TRI-PARTY AGREEMENT

Change Notice Number	TPA CHANGE NOTICE FORM	Date:
TPA-CN- 0894		June 24, 2020

Document Number, Title, and Revision:	Date Document Last Issued:
DOE/RL-2013-48, *Operation and Maintenance Plan for the 100-KR-4 Pump and Treat Systems*, Rev. 1	July 18, 2018

Approved Change Notices Against this Document: NA

Originator: E.T. Glossbrenner	Phone: (509)376-5828

Description of Change:
This change notice amends DOE/RL-2013-48 to update wells associated with the 100-KR-4 P&T systems through the end of 2019 and reduces the in-process sampling frequency for the IX resin vessels.

M. W. Cline (**DOE**) and L. C. Buelow (**Lead Regulatory Agency**) agree that the proposed change modifies an approved workplan/document and will be processed in accordance with the Tri-Party Agreement Action Plan, Section 9.0, *Documentation and Records,* and not Chapter 12.0, *Changes to the Agreement*.

The following changes are made:

- Page 1-3 - Changed 2017 to 2019 and updated the list of annual P&T reports.
- Page 1-4 – Changed 2017 to 2019.
- Page 1-5 – Update Figure 1-2 to current conditions as of the end of 2019.
- Page 1-7 – Update Figure 1-4 to incorporate use of an infiltration gallery.
- Page 1-8 – Changed 2017 to 2019; Update Table 1-1 and Table 1-2 to reflect current conditions through the end of the 2019.
- Page 4-2 – Update Table 4-2 to reduce sampling frequency for IX vessels.
- Page 8-3 – Updated and added references listed on Page 1-3.

Additions are shown using <u>double underline</u>. Deletions are shown using ~~strikeout~~.

Note: Include affected page number(s): 1-3, 1-4, 1-5, 1-7, 1-8, 4-2, and 8-3

Justification and Impacts of Change:

Per DOE/RL-2013-48, Rev. 1, any additional extraction or injection wells added to the P&T system require a change notice or revision to the SAP, as described in Section 5.4 and Table 5-1. This change notice incorporates well realignments through the end of the calendar year 2019 as well as reduce the required in-process sampling frequency for the IX resin vessels based on current chromium concentrations observed at the 100-KR-4 OU P&T systems.

Approvals:

Michael W. Cline — Digitally signed by Michael W. Cline Date: 2020.06.24 13:35:42 -07'00'		[X] Approved [ ] Disapproved
DOE Project Manager	Date	
Buelow, Laura — Digitally signed by Buelow, Laura Date: 2020.06.29 14:06:21 -07'00'		[X] Approved [ ] Disapproved
EPA Project Manager	Date	
N/A		[ ] Approved [ ] Disapproved
Ecology Project Manager	Date	

- O&M methods and training
- Inspection requirements
- System monitoring
- Reporting
- Decontamination and decommissioning
- Health, safety, and QA

The O&M plan includes information for scheduling maintenance activities to minimize effects to system performance.

This O&M plan presents information based on the system design at the end of calendar year ~~2017~~2019. Information on previous system design, project history, and remedial performance is provided in the annual summary reports for P&T operations. The following reports summarize operations for the KW, KX, and KR4 P&T systems:

