Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

15-AMRP-0285

AUG 07 2015

Ms. J. A. Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 100-D-100, STAINED SOIL NEAR THE 183-DR RAILROAD TRACK WASTE SITE, REVISION 0

Attached for your use are the approved Waste Site Reclassification Forms No. 2014-025, 2015-028, and 2015-029, and supporting, "Remaining Sites Verification Package for the 100-D-100, Stained Soil Near the 183-DR Railroad Track Waste Site," Rev. 0. If you have questions, please contact me or your staff may contact Tom Post of my staff, at (509) 376-3232.

Sincerely,

Mark S. French, Director
River Corridor Division

AMRP:TCP

Attachment

cc w/attachs:
N. M. Menard, Ecology
Administrative Record, H6-08

cc w/o attach:
R. D. Cantwell, WCH
A. L. Espinoza, MSA
S. L. Feaster, WCH
T. Q. Howell, WCH

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-2 **Control No.:** 2014-025
Waste Site Code(s)/Subsite Code(s): 100-D-100

Reclassification Category: Interim ☒ Final ☐
Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐
RCRA Post-closure ☐ Consolidated ☐ None ☐
Approvals Needed: DOE ☒ Ecology ☒ EPA ☐

Description of current waste site condition:

The 100-D-100, Stained Soil Near the 183-DR Railroad Track waste site was the location where stained surface soil was identified on April 6, 2008, near the former sodium dichromate/acid railcar and truck unloading station. At the time of the discovery, the area was roped off to control access and a soil fixative was applied to control dust. Five focused soil samples were collected to evaluate contaminants associated with the stained soil. Chromium and hexavalent chromium were present in all of the samples, with a maximum concentration of 1,310 mg/kg total chromium and 2,110 mg/kg hexavalent chromium. In April 2009, test pits and trenches were excavated and sampled at the 100-D-100 waste site to a depth of 4.6 m (15 ft) below ground surface (bgs) to evaluate the extent of hexavalent chromium contamination (WCH 2009). The results of this sampling indicated that remediation of subsurface soil at the 100-D-100 waste site was necessary.

The 100-D-100 waste site was identified for remediation in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2009), and added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999).

Remediation of the 100-D-100 waste site was initiated in August 2011 and continued through October 2011, to a depth of approximately 16 m (52.5 ft) bgs, with the bottom of the excavation at an elevation of 128 m (419.9 ft) above mean sea level (amsl). This excavation depth was identified as the 100-D-100 Tier II excavation. Hexavalent chromium contamination exceeding cleanup criteria was present at the base of the Tier II excavation and in portions of the sidewalls of the excavation. Therefore, a Tier III excavation continued to a depth of approximately 26 m (85.3 ft) bgs with the bottom of the excavation at an elevation of 118 m (387 ft) amsl, the estimated average elevation of groundwater. Due to the depth and size of this excavation, considerable layback and overburden soil was removed and stockpiled. Excavation of the 100-D-100 waste site was completed on January 30, 2014. Approximately 196,000 bank cubic meters (BCM) (256,360 bank cubic yards [BCY]) of contaminated soil was excavated and disposed of at the Environmental Restoration Disposal Facility (ERDF). Approximately 29,000 BCM (37,900 BCY) of this material was treated at ERDF as land disposal restricted for chromium. Approximately 330,000 BCM (431,600 BCY) of overburden/layback soil was identified for use a clean backfill material. No anomalies were identified during remediation.

After vadose zone remediation was completed in January 2014, elevated levels of hexavalent chromium remained in the soil at the interface of the vadose zone with the unconfined aquifer. Therefore, an investigation was initiated by the CH2M Hill Plateau Remediation Company to determine the distribution and potential persistence of hexavalent chromium within the aquifer and the aquifer sediment. Four temporary boreholes were drilled at the bottom of the 100-D-100 excavation beginning on April 24, 2014, and were completed on May 12, 2014, to assess the vertical and horizontal distribution of hexavalent chromium remaining in the aquifer. Based upon the results of this investigation, it was decided to remove approximately 3 m (10 ft) of aquifer sediment from below the seasonal low water table. This additional removal was performed from December 15, 2014, through February 4, 2015. Approximately 15,589 BCM (20,390 BCY) of aquifer sediment was removed, dewatered, and disposed to ERDF.

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-2 **Control No.:** 2014-025
Waste Site Code(s)/Subsite Code(s): 100-D-100

Verification soil samples were collected over multiple sampling events to support use of the overburden/layback soil as clean backfill for several previously remediated and closed waste sites. Verification samples were also collected from the excavation sidewalls, the footprints of waste staging pile areas, and an equipment decontamination area to support closeout of the 100-D-100 waste site.

Remediation, verification sampling, and comparison of verification sample results against cleanup levels have been performed in accordance with the remedial action objectives (RAOs) and remedial action goals (RAGs) established by the Remaining Sites ROD (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Areas* (100 Area RDR/RAWP), DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009b). The selected action involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification to Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-100 waste site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the Remaining sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-D-100, Stained Soil Near the 183-DR Railroad Track Waste Site* (attached). The site does not have residual contamination concentrations in the vadose zone that would require any institutional controls.

Regulator comments:

Waste Site Controls:

Engineered Controls: ☐ Yes ☒ No Institutional Controls: ☐ Yes ☒ No O&M Requirements: ☐ Yes ☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements, including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

J. P Neath	JP Neath	7/23/15
DOE Federal Project Director (printed)	Signature	Date
N. Menard	Nina M. Menard	8/3/15
Ecology Project Manager (printed)	Signature	Date
N/A		
EPA Project Manager (printed)	Signature	Date

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-2 **Control No.:** 2014-025
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The 100-D-100 waste site was identified for remediation in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2009), and added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999).

Remediation of the 100-D-100 waste site was initiated in August 2011 and continued through October 2011, to a depth of approximately 16 m (52.5 ft) bgs, with the bottom of the excavation at an elevation of 128 m (419.9 ft) above mean sea level (amsl). This excavation depth was identified as the 100-D-100 Tier II excavation. Hexavalent chromium contamination exceeding cleanup criteria was present at the base of the Tier II excavation and in portions of the sidewalls of the excavation. Therefore, a Tier III excavation continued to a depth of approximately 26 m (85.3 ft) bgs with the bottom of the excavation at an elevation of 118 m (387 ft) amsl, the estimated average elevation of groundwater. Due to the depth and size of this excavation, considerable layback and overburden soil was removed and stockpiled. Excavation of the 100-D-100 waste site was completed on January 30, 2014. Approximately 196,000 bank cubic meters (BCM) (256,360 bank cubic yards [BCY]) of contaminated soil was excavated and disposed of at the Environmental Restoration Disposal Facility (ERDF). Approximately 29,000 BCM (37,900 BCY) of this material was treated at ERDF as land disposal restricted for chromium. Approximately 330,000 BCM (431,600 BCY) of overburden/layback soil was identified for use a clean backfill material. No anomalies were identified during remediation.

After vadose zone remediation was completed in January 2014, elevated levels of hexavalent chromium remained in the soil at the interface of the vadose zone with the unconfined aquifer. Therefore, an investigation was initiated by the CH2M Hill Plateau Remediation Company to determine the distribution and potential persistence of hexavalent chromium within the aquifer and the aquifer sediment. Four temporary boreholes were drilled at the bottom of the 100-D-100 excavation beginning on April 24, 2014, and were completed on May 12, 2014, to assess the vertical and horizontal distribution of hexavalent chromium remaining in the aquifer. Based upon the results of this investigation, it was decided to remove approximately 3 m (10 ft) of aquifer sediment from below the seasonal low water table. This additional removal was performed from December 15, 2014, through February 4, 2015. Approximately 15,589 BCM (20,390 BCY) of aquifer sediment was removed, dewatered, and disposed to ERDF.

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-2 **Control No.:** 2014-025
Waste Site Code(s)/Subsite Code(s): 100-D-100

Verification soil samples were collected over multiple sampling events to support use of the overburden/layback soil as clean backfill for several previously remediated and closed waste sites. Verification samples were also collected from the excavation sidewalls, the footprints of waste staging pile areas, and an equipment decontamination area to support closeout of the 100-D-100 waste site.

Remediation, verification sampling, and comparison of verification sample results against cleanup levels have been performed in accordance with the remedial action objectives (RAOs) and remedial action goals (RAGs) established by the Remaining Sites ROD (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Areas* (100 Area RDR/RAWP), DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009b). The selected action involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification to Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-100 waste site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the Remaining sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-D-100, Stained Soil Near the 183-DR Railroad Track Waste Site* (attached). The site does not have residual contamination concentrations in the vadose zone that would require any institutional controls.

Regulator comments:

Waste Site Controls:

Engineered Controls:	☐ Yes ☒ No	Institutional Controls:	☐ Yes ☒ No	O&M Requirements:	☐ Yes ☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements, including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

J. P Neath		
DOE Federal Project Director (printed)	Signature	Date
N. Menard		
Ecology Project Manager (printed)	Signature	Date
N/A		
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-100, STAINED SOIL NEAR THE 183-DR RAILROAD TRACK WASTE SITE

Attachment to Waste Site Reclassification Form 2014-025

August 2015

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-100, STAINED SOIL NEAR THE 183-DR RAILROAD TRACK WASTE SITE

EXECUTIVE SUMMARY

The 100-D-100, Stained Soil Near the 183-DR Railroad Track waste site is within the 100-DR-2 Operable Unit and was identified as a candidate site in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision* (EPA 2009) and added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Unit* (Remaining Sites ROD) (EPA 1999).

Stained surface soil was identified on April 6, 2008, near the former sodium dichromate/acid railcar and truck unloading station. The area was roped off to control access and a soil fixative was applied to control dust. Five focused soil samples were collected to evaluate potential contaminants associated with the stains. Chromium and hexavalent chromium were present in all of the samples. The sample collected from the most visibly stained soil at Washington State Plane coordinates N 151365, E 573355 exhibited the highest concentrations of contamination, with chromium at 1,310 mg/kg and hexavalent chromium at 2,110 mg/kg.

In April 2009, test pits and trenches were excavated and sampled at the 100-D-100 waste site to a depth of 4.6 m (15 ft) to evaluate the extent of hexavalent chromium contamination (WCH 2009). The results of this sampling indicated that remediation of subsurface soil at the 100-D-100 waste site was necessary.

Remediation of the 100-D-100 waste site was initiated in August 2011 and continued through October 2011, to a depth of approximately 16 m (52.5 ft) below ground surface (bgs) with the bottom of the excavation at an elevation of 128 m (419.9 ft) above mean sea level (amsl). This excavation depth is identified as the 100-D-100 Tier II excavation. Hexavalent chromium contamination exceeding cleanup criteria was present at the base of the Tier II excavation and in portions of the sidewalls of the excavation. Therefore, a Tier III excavation continued to a depth of approximately 26 m (85.3 ft) bgs with the bottom of the excavation at an elevation of 118 m (387 ft) amsl, the estimated elevation of groundwater. Due to the depth and size of this excavation, considerable layback and overburden soil was removed and stockpiled. Remediation was completed on January 30, 2014. Approximately 196,000 bank cubic meters (BCM) (256,360 bank cubic yards [BCY]) of contaminated soil was excavated and disposed of at the Environmental Restoration Disposal Facility (ERDF). Approximately 29,000 BCM (37,900 BCY) of this material was treated at ERDF as land disposal restricted for chromium. Approximately 330,000 BCM (431,600 BCY) of overburden/layback soil was available for use as clean backfill material. No anomalies were identified during remediation.

After vadose zone remediation was completed in January 2014, elevated levels of hexavalent chromium remained in the soil at the interface of the vadose zone with the unconfined aquifer.

Therefore, an investigation was initiated by the CH2M Hill Plateau Remediation Company to determine the distribution and potential persistence of hexavalent chromium within the aquifer and the aquifer sediment. Four temporary boreholes were drilled at the bottom of the 100-D-100 excavation beginning on April 24, 2014, and were completed on May 12, 2014, to assess the vertical and horizontal distribution of hexavalent chromium remaining in the aquifer. Based upon the results of this investigation, it was decided to remove approximately 3 m (10 ft) of aquifer sediment from below the seasonal low water table. This additional removal was performed from December 15, 2014, through February 4, 2015. Approximately 15,589 BCM (20,390 BCY) of aquifer sediment was removed, dewatered, and disposed to ERDF.

Verification sampling to support closure of the 100-D-100 waste site was performed over multiple sampling events from October 2013, through March 2014. Verification samples were collected from the excavation sidewalls, the footprints of waste staging pile areas, and an equipment decontamination area. Verification samples were also collected to support use of the 100-D-100 overburden/layback soil as clean backfill for several previously remediated and closed waste sites.

The verification sampling results indicate that the 100-D-100 waste site remedial action achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs) established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999).

A summary of the cleanup evaluation for the results from the verification sampling against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 100-D-100 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedure* (DOE-RL 2011).

In accordance with this evaluation, the verification sampling results support a reclassification of this waste site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses, as bounded by the rural-residential scenario, and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that vadose zone residual contaminant concentrations are protective of groundwater and the Columbia River. The site does not have residual contaminant concentrations in the vadose zone that would require any institutional controls.

Table ES-1. Summary of Remedial Action Goals for the 100-D-100 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain a dose rate of <15 mrem/yr above background over 1,000 years.	Radionuclides were not identified as COPCs for the 100-D-100 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COC/COPC concentrations are below the direct-exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All individual hazard quotients are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient as evaluated using the highest calculated value for all decision units (1.2×10^{-1}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	All individual carcinogen risk values are $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk for the 100-D-100 waste sites as evaluated using the highest calculated value for all decision units (1.4×10^{-6}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides are not COCs/COPCs for the 100-D-100 waste sites.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L [c].		

Table ES-1. Summary of Remedial Action Goals for the 100-D-100 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	All COPCs were quantified below groundwater and/or river protection soil RAGs with the exception of the following: • Selenium that was detected at 1.2 mg/kg in one sample for the overburden/ layback decision unit for lift 3 that was placed in the southern portion of the 100-D-50:6 waste site excavation. The field duplicate sample at this same location did not detect selenium. Additionally, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), selenium having a partitioning coefficient (K_d) of 5 mL/g is not expected to migrate more than 15 m (49.2 ft) vertically in 1,000 years. The vadose zone below this selenium detection is approximately 15.5 m (50.9 ft) thick. Therefore, this residual concentration of selenium is predicted to be protective of groundwater and the Columbia River. • Mercury, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene that were detected in one SPA that was used to stage waste for multiple waste sites [d]. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), residual concentrations of these constituents are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years based on the K_d of mercury (30 mL/g), the contaminant having the lowest K_d. The vadose zone below this SPA is approximately 26 m (85.3 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration to activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).
[d] Mercury, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene are not COPCs for the 100-D-100 waste site. These COPCs were associated with waste staged from the 100-D-72, 100-D-31:11, 100-D-31:12, 100-D-81, and 100-D-50:7 waste sites,

COC = contaminant of concern
COPC = contaminant of potential concern
MCL = maximum contaminant level
NA = not applicable
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
SPA = staging pile area

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-100 waste site contaminants of concern and other constituents in Appendix A. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, manganese, selenium, vanadium, zinc, and high molecular weight polycyclic aromatic hydrocarbons. Ecological screening levels from *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were exceeded for boron, mercury, molybdenum, selenium, and vanadium. Because concentrations of antimony, manganese, vanadium, and zinc are below Hanford Site (DOE-RL 2001) or Washington State (Ecology 1994) background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for this site. A table showing contaminant concentrations from the 100-D-100 waste site that exceed ecological screening levels is provided in Appendix A.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-100, STAINED SOIL NEAR THE 183-DR RAILROAD TRACK WASTE SITE

STATEMENT OF PROTECTIVENESS

The 100-D-100, Stained Soil Near the 183-DR Railroad Track waste site verification sampling data, site evaluations, and supporting documentation demonstrate that this site meets the objectives to support a reclassification of this site to Interim Closed Out as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The results show that residual soil concentrations support land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]) and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Contamination from the 100-D-100 waste site that extended into the deep zone (greater than 4.6 m [15 ft] below ground surface [bgs]) has been removed through removal of the vadose zone. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-100 waste site contaminants of concern (COC) and other constituents in Appendix A. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, manganese, selenium, vanadium, zinc, and high molecular weight polycyclic aromatic hydrocarbons. Ecological screening levels from *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were exceeded for boron, mercury, molybdenum, selenium, and vanadium. Because concentrations of antimony, manganese, vanadium, and zinc are below Hanford Site (DOE-RL 2001) or Washington State (Ecology 1994) background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for this site. A table showing contaminant concentrations from the 100-D-100 waste site that exceed ecological screening levels is provided in Appendix A.

SITE LOCATION

The 100-D-100 waste site is located in the 100-DR-2 Operable Unit of the Hanford Site, north of the demolished 183-DR Headhouse and approximately 38 m (125 ft) south of the former sodium dichromate and acid railcar and truck unloading station (100-D-12) (Figure 1).

HISTORICAL INFORMATION

Stained surface soil was identified on April 6, 2008, near the southern portion of the 100-D-56 pipeline remediation. The area was roped off to control access, and a soil fixative was applied to control dust (Figure 2). Five bias (focused) samples (J16M48, J16M49, J16M50, J16M51, and J16M52) were collected to evaluate potential contaminants associated with the stains. Chromium and hexavalent chromium were present in all of the samples. The sample (J16M52) collected from the most visibly stained soil at Washington State Plane coordinates N 151365, E 573355 exhibited the highest concentrations of contamination, with chromium at 1,310 mg/kg and hexavalent chromium at 2,110 mg/kg. The soil samples results are provided in Appendix B. Figure 2 provides a photograph of the site at the time of discovery.

Historical research indicates that several buildings and waste sites were associated with sodium dichromate use. Originally, from about 1944 until 1950, the receiving, mixing, and transfer of sodium dichromate and other water treatment chemicals occurred in the 108-D Building. The chemicals were unloaded from railcars in either bags or barrels. Sodium dichromate was received in crystalline form, dissolved in water, and diluted to a 10% to 15% dichromate solution then transferred to feed tanks in the 105-D and 185-D Buildings (Sharpe 2006).

Sufficient sodium dichromate was added to reactor cooling water so that the instantaneous concentration was 2.0 parts per million, as required by the reactor cooling water specifications (GE 1953). When the transfer of the sodium dichromate system from the 108-D Building to the 185-D Building was completed, the use of dry material handling was replaced with use of concentrated liquid sodium dichromate that was delivered by railcar and truck to an unloading facility/pumping station (100-D-12). The sodium dichromate pumping station was located south of the 183-D Building, next to the railroad tracks. A 7.6-cm (3-in.)-diameter underground pipeline (100-D-56) provided the means to pump stock solution to storage tanks in the 185-D Building (Lerch 1998). The 100-D-12 site was remediated in April 2000 and interim closed out through a cleanup verification package (BHI 2000). Figures 3 and 4 provide historical photographs of the railroad unloading area adjacent to the 100-D-100 waste site and show the approximate location of the 100-D-100 waste site.

The historical use of sodium dichromate in 100 Area reactor operations has resulted in elevated hexavalent chromium contamination in groundwater at the 100-D Area. Extensive soil and groundwater investigations of the chromium contamination have been performed to define the nature and extent of the contamination and to locate sources contributing to groundwater contamination. These investigations are summarized in *Results of Hexavalent Chromium Sampling Near 100-D Area Sodium Dichromate Transfer Station Railroad Tracks* (BHI 2004).

Figure 1. The 100-D-100 Waste Site Location Map.

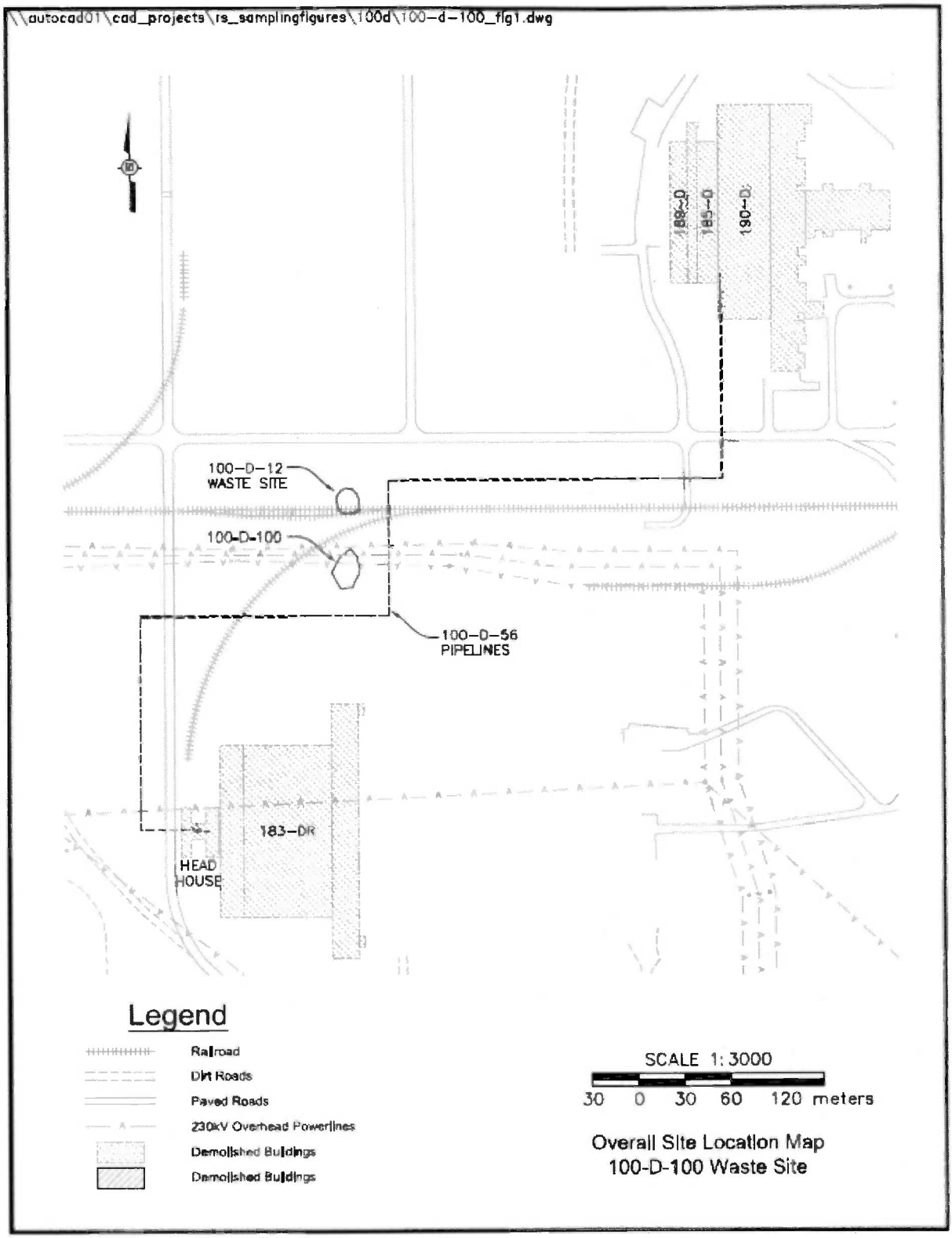


Figure 2. Surface Stained Soil Area, Looking Southwest (April 6, 2008).

Figure 3. The 100-D-100 Waste Site, Looking North (March 8, 1956).

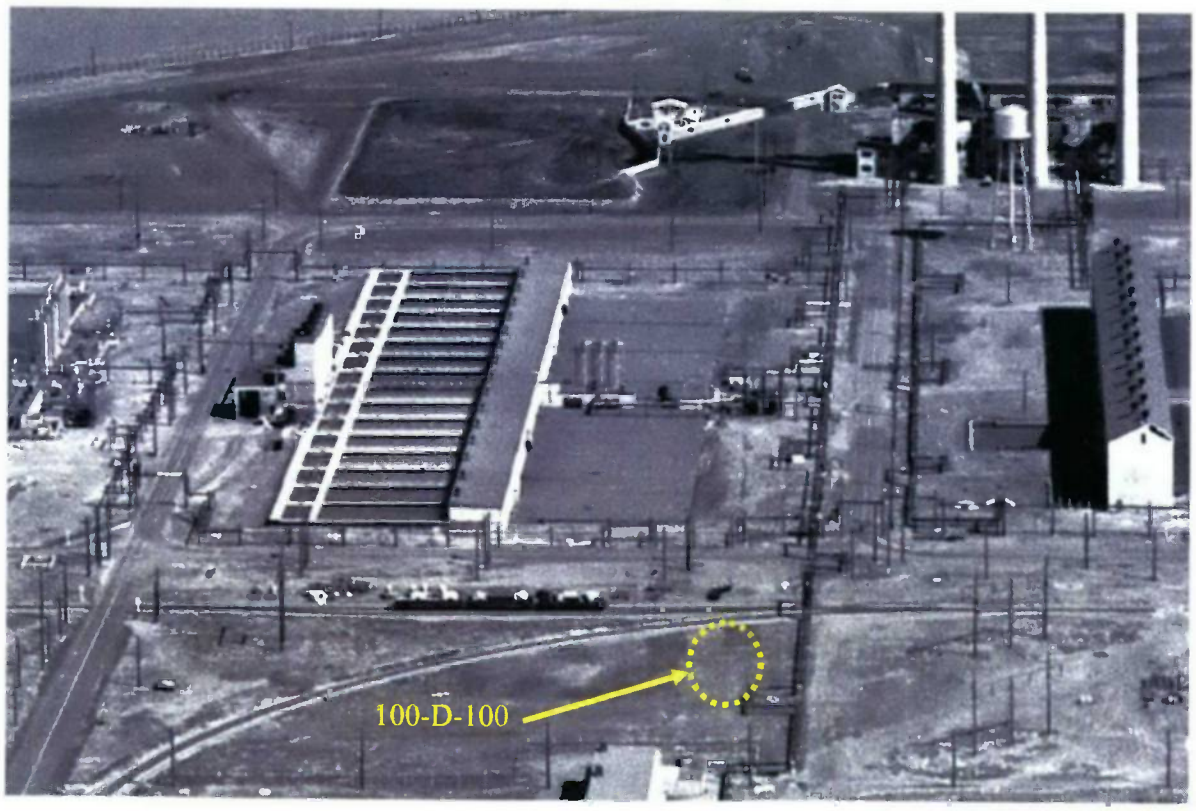
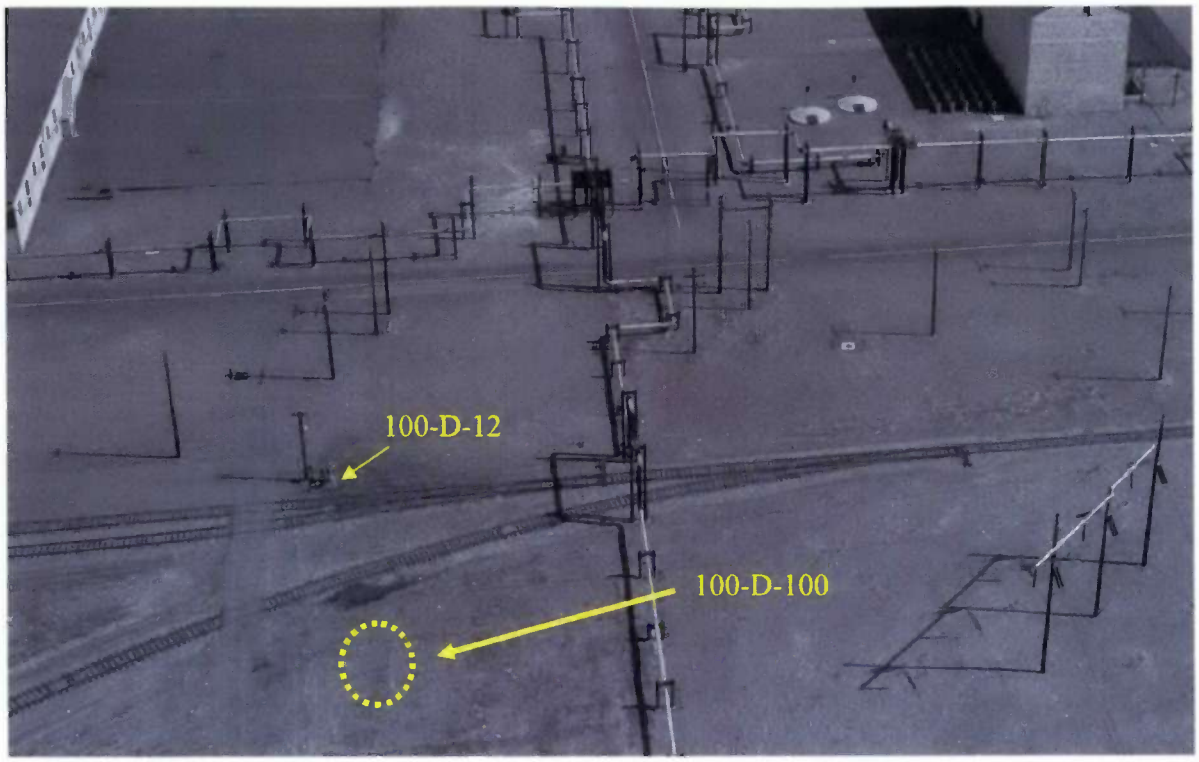


Figure 4. The 100-D-100 Waste Site, Looking North (June 11, 1964).



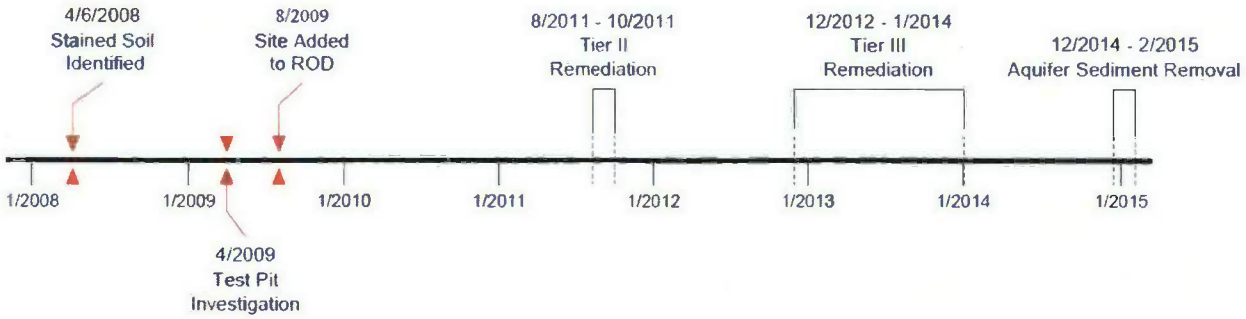
In April 2009, a test pit and trench were excavated and sampled at the 100-D-100 waste site to a depth of 4.6 m (15 ft) to evaluate the extent of hexavalent chromium contamination (WCH 2009). The results of this sampling indicated that remediation of subsurface soil at the 100-D-100 waste site was necessary. The results of this sampling are available in the River Corridor Closure Contractor's Stewardship Information System and are summarized in Appendix B.

REMEDIAL ACTION SUMMARY

Remediation of the 100-D-100 waste site was initiated in August 2011 and continued through October 2011, to a depth of approximately 16 m (52.5 ft) bgs, with the bottom of the excavation at an elevation of 128 m (419.9 ft) above mean sea level (amsl). This excavation depth was identified as the 100-D-100 Tier II excavation (Figure 5). Hexavalent chromium contamination exceeding cleanup criteria was present at the base of the Tier II excavation and in portions of the sidewalls of the excavation. Therefore, a Tier III excavation was continued to a depth of approximately 26 m (85.3 ft) bgs with the bottom of the excavation at an elevation of 118 m (387 ft) amsl, the estimated elevation of groundwater. Figure 6 presents a timeline for the 100-D-100 waste site remedial activities.

Figure 5. The 100-D-100 Tier II Excavation, Looking Northeast (November 12, 2012).

Figure 6. Timeline of Remedial Activities for the 100-D-100 Waste Site.



Due to the depth and size of this excavation, considerable layback and overburden soil was removed. With the Washington State Department of Ecology (Ecology) approval of verification sampling designs and verification sampling results, the majority of this overburden/layback soil was placed as clean backfill into previously remediated and closed waste sites to avoid double

handling of the soil. Some overburden/ layback soil was also placed in soil stockpiles for later use as clean backfill. Contaminated material removed during remediation was placed in Ecology-approved waste staging pile areas (SPAs) prior to shipment to the Environmental Restoration Disposal Facility (ERDF). This remaining sites verification package presents the results of all verification sampling that has been performed for the 100-D-100 waste site remediation, including verification sampling of the excavation, the overburden/layback soil, an equipment decontamination area, and the closeout of waste SPAs. Figure 7 shows the location of the 100-D-100 waste site verification sampling decision units.

During the removal of 100-D-100 layback/overburden material, two french drains were encountered and removed for disposal to the ERDF. A sample of the material associated with each of these drains was collected. A sample (J1R8W8) from the french drain (Figure 8) located in the northeast portion of the site at Hanford Site coordinates N 151405, E 573381 had 36.9 mg/kg total chromium and 0.230 mg/kg hexavalent chromium. A sample (J1R6J2) from the french drain (Figure 9) located in the southeast portion of the site at Hanford Site coordinates N 151321, E 573382 had 18 mg/kg total chromium and 0.267 hexavalent chromium.

As remediation progressed, in-process samples were collected to guide the excavation and support waste management decisions. The excavation was performed in 1.5-m (5-ft) lifts, with the collection of soil samples at the top of each lift prior to excavation. The composite soil samples were collected on a grid and used to make decisions for each lift. The results of this sampling are provided in Appendix C.

In June 2013, after removal of overburden and layback soil to an estimated depth of 15.2 m (50 ft), field observations and in-process sample results indicated a design change for the Tier III excavation was needed. This resulted in the expansion of the excavation to the north and south. Remediation of the site continued until groundwater was encountered at an elevation of 118 m (387 ft) amsl (a depth of 26 m [85.3 ft] bgs).

In January 2014, discolored soil was noted in the lower northeast sidewall of the 100-D-100 excavation. This location coincides with the location of some leaking sodium dichromate valves that were associated with the sodium dichromate pipelines and were removed during remediation of the 100-D-56:2 sodium dichromate pipeline waste site. Additional information concerning these valves and the remediation of the 100-D-56:2 pipelines are provided in the *Remaining Sites Verification Package for 100-D-56:2, South Portion of the 100-D-56 Sodium Dichromate Underground Supply Lines Waste Site* (WCH 2011). Figure 10 is an aerial photograph that shows the locations of historical sources of sodium dichromate contamination in relationship to the 100-D-100 excavation. As shown in this figure, there are four main sources of chromium contamination to the soil associated with the 100-D-100 waste site: (1) the 100-D-12 sodium dichromate transfer station, (2) the 100-D-56:2 sodium dichromate pipelines, (3) the 100-D-56:2 sodium dichromate pipeline valves, and (4) the historical release to the surface soil that was first identified as the 100-D-100 waste site and is likely due to spills to the ground during railcar unloading events.

Figure 7. Map of Decision Units for the 100-D-100 Waste Site.

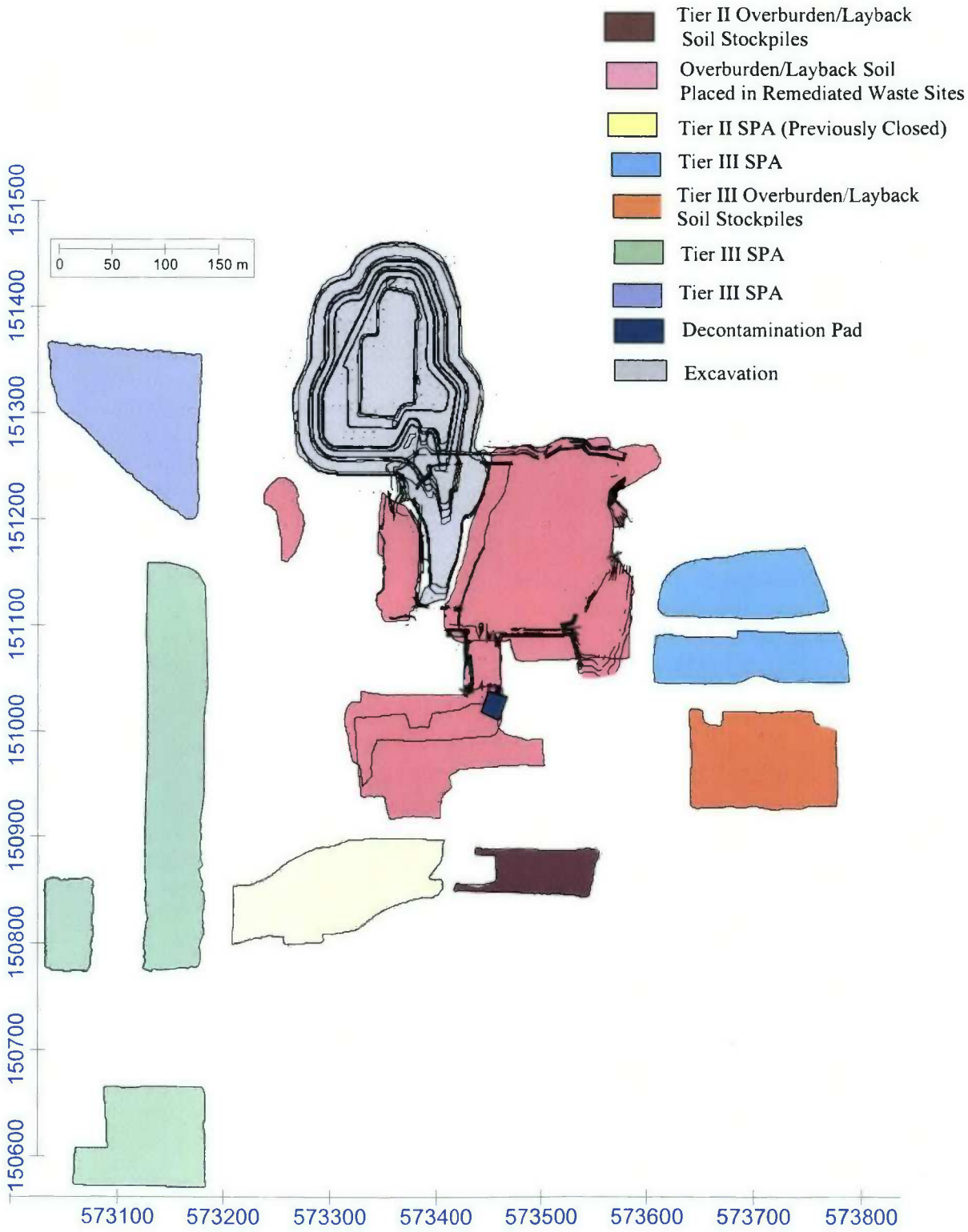
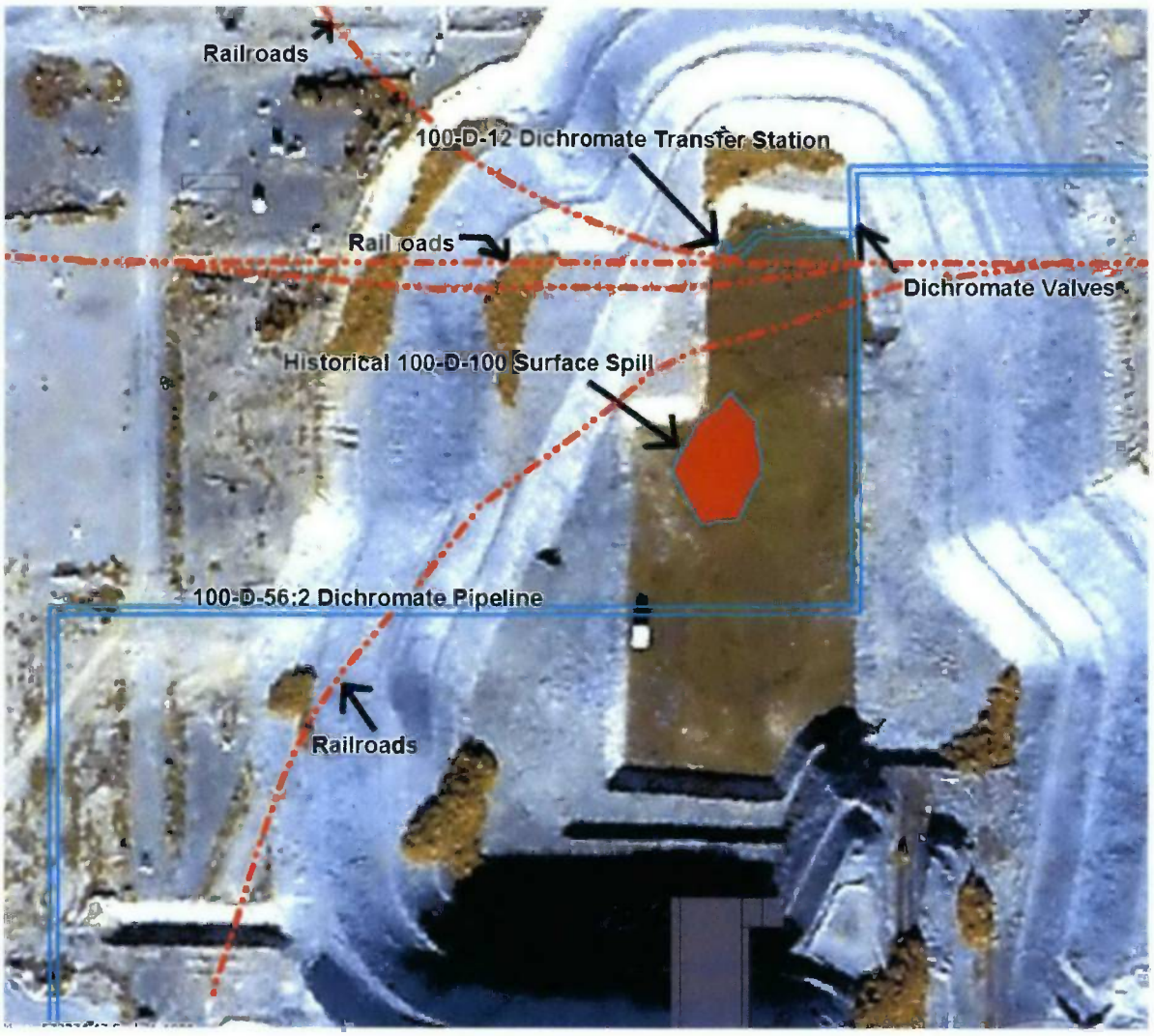


Figure 8. French Drain Removed from Northeast Excavation Area (January 9, 2013).

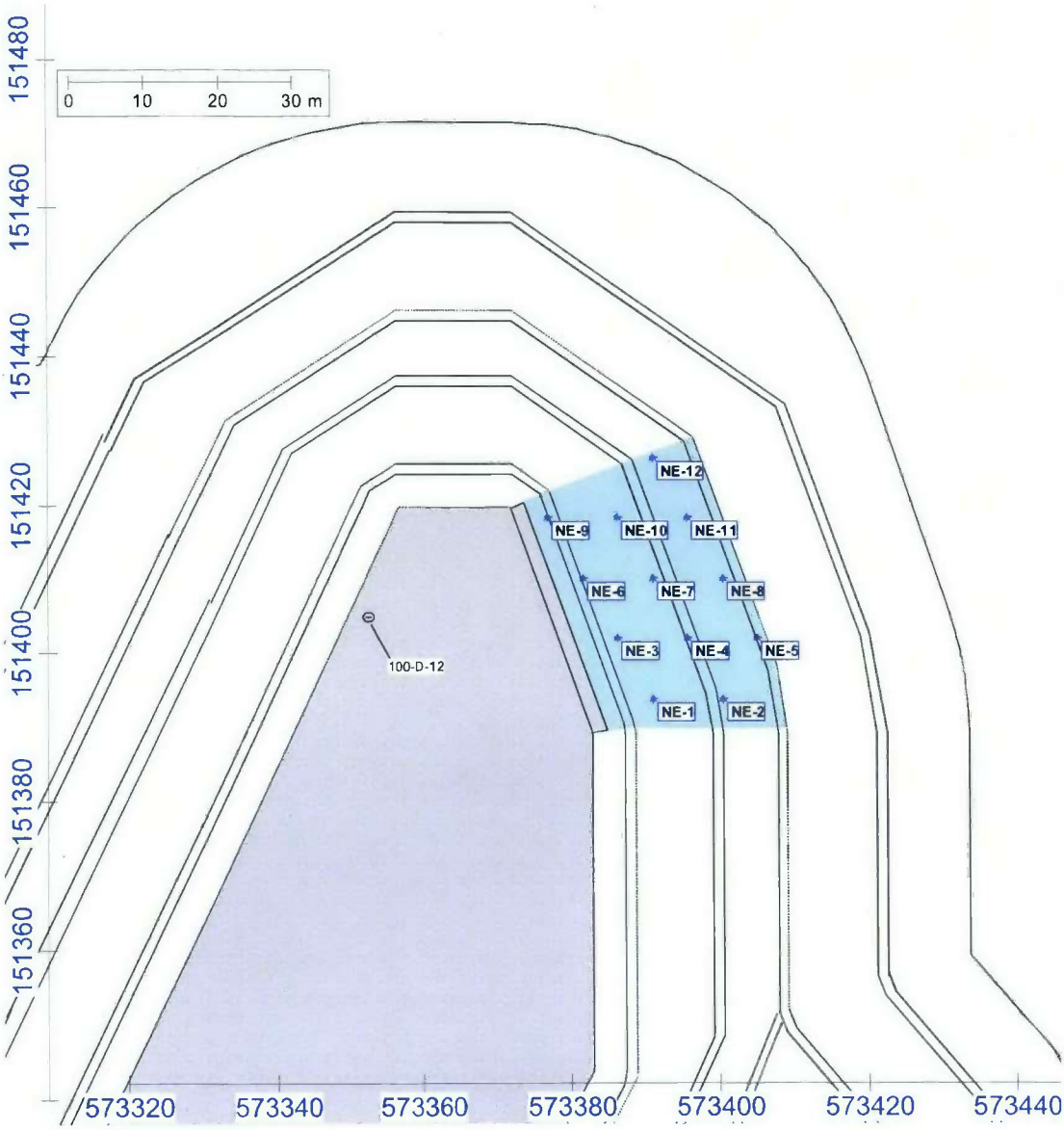
Figure 9. French Drain Removed from Southeast Excavation Area (December 26, 2012).

