Section 4

Nature and Extent of Contamination

In Sections 2 through 3 of this report, the physical characteristics of the SFB were presented, along with past and current investigative activities that have led to the development of this RI Update Report. With the physical model of the SFB established, this section adds the nature and extent of contamination, which will form the basis for the SFB flow and transport modeling and risk evaluation and provide for future evaluation of remedial alternatives. The specific topics covered in this section of the report include:

- **Section 4.1: Sources of Contamination and Release Mechanisms.** Provides an overview of the potential sources and the release mechanisms for contamination in the SFB.
- **Section 4.2: Nature of Contamination.** Describes the results of groundwater sampling by LADWP between 2012 and 2014, specifically work performed in the TJ, RT, and NHW areas.
- **Section 4.3: Chemicals of Concern Evaluation.** Establishes the list of COCs in the SFB and evaluates the COC list compared to screening criteria and trends to prioritize the COCs for detailed analysis.
- **Section 4.4: Extent of High-Priority Organic COCs.** Describes the extent of contamination areally and vertically in the SFB for those organic COCs established as being of high priority.
- **Section 4.5: Extent of High-Priority Inorganic COCs.** Describes the extent of contamination areally and vertically in the SFB for those inorganic COCs established as being of high priority.
- **Section 4.6: Mass and Volume Estimates of High-Priority COCs.** Develops estimates of the volume and mass of the high-priority COCs in groundwater.

This section of the RI Update Report includes the synthesis of data from a number of different sources over an extended period of time. Each section outlines the specific data sources that were used in performing the data analysis, but the primary sources include monthly analytical data from LADWP's production wells, data from PRPs in the basin that are uploaded to the USEPA SFV database, and data from LADWP's 2012/2013 and 2014 monitoring events in which both old and new wells were sampled using the full Policy Memo 97-005 list of analytes (see Section 2). A summary of the data used in the development of figures in this section of the report is included in Appendix D.

4.1 Sources of Contamination and Release Mechanisms

As discussed in Section 2 of this report, the SFB has been studied for more than 30 years. During this time, extensive investigative work has been completed to identify sources of contamination in the SFB and the PRPs. This RI Update Report was not developed to identify specific sources of contamination, because the goal of this document is to assess the condition of groundwater throughout the SFB, and specifically the areas where LADWP will be performing future remedial actions for groundwater. Though a discussion of specific sources is not presented, it is important to understand the general conditions under which the chemicals were released in order to determine their current distribution; however, it is more important to understand what the long-term impacts from these sources may be and how they may affect the remedial strategy for the basin. Figure 4-1 of this report shows a schematic representation of sources and release mechanisms in the SFB.

Sources of chemical releases in the SFB have originated from multiple anthropogenic activities. For chlorinated solvents and Cr(VI), the primary releases were typically leaking storage tanks or piping, leaching from sumps of other disposal practices, and spills or generally poor housekeeping from the aerospace manufacturers and supporting industries. For other chemicals, such as nutrients (nitrate and manganese) and other inorganic chemicals (e.g., perchlorate), there are multiple potential sources such as agricultural practices and other industrial and/or municipal practices in the basin. It should also be noted that closed landfills could be a source of both organic and inorganic chemicals if they are unlined or a liner failure has occurred. Over the last 30 years, as the impacts have been identified, the releases have decreased or ceased entirely because of reduced use of chemicals, remediation of soil and groundwater impacts, better housekeeping, and employing best management practices to prevent future releases. This is especially true for former manufacturing facilities in the SFB. However, it can be assumed that there are operations that continue to impact soil and groundwater because of the size and diverse land uses of the SFB. If unmitigated, some sources, such as landfills, would cause long-term and continual impacts to the SFB.

As can be seen from Figure 4-1, because of the depth to groundwater (typically 50 to 400 feet bgs depending on location), impacts started out as releases to soil. The chemicals in soil have migrated downward through the unsaturated (vadose) zone to groundwater naturally through infiltration or through a steady release, such as a leaking tank or pipeline. As the chemicals moved vertically through the vadose zone, adsorption and other processes cause the chemicals to accumulate in the vadose zone, leaving residual concentrations in soil. Through remediation by the PRPs, the concentrations of these chemicals have been and will continue to be diminished over time.

Once in groundwater, these sources have created dissolved-phase chemical plumes that have migrated with natural groundwater flow and/or been transported through groundwater extraction and created large diffuse plumes downgradient of the source areas. Because of the mass of chemicals in the saturated zone, these source areas contribute ongoing mass to the dissolved-phase groundwater plumes. Through remedial activities by the PRPs, these sources can also be reduced in strength and contained to a limited area, or even effectively eliminated.

4.2 Nature of Contamination

The discussion of the nature of contamination in the SFB will focus on the results of sampling existing and new monitoring wells during the 2012/2013 and 2014 monitoring events performed by LADWP (Section 2). Additional data sources will be used to fill in data gaps, but the data collected by LADWP is the most complete of all of the data sets, having a full list of chemicals that could be present in groundwater along with rigorous data validation.

As presented in Section 2.6, a total of 25 clustered monitoring well sites (three wells per location for a total of 75 wells) were installed between 2013 and 2014. These wells (2014 monitoring event) along with 36 existing monitoring wells and 31 production wells (2012/2013 monitoring event) were sampled using an expanded analyte list (see Section 2.6). Table 4-1 includes the number of production and monitoring wells, along with the number of intervals sampled during the 2012/2013 and the 2014 monitoring events.

Use of contents on this sheet is subject to the limitations specified at the end of this document.

Table 4-1. Wells Sampled During the 2012/2013 and 2014 Monitoring Events

Well Field	2012/2013 Event			2014 Event		Total Sampling Intervals
	Production Wells	Monitoring Wells	Sampling Intervals	Monitoring Wells	Sampling Intervals	
Tujunga	3	10	16	8	24	40
Rinaldi-Toluca	4	7	11	10	30	41
North Hollywood East	11	6	17	--	--	17
North Hollywood West	5	5	16	7	21	37
Whitnall	3	3	6	--	--	6
Verdugo	1	3	4	--	--	4
Erwin	2	--	2	--	--	2
Pollock	2	2	4	--	--	4

The following sections present a summary of the results of these sampling events for organic compounds, inorganic compounds (including general water chemistry), radionuclides, bacterial indicators, and pharmaceutical compounds. The results of these samples will be compared to specific regulatory thresholds that include the following:

- Maximum contaminant levels (MCLs): California Primary MCLs established by DDW, or federal MCLs if a California MCL has not been developed.
- Secondary MCLs (SMCLs): The California MCL was used unless it has not been developed, in which case the federal MCL was used.
- Notification levels (NLs): NLs are health-based advisory levels developed by the DDW for those chemicals that do not have MCLs.
- Preliminary health goals (PHGs): PHGs are established by the California Office of Health and Environmental Hazard Assessment as risk-based levels at which consumption will not cause a significant health risk.

Tables and laboratory reports from these sampling events are included in their respective reports included within Appendices B and C of this report.

4.2.1 Organic Compounds

Organic compounds include VOCs, semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), fumigants, explosives, and herbicides. A number of VOCs and SVOCs were reported in samples from the 2012/2013 and 2014 monitoring events, but generally, concentrations were low and below current regulatory thresholds. Of the compounds reported by the laboratory, a total of 12 compounds had concentrations above the current regulatory thresholds and include:

- **VOCs:**
  - PCE
  - TCE
  - Carbon tetrachloride (CTET)
  - Cis-1,2-dichloroethene (cis-1,2-DCE)
  - 1,1-DCE

  - 1,1-Dichloroethane (1,1-DCA)
  - 1,2-DCA
  - Methyl tertiary butyl ether (MTBE)
  - Trichloroflouromethane (Freon 11)
  - 1,2,3-Trichloropropane (1,2,3-TCP)
- **SVOCs:**
  - 1,4-Dioxane
  - Bis(2-ethylhexyl)phthalate (DEHP)

Pesticides, explosives, fumigants, herbicides, and PCBs were detected in a very small number of samples collected during this event (less than 1 percent) and were all below current regulatory thresholds. Table 4-2 provides a summary of the organic compounds detected above regulatory thresholds for each of the well fields, along with maximum concentrations in the monitoring well and production well from the 2012/2013 and 2014 monitoring. Figures 4-2 through 4-4 show compounds above regulatory limits for the TJ, RT, and NHW well fields, respectively.

Table 4-2. Organic Compounds by Well Field Detected above Regulatory Thresholds 2012/2013 and 2014 Monitoring Events

Well Field	Compound	Regulatory Threshold (μg/L)*	Total Detects	Total Exceedances	Monitoring Wells		Production Wells	
					Maximum Concentration (μg/L)	Location of Maximum Concentration	Maximum Concentration (μg/L)	Location of Maximum Concentration
TUJUNGA	PCE	5	21	11	110	TJ-MW-10-860	2.8	TJ-03
	TCE	5	22	14	91	TJ-MW-10-860	6.8	TJ-10
	Cis-1,2-DCE	6	14	4	41	TJ-MW-11-560	ND	--
	1,1-DCE	6	16	10	27	TJ-MW-11-900	0.57	TJ-10
	1,1-DCA	5	10	0	4.4	TJ-MW-11-900	--	--
	1,2-DCA	0.5	1	1	0.58	TJ-MW-11-900	--	--
	Freon 11	150	5	1	180	TJ-MW-09-850	45	TJ-12
	MTBE	5	3	2	18	TJ-MW-13-910	--	--
	1,4-Dioxane	1[a]	28	9	4.7	TJ-MW-13-910	0.55	TJ-10
	DEHP	4	1	0	ND	--	1.3	TJ-10
RINALDI-TOLUCA	PCE	5	9	0	3.1	NH-C05-320	1.5	RT-01
	TCE	5	13	7	40	RT-MW-07-340	18	RT-01
	Cis-1,2-DCE	6	3	0	0.5	NH-VPB-06	0.18	RT-01
	1,1-DCE	6	1	0	0.45	NH-VPB-06	ND	--
	1,2-DCA	0.5	1	1	0.58	RT-MW-04-730	--	--
	Freon 11	150	1	0	ND	--	0.61	RT-08

Table 4-2. Organic Compounds by Well Field Detected above Regulatory Thresholds 2012/2013 and 2014 Monitoring Events

Well Field	Compound	Regulatory Threshold (µg/L)*	Total Detects	Total Exceedances	Monitoring Wells		Production Wells	
					Maximum Concentration (µg/L)	Location of Maximum Concentration	Maximum Concentration (µg/L)	Location of Maximum Concentration
	CTET	0.5	2	0	0.28	RT-MW-04-730	ND	--
	1,4-Dioxane	1[a]	16	1	1	NH-VPB-06	0.15	RT-01
	DEHP	4	2	1	14	NH-VPB-06	ND	--
NORTH HOLLYWOOD WEST	PCE	5	12	5	72	NH-MW-06-280	8	NH-23
	TCE	5	12	6	98	NH-MW-06-280	18	NH-23
	Cis-1,2-DCE	6	8	0	3.9	NH-MW-06-280	0.71	NH-23
	1,1-DCE	6	8	0	3.9	NH-MW-01-288	1.3	NH-25
	1,1-DCA	5	2	1	7.7	NH-MW-06-280	--	--
	1,2-DCA	0.5	2	1	0.58	NH-MW-11-280	--	--
	Freon 11	150	1	0	ND	--	0.28	NH-23
	MTBE	13/5[b]	1	1	6.2	NH-VPB-02	ND	--
	1,2,3-TCP	0.005[a]	2	0	0.0012	NH-MW-02-305	0.0021	NH-43A
	1,4-Dioxane	1[a]	14	4	9.7	NH-MW-11-280	7.6	NH-23
	DEHP	4	1	0	1.2	NH-MW-02-333	ND	--
NORTH HOLLYWOOD EAST	PCE	5	16	6	57	NH-C01-325	13	NHE-05
	TCE	5	17	5	11	NH-C01-325	69	NHE-03
	Cis-1,2-DCE	6	14	2	36	NH-C01-325	6.9	NHE-05
	1,1-DCE	6	11	2	21	NH-C01-450	3.9	NHE-03
	1,2-DCA	0.5	9	1	0.22	NH-C01-450	0.6	NHE-01
	Freon 11	150	6	0	1.1	NH-C01-325, NH-C01-450	1	NHE-01
	Carbon tetrachloride	0.5	1	1	ND	--	0.8	NHE-08
	1,2,3-TCP	0.005[a]	5	2	0.046	NH-C01-780	0.0053	NHE-05
	1,4-Dioxane	1[a]	18	6	1.7	NH-C01-450	4.4	NHE-01
	DEHP	4	1	0	ND	--	1.3	NHE-01
ERWIN	PCE	5	1	0	--	--	2.3	ER-06
	TCE	5	3	1	--	--	33	ER-06

Table 4-2. Organic Compounds by Well Field Detected above Regulatory Thresholds 2012/2013 and 2014 Monitoring Events

