongoing Phase 2 fieldwork, the quarterly monitoring program and a geophysical study north of Highway 30 [currently being designed]) to support final design of the groundwater extraction system and the associated groundwater monitoring program. The draft final design report is scheduled to be submitted in 2008.

1.0 INTRODUCTION

This report provides an evaluation of the 2007 test groundwater extraction system operation in the Simplot Plant Area of the Eastern Michaud Flats (EMF) Superfund Site (Figure 1-1) and associated groundwater monitoring data. The EMF Site is located near Pocatello, Idaho and is been divided into three areas in the Record of Decision (ROD; EPA, 1998):

- The **FMC Plant Area** includes the FMC Elemental Phosphorus Facility (which ceased operations in December 2001) and contiguous land owned by FMC;
- The **Simplot Plant Area** includes the J.R. Simplot Don Plant, which produces phosphoric acid and a variety of liquid and solid fertilizers, and contiguous land owned by Simplot; and
- The **Offplant Area** surrounds the FMC and Simplot Plant Areas.

The Don Plant began production of a single superphosphate fertilizer in 1944. Phosphoric acid production began in 1954. The plant currently produces a variety of solid and liquid phosphorus- and nitrogen-based fertilizers. The principal raw material for the process is phosphate ore, which is conveyed to the facility via a slurry pipeline from the Smoky Canyon mine, near Afton, Wyoming. The primary byproduct from the Don Plant process is gypsum (calcium sulfate), which is stacked on site (the gypsum stack).

The Simplot Don Plant covers approximately 745 acres and adjoins the eastern property boundary of the FMC facility. The main portion of the plant lies approximately 500 feet southwest of the Portneuf River. Of the 745 acres, approximately 400 acres are committed to the gypsum stack. Another 185 acres are occupied by the plant and its infrastructure. The remaining acreage to the south and southeast of the plant consists of cliffs and rugged steep terrain.

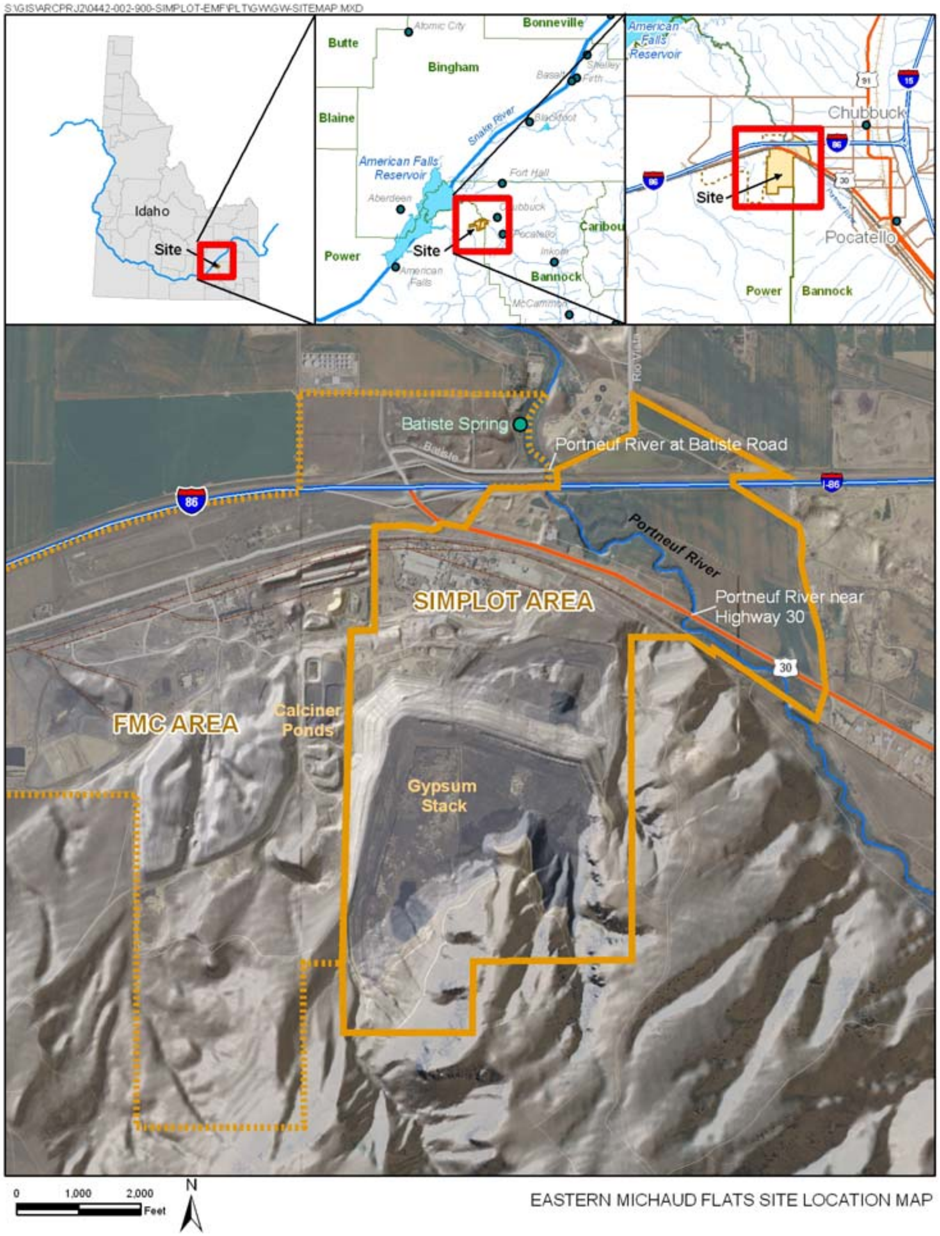

Figure 1-1: Site Location Map

The groundwater extraction system is being designed and implemented in accordance with a Remedial Design/Remedial Action Consent Decree (EPA 2002). This is occurring in a phased approach that includes the operation of a test groundwater extraction system to provide data to support design of the final system.

The test extraction system consists of a network of extraction wells near the northern and northwestern edge of the gypsum stack. The wells have been located to intercept Upper Zone and Lower Zone groundwater affected by gypsum stack seepage as it flows north from beneath the stack to the Don Plant facility area, where it mixes with groundwater inflow from the Michaud

Gravels and ultimately discharges to the Portneuf River. The test extraction well network that was operational in 2007 is divided into three groups: the West Plant Area, the East Plant Area Upper Zone, and the East Plant Area Lower Zone. The West Plant Area contains extraction wells 401 and 402. The East Plant Area Upper Zone contains extraction wells 404 through 409. The East Plant Area Lower Zone contains extraction wells 410 and 411. Additional test extraction wells were installed as part of the ongoing Phase 2 field work (NewFields 2006b) during 2007 and were brought online in January 2008. Figure 1-2 presents the location of the test extraction system wells and the Phase 2 wells.

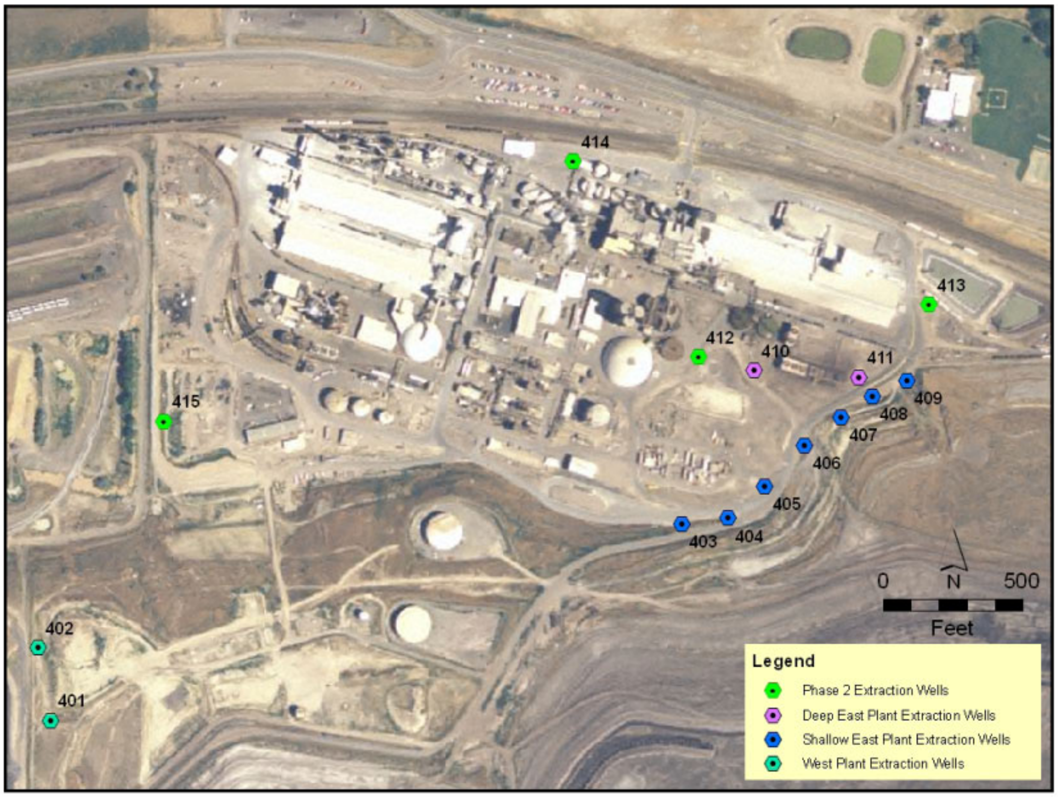

Figure 1-2: Extraction Well Locations

The test extraction system began routine operation in June 2004, when wells 401, 402, 410 and 411 were brought on line. The East Plant Upper Zone wells (404 through 409) were brought on line from August through October 2004, as operational difficulties related to lower-than-expected extraction flows were resolved. Details of the startup and initial operation and effect of the system were provided in the 2004, 2005 and 2006 annual reports (MFG 2005, NewFields 2006a, 2007a). Groundwater monitoring has been performed on a routine basis since the Remedial Investigation began in 1992. Quarterly monitoring to support remedial design/remedial action began in August 2003 when a baseline sampling event was performed to characterize conditions prior to the operation of the extraction system. In 2007, monitoring was performed in February/March, May, July/August and November/December.

Data related to the extraction test system operation and to groundwater monitoring in 2007 have been provided previously in a variety of reports:

- Groundwater extraction flows, operation data and maintenance activities have been documented in weekly and monthly reports provided via e-mail;

- Groundwater extraction system operational summaries have been provided in four quarterly reports (NewFields 2007b, c, d, and 2008a); and

- Groundwater monitoring data have been provided in four quarterly reports (NewFields 2007e, f, g, and 2008b).

This document provides more detailed analyses of the extraction system operation and groundwater data, including an assessment of the effects of extraction on downgradient groundwater chemistry and other data trends. The analyses, along with the findings of the ongoing Phase 2 field work, will support final design of the extraction system, scheduled for submittal in 2008.

Information on the test groundwater extraction system operation in 2007 is provided in Section 2. An evaluation of water flows within the Don Plant process and effects of the addition of extraction water flows is described in Section 3. Section 4 provides an assessment of groundwater monitoring data.

2.0 TEST GROUNDWATER EXTRACTION SYSTEM OPERATION

This section provides a summary of the operation of the test extraction system, including overall performance and constituent mass removal, maintenance and individual well performance.

2.1 Well Operation Summary

The test extraction system was operated throughout the year. The system was shut down from May 29 to June 19 when the facility was taken offline for routine maintenance (plant "turnaround").

A summary of the operation of the extraction wells, including percent time online and extraction rates during the 2007 for each well is presented in Table 2-1.

Table 2-1: Extraction Well 2007 Operation Summary

Extraction Well	Time Well Online (%)[1]	Operating Extraction Rate (gpm)[1]	
		Maximum	Average
West Plant Area			
401	81.9	57.5	31.0
402	77.6	52.2	25.7
East Plant Area – Upper Zone			
404	99.9	3.6	2.1
405	99.7	8.7	5.2
406	97.4	25.1	16.5
407	99.9	8.5	7.2
408	83.1	1.5	0.6
409	100	8.5	5.6
East Plant Area – Lower Zone			
410	99.8	141.8	99.8
411	97.5	100.3	76.3
		Total:	270

[1]*Excludes the shut-down time due to the Don Plant turnaround.*

All extraction wells except wells 401, 402 and 408 were in operation at least 95 percent of the year (excluding the down time from the Don Plant turnaround). Down time at wells 401 and 402 is attributed to Plant maintenance on the discharge piping and East Decant Ponds where 401 and 402 directly discharge. Well 408 continues to have an overall decreasing water level within the well resulting in numerous low water level alarms and the well going off line.

A summary of the removal of key constituents by the extraction system is provided in Table 2-2.

Table 2-2: Mass Removal Summary, Test Extraction System

Extraction Well	Average Operating Extraction Rate (gpm)[1]	2007 Mass Removal (lb/day)[2]		
		Arsenic	Orthophosphate (as Total Phosphorus)	Sulfate
West Plant Area				
401	31.0	0.149	46	862
402	25.7	0.111	33	716
Subtotal		0.26	79	1,578
East Plant Area – Upper Zone				
404	2.1	0.010	4	65
405	5.2	0.023	29	200
406	16.5	0.064	119	578
407	7.2	0.028	43	250
408	0.6	0.002	3	20
409	5.6	0.023	27	191
Subtotal		0.15	225	1,304
East Plant Area – Lower Zone				
410	99.8	0.429	366	3,305
411	76.3	0.277	335	2,451
Subtotal		0.71	702	5,756
TOTAL	**270**	**1.12**	**1,006**	**8,638**

[1] *Excludes the shut-down time due to the Don Plant turnaround.*

[2] *Calculated using the flow volume discharged each quarter multiplied by that quarter's sampling results.*

Mass was also removed by facility production well SWP-4. Based on the average quarterly flow rate and the measured concentrations each quarter, it is estimated that SWP-4 removed 0.55 pounds of Arsenic per day from the groundwater system on average. The resulting total removal of arsenic (test extraction system and SWP-4) is 1.67 pounds per day. The current estimate of the mass flux of arsenic in groundwater downgradient of the gypsum stack and Phosphoric Acid Plant is 6.3 pounds per day (NewFields 2005). Therefore, it is estimated that approximately 27 percent of the Arsenic mass in groundwater from Simplot sources was removed by extraction in 2007.

2.2 Well Maintenance Summary

2.2.1 West Plant Extraction Wells

The West Plant extraction wells (Wells 401 and 402) were operated without significant problems in the first and fourth quarters of 2007. Both wells were shut down in early May to allow plant personnel to reroute and modify the existing discharge pipes to accommodate the needed discharge pipes for extraction wells that were installed as part of Phase 2 field activities during the third and fourth quarters. Once the pipe maintenance and plant turnaround where completed the wells were brought back online. The wells were, again, taken offline at the end of June, and remained off until September 17th, for maintenance being performed at the East Decant Ponds where the wells directly discharge. Well 402 had maintenance performed on the water level indicator in late October and once the problem was corrected the well functioned without incident for the remainder of the year.

2.2.2 East Plant Upper Zone Extraction Wells

Most of the East Plant Upper Zone extraction wells (Wells 404 through 409) were operated without significant problems in 2007. All wells were offline during several general power failures once in March and twice in April, 12 hours each time and during plant shutdown for maintenance in May and June for turnaround. Wells 406 and 408 experienced the most maintenance issues.

Well 406 experienced a several shut downs early in the year caused by low level alarms. The shut downs were brief and by the end of the first quarter the number of low level alarms decreased.

Well 408 was down a number of times because of low level alarms. These alarms are caused by an overall decreasing water level within the well. As a result the well would pump for a period of time until the water level got low enough that the pump had to be shut down to prevent damage to the pump. Once the water level was allowed to recover the well resumed pumping.

2.2.3 East Plant Lower Zone Extraction Wells

The East Plant Lower Zone extraction wells operated more than 97 percent of the time during 2007 (Table 2-1). The brief well shut downs were mostly due to power outages and routine maintenance. Both wells operated with no major mechanical problems in 2007.

2.3 Well Performance Summary

Flow and water level data are collected continuously for each extraction well. Flow rates are measured with electromagnetic flow meters (manufactured by Krohne). In all the East Plant Upper Zone extraction wells, the water levels are measured with admittance-to-current transducers, otherwise known as capacitance probes (manufactured by Drexelbrook). The Drexelbrook level indicators are configured to provide only a relative reading of water level in the well and are primarily used to control pumping rate. In Wells 401, 402, 410, and 411 the Drexelbrook water level indicators were switched to pressure transducers (manufactured by InSitu) in August 2006. The InSitu level indicators provide more reliable pump control and may provide more accurate water level indication. All of the well pumps are fitted with a variable frequency drive (VFD) which allows the speed of the pump motor to be varied to regulate flow rate. The flow and water level data have been examined and an assessment of the performance of each well has been made, as described in the following subsections.

Additional well testing and optimization will be performed as part of the Phase 2 field work in April 2008.

2.3.1 West Plant Extraction Wells

2.3.1.1 Well 401

Well 401 maintained a consistent pumping range from about 45 to 50 gpm when in operation from January to July. Some difficulty was experienced controlling the pumping rate in January and February due to low-level alarm shut downs caused by a faulty low level control. The level control unit was replaced in early March. From September until the end of the year the flow rate was maintained just under 45 to 50 gpm with the pump operating at a consistent speed and maintaining a consistent water level (see Figure 2-1). Based on this information, there was no apparent degradation in the performance of this well in 2007.

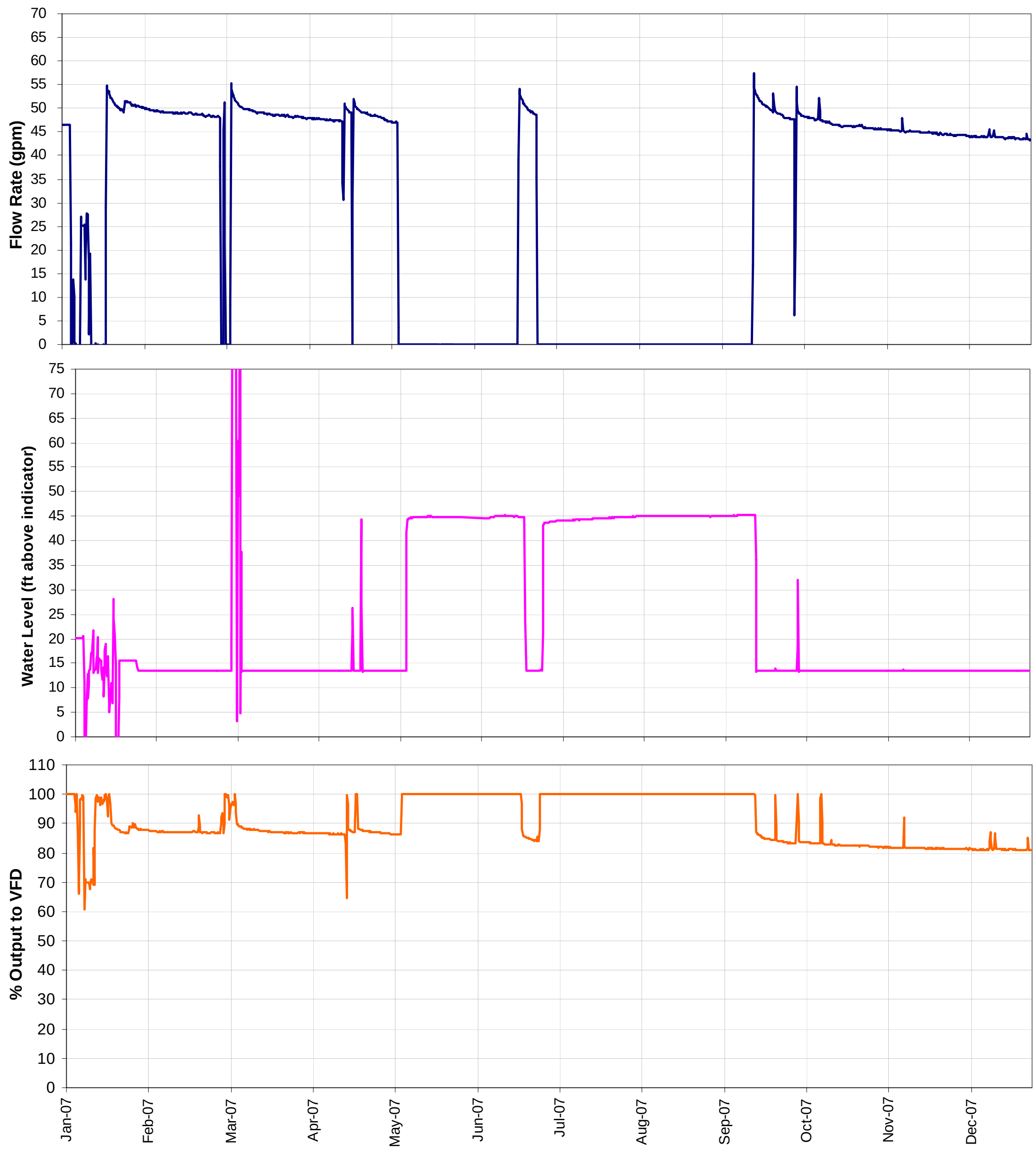

Figure 2-1: Well 401 Flow Rate, Water Level, and Relative Pump Speed

2.3.1.2 Well 402

Early in the year Well 402 was shut down for brief periods of time due to low level alarms. The low level indicator was replaced in late October. Well 402 maintained a pumping rate of about 20 gpm throughout the rest of the year with the pump operating at a consistent speed and maintaining a consistent water level (see Figure 2-2). Based on this information, there is no apparent degradation in the performance of this well in 2007.

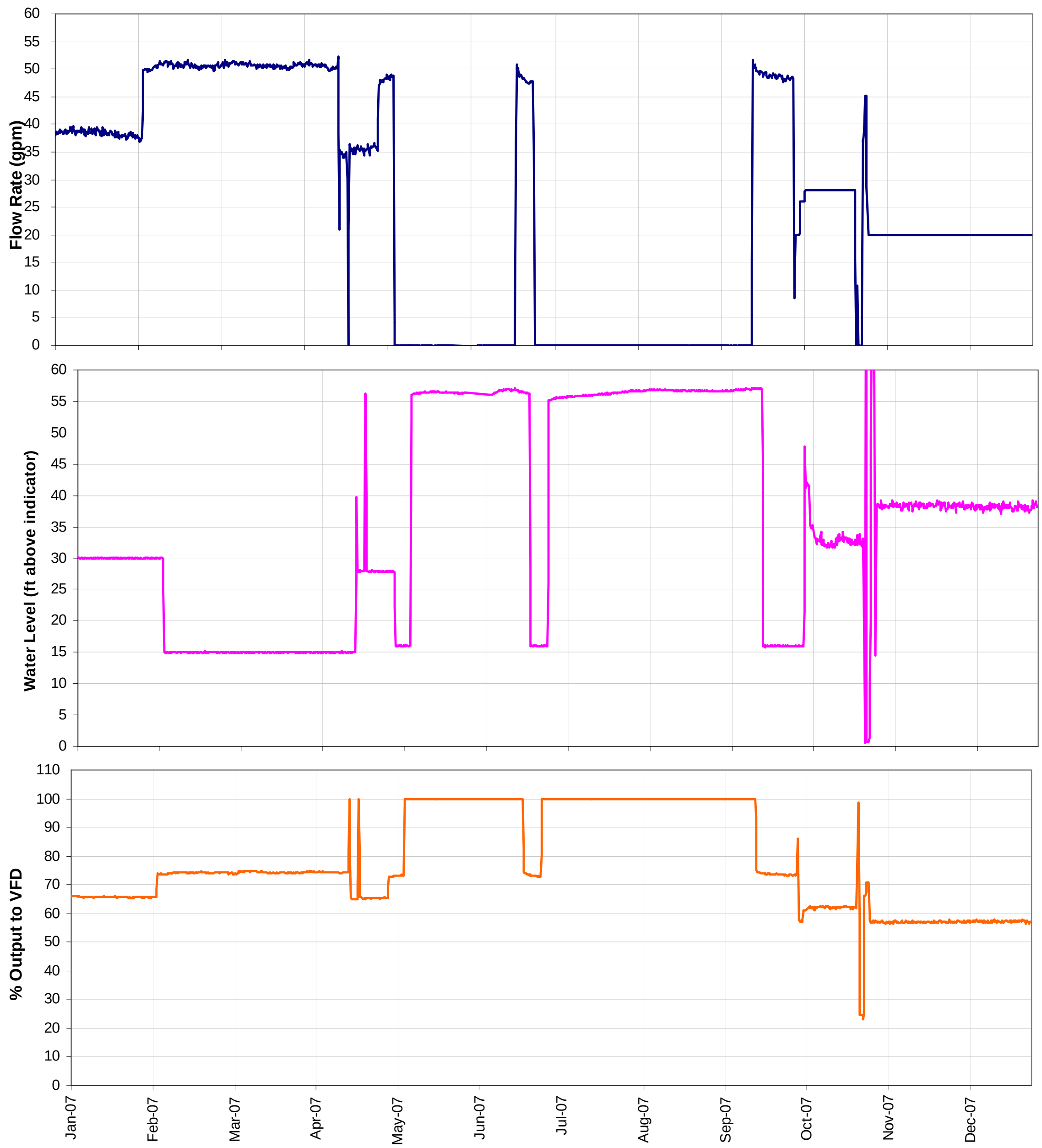

Figure 2-2: Well 402 Flow Rate, Water Level, and Relative Pump Speed

2.3.2 East Plant Upper Zone Extraction Wells

The following sub-sections provide details on the operation and performance for each well in the East Plant Area (upper zone).

2.3.2.1 Well 404

Well 404 maintained a consistent pumping rate of about 1.5 to 3 gpm throughout the year (see Figure 2-3). Based on this information, there was no apparent degradation in the performance of this well in 2007.

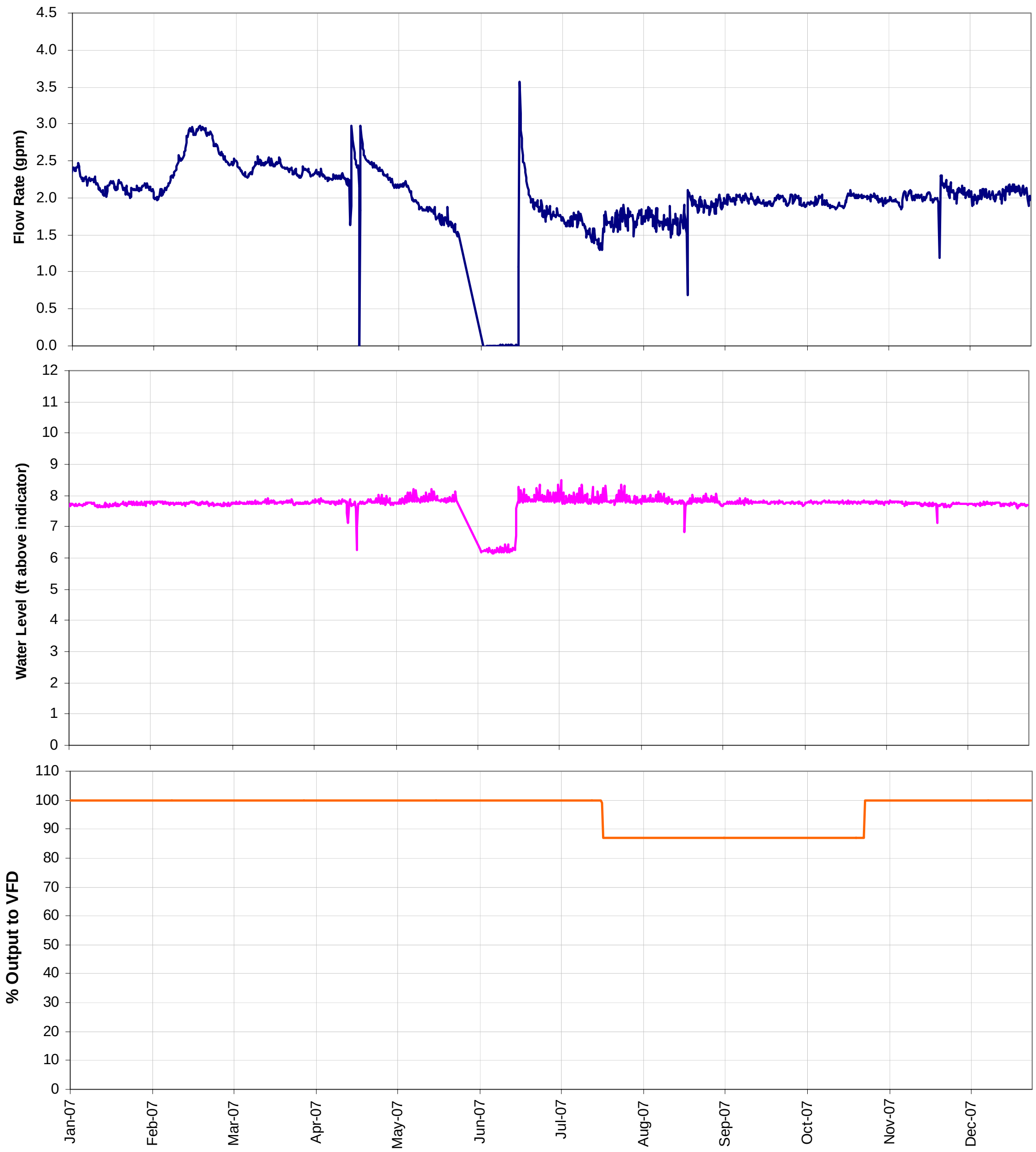

Figure 2-3: Well 404 Flow Rate, Water Level, and Relative Pump Speed

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2.3.2.2 Well 405

Level readings from Well 405 are in error from January until the signal was repaired on February 13. After this time, the flow rate was maintained at from 3 to 7 gpm until the end of the year with the pump operating at a consistent speed and maintaining a consistent water level (see Figure 2-4). Based on this information, there was no apparent degradation in the performance of this well in 2007.