Figure 10. Location of Historical Sodium Dichromate Sources and Releases (January 2014).



To evaluate the northeast sidewall where the pipeline valves leaked, thirteen in-process samples were collected at depths of 19.2 to 22.9 m (63 to 75 ft) bgs to evaluate residual hexavalent chromium contamination (WCH 2014b). Nine of these samples exceeded soil cleanup criteria; the maximum result for hexavalent chromium in these samples was 11 mg/kg. Considering this information, a decision was made to remove additional soil from the lower sidewall at the northeast corner of the excavation. After this additional removal was complete, 12 in-process statistical samples were collected from within this area (Figure 11). The results indicated that adequate soil removal was performed. It was agreed on March 6, 2014, that this area would be included with the final verification sampling decision units for the excavation (WCH 2014a).

Figure 11. In-Process Sample Locations for Evaluation of the Northeast Corner of the 100-D-100 Excavation.



Vadose zone remediation of the 100-D-100 waste site was completed on January 30, 2014. Approximately 196,000 bank cubic meters (BCM) (256,360 bank cubic yards [BCY]) of contaminated soil was excavated and disposed of at the ERDF. Approximately 29,000 BCM (37,900 BCY) of this material was treated at ERDF as land disposal restricted for chromium. Approximately 330,000 BCM (431,600 BCY) of overburden/layback soil was available for use as clean backfill material. No anomalies were identified during remediation. Aerial photographs (Figures 12 and 13) taken April 10, 2014, show the extent of remediation performed at the waste site.

Figure 12. Aerial Photograph of the Excavated 100-D-100 Waste Site (April 10, 2014).

Figure 13. 100-D-100 Excavation at Completion of Vadose Zone Remediation (April 10, 2014).

After vadose zone remediation was completed in January 2014, elevated levels of hexavalent chromium remained at the interface of the vadose zone with the unconfined aquifer. Therefore, an investigation was initiated by the CH2M Hill Plateau Remediation Company to determine the distribution and potential persistence of hexavalent chromium within the aquifer and the aquifer sediment. Four temporary boreholes were drilled at the bottom of the 100-D-100 excavation beginning on April 24, 2014, and were completed May 12, 2014, to assess the vertical and horizontal distribution of hexavalent chromium remaining in the aquifer and the aquifer sediment. To support location of a drill rig at the base of the excavation, a drilling pad with access to the drill locations was constructed at the base of the excavation. Figure 14 provides an aerial photograph showing the drill site access and the drill rig and support equipment located within the excavation.

Figure 14. Removal of Aquifer Sediment at the 100-D-100 Waste Site (December 17, 2014).

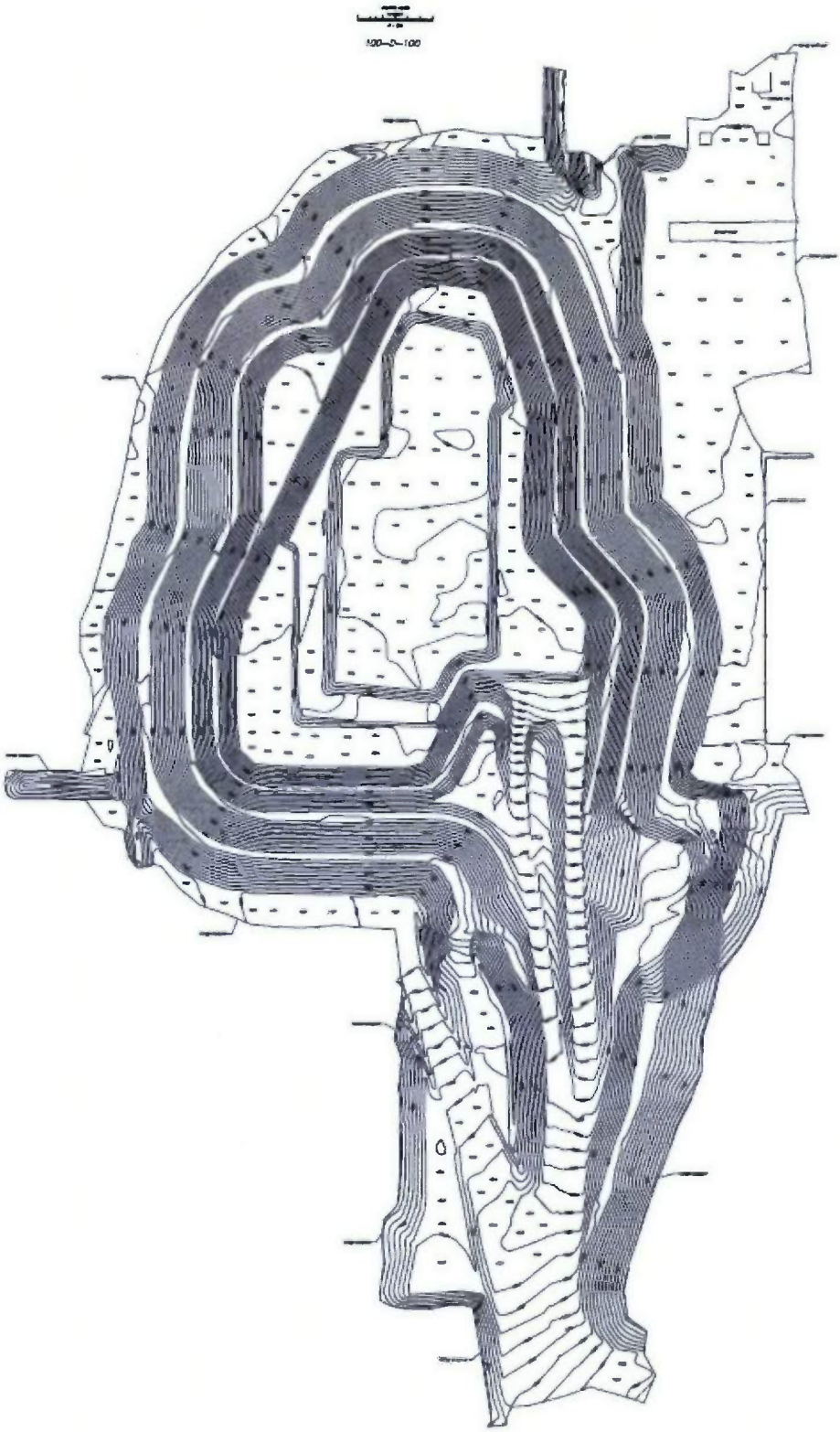
Based upon the results of this investigation, as reported in SGW-58416, *Persistent Source Investigation at 100-D Area* (CHPRC 2015), it was decided to remove approximately 3 m (10 ft) of aquifer sediment from below the elevation of the seasonal low water table (Figures 15 and 16). This additional removal was performed from December 15, 2014, through February 4, 2015, and extended to a depth of approximately 115 m (377.3 ft) amsl. Approximately 15,589 BCM (20,390 BCY) of aquifer sediment was removed, dewatered, and disposed to ERDF.

The post-excavation civil survey of the remediated the 100-D-100 waste site, prior to removal of the aquifer sediment, is provided in Figure 17. The gridded in-process soil sample results for hexavalent chromium that were collected during this excavation were entered in spatial modeling software and are presented in Appendix C. Images of the hexavalent chromium plume were developed from this data and are shown in Appendix C. Discussion concerning the geology encountered during the excavation at these waste sites is provided in Appendix D. As can be seen in the plume images (Appendix C), the geology (Appendix D) controlled the migration of the chromium contamination from the sources through the vadose zone. The chromium contamination was released from the spill site and traveled vertically through an upper gravel unit until encountering a more porous black sand unit that allowed the contamination to disperse laterally and vertically to the south along southern dipping beds within this blank sand unit and a lower gravel unit. As the contamination transitioned vertically from the lower gravel unit of the Hanford formation to the underlying finer grained, indurated sediment of the Ringold Formation, additional lateral spreading of contamination at this interface and within the Ringold Formation occurred.

Figure 15. Removal of Aquifer Sediment at the 100-D-100 Waste Site (December 17, 2014).

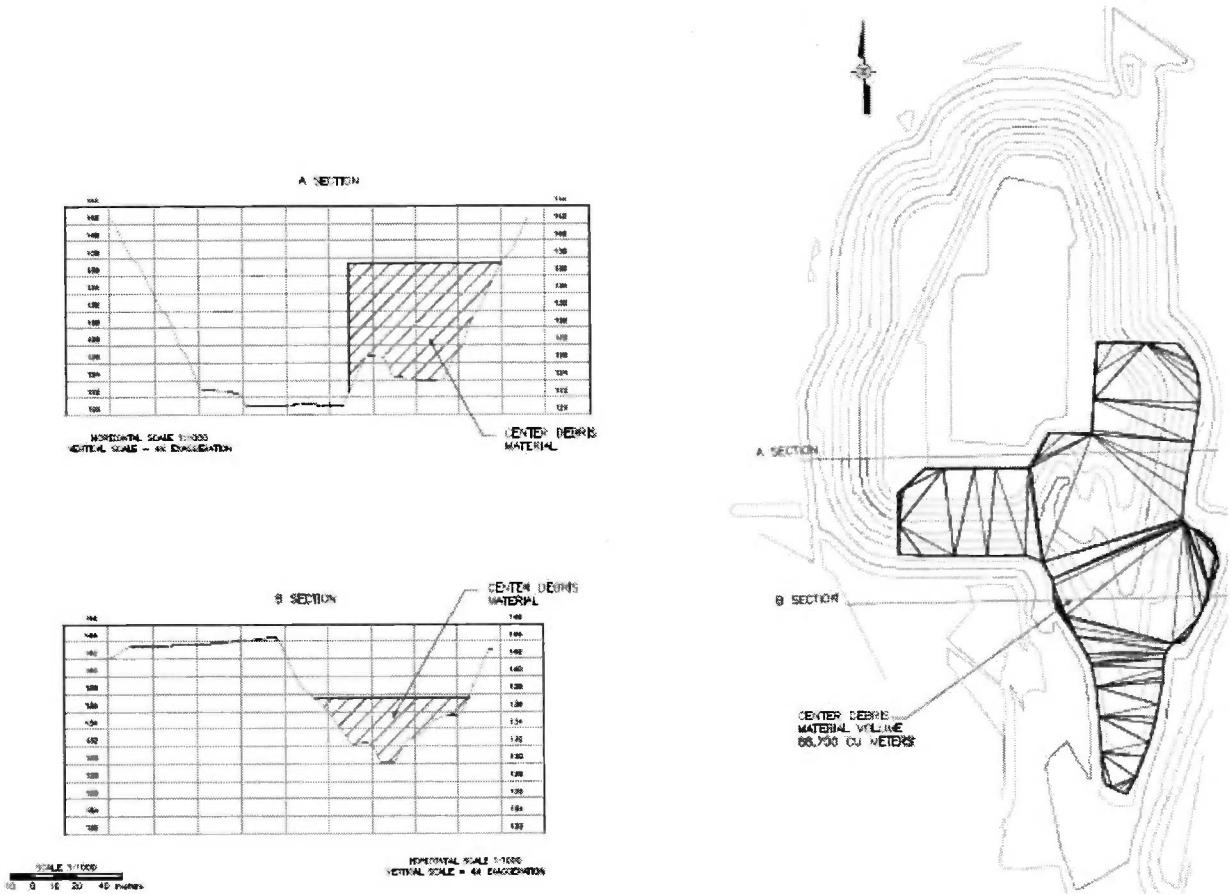
Figure 16. Aerial Photograph Showing Aquifer Sediment Removal at the Base of the 100-D-100 Waste Site (December 30, 2014).

Figure 17. Post-Vadose Zone Remediation Civil Survey of the 100-D-100 Excavation.



An agreement with Ecology (WCH 2013f) allows use of clean concrete and steel debris encountered during remediation to be used as backfill for a portion of the 100-D-100 waste site. Figure 18 provides the locations within the 100-D-100 excavation that were identified as acceptable for placement of debris. The agreement specified that the excavation would be backfilled with soil approximately 3 m (10 ft) above groundwater. Clean concrete and steel debris could be placed over the soil to an elevation that would be no closer than 6.1 m (20 ft) from the backfilled surface grade for the waste sites.

Figure 18. Debris Material Backfill Plan for the 100-D-100 Waste Site Excavation.



VERIFICATION SAMPLING ACTIVITIES

Verification sampling for the 100-D-100 waste site consisted of 8 decision units for the excavation, 4 decision units for SPAs, 17 decision units for overburden/layback, and 1 decision unit for the equipment decontamination area. Verification sampling designs were provided in approved verification work instructions (WCH 2013g, 2013h, 2013i, 2014f, 2014g, and 2014h, 2015). Verification sampling designs for overburden/layback lifts were provided to Ecology for concurrence prior to sampling.

Verification sampling of the excavation was performed on October 21, 2013; February 20 and 24, 2014; and March 4, 11, and 19, 2014. Verification sampling of SPAs and overburden/layback was performed throughout the duration of the field activities, as needed, to support decision making related to closure of SPAs and use of overburden/layback for backfill. Specific verification sampling dates can be found in the calculation briefs for the upper confidence limits (UCLs) of the samples provided in Appendix E.

Verification sampling was performed to support a determination that residual contaminant concentrations at these waste sites meet the cleanup criteria specified in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The verification sample results are provided in Appendix E and indicate that the waste removal action achieved compliance with the remedial action objectives and remedial action goals (RAGs) for the 100-D-100 waste site.

The following subsections provide additional discussion of the information that was used to develop the verification sampling design. The statistical results of the verification sampling are also summarized to support interim closure of these waste sites.

Contaminants of Concern for Verification Sampling

The COCs for verification sampling were determined in consideration of process knowledge, historical sampling information, in-process sampling results from Tier I and Tier II remediation, and in consultation with Ecology. The COCs include hexavalent chromium and total chromium.

The analytical methods performed to evaluate the 100-D-100 waste site COCs are provided in Table 1.

Table 1. Laboratory Analytical Methods.

Analytical Method	Contaminants of Concern
ICP metals [a] – EPA Method 6010	Chromium (total)
Hexavalent chromium – EPA Method 7196	Hexavalent chromium

[a] The expanded list of ICP metals was requested to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma

Verification Sampling Design

Statistical sampling designs were developed for collection of verification samples for the 100-D-100 waste site decision units. Since the excavation was completed to the top of the saturated zone at an elevation of approximately 118 m (387 ft) amsl, only the sidewalls of the excavation were sampled to support closeout of the waste site. The sampling designs were developed using the post excavation civil survey as a base map for stratifying the waste site into sampling areas and locating verification samples.

The Visual Sample Plan[1] was used to develop the statistical sampling design and identify verification sample locations as provided for in the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009a). Historical information, in-process sample results, knowledge from field observations, site-specific lithology/geology, and location of potential chromium sources were used to stratify the planned excavation into eight decision units. Twelve statistical samples were collected from each decision unit using a systematic grid. A discrete soil sample was collected at each sample location. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the 100 Area SAP (DOE-RL 2009a).

Additional information related to verification sampling can be found in the field sampling logbooks (WCH 2013a, 2013b, 2013c, 2013d, 2013e, 2014a, 2014b, 2014c, 2014d, and 2014e). Summary tables of the verification sampling and the sample locations are provided in Appendix F.

Verification Sample Results

All verification samples were collected for full protocol laboratory analyses using EPA-approved analytical methods. Evaluation of the verification data for the 100-D-100 waste site was performed by direct comparison of the statistical or maximum sample results for each COC and contaminant of potential concern (COPC) against the cleanup criteria.

The primary statistical calculation to evaluate compliance with cleanup standards is the 95% UCL on the arithmetic mean of the data. The 95% UCL values for each detected COC and COPC are computed for the decision units as specified by the 100 Area RDR/RAWP (DOE-RL 2009b). The calculations are provided in Appendix E. When a nonradionuclide COC/COPC was detected in fewer than 50% of the verification samples collected for the decision unit, the maximum detected value was used for comparison to the RAGs. If no detections for a given COC/COPC were reported in the data set, then no statistical calculation or evaluation was performed for that COC/COPC.

[1] Visual Sample Plan is a site map-based user-interface program that may be downloaded at http://vsp.pnnl.gov/documentation.stm

Comparisons of the results for each COC/COPC from the 100-D-100 waste site against the RAGs are summarized in Tables 2 through 31. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2014) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations; therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in the tables.

Table 2. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Excavation Decision Unit 1 Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.1 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	76.0 (<BG)	5,600	200	400	No	--
Beryllium	0.18 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.3	7,200	320	-- [f]	No	--
Chromium (total)	7.8 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	9.4 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	15.3 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.176	2.1 [d]	4.8	2	No	--
Lead	4.2 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	318 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.32	400	8	-- [f]	No	--
Nickel	10.3 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	65.4 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	44.7 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0523).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 3. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Excavation Decision Unit 2 Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.0 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	65.1 (<BG)	5,600	200	400	No	--
Boron [d]	0.99	7,200	320	-- [e]	No	--
Cadmium [f]	0.10 (<BG)	13.9 [g]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	6.3 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.3 (<BG)	24	15.7 [c]	-- [e]	No	--
Copper	14.0 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [d]	0.559	2.1 [g]	4.8	2	No	--
Lead	3.7 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	283 (<BG)	3,760	512 [c]	512 [c]	No	--
Mercury [h]	0.012 (<BG)	24	0.33 [c]	0.33 [c]	No	--
Molybdenum [d]	0.32	400	8	-- [e]	No	--
Nickel	9.5 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	59.8 (<BG)	560	85.1 [c]	-- [e]	No	--
Zinc	42.4 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0523).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] No Hanford Site-specific or Washington State background value available.

[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[g] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[h] Mercury was not a COPC for the 100-D-100 waste site; the analysis was mistakenly requested with the metals analysis for this set of verification samples.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 4. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Excavation Decision Unit 3 Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.0 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	65.2 (<BG)	5,600	200	400	No	--
Cadmium [d]	0.14 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	5.5 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	9.3 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	17.3 (<BG)	2,960	59.2	22.0 [c]	No	--
Lead	2.9 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	298 (<BG)	3,760	512 [c]	512 [c]	No	--
Nickel	8.8 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	68.9 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	47.1 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0523).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 5. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Excavation Decision Unit 4 Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.1 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	69.3 (<BG)	5,600	200	400	No	--
Cadmium [d]	0.13 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	4.4 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	10.0 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	16.1 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.198	2.1 [e]	4.8	2	No	--
Lead	3.4 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	342 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.25	400	8	-- [f]	No	--
Nickel	8.6 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	75.5 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	49.3 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0523).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 6. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Excavation Decision Unit 5 Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.2 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	71.4 (<BG)	5,600	200	400	No	--
Cadmium [d]	0.011 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	4.2 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.2 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	12.9 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.247	2.1 [e]	4.8	2	No	--
Lead	2.6 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	313 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.29	400	8	-- [f]	No	--
Nickel	8.2 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	65.6 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	40.0 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0523).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 7. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Excavation Decision Unit 6 Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.6 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	70.9 (<BG)	5,600	200	400	No	--
Beryllium	0.074 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.12 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	8.9 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.2 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	13.1 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.192	2.1 [d]	4.8	2	No	--
Lead	4.1 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	279 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.33	400	8	-- [f]	No	--
Nickel	12.5 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	51.2 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	36.0 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0523).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 8. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Excavation Decision Unit 7 Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.2 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	54.5 (<BG)	5,600	200	400	No	--
Beryllium	0.097 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.013 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	7.3 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.6 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	12.9 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.310	2.1 [d]	4.8	2	No	--
Lead	2.7 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	267 (<BG)	3,760	512 [c]	512 [c]	No	--
Nickel	10.8 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	60.5 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	40.0 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0523).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 9. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Excavation Decision Unit 8 Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.49 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	2.2 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	62.7 (<BG)	5,600	200	400	No	--
Beryllium	0.060 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.3	7,200	320	-- [f]	No	--
Cadmium [g]	0.14 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	7.7 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.6 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	14.3 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.219	2.1 [d]	4.8	2	No	--
Lead	3.2 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	293 (<BG)	3,760	512 [c]	512 [c]	No	--
Nickel	10.3 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	62.9 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	42.3 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0523).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 10. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Tier II SPA Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.7 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	65.5 (<BG)	5,600	200	400	No	--
Beryllium	0.029 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.5	7,200	320	-- [f]	No	--
Cadmium [g]	0.20 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	12.5 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.5 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	17.6 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.606	2.1 [d]	4.8	2	No	--
Lead	5.2 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	340 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.30	400	8	-- [f]	No	--
Nickel	12.3 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	54.6 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	42.8 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0511).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] No Hanford Site-specific or Washington State background value available.

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 11. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Tier II Overburden/Layback Soil Stockpile Statistical Verification Samples [a].

COPC	Statistical or Maximum Result [c] (mg/kg)	Remedial Action Goals [b]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.4 (<BG)	20 [d]	20 [d]	20 [d]	No	--
Barium	59.8 (<BG)	5,600	200	400	No	--
Beryllium	0.36 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Cadmium [f]	0.18 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium (total)	8.7 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	9.2 (<BG)	24	15.7 [d]	NA	No	--
Copper	15.8 (<BG)	2,960	59.2	22.0 [d]	No	--
Hexavalent chromium [g]	0.340	2.1 [e]	4.8	2	No	--
Lead	3.9 (<BG)	353	10.2 [d]	10.2 [d]	No	--
Manganese	305 (<BG)	3,760	512 [d]	512 [d]	No	--
Molybdenum [g]	0.29	400	8	-- [h]	No	--
Nickel	10.9 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	70.9 (<BG)	560	85.1 [d]	-- [h]	No	--
Zinc	44.1 (<BG)	24,000	480	67.8 [d]	No	--
Chloride [i]	3.3 (<BG)	--	25,000	-- [h]	No	--
Fluoride [i]	0.85 (<BG)	4,800	96	400	No	--
Nitrogen in nitrate [i]	0.81 (<BG)	128,000	1,000	2,000	No	--
Nitrogen in nitrate and nitrite [i]	0.59 (<BG)	128,000	1,000	2,000	No	--
Nitrogen in nitrite [i]	0.66	8,000	100	200	No	--
Sulfate [i]	5.7 (<BG)	--	25,000	-- [h]	No	--

[a] These Tier II overburden/layback soil stockpiles were previously presented in a backfill concurrence that was approved by Ecology and DOE on May 16, 2013 (CCN 0635352, "Backfill Concurrence Checklist, 100-D Overburden Stockpiles from the 100-D-30, 100-D-31:1, 100-D-31:12, 100-D-50:7, 100-D-100, and 100-D-104 Waste Sites").

[b] RAGs obtained from the 100 Areas RDR/RAWP (DOE-RL 2009b).

[c] Maximum or 95% UCL, depending on data censorship, as described in Appendix E, (Calculation 0100D-CA-V0495).

[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project managers, as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009).

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3]) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[g] No Hanford Site-specific or Washington State background value available.

[h] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

[i] Anions were not COPCs for the 100-D-100 waste site. However, overburden soil from the 100-D-104 waste site was placed in this stockpile with 100-D-100 overburden soil and anions analysis was unnecessarily requested in the verification work instruction (WCH 2013g) for this overburden.

-- = not applicable
BG = background
COPC = contaminant of potential concern
DOE = U.S. Department of Energy
Ecology = Washington State Department of Ecology
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 12. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Tier III Overburden/Layback Soil Stockpile (SP1VL1) Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	1.8 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	70 (<BG)	5,600	200	400	No	--
Boron [d]	1.2	7,200	320	-- [e]	No	--
Cadmium [f]	0.18 (<BG)	13.9 [g]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	8.3 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	9.4 (<BG)	24	15.7 [c]	-- [e]	No	--
Copper	15.1 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [d]	1.04	2.1 [g]	4.8	2	No	--
Lead	3.2 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	320 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [d]	0.38	400	8	-- [e]	No	--
Nickel	10.6 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	61.9 (<BG)	560	85.1 [c]	-- [e]	No	--
Zinc	43.9 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] No Hanford Site-specific or Washington State background value available.

[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[g] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 13. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (BFVL1) Placed in 100-D-50:1 Excavation (Lift 1, 0 to ~8 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	1.8 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	78.7 (<BG)	5,600	200	400	No	--
Beryllium	0.43 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.21 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	5.1 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.6 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	14.6 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.182	2.1 [d]	4.8	2	No	--
Lead	1.6 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	332 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.27	400	8	-- [f]	No	--
Nickel	8.8 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	65.3 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	43.9 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 14. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (BFVL2) Placed in 100-D-50:1 Excavation (Lift 2, 8 to ~16 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.97 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	1.8 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	71.8 (<BG)	5,600	200	400	No	--
Cadmium [d]	0.13 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	5.0 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	10.7 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	12.4 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.359	2.1 [e]	4.8	2	No	--
Lead	1.7 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	330 (<BG)	3,760	512 [c]	512 [c]	No	--
Nickel	8.5 (<BG)	1,600	19.1 [c]	27.4	No	--
Silver	0.22 (<BG)	400	8	0.73 [c]	No	--
Vanadium	72.0 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	44.7 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 15. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (BFVL3) Placed in 100-D-50:1 Excavation (Lift 3, 16 to ~24 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.70 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	3.4 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	75.1 (<BG)	5,600	200	400	No	--
Beryllium	0.38 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	0.88	7,200	320	-- [f]	No	--
Cadmium [g]	0.19 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	8.4 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.7 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	15.0 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.215	2.1 [d]	4.8	2	No	--
Lead	6.7 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	322 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.26	400	8	-- [f]	No	--
Nickel	11.1 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	57.0 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	41.6 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] No Hanford Site-specific or Washington State background value available.

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 16. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (BFVL4) Placed in 100-D-50:1 Excavation (Lift 4, 8 ft Thick Lift Placed from 24 ft to Ground Surface).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.3 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	73.4 (<BG)	5,600	200	400	No	--
Beryllium	0.22 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	0.91	7,200	320	-- [f]	No	--
Cadmium [g]	0.23 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	6.5 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	9.7 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	15.6 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.242	2.1 [d]	4.8	2	No	--
Lead	3.3 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	308 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.22	400	8	-- [f]	No	--
Nickel	9.7 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	75.7 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	50.0 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 17. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (BFVL5) Placed in 100-D-50:1 Excavation (Lift 5, 8 ft Thick Lift Placed from Ground Surface to 8 ft Above Ground Surface).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.2 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	66.8 (<BG)	5,600	200	400	No	--
Beryllium	0.13 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.13 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	6.2 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.8 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	14.9 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.174	2.1 [d]	4.8	2	No	--
Lead	3.3 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	293 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.33	400	8	-- [f]	No	--
Nickel	8.8 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	55.2 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	39.7 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 18. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (BFVL1) Placed in the 100-D-62/100-D-77 Excavations (Lift 1, 0 to ~8 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.2 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	70.9 (<BG)	5,600	200	400	No	--
Beryllium	0.25 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.16 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	5.7 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	9.7 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	15.9 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.416	2.1 [d]	4.8	2	No	--
Lead	3.4 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	301 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.28	400	8	-- [f]	No	--
Nickel	8.0 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	76.3 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	49.7 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] No Hanford Site-specific or Washington State background value available.

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COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 19. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (BFVL2) Placed in the 100-D-62/100-D-77 Excavations (Lift 2, 8 to ~16 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.3 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	68.8 (<BG)	5,600	200	400	No	--
Beryllium	0.52 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.11 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	4.5 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.1 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	13.0 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.170	2.1 [d]	4.8	2	No	--
Lead	2.4 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	292 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.40	400	8	-- [f]	No	--
Nickel	8.7 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	61.7 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	40.4 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] No Hanford Site-specific or Washington State background value available.

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BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 20. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (VLIN1) Placed in the North Portion of the 100-D-50:6 Excavation (Lift 1, ~ 0 to 8 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.9 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	62.7 (<BG)	5,600	200	400	No	--
Beryllium	0.22 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.0	7,200	320	-- [f]	No	--
Cadmium [g]	0.15 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	9.4 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.9 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	14.8 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.375	2.1 [d]	4.8	2	No	--
Lead	3.7 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	289 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.22	400	8	-- [f]	No	--
Nickel	9.9 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	54.8 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	38.4 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] No Hanford Site-specific or Washington State background value available.

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 21. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (SP2VL2N) Placed in the North Portion of the 100-D-50:6 Excavation (Lift 2, ~ 8 to 16 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.2 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	71.0 (<BG)	5,600	200	400	No	--
Beryllium	0.17 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.18 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	4.8 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.8 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	14.4 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.288	2.1 [d]	4.8	2	No	--
Lead	3.3 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	287 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.29	400	8	-- [f]	No	--
Nickel	8.1 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	44.0 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	35.4 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 22. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (SP2VL3N) Placed in the North Portion of the 100-D-50:6 Excavation (Lift 3, ~ 16 to 24 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.1 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	68.4 (<BG)	5,600	200	400	No	--
Beryllium	0.28 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.17 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	4.8 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	10.5 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	15.6 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [g]	0.247	2.1 [d]	4.8	2	No	--
Lead	2.6 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	331 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.31	400	8	-- [f]	No	--
Nickel	8.2 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	84.5 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	51.0 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 23. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (VL1S) Placed in the South Portion of the 100-D-50:6 Excavation (Lift 1, ~ 0 to 8 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.1 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	63.6 (<BG)	5,600	200	400	No	--
Beryllium	0.23 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.6	7,200	320	-- [f]	No	--
Cadmium [g]	0.16 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	8.9 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.2 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	15.3 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.577	2.1 [d]	4.8	2	No	--
Lead	4.3 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	302 (<BG)	3,760	512 [c]	512 [c]	No	--
Mercury [h]	0.14 (<BG)	24	0.33 [c]	0.33 [c]	No	--
Molybdenum [e]	0.23	400	8	-- [f]	No	--
Nickel	10.8 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	61.7 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	40.8 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] No Hanford Site-specific or Washington State background value available.

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[h] Mercury was not a COPC for the 100-D-100 waste site; the analysis was mistakenly requested with the metals analysis for this set of verification samples.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 24. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (SP2VL2S) Placed in the South Portion of the 100-D-50:6 Excavation (Lift 2, ~ 8 to 16 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.7 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	67.8 (<BG)	5,600	200	400	No	--
Beryllium	0.67 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Chromium (total)	6.1 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	10.6 (<BG)	24	15.7 [c]	-- [e]	No	--
Copper	17.3 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [f]	0.482	2.1 [d]	4.8	2	No	--
Lead	3.6 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	306 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [f]	0.28	400	8	-- [e]	No	--
Nickel	10.2 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	77.9 (<BG)	560	85.1 [c]	-- [e]	No	--
Zinc	52.2 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[f] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 25. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (SP2VL3S) Placed in the South Portion of the 100-D-50:6 Excavation (Lift 3, ~ 16 to 24 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	1.5 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	1.2 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	73.4 (<BG)	5,600	200	400	No	--
Beryllium	0.10 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.3	7,200	320	-- [f]	No	--
Cadmium [g]	0.13 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	6.1 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	10 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	14.5 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.252	2.1 [d]	4.8	2	No	--
Lead	2.8 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	312 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.38	400	8	-- [f]	No	--
Nickel	9.4 (<BG)	1,600	19.1 [c]	27.4	No	--
Selenium [g]	1.2	400	5	1	Yes	Yes [h]
Vanadium	68.9 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	45.2 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] No Hanford Site-specific or Washington State background value available.

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[h] Selenium was detected at 1.2 mg/kg in one sample for this overburden/layback decision unit. The field duplicate sample at this same location did not detect selenium. Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), this residual concentration of selenium is not expected to migrate more than 15 m (49.2 ft) vertically in 1,000 years based on the selenium distribution coefficient of 5 mL/g. The vadose zone below this selenium detection is approximately 15.5 m (50.9 ft) thick. Therefore, this residual concentration of selenium is predicted to be protective of groundwater and the Columbia River.

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AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 26. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (SP2VL4S) Placed in the South Portion of the 100-D-50:6 Excavation (Lift 4, ~ 24 to 32 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	1.5 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	66.4 (<BG)	5,600	200	400	No	--
Beryllium	0.055 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.15 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	4.5 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.6 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	12.8 (<BG)	2,960	59.2	22.0 [c]	No	--
Lead	2.4 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	301 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [g]	0.27	400	8	-- [f]	No	--
Nickel	7.9 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	62.3 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	41.6 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.

[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 27. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Overburden/Layback Soil (SP2VL1W) Placed in the West Portion of the 100-D-50:6 Excavation (Lift 1, ~ 0 to 8 ft).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.45 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	1.1 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	73.7 (<BG)	5,600	200	400	No	--
Chromium (total)	6.0 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	10.1 (<BG)	24	15.7 [c]	-- [d]	No	--
Copper	12.6 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.242	2.1 [f]	4.8	2	No	--
Lead	2.9 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	286 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.34	400	8	-- [d]	No	--
Nickel	11.0 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	64.1 (<BG)	560	85.1 [c]	-- [d]	No	--
Zinc	43.0 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0529).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[e] No Hanford Site-specific or Washington State background value available.
[f] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 28. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Tier III SPA (SPA1) Statistical Verification Samples (Located Southeast of the 100-D-100 Excavation).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.40 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	2.7 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	67.5 (<BG)	5,600	200	400	No	--
Beryllium	0.28 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.3	7,200	320	-- [f]	No	--
Cadmium [g]	0.15 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	9.5 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.6 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	16.2 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.312	2.1 [d]	4.8	2	No	--
Lead	4.8 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	311 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.52	400	8	-- [f]	No	--
Nickel	11.7 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	51.3 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	41.3 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0568).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 29. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Tier III SPA Statistical Verification Samples (Located Southwest of the 100-D-100 Excavation).

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.9 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	71.5 (<BG)	5,600	200	400	No	--
Beryllium	0.12 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.6	7,200	320	-- [f]	No	--
Cadmium [g]	0.045 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	8.1 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.5 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	16.8 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.308	2.1 [d]	4.8	2	No	--
Lead	4.0 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	288 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.51	400	8	-- [f]	No	--
Nickel	11.2 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	53.0 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	38.8 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0532).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 30. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Tier III, 100-D-72, 10-D-31:11, 100-D-31:12, 100-D-81, and 100-D-50:7 SPA Statistical Verification Samples (Located West of the 100-D-100 Excavation). (3 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.42(<BG)	32	5 [c]	5 [c]	No	--
Arsenic	3.0 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	61.2 (<BG)	5,600	200	400	No	--
Beryllium	0.19 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	2.2	7,200	320	-- [f]	No	--
Cadmium [g]	0.037 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	7.8 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.8 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	13.5 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.409	2.1 [d]	4.8	2	No	--
Lead	3.2 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	282 (<BG)	3,760	512 [c]	512 [c]	No	--
Mercury [k]	0.37	24	0.33 [c]	0.33 [c]	Yes	Yes [h]
Nickel	9.1 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	52.3 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	36.7 (<BG)	24,000	480	67.8 [c]	No	--
Chloride	10.2 (<BG)	--	25,000	-- [f]	No	--
Flouride	1.1 (<BG)	4,800	96	400	No	--
Nitrogen in nitrate [k]	6.7 (<BG)	128,000	1,000	2,000	No	--
Nitrogen in nitrate and nitrite [k]	24.4	8,000	100	200	No	--
Nitrogen in nitrite [k]	1.1	8,000	100	200	No	--
Sulfate [k]	33.3 (<BG)	--	25,000	-- [f]	No	--
TPH – diesel range [k]	8.4	200	200	200	No	--
TPH – diesel range [k] extended	18	200	200	200	No	--
Acenapthene [k] (Method 8270)	0.038	4,800	129	129	No	--
Acenapthene [k] (Method 8310)	0.026	4,800	129	129	No	--
Anthracene [k] (Method 8270)	0.063	24,000	240	1,920	No	--
Benzo(a)anthracene [k] (Method 8270)	0.092	1.37	0.33 [i]	0.33 [i]	No	--
Benzo(a)anthracene [k] (Method 8310)	0.033	1.37	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(a)pyrene [k] (Method 8270)	0.086	0.137	0.33 [i]	0.33 [i]	No	--
Benzo(a)pyrene [k] (Method 8310)	0.038	0.137	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(b)fluoranthene [k] (Method 8270)	0.18	1.37	0.33 [i]	0.33 [i]	No	--

Table 30. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Tier III, 100-D-72, 10-D-31:11, 100-D-31:12, 100-D-81, and 100-D-50:7 SPA Statistical Verification Samples (Located West of the 100-D-100 Excavation). (3 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Benzo(b)fluoranthene [k] (Method 8310)	0.036	1.37	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(ghi)perylene [j,k] (Method 8270)	0.16	2,400	48	192	No	--
Benzo(ghi)perylene [j,k] (Method 8310)	0.060	2,400	48	192	No	--
Benzo(k)fluoranthene [k] (Method 8310)	0.015	1.37	0.015 [i]	0.015 [i]	No	--
Carbazole [k] (Method 8270)	0.068	50	0.438	-- [f]	No	--
Chrysene [k] (Method 8270)	0.31	13.7	0.12	0.33 [i]	Yes	Yes [h]
Chrysene [k] (Method 8310)	0.032	13.7	0.12	0.1 [i]	No	--
Dibenz[a,h]anthracene [k] (Method 8270)	0.035	1.37	0.33 [i]	0.33 [i]	No	--
Dibenz[a,h]anthracene [k] (Method 8310)	0.023	1.37	0.03 [i]	0.03 [i]	No	--
Dibenzofuran [k]	0.022	160	3.20	-- [f]	No	--
Fluoranthene [k] (Method 8270)	0.24	3,200	64	18.0	No	--
Fluoranthene [k] (Method 8310)	0.063	3,200	64	18.0	No	--
Fluorene [k] (Method 8270)	0.021	3,200	64	260	No	--
Fluorene [k] (Method 8310)	0.016	3,200	64	260	No	--
Indeno(1,2,3-cd)pyrene [k] (Method 8270)	0.22	1.37	0.33 [i]	0.33 [i]	No	--
Indeno(1,2,3-cd)pyrene [k] (Method 8310)	0.055	1.37	0.33 [i]	0.33 [i]	Yes	Yes [h]
Phenanthrene [j,k] (Method 8270)	0.16	24,000	240	1,920	No	--
Phenanthrene [j,k] (Method 8270)	0.084	24,000	240	1,920	No	--
Pyrene [k] (Method 8270)	1.2	2,400	48	192	No	--

Table 30. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Tier III, 100-D-72, 10-D-31:11, 100-D-31:12, 100-D-81, and 100-D-50:7 SPA Statistical Verification Samples (Located West of the 100-D-100 Excavation). (3 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Pyrene [k] (Method 8310)	0.069	2,400	48	192	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix E (Calculation 0100D-CA-V0573).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[h] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), residual concentrations of mercury, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years based on the K_d of mercury (30 mL/g), the contaminant having the lowest K_d. The vadose zone below this SPA is approximately 26 m (85.3 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.
[i] Where cleanup levels are less than RDLs, cleanup levels default to the RDLs per WAC 173-340-707(2) (Ecology 1996).
[j] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
Benzo(ghi)perylene surrogate: pyrene
Phenanthrene surrogate: anthracene
[k] Anions, PAH, TPH, SVOA, and mercury were not COPCs for the 100-D-100 waste site. However, these COPCs were analyzed as specified in the work instruction (WCH 2014g) because they were associated with other waste sites that staged waste at this waste staging pile area.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
K_d = partitioning coefficient
PAH = polycyclic aromatic hydrocarbons
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
SVOA = semi-volatile organic analysis
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Table 31. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-D-100 Decontamination Pad Verification Samples.

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	1.9 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	2.6 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	79.5 (<BG)	5,600	200	400	No	--
Boron [d]	1.7	7,200	320	-- [e]	No	--
Cadmium [f]	0.12 (<BG)	13.9 [g]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	9.2 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.9 (<BG)	24	15.7 [c]	-- [e]	No	--
Copper	13.3 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [d]	0.551	2.1 [g]	4.8	2	No	--
Lead	6.0 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	317 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [d]	2.2	400	8	-- [e]	No	--
Nickel	10.1 (<BG)	1,600	19.1 [c]	27.4	No	--
Silver	0.22 (<BG)	400	8	0.73 [c]	No	--
Vanadium	64.5 (<BG)	560	85.1 [c]	-- [e]	No	--
Zinc	58.0 (<BG)	24,000	480	67.8 [c]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] Maximum value as described in Appendix E (Calculation 0100D-CA-V0571).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] No Hanford Site-specific or Washington State background value available.
[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).
[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[g] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3) (1996), (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

The complete laboratory results for all constituents are stored in a Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are presented in Attachment 1 of the 95% UCL calculations (Appendix E).

VERIFICATION SAMPLE DATA EVALUATION

This section demonstrates that remedial action at the 100-D-100 waste site achieves the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the

Remaining Sites ROD (EPA 1999) and documented in the 100 Area RDR/RAWP (DOE-RL 2009b).

Attainment of Nonradionuclide RAGs

Tables 2 through 31 compare the cleanup verification samples for the 100-D-100 waste site decision units to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All COCs and COPCs were quantified at concentrations below direct exposure RAGs. All COCs/COPCs were quantified below groundwater and/or river protection soil RAGs with the exception of selenium that was detected in one sample for an overburden/layback soil decision unit (see Table 25) and mercury and several polycyclic aromatic hydrocarbons that were detected in one SPA (see Table 30). In all instances, RESidual RADioactivity (RESRAD) modeling, as discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), predicts that residual concentrations of these constituents will be protective of groundwater and the Columbia River, specifically the following:

- Selenium was detected at 1.2 mg/kg, slightly exceeding the cleanup level for protection of the Columbia River in one sample for the overburden/layback decision unit for lift three that was placed in the south portion of the 100-D-50:6 excavation (see Table 25). A field duplicate sample at this same location did not detect selenium. Additionally, based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE/RL 2009b), selenium having a partitioning coefficient (K_d) of 5 mL/g is not expected to migrate more than 15 m (49.2 ft) vertically in 1,000 years. The vadose zone below this selenium detection is approximately 15.5 m (50.9 ft) thick; therefore, this residual concentration of selenium is predicted to be protective of groundwater and the Columbia River.

- Mercury, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected in one SPA that was used to stage waste for multiple waste sites at concentrations exceeding soil cleanup criteria for protection of groundwater and the Columbia River (see Table 30). However, based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE/RL 2009b), residual concentrations of these constituents are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years based on the K_d of 30 mL/g for mercury, the contaminant having the lowest K_d. The vadose zone below this SPA is approximately 26 m (85.3 ft) thick; therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

Three-Part Test for Nonradionuclides

A RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test, which consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) the percentage of samples exceeding the cleanup criteria must be less than 10% of the data set, and (3) no single detection shall exceed two times the cleanup criteria.

The application of the three-part test for the 100-D-100 waste site is included in the 95% UCL calculations provided in Appendix E of this remaining sites verification package, where half or

more of the data set was detected. The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs with the exception of the following:

- Vanadium detected in 100-D-100 overburden/layback soil (SP2VL3N) placed as lift 3 in the south portion of the 100-D-50:6 excavation fails the second part of the three-part test due to 3 of 12 samples slightly exceeding the cleanup criteria.

- Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene detected in a waste staging pile area used for multiple waste sites fails one or more of the three-part test.

In all instances, RESRAD modeling, as discussed in "Attainment of NonRadionuclide RAGs" (above) and in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), predicts residual concentrations of these constituents are protective of groundwater and the Columbia River.

An additional application of the three-part test is included for the statistical data sets that default to the maximum because less than half of the data set was detected. The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs with the exception of the following:

- Dibenzo[a,h]anthracene, mercury, and chrysene detected in a waste staging pile area used for multiple waste sites fails one or more parts of the three-part test.

- Selenium detected in the overburden/layback soil placed in the south portion of the 100-D-50:6 excavation exceeded the first part of the three-part test.

However, based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of chrysene is predicted to be protective of groundwater and the Columbia River.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. For the 100-D-100 waste site, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels is 1.2×10^{-1}, which is less than 1.0. The individual carcinogenic risk values for the carcinogenic constituents detected above background are less than 1×10^{-6}, and the cumulative carcinogenic risk value is 1.4×10^{-6}, which is less than 1×10^{-5}. These values are conservative and represent the highest calculated value for all the decision units. Therefore, the 100-D-100 waste site meets

the requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the 100 Area RDR/RAWP (DOE-RL 2009b).

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 100-D-100 waste site included a calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no background value. All individual hazard quotients for noncarcinogenic and carcinogenic constituents are less than 1.0. The cumulative noncarcinogenic hazard quotient for groundwater protection for nonradionuclides at the 100-D-100 waste site is 5.1×10^{-1}, which is less than 1.0. The cumulative excess cancer risk for nonradionuclides is 1.4×10^{-9}, which is also less than 1.0. Therefore, nonradionuclide risk requirements related to groundwater are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2013g, 2013h, 2013i, 2014f, 2014g, and 2014h, 2015), the field logbooks (WCH 2013a, 2013b, 2013c, 2013d, 2013e, 2014a, 2014b, 2014c, 2014d, and 2014e), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 100-D-100 waste site established that the data are of the right type, quality, and quantity to support site closeout decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in a WCH project-specific database for data evaluation prior to archival in HEIS and are summarized in Appendix E. The detailed DQA is presented in Appendix G.

SUMMARY FOR INTERIM CLOSURE

The 100-D-100 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COCs/COPCs at the site meet the remedial action objectives for direct exposure, groundwater protection, and river protection.

In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-100 waste site to Interim Closed Out. After remediation, residual contamination above direct exposure levels was not observed in the shallow or deep zone soils.

Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the sites are not required.

REFERENCES

0635352, 2013, "Backfill Concurrence for 100-D Overburden Stockpiles from 100-D-30, 100-D-31:11, 100-D-31:12, 100-D-50:7, 100-D-100, and 100-D-104 Waste Sites," Washington Closure Hanford, Richland, Washington.

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.

