APPENDIX G.12

OUTER AREA SITES (CP-LS-18 CENTRAL PLATEAU) EVALUATION UNIT SUMMARY TEMPLATE

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PART I. EXECUTIVE SUMMARY

EU LOCATION

The Outer Area Sites EU consists of the Nonradioactive Dangerous Waste Landfill (NRDWL) and the Solid Waste Landfill (SWL) and other waste sites, miscellaneous buildings, and structures in the 600 Area of the Hanford site. The NRDWL and SWL sites are located in the central part of the Hanford Site about 3.4 mi. southeast of the 200 East Area.

RELATED EUS

Not applicable

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES[1]

Four main waste types (sanitary solid waste, asbestos, liquid waste, and drummed dangerous waste) were disposed at the Nonradioactive Dangerous Waste Landfill (NRDWL) and the Solid Waste Landfill (SWL). In addition to dangerous waste, the NRDWL also received a small amount of sanitary solid waste and a substantial amount of both friable and non-friable asbestos-containing waste material (over 50 percent by volume) through 1988 when it ceased operations. Beginning in 1975, drummed chemical waste was disposed of in six trenches, asbestos in nine trenches, and nonhazardous solid waste in one trench; three trenches were unused. Dangerous waste was disposed of in six dedicated trenches. Based on available information, including detailed disposal records and operator knowledge, all dangerous waste was containerized in drums prior to being placed in a trench. Asbestos waste generally was not containerized prior to disposal; however, it was disposed of and covered in accordance with regulatory requirements in place at the time.

SWL (also known historically as the 600 Central Landfill) is a solid waste landfill adjacent to NRDWL on the south side. It is a much larger facility (67 ac) that received nondangerous and nonradioactive solid waste (i.e., principally solid waste, including paper, construction debris, asbestos, and lunchroom waste) from 1973 through March 1996. SWL also received limited liquid wastes, approximately 1,200,000 gal of sewage and 1100 Area catch tank liquid, and approximately 100,000 gal of garage wash water. The liquid waste was discharged to east-west oriented trenches at the perimeter of the main solid-waste area, along the northeast and northwest boundaries of the SWL (refer to Figure 2). Based on available analytical data, the liquid waste (likely the garage wash water) contained residual amounts of carbon tetrachloride, 1,1,1 TCA, TCE and PCE. Because of high hydraulic loading (compared to natural recharge rates) these contaminants were prone to migrate more quickly to groundwater than simple leachate generated from NRDWL/SWL via natural recharge. Because of the materials disposed, these trenches are considered one of the leading contributors to groundwater impacts from NRDWL/SWL releases.

[1] US Department of Energy, Richlands Operations Office, *Environmental Assessment, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington*, DOE/EA-1707D, Revised Predecisional Draft, August 2011.

BRIEF NARRATIVE DESCRIPTION [1]

NRDWL is an inactive non-operating landfill centrally located within the 600 Area of the Hanford Site. The landfill provided a site for disposal of nonradioactive dangerous waste generated from process operations, research and development laboratory maintenance activities, and transportation functions throughout Hanford. It operated from 1975 through 1985, and occupies an area of approximately 10 ac. The landfill consists of 19 parallel trenches, each about 122 m (400 ft) long, 4.9 m (18 ft) wide at the base, and 4.6 m (15 ft) deep. A triangular column of undisturbed soil with approximately 1:1 side slopes separated the trenches as they were constructed. The final profile of the trench varied depending on the type of waste received. The trenches typically were backfilled and covered with 2 to 3 m (6 to 10 ft) of soil at the end of each operating day.

The majority of the waste disposed at SWL consisted of sanitary solid waste composed mostly of office and lunchroom waste and construction and demolition debris. The waste generally was not containerized prior to disposal. The sanitary solid waste mass has no known specific source areas but originated from throughout Hanford Site operations. It is located in all of the trenches in Phase I and in most of the north and middle units of Phase II of the SWL. The estimated total volume of sanitary solid waste is approximately 400,000 m^3.

Both landfills currently do not have an engineered permanent cover; the operational covers are a non-vegetated, very coarse-textured, loamy sand/sand cover with a very low water-holding capacity. Groundwater historically has been impacted from leachate migrating out of the waste material through the vadose zone and into groundwater. However, current NRDWL/SWL trends in groundwater quality indicate contaminants of concern (COCs) at or below detection levels (DOE/RL-2010-28).

Groundwater monitoring at the SWL has been performed for over twenty years in accordance with a site specific monitoring plan and is coordinated with the overall Hanford Site groundwater-monitoring project (200-PO-1 OU). The monitoring network consists of two upgradient wells on the west side of the SWL (Well 699-26-35A is shared with the NRDWL) and seven downgradient wells along the east and south of the SWL. Several new monitoring wells are planned for post-closure period that include 2 new upgradient monitoring wells.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table G.12-1 provides a summary of nuclear and industrial safety related risks to humans and impacts to important physical Hanford site resources.

Human Health

A Facility Worker is deemed to be an individual located anywhere within the physical boundaries of the CP-LS-18 Outside Area Sites; a Co-located Person (CP) is an individual located 100 meters from the physical boundaries of the Area; and the Public is an individual located at the closest point on the Hanford Site boundary not subject to DOE access control. The nuclear-related risks to humans are based on unmitigated (unprotected or controlled conditions) dose exposures expressed in a range of from *Not Discernible* (*ND*) to *High*. The estimated mitigated exposure, which takes engineered and administrative controls and protections into consideration, is shown in Table G.12-1 in parentheses.

Groundwater and Columbia River

Direct impacts to groundwater resources and the Columbia River have been rated based on available information for the current status and estimates for future time periods. These impacts are also expressed in a range of from *Not Discernible* (*ND*) to *Very High*.

Ecological Resources[2]

The risk ratings are based on the degree of physical disruption (and potential additional exposure to contaminants) in the current status and as a potential result of remediation options.

Cultural Resources[2]

No risk ratings are provided for Cultural Resources. The Table identifies the three overlapping Cultural Resource landscapes that have been evaluated: Native American (approximately 10,000 years ago to the present); Pre-Hanford Era (1805 to 1943) and Manhattan/Cold War Era (1943 to 1990); and provides initial information on whether an impact (both direct and indirect) is KNOWN (presence of cultural resources established), UNKNOWN (uncertainty about presence of cultural resources), or NONE (no cultural resources present) based on written or oral documentation gathered on the entire EU and buffer area. Direct impacts include but are not limited to physical destruction (all or part) or alteration such as diminished integrity. Indirect impacts include but are not limited to the introduction of visual, atmospheric, or audible elements that diminish the cultural resource's significant historic features. Impacts to Cultural Resources as a result of proposed future cleanup activities will be evaluated in depth under Section 106 of the National Historic Preservation Act (16 USC 470, et. seq.) during the planning for remedial action.

[2] References throughout this Evaluation Unit Summary Template supporting analyses related to Ecological Resources and/or Cultural Resources may be found in Appendices J and K, respectively. Refer to the specific EU when searching for the reference.

Table G.12-1. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., "Very High" (Low)).

Population or Resource		Evaluation Time Period Active Cleanup (to 2064) **Current Condition:** No Activity	 **From Cleanup Actions:** Final D&D
Human Health	Facility Worker	Not Discernible (ND)	***Proposed method***: ND
	Co-located Person	ND	***Proposed method***: ND
	Public	ND	***Proposed method***: ND
Environmental	Groundwater (A&B) from vadose zone[(a)]	*Medium* – CCl_4 *Low* – Cr(tot) & Cr-VI *ND* – other PCs **Overall**: *Medium*	*Medium* – CCl_4 *Low* – Cr(tot) & Cr-VI *ND* – other PCs **Overall**: *Medium*
	Columbia River from vadose zone[(a)]	Benthic and Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*	Benthic and Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*
	Ecological Resources[(b)]	Low	Very High
Social	Cultural Resources[(b)]	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Unknown **Manhattan/Cold War** Direct: Known Indirect: None	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Unknown **Manhattan/Cold War** Direct: Known Indirect: None

a. Threat to groundwater or the Columbia River from Group A and B primary contaminants (PCs) (Table 6-1, CRESP 2015) remaining in the vadose zone.

b. For both Ecological and Cultural Resources see Appendices J and K, respectively, for a complete description of Ecological Field Assessments and literature review for Cultural Resources. Ecological ratings are described in Table 4-11 of the Final Report.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE HUMAN HEALTH