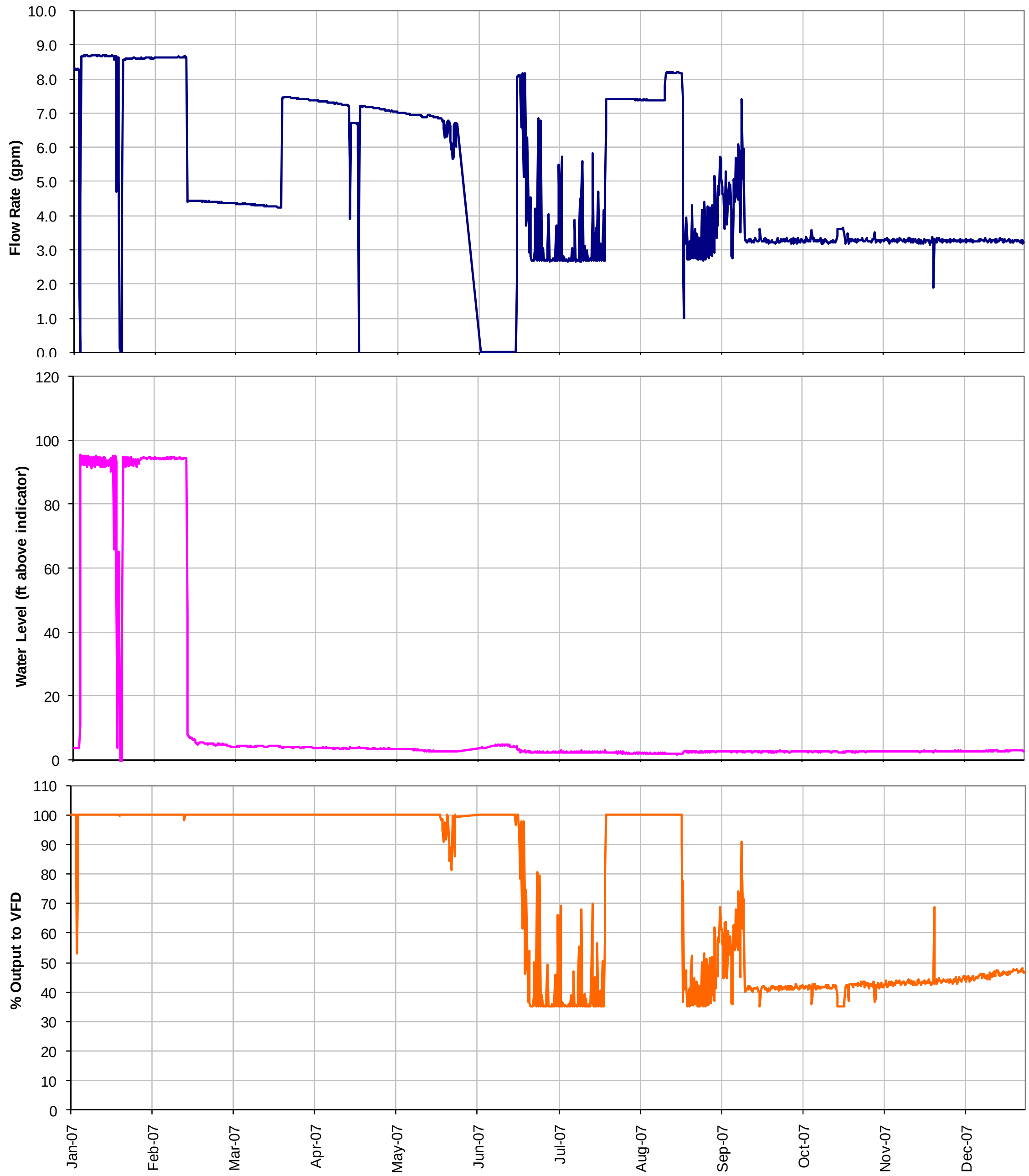


Figure 2-4: Well 405 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.3 Well 406

Well 406 was operated at a flow rate from 18 to 24 gpm until turnaround. After turnaround the rate was consistent from 18 to 20 gpm until late November. After routine maintenance the well resumed pumping from 9 to 12 gpm until the end of the year (see Figure 2-5). Based on this information, there was no apparent degradation in the performance of this well in 2007.

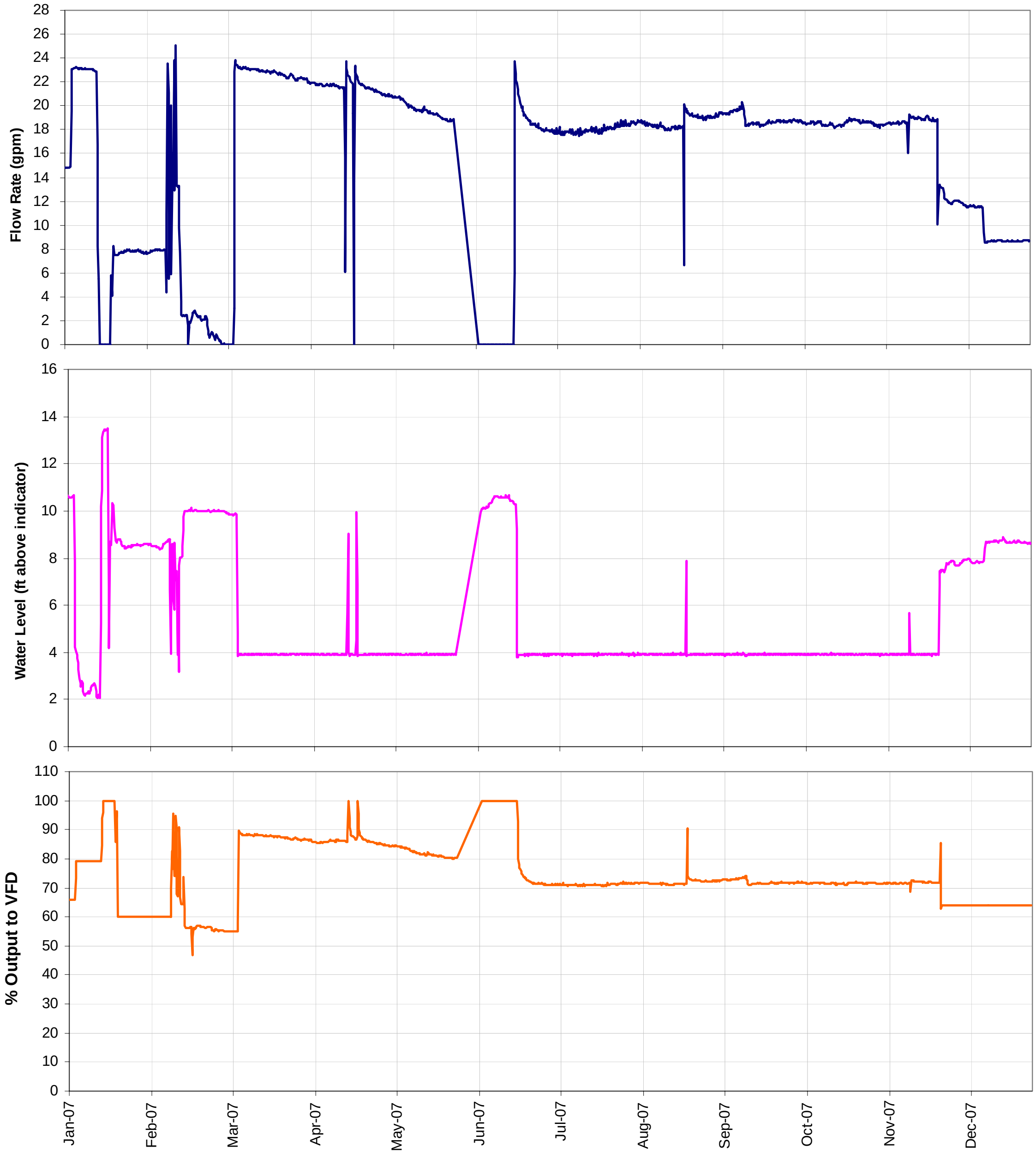


Figure 2-5: Well 406 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.4 Well 407

Well 407 maintained a pumping rate of about 8 gpm throughout the majority of the year (see Figure 2-6). Routine maintenance resulted in lower temporary flows. Based on this information, there was no apparent degradation in the performance of this well in 2007.

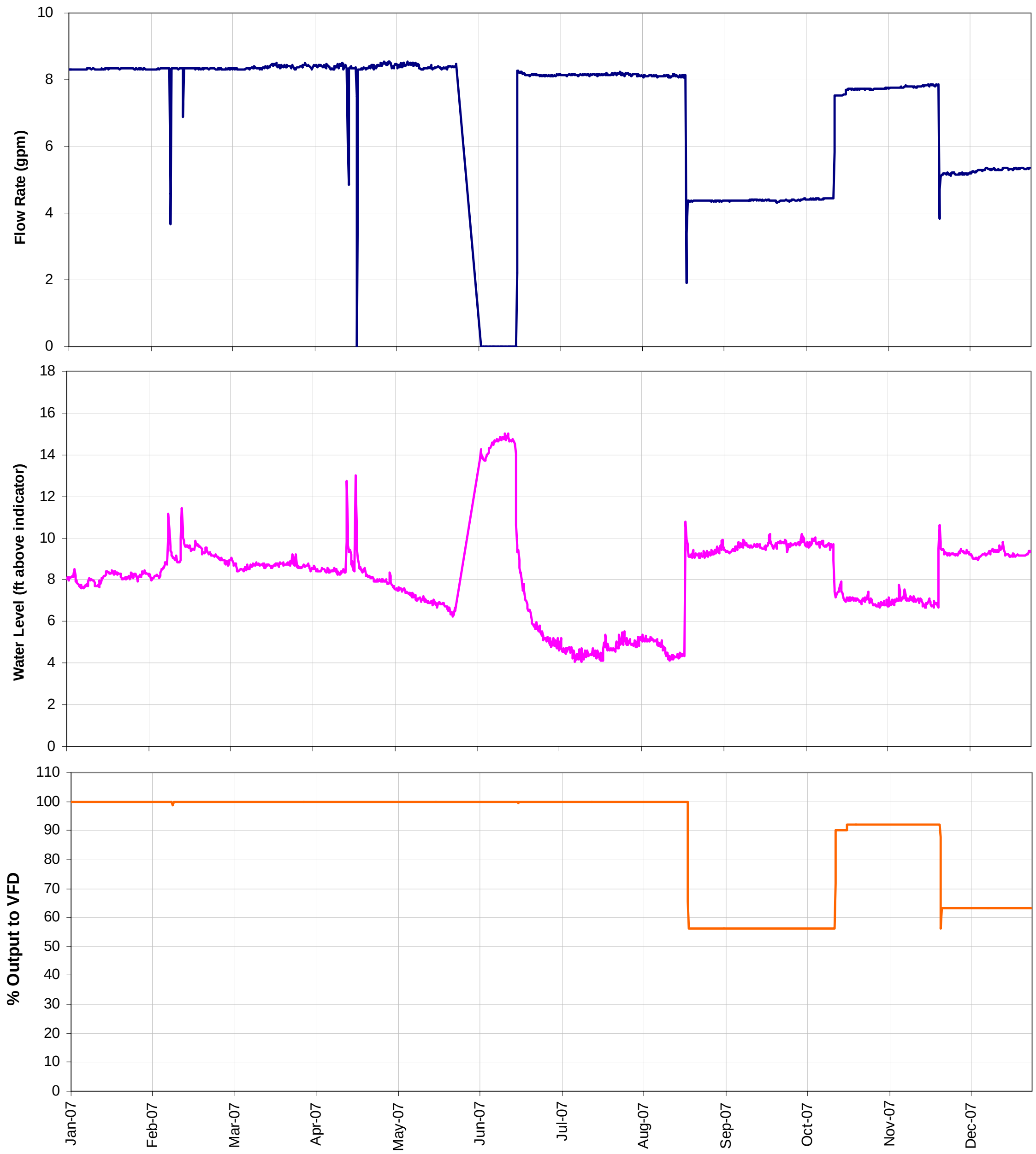


Figure 2-6: Well 407 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.5 Well 408

Well 408 was operated at pumping rates typically from 0.5 to 1 gpm throughout most of the year (see Figure 2-7). A large amount of drawdown is obtained pumping the well at low flow rates. In the later part of the year pumping could not be sustained. The performance of this well will be evaluated during the Phase 2 well performance tests.

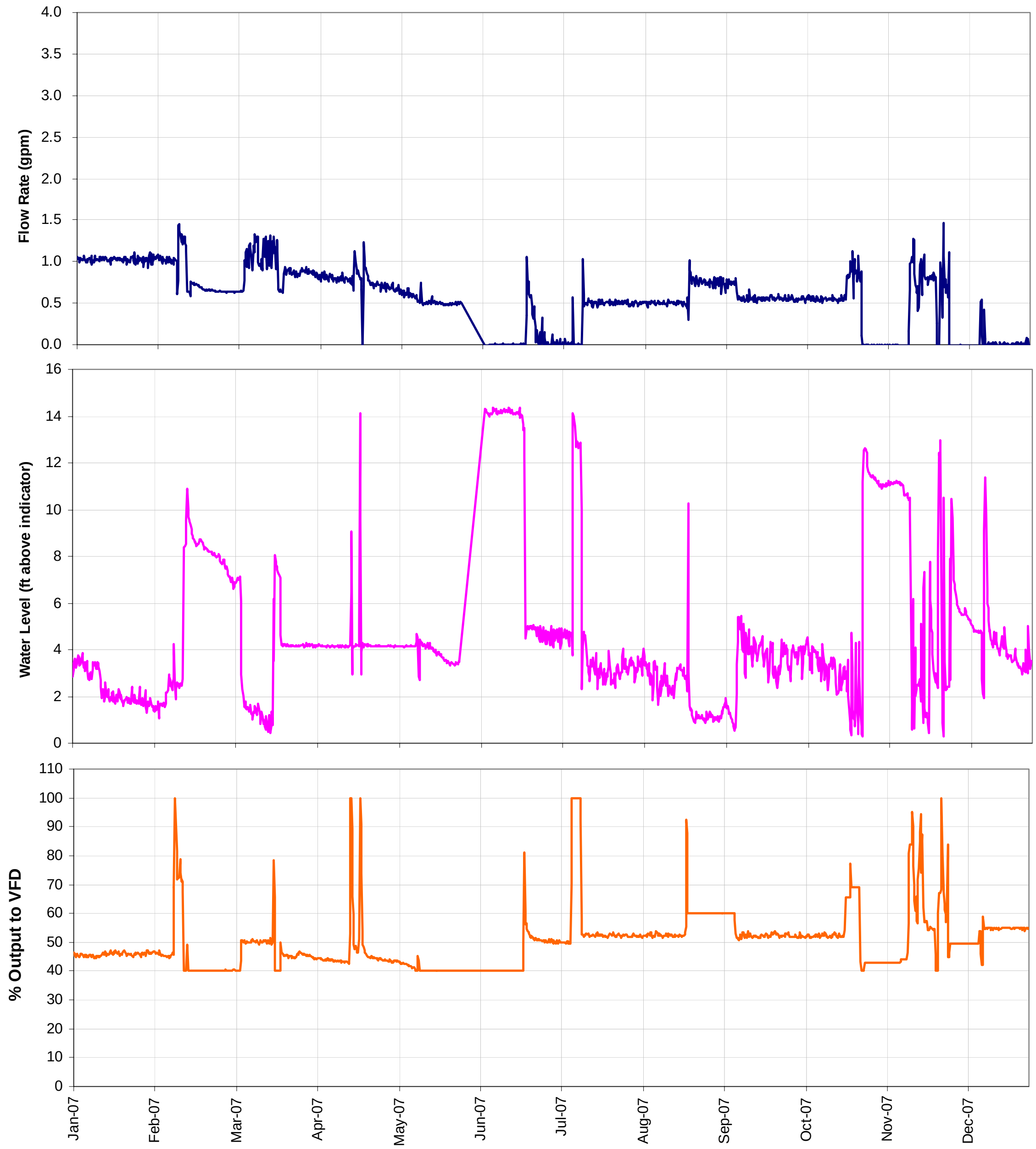


Figure 2-7: Well 408 Flow Rate, Water Level, and Relative Pump Speed

2.3.2.6 Well 409

Well 409 maintained a consistent pumping rate of about 5 to 8 gpm throughout the majority of the year (see Figure 2-8). Based on this information, there is no apparent degradation in the performance of this well in 2007.

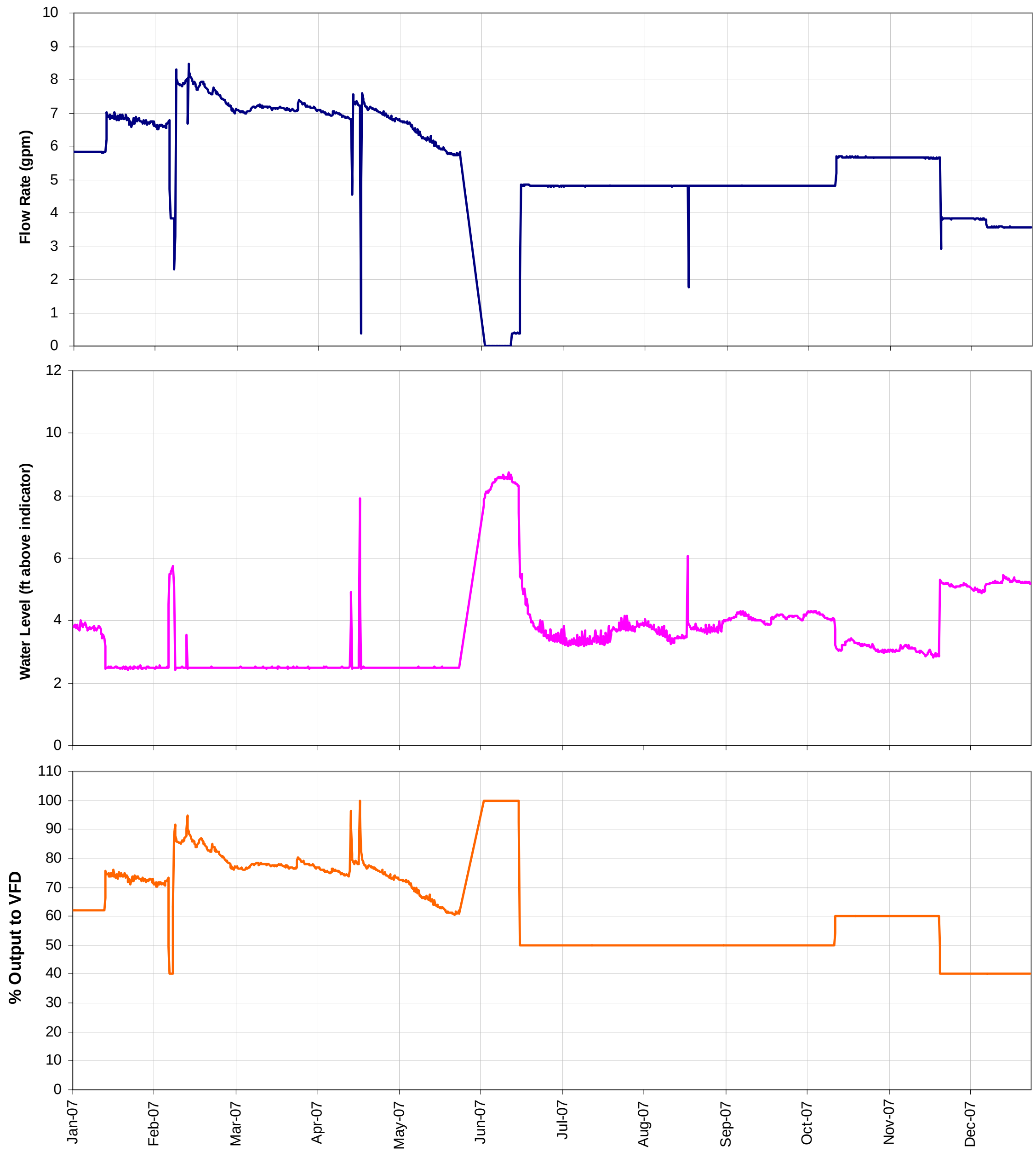


Figure 2-8: Well 409 Flow Rate, Water Level, and Relative Pump Speed

2.3.3 East Plant Lower Zone Extraction Wells

The following sub-sections give details on the operation and performance for each well in the East Plant Area (Lower Zone).

2.3.3.1 Well 410

Well 410 was operated at a flow rate of between 80 and 120 gpm throughout the year. Flow rates were generally higher after a shutdown period when the well has been able to recharge, then declines with time, stabilizing near 100 gpm (see Figure 2-9). There was no indication that the well performance significantly degraded in performance in 2007. Work is continuing on optimizing the flow rate.

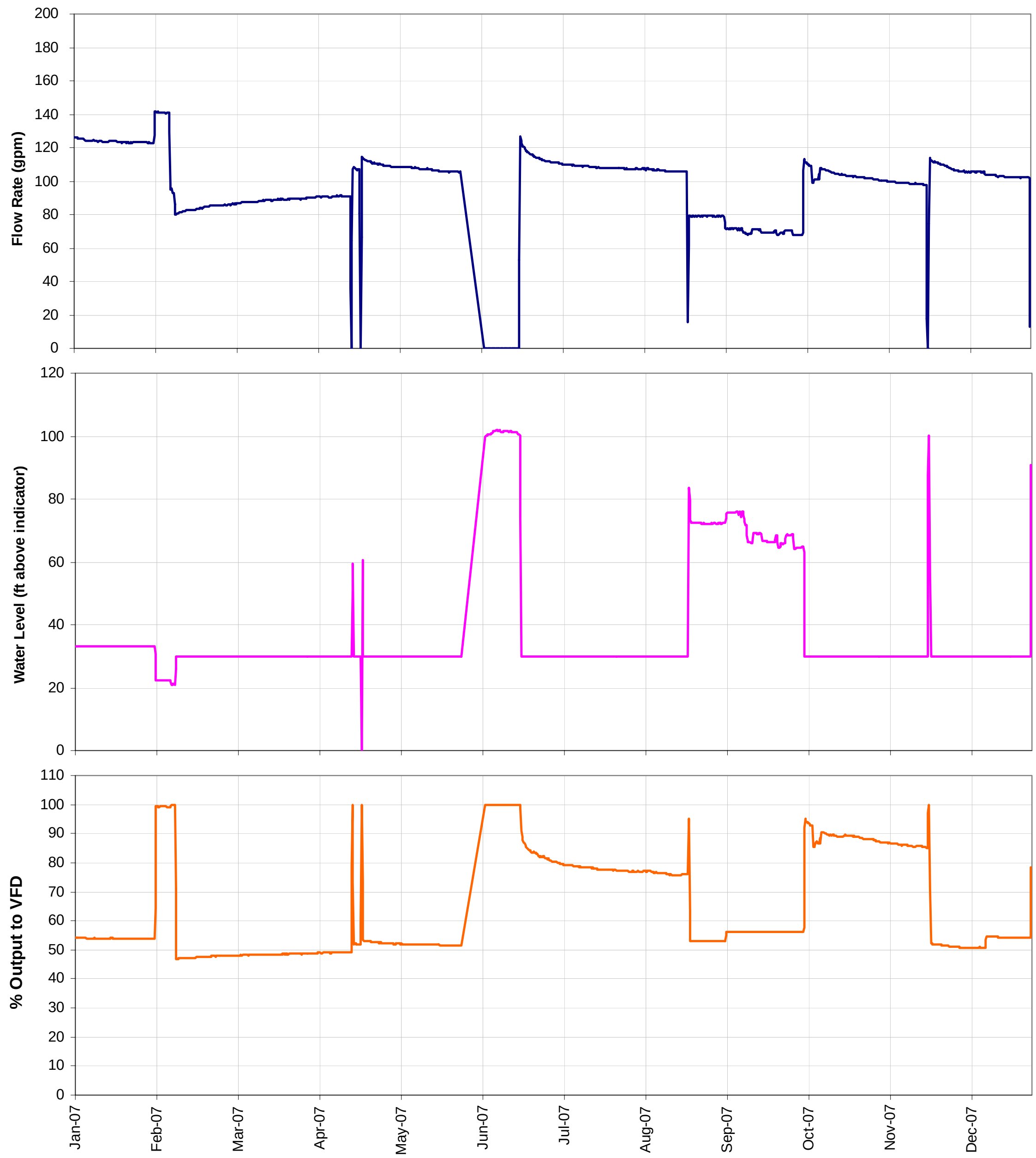


Figure 2-9: Well 410 Flow Rate, Water Level, and Relative Pump Speed

2.3.3.2 Well 411

Well 411 was operated at a flow rate of between 80 and 100 gpm throughout the year. Flow rates were generally higher after shutdown periods when the well was able to recharge, then declined with time, stabilizing near 90 gpm (see Figure 2-10). There was no indication that the well performance significantly degraded in performance in 2007.

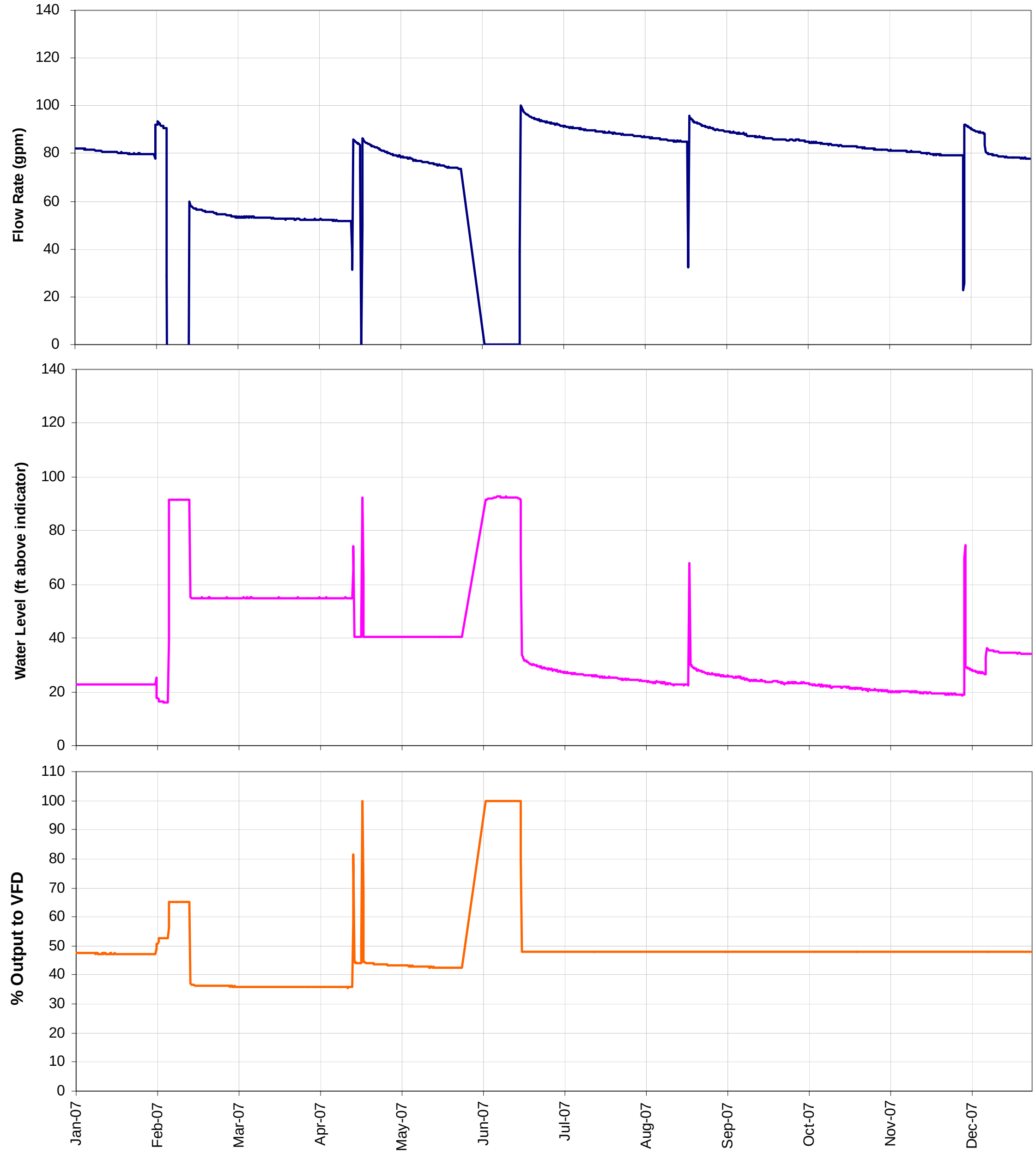


Figure 2-10: Well 411 Flow Rate, Water Level, and Relative Pump Speed

3.0 DON PLANT FACILITY WATER FLOWS

The Don Plant water balance is complex and it is integral to successful facility operation. Numerous unit operations require different water flows and have different minimum water quality requirements. Flows are continuously measured at key points within the process as part of routine operation and have been reported to EPA on a monthly basis.

- Production Wells Fresh water is pumped from three production wells (SWP-4, SWP-5 and SWP-7). Flows are measured continuously at SWP-5 and SWP-7 and at various downgradient locations. Flows from SWP-4 are calculated from the total downgradient flows and the other production well flows.

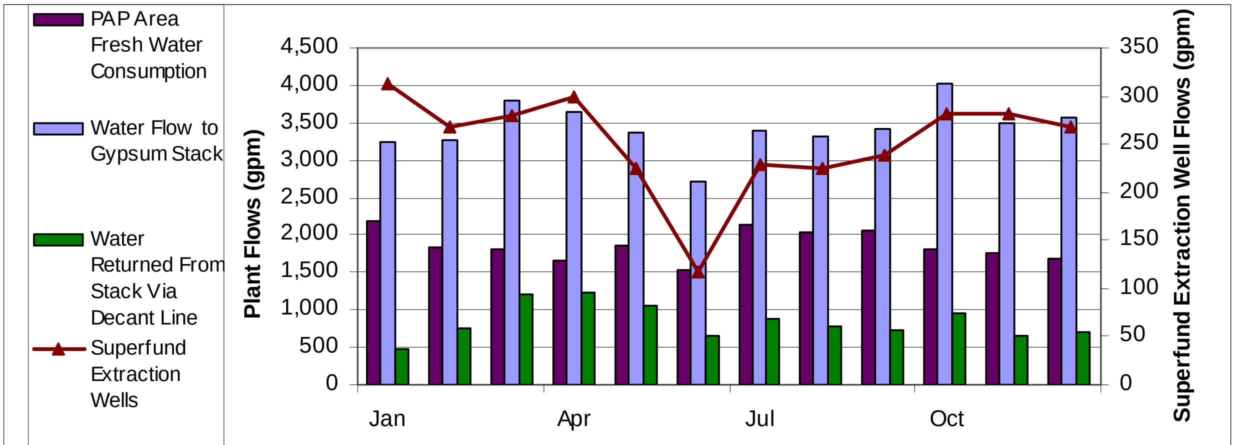
- Phosphoric Acid Plant A portion of the production well water is sent to the Phosphoric Acid Plant. Water requirements are driven by process conditions including production rate and associated cooling needs. Flows are measured at four different locations in the Phosphoric Acid Plant and the total flow is reported.

- Extraction Wells Extraction well flows are sent to the Phosphoric Acid Plant reclaim cooling towers, replacing production well water that was previously used for makeup. Flows are measured continuously for each extraction well (see Section 2.0).

- Water Flows to Gypsum Stack The principal byproduct of the Phosphoric Acid Plant process is gypsum which is slurried to the gypsum stack. The process is operated to maintain the solids content of the slurry within a given range (typically 28 to 32%). Effluent water from the Phosphoric Acid Plant unit operations (such as scrubber water blowdown and reclaim cooling system blowdown) is used as needed to maintain the required solids content The slurry density, solids content and total flow are measured continuously at the gypsum thickeners. The water flow is calculated based on the data collected and the density of gypsum.

- Gypsum Stack Decant Return Water from the gypsum slurry forms ponds on the top of the stack as the gypsum settles out. The extent of the ponded water is managed to allow dike building operations to occur. Water is pumped from the ponded area back to the reclaim cooling system. The flow rate is set by the operators on an as-needed basis.

