

WASTE SITE RECLASSIFICATION FORM

Date Submitted: <u>August 28, 2012</u>	Operable Unit(s): <u>100-KR-1</u>	Control Number: 2012-013
Originator: <u>Laura J. Cusack</u>	Waste Site Code: <u>100-K-63</u>	
Phone: <u>(509) 376-1595</u>	Type of Reclassification Action: Closed Out <input type="checkbox"/> Interim Closed Out <input checked="" type="checkbox"/> No Action <input type="checkbox"/> RCRA Postclosure <input type="checkbox"/> Rejected <input type="checkbox"/> Consolidated <input type="checkbox"/>	

This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.

Description of current waste site condition:

(Summarize status of investigation/remediation of the waste sites.)

The 100-K-63 waste site encompasses a large portion of the 100-K flood plain along the shore of the Columbia River, north of 105-KW Reactor Area and the former site of the 107-KW Retention Basin. Significant quantities of the leakage from the 107-KW retention basin accumulated on the floodplain over time and created preferential pathways through the natural topography of the site. The effluent concentrated in natural depressions, creating areas with potentially increased levels of contamination.

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Remediation of the 100-K-63 Waste Site began in July 2010 and was completed by November 2010. Radiological surveys of the waste site and in-process samples were used to guide the excavation. Field verification sampling began August 17, 2011 and was completed September 15, 2011 following the *100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev. 5, (SAP)* and RA-00401, *Verification Sampling Instruction for the 100-KW Floodplain Contamination, Waste Site 100-K-63 (SI)*.

Approximately 85,431 tons contaminated soil and debris was disposed of in the ERDF as part of this remedial action.

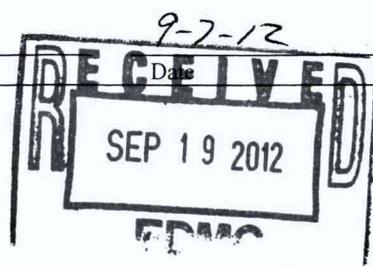
Basis for reclassification:

The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in 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, EPA/ROD/R10-99/039 (100 Area Remaining Sites ROD) U.S. Environmental Protection Agency, Region 10, Seattle, Washington following the requirements of the Remedial Design Report/Remedial Action Work Plan for the 100 Area, DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland, Washington, the SAP (DOE/RL-96-22) and the SI (RA-00371). Therefore, the current status of the waste site meets the remediation requirements of the 100 Area Remaining Sites ROD (EPA/ROD/R10-99/039) and supports reclassification of this site to Interim Closed Out. In accordance with DOE/RL-96-17, the removal and disposal of waste site 100-K-63 supports future land uses that can be represented (or bounded) by a rural-residential exposure scenario. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-KR-2 Operable Unit Waste Sites: 100-K-63, DOE/RL-2012-25* (attached).

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.

<u>TOM K. TEYNOR (STEVE BALONE)</u>	<u>[Signature]</u> for TKT	<u>9/7/2012</u>
DOE Federal Project Director (printed)	Signature	Date
Ecology Project Manager (printed)	Signature	Date
<u>Red Gibbs</u>	<u>[Signature]</u>	<u>9-7-12</u>
Project Manager (printed)	Signature	Date



Remaining Sites Verification Package for the 100-KR-1 Operable Unit Waste Site: 100-K-63

Documentation for Waste Site Reclassification From 2012-013

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

 **CH2MHILL**
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

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Further Dissemination Unlimited

Remaining Sites Verification Package for the 100-KR-1 Operable Unit Waste Site: 100-K-63

Documentation for Waste Site Reclassification From 2012-013

K. M. Whitley
CH2M HILL Plateau Remediation Company

Date Published
September 2012

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

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under Contract DE-AC06-08RL14788

 **CH2MHILL**
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

APPROVED

By Shauna E. Adams at 9:24 am, Sep 13, 2012

Release Approval

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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.

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Remaining Sites Verification Package for the 100-KR-1 Operable Unit Waste Site: 100-K-63

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
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 **CH2MHILL**
Plateau Remediation Company
P.O. Box 1600
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Executive Summary

This Remaining Sites Verification Package (RSVP) summarizes the completion of the interim remedial action performed on one waste site in the 100-KR-1 Operable Unit (OU):

- 100-K-63, 100-KW Floodplain Contamination Area

The interim remedial action was completed by the U.S. Department of Energy, Richland Operations Office (DOE-RL) under a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remedial action authorized by 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* (EPA/ROD/R10-99/039, referred to as the 100 Area Remaining Sites ROD).

The selected remedy for the 100-K-63 Waste Site was Remove/Treat/Dispose (RTD). The RTD remedy was performed in accordance with the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE/RL-96-17, RDR/RAWP for the 100 Area). The waste site and the contaminant source has been remediated to levels that satisfy the remedial action objectives (RAOs). Evaluation of sampling results supports interim close-out of waste site 100-K-63.

Completion of this remedial action provides the basis to change the status of the waste site to “interim closed out” in accordance with the process and definitions described in the *Tri-Party Agreement Handbook Management Procedures* (Ecology et al. 2007). The information obtained through performance of this interim remedial action will be used to support consideration of future remedial actions and final closure.

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Terms

AQA	Analytical Quality Associates, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	contaminant of concern
DOE-RL	U.S. Department of Energy, Richland Operations Office
DQA	data quality assessment
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant difference
FY	fiscal year
GPERS	Global Positioning Environmental Radiological Survey
HEIS	Hanford Environmental Information System
HQ	hazard quotient
NPL	National Priorities List
OU	operable unit
PNNL	Pacific Northwest National Laboratory
QC	quality control
RAG	remedial action goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act of 1976
RESRAD	Residual Radioactivity
ROD	record of decision
RSVP	Remaining Sites Verification Package
RTD	Remove/Treat/Dispose
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act of 1986

SDG	sample delivery groups
SI	sampling instruction
Tri-Party Agreement or TPA	Hanford Federal Facility Agreement and Consent Order
UCL	upper confidence limit

1 Introduction

This Remaining Sites Verification Package (RSVP) documents the interim remedial action that the U.S. Department of Energy, Richland Operations Office (DOE-RL) completed for the 100-K-63 Waste Site, 100-KW Floodplain Contamination Area, located at the Hanford Site in the 100-KR-1 Operable Unit (OU). The 100-K-63 Waste Site was added into the 100 Area Remaining Sites ROD in the 2004 *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision* (EPA, 2004) (ESD, 2004). The remediation began in 2010, with interim backfill and revegetation completed in 2012. The remediation occurred between July 2010 and November 2010, with final sampling completed in September 2011. This report documents the remediation of the waste site and verification sampling of the remediation footprint, providing the basis for interim closure of the waste site consistent with the requirements of 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* (EPA/ROD/R10-99/039, 100 Area Remaining Sites Record of Decision [ROD]).

This RSVP provides the following information documenting interim completion of the remediation of the 100-K-63 Waste Site:

- Background, historical information, regulatory enforcement history, and environmental setting
- Description of the completed action, remedial action objectives (RAOs), remedial action goals (RAGs), and exposure and land use assumptions established in the related regulatory documents
- Summary of the completed action, verification sampling approach and analytical data, and demonstration that RAOs have been met
- Estimated cost of the project

Field implementation of the remediation followed DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP for the 100 Area); DOE/RL-96-22, *100 Area Remedial Action Sampling and Analysis Plan* (SAP); and RA-00401, *Verification Sampling Instruction for the 100-KW Floodplain Contamination, Waste Site 100-K-63* (SI).

1.1 Site Description

The Hanford Site, located in southeastern Washington State and situated along the Columbia River, is approximately 1,518 km² (586 mi²) in size. The Hanford Site mission from the early 1940s to approximately 1989 included defense-related nuclear research, development, and weapons material production activities. These activities created chemical and radioactive wastes. The Hanford Site mission now is focused on the cleanup of those wastes and ultimate closure of the site.

The 100 Area, which encompasses approximately 68 km² (26 mi²) bordering the southern shore of the Columbia River, included six reactor areas (i.e., 100-B/C, 100-D/DR, 100-F, 100-H, 100-K, and 100-N) (Figure 1-1) that contained nine reactors. The 100-K-63 Waste Site is included in the 100-K Area, which is subdivided into three cleanup OUs; two OUs address cleanup of the soil (100-KR-1 and 100-KR-2 OUs) and one OU addresses groundwater contamination (100-KR-4 OU) that resulted from past operations. The 100-KR-1 and 100-KR-2 OUs encompass liquid waste disposal sites, burial grounds, and soil waste sites. Figure 1-2 depicts the waste site addressed in this RSVP, which were located in the 100-KR-2 OU.

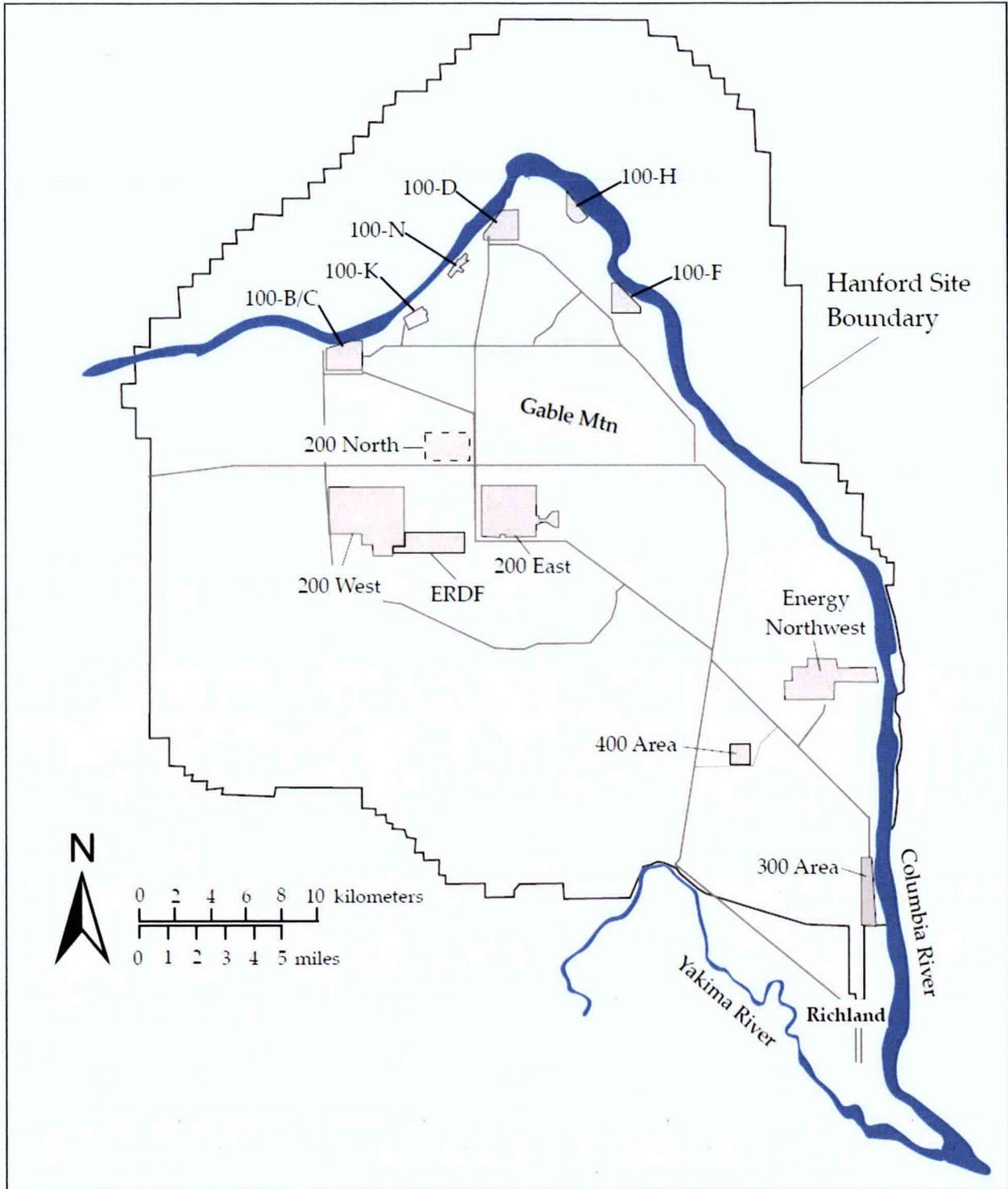


Figure 1-1. Hanford Site Map Including the 100-K Area

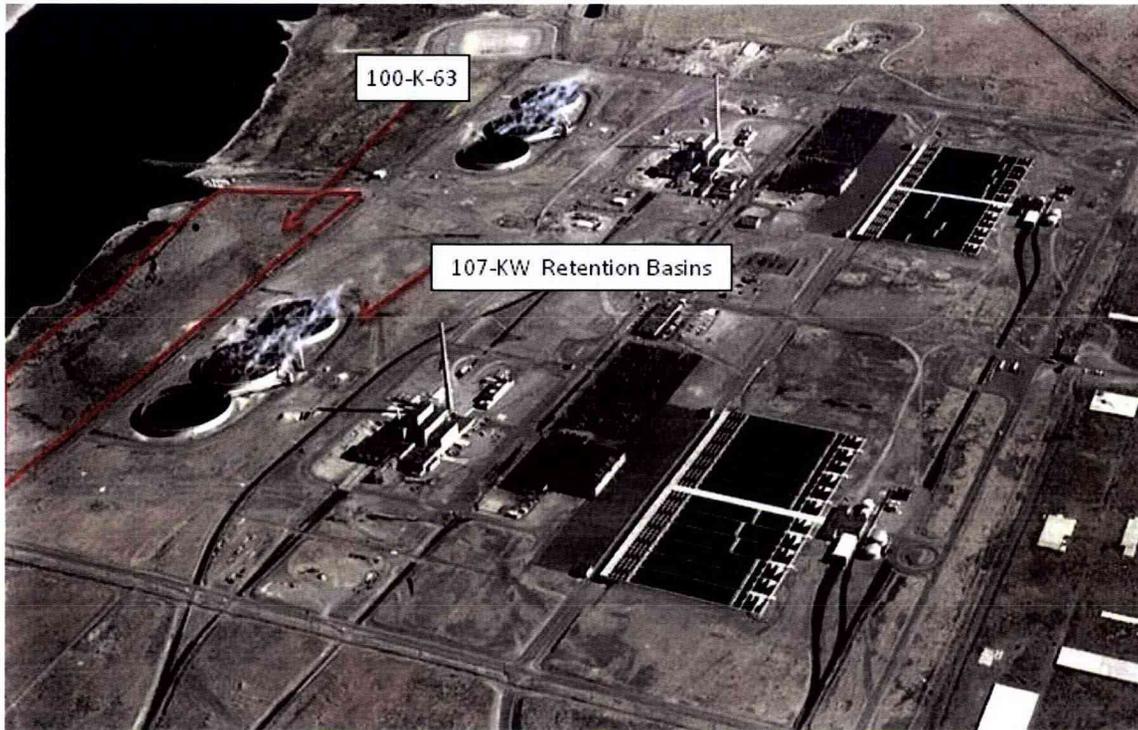


Figure 1-2. 100-K-63 Waste Site Location within the 100-K Area

1.2 Regulatory and Enforcement History

The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) was enacted to enable the Federal government to conduct cleanup of hazardous substances released into the environment. In 1986, CERCLA was amended by the *Superfund Amendments and Reauthorization Act of 1986*, (SARA) which included Section 120 (42 USC 9620, “Federal Facilities”), developed specifically for federal facility cleanup. Presidential Executive Order 12580 delegated to DOE the primary authority to conduct removal and remedial actions under authority of CERCLA Section 104, “Response Authorities”.