Well Field	Compound	Regulatory Threshold (µg/L)*	Total Detects	Total Exceedances	Monitoring Wells		Production Wells	
					Maximum Concentration (µg/L)	Location of Maximum Concentration	Maximum Concentration (µg/L)	Location of Maximum Concentration
	Cis-1,2-DCE	6	1	0	--	--	0.43	ER-06
	1,4-Dioxane	1[a]	3	0	--	--	0.65	ER-06
WHITNALL	PCE	5	5	0	2.9	NH-C02-325	2.5	WH-04, WH-05
	TCE	5	6	1	5.5	NH-C02-220	1.2	WH-04, WH-05
	Cis-1,2-DCE	6	4	0	0.71	NH-C02-325	0.24	WH-04
	1,2-DCA	0.5	1	0	0.14	NH-C02-325	ND	--
	Freon 11	150	1	0	0.19	NH-C02-325	ND	--
	Carbon tetrachloride	0.5	1	1	1.2	NH-C02-220	0.5	WH-04
	1,2,3-TCP	0.005[a]	1	0	0.0018	NH-C02-325	ND	--
	1,4-Dioxane	1[a]	5	0	0.99	NH-C02-325	0.16	WH-04
VERDUGO	PCE	5	2	0	4.3	NH-C06-285	ND	--
	TCE	5	2	1	82	NH-C06-285	0.98	VE-11
	Cis-1,2-DCE	6	1	0	0.15	NH-C06-285	ND	--
	1,1-DCE	6	1	0	0.24	NH-C06-285	ND	--
	Carbon tetrachloride	0.5	1	1	0.71	NH-C06-285	ND	--
	1,2,3-TCP	0.005[a]	2	0	0.0026	NH-C06-285	0.0024	VE-11
	1,4-Dioxane	1[a]	2	0	0.22	NH-C06-285	ND	--
POLLOCK	PCE	5	4	1	4.8	PO-VPB-03	10	PL-06
	TCE	5	4	3	44	PO-VPB-07	9.3	PL-06
	Cis-1,2-DCE	6	3	0	0.38	PO-VPB-03	0.38	PL-06
	1,1-DCE	6	2	0	ND	--	5.4	PL-06
	1,2,3-TCP	0.005[a]	1	1	ND	--	0.0067	PL-06
	1,4-Dioxane	1[a]	3	1	0.17	PO-VPB-03	4.2	PL-06

µg/L = micrograms per liter

ND = not detected in these wells

Data flags are not shown.

** State MCL unless otherwise denoted.*

[a] *NL*

[b] *State Secondary MCL*

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4.2.2 Inorganic Compounds

Inorganic compounds analyzed during this project include metals, cations and anions, general water quality measurements such as TDS and odor, and measurements for treatment design such as the Langelier Index. Compounds detected above current regulatory thresholds include:

- Cr(VI)
- Aluminum
- Boron
- Chlorate
- Manganese
- Mercury
- Iron
- Nitrate
- Nitrogen, nitrate-nitrite
- Odor
- Perchlorate
- Specific conductance
- Sulfate
- TDS

A description of inorganic chemicals detected above regulatory thresholds for each of the well fields is presented in Table 4-3, along with the maximum concentrations in the monitoring well and production wells. Figures 4-2 through 4-4 show compounds above regulatory limits for the TJ, RT, and NHW well fields, respectively.

Table 4-3. Inorganic Compounds by Well Field Detected above Regulatory Thresholds

Well Field	Compound (Units)	Regulatory Threshold*	Total Detects	Total Exceedances	Monitoring Wells		Production Wells	
					Maximum Concentration	Location of Maximum Concentration	Maximum Concentration	Location of Maximum Concentration
TUJUNGA	Cr(VI) (µg/L)	10	31	0	3.9	TJ-MW-08-390	1.2	TJ-03
	Boron (µg/L)	1,000	36	0	320	TJ-MW-03	150	TJ-12
	Aluminum (µg/L)	1,000/200	36	0	140	TJ-MW-08-810	2.8	TJ-03
	Chlorate (µg/L)	800[c]	31	0	640	HR-MW-01	43	TJ-03
	Manganese (µg/L)	50[b]/500[c]	35	2	150	TJ-MW-14-900	0.18	TJ-10
	Iron (µg/L)	300[b]	15	1	540	TJ-MW-01	ND	--
	Nitrate (mg/L)	45	35	6	77	TJ-MW-06-400	27	TJ-10
	Nitrogen, nitrate-nitrite (µg/L)	10,000	35	7	17,000	TJ-MW-06-400	6,200	TJ-10
	Odor (TON)	3[b]	42	0	1	All	1	All
	Perchlorate	6	6	0	5.5	TJ-MW-06-400	--	--
	Specific conductance (µmhos/cm)	900[b]	38	7	1,200	TJ-MW-12-490	760	TJ-10
	Sulfate (mg/L)	250[b]	38	1	260	TJ-MW-12-490	95	TJ-10
	TDS (mg/L)	500[b]	38	14	1,000	TJ-MW-14-580	470	TJ-10

Table 4-3. Inorganic Compounds by Well Field Detected above Regulatory Thresholds

Well Field	Compound (Units)	Regulatory Threshold*	Total Detects	Total Exceedances	Monitoring Wells		Production Wells	
					Maximum Concentration	Location of Maximum Concentration	Maximum Concentration	Location of Maximum Concentration
RINALDI-TOLUCA	Cr(VI) (µg/L)	10	35	1	12	RT-MW-09-300	1.8	RT-15
	Boron (µg/L)	1,000	41	0	360	RT-MW-09-560	230	RT-08
	Aluminum (µg/L)	1,000/200[b]	40	1	620	NH-VPB-06	17	RT-08
	Chlorate (µg/L)	800[c]	31	0	450	RT-MW-07-340	170	RT-08
	Manganese (µg/L)	50[b]/500[c]	41	3	7,000	RT-MW-02-370	6.3	RT-15
	Mercury (µg/L)	2	2	1	ND	--	2.7	RT-08
	Iron (µg/L)	300[b]	21	2	3,300	NH-VPB-06	200	RT-15
	Nitrate (mg/L)	45	41	4	71	RT-MW-09-300	17	RT-10
	Nitrogen, nitrate-nitrite (µg/L)	10,000	41	3	16,000	RT-MW-09-300 RT-MW-04-320	3,900	RT-10
	Odor (TON)	3[b]	41	1	5	RT-MW-02-370	1	All
	Perchlorate (µg/L)	6	3	2	11	RT-MW-02-810 RT-MW-02-730	--	--
	Specific conductance (µmhos/cm)	900[b]	41	7	1,900	RT-MW-06-510 RT-MW-09-560	580	RT-10
	Sulfate (mg/L)	250[b]	41	5	680	RT-MW-09-560	63	RT-10
	TDS (mg/L)	500[b]	41	12	1,300	RT-MW-06-510 RT-MW-09-500	360	RT-01, RT-10
NORTH HOLLYWOOD WEST	Cr(VI) (µg/L)	0.02[a]/10	27	0	8.7	NH-MW-06-280	3.1	NH-037
	Aluminum (µg/L)	1,000/200[b]	34	3	490	NH-MW-01-375	15	NH043A
	Boron (µg/L)	1,000	37	1	1,000	NH-MW-10-820	250	NH025
	Chlorate (µg/L)	800[c]	26	2	1,400	NH-VPB-02	190	NH023
	Manganese (µg/L)	50[b]/500[c]	35	9	440	NH-MW-04-385	2.6	NH004
	Mercury (µg/L)	2	1	0	ND	--	0.071	NH-023
	Iron (µg/L)	300[b]	30	4	660	NH-MW-01-375	49	NH004
	Nitrate (mg/L)	45	32	3	61	NH-VPB-02	27	NH023
	Nitrogen, nitrate-nitrite (µg/L)	10,000	34	3	14,000	NH-VPB-02	6,100	NH023
	Odor (TON)	3[b]	35	1	8	NH-MW-03-772	1	All
	Specific conductance (µmhos/cm)	900[b]	35	34	1,900	NH-MW-02-375 NH-MW-10-450	1,600	NH004
	Sulfate (mg/L)	250[b]	35	27	780	NH-MW-10-450	530	NH004
	TDS (mg/L)	500[b]	35	32	1,400	NH-MW-02-375 NH-MW-10-450	1,100	NH004

Table 4-3. Inorganic Compounds by Well Field Detected above Regulatory Thresholds

Well Field	Compound (Units)	Regulatory Threshold*	Total Detects	Total Exceedances	Monitoring Wells		Production Wells	
					Maximum Concentration	Location of Maximum Concentration	Maximum Concentration	Location of Maximum Concentration
NORTH HOLLYWOOD EAST	Cr(VI) (µg/L)	0.02[a]/10	16	1	2.7	NH-C03-380	55	NHE-03
	Aluminum (µg/L)	1,000/200[b]	15	1	260	NH-C03-380	11	NH-40
	Boron (µg/L)	1,000	17	0	250	NH-C01-325	630	NHE-01
	Chlorate (µg/L)	800[c]	12	0	470	NH-C01-325	310	NHE-01
	Manganese (µg/L)	50[b]/500[c]	14	0	47	NH-C01-780	42	NHE-01
	Mercury (µg/L)	2	3	0	ND	--	0.49	NH-17
	Iron (µg/L)	300[b]	12	2	1,800	NH-C03-380	870	NHE-05
	Nitrate (mg/L)	45	17	1	6.3	NH-C01-325	90	NHE-01
	Nitrogen, nitrate-nitrite (µg/L)	10,000	17	1	9,500	NH-C01-325	20,000	NHE-01
	Odor (TON)	3[b]	17	0	1	All	1	All
	Specific conductance (µmhos/cm)	900[b]	17	4	1,500	NH-C01-325	960	NHE-01
	Sulfate (mg/L)	250[b]	17	1	77	NH-C01-450	69	NHE-01
	TDS (mg/L)	500[b]	17	5	890	NH-C01-325	600	NHE-01
ERWIN	Cr(VI) (µg/L)	0.02[a]/10	2	0	--	--	2.8	ER-06
	Aluminum (µg/L)	1,000/200[b]	1	0	--	--	5.8	ER-06
	Boron (µg/L)	1,000	2	0	--	--	260	ER-10
	Manganese (µg/L)	50[b]/500[c]	2	0	--	--	1.1	ER-10
	Mercury (µg/L)	2	2	0	--	--	0.057	ER-06
	Iron (µg/L)	300[b]	2	0	--	--	36	ER-10
	Nitrate (mg/L)	45	2	0	--	--	7.4	ER-10
	Nitrogen, nitrate-nitrite (µg/L)	10,000	2	0	--	--	6,600	ER-06
	Odor (TON)	3[b]	2	0	--	--	1	All
	Specific conductance (µmhos/cm)	900[b]	2	1	--	--	940	ER-10
	Sulfate (mg/L)	250[b]	2	1	--	--	250	ER-10
	TDS (mg/L)	500[b]	2	2	--	--	620	ER-10

Table 4-3. Inorganic Compounds by Well Field Detected above Regulatory Thresholds

Well Field	Compound (Units)	Regulatory Threshold*	Total Detects	Total Exceedances	Monitoring Wells		Production Wells	
					Maximum Concentration	Location of Maximum Concentration	Maximum Concentration	Location of Maximum Concentration
WHITNALL	Cr(VI) (µg/L)	0.02[a]/10	6	0	2.3	NH-C02-220	1.8	WH-05
	Aluminum (µg/L)	1,000/200[b]	6	1	400	NH-C02-220	9.4	WH-04
	Boron (µg/L)	1,000	6	0	140	NH-C02-325	320	WH-07
	Manganese (µg/L)	50[b]/500[c]	6	0	9.7	NH-C02-520	0.53	WH-04
	Mercury (µg/L)	2	1	0	ND	--	0.098	WH-07
	Iron (µg/L)	300[b]	4	1	460	NH-C02-220	150	WH-07
	Nitrate (mg/L)	45	6	1	60	NH-C02-220	8.6	WH-04
	Nitrogen, nitrate-nitrite (µg/L)	10,000	6	1	13,000	NH-C02-220	2,400	WH-05
	Odor (TON)	3[b]	5	0	1	All	1	All
	Specific conductance (µmhos/cm)	900[b]	6	0	860	NH-C02-220	820	WH-07
	Sulfate (mg/L)	250[b]	6	0	95	NH-C02-220	150	WH-07
	TDS (mg/L)	500[b]	6	2	570	NH-C02-220	520	WH-07
VERDUGO	Cr(VI) (µg/L)	0.02[a]/10	3	0	3.8	NH-C06-285	1.4	VE-11
	Aluminum (µg/L)	1,000/200[b]	4	0	250	NH-C06-160	3.3	VE-11
	Boron (µg/L)	1,000	4	0	220	NH-C06-425	370	VE-11
	Manganese (µg/L)	50[b]/500[c]	4	0	40	NH-C06-425	5.5	VE-11
	Mercury (µg/L)	2	1	0	ND	--	0.1	VE-11
	Iron (µg/L)	300[b]	4	1	620	NH-C06-425	17	VE-11
	Nitrate (mg/L)	45	4	1	110	NH-C06-160	8	VE-11
	Nitrogen, nitrate-nitrite (µg/L)	10,000	4	1	26,000	NH-C06-160	1,800	VE-11
	Odor (TON)	3[b]	3	0	1	All	1	VE-11
	Specific conductance (µmhos/cm)	900[b]	4	4	1,200	NH-C06-425	1,100	VE-11
	Sulfate (mg/L)	250[b]	4	2	390	NH-C06-425	280	VE-11
	TDS (mg/L)	500[b]	4	4	840	NH-C06-425	760	VE-11