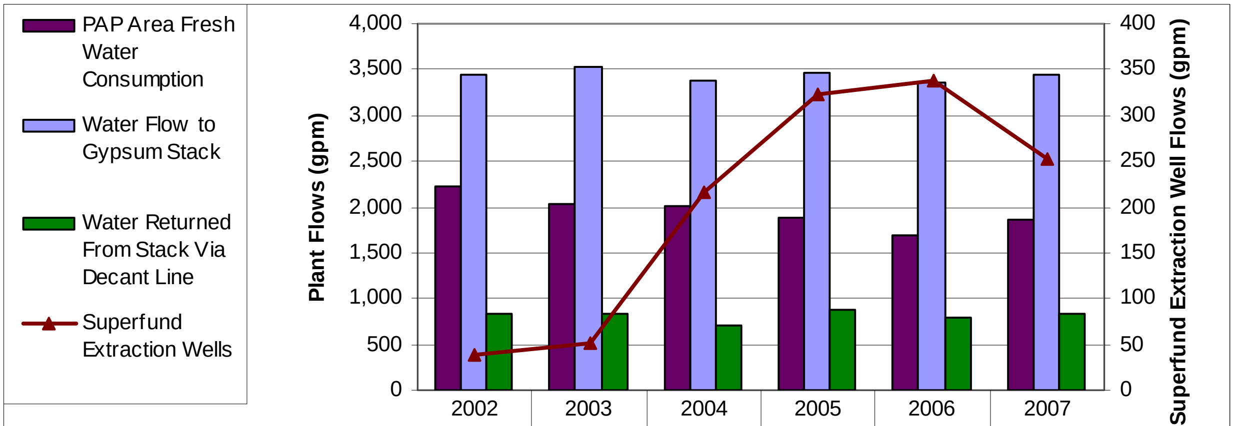
Monthly water flows related to the Phosphoric Acid Plant for 2007 are shown in Figure 3-1. Overall there are relatively minor changes in average flows from month to month and significant seasonal effects are not evident. A decrease for all flows occurred in June when facility turnaround occurred.



	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
PAP Area Fresh Water Consumption	2,180	1,830	1,803	1,671	1,864	1,524	2,137	2,028	2,073	1,800	1,757	1,696
Water Flow to Gypsum Stack	3,231	3,280	3,804	3,653	3,379	2,707	3,402	3,313	3,411	4,012	3,501	3,561
Water Returned From Stack Via Decant Line	470	753	1,216	1,244	1,068	645	879	785	724	954	650	715
Superfund Extraction Wells	313	268	279	300	225	117	228	224	238	282	282	268

Figure 3-1: Monthly Plant Flows

As shown on Figure 3-2, flows from the test extraction system are relatively small compared to other inputs. Since 2002, the average flow from the extraction wells has increased from less than fifty to approximately 340 gallons per minute. The decrease in the extraction well flows from 2006 to 2007 can be attributed to the number of upgrades being performed at the plant that resulted in well shut downs. As a result, there was a slight increase in fresh water consumption in the Phosphoric Acid Plant area. This is expected because the lower flow from test extraction wells to the reclaim cooling system has increased the demand for fresh water input. The overall water flow to the gypsum stack has not been affected.



	2002	2003	2004	2005	2006	2007
PAP Area Fresh Water Consumption	2,215	2,023	2,017	1,884	1,696	1,864
Water Flow to Gypsum Stack	3,447	3,530	3,373	3,461	3,348	3,438
Water Returned From Stack Via Decant Line	834	835	696	880	788	842
Superfund Extraction Wells	39	52	216	323	337	252

Figure 3-2: Yearly Plant Flows

There were no significant changes to the relative pumping rates from the production wells in 2007 from the end of the fourth quarter 2006. As shown in Figure 3-3, flows from SWP-4 ranged from 1,100 to 1,400 gpm, SWP-5 pumping rates were from 1,400 to 1,600 gpm, and SWP-7 remained relatively constant at 1,200 gpm.

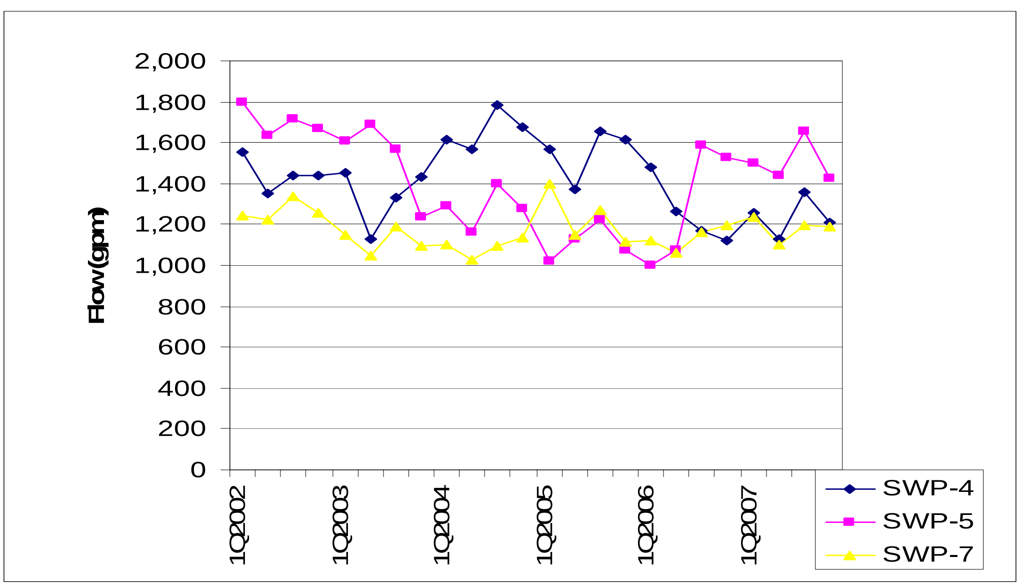


Figure 3-3: Quarterly Production Well Flows

4.0 GROUNDWATER MONITORING

This section provides a summary evaluation of the recent groundwater data with an emphasis on interpretation of conditions in key areas relative to sources, target extraction area and downgradient areas.

Routine groundwater monitoring has been performed at the Site since the Remedial Investigation began in 1992. To support the design of the groundwater extraction system a baseline groundwater monitoring event was performed in August 2003 and monitoring has been performed quarterly since that time, with essentially the same scope (sampling locations and analytes). Four sampling events were performed in 2007: in February/March, May, July/August and November/December. The monitoring analyte list is shown in Table 4-1. Sampling locations are listed on Table 4-2 and locations are shown on Figures 4-1 and 4-2.

Table 4-1: Groundwater Monitoring Analyte List - 2007.

General Chemistry	Metals	Field Parameters
Alkalinity	Arsenic, Total*	Eh
Chloride	Calcium, Total	Oxygen, Dissolved
Hardness	Magnesium, Total	pH
Nitrite+Nitrate (as N)	Potassium, Total	Specific Conductivity
Phosphorus, Total	Selenium, Total*+	Temperature
Sulfate	Sodium, Total	Turbidity
TDS		

* During the first and second quarters of 2007, when sample turbidity exceeded 10 NTU, the sample was filtered and dissolved Arsenic and Selenium concentrations were also measured.
+ Selenium was only measured during the first and second quarters of 2007.

Table 4-2: Groundwater Monitoring Locations - 2007.

Upper Zone							Lower Zone		
189	316[1]	333	348	358	408	529BR[4]	305	346	528CR[4]
190	318	334	350	367[2]	409	BRS[5]	309	347	528DR[4]
191	320	335S	351	401[3]	503	BTS[6]	315	410	529CR[4]
307	325	336	352[1]	402[3]	505		317	411	529DR[4]
308	327	338	354	404	518		326	504	SWP-4
310	328	339[1]	355[1]	405	527		335D	519	SWP-5
312	331	340	356	406	528AR[4]		337[1]	526	SWP-7
313	332	342	357	407	529AR[4]		344[1]	528BR[4]	

[1] These wells were only sampled in the first quarter of 2007.
[2] Well 367 was only sampled in the third quarter of 2007.
[3] Wells 401 and 402 were offline for the second and third quarters of 2007.
[4] Wells 528 and 529 were retrofitted into 4 one-inch nested wells prior to fourth quarter sampling in 2007.
[5] The Spring at Batiste Road
[6] Batiste Spring

NEWFIELDS

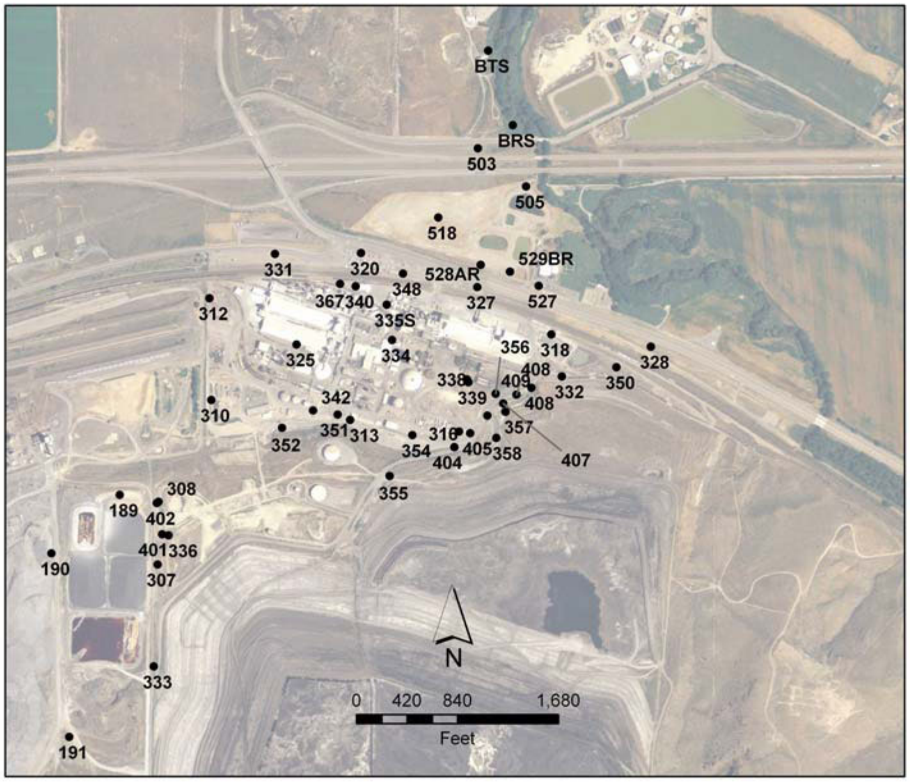


Figure 4-1: Groundwater Quality Monitoring Locations in the Upper Zone – 2007.

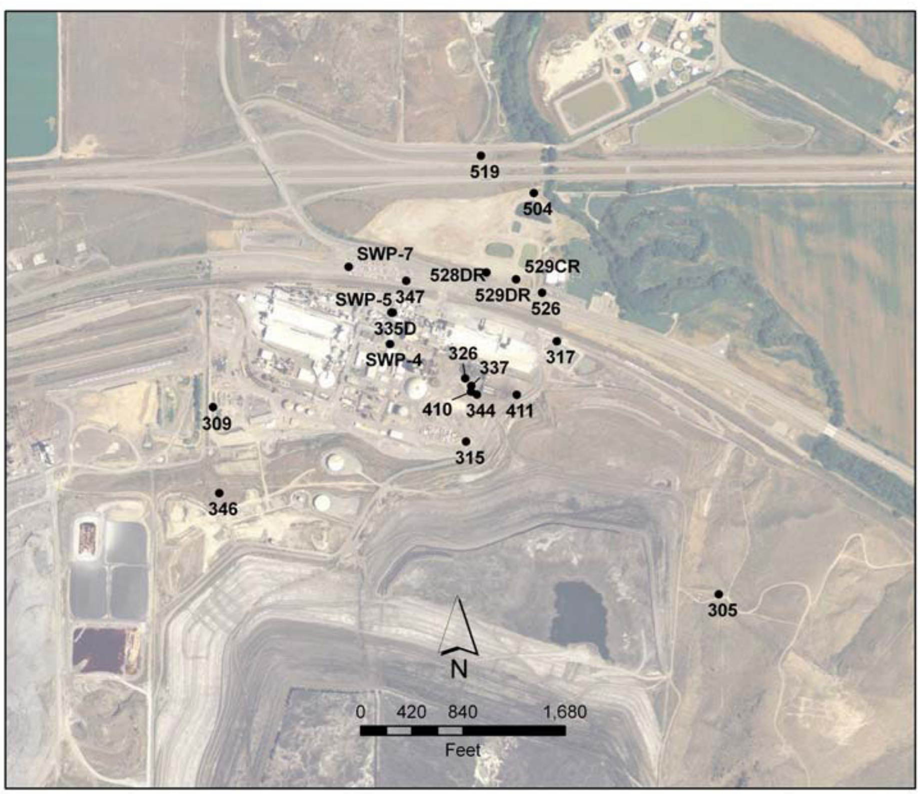


Figure 4-2: Groundwater Quality Monitoring Locations in the Lower Zone – 2007.

Data from these monitoring events have already been reported (NewFields 2007e, f, g and 2008b).

As described above, the test groundwater extraction system began routine operation in June 2004 (the West Plant Area and East Plant Area Lower Zone extraction wells began operation in late June 2004; the East Plant Upper Zone Wells were brought on line from August to October 2004 [MFG, 2005]).

For the purposes of evaluation of groundwater data and design of the extraction system, the Simplot area has been divided into distinct areas (see Figures 4-3 and 4-4):

- East Plant Area (Upper Zone and Lower Zone)
- Central Plant Area (Upper Zone and Lower Zone)
- West Plant Area
- North of I-86/Porteuf River Springs (Upper and Lower Zone)

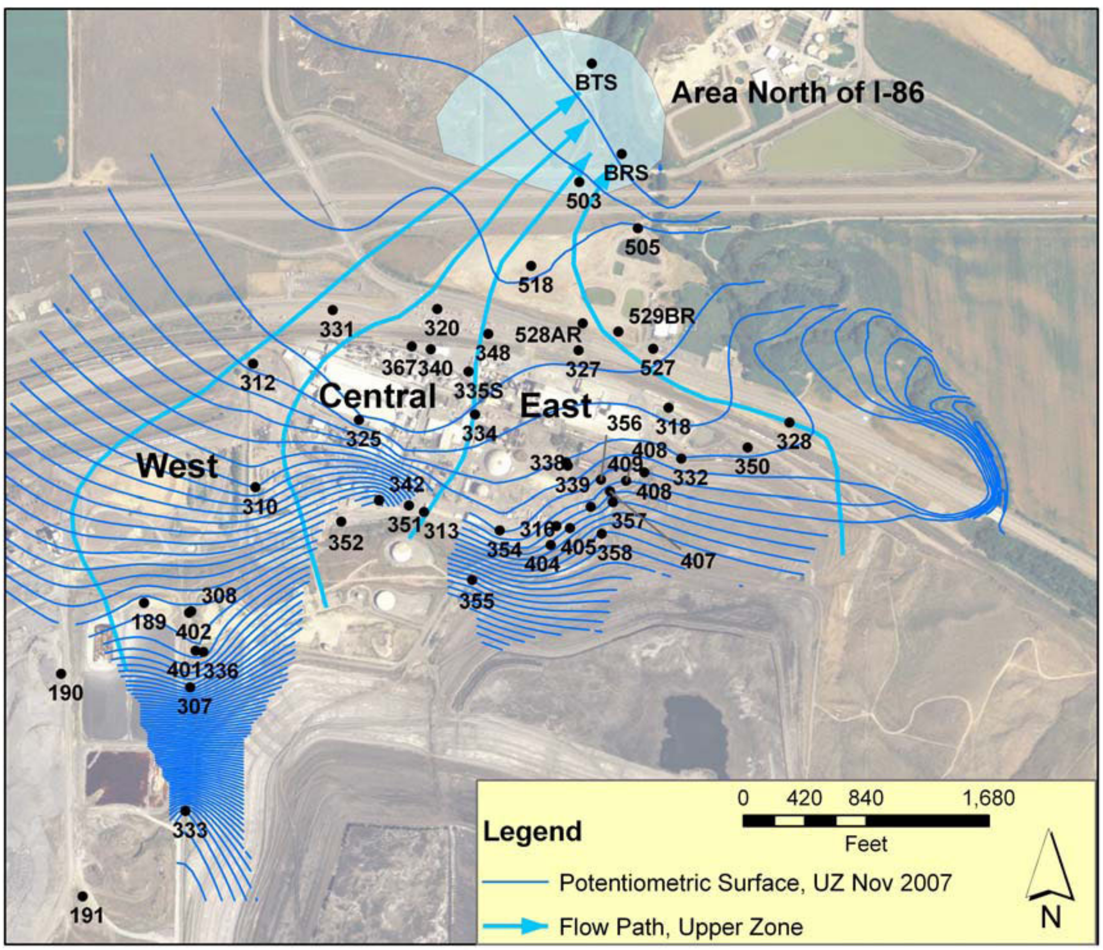


Figure 4-3: Groundwater Areas (Upper Zone).

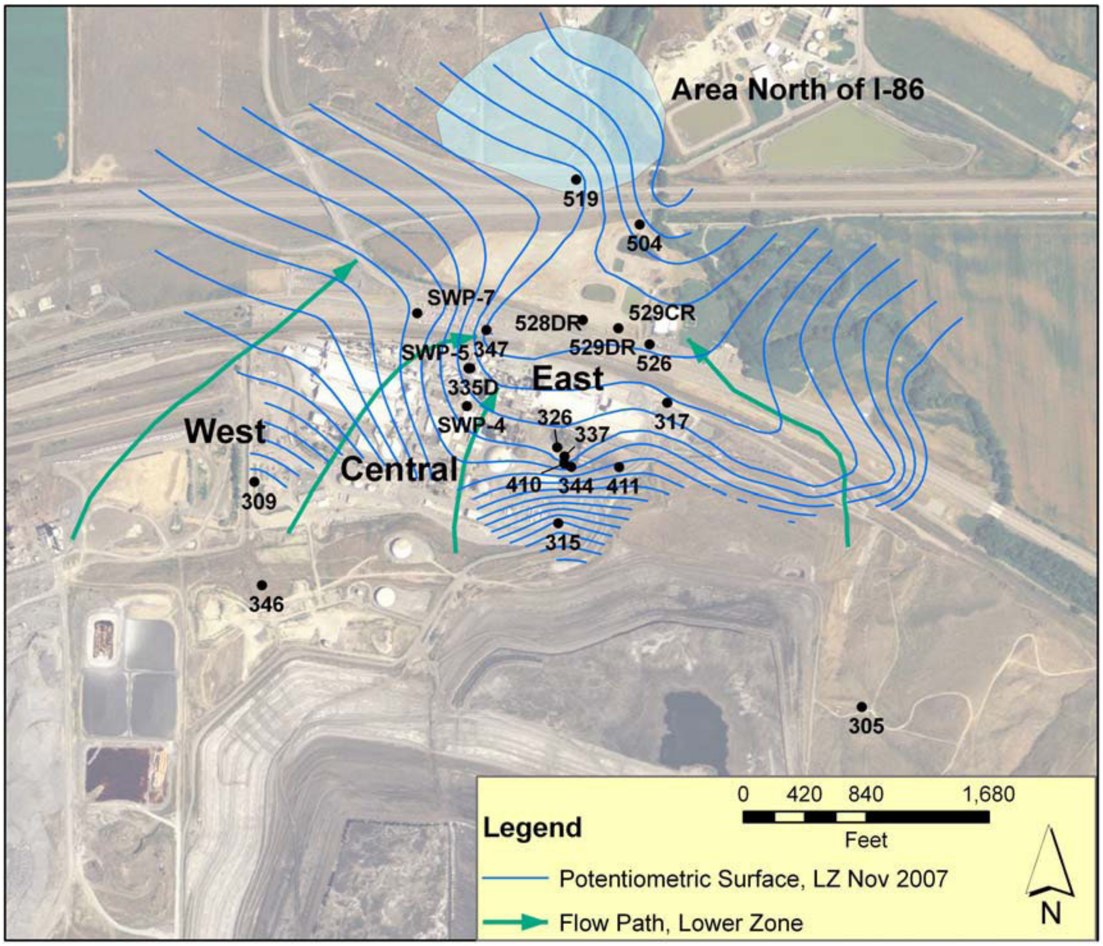


Figure 4-4: Groundwater Areas (Lower Zone).

Constituent concentrations measured in groundwater in the November 2007 monitoring event are shown in Figures 4-5 and 4-6. Groundwater monitoring data are evaluated for each of these areas in the following subsections.

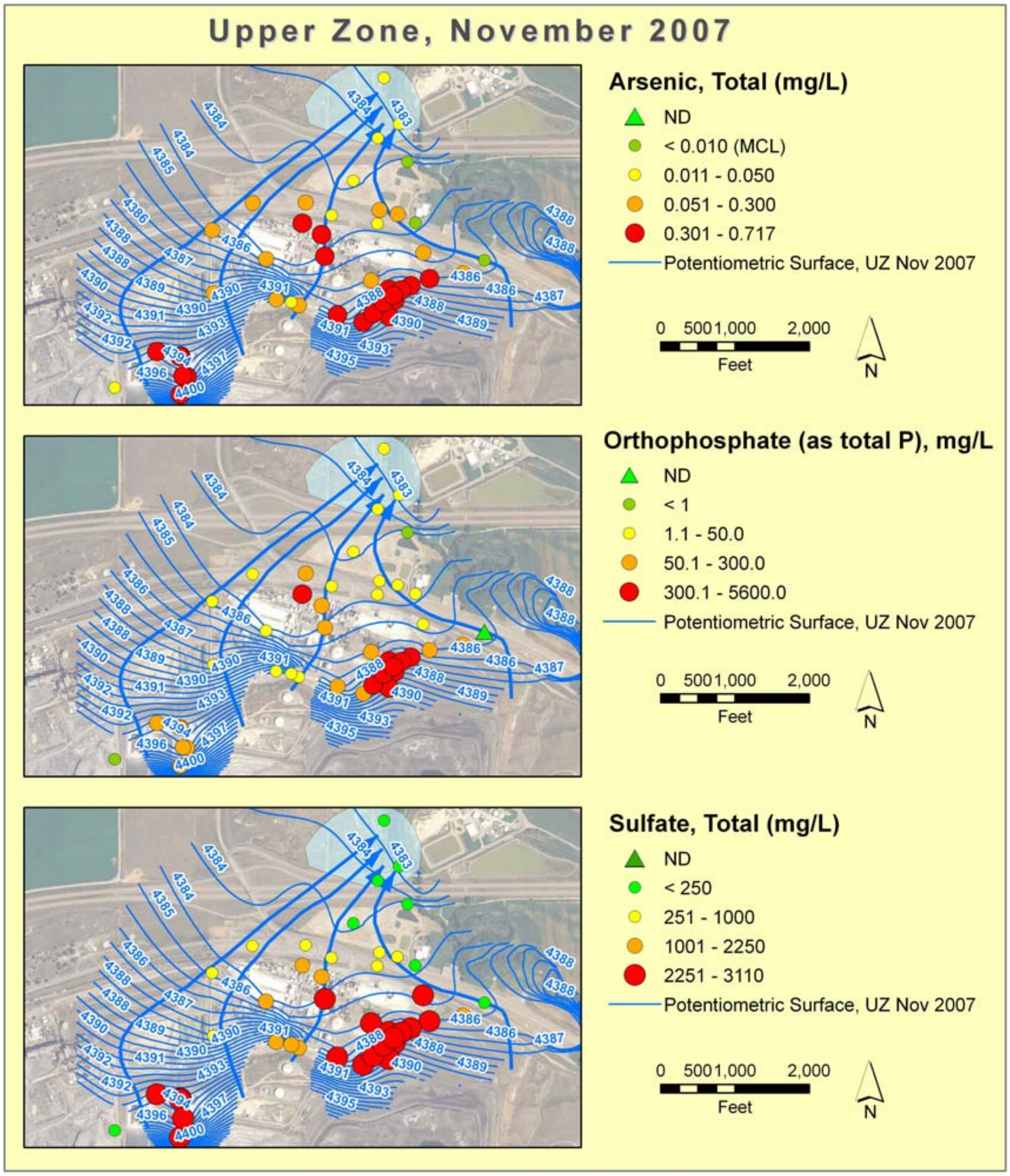


Figure 4-5: Upper Zone Constituent Concentrations, November 2007

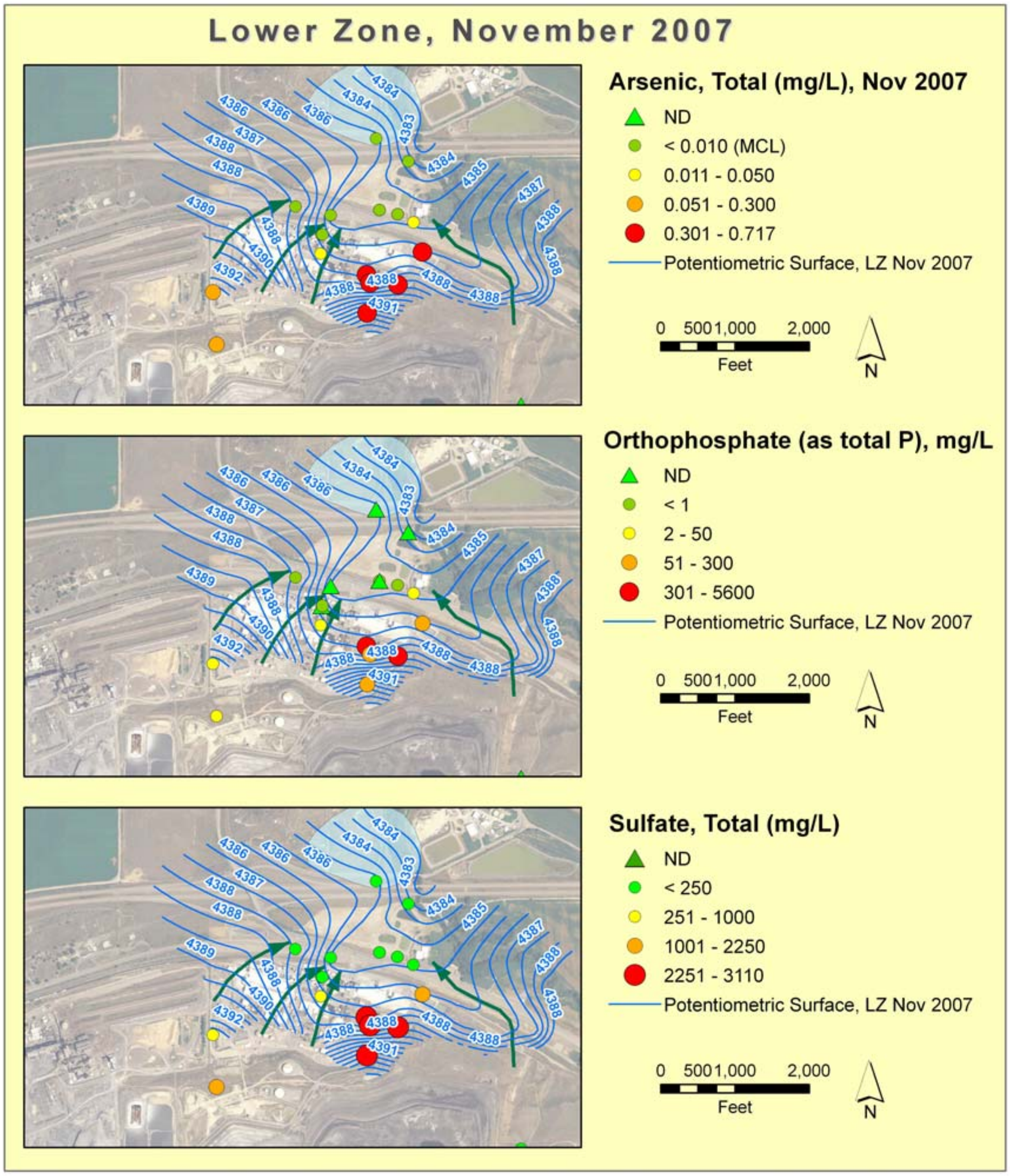


Figure 4-6: Lower Zone Constituent Concentrations, November 2007

4.1 Groundwater Levels

Groundwater levels at selected across the site are shown in Figure 4-7. Groundwater levels were lowest in the summer sampling event. The large increase observed in the spring 2006 sampling event was not repeated in 2007 and the magnitude of water level fluctuations was generally consistent with previous years.

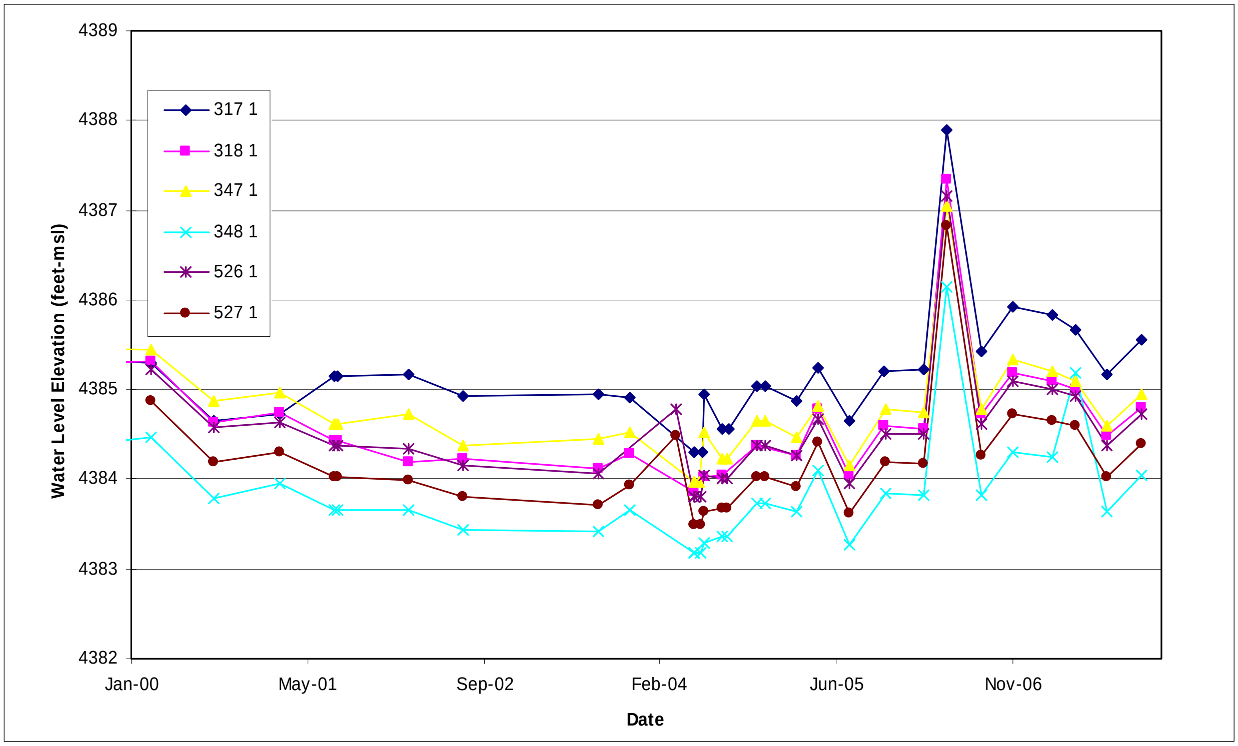


Figure 4-7: Groundwater Levels in Selected Upper and Lower Zone wells Since 2000

4.2 East Plant Area

4.2.1 Upper Zone

The East Plant Upper Zone area and associated groundwater extraction and monitoring wells are shown in Figure 4-8.