In 1987, the Federal government determined that wastes which included a mixture of radioactive and hazardous chemical components were subject to regulation under the *Resource Conservation and Recovery Act of 1976* (RCRA) and its Washington State counterpart. In 1989, DOE, the U.S. Environmental Protection Agency (EPA) and Washington Department of Ecology (Ecology) signed the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989, also known as the Tri-Party Agreement or TPA). The TPA implemented DOE’s exercise of CERCLA remedial action authority under EPA oversight, in accordance with CERCLA Section 120, and also included an Ecology Consent Order containing a schedule for bringing all current Hanford hazardous waste operations into compliance with RCRA under the new mixed waste requirements. DOE’s authority to conduct removal actions under CERCLA Section 104 is independent of the TPA, but is exercised cooperatively with the respective oversight authorities of EPA and Ecology.

During this timeframe, the Hanford Site was proposed for inclusion on the Superfund National Priorities List (NPL, 53 FR 23988, “National Priorities List for Uncontrolled Hazardous Waste Sites – Update 7”). EPA placed the Hanford Site’s 100, 200, 300, and 1100 Areas on the NPL on November 3, 1989 (54 FR 41015, “National Priorities List for Uncontrolled Hazardous Waste Sites – Final Rule 10/04/89”). These areas were then further divided into CERCLA OUs.

The 100-K-63 Waste Site was remediated in accordance with the 100 Area Remaining Sites ROD (EPA/ROD/R10-99/039) and the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision* (EPA, 2004). Field implementation of the remediation followed the RDR/RAWP for the 100 Area (DOE/RL-96-17).

1.3 Environmental Setting

The Hanford Site is located within the semiarid Pasco Basin in the northern portion of the Columbia Plateau. Average annual precipitation on the Hanford Site is 16 cm (6.3 in). The document *Estimated Recharge Rates at the Hanford Site* (PNL-10285) indicates an aquifer recharge range of 2.6 to 17.3 mm/yr (0.1 to 0.68 in/yr) for the 100 Area. Bedrock beneath the site is basalt of the Columbia River Basalt Group. The top of the basalt in the 100 Area ranges in elevation from 46 m (150 ft) above sea level near 100-H to 64 m (209 ft) below sea level near 100-B/C.

The Ringold Formation and Hanford formation (informal designation) cover the basalt throughout the 100 Area. These units are dominated by poorly consolidated, river-deposited, well-drained sands, gravels, cobbles, and boulders. The Ringold Formation is an interstratified sequence of unconsolidated clay, silt, sand, and gravel-to-cobble sediment deposited by the ancestral Columbia River. The Hanford formation consists of uncemented gravels, sands, and silts deposited by Pleistocene cataclysmic floodwaters. Groundwater from the Hanford Site discharges to the Columbia River, the dominant surface-water body of the Hanford Site. The uses of the Columbia River include the production of hydroelectric power, irrigation, drinking water, recreation (e.g., hunting and fishing), and natural resources.

Groundwater flows into the 100 Area from the south, through the gaps between Umtanum Ridge, Gable Butte, and Gable Mountain and discharges to the Columbia River. Groundwater flow is predominantly northwest in 100-K. The depth to groundwater at the 100-K-63 Waste Site is approximately 8.8 m (28.9 ft) below the original grade of the waste site.

Within the 100-K Area, the land is highly disturbed; however, the surrounding area is characterized as an arid to semiarid shrub-steppe vegetation zone. The plant community to the west comprises a sagebrush and Sandberg's bluegrass association. The plant community to the east is dominated by cheatgrass, Sandberg's bluegrass, rabbitbrush, Russian thistle, and tumble-mustard. The animal community in the surrounding area includes birds, mammals, reptiles, and insect groups that are adapted to the semiarid environment. The ecological setting of the Hanford Site, including the 100-K Area, is described in *Hanford Site National Environmental Policy Act (NEPA) Characterization* (PNNL-6415).

2 Waste Site Background

This section describes the 100-K-63 Waste Site, as well as the remedy and completion criteria.

2.1 100-K-63 Waste Site Description

The 100-K-63 Waste Site is located south of the Columbia River shoreline and north of the 107-KW Retention Basins (Figure 1-2).

The 100-K-63 Waste Site encompasses a large portion of the 100-K flood plain along the shore of the Columbia River, north of 105-KW Reactor Area and the former site of the 107-KW Retention Basin. During reactor operations the 107-KW Retention Basins received cooling water effluent from the 105-KW Reactor to allow for radioactive decay and thermal cooling prior to release to the Columbia River. The 107-KW Retention Basins and their effluent lines developed leaks during their operating life. Most of the leakage was diverted to metal culverts, conveying the effluent to an open drainage ditch through the floodplain, which discharged to the Columbia River (Figure 2-1). However, significant

quantities of the leakage accumulated on the floodplain over time and created preferential pathways through the natural topography of the site. The effluent concentrated in natural depressions, creating areas with potentially increased levels of contamination. Historical photographs taken during the operating period of the 107-KW Retention Basins show increased vegetation within the 100-K-63 Waste Site due to the periods of significant effluent leakage from the basins, which overflowed from the open drainage ditches and spread over the floodplain area. The 107-KW Retention Basins were demolished in 1995.

Radiological surveys of 100-K-63 were performed in 1988, 1992, and 1994 with soil samples collected in 1994. This data resulted in the radiological posting of the 100-K-63 Waste Site, with portions of the waste site posted as Soil Contamination Area and Underground Radioactive Material Area.



Figure 2.1 Culvert Locations within the 100-K-63 Waste Site Excavation (September 2011)

2.2 Description of the Remedy

The selected remedy for the 100 Area Remaining Sites ROD is Remove/Treat/Dispose (RTD). This was achieved for the 100-K-63 Waste Site through removal and disposal of the contaminated soils.

2.2.1 Completion Criteria

The following RAOs were identified in the RDR/RAWP for the 100 Area (DOE/RL-96-17) as the objectives for the remediation of the 100-K-63 Waste Site:

- Protect human and ecological receptors from exposure to contaminants in soils, structures, and debris by dermal exposure, inhalation, or ingestion of radionuclides, inorganics, or organics.
- Control the sources of groundwater contamination to minimize the impacts to groundwater resources, protect the Columbia River from further adverse impacts, and reduce the degree of groundwater cleanup that may be required under future actions.

The following two additional RAOs are also included in the RDR/RAWP for the 100 Area (DOE/RL-96-17) based on additional 100 Area RODs, which utilize the same RDR/RAWP:

- To the extent practicable, return soil concentrations to levels that allow for unlimited future use and exposure. Where it is not practicable to remediate to levels that will allow for unrestricted use in all areas, institutional controls and long-term monitoring will be required.
- Provide conditions suitable for future land use of the 100 Areas.

Section 5 documents the attainment of all four RAOs and the RAGs for this interim remedial action.

2.2.2 Exposure and Land-use Assumptions

This interim remedial action was conducted to achieve cleanup consistent with a rural-residential exposure scenario.

2.2.3 Design Summary

The interim remedial action for the 100-K-63 Waste Site planned to use the observation approach based on field investigations and research of process history. A pre-remediation radiological survey provided the means to locate potential contamination locations with further pre-remediation field investigations refining areas of potential contamination. As remediation progressed, radiological surveying and in-process sampling was to guide excavation. Prior to initiating remediation, an evaluation was conducted to determine the amount of fill present above native sediment. Geographic Information System analysis using topographic maps, pre-Hanford and Hanford era photos determined that 100-K-63 contained between 10 and 35 feet of fill from the construction of the 105-KW reactor. **The maximum excavation depth of 4.6 m (15 ft) below grade surface was agreed to with cultural resource experts in consult with the Tribes.**

The excavation was planned to focus on the drainage ditches that carried the effluent to the river which coincided with elevated radiological readings indicated by the Global Positioning Environmental Radiological Survey (GPERS) (Figure 3-1). Additionally, the four culverts which discharged directly into the waste site were to be removed.

2.3 Record of Decision Amendments, Significant Differences, or Waivers

The 100-K-63 Waste Site was incorporated into the 100 Area Remaining Sites ROD (EPA/ROD/R10-99/039) through inclusion in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision* (EPA, 2004). No ROD amendments or waivers apply to this interim remedial action.

3 Remedial Activity Summary

This section describes actions taken to complete the remediation of the 100-K-63 Waste Site.

3.1 Summary of Activities

Remediation of the 100-K-63 Waste Site began in July 2010 and was completed by November 2010. The remediation was conducted as planned in Section 2.2.3 with a maximum excavation depth of 4.05 m (13.3 ft). Radiological surveys of the waste site and in-process samples were used to guide the excavation. Concurrent with excavation of the waste site, thirty-one discrete and composite surface in-process samples were collected within the excavation area (Figure 3-2). To evaluate the un-excavated portion of the waste site pothole sampling was performed at 18 locations from multiple depths per pothole, resulting in an additional forty-six samples with sample depths ranging from surface to 2.67 m (14 ft) below ground surface. The sample locations in the unexcavated portion of the waste site were focused in low-lying depressions, channels, and soil erosion locations caused by effluent discharges, which had the greatest potential for contaminant accumulation.

In-process soil sample results indicated that neither the excavated nor unexcavated portions of the waste site had contaminants of concern greater than the RAGs listed in the RDR/RAWP (DOE/RL-96-17). Eleven in-process pothole sample analyses for hexavalent chromium were rejected per the data validation (as discussed further in Section 5.3.1). No other COCs exceeded RAGs for these in-process samples with rejected hexavalent chromium values that would indicate potential co-contamination. Verification sampling later verified no hexavalent chromium contamination. In-process soil sample results are presented in Appendix B.

All of the areas with elevated radiological readings were remediated. No staining or other visible identifiers which would indicate a need for further remediation were observed. The radiological, visual, and in-process analytical evaluations were used to determine that the 100-K-63 Waste Site was ready for final verification sampling and analysis to evaluate protectiveness for interim closure of the waste site.

During active excavation of the waste site on September 23, 2010, there was an inadvertent discovery of cultural material. Work at the 100-K-63 Waste Site was suspended for a cultural resources impact assessment. Field verification sampling began August 17, 2011 and was completed September 15, 2011. A qualified archeologist observed all intrusive activities to ensure there was no disturbance to cultural materials, including the application of fiber mulch and backfilling. Following verification sampling, an assessment of the archaeological site within the 100-K-63 Waste Site was completed. On September 15, 2011 a detailed mapping of the cultural materials present in the excavated portion of 100-K-63 was completed in compliance with agreements reached by DOE and the SHPO. A fiber mulch was applied to prevent further erosion of the excavated waste site area after sampling. Interim backfill was completed in October of 2011. Interim revegetation was completed in February of 2012.

All contaminated soils and structures (approximately 85,431 tons) removed as part of the remediation were disposed of at the Environmental Restoration Disposal Facility (ERDF). The post-remediation civil survey and an aerial photograph for the 100-K-63 Waste Site are provided in Figures 3-3 and 3-4, respectively.

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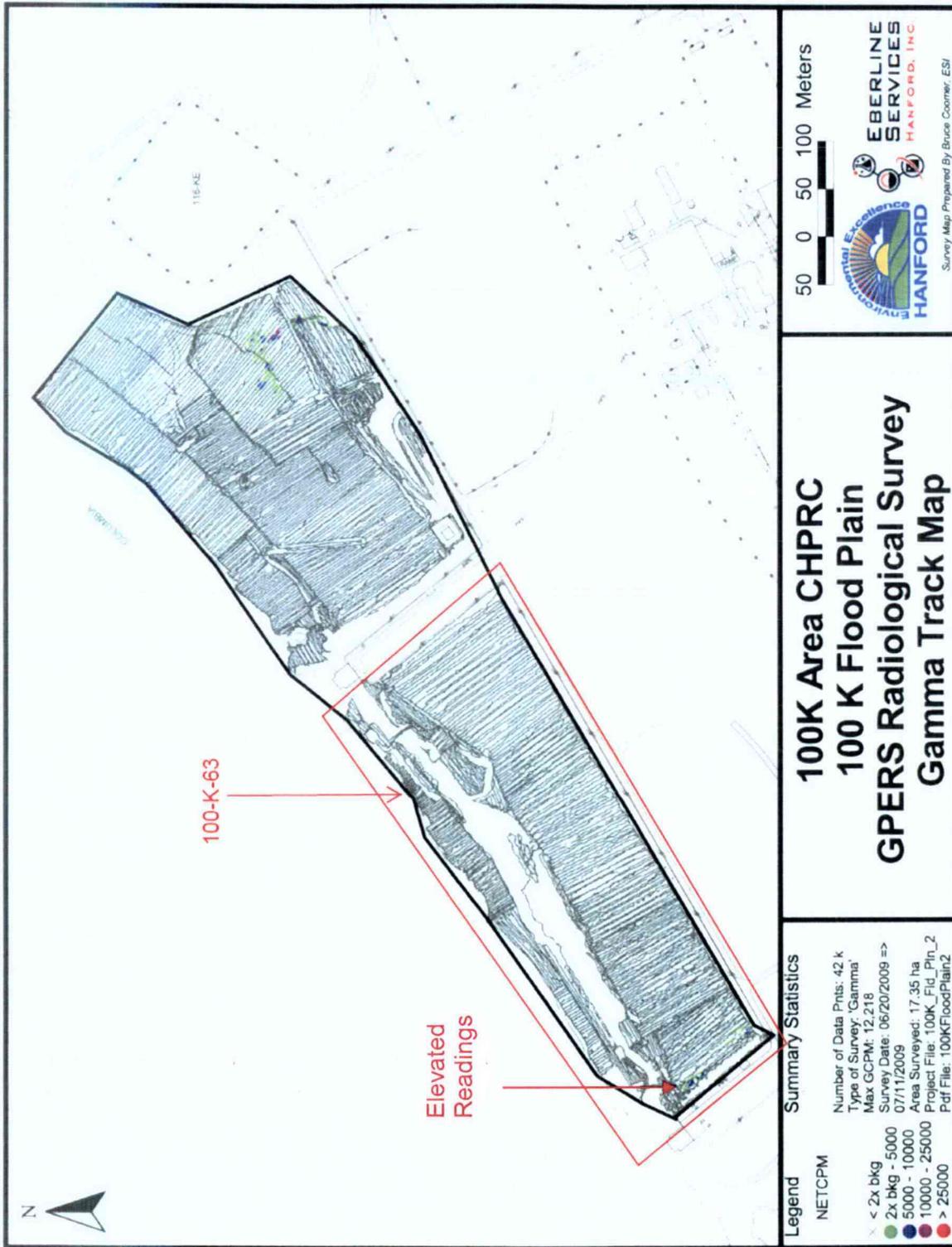