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Table 4-3. Inorganic Compounds by Well Field Detected above Regulatory Thresholds

Well Field	Compound (Units)	Regulatory Threshold*	Total Detects	Total Exceedances	Monitoring Wells		Production Wells	
					Maximum Concentration	Location of Maximum Concentration	Maximum Concentration	Location of Maximum Concentration
POLLOCK	Cr(VI) (µg/L)	0.02[a]/10	4	0	2.4	PO-VPB-03	1.9	PL006
	Aluminum (µg/L)	1,000/200[b]	3	0	3.5	PO-VPB-03	2.4	PL006
	Boron	1,000	4	0	210	PO-VPB-07	250	PL004
	Manganese (µg/L)	50[b]/500[c]	2	0	3	PO-VPB-07	ND	--
	Iron (µg/L)	300[b]	2	0	28	PO-VPB-07	ND	--
	Nitrate (mg/L)	45	4	2	49	PO-VPB-07	37	PL006
	Nitrogen, nitrate-nitrite (µg/L)	10,000	4	1	11,000	PO-VPB-07	8,300	PL006
	Odor (TON)	3[b]	4	0	1	All	1	All
	Specific conductance (µmhos/cm)	900[b]	4	3	1,900	PO-VPB-07	1,100	PL006
	Sulfate (mg/L)	250[b]	4	1	270	PO-VPB-07	160	PL006
	TDS (mg/L)	500[b]	4	4	1,200	PO-VPB-07	710	PL006

mg/L = milligrams per liter

µmhos/cm = micro units of conductivity per centimeter

TON = threshold odor number

ND = not detected in these wells

All = all detects at all wells within the well field were the same value.

Data flags are not shown.

** State MCL unless otherwise denoted.*

[a] *PHG*

[b] *State Secondary MCL*

[c] *NL*

4.2.3 Bacterial Indicators

Bacterial indicators monitored include heterotrophic plate count, total coliform, fecal coliform, and *Escherichia coli* (*E. coli*). Although there are no quantitative regulatory thresholds for these bacterial indicators, MCLs are based on the number of detections over a set period of time. During this event, all of the four indicators were reported on laboratory results. A brief description of the distribution of the reported bacterial indicators is presented below:

- **Heterotrophic plate count (HPC):** An HPC was reported for most monitoring wells and 13 production wells with the highest counts (greater than 1,000 colony forming units per milliliter [CFU/mL]) reported in the TJ, NH, and RT well fields.
- **Total coliform:** Total coliform was reported in 15 monitoring wells (not reported in any production wells) during the two sampling events spanning most of the well fields with the highest results being reported in the NHW, TJ, and RT well fields.
- **Fecal coliform and *E. coli:*** Corresponding with the high total coliform concentrations, fecal coliform and *E. coli* were reported in the NHW and RT well fields. Neither bacterial indicator was reported in LADWP's production wells.

4.2.4 Radionuclides

Radionuclides were detected in all of the wells sampled. Despite the frequent reporting of radionuclides, only a small number of detections were above regulatory limits. Radium 226 and 228 were reported above their corresponding PHGs in several wells from the three well fields, but generally near the reporting limit and corresponding PHG value. Gross Alpha and uranium were also reported above MCLs primarily in the NH and Whitnall well fields, but in less than 1 percent of the samples collected. Both of these radionuclides are naturally occurring in groundwater and commonly reported even though infrequently reported above their respective MCLs. It should be noted that many radionuclides are reported as a mean concentration along with a standard deviation.

4.2.5 Pharmaceutical and Personal Care Compounds

Pharmaceutical compounds do not generally have regulatory thresholds or other goals but are of emerging concern by the regulatory community. Studies have shown that pharmaceuticals are present in our nation’s water bodies. Further research suggests that certain drugs may cause ecological harm. USEPA is investigating this topic and developing strategies to help protect the health of both the environment and the public. To date, scientists have found no evidence of adverse human health effects from pharmaceuticals and personal care products in the environment. Below is a list of the compounds detected during this monitoring event:

- Amoxicillin
- Azithromycin
- Bisphenol A
- Caffeine
- Carbamazepine
- Triclosan
- Methylene blue
- Ciprofloxacin
- Gemfibrozil
- Ibuprofen
- Methadone
- Morphine
- Salicylic acid

The most commonly-detected compounds were bisphenol A, caffeine, and salycillic acid, which were detected in over 50 percent of the wells monitored and from all of the well fields (Appendices B and C). Bisphenyl A was detected at a maximum concentration of 65 nanograms per liter (ng/L) in the production wells (NHE-05) and a maximum concentration of 3,500 ng/L in the monitoring wells (NH-VPB-06). Caffeine was detected at a maximum concentration of 24 ng/L (NH-VPB-06), but was otherwise generally detected near the laboratory reporting limit.

The second group of most commonly-detected compounds includes ciprofloxacin, ibuprofen, and zithromycin. These were mostly present in the NH well fields, but were detected in most of the other well fields at low concentrations near the reporting limits. The other pharmaceuticals were detected at low percentages (less than 10 percent) and generally near the laboratory reporting limit.

4.3 Chemicals of Concern Evaluation

Establishing COCs for a project typically involves several steps, starting with the development of the project’s data quality objectives through the evaluation of potential remedial alternatives. As a general definition, a COC is a chemical present in soil, air, and/or groundwater that could pose a potential risk to human health and the environment through a complete exposure pathway, such as ingestion or inhalation. Typically the RI establishes a list of COPCs and through a baseline risk evaluation the list of COPCs has been narrowed to the list of COC as was performed in the 1992 RI. Section 7 of this report includes a discussion of risk, but this RI does not include an updated baseline risk assessment as would typically be performed under CERCLA to establish COCs. This

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update is not considered required for this document because the exposure pathways have not changed from the 1992 RI and NLs and MCLs (which are established based on risk to human health) as well as other applicable relevant and appropriate requirements will be used to develop remedial alternatives.

For this RI Update, COCs include any chemical reported above a regulatory threshold during groundwater sampling in any of the monitoring wells and production wells (sampled by LADWP, USEPA, or other PRPs) dating to 1980. Though Section 4.2 focused on the recent sampling performed by LADWP, this evaluation includes an expanded data set to better understand chemicals in groundwater throughout the SFB. The following data sources were used in this COC evaluation:

- Groundwater and analytical data collected as part of the GSIS project between 2012 and 2014.
- Monthly analytical data from LADWP's production wells, collected since 2000. It should be noted that these data are not specifically collected for groundwater monitoring, but they provide the highest density of data collection for evaluating concentration trends in the SFB.
- Analytical data from the USEPA database for the San Fernando Valley (SFV Database) that includes data from the original 1992 RI wells, new wells installed by USEPA, along with data from wells installed and operated by PRPs in the SFB, dating back to the start of investigation in the SFB in 1980.

The data set for this evaluation does not include those sources with known data quality deficiencies that may prevent an accurate portrayal of groundwater quality in the SFB. These data sources include data uploaded to the State of California's GeoTracker database that are not concurrently loaded to the USEPA database or older reports in which no electronic data are available.

An initial screening of the data sources identified 93 chemicals that have been reported in groundwater above current regulatory thresholds at least once since the start of sampling in the SFB. Regulatory thresholds considered include the MCLs, SMCLs, ALs, and PHGs.

While 93 chemicals were identified, most of these chemicals are detected in isolated wells, are not located near drinking water wells, or have not been reported during recent sampling of monitoring wells or production wells. For the purposes of this RI Update Report, the list of chemicals was prioritized to identify the highest-priority chemicals for further evaluation and for evaluation of remedial alternatives during the Draft FS.

The process of prioritizing the chemicals was generally based on protocols developed by USEPA Region 8 (USEPA 1994). This protocol includes criteria-centered chemical properties, results compared to background and regulatory standards, and frequency of detection. This guidance was used to establish a similar set of criteria specific for the SFB. Because of the unique properties of the SFB, including physical constraints, objectives of SFB usage, and potential receptors and exposure pathways, site-specific criteria were developed for establishing the COCs. The criteria established for this project are presented below:

1. **Original 1992 RI COC:** The 1992 RI Report included a detailed analysis of chemicals present in groundwater in the SFB and included a baseline human-health risk assessment to establish COCs. Because receptors and exposure pathways are the same, these chemicals could still pose a risk if present in groundwater.
2. **Commonly reported:** Present in more than 5 percent of monitoring and production wells above established regulatory criteria (e.g., MCLs). This threshold indicates that the compound is commonly reported in the SFB both spatially and temporally.
3. **Above the California MCL:** This varies depending on the COC (see Table 4-4). Chemicals above regulatory limits could pose a risk to human health and the environment and are a typical evaluation threshold for drinking water.

4. **Reported above MCL in production wells:** This includes a review if the compound was reported in at least one production well operated by LADWP above regulatory limits. This indicates that the compound has already migrated from the source areas and impacted LADWP's production.
5. **Carcinogen or high toxicity:** This is based on USEPA Region 9 Regional Screening Levels (RSLs) for toxicity and hazard index of tap water. The toxicity screen was performed for those chemicals with tap water limits less than 100 µg/L based on the chemicals hazard index or carcinogenic target risk. These include chemicals with regulatory limits, but also include chemicals without limits that have a significant risk to human health or the environment.
6. **Requires specialized treatment:** In other words, the chemical is reported above regulatory limits in LADWP's production wells and would require an additional treatment phase to remove the chemical to meet regulatory limits.

The process of evaluating each of the chemicals is included in Table 4-4. If the chemical satisfied any of the above requirements, then it was given a check mark, which was summed at the end of the table to give the chemical a score. The chemicals were then sorted based on highest to lowest scores. As can be seen through the table, the chemicals that met four of five of the criteria are generally at the top and comprise the "high-priority" chemicals with other chemicals in the "moderate" to "low" priority categories.

Using the above criteria, 12 COCs were determined to be high priority, thereby requiring a more detailed evaluation of the nature and extent of contamination for the purpose of evaluating risk and development of remedial alternatives in the feasibility study. These include:

- TCE
- PCE
- Cis-1,2-DCE
- 1,1-DCE
- 1,2-DCA
- CTET
- 1,2,3-TCP
- 1,4-Dioxane
- NDMA
- Cr(VI)
- Perchlorate
- Nitrate (as NO_3)

4.3.1 Description of High-Priority Chemicals

The 12 COCs established from the process described above have generally been known contaminants in the SFB and required remediation by PRPs and/or treatment by LADWP for potable water usage. The following sections give a description of each of these chemicals, including usage and occurrence in groundwater, and also present the current trends for these chemicals in LADWP's production wells. Concentrations versus time plots to evaluate trends for the 12 COCs are included in Appendix H of this report.