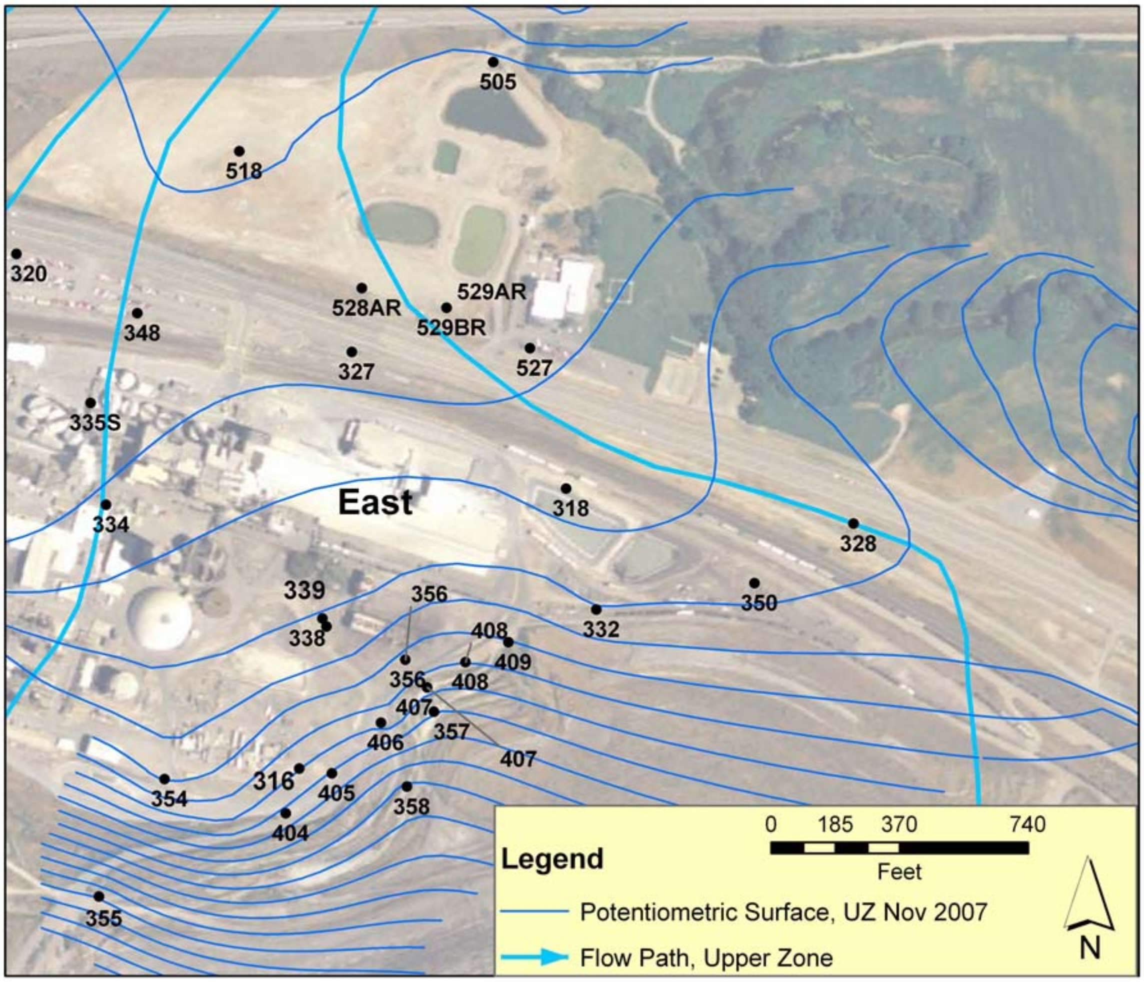


Figure 4-8: East Plant Area Upper Zone Wells.

Arsenic concentrations measured in the extraction wells (404 through 409) are shown in Figure 4-9. Concentrations at each well have remained relatively stable since pumping began in late 2004 with an overall slight downward trend. The relatively low concentration measured in well 404 in August 2007 appears to be an anomaly. Spatially concentrations have ranged from approximately 0.3 mg/L to 0.65 mg/L, with the two most westerly wells 404 and 405 having the highest levels.

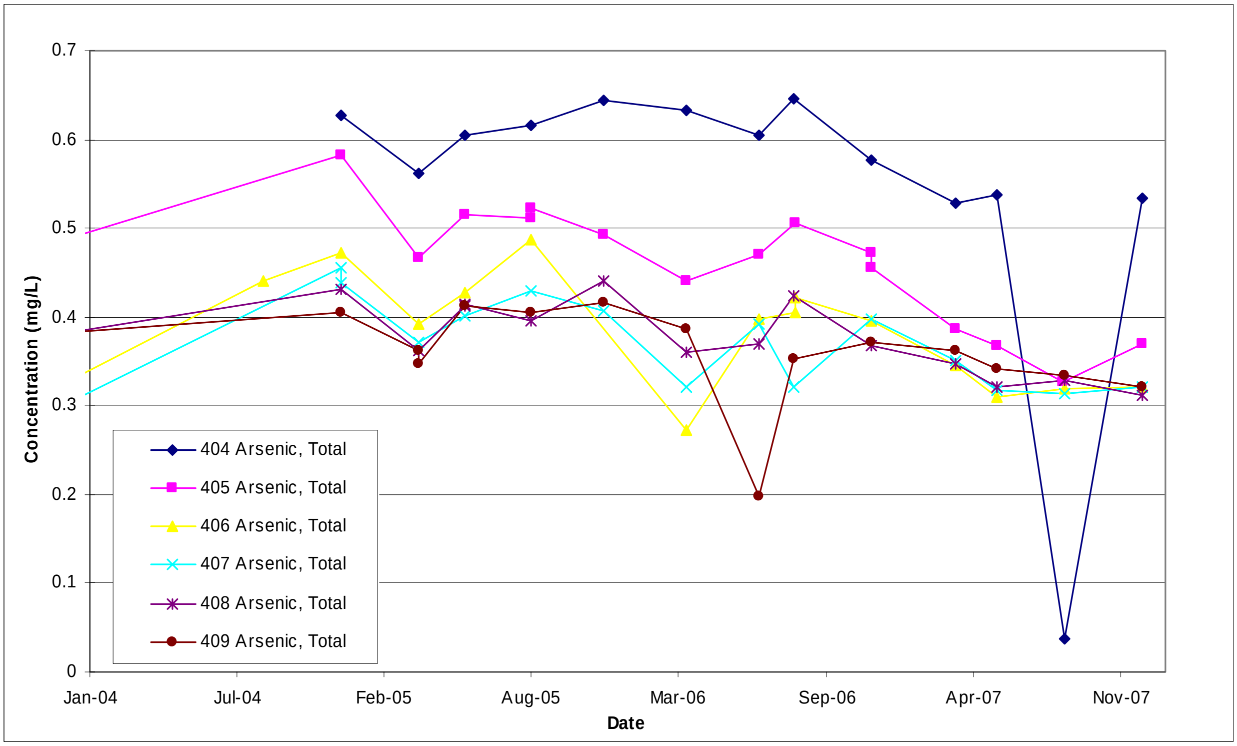


Figure 4-9: Arsenic Concentrations – East Plant Upper Zone Extraction Wells

Arsenic concentrations in monitoring wells immediately downgradient of the extraction wells have typically ranged between 0.2 and 0.45 mg/L (see Figure 4-10). Further downgradient Arsenic concentrations reduce to between approximately 0.01 and 0.02 mg/L (Figure 4-11). Concentrations have been relatively stable over time and no downward trend is apparent after the test extraction system became operational.

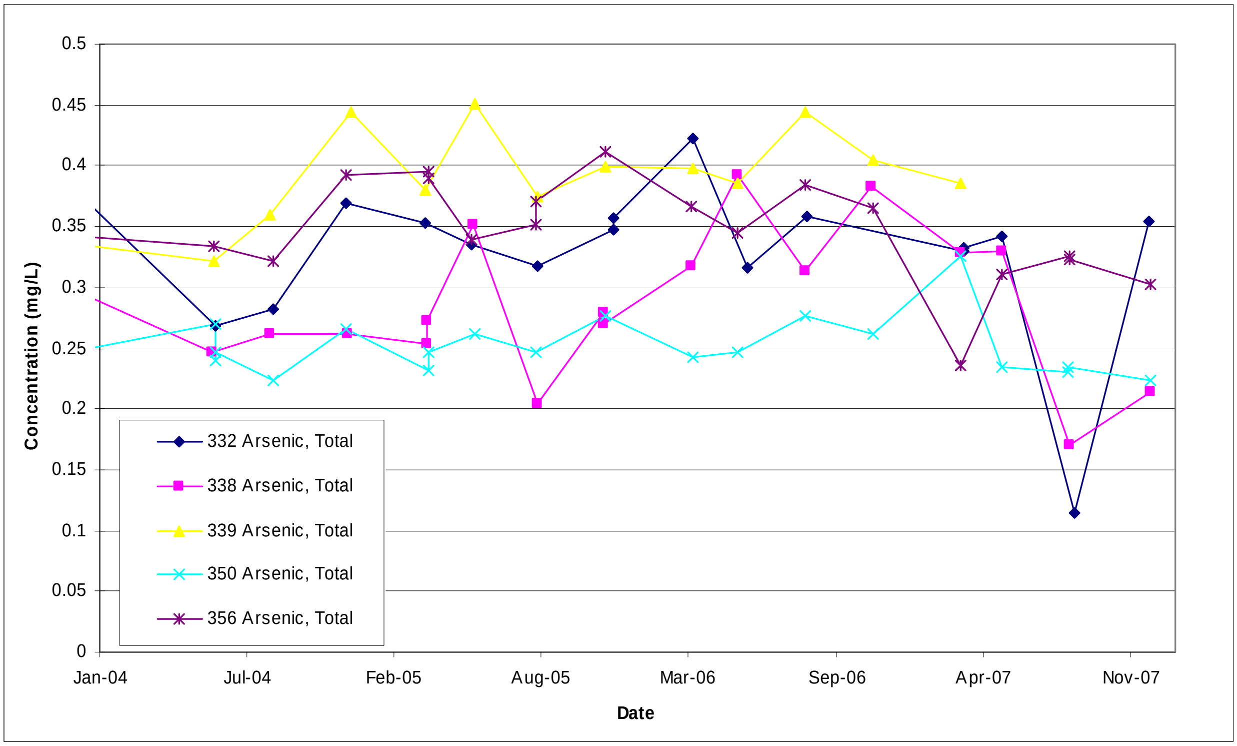


Figure 4-10: Arsenic Concentrations – Vicinity of East Plant Upper Zone Extraction Area

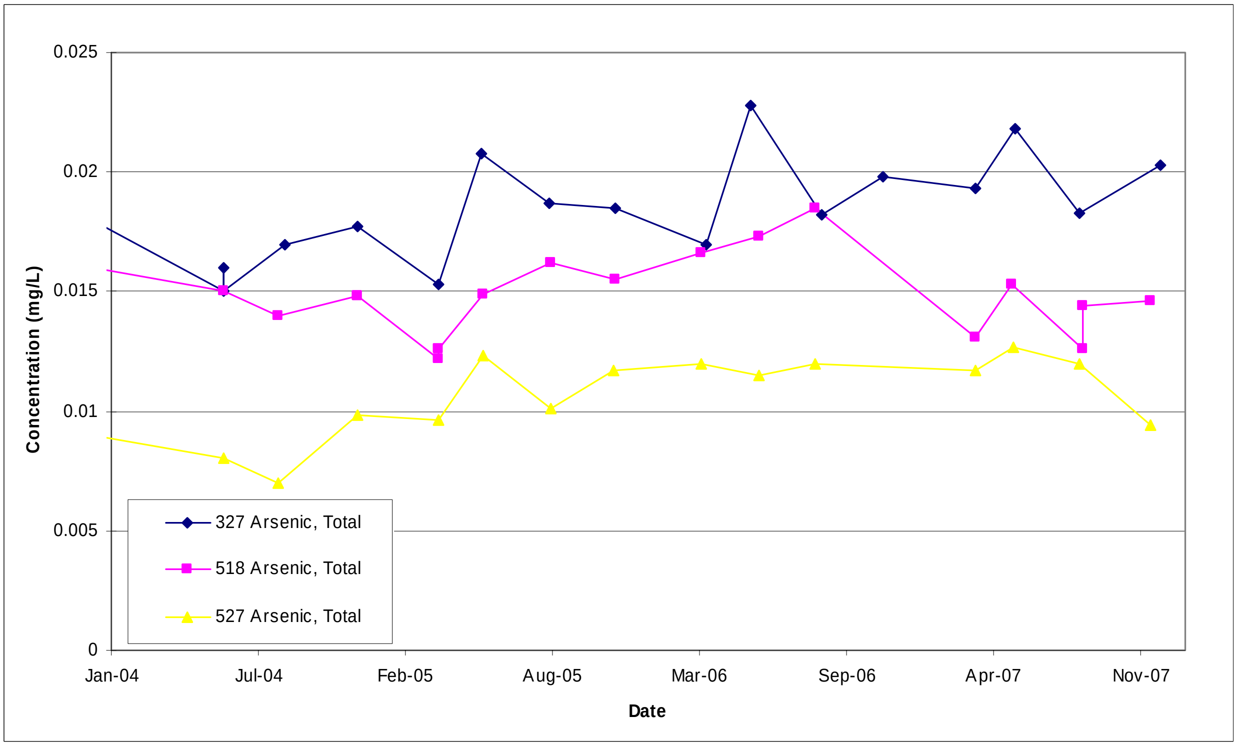


Figure 4-11: Arsenic Concentrations Downgradient of the East Plant Upper Zone Extraction Area

Concentrations of different constituents undergo similar reductions as Upper Zone groundwater migrates north from the stack area (see Figure 4-12, data are from November 2007). This reduction in concentrations is the result of mixing of stack-affected groundwater with river-influenced water from the east. Arsenic concentrations at well 328 (the furthest well to the northeast of the extraction area – see Figure 4-3) have consistently been below detection limits and groundwater at this location appears representative of unimpacted conditions.

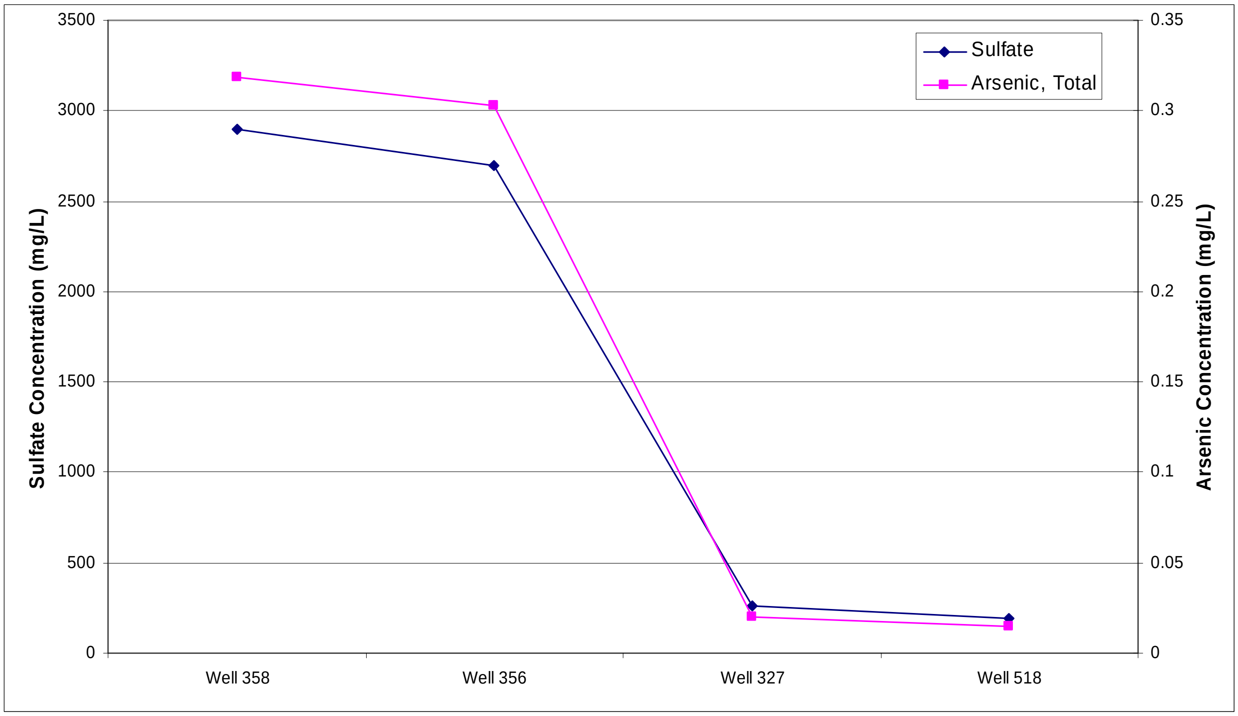


Figure 4-12: Arsenic and Sulfate Concentrations Along an Approximate Flow Path Downgradient of the Upper Zone Extraction Area

4.2.2 Lower Zone

Lower Zone groundwater extraction and monitoring wells in the East Plant area are shown on Figure 4-13.

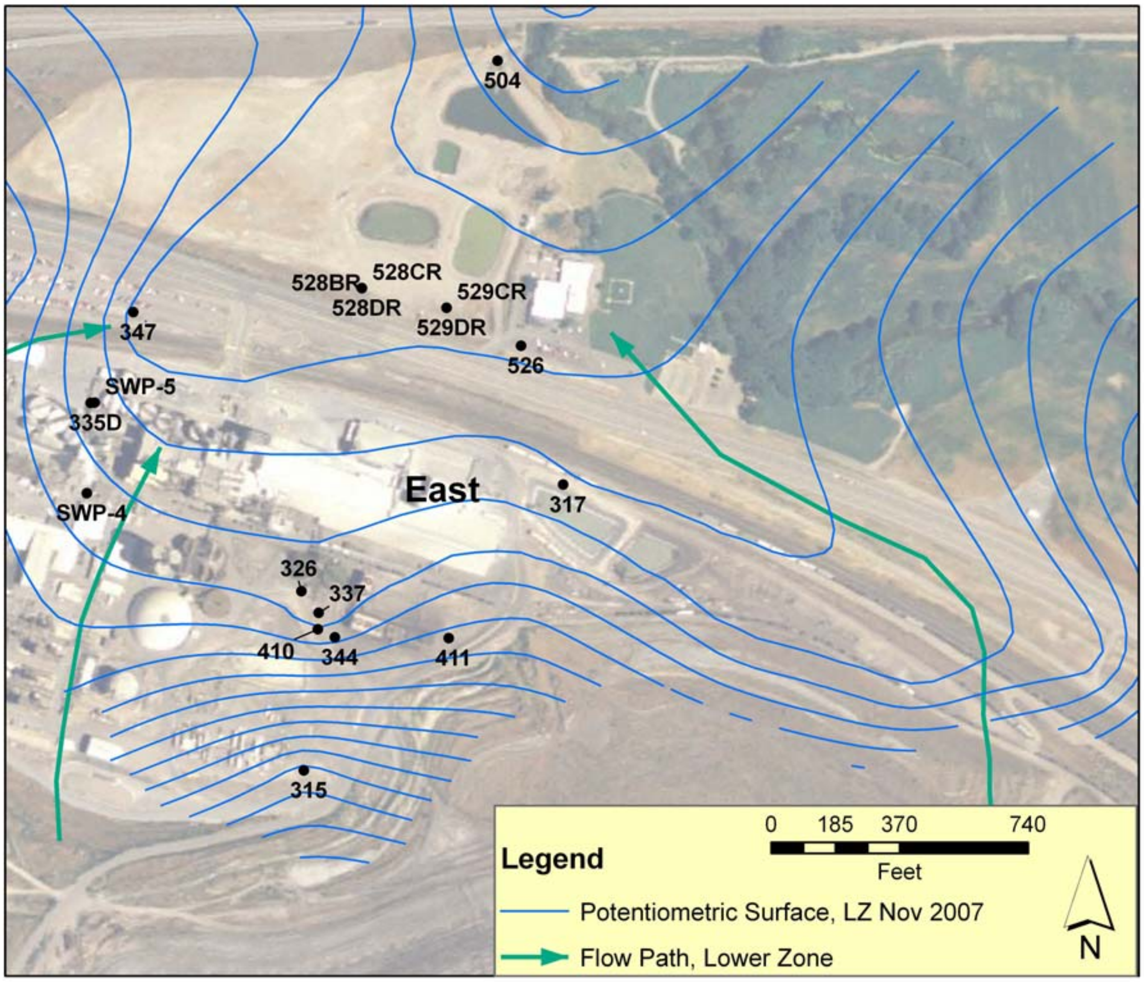


Figure 4-13: East Plant Lower Zone Monitoring Wells.

As described above, East Plant Lower Zone extraction wells 410 and 411 began routine operation in June 2004. Arsenic concentrations in extracted groundwater and nearby Lower Zone areas have remained relatively consistent, typically between 0.3 and 0.5 mg/L (see Figure 4-14), however, an overall downward trend is apparent.

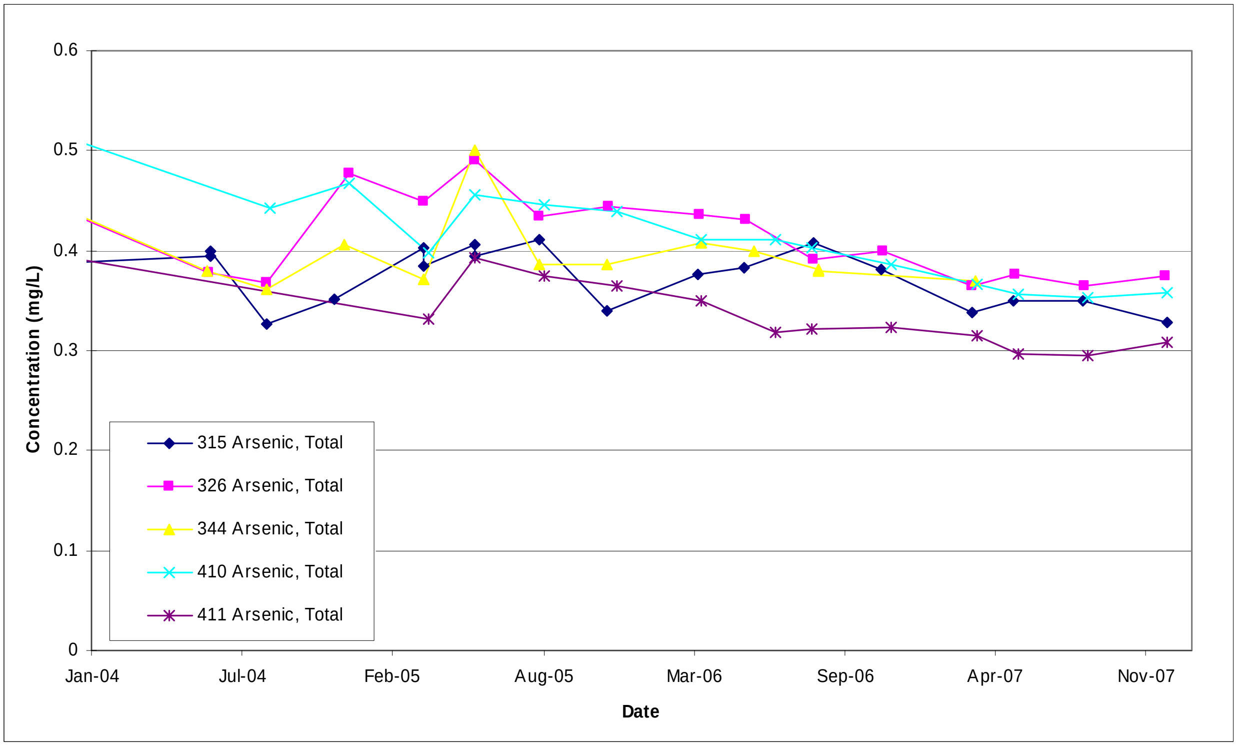


Figure 4-14: Arsenic Concentrations – East Plant Lower Zone Extraction Wells and Nearby Monitoring Wells

Concentrations of constituents in groundwater downgradient of the East Plant Lower Zone extraction system decreased after the test extraction system became operational and remained at those levels in 2007. This indicates that extraction is having a significant and sustainable effect on downgradient constituent concentrations. Figure 4-15 shows Arsenic and Orthophosphate (as Total Phosphorus) concentrations measured in well 526 over time.

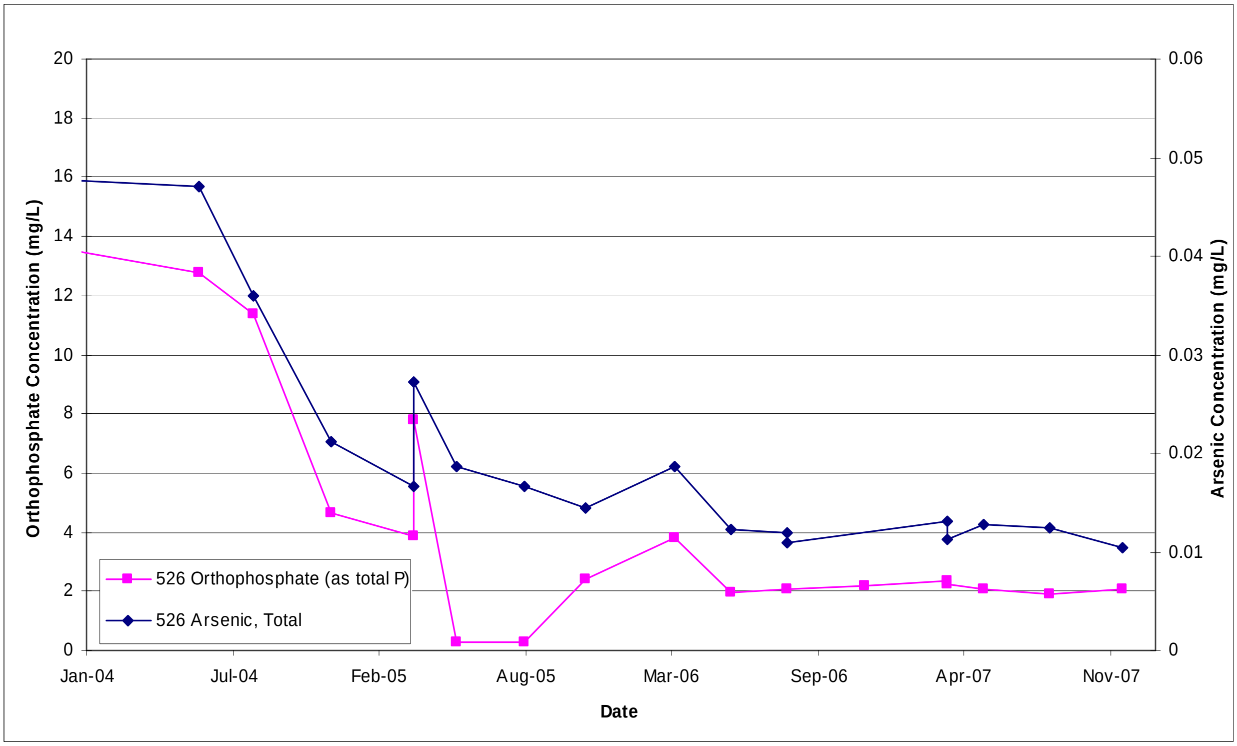
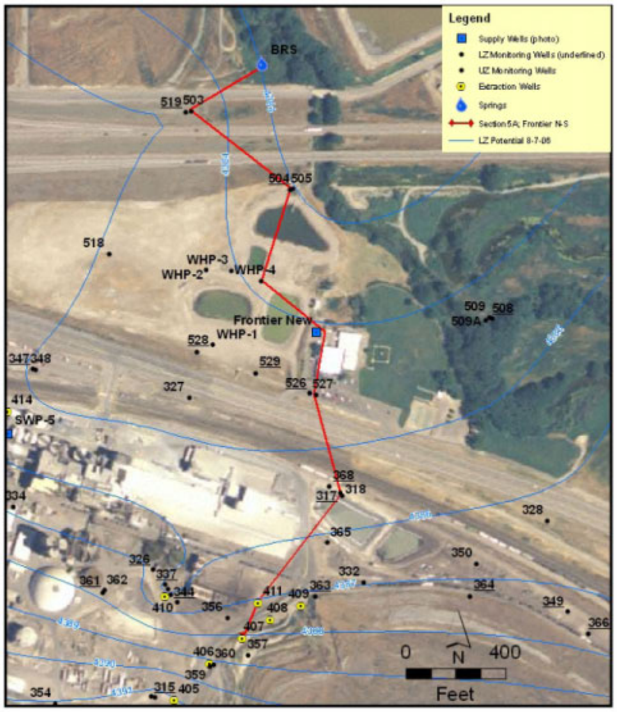


Figure 4-15: Well 526 Arsenic and Orthophosphate (as Total Phosphorus) Concentrations Versus Time – East Plant Lower Zone Downgradient of Test Extraction Wells

The 2007 monitoring data confirm that the extraction of Lower Zone groundwater has resulted in the reductions of constituent concentrations at well 526. Figure 4-16 shows the geologic cross section along the direction of groundwater flow from the extraction wells downgradient to the north. The timeframe for concentration reductions is generally consistent with groundwater travel times, estimated from aquifer properties and potentiometric surfaces, being around the order of one year or less from the extraction wells to the area of well 526. A likely effect is that unimpacted deep groundwater is replacing the impacted groundwater at the well locations, resulting in lower constituent concentrations.

It is also noted that no lag in concentration reduction is apparent between Arsenic and Orthophosphate (as Total Phosphorus). Orthophosphate (as Total Phosphorus) is predicted to be somewhat attenuated in the aquifer. Ongoing desorption/dissolution from aquifer solids into downgradient groundwater after the extraction system becomes fully operational is a technical issue related to the Portneuf River TMDL. These data indicate that this desorption/dissolution effect is not significant. Reductions of Orthophosphate (as Total Phosphorus) loading to the river from Simplot sources are therefore expected to reduce over the same timeframe as Arsenic; generally consistent with groundwater travel times.



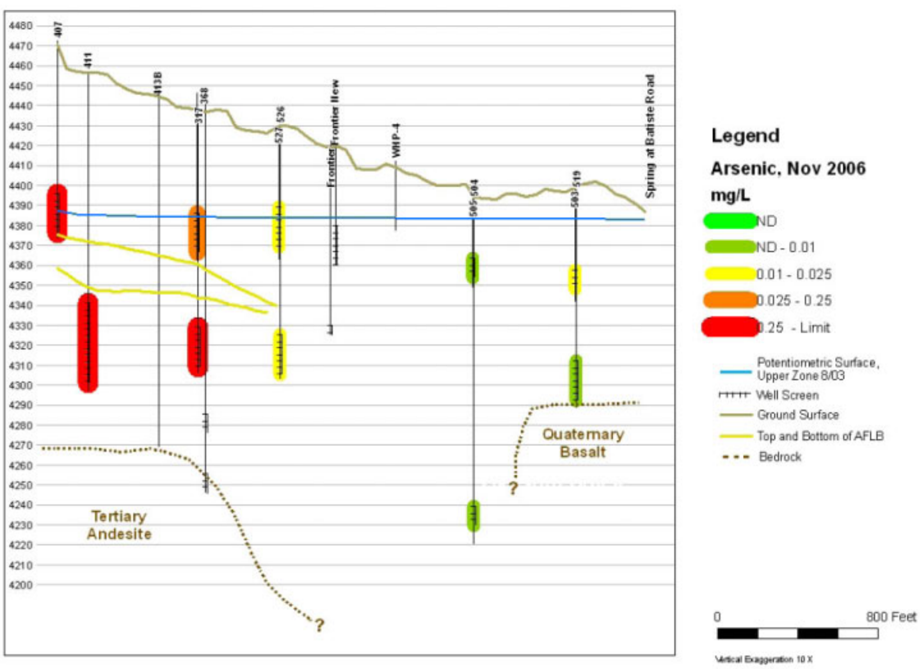


Figure 4-16: East Plant Lower Zone Cross Section – Downgradient From Extraction Wells

4.3 Central Plant

4.3.1 Upper Zone

Central Plant Upper Zone groundwater monitoring wells locations are shown on Figure 4-17.