Figure 3-1. 100-K Area, 100-K-63 Waste Site Pre-Remediation Global Positioning Environmental Radiological Survey

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Excavation and Pothole Sample Locations at 100-K-63

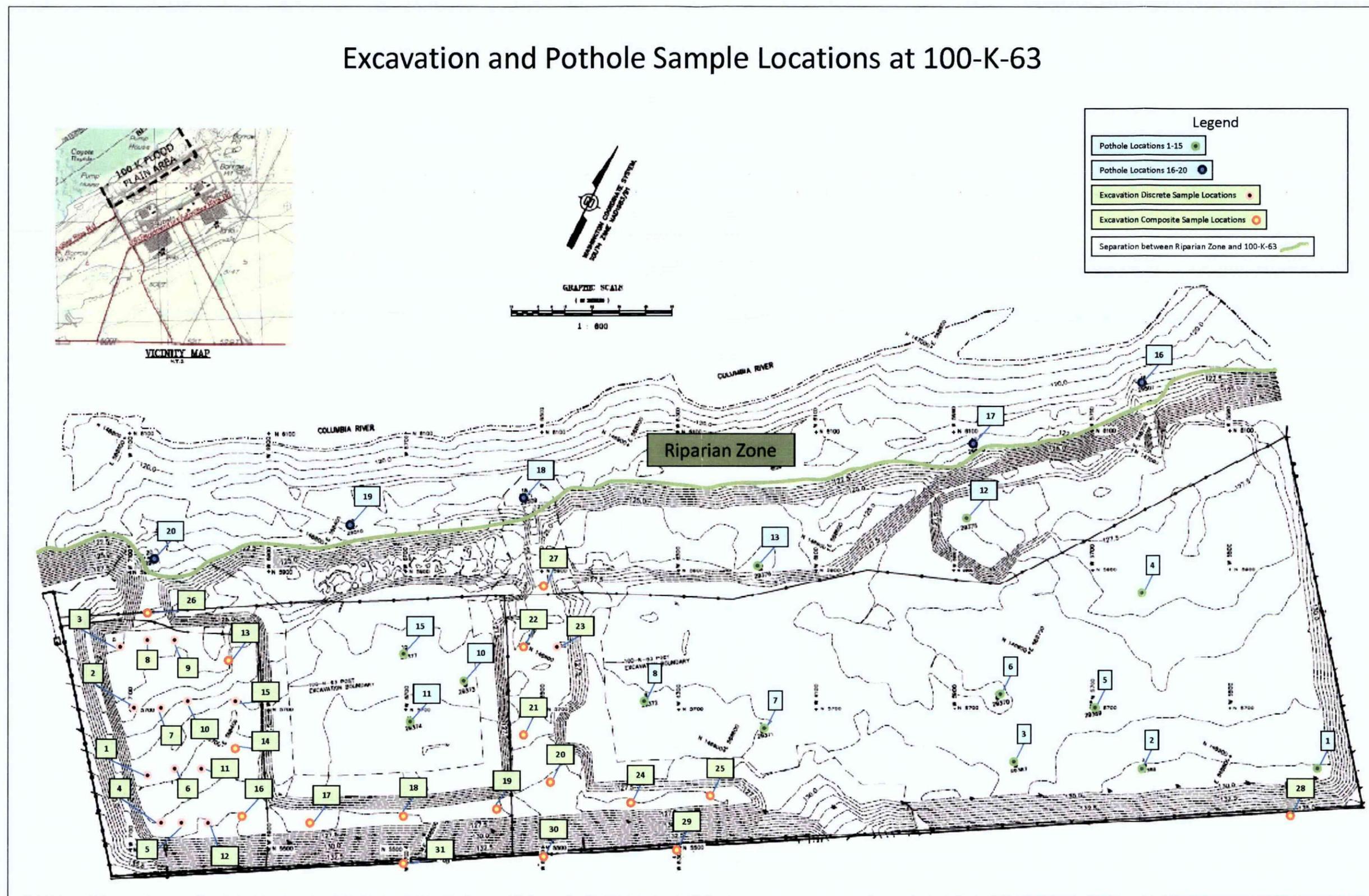
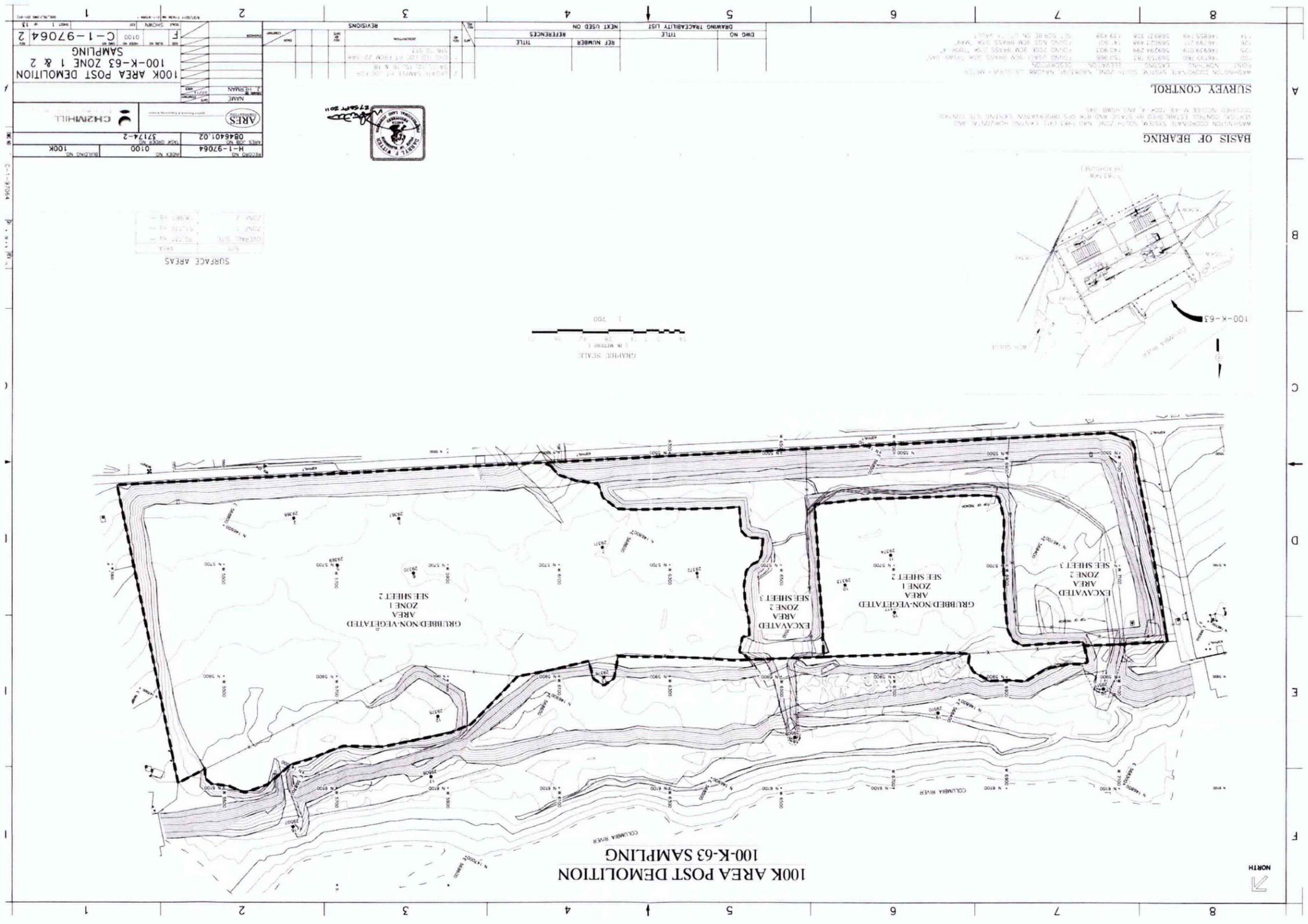


Figure 3-2. 100-K Area, 100-K-63 Waste Site In-Process Sampling Locations



BASIS OF BEARING
 WASHINGTON COORDINATE SYSTEM SOUTH ZONE, NAD83/91, NAVD83, US SURVEY METERS
 POINT: 100K-63, ELEVATION: 5100.00, DISTANCE: 100.00, BEARING: 0.00, AZIMUTH: 0.00
 100-K-63
 COLUMBIA RIVER
 NORTH

GRAPHIC SCALE
 1 IN. REPRESENTS 100 FEET
 0 10 20 30 40 50 60 70 80 90 100

SURFACE AREAS
 SURFACE AREA: 100,000 SQ. FT.
 OVERALL SITE: 100,000 SQ. FT.
 ZONE 1: 10,000 SQ. FT.
 ZONE 2: 10,000 SQ. FT.
 ZONE 3: 10,000 SQ. FT.

NO.	DATE	DESCRIPTION
1	01/00	ISSUED FOR CONSTRUCTION
2	01/00	ISSUED FOR CONSTRUCTION
3	01/00	ISSUED FOR CONSTRUCTION
4	01/00	ISSUED FOR CONSTRUCTION
5	01/00	ISSUED FOR CONSTRUCTION
6	01/00	ISSUED FOR CONSTRUCTION
7	01/00	ISSUED FOR CONSTRUCTION
8	01/00	ISSUED FOR CONSTRUCTION

**100K AREA POST DEMOLITION
100-K-63 ZONE 1 & 2
SAMPLING**
 PROJECT NO: H-1-97064
 DRAWING NO: 0846401.02
 SHEET NO: 3717A-2
 BILLING NO: 100K
 CH2MHILL
 ARS
 NAME: J. J. ROYAN
 TITLE: PROJECT MANAGER
 DATE: 01/00
 SCALE: AS SHOWN
 SHEET 1 OF 13
 C-1-97064

Figure 3-3. 100-K Area, 100-K-63 Waste Site Post Remediation Civil Survey

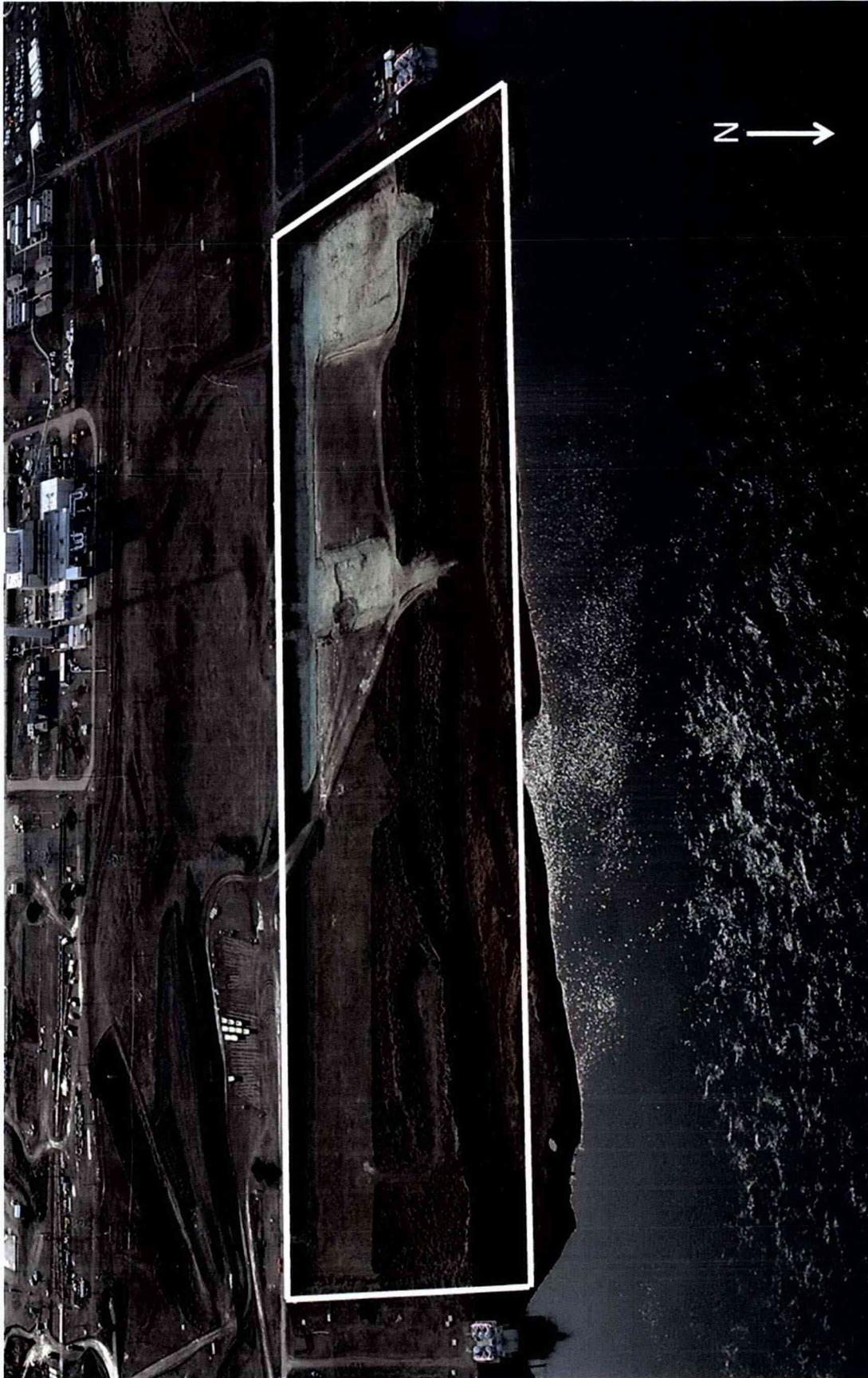


Figure 3-4. Aerial Photograph of the 100-K-63 Waste Site Post Remediation (December 2010)

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3.2 Verification Activities

Verification sampling and laboratory analysis were conducted for the 100-K-63 Waste Site in accordance with the SAP (DOE/RL-96-22) and the SI (RA-00401). Verification sampling began August 17, 2011 and was completed September 15, 2011.

Photographs of the sampling activity are provided in Appendix A.

3.2.1 Contaminants of Concern

Table 3-1 lists the COCs associated with the 100-K-63 Waste Site. These COCs are based upon process knowledge of fission products expected with reactor cooling water. Hexavalent chromium is the primary groundwater contaminant underlying the 100-K area and thus is included in the COC list.

Table 3-1. Contaminants of Concern for the 100-K Area, 100-K-63 Waste Site

Nonradioactive		
Chromium (VI)		
Radioactive		
Cesium-137	Cobalt-60	Europium-152
Europium-154	Europium-155	Strontium-90

3.2.2 Verification Sampling Design

The verification sampling design divided 100-K-63 into two shallow zone (<4.6 m [< 15 ft]) decision units. Zone 1 was the unexcavated area decision unit and Zone 2 was the excavated area decision unit (Figure 3-5).