BHI, 2000, *Cleanup Verification Package for the 100-D-12 Sodium Dichromate Pump Station*, CVP-2000-00016, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001, *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2004, *Results of Hexavalent Chromium Sampling Near 100-D Area Sodium Dichromate Transfer Station Railroad Tracks*, BHI-01747, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

CHPRC, 2015, *Persistent Source Investigation at 100-D Area*, SGW-58416, Rev. 1, CH2M Hill Plateau Remediation Company, Richland, Washington.

DOE Order 5400.5, *Radiation Protection of the Public and Environment*, as amended, U.S. Department of Energy, Washington, D.C.

DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes,* DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2011, *Tri-Party Agreement Handbook Management Procedures*, RL-TPA-90-0001, Rev. 2, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2014, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

ENV-1, *Environmental Monitoring & Management*, Washington Closure Hanford, Richland, Washington.

EPA, 1989, *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)*, Interim Final, EPA/540/1-89/002, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2009, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

GE, 1953, *Process Specifications Reactor Cooling Water Treatment*, HW-28505, General Electric Company, Richland, Washington.

Lerch, J. A., 1998, *100-D Area Chromium Study Summary Report*, BHI-01185, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Sharpe, J. J., 2006, "Sodium Dichromate Investigation for the 105-D/105-DR Reactor Area Report," CCN 129547 to Distribution, Washington Closure Hanford, Richland, Washington, August 30.

WAC 173-340, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code.*

WCH 2009, *Sampling and Analysis Instruction for Initial Characterization of Shallow Zone/Surface Soils at 100-D-100*, WCH-342, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2011, *Remaining Sites Verification Package for the 100-D-56:2, South Portion of the 100-D-56 Sodium Dichromate Underground Supply Lines Waste Site*, RSVP-2009-016, Rev. 1, Washington Closure Hanford, Richland, Washington.

WCH, 2013a, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-15, Washington Closure Hanford, Richland, Washington.

WCH, 2013b, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-16, Washington Closure Hanford, Richland, Washington.

WCH, 2013c, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-17, Washington Closure Hanford, Richland, Washington.

WCH, 2013d, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-19, Washington Closure Hanford, Richland, Washington.

WCH, 2013e, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-20, Washington Closure Hanford, Richland, Washington.

WCH, 2013f, "Amended Debris as Backfill Agreement," CCN 172300 to S. W. Callison, Washington Closure Hanford, from A. Kapell, Washington State Department of Ecology, Richland, Washington, August 14.

WCH, 2013g, *Work Instruction for Verification Sampling of the100-D Overburden Stockpiles from 100-D-30, 100-D-31:11, 100-D-31:12, 100-D-50:7, 100-D-100, and 100-D-104 Waste Sites,* 0100D-WI-G0125, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2013h, *Work Instruction for Verification Sampling of the 100-D-100 Tier III Excavation Overburden/Layback Soil Stockpiles,* 0100D-WI-G0126, Rev. 2, Washington Closure Hanford, Richland, Washington.

WCH, 2013i, *Work Instruction for Verification Sampling of the 100-D-100 Waste Site Staging Pile Area,* 0100D-WI-G0131, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014a, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-18, Washington Closure Hanford, Richland, Washington.

WCH, 2014b, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-21, Washington Closure Hanford, Richland, Washington.

WCH, 2014c, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-22, Washington Closure Hanford, Richland, Washington.

WCH, 2014d, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-23, Washington Closure Hanford, Richland, Washington.

WCH, 2014e, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-24, Washington Closure Hanford, Richland, Washington.

WCH, 2014f, *Work Instruction for Verification Sampling of the 100-D-30/100-D-104 TIER III Excavation,* 0100D-WI-G0132, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014g, *Work Instruction for Verification Sampling of the 100-D-72, 100-D-31:11, 100-D-31:12, 100-D-108, and 100-D-109 Waste Sites,* 0100D-WI-G0139, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014h, *Work Instruction for Verification Sampling of the 100-D-100 Waste Site Decontamination Pad,* 0100D-WI-G0145, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2015, *Work Instruction for Verification Sampling of the 100-D-100 Tier III Excavation,* 0100D-WI-G0066, Rev. 2, Washington Closure Hanford, Richland, Washington.

WDOH, 1997, *Hanford Guidance for Radiological Cleanup*, WDOH/320-015, Rev. 1, Washington State Department of Health, Olympia, Washington.

APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum or Statistical Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-D-100 Waste Site Remediation [a].

Hazardous Substance		2007 WAC 173-340, Table 749-3			EPA Ecological Soil Screening Levels [b]				Waste Site Analyses
	Background	Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals (mg/kg)									
Antimony	5	5	--	--	--	78	--	0.27	1.9 (<BG)
Boron	--	0.5	--	--	--	--	--	--	2.2
Manganese	512	1,100 [d]	--	1,500	220	450	4,300	4,000	342 (<BG)
Mercury	0.33	0.3	0.1	5.5	--	--	--	--	0.37
Molybdenum	--	2	--	7	--	--	--	--	2.2
Selenium	0.78	1	70	0.3	0.52	4.1	1.2	0.63	1.2
Vanadium	85.1	2	--	--	--	--	7.8	280	84.5 (<BG)
Zinc	67.8	86 [d]	200	360	160	120	46	79	58.0 (<BG)
Nonchlorinated Organics (mg/kg)									
High molecular weight PAH [e]	--	--	--	--	--	18	--	1.1	2.298

NOTE: Shaded cells are exceeded by the maximum or the statistical result.
Blank cells = Values not available.

[a] Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. All exceedances must be evaluated in the context of additional lines of evidence for ecological effects following a baseline risk assessment for the Columbia River corridor portion of the Hanford Site, which will include a more complete quantitative ecological risk assessment.

[b] Available on the Internet at www.epa.gov/ecotox/ecossl.

[c] Wildlife.

[d] Benchmark replaced by Washington State natural background concentration from Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication 94-115, Washington State Department of Ecology, Olympia, Washington.

[e] High molecular weight polynuclear aromatic hydrocarbon (e.g., benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene, perylene, pyrene).

-- = not available
BG = background
EPA = U.S. Environmental Protection Agency
PAH = polycyclic aromatic hydrocarbons
WAC = *Washington Administrative Code*

APPENDIX B

IN-PROCESS SAMPLE RESULTS

Table B-1. Sampling Results from Stained Soil Within the 100-D-100 Waste Site.

HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Bismuth			Boron		
		mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J16M48	04/07/08	5450		10.5	0.79	U	0.79	3.1		1.3	69.9		0.26	0.73		0.13	1.6	U	1.6	2.7		1.3
J16M49	04/07/08	7030		11.3	0.85	U	0.85	3.9		1.4	88.2		0.28	0.7		0.14	1.7	U	1.7	4.1		1.4
J16M51	04/07/08	8000		11.1	0.83	U	0.83	4.2		1.4	83.5		0.28	0.72		0.14	2		1.7	3.6		1.4
J16M52	04/07/08	6200		11.1	0.84	U	0.84	3.2		1.4	69.3		0.28	0.69		0.14	1.7	U	1.7	6		1.4
J16M50	04/07/08	7720		10	0.75	U	0.75	3.4		1.2	78.3		0.25	0.71		0.12	1.5	U	1.5	3.2		1.2

HEIS Number	Sample Date	Cadmium			Calcium			Total Chromium			Cobalt			Copper			Hexavalent Chromium			Iron		
		mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J16M48	04/07/08	0.13	U	0.13	5310	C	10.5	101		0.53	8.5		0.53	13.6		0.53	4.3		0.2	25400		11.9
J16M49	04/07/08	0.14	U	0.14	20100	C	11.3	131		0.56	8.5		0.56	16.9		0.56	8.2		0.22	24300		12.7
J16M51	04/07/08	0.14	U	0.14	10100	C	11.1	369		0.55	8.8		0.55	15.8		0.55	6.4		0.21	24800		12.4
J16M52	04/07/08	0.14	U	0.14	6090	C	11.1	1310		0.56	8.2		0.56	16.2		0.56	2110		42.3	23600		12.5
J16M50	04/07/08	0.12	U	0.12	4590	C	10	176		0.5	9		0.5	17.6		0.5	52.1		2.1	25700		11.2

HEIS Number	Sample Date	Lead			Lithium			Magnesium			Manganese			Mercury			Molybdedum			Nickel		
		mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J16M48	04/07/08	4		0.79	5.1		0.11	4310		6.6	326		0.11	0.008	U	0.01	0.79	U	0.79	9.9		0.53
J16M49	04/07/08	4.2		0.85	7.5		0.11	5300		7	344		0.11	0.01	U	0.01	0.85	U	0.85	12.4		0.56
J16M51	04/07/08	4.5		0.83	8.2		0.11	5230		6.9	356		0.11	0.009	U	0.01	0.83	U	0.83	12.8		0.55
J16M52	04/07/08	3.4		0.84	6.6		0.11	4580		7	309		0.11	0.009	U	0.01	1.1		0.84	11.7		0.56
J16M50	04/07/08	4.2		0.75	7.8		0.1	4960		6.2	354		0.1	0.01	U	0.01	0.75	U	0.75	12.7		0.5

HEIS Number	Sample Date	Phosphorus			Potassium			Selenium			Silicon			Silver			Sodium			Strontium		
		mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J16M48	04/07/08	1040		13.2	855		10.5	1.6	U	1.6	385		10.5	0.26	U	0.26	301	C	5.3	24.9	C	0.08
J16M49	04/07/08	996		14.1	1080		11.3	1.7	U	1.7	480		11.3	0.28	U	0.28	1630	C	5.6	42.6	C	0.08
J16M51	04/07/08	924		13.8	1190		11.1	1.7	U	1.7	401		11.1	0.28	U	0.28	2140	C	5.5	27.4	C	0.08
J16M52	04/07/08	848		13.9	1110		11.1	1.7	U	1.7	416		11.1	0.28	U	0.28	5130	C	5.6	22.4	C	0.08
J16M50	04/07/08	994		12.5	1310		10	1.5	U	1.5	367		10	0.25	U	0.25	1550	C	5	22	C	0.07

HEIS Number	Sample Date	Thallium			Tin			Uranium			Vanadium			Zinc		
		mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J16M48	04/07/08	1.6	U	1.6	1.6	U	1.6	5.3	U	5.3	65.5		0.37	48.7		1.6
J16M49	04/07/08	1.7	U	1.7	1.7	U	1.7	5.6	U	5.6	63.4		0.39	45.1		1.7
J16M51	04/07/08	1.7	U	1.7	1.7	U	1.7	5.5	U	5.5	59.9		0.39	44.3		1.7
J16M52	04/07/08	1.7	U	1.7	1.7	U	1.7	5.6	U	5.6	63.6		0.39	43		1.7
J16M50	04/07/08	1.5	U	1.5	1.5	U	1.5	5	U	5	59.5		0.35	49.7		1.5

Qualifier List

B = estimated result; results is less than reporting limit but greater than the method detection limit
C = method blank contamination
D = dilution
L = serial dilution in analytical batch indicates physical and chemical interferences are present
M = sample duplicate precision not met
N = spiked sample recovery not within control limits
U = undetected
X = serial dilution in the analytical batch indicates that physical and chemical interferences are present

Table B-2. The 100-D-100 Test Pit and Test Trench Sample Summary. (7 Pages).

HEIS Number	Location	Depth (ft)	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J18NF9	Test Pit	1	04/21/09	5400	L	1.6	0.4	UM	0.4	3.4		0.7	53	L	0.08	0.19	B	0.04	1	UM	1
J18NH0	Test Pit	3	04/23/09	5100	L	1.6	0.4	U	0.4	2.7		0.69	41	L	0.08	0.12	B	0.04	1	U	1
J18NH1	Test Pit	5	04/23/09	4200	L	1.6	0.4	U	0.4	1.6	B	0.7	57	L	0.08	0.13	B	0.04	2.1		1
J18NH2	Test Pit	7	04/23/09	3800	L	1.6	0.39	U	0.39	2	B	0.68	52	L	0.08	0.1	B	0.03	1	U	1
J18NH3	Test Pit	9	04/23/09	5800	L	1.7	0.41	U	0.41	2.4		0.71	56	L	0.08	0.19	B	0.04	1.1	U	1.1
J18NH4	Test Pit	11	04/23/09	5400	L	1.7	0.41	U	0.41	2.7		0.71	61	L	0.08	0.2	B	0.04	1.1	U	1.1
J18NH5	Test Pit	15	04/23/09	5000	L	1.7	0.41	U	0.41	2.8		0.7	62	L	0.08	0.19	B	0.04	1	U	1
J18NH6	Trench East End	1	04/21/09	5900		1.6	1.1	BM	0.4	3.5		0.69	74		0.08	0.81		0.03	1	U	1
J18NH7	Trench East End	3	04/22/09	5100		1.6	0.4	U	0.4	2.3		0.69	60		0.08	0.69		0.04	1	U	1
J18NH8	Trench East End	5	04/22/09	6000		1.7	0.41	U	0.41	2.6		0.71	81		0.08	1		0.04	1.1	U	1.1
J18NH9	Trench East End	7	04/22/09	4000		1.6	0.39	U	0.39	1.6	B	0.68	55		0.08	0.93		0.03	1	U	1
J18NJ0	Trench East End	9	04/22/09	4500		1.6	0.39	U	0.39	1.7	B	0.69	66		0.08	0.93		0.03	1	U	1
J18NJ1	Trench East End	11	04/22/09	5000		1.6	0.4	U	0.4	1.9	B	0.69	62		0.08	0.79		0.04	2.5		1
J18NJ2	Trench East End	15	04/22/09	5600		1.7	0.4	U	0.4	2	B	0.7	76		0.08	0.81		0.04	1	U	1
J18NJ3	Trench Middle	1	04/21/09	6300	L	1.6	0.43	B	0.39	3.6		0.68	75	L	0.08	0.69		0.03	1	U	1
J18NJ4	Trench Middle	3	04/22/09	5900	L	1.6	0.4	U	0.4	3.4		0.7	57	L	0.08	0.78		0.04	1	U	1
J18NJ5	Trench Middle	5	04/22/09	4400	L	1.6	0.4	U	0.4	2.1		0.7	56	L	0.08	0.77		0.04	1	U	1
J18NJ6	Trench Middle	7	04/22/09	4600	L	1.6	0.4	U	0.4	1.6	B	0.69	53	L	0.08	0.99		0.03	1	U	1
J18NJ7	Trench Middle	9	04/22/09	4800	L	1.6	0.4	U	0.4	1.8	B	0.69	68	L	0.08	1		0.03	1	U	1
J18NJ8	Trench Middle	11	04/22/09	4500	L	1.7	0.4	U	0.4	2	B	0.7	68	L	0.08	0.72		0.04	1	U	1
J18NJ9	Trench Middle	15	04/22/09	6600	L	1.7	0.41	U	0.41	2.7		0.72	72	L	0.08	0.84		0.04	1.1	U	1.1
J18NK0	Trench West End	1	04/21/09	5400		1.6	0.38	U	0.38	3.2		0.67	46		0.08	0.18	B	0.03	3.3	M	0.99
J18NK1	Trench West End	3	04/22/09	4600		1.6	0.76	B	0.39	1.9	B	0.69	50		0.08	0.77		0.03	1	U	1
J18NK2	Trench West End	5	04/22/09	5400		1.7	0.52	B	0.4	2.7		0.7	96		0.08	1		0.04	1	U	1
J18NK3	Trench West End	7	04/22/09	4900		1.6	0.52	B	0.4	2	B	0.69	54		0.08	1		0.04	1	U	1
J18NK4	Trench West End	9	04/22/09	4100		1.6	0.55	B	0.39	1.8	B	0.68	65		0.08	0.96		0.03	1	U	1
J18NK5	Trench West End	11	04/22/09	5400		1.7	0.44	B	0.4	2.1		0.7	77		0.08	0.94		0.04	1	U	1
J18NK6	Trench West End	15	04/22/09	5100		1.7	0.51	B	0.41	2	B	0.71	68		0.08	0.89		0.04	1	U	1
J18NF8	Trench West End	5	04/22/09	5700		1.6	0.4	U	0.4	2.3		0.7	62		0.08	0.9		0.04	1	U	1
J18NF7	Test Pit	1	04/21/09	6000		1.6	0.4	U	0.4	3.5		0.7	57		0.08	0.7		0.04	1.3	B	1
J18NF6	Equipment Blank	NA	04/22/09	180	N	1.6	0.38	U	0.38	0.66	U	0.66	3.2	M	0.08	0.033	U	0.03	0.98	U	0.98
J18PH5	North of trench	1	04/21/09	5900		1.6	0.7	B	0.4	3.6		0.69	67		0.08	0.76		0.03	2.1	C	1

Table B-2. The 100-D-100 Test Pit and Test Trench Sample Summary. (7 Pages).

HEIS Number	Location	Depth (ft)	Sample Date	Cadmium			Calcium			Total Chromium			Cobalt			Copper			Hexavalent Chromium		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J18NF9	Test Pit	1	04/21/09	0.092	B	0.04	11000	L	15	79	L	0.06	6.9	L	0.11	13	L	0.23	30		0.16
J18NH0	Test Pit	3	04/23/09	0.062	B	0.04	4600	L	15	11	L	0.06	8.5	L	0.11	17	L	0.23	1.49		0.16
J18NH1	Test Pit	5	04/23/09	0.06	B	0.04	4500	L	15	6.3	L	0.06	8.2	L	0.11	12	L	0.23	1.73		0.16
J18NH2	Test Pit	7	04/23/09	0.044	B	0.04	4900	L	15	8.1	L	0.06	8.8	L	0.1	13	L	0.22	0.796		0.16
J18NH3	Test Pit	9	04/23/09	0.049	B	0.04	5100	L	15	11	L	0.06	8.3	L	0.11	15	L	0.23	3.06		0.16
J18NH4	Test Pit	11	04/23/09	0.044	U	0.04	6400	L	15	13	L	0.06	7.9	L	0.11	15	L	0.23	4.91		0.16
J18NH5	Test Pit	15	04/23/09	0.044	U	0.04	5200	L	15	12	L	0.06	8.2	L	0.11	15	L	0.23	4.14		0.16
J18NH6	Trench East End	1	04/21/09	0.071	BM	0.04	11000		15	150	L	0.06	8.7	L	0.1	15		0.23	87		1.54
J18NH7	Trench East End	3	04/22/09	0.043	U	0.04	6300		15	30	L	0.06	7.4	L	0.1	14		0.23	3.27		0.16
J18NH8	Trench East End	5	04/22/09	0.044	U	0.04	5700		15	28	L	0.06	9.1	L	0.11	14		0.23	2.23		0.16
J18NH9	Trench East End	7	04/22/09	0.042	U	0.04	4700		15	14	L	0.06	9.4	L	0.1	12		0.22	0.155	U	0.16
J18NJ0	Trench East End	9	04/22/09	0.043	U	0.04	4700		15	15	L	0.06	9.1	L	0.1	12		0.23	4.72		0.16
J18NJ1	Trench East End	11	04/22/09	0.043	U	0.04	6800		15	17	L	0.06	7.4	L	0.1	13		0.23	1.73		0.16
J18NJ2	Trench East End	15	04/22/09	0.044	U	0.04	5000		15	31	L	0.06	8.1	L	0.11	12		0.23	17.6		0.16
J18NJ3	Trench Middle	1	04/21/09	0.043	U	0.04	15000	L	15	46	L	0.06	6.9	L	0.1	12	L	0.22	1.93		0.16
J18NJ4	Trench Middle	3	04/22/09	0.043	U	0.04	8800	L	15	25	L	0.06	7.8	L	0.11	15	L	0.23	1.03		0.16
J18NJ5	Trench Middle	5	04/22/09	0.043	U	0.04	3900	L	15	10	L	0.06	7.9	L	0.11	11	L	0.23	1.15		0.16
J18NJ6	Trench Middle	7	04/22/09	0.043	U	0.04	4500	L	15	11	L	0.06	9.3	L	0.1	12	L	0.23	0.94		0.16
J18NJ7	Trench Middle	9	04/22/09	0.043	U	0.04	4600	L	15	13	L	0.06	9.1	L	0.1	11	L	0.23	1.46		0.16
J18NJ8	Trench Middle	11	04/22/09	0.044	U	0.04	4100	L	15	13	L	0.06	8.4	L	0.11	16	L	0.23	2.75		0.16
J18NJ9	Trench Middle	15	04/22/09	0.044	U	0.04	5900	L	15	29	L	0.06	8.3	L	0.11	14	L	0.24	12.1		0.16
J18NK0	Trench West End	1	04/21/09	0.074	B	0.04	8100		14	41		0.06	6.4	L	0.1	13		0.22	1.77		0.16
J18NK1	Trench West End	3	04/22/09	0.043	U	0.04	5900		15	9.1	L	0.06	9.4	L	0.1	15		0.23	0.175		0.16
J18NK2	Trench West End	5	04/22/09	0.044	U	0.04	5000		15	8.4	L	0.06	13	L	0.11	17		0.23	0.527		0.16
J18NK3	Trench West End	7	04/22/09	0.043	U	0.04	5300		15	9.4	L	0.06	11	L	0.1	16		0.23	1.02		0.16
J18NK4	Trench West End	9	04/22/09	0.042	U	0.04	4700		15	9.2	L	0.06	11	L	0.1	15		0.22	1.28		0.16
J18NK5	Trench West End	11	04/22/09	0.044	U	0.04	5500		15	15	L	0.06	11	L	0.11	16		0.23	3.16		0.16
J18NK6	Trench West End	15	04/22/09	0.044	U	0.04	5100		15	13	L	0.06	10	L	0.11	15		0.23	2.51		0.16
J18NF8	Trench West End	5	04/22/09	0.044	U	0.04	4800		15	7.4		0.06	8.7		0.11	13		0.23	0.57		0.16
J18NF7	Test Pit	1	04/21/09	0.043	U	0.04	11000		15	86		0.06	7.4		0.11	13		0.23	29.3		0.16
J18NF6	Equipment Blank	NA	04/22/09	0.041	U	0.04	53	C	14	0.16	B	0.06	0.1	U	0.1	0.43	BC	0.22	0.155	U	0.16
J18PH5	North of trench	1	04/21/09	0.043	U	0.04	11000		15	86		0.06	8	L	0.1	13	L	0.23	33.7		0.16

Table B-2. The 100-D-100 Test Pit and Test Trench Sample Summary. (7 Pages).

HEIS Number	Location	Depth (ft)	Sample Date	Iron			Lead			Lithium			Magnesium			Manganese			Mercury		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J18NF9	Test Pit	1	04/21/09	19000	L	4	2.5		0.29	5.5	N	0.32	4600	L	3.9	270	L	0.11	0.0059	U	0.01
J18NH0	Test Pit	3	04/23/09	23000	L	4	3.1		0.28	5.1		0.32	4300	L	3.9	300	L	0.11	0.0058	U	0.01
J18NH1	Test Pit	5	04/23/09	22000	L	4	3.3		0.28	4.6		0.32	3800	L	3.9	290	L	0.11	0.0058	U	0.01
J18NH2	Test Pit	7	04/23/09	24000	L	3.9	2.1		0.28	3.6		0.31	4200	L	3.8	280	L	0.1	0.0057	U	0.01
J18NH3	Test Pit	9	04/23/09	21000	L	4.1	3.6		0.29	5.6		0.32	4300	L	4	280	L	0.11	0.006	U	0.01
J18NH4	Test Pit	11	04/23/09	21000	L	4.1	3.7		0.29	5.8		0.32	4200	L	4	290	L	0.11	0.0059	U	0.01
J18NH5	Test Pit	15	04/23/09	21000	L	4.1	3.2		0.29	5.6		0.32	4200	L	3.9	300	L	0.11	0.0059	U	0.01
J18NH6	Trench East End	1	04/21/09	20000		4	3		0.28	5.7		0.31	4500		3.9	270	L	0.1	0.0058	U	0.01
J18NH7	Trench East End	3	04/22/09	21000		4	2.4		0.28	5.1		0.31	4300		3.9	280	L	0.1	0.0058	U	0.01
J18NH8	Trench East End	5	04/22/09	26000		4.1	3.5		0.29	5.8		0.32	4800		4	310	L	0.11	0.0059	U	0.01
J18NH9	Trench East End	7	04/22/09	25000		3.9	2		0.28	3.6		0.31	4100		3.8	290	L	0.1	0.0057	U	0.01
J18NJ0	Trench East End	9	04/22/09	25000		3.9	2.1		0.28	3.8		0.31	4100		3.8	340	L	0.1	0.0057	U	0.01
J18NJ1	Trench East End	11	04/22/09	22000		4	2.7		0.28	3.9		0.31	3700		3.9	230	L	0.1	0.0058	U	0.01
J18NJ2	Trench East End	15	04/22/09	21000		4	3		0.29	5.9		0.32	4200		3.9	270	L	0.11	0.0059	U	0.01
J18NJ3	Trench Middle	1	04/21/09	19000	L	3.9	3		0.28	6.1	N	0.31	4300	L	3.8	260	L	0.1	0.0057	U	0.01
J18NJ4	Trench Middle	3	04/22/09	22000	L	4	3		0.28	5.8		0.32	4700	L	3.9	280	L	0.11	0.0058	U	0.01
J18NJ5	Trench Middle	5	04/22/09	22000	L	4	2.4		0.29	4.1		0.32	4000	L	3.9	270	L	0.11	0.0059	U	0.01
J18NJ6	Trench Middle	7	04/22/09	26000	L	4	2		0.28	3.5		0.31	3900	L	3.8	290	L	0.1	0.0058	U	0.01
J18NJ7	Trench Middle	9	04/22/09	26000	L	4	2.1		0.28	3.9		0.31	4000	L	3.9	330	L	0.1	0.0058	U	0.01
J18NJ8	Trench Middle	11	04/22/09	20000	L	4	2.7		0.29	4.5		0.32	3500	L	3.9	250	L	0.11	0.0059	U	0.01
J18NJ9	Trench Middle	15	04/22/09	22000	L	4.1	3.7		0.29	5.9		0.33	4400	L	4	290	L	0.11	0.006	U	0.01
J18NK0	Trench West End	1	04/21/09	18000	L	3.8	2.7		0.27	6	N	0.3	4400	L	3.7	250	L	0.1	0.0056	U	0.01
J18NK1	Trench West End	3	04/22/09	21000	L	3.9	2.3		0.28	4.3		0.31	4100		3.8	260	L	0.1	0.0071	BM	0.01
J18NK2	Trench West End	5	04/22/09	25000	L	4	3.5		0.29	5.9		0.32	5000		3.9	480	L	0.11	0.0059	U	0.01
J18NK3	Trench West End	7	04/22/09	25000	L	4	2.7		0.28	4.7		0.31	4100		3.9	310	L	0.1	0.0058	U	0.01
J18NK4	Trench West End	9	04/22/09	24000	L	3.9	2.2		0.28	3.5		0.31	4000		3.8	280	L	0.1	0.0057	U	0.01
J18NK5	Trench West End	11	04/22/09	22000	L	4	3.2		0.29	5.6		0.32	4300		3.9	290	L	0.11	0.0059	U	0.01
J18NK6	Trench West End	15	04/22/09	22000	L	4.1	3		0.29	5.2		0.32	4200		4	290	L	0.11	0.0059	U	0.01
J18NF8	Trench West End	5	04/22/09	24000		4	3.1		0.29	5.4		0.32	4600		3.9	300		0.11	0.0059	U	0.01
J18NF7	Test Pit	1	04/21/09	20000		4	2.9		0.29	5.5		0.32	4700		3.9	270		0.11	0.0059	U	0.01
J18NF6	Equipment Blank	NA	04/22/09	240	N	3.8	0.47	BM	0.27	0.3	U	0.3	27		3.7	4		0.1	0.0055	U	0.01
J18PH5	North of trench	1	04/21/09	21000		4	3.2		0.28	5.8		0.31	4700		3.8	290		0.1	0.0057	U	0.01

Table B-2. The 100-D-100 Test Pit and Test Trench Sample Summary. (7 Pages).

HEIS Number	Location	Depth (ft)	Sample Date	Molybdedum			Nickel			Potassium			Selenium			Silicon			Silver		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J18NF9	Test Pit	1	04/21/09	0.28	U	0.28	9.4	L	0.13	700		43	0.91	U	0.91	340	L	2.2	0.17	U	0.17
J18NH0	Test Pit	3	04/23/09	0.27	U	0.27	8.1	L	0.13	710		43	0.9	U	0.9	240	L	2.2	0.17	UN	0.17
J18NH1	Test Pit	5	04/23/09	0.27	U	0.27	6.5	L	0.13	820		43	0.91	U	0.91	320	L	2.2	0.17	U	0.17
J18NH2	Test Pit	7	04/23/09	0.27	U	0.27	12	L	0.13	500		42	0.89	U	0.89	210	L	2.2	0.17	U	0.17
J18NH3	Test Pit	9	04/23/09	0.28	U	0.28	10	L	0.13	890		44	0.93	U	0.93	250	L	2.3	0.17	U	0.17
J18NH4	Test Pit	11	04/23/09	0.28	U	0.28	8	L	0.13	820		44	0.92	U	0.92	340	L	2.3	0.17	U	0.17
J18NH5	Test Pit	15	04/23/09	0.28	U	0.28	11	L	0.13	720		44	0.92	U	0.92	260	L	2.2	0.17	U	0.17
J18NH6	Trench East End	1	04/21/09	0.45	BM	0.27	10	L	0.13	790		43	0.9	U	0.9	220	LM	2.2	0.17	U	0.17
J18NH7	Trench East End	3	04/22/09	0.27	U	0.27	8.2	L	0.13	680		43	0.9	U	0.9	360	L	2.2	0.17	U	0.17
J18NH8	Trench East End	5	04/22/09	0.28	U	0.28	10	L	0.13	970		44	0.92	U	0.92	910	L	2.3	0.17	U	0.17
J18NH9	Trench East End	7	04/22/09	0.28	B	0.27	8.1	L	0.13	550		42	0.89	U	0.89	410	L	2.2	0.17	U	0.17
J18NJ0	Trench East End	9	04/22/09	0.27	B	0.27	9.5	L	0.13	640		43	0.89	U	0.89	400	L	2.2	0.17	U	0.17
J18NJ1	Trench East End	11	04/22/09	0.27	U	0.27	7.3	L	0.13	630		43	0.9	U	0.9	460	L	2.2	0.17	U	0.17
J18NJ2	Trench East End	15	04/22/09	0.28	U	0.28	9.2	L	0.13	810		44	0.92	U	0.92	550	L	2.2	0.17	U	0.17
J18NJ3	Trench Middle	1	04/21/09	0.31	B	0.27	10	L	0.13	790		43	0.89	U	0.89	340	L	2.2	0.17	UN	0.17
J18NJ4	Trench Middle	3	04/22/09	0.27	U	0.27	13	L	0.13	740		43	0.91	U	0.91	260	L	2.2	0.17	U	0.17
J18NJ5	Trench Middle	5	04/22/09	0.28	U	0.28	8	L	0.13	680		43	0.91	U	0.91	460	L	2.2	0.17	U	0.17
J18NJ6	Trench Middle	7	04/22/09	0.27	U	0.27	8.2	L	0.13	540		43	0.89	U	0.89	270	L	2.2	0.17	U	0.17
J18NJ7	Trench Middle	9	04/22/09	0.31	B	0.27	8.5	L	0.13	630		43	0.9	U	0.9	420	L	2.2	0.17	U	0.17
J18NJ8	Trench Middle	11	04/22/09	0.28	U	0.28	7.3	L	0.13	710		44	0.92	U	0.92	510	L	2.2	0.17	U	0.17
J18NJ9	Trench Middle	15	04/22/09	0.28	U	0.28	11	L	0.13	950		44	0.93	U	0.93	470	L	2.3	0.17	U	0.17
J18NK0	Trench West End	1	04/21/09	0.26	U	0.26	9.8	L	0.12	760		41	0.87	U	0.87	370	LN	2.1	0.16	U	0.16
J18NK1	Trench West End	3	04/22/09	0.38	B	0.27	10	L	0.13	550		43	0.89	U	0.89	200	L	2.2	0.17	U	0.17
J18NK2	Trench West End	5	04/22/09	0.3	B	0.28	13	L	0.13	890		44	0.92	U	0.92	300	L	2.2	0.17	U	0.17
J18NK3	Trench West End	7	04/22/09	0.32	B	0.27	8	L	0.13	750		43	0.9	U	0.9	260	L	2.2	0.17	U	0.17
J18NK4	Trench West End	9	04/22/09	0.28	B	0.27	9.6	L	0.13	590		42	0.89	U	0.89	190	L	2.2	0.17	U	0.17
J18NK5	Trench West End	11	04/22/09	0.28	U	0.28	10	L	0.13	840		44	0.92	U	0.92	280	L	2.2	0.17	U	0.17
J18NK6	Trench West End	15	04/22/09	0.28	U	0.28	10	L	0.13	780		44	0.92	U	0.92	240	L	2.2	0.17	U	0.17
J18NF8	Trench West End	5	04/22/09	0.28	U	0.28	8.2		0.13	850		44	0.91	U	0.91	570		2.2	0.17	U	0.17
J18NF7	Test Pit	1	04/21/09	0.28	U	0.28	9.8		0.13	750		43	0.91	U	0.91	460		2.2	0.17	U	0.17
J18NF6	Equipment Blank	NA	04/22/09	0.26	U	0.26	0.12	U	0.12	44	BM	41	0.86	U	0.86	160		2.1	0.16	U	0.16
J18PH5	North of trench	1	04/21/09	0.35	B	0.27	10		0.13	740		43	0.89	U	0.89	390	N	2.2	0.17	U	0.17

Table B-2. The 100-D-100 Test Pit and Test Trench Sample Summary. (7 Pages).

HEIS Number	Location	Depth (ft)	Sample Date	Sodium			Vanadium			Zinc		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J18NF9	Test Pit	1	04/21/09	600		63	54	L	0.1	36	L	0.42
J18NH0	Test Pit	3	04/23/09	520		62	69	L	0.1	42	L	0.42
J18NH1	Test Pit	5	04/23/09	360		62	57	L	0.1	39	L	0.42
J18NH2	Test Pit	7	04/23/09	400		61	69	L	0.1	43	L	0.41
J18NH3	Test Pit	9	04/23/09	540		64	58	L	0.1	42	L	0.43
J18NH4	Test Pit	11	04/23/09	510		63	58	L	0.1	40	L	0.43
J18NH5	Test Pit	15	04/23/09	560		63	54	L	0.1	40	L	0.42
J18NH6	Trench East End	1	04/21/09	1200		61	60		0.1	40	L	0.41
J18NH7	Trench East End	3	04/22/09	610		62	53		0.1	34	L	0.42
J18NH8	Trench East End	5	04/22/09	660		63	68		0.1	45	L	0.43
J18NH9	Trench East End	7	04/22/09	620		61	71		0.1	42	L	0.41
J18NJ0	Trench East End	9	04/22/09	560		61	71		0.1	42	L	0.41
J18NJ1	Trench East End	11	04/22/09	630		62	57		0.1	38	L	0.42
J18NJ2	Trench East End	15	04/22/09	480		63	56		0.1	40	L	0.42
J18NJ3	Trench Middle	1	04/21/09	920		61	51	L	0.1	34	L	0.41
J18NJ4	Trench Middle	3	04/22/09	820		62	61	L	0.1	40	L	0.42
J18NJ5	Trench Middle	5	04/22/09	570		62	58	L	0.1	37	L	0.42
J18NJ6	Trench Middle	7	04/22/09	680		61	75	L	0.1	42	L	0.41
J18NJ7	Trench Middle	9	04/22/09	690		62	73	L	0.1	43	L	0.42
J18NJ8	Trench Middle	11	04/22/09	530		63	53	L	0.1	35	L	0.42
J18NJ9	Trench Middle	15	04/22/09	680		64	58	L	0.1	39	L	0.43
J18NK0	Trench West End	1	04/21/09	490		60	50		0.1	35	L	0.4
J18NK1	Trench West End	3	04/22/09	660		61	61	L	0.1	38	L	0.41
J18NK2	Trench West End	5	04/22/09	600		63	70	L	0.1	46	L	0.42
J18NK3	Trench West End	7	04/22/09	650		62	75	L	0.1	46	L	0.42
J18NK4	Trench West End	9	04/22/09	560		61	71	L	0.1	42	L	0.41
J18NK5	Trench West End	11	04/22/09	730		63	65	L	0.1	43	L	0.42
J18NK6	Trench West End	15	04/22/09	510		63	63	L	0.1	40	L	0.43
J18NF8	Trench West End	5	04/22/09	590		63	66		0.1	42		0.42
J18NF7	Test Pit	1	04/21/09	640		62	55		0.1	35		0.42
J18NF6	Equipment Blank	NA	04/22/09	59	U	59	0.32	B	0.09	0.73	B	0.4
J18PH5	North of trench	1	04/21/09	1600		61	56		0.1	36		0.41

HEIS Number	Location	Depth (ft)	Sample Date	Arsenic-TCLP			Barium-TCLP			Cadmium-TCLP			Chromium-TCLP		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J18NH6	Trench Middle	7	04/21/09	0.022	UM	0.022	0.38	BC	0.0025	0.002	U	0.002	5.9		0.003

HEIS Number	Location	Depth (ft)	Sample Date	Lead-TCLP			Mercury-TCLP			Selenium-TCLP			Silver-TCLP		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J18NH6	Trench Middle	7	04/21/09	0.013	U	0.013	7.8E-05	BC	2.7E-05	0.024	U	0.024	0.0045	U	0.0045

Table B-2. The 100-D-100 Test Pit and Test Trench Sample Summary. (7 Pages).

HEIS Number	Location	Depth (ft)	Sample Date	Bromide			Chloride			Fluoride			Nitrogen in Nitrate		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J18NF9	Test Pit	1	04/21/09	1.6	B	0.41	11		2.1	3	B	0.87	57	N	0.33
J18NH0	Test Pit	3	04/23/09	0.41	U	0.41	4	BM	2.1	3.8	BMN	0.86	3.2		0.33
J18NH1	Test Pit	5	04/23/09	0.41	U	0.41	6.7		2.1	2.1	B	0.87	3.3		0.33
J18NH2	Test Pit	7	04/23/09	0.4	U	0.4	6.4		2	1.1	B	0.85	2	B	0.32
J18NH3	Test Pit	9	04/23/09	0.45	B	0.42	8.8		2.1	1.3	B	0.89	8.3		0.34
J18NH4	Test Pit	11	04/23/09	0.49	B	0.42	7.9		2.1	0.88	U	0.88	9.5		0.34
J18NH5	Test Pit	15	04/23/09	0.41	U	0.41	7.5		2.1	1.2	B	0.88	5.4		0.34
J18NH6	Trench East End	1	04/21/09	1.9	B	0.4	15		2.1	3.6	B	0.86	110	DN	0.65
J18NH7	Trench East End	3	04/22/09	0.41	U	0.41	4.7	B	2.1	2.3	B	0.86	3.4		0.33
J18NH8	Trench East End	5	04/22/09	0.42	U	0.42	5.6		2.1	1	B	0.88	7.1		0.34
J18NH9	Trench East End	7	04/22/09	0.4	U	0.4	4.3	B	2	1.1	B	0.85	2.3	B	0.33
J18NJ0	Trench East End	9	04/22/09	0.4	U	0.4	3.9	B	2	1.1	B	0.85	2	B	0.33
J18NJ1	Trench East End	11	04/22/09	0.41	U	0.41	5	B	2.1	1.3	B	0.86	2.2	B	0.33
J18NJ2	Trench East End	15	04/22/09	0.41	U	0.41	4.7	B	2.1	1.1	B	0.88	2.3	B	0.33
J18NJ3	Trench Middle	1	04/21/09	0.4	U	0.4	4.5	B	2	10		0.85	3.8		0.33
J18NJ4	Trench Middle	3	04/22/09	0.41	U	0.41	4.8	B	2.1	3.5	B	0.87	6.6		0.33
J18NJ5	Trench Middle	5	04/22/09	0.41	U	0.41	4.9	B	2.1	3.1	B	0.87	4.4		0.33
J18NJ6	Trench Middle	7	04/22/09	0.4	U	0.4	4.2	B	2	2	B	0.85	2	B	0.33
J18NJ7	Trench Middle	9	04/22/09	0.4	U	0.4	4.8	B	2.1	0.97	B	0.86	2.4	B	0.33
J18NJ8	Trench Middle	11	04/22/09	0.41	U	0.41	5.1	B	2.1	1.7	B	0.88	3.1		0.33
J18NJ9	Trench Middle	15	04/22/09	0.42	U	0.42	5.6		2.1	1.1	B	0.89	3		0.34
J18NK0	Trench West End	1	04/21/09	0.39	U	0.39	3.2	B	2	1.4	B	0.83	2.3	B	0.32
J18NK1	Trench West End	3	04/22/09	0.4	U	0.4	5	BM	2	1.2	B	0.85	0.52	B	0.33
J18NK2	Trench West End	5	04/22/09	0.41	U	0.41	7.1		2.1	1.4	B	0.88	0.86	B	0.33
J18NK3	Trench West End	7	04/22/09	0.41	U	0.41	6.7		2.1	1.6	B	0.86	0.87	B	0.33
J18NK4	Trench West End	9	04/22/09	0.4	U	0.4	6.3		2	0.85	U	0.85	0.51	B	0.32
J18NK5	Trench West End	11	04/22/09	0.41	U	0.41	7.4		2.1	1.2	B	0.88	0.78	B	0.33
J18NK6	Trench West End	15	04/22/09	0.42	U	0.42	7		2.1	1.1	B	0.88	0.88	B	0.34
J18NF8	Trench West End	5	04/22/09	0.41	U	0.41	4.5	B	2.1	1.6	B	0.87	1.1	B	0.33
J18NF7	Test Pit	1	04/21/09	1.5	B	0.41	17		2.1	2.7	B	0.87	53		0.33
J18NF6	Equipment Blank	NA	04/22/09	0.39	U	0.39	5.3		2	0.82	U	0.82	0.31	U	0.31
J18PH5	North of trench	1	04/21/09	4.2	M	2	36		2	4	B	0.85	170	D	1.6

Table B-2. The 100-D-100 Test Pit and Test Trench Sample Summary. (7 Pages).