- DOE/RL-2011-25, *Calendar Year 2010 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump-and-Treat Operations and 100-NR-2 Groundwater Remediation*.
- DOE/RL-2012-02, *Calendar Year 2011 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump-and-Treat Operations, and 100-NR-2 Groundwater Remediation.*
- DOE/RL-2013-13, *Calendar Year 2012 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump-and-Treat Operations, and 100-NR-2 Groundwater Remediation.*
- DOE/RL-2014-25, *Calendar Year 2013 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump-and-Treat Operations, and 100-NR-2 Groundwater Remediation.*
- DOE/RL-2015-05, *Calendar Year 2014 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump and Treat Operations, and 100-NR-2 Groundwater Remediation*.
- DOE/RL-2016-19, *Calendar Year 2015 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump and Treat Operations, and 100-NR-2 Groundwater Remediation*.
- DOE/RL-2016-68, *Calendar Year 2016 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump and Treat Operations, and 100-NR-2 Groundwater Remediation*.
- DOE/RL-2017-67, Calendar Year 2017 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump and Treat Operations, and 100-NR-2 Groundwater Remediation ~~(pending)~~.
- DOE/RL-2018-67, *Calendar Year 2018 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump and Treat Operations, and 100-NR-2 Groundwater Remediation.*
- DOE/RL-2019-67, *Calendar Year 2019 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump and Treat Operations, and 100-NR-2 Groundwater Remediation* (pending).

This plan is updated or revised when relevant or substantive changes are made to the operating system or supporting primary documents that affect the project, as described in the 100-KR-4 RD/RAWP (DOE/RL-2013-33).

1.3 Remedy Description

Removal of Cr(VI) from contaminated groundwater using P&T technology was selected by the interim action ROD as the interim remedy for 100-KR-4 OU groundwater contaminated with Cr(VI). The remedy consists of extraction wells located within the plume, IX systems to remove Cr(VI), and injection wells to return treated water to the aquifer. As the lead agency, DOE implemented these interim remedies within the 100-KR-4 OU. The remedy includes ICs to prevent exposure of human receptors to contaminated groundwater. The following sections provide a brief description of the interim remedies.

1.3.1 Pump and Treat Systems

The three P&T systems operating in the 100-KR-4 OU are similar in their design, construction, and operation. The KR4 system was the first system installed and began operation in 1997. This system was designed to remediate groundwater around the 116-K-2 Trench. The KW system was the second system installed, and it began remediating Cr(VI) in the KW Reactor area in January 2007. The KX system is the third and newest system and began operation in February 2009. The KX system is used primarily to treat Cr(VI) in groundwater that has migrated from the 116-K-2 Trench area toward N Reactor. The KR4 system was originally designed to process up to 1,130 L/min (300 gpm), the KW system was originally designed to process up to 760 L/min (200 gpm), and the KX system was originally designed to process up to 2,300 L/min (600 gpm). At the end of calendar year 2015, modifications to the P&T systems provided facility operating capacities of 1,250 L/min (330 gpm) for the KR4 and KW P&T systems, and 3,400 L/min (900 gpm) for the KX P&T system.

Each P&T system includes an extraction well network, a treatment building, an injection well network, conveyance piping, and support equipment and components. The KR4 and KX systems also include transfer buildings. Water is pumped from the extraction wells to collection tanks in the transfer buildings, then to the treatment building, or directly to collection tanks in the treatment building, depending on system configuration. The extraction well system is operated and managed to remove Cr(VI) mass efficiently while protecting the Columbia River. Figure 1-2 shows the layout of the KR4, KW, and KX P&T systems and the extraction/injection well networks as of the end of ~~2017~~2019.