The Zone 1 decision unit was approximately 51,770 m² (557,248 ft²). The area was divided into fourteen subunits with each subunit divided into four sample areas. Four sample increments were collected from randomly selected nodes within each sample area and combined into a single composite sample for each sample area (Figures 3-6 through 3-13). A total of 56 composite sample were collected from Zone 1.

Zone 2 decision unit was approximately 18,961 m² (204,095 ft²). The area was divided into five subunits with each subunit divided into four sample areas. Four sample increments were collected from randomly selected nodes within each sample area and combined into a single composite sample for each sample area (Figures 3-14 through 3-17). A total of 20 composite samples were collected from Zone 2.

For the 100-K-63 Waste Site overall, 76 composite samples of soil were collected along with four equipment blanks and four duplicate composite soil samples.

Specific requirements for sample handling, custody, preservation, containers, and holding times, field and laboratory quality control (QC), instrument calibration and maintenance, field documentation, and waste management were conducted in accordance with the SAP (DOE/RL-96-22).

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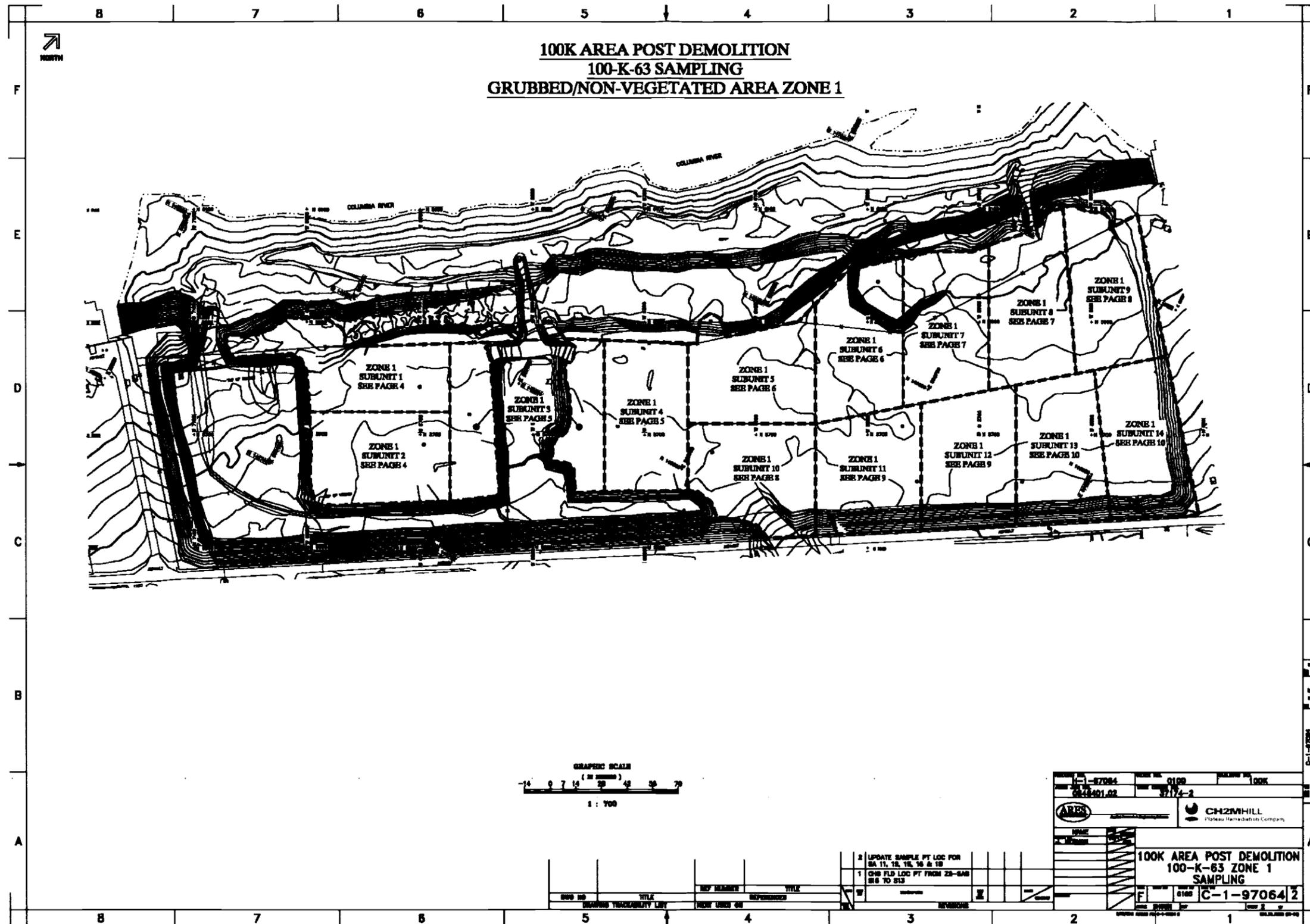