Table 4-4. Chemical of Concern Evaluation for the San Fernando Basin

Chemical	Chemical Information				Chemical of Concern Evaluation									Most Impacted Well Fields
	Action Level	Total Exceedances of Action Level	Total Samples Collected	Percent Exceeded Applicable Action Level	Original RI COC	Commonly Reported (>5%)	Chemical Detected Above CAMCLP	Reported in Production Well	Carcinogen or High Toxicity[1]	May Require Specialized Treatment[2]	Sum	Additional Notes	Priority	
TCE	CAMCLP	13,486	39,880	33.82%	X	X	X	X	X		5		High Priority	All Well Fields
PCE	CAMCLP	8,837	40,424	21.86%	X	X	X	X	X		5		High Priority	NHE, NHW, TJ, PL
1,1-DCE	CAMCLP	2,254	25,612	8.80%	X	X	X	X	X		5		High Priority	NHE, TJ, PL
CR VI	CAMCLP	1,377	6,458	21.32%		X	X	X	X	X	5		High Priority	NHE
CTET	CAMCLP	5,515	43,261	12.75%	X	X	X	X	X		5		High Priority	TJ, NHE
1,2-DCA	CAMCLP	2,439	33,603	7.26%	X	X	X	X	X		5		High Priority	NHE
PERCHLORATE	CAMCLP	238	10,262	2.32%			X	X	X	X	4		High Priority	RT, TJ
1,4-DIOXANE	NOTIFICATION	2,645	6,826	38.75%		X		X	X	X	4		High Priority	NHE
1,2,3-TCP	NOTIFICATION	2,665	27,830	9.58%		X		X	X	X	4		High Priority	TJ
cis-1,2-DCE	CAMCLP	2,538	31,746	7.99%		X	X	X	X		4		High Priority	NHE
NDMA	NOTIFICATION	301	3,945	7.63%		X		X	X	X	4		High Priority	NHE, TJ
Nitrate (as NO3)	CAMCLP	255	43,394	0.59%	X		X	X	X		4		High Priority	NHE, TJ
NITROGEN, NITRATE-NITRITE	CAMCLP	101	631	16.01%		X	X	X			3		Moderate Priority	NHE, TJ
ARSENIC	CAMCLP	169	10,379	1.63%	X		X		X		3	D	Moderate Priority	--
URANIUM, TOTAL	CAMCLP	38	405	9.38%		X	X		X		3	B	Moderate Priority	--
MANGANESE	CAMCLS	1,330	10,635	12.51%		X		X	X		3		Moderate Priority	NHW
MERCURY	CAMCLP	78	10,005	0.78%			X	X	X		3	B	Moderate Priority	RT
1,1-DICHLOROETHANE	CAMCLP	1,256	35,676	3.52%			X	X	X		3	A	Moderate Priority	NHE
TRICHLOROFLUOROMETHANE	CAMCLP	20	32,388	0.06%			X	X	X		3	A,B	Moderate Priority	TJ
SULFATE (AS SO4)	CAMCLS	442	9,358	4.72%		X		X			2	B	Moderate Priority	NHW
IRON	CAMCLS	1,440	10,759	13.38%		X		X			2		Moderate Priority	All Well Fields
ALPHA, GROSS	CAMCLP	57	1,364	4.18%			X	X			2	B	Moderate Priority	NHE
1,1,1-TRICHLOROETHANE	CAMCLP	159	33,415	0.48%			X		X		2	A, D	Moderate Priority	--
SPECIFIC CONDUCTANCE	CAMCLS	2,500	3,119	80.15%		X		X			2		Low Priority	All Well Fields
TOTAL DISSOLVED SOLIDS (TDS)	CAMCLS	3,674	7,647	48.04%		X		X			2		Low Priority	NHW, PL
TURBIDITY	CAMCLS	868	11,578	7.50%				X			1		Low Priority	All Well Fields
TOTAL TRIHALOMETHANES	CAMCLP	488	24,959	1.96%			X				1		Low Priority	--
COLOR	CAMCLS	29	1,491	1.95%		X		X			2		Low Priority	All Well Fields
CHLORIDE (AS CL)	CAMCLS	123	8,479	1.45%							0		Low Priority	--
BORON	NOTIFICATION	30	3,660	0.82%							0	C	Low Priority	--
ODOR	CAMCLS	6	946	0.63%		X		X			2		Low Priority	All Well Fields
TOTAL HALOACETIC ACIDS	CAMCLP	1	193	0.52%			X				1		Low Priority	--
NITROGEN, NITRITE	CAMCLP	13	3,058	0.43%			X				1		Low Priority	--
FLUORIDE	CAMCLP	50	15,928	0.31%			X		X		2		Low Priority	--
ASBESTOS	CAMCLP	1	374	0.27%			X				1		Low Priority	--

Table 4-4. Chemical of Concern Evaluation for the San Fernando Basin

Chemical	Chemical Information				Chemical of Concern Evaluation									Most Impacted Well Fields
	Action Level	Total Exceedances of Action Level	Total Samples Collected	Percent Exceeded Applicable Action Level	Original RI COC	Commonly Reported (>5%)	Chemical Detected Above CAMCLP	Reported in Production Well	Carcinogen or High Toxicity[1]	May Require Specialized Treatment[2]	Sum	Additional Notes	Priority	
CHLORATE	NOTIFICATION	2	888	0.23%							0		Low Priority	--
METHYLENE BLUE ACTIVE SUBSTANCES	CAMCLS	4	1,641	0.24%							0	F	Low Priority	--
CHROMIUM, TOTAL	CAMCLP	822	9,860	8.34%	X	X	X	X			4	C	Low Priority	NHE
ALUMINUM	CAMCLS	210	5,145	4.08%							0	C	Low Priority	--
NICKEL	CAMCLP	389	10,129	3.84%			X				1	C	Low Priority	--
THALLIUM	CAMCLP	236	9,946	2.37%			X				1	C	Low Priority	--
ANTIMONY	CAMCLP	222	9,880	2.25%			X		X		2	C	Low Priority	--
LEAD	CAMCLP	205	10,443	1.96%			X				1	C	Low Priority	--
CADMIUM	CAMCLP	65	10,397	0.63%			X		X		2	C	Low Priority	--
VANADIUM	NOTIFICATION	58	10,551	0.55%					X		1	C	Low Priority	--
CYANIDE	CAMCLP	4	1,189	0.34%			X		X		2	C	Low Priority	--
BERYLLIUM	CAMCLP	24	10,022	0.24%			X		X		2	C	Low Priority	--
COPPER	CAMCLP	15	10,531	0.14%			X		X		2	C	Low Priority	--
SELENIUM	CAMCLP	12	10,246	0.12%			X		X		2	C	Low Priority	--
ZINC	CAMCLS	12	10,952	0.11%							0	C, F	Low Priority	--
BARIUM	CAMCLP	10	10,165	0.10%			X				1	C	Low Priority	--
SILVER	CAMCLS	6	10,224	0.06%					X		1	C	Low Priority	--
PCB-1248 (AROCLOR 1248)	CAMCLP	94	1,077	8.73%		X	X		X		--	E	Low Priority	--
PCB-1254 (AROCLOR 1254)	CAMCLP	86	1,069	8.04%		X	X		X		--	E	Low Priority	--
PCB-1016 (AROCLOR 1016)	CAMCLP	86	1,077	7.99%		X	X		X		--	E	Low Priority	--
PCB-1242 (AROCLOR 1242)	CAMCLP	86	1,077	7.99%		X	X		X		--	E	Low Priority	--
PCB-1260 (AROCLOR 1260)	CAMCLP	85	1,075	7.91%		X	X		X		--	E	Low Priority	--
PCB-1221 (AROCLOR 1221)	CAMCLP	85	1,077	7.89%		X	X		X		--	E	Low Priority	--
PCB-1232 (AROCLOR 1232)	CAMCLP	85	1,077	7.89%		X	X		X		--	E	Low Priority	--
BIS(2-ETHYLHEXYL) PHTHALATE	CAMCLP	68	2,038	3.34%			X				1	A	Low Priority	--
METHYLENE CHLORIDE	CAMCLP	461	21,465	2.15%			X		X		2	A, F	Low Priority	--
VINYL CHLORIDE	CAMCLP	434	32,691	1.33%			X		X		2	A	Low Priority	NHE
TERT-BUTYL ALCOHOL	NOTIFICATION	13	1,044	1.25%					X		1	A	Low Priority	--
BENZENE	CAMCLP	374	33,105	1.13%			X		X		2	A	Low Priority	--
1,1,2-TRICHLOROETHANE	CAMCLP	261	33,223	0.79%			X		X		2	A	Low Priority	--
1,2-DIBROMO-3-CHLOROPROPANE	CAMCLP	154	24,006	0.64%			X		X		2	A	Low Priority	--
TRANS-1,2-DICHLOROETHENE	CAMCLP	74	20,539	0.36%			X		X		2	A,F	Low Priority	--
NAPHTHALENE	NOTIFICATION	92	24,507	0.38%					X		1	A	Low Priority	--
METHYL TERT BUTYL ETHER (MTBE)	CAMCLS	82	23,887	0.34%			X		X		2	B	Low Priority	--
N-NITROSODI-N-PROPYLAMINE	NOTIFICATION	6	2,077	0.29%							0	A	Low Priority	--

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Table 4-4. Chemical of Concern Evaluation for the San Fernando Basin

Chemical	Chemical Information				Chemical of Concern Evaluation									Most Impacted Well Fields
	Action Level	Total Exceedances of Action Level	Total Samples Collected	Percent Exceeded Applicable Action Level	Original RI COC	Commonly Reported (>5%)	Chemical Detected Above CAMCLP	Reported in Production Well	Carcinogen or High Toxicity[1]	May Require Specialized Treatment[2]	Sum	Additional Notes	Priority	
BENZO(A)PYRENE	CAMCLP	5	1,799	0.28%			X		X		2	A,F	Low Priority	--
1,1,2,2-TETRACHLOROETHANE	CAMCLP	76	30,734	0.25%			X				1	A	Low Priority	--
TOLUENE	CAMCLP	66	33,430	0.20%			X				1	A	Low Priority	--
2-CHLOROTOLUENE	NOTIFICATION	42	22,723	0.18%							0	A,F	Low Priority	--
PENTACHLOROPHENOL	CAMCLP	3	1,987	0.15%			X				1	A,F	Low Priority	--
HEXACHLOROBENZENE	CAMCLP	3	1,994	0.15%			X				1	A,F	Low Priority	--
1,4-DICHLOROBENZENE	CAMCLP	45	29,506	0.15%			X		X		2	A	Low Priority	--
ETHYLBENZENE	CAMCLP	43	31,625	0.14%			X		X		2	A	Low Priority	--
1,2,4-TRIMETHYLBENZENE	NOTIFICATION	19	14,748	0.13%							0	A,F	Low Priority	--
1,2-DICHLOROPROPANE	CAMCLP	38	32,573	0.12%			X		X		2	A	Low Priority	--
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	CAMCLP	14	15,725	0.09%			X				1	A,F	Low Priority	--
4-METHYL-2-PENTANONE	NOTIFICATION	21	25,471	0.08%							0	A	Low Priority	--
N-PROPYLBENZENE	NOTIFICATION	15	23,243	0.06%							0	A,F	Low Priority	--
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	NOTIFICATION	13	23,283	0.06%							0	A,F	Low Priority	--
CHLOROBENZENE	CAMCLP	8	21,154	0.04%			X				1	A,F	Low Priority	--
N-PROPYLBENZENE	NOTIFICATION	6	15,118	0.04%							0	A	Low Priority	--
CARBON DISULFIDE	NOTIFICATION	5	14,229	0.04%					X		1	A	Low Priority	--
TOTAL, 1,3-DICHLOROPROPENE	CAMCLP	3	17,222	0.02%			X		X		2	A	Low Priority	--
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	CAMCLP	1	12,157	0.01%			X				1	A,F	Low Priority	--
ATRAZINE	CAMCLP	53	1,004	5.28%			X		X	X	3		Low Priority	--
GAMMA BHC (LINDANE)	CAMCLP	31	1,147	2.70%			X		X	X	3	F	Low Priority	
RADIUM-228	PHG	1,260	1,641	76.78%				X	X		2		Low Priority	All Well Fields
RADIUM-226	PHG	1,057	1,381	76.54%				X	X		2		Low Priority	All Well Fields

1 - Based on USEPA Region 9 RSLs for toxicity and hazard index of tap water. Toxicity screen for those chemicals with tap water concentration under 100 micrograms per liter based on hazard index.

2 - This is based on presence of chemical in production wells, current treatment of groundwater by LADWP, and future usage of water by LADWP.

A - Organic Compound would be treated through treatment of higher priority chemical.

B- Compound has been given higher priority due to relative toxicity and presence in production wells.

C - Inorganic Compound would be treated through treatment of higher priority chemical.

D - Priority increased for arsenic and 1,1,1-TCA based on historic risk in the basin associated with these chemicals.

E - PCBs were reported in low number of monitoring wells away from well fields. PCBs have low mobility and concentration are low in the MWs so they are considered low priority. Not reported in any MWs near current well fields.

F - This chemical has not been reported in the SFB since 2005 above the current regulatory threshold. In addition, due to the age of this data, changes in analytical methods, and lack of data quality information; this data should not be relied upon for quantitative analysis or evaluation of risk.

CAMCLP - Primary California Maximum Contaminant Level

CAMCLS - Secondary California Maximum Contaminant Level

COC - chemical of concern

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4.3.1.1 TCE

TCE is a clear, colorless liquid with a characteristic chloroform odor. It is used primarily to remove grease from fabricated metal parts and in the production of some textiles (USEPA 2013). As stated in Section 4.1, TCE in groundwater is primarily from releases associated with former aerospace manufacturing and associated industries in the SFB. TCE can also be produced through reductive dechlorination of PCE. The California primary MCL for TCE is 5 µg/L.

TCE met five of the six criteria established for evaluating COCs, and is therefore considered a high-priority COC for the SFB. It is present in at least one well in all of the well fields, including the southern SFB well fields (i.e., Pollock, Whitnall, Erwin, and Verdugo), above the MCL. In over 33 percent of groundwater samples collected since 1980, it exceeded the MCL. It was identified in the 1992 RI as a COC and is reported in over 72 percent of the production wells since 2000. TCE is a known carcinogen and may cause liver damage or failure (USEPA 2013).