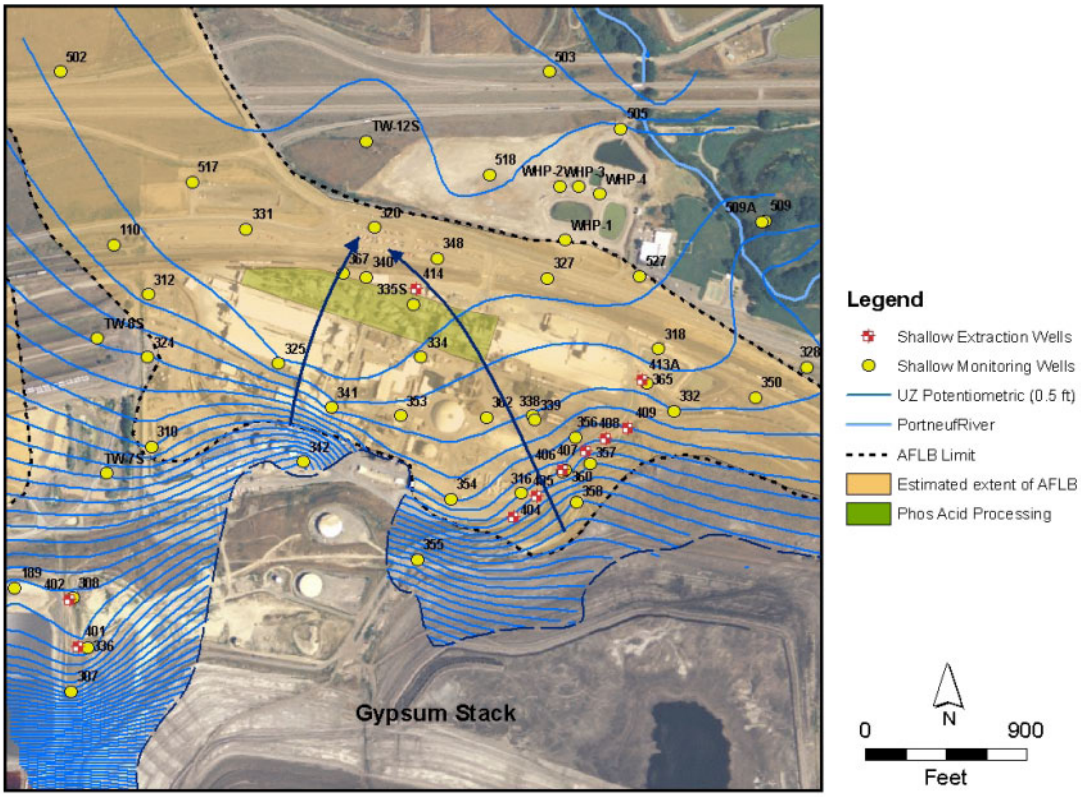


Figure 4-17: Central Plant Upper Zone Monitoring Wells

Central Plant Upper Zone groundwater is impacted by two distinct sources: the gypsum stack and the Phosphoric Acid Plant. The Phosphoric Acid Plant is located in an area of converging groundwater flow in the Upper Zone (Figure 4-17) with upgradient sources of flow in the southeastern portion of the plant area, near the toe of the gypsum stack, and in the south and southwestern portions of the site.

Upgradient of the Phosphoric Acid Plant, concentrations of Arsenic, Orthophosphate (as Total Phosphorus) and Sulfate are consistent with levels associated with the gypsum stack. For example, Arsenic concentrations in 2007 were in the range of 0.5 mg/L at well 334 and 0.1 mg/L at well 325 (see Figure 4-21). Concentrations of arsenic in groundwater down gradient from the gypsum stack vary as a result of the location of preferential flow paths. The higher concentrations at well 334 are caused by a bedrock knob located upgradient of well 325 that directs stack-affected groundwater flow to the east toward well 334. The variation in Orthophosphate (as Total Phosphorus) concentrations in Upper Zone groundwater is shown in

Figure 4-18. Concentrations in upgradient groundwater originating in the southeastern portion of the plant area, at the toe of the gypsum stack, have ranged from about 18 to 680 mg/L with a mean of 260 mg/L (Figure 4-19). Concentrations in upgradient groundwater originating in the south and southwestern portion of the plant area have ranged from non-detected to about 68 mg/L with a mean of 19 mg/L (Figure 4-20).

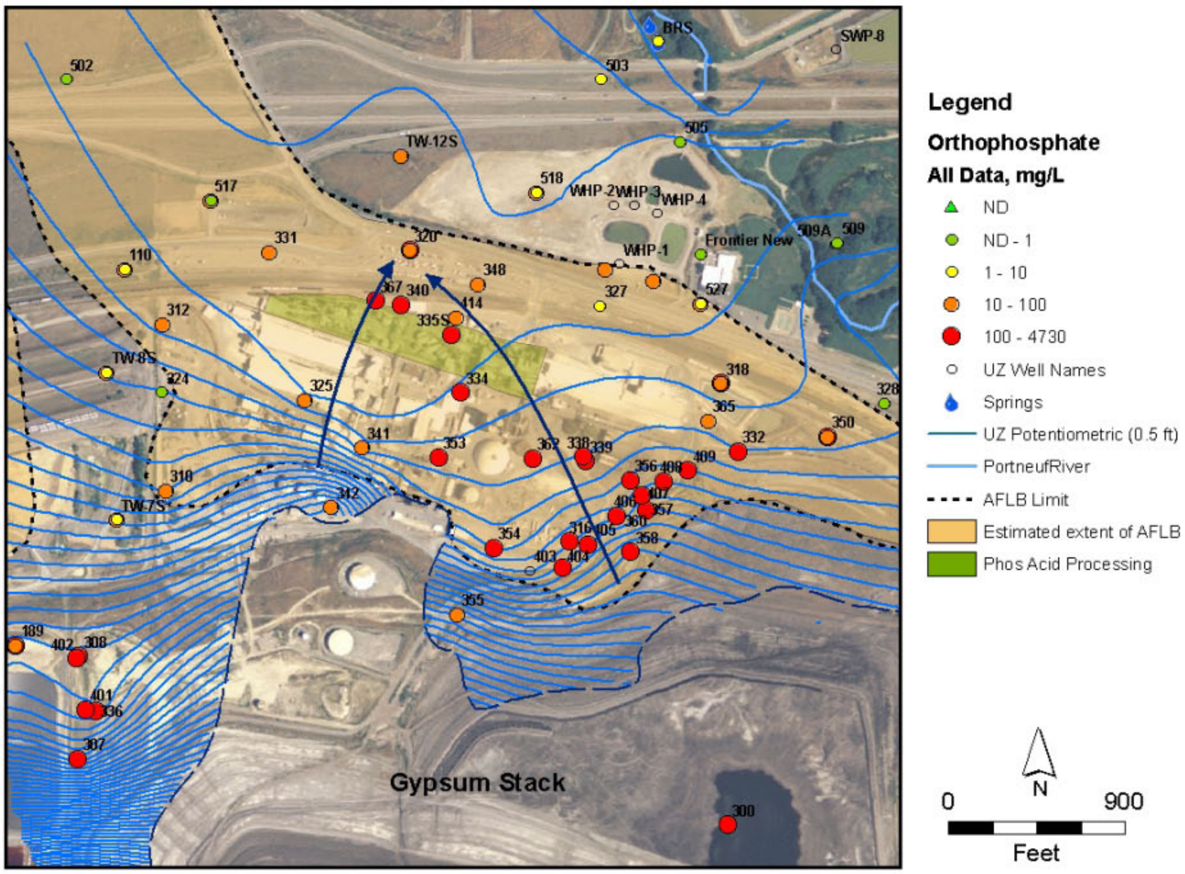
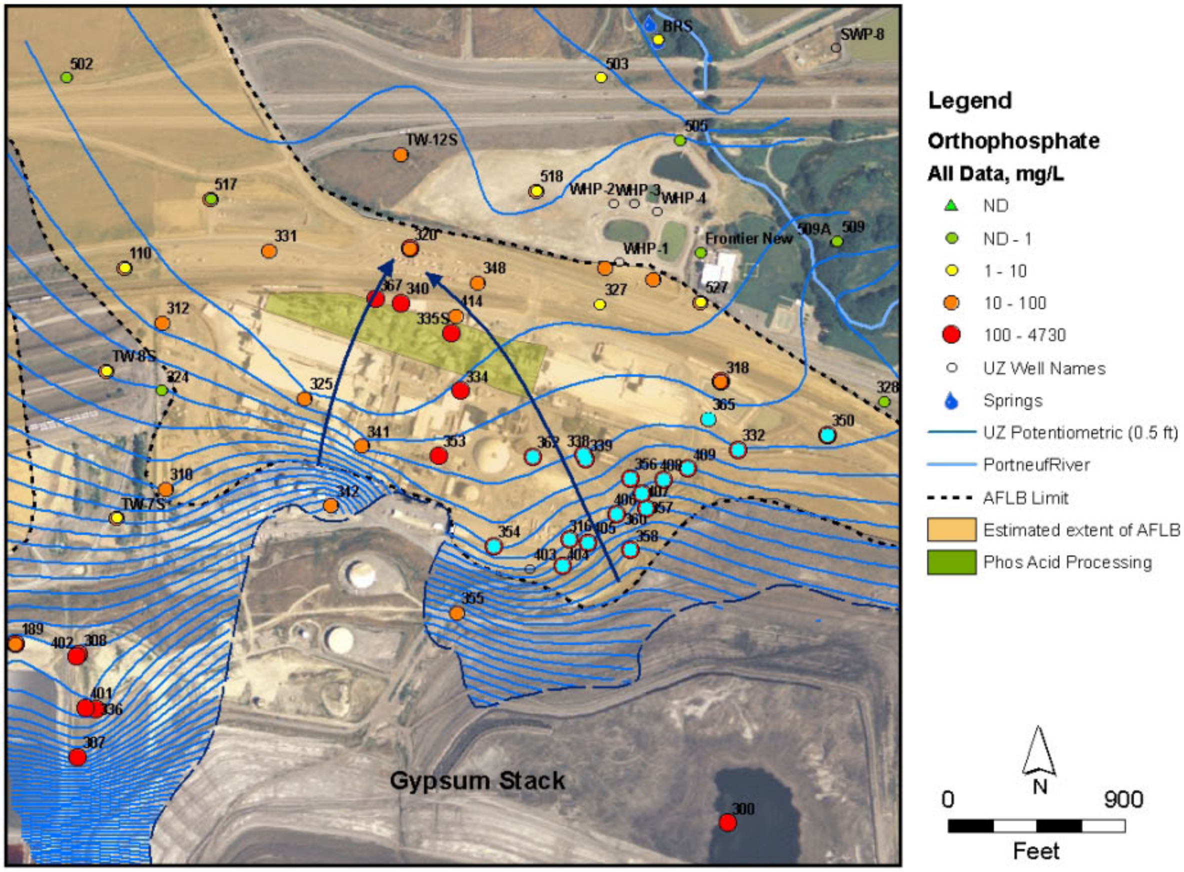
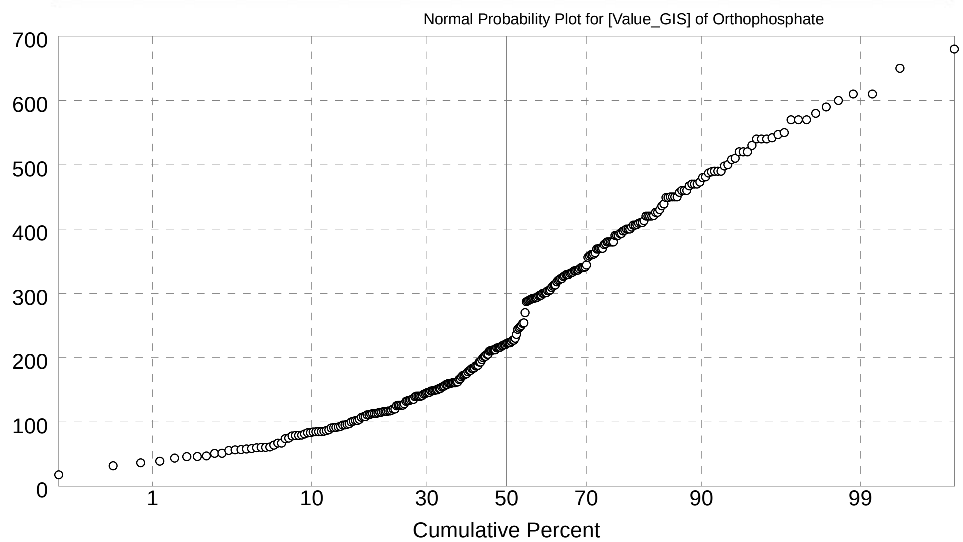


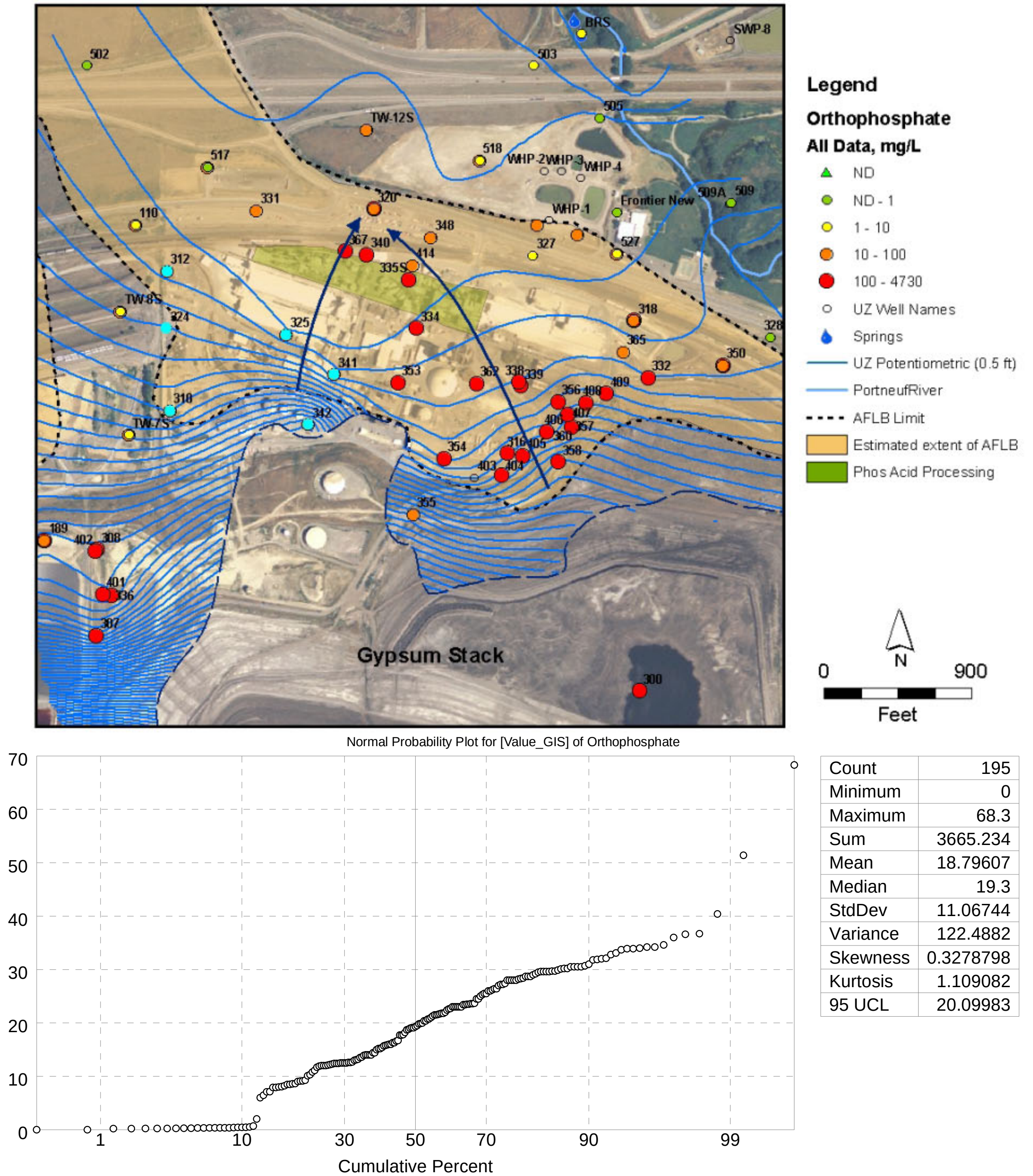
Figure 4-18: Historical Concentrations of Orthophosphate (as total P) Concentrations in Upper Zone Groundwater (November 2007 Potentiometric Surface Shown)





Count	309
Minimum	17.8
Maximum	680.0
Sum	80319.3
Mean	259.933
Median	222.0
StdDev	152.6736
Variance	23309.23
Skewness	0.4772031
Kurtosis	-0.7927236
95 UCL	274.2203

Figure 4-19: Distribution of Orthophosphate Concentrations (mg/L as total P) Downgradient of Gypsum Stack in the East Plant. Selected Wells are Shown in Light Blue.



Count	195
Minimum	0
Maximum	68.3
Sum	3665.234
Mean	18.79607
Median	19.3
StdDev	11.06744
Variance	122.4882
Skewness	0.3278798
Kurtosis	1.109082
95 UCL	20.09983

Figure 4-20: Distribution of Orthophosphate Concentrations (mg/L as total P) Downgradient of Gypsum Stack in the East Plant. Selected Wells are Shown in Light Blue.

Orthophosphate (as Total Phosphorus) and sulfate concentrations were in the range of 120 mg/L and 2,400 mg/L respectively at well 334 in 2007. The Arsenic and Orthophosphate (as Total Phosphorus) concentrations in wells 340 and 367, within the Phosphoric Acid Plant facility area, were higher than would be expected for stack impacts alone, indicating the presence of a distinct facility-related source or sources (see Figures 4-21 and 4-22). Sulfate concentrations are not elevated compared to stack-only effects (see Figure 4-23). This is consistent with expectations of a facility source in this area: Sulfate is associated with the gypsum (process byproduct) and the Phosphoric Acid Plant area around wells 340 and 367 is associated with processing and storage of phosphoric acid materials.

Although the concentrations at wells 367 and 340 are relatively high, they quickly decrease downgradient. For example, at well 320, which is approximately 300 feet north of wells 340 and 367 and directly downgradient, the Orthophosphate (as Total Phosphorus) concentration ranged between 80 and 136 mg/L in 2007. This appears to indicate that the source is localized with a relatively small mass flux. Arsenic concentrations were also elevated at wells 340 and 367, ranging from approximately 0.23 to 0.85 mg/L in 2007, compared with upgradient concentrations (wells 325 and 334) in the range of 0.12 to 0.49 mg/L.

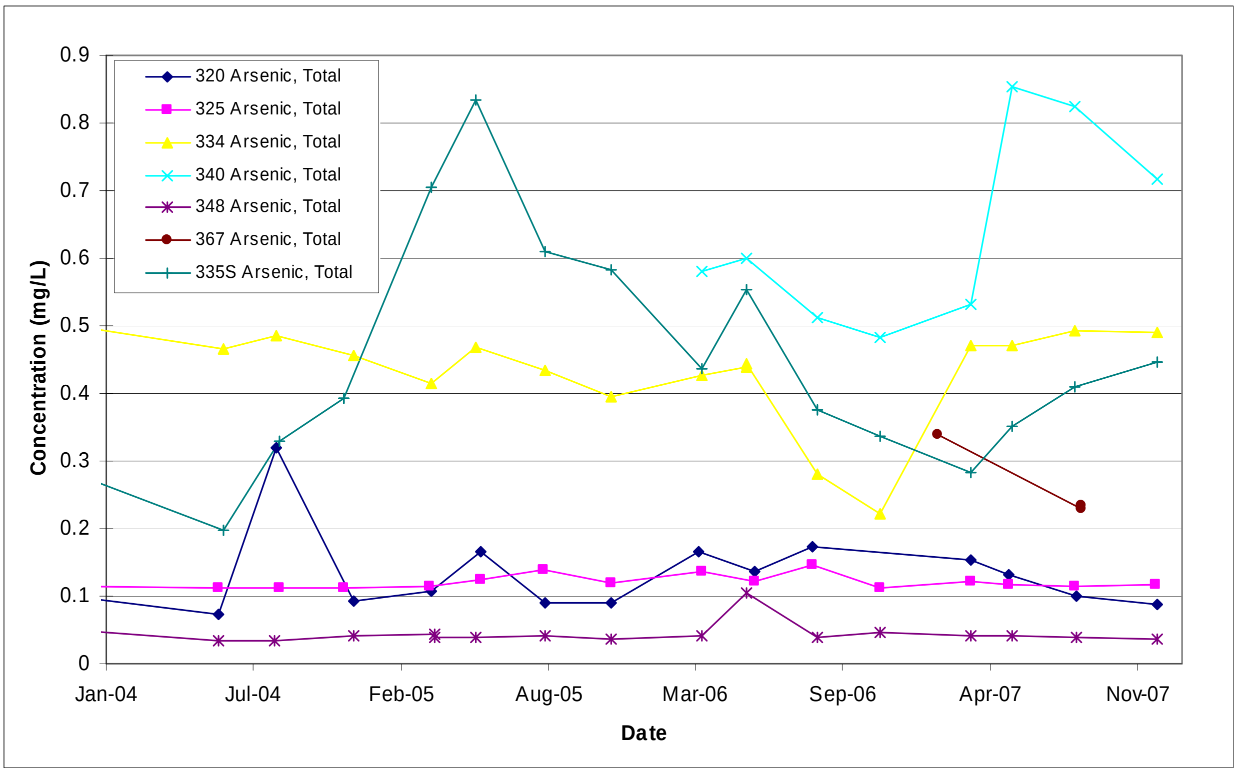


Figure 4-21: Central Plant Upper Zone Arsenic Concentrations

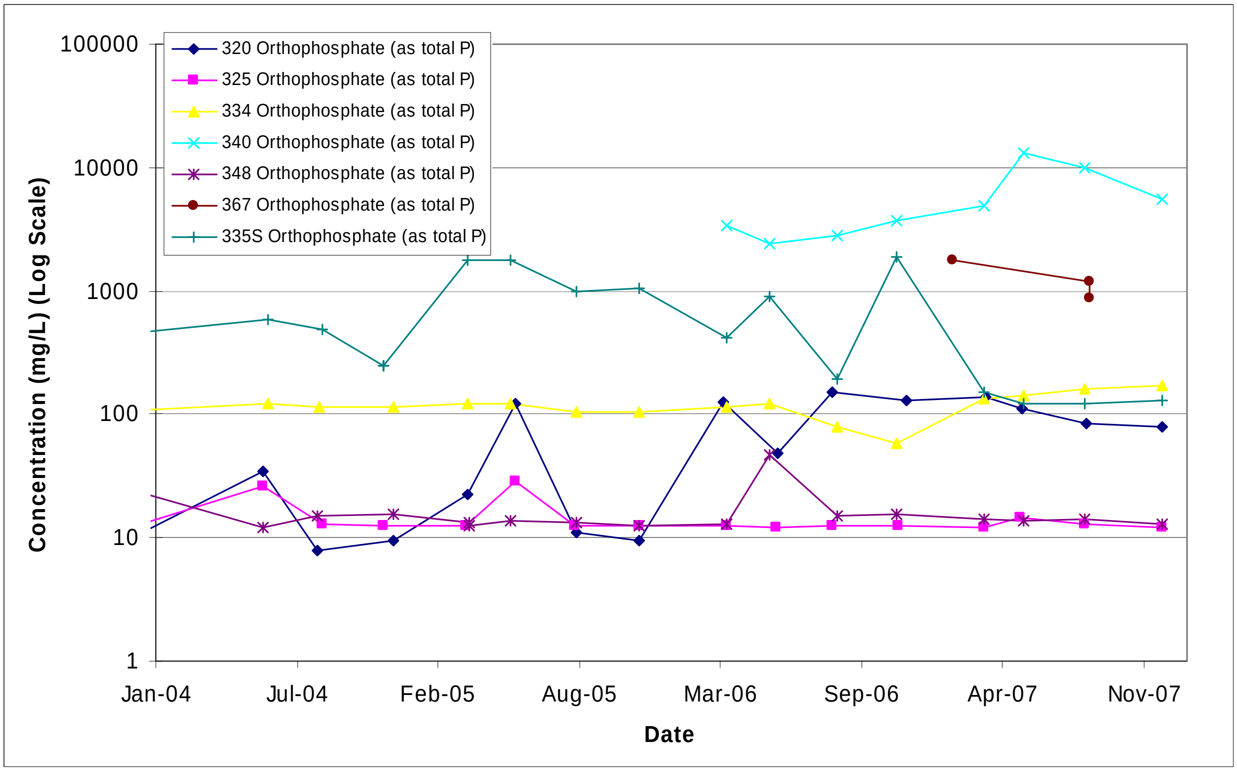


Figure 4-22: Central Plant Upper Zone Orthphosphate (as Total Phosphorus) Concentrations

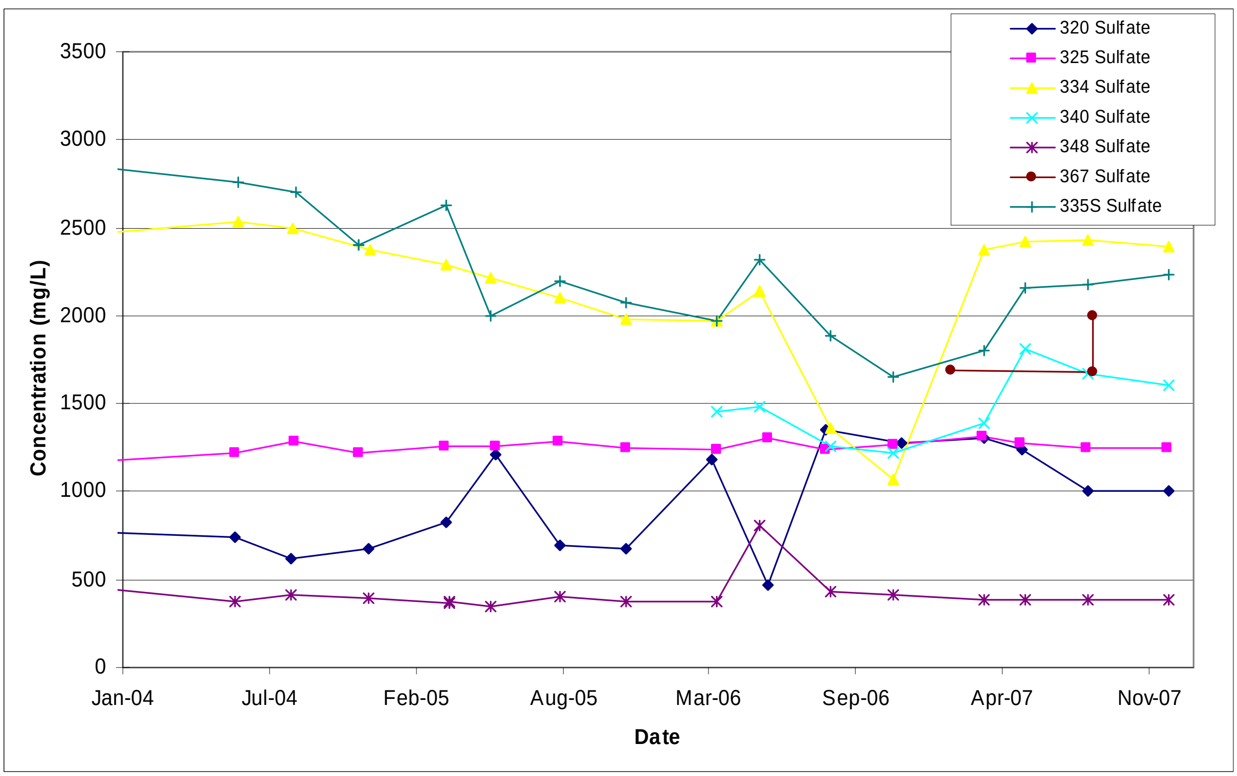


Figure 4-23: Central Plant Upper Zone Sulfate Concentrations

Summary of Phosphoric Acid Plant Operations

The general layout of the Phosphoric Acid Plant and key features is shown on Figure 4-24.

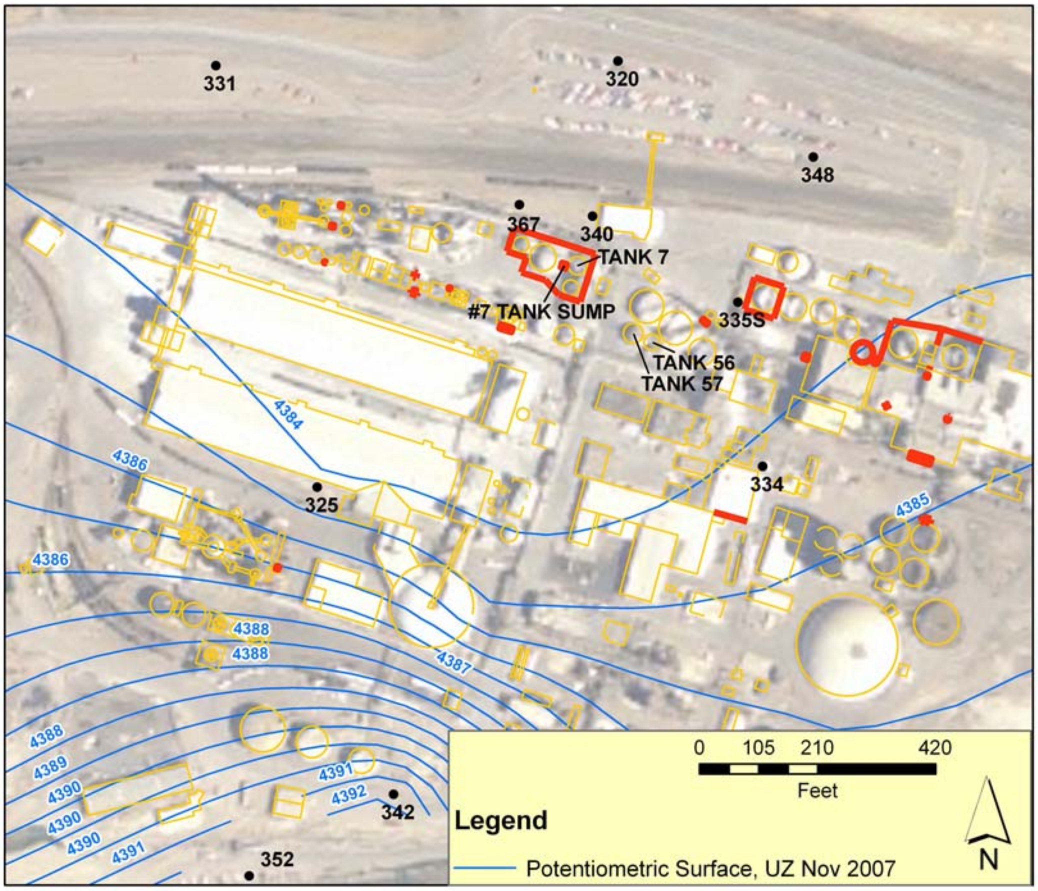


Figure 4-24: Phosphoric Acid Plant and Key Features

The Di-hydrate Wet Process for phosphoric acid production is used at the Don Plant. This process uses sulfuric acid to react with phosphate ore to produce phosphoric acid and gypsum. After ore digestion, the phosphoric acid slurry is separated into product phosphoric acid (liquid) and byproduct, gypsum (solid) using belt filters. The gypsum is sent to a stack for long term site storage.

The phosphoric acid from the belt filters is sent to stage 1 concentration where the acid is concentrated from 25%-27% phosphate (as P2O5), to a nominal 43% phosphate (as P2O5). Forced circulation evaporators are used to concentrate the phosphoric acid. Due to this acid concentrating, some impurities initially dissolved in phosphoric acid reach solubility limits and precipitate, forming solids. The product from the stage 1 concentration is sent to a clarifier to separate the majority of these solids from the liquid phosphoric acid.