Figure 3-6. Zone 1 Subunits Layout

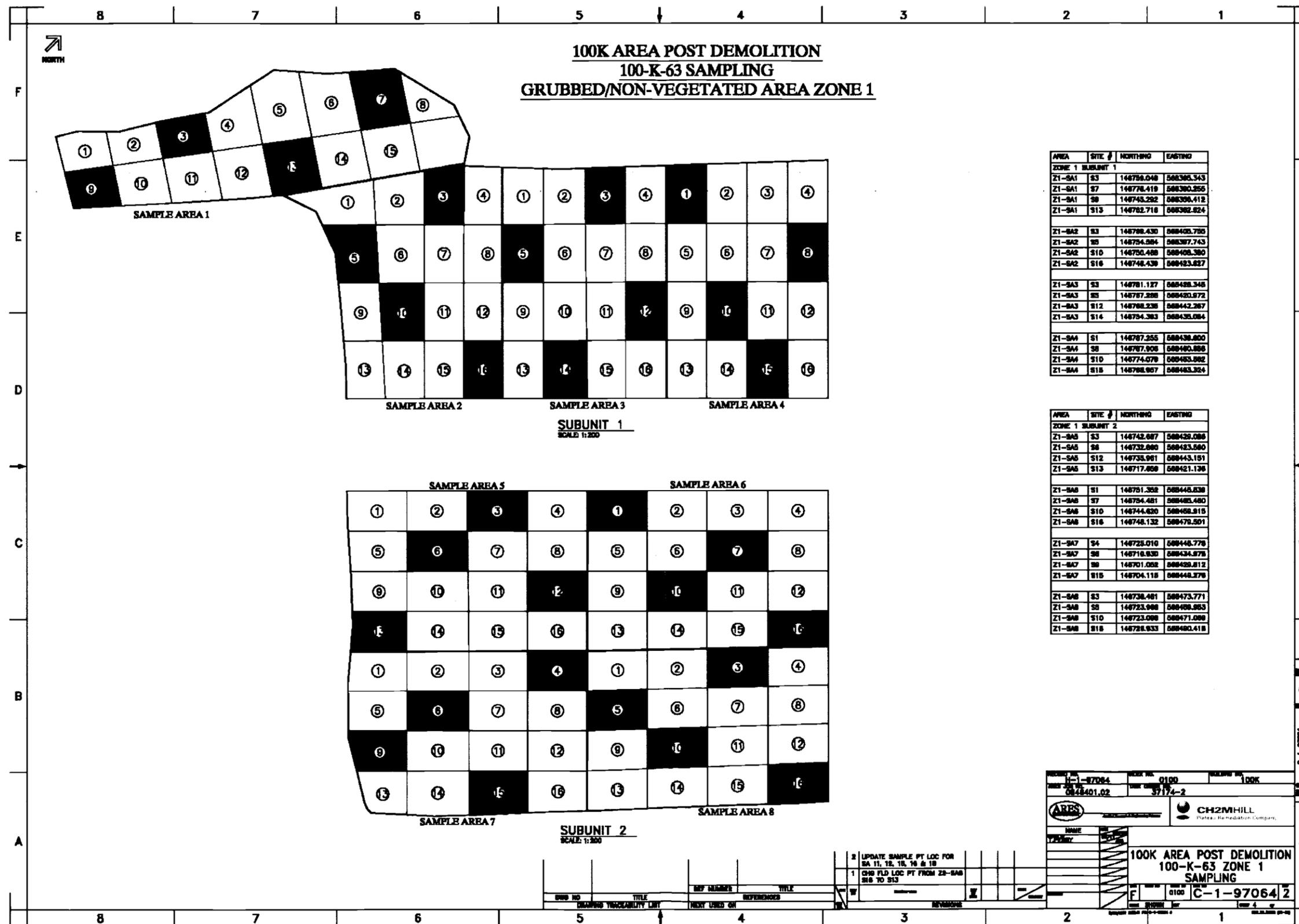


Figure 3-7. Zone 1 Subunits 1 and 2 Sample Design Layout

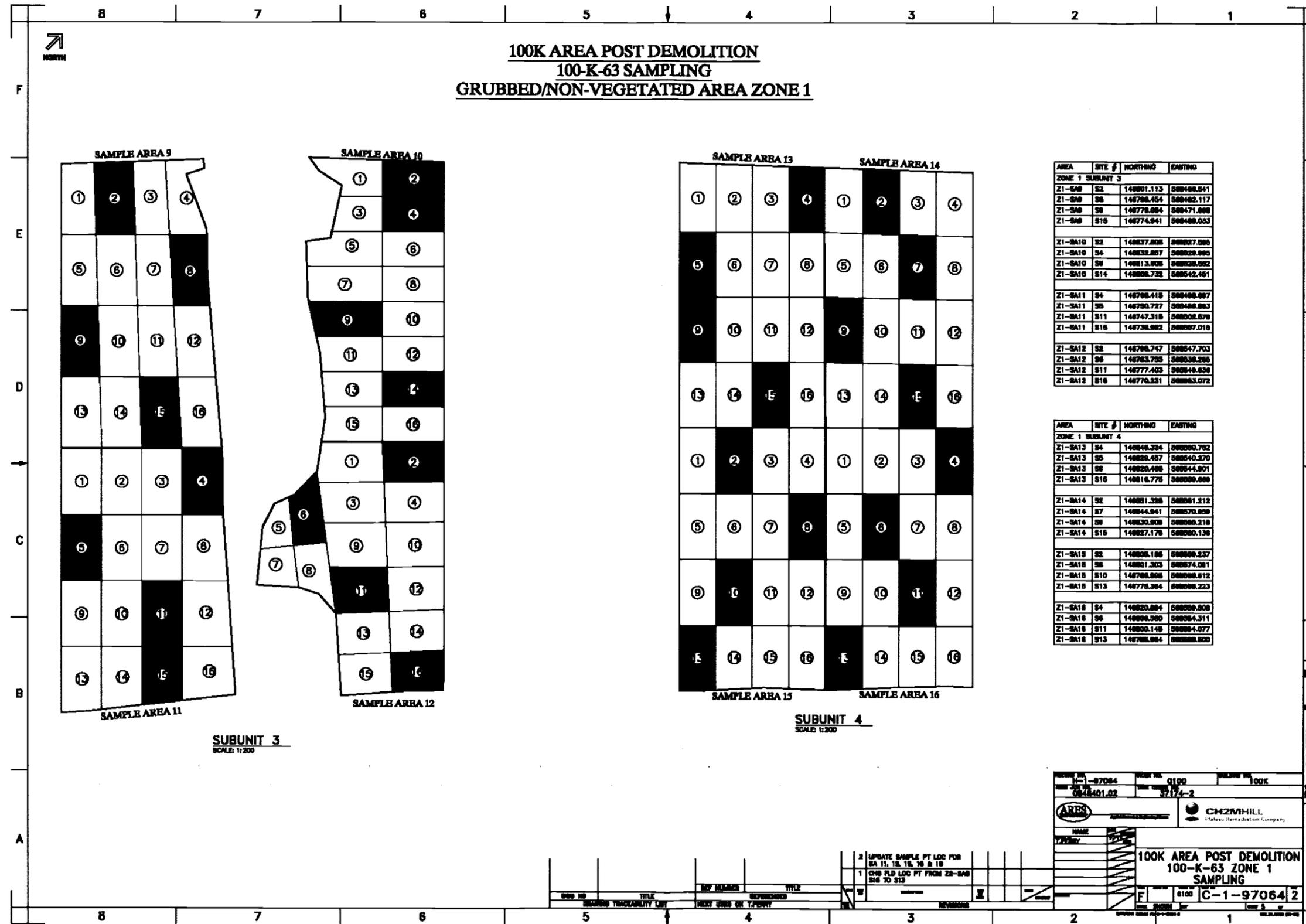


Figure 3-8. Zone 1 Subunits 3 and 4 Sample Design Layout

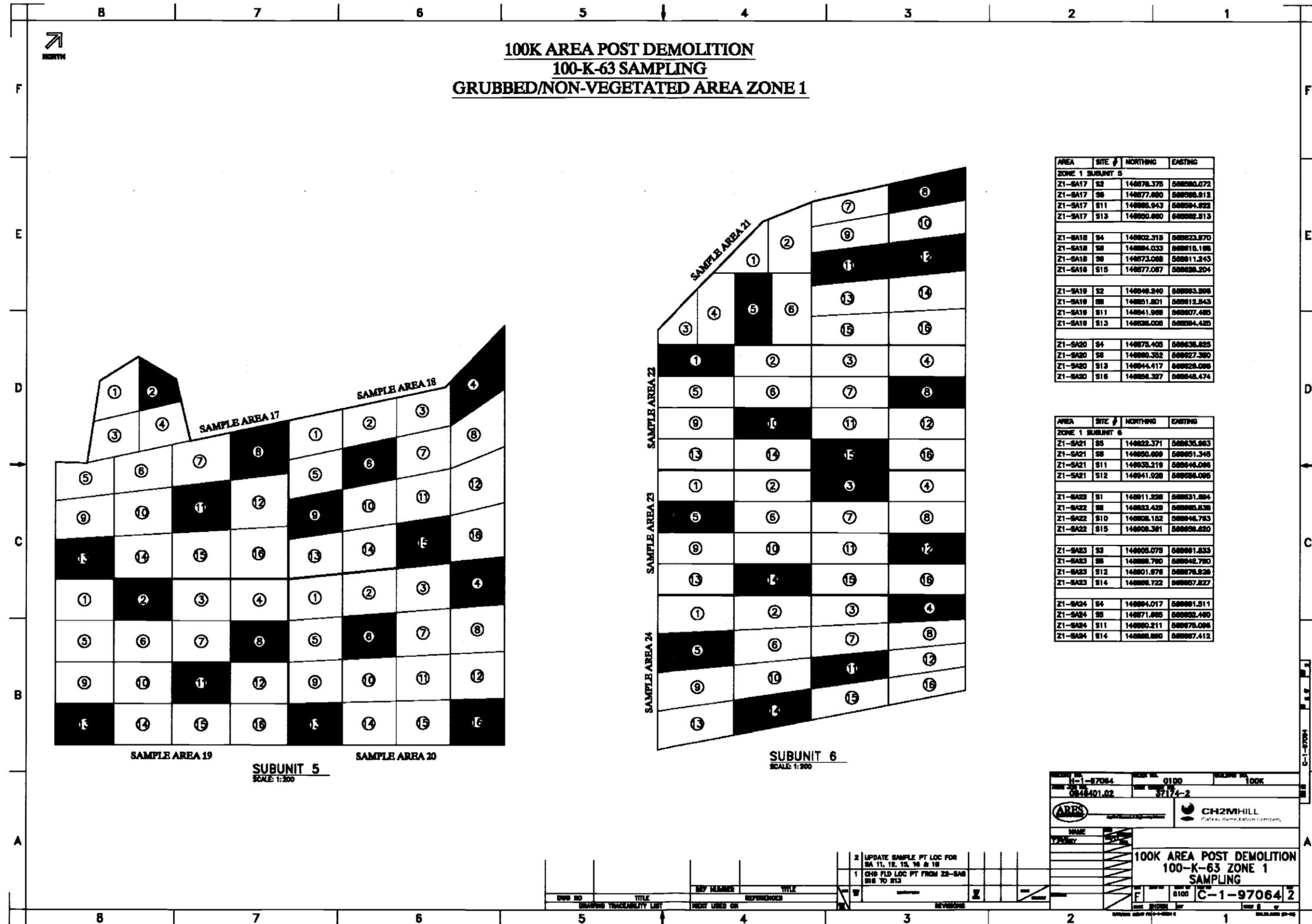


Figure 3-9. Zone 1 Subunits 5 and 6 Sample Design Layout

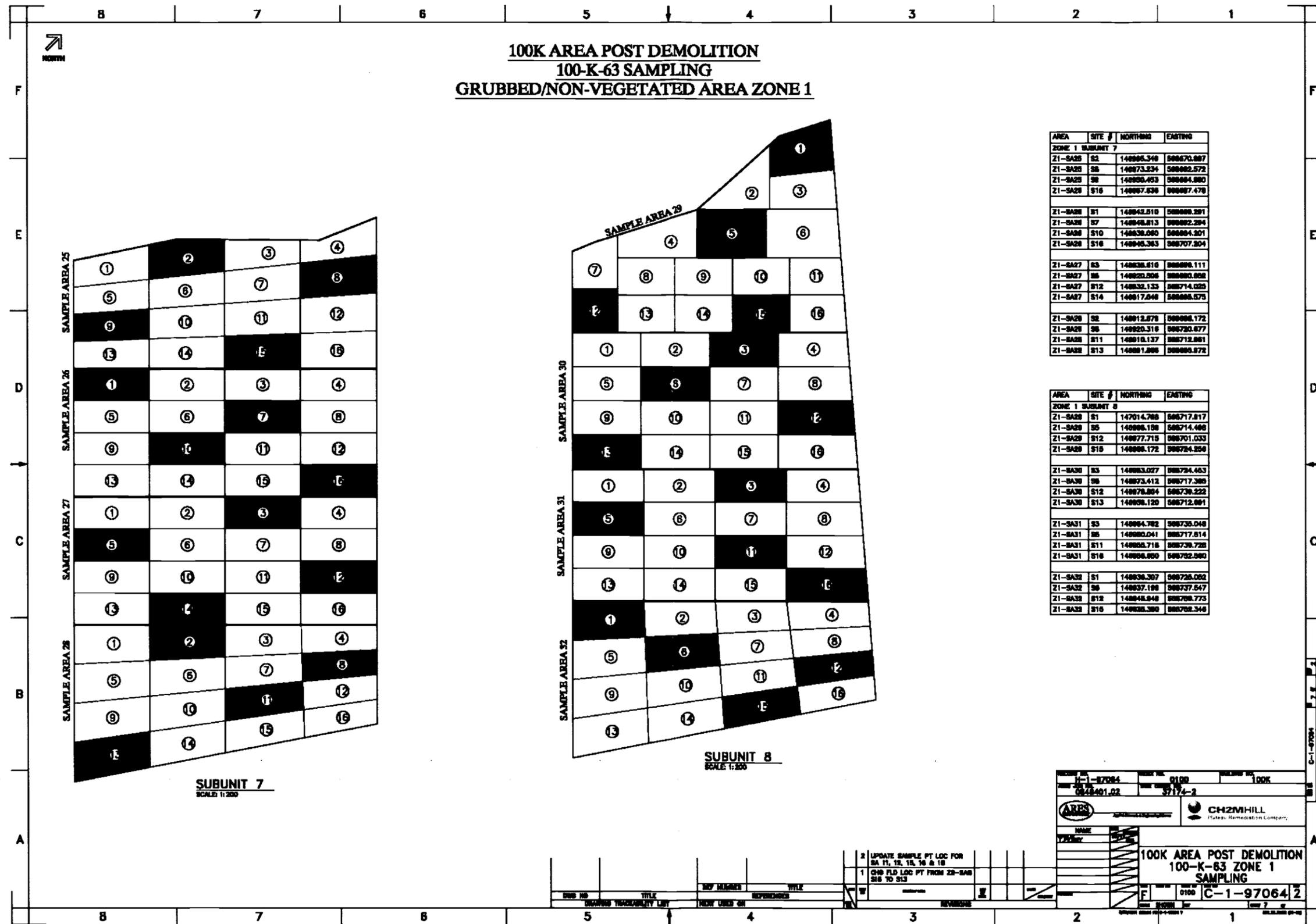


Figure 3-10. Zone 1 Subunits 7 and 8 Sample Design Layout

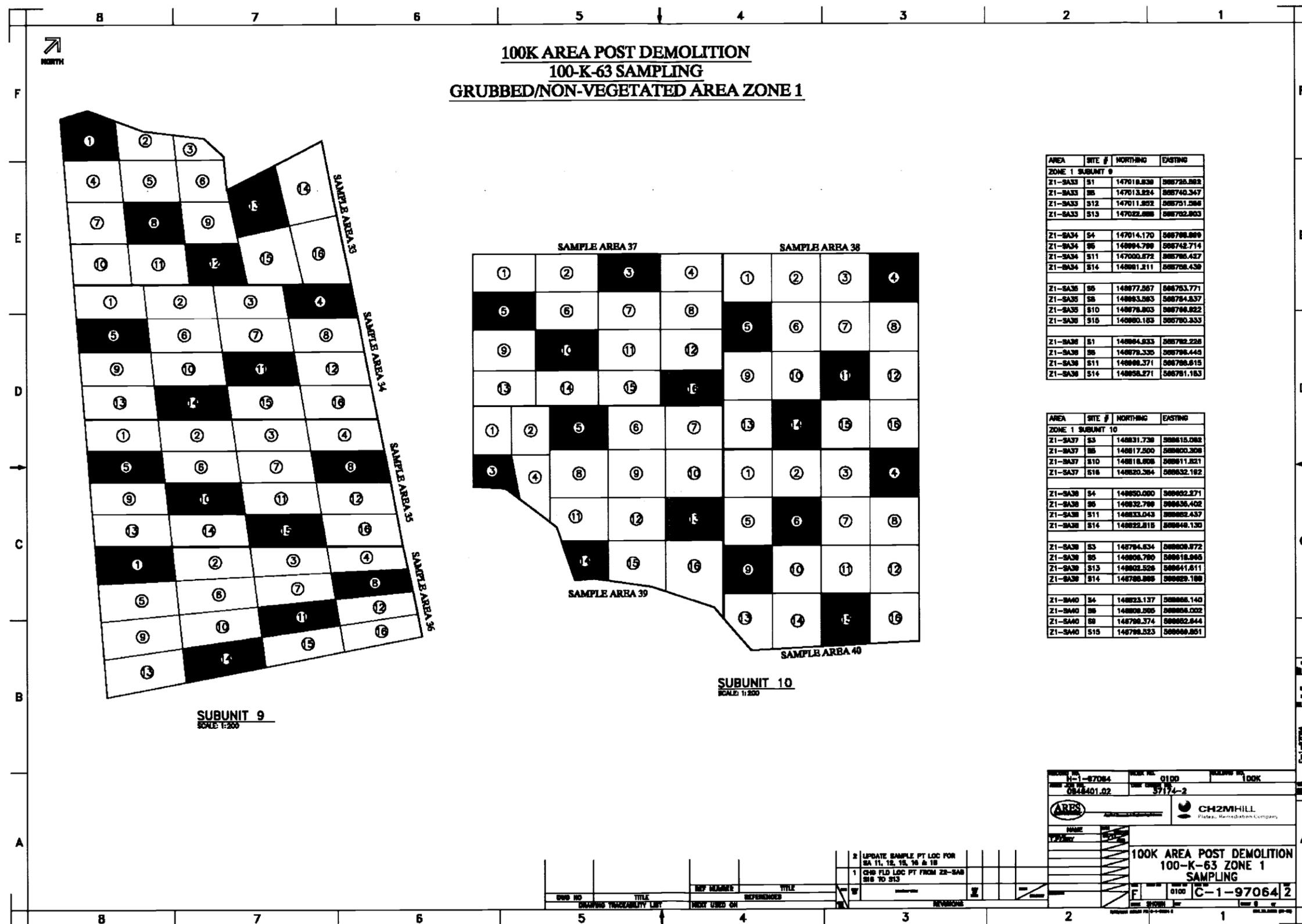


Figure 3-11. Zone 1 Subunits 9 and 10 Sample Design Layout

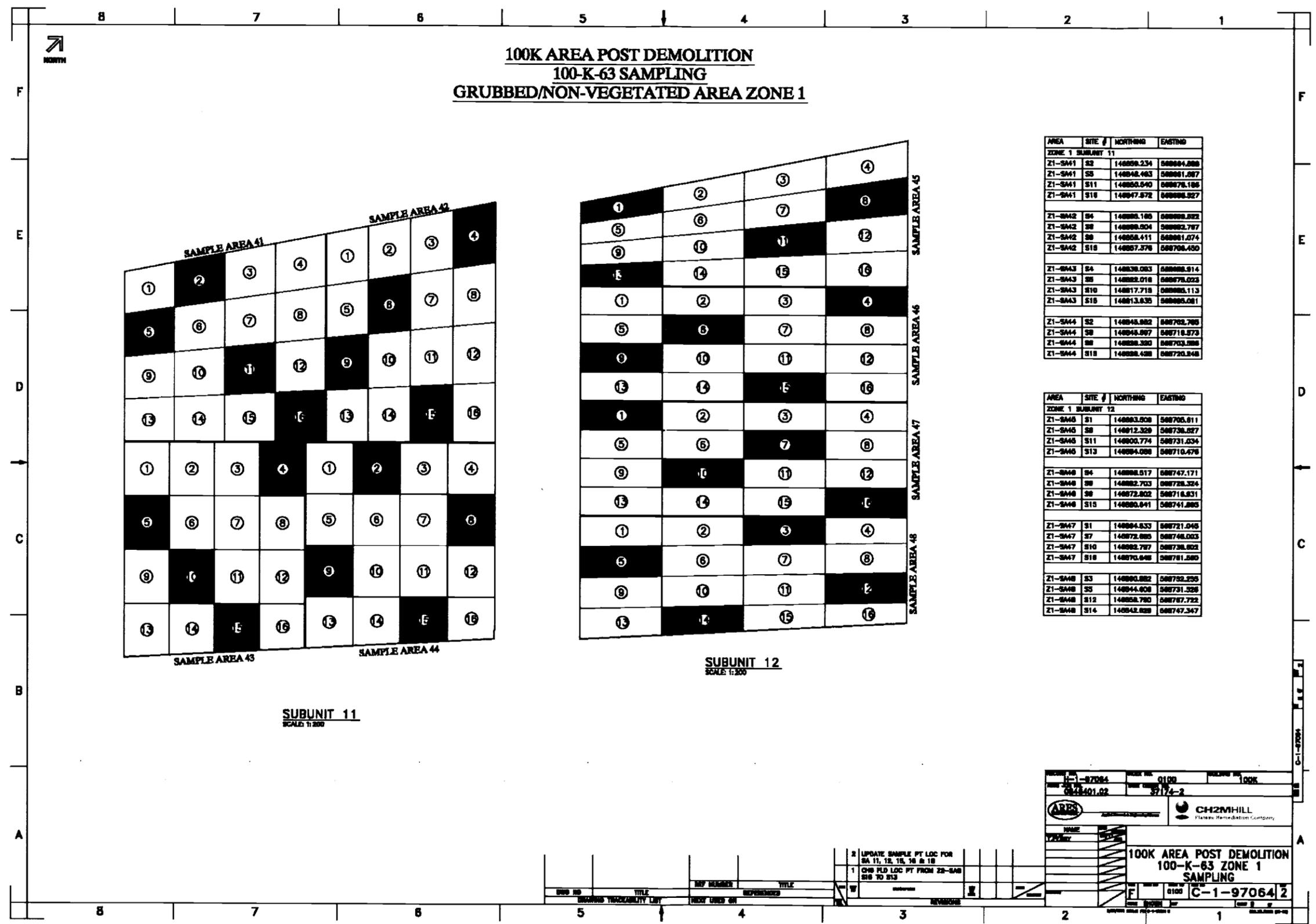


Figure 3-12. Zone 1 Subunits 11 and 12 Sample Design Layout

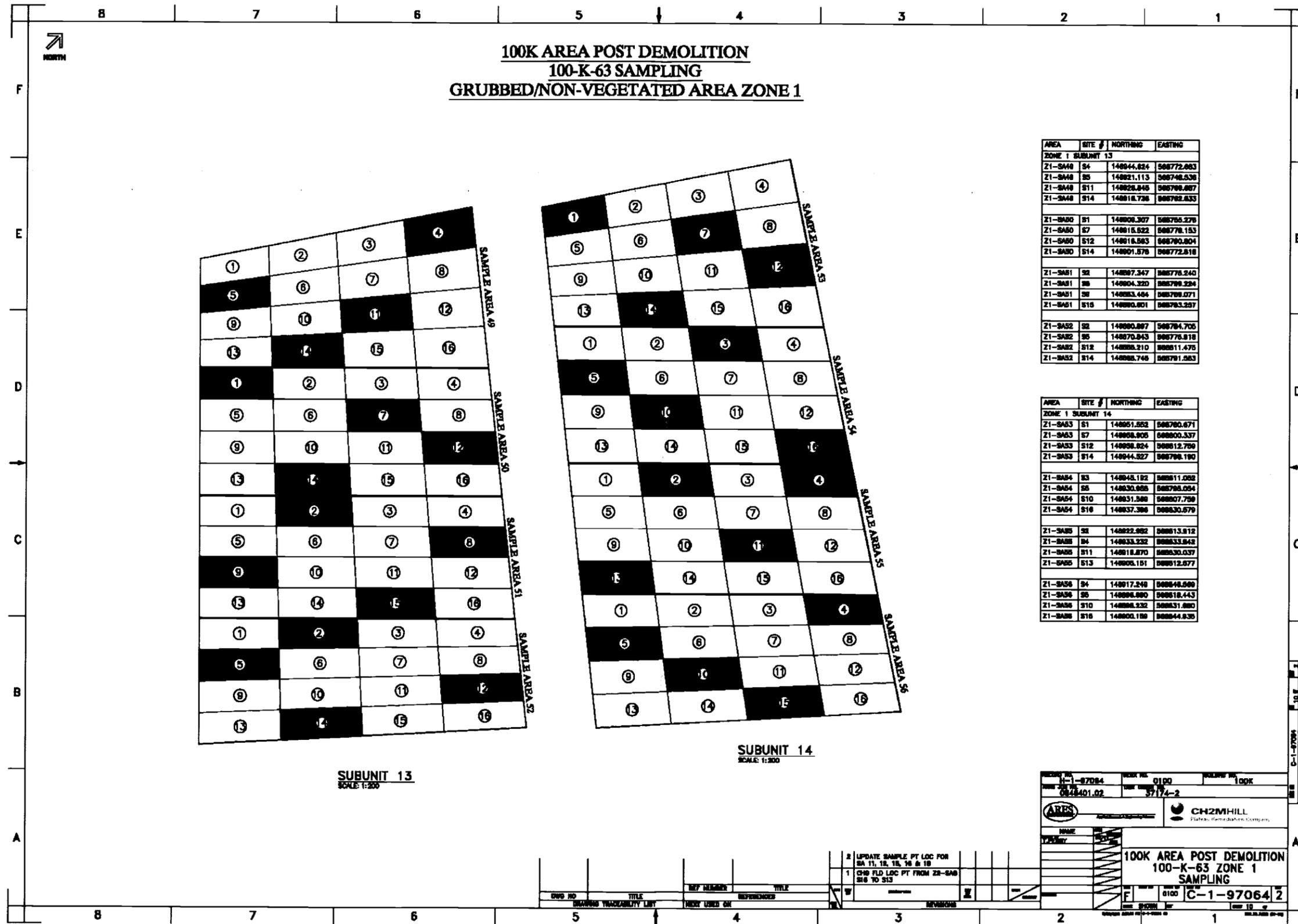


Figure 3-13. Zone 1 Subunits 13 and 14 Sample Design Layout

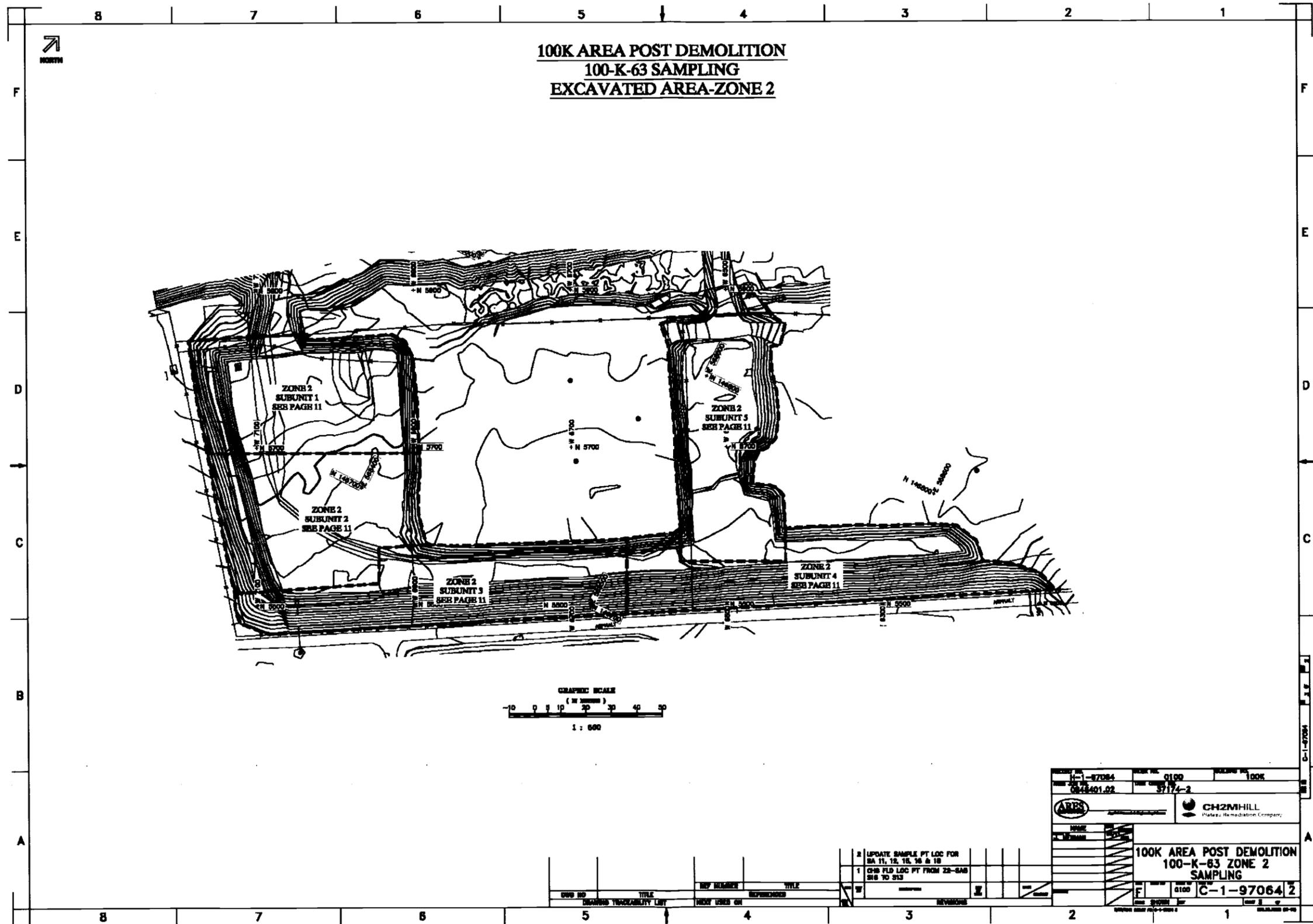


Figure 3-14. Zone 2 Subunits Layout

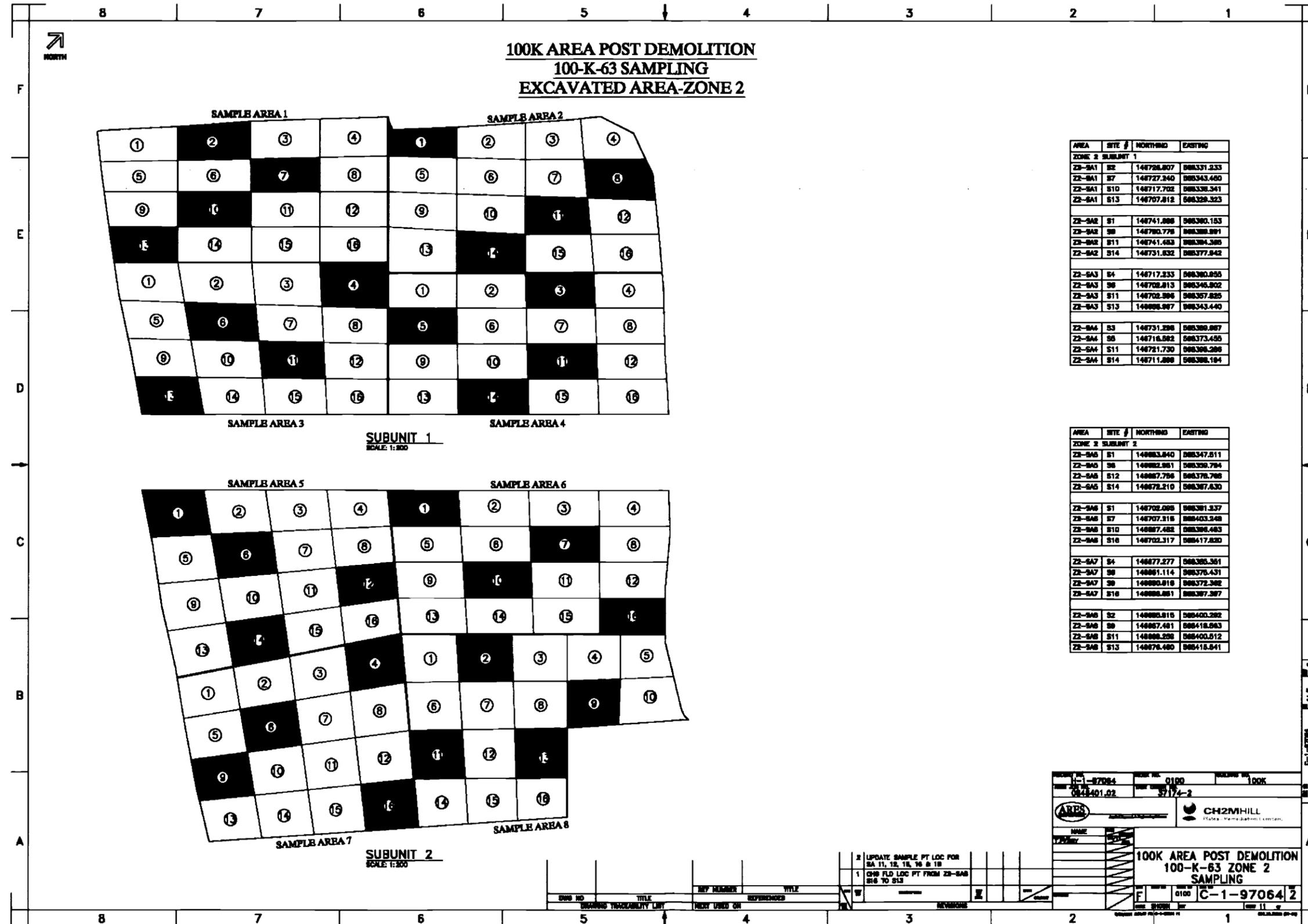


Figure 3-15. Zone 2 Subunits 1 and 2 Sample Design Layout

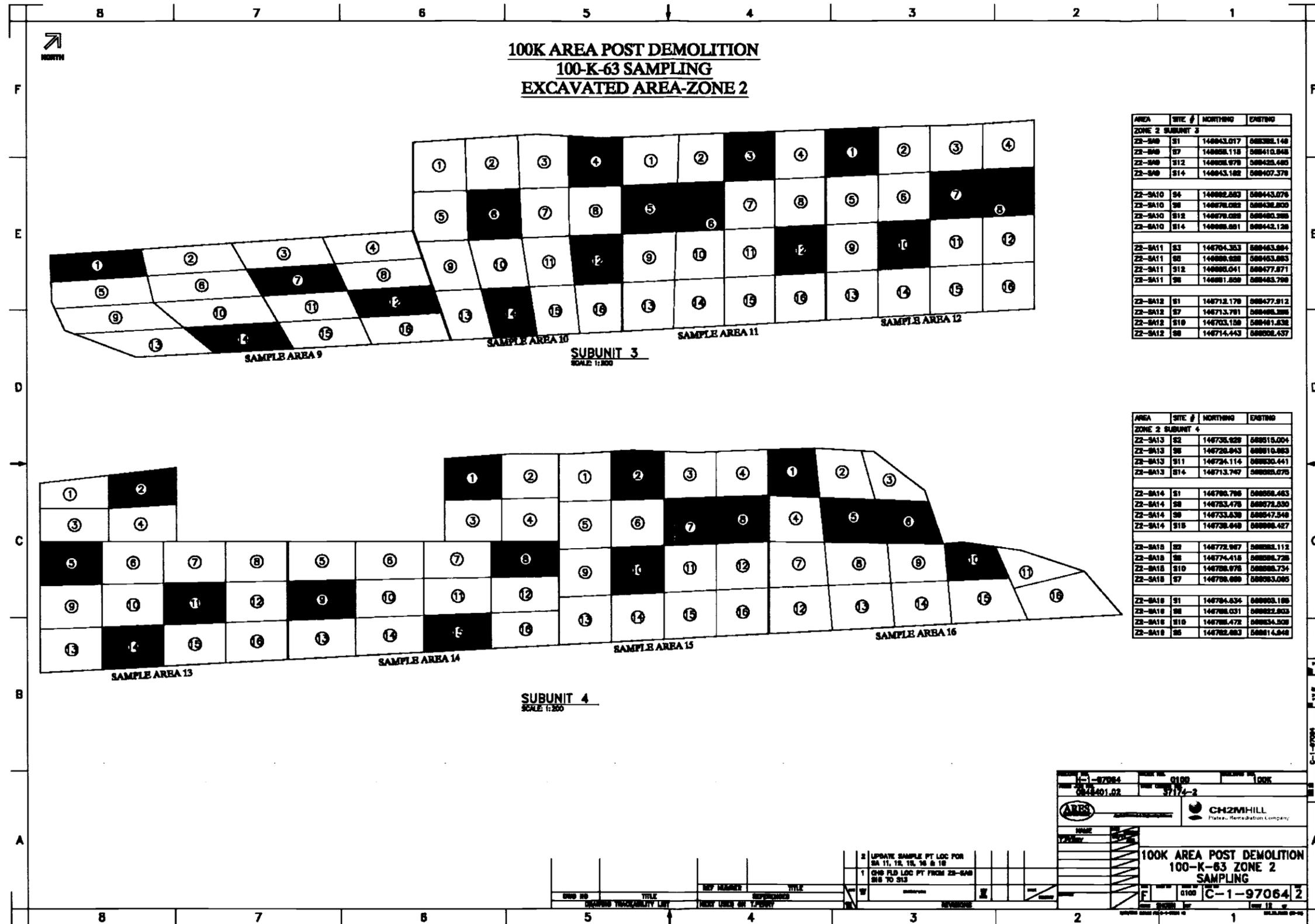


Figure 3-16. Zone 2 Subunits 3 and 4 Sample Design Layout

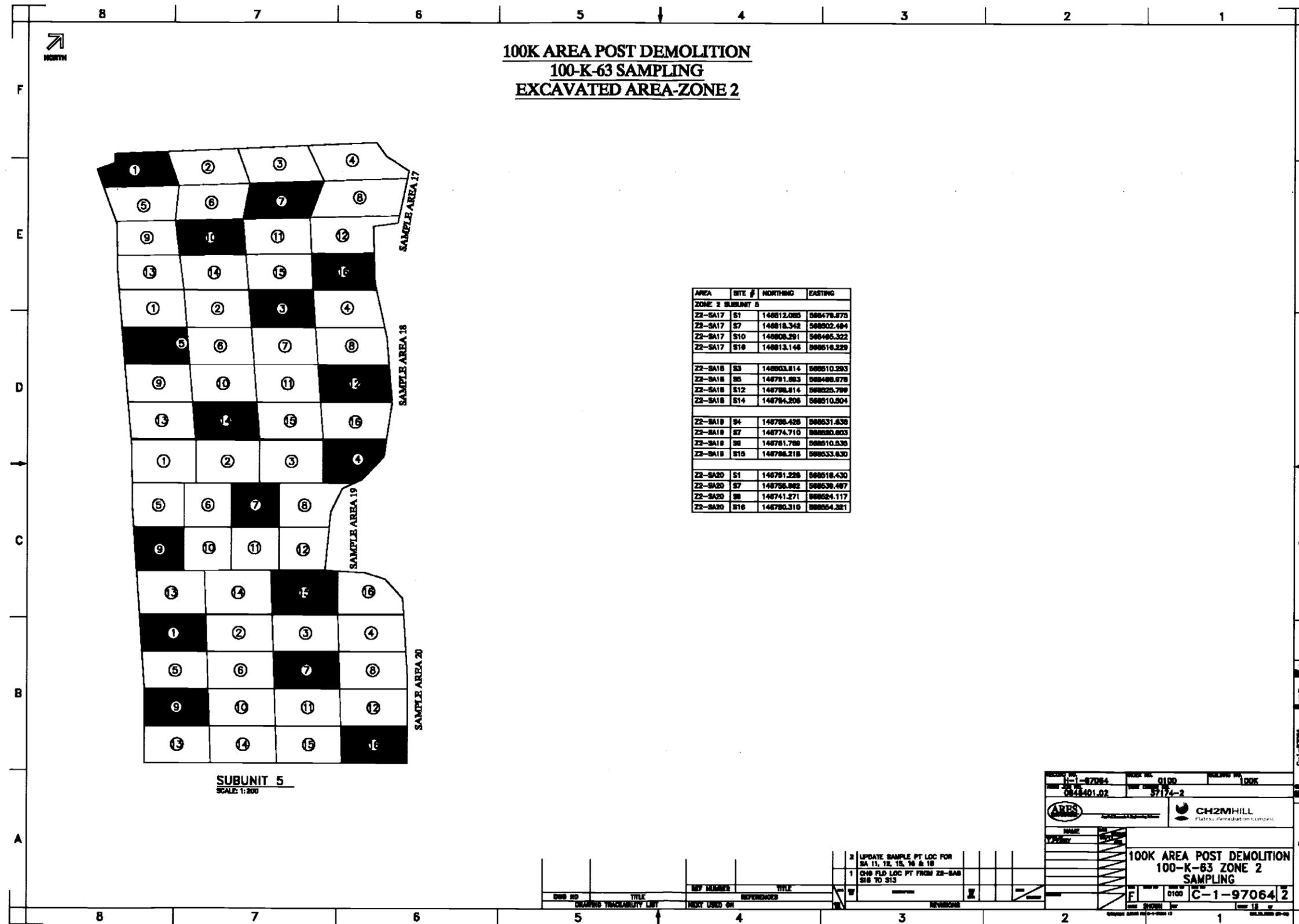


Figure 3-17. Zone 2 Subunit 5 Sample Design Layout

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4 Chronology of Events

This section provides the significant events and activities pertinent to the remediation of the 100-K-63 Waste Site. Table 4-1 lists those events chronologically.

Table 4-1. Chronology of Events for 100-K-63 Waste Site

Date	Event
1954-1970	107-KW Retention Basin received 105-KW Reactor effluent and developed leaks in the basin and in the effluent lines, which contaminated the 100-KW Floodplain.
1970	Operation of the 107-KW Retention Basin ended.
1988	100-KW Floodplain is radiologically surveyed and contamination is detected.
1992 - 1994	A detailed radiological survey and soil sampling was completed and the area was posted for surface and underground soil contamination.
1996	The 100-KW Floodplain area was fenced as a deterrent to inadvertent entry to this area by the public.
1997	The 100-KW Floodplain area was designated as the 100-K-63 Waste Site.
July 1999	EPA/ROD/R10-99/039, <i>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 (100 Area Remaining Sites)</i> was approved by DOE, EPA, and Ecology.
April 2004	EPA, 2004, <i>Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision</i> was approved by DOE, EPA, and Ecology. This added the 100-K-63 Waste Site into the CERCLA Remedial Action.
October 2009	DOE/RL-96-17, <i>Remedial Design Report/Remedial Action Work Plan for the 100 Area</i> , Revision 6 was approved by DOE, EPA, and Ecology.
October 2009	DOE/RL-96-22, <i>100 Area Remedial Action Sampling and Analysis Plan</i> , Revision 5 was approved by DOE, EPA, and Ecology.
July 2010	Waste site remediation was initiated.
September 2010	In-process pothole sampling was conducted in remaining non-excavated portion of the waste site to determine the extent of contamination.
September 2010	Cultural materials were discovered in the excavation area.
November 2010	Waste site excavation was completed.
August 2011	Verification sampling began.
September 2011	RA-00401, <i>Verification Sampling Instruction for the 100-KW Floodplain Contamination, Waste Site 100-K-63</i> , Rev. 0 was approved by DOE and EPA.
September 2011	Verification sampling was completed.
September 2011	RA-00402, <i>Backfill Concurrence Checklist for the 100-K-63 Waste Site Excavation Area</i> , Rev. 0 approved by DOE and EPA.
October 2011	Interim backfilling was completed.
February 2012	Interim revegetation was completed.

5 Performance Standards and Quality Control

This section addresses the process for demonstrating achievement of the RAOs and RAGs and maintaining the required quality controls during remedial activities, including a data quality assessment, and documents that the remaining waste site configuration is protective of human health and the environment.

5.1 Protectiveness Evaluation

5.1.1 Attainment of Cleanup Levels and Remedial Action Objectives

The comparison of the maximum analytical verification results against the applicable criteria for the 100-K-63 Waste Site are summarized in Table 5-1. Since none of the COCs exceeded the RAGs, additional evaluation was not necessary. Table 5-2 provides a summary of the RAGs, remediation results, and the attainment of the RAOs as documented in Appendices C through G. Detailed analytical results in Hanford Environmental Information System (HEIS) can be located through the tracking numbers available in data tables located in Appendix B.