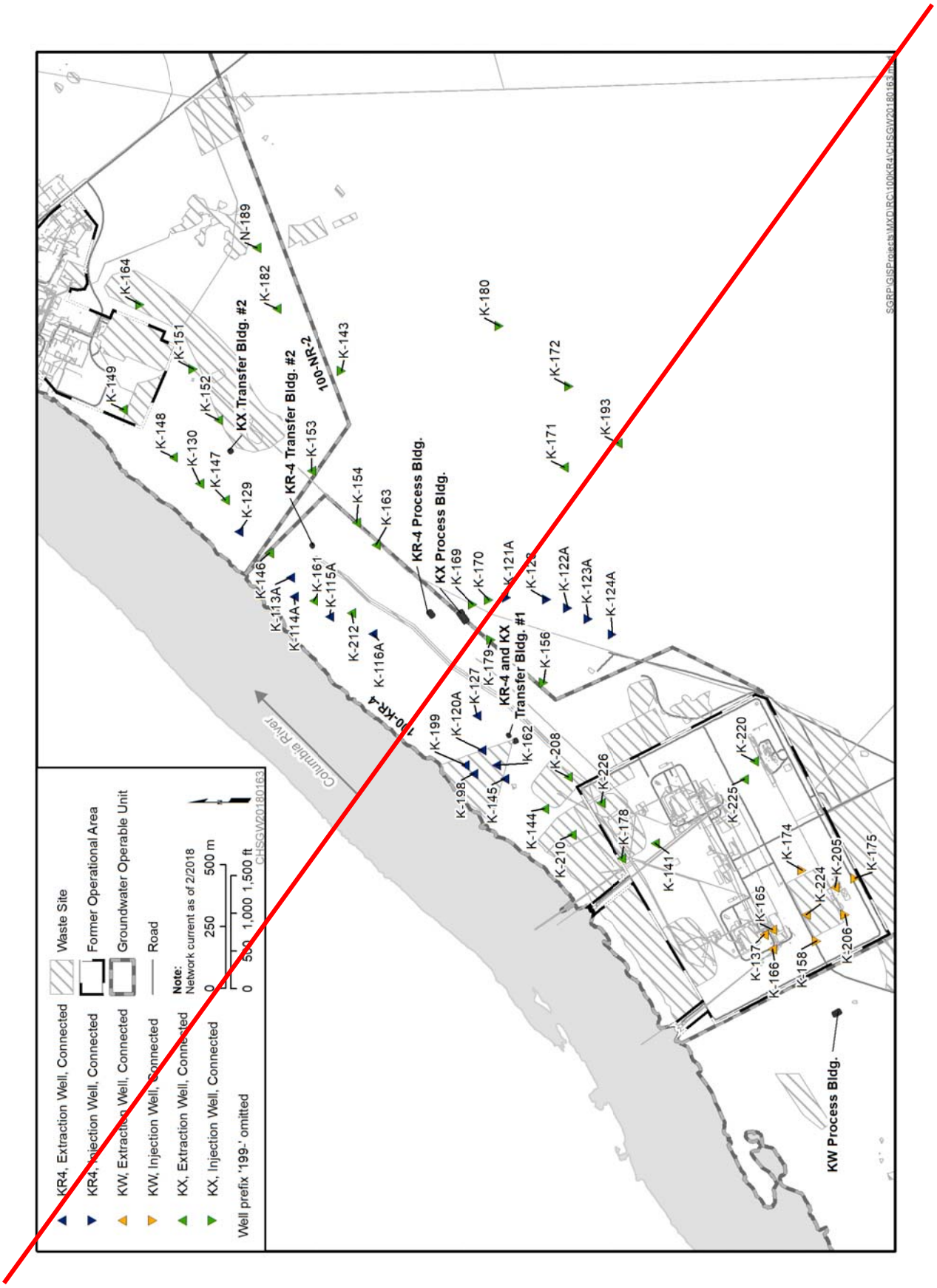
System modifications are implemented for the KR4, KW, and KX P&T systems based on changes in Cr(VI) concentrations in groundwater and changing contaminant plume configurations. Extraction and injection well configurations and facility equipment are modified when it is determined to be beneficial to the cleanup progress and completion of the remedial action. This may include rebound studies and treatability tests. Current system configurations can be found in the most recent version of the annual pump and treat report. However, the annual reports reflect the system configuration when they were issued and may not contain the most recent system configurations.

Figure 1-3 presents a simple line diagram of the KR4 and KX treatment systems, and Figure 1-4 presents a simple line diagram for the KW treatment system.