TCE trends in LADWP's production wells are dependent on the location of the pumping well as compared to the contaminant plumes (Appendix H). In general, TCE concentrations rise during periods of increased pumping, specifically for wells located downgradient of known TCE sources, and decrease during periods of non-operation. Some additional observations from the production wells include the following:

- TCE in the TJ well field is cyclical but stable, with wells in the center of the well field consistently exceeding the MCL.
- The RT production wells also have cyclical but generally stable concentrations of TCE, with concentrations generally being higher in the southern production wells. Detections of TCE in RT-08 and RT-09 have increased in frequency since 2008, and an overall increasing trend is observed in well RT-10. Wells RT-11 through RT-15 have had generally increasing trends since 2010.
- Wells in the western portion of the NHW well field generally do not have reported concentrations of TCE. Of the remaining wells, NH-22, NH-23, and NH-26 have shown an increase in the frequency of detection and increasing trends since approximately 2005. The remaining wells that have reported concentrations of TCE are generally cyclical, but stable.
- NHE wells located adjacent to the source areas have generally stable concentrations (NHE-02 and NHE-03), with wells downgradient of the source area having stable or decreasing concentrations.
- The southern well fields have variable trends with increasing concentrations observed in the Erwin production wells, decreasing concentrations in some of the Whitnall wells, and generally stable concentrations in the remaining well fields including Pollock and Verdugo.

4.3.1.2 PCE

PCE is a colorless liquid with an ether-like odor. PCE is commonly used in the textile industry, and as a component of aerosol dry-cleaning products (USEPA 2013). Similar to TCE, the primary sources of PCE are former aerospace manufacturers in the SFB. The California primary MCL for PCE is 5 µg/L. PCE met five of the six criteria presented in Table 4-4, and is therefore considered a high-priority COC. PCE is present above its MCL in the NHW and NHE production wells, TJ production wells, and Pollock production wells. In over 21 percent of groundwater samples collected in the SFB since 1980, it exceeded the MCL. It was identified in the 1992 RI as a COC and has been reported at least once in almost 43 percent of the production wells since 2000. PCE is a known carcinogen and may cause liver damage or failure (USEPA 2013).

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PCE trends in the production wells are generally similar to TCE, with concentrations generally responding to pumping depending on the location of the well as compared to the source areas Appendix H). Some general observations of PCE trends are presented below:

- Unlike TCE, PCE concentrations in the center of the TJ well field (TJ-06 and TJ-07) have a generally increasing trend in concentrations, with concentrations in adjacent wells remaining stable.
- Concentrations in the RT and southern well fields are generally stable or follow the pumping cycles, rising during increased pumping and falling during periods of in-operation.
- Concentrations are generally stable in NHW, though the frequency of detection of this compound has increased in several of the wells, such as NH-23 and NH-26, which have both increased concentrations and frequency of detection since 2006, and NH-07, which has increased in the number of detections and has had a generally increasing trend since 2009.
- NHE wells are generally stable or decreasing with the exception of NHE-02, located adjacent to the PCE source area, which shows an increasing trend.

4.3.1.3 Cis-1,2-DCE

Cis-1,2-DCE is an odorless organic liquid used as a solvent for waxes and resins, in the extraction of rubber, as a refrigerant, in the manufacture of pharmaceuticals and artificial pearls, in the extraction of oils and fats from fish and meat, and in making other organics (USEPA 2013). Cis-1,2-DCE is also a product of reductive dechlorination of higher chlorinated compounds such as TCE. The California primary MCL for cis-1,2-DCE is 6 μg/L.

Cis-1,2-DCE met four of the six categories in Table 4-4, and therefore is considered a high-priority COC. Cis-1,2-DCE is present above its MCL in the NHE production wells. In approximately 8 percent of groundwater samples collected in the SFB since 1980, it exceeded the MCL. It was identified in the 1992 RI as a COC and has been reported at least once in almost 5 percent of the production wells since 2000. Cis-1,2-DCE is a known carcinogen and may cause liver damage or failure (USEPA 2013).

Concentrations of cis-1,2-DCE in the production wells are generally limited, with the TJ and NHE wells being generally stable and below the MCL. This compound is generally not detected in the NHW, RT, or the southern area production wells.

4.3.1.4 1,1-DCE

1,1-DCE is an organic liquid with a mild, sweet, chloroform-like odor. 1,1-DCE is used in making adhesives, synthetic fibers, refrigerants, food packaging, and coating resins such as the Saran types (USEPA 2013). 1,1-DCE is also a product of abiotic and biotic reduction of higher chlorinated compounds. The California primary MCL for 1,1-DCE is 6 μg/L.

1,1-DCE met four of the six criteria in Table 4-4, and is therefore considered a high-priority COC. It is present in the NHE, TJ, and Pollock production wells above the MCL. In approximately 9 percent of groundwater samples collected in the SFB since 1980, it exceeded the MCL. It was identified in the 1992 RI as a COC and has been reported at least once in 23 percent of the production wells. 1,1-DCE is a known carcinogen and may cause liver damage or failure (USEPA 2013).

1,1-DCE is most commonly reported in the TJ, NHE, and Pollock well fields where this compound regularly exceeds MCLs and requires treatment. Trends in these wells are generally cyclical but stable. Some additional observations of 1,1-DCE are presented below:

- Trends are generally stable in NHW, but since 2010 NH-22, NH-26 and NH-25 appear to show increasing trends.

- In NHE, increasing trends are observed in NHE-2 and NHE-3 located adjacent to the NHOU source area (Appendix H).
- Concentrations in the Pollock well field are stable, but there was a sharp increase in concentration and the frequency of detection in both production wells starting in 2006.

4.3.1.5 1,2-DCA

1,2-DCA is a colorless, oily, organic liquid with a sweet, chloroform-like odor. 1,2-DCA is used to make chemicals involved in plastics, rubber, and synthetic textile fibers. It is also used as a solvent for resins and fats, photography, photocopying, cosmetics, drugs, and a fumigant for grains and orchards (USEPA 2013). 1,2-DCA can also be produced through abiotic or biotic reduction of the higher chlorinated compound 1,1,2-trichloroethane. The California primary MCL for 1,2-DCA is 0.5 µg/L.

1,2-DCA met four of the six criteria in Table 4-4, and is therefore considered a high-priority COC. 1,2-DCA is present in the NHE production wells above the MCL. In over 7 percent of groundwater samples collected from the SFB since 1980, it exceeded the MCL. It was identified in the 1992 RI as a COC and has been reported at least once in 12 percent of the production wells since 2000. 1,2-DCA is a known carcinogen (USEPA 2013).

1,2-DCA is reported in only the RT and NHE production wells with the wells in both well fields being generally below the laboratory reporting limit and the MCL. Concentrations have historically been the highest in wells NHE-3, NHE-4, and NHE-5 from the NHE well field, but all of these wells show a decrease in concentrations over time (Appendix H).

4.3.1.6 CTET

CTET is a clear, heavy organic liquid with a sweet aromatic odor similar to chloroform. CTET is used to make chlorofluorocarbon propellants and refrigerants. It has also been used as a dry cleaning agent; as a fire extinguisher; to make nylons; and as a solvent for rubber cement, soaps, and insecticides (USEPA 2013). CTET is most prominent in areas of aerospace manufacturing similar to other chlorinated solvents. The California primary MCL for CTET is 0.5 µg/L.

CTET met four of the six criteria in Table 4-4, and is therefore considered a high-priority COC It is present in the NHE production wells above the MCL. In over 7 percent of groundwater samples collected in the SFB since 1980, it exceeded the MCL. It was identified in the 1992 RI as a COC and has been reported at least once in nearly 20 percent of the production wells since 2000. CTET is a known carcinogen and could cause liver damage or failure (USEPA 2013).

CTET is reported in production wells from the TJ, NHE, and Pollock well fields. Observations from these well fields including trends are presented below:

- Similar to other compounds, CTET is found primarily in the center of the TJ well field with concentrations being cyclical, but overall stable and around the MCL.
- Concentrations of CTET are the highest in NHE with NHE-2 and NHE-8 regularly exceeding the MCL. Concentrations in NHE-2 are generally stable, while concentrations in NHE-8 appear to show an overall decreasing trend.
- Concentrations in the Pollock well field are below the MCL and stable.

4.3.1.7 1,2,3-TCP

1,2,3-TCP (also known as allyl trichloride, glycerol trichlorohydrin, and trichlorohydrin) is a colorless to straw-colored organic liquid. 1,2,3-TCP has been used as an industrial solvent and as a cleaning and degreasing agent; it has been found as an impurity resulting from the production of soil fumigants. 1,2,3-TCP is currently used as a chemical intermediate in the production of other chemicals (including polysulfone liquid polymers and dichloropropene), and in the synthesis of hexafluoropropylene. In addition, it is used as a cross-linking agent in the production of polysulfides (USEPA 2013). The notification level for 1,2,3-TCP is 0.005 µg/L.

1,2,3-TCP met four out of the six criteria presented in Table 4-4, and is therefore considered a high-priority COC. It is present in the TJ production wells above the MCL. In almost 10 percent of groundwater samples collected from the SFB, it exceeded the notification level. It has been reported in 12 percent of the production wells at least once since 2000. 1,2,3-TCP is a known carcinogen (USEPA 2013). It would require specialized treatment in select wells if the water from that well will be used as a potable source.

There are currently not enough 1,2,3-TCP data in any of the well fields to establish trends.

4.3.1.8 1,4-Dioxane

1,4-Dioxane (also known as dioxane, dioxan, p-dioxane, diethylene dioxide, diethylene oxide, diethylene ether, and glycol ethylene ether) is a colorless, flammable organic liquid. 1,4-Dioxane is a likely contaminant at many sites impacted with certain chlorinated solvents (particularly 1,1,1-trichloroethane [TCA]) because of its widespread use as a stabilizer for chlorinated solvents. It is used as a stabilizer for chlorinated solvents such as TCA, a solvent for impregnating cellulose acetate membrane filters, a wetting and dispersing agent in textile processes, and a laboratory cryoscopic solvent for molecular mass determinations. It is used in many products, including paint strippers, dyes, greases, varnishes, and waxes. 1,4-Dioxane is also found as an impurity in antifreeze and aircraft deicing fluids and in some consumer products (USEPA 2013). The notification level for 1,4-Dioxane is 1 µg/L.

1,4-Dioxane met four of the six categories in Table 4-4, and is therefore considered a high-priority COC. It is present in the NHE production. In almost 39 percent of groundwater samples collected from the SFB, it exceeded the notification level, and has been reported at least once in almost 17 percent of the production wells. 1,4-Dioxane is a known carcinogen (USEPA 2013). It would require specialized treatment in select wells if the water from that well will be used as a potable source.

1,4-Dioxane is reported in a number of well fields, but there are generally not enough data to establish trends in the TJ, RT, NHW, or southern area production wells. Concentrations in the NHE wells are generally stable (Appendix H).

4.3.1.9 NDMA

NDMA (also known as dimethylnitrosamine [DMNA], nitrosodimethylamine, N-methyl-N-nitrosomethanamine, and N,N-dimethylnitrosamine) is a yellow organic liquid with faint characteristic or no distinct odor. NDMA is not currently produced in pure form or commercially used in the United States, except for research purposes. It was formerly used in production of liquid rocket fuel, antioxidants, and additives for lubricants and softeners for copolymers (USEPA 2013). The notification level for NDMA is 0.01 µg/L.

NDMA met four of the six criteria presented in Table 4-4, and is therefore considered a high-priority COC. It is present in the NHE production wells. In over 7.5 percent of groundwater samples collected from the SFB, it exceeded the notification level. It has been reported at least once in 3 percent of the production wells since 2000. NDMA is a known carcinogen (USEPA 2013), and it would require specialized treatment in select wells if the water from that well will be used as a potable source.

There are currently not enough NDMA data in any of the well fields to establish trends.

4.3.1.10 Hexavalent Chromium

Hexavalent chromium is a greenish-blue, odorless, and tasteless metallic solid. Cr(VI) (also known as chromium-6, Cr6, and Cr(VI)) is one of the two most common forms of chromium occurring naturally in waters (the other being chromium-3 or trivalent chromium). Cr(VI) occurs naturally in the environment from the erosion of natural chromium deposits and it can also be produced by industrial processes. There are demonstrated instances of chromium being released to the environment by leakage, poor storage, or inadequate industrial waste disposal practices. Cr(VI) is used for chrome plating, dyes and pigments, and leather and wood preservation (USEPA 2013). The California primary MCL for Cr(VI) is 10 µg/L.

Cr(VI) met four of the six criteria in Table 4-4, and is therefore considered a high-priority COC. It is present in NH production wells over the MCL. In over 21 percent of groundwater samples collected from the SFB, it exceeded the MCL. It has been reported at least once in nearly 5 percent of the production wells. Cr(VI) is a known carcinogen and could cause liver damage or failure (USEPA 2013). It would require specialized treatment in select wells if the water from that well will be used as a potable source.