Current

No radioactive contaminants are present in the two landfills, and the various chemical contaminants buried at the site do not present a risk to human health as they relate to air or surface soil pathways.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

DOE's proposed action (closing landfills under RCRA by installing a barrier over waste left in place) is believed to be protective of human health and the environment and is compliant with applicable regulations. Environmental impacts associated with proposed closure activities are expected to be minimal. Worker and offsite radiological dose consequences are expected to be minimal, due to the absence of radionuclides in the wastes disposed of at NRDWL and SWL. Worker and offsite exposure to hazardous chemicals from closure activities are expected to be small due to the non-invasive nature of the proposed action. However, this would not be the case if the waste forms were exhumed. [3]

Groundwater, Vadose Zone, and Columbia River

Current

The CP-LS-18 (Outer Area Sites) EU is to the southeast of 200 East Area in the 200-PO groundwater interest area (GWIA). The 200-PO GWIA is described in the CP-GW-1 EU (Appendix D.5). The saturated zone beneath the CP-LS-18 area have elevated levels of I-129 and tritium (H-3) based on 2014 groundwater results (http://phoenix.pnnl.gov/apps/gw/phoenix.html); CP-LS-18 waste sites are not suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). The current threats to groundwater and the Columbia River from contaminants already in the 200-PO groundwater are evaluated as part of the CP-GW-1 EU (Appendix D.5). However, current threats to groundwater corresponding to only the CP-LS-18 EU contaminants *remaining* in the vadose zone (Table G.12-6) has an overall rating of *Medium* (related to carbon tetrachloride) as described in **Part V**. In the 200 East Area, contaminated 200-PO groundwater is monitored (DOE/RL-2016-09, Rev. 0). As indicated in **Part V**, no plumes have been linked to CP-LS-18 waste sites. Threats from contaminated groundwater in the 200 East Area to contaminate additional groundwater or the Columbia River are evaluated as part of the CP-GW-1 EU (Appendix D.5).

For the 200-PO GWIA, no plume from the CP-LS-18 EU currently intersects the Columbia River at concentrations exceeding the corresponding water quality standard (WQS) as described in **Part V**. Thus current impacts to the Columbia River benthic and riparian ecology would be rated as *Not Discernible* (*ND*). Furthermore, the large dilution effect of the Columbia River on contamination from the seeps and groundwater upwellings also results in *ND* ratings. Thus the overall rating for the Columbia River during the Current period is *ND*.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

As described in **Part VI**, the plausible remedial actions for the CP-LS-18 EU waste sites would primarily involve installation of an ET cover over existing contamination and log-term monitoring. Contaminants from the CP-LS-18 EU waste sites are suspected of impacting the vadose zone (as they consist of unlined trenches) but not yet the groundwater; treatment options are still being considered for the 200 East groundwater. Secondary sources in the vadose thus threaten to impact groundwater in the future, including the Active Cleanup period. The *Medium* (carbon tetrachloride) and *Low* (total and hexavalent chromium) ratings for the CP-LS-18 EU waste sites (Table G.12-5) are associated with primary contaminants that may impact groundwater in the 200 East Area (CP-GW-1, Appendix D.5).

[3] US Department of Energy, Richlands Operations Office, *Environmental Assessment, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington*, DOE/EA-1707D, Revised Predecisional Draft, August 2011.

As described in **Part V**, the groundwater transport analysis in the TC&WM EIS does not necessarily cover the area in and around the CP-LS-18 waste sites. However, the groundwater transport results and more recent groundwater data would suggest that contamination from CP-LS-18 would not be expected to significantly impact groundwater or the Columbia River over the evaluation period. Furthermore, expected remedial options would tend to limit infiltrating water, which is the primary motive force to release and transport contaminants to groundwater. However, remedial actions have not begun in the area around CP-LS-18. Because there appears to be insufficient impact to the overall rating for CP-LS-18 from radioactive decay (since carbon tetrachloride is the risk driver) and lack of treatment of 200 East groundwater, the current ratings for CP-LS-18 Group A and B contaminants are not changed after the Active Cleanup period. There would not be a sufficient impact on peak concentrations in near-shore region of the Columbia River during or after cleanup to modify ratings (which are already *ND*). Thus the ratings for current threats provided in Table G.12-5 would not be modified (after the Active Cleanup period). The overall rating thus remains *Medium* (carbon tetrachloride) after the Active Cleanup period.

Ecological Resources

Current

The EU is 100% level 3 or higher resources (due to revegetation), and the buffer is predominately level 5, and the buffer area is connected to level 5 resources. Thus, any activity within the EU has the potential to disrupt any valuable resources

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Because of the high resource value, any remediation involving frequent pedestrian and vehicle traffic will disrupt a high functioning landscape of valuable resources. The buffer is classified as an element occurrence, and the EU has the potential of succession into a higher resource level. Truck traffic could introduce exotic species. Loss of biologically active soil will have long-term effects that impact revegetation and biological integrity of the region. Further disruption of the soil will impact the seed bank of high quality species.

Cultural Resources

Current

Much of the land within the EU is extensively disturbed and most of the EU has been inventoried for cultural resources. An NHPA Section 106 review has been completed for the closure of the NRDWL/SWL. Geomorphology indicates a moderate potential to contain intact archaeological resources on the surface and/or subsurface. Traditional cultural places are visible from EU. One archaeological site (that remains unevaluated for the National Register) is located within 500 meters of the EU.

One historic road (determined not eligible for the National Register) is located within the EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Archaeological investigations and monitoring may need to occur prior to remediation. The geomorphology indicates a moderate potential for intact archaeological resources. Remediation disturbance may result in impacts to archaeological resources if they are present in the subsurface. Temporary indirect effects to viewshed are possible during remediation. Permanent indirect effects are possible from evapotranspiration barrier/cover and if contamination remains after remediation.

Remediation disturbance may result in impacts to archaeological resources.

Considerations for Timing of the Cleanup Actions

No risks or other conditions require an immediate or high priority be given to cleanup actions. In addition, cleanup will not involve removal of any contaminants in the landfills. Army Loop Road would be used to transport material from Borrow Area C to NRDWL/SWL. Originally this road was constructed at a width of 20 ft, but currently only about 18 ft are passable because of age deterioration and vegetation encroachment. Army Loop Road from Beloit Avenue to the northeastern corner of the landfill area would need to be upgraded and repaired to provide for safe, two-way traffic. Road repairs would consist of clearing existing road, expanding existing road, and laying gravel. Although the road would be used to transport material from Borrow Area C for cover installation, dust suppressants would be applied routinely, it would be graded, and additional gravel would be added as needed.

The saturated zone beneath the CP-LS-18 area currently has elevated levels of levels of I-129 and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Waste sites within the CP-LS-18 EU are not suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) but may be currently contributing contamination to the vadose zone. Monitoring of groundwater is being conducted within the 200-PO GWIA as described in Appendix D.5. Some plume areas have increased (e.g., I-129 in 200-PO) and concentrations continue to exceed cleanup levels for many primary contaminants. Thus cleanup actions are warranted for this EU. There is potential for additional contaminant release and migration through the vadose that may eventually impact groundwater as long as cleanup activities are delayed.

Near-Term, Post-Cleanup Risks and Potential Impacts

Postclosure activities would include long-term groundwater monitoring activities (including installation of 6 additional wells [2 new upgradient, 4 new downgradient, and one replacement), periodic inspections, and maintenance activities to ensure the long-term integrity of the closed landfill. Groundwater monitoring would continue during the postclosure period consistent with a compliant, State-approved groundwater monitoring program. Additional activities would be identified in the approved RCRA closure plan.

Groundwater: During the Near-term, Post-Cleanup period (described in **Parts V** and **VI** and Table G.12-6), ratings are maintained at *Low* (total and hexavalent chromium) and *Medium* (carbon tetrachloride) for Group A and B primary contaminants with reported inventories to account for the fact that treatment options have not been selected for 200 East groundwater and to address uncertainties.

Columbia River: As indicated in **Part V**, no Group A or B primary contaminants from the 200 East Area[4] are predicted to have concentrations exceeding screening values in this evaluation period. Thus ratings will not be modified, and all ratings are *Not Discernible* (*ND*) as is the overall rating (Table G.12-6).