For statistical sampling the comparison is made against the 95% UCL for each COC. However, a preliminary screening is performed against the maximum detected values. The 95% UCL is then calculated for COCs whose maximum detected value exceeds a RAG. Table 5-1 shows that for all COCs, the maximum detected soil concentration is less than all RAGs therefore, a 95% UCL calculation is not required. In addition to meeting the RAGs for individual constituents, when multiple constituents are present, an evaluation of the cumulative effects is required.

5.1.2 Three-Part Test for Nonradionuclides

The sampling results for nonradionuclides must be evaluated using the WAC 173-340-740(7) three part test to ensure that the cleanup is complete and protective of human health and the environment. However, since there was only one non-radionuclide COC, and it did not exceed RAGs, this evaluation was not required.

5.1.3 Fate and Transport of COCs in the Vadose Zone

Evaluation of the maximum results from the verification sampling at the 100-K-63 Waste Site indicates that all COCs were undetected or quantified below RAGs; therefore, fate and transport modeling of the COCs through the vadose zone was not performed.

5.1.4 Direct Contact and Groundwater Protection Risk Evaluation for Nonradionuclides

Assessment of the risk for the 100-K-63 Waste Site was determined by calculation of the hazard quotient and excess carcinogenic risk values for direct contact and groundwater protection for nonradionuclides (Appendix E). These risk values were calculated for the 100-K-63 waste site using the maximum detected soil concentration values. Since there is only one nonradionuclide COC cumulative calculations are not necessary.

The requirements include an individual noncarcinogenic hazard quotient of less than 1.0. The calculation indicates that the individual hazard quotient for the noncarcinogenic constituent (i.e., chromium VI) for direct contact and groundwater protection is 1.58E-03 (less than 1.0).

The individual excess cancer risk must be less than 1.0E-06. The excess cancer risk calculation indicates that the individual risks for the carcinogenic constituent (i.e., chromium VI) for direct contact and groundwater protection is 1.81E-07 (less than 1.0E-06).

5.1.5 Statement of Protectiveness

This RSVP documents that the 100-K-63 Waste Site meets the remedial action objectives of the 100 Area Remaining Sites ROD (EPA/ROD/R10-99/039) and can be reclassified as interim closed. The results of verification sampling demonstrate that residual contaminant concentrations do not preclude any future use and are protective of groundwater and the Columbia River.

Soil cleanup levels were established in the 100 Area Remaining Sites ROD based on a limited ecological risk assessment. Although not required, a comparison of the ecological risk screening levels (WAC 173-340, Table 749-3 and EPA guidance) was completed of the 100-K-63 waste site nonradionuclide COCs (Appendix H). Hexavalent chromium, the only nonradionuclide COC exceeding background and therefore compared, did not exceed the ecological screening levels.

Table 5-1. Comparison of Maximum Post-Remediation Soil Concentration to Remedial Action Goals for the 100-K-63 Waste Site

Contaminant of Concern	Hanford Site-Specific Background Activity (pCi/g)	Remedial Action Goals (pCi/g) ^a					Does the Maximum Result Pass RESRAD Modeling?	Fraction of Maximum Soil Concentration Divided by Direct Exposure ^d
		Maximum Soil Concentration (pCi/g)	Direct Exposure (pCi/g)	Soil Cleanup Level for Groundwater Protection (pCi/g)	Soil Cleanup Level for River Protection (pCi/g)	Does the Maximum Exceed RAGs?		
Cesium-137	1.1	1.2	6.2	1,465	2,930	NA	0.194	
Cobalt-60	0.008	0.041	1.4	13,900	27,800	NA	0.029	
Europium-152	NA ^b	0.67	3.3	NA ^c	NA ^c	NA	0.203	
Europium-154	0.033	0.16	3.0	NA ^c	NA ^c	NA	0.053	
Europium-155	0.054	0.20	125	NA ^c	NA ^c	NA	0.0016	
Strontium-90	0.18	2.1	4.5	27.6	55.2	NA	0.467	

Contaminant of Concern	Hanford Site-Specific Background Concentration (mg/kg)	Remedial Action Goals (mg/kg) ^a					Does the Maximum Result Pass RESRAD Modeling?	Hazard Quotient ^e
		Maximum Soil Concentration (mg/kg)	Direct Exposure (mg/kg)	Soil Cleanup Level for Groundwater Protection (mg/kg)	Soil Cleanup Level for River Protection (mg/kg)	Does the Maximum Exceed RAGs?		
Chromium VI	NA ^b	0.38	2.1 ^d	4.8	2	No	1.58E-03	

a. RAGs obtained from the RDR/RAWP for the 100 Area (DOE/RL-96-17).
b. No Hanford Site specific or Washington State background value available.