Concentrations of Cr(VI) in LADWP's production wells are generally stable, though there are a limited amount of Cr(VI) data from the TJ and RT production wells to establish trends. Trends in wells located in the center of the impacted area (NHE-2 and NHE-3) in NHE have had overall increasing trends since the start of pumping (Appendix H).

4.3.1.11 Perchlorate

Perchlorate is a salt derived from perchloric acid, which contains the perchlorate ion. Perchlorate can be naturally occurring or manufactured and used in solid rocket propellants, flares, fireworks, pyrotechnic devices, explosives, blasting agents, batteries (battery numbers that start with CR), air bag initiators, and bleach. Perchlorates can be unstable and are typically powerful oxidizers. The California primary MCL for perchlorate is 6 µg/L.

Perchlorate met four of the five categories in Table 4-4, and is therefore considered a high-priority COC. It is present in the TJ and RT production wells. In over2 percent of groundwater samples collected from the SFB, it exceeded the MCL, and has been reported at least once in over 6 percent of the production wells. Perchlorate can disrupt the thyroid's ability to produce hormones needed for normal growth and development (USEPA 2013). It would require specialized treatment in select wells if the water from that well will be used as a potable source.

Similar to other chemicals, perchlorate trends in the production wells in TJ and RT generally coincide with pumping, with concentrations increasing during increased pumping, though these wells are not heavily pumped because of impacts (Appendix H). The only remaining well field with consistent detections of perchlorate is Pollock, with most of the recent detections likely being due to better laboratory methods and lower reporting limits since approximately 2010.

4.3.1.12 Nitrate (as NO_3)

Nitrate (as NO_3) is a nitrogen-oxygen chemical unit that combines with various organic and inorganic compounds. Nitrate occurs naturally in the environment, but the greatest use of nitrates is as a fertilizer with other sources including wastewater and septic systems. Once taken into the body, nitrates are converted to nitrites (USEPA 2013). The California primary MCL for nitrate is 45 mg/L.

Nitrate met four of the six screening criteria, and is therefore considered a high-priority COC. It is present in the NHE and the TJ production wells; however, less than 1 percent of samples collected exceeded the MCL. It was identified in the 1992 RI as a COC. It is known to cause blue baby syndrome and death in infants under 6 months of age (USEPA 2013). Nitrate is currently controlled by LADWP per its operational permit, through blending of waters from different well fields in the SFB.

Trends in nitrate in the production wells are generally stable in all of the well fields, with the following exceptions:

- In the TJ production wells there is an apparent decrease in concentrations during high pumping intervals, as noted for wells TJ-06 and TJ-07.
- Concentrations in the NHW production wells generally follow pumping cycles with increasing concentrations during increased pumping.
- Overall, nitrate concentrations in the southern well fields are generally stable, though concentration trends in some of the WH production wells have a decreasing trend in concentrations.

4.3.2 Chemicals of Potential Concern: Moderate Priority

The 12 chemicals described above are high priority and will be the focus of this RI Update Report and the Draft FS Report; however, the remaining chemicals presented in Table 4-4 were reported above established regulatory limits and/or met other criteria in the COC screening and should be continually evaluated. The chemicals discussed below were identified as posing a moderate concern, but are important to note because of their impact on some of the well fields.

4.3.2.1 Trichloroflouromethane

Trichloroflouromethane (also known as Freon 11) has been consistently reported in the TJ well field with TJ-12 having several detections above the MCL and a concentration of 49 µg/L during the last monitoring event; however, it has been reported in only a few wells above the MCL. This compound was also reported above the MCL in TJ-MW-09 at a depth of 850 feet bgs above the MCL (150 µg/L) with a concentration of 180 µg/L. This compound is commonly used as a refrigerant, and is typically released to the environment through mishandling or landfilling of cooling systems. As noted in Table 4-4, this chemical would be treated through treatment of the other high-priority COCs.

4.3.2.2 Total Dissolved Solids

Water quality as measured by TDS is generally good in the SFB. However, it does pose a concern in some areas, specifically in NH, where most of the production wells exceed the SMCL of 500 mg/L for TDS. Additional production wells in TJ and RT also currently or historically have exceeded the SMCL for TDS. The sources of the elevated TDS in these areas are unknown; they generally coincide with the elevated nitrate concentrations, and therefore may be from related sources (e.g., agricultural land use of the SFV).

4.4 Extent of High-Priority Organic Chemicals of Concern

A total of nine organic chemicals were identified as high-priority COCs. The organic COCs are generally associated with use of chlorinated solvents in the basin and are the primary solvent (TCE, PCE, 1,2,3-TCP, and CTET), a daughter product through abiotic or biotic reduction (cis-1,2-DCE, 1,1-DCE, 1,2-DCA), or, in the case of 1,4-dioxane, is directly associated with chlorinated solvent usage a chemical stabilizer. Because of the relation of these compounds, they were generally released simultaneously or in sequence as substitutions in solvents were made (e.g., TCE usage gave way to 1,1,1-TCA in the 1970s); hence, they have a similar horizontal and vertical distribution.

This section presents a detailed discussion of the extents of these chemicals focusing on TCE, PCE, cis-1,2-DCE, 1,1-DCE, 1,2,3-TCP, and 1,4-dioxane. CTET, 1,2-DCA, and NDMA are high-priority COCs, but because of their sporadic detection in monitoring wells and production wells in the SFB, a detailed summary of their extents is not presented in this report, and maps of their distribution have not been developed. Though not presented, these chemicals generally occur in the same areas as the other organic chemicals and are related to the primary releases. In the case of NDMA, it may originate from disinfection or from similar sources as perchlorate.

A number of figures have been developed to support this discussion. These include areal plume maps for both shallow (Figures 4-5a through 4-10a) and deep (Figures 4-5b through 4-10b) groundwater; five cross-sections through the TCE, PCE, 1,1-DCE, and 1,4-dioxane plumes (Figures 4-14 through 4-17, denoted as a, b, c, d, and e); large plume maps included as plates in Appendix I; and 3D plume models includes as Figures 4-23 through 4-28. As stated on the figures, for the purposes of this discussion shallow groundwater generally coincides with hydrostratigraphic Layers 1 and 2a as presented in Section 3, with deeper groundwater being associated with hydrostratigraphic Layers 2b and 3. Wells were generally segregated based on the screen interval compared to these layers, but in areas where these layers are not as well defined, such as the TJ and wells from the GNOU/GSOU to Pollock, wells screened within 50 feet of the water table are generally considered shallow and the remainder deep. All of the wells from the GNOU/GSOU to Pollock are considered shallow because of the decreased depth to water and vertical extent of alluvial materials, as presented in Section 3.

4.4.1 TCE

TCE is the most widely-distributed COC in shallow groundwater in the SFB, occurring northwest of the TJ well field, to the southern part of the SFB and the Pollock well field (Figure 4-5a). As presented in Table 4-4, TCE was the most commonly-reported COC above its MCL (5 µg/L), being reported in over 30 percent of all samples collected. There are numerous sources of TCE but the plumes are generally diffuse with concentrations between 0.5 and 5 µg/L, occupying an area of approximately 22 square miles.

Tujunga Area

Near the TJ well field, TCE is reported in a number of wells, and the area of contamination in the shallow groundwater extends from the production wells approximately 3.4 miles to the northeast and occupies an area of approximately 2 square miles (Figure 4-5a). The maximum concentration of TCE in shallow groundwater in the TJ area was observed in TJ-MW-14 at a concentration of 19 µg/L. As presented in Section 2.5.5, a number of PRPs are upgradient of the TJ well field on the north side of the Verdugo Fault Zone (Figure 4-5a). Wells located near the PRPs show generally shallow contamination that is controlled by groundwater flow and is affected by the Verdugo Fault Zone and related fault splays. These wells have water levels that are several hundred feet higher than the wells on the south side of the fault zone (Figure 4-14a), and a flow direction toward the fault zone. As discussed in Section 3, the fault zone provides a barrier to flow, though recent investigations have shown that it is not impermeable, with areas of the fault zone that likely allow both movement of groundwater and transport of chemicals such as TCE. This transport through the fault likely contributes to the shallow impacts observed in the northern monitoring wells (e.g., TJ-MW-12) downgradient to the production wells.

Unlike other areas of the SFB, TCE concentrations are generally greater at depth in the TJ area with the highest concentrations in the monitoring wells being reported in TJ-MW-10 (91 µg/L) screened between 840 and 880 feet bgs (Figure 4-5b and Figure 4-14a). The TCE concentrations in the monitoring wells extend from the production wells to the north toward the Verdugo Fault Zone, where data become unavailable. The deeper groundwater having higher concentrations could indicate preferential flow to the lower zones as the TCE is transported downgradient from the north, through the Verdugo Fault Zone toward the production wells. The TJ production wells with the highest concentrations are located in the center of the well field and include TJ-05 through TJ-08 (Figure 4-5b and Figure 4-14b). The maximum concentration in the production wells was observed in TJ-07 during recent monitoring at a concentration of 22 µg/L.

Based on the depth of the TCE contamination and lack of contamination downgradient of the TJ production wells, it appears that the production wells are capturing the plume migrating downgradient from the north. This is supported by the TCE trends in the production wells, which show increased concentrations during pumping as the plume is funneled to the center of the well field (Appendix H).

Rinaldi-Toluca Area

The RT area has the lowest TCE concentrations of the three northern well fields and appears to have TCE associated primarily with mobilization of the TCE plumes in the NHE area during increased pumping (Figure 4-5a). Recent monitoring of the RT area reported maximum concentrations in the monitoring wells of 120 µg/L (NH-C11-295) and 20.5 µg/L (RT-14) in the production wells. TCE is generally confined to the southern section of the RT well field south of production well RT-02 (Figure 4-5a). The highest concentrations near the RT well field are in two areas: one east of the southern RT well field and north of the NHW well field near the Hewitt Pit where several wells are above 50 µg/L, and another area directly south of the RT well field in the NHOU where a number of wells are greater than 100 µg/L (Figure 4-5a).

Similar to most areas of the SFB, TCE is generally highest in the shallow zone near the RT well field, but similar to TJ there is an area of higher concentrations at depth at monitoring well RT-MW-02 with a concentration of 4 µg/L from the well screened between 790 and 830 feet bgs (Figure 4-5b and Figure 4-14c).

Based on the location of the TCE plumes in the southern section of the well field and the concentration trends, it appears that the TCE plume is pulled northward during operation of the RT production wells during pumping cycles, followed by retreat of the plume during periods of inactivity.

North Hollywood Area

Out of the three northern well fields, TCE is the most prevalent in the NH well field, specifically the eastern portion of the well field near the NHOU source area where a maximum concentration of 670 µg/L was observed. In the NHW portion of the well field, the TCE impacts are generally confined to the area east of NH-22 (NHE), with the highest concentration coming from between the NHW production wells and the southern section of the RT production wells (Figure 4-5a). A previously-unidentified area of elevated TCE concentrations (5 µg/L) was observed in shallow groundwater near monitoring well NH-MW-10, installed in 2014 approximately two miles west of the RT well field. There are currently no upgradient wells to evaluate the extent or location of another potential source area.

The NHE production wells are located immediately adjacent to the primary source area for the NHOU, and TCE concentrations in all of the NHE production wells along with the aeration wells are elevated above the MCL. TCE is concentrated in the shallow zone near the NH well fields with maximum concentrations being up to one order of magnitude lower in wells screened in the deeper groundwater zones versus the shallow zone (Figure 4-5b and Figure 4-14d). Based on trends in concentrations, wells in the center of the plume have stable concentrations (NHE-02 and NHE-03), while wells downgradient of the source area (e.g., NHE-07) have decreasing concentrations, which may indicate some plume contraction in response to the remedial activities in the center of the plume.

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Southern Area

TCE from all of the upgradient sources and multiple downgradient sources, including the BOU, GOU, and NHOU, funnels to the south following the groundwater flow direction, so that the TCE plume extends from the NH well field down to the Pollock well field with all of the monitoring and production wells in between generally having some level of TCE impact. The highest TCE concentrations reported in the SFB (concentration greater than 1,000 µg/L) are in the GOU from several sources located adjacent to Interstate 5 and near the Los Angeles River (Figure 4-5a). Similar to other areas, contamination is highest in the shallow groundwater, though as stated in the start of this section the depth to groundwater and extent of the alluvial materials decreases in this southern part of the SFB so that the shallow and deep zones identified in the TJ, RT, and NH areas do not have significant hydrogeologic separation.

4.4.2 PCE

After TCE, PCE (MCL of 5 µg/L) is the most widely-distributed VOC in the SFB, being reported from the TJ well field 13 miles downgradient to the Pollock well field in shallow groundwater (Figure 4-6a). Similar to TCE, most of the PCE is located in shallow groundwater, but there are deeper impacts in the TJ area as well as the NH area. The area of shallow groundwater impacted with PCE occupies an area of 20 square miles in the SFB.