[4] As described in Appendix E.7 (CP-TF-5), only the tritium (Group C) plume from 200-PO currently intersects the Columbia River at concentrations exceeding the appropriate water quality standard (WQS). Using the methodology (CRESP 2015a), because this plume is not associated with the CP-LS-18 EU (DOE/RL-2016-09, Rev. 0), a *Not Discernible* (*ND*) rating for the current impact of tritium on the Columbia River would be ascribed. Because there is no likely scenario where CP-LS-18 EU waste sites could contaminate the Columbia River in amounts exceeding the WQS, ratings remain *ND* for the Near-term, Post-Cleanup period.

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

The NRDWL and SWL are included in the 200-SW- 1 OU. The 200-SW-1 OU is a process-based OU composed of nonradioactive landfills.

COMMON NAME(S) FOR EU

600 Central landfill, NRDWL and SWL

KEY WORDS

Nonradioactive waste landfill

REGULATORY STATUS: (RCRA, CERCLA, ROD IN DISPOSITION TABLE FOR MANY)

Regulatory basis

RCRA and Washington Administrative Code (WAC) 173-303, "Dangerous Waste Regulations."

Applicable regulatory documentation

Environmental Assessment, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington, DOE/EA-1707D, Revised Predecisional Draft, August 2011.

The NRDWL and SWL are included in DOE/EIS-0391, *Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (TC&WM EIS) as part of the cumulative impacts analysis.

The landfills are non-operating and are being proposed for closure under the requirements of Washington Administrative Code (WAC) 173-303, "Dangerous Waste Regulations." The closure of SWL under WAC 173-350-400 "Limited Purpose Landfill" requirements is being deferred to the equal or more stringent permit requirements of the Dangerous Waste Regulations (WAC 173-303-610 and WAC 173-303-665) to achieve uniformity of environmental protection and efficiency of design, construction, and postclosure care activities.

Applicable Consent Decree or TPA milestones

The *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989) outlines the approach that DOE will take for permitting and closure of the Hanford RCRA/HWMA21 regulated treatment, storage, and disposal units. These two landfills are included in a draft remedial investigation/feasibility study work plan completed in September 2007 (DOE/RL-2004-60). The remedial investigation/feasibility study process under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), or closure in accordance with applicable RCW 70.105 and WAC 173-303 regulations, will be used to reach a decision that will meet requirements for both National Priorities List cleanup and RCRA/HWMA corrective action (DOE/RL-2004-60).

During discussions in 2015-16 regarding possible revisions to the Tri-Party Agreement, Ecology, in consultation with EPA Region 10 indicated that it prefers to set the closure dates for the NRDWL, SWL, and 400 Area Treatment, Storage, Disposal Facilities (TSDFs) through a permitting process, rather than by setting a TPA milestone date.

RISK REVIEW EVALUATION INFORMATION

Completed

August 5, 2016, updated February 23, 2017

Evaluated by

Henry Mayer, Amoret Bunn, Jennifer Salisbury, and Kevin Brown

Ratings/Impacts Reviewed by

Kathryn Higley

PART III. SUMMARY DESCRIPTION

CURRENT LAND USE

Industrial

DESIGNATED FUTURE LAND USE

After the NRDWL/SWL is closed, the future land use, Conservation (Mining), will be consistent with the land use described in *The Future for Hanford: Uses and Cleanup* (Hanford Future Site Uses Working Group, 1992**),** the *Final Hanford Comprehensive Land- Use Plan Environmental Impact Statement* (DOE/EIS-0222-F), and the *Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (DOE/EIS-0391). Appropriate institutional controls will be implemented at NRDWL/SWL to restrict intrusive activities at the site. Deed restrictions will also be placed on the property restricting development or mining-related activities, as described in DOE/EIS-0391.[5]

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

Four main waste types (sanitary solid waste, asbestos, liquid waste, and drummed dangerous waste) were disposed at the Nonradioactive Dangerous Waste Landfill (NRDWL) and the Solid Waste Landfill (SWL). In addition to dangerous waste, the NRDWL also received a small amount of sanitary solid waste and a substantial amount of both friable and non-friable asbestos-containing waste material (over 50 percent by volume) through 1988 when it ceased operations. Beginning in 1975, drummed chemical waste was disposed of in six trenches, asbestos in nine trenches, and nonhazardous solid waste in one trench; three trenches were unused. Dangerous waste was disposed of in six dedicated trenches. Based on available information, including detailed disposal records and operator knowledge, all dangerous waste was containerized in drums prior to being placed in a trench. Asbestos waste generally was not containerized prior to disposal; however, it was disposed of and covered in accordance with regulatory requirements in place at the time.

[5] US Department of Energy, Richland Operations Office, *Nonradioactive Dangerous Waste Landfill/Solid Waste Landfill Closure/Postclosure Plan*, DOE/RL-90-17, Revision 2, December 2010.

SWL (also known historically as the 600 Central Landfill) is a solid waste landfill adjacent to NRDWL on the south side. It is a much larger facility (67 ac) that received nondangerous and nonradioactive solid waste (i.e., principally solid waste, including paper, construction debris, asbestos, and lunchroom waste) from 1973 through March 1996. SWL also received limited liquid wastes, approximately 1,200,000 gal of sewage and 1100 Area catch tank liquid, and approximately 100,000 gal of garage wash water. The liquid waste was discharged to east-west oriented trenches at the perimeter of the main solid-waste area, along the northeast and northwest boundaries of the SWL (refer to Figure 2). Based on available analytical data, the liquid waste (likely the garage wash water) contained residual amounts of carbon tetrachloride, 1,1,1 TCA, TCE and PCE. Because of high hydraulic loading (compared to natural recharge rates) these contaminants were prone to migrate more quickly to groundwater than simple leachate generated from NRDWL/SWL via natural recharge. Because of the materials disposed, these trenches are considered one of the leading contributors to groundwater impacts from NRDWL/SWL releases.

High-Level Waste Tanks and Ancillary Equipment

Not applicable

Groundwater Plumes

The saturated zone beneath the CP-LS-18 area currently has elevated levels of I-129 and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). The 200 East Area plumes are described in detail in the CP-GW-1 EU (Appendix D.5). No waste sites within the CP-LS-18 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0), and no plumes have been linked to CP-LS-18 sources (DOE/RL-2016-09, Rev. 0). Monitoring of groundwater is being conducted within the 200-PO GWIA, which is described as part of the CP-GW-1 EU (Appendix D.5).

Operating Facilities

Not applicable

D&D of Inactive Facilities

Not applicable

LOCATION AND LAYOUT MAPS

NRDWL is an inactive non-operating landfill centrally located within the 600 Area of the Hanford Site. It is located about 2.5 mi southeast of the 200-East Area on Army Loop Road, southwest of the Route 4 intersection and southeast of the 200-East Area. SWL is a much large solid waste landfill adjacent to NRDWL on the south side.

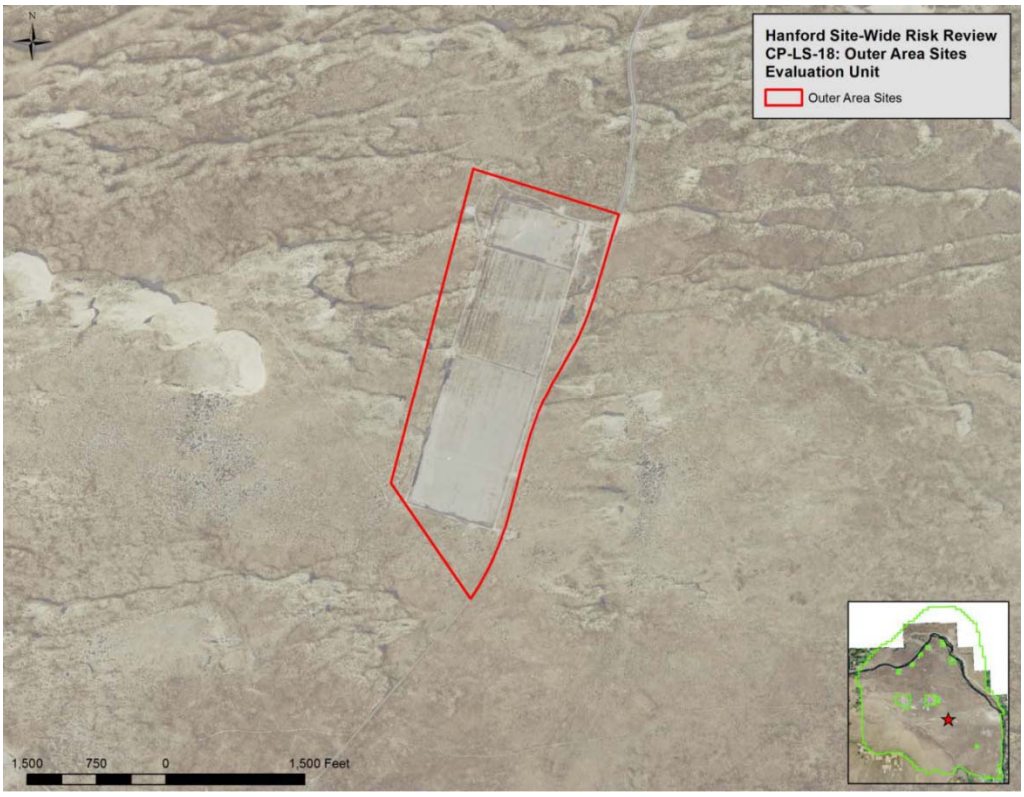

Figure G.12-1. Outside Area Sites EU Location.