Cr(IV) is removed from the extracted groundwater using IX technology. A summary of resin evaluations and process alternatives analysis performed to support resin selection and facility design and a recommended strategy for resin management for 100 Area chromium P&T systems are provided in SGW-46621, *100 Area Groundwater Chromium Resin Management Strategy for Ion Exchange Systems*. A successful test was conducted for ResinTech® SIR-700 conversion of the KW P&T system (SGW-51721, *100-KW Pump and Treat ResinTech SIR-700 Test Results and Recommendations for Use Across 100-KR-4 Operable Unit*). The successful conversion led to selection and use of ResinTech SIR-700 in the KR4, KW, and KX P&T systems.

ResinTech SIR-700 is a weak base anion exchange resin with high selectivity and capacity for chromate and dichromate. Influent pH adjustment is accomplished by the addition of an acid. This adjustment typically takes place within the influent tank in the treatment building. Following influent pH adjustment, the influent is directed to one or more of the IX trains located within the treatment building. Currently, treated water is routed to effluent tanks and then to the injection wells in the KR4, KW, and KX P&T systems.

® ResinTech is a registered trademark of ResinTech Inc., West Berlin, New Jersey.


KR4, Extraction Well, Connected
KR4, Injection Well, Connected
KW, Extraction Well, Connected
KW, Injection Well, Connected