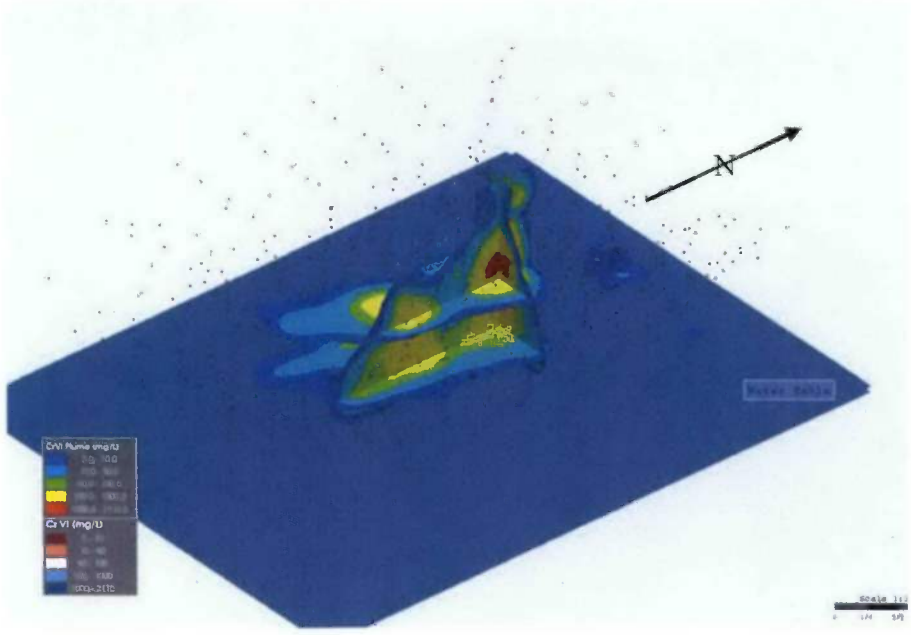
HEIS Number	Location	Depth (ft)	Sample Date	Nitrogen in Nitrite			Phosphorous in Phosphate			Sulfate			% moisture (wet sample)
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg
J18NF9	Test Pit	1	04/21/09	0.36	U	0.36	1.3	U	1.3	98		1.8	5.6
J18NH0	Test Pit	3	04/23/09	0.35	U	0.35	1.3	U	1.3	24	M	1.8	4.8
J18NH1	Test Pit	5	04/23/09	0.43	B	0.35	1.3	U	1.3	240		1.8	5.1
J18NH2	Test Pit	7	04/23/09	0.42	B	0.35	1.3	U	1.3	28		1.8	3.1
J18NH3	Test Pit	9	04/23/09	0.46	B	0.36	1.3	U	1.3	93		1.9	7.2
J18NH4	Test Pit	11	04/23/09	0.43	B	0.36	1.3	U	1.3	92		1.9	7
J18NH5	Test Pit	15	04/23/09	0.41	B	0.36	1.3	U	1.3	72		1.8	6.3
J18NH6	Trench East End	1	04/21/09	0.35	U	0.35	1.3	U	1.3	430		1.8	3.9
J18NH7	Trench East End	3	04/22/09	0.43	B	0.35	1.3	U	1.3	44		1.8	4.6
J18NH8	Trench East End	5	04/22/09	0.4	B	0.36	1.3	U	1.3	480		1.9	6.7
J18NH9	Trench East End	7	04/22/09	0.35	U	0.35	1.3	U	1.3	110		1.8	3.4
J18NJ0	Trench East End	9	04/22/09	0.35	U	0.35	1.3	U	1.3	170		1.8	3.8
J18NJ1	Trench East End	11	04/22/09	0.46	B	0.35	1.3	U	1.3	360		1.8	4.7
J18NJ2	Trench East End	15	04/22/09	0.43	B	0.36	1.3	U	1.3	93		1.8	6.1
J18NJ3	Trench Middle	1	04/21/09	0.35	U	0.35	1.3	U	1.3	5.3		1.8	3.5
J18NJ4	Trench Middle	3	04/22/09	0.46	B	0.35	1.3	U	1.3	15		1.8	5.1
J18NJ5	Trench Middle	5	04/22/09	0.44	B	0.36	1.3	U	1.3	26		1.8	5.6
J18NJ6	Trench Middle	7	04/22/09	0.37	B	0.35	1.3	U	1.3	25		1.8	3.8
J18NJ7	Trench Middle	9	04/22/09	0.37	B	0.35	1.3	U	1.3	35		1.8	4.1
J18NJ8	Trench Middle	11	04/22/09	0.41	B	0.36	1.3	U	1.3	49		1.8	6.1
J18NJ9	Trench Middle	15	04/22/09	0.41	B	0.36	1.3	U	1.3	79		1.9	7.8
J18NK0	Trench West End	1	04/21/09	0.34	U	0.34	1.3	U	1.3	5		1.7	0.98
J18NK1	Trench West End	3	04/22/09	0.38	B	0.35	1.3	U	1.3	2.7	B	1.8	3.7
J18NK2	Trench West End	5	04/22/09	0.4	B	0.36	1.3	U	1.3	18		1.8	6.1
J18NK3	Trench West End	7	04/22/09	0.43	B	0.35	1.3	U	1.3	150		1.8	4.6
J18NK4	Trench West End	9	04/22/09	0.4	B	0.35	1.3	U	1.3	120		1.8	3.2
J18NK5	Trench West End	11	04/22/09	0.39	B	0.36	1.3	U	1.3	310		1.8	6.2
J18NK6	Trench West End	15	04/22/09	0.4	B	0.36	1.3	U	1.3	51		1.9	6.6
J18NF8	Trench West End	5	04/22/09	0.36	U	0.36	1.3	U	1.3	25		1.8	5.9
J18NF7	Test Pit	1	04/21/09	0.36	U	0.36	1.3	U	1.3	88		1.8	5.6
J18NF6	Equipment Blank	NA	04/22/09	0.34	U	0.34	1.2	U	1.2	1.9	B	1.7	0.12
J18PH5	North of trench	1	04/21/09	0.35	U	0.35	1.3	U	1.3	920	D	9	3.8

APPENDIX C

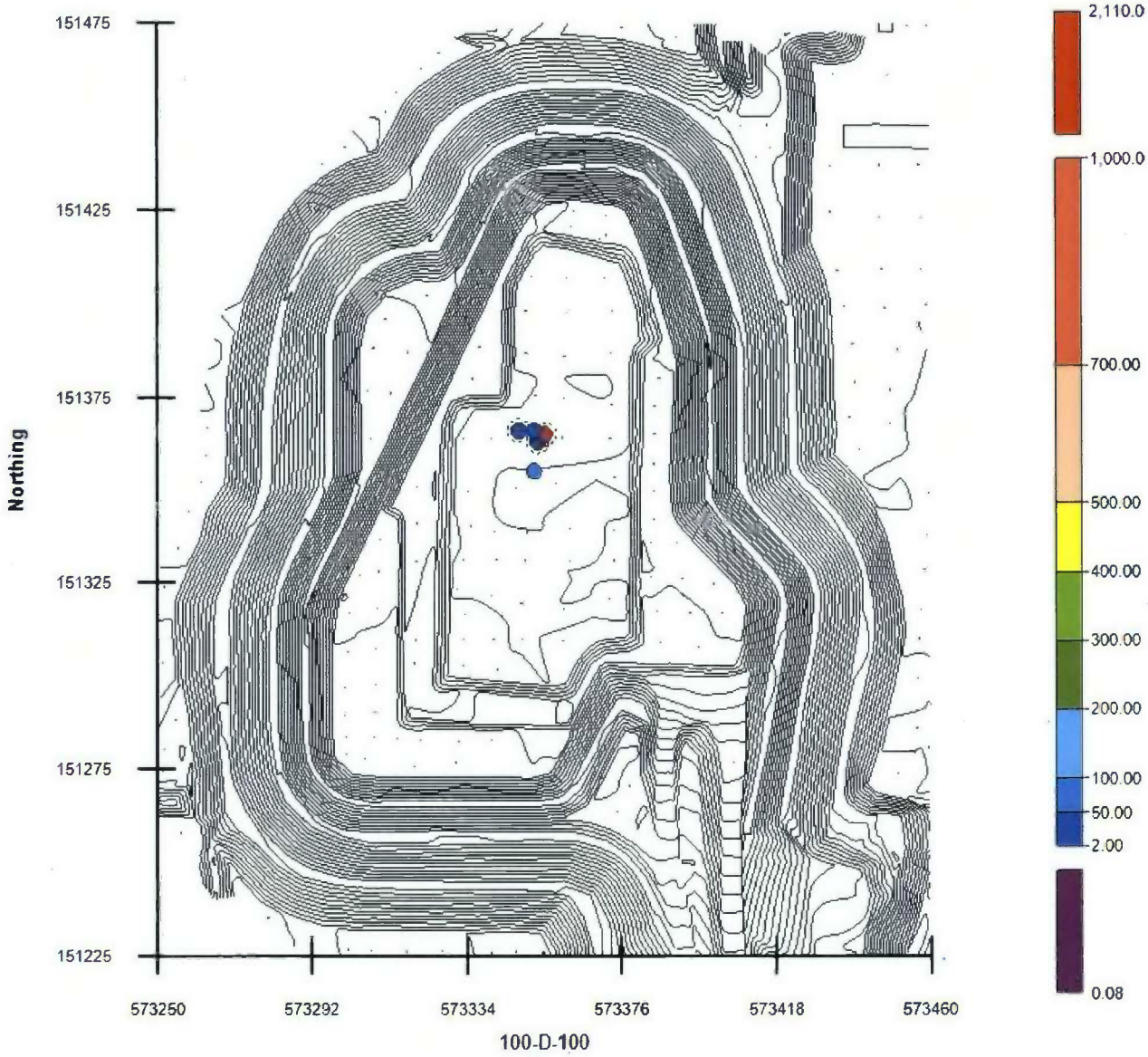
IN-PROCESS GRIDDED SAMPLE DATA EVALUATION USED TO GUIDE EXCAVATION

C-1. Model of Hexavalent Chromium Plume in the Vadose Zone at the 100-D-100 Waste Site Using Gridded Sample Results (Results Greater than 2.0 mg/kg).

C-2. Cross Section of Hexavalent Chromium in the Vadose Zone at the 100-D-100 Waste Site Using Gridded Sample Results (mg/kg).

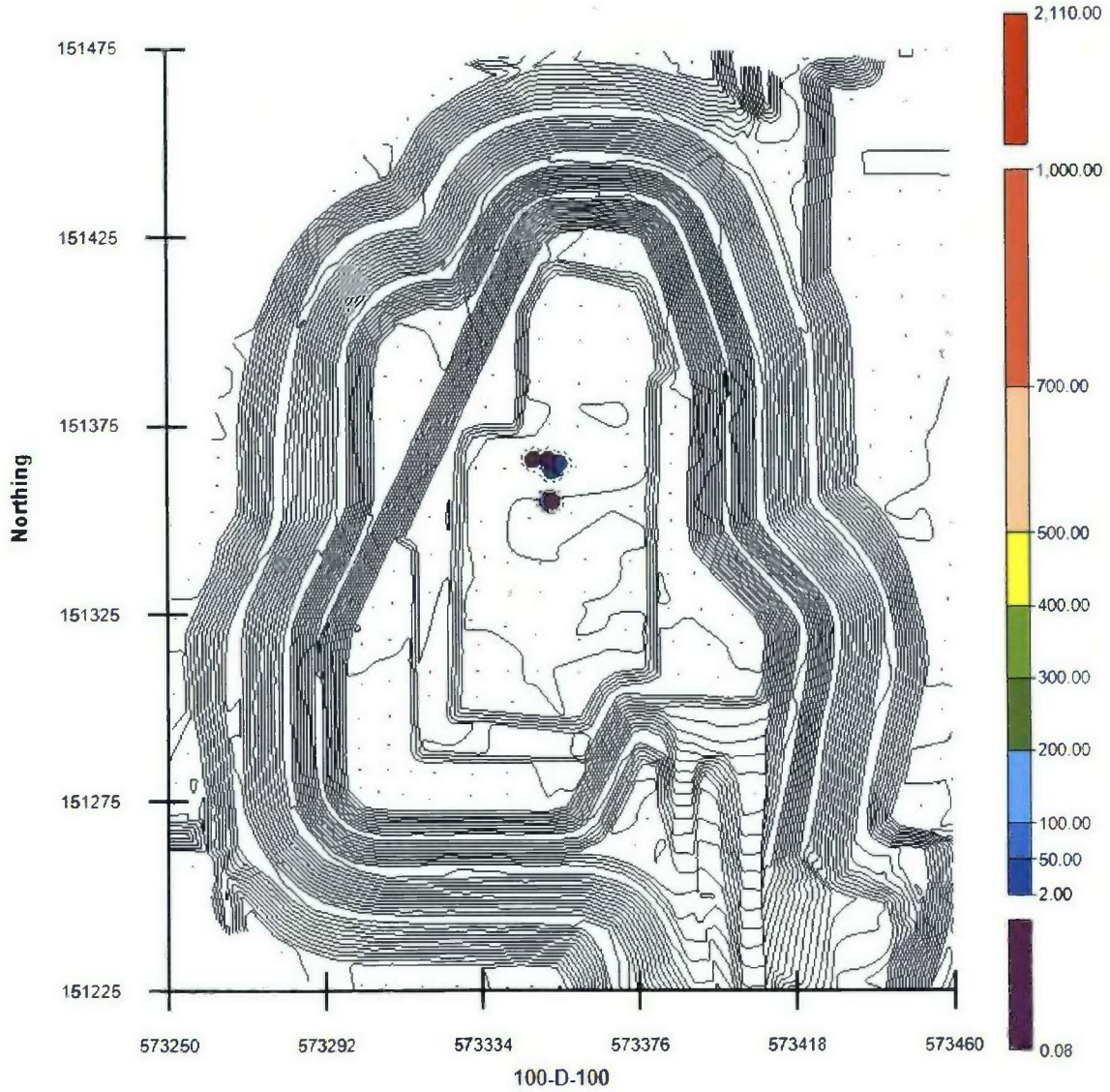


Hexavalent Chromium Samples



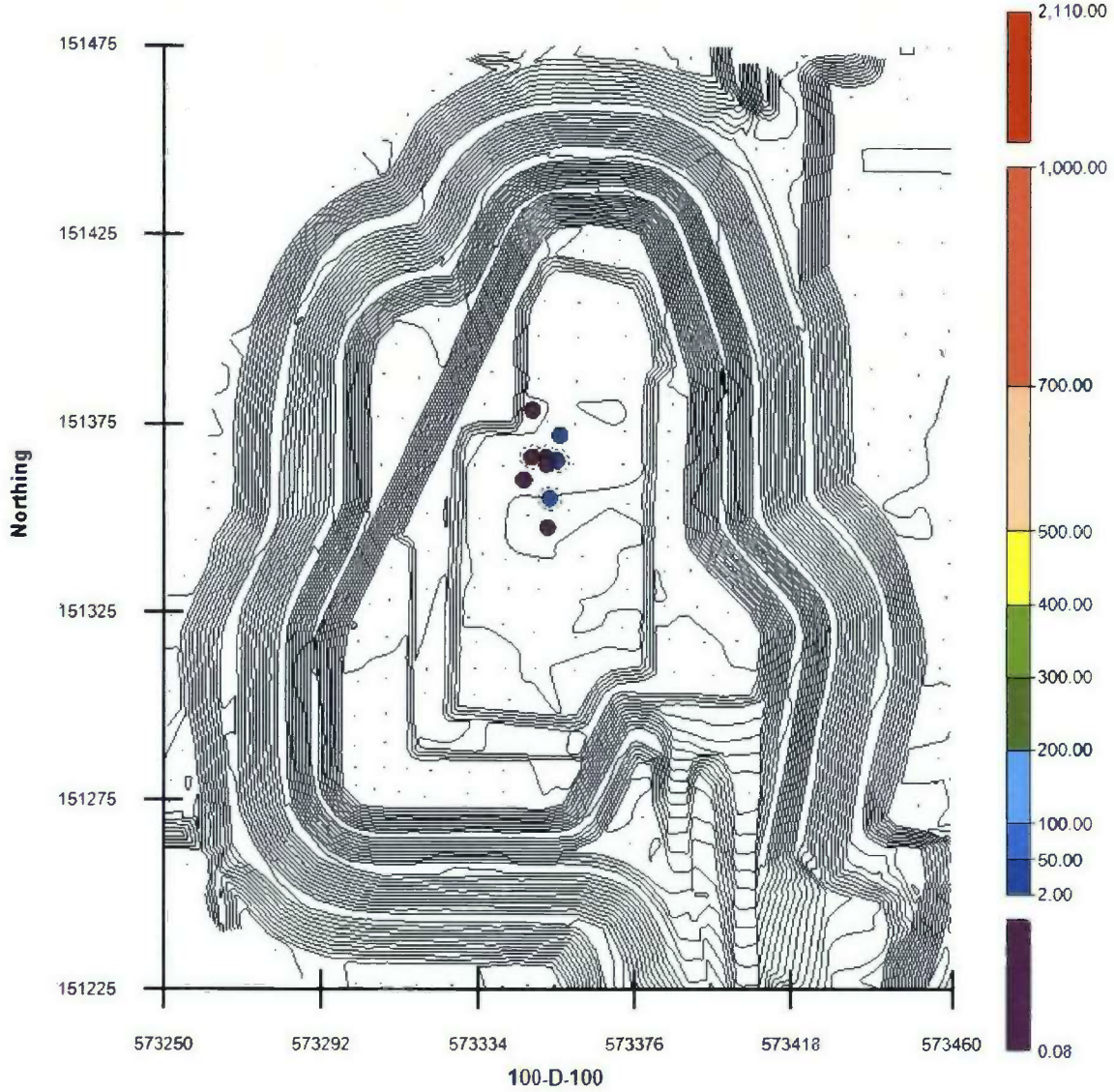
Surface (mg/kg)

Hexavalent Chromium Samples



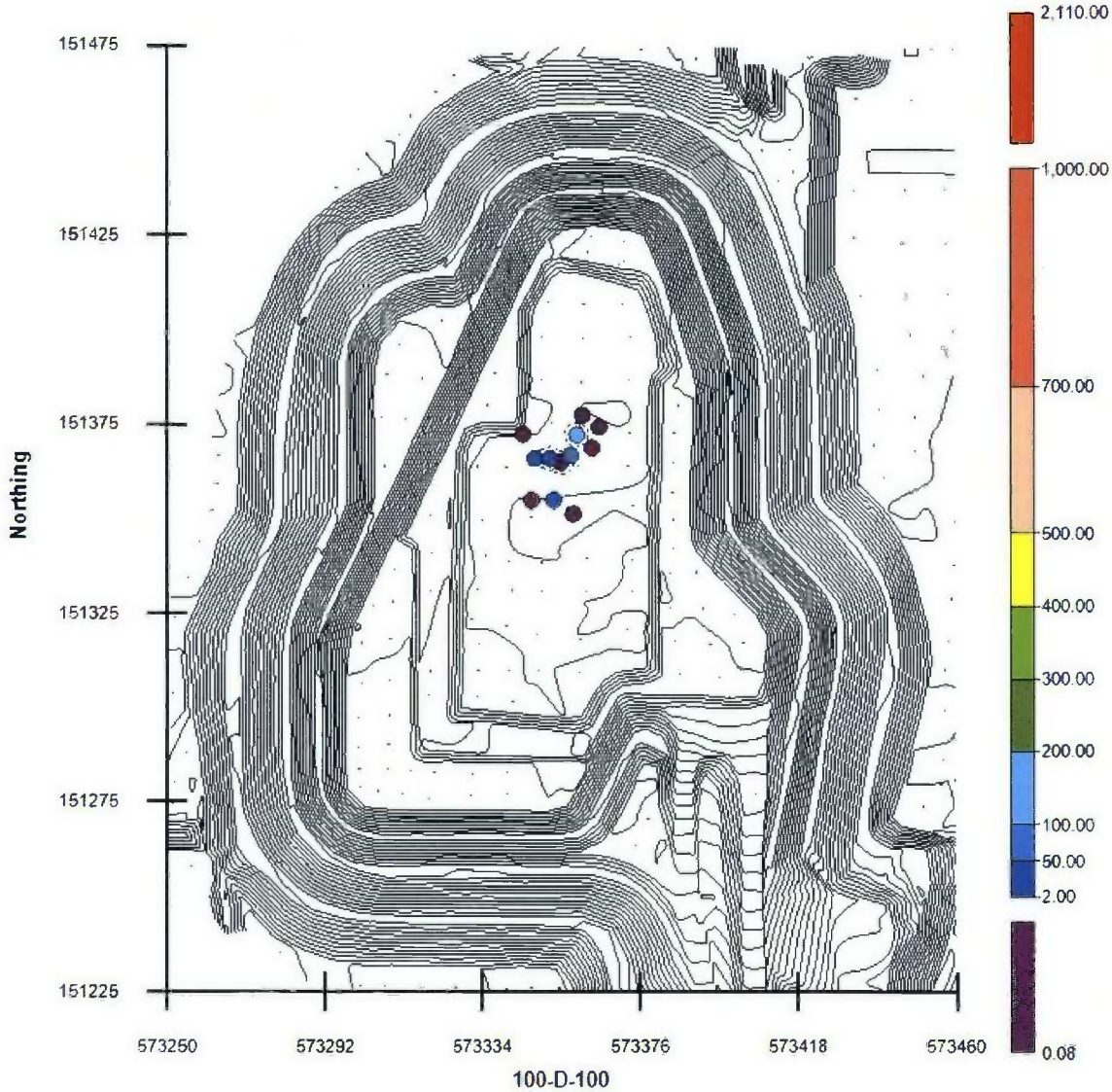
Surface to 5 ft Depth (mg/kg)

Hexavalent Chromium Samples



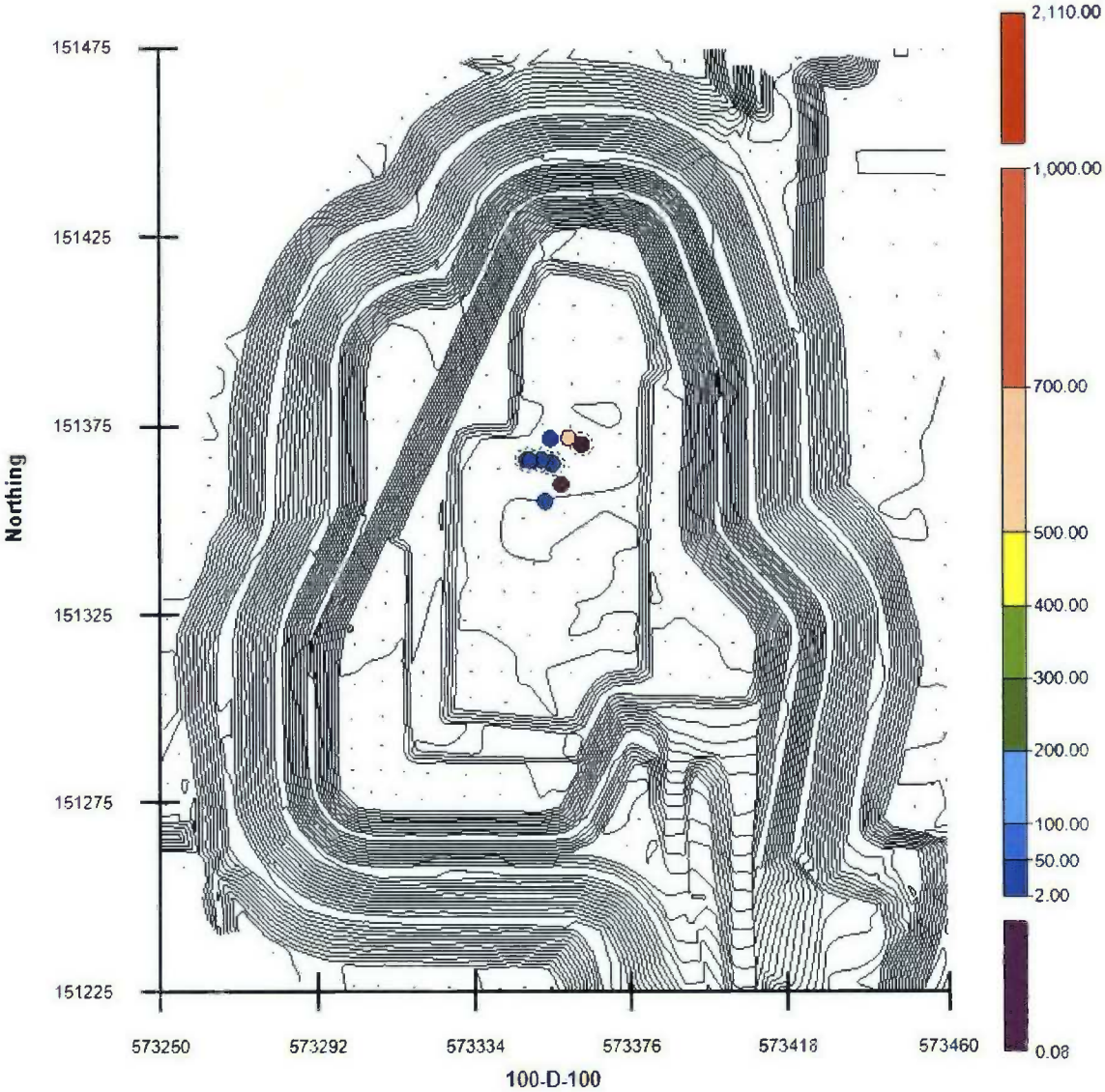
5 Foot Depth (mg/kg)

Hexavalent Chromium Samples



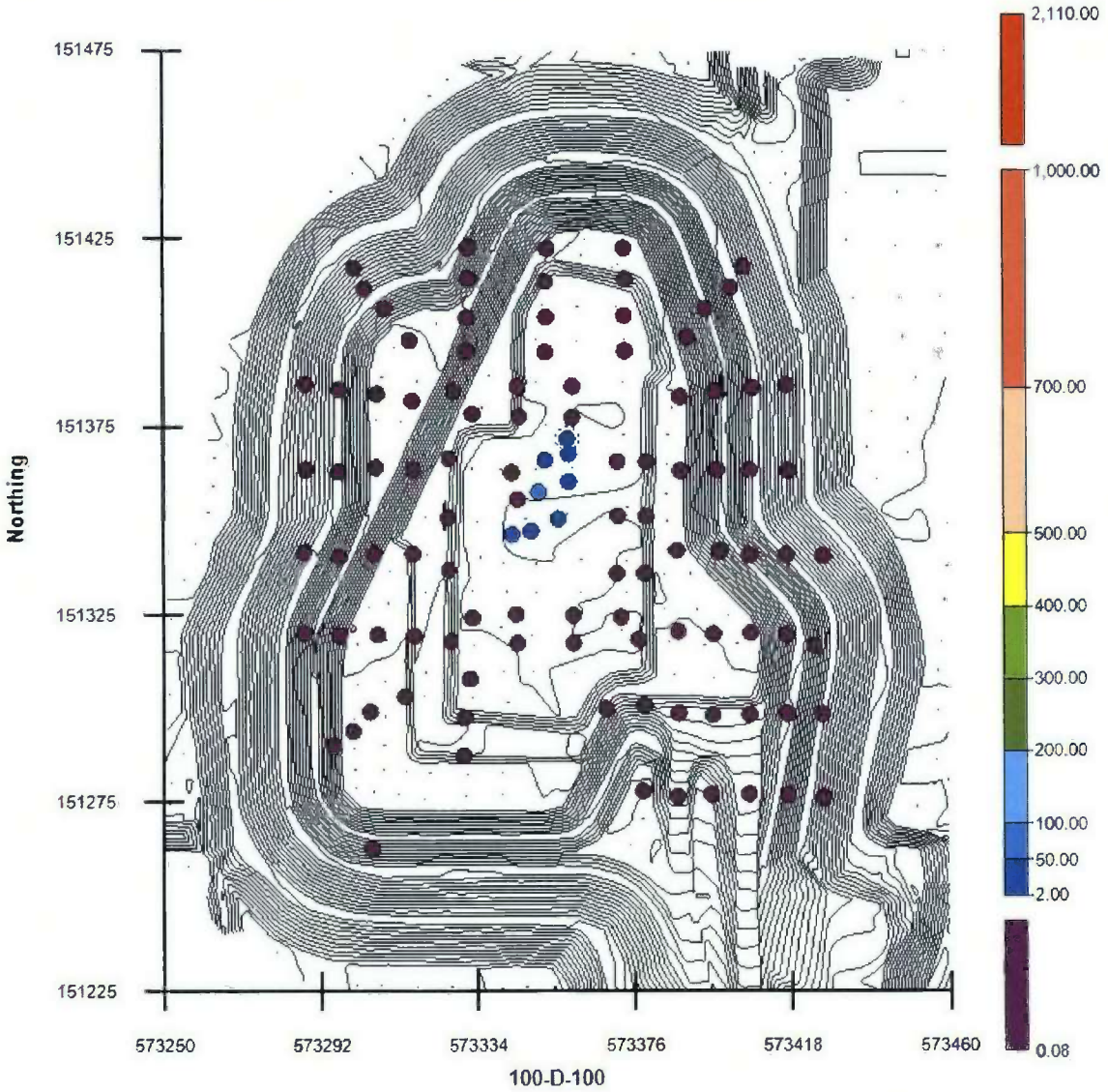
10 Foot Depth (mg/kg)

Hexavalent Chromium Samples



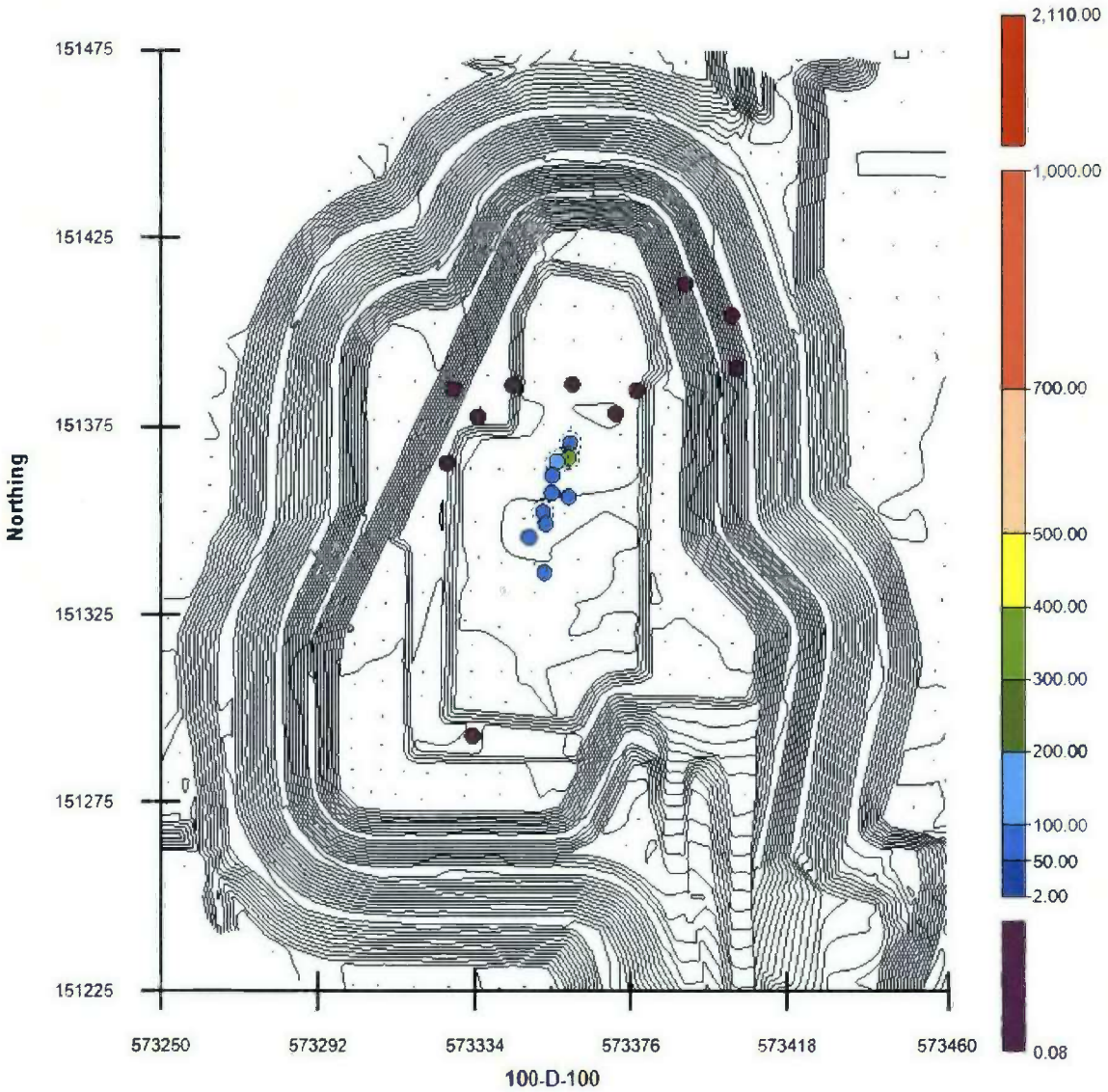
15 Foot Depth (mg/kg)

Hexavalent Chromium Samples



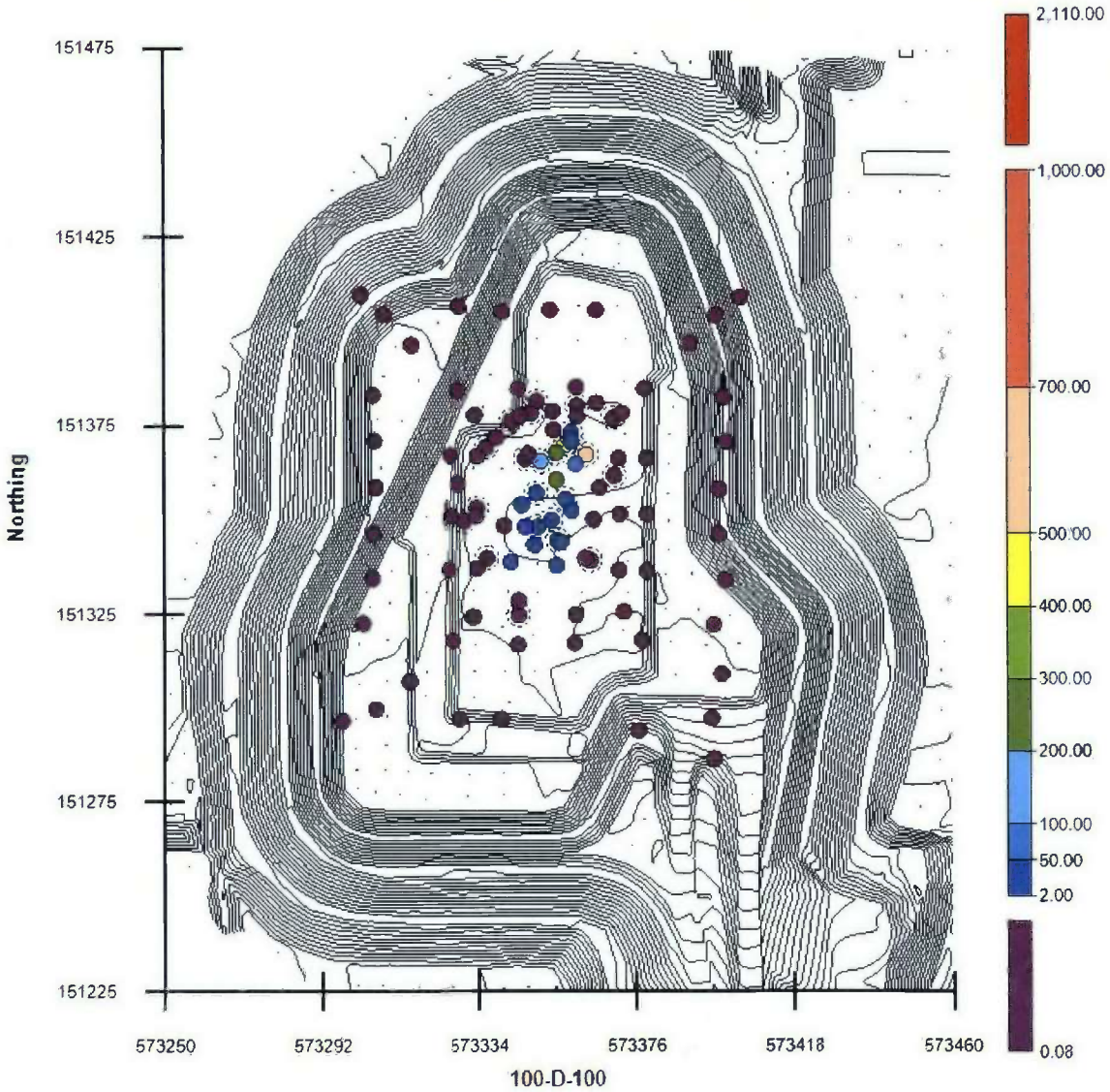
20 Foot Depth (mg/kg)

Hexavalent Chromium Samples



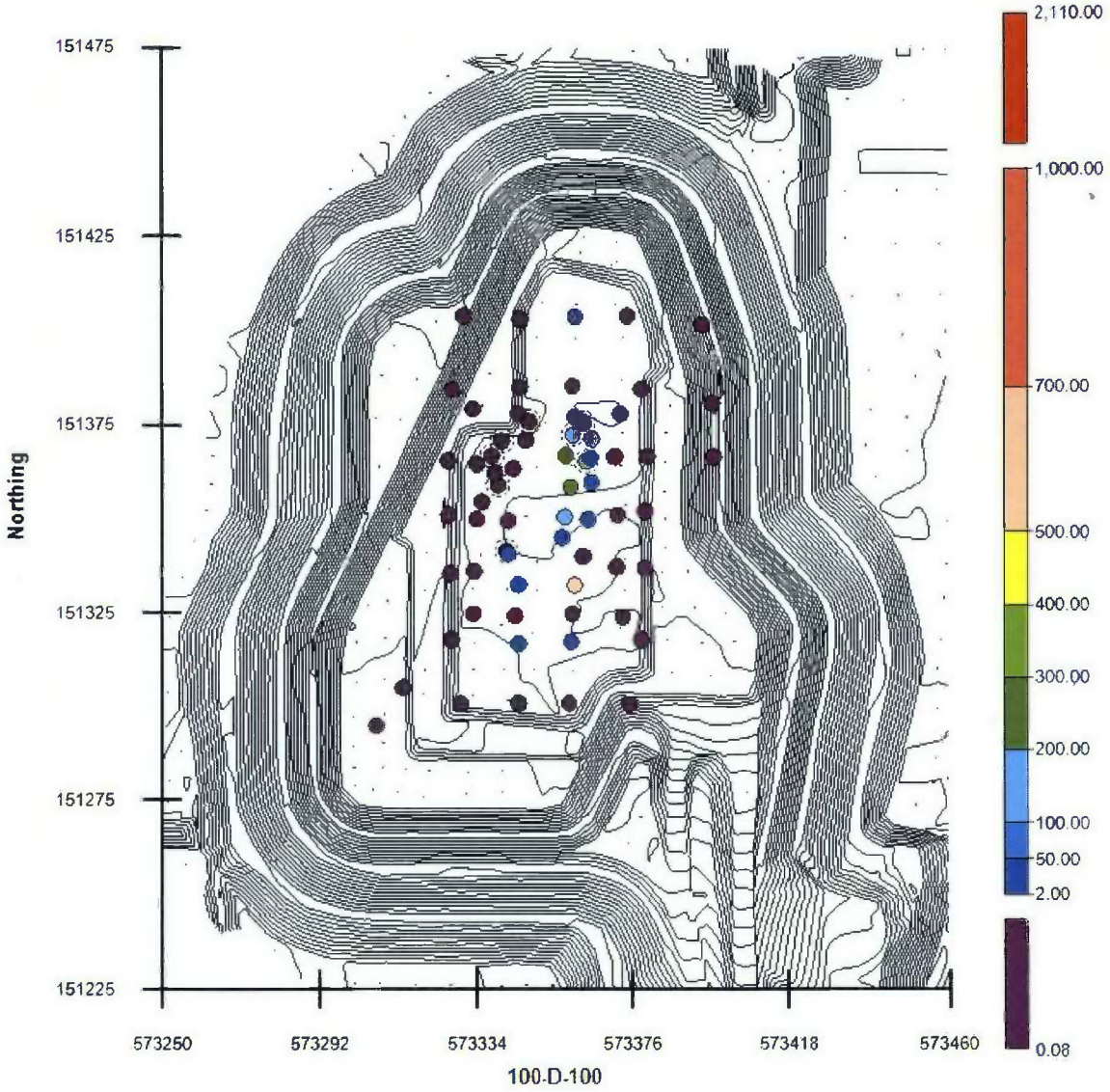
25 Foot Depth (mg/kg)

Hexavalent Chromium Samples



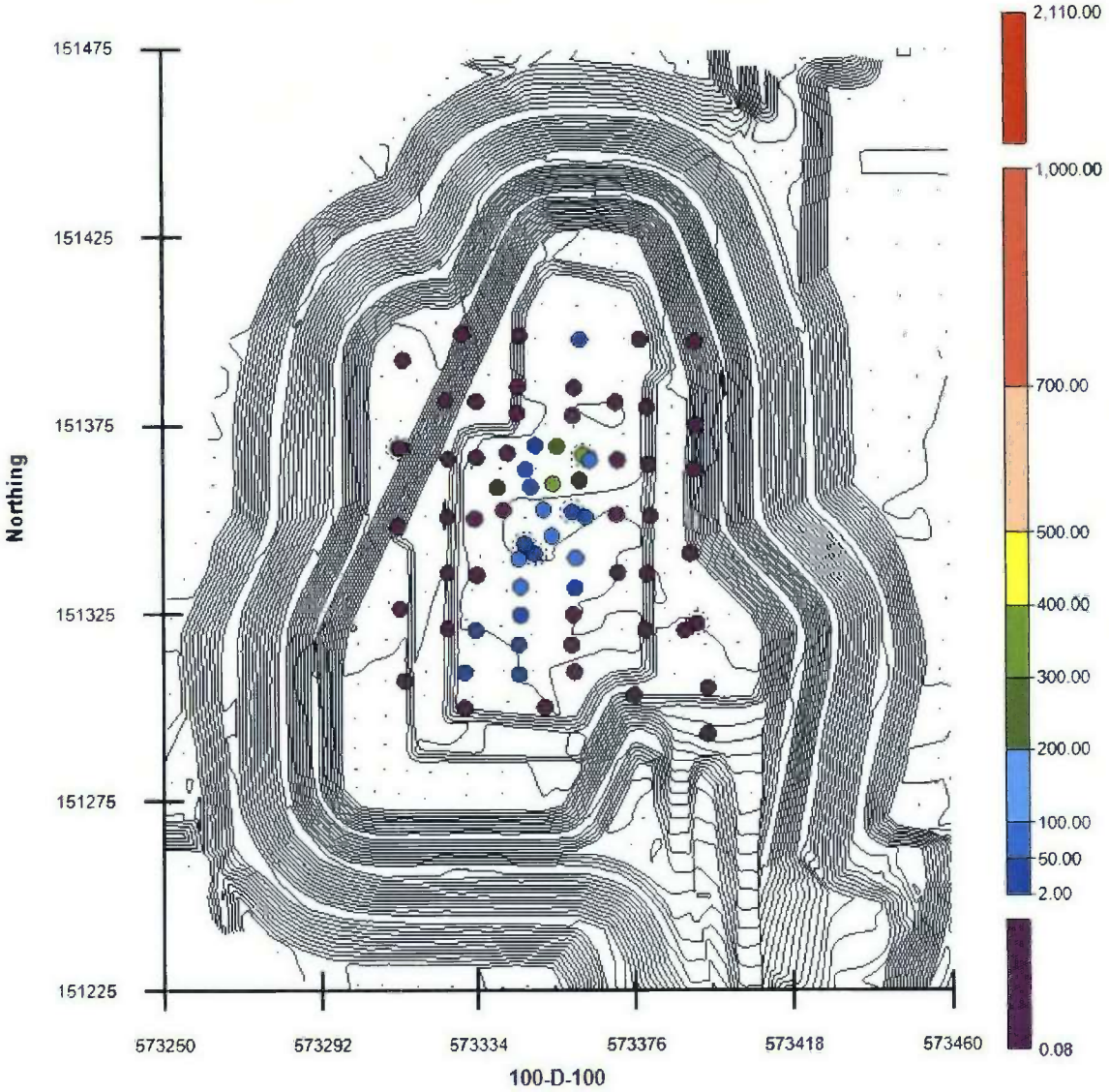
30 Foot Depth (mg/kg)

Hexavalent Chromium Samples



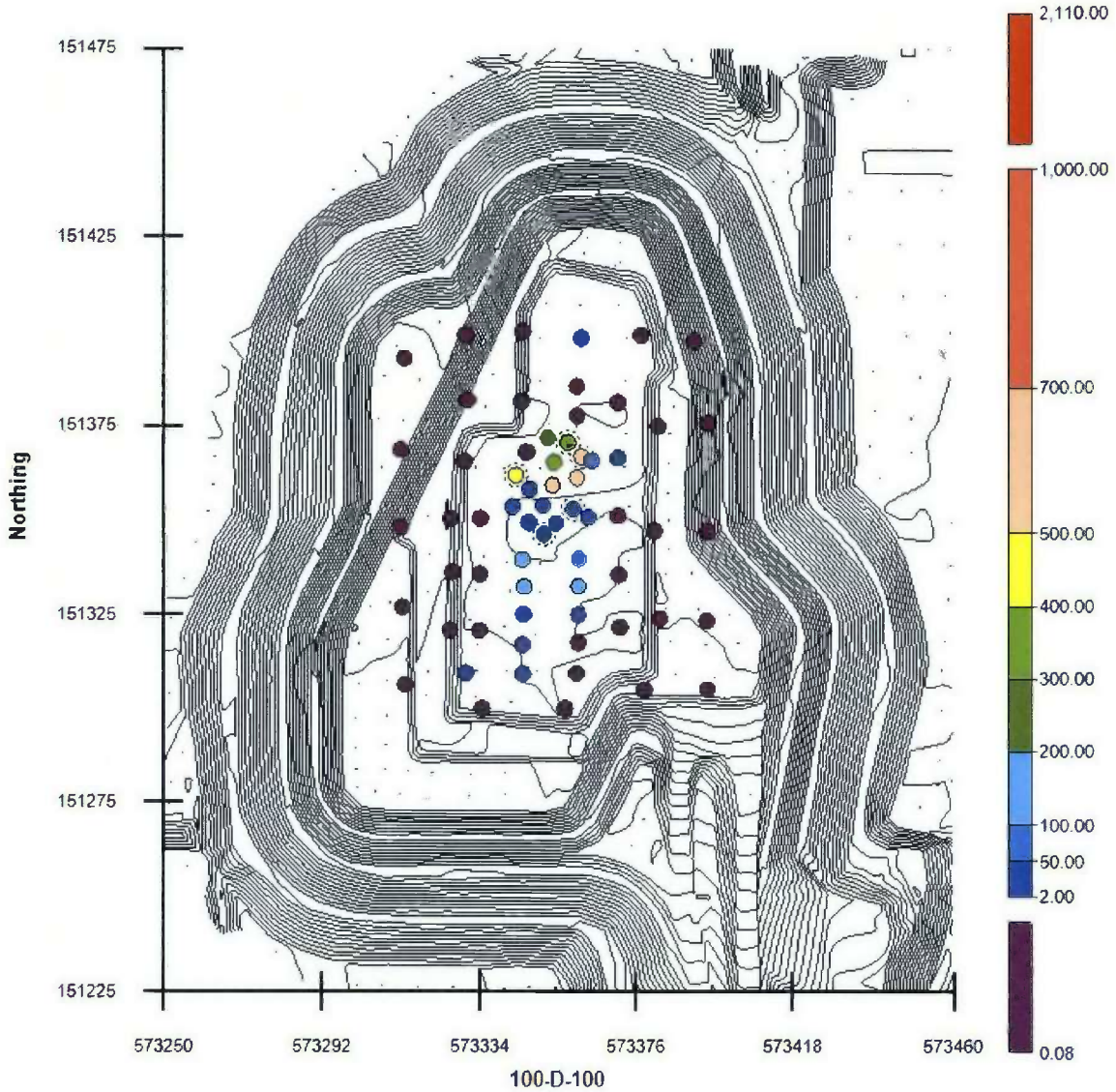
35 Foot Depth (mg/kg)