c. For cleanup levels protective of groundwater or the Columbia River RESRAD predicts these radionuclides will not reach groundwater within 1,000 years.
d. See Appendix C.
e. See Appendix E
NA = not applicable
RAG = remedial action goal
RESRAD = Residual Radioactivity (dose assessment model)

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Table 5-2. Summary of Cleanup Verification Results for the 100-K-63 Waste Site

Remedial Action Goal (RAG)	Evaluation Method	Performance Results	RAOs Attained?
Direct Exposure Radionuclides			
Attain <15 mrem/yr dose rate above background over 1,000 years	Compared dose and risk goals to RESRAD model outputs based on land use assumptions	Activities of individual radionuclide contaminants were less than the direct exposure RAGs, which are equivalent to a 15 mrem/yr dose rate. The sum of the fractions for the detected radionuclides is 0.94, which is <1.0. Therefore, cumulative radionuclide activities are below the 15 mrem/yr dose rate. (Appendix C).	Yes
Direct Exposure Nonradionuclides			
Attain individual COC RAGs	Compared goals with verification data set values	The individual COC concentrations are below the direct exposure RAGs (Appendix D).	Yes
Risk Requirements Nonradionuclides			
Attain a hazard quotient of <1.0 for all individual noncarcinogens	Compared goals with individual hazard quotients calculated from verification data set values	The hazard quotients for the individual nonradionuclide COCs are 1.58E-03 (Appendix E).	Yes
Attain a cumulative hazard quotient of <1.0 for noncarcinogens	Compared goals with cumulative hazard quotients calculated from verification data set values	The cumulative hazard quotient is 1.58E-03 which is <1.0 (Appendix E). With only one nonradionuclide COC, the cumulative hazard quotient equals the hazard quotient.	Yes
Attain an excess cancer risk of <1.0E-06 for individual carcinogens	Compared goals with excess cancer risk calculated from verification data set values	The excess cancer risk for the individual nonradionuclide COCs is less 1.81E-07 (Appendix E).	Yes
Attain a cumulative excess cancer risk of <1.0E-05 for carcinogens	Compared goals with cumulative excess cancer risk calculated from verification data set values	The cumulative excess cancer risk is 1.81E-07 which is <1.0E-05 (Appendix E).	Yes
Groundwater/Columbia River Protection Radionuclides			
Attain single COC groundwater and Columbia River protection RAGs	Compared goals with COC groundwater/Columbia River protection RAGs	Maximum residual concentrations of radionuclide COCs were detected below groundwater and Columbia River protection exposure criteria (Appendix F).	Yes

Table 5-2. Summary of Cleanup Verification Results for the 100-K-63 Waste Site

Remedial Action Goal (RAG)	Evaluation Method	Performance Results	RAOs Attained?
Attain national primary drinking water regulations: ^a 4 mrem/yr (beta/gamma) dose rate to target receptor/organs	Compared goals with COC groundwater/ Columbia River protection RAGs	Maximum residual concentrations of beta/gamma radionuclide COCs were detected below groundwater and Columbia River protection exposure criteria (Appendix C, Footnote b).	Yes
Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide from DOE-RL Order 5400.5 ^b	Compared goals with COC groundwater/ Columbia River protection RAGs	Alpha emitting radionuclides were not considered as COCs for the 100-K-63 Waste Site.	NA
Meet total uranium standard of 21.2 pCi/L	Compared goals with COC groundwater/ Columbia River protection RAGs	Uranium isotopes were not considered as COCs for the 100-K-63 Waste Site.	NA
Groundwater/Columbia River Protection Nonradionuclides			
Attain individual non-radionuclide groundwater and Columbia River cleanup requirements	Compared goals with COC groundwater/ Columbia River protection RAGs	The maximum detected results for the nonradionuclide COC is below the RAGs for protection of groundwater and the Columbia River (Appendix G).	Yes
<p>a. "National Primary Drinking Water Regulations" (40 CFR 141).</p> <p>b. Radiation Protection of the Public and the Environment (DOE-RL Order 5400.5).</p> <p>COC = contaminant of concern</p> <p>DOE = U.S. Department of Energy</p> <p>MCL = maximum contaminant level</p> <p>mrem = millirem</p> <p>NA = Not Applicable</p> <p>RAG = remedial action goal</p> <p>RAO = remedial action objectives</p> <p>RESRAD = residual radioactivity (dose model)</p>			

5.2 Construction Quality Assurance/Quality Control

No construction-related aspects were implemented as part of the interim remedial action for this waste site. Therefore, this section is not applicable.