Tujunga Area

The maximum concentrations of monitoring wells and production wells in the TJ area during recent sampling were 110 (TJ-MW-10-860) and 27.6 µg/L (TJ-07), respectively. The PCE impacts in shallow groundwater extend from the production wells approximately 3.3 miles to the north and occupy an area of 2 square miles (Figure 4-6a). Similar to TCE, several wells north of the Verdugo Fault Zone have elevated concentrations of PCE near PRPs. PCE also appears to migrate like TCE toward the Verdugo Fault Zone following the direction of groundwater flow, with concentrations being present in shallow groundwater on the south side of the fault zone (represented by TJ-MW-12), which may be attributed to flow through a permeable portion of the fault.

Similar to TCE, the highest PCE concentrations are found in deep groundwater, with the highest concentrations being located in TJ-MW-10 screened from 840 to 880 feet bgs (Figure 4-6b and Figure 4-15a). Impacts to deep groundwater occupy an area of 1.8 square miles trending from the production wells to the northeast, where data become sparse as the Verdugo Fault Zone is encountered.

PCE in the TJ production wells is highest in the center of the well field in wells TJ-05 through TJ-08 (Figure 4-15b). As presented in Section 4.2, PCE concentrations are generally increasing in the production wells in the center of the TJ well field, and it appears that the production wells are capturing the plume migrating from the north.

Rinaldi-Toluca Area

PCE is not as prevalent in the RT area as in other well fields, as can be seen by a maximum concentration of 2.22 µg/L (RT-01) in LADWP's production wells. However, there is a potential source of PCE west of the RT well field and just north of the NHW well field near the Hewitt Pit, with a number of wells above the MCL and a maximum concentration of 110 µg/L (Figure 4-6a). There is likely another source area east of the RT production wells (south of the Penrose, Strathern, and Tuxford landfills) based on the high concentration (>50 µg/L) observed in USEPA well NH-C01. Both of these areas appear to impact the southern RT production wells, with trends of PCE in these wells generally following periods of elevated pumping, indicating that the plume is pulled toward these wells during operation (Appendix H).

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Vertically, concentrations are the highest in shallow groundwater near the RT well field (Figure 4-6b and Figure 4-15c) with concentrations generally being an order of magnitude lower at depth. Though concentrations are generally lower, a number of deep monitoring wells show that vertical migration of PCE has occurred as seen near the Hewitt Pit and Strathern, Tuxford, and Penrose landfills.

North Hollywood Area

Unlike TCE, there appear to be a number of PCE sources besides just the NHOU source area in the vicinity in the NHW and NHE areas. As discussed for the RT area, there is a potential source area north of the NHW production wells near the Hewitt Pit that appears to be captured by both the RT and NHW well fields (Figure 4-6a). In NHW, this can be seen by elevated concentrations of PCE in several of the northernmost wells, including NH-037, where there are consistent detections of PCE during periods of pumping (Appendix H).

Based on the wells installed west of the RT well field, there also appears to be a potential source of PCE west of the NHW wells. This can be observed through concentrations in the westernmost monitoring well (NH-MW-08) at 22 and 0.5 μg/L at depths of 430 and 770 feet bgs, respectively (Figure 4-6b). NH-07, which is located approximately 1.3 miles east of NH-MW-08, has had consistent PCE concentration since 2009 with a generally increasing trend. PCE in NH-32, located near NH-06, has generally been below the laboratory reporting limit, perhaps because of the depth and greater pumping from this well causing dilution of PCE (Figure 4-15d).

Concentrations in the eastern portion of NHW and the wells in NHE have a similar pattern of PCE impacts to those observed for TCE, but at lower concentrations. The impacts are centered on the NHOU source area with concentrations near the source area between 20 and 50 μg/L. In the deeper groundwater zones PCE is present but at lower concentrations, with the maximum concentration being observed in well V13ALS17A at 11 μg/L.

Southern Area

As stated earlier, PCE extends from the TJ area to the Pollock production wells. There are several sources between the NH well field and Pollock, including impacts from the BOU and GOU where the highest concentrations are currently observed. In the BOU, concentrations in shallow groundwater exceed 100 μg/L, with the area of impacts greater than 100 μg/L occupying an area of approximately 1.2 square miles in shallow groundwater and 0.3 square mile in deep groundwater.

PCE concentrations near the GOU also exceed 100 μg/L, but occupy a smaller area with concentrations above 100 μg/L having an extent of 0.15 square mile. Between the GOU and the Pollock well fields there are several areas with concentrations above the MCL, but all of the wells along the entire stretch near the Los Angeles River have detectable concentrations of PCE.

4.4.3 Cis-1,2-DCE and 1,1-DCE

Cis-1,2-DCE and 1,1-DCE are both daughter products of either chemical or microbial reduction of higher chlorinated compounds such as TCE and 1,1,1-TCA. Because of this mechanism of production, they are both located in similar areas to the TCE and PCE impacts and are at generally lower concentrations and areal extents. Because these chemicals occur and behave in a similar fashion in the environment, they are discussed together in this section of the report.

Tujunga Area

Both cis-1,2-DCE and 1,1-DCE are reported near the TJ well field at maximum concentrations of 41 (TJ-MW-11-560) and 27 μg/L (TJ-MW-11-900), respectively, in the monitoring wells, and 0.729 (TJ-07) and 9.23 (TJ-08), respectively, in the production wells. Similar to TCE and PCE, concentrations of these chemicals are the highest in the deeper groundwater samples from 500 to

900 feet bgs (Figure 4-7b and Figure 4-8b) and have a similar pattern emanating from a source upgradient of the TJ production wells. As with other chlorinated solvents, the impacts are highest in the center of the TJ well fields as observed by TJ-06 and adjacent wells (Figure 4-16a).

The overall areal extents of 1,1-DCE above the MCL (6 µg/L) is approximately 0.90 and 0.40 square mile in shallow and deep groundwater, respectively (Figure 4-7a and Figure 4-7b). The extent of cis-1,2-DCE above the MCL is 0.05 and 0.13 square mile, respectively, based on the shallow and deep groundwater maps (Figures Figure 4-8a and Figure 4-8b).

Rinaldi-Toluca Area

In the RT well field, 1,1-DCE and cis-1,2-DCE are not generally reported in the production wells or are very low concentrations, and unlike TCE and PCE there does not appear to be significant movement of the plumes during pumping based on the time-concentration plots (Appendix H). These compounds are found in two general areas coinciding with the occurrence of other solvents generally west of the well field near the Hewitt Pit and east of the well field between the NHOU and the Penrose, Strathern, and Tuxford landfills (Figure 4-7a and Figure 4-8a). Maximum concentrations of cis-1,2-DCE and 1,1-DCE west of the RT well field are 16 and 5.9 µg/L, respectively, from wells V14HEWMW4 and V14HEWMW1 located adjacent to the Hewitt Pit. The maximum concentrations of cis-1,2-DCE and 1,1-DCE east of the RT well field are 46 and 24 µg/L, from NH-C16-320 and V14107D8 located near the Penrose, Strathern, and Tuxford landfills.

North Hollywood Area

The NHW well field has historically not had detectable concentrations of cis-1,2-DCE or 1,1-DCE and no significant concentrations of these chemicals were found during the 2012 through 2014 sampling performed at new or existing wells. There are some limited occurrences of these chemicals in the NHE area. These are most notably near the NHOU where a small area of 1,1-DCE is present above the MCL. Maximum 1,1-DCE concentrations in this area were observed at 28 µg/L during recent sampling (Figure 4-7a). Similar to PCE, concentrations of 1,1-DCE, as observed in NHE-02 and NHE-03, have shown an increasing trend while the remaining wells in NHE have stable or decreasing concentrations. Concentrations of these chemicals are generally limited to shallow groundwater with the only deeper detections being just above the laboratory method detection limit (Figures 4-7b, 4-8b, and 4-16e).

Southern Area

Similar to TCE and PCE, between NH and Pollock there are a number of sources as observed by several plumes moving downgradient from NH, including those in the BOU and GOU (Figures 4-7a and 4-7b). Near the BOU, maximum concentrations of cis-1,2-DCE and 1,1-DCE are 6.74 and 25.7 µg/L, respectively. 1,1-DCE concentrations in excess of the MCL encompasses an area of 0.11 square mile. From the BOU to the south, there are three separate areas with concentrations above 100 µg/L for both cis-1,2-DCE and 1,1-DCE, with concentrations above the MCL occupying a total area of approximately 0.25 and 0.40 square mile, respectively.

4.4.4 1,2,3-TCP

1,2,3-TCP was generally released at similar locations to TCE and PCE, though is not as prevalent as those chemicals in the SFB and was probably released during later operations as other chemicals were phased out. Based on the most recent sampling results, 1,2,3-TCP was not reported above the action level of 0.005 µg/L in the TJ, RT, or NHW area, though it has been historically reported above the action level in production wells from TJ and NHE. The primary 1,2,3-TCP impacts in the SFB extend from the eastern section of the NHOU and BOU to the GOU.

The largest area of 1,2,3-TCP above the notification level occurs in the eastern section of the NHOU, extending into the BOU. The maximum concentration was reported at 14.5 µg/L. Impacts from this area trend to the south with the direction of groundwater flow eventually merging with the GOU and occupying a total area of approximately 4 square miles (Figure 4-9a). These impacts are generally confined to shallow groundwater with few reported concentrations in deeper screened production or monitoring wells (Figure 4-9b).

4.4.5 1,4-Dioxane

1,4-Dioxane in SFB groundwater generally has a similar pattern to TCE and PCE, which coincides with its use as a stabilizer for chlorinated solvents. The plumes in shallow groundwater above the laboratory method detection limit occupy an area of approximately 13 square miles and extend from the area north of TJ, 17 miles to the south to the Pollock well field (Figure 4-10a). The NL for 1,4-dioxane is currently 1 µg/L.

Tujunga Area

1,4-Dioxane north of the TJ production wells occupies an area of 2.0 square miles in shallow groundwater (Figure 4-10a) and 2.5 square miles in deeper groundwater zones (Figure 4-10b). Similar to the other high-priority organic compounds, concentrations are higher in deeper screened wells with a maximum concentration of 7.7 µg/L being observed in well TJ-MW-10 screened between 840 and 880 feet bgs (Figure 4-17a). 1,4-Dioxane was reported at a maximum concentration of 1.06 µg/L in the TJ production wells with concentrations being the highest in the center of the well field along with the production wells on the eastern end (Figure 4-17b).

Rinaldi-Toluca Area

1,4-Dioxane near the RT well field occurs in two general areas near the Hewitt Pit east of the production wells and to the west of the production wells near the Penrose, Strathern, and Tuxford landfills (Figure 4-10a). Concentrations in these two areas are above the notification level with the area of impacts near the Hewitt Pit above the notification level occupying an area of 0.11 square mile with a maximum concentration of 460 µg/L in well V14HEWMW4. This well is located approximately 1/4 mile from the LADWP production wells (Figure 4-10a). The area of impact near the Penrose, Strathern, and Tuxford landfills occupies an area of approximately 0.1 square mile with a maximum concentration of 16 µg/L in well V14107D8. This well is located approximately 1 mile from the RT production wells.

Vertically, 1,4-dioxane is highest in shallow groundwater with impacts in deeper wells generally being an order of magnitude lower (Figure 4-10b and Figure 4-17c). The RT production wells reflect these deeper concentrations with the highest concentration during recent monitoring being observed in well RT-15 in the southernmost section of the well field, at a concentration of 0.056 µg/L and generally having steady trends (Appendix H).

North Hollywood Area

Near the NHW production wells, 1,4-dioxane in shallow groundwater above the notification level is generally located immediately east of the well field and appears to be influenced by the plume emanating from the Hewitt Pit area north of the well field and from the impacts east of the well field (Figure 4-10a). Concentrations in wells immediately east of the NHW production wells are generally above the notification level with well NH-C09-310 located 1/4 mile east of the well field having a 1,4-dioxane concentration of 110 µg/L based on recent sampling. Concentrations in this area generally decrease with depth, though there is a separate area west of the production wells where 1,-4-dioxane was detected only in deeper groundwater (NH-MW-08-430 at 0.13 µg/L) (Figure 4-10b).

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This area of impacts coincides with the PCE result from this same well with elevated concentrations as compared to the surrounding wells (Figure 4-17d).

NHE has historically had high concentrations of 1,4-dioxane as can be seen by the steady concentrations above the notification level in wells located in NHE. Similar to the other solvents, concentrations in this area are centered on the NHOU, with concentrations above the action level occupying an area of 0.15 square mile with a maximum concentration of 7.5 µg/L (Figure 4-10a). Similar to NHW and RT, concentrations in deeper groundwater zones are roughly an order of magnitude lower than shallow groundwater samples (Figures 4-10b and 4-17e).

Southern Areas

1,4-Dioxane is present in groundwater from the NHOU to the Pollock well field with several apparent source areas in between. In the BOU, concentrations are generally in the range of 0.1 to 4 µg/L, with a small area of impacts above the action level (approximately 0.2 square mile) (Figure 4-10a). There are two areas of impacts above the notification levels in the GOU, with the northern plume occupying areas of approximately 0.13 square mile with a maximum concentration of 23 µg/L and the southern plume occupying an area of 0.05 square mile with a maximum concentration of 16 µg/L. Concentrations in the Pollock production wells are stable with concentrations in PO-06 generally exceeding the action level.