Hexavalent Chromium Samples



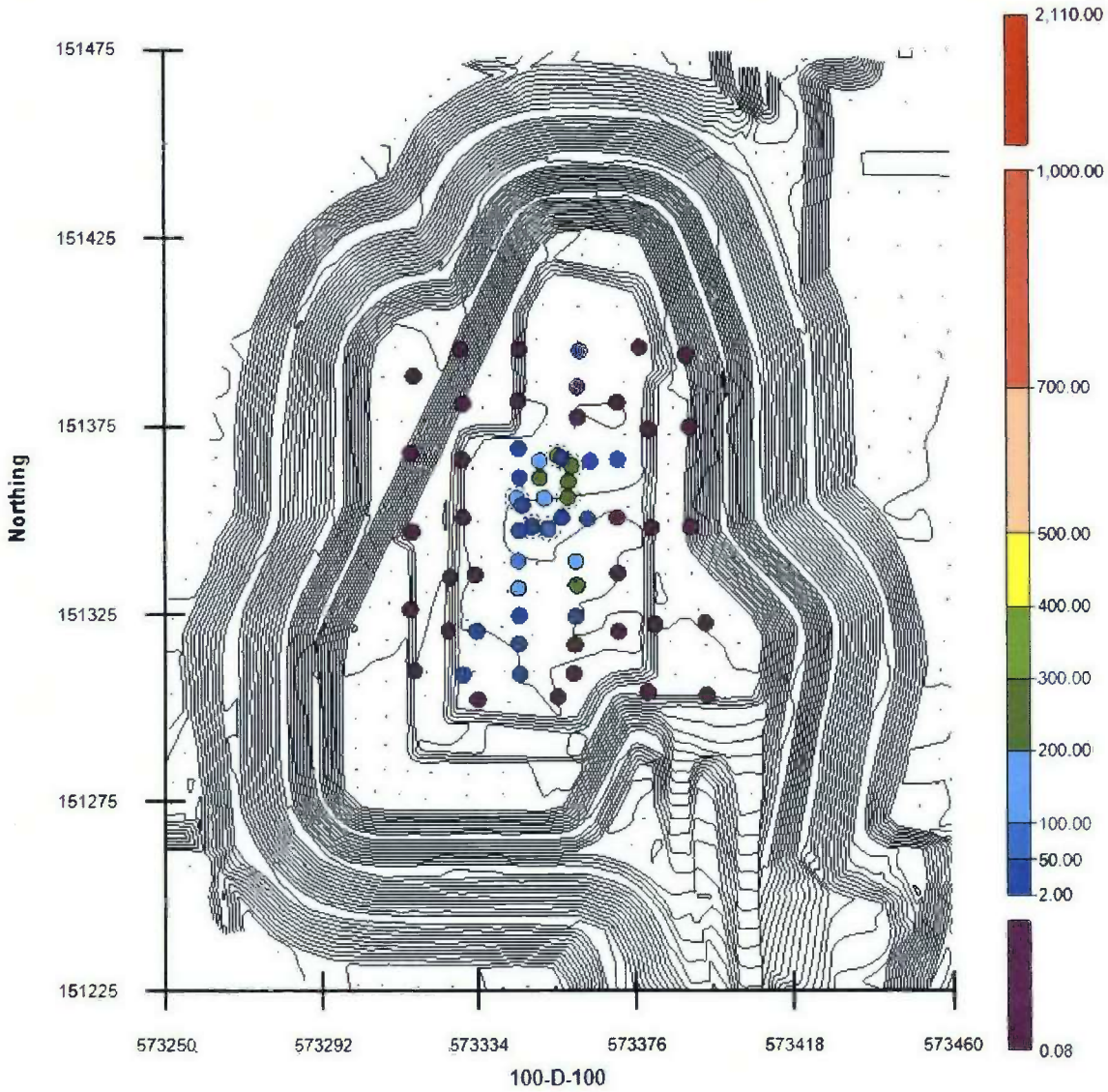
40 Foot Depth (mg/kg)

Hexavalent Chromium Samples



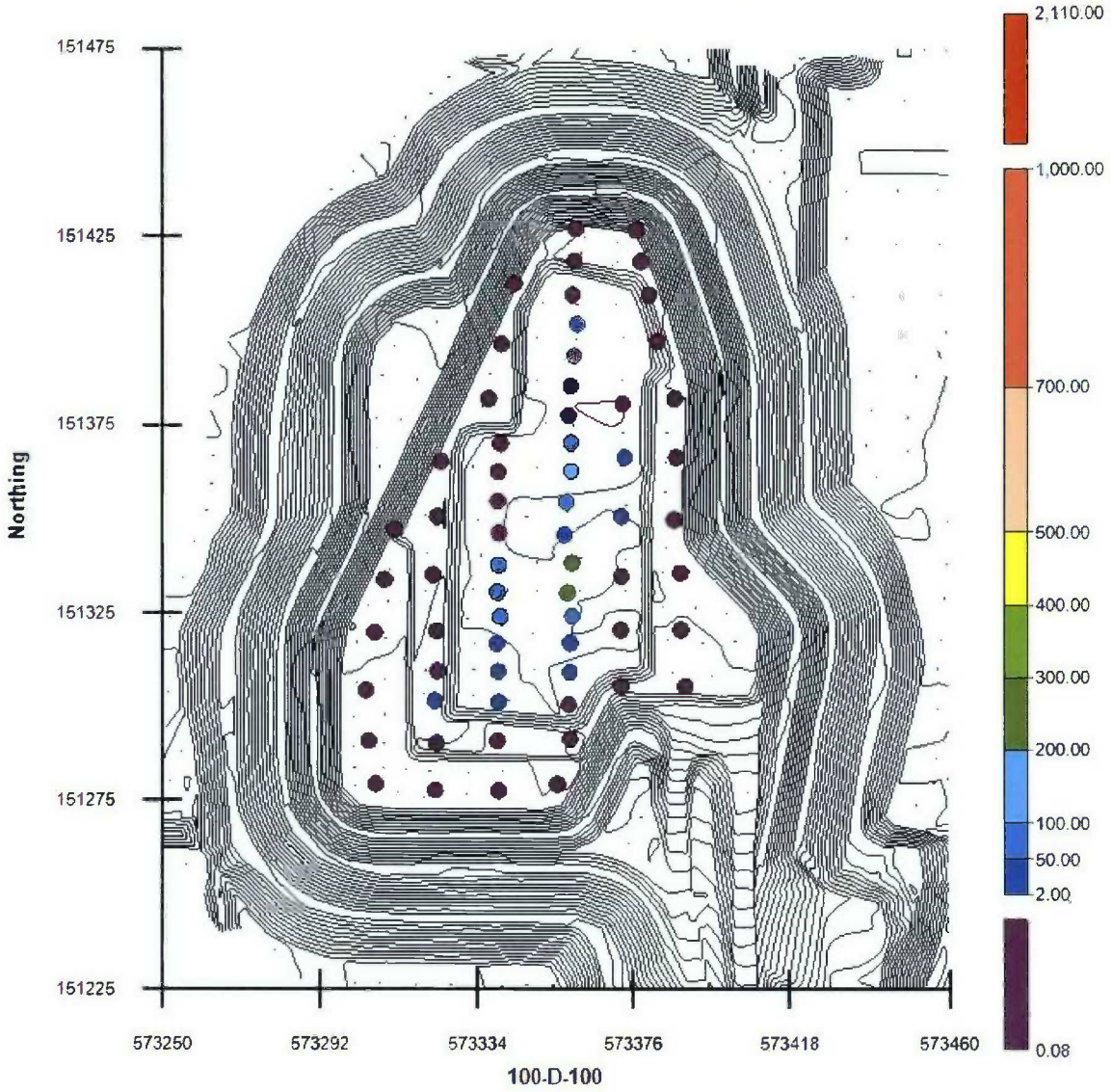
45 Foot Depth (mg/kg)

Hexavalent Chromium Samples



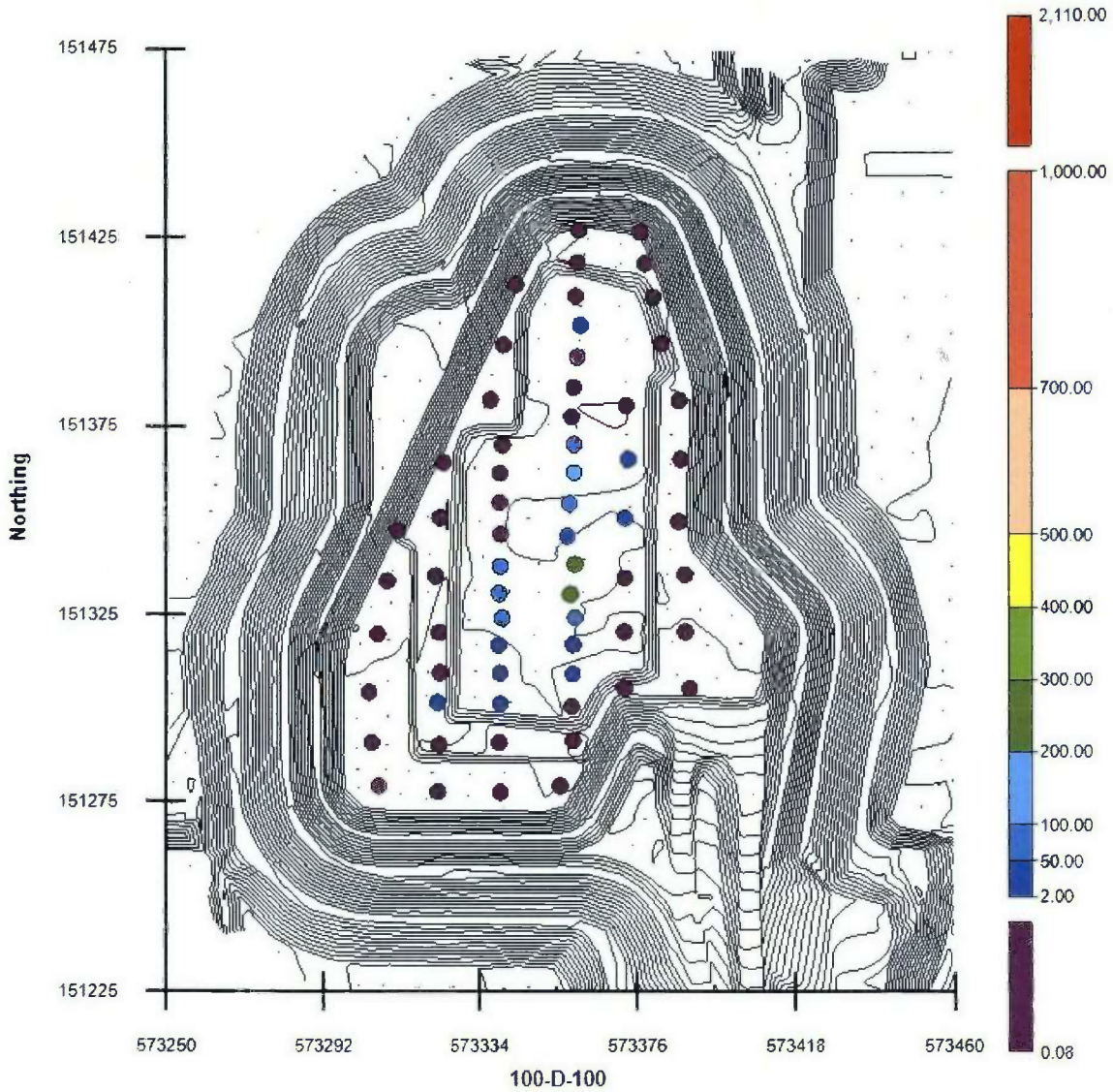
50 Foot Depth (mg/kg)

Hexavalent Chromium Samples



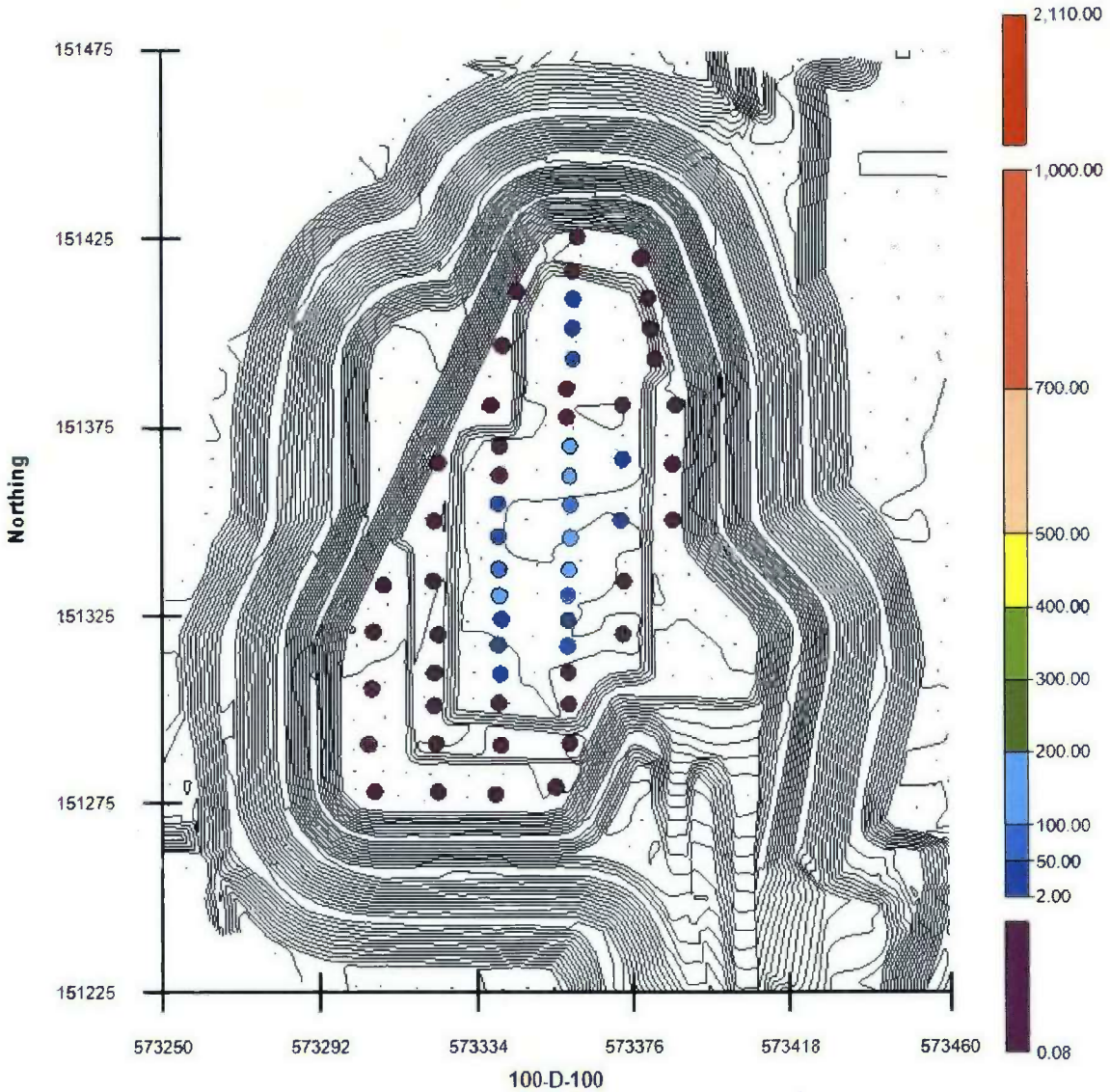
55 Foot Depth (mg/kg)

Hexavalent Chromium Samples



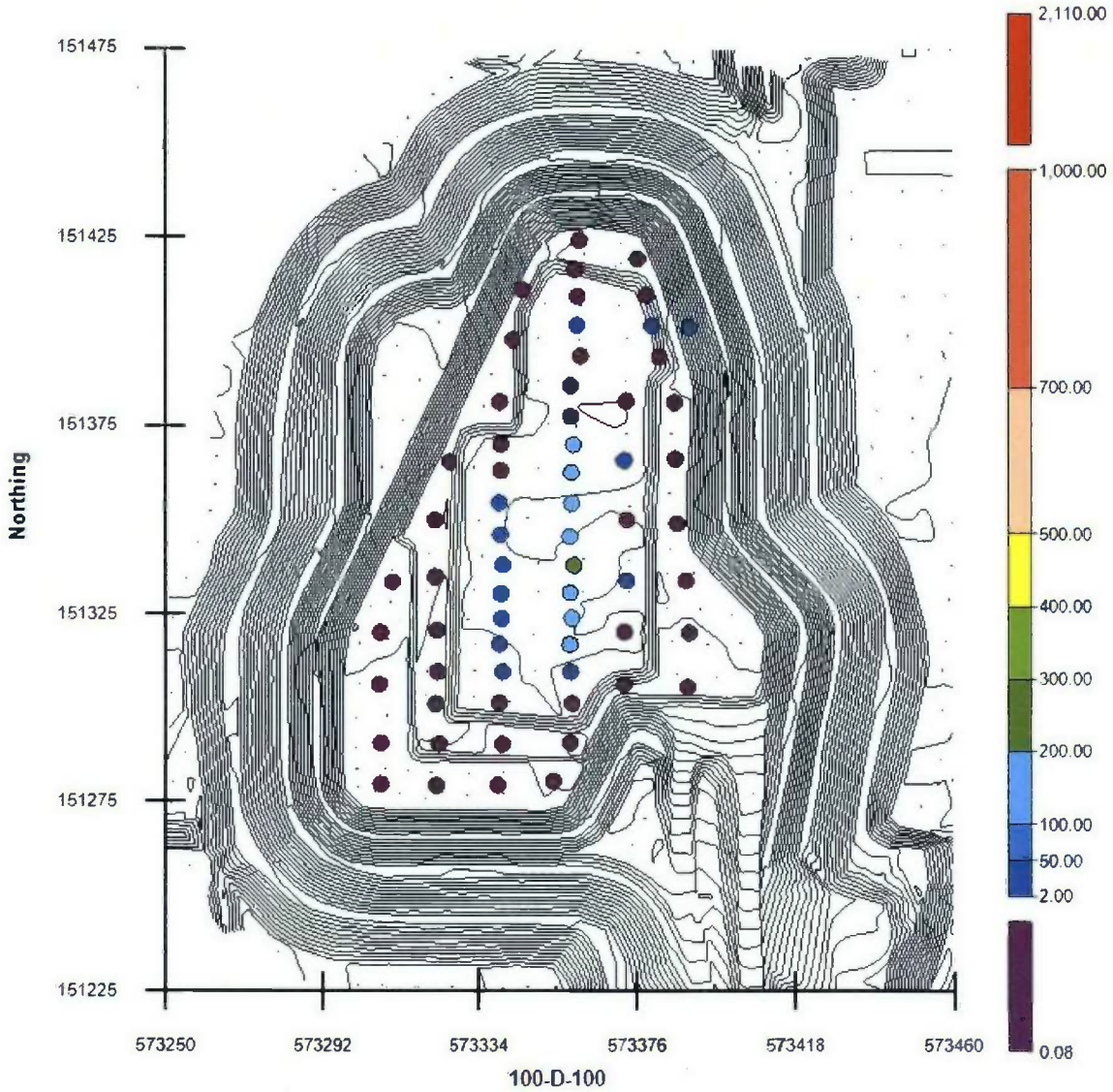
60 Foot Depth (mg/kg)

Hexavalent Chromium Samples



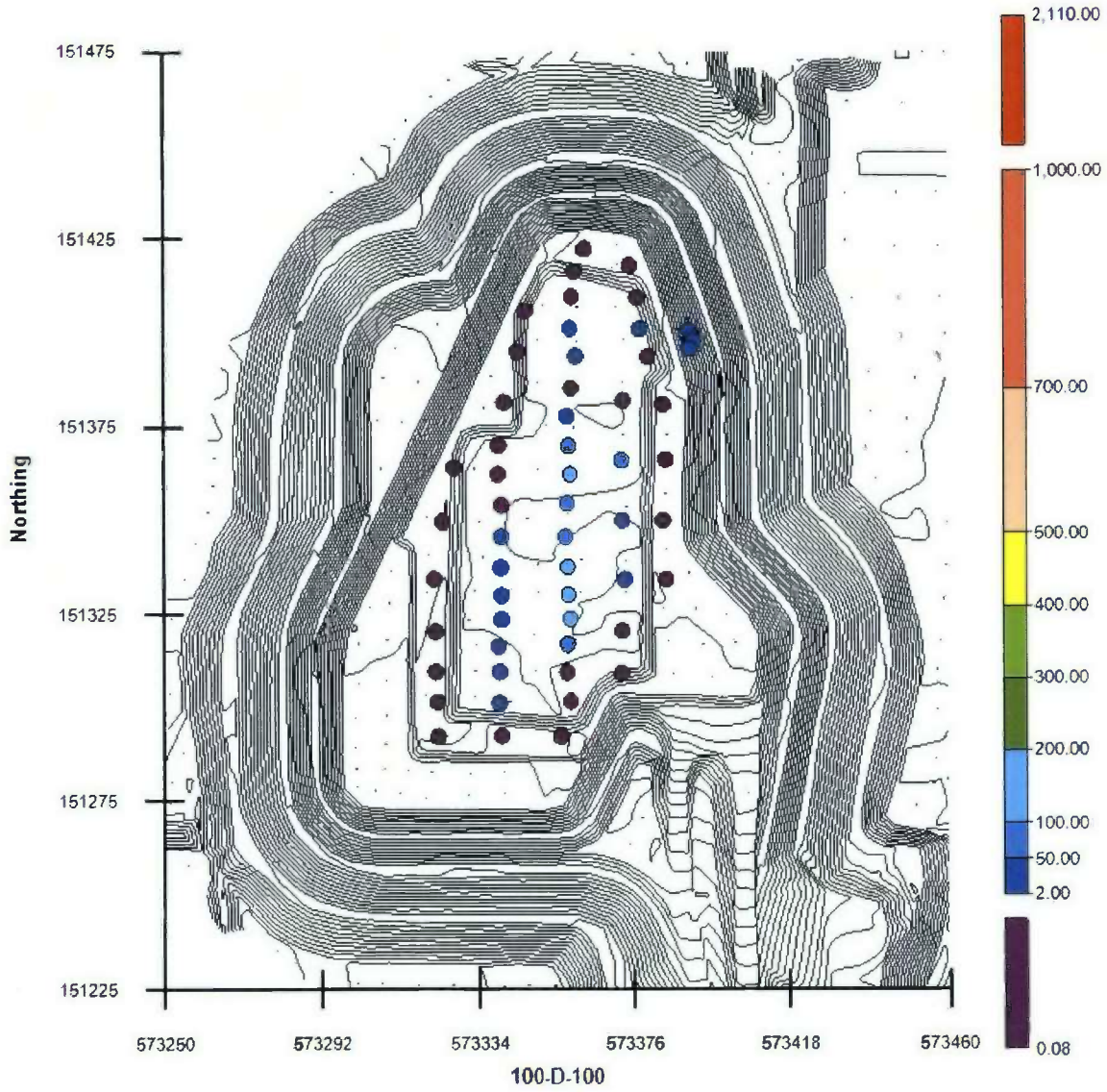
65 Foot Depth (mg/kg)

Hexavalent Chromium Samples



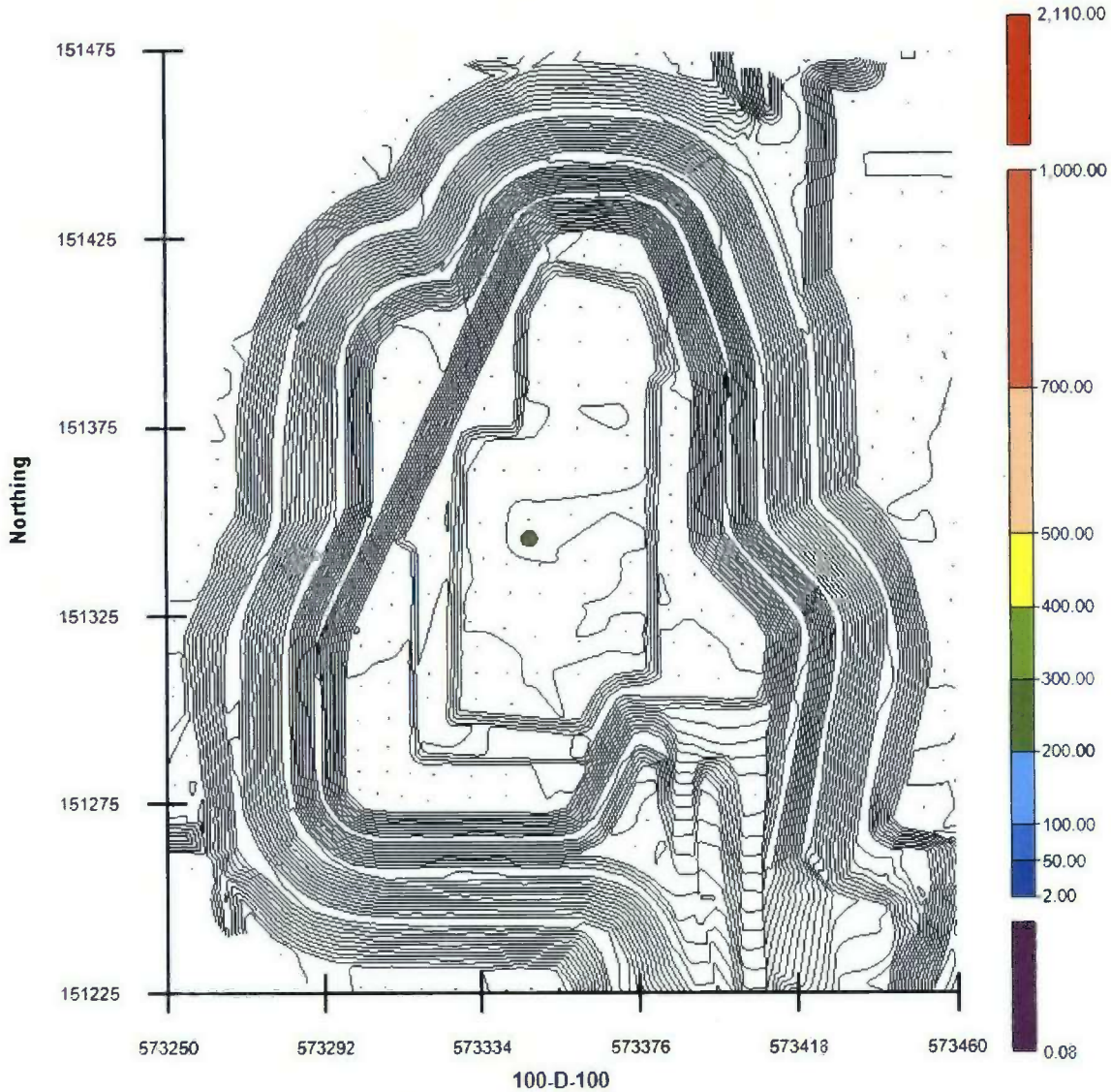
70 Foot Depth (mg/kg)

Hexavalent Chromium Samples



75 Foot Depth (mg/kg)

Hexavalent Chromium Samples



80 Foot Depth (mg/kg)

APPENDIX D

VADOSE ZONE GEOLOGY AT THE 100-D-30/100-D-104 AND 100-D-100 WASTE SITES

APPENDIX D

VADOSE ZONE GEOLOGY AT THE 100-D-30/100-D-104 AND 100-D-100 WASTE SITES

This appendix provides a description of the geologic features observed during and post-excavation of the 100-D-30/100-D-104 and 100-D-100 waste sites that were excavations to groundwater to remove chromium contaminated soil. The 100-D-30/100-D-104 excavation was approximately 160 m (525 ft) wide by 300 m (984 ft) long and up to 25 m (82 ft) deep. The 100-D-100 excavation was approximately 200 m (656 ft) wide by 240 m (787 ft) long and up to 25 m (82 ft) deep, not including the additional 3 m (10 ft) of aquifer sediment removed below the water table at the 100-D-100 waste site. The stratigraphy consists of sediments of the Missoula floods that comprise the Hanford formation and the older Ringold Formation lacustrine and fluvial deposits associated with the ancestral Columbia River. The lithology of the Hanford formation is dominated sands and gravels that are largely unconsolidated and exhibit cross stratification and foreset beds. The sedimentary layers of the Ringold Formation are flat lying with inter-bedded sand, silt, and fine grained gravel. The general framework of the site geology was published in *Geologic Setting of the 100-HR-3 Operable Unit, Hanford Site, South-Central Washington* (Lindsey and Jaeger 1993).

GEOLOGY OF THE 100-D-100 AND THE 100-D-30/100-D-104 EXCAVATIONS

Anthropogenic-Fill Material – Sand, gravel, and construction debris from Hanford operations (up to several meters) and minor surface disturbances from pre-Hanford agriculture activities.

Eolian Sand – Local accumulations of Holocene silty medium to fine sand commonly mixed with basalt granules and small pebbles commonly 15 to 60 cm (5.9 to 23.6 in.) thick. The eolian sand is tan in color due to the felsic-rich sediments (quartz and feldspar). The eolian sand has infiltrated over a meter into the Upper Gravel Unit.

Hanford Formation – Includes gravel- and sand-dominated deposits from Pleistocene cataclysmic glacial outburst floods and meltwater runoff. The Hanford formation in the 100-D-30/100-D-104 and 100-D-100 excavations is divided into four units based on lithofacies, gravel-clast composition, and stratigraphic position.

- Upper Gravel Unit – Consists of channel-fill sandy gravel to silty sandy gravel. The gravel is clast supported, poorly sorted, loosely compacted, and dark gray in color. The gravel deposit is dominated by large-scale planar cross beds (Gp) and foreset beds that are several meters thick and extend across the 100-D-30/100-D-104 and 100-D-100 excavations. The cross beds and foreset beds provide preferential pathways for transport of hexavalent chromium contamination in the vadose zone along the dip of the bedding and provide a mechanism for both lateral and vertical migration of contamination. Other minor lithofacies in the Upper Gravel Unit include crude horizontal beds (Gh) and low-angle cross beds (Gt) are present as shallow erosional channel fill near the top of the unit (e.g., east wall of the

100-D-100 excavation). Gravel clasts are pebble and cobble in size (90:10), subrounded to rounded in shape, and composed largely of basalt (>80% based on pebble count) with minor contributions of granite, quartzite, volcanic porphyries, and other metamorphics. The gravel matrix is mainly very coarse to medium sand, but ranges from very coarse sand to mud (silt and clay). Sand grains are subrounded to subangular in shape. The composition of the sandy matrix is similar to the clast composition (i.e., very high in basalt). The finer fraction (finer than medium sand) is composed of quartzofeldspathic minerals with minor amounts of basalt. Locally, the gravel has an open-framework fabric. Thin coatings of calcium carbonate formed on the underside of gravel clasts in the upper meter of the Upper Gravel Unit in areas beneath native soils. The upper bounding surface with the native eolian soil is sharp and distinct due to color and grain size contrast. The lower bounding surface is sharp with an erosional surface scoured into the Black Sand Unit. Paleocurrent analysis of cross bedding and bedform accretion directions indicate an easterly flow of outburst floods. The Upper Gravel Unit was deposited by a single cataclysmic outburst flood followed by minor channeling and channel filling.

- Black Sand Unit – Forms a series of channel-fill gravelly sand to granule deposits. The unit is moderately well sorted, loosely compacted, and dark gray in color. Lithofacies include horizontally laminated beds (Sh), low-angle cross beds (Sl), and high-angle planar cross beds (Sp). Several gravelly sand/granule beds are continuous across the excavations, but most beds have short lateral extents due to erosional truncations. Sand beds range in size from very coarse to coarse sand to granules. Grains are subrounded to subangular in shape and composed primarily of basalt fragments (estimated to be greater than 80%). The mud (silt and clay) fraction makes up less than 10% of the unit and is mainly felsic (quartz and feldspar) with lesser amounts of basalt. Beds commonly are normally graded, often with a thin basalt layer (one to two pebbles thick) of gravel. Interbedded with the gravelly sand/granule beds, are thin stringers of fine sand or gravel. The stringers are less than 30 cm (11.8 in.) thick. The upper and lower bounding surfaces are sharp. The Black Sand Unit was deposited by glaciofluvial floodwater/meltwater with a high bedload and rapidly shifting channels that eroded channel bars and subsequently aggraded sediments by lateral, downstream, and vertical accretion. Paleocurrent analysis indicates a general easterly to southeasterly flow direction of glaciofluvial floodwater/meltwater runoff.

- Middle Gravel Unit – Consists of sandy gravel to silty sandy gravel that has similar textural, compositional and lithofacies characteristics as the Upper Gravel Unit. The Middle Gravel Unit forms a 2.5-m (8.2-in.) thick lens within the Black Sand Unit along the south wall of the 100-D-30/100-D-104 excavation. The unit is not observed in the 100-D-100 excavation. The upper and lower bounding surfaces are sharp and distinct. The Middle Gravel Unit is a channel-fill deposit in a channel scoured into the Black Sand Unit and subsequently filled with high-energy coarse basaltic gravel during a falling hydrograph. The deposit is likely derived from a river flood event or a high elevation channel filling during a small-scale glaciofluvial outburst flood event.

- Lower Gravel Unit – Sandy gravel that occurs as two distinct lateral facies: (1) a felsic facies that is present in the 100-D-30/100-D-104 excavation and northern portion of the 100-D-100 excavation and (2) a basalt (mafic) facies that occurs in the southern part of the

100-D-100 excavation. The lateral transition between the two facies is gradational and occurs over tens of meters.

- The felsic facies is moderately well sorted, loosely compacted, and light colored. The unit consists of low-angle (Gt) and high-angle planar (Gp) cross bed lithofacies. The gravel is predominantly quartzite and basalt with lesser contributions of granite, volcanic porphryries, and other metamorphics. The clasts are pebble to cobble in size, rounded to subrounded in shape, and show little evidence of weathering (absence of weathering rinds, significant staining, or cementation). The matrix is coarse to medium sand and is composed of 80% felsic (quartzofeldspathic) and 20% basalt grains. In the 100-D-100 excavation the lower part of the gravel contains abundant concretions (sand cemented calcium carbonate) and rip-up clasts scattered throughout. The concretions are irregular in shape, loose, and slightly abraded indicating that the compact masses formed as a precipitate in another sediment body and were entrained, transported, and deposited along with the sandy gravel to form the Lower Gravel Unit.

- The basalt (mafic) facies is poorly sorted, loosely compacted, and dark colored. The main lithofacies includes high-angle planar cross beds (Gp), crude horizontal beds (Gh), and low-angle cross beds (Gt). The gravel composition is dominated by basalt clasts with only minor contributions from other rock types. The gravel has a broad range of clast sizes including cobbles, pebbles, and granules. The clasts are rounded to subangular in shape with fresh abraded surfaces. The matrix is predominantly very coarse to medium sand that is composed chiefly of basalt. The fine fraction of the matrix (very fine sand and silt) constitutes a few percent by weight and is largely quartzofeldspathic. Concretions that occur in the felsic facies of the Lower Gravel Unit have not been observed in the basalt facies.

The Lower Gravel Unit is a glaciofluvial deposit from outburst flooding down the Columbia River Valley. The flood deposits are derived from two primary sources: (1) local upstream bank erosion of Ringold channel deposits based on presence of abundant Ringold gravel/sand and intact concretions that were mixed with basaltic sand and (2) basaltic debris eroded from the Columbia Plateau upstream of the excavations. The age of the Lower Gravel Unit is likely pre-Wisconsin based on Stage I to II caliche capping sandy gravel beneath basaltic sand encountered 12 m (40 ft) beneath the 118-D-1 Burial Ground.

Ringold Formation – Includes sedimentary deposits of Mio-Pliocene age that originated from fluvial and lacustrine processes along with secondary surficial processes that acted across basins of the central Columbia Plateau. The Ringold Formation at the 100-D-30/100-D-104 and 100-D-100 excavations is divided into two units based on sediment texture: the Interbedded Sand and Gravel Unit and the Mud Unit. The description of the coarse-grained unit is based on field observations and measurements of excavation walls and descriptions of samples from four boreholes drilled into the floor of the 100-D-100 excavation (CHPRC 2015). The Mud Unit descriptions are based on samples collected from boreholes in the central 100-D Area.

- <u>Interbedded Sand and Gravel Unit (RE)</u> – The unit includes multi-story stacked beds of sandy gravel and sand/silty sand. Sandy gravel beds are clast supported, moderately well

sorted, poorly consolidated, to loosely compacted. The unit is lighter in color than stratigraphic units of the Hanford formation. The lighter color is due to (1) the abundance of acidic volcanic and quartzite gravel clasts and (2) the presence of a light-colored, felsic-rich sand matrix. Lithofacies observed in the Interbedded Sand and Gravel Unit include massive gravel (Gms), crude horizontal bedding (Gh), massive sand (Sm), horizontal-laminated sand (Sh), and low-angle cross beds (St). Gravel deposits are bimodal in texture with a pebble to cobble coarse fraction and a sand matrix that is typically coarse to fine grained. Gravel composition is mainly basalt, granite, and quartzite with lesser volcanic porphyries and other metamorphic and sedimentary rocks. Some beds are normally graded from a basalt pebbly (granules) coarse to fine sand upward to silty coarse to fine sand. The sand matrix and sand lenses are quartzofeldspathic with a minor basalt and mica (muscovite). Thicker gravel bodies (greater than 2 m [6.6 ft] thick) are persistent laterally across the 100-D-30/100-D-104 and 100-D-100 excavations. Thin sand and gravel bodies (less than 1 m [3.3 ft] thick) extend laterally up to 100 m (328 ft) with sand bodies generally less than 1 m (3.3 ft) thick. These horizontal bedding planes can promote lateral spreading of contamination along the bedding planes. The unit is highly bedded and more texturally varied as compared to other Ringold gravel units south and west of the 100-D Area. The average number of beds beneath the 100-D-100 waste site is 13 (ranging from 8 to 17). Texturally, the beds are largely gravel (70% sandy gravel and gravelly sand beds) with interbedded sand (30% of beds). The following is a list of average bed thicknesses:

- Sandy gravels 60 cm (23.6 in.) thick (ranging from 15 cm to 3 m [5.9 in. to 9.8 ft])
- Gravelly sand 30 cm (11.8 in.) thick (ranging 15 to 60 cm [5.9 to 23.6 in.] thick)
- Sand 60 cm (23.6 in.) thick (ranging 15 cm to 2 m [5.9 in. to 6.6 ft]).

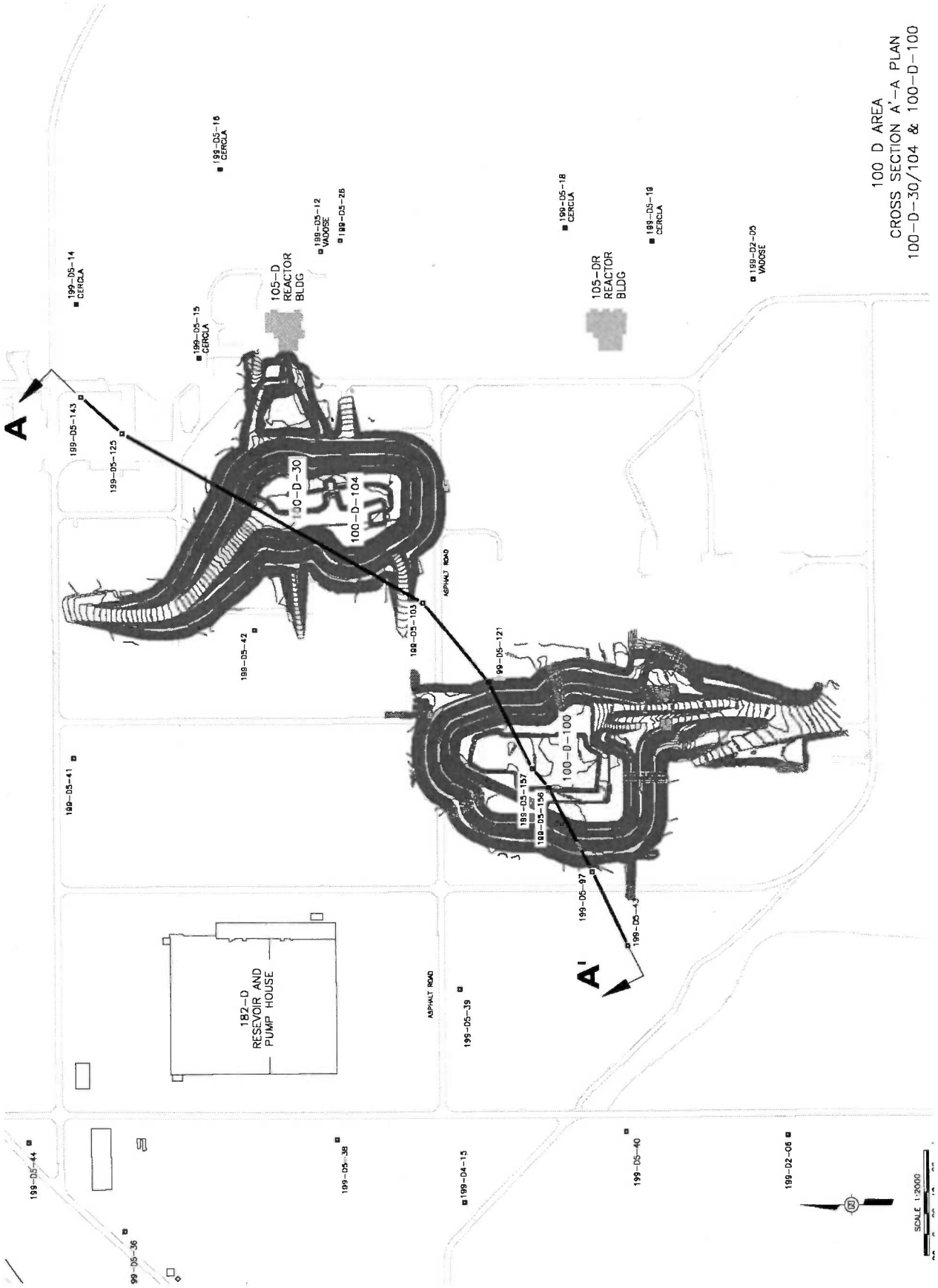
Local cut-and-fill channel deposits were observed along the ramp of the 100-D-30/100-D-104 excavation. The fill features include low-angle cross bedded sand (St). The channel is less than 2 m (6.6 ft) thick and less than 10 m (32.8 ft) wide. The upper bounding surface is sharp and distinct with an approximate 6 degree dip to the south to southeast. The lower contact with the Mud Unit forms an undulating surface and is sharp and distinct over much of the central 100-D Area except in several boreholes to the west of the excavation where the contact is gradational. The interbedded sand and gravel unit represents the distal channel-fill deposits of an ancient Columbia River flowing through the northern Pasco Basin. The unit is part of the Ringold E unit of the Ringold Formation.

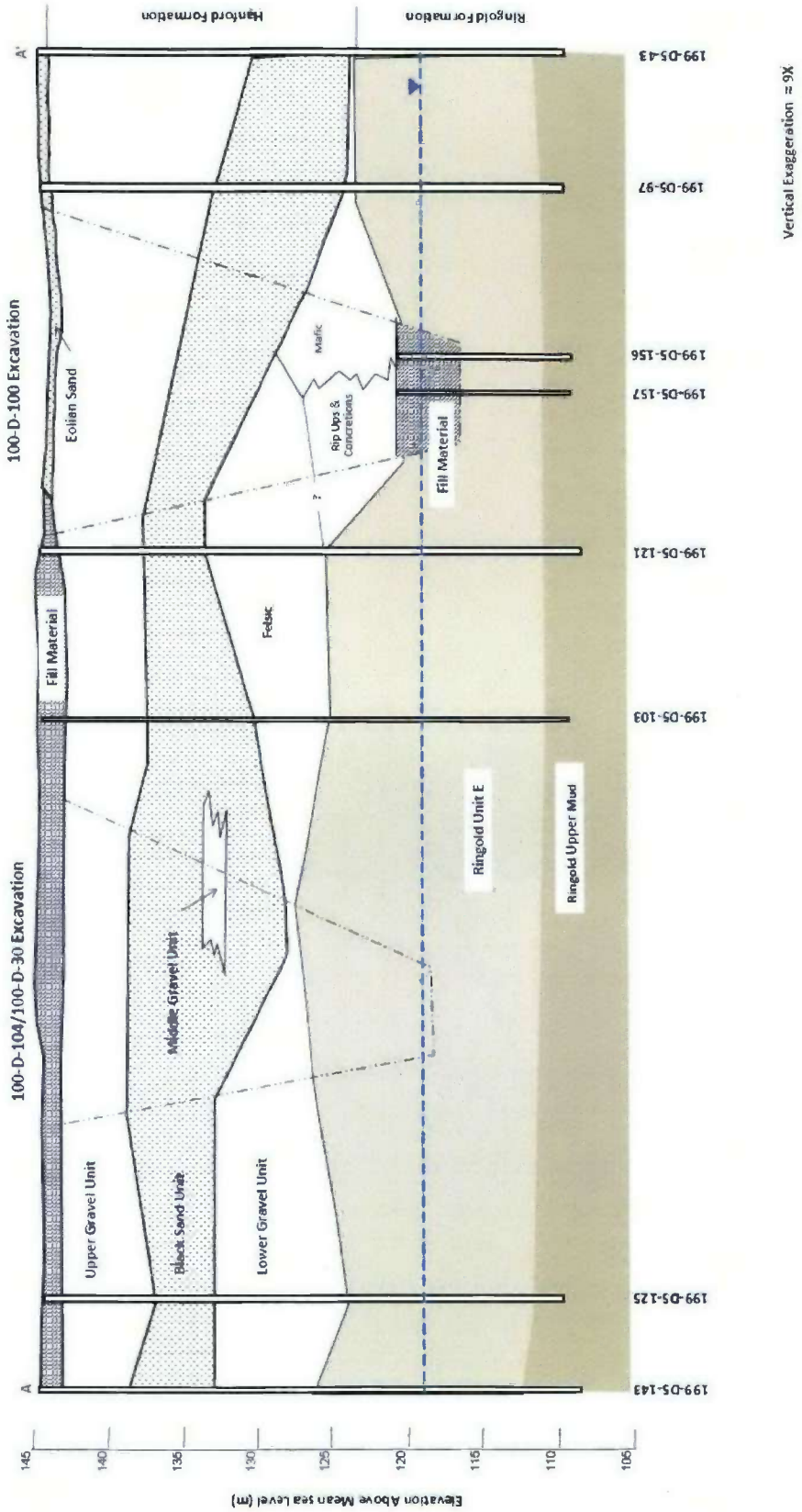
- Mud Unit (RUM) – A compact fine-grained unit mainly consisting of mud (silt and clay) with varying amounts of sand. The unit ranges from a massive mud (Fm) (greater than 95% mud with varying amounts of silt and clay) with very fine quartz sand to thin stratified mud and sand beds (Fl). Individual beds are often well sorted. Sand beds texturally range from very fine sand to coarse to very fine sand with sand grains composed mainly of quartz. Locally, the unit includes very fine angular pebbles (greater than 5%) within the top 30 cm (11.8 in.) and within sand beds. The unit has evidence of bioturbation based on the presence of black streaks of organic material or iron oxides. The Mud Unit was deposited in an overbank setting and was modified by surficial processes.