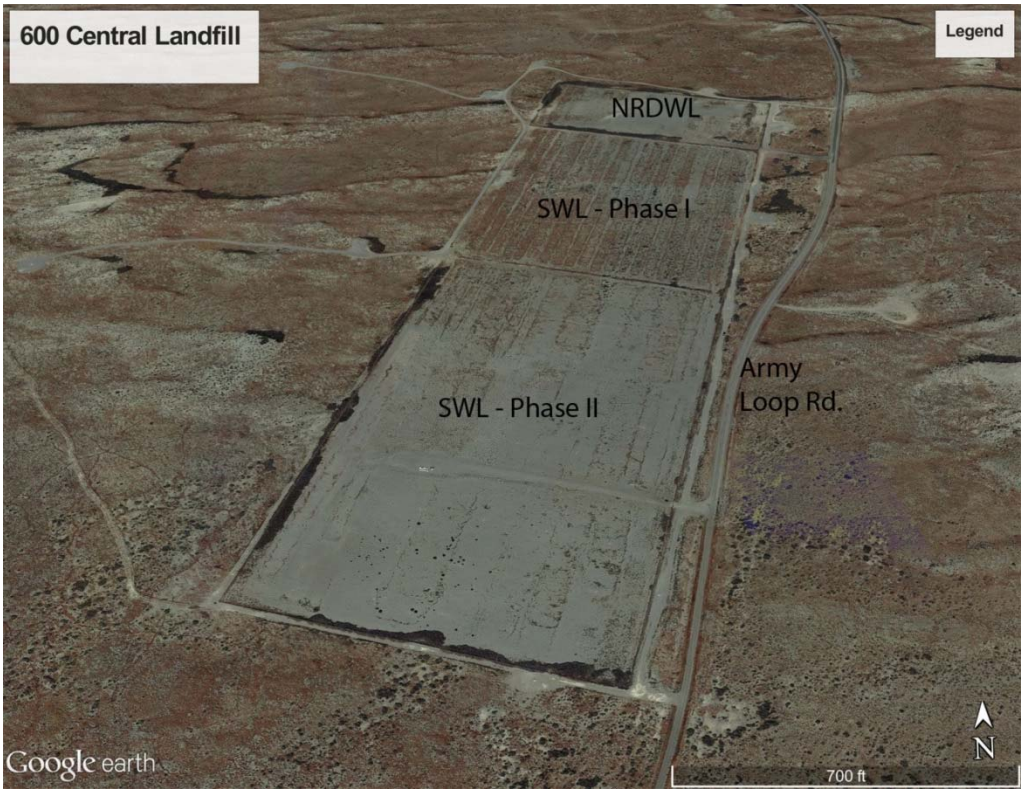

Figure G.12-2. NRDWL and SWL Site Aerial View.

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

NRDWL is an inactive non-operating landfill that provided a site for disposal of nonradioactive dangerous waste generated from process operations, research and development laboratory maintenance activities, and transportation functions throughout Hanford. It operated from 1975 through 1988, and occupies an area of approximately 10 ac.

The majority of the waste disposed at the much larger SWL consisted of sanitary solid waste composed mostly of office and lunchroom waste and construction and demolition debris. The waste generally was not containerized prior to disposal. The sanitary solid waste mass has no known specific source areas but originated from throughout Hanford Site operations.

Neither landfill currently has an engineered permanent cover; the operational covers are a non-vegetated, very coarse-textured, loamy sand/sand cover with a very low water-holding capacity. Groundwater historically has been impacted from leachate migrating out of the waste material through the vadose zone and into groundwater. Groundwater monitoring at the SWL has been performed for over twenty years in accordance with a site specific monitoring plan and is coordinated with the overall Hanford Site groundwater-monitoring project (200-PO-1 OU).

LEGACY SOURCE SITES

The NRDWL received nonradioactive, dangerous waste constituents from Hanford Site operations from 1975 through 1985**.** In addition to dangerous waste constituents, the NRDWL received over 50 percent of its waste volume in the form of friable and non-friable asbestos-containing material through 1988. Sanitary solid waste was placed in one trench that operated during 1976. Because of the presence of regulated dangerous waste in the chemical trenches, the northernmost unit of the Central Landfill footprint was formally designated NRDWL and a RCRA TSD unit.

The NRDWL used the trench landfill method where waste was placed in a trench and covered. As additional landfill space was needed, new trenches were excavated with a dragline excavator following surveyed center lines at 46 ft spacing. Excavated soil was deposited on both sides of the trench in the form of spoil piles and was reserved for use as cover material. At the end of each day, a portion of the spoil piles were pushed over the filled portion of trenches to make an operational cover. When the NRDWL ceased accepting waste, the area was final graded and the operational cover became the interim cover that is currently in place. All materials used to construct the operational/interim cover originated from NRDWL excavations. No new material was added or imported to create the NRDWL interim cover. All trenches were excavated to approximately 400 ft in length, 16 ft in width at the base, and 16 ft in depth. A triangular column of undisturbed soil with approximately 1: 1 side slopes separated trenches. The final profile of the trench varied depending on the type of waste received.

Native cover soils were not typically adequate to support heavy vehicle traffic. A 7.9 to 11.8in. gravel or cobble layer was occasionally placed on top of the filled areas as a temporary road base to allow vehicles to reach the working face. After a trench was filled, the remaining spoil pile was bulldozed over the trench to form an operational cover. The operational cover was typically 3.3 ft thick, but varied from 2.0 to 4 ft, depending on the thickness and type of waste disposed (i.e., sanitary).

The total maximum quantity of dangerous waste currently in the NRDWL is approximately 323,000 lb. However, the original waste inventory was slightly higher-approximately 311,000 lb). The maximum

estimate is based on the current inventory and takes into account the waste (approximately 13,000 lb) removed from Trench 19N during an excavation in 1985.

The SWL is approximately 2,980 ft in length and 965 ft in width. It is divided into five units, each consisting of a series of parallel trenches. The two oldest units are identified as the Phase I area, covering approximately 28 ac, which was active between 1973 and 1982. Phase II is divided into three units: north, middle, and south. Phase II was constructed in 1982 and covers approximately 38 ac. In 1996, all excavated solid waste trenches had interim soil covers of excavated trench material. The soil covers ranged in thickness from 2 to 4 ft. The site has been graded and contoured to reduce infiltration of moisture from precipitation into the disposal trenches.

The general method of landfill operations used at the SWL was the trench method. Waste was placed in an excavated trench and covered with soil. As landfill space was needed, additional trenches were excavated along 46 ft center lines. The landfill was managed in panels that consisted of a series of parallel trenches approximately 530 to 620 ft long. Although the landfill was developed in panels, the trenches were actually constructed to be continuous within a phase area. Excavated soil was deposited on both sides of the trenches as spoil piles and was reserved as operational cover material after the waste was disposed.

The SWL received a variety of nondangerous, nonradioactive sanitary wastes and friable and non-friable asbestos wastes generated from Hanford Site operations. The SWL did not accept waste from the general public. Disposal of radioactive and process chemical waste was prohibited. Disposal of free liquids (such as sewage and catch tank liquids from shop facilities) was initiated in 1975 and discontinued in April 1987.

The SWL ceased operation in March 1996. The site was graded (3 percent maximum slopes) and contoured to control run-on/runoff, which initiated interim closure care.