4.5 Extent of High-Priority Inorganic Chemicals of Concern

Three inorganic COCs were identified as high-priority and include Cr(VI), perchlorate, and nitrate. Unlike the organic COCs, the inorganic COCs come from diverse sources with Cr(VI) coming from natural and manufacturing sources, perchlorate coming from not yet identified sources though likely through explosive manufacturing or disposal, and nitrate being attributed primarily to historical agricultural and domestic land uses in the SFB. A description of each inorganic compound and its extents in the SFB are presented in the following sections of this report.

A number of figures have been developed to support this discussion. These include areal plume maps for both shallow (Figures 4-11a through 4-13a) and deep (Figures 4-11b through 4-13b) groundwater, five cross-sections through the Cr(VI) and perchlorate plumes (Figures 4-18 through 4-19, denoted as a, b, c, d, and e), large plume maps included as plates in Appendix I, and 3D plume models included as Figures 4-20 through 4-25.

4.5.1 Hexavalent Chromium

Cr(VI) is the most prevalent of the inorganic COCs being reported in all of the well fields, with a number of wells having concentrations above the MCL of 10 µg/L. There have been a number of releases of Cr(VI) in the SFB, but Cr(VI) also occurs naturally in groundwater. Though trivalent chromium is the more stable condition of chromium in the environment, the alkaline (pH greater than 7.0) and aerobic groundwater in the basin (high DO content and positive oxidation-reduction potential) is a conducive environment for natural Cr(VI) to be the dominant valence state for chromium in groundwater. This condition is further supported by the relationship of total chromium and Cr(VI), where Cr(VI) makes up most and sometimes all of the chromium reported in groundwater.

Tujunga Area

Cr(VI) concentrations are generally below the MCL in the TJ area, with concentrations ranging from below the method detection limit to 3.9 µg/L in both the production wells and monitoring wells sampled by LADWP. As presented on Figure 4-11a, there is an area approximately 2.8 miles north and upgradient of the TJ production wells where there are several wells with concentrations above

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the MCL with a maximum concentration greater than 100 µg/L. This area is small, occupying an area of only 0.1 square mile. Vertically, Cr(VI) is similar in shallow and deep groundwater in the TJ area (Figure 4-11b and Figure 4-18a).

Rinaldi-Toluca Area

Concentrations of Cr(VI) are generally similar in the RT and TJ areas, and between shallow and deep groundwater wells (Figure 4-18c). The two exceptions to relatively consistent concentrations are values of 6.3 and 12 µg/L in RT-MW-10 and RT-MW-09, respectively (Figure 4-11a). These concentrations are significantly greater than the other wells in the RT and TJ well fields. Both of these detections were in shallow groundwater in the western section of the RT area, away from the known source areas in the SFB (Figure 4-11a).

North Hollywood Area

The highest Cr(VI) concentration in the NH area is from the NHOU source area located adjacent to the production wells. The impacts in this area above the MCL occupy an area of approximately 0.15 square mile around NHE extraction wells NHE-2 and NHE-3 (Figure 4-11a). Concentrations of Cr(VI) in this area range from values just above the MCL up to 4,000 µg/L. Though concentrations are high in shallow groundwater, concentrations are much lower in the deep groundwater with the maximum concentrations in deep groundwater from this area being up to 2 orders of magnitude lower (Figure 4-11b).

Concentrations of Cr(VI) in NHW are generally similar to the TJ and RT well fields, though concentrations generally increase progressing from west to east toward the source area in NHE. The maximum concentration observed in NHW is from the shallow well at NH-MW-06 with a concentration of 8.7 µg/L (Figure 4-18d). Additional elevated concentrations of Cr(VI are observed) northwest of the production wells with the maximum concentration observed in NH-MW-09 at a concentration of 7.7 µg/L (Figure 4-10a). NHW production wells have concentrations generally ranging between 2 and 5 µg/L.

Southern Areas

The highest concentrations of Cr(VI) are generally present in wells located from the start of the Los Angeles River Narrows down to the Pollock well field. Cr(VI) in production wells located in Whitnall, Verdugo, and Erwin have generally stable concentrations in the 1 to 4 µg/L range. There are two primary areas of impacts north of Pollock in the GOU area with concentrations in some wells being greater than 1,000 µg/L. The first area above the MCL occupies an approximate area of 0.34 square mile along a 1.2-mile-long stretch of Interstate-5 (Figure 4-11a). The bigger area of impacts is approximately 1.5 miles to the south and downgradient with that area of impacts occupying an area of 0.4 square mile with at least one well with recent concentrations above 10,000 µg/L (Figure 4-11a). The Pollock production wells are located approximately 1.3 miles from the leading edge of the Cr(VI) groundwater impacts. Concentrations of Cr(VI) in the Pollock production wells are currently below the MCL with stable concentrations between 2 and 4 µg/L.

4.5.2 Perchlorate

The extent of perchlorate includes pockets of impacts in both shallow and deep groundwater of the SFB, with the bulk of the perchlorate being located south of the NH area down toward the Pollock well field (Figure 4-12a). Though reported in less than 3 percent of the wells in the SFB, perchlorate has had a significant impact on several of the RT production wells, with concentrations currently above the MCL of 6 µg/L, and it has historically impacted wells in TJ and Pollock. A description of the perchlorate distribution in each of the wells fields is presented below.

Tujunga Area

Similar to some of the other chemicals discussed earlier, perchlorate is reported in both shallow and deep groundwater in the TJ well field, with the highest concentration being reported in the shallow zone immediately adjacent to the eastern section of the TJ well field (TJ-MW-06 at a concentration of 5.5 µg/L) (Figure 4-12a). Though reported to a maximum depth of 860 feet bgs, in well TJ-MW-06, concentrations are heterogeneous, being reported in some intervals within the monitoring wells but not others. This is noted by the top and bottom screen interval of TJ-MW-06 having reported concentrations, but it not being reported in the middle screen interval (Figure 4-19a).

Though a specific source has not been identified, it appears that perchlorate is present in a fairly small area to the northeast of the TJ well field (approximately 1 square mile in size) with another small area of impacts from sites approximately three miles to the north. The area of impacts adjacent to the well fields appears to be captured by the eastern production wells (TJ-10, TJ-11, and TJ-12) (Figure 4-19b).

Rinaldi-Toluca Area

The RT production and monitoring wells have elevated perchlorate in the northern section of the well field (Figure 4-12a). Unlike other areas of perchlorate contamination, the perchlorate is reported only in the deep monitoring wells at RT-MW-04, RT-MW-06, and RT-MW-10 below a depth of 630 feet bgs (Figure 4-12b and Figure 4-19d). The perchlorate impacts in this area occupy approximately 0.9 square mile areally, and based on the groundwater flow direction and configuration of the plume, the perchlorate appears to be emanating from a source to the east where it is captured by the RT production wells.

Based on concentrations in the RT production wells, this plume has impacted RT-02, RT-03, and RT-04 with concentrations in these production wells near or exceeding the MCL frequently since 2011. As stated in Section 4.4, perchlorate concentrations generally follow pumping cycles in the RT well field. With that said, concentrations have appeared higher in the production wells since 2011 (Appendix H), which may indicate that more of the plume is being captured as it has expanded from the source area.

North Hollywood Area

Perchlorate is generally not reported in shallow or deep groundwater in the NHW area, and concentrations are generally low and below the MCL in the NHE area (Figure 4-12a). In NHE, the maximum reported concentration from recent monitoring was from V13ALS14B, at a concentration of 4.9 µg/L. Perchlorate is generally confined to shallow groundwater in this area with only a few detections in deeper groundwater zones (Figure 4-12b). None of LADWP's monitoring wells or production wells have current concentrations of perchlorate.

Southern Area

There are two general areas of perchlorate impacts south of the NH well field. The first includes two low-concentration plumes (less than MCL) south and east of the NH well field in the BOU, each approximately 2 miles long. The second and larger area of impacts is located in the GOU and from the crystal springs area through the Los Angeles River Narrows, approximately 6 miles down to the Pollock well field (Figure 4-12a). In LADWP's southern production wells, only the Pollock wells have reported concentrations of perchlorate with maximum concentrations near 3 µg/L and most samples being below the laboratory reporting limit. Concentration in the Pollock wells appears to be stable, with the more frequent detections recently being associated with laboratories being able to achieve lower reporting limits for this chemical since 2010 (Appendix H).

4.5.3 Nitrate as NO_3

As discussed in the beginning of this section, nitrate in the SFB has been attributed to agricultural fertilizer uses, and there is likely some input from historical use of septic systems and other wastewater sources. Nitrate concentrations are ubiquitous in the SFB, being reported in most monitoring and production wells at varying concentrations. Though reported in most wells, there are only a few areas in the SFB where concentrations are above the MCL of 45 mg/L, and the elevated concentrations are almost entirely confined to shallow groundwater as would be anticipated with a shallow and laterally extensive release, such as agricultural use. For that reason, only plume maps for shallow zone wells are included in this report.

Tujunga Area

Concentrations of nitrate in the TJ well field above the MCL are located in a plume that extends generally from approximately 2 miles north and down to the well field and occupies an area of approximately 1.4 square miles (Figure 13a). The highest concentration from recent monitoring was observed in TJ-MW-06, immediately adjacent to the well field at a concentration of 77 mg/L. Nitrate concentrations in the TJ production wells have historically been in the range of 20 to 30 mg/L, with slightly higher concentrations in the center of the well field as compared to the eastern or western sides.

Rinaldi-Toluca Area

Though some nitrate concentrations above the MCL are observed south of the RT well field, the monitoring wells and RT production wells do not generally have high nitrate concentrations. The highest concentrations in the RT production wells occur toward the center of the well field, with RT-10 having the highest current concentrations ranging between 20 and 30 mg/L during recent monitoring events.

North Hollywood Area

Nitrate concentrations near the NH well fields range from values below the laboratory reporting limit to a maximum value of 85 mg/L during the last monitoring event. Values above the MCL are confined to the NHE well field, with concentrations becoming progressively higher from NHW to NHE (Figure 4-13a). As presented in Section 4.4, it appears that there is some response in nitrate concentration to pumping in the NHW wells (Appendix H). This may indicate some mobilization and capture of the nitrate plume from the east during higher pumping intervals.

Southern Area

Between the NH well fields and the Pollock well field there are three areas of elevated nitrate concentrations, with two of these areas having identifiable sources with concentrations above 100 mg/L (Figure 4-13a). The northernmost area is the largest, occupying an area of 2.3 square miles. The other two areas are smaller, at less than 1 square mile in size (Figure 4-12a).

4.6 Mass and Volume Estimates of High-Priority Chemicals of Concern

As part of the evaluation of the nature and extent of contamination in the SFB, the chemical mass and volume of the aquifer impacted by select high-priority COCs has been calculated. The mass calculation was performed using the automated mass calculation ability in the program Entervol™, which also was used in development of the 3D plume models. This program develops a 3D view of the dissolved-phase plume using the available depth specific data along with geostatistical methods (i.e., kriging) to develop the shape of the plume in the saturated zone.

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Figures of the 3D plumes for TCE, PCE, 1,1-DCE, 1,4-dioxane, Cr(VI,) and perchlorate are included as Figures 4-20 through 4-26 of this report.

Some of the COCs have a significant adsorbed-phase mass, so the volume and average concentration of the plume provided by Entervol were used along with aquifer-specific information from the GSIS well installation (Table 2-4) to calculate the adsorbed-phase mass. The equation is provided below:

*Adsorbed mass = (volume of aquifer * bulk density * groundwater concentration * partition coefficient [K_D])*

It should be noted that these estimate are based on the density of the data, so a number of the high priority chemicals do not have sufficient data or detections to produce reliable mass estimates including 1,1-DCE and perchlorate. With this in mind TCE, PCE, 1,4-dioxane, and Cr(VI) were selected to estimate mass in the saturated zone due to the high density of data and representativeness of the impacted volume of the aquifer. It should be noted that due to the presence of background Cr(VI) in the SFB, only the mass in areas where concentrations were above the MCL were calculated. Table 4-5 below includes mass estimates for TCE, PCE, 1,4-dioxane and Cr(VI) and the calculation worksheets are included in Appendix J.

Table 4-5. Volume and Mass Estimates for High-Priority COC in the SFB

COC	Dissolved-Phase Mass (kilograms)	Adsorbed-Phase Mass (kilograms)[a]	Total Mass (kilograms)	Total Volume of Water (AF)
TCE	138,670	39,047	177,717	3,570,000
PCE	134,070	59,047	193,117	3,118,000
1,4-Dioxane	4,369	53	4,422	2,252,000
Cr(VI)	41,170	--	41,170	745,300

[a] *Adsorbed phase mass was not calculated for Cr(VI) due to solubility and low adsorption.*