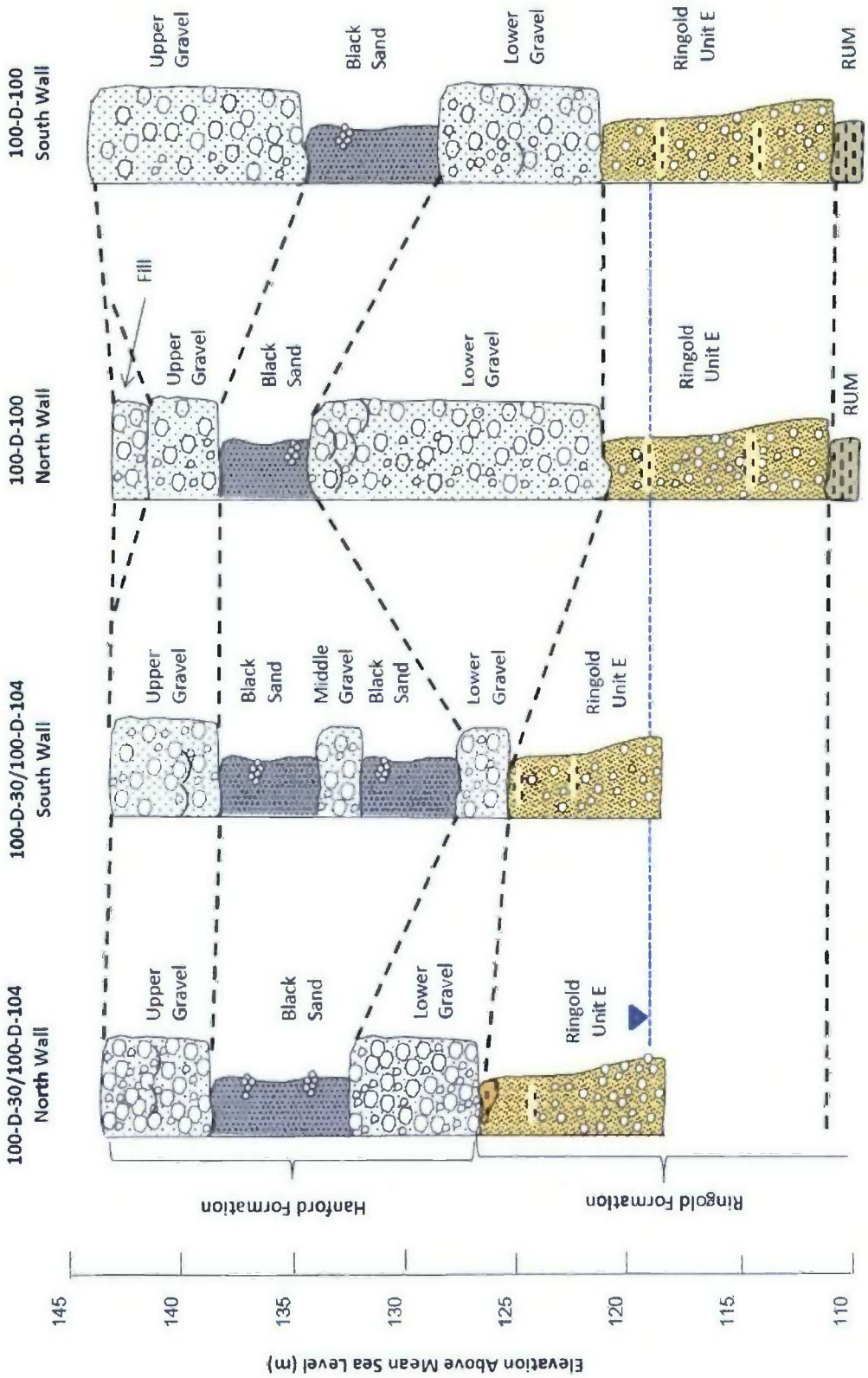
REFERENCES

CHPRC, 2015, *Persistent Source Investigation at 100-D Area*, SGW-58416, Rev. 1, CH2M Hill Plateau Remediation Company, Richland, Washington.

Lindsey, K. A., and G. K. Jaeger, 1993, *Geologic Setting of the 100-HR-3 Operable Unit, Hanford Site, South-Central Washington*, WHC-SD-EN-TI-132, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

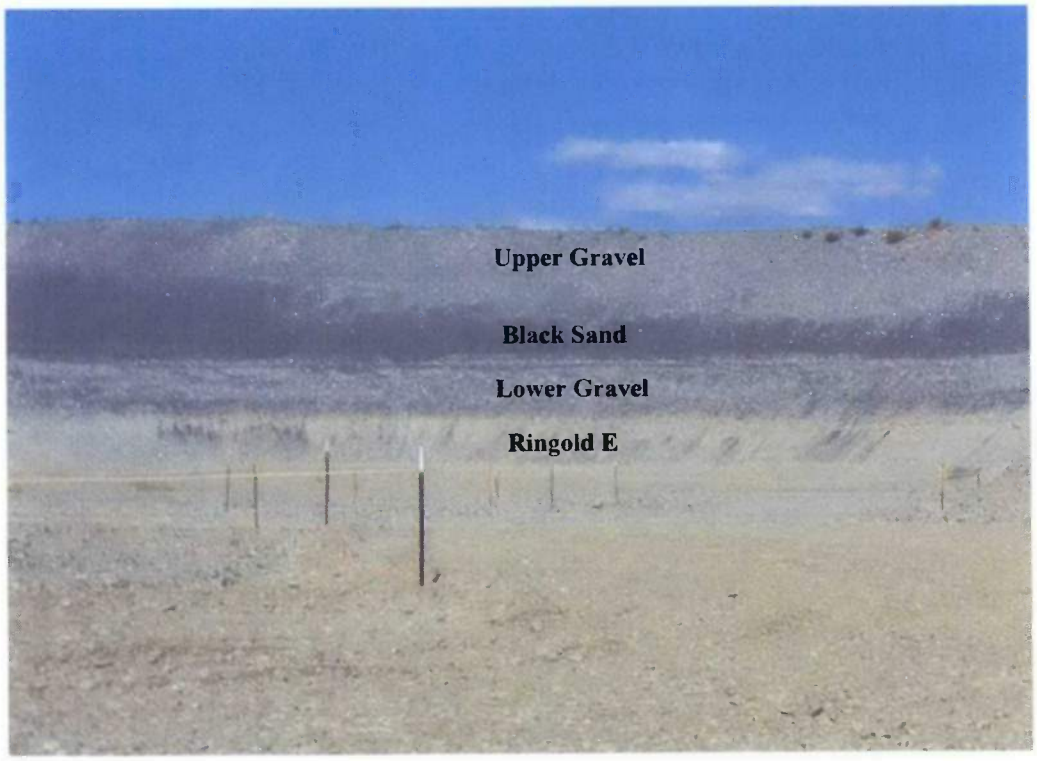

100 D AREA
CROSS SECTION A'-A PLAN
100-D-30/104 & 100-D-100
A
A'
105-D REACTOR BLDG
105-DR REACTOR BLDG
182-D RESEVOIR AND PUMP HOUSE
100-D-30
100-D-104
100-D-100
ASPHALT ROAD
199-D5-14 CERCLA
199-D5-15 CERCLA
199-D5-16 CERCLA
199-D5-12 VADOSE
199-D5-26
199-D5-18 CERCLA
199-D5-19 CERCLA
199-D2-05 VADOSE
199-D5-143
199-D5-125
199-D5-42
199-D5-103
199-D5-121
199-D5-41
199-D5-157
199-D5-156
199-D5-97
199-D5-39
199-D5-44
199-D5-36
199-D4-13
199-D5-40
199-D2-06
SCALE 1:2000


A
A'
100-D-104/100-D-30 Excavation
100-D-100 Excavation
Upper Gravel Unit
Middle Gravel Unit
Black Sand Unit
Lower Gravel Unit
Fill Material
Eolian Sand
Felsic
Mafic
Rip Raps & Concretions
Fill Material
Ringold Unit E
Ringold Upper Mud
Hanford Formation
Ringold Formation
199-D5-143
199-D5-125
199-D5-103
199-D5-121
199-D5-157
199-D5-156
199-D5-97
199-D5-43
Vertical Exaggeration ≈ 9X
Elevation Above Mean sea Level (m)
145
140
135
130
125
120
115
110
105


100-D-100 South Wall
100-D-100 North Wall
100-D-30/100-D-104 South Wall
100-D-30/100-D-104 North Wall
Fill
Upper Gravel
Black Sand
Middle Gravel
Lower Gravel
Ringold Unit E
RUM
Hanford Formation
Ringold Formation
145
140
135
130
125
120
115
110
Elevation Above Mean Sea Level (m)

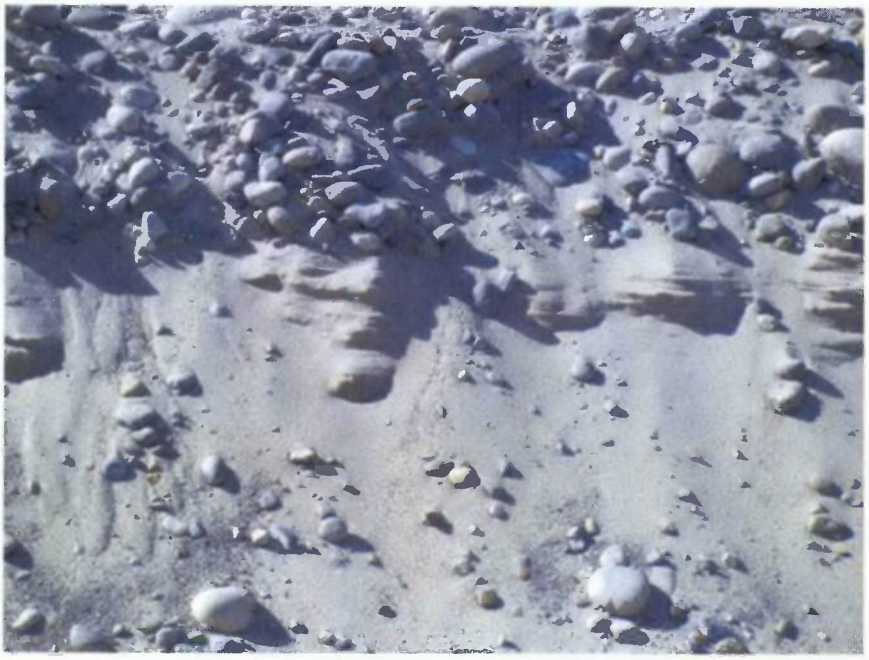
D-1. The 100-D-30 Tier II Excavation Showing Upper Gravel Unit and Underlying Black Sand.

D-2. The 100-D-30/100-D-104 Excavation North Wall.



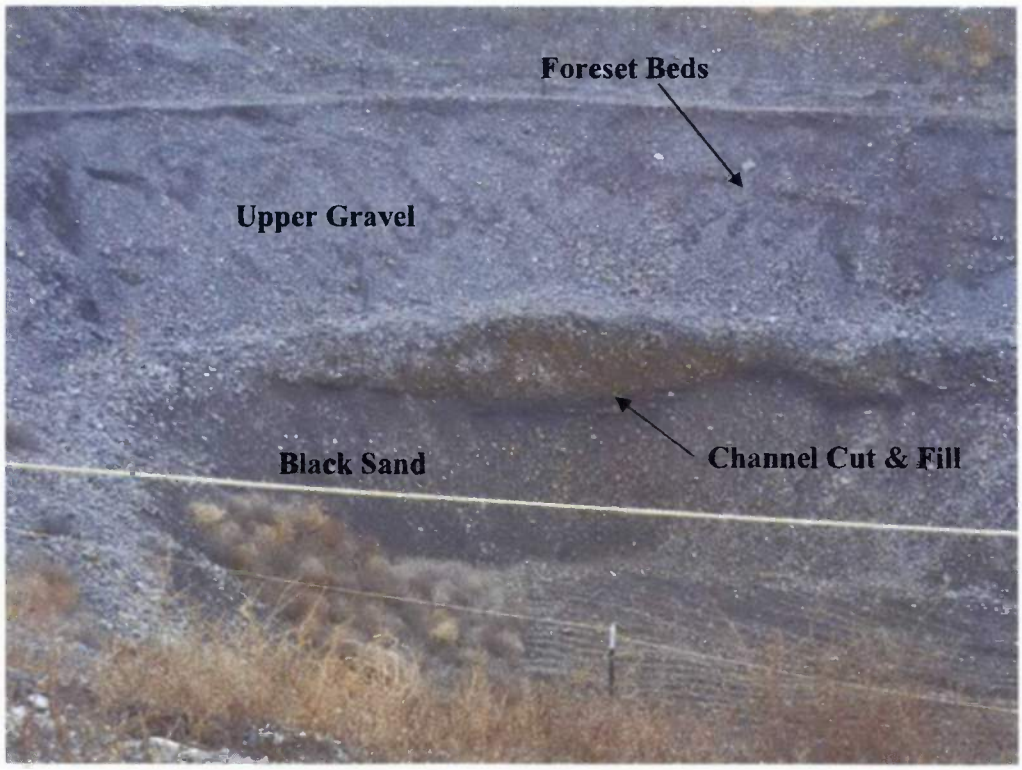
D-3. Hanford/Ringold Contact Exposed in the 100-D-30/ 100-D-104 Excavation Sidewalls.

D-4. Hanford Lower Gravel Overlying Ringold Sand in the West Wall of the 100-D-30/100-D-104 Waste Site.



D-5. Hanford Lower Gravel Contact with Ringold in the North Wall of the 100-D-30/100-D-104 Waste Site.

D-6. Hanford Upper Gravel Overlying Black Sand in the Northeast Wall of the 100-D-100 Waste Site.



D-7. Upper Gravel Contact with Black Sand at 35 ft Depth at the 100-D-100 Waste Site.

D-8. Foreset Beds Dipping East in Lower Gravel at the 100-D-100 Waste Site.

D-9. Hanford/Ringold Contact in Test Pit in the Southeast Floor of the 100-D-100 Waste Site.

D-10. Hanford/Ringold Contact in the East Wall at the 100-D-100 Waste Site.

D-11. Hanford/Ringold Contact at the 100-D-100 Excavation.

D-12. Bedding in Ringold at the 100-D-100 Excavation.

APPENDIX E

CALCULATIONS

APPENDIX E

CALCULATION BRIEFS

The calculations in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the file will be stored in a U.S. Department of Energy, Richland Operations Office repository. These calculations have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculation," Washington Closure Hanford, Richland, Washington. The following calculations are provided on CD.

Decision Unit	UCL	HQ	GWHQ
The Tier II 100-D overburden stockpiles (Decision Unit 4 applies for the 100-D-100 waste site)	0100D-CA-V0495	0100D-CA-V0496	0100D-CA-V0557
Previously closed the Tier II 100-D-100 waste staging pile area	0100D-CA-V0511	0100D-CA-V0512	0100D-CA-V0513
The 100-D-100 excavation	0100D-CA-V0523	0100D-CA-V0524	0100D-CA-V0525
The 100-D-100 overburden/layback soil placed in remediated waste sites and stockpiles; waste staging pile 5	0100D-CA-V0529	0100D-CA-V0530	0100D-CA-V0531
The 100-D-100 waste staging pile area	0100D-CA-V0532	0100D-CA-V0533	0100D-CA-V0534
The Tier III 100-D-100 waste staging pile area	0100-D-CA-V0568	0100D-CA-V0569	0100D-CA-V0570
Waste staging pile area for the 100-D-31:11, 100-D-31:12, 100-D-50:7, 100-D-72, 100-D-81, 100-D-100, and 100-D-108 waste sites	0100-D-CA-V0573	0100D-CA-V0574	0100D-CA-V0575
The 100-D-100 equipment decontamination pad	Not applicable (focus sampling)	0100D-CA-V0571	0100D-CA-V0572

DISCLAIMER FOR CALCULATIONS

The calculations provided in this appendix have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

100-D Overburden Stockpiles Cleanup Verification 95% UCL Calculation, 0100D-CA-V0495, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Staging Pile Area Cleanup Verification 95% UCL Calculations, 0100D-CA-V0511, Rev. 0 Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Cleanup Verification 95% UCL Calculation, 0100D-CA-V0523, Rev. 1 Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Lifts Cleanup Verification 95% UCL Calculations, 0100D-CA-V0529, Rev. 0 Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Staging Pile Areas Cleanup Verification 95% UCL Calculations, 0100D-CA-V0532, Rev. 0 Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Staging Pile Area 1 Cleanup Verification 95% UCL Calculations, 0100D-CA-V0568, Rev. 0 Washington Closure Hanford, Richland, Washington.

100-D-31:11, 100-D-31:12, 100-D-50:7, 100-D-59, 100-D-72, 100-D-81, 100-D-100, and 100-D-108 Waste Site Cleanup Verification 95% UCL Calculations, 0100D-CA-V0573, Rev. 1 Washington Closure Hanford, Richland, Washington.

100-D Overburden Stockpiles Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0496, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Staging Pile Area Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100D-CA-V0512, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0524, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Lifts Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0530, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Staging Pile Areas Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0533, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Staging Pile Area 1 Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0569, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Decontamination Pad Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0571, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-31:11, 100-D-31:12, 100-D-50:7, 100-D-59, 100-D-72, 100-D-81, 100-D-100, and 100-D-108 Waste Sites Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0574, Rev. 1 Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Staging Pile Area Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0513, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0525, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Lifts Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0531, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Staging Pile Areas Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0534, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-30, 100-D-100, and 100-D-104 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0557, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Staging Pile Area 1 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0570, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-100 Waste Site Decontamination Pad Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0572, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-31:11, 100-D-31:12, 100-D-50:7, 100-D-59, 100-D-72, 100-D-81, 100-D-100, and 100-D-108 Waste Sites Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0575, Rev. 0, Washington Closure Hanford, Richland, Washington.

APPENDIX F

VERIFICATION SAMPLE SUMMARY TABLES AND SAMPLE LOCATIONS

Table F-1. The 100-D-100 Excavation Verification Sample Summary. (3 Pages)

Sample Location	HEIS Sample Number	Washington State Plane Coordinates		Sample Analysis
		Easting	Northing	
Sample Area 1				
EXC1-1	J1RXP1	573361.5	151245.0	ICP metals [a], hexavalent chromium
EXC1-2	J1RXP2	573325.9	151247.4	
EXC1-3	J1RXP3	573425.8	151395.6	
EXC1-4	J1RXP4	573290.2	151249.9	
EXC1-5	J1RXP5	573410.1	151427.8	
EXC1-6	J1RXP6	573274.5	151282.0	
EXC1-7	J1RXP7	573394.4	151459.9	
EXC1-8	J1RXP8	573258.8	151314.2	
EXC1-9	J1RXP9	573278.8	151343.8	
EXC1-10	J1RXR0	573298.8	151373.4	
EXC1-11	J1RXR1	573318.8	151403.1	
EXC1-12	J1RXR2	573358.7	151462.4	
EXC1-13	J1RXR3	573283.1	151405.6	
EXC1-14	J1RXR4	573303.1	151435.2	
Sample Area 2				
EXC2-1	J1RXR5	573380.4	151093.9	ICP metals [a], hexavalent chromium
EXC2-2	J1RXR6	573421.0	151093.9	
EXC2-3	J1RXR7	573360.1	151129.1	
EXC2-4	J1RXR8	573400.7	151129.1	
EXC2-5	J1RXR9	573380.4	151164.3	
EXC2-6	J1RXT0	573421.0	151164.3	
EXC2-7	J1RXT1	573360.1	151199.5	
EXC2-8	J1RXT2	573400.7	151199.5	
EXC2-9	J1RXT3	573441.4	151199.5	
EXC2-10	J1RXT4	573380.4	151234.8	
EXC2-11	J1RXT5	573421.0	151234.8	
EXC2-12	J1RXT6	573461.7	151234.8	
Sample Area 3				
EXC3-1	J1T7C5	573298.7	151275.9	ICP metals [a], hexavalent chromium
EXC3-2	J1T7C6	573414.5	151338.2	
EXC3-3	J1T7C7	573339.3	151281.0	
EXC3-4	J1T7C8	573320.5	151266.7	
EXC3-5	J1T7C9	573417.5	151314.8	
EXC3-6	J1T7D0	573398.7	151300.5	
EXC3-7	J1T7D1	573379.9	151286.2	
EXC3-8	J1T7D2	573361.1	151271.9	
EXC3-9	J1T7D3	573342.3	151257.6	
EXC3-10	J1T7D4	573420.5	151291.3	
EXC3-11	J1T7D5	573401.7	151277.0	

Table F-1. The 100-D-100 Excavation Verification Sample Summary. (3 Pages)

Sample Location	HEIS Sample Number	Washington State Plane Coordinates		Sample Analysis
		Easting	Northing	
EXC3-12	J1T7D6	573382.8	151262.7	ICP metals [a], hexavalent chromium
Duplicate of J1T7D5	J1T7D7	573401.7	151277.0	
Sample Area 4				
EXC4-1	J1T7D9	573288.8	151287.1	ICP metals [a], hexavalent chromium
EXC4-2	J1T7F0	573309.5	151287.1	
EXC4-3	J1T7F1	573299.2	151305.0	
EXC4-4	J1T7F2	573288.8	151322.9	
EXC4-5	J1T7F3	573309.5	151322.9	
EXC4-6	J1T7F4	573299.2	151340.7	
EXC4-7	J1T7F5	573309.5	151358.6	
EXC4-8	J1T7F6	573299.2	151376.5	
EXC4-9	J1T7F7	573319.8	151376.5	
EXC4-10	J1T7F8	573309.5	151394.3	
EXC4-11	J1T7F9	573330.1	151394.3	
EXC4-12	J1T7H0	573319.8	151412.2	
Duplicate of J1T7F6	J1T7H1	573299.2	151376.5	
Sample Area 5				
EXC5-1	J1TDR2	573392.4	151346.8	ICP metals [a], hexavalent chromium
EXC5-2	J1TDR3	573401.2	151362.1	
EXC5-3	J1TDR4	573392.4	151377.3	
EXC5-4	J1TDR5	573401.2	151392.5	
EXC5-5	J1TDR6	573339.7	151407.7	
EXC5-6	J1TDR7	573392.4	151407.7	
EXC5-7	J1TDR8	573331.0	151422.9	
EXC5-8	J1TDR9	573348.5	151422.9	
EXC5-9	J1TDT0	573383.7	151422.9	
EXC5-10	J1TDT1	573339.7	151438.1	
EXC5-11	J1TDT2	573357.3	151438.1	
EXC5-12	J1TDT3	573374.9	151438.1	
Duplicate of J1TDR5	J1TDT4	573401.2	151392.5	ICP metals [a], hexavalent chromium
Sample Area 6				
EXC6-1	J1TDT5	573317.5	151351.7	ICP metals [a], hexavalent chromium
EXC6-2	J1TDT6	573325.7	151361.5	
EXC6-3	J1TDT7	573337.6	151393.1	
EXC6-4	J1TDT8	573342.0	151381.1	
EXC6-5	J1TDT9	573345.7	151402.9	
EXC6-6	J1TDV0	573362.0	151422.5	
EXC6-7	J1TDV1	573379.7	151374.6	
EXC6-8	J1TDV2	573384.1	151362.7	

Table F-1. The 100-D-100 Excavation Verification Sample Summary. (3 Pages)

Sample Location	HEIS Sample Number	Washington State Plane Coordinates		Sample Analysis
		Easting	Northing	
EXC6-9	J1TDV3	573388.5	151350.7	ICP metals [a], hexavalent chromium
EXC6-10	J1TDV4	573374.6	151420.3	
EXC6-11	J1TDV5	573383.4	151396.4	
EXC6-12	J1TDV6	573387.8	151384.4	
Duplicate of J1TDV6	J1TDV7	573387.8	151384.4	
Sample Area 7				
EXC7-1	J1T7J7	573328.2	151288.7	ICP metals [a], hexavalent chromium
EXC7-2	J1T7J8	573342.1	151288.7	
EXC7-3	J1T7J9	573355.9	151288.7	
EXC7-4	J1T7K0	573321.3	151300.7	
EXC7-5	J1T7K1	573362.8	151300.7	
EXC7-6	J1T7K2	573328.2	151312.7	
EXC7-7	J1T7K3	573383.6	151312.7	
EXC7-8	J1T7K4	573397.4	151312.7	
EXC7-9	J1T7K5	573321.3	151324.6	
EXC7-10	J1T7K6	573404.3	151324.6	
EXC7-11	J1T7K7	573328.2	151336.6	
EXC7-12	J1T7K8	573383.6	151336.6	
Duplicate of J1T7K8	J1T7K9	573383.6	151336.6	
Equipment blank	J1T7L0	NA	NA	
Sample Area 8				
EXC8-1	J1TDV8	573434.3	151274. 2	ICP metals [a], hexavalent chromium
EXC8-2	J1TDV9	573427.2	151286.7	
EXC8-3	J1TDW0	573441.5	151286.7	
EXC8-4	J1TDW1	573434.3	151299.1	
EXC8-5	J1TDW2	573448.7	151299.1	
EXC8-6	J1TDW3	573441.5	151311.5	
EXC8-7	J1TDW4	573434.3	151323.9	
EXC8-8	J1TDW5	573448.7	151323.9	
EXC8-9	J1TDW6	573427.2	151336.3	
EXC8-10	J1TDW7	573441.5	151336.3	
EXC8-11	J1TDW8	573420.0	151348.8	
EXC8-12	J1TDW9	573434.3	151348.8	

[a] The expanded list of ICP metals was performed to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-2. The 100-D-100 Tier II Staging Pile Area Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SPA5-1	J1RVF4	573228.6	150819.7	Chromium (total) [a], hexavalent chromium
SPA5-2	J1RVF5	573264.5	150819.7	
SPA5-3	J1RVF6	573300.3	150819.7	
SPA5-4	J1RVF7	573210.7	150850.8	
SPA5-5	J1RVF8	573246.5	150850.8	
SPA5-6	J1RVF9	573282.4	150850.8	
SPA5-7	J1RVH0	573318.3	150850.8	
SPA5-8	J1RVH1	573354.1	150850.8	
SPA5-9	J1RVH2	573390.0	150850.8	
SPA5-10	J1RVH3	573300.3	150881.8	
SPA5-11	J1RVH4	573336.2	150881.8	
SPA5-12	J1RVH5	573372.1	150881.8	
Duplicate of J1RVF4	J1RVH7	573228.6	150819.7	
Equipment blank	J1RVH6	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-3. The 100-D-100 Tier II Overburden/Layback Soil Stockpile Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
DU4-1	J1RDK3	150994.6	573054.3	ICP metals [a], mercury, hexavalent chromium, IC anions, and nitrate/nitrite, and pH
DU4-2	J1RDK4	151062.3	573042.2	
DU4-3	J1RDK5	151031.9	573067.8	
DU4-4	J1RDK6	151001.5	573093.4	
DU4-5	J1RDK7	151069.3	573081.3	
DU4-6	J1RDK8	151038.9	573106.9	
DU4-7	J1RDK9	151167.4	573043.7	
DU4-8	J1RDL0	151137.0	573069.3	
DU4-9	J1RDL1	151106.6	573094.9	
DU4-10	J1RDL2	150854.1	573442.4	
DU4-11	J1RDL3	150861.0	573481.5	
DU4-12	J1RDL4	150868.0	573520.6	
Duplicate of J1RDK8	J1RDL5	151038.9	573106.9	
Equipment blank	J1RDK2	NA	NA	ICP metals [a], mercury, and SVOA

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
IC = ion chromatography
ICP = inductively coupled plasma
NA = not applicable
pH = hydrogen ion concentration
SVOA = semivolatile organic analysis

Table F-4. The 100-D-100 Tier III Overburden/Layback Soil (SP1VL1) Stockpile (Lift 1, 0 to 8 ft Above Ground Surface) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SP1VL1-1	J1RD87	573656.6	150940.3	Chromium (total) [a], hexavalent chromium
SP1VL1-2	J1RD88	573690.3	150940.3	
SP1VL1-3	J1RD89	573724.0	150940.3	
SP1VL1-4	J1RD90	573757.7	150940.3	
SP1VL1-5	J1RD91	573673.5	150969.4	
SP1VL1-6	J1RD92	573707.2	150969.4	
SP1VL1-7	J1RD93	573740.9	150969.4	
SP1VL1-8	J1RD94	573774.5	150969.4	
SP1VL1-9	J1RD95	573656.6	150998.6	
SP1VL1-10	J1RD96	573690.3	150998.6	
SP1VL1-11	J1RD97	573724.0	150998.6	
SP1VL1-12	J1RD98	573757.7	150998.6	
Duplicate of J1RD94	J1RD99	573774.5	150969.4	
Equipment blank	J1RDC0	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-5. The 100-D-100 Overburden/Layback Soil (BFVL1) Placed in the 100-D-50:1 Excavation (Lift 1, 0 to 8 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
BFVL1-1	J1RMC3	573332.9	151011.4	Chromium (total) [a], hexavalent chromium
BFVL1-2	J1RMC4	573340.7	151006.6	
BFVL1-3	J1RMC5	573348.8	151010.9	
BFVL1-4	J1RMC6	573364.7	151010.5	
BFVL1-5	J1RMC7	573380.5	151010.0	
BFVL1-6	J1RMC8	573396.4	151009.6	
BFVL1-7	J1RMC9	573404.5	151013.9	
BFVL1-8	J1RMD0	573412.3	151009.1	
BFVL1-9	J1RMD1	573420.3	151013.5	
BFVL1-10	J1RMD2	573428.1	151008.7	
BFVL1-11	J1RMD3	573436.2	151013.0	
BFVL1-12	J1RMD4	573444.0	151008.2	
Duplicate of J1RMC3	J1RMD5	573332.9	151011.4	
Equipment blank	J1RMD6	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-6. The 100-D-100 Overburden/Layback Soil (BFVL2) Placed in the 100-D-50:1 Excavation (Lift 2, 8 to 16 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
BFVL2-1	J1RNM9	573330.2	150998.5	Chromium (total) [a], hexavalent chromium
BFVL2-2	J1RNN0	573329.2	151013.7	
BFVL2-3	J1RNN1	573342.9	151007.0	
BFVL2-4	J1RNN2	573356.6	151000.2	
BFVL2-5	J1RNN3	573355.6	151015.5	
BFVL2-6	J1RNN4	573369.3	151008.7	
BFVL2-7	J1RNN5	573382.9	151002.0	
BFVL2-8	J1RNN6	573395.6	151010.4	
BFVL2-9	J1RNN7	573409.3	151003.7	
BFVL2-10	J1RNN8	573422.0	151012.2	
BFVL2-11	J1RNN9	573435.7	151005.4	
BFVL2-12	J1RNP0	573448.3	151013.9	
Duplicate of J1RNM9	J1RNP1	573330.2	150998.5	
Equipment blank	J1RNP2	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-7. The 100-D-100 Overburden/Layback Soil (BFVL3) Placed in the 100-D-50:1 Excavation (Lift 3, 16 to 24 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
BFVL3-1	J1RV02	573332.9	150979.1	Chromium (total) [a], hexavalent chromium
BFVL3-2	J1RV03	573388.3	150994.4	
BFVL3-3	J1RV04	573406.8	150999.5	
BFVL3-4	J1RV05	573425.2	151004.7	
BFVL3-5	J1RV06	573443.7	151009.8	
BFVL3-6	J1RV07	573337.7	150997.6	
BFVL3-7	J1RV08	573356.2	151002.7	
BFVL3-8	J1RV09	573374.6	151007.9	
BFVL3-9	J1RV10	573393.1	151013.0	
BFVL3-10	J1RV11	573411.6	151018.1	
BFVL3-11	J1RV12	573324.0	151011.1	
BFVL3-12	J1RV13	573342.5	151016.2	
Duplicate of J1RV06	J1RV15	573443.7	151009.8	
Equipment blank	J1RV14	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-8. The 100-D-100 Overburden/Layback Soil (BFVL4) Placed in the 100-D-50:1 Excavation (Lift 4, 24 ft to Ground Surface) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
BFVL4-1	J1RW78	573323.3	151003.6	Chromium (total) [a], hexavalent chromium
BFVL4-2	J1RW80	573331.8	150979.1	
BFVL4-3	J1RW81	573340.2	151023.3	
BFVL4-4	J1RW82	573348.8	150998.8	
BFVL4-5	J1RW83	573365.7	151018.4	
BFVL4-6	J1RW84	573374.3	150993.9	
BFVL4-7	J1RW85	573391.2	151013.6	
BFVL4-8	J1RW86	573408.2	151033.2	
BFVL4-9	J1RW87	573416.7	151008.7	
BFVL4-10	J1RW88	573433.7	151028.4	
BFVL4-11	J1RW89	573442.2	151003.9	
BFVL4-12	J1RW90	573459.1	151023.5	
Duplicate of J1RW78	J1RW79	573323.3	151003.6	
Equipment blank	J1RW77	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-9. The 100-D-100 Overburden/Layback Soil (BFVL5) Placed in the 100-D-50:1 Excavation (8 ft Thick Lift Placed From Ground Surface to 8 ft Above Ground Surface) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
BFVL5-1	J1T744	573337.8	150947.8	Chromium (total) [a], hexavalent chromium
BFVL5-2	J1T745	573370.8	150947.8	
BFVL5-3	J1T746	573403.9	150947.8	
BFVL5-4	J1T747	573354.3	150976.4	
BFVL5-5	J1T748	573387.3	150976.4	
BFVL5-6	J1T749	573420.4	150976.4	
BFVL5-7	J1T750	573453.4	150976.4	
BFVL5-8	J1T751	573486.5	150976.4	
BFVL5-9	J1T752	573337.8	151005.0	
BFVL5-10	J1T753	573370.8	151005.0	
BFVL5-11	J1T754	573403.9	151005.0	
BFVL5-12	J1T755	573436.9	151005.0	
Duplicate of J1T754	J1T756	573403.9	151005.0	
Equipment blank	J1T757	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-10. The 100-D-100 Overburden/Layback Soil (BFVL1) Placed in the 100-D-62/ 100-D-77 Excavation (Lift 1, ~0 to 8 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
BFVL1-1	J1T0R6	573247.0	151219.9	Chromium (total) [a], hexavalent chromium
BFVL1-2	J1T0R7	573252.2	151219.9	
BFVL1-3	J1T0R8	573257.5	151219.9	
BFVL1-4	J1T0R9	573262.8	151219.9	
BFVL1-5	J1T0T0	573244.3	151224.4	
BFVL1-6	J1T0T1	573249.6	151224.4	
BFVL1-7	J1T0T2	573254.9	151224.4	
BFVL1-8	J1T0T3	573260.2	151224.4	
BFVL1-9	J1T0T4	573247.0	151229.0	
BFVL1-10	J1T0T5	573252.2	151229.0	
BFVL1-11	J1T0T6	573257.5	151229.0	
BFVL1-12	J1T0T7	573254.9	151233.6	
Duplicate of J1T0R6	J1T0T8	573247.0	151219.9	
Equipment blank	J1T0T9	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-11. The 100-D-100 Overburden/Layback Soil (BFVL2) Placed in the 100-D-62/ 100-D-77 Excavation (Lift 2, ~8 to 16 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
BFVL2-1	J1T671	573258.7	151169.9	Chromium (total) [a], hexavalent chromium
BFVL2-2	J1T672	573265.1	151181.0	
BFVL2-3	J1T673	573258.7	151192.1	
BFVL2-4	J1T674	573271.5	151192.1	
BFVL2-5	J1T675	573252.3	151203.1	
BFVL2-6	J1T676	573265.1	151203.1	
BFVL2-7	J1T677	573245.9	151214.2	
BFVL2-8	J1T678	573258.7	151214.2	
BFVL2-9	J1T679	573239.5	151225.3	
BFVL2-10	J1T680	573252.3	151225.3	
BFVL2-11	J1T681	573265.1	151225.3	
BFVL2-12	J1T682	573258.7	151236.3	
Duplicate of J1T671	J1T683	573258.7	151169.9	
Equipment blank	J1T684	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-12. The 100-D-100 Overburden/Layback Soil (VL1N1) Placed in the North Portion of the 100-D-56:6 Excavation (Lift 1, ~0 to 8 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
VL1N-1	J1R912	573423.3	151173.9	Chromium (total) [a], hexavalent chromium
VL1N-2	J1R913	573449.9	151173.9	
VL1N-3	J1R914	573476.5	151173.9	
VL1N-4	J1R915	573503.1	151173.9	
VL1N-5	J1R916	573436.6	151196.9	
VL1N-6	J1R917	573463.2	151196.9	
VL1N-7	J1R918	573489.8	151196.9	
VL1N-8	J1R919	573449.9	151220.0	
VL1N-9	J1R920	573476.5	151220.0	
VL1N-10	J1R921	573503.1	151220.0	
VL1N-11	J1R922	573463.2	151243.0	
VL1N-12	J1R923	573489.8	151243.0	
Duplicate of J1R916	J1R924	573436.6	151196.9	
Equipment blank	J1R925	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-13. The 100-D-100 Overburden/Layback Soil (SP2VL2N) Placed in the North Portion of the 100-D-56:6 Excavation (Lift 2, ~8 to 16 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SP2VL2N-1	J1RV96	573442.2	151192.1	Chromium (total) [a], hexavalent chromium
SP2VL2N-2	J1RV97	573475.5	151192.1	
SP2VL2N-3	J1RV98	573508.7	151192.1	
SP2VL2N-4	J1RV99	573542.0	151192.1	
SP2VL2N-5	J1RVC0	573458.8	151220.9	
SP2VL2N-6	J1RVC1	573492.1	151220.9	
SP2VL2N-7	J1RVC2	573525.4	151220.9	
SP2VL2N-8	J1RVC3	573558.6	151220.9	
SP2VL2N-9	J1RVC4	573475.5	151249.7	
SP2VL2N-10	J1RVC5	573508.7	151249.7	
SP2VL2N-11	J1RVC6	573542.0	151249.7	
SP2VL2N-12	J1RVC7	573575.2	151249.7	
Duplicate of J1RV99	J1RVC8	573542.0	151192.1	
Equipment blank	J1RVC9	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-14. The 100-D-100 Overburden/Layback Soil (SP2VL3N) Placed in the North Portion of the 100-D-56:6 Excavation (Lift 3, ~16 to 24 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SP2VL3N-1	J1T0P2	573459.7	151201.2	Chromium (total) [a], hexavalent chromium
SP2VL3N-2	J1T0P3	573487.7	151201.2	
SP2VL3N-3	J1T0P4	573515.7	151201.2	
SP2VL3N-4	J1T0P5	573543.6	151201.2	
SP2VL3N-5	J1T0P6	573473.7	151225.4	
SP2VL3N-6	J1T0P7	573501.7	151225.4	
SP2VL3N-7	J1T0P8	573529.7	151225.4	
SP2VL3N-8	J1T0P9	573557.6	151225.4	
SP2VL3N-9	J1T0R0	573487.7	151249.7	
SP2VL3N-10	J1T0R1	573515.7	151249.7	
SP2VL3N-11	J1T0R2	573543.6	151249.7	
SP2VL3N-12	J1T0R3	573571.6	151249.7	
Duplicate of J1T0P2	J1T0R4	573459.7	151201.2	
Equipment blank	J1T0R5	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-15. The 100-D-100 Overburden/Layback Soil (VL1S) Placed in the South Portion of the 100-D-56:6 Excavation (Lift 1, ~0 to 8 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
VL1S-1	J1R8X8	573465.6	151109.7	Chromium (total) [a], hexavalent chromium
VL1S-2	J1R8X9	573493.1	151109.7	
VL1S-3	J1R900	573520.7	151109.7	
VL1S-4	J1R901	573548.2	151109.7	
VL1S-5	J1R902	573424.3	151133.5	
VL1S-6	J1R903	573451.8	151133.5	
VL1S-7	J1R904	573479.3	151133.5	
VL1S-8	J1R905	573506.9	151133.5	
VL1S-9	J1R906	573534.4	151133.5	
VL1S-10	J1R907	573438.0	151157.4	
VL1S-11	J1R908	573465.6	151157.4	
VL1S-12	J1R909	573493.1	151157.4	
Duplicate of J1R900	J1R910	573520.7	151109.7	
Equipment blank	J1R911	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-16. The 100-D-100 Overburden/Layback Soil (SP2VL2S) Placed in the South Portion of the 100-D-56:6 Excavation (Lift 2, ~8 to 16 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SP2VL2S-1	J1RFF3	573450.8	151058.3	Chromium (total) [a], hexavalent chromium
SP2VL2S-2	J1RFF4	573432.4	151090.2	
SP2VL2S-3	J1RFF5	573543.0	151090.2	
SP2VL2S-4	J1RFF6	573413.9	151122.2	
SP2VL2S-5	J1RFF7	573450.8	151122.2	
SP2VL2S-6	J1RFF8	573487.7	151122.2	
SP2VL2S-7	J1RFF9	573524.5	151122.2	
SP2VL2S-8	J1RFH0	573561.4	151122.2	
SP2VL2S-9	J1RFH1	573432.4	151154.1	
SP2VL2S-10	J1RFH2	573469.2	151154.1	
SP2VL2S-11	J1RFH3	573506.1	151154.1	
SP2VL2S-12	J1RFH4	573543.0	151154.1	
Duplicate of J1RFF6	J1RFH5	573413.9	151122.2	
Equipment blank	J1RFH6	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-17. The 100-D-100 Overburden/Layback Soil (SP2VL3S) Placed in the South Portion of the 100-D-56:6 Excavation (Lift 3, ~16 to 24 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SP2VL3S-1	J1RLK4	573438.0	151050.9	Chromium (total) [a], hexavalent chromium
SP2VL3S-2	J1RLK5	573556.3	151050.9	
SP2VL3S-3	J1RLK6	573457.7	151085.0	
SP2VL3S-4	J1RLK7	573536.6	151085.0	
SP2VL3S-5	J1RLK8	573576.0	151085.0	
SP2VL3S-6	J1RLK9	573438.0	151119.2	
SP2VL3S-7	J1RLL0	573477.4	151119.2	
SP2VL3S-8	J1RLL1	573516.9	151119.2	
SP2VL3S-9	J1RLL2	573556.3	151119.2	
SP2VL3S-10	J1RLL3	573457.7	151153.4	
SP2VL3S-11	J1RLL4	573497.1	151153.4	
SP2VL3S-12	J1RLL5	573536.6	151153.4	
Duplicate of J1RLK4	J1RLL6	573438.0	151050.9	
Equipment blank	J1RLL7	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-18. The 100-D-100 Overburden/Layback Soil (SP2VL4S) Placed in the South Portion of the 100-D-56:6 Excavation (Lift 4, ~24 to 32 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SP2VL4S-1	J1T3W8	573451.1	151098.0	Chromium (total) [a], hexavalent chromium
SP2VL4S-2	J1T3W9	573485.8	151098.0	
SP2VL4S-3	J1T3X0	573520.4	151098.0	
SP2VL4S-4	J1T3X1	573555.1	151098.0	
SP2VL4S-5	J1T3X2	573433.8	151128.0	
SP2VL4S-6	J1T3X3	573468.5	151128.0	
SP2VL4S-7	J1T3X4	573503.1	151128.0	
SP2VL4S-8	J1T3X5	573537.8	151128.0	
SP2VL4S-9	J1T3X6	573572.4	151128.0	
SP2VL4S-10	J1T3X7	573451.1	151158.0	
SP2VL4S-11	J1T3X8	573485.8	151158.0	
SP2VL4S-12	J1T3X9	573520.4	151158.0	
Duplicate of J1T3X9	J1T400	573520.4	151158.0	
Equipment blank	J1T401	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-19. The 100-D-100 Overburden/Layback Soil (SP2VL1W) Placed in the West Portion of the 100-D-56:6 Excavation (Lift 1, ~0 to 8 ft) Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SP2VL1W-1	J1RHL3	573362.4	151109.9	Chromium (total) [a], hexavalent chromium
SP2VL1W-2	J1RHL4	573352.8	151126.6	
SP2VL1W-3	J1RHL5	573372.0	151126.6	
SP2VL1W-4	J1RHL6	573362.4	151143.2	
SP2VL1W-5	J1RHL7	573381.6	151143.2	
SP2VL1W-6	J1RHL8	573352.8	151159.9	
SP2VL1W-7	J1RHL9	573372.0	151159.9	
SP2VL1W-8	J1RHM0	573362.4	151176.5	
SP2VL1W-9	J1RHM1	573381.6	151176.5	
SP2VL1W-10	J1RHM2	573352.8	151193.2	
SP2VL1W-11	J1RHM3	573372.0	151193.2	
SP2VL1W-12	J1RHM4	573362.4	151209.8	
Duplicate of J1RHM4	J1RHM5	573362.4	151209.8	
Equipment blank	J1RHM6	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Table F-20. The 100-D-100 Tier III Waste Staging Pile Area Footprint Located Southeast of the 100-D-100 Waste Site Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SPA1-1	J1TLW9	573730.0	151050.7	Chromium (total) [a], hexavalent chromium
SPA1-2	J1TLX0	573766.7	151066.0	
SPA1-3	J1TLX1	573661.6	151059.7	
SPA1-4	J1TLX2	573698.4	151075.0	
SPA1-5	J1TLX3	573735.1	151090.2	
SPA1-6	J1TLX4	573630.0	151083.9	
SPA1-7	J1TLX5	573703.6	151114.4	
SPA1-8	J1TLX6	573740.3	151129.6	
SPA1-9	J1TLX7	573635.2	151123.4	
SPA1-10	J1TLX8	573672.0	151138.6	
SPA1-11	J15LX9	573708.8	151153.9	
SPA1-12	J1TM00	573745.5	151169.1	
Duplicate of J1TLX4	J1TM01	573630.0	151083.9	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
SPA = staging pile area

Table F-21. The 100-D-100 Tier III Waste Staging Pile Area Footprint Located Southwest of the 100-D-100 Waste Site Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates		Sample Analysis
		Easting	Northing	
SPA-1	J1TPJ4	573108.6	150607.6	Chromium (total) [a], hexavalent chromium
SPA-2	J1TPJ5	573165.6	150607.6	
SPA-3	J1TPJ6	573137.1	150657.0	
SPA-4	J1TPJ7	573051.5	150805.3	
SPA-5	J1TPJ8	573165.6	150805.3	
SPA-6	J1TPJ9	573137.1	150854.7	
SPA-7	J1TPK0	573165.6	150904.2	
SPA-8	J1TPK1	573137.1	150953.6	
SPA-9	J1TPK2	573165.6	151003.0	
SPA-10	J1TPK3	573137.1	151052.4	
SPA-11	J1TPK4	573165.6	151101.9	
SPA-12	J1TPK5	573137.1	151151.3	
Duplicate of J1TPJ4	J1TPK6	573108.6	150607.6	Chromium (total) [a], hexavalent chromium
Equipment blank	J1TPK7	NA	NA	Chromium (total) [a], hexavalent chromium

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
SPA = staging pile area

Table F-22. The 100-D-100 Tier III, 100-D-72, 100-D-31:1, 100-D-31:12, 100-D-81, and 100-D-50:7 Waste Staging Pile Area Footprint Located to the West of the 100-D-100 Waste Site Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
SPA-1	J1V058	573155.4	151231.2	ICP metals, mercury, hexavalent chromium, IC anions, nitrate, nitrite, PAH, PCB, pesticide, pH, SVOC, TPH
SPA-2	J1V059	573092.3	151267.6	
SPA-3	J1V060	573134.4	151267.6	
SPA-4	J1V061	573071.2	151304.1	
SPA-5	J1V062	573113.3	151304.1	
SPA-6	J1V063	573155.4	151304.1	
SPA-7	J1V064	573050.1	151340.6	
SPA-8	J1V065	573092.3	151340.6	
SPA-9	J1V066	573134.4	151340.6	
SPA-10	J1V067	573176.5	151340.6	
SPA-11	J1V068	573113.3	151377	
SPA-12	J1V069	573155.4	151377	
Duplicate of J1V060	J1V070	573134.4	151267.6	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
IC = ion chromatography
ICP = inductively coupled plasma
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
pH = hydrogen ion concentration
SPA = staging pile area
SVOC = semivolatile organic analysis
TPH = total petroleum hydrocarbons

Table F-23. The 100-D-100 Waste Site Equipment Decontamination Pad Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
DP-1	J1V0P8	573434.3	151060.9	Chromium (total) [a], hexavalent chromium
DP-2	J1V0P9	573439.6	151059.2	
DP-3	J1V0R0	573436.4	151052.0	
DP-4	J1V0R1	573431.5	151053.8	
Duplicate of J1V0P8	J1V0R2	573434.3	151060.9	
Equipment blank	J1V0R3	NA	NA	

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Figure F-1. Verification Sample Locations for the 100-D-100 Excavation Decision Units 1, 3, 4, 5, 6, 7, and 8.