The clarified phosphoric acid can then be sent to stage 2 concentration, where the acid is concentrated from a nominal 43% to a nominal 53% phosphate (as P2O5). Forced circulation evaporators are used to concentrate the phosphoric acid. As with stage 1, the product from stage 2 is sent to a clarifier to separate precipitated solids from the liquid phosphoric acid.

The principal facility features that have the potential to release process liquids to the subsurface are sumps and pads. These are the focus of on-going evaluation and maintenance activities.

Discussion of Well 335S Data

Well 335S was installed in 1995. Orthophosphate (as Total Phosphorus) concentrations in the late 1990s were measured as high as 4,000 mg/L (see Figure 4-25), indicating the presence of a Phosphoric Acid Plant source in the vicinity of the well. Concentrations in 2004 through 2006 were variable, ranging from approximately 300 to 2,000 mg/L. However, in 2007 all concentrations were in the range of 120 to 200 mg/L, consistent with levels associated with gypsum stack impacts. The highly variable concentrations indicate that levels are strongly associated with ongoing releases rather than residual material from historical releases in the vadose continuing to transport or secondary sources (i.e., release from aquifer solids by desorption or dissolution). This is further supported by the fact that concentrations dropped from 1,910 mg/L in November 2006 to 150 mg/L in March 2007. The decrease is most likely related to the replacement of the #5 Sump box/can in late 2006 and placement of an impervious sealant on the pad in January 2007. The rapid decrease to background (gypstack) levels demonstrates that secondary sources in the vadose zone are not significant – if they were then the decrease would have occurred more slowly as residual materials continued to transport. Further, the continuing background levels (123 mg/L, 120 mg/L and 130 mg/L in May, August and November 2007) confirms that the Phosphoric Acid Plant source has been effectively controlled.

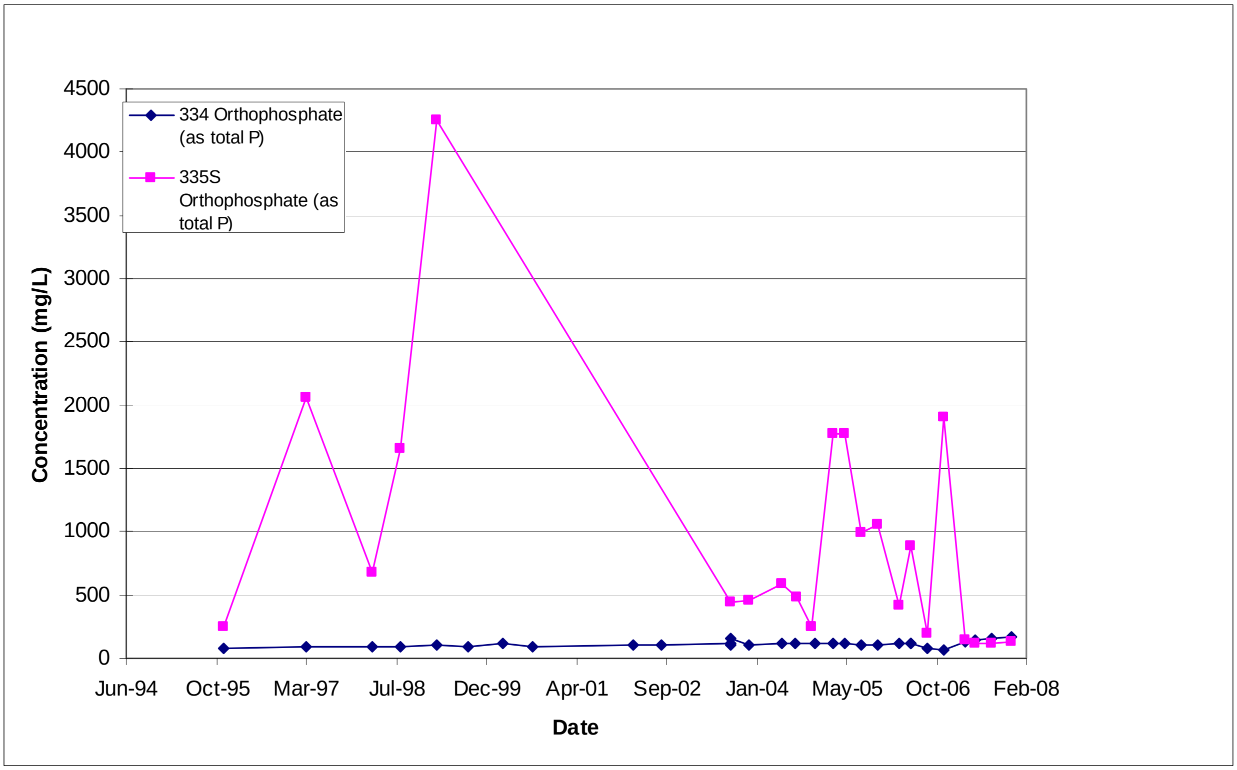


Figure 4-25: Orthophophate (as Total Phosphorus) Concentrations at well 335S in the Central Plant Area

Discussion of 2007 Data for Wells 340 and 367

Well 367 was installed as part of the on-going Phase 2 field work to evaluate the western extent of potential impacts from Phosphoric Acid Plant sources and provide adequate spatial coverage downgradient of potential facility source areas (Figure 4-26). During well development and groundwater sampling conducted immediately following installation in February 2007, an elevated groundwater temperature was identified in the well (31.6 ^{o}C compared to ambient groundwater temperature of 15 to 17 ^{o}C). In 2007 sample results indicated elevated concentrations of Orthophosphate (as Total Phosphorus) and depressed pH in groundwater samples collected from wells 340 and 367.

As a result of these findings, Simplot initiated weekly groundwater sampling at both these wells and continuous water level and temperature monitoring at well 367. These data have been reported monthly to the EPA. At well 340, Orthophosphate (as Total Phosphorus) concentrations were approximately 10,000 mg/L in May and declined steadily to below 5,000 mg/L in late November (see Figure 4-27). Similarly, Orthophosphate (as Total Phosphorus) concentrations in well 367 decreased from approximately 1,900 mg/L in May to 500 mg/L in late November.

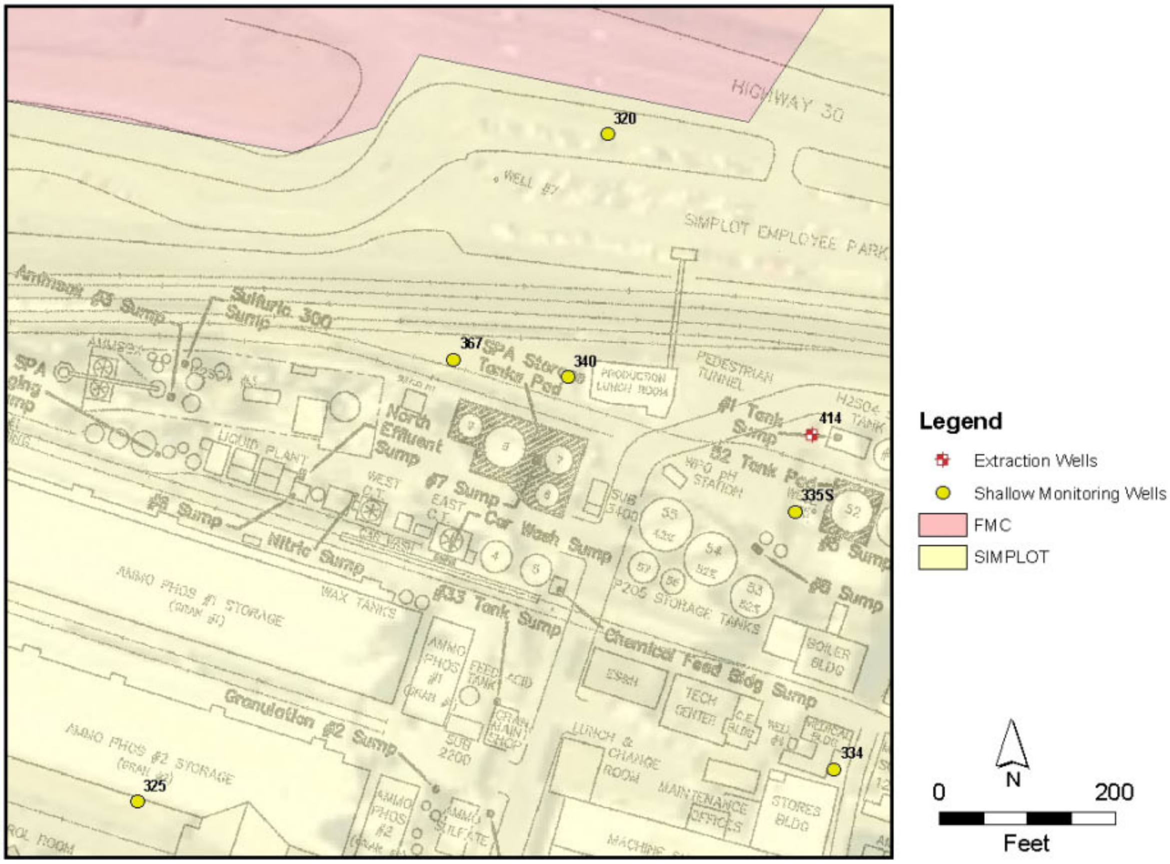
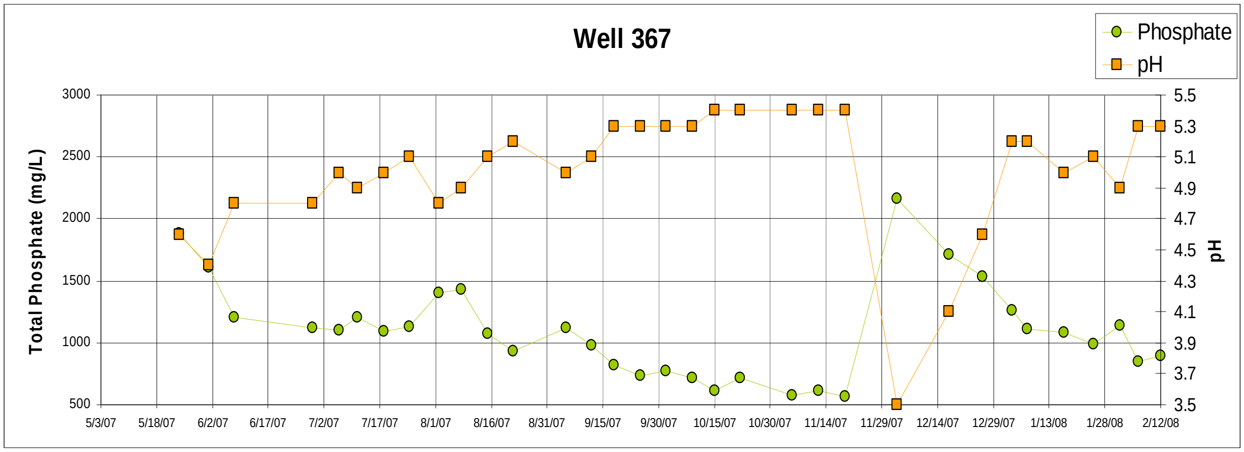


Figure 4-26: Location of Shallow Monitoring Wells and Test Extraction Wells in the Central Rlant Area



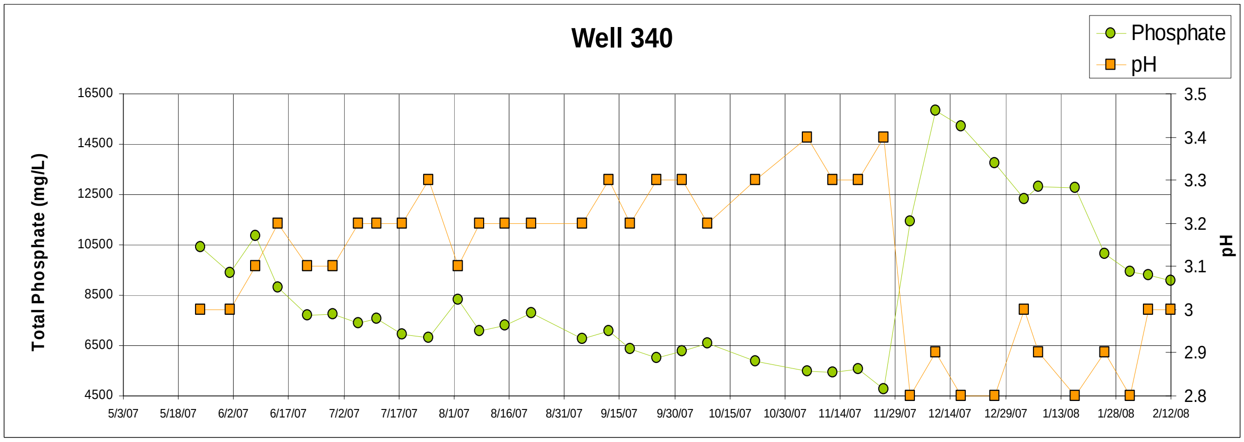


Figure 4-27: Orthophosphate (as Total Phosphorus) Level and pH in Wells 367 and 340 (Weekly Sampling)

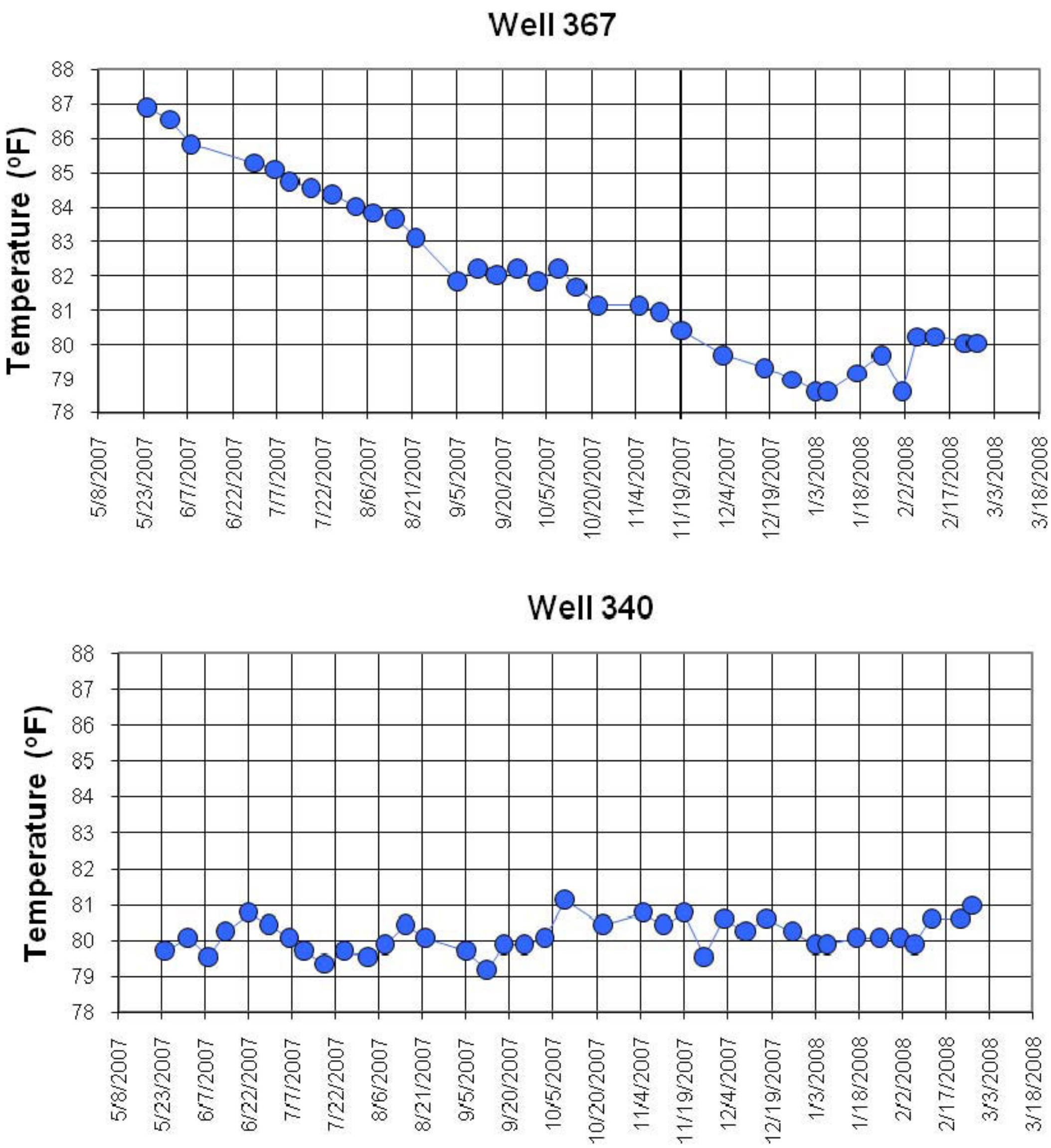


Figure 4-28: Groundwater Temperature Measured During Sampling at Wells 340 and 367

Orthophosphate (as Total Phosphorus) concentrations increased sharply and pH decreased sharply in groundwater samples collected from both wells on December 3. The pH and Orthophosphate (as Total Phosphorus) levels indicate that the source occurred within the plant area in mid to late November. The lack of correlation with the elevated temperature indicates that the source of the Orthophosphate (as Total Phosphorus) and the source of the hot water are different.

On December 7, 2007, inspections found that concrete below the brick on #7 tank sump was degraded. Phosphoric acid was observed within the sump during the inspection. Actions were taken immediately to rectify the situation. By December 17, repairs to the sump were completed. Concentrations of Orthophosphate (as Total Phosphorus) in samples obtained from well 340 peaked at 15,814 mg/L on December 10, 2007 and have declined to 8,153 mg/L by February 22, 2008.

The subsurface in the vicinity of the PAP consists of about 60 feet of unsaturated materials to groundwater. The unsaturated materials consist of cobbles, gravel and sand of the Michaud Formation (Figure 4-29). The saturated hydraulic conductivity of this material is estimated to be about 1,000 to 2,000 ft/day (Phase 2 tests are pending) and transport time through unsaturated conditions will be very rapid, likely less than one day. While vadose zone transport is typically characterized as vertical, significant lateral movement is typically observed. Based on water level measurements made in November 2007, the ambient hydraulic gradient in the vicinity of well 340 is about 0.0007 ft/ft, and the groundwater flow velocity is about 5 to 10 ft/day. If the hydraulic gradient in the saturated zone has steepened due to the influence of the source, the flow velocity could be higher. In addition, it is possible that rapid lateral transport occurs in the vadose zone.

Well 340 is about 100 feet directly down gradient of #7 sump. Based on the flow velocity discussed above, transport from #7 sump to well 340 could occur in less than 10 days.

The rate of decline in the total phosphate concentration at well 340 is proportional to the volume of the source material. Water from the source will be stored as the unsaturated zone is brought closer to saturation, then will drain back to the original moisture condition over time once the source has stopped. The rate of draindown is a function of the material texture, moisture content, and hydraulic conductivity and generally follows a exponential-type decay curve. Draindown continues until a residual moisture content is reached, for coarse grained materials, the residual moisture content is typically less than 10% of the void area of the material.

During drilling of borings in the vicinity, the unsaturated Michaud Formation was observed to be composed of mostly quartzite and metasedimentary sands and gravels with varying amounts of silt. Field tests of the fine grained fraction show an acid reaction typically attributed to the presence of calcite. This material would have some buffering capacity, however, the low pH observed in wells 367 and 340 indicates that the acid has overcome any buffering effect that is present in the saturated or unsaturated zones of the Michaud Gravel along the transport pathway. As a result, it is likely that there is a reduced potential for precipitation of phosphate during transport and any subsequent dissolution of phosphorus as a secondary source. This is supported by the 335S data described above.

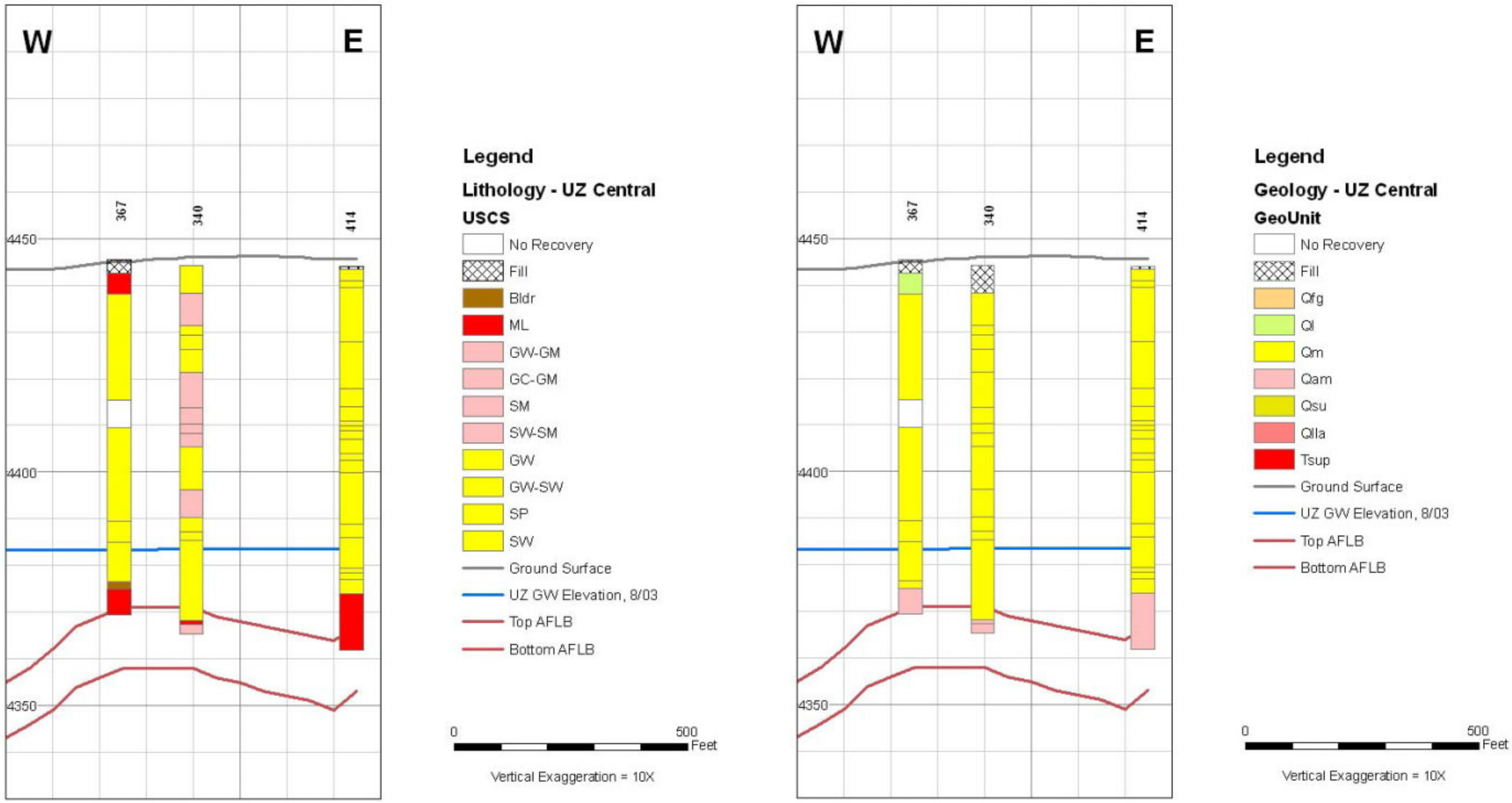


Figure 4-29: East-West Cross Section from Well 367 to Well 414.

As with well 335S, orthophosphate concentrations in well 340 would be expected to return to concentrations representative of the effects of only the gypsum stack when contributions of the Phosphoric Acid Plant are controlled. Long-term data indicate that, prior to 2006, Orthophosphate (as Total Phosphorus) concentrations were as low as 370 mg/L (Figure 4-30). While this is in the range of concentrations expected from contributing gypsum stack groundwater, it is higher than the mean (270 mg/L) and higher than concentrations in the upgradient well 334 (around 120 mg/L in 2007). There are two possible explanations of the higher than expected concentrations at well 340:

- Plant maintenance records indicate that there have been a number deficiencies in secondary containment in the past in the Phosphoric Acid Plant area that could have lead to a series of small individual contributions of Orthophosphate (as total Phosphate) to groundwater over a period of several years.

- There is a preferential pathway of higher concentration groundwater influenced by the gypsum stack that is being observed in well 340 but not well 334.

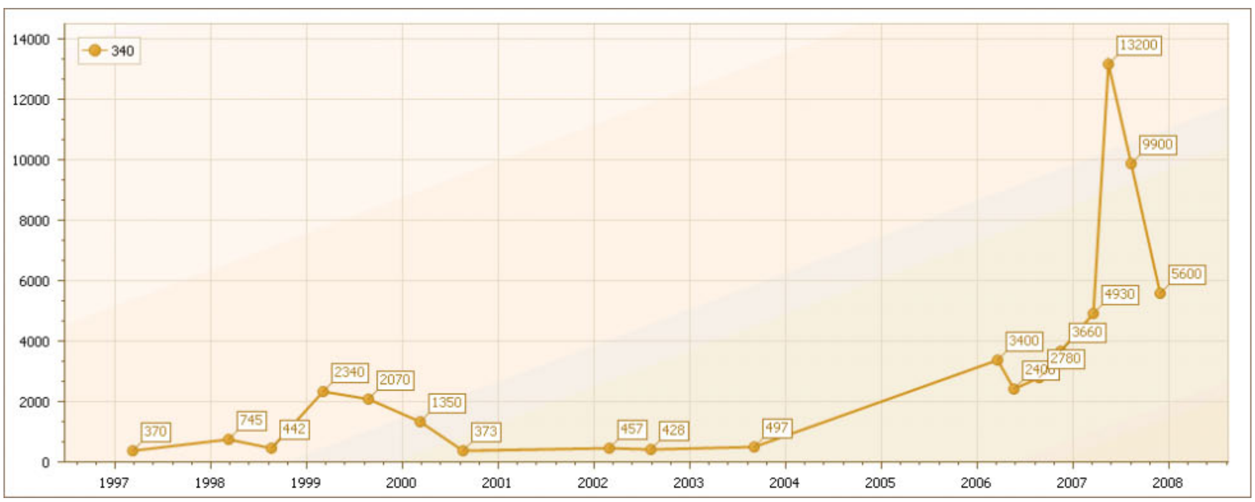


Figure 4-30: Orthophosphate concentrations in routine groundwater samples from Well 340 for the period of record.

<u>Don Plant Source Control Evaluations</u>

The Don Plant has recently established a Sump & Pad Team to identify and prioritize issues related to sumps and pads throughout the plant that could affect groundwater.

The team met initially in December 2007 to identify the goals of the team and assign responsibilities to each member. In January 2008, the team compiled historical data relating to sump inspections and groundwater evaluations. In addition, Production led a tour of the Super Phosphoric Acid and Phosphoric Acid Plants that included all team members to see first-hand what the issues were in the field.

Based on this evaluation, a number of activities were planned to eliminate releases and reduce the potential for impacts to the groundwater. These activities included items such as:

- Repairing or replacing selected pads and sumps,
- Eliminate condensate and other liquid stream from reporting to the pads, and
- Prevent area of standing liquid by routing liquid directly to launders or sumps.

Key Findings/Activities to Support CERCLA Remedial Design

The key findings from the evaluations described above are:

- o In the past, secondary containment structures have occasionally become compromised, allowing liquid process materials from the Phosphoric Acid Plant to escape and migrate into the subsurface. Routine inspection and maintenance of in-plant production areas allow such problems to be located and mitigated rapidly.
- o Process liquids move rapidly to groundwater through highly permeable unsaturated materials.
- o Constituent concentrations in the Upper Zone groundwater are elevated as a result of Phosphoric Acid Plant releases. The Upper Zone has a relatively thin saturated thickness, high hydraulic conductivity and reacts quickly to source inputs.
- o Impacts are limited to Upper Zone groundwater. Downward migration is limited by presence of the AFLB. Beyond AFLB, upward gradient keeps migration in groundwater in the upper portion of the saturated zone as transport proceeds to the river.
- o Down gradient trends indicate that the mass in the release is not sufficient to result in large increases in groundwater concentrations
- o Once sources are controlled, concentrations reduce to levels consistent with gypsum stack impacts. Secondary sources (i.e., desorption/dissolution of phosphorus from aquifer solids) is not significant.

The Central Plant Area is being investigated as part of the Phase 2 Data Gap investigation. Data related to the extent of affected groundwater and hydraulic properties of hydrostratigraphic units in the Central Plant Area are being collected and work is still in progress. Work completed so far as part of this investigation includes the installation of wells 367 and 414 to further characterize the extent of COCs in groundwater north of the Phosphoric Acid Plant. Well 414 is a test extraction well and was added to the extraction system in December.

Additional actions that will be performed include:

- A multi-well aquifer test will be conducted using well 414 as the pumping well and well 335S as the primary observation well. This test will allow an assessment of the hydraulic properties in this portion of the Upper Zone that can be used in citing additional extraction wells down gradient of the Phosphoric Acid Plant.

- Geophysical survey to delineate the extent of affected groundwater down gradient.

- Continuation of weekly monitoring at wells 340 and 367 and quarterly monitoring at other wells in the vicinity.

In addition, Simplot has implemented an aggressive inspection/maintenance program to address potential current and future source areas.

Existing information indicates that the best action for the elevated concentrations of plant affected groundwater in the Central Plant Area is to control sources within and around the Phosphoric Acid Plant. The findings of this program, along with field data, will be used to support the decision of whether additional groundwater extraction wells are appropriate for this area. This evaluation will be documented in detail in the Prefinal Groundwater Extraction System Remedial Design Report.

4.3.2 Lower Zone

Central Plant Lower Zone wells locations are shown on Figure 4-31.