GROUNDWATER PLUMES

The saturated zone beneath the CP-LS-18 area currently has elevated levels of I-129 and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Plumes in the 200-PO GWIA are described in CP-GW-1 EU (Appendix D.5). No CP-LS-18 waste sites with reported inventories (Table G.12-2 through Table G.12-4) are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). Monitoring of groundwater is being conducted within the 200-PO GWIA.

D&D OF INACTIVE FACILITIES

Not applicable

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

All of the Outer Area Sites EU is classified as level 3 or above biological resources: the majority (101.4 acres, 76%) is classified as level 3, while the remainder (32 acres, 24%) is classified as level 5 (Appendix J, Table J.42 and Figure J.44**Error! Reference source not found.**). The level 5 areas are considered irreplaceable habitat and are part of a larger plant community classified as an element occurrence by the Washington Natural Heritage Program (DOE/RL-96-32 2013).

The amount and proximity of biological resources surrounding the Outer Area Sites EU were examined within the adjacent landscape buffer area, which extends 4,614 feet (1,406 m) from the geometric center of the EU (Appendix J, Table J.42) and consists primarily of level 5 resources. Approximately 87% (1,341 ac) of the combined total area (EU plus adjacent landscape buffer) consists of level 5 resources; again this area is classified as an antelope bitterbrush/Indian ricegrass sand dune complex element occurrence. Level 3 resources make up the remainder of the combined total area (12.7%, 195 ac). The proportion of level 3 or above resources lost from remediation actions in the EU would be approximately 4% at the landscape level (Appendix J, **Error! Reference source not found.**). The proportion of level 3 or above resources lost from remediation actions in the EU would be approximately 8.7% at the landscape level (Appendix J, Table J.42).

Field Survey

The Outer Area Sites (Central Landfill) EU is a former solid waste disposal site that has been closed and revegetated with native vegetation. It is bordered on the east side by Army Loop Road (Appendix J, Figure 1). The footprint of the landfill covers most of the area within the EU boundary and is characterized by native successional shrubs in the overstory and native grasses in the understory. The north approximate one-third (Survey Area 3-1) of the landfill footprint currently supports 2% cover of gray rabbitbrush (*Ericameria nauseosa*), 15% cover of Indian ricegrass (*Achnatherum hymenoides*), and 5% cover of needle-and-thread grass (*Hesperostipa comata*); the south approximate two-thirds (Survey Areas 3-2 and 3-3) of the landfill footprint currently supports 15% gray rabbitbrush, 10% Indian ricegrass, and 5% needle-and-thread grass (Appendix J, Table J.41). Various other native and non-native grasses and forbs are present in the area as well.

The west margin (Survey Area 5-2) and south corner (Survey Area 5-1) of the EU consist of shrub-steppe habitat relatively undisturbed by landfill activities, though past fires have affected the vegetation by reducing shrub cover. These areas are characterized by the native climax shrubs big sagebrush (*Artemisia tridentata*) and antelope bitterbrush (*Purshia tridentata*) in the overstory, with a combined canopy cover ranging from 2-12%. The dominant understory grasses include: native Indian ricegrass (10%) and native needle-and-thread grass (15%) in Survey Area 5-2, native Sandberg's bluegrass (25%) in Survey Area 5-1, and non-native cheatgrass (*Bromus tectorum*) ranging from 20-30% across both areas (Appendix J, Table J. 41). A wide variety of native and non-native forbs and other grasses are also present in the area; see the field data records at the end of this section for the full list of plant species recorded during the survey.

Several wildlife species typical of such habitats, or their sign, were observed during the survey. Of note are loggerhead shrike (*Lanius ludovicianus*) a Washington State Candidate species and American badger (*Taxidea taxus*) a Washington State Monitor species. See the field data records section of the EU description in Appendix J for the full list of wildlife species recorded during the survey in 2015.

CULTURAL RESOURCES SETTING

Most of the CP-LS-18, Outer Area Sites EU has been inventoried for archaeological resources, with one resource identified and recorded within the EU boundary; a historic road associated with the Manhattan Project/Cold War Era landscape, which has been determined not eligible for listing in the National Register of Historic Places. Closure of the NRDWL/SWL has been addressed in an NHPA Section 106 Review, *Cultural Resources Review for Closure of the Nonradioactive Dangerous Waste Landfill and Solid Waste Landfill, 600 Area, Hanford Site, Benton County, Washington, HCRC# 2010-600-018* (Gutzeit et al. 2010) and associated *Environmental Assessment for the Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington* (DOE/EA-1707D)

(DOE-RL 2011). No additional archaeological sites and/or TCPs are known to be located within the boundary of the EU. The land within the central portion of the EU is heavily disturbed from the installation of the NRDWL/SWL. Additional disturbances within the EU are noted from the installation of monitoring wells, well pads and associated access roads. There is a low degree of potential for the existence of intact archaeological resources within these disturbed areas; however, a moderate degree of potential for subsurface archaeological resources does exist within the isolated pockets of undisturbed deposits surrounding the landfill and in areas that have not been previously inventoried.

There is one archaeological site, associated with the Native American Precontact and Ethnographic Landscape, located within 500 meters of the EU. This archaeological resource has not been evaluated for listing in the National Register of Historic Places.

Historic maps and aerial imagery indicate that the area was relatively undeveloped with the exception of some historic use as evidenced by the presence of trails/roads in the general vicinity of the EU. This suggests a low potential for archaeological resources associated with the Pre-Hanford Early Settlers/Farming Landscape to be present within the EU Geomorphology indicates a moderate potential for the presence of archaeological resources associated with the Native American Precontact and Ethnographic Landscape to be present within the intact, undisturbed Holocene dune sand deposits located within the EU boundary. Extensive ground disturbance within the central portion of the EU, however, may negate this moderate potential.

Because of the potential for intact archaeological deposits within the CP-LS-18, Outer Area Sites EU, it may be appropriate to conduct surface and subsurface archaeological investigations in these areas prior to initiating a remediation activity. Indirect effects are always possible when TCPs are known to be located in the general vicinity. Consultation with Hanford Tribes (Confederated Bands of the Yakama Nation, Wanapum, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce) and other groups who may have an interest in the areas (e.g. East Benton Historical Society, Prosser Cemetery Association, Franklin County Historical Society, the Reach, and the B-Reactor Museum Association) may need to occur. Consultation with Hanford Tribes may also be necessary to provide input on indirect effects to both recorded and potential unrecorded TCPs in the area and other cultural resource issues of concern.

PART V. WASTE AND CONTAMINATION INVENTORY

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

Four main waste types (sanitary solid waste, asbestos, liquid waste, and drummed dangerous waste) were disposed at the Nonradioactive Dangerous Waste Landfill (RDWL) and the Solid Waste Landfill (SWL). In addition to dangerous waste, the NRDWL also received a small amount of sanitary solid waste and a substantial amount of both friable and non-friable asbestos-containing waste material (over 50 percent by volume) through 1988 when it ceased operations. Beginning in 1975, drummed chemical waste was disposed of in six trenches, asbestos in nine trenches, and nonhazardous solid waste in one trench; three trenches were unused. Dangerous waste was disposed of in six dedicated trenches. Based on available information, including detailed disposal records and operator knowledge, all dangerous waste was containerized in drums prior to being placed in a trench. Asbestos waste generally was not containerized prior to disposal; however, it was disposed of and covered in accordance with regulatory requirements in place at the time.

SWL is a much larger facility (67 ac) that received nondangerous and nonradioactive solid waste (i.e., principally solid waste, including paper, construction debris, asbestos, and lunchroom waste) from 1973 through March 1996. SWL also received limited liquid wastes, approximately 1,200,000 gal of sewage and 1100 Area catch tank liquid, and approximately 100,000 gal of garage wash water. The liquid waste was discharged to east-west oriented trenches at the perimeter of the main solid-waste area, along the northeast and northwest boundaries of the SWL (refer to Figure G.12-2). Based on available analytical data, the liquid waste (likely the garage wash water) contained residual amounts of carbon tetrachloride, 1,1,1 TCA, TCE and PCE. Because of high hydraulic loading (compared to natural recharge rates) these contaminants were prone to migrate more quickly to groundwater than simple leachate generated from NRDWL/SWL via natural recharge. Because of the materials disposed, these trenches are considered one of the leading contributors to groundwater impacts from NRDWL/SWL releases.