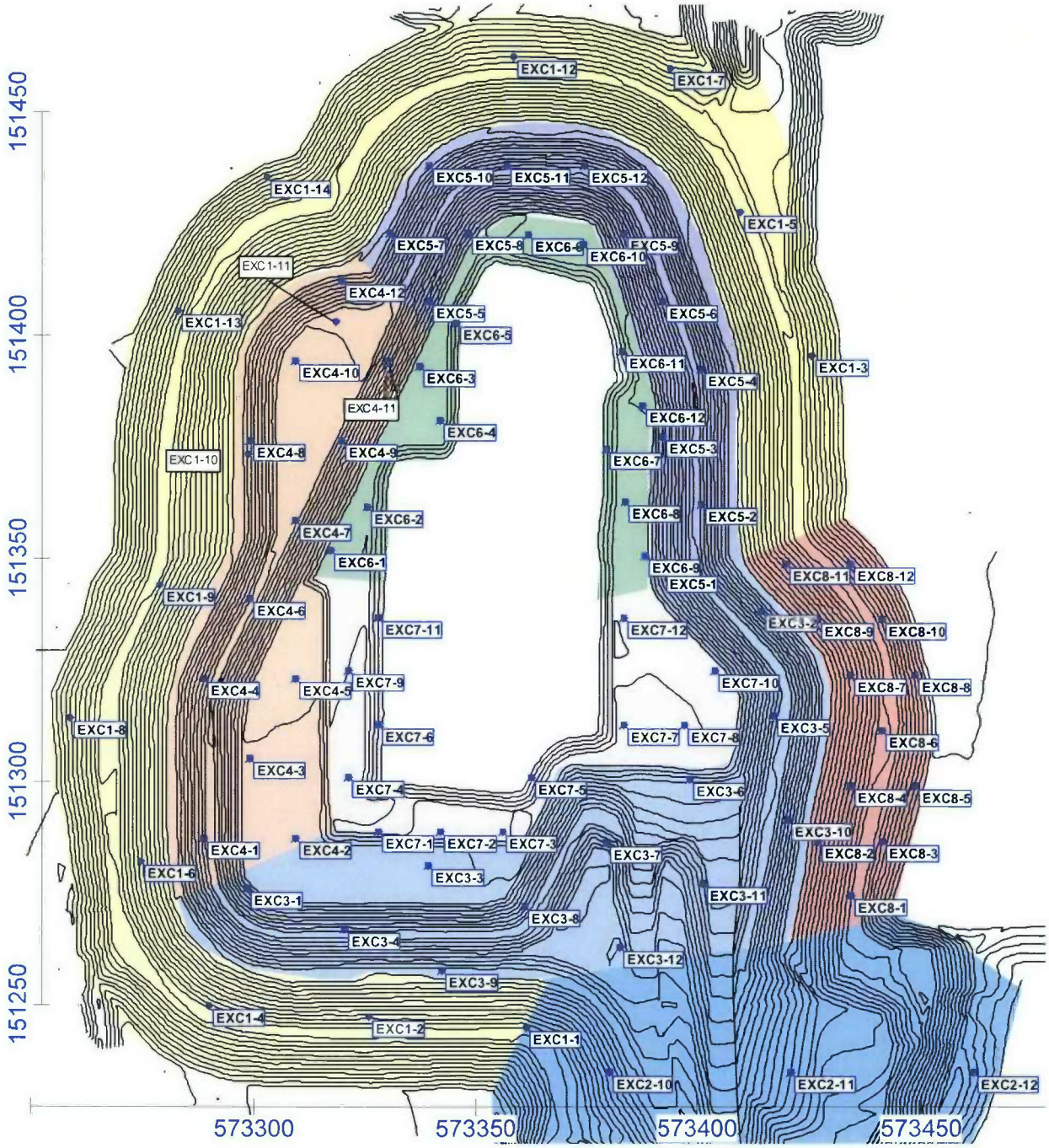


Figure F-2. Verification Sample Locations for the 100-D-100 Excavation Decision Unit 2.

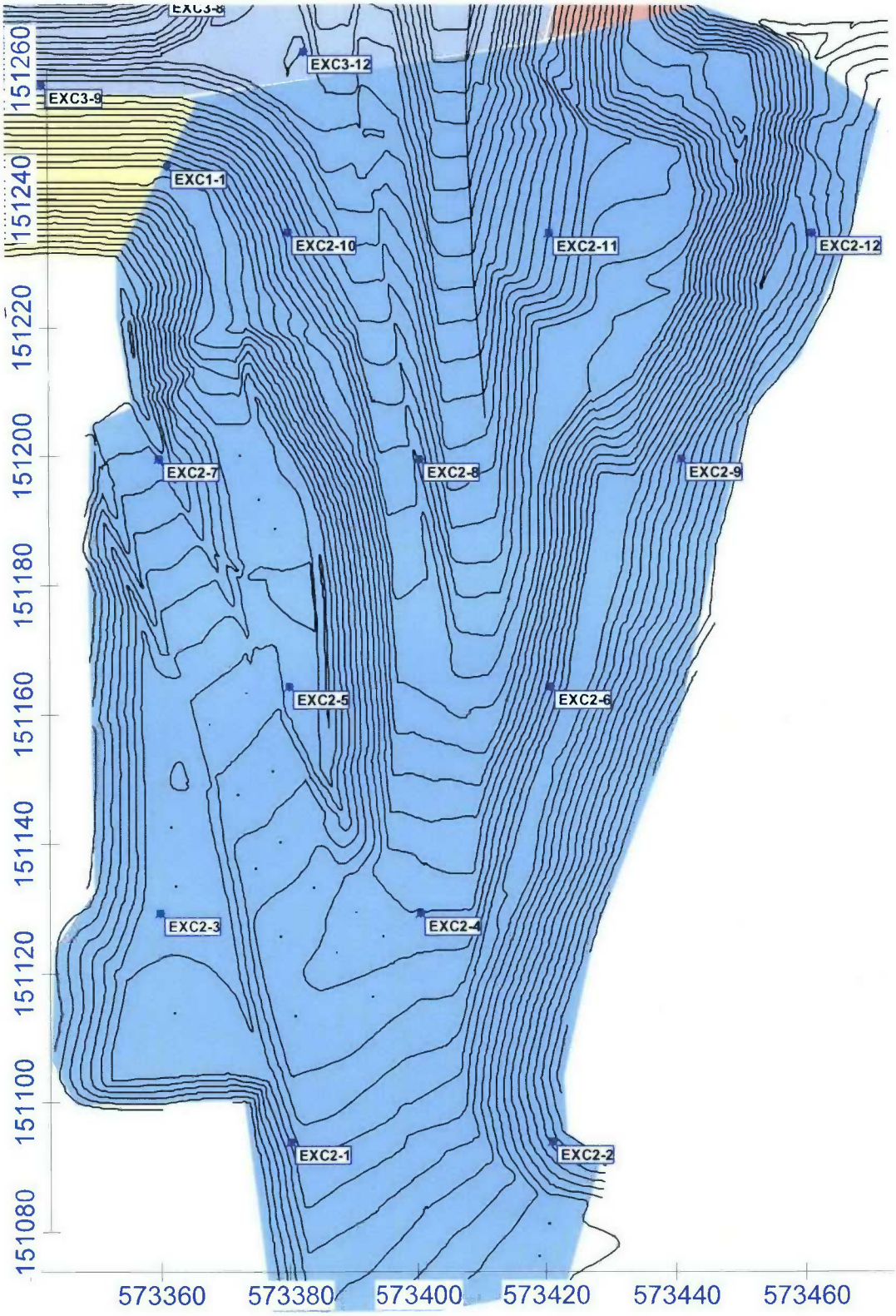


Figure F-3. Verification Sample Locations for the 100-D-100 Tier II Staging Pile Area.

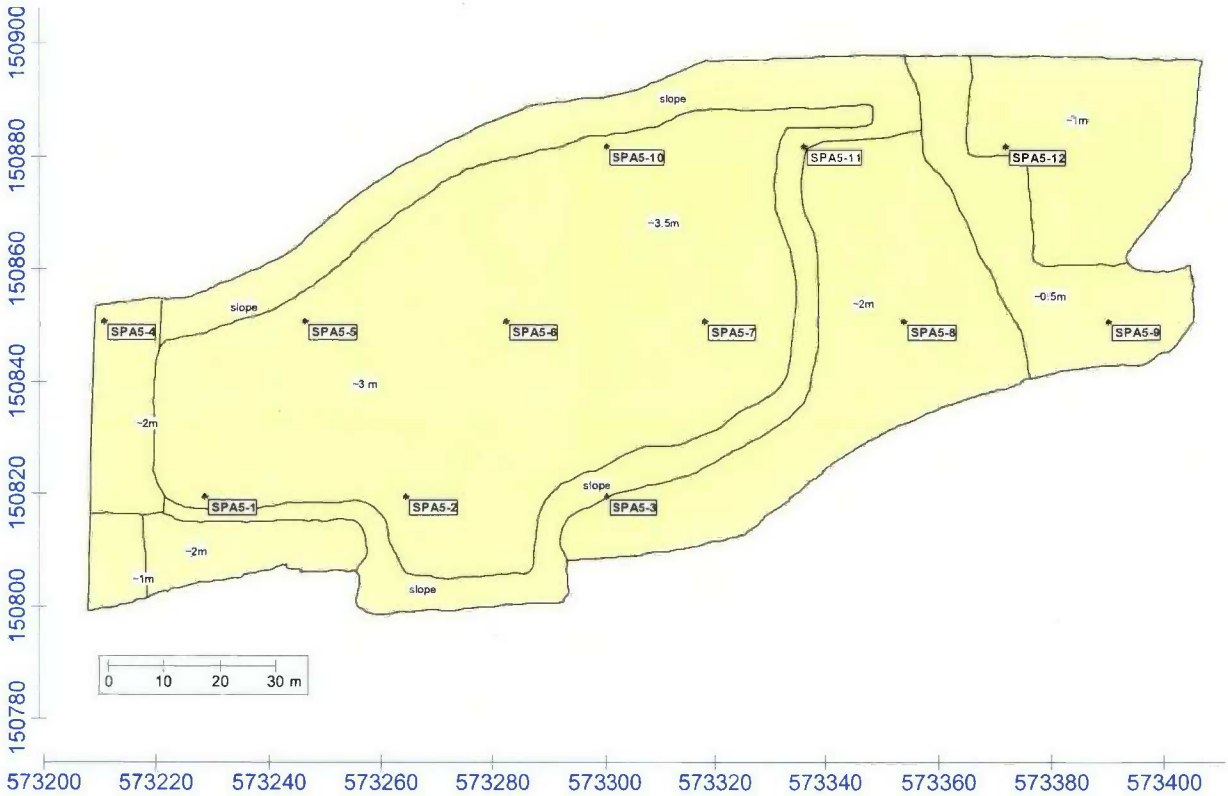


Figure F-4. Verification Sample Locations for the 100-D-100 Tier II Overburden/Layback Soil Stockpile.

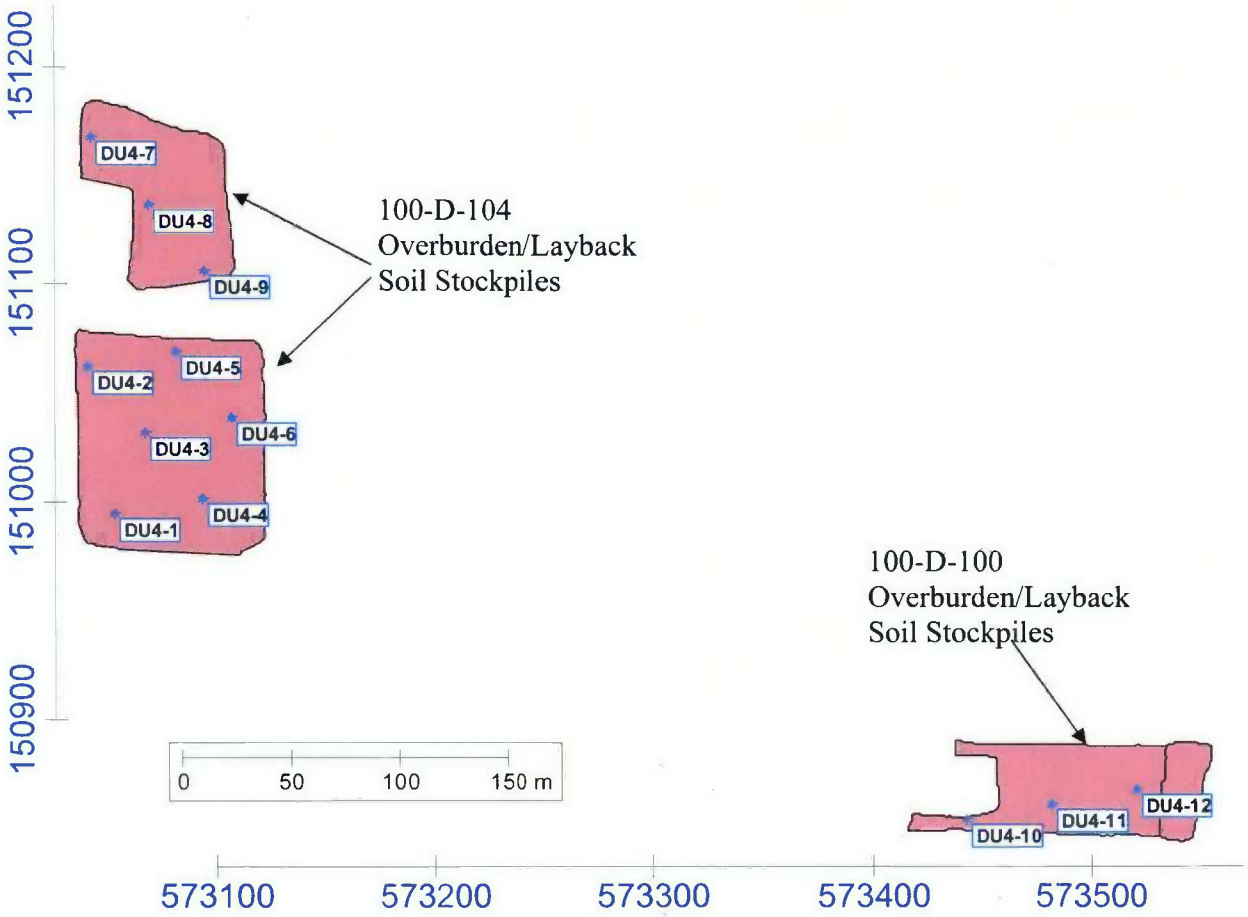


Figure F-5. Verification Sample Locations for the 100-D-100 Tier III Overburden/Layback Soil (SP1VL1) Stockpile (Lift 1, 0 to 8 ft).

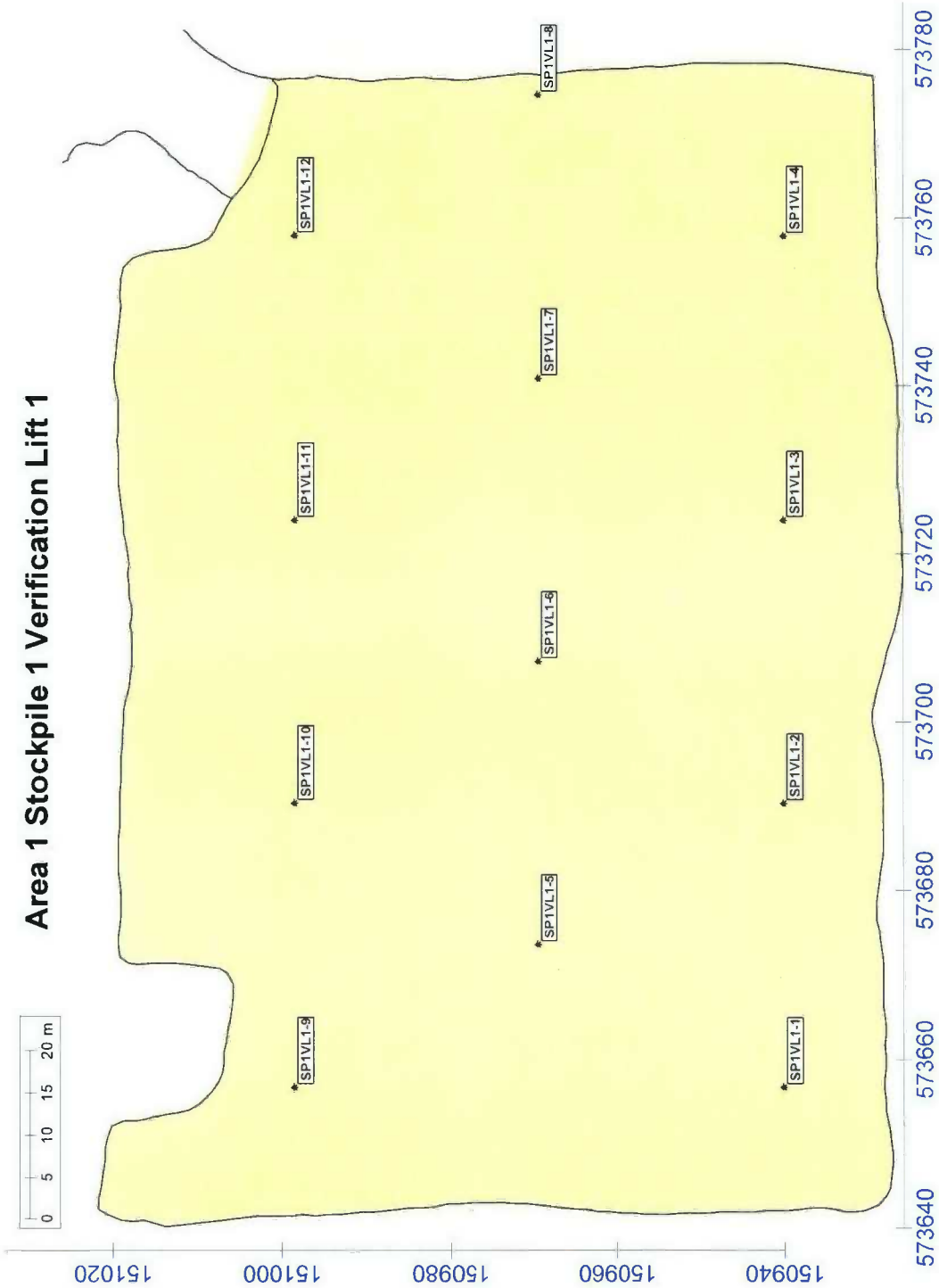


Figure F-6. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (BFVL1) Placed in the 100-D-50:1 Excavation (Lift 1, 0 to 8 ft).

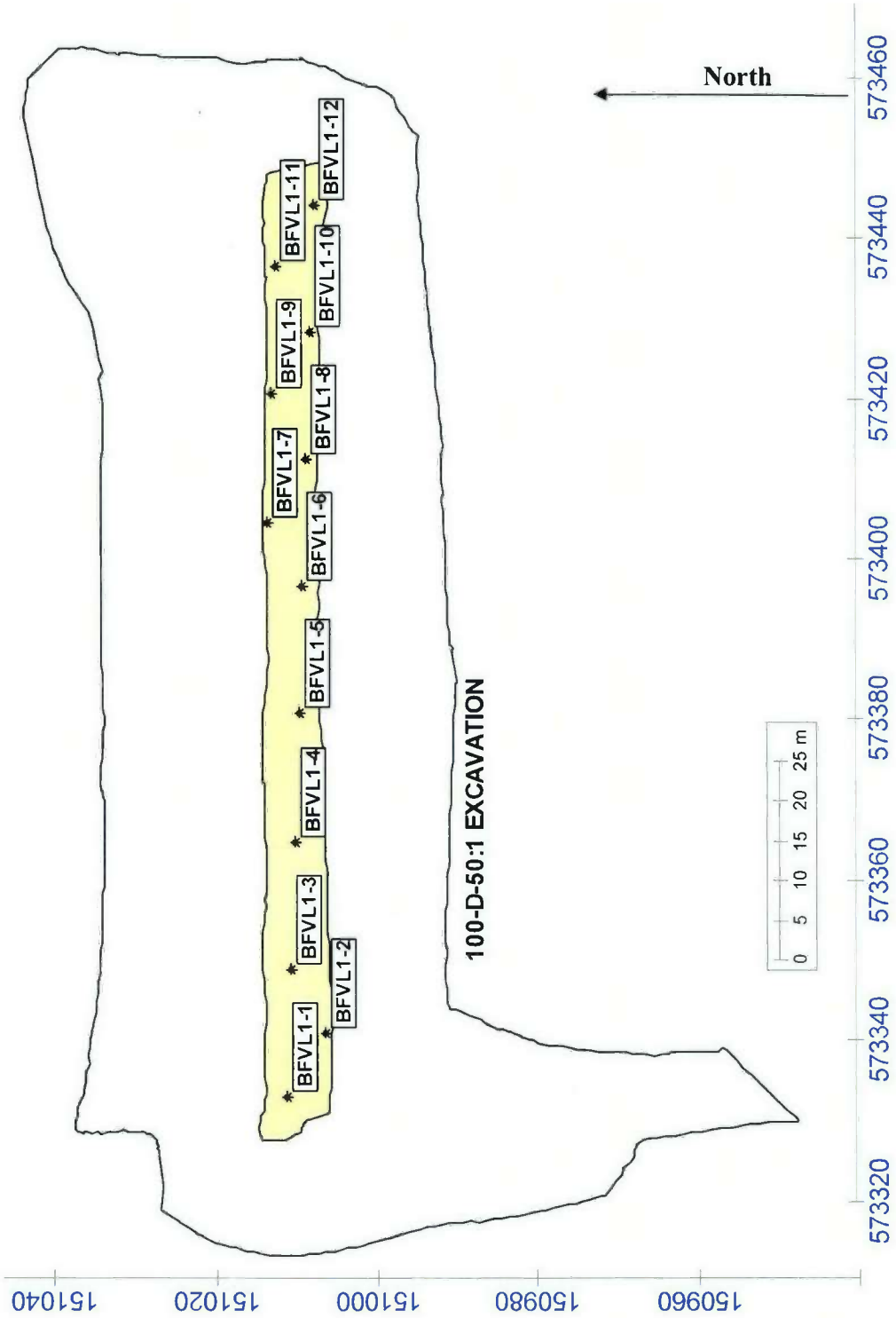


Figure F-7. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (BFVL2) Placed in the 100-D-50:1 Excavation (Lift 2, 8 to 16 ft).

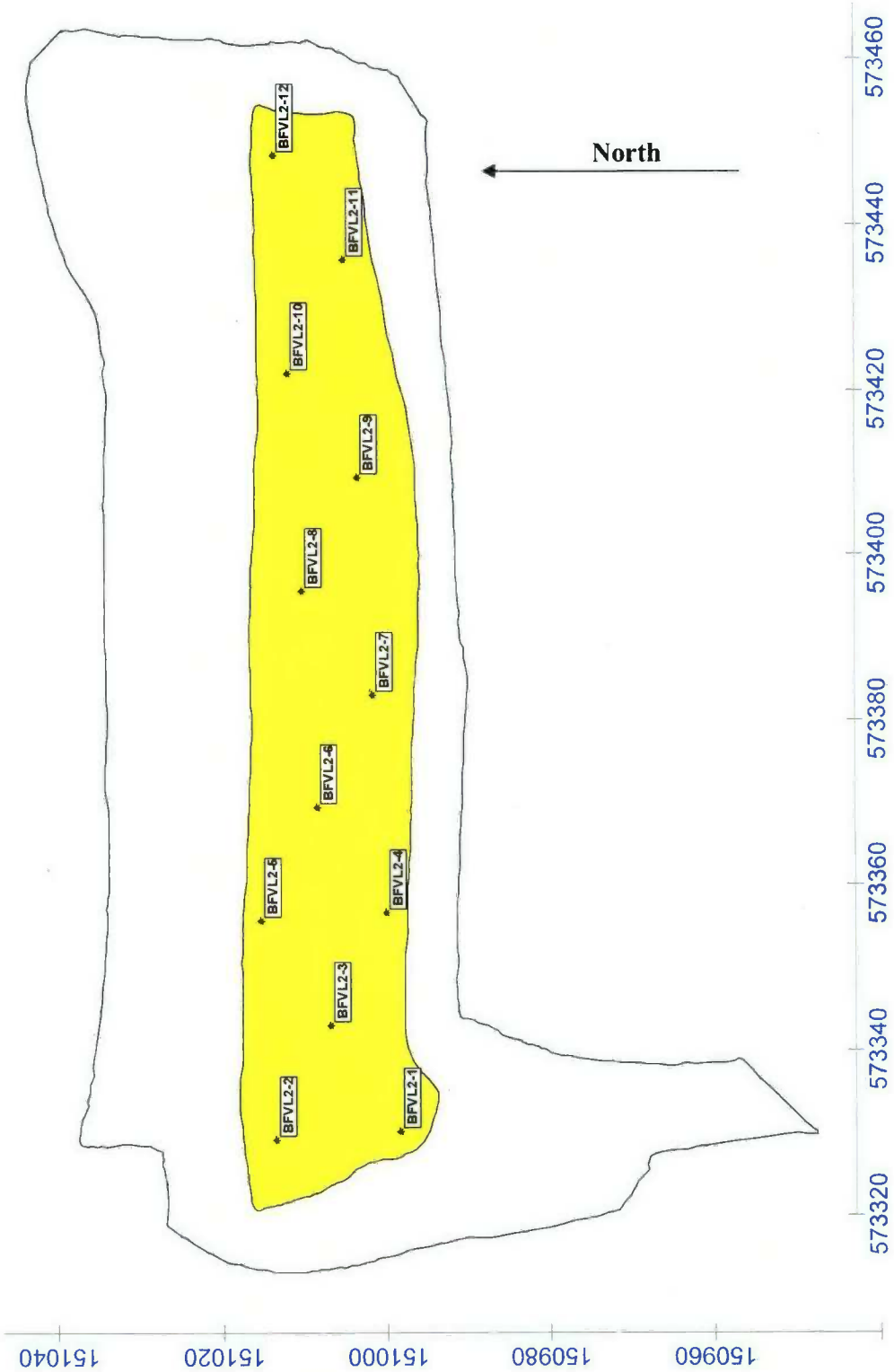


Figure F-8. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (BFVL3) Placed in the 100-D-50:1 Excavation (Lift 3, 16 to 24 ft).

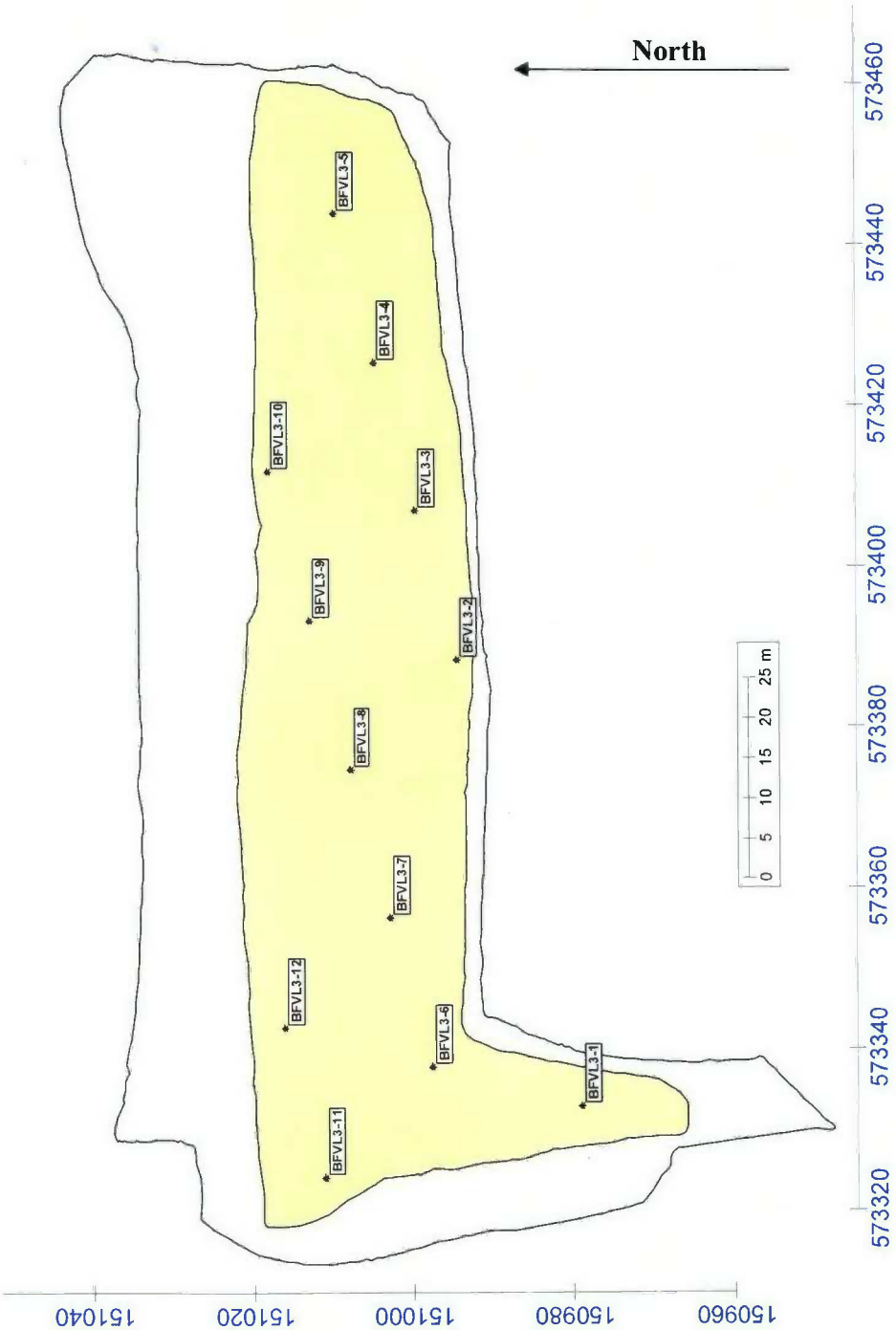


Figure F-9. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (BFVL4) Placed in the 100-D-50:1 Excavation (Lift 4, 8 ft Thick Lift Placed from 24 ft to Ground Surface).

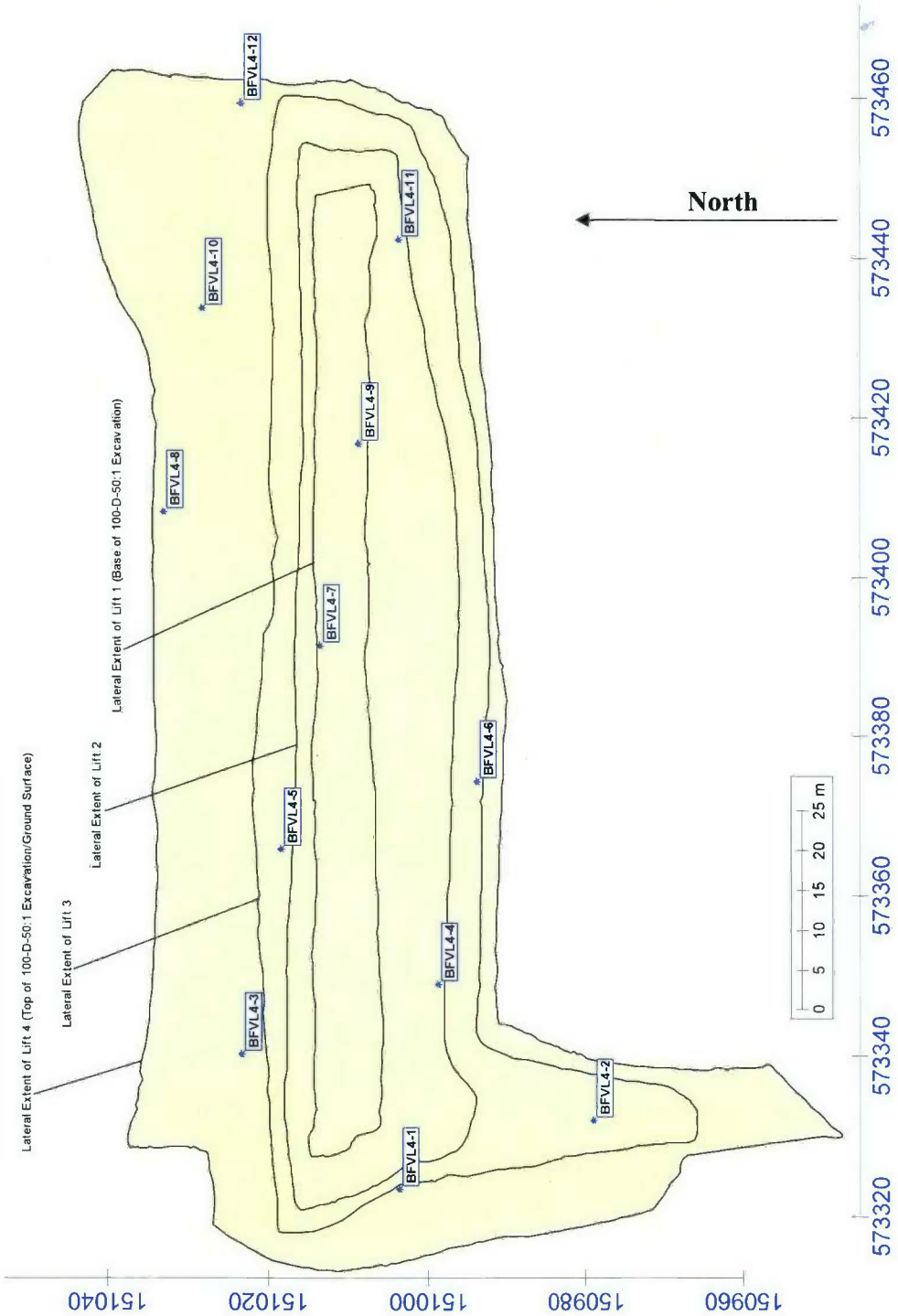


Figure F-10. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (BFVL5) Placed in the 100-D-50:1 Excavation (Lift 5, 8 ft Thick Lift Placed from Ground Surface to 8 ft Above Ground Surface).

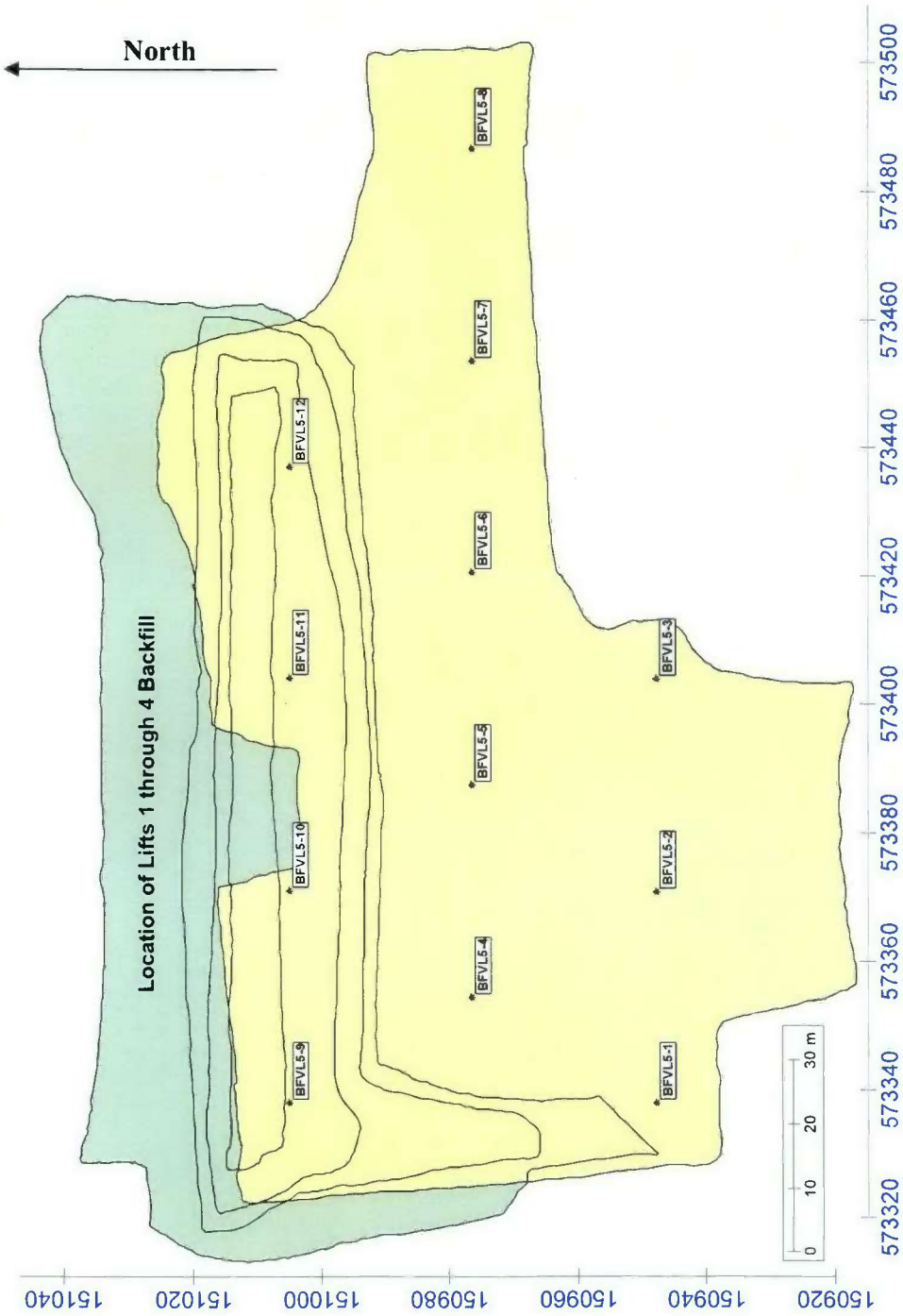


Figure F-11. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (BFVL1) Placed in the 100-D-62/100-D-77 Excavation (Lift 1, ~0 to 8 ft).

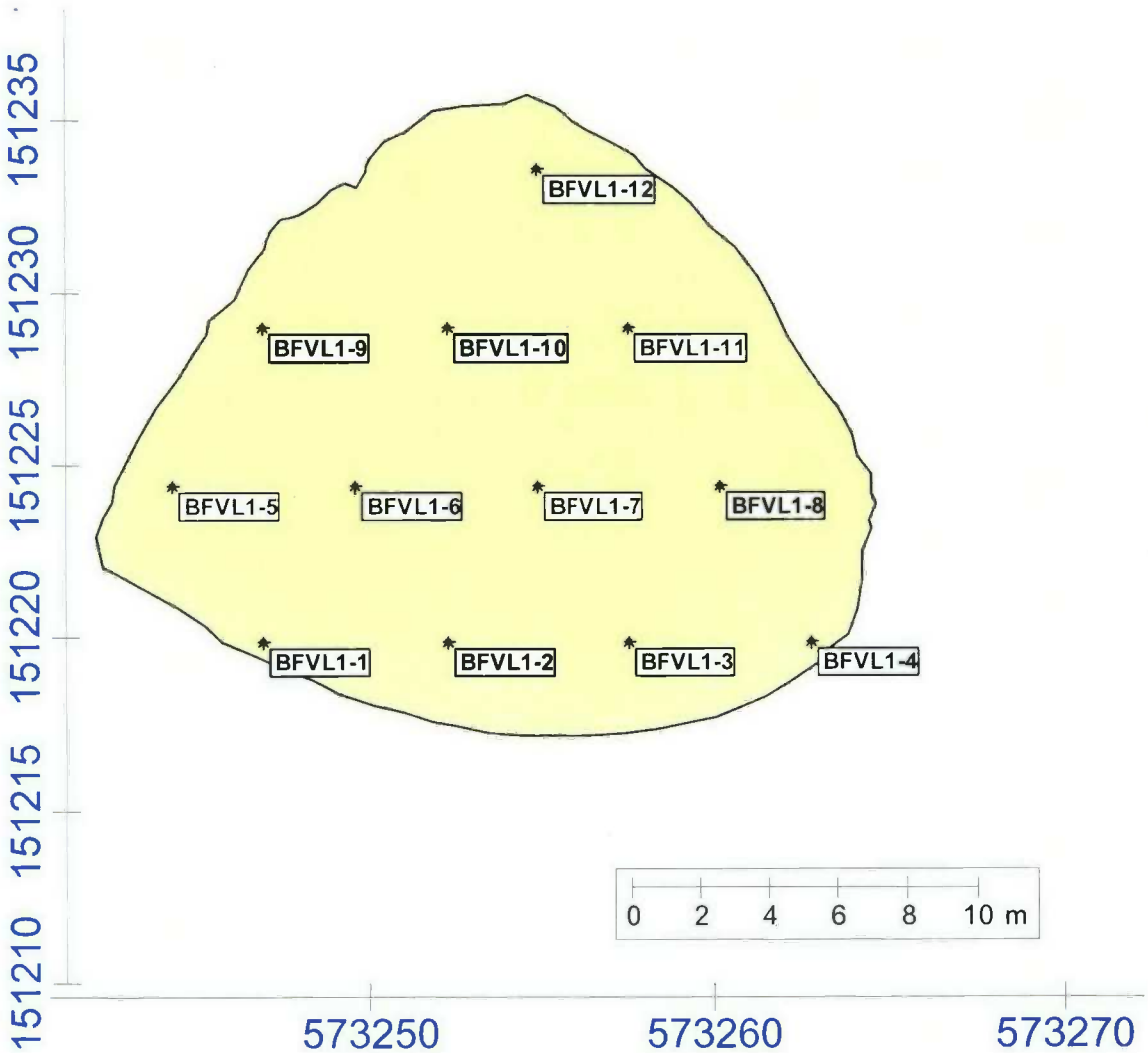


Figure F-12. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (BFVL2) Placed in the 100-D-62/100-D-77 Excavation (Lift 2, ~8 to 16 ft).

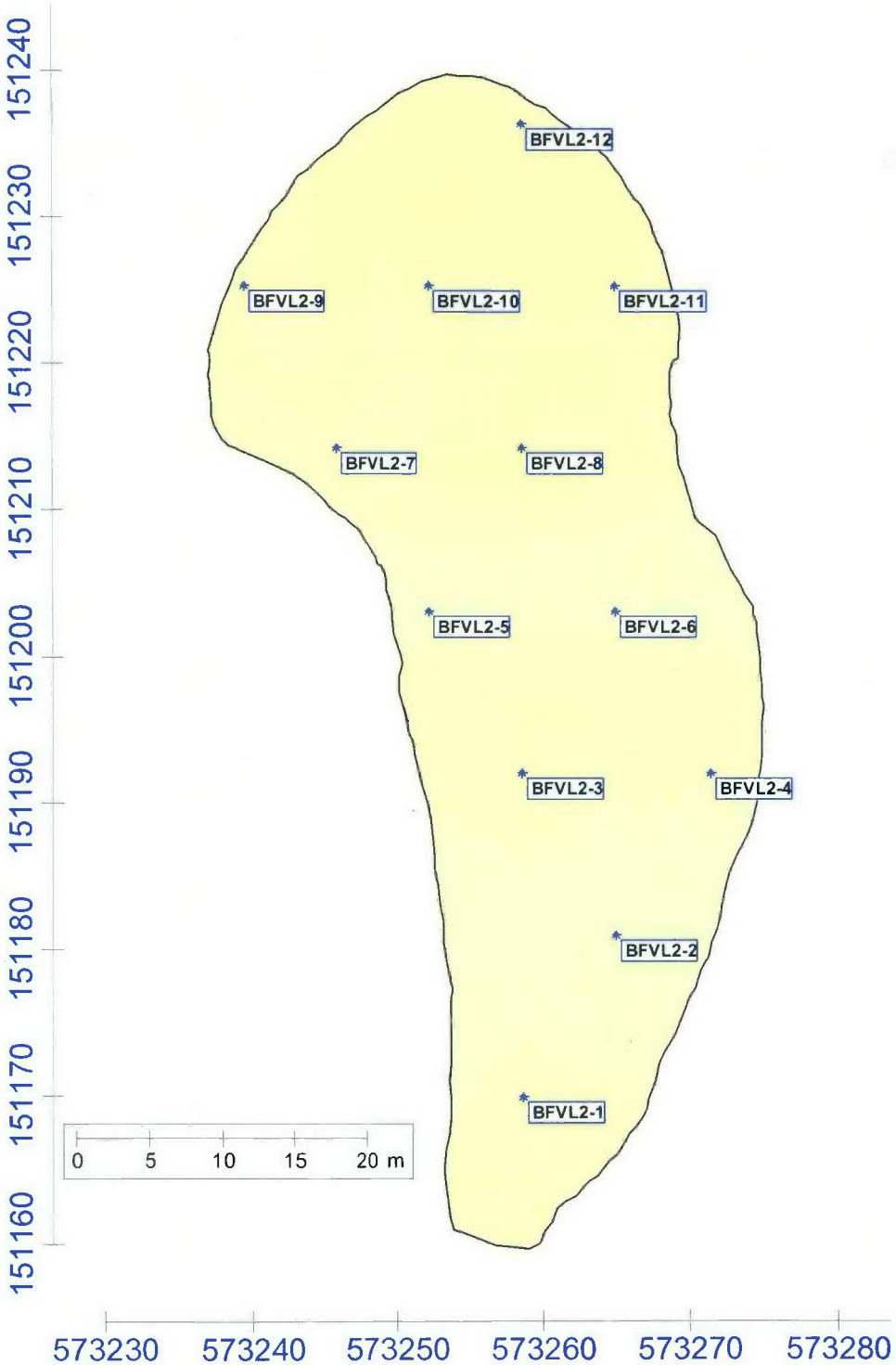


Figure F-13. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (VL1N1) Placed in the North Portion of the 100-D-50:6 Excavation (Lift 1, ~0 to 8 ft).