KX, Extraction Well, Connected
KX, Injection Well, Connected
Well prefix '199-' omitted
Waste Site
Former Operational Area
Groundwater Operable Unit
Road
Note:
Network current as of 2/2018
0 250 500 m
0 500 1,000 1,500 ft
CHSGW20180163
Columbia River
100-KR-4
100-NR-2
KR-4 Process Bldg.
KX Process Bldg.
KR-4 and KX Transfer Bldg. #1
KR-4 Transfer Bldg. #2
KX Transfer Bldg. #2
KW Process Bldg.
K-113A
K-114A
K-115A
K-116A
K-120A
K-121A
K-122A
K-123A
K-124A
K-127
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K-130
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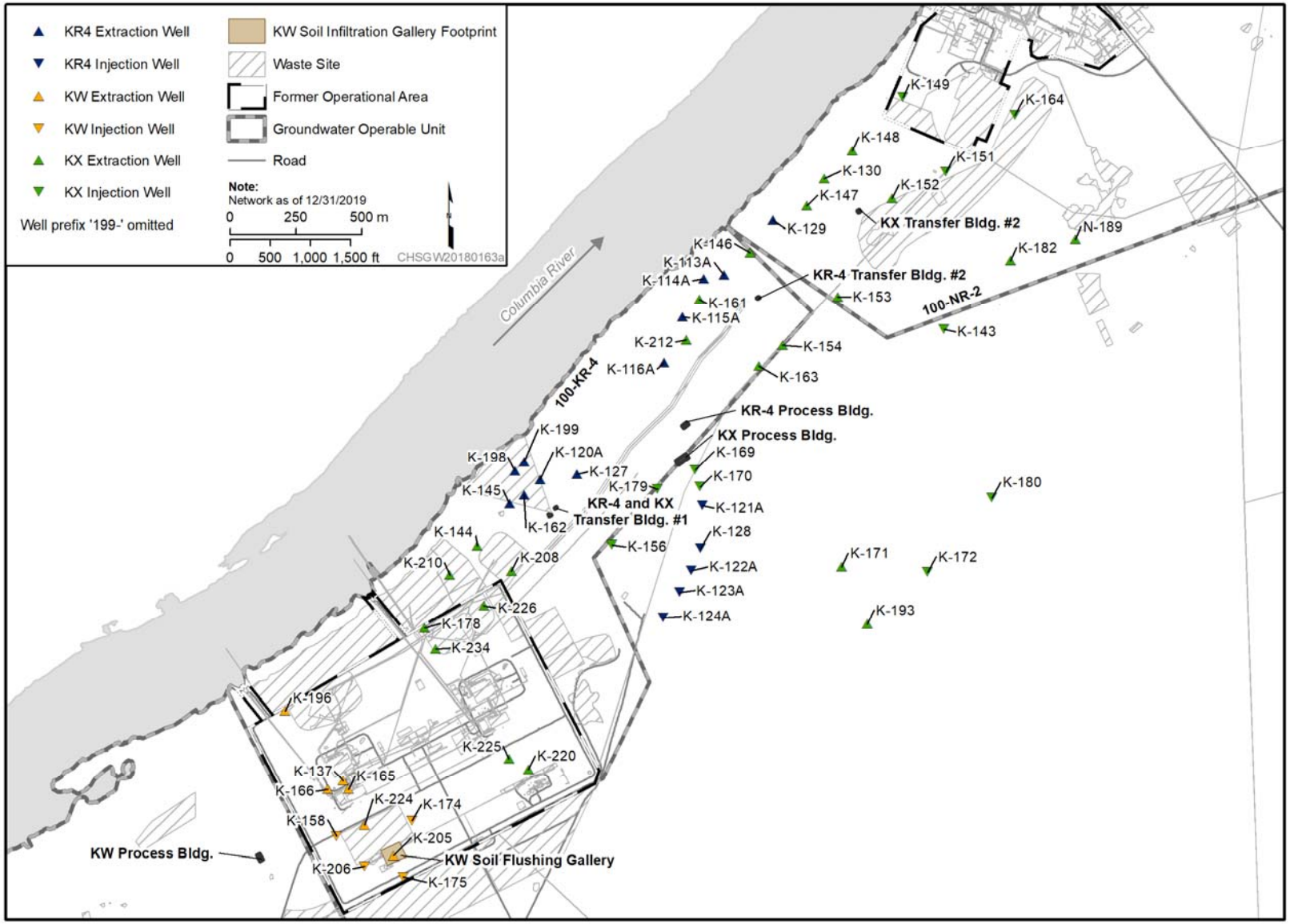
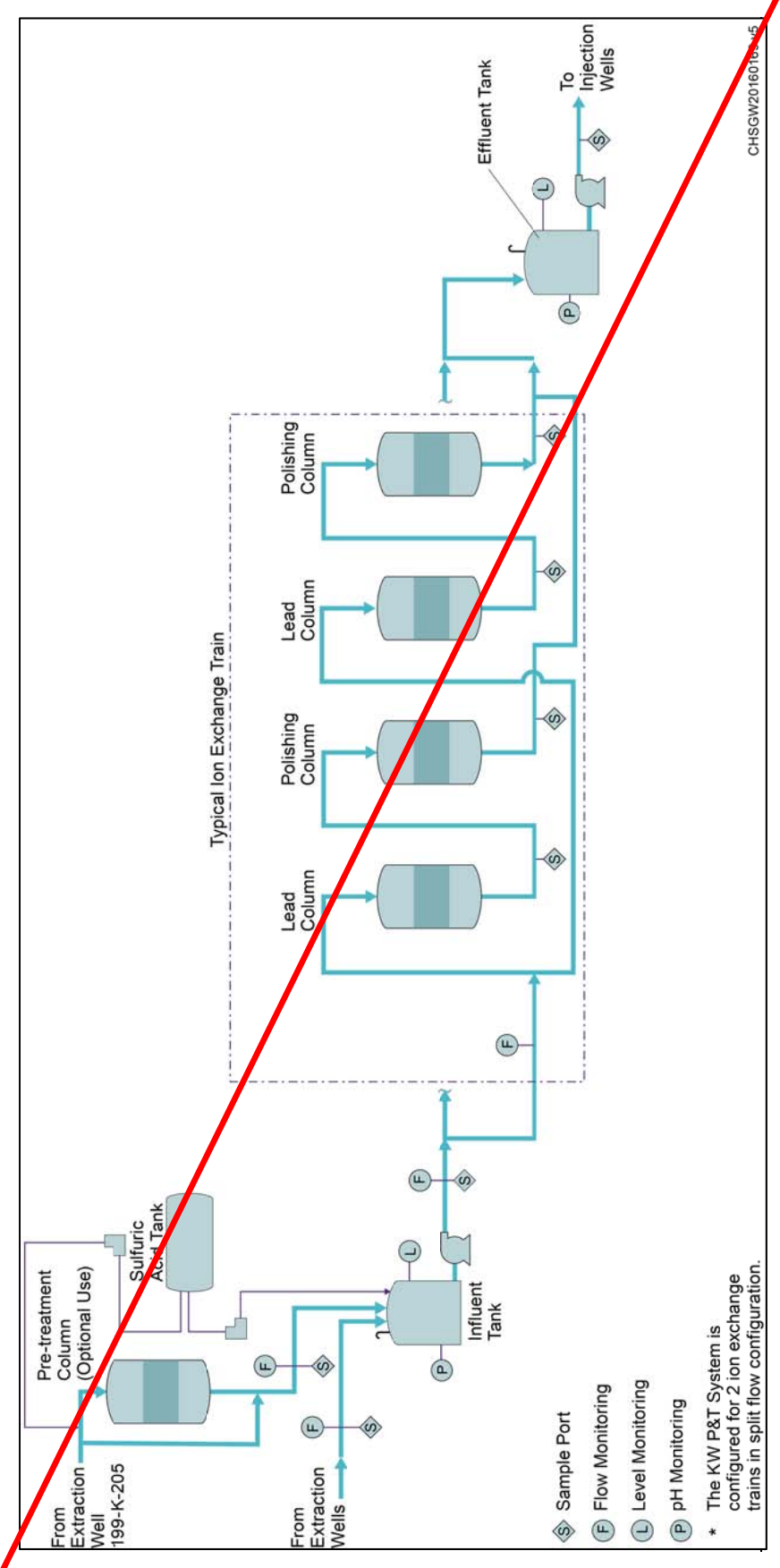
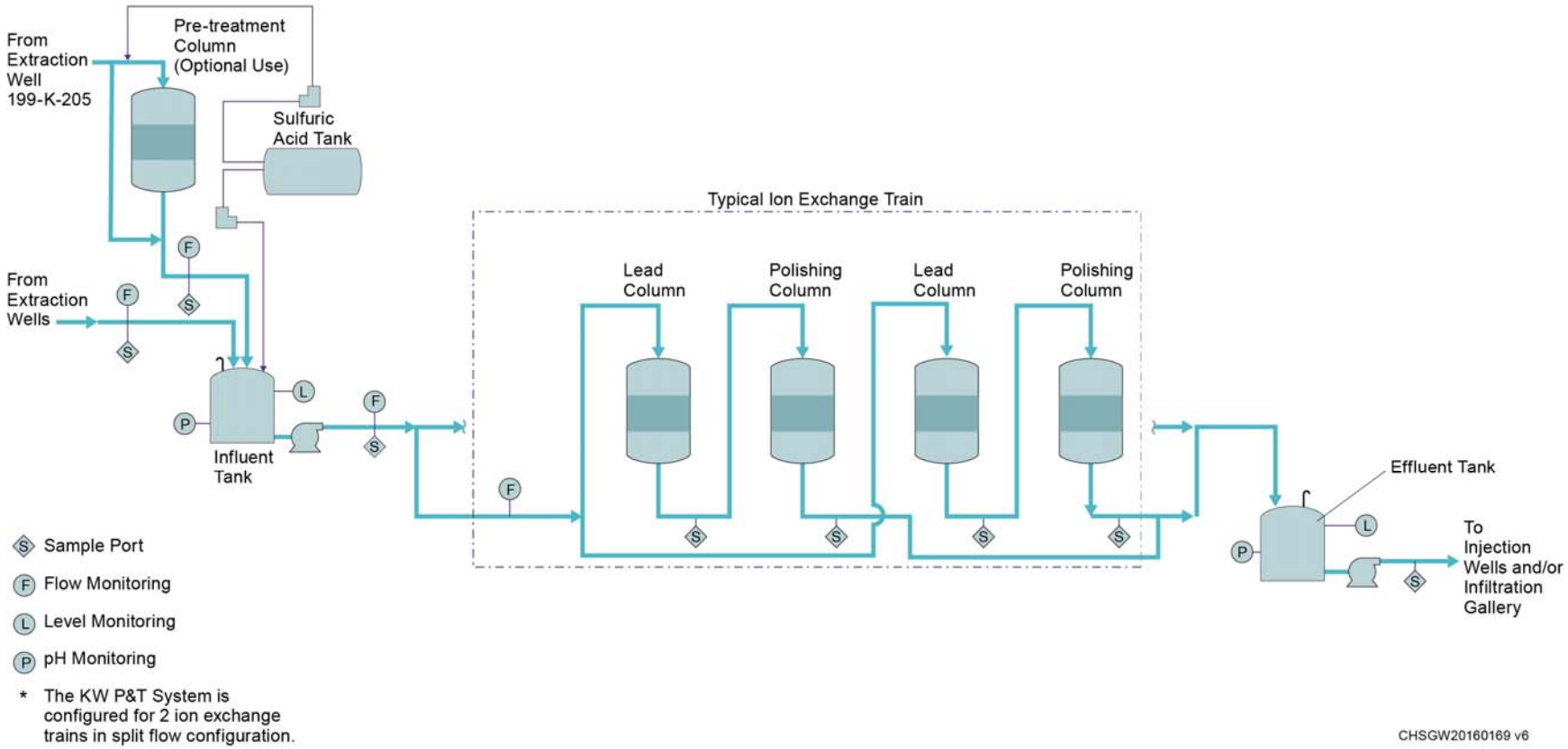