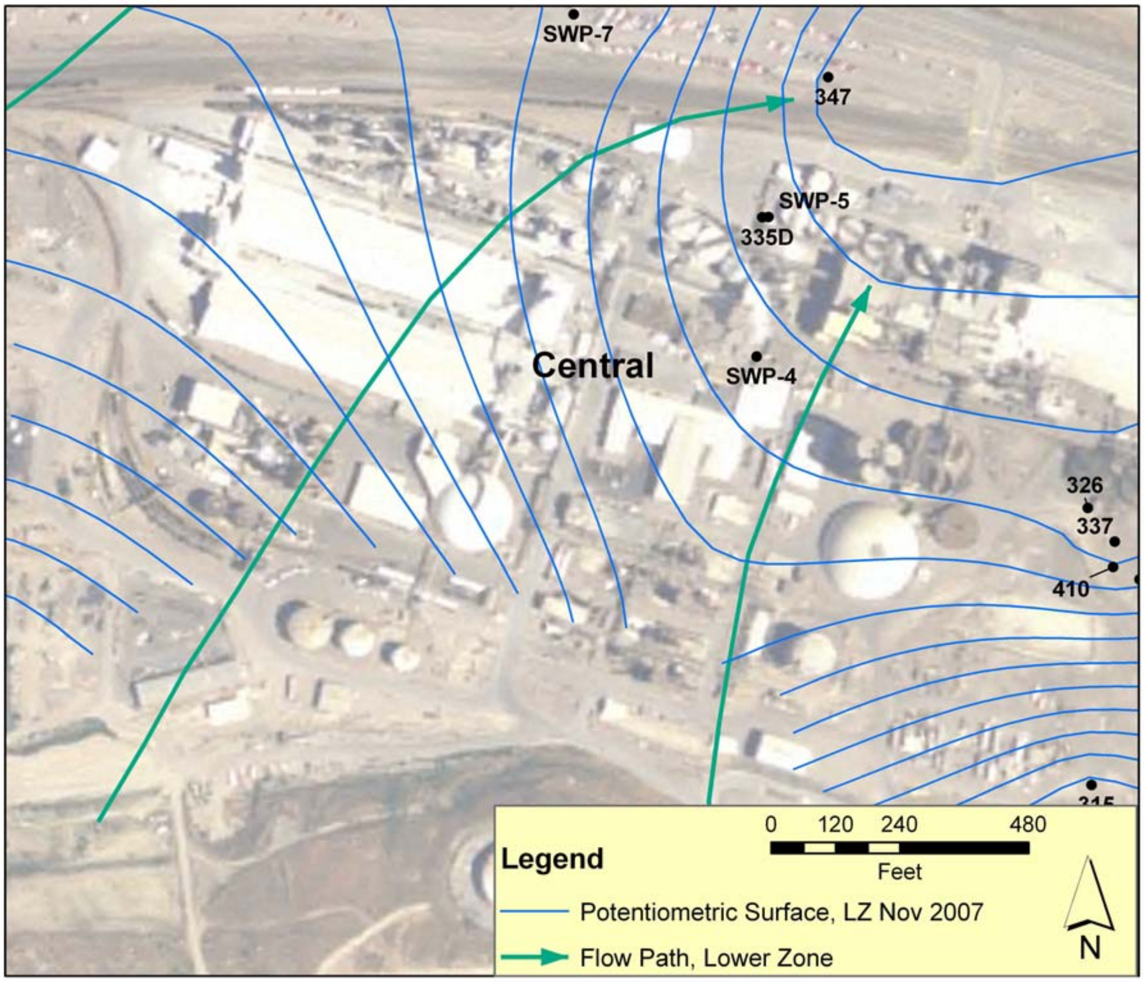


Figure 4-31: Central Plant Lower Zone Well Locations

Conditions in the Central Plant Lower Zone are dominated by the presence of facility production wells that pump approximately 4,000 gpm on a consistent basis (see Section 3.0).

Constituent concentrations are elevated in groundwater pumped from production well SWP-4 (see Figures 4-32 and 4-33). Based on a simple mass balance for Arsenic and Sulfate (measured concentrations, background concentrations and total production well flow), it is estimated that the well captures approximately 185 gpm of stack-affected groundwater (NewFields 2005). Concentrations of Arsenic and Sulfate in SWP-4 have been decreasing since 2004. Concentrations in monitoring wells downgradient of SWP-4 (wells 335D and 347) are in the range of background levels, or only slightly elevated, indicating the SWP-4 is effective in capturing stack-affected groundwater in this area.

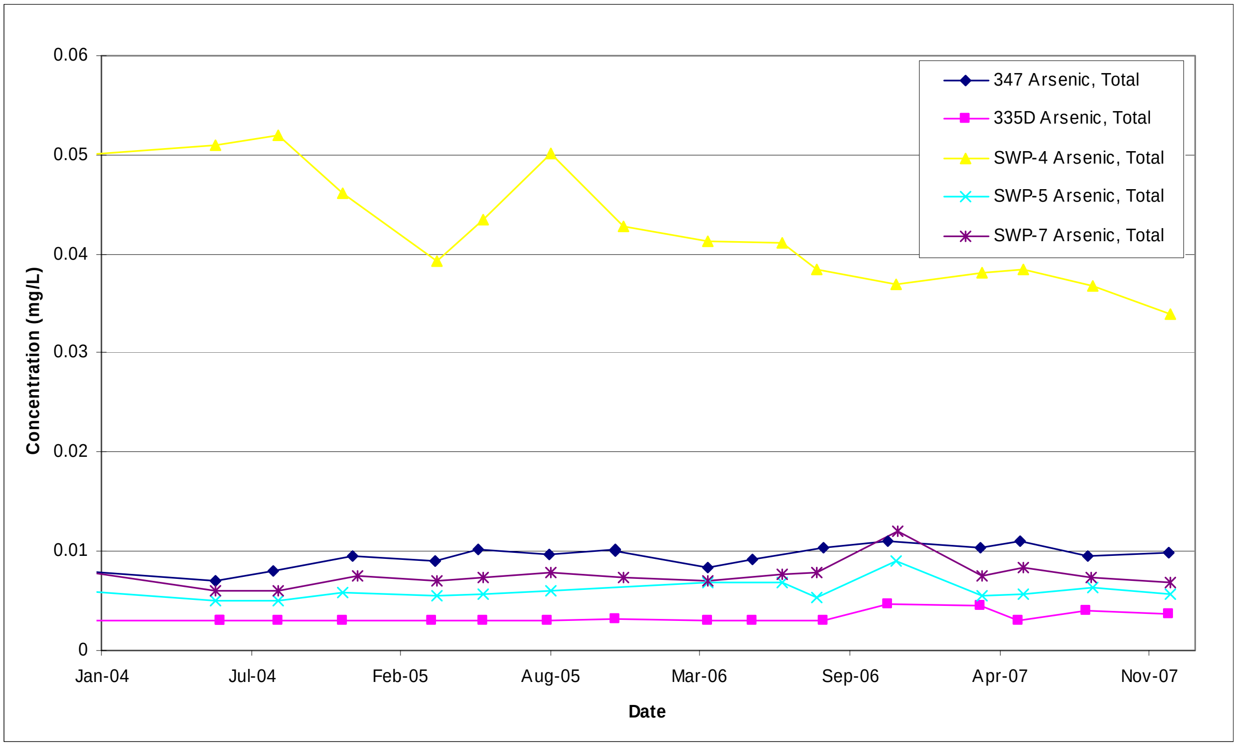


Figure 4-32: Central Plant Lower Zone Arsenic Concentrations

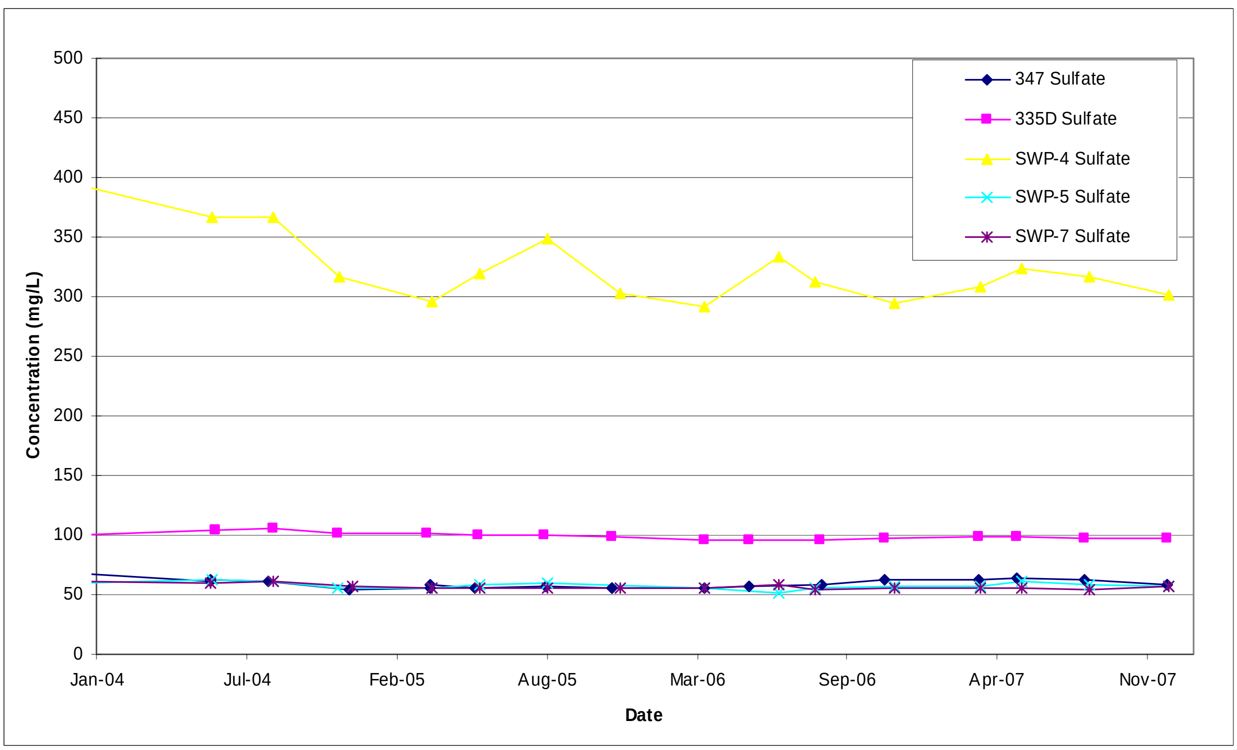


Figure 4-33: Central Plant Lower Zone Sulfate Concentrations

It is further noted that even though the production wells extract a significant flow of Lower Zone groundwater, there is still an upward gradient, as illustrated by the higher Lower Zone than Upper Zone groundwater surface elevations in Figure 4-34.

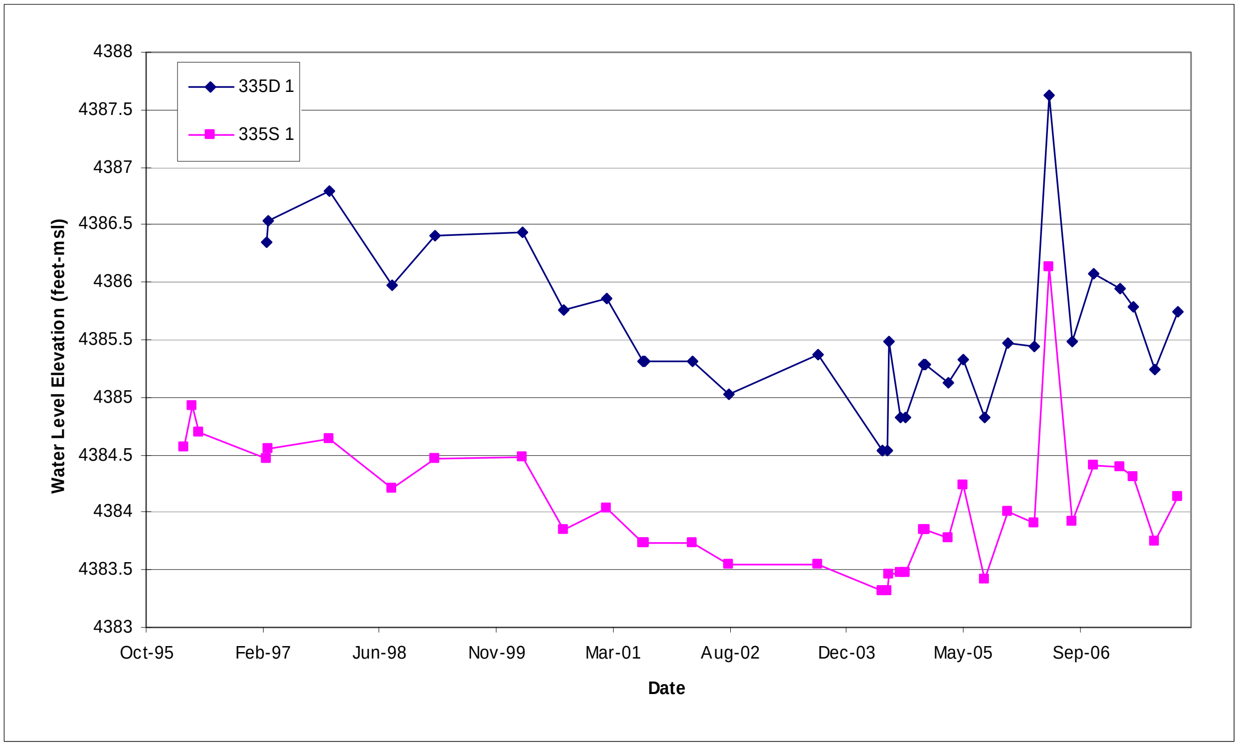


Figure 4-34: Central Plant Upper and Lower Zone Groundwater Surface Elevations 1995 to 2007

4.4 West Plant Area

The site features and groundwater wells in West Plant Area are shown on Figure 4-35 (Upper Zone wells) and 4-36 (Lower Zone Wells). Note that since the American Falls Lake Bed is absent south of wells 309/310 there is no definitive separating unit between the Upper Zone and Lower Zone in the area of the extraction wells.

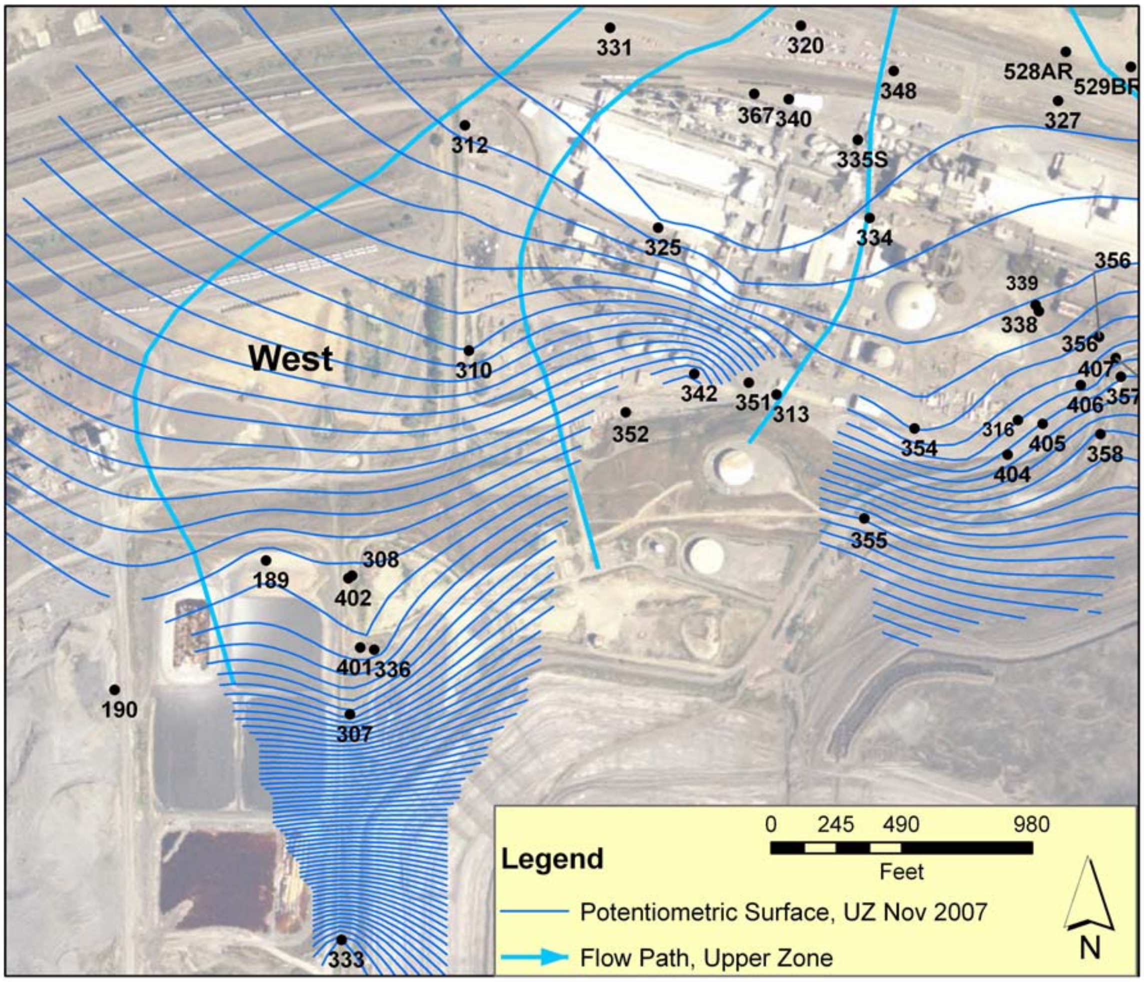


Figure 4-35: West Plant Area Upper Zone Wells

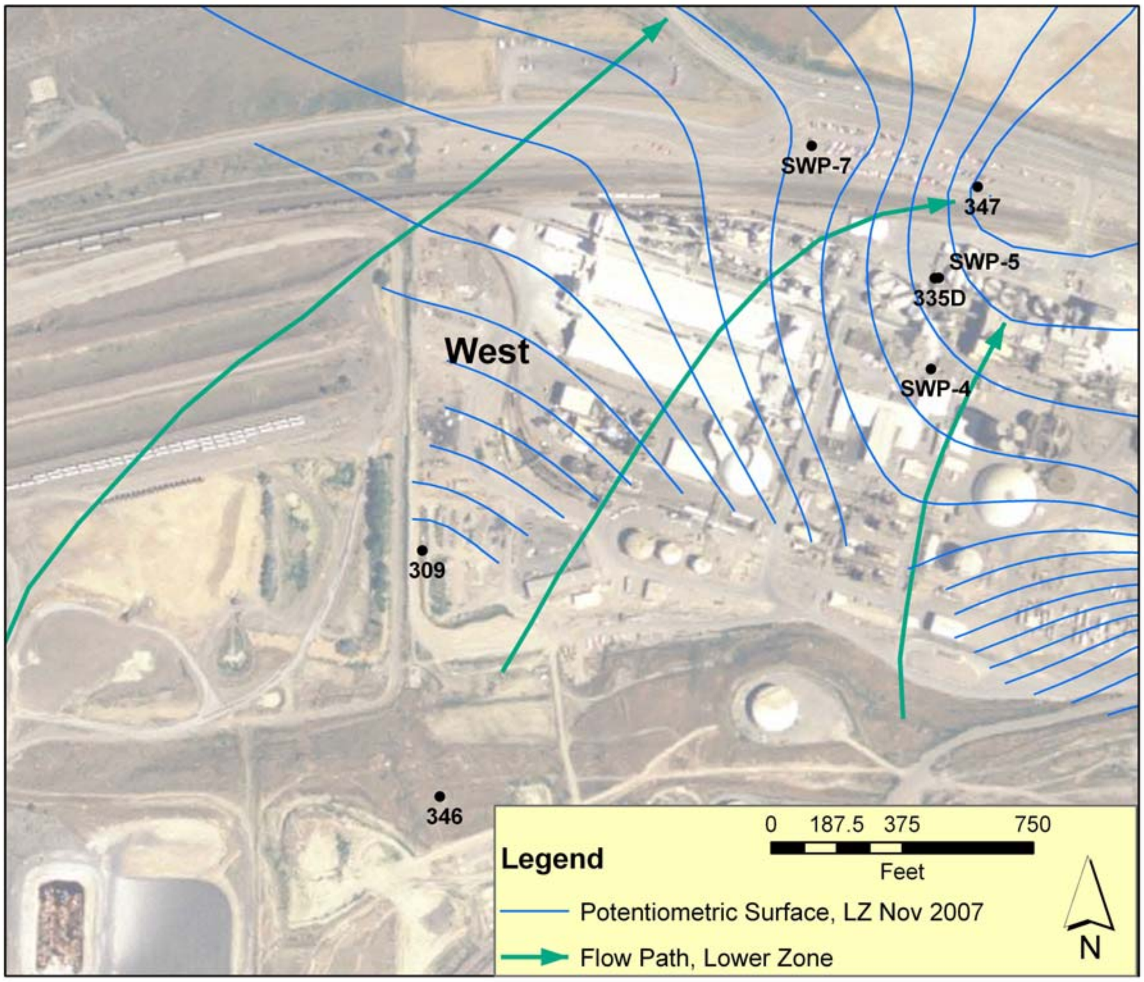


Figure 4-36: West Plant Area Lower Zone Wells

Figure 4-37 shows the groundwater level elevation measured in wells in the West Plant Area since 1992. These wells are in the unconsolidated material within the relict channel (NewFields 2005). As shown, water levels have dropped between 8 and 15 feet in the period from 1997 to 2006 and have rebounded slightly since then. This water level drop may have been caused different factors, in particular:

- Input flows from fenceline sources may have decreased; and
- Regional drought conditions have reduced groundwater flows from the Bannock Hills.

Water levels increased for the first time since 1997 in 2006 and 2007, possibly reflecting the effect of the higher precipitation.

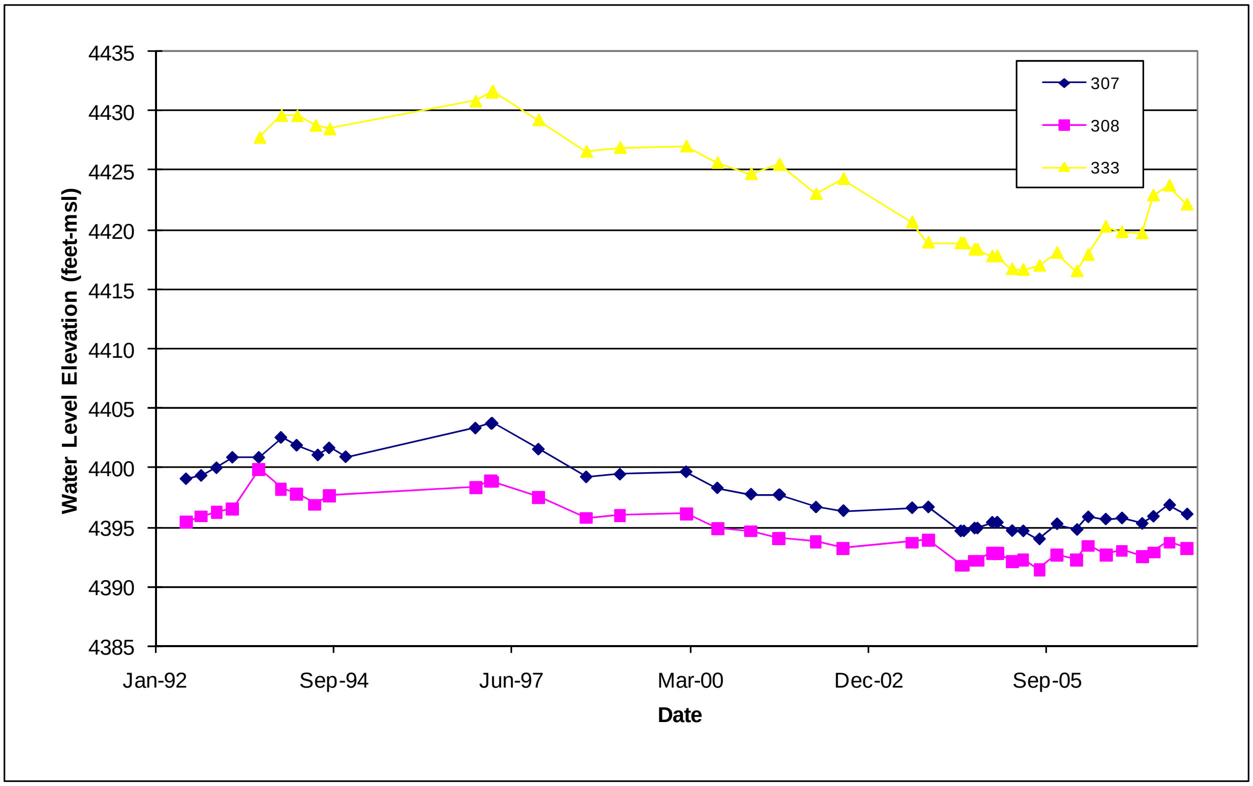


Figure 4-37: West Plant Area Groundwater Surface Elevation 1992 to 2007

During the same period, constituent concentrations in groundwater in this area have remained relatively consistent (for example, see recent Arsenic concentrations on Figure 4-38).

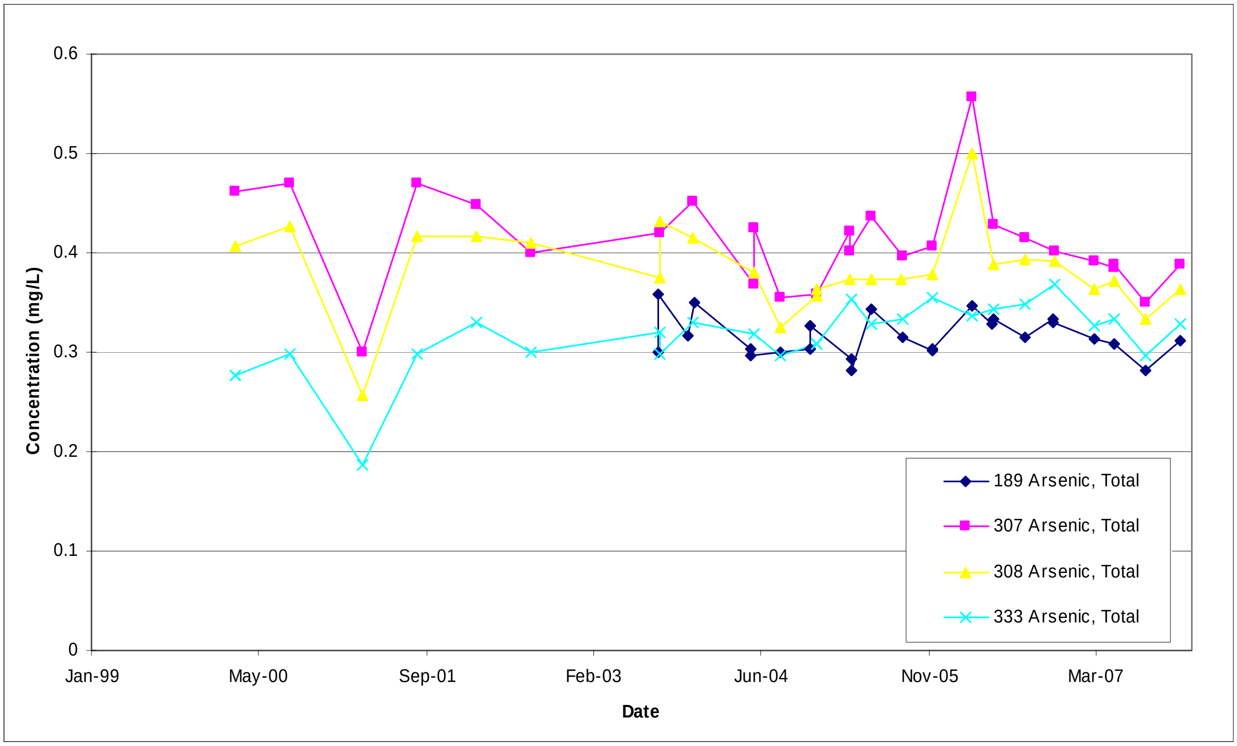


Figure 4-38 West Plant Area Arsenic Concentrations 1999 to 2007

The combination of lower water levels and relatively consistent constituent concentrations indicates that mass flux of constituents in groundwater in this area is lower than historical levels.

Arsenic and Sulfate concentrations immediately downgradient of the extraction wells are shown in Figures 4-39 and 4-40. Concentrations were increasing at well 310 in 2005, but decreased in 2006 and 2007. This is an Upper Zone well that is predicted to receive stack-affected groundwater from east of the 401/402 extraction well pair. A test extraction well (415) has been installed in this area as part of the Phase 2 field work and was brought on-line in January 2008. Farther to the north, Arsenic and Sulfate concentrations have shown a slight decreasing trend in recent years (i.e., at well 312; see Figures 4-39 and 4-40).

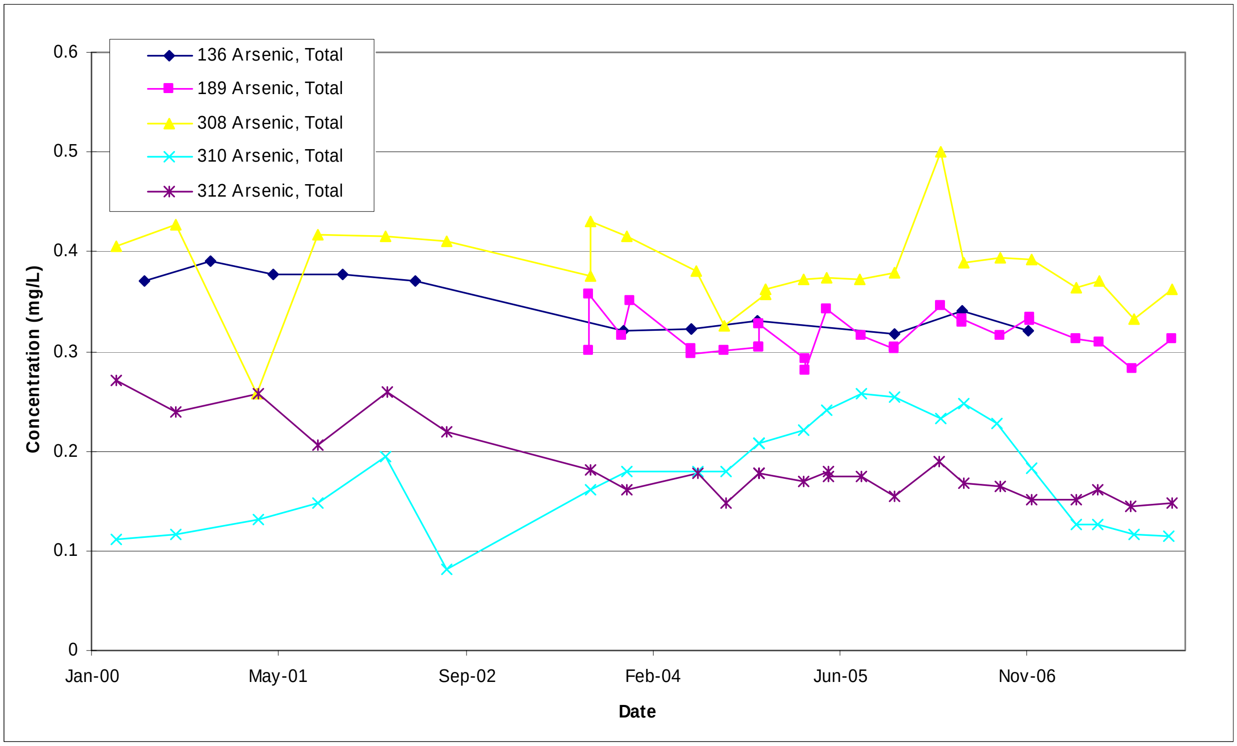


Figure 4-39: West Plant Area Arsenic Concentrations 2000 to 2007

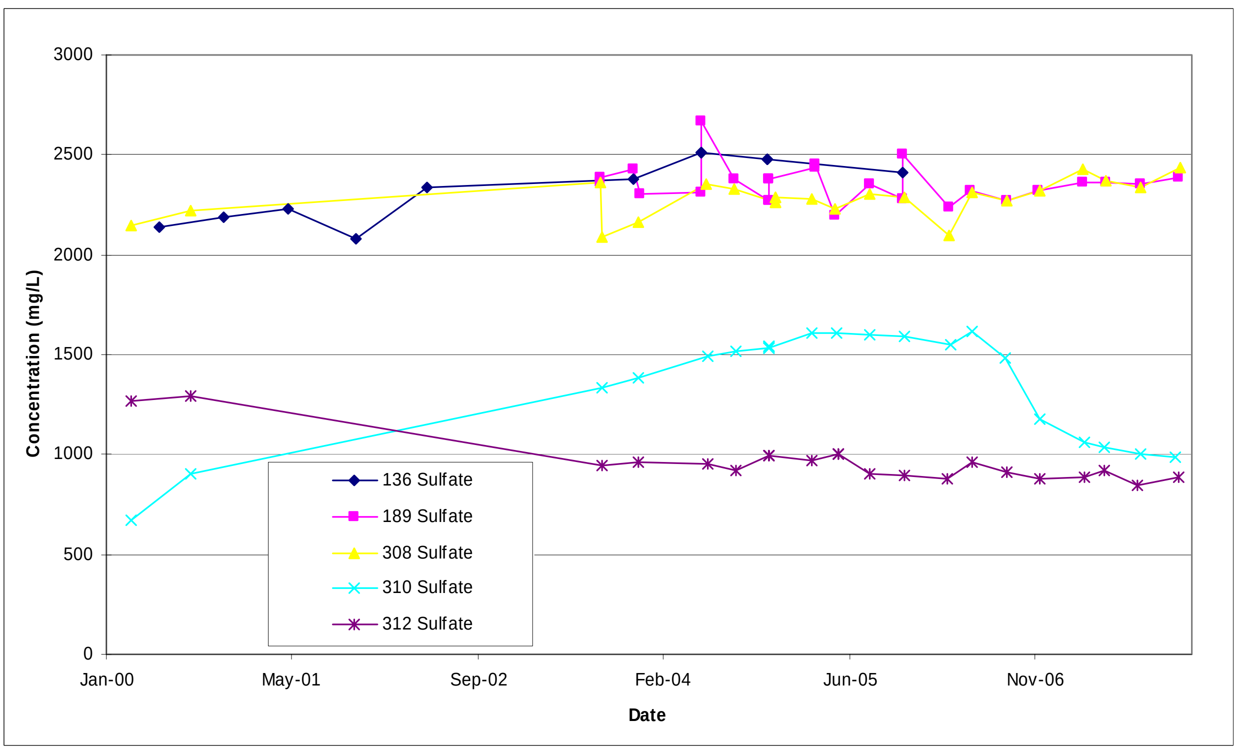


Figure 4-40: West Plant Area Sulfate Concentrations 2000 to 2007

4.5 Area North of I-86/Portneuf River Springs

Site features and groundwater monitoring wells north of I-86 and spring sampling points are shown on Figures 4-41 and 4-42.