Vadose Zone Contamination

The CP-LS-18 waste site with reported inventories (Table G.12-2 through Table G.12-4) is a burial ground site (unlined) that represents soil and other vadose zone contamination. The inventories represent the reported contamination originally discharged to the vadose zone from the CP-LS-18 waste sites. These values are used to estimate the inventory remaining in the vadose zone using the process described in the Methodology Report (CRESP 2015) for the 2013 groundwater plume information as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1. The focus in this section will be on the Group A and B contaminants (CRESP 2015) in the vadose zone due to their mobility and persistence and potential threats to groundwater (a protected resource); however, no plumes have been associated with CP-LS-18 waste sites. To summarize[6]:

- *Carbon tetrachloride* (CCl_4) and *chromium* – There are reported inventories for carbon tetrachloride and chromium in the CP-LS-18 waste sites (Table G.12-4 but there are no plumes in 200 East associated with these contaminants (and thus CP-LS-18 sources). The inventory is dominated by the 600 NRDWL, which is the only site with a reported inventory.
- *Other Group A&B Primary Contaminants (PCs)* – There are no reported vadose zone inventories in the CP-LS-18 waste sites for radionuclides (because of types of waste disposed) (Table G.12-2 and Table G.12-3) or other Group A and B primary contaminants (Table G.12-4).

No CP-LS-18 waste sites have been linked to existing plumes in the Hanford Central Plateau (DOE-RL/2016-09, Rev. 0). For the other Group A and B constituents, the TC&WM EIS groundwater transport analysis indicates that predicted peak concentrations (for contaminants with reported inventories) at the Columbia River Nearshore boundary (which is the closest area evaluated downgradient of the CP-LS-18 EU) for chromium could exceed thresholds during the evaluation period; however, there is no current plume and groundwater monitoring results indicate that chromium is moving much slower than predicted in the TC&WM EIS. The ratings for these are thus not changed based on this analysis.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015) for the 2013 groundwater results as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1, the remaining vadose zone inventories for CP-LS-18 in Table G.12-5 are estimated by difference and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone. The vadose zone (VZ) ratings are *Medium* for carbon

[6] The plume information is primarily taken from PHOENIX (http://phoenix.pnnl.gov/apps/gw/phoenix.html) that show the 2014 groundwater plumes. These plumes were assumed representative of 2015 groundwater plumes.

tetrachloride and *Low* for total and hexavalent chromium. The overall current rating is defined as the highest over all the ratings and thus *Medium*.

Groundwater Plumes

No sites within the CP-LS-18 EU with reported inventories are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). Monitoring of groundwater is being conducted within the 200-PO GWIA as described in CP-GW-1 EU (Appendix D.5). As shown in Table G.12-5, no saturated zone inventories have been associated with CP-LS-18; the process for deriving these inventories is described in CRESP Methodology Report (CRESP 2015) originally for the 2013 groundwater plume information as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1.

In general the 2015 groundwater plumes are evaluated in separate EUs (see Appendix D.1 through Appendix D.6); furthermore, as described in the previous sections, no portions of the groundwater plumes are associated with CP-LS-18 (DOE/RL-2016-09, Rev. 0). Note that I-129 is the primary risk driver for the 200-PO GWIA; however, there are no CP-LS-18 sources associated with these plumes, and the remaining vadose zone sources from other EUs would drive future risks to groundwater.

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there may be a significant impact from emplacing an engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations (relative to thresholds) at various areas within the Central Plateau. However, the TC&WM EIS transport analysis did not specifically cover the area including the CP-LS-18 waste sites, and thus impacts must inferred from those at the Columbia River Nearshore, which is downgradient from CP-LS-18 and included sources other than those in CP-LS-18[7]. For the Group A and B contaminants with reported inventories, only the chromium concentration is predicted to exceed thresholds during the evaluation period (Appendix O, DOE/EIS-0391 2012). However, recent groundwater monitoring results suggest that chromium is moving significantly slower than predicted in the TC&WM EIS.

Since the predicted peak concentrations are predicted to remain above thresholds for chromium even after surface barrier emplacement, it is decided to not alter the CP-LS-18 ratings related to groundwater based on different recharge rate scenarios. This effect is likely not due to an ineffective surface barrier but instead the amount of these contaminants already in the groundwater and possible contributions of sources outside CP-LS-18 (as assumed in the TC&WM EIS analysis). Furthermore, groundwater is not yet being treated in the area and thus there is no basis yet for changing ratings for CP-LS-18.

Columbia River

Threats to the Columbia River similar to those presented by the CP-LS-18 EU were evaluated in Section 6.5 of Appendix E.6 for CP-TF-5 (A-AX Single-shell Tank and Waste Farm) where all risks and potential impacts were rated *Not Discernible* (*ND*).

[7] Analyses specific to each Tank Farm or Central Plateau EU are not available; thus the aggregate screening analysis provided in the TC&WM EIS was used as an indication.

Table G.12-2. Inventory of Primary Contaminants [(a)]

WIDS	Description	Decay Date	Ref	Am-241 (Ci)	C-14 (Ci)	Cl-36 (Ci)	Co-60 (Ci)	Cs-137 (Ci)	Eu-152 (Ci)	Eu-154 (Ci)	H-3 (Ci)	I-129 (Ci)
All	Sum			NR	NR	NR	NR	NR	NR	NR	NR	NR
600 NRDWL	Burial Ground		DOE/EA-1707D[(b)]	NR	NR	NR	NR	NR	NR	NR	NR	NR

a. NR = Not reported
b. DOE/EA-1707D, Revised Predecisional Draft, *Environmental Assessment, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington*

Table G.12-3. Inventory of Primary Contaminants (cont)[(a)]

WIDS	Description	Decay Date	Ref	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)
All	Sum			NR	NR	NR	NR	NR	NR
600 NRDWL	Burial Ground		DOE/EA-1707D[(b)]	NR	NR	NR	NR	NR	NR

a. NR = Not reported
b. DOE/EA-1707D, Revised Predecisional Draft, *Environmental Assessment, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington*

Table G.12-4. Inventory of Primary Contaminants (cont)[(a)]

WIDS	Description	Ref	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
All	Sum		94	NR	26	NR	140	11,000	10	NR	NR	0
600 NRDWL	Burial Ground	DOE/EA-1707D[(b)]	94	NR	26	NR	140	11,000	10	NR	NR	0

a. NR = Not reported
b. DOE/EA-1707D, Revised Predecisional Draft, *Environmental Assessment, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington*

Table G.12-5. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the Evaluation Unit

PC	Group	WQS	Porosity[a]	K_d (mL/g)[a]	ρ (kg/L)[a]	VZ Source M^{Source}	SZ Total M^{SZ}	Treated[c] M^{Treat}	VZ Remaining M^{Tot}	VZ GTM (Mm^3)	VZ Rating[d]
C-14	A	2000 pCi/L	0.25	0	1.82	---	---	---	---	---	*ND*
I-129	A	1 pCi/L	0.25	0.2	1.82	---	---	---	---	---	*ND*
Sr-90	B	8 pCi/L	0.25	22	1.82	---	---	---	---	---	*ND*
Tc-99	A	900 pCi/L	0.25	0	1.82	---	---	---	---	---	*ND*
CCl4	A	5 µg/L	0.25	0	1.82	9.40E+01 kg	---	---	9.40E+01 kg	1.88E+01	*Medium*
Cr	B	100 µg/L	0.25	0	1.82	2.64E+01 kg	---	---	2.64E+01 kg	2.64E-01	*Low*
Cr-VI	A	48 µg/L[b]	0.25	0	1.82	2.64E+01 kg	---	---	2.64E+01 kg	5.50E-01	*Low*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	---	---	---	---	---	*ND*

a. Parameters obtained from the analysis provided in Attachment 6-1 to Methodology Report (CRESP 2015).

b. "Model Toxics Control Act—Cleanup" (WAC 173‑340) Method B groundwater cleanup level for hexavalent chromium.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0).

d. Groundwater Threat Metric rating based on Table 6-3, Methodology Report (CRESP 2015).

PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

Pathways and Barriers

Briefly describe the current institutional, engineered and natural barriers that prevent release or dispersion of contamination, risk to human health and impacts to resources:

1. What nuclear and non-nuclear safety accident scenarios dominate risk at the facility? What are the response times associated with each postulated scenario?

No radioactive materials are present in this EU.

2. What are the active safety class and safety significant systems and controls?

Not applicable

3. What are the passive safety class and safety significant systems and controls?

Not applicable

4. What are the current barriers to release or dispersion of contamination from the primary facility? What is the integrity of each of these barriers? Are there completed pathways to receptors or are such pathways likely to be completed during the evaluation period?