Figure 1-2. 100-KR-4 Operable Unit Pump and Treat System, ~~2017~~2019


From Extraction Well 199-K-205
Pre-treatment Column (Optional Use)
Sulfuric Acid Tank
From Extraction Wells
Influent Tank
Typical Ion Exchange Train
Lead Column
Polishing Column
Lead Column
Polishing Column
Effluent Tank
To Injection Wells
Sample Port
Flow Monitoring
Level Monitoring
pH Monitoring
* The KW P&T System is configured for 2 ion exchange trains in split flow configuration.
CHSGW20160105-5



Note: Components and locations may vary from those shown.

Figure 1-4. Simple Line Diagram of the KW Treatment System

Table 1-1 summarizes the treatment capabilities and performance of the three P&T systems through December 31, ~~2017~~2019. The extraction well system is operated and managed to remove Cr(VI) mass efficiently while protecting the Columbia River. The interim action ROD amendment requires Cr(VI) removal to the maximum extent practicable, and not to exceed 20 µg/L. The 100-KR-4 P&T systems include the extraction and injection wells shown in Table 1-2 as of the end of ~~2017~~2019.

Table 1-1. 100-KR-4 Pump and Treat Systems Performance Summary (as of 12/31/~~2017~~2019)

System	Current Capacity (gpm/L/min)	Volume Treated (million gal/million L)	Mass Removed Cr(VI) (lb/kg)
KR4	330/1,250	~~2,378/9,000~~2,644/10,010	~~836/379~~842/382
KW	330/1,250	~~1,120/4,239~~1,439/5,448	~~563/255~~624/283
KX	900/3,400	2,735/10,351~~3~~,715/14,064	~~594/269~~712/323

Table 1-2. 100-KR-4 Pump and Treat System Wells (~~2017~~2019)