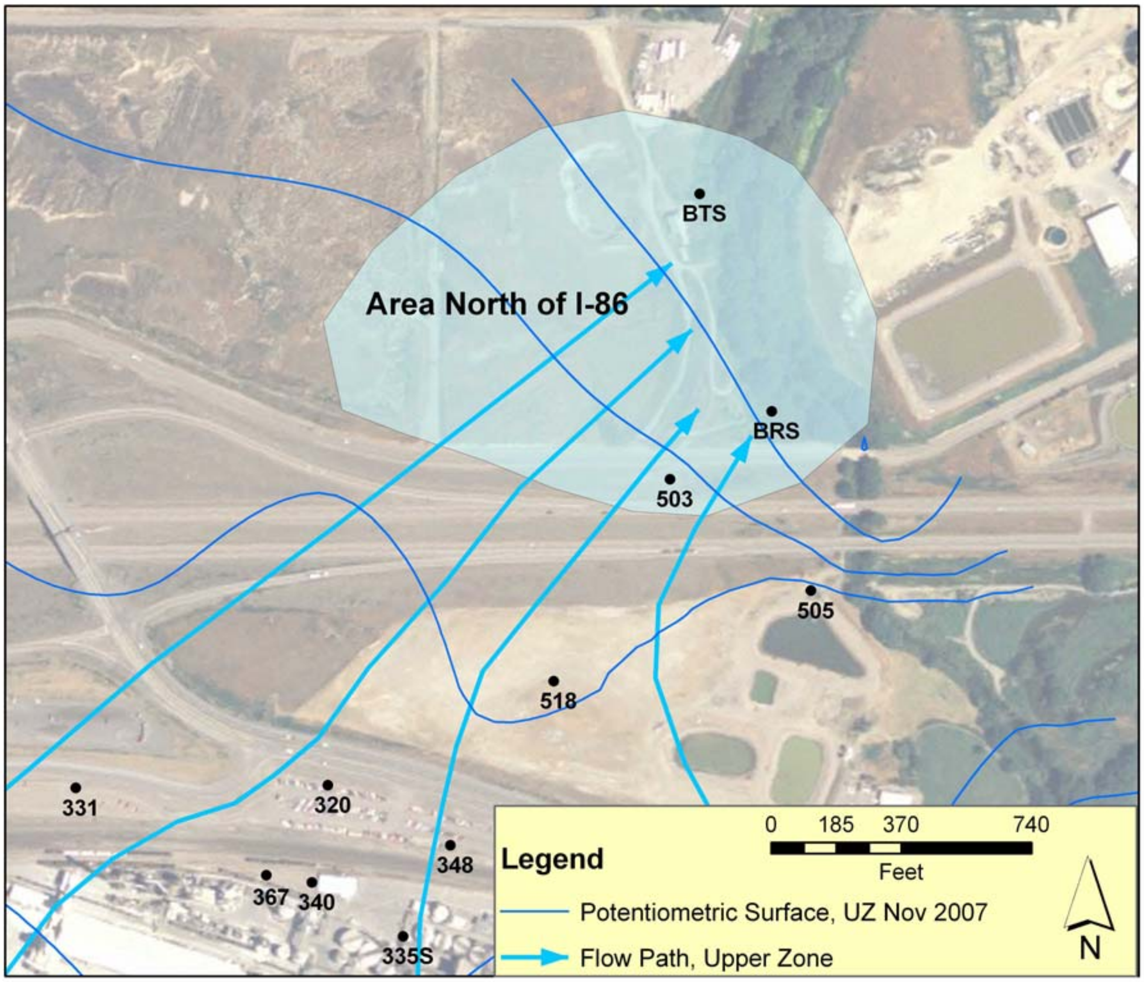


Figure 4-41: Upper Zone Wells and Spring Locations – Area North of I-86

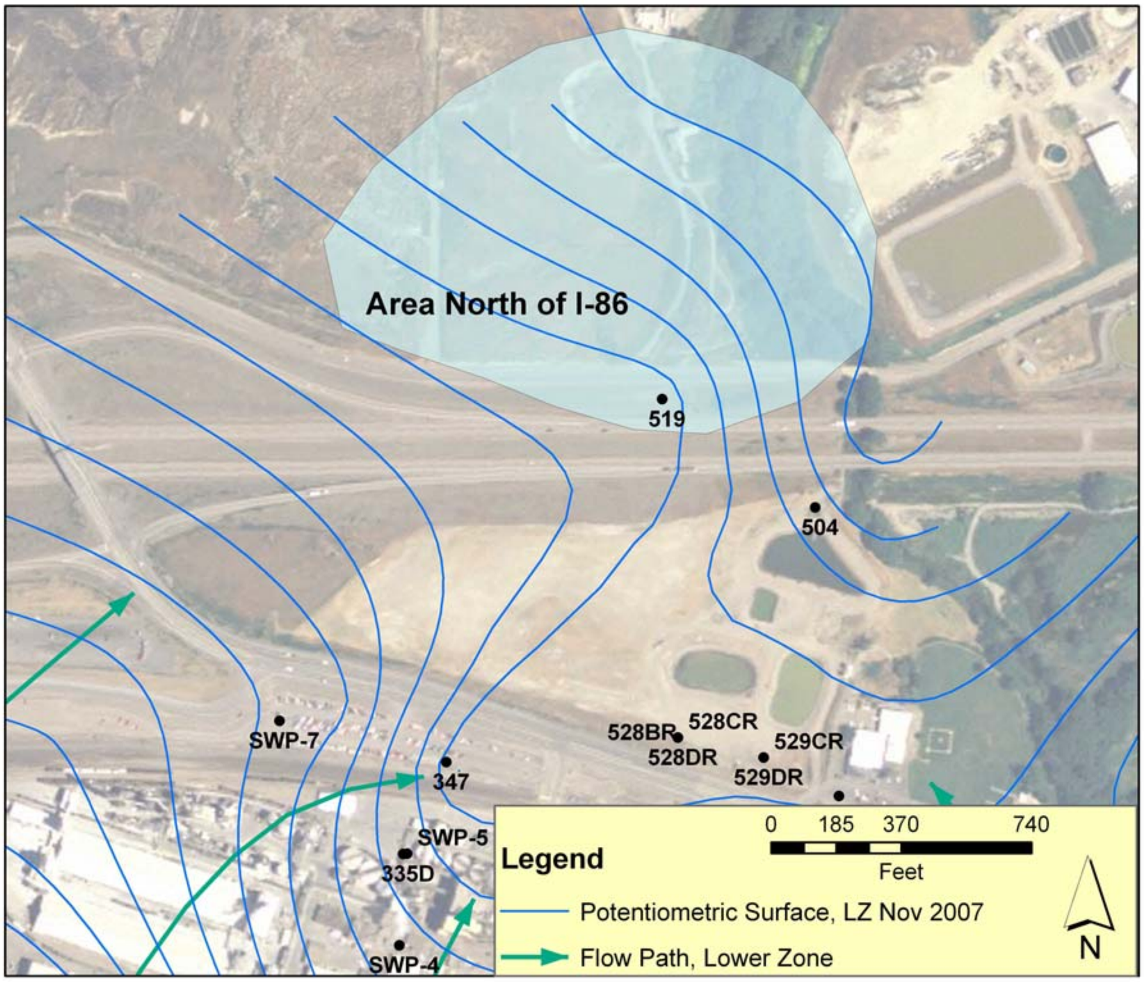


Figure 4-42: Lower Zone Wells and Spring Locations – Area North of I-86

Arsenic, Sulfate and Orthophosphate (as Total Phosphorus) concentrations in groundwater and Portneuf River springs are shown on Figures 4-43 through 4-45. Concentrations of Arsenic and Sulfate in Upper Zone well 503 are relatively constant with time (typical ranges: Arsenic 0.01 to 0.02 mg/L and Sulfate 160 to 200 mg/L in the period since the August 2003 baseline monitoring event). Orthophosphate (as Total Phosphorus) concentrations, typically in the range of 4 mg/L, were lower in the second and third quarter monitoring event (0.6 and 0.41 mg/L, respectively), before returning to 4.5 mg/L in the fourth quarter event. Concentrations in deeper well 519 are consistent with levels unaffected by Site sources.

Batiste Spring (BTS) is located at the very northern edge of the plume and it appears that on some occasions it has historically received a proportion of unaffected groundwater input. Concentrations were relatively high in 2005 and 2006 and generally reduced in 2007. Concentrations were quite variable in Batiste Spring in 2007, with Arsenic concentrations ranging from 0.007 to 0.037 mg/L and Orthophosphate (as Total Phosphorus) ranging from 5 to 29 mg/L. Concentrations measured in the Spring at Batiste Road (BRS) have typically been lower than at Batiste Spring in recent years, but showed an increasing trend in the latter part of

2007, with Arsenic being relatively similar, Orthophosphate (as Total Phosphorus) being higher and Sulfate being lower at the Spring at Batiste Road than as Batiste Spring at the end of the year.

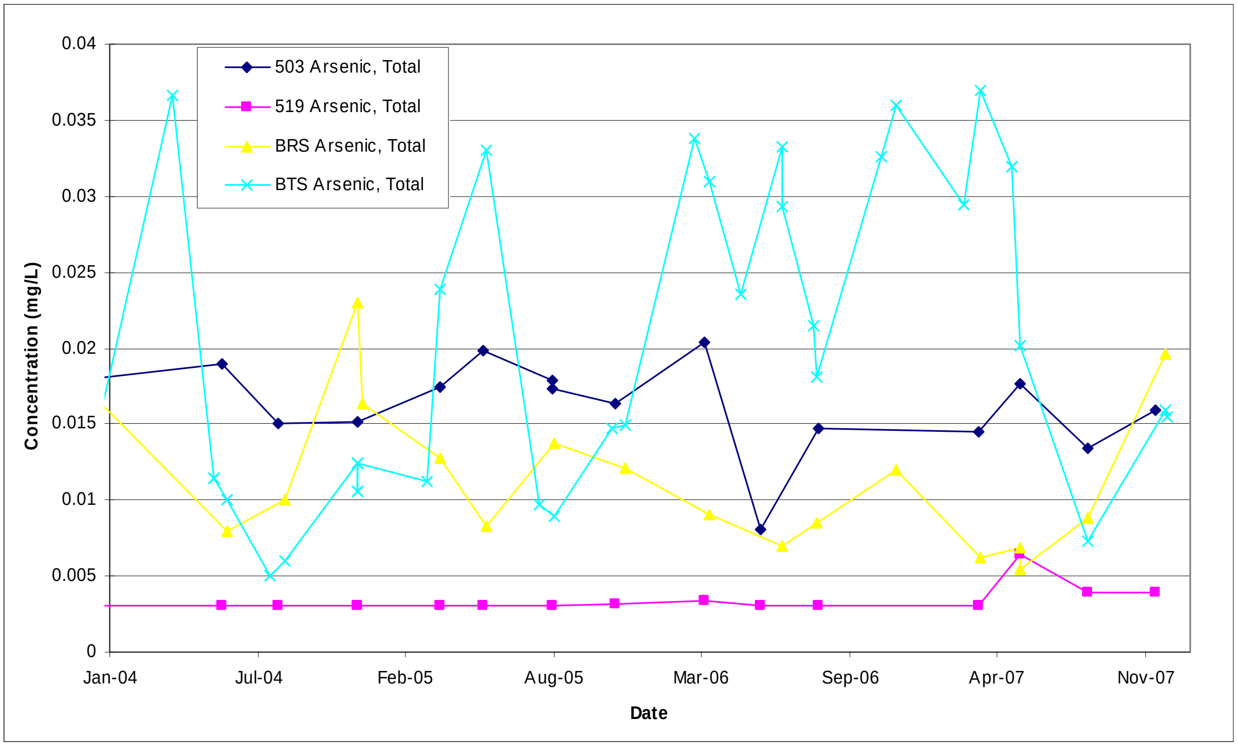


Figure 4-43: Arsenic Concentrations in Groundwater Wells North of I-86 and in Portneuf River Springs

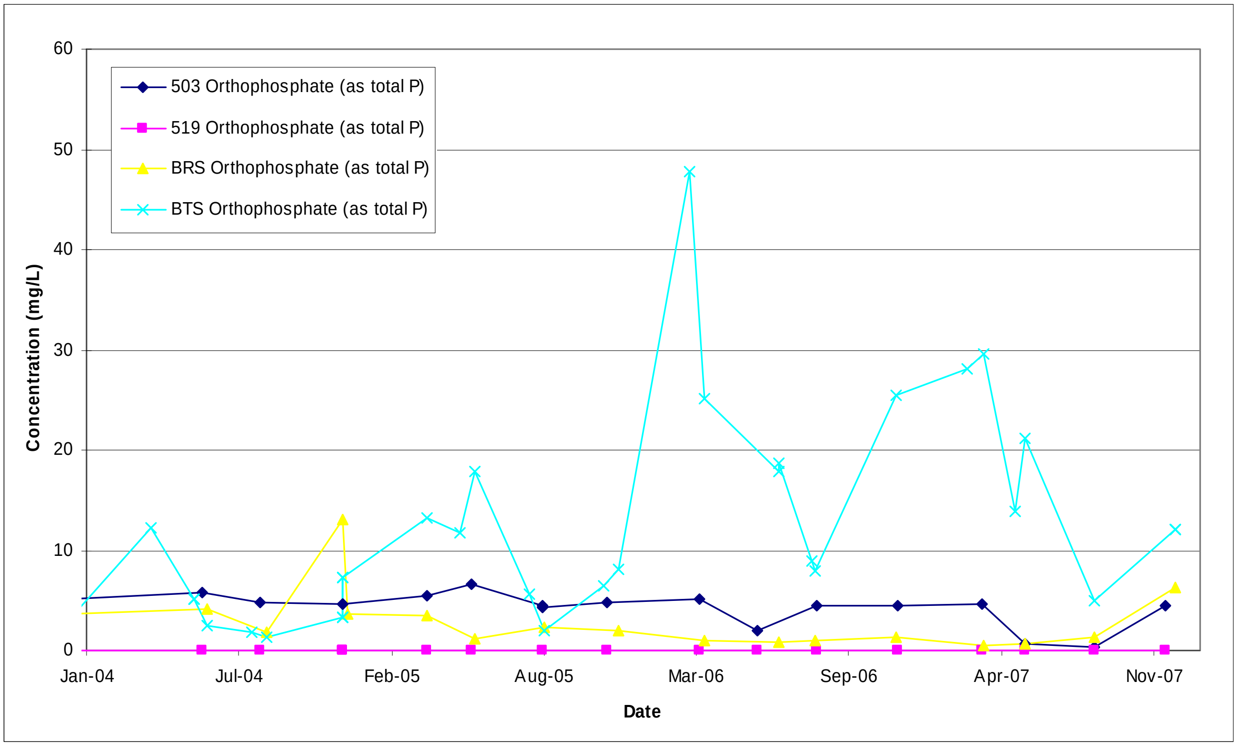


Figure 4-44: Orthophosphate (as Total Phosphorus) Concentrations in Groundwater Wells North of I-86 and in Porteneuf River Springs

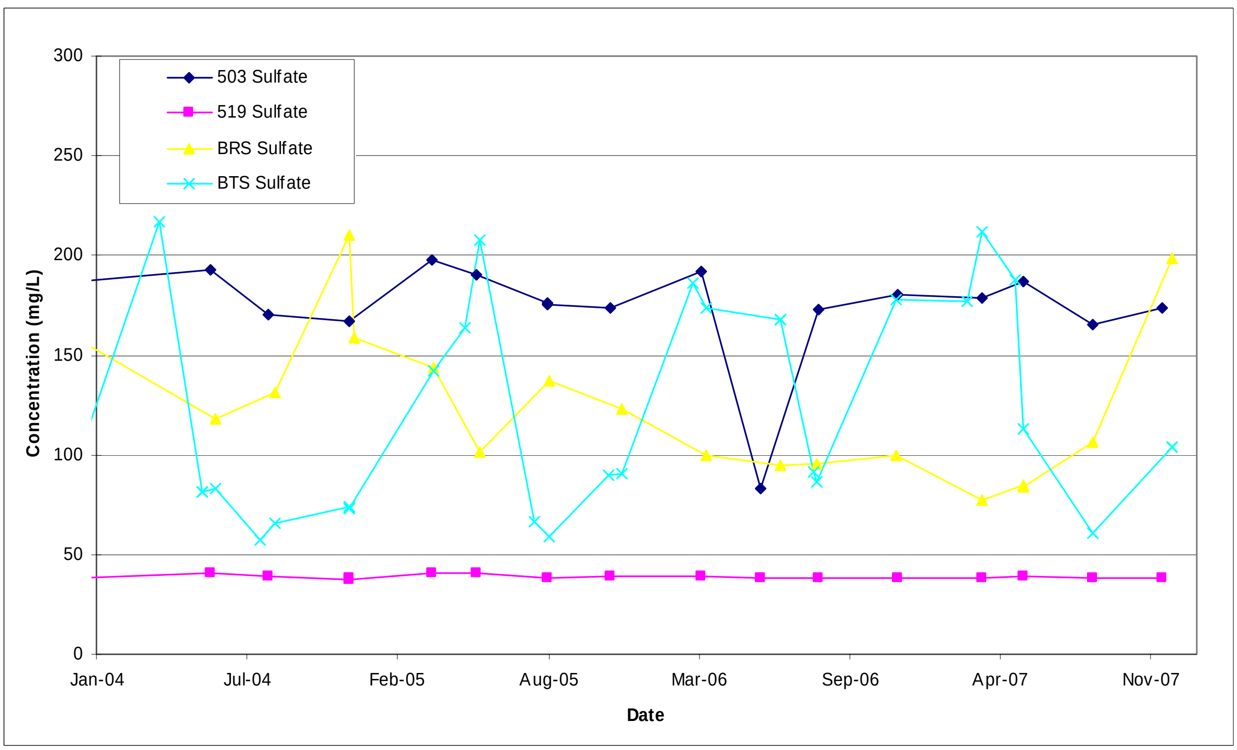


Figure 4-45: Sulfate Concentrations in Groundwater Wells North of I-86 and in Portneuf River Springs

There is a strong correlation between constituent concentrations measured at the springs. For example, Figure 4-46 shows Arsenic concentrations plotted against Orthophosphate (as Total Phosphorus) concentrations measured since 2000 in Batiste Spring. Figure 4-47 shows Arsenic concentrations plotted against Sulfate concentrations from the same dataset. Concentrations are strongly correlated with Correlation Coefficients of 0.73 (Arsenic and Orthophosphate (as Total Phosphorus)) and 0.90 (Arsenic and Sulfate).

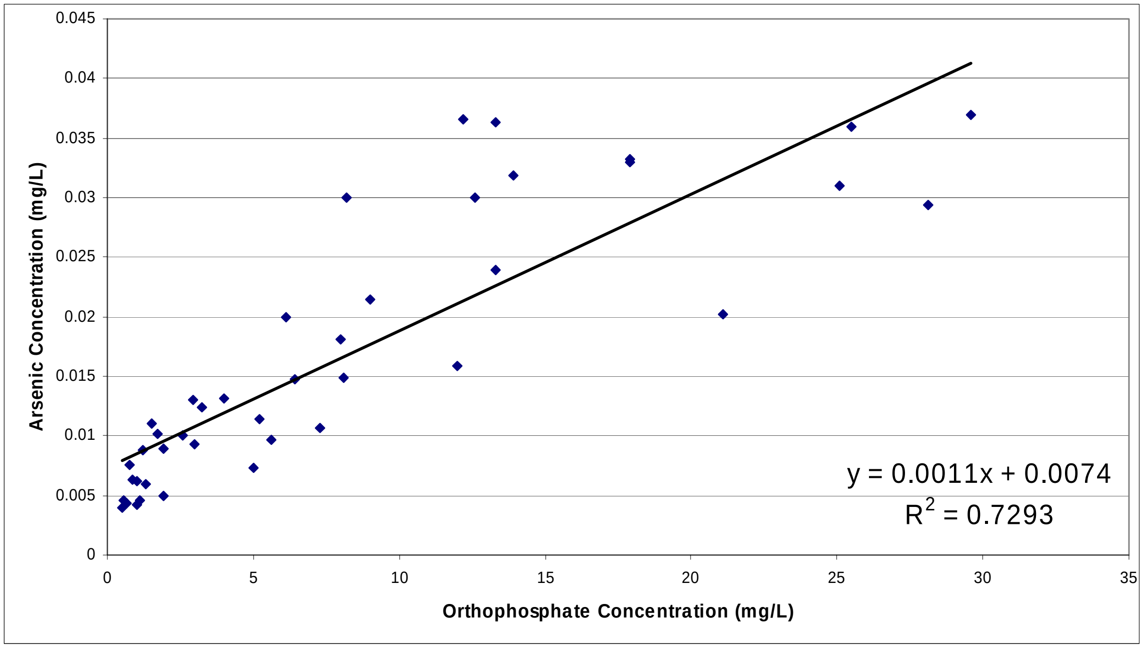


Figure 4-46: Arsenic Concentrations Plotted Against Orthophosphate (as Total Phosphorus) Concentrations – Batiste Spring 2000 to 2007 Dataset

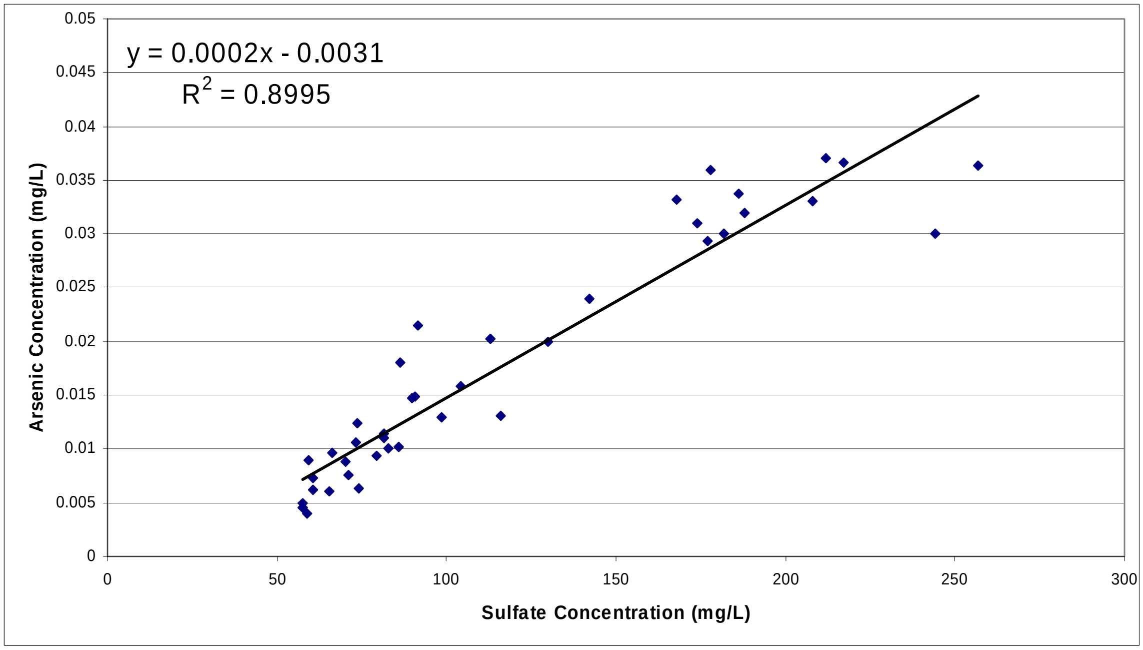


Figure 4-47: Arsenic Concentrations Plotted Against Sulfate Concentrations – Batiste Spring 2000 to 2007 Dataset

5.0 SUMMARY AND CONCLUSIONS

This report provides an evaluation of the test groundwater extraction system operation and of groundwater data collected in 2007 in, and downgradient of, the Simplot Plant Area of the Eastern Michaud Flats Superfund Site.

The groundwater extraction system is being designed and implemented in accordance with a Remedial Design/Remedial Action Consent Decree (EPA, 2002). This is occurring in a phased approach that includes the operation of a test groundwater extraction system to provide data to support design of the final system. The test extraction system began routine operation in June through October 2004. Ongoing groundwater monitoring, performed in quarterly events in February/March, May, July/August and November/December 2007, provided data to assess effects of the test extraction system on downgradient groundwater conditions. Field work to fill remaining data gaps necessary to support final design of the groundwater extraction system is ongoing. This "Phase 2" work included installation of additional test extraction wells that were brought online in January 2008. Other studies, such as a geophysical survey of the plume north of Highway 30 are also being developed.

The test extraction system was operated throughout the year. It was shut down for approximately three weeks in late May/early June when the facility was taken offline for routine maintenance (Don Plant "turnaround"). Performance of individual wells was consistent with that in previous years. Overall the average flow of extracted groundwater was lower in 2007 than 2006, primarily due to certain wells being offline to allow for piping upgrades for new extraction wells and for maintenance within the facility. It is estimated that the test extraction system, along with the facility production well SWP-4, removed approximately 27 percent of the arsenic mass flux in groundwater downgradient of the source areas. The system is also estimated to have removed an average of 1,000 pounds per day on average of Orthophosphate (as Total Phosphorus) in 2007.

Groundwater from the test extraction system is used as makeup water in the Phosphoric Acid Plant portion of the Don Plant. The Don Plant water balance is complex and is integral to successful facility operation. Numerous unit operations require specific water flows and have different minimum water quality requirements. Flows are continuously measured at key points within the process as part of routine operation. Flows from the test extraction system are relatively small compared to other inputs; 270 gallons per minute from the extraction system on average compared to approximately 4,000 gallons per minute from the facility production wells. Since 2002, the average flow from the extraction wells has increased from less than fifty to the range of 300 gallons per minute. A corresponding decrease in fresh water consumption in the Phosphoric Acid Plant has occurred. This is expected because addition of test extraction groundwater to the reclaim cooling system has reduced the demand for fresh water input. The overall water flow to the gypsum stack has not been affected.

Assessment of groundwater data collected in 2007 identified the following key conclusions:

- o Constituent concentrations in East Plant Lower Zone groundwater downgradient of the test extraction system decreased significantly in 2005 and remained at those levels in 2006 and 2007. This appears to be a direct effect of the extraction system. Arsenic, Sulfate and Orthophosphate (as Total Phosphorus) concentrations all decreased in a similar manner. This provides evidence that phosphorus desorption/dissolution effects are not significant and that Orthophosphate (as Total Phosphorus) concentrations in groundwater will decline on a similar timeframe as Arsenic concentrations downgradient of the extraction system.

- o A source, or sources, of Arsenic and Orthophosphate (as Total Phosphorus) to Upper Zone groundwater is present in the Phosphoric Acid Plant area. A detailed evaluation is ongoing in this area including weekly sampling of key groundwater wells and an aggressive source identification/control program. The key findings are:

  - o Liquid process materials from the Phosphoric Acid Plant have breached facility containment in the past and traveled into the subsurface.

  - o Process liquids move rapidly to groundwater through highly permeable unsaturated materials.

  - o Constituent concentrations in the Upper Zone groundwater have been elevated as a result of Phosphoric Acid Plant releases. The Upper Zone has a relatively thin saturated thickness, high hydraulic conductivity and reacts quickly to source inputs.

  - o Impacts are limited to Upper Zone groundwater. Downward migration is limited by presence of the AFLB. Beyond AFLB, upward gradient keeps migration in groundwater in the upper portion of the saturated zone as transport proceeds to the river.

  - o Down gradient data indicate that the mass in the release is not sufficient to result in large increases in groundwater concentrations

  - o Once sources are controlled, concentrations reduce to levels consistent with gypsum stack impacts. Secondary sources (i.e., desorption/dissolution of phosphorus from aquifer solids) are not significant. This is demonstrated by the reduction of Orthophosphate (as Total Phosphorus) concentrations at well 335S to background (gypstack) levels from December 2006 to March 2007 and maintenance of those levels throughout 2007.

The Central Plant Area is being investigated as part of the Phase 2 Data Gap investigation. In addition, Simplot has implemented an aggressive inspection/maintenance program to address potential current and future source areas. Existing information indicates that the best action for the elevated concentrations of plant affected groundwater in the Central Plant Area is to control sources within and around the Phosphoric Acid Plant. The findings of this program, along with field data, will be used to support the decision of whether additional groundwater extraction wells are appropriate for this area. This evaluation will be documented in detail in the draft Final Groundwater Extraction System Remedial Design Report, to be submitted in 2008.

- Constituent concentrations in Batiste Spring and the Spring at Batiste were variable in 2007. Arsenic concentrations increased in the Spring at Batiste Road (0.006 mg/L in the first quarter, 0.020 mg/L in the fourth quarter) and decreased at Batiste Spring (0.03 mg/L to 0.016 mg/L from first to fourth quarters). This likely reflects small changes in the location of the plume caused by regional groundwater/surface water effects. Orthophosphate (as Total Phosphorus) concentrations showed the same trends.

- Constituent concentrations in East Plant Upper Zone groundwater decrease rapidly downgradient of the target extraction area. This appears to be primarily due to mixing with river-influenced groundwater from the east.

- Constituent concentrations in Central Plant Lower Zone groundwater downgradient of production well SWP-4 are at or near regional groundwater levels, indicating that SWP-4 effectively captures all gypsum stack-affected groundwater in the area.

- Concentrations of constituents in West Plant groundwater in the target extraction areas have been relatively stable. Overall the estimated mass flux of constituents in the West Plant Area are considerably lower than the East Plant Area.

The evaluations provided in this report will be expanded and integrated with other Site data (including the findings of the ongoing Phase 2 fieldwork and the quarterly monitoring program) to support final design of the groundwater extraction system and the associated groundwater monitoring program. The draft final design report is scheduled to be submitted in 2008.

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