Figure F-14. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (SP2VL2N) Placed in the North Portion of the 100-D-50:6 Excavation (Lift 2, ~8 to 16 ft).

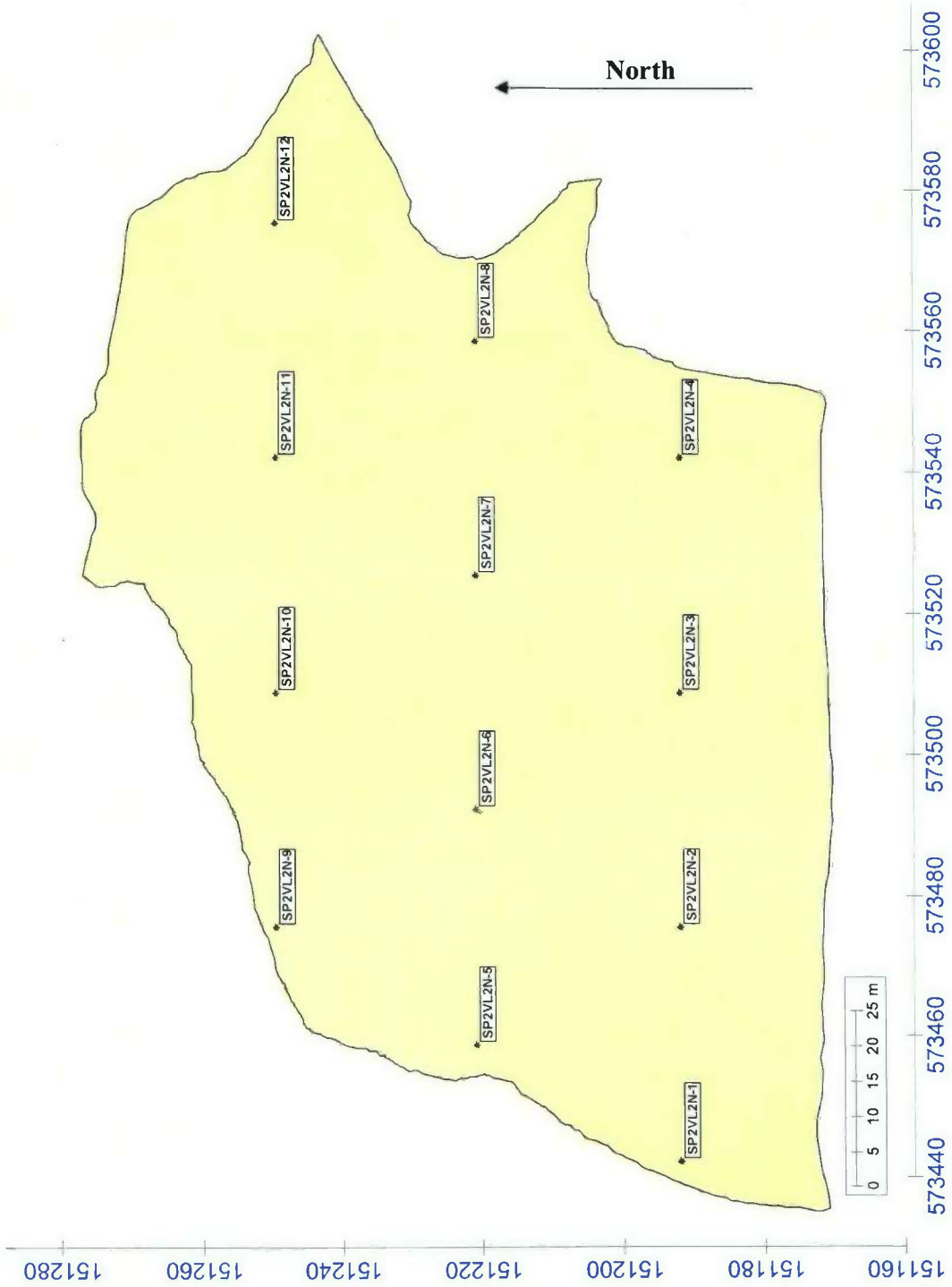


Figure F-15. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (SP2VL3N) Placed in the North Portion of the 100-D-50:6 Excavation (Lift 3, ~16 to 24 ft).

Figure F-16. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (VL1S) Placed in the South Portion of the 100-D-50:6 Excavation (Lift 1, ~0 to 8 ft).

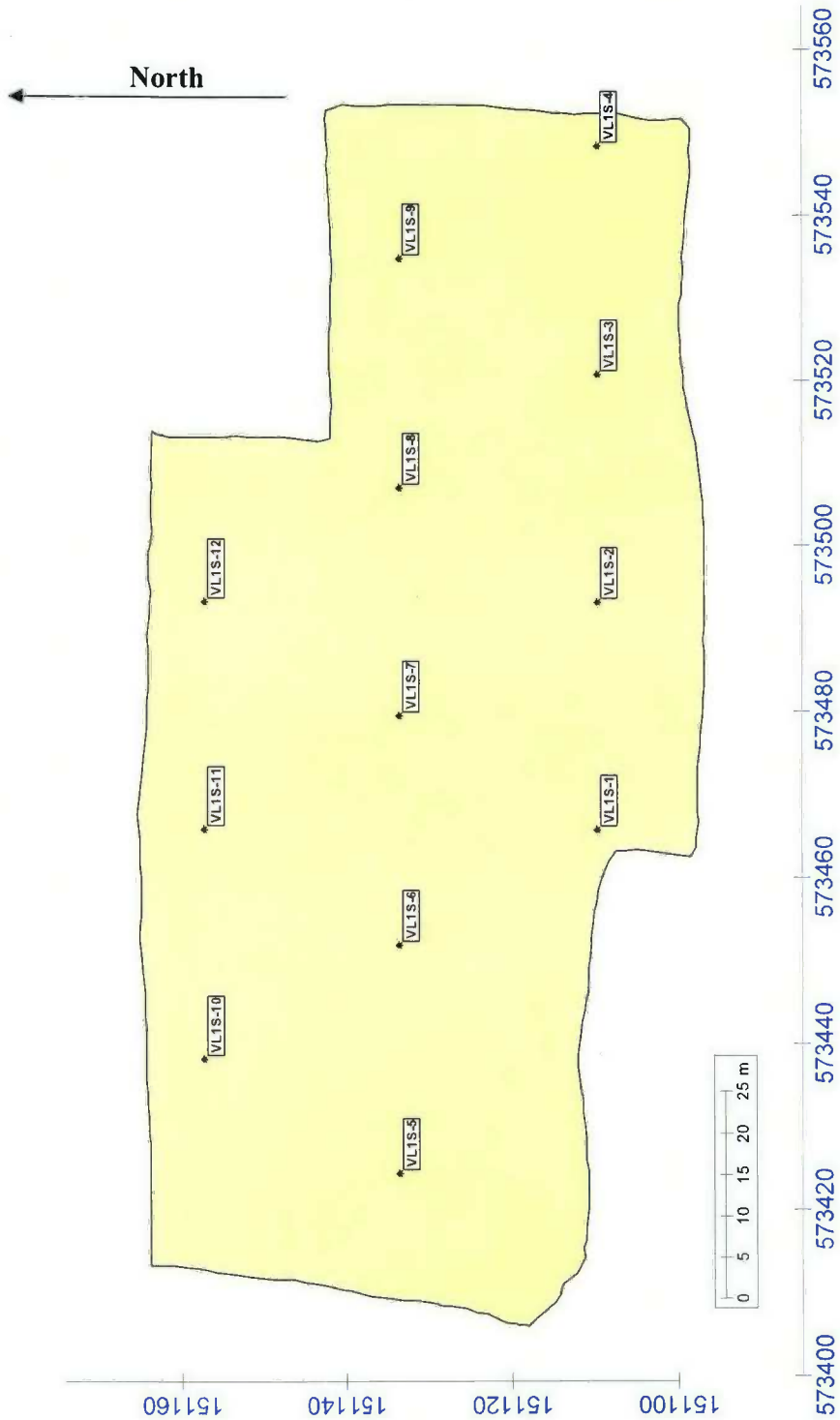


Figure F-17. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (SP2VL2S) Placed in the South Portion of the 100-D-50:6 Excavation (Lift 2, ~8 to 16 ft).

Figure F-18. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (SP2VL3S) Placed in the South Portion of the 100-D-50:6 Excavation (Lift 3, ~16 to 24 ft).

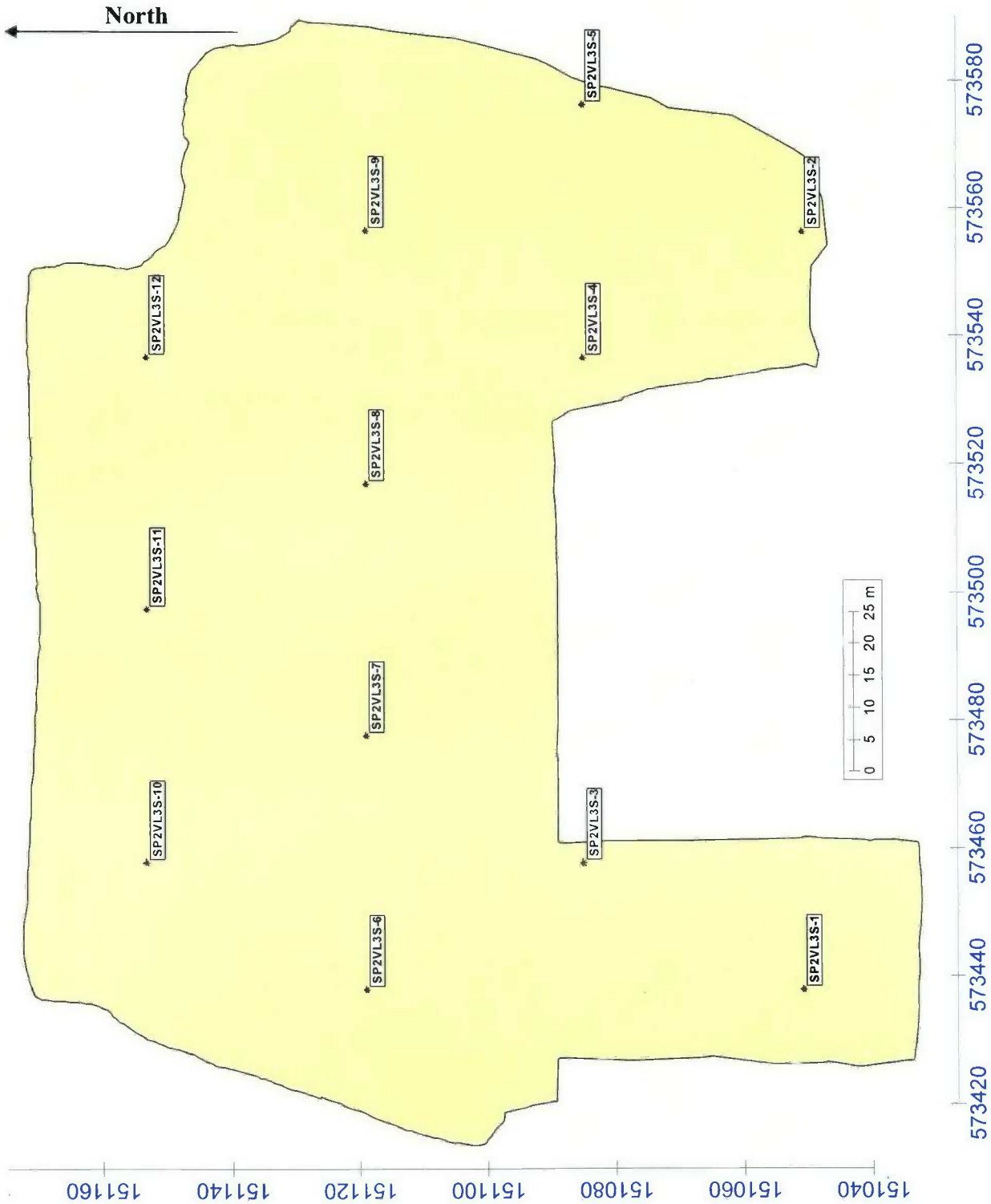


Figure F-19. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (SP2VL4S) Placed in the South Portion of the 100-D-50:6 Excavation (Lift 4, ~24 to 32 ft).

Figure F-20. Verification Sample Locations for the 100-D-100 Overburden/Layback Soil (SP2VL1W) Placed in the West Portion of the 100-D-50:6 Excavation (Lift 1, ~0 to 8 ft).

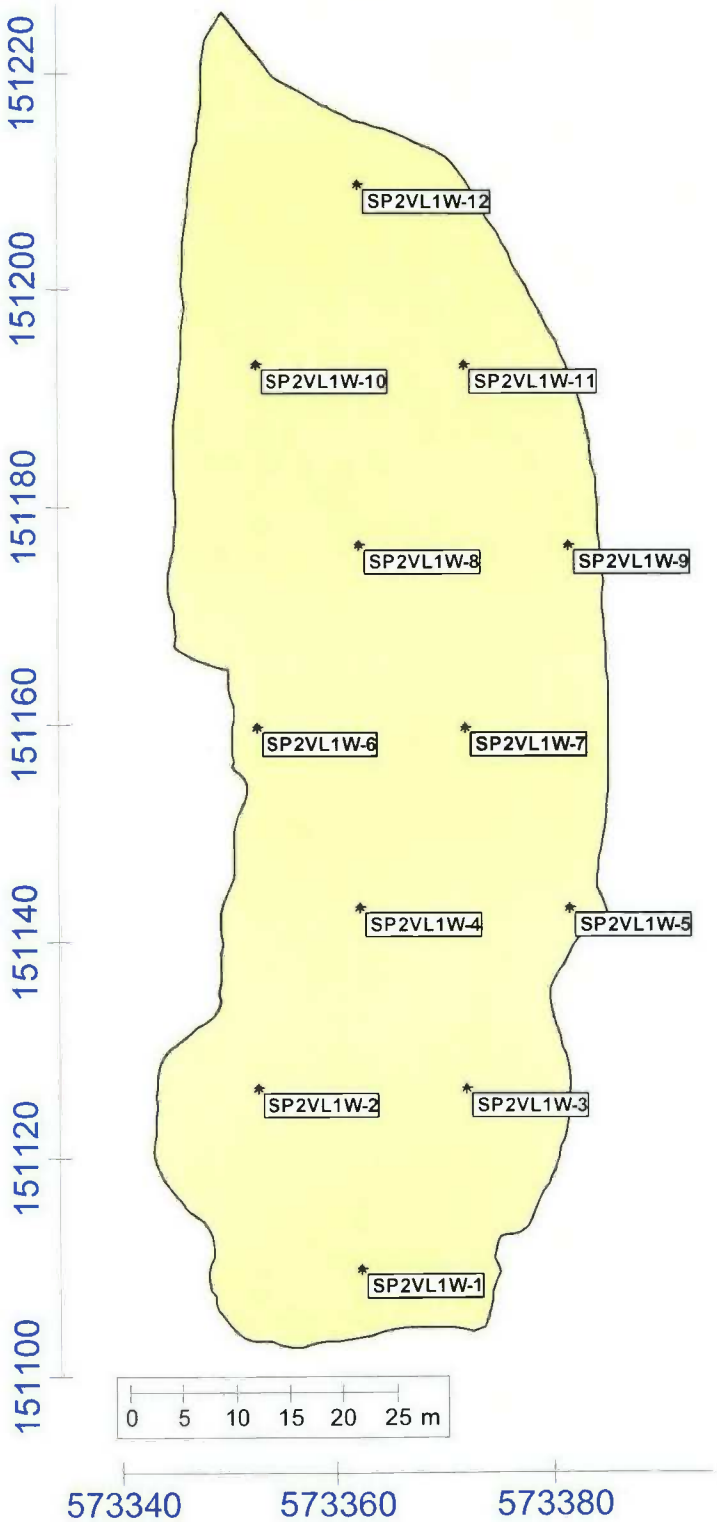


Figure F-21. Verification Sample Locations for the 100-D-100 Tier III Staging Pile Area Located to the Southeast of the 100-D-100 Excavation.

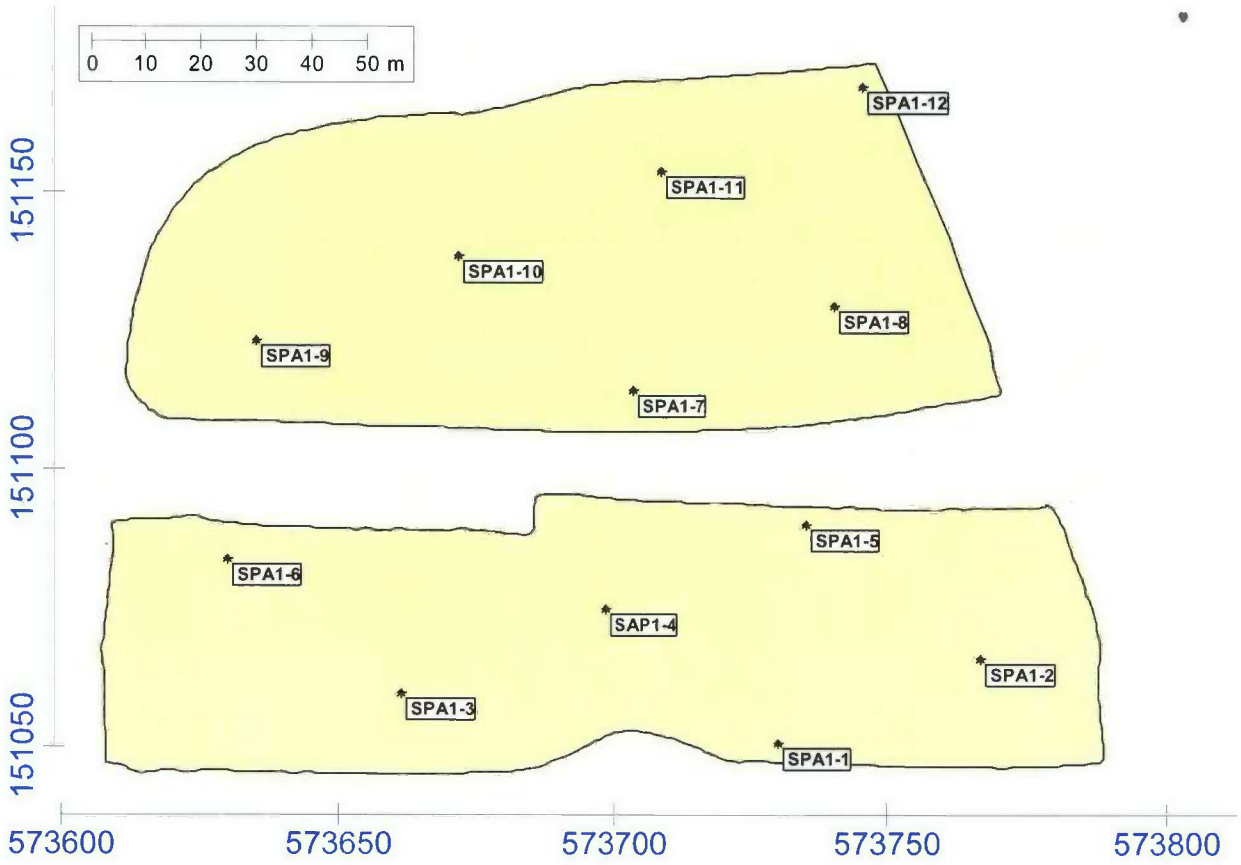


Figure F-22. Verification Sample Locations for the 100-D-100 Tier III Staging Pile Area Located Southwest of the 100-D-100 Excavation.

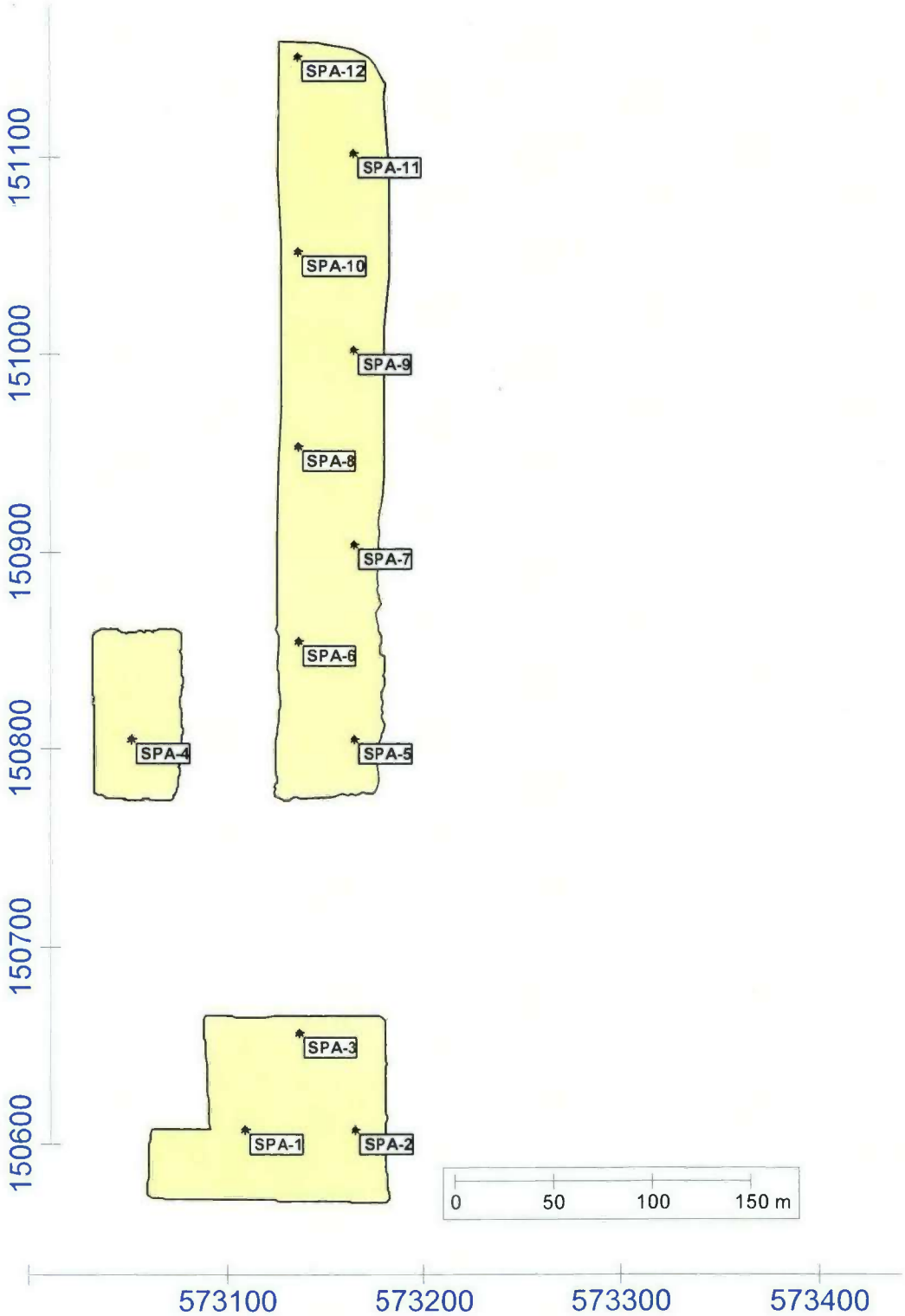


Figure F-23. Verification Sample Locations for 100-D-100 Tier III, 100-D-72, 100-D-31:11, 100-D-31:12, 100-D-81, and 100-D-50:7 Staging Pile Area Located to the West of the 100-D-100 Excavation.

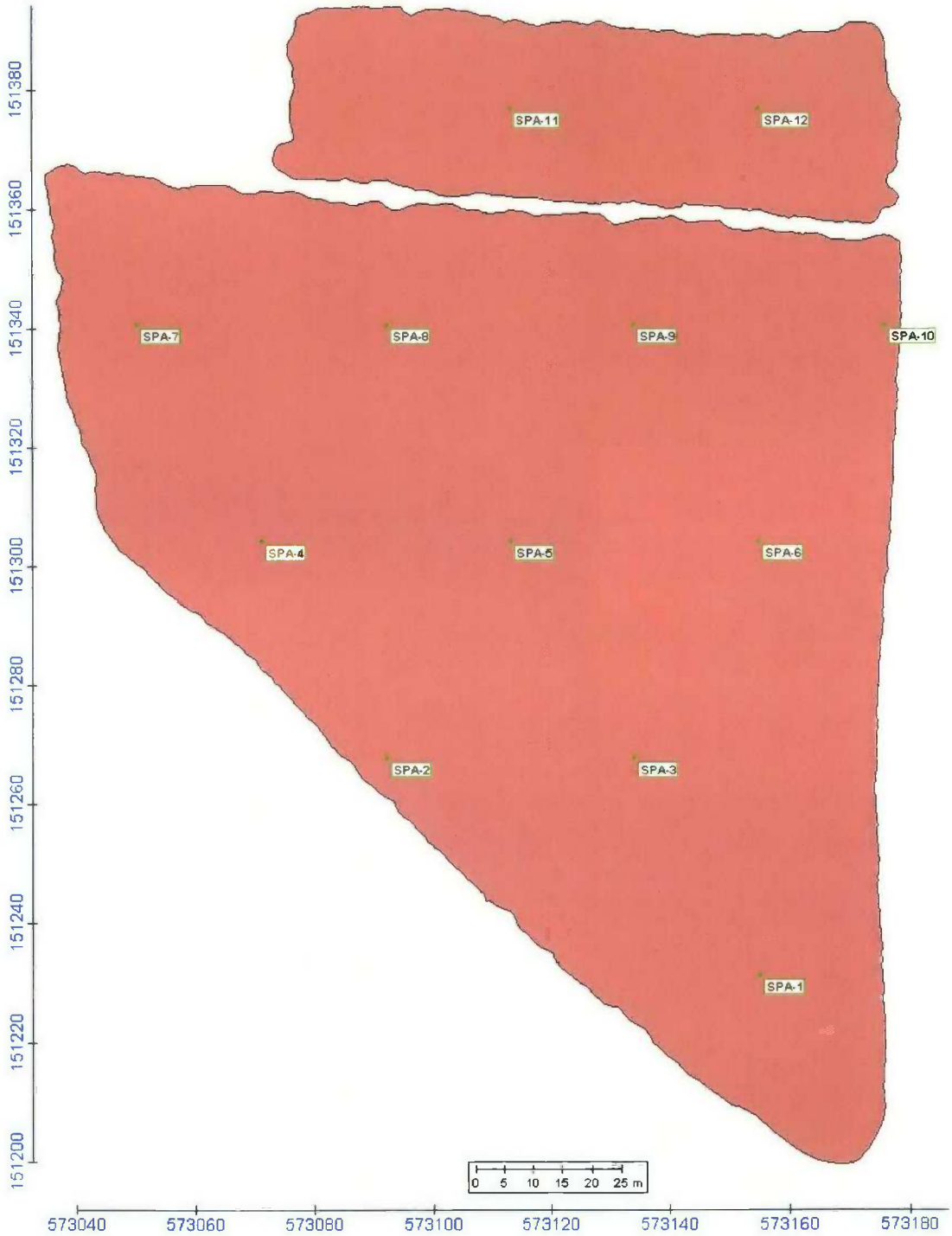
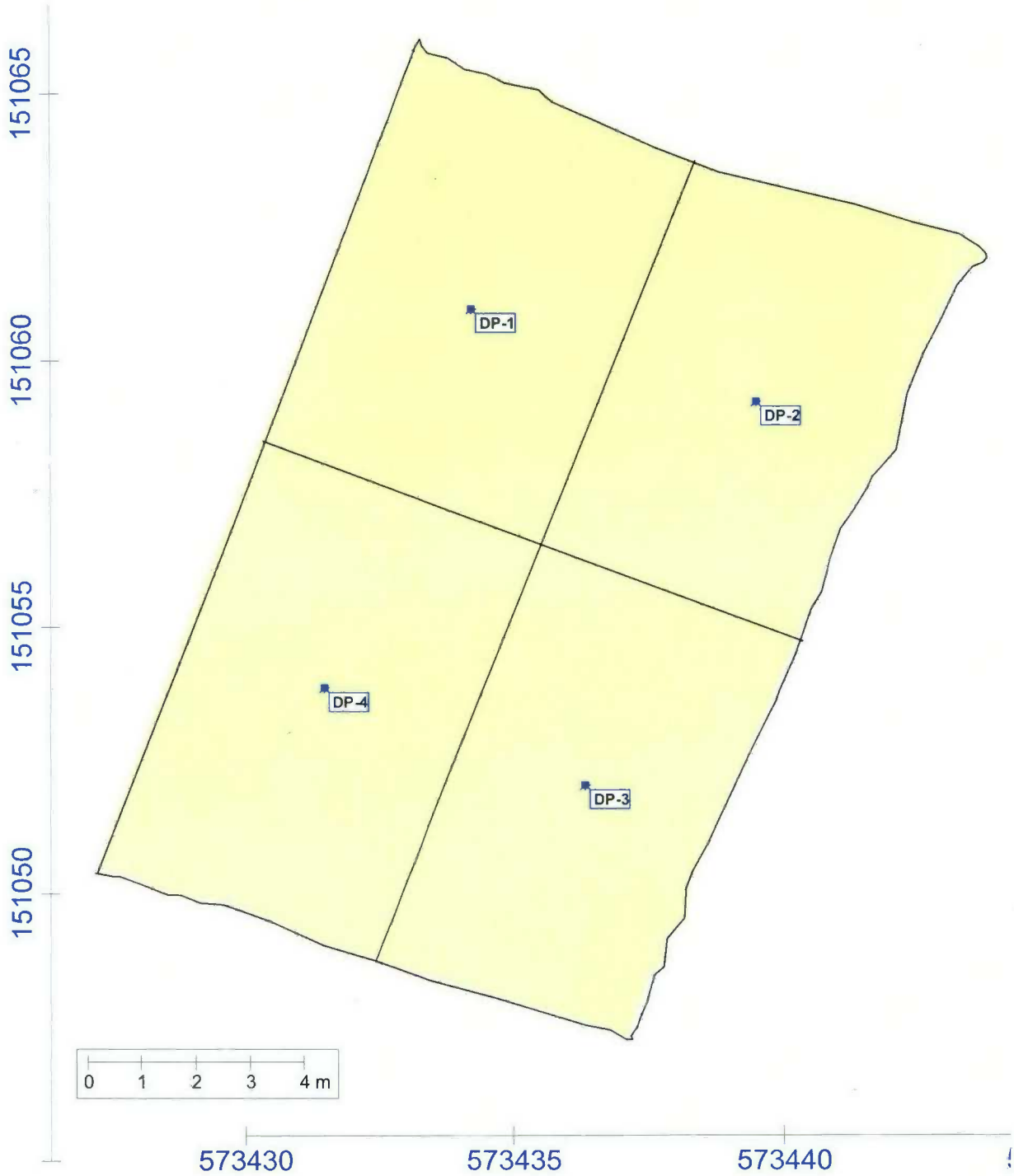


Figure F-24. Verification Sample Locations for the 100-D-100 Waste Site Equipment Decontamination Pad.



APPENDIX G

DATA QUALITY ASSESSMENT

APPENDIX G

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample designs (WCH 2013f, 2013g,2013h, 2014a, 2014b, 2014c, and 2015b,). This DQA was performed in accordance with site-specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009).

A review of the sample designs (WCH 2013f,2013g , 2013h, 2014a, 2014b, 2014c, and 2015b), the field logbooks (WCH 2013a, 2013b, 2013c, 2013d, 2013e, 2013h, 2014d, 2014e, 2014f, 2014g, 2014h, and 2015a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample designs.

To ensure quality data, the 100 Area SAP (DOE-RL 2009) data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification data from samples collected at the 100-D-100 excavation and related sites were provided by the laboratory in 29 sample delivery groups Table G-1.

The data set for the 100-D-100 waste site is large due to the size of the excavation and the number of associated staging pile area and overburden area decision units. However, this data set is simplified by the fact that only two analytical methods were run on the samples, inductively coupled plasma (ICP) metals and hexavalent chromium. The hexavalent chromium analysis is robust and no major or minor deficiencies were found associated with the data.

The following comments apply to the entire data set.

In the ICP metals analyses, serial dilutions of digestates indicate physical and chemical interferences are present for target analytes. The laboratory has qualified all of the associated data with "X" qualifiers. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analyses, low-level concentrations of target analytes were detected in the method blanks (MBs). Where these detections were less than half of the reporting limits they will not impact the field sample data. Where these detections are less than $1/20^{th}$ of the field sample results they also will not impact the field sample data. All of the detections in the MBs fall into these categories. The data are usable for decision-making purposes.

Table G-1. The 100-D-100 Verification Sampling Data Sets by Sample Delivery Group. (2 Pages)

SDG	Number of Samples	Sample Numbers	Duplicate Pair	Equipment Blank	Collection Date	Logbook
J02013 [a]	14	J1RXP1 - J1RXP9, J1RXR0-J1RXR4	NA	NA	10/21/2013	EL-1607-20
JP0439 [b]	14	J1R8X8, J1R8X9, J1R900 - J1R909, J1R910, J1R911	J1R900 J1R910	J1R911	1/14/2013	EL-1607-15
JP0441 [b]	14	J1R912 - J1R919, J1R920 - J1R925	J1R916 J1R924	J1R925	1/15/2013	EL-1607-15
JP0448 [b]	14	J1RD87 - J1RD89, J1RD90 - J1RD99, J1RDC0	J1RD94 J1RD99	J1RDC0	1/29/2013	EL-1607-15
JP0472 [b]	14	J1RFF3- J1RFF9, J1RFH0 - J1RFH6	J1RFF6 J1RFH5	J1RFH6	2/14/2013	EL1607-16
JP0499 [b, c]	14	J1RHL3 - J1RHL9, J1RHM0 - J1RHM6	J1RHM4 J1RHM5	J1RHM6	3/16/2013	EL1607-16
JP0532 [b]	14	J1RLK4 - J1RLK9, J1RLL0 - J1RLL7	J1RLK4 J1RLL6	J1RLL7	5/5/2013	EL-1607-17
JP0566 [b]	14	J1RMC3 - J1RMC9, J1RMD0 - J1RMD6	J1RMC3 J1RMD5	J1RMD6	5/5/2013	EL-1607-18
JP0579 [b]	14	J1RNM9, J1RNN0 - J1RNN9, J1RNP0 - J1RNP2	J1RMN9 J1RNP1	J1RNP2	6/12/2013	EL-1607-18
JP0588 [b]	14	J1RV02 - J1RV09, J1RV10 - J1RV15	J1RV06 J1RV15	J1RV14	7/16/2013	EL-1607-19
JP0591 [b]	14	J1RV96 - J1RV99, J1RVC0 - J1RVC9	J1RV99 J1RVC8	J1RVC9	7/19/2013	EL-1607-19
JP0592 [d]	14	J1RVF4 - J1RVF9, J1RVH0 - J1RVH7	J1RVF4 J1RVH7	J1RVH6	7/23/2013	EL-1607-19
JP0602 [b]	14	J1RW77 - J1RW79 J1RW80 - J1RW89, J1RW90	J1RW78 J1RW79	J1RW77	8/5/2013	EL-1607-19
JP0630 [b]	14	J1T0R6 - J1T0R9, J1T0T0 - J1T0T9	J1T0R6 J1T0T8	J1T0T9	9/10/2013	EL-1607-20
JP0632 [b]	14	J1T0P2 - J1T0P9, J1T0R0 - J1T0R5	J1T0P2 J1T0R4	J1T0R5	9/11/2013	EL-1607-20
JP0647 [b]	14	J1T3W8, J1T3W9, J1T3X0 - J1T3X9, J1T400, J1T401	J1T3X9 J1T400	J1T401	10/21/2013	EL-1607-21
JP0667 [b]	14	J1T671 - J1T679, J1T680 - J1T684	J1T671 J1T683	J1T684	11/20/2013	EL-1607-22
JP0694 [b]	14	J1T744 - J1T749, J1T750 - J1T757	J1T754 J1T756	J1T757	1/13/2014	EL-1607-22
JP0720 [e]	13	J1T843 - J1T849, J1T850 - J1T855	NA	NA	2/3/2014	EL-1607-23
JP0736 [a]	13	J1TDR2- J1TDR9, J1TDT0 - J1TDT4	J1TDR5 J1TDT4	NA	2/20/2014	EL-1607-23
JP0737 [a, c]	13	J1TDT5 - J1TDT9, J1TDV0 - J1TDV7	J1TDV6 J1TDV7	NA	2/20/2014	EL-1607-23

Table G-1. The 100-D-100 Verification Sampling Data Sets by Sample Delivery Group. (2 Pages)

SDG	Number of Samples	Sample Numbers	Duplicate Pair	Equipment Blank	Collection Date	Logbook
JP0738 [a]	14	J1T7J7 - J1T7J9, J1T7K0 - J1T7K9, J1T7L0	J1T7K8 J1T7K9	J1T7L0	2/24/2014	EL-1607-23
JP0750 [a]	12	J1RXR5 - J1RXR9, J1RXT0 - J1RXT6	NA	NA	3/4/2014	EL-1607-20
JP0754 [a]	13	J1T7D9, J1T7F0 - J1T7F9, J1T7H0, J1T7H1	J1T7F6 J1T7H1	NA	3/11/2014	EL-1607-23
JP0755 [a]	13	J1T7C5 - J1T7C9, J1T7D0 - J1T7D7	J1T7D5 J1T7D7	NA	3/11/2014	EL-1607-23
JP0760 [a]	12	J1TDV8, J1TDV9, J1TDW0 - J1TDW9	NA	NA	3/19/2014	EL-1607-23
JP0812 [d]	14	J1TPJ4 - J1TPJ9, J1TPK0 - J1TPK7	J1TPJ4 J1TPK6	J1TPK7	5/27/2014	EL-1607-24
JP0822 [d]	13	J1TLW9, J1TLX0 - J1TLX9, J1TM00, J1TM01	J1TLX4 J1TM01	NA	6/30/2014	EL-1607-24
JP0869 [f]	6	J1V0P8, J1V0P9, J1V0R0 - J1V0R3	J1V0P8 J1V0R2	J1V0R3	10/6/2014	EL-1662-03

[a] Excavation samples.
[b] Overburden/layback samples.
[c] SDGs JP0499 and JP0737 were submitted for third-party validation.
[d] SPA samples.
[e] Northeast corner of excavation.
[f] Decontamination pad samples.
NA = not applicable
SDG = sample delivery group

In the ICP metals analysis, matrix spike results for some target analytes are outside the applicable quality control (QC) limits. The laboratory has qualified the associated data with "N" flags. Where third-party validation identified these deficiencies the data were qualified as estimated with "J" flags. All of these data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the relative percent differences (RPDs) calculated for several target analytes are outside the QC limits. The laboratory has qualified the associated data with "M" flags. Acceptable laboratory control sample recoveries indicate that the analytical system was operating within control. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory control sample recoveries for several target analytes are outside the QC limits. Third-party validation qualified all data as estimated with "J" flags. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference (RPD) evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported in the previous sections.

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples listed in the field logbook (WCH 2013a, 2013b, 2013c, 2013d, 2013e, 2014d, 2014e, 2014f, 2014g, 2014h, 2015a) are shown in Table G-2. The main and QA/QC sample results are presented in Appendix E.

Table G-2. Field Quality Assurance/Quality Control Samples.

Sample Area		Main Sample	Duplicate Sample
Excavation Area	EXC3	J1T7D5	J1T7D7
	EXC4	J1T7F6	J1T7H1
	EXC5	J1TDR5	J1TDT4
	EXC6	J1TDV6	J1TDV7
	EXC7	J1T7K8	J1T7K9
SPA		J1RVF4	J1RVH7
		J1TPJ4	J1TPK6
		J1TLX4	J1TM01
Overburden		J1R900	J1R910
		J1R916	J1R924
		J1RD94	J1RD99
		J1RFF6	J1RFH5
		J1RHM4	J1RHM5
		J1RLK4	J1RLL6
		J1RMC3	J1RMD5
		J1RNM9	J1RNP1
		J1RV06	J1RV15
		J1RV99	J1RVC8
		J1RW78	J1RW79
		J1T0R6	J1T0T8
		J1T0P2	J1T0R4
		J1T3X9	J1T400
		J1T671	J1T683
		J1T754	J1T756
Decontamination Pad		J1V0P8	J1V0R2

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern. Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than five times the TDL) are not considered to be indicative of the analytical system performance. The calculation briefs in Appendix B provide details on duplicate pair evaluation and RPD calculation.

In the excavation area duplicate evaluation, the RPDs calculated for barium (34.6%, 32.4%) are above the acceptance criteria of 30%. Similarly, the RPDs for chromium (39.6%) in the overburden and silicone (31.3%, 46.1%) and chromium (30.7%) in the staging pile areas are above the acceptance criteria of 30%.

Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. There is no indication that the analytical system was operating out of control. The data are usable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL, including undetected analytes (Appendix B). In these cases a control limit of ±2 times the TDL is used to indicate that a visual check of the data is required by the reviewer. No additional deficiencies were noted. The data are usable for decision-making purposes.

A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

SUMMARY

Limited, random, or sample matrix-specific influenced batch QC issues, such as those discussed above, are a potential for any analysis. The number and types seen in these data are within expectations for the matrix types and analyses performed. The DQA review of the 100-D-100 waste site sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the 100-D-100 waste site data set concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

The verification sample analytical data are stored in the Washington Closure Hanford project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix E.

REFERENCES

BHI, 2000, *Data Validation Procedure for Chemical Analysis*, BHI-01435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 2009, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 2006, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2013a, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-15, Washington Closure Hanford, Richland, Washington.

WCH, 2013b, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-16, Washington Closure Hanford, Richland, Washington.

WCH, 2013c, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-17, Washington Closure Hanford, Richland, Washington.

WCH, 2013d, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-19, Washington Closure Hanford, Richland, Washington.

WCH, 2013e, *100D Field Remediation Project Sampling and Field Notes*, Logbook EL-1607-20, Washington Closure Hanford, Richland, Washington.

WCH, 2013f, *Work Instruction for Verification Sampling of the 100-D-100 Waste Site Staging Pile Area,* 0100D-WI-G0131, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2013g, *Work Instruction for Verification Sampling of the 100-D-100 Tier III Excavation Overburden/Layback Soil Stockpiles*, 0100D-WI-G0126, Rev. 2, Washington Closure Hanford, Richland, Washington.

WCH, 2013h, *Work Instruction for Verification Sampling of the 100D Overburden Stockpiles from the 100-D-30, 100-D-31:11, 100-D-31:12, 100-D-50:7, 100-D-100, and 100-D-104 Waste Sites,* 0100D-WI-G0125, Rev. 0, Washington Closure

WCH, 2014a, *Work Instruction for Verification Sampling of the 100-D-100 Waste Site Decontamination Pad*, 0100D-WI-G0145, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014b, *Work Instruction for Verification Sampling of the 100-D-30/100-D-104 TIER III Excavation,* 0100D-WI-G0132, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014c, *Work Instruction for Verification Sampling of the 100-D-72, 100-D-31:11, 100-D-31:12, 100-D-108, and 100-D-109 Waste Sites,* 0100D-WI-G0139, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014d, *100D Field Remediation Project Sampling and Field Notes,* Logbook EL-1607-18, Washington Closure Hanford, Richland, Washington.

WCH, 2014e, *100D Field Remediation Project Sampling and Field Notes,* Logbook EL-1607-21, Washington Closure Hanford, Richland, Washington.

WCH, 2014f, *100D Field Remediation Project Sampling and Field Notes,* Logbook EL-1607-22, Washington Closure Hanford, Richland, Washington.

WCH, 2014g, *100D Field Remediation Project Sampling and Field Notes,* Logbook EL-1607-23, Washington Closure Hanford, Richland, Washington.

WCH, 2014h, *100D Field Remediation Project Sampling and Field Notes,* Logbook EL-1607-24, Washington Closure Hanford, Richland, Washington.

WCH, 2015a, *100D Field Remediation Miscellaneous Sampling Activities,* Logbook EL-1662-03, Washington Closure Hanford, Richland, Washington.

WCH, 2015b, *Work Instruction for Verification Sampling of the 100-D-100 Tier III Excavation,* 0100D-WI-G0066, Rev. 2, Washington Closure Hanford, Richland, Washington.