KR4		KW	KX		
Extraction Wells					
199-K-113A	199-K-162	199-K-137	199-K-130	199-K-154	199-K-210
199-K-114A	199-K-198	199-K-165	~~199-K-141~~	199-K-161	199-K-212
199-K-115A	199-K-199	199-K-166	199-K-144	199-K-163	199-K-220
199-K-116A	--	199-K-196	199-K-146	199-K-171	199-K-225
199-K-120A	--	199-K-205	199-K-147	199-K-178	199-K-226
199-K-127	--	199-K-224	199-K-148	199-K-182	-199-K-234
199-K-129	--	--	199-K-152	199-K-193	199-N-189
199-K-145	--	--	199-K-153	199-K-208	--
Injection Wells					
199-K-121A	199-K-128	199-K-158	199-K-143	199-K-164	199-K-180
199-K-122A	--	199-K-174	199-K-149	199-K-170	--
199-K-123A	--	199-K-175	199-K-151	199-K-172	--
199-K-124A	--	199-K-206	199-K-156	199-K-179	--
		KW Infiltration Gallery			

The influent Cr(VI) concentrations at the KR4 P&T system were below interim action cleanup levels in ~~2017~~2019, and are expected to remain low. Currently, the primary function of the KR4 P&T system is for hydraulic control of contaminant plumes. Because influent Cr(VI) concentrations are below interim action cleanup levels and are expected to remain low, acid use at the KR4 P&T system may be discontinued except for periodic use to remove scale buildup and biofouling in the IX treatment trains. The system is monitored to determine the appropriate amount of acid needed in order to maintain plant operations. Of the three 100-KR-4 OU P&T systems, the KX P&T system is anticipated to remain operational for the longest period.

During P&T system operations, groundwater elevation data are collected from the system well network by water level transducers. Water level data are used to control the extraction rates and injection rates, and assess the need to rebalance flow rates to optimize capture zone boundaries. The water level data are also integrated with the sitewide water level data to construct groundwater elevation contour maps for evaluating groundwater flow directions, hydraulic gradients, and hydraulic capture and flow control.

Water levels are continuously monitored in extraction wells based on height above the pump. Injection wellhead levels are monitored continuously as depth below ground surface. These measurements are relayed to PLCs where the information is used to control pumps and valves in order to maintain efficient system operation. Control limits are set for the PLCs to prevent extraction well pumps from running dry and to prevent injection wells from flooding to the ground surface.

4.2 Treatment Process Water Monitoring

Treatment process water monitoring includes collecting process water samples from the extraction wells, influent tanks, IX resin vessels, and effluent tanks in order to monitor the contaminant concentrations through the treatment process and ensure the system is operating as expected. The data are also used to assess Cr(VI) removal efficiency and the need for IX resin change-out. The data collected from extraction wells and effluent tanks also provide information for performance monitoring and process optimization.

Figures 1-3 and 1-4 present schematics of the treatment system showing typical sampling locations for the influent tanks, IX resin vessels, and effluent tanks. Extraction well samples are collected from a port located “downstream” of the extraction line filter. Cr(VI) concentrations at injection wells are obtained from effluent tank samples.

Treatment process water samples are collected and analyzed by system operators in accordance with the operations method listed in Table 3-3. Table 4-2 summarizes the frequency for treatment process water Cr(VI) monitoring. In addition to the treatment process water monitoring, performance monitoring (as described in the 100-KR-4 SAP [DOE/RL-2013-29]) analyzes groundwater samples at the laboratory using EPA Method 7196 for Cr(VI).

Table 4-2. Treatment Process Water Monitoring for Cr(VI)

Parameter	Location	Data Use	Typical Frequency
Cr(VI)	Extraction wells	Monitor remedy performance and transient conditions	Monthly
	Influent/effluent tanks, ~~resin vessels~~	Monitor IX resin performance and mass removal; demonstrate achievement of discharge requirements	Weekly
	Resin vessels	Monitor IX resin performance and mass removal.	Monthly*

* - IX vessels may be sampled more frequently as directed by P&T operations.

Additional parameters may be measured as determined by the design authority and project scientist, to monitor operational performance and effects.

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SGW-46621, 2010, *100 Area Groundwater Chromium Resin Management Strategy for Ion Exchange Systems*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0081273H.