Contaminants are buried and covered with 2-4 ft. of dirt or gravel.

5. What forms of initiating events may lead to degradation or failure of each of the barriers?

Not applicable

6. What are the primary pathways and populations or resources at risk from this source?

Some continuing risk to ground water through soil migration

7. What is the time frame from each of the initiating events to human exposure or impacts to resources?

Not applicable

8. Are there current on-going releases to the environment or receptors?

Some continuing release to groundwater; monitoring has been carried out for past 20 years.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker

Low to None

Co-Located Person (CP)

None

Public

None

Groundwater

Table G.12-5 represents the risks and associated ratings for groundwater from remaining vadose zone contamination associated with the CP-LS-18 waste sites. Sites within the CP-LS-18 EU may have contaminated the local vadose zone but are not suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). The current risk and potential impact ratings for the CP-LS-18 EU Group A and B primary contaminants are *Medium* (carbon tetrachloride) and *Low* (total and hexavalent chromium) (Table G.12-5). Monitoring of groundwater is being conducted within the 200-PO GWIA as described CP-GW-1 EU (Appendix D.5). No current plumes have been linked to CP-LS-18 EU waste sites.

Columbia River

As described in Appendix D.5 (CP-GW-1 EU) and **Part V**, no plumes from CP-LS-18 waste sites currently intersect the Columbia River; thus current ratings for all contaminants for the benthic, riparian, and free-flowing ecology are *ND*.

Ecological Resources

Summary of Ecological Review:

- 100% of the EU is classified as level 3 or above biological resources (76% level 3, 24% level 5).
- The level 3 area which makes up the majority of the EU consists of revegetated successional shrub-steppe habitat, while the level 5 area is classified as an element occurrence.
- A loss of 8.7% of level 3 or above resources would occur at the landscape level from remediation actions.

Cultural Resources

The CP-LS-18, Outer Area Sites EU is located in the 600 Area of the Hanford Site and is comprised of the Nonradioactive Dangerous Waste Landfill/Solid Waste Landfill (NRDWL/SWL). The NRDWL/SWL adjoin each other and started receiving waste in the 1970s. The NRDWL accepted waste from Hanford Site operations associated with laboratory work, process operations, maintenance, and transportation functions throughout the Hanford Site (Washington State Department of Ecology 2015). The NRDWL/SWL have been inactive (i.e. not receiving waste) since 1988 and 1996, respectively. Most of the EU has been inventoried for cultural resources under HCRC# 87-600-006 (Hoover & Chatters 1988), HCRC# 89-600-002 (Cadoret 1989), HCRC# 92-600-022 (Wright 1992), HCRC# 99-600-005b (Wright 1999), HCRC# 2010-600-018 (Gutzeit et al.), HCRC# 2010-600-020 (Sharpe 2010), HCRC# 2013-600-018, (Sexton et al. 2013), HCRC# 2014-600-017 (Fergusson 2014), with only one archaeological resource identified (a historic roadway associated with the Manhattan Project/Cold War Era Landscape). Closure of the NRDWL/SWL has been addressed in an NHPA Section 106 Review, *Cultural Resources Review for Closure of the Nonradioactive Dangerous Waste Landfill and Solid Waste Landfill, 600 Area, Hanford Site, Benton County, Washington, HCRC# 2010-600-018* (Gutzeit et al. 2010) and associated *Environmental Assessment for the Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington* (DOE/EA-1707D) (DOE-RL 2011). Much of the land within the EU is extensively disturbed from the installation and use of the landfill area, well drilling and installation and use of area roadways. While surface archaeological inventories of the EU have shown a low potential for archaeological resources, there is the potential to encounter subsurface archaeological resources, especially in isolated pockets of undisturbed soils (such as those surrounding the fenced landfill area).

Archaeological sites, buildings and Traditional Cultural Properties (TCPs) located within the EU[8]

- One historic road associated with the Manhattan Project/Cold War Era Landscape has been recorded within the CP-LS-18, Outer Area Sites EU. This road has been determined not eligible for inclusion in the National Register of Historic Places.
- No additional archaeological sites, buildings, and/or TCPs are known to be located within the EU.

Archaeological sites, buildings and TCPs located within 500 meters of the EU

- There is one archaeological site, associated with the Native American Precontact and Ethnographic Landscape, located within 500 meters of the CP-LS-18, Outer Area Sites EU. This archaeological resource has not been evaluated for listing in the National Register of Historic Places.

Closest Recorded TCP

There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the CP-LS-18, Outer Area Sites EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

Currently, the proposed closure activities are addressed under a single plan for both facilities in DOE/RL-90-17 (Revision 2), *Nonradioactive Dangerous Waste Landfill/Solid Waste Landfill Closure/Postclosure Plan*. The proposed closure activities would focus on final barrier installation including oversight of the unit during barrier installation and appropriate certifications. A uniform design for a single evapotranspiration (ET) barrier over both NRDWL and SWL would be used. The ET barrier would consist of a fine-grained, low permeability soil and a top layer of the same fine-grained soil modified with an erosion resistant top soil that would sustain native vegetation. The proposed landfill closure activities would slightly expand the current footprint of the areas associated with NRDWL and SWL, which are largely sites that were previously disturbed during construction and operation of the landfills.

Existing waste within NRDWL/SWL, including containerized dangerous waste, asbestos materials, and sanitary waste, will be left in place beneath the ET cover. As part of construction, geophysical surveys will be performed to assess the subsurface distribution of waste containers and voids within the NRDWL/SWL. This survey will support the final detailed cover design and determine if any void reduction or compaction will be required as part of construction so as to minimize the potential for future settling or subsidence.

Postclosure activities would include long-term groundwater monitoring activities (including installation of 6 additional wells [2 new upgradient, 4 new downgradient, and one replacement), periodic inspections, and maintenance activities to ensure the long-term integrity of the closed landfill. Groundwater monitoring would continue during the postclosure period consistent with a compliant, State-approved groundwater monitoring program. Additional activities would be identified in the approved RCRA closure plan.

[8] Traditional cultural property has been defined by the National Park Service as "a property, a place, that is eligible for inclusion on the National Register of Historic Places because of its association with cultural practices and beliefs that are (a) rooted in the history of a community, and (b) are important to maintaining the continuity of that community's traditional beliefs and practices" (Parker & King 1998).

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

Currently existing inventories at NRDWL and SWL will remain after final closure.

Risks and Potential Impacts Associated with Cleanup

Risks to human health will largely be related to possible industrial accidents related to the trucking of fill and construction of the protective cover.

POPULATIONS AND RESOURCES AT RISK OR POTENTIALLY IMPACTED DURING OR AS A CONSEQUENCE OF CLEANUP ACTIONS

Facility Worker

None. No radioactive contaminants are present in the two landfills, and the various chemical contaminants buried at the site do not present a risk to human health as it relates to air or surface soil pathways.

Co-located Person

None, as above

Public

None, as above

Groundwater

As described in **Part V**, there is unlikely to be a significant impact during this period to groundwater (as a protected resource) from mobile primary contaminants from CP-LS-18. However, there are contaminant sources (legacy source sites) in the vadose zone that pose continuing risk to groundwater (via the vadose zone). Because the area associated with CP-LS-18 sources is best represented by the Columbia River Nearshore analyses (see previous section), the vadose zone (VZ) GTM values for the Group A and B primary contaminants for CP-LS-18 (during the Active Cleanup period) translate to ratings of *ND* to *Medium* (because of contaminants in the vadose zone to be treated). Groundwater in the area is being monitored, which when combined with the fact that remedial actions have not yet begun, result in no changes to ratings. These ratings correspond to an overall rating of *Medium* for both the Active and Near-term, Post-Cleanup periods. The 200 East Area will continue to be monitored during this evaluation period to see if major changes result in additional groundwater contamination.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

As described in **Part V**, impacts to the Columbia River benthic, riparian, and free-flowing ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible* (*ND*). Additional information on groundwater plumes and potential threats associated with sources including those from CP-LS-18 waste sites are described in Appendix G.5 for the CP-GW-1 EU.

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

Remove, Treat and Dispose of waste involves personnel through the target (remediation) area, car and pickup truck traffic through the non-target and target (remediation) area, truck, heavy equipment (including drill rigs) traffic on roads through the non-target and target area, caps (and other containment), soil removal and contamination in the soil, vegetation control, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on tires of vehicles or blowing from heavy equipment; injure or kill vegetation or small invertebrates or small animals; vehicle traffic can make paths, compact soil, scare or displace animals, can impact animal behavior or reproductive success; affect animal dispersion and habitat use (e.g., some birds avoid nesting near roads because of song masking); displacement of animals from near roads due to increased noise or other disturbances; and heavy equipment may permanently destroy areas of the site with intense activity. Soil removal can cause more severe effects because of blowing soil (and seeds). During remediation, radionuclides or other contaminants could be released or spilled on the surface, and depending upon the type and quantity, could have adverse effects on the plants and animals on-site. Use of non-specific herbicides for vegetation control results in some mortality of native vegetation (especially native forbes), and allows exotic species to move in; it may change species composition of native communities, but it also could make it easier for native species to move in; improved methods could yield positive results. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area.

Alternatively, barriers could be the remediation option and involves personnel car and pickup truck traffic through the non-target and target (remediation) area, truck and heavy equipment traffic on roads through the non-target and target area, dust suppression, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on person (boots, clothes, equipment) or tires of vehicles or blowing from heavy equipment; injure vegetation or small invertebrates or small animals (e.g., insects, snakes); make paths or compact soil; scare or displace animals. Caps and other containment can cause compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Destruction of soil invertebrates at depths of pits. Potential bringing up of dormant seeds from soil layers; disruption of ground-living small mammals and hibernation sites of snakes and other animals on-site of containment; often disrupts local aquatic environment and drainage; often non-native plants used on caps (which can become exotic/alien adjacent to the containment site). Additional water from dust suppression could lead to more diverse and abundant vegetation in areas that receive water, which could encourage invasion of exotic species; the latter could displace native plant communities; excessive dust suppression activities could lead to compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. These effects will be higher in the EU itself.

Cultural Resources

Potential direct effects are possible from personnel, car, pick-up, truck and heavy equipment traffic/use through both target (remediation) and non-target areas during active cleanup. These activities may

inadvertently expose resources close to the surface. Additionally, traffic through these areas may lead to the introduction of invasive species and/or a decrease in the presence of native plants used for medicinal or tribal religious purposes. Heavy equipment use for remedial activities (such as RTD of waste and/or contaminated soils) may lead to an alteration of the landscape, and the act of soil removal may destroy resources; if resources are not destroyed, then, soil removal may disturb or adversely affect resources. Utilization of caps, barriers and/or other containments may destroy resources located close to the surface. If resources are not destroyed, containments may disturb or adversely affect resources. Lastly, during remediation, radionuclides or other contamination released or spilled on the surface could have long-term effects if the contamination remains and resources become contaminated and/or plants having cultural importance to Tribes do no recolonize or thrive.

Potential indirect effects are possible from personnel traffic through target (remediation) areas as well as car, pick-up, truck and heavy equipment traffic/use through both target (remediation) and non-target areas. It is possible that these activities may decrease viewshed values and/or impact viewshed through the introduction of increased dust, the creation of trails, etc. Heavy equipment use for remedial actions/soil removal and the utilization of caps and/or other containments (i.e. barriers) could potentially cause alterations to the landscape and impacts to viewsheds. Lastly, during remediation, radionuclides or other contamination released or spilled on the surface could have long-term effects if the contamination remains and resources become contaminated and/or plants having cultural importance to Tribes do no recolonize or thrive.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

No radioactive contaminants are present in the two landfills, and the various chemical contaminants buried at the site do not present a risk to human health as it relates to air or surface soil pathways. However, the proposed cap/barrier over the landfills will limit further migration of contaminants to groundwater.

NEAR-TERM, POST-CLEANUP STATUS, RISKS AND POTENTIAL IMPACTS

Postclosure activities would include long-term groundwater monitoring activities (including installation of 6 additional wells [2 new upgradient, 4 new downgradient, and one replacement), periodic inspections, and maintenance activities to ensure the long-term integrity of the closed landfill. Groundwater monitoring would continue during the postclosure period consistent with a compliant, State-approved groundwater monitoring program. Additional activities would be identified in the approved RCRA closure plan.

POPULATIONS AND RESOURCES AT RISK OR POTENTIALLY IMPACTED AFTER CLEANUP ACTIONS (FROM RESIDUAL CONTAMINANT INVENTORY OR LONG-TERM ACTIVITIES)

Table G.12-6. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup.

Population or Resource		Risk/Impact Rating	Comments
Human	Facility Worker	ND	Worker and offsite radiological dose consequences are expected to be minimal, due to the absence of radionuclides in the wastes disposed of at NRDWL and SWL. Worker and offsite exposure to hazardous chemicals from closure activities are expected to be small due to the non-invasive nature of the proposed action. [9]
	Co-located Person	ND	
	Public	ND	
Environmental	Groundwater (A&B) from vadose zone[(a)]	*Medium* (CCl_4) *Low* (Cr(tot) and Cr-VI) **Overall**: *Medium*	*Current* GTM values for Group A&B primary contaminants (Table G.12-6): *Medium* (CCl_4), *Low* (Cr-tot and Cr-VI), *ND* (others). No treatment in 200 East thus no changes to ratings. Also predicted impact from changes in recharge rates not taken into account to address uncertainties.
	Columbia River from vadose zone[(a)]	Benthic: *Not Discernible* (*ND*) Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*	TC&WM EIS screening results indicate that exposure to radioactive and chemical contaminants from peak groundwater discharge below benchmarks for both benthic and riparian receptors (**Part V**). Dilution factor of greater than 100 million between Columbia River and upwellings.
	Ecological Resources[(b)]	Medium-High	The uncertainty of remediation options for this EU makes it difficult to predict future risk to the resources. Given the high value of the resources in the EU and buffer then any continued disruption would have high potential risk of impact.
Social	Cultural Resources[(b)]	**Native American**	Permanent indirect effects are

[9] US Department of Energy, Richlands Operations Office, *Environmental Assessment, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington*, DOE/EA-1707D, Revised Predecisional Draft, August 2011.

Population or Resource		Risk/Impact Rating	Comments
		Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Unknown **Manhattan/Cold War** Direct: Known Indirect: None	possible from evapotranspiration barrier/cover and if contamination remains after remediation. Disturbance associated with closure and monitoring activities is possible.

a. Threat to groundwater or Columbia River for Group A and B contaminants remaining in the vadose zone. Threats from existing plumes associated with the CP-LS-18 EU are described in **Part V** with more detailed evaluation in Appendix G.5 (CP-GW-1).

b. For both Ecological and Cultural Resources see Appendices J and K, respectively, for a complete description of Ecological Field Assessments and literature review for Cultural Resources. Ecological ratings are described in Table 4-11 of the Final Report.

LONG-TERM, POST-CLEANUP STATUS – INVENTORIES AND RISKS AND POTENTIAL IMPACT PATHWAYS

Postclosure activities would include long-term groundwater monitoring activities (including installation of 6 additional wells [two new upgradient, four new downgradient, and one replacement), periodic inspections, and maintenance activities to ensure the long-term integrity of the closed landfill. Groundwater monitoring would continue during the postclosure period consistent with a compliant, State-approved groundwater monitoring program. Additional activities would be identified in the approved RCRA closure plan.

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

Table G.12-7. Hanford Site-Wide Risk Review CP-LS-18 (Outer Area Sites) Waste Site and Facility List

Site Code	Name, Aliases, Description	Feature Type	Site Status	ERS Classification	ERS Reclassification	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation	Comments
600 CL	600 CL; 671 Facility; Central Landfill; Central Waste Landfill; CWL; Solid Waste Landfill; SWL; 600 Area Central Landfill	Waste Site	Inactive	Accepted	None	Sanitary Landfill	Burial Ground	200-SW-1		
600 NRDWL	600 NRDWL; Nonradioactive Dangerous Waste Landfill (Central Landfill); NRDW Landfill; NRDWL; 600 Area Nonradioactive Dangerous Waste Landfill	Waste Site	Inactive	Accepted	None	Sanitary Landfill	Burial Ground	200-SW-1		
UPR-200-E-83	UPR-200-E-83; Zone A, Zone B, Zone C; BC Controlled Area; BC Cribs Controlled Area; BCCA; UN-200-E-83; UN-216-E-11	Waste Site	Inactive	Accepted	None	Contamination Migration	Unplanned Release - Surface/Near Surface	200-OA-1	X	Included in BC Control Zone Eval.

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