5.3 Cleanup Verification Quality Assurance/Quality Control

A Data Quality Assessment (DQA) was performed to compare the sampling approach and analytical data with the sampling and data requirements and objectives specified by the SAP (DOE/RL-96-22). This DQA involved evaluation of the data to determine if they are of the right type, quality, and quantity to

support the intended use. The assessment completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality process.

A Level C data validation by a third-party validator, based on EPA functional guidelines (i.e., HNF-20433 and HNF-20434) was performed for all of the sampling and analysis data for the samples collected. Level C validation is a review of the QC data and specifically requires verification of deliverables requested versus reported analyses, and qualification of the results based on the following:

- Analytical holding times
- Method blank results
- Matrix spike/matrix spike duplicate
- Surrogate recoveries
- Duplicates
- Analytical method blanks.

5.3.1 Data Quality Assessment

The completed data packages for the verification sampling and analysis were validated by Analytical Quality Associates, Inc., (AQA) a qualified independent contractor providing third-party validation. Specific data quality objectives for the waste site is found in the SAP (DOE/RL-96-22). All samples were collected per the sample design described in Sections 3.2.3.1. The COCs for the 100-K-63 Waste Site are listed in Section 3.2.1.

Third party validation was performed on the SDGs from the in-process pothole sampling (WSCF102445, WSCF102425, WSCF102473, WSCF102537, WSCF102515, WSCF102464, H4381, H4383, H4393, and H4407). *Data Validation Report for CH2M HILL Plateau Remediation Company VSR12-005, 100-K-63 Pothole Sample Project KW Floodplain, Chemical & Radiochemical Validation - Level C* (AQA 2011c) for in-process pothole sampling resulted in major deficiencies due to exceedance of the holding times for hexavalent chromium affecting 13 of the 59 sample analyses. Minor deficiencies were also found and are discussed below. The 100-K-63 Waste Site in-process sampling and analysis data, from samples collected during remediation, were found to be useable for decision-making purposes, except for the affected hexavalent chromium results.

Sampling and analysis data generated from all of the samples collected at the 100-K-63 Waste Site after remediation are included in Sample Delivery Groups (SDGs) WSCF112993, WSCF113002, WSCF113017, SL1137, WSCF113047, WSCF113057, WSCF113116, WSCF113156, WSCF113177, WSCF113192, WSCF113205, W06240, W06241 and W06242. Third-party validation was performed on the SDGs and summarized in *Data Validation Report for CH2M HILL Plateau Remediation Company VSR11-056, 100-K Project, Waste Site 100-K-63, Excavated Area* (AQA 2011a) and *Data Validation Report for CH2M HILL Plateau Remediation Company VSR12-003, 100-K-63 Unexcavated Area, KW Floodplain, Chemical Validation - Level C* (AQA 2011b), and resulted in no major deficiencies. Minor deficiencies are discussed below. The third-party validator also reviewed the analytical information for the equipment blanks and duplicates, and found all information to be useable in the two reports. The 100-K-63 Waste Site verification sampling and analysis data were found to be useable for decision-making purposes.

In-Process Focused Pothole Samples:

Chromium VI Analysis: A major deficiency led to the qualification of some of the hexavalent chromium sample results as unusable due to exceedance of the holding time.

Gamma Scan and Strontium-89/90 Analyses: No minor deficiencies were found.

Equipment Blank: The hexavalent chromium result for the equipment blanks was qualified as unusable due to analysis at greater than 2 times the holding time for the sample.

Field Duplicate Sample: All field duplicate results were acceptable.

Excavated Area Verification Samples:

Chromium VI Analysis: The matrix spike recovery was less than the lower accuracy limit in the SAP (DOE/RL-96-22) for the hexavalent chromium samples.

Gamma Scan and Strontium-89/90 Analyses: No minor deficiencies were found.

Equipment Blanks: The equipment blanks had strontium-89/90 detected in equipment blank B2FX96.

Field Duplicate Samples: All field duplicate results were acceptable.

Unexcavated Area Verification Samples:

Chromium VI Analysis: The matrix spike recovery was less than the lower accuracy limit in the SAP (DOE/RL-96-22) for the hexavalent chromium samples.

Gamma Scan and Strontium-89/90 Analyses: Minor deficiencies led to the qualification of sample results as estimates due to laboratory blank contamination for strontium-89/90.

Equipment Blanks: The equipment blank B2FXJ3 had strontium-89/90 detected. All other equipment blank results were acceptable.

Field Duplicate Samples: All field duplicate results were acceptable with the exception of field duplicate samples B2FXJ2 and B2FXF7, which had strontium-89/90 differences greater than 2 times the minimum detected concentrations, and samples B2FXJ6 and B2FXH7 had cesium-137 differences greater than 2 times the minimum detected concentrations.

Conclusion: The DQA review for the 100-K-63 Waste Site found the results to be accurate within the standard errors associated with the methods, including sampling and sample handling with the exception of hexavalent chromium for 13 of the in-process pothole samples (1 equipment blank, 1 duplicate, 11 soil samples). The review also included sample design, a review of the field logbook(s) and sample handling, and all applicable analytical data packages. The remaining data are of the right type, quality, and quantity to support interim close out of the waste site. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected because of QA/QC deficiencies. All analytical data were found acceptable for use in verifying achievement of the RAOs and RAGs associated with the waste site in accordance with the RDR/RAWP for the 100 Area (DOE/RL-96-17). All of the sampling analytical data are stored in the HEIS and are summarized in Appendix B. All qualifiers have also been added accordingly into the data for Appendix B.

5.4 Regulatory Oversight

EPA is the lead regulatory agency for this interim remedial action; they provided the necessary oversight.

6 Final Inspection and Certifications

No final inspections or certifications are applicable to or required by the interim remedial action for the 100-K-63 Waste Site.

7 Operation and Maintenance Activities

The 100-K-63 Waste Site was removed and disposed. No post-remediation controls were implemented for this waste site. Revegetated areas will be monitored in accordance with Appendix H of the RDR/RAWP (DOE/RL-96-17).

8 Summary of Project Costs

The cost for the remediation of the 100-K-63 Waste Site was \$1,187,000, including the disposal of 85,431 tons of contaminated soil and debris in the Environmental Restoration Disposal Facility.

9 Observations and Lessons Learned

No observations or lessons learned are associated with this interim remedial action.

10 Contact Information

This section provides the contact information for the DOE-RL contractor, DOE-RL, and agency representatives.

DOE-RL Contractor:

L. Ty Blackford, Waste and Fuels and D4 Project Vice President
CH2M HILL Plateau Remediation Company
P.O. Box 1600, MSIN T4-09
Richland, Washington
Telephone: (509) 373-1713

DOE-RL Project Manager:

Thomas K. Teynor, Director
Richland Operations Office
U.S. Department of Energy
P.O. Box 550
Richland, Washington
Telephone: (509) 376-6363

Lead Regulatory Agency Project Manager:

Rod A. Lobos, 100-K Project Manager
U.S. Environmental Protection Agency, Region 10
309 Bradley Street, Suite 115
Richland, Washington
Telephone: (509) 376-3749

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Appendix A

Waste Site Verification Sampling Photographs

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Figure A-1. Sampler and Archaeologist Collecting Verification Samples at 100-K-63



Figure A-2. 100-K-63 Composite Verification Sampling

Appendix B

Waste Site Verification Sampling Results and In-Process Excavation and Potholing Sampling Results

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Analytical Data for Verification Soil Sampling at 100-K-63,

Tables B-1 and B-2

Table B-1. 100-K-63 Excavation Area Verification Sample Results

Contaminants of Concern	Sample Area S1	Sample Area S2	Sample Area S3	Sample Area S4	Sample Area S5	Sample Area S6
	Sample #1 HEIS # B2FX82	Sample #2 HEIS # B2FX93	Sample #3 HEIS # B2FX97	Sample #4 HEIS # B2FX98	Sample #5 HEIS # B2FX99	Sample #6 HEIS # B2FX80
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UN 0.1	UN 0.1	UN 0.1	UN 0.1	UNJ 0.099	UN 0.1
	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Radionuclides						
Cesium-137	0.74	U -0.015	-0.015	U 0.009	0.032	U -0.0059
Cobalt-60	U -0.0088	U 0.00085	U -0.0038	U 0.00045	U 0.013	U 0.0075
Europium-152	0.31	U -0.0053	U 0.064	U 0.025	U -0.048	U -0.016
Europium-154	U 0.023	U 0.03	U -0.013	U 0.064	U -0.047	U 0.032
Europium-155	U 0.05	U 0.11	U 0.078	U 0.12	U 0.065	U -0.014
Strontium-90	0.69	U 0.076	1.1	U 0.23	U 0.34	U -0.62

J – Sample estimated and less than the reporting limit
HEIS = Hanford Environmental Information System
N – MS and/or MDS recovery outside control limits.
U – Analyzed for but not detected above limiting criteria

B-2

Table B-1. 100-K-63 Excavation Area Verification Sample Results

Contaminants of Concern	Sample Area S7	Sample Area S8	Sample Area S9	Sample Area S10	Sample Area S11	Sample Area S12
	Sample #7 HEIS # B2FX81	Sample #8 HEIS # B2FX82	Sample #9 HEIS # B2FX83	Sample #10 HEIS # B2FX83	Sample #11 HEIS # B2FX84	Sample #12 HEIS # B2FX85
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UN 0.1	UN 0.1	UN 0.1	UN 0.1	UN 0.1	UNJ 0.094
	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Radionuclides						
Cesium-137	U 0.008	0.043	0.33	0.32	U -0.0069	0.047
Cobalt-60	U -0.004	U -0.0024	U -0.011	U -0.0033	U -0.0039	U -0.013
Europium-152	U 0.0094	U 0.024	U 0.11	U 0.068	U 0.022	U 0.083
Europium-154	U -0.016	U -0.016	U -0.022	U 0.015	U -0.0079	U -0.014
Europium-155	U 0.091	U 0.034	U -0.014	U 0.086	U 0.052	U 0.18
Strontium-90	U 0.27	U 0.024	UJ -0.52	U 0.28	U 0.32	0.55

J – Sample estimated and less than the reporting limit
HEIS = Hanford Environmental Information System
N – MS and/or MDS recovery outside control limits.
U – Analyzed for but not detected above limiting criteria

Table B-1. 100-K-63 Excavation Area Verification Sample Results

Contaminants of Concern	Sample Area S13	Sample Area S14	Sample Area S15	Sample Area S16	Sample Area S17	Sample Area S18
	Sample #13 HEIS # B2FX86	Sample #14 HEIS # B2FX87	Sample #15 HEIS # B2FX88	Sample #16 HEIS # B2FX89	Sample #17 HEIS # B2FX90	Sample #18 HEIS # B2FX91
<i>Metals</i>	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UNJ 0.099	UNJ 0.098	UNJ 0.1	UNJ 0.1	UNJ 0.1	UNJ 0.098
<i>Radionuclides</i>	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.13	1.2	U 0.01	0.05	0.081	U 0.024
Cobalt-60	U 0.0021	0.041	U 0.0041	U -0.0028	U 0.013	U 0.0094
Europium-152	0.11	0.64	U -0.022	U 0.019	U 0.046	U -0.0019
Europium-154	U -0.0072	0.14	U 0.00076	U 0.034	U -0.0054	U -0.0055
Europium-155	U 0.041	U -0.012	U -0.00077	U 0.11	U 0.045	U 0.13
Strontium-90	U 0.31	U 0.29	U 0.22	0.41	0.79	0.58

J – Sample estimated and less than the reporting limit

HEIS = Hanford Environmental Information System

N – MS and/or MDS recovery outside control limits.

U – Analyzed for but not detected above limiting criteria

Table B-1. 100-K-63 Excavation Area Verification Sample Results

Contaminants of Concern	Sample Area S19	Sample Area S20	Sample Area S5 (DUP)	Equipment Blank
	Sample #19 HEIS # B2FX92	Sample #20 HEIS # B2FX94	Sample #21 HEIS # B2FX95	Sample #22 HEIS # B2FX96
<i>Metals</i>	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UNJ 0.1	UNJ 0.1	UNJ 0.1	UN 0.1
<i>Radionuclides</i>	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.032	0.039	U 0.0054	U -0.01
Cobalt-60	U -0.0056	U -0.0025	U 0.0061	U -0.0038
Europium-152	U 0.0069	U -0.00045	U 0.019	U 0.013
Europium-154	U -0.009	U -0.012	U -0.0085	U -0.0016
Europium-155	U -0.044	U 0.051	U 0.18	U -0.0084
Strontium-90	U -0.34	0.59	U 0.057	U 0.52

J – Sample estimated and less than the reporting limit

HEIS = Hanford Environmental Information System

N – MS and/or MDS recovery outside control limits.

U – Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S1 Sample #1 HEIS # B2FXB4		Sample Area S2 Sample #2 HEIS # B2FXC5		Sample Area S3 Sample #3 HEIS # B2FXD6		Sample Area S4 Sample #4 HEIS # B2FXF7		Sample Area S5 Sample #5 HEIS # B2FXH8		Sample Area S6 Sample #6 HEIS # B2FXJ8	
	(mg/kg) UDNJ 0.45 (pCi/g)	(mg/kg) UDNJ 0.49 (pCi/g)	(mg/kg) UDNJ 0.51 (pCi/g)	(mg/kg) UDNJ 0.51 (pCi/g)	(mg/kg) UDNJ 0.51 (pCi/g)	(mg/kg) UDNJ 0.51 (pCi/g)	(mg/kg) UDNJ 0.48 (pCi/g)	(mg/kg) UDNJ 0.48 (pCi/g)	(mg/kg) UDNJ 0.47 (pCi/g)	(mg/kg) UDNJ 0.47 (pCi/g)	(mg/kg) UDNJ 0.47 (pCi/g)	(mg/kg) UDNJ 0.47 (pCi/g)
Metals												
Chromium VI	0.1	0.16	0.37	0.33	0.16	0.13	0.16	0.16	0.13	0.13	0.13	0.13
Cesium-137	U -0.014	U -0.021	U -0.00072	U -0.0015	U -0.0018	U 0.02	U -0.0018	U 0.02	U 0.014	U 0.014	U 0.014	U 0.014
Cobalt-60	U 0.00041	U -0.032	U 0.073	U -0.013	U -0.014	U 0.04	U -0.014	U 0.04	U 0.004	U 0.004	U 0.004	U 0.004
Europium-152	U -0.0075	U -0.025	U 0.033	U 0.027	U 0.004	U 0.023	U 0.004	U 0.023	U 0.016	U 0.016	U 0.023	U 0.023
Europium-154	U 0.26	U 0.046	U 0.11	U 0.01	U 0.16	U 0.023	U 0.16	U 0.023	J 0.49	J 0.49	U -0.27	U -0.27
Europium-155	2.1	U 0.13	J 1.2	J 1.6	J 0.49	U -0.27	J 0.49	U -0.27				
Strontium-90												

D - Analyte was reported at a secondary dilution factor.
 J - Sample estimated and less than the reporting limit
 HEIS = Hanford Environmental Information System

N - MS and/or MDS recovery outside control limits.
 U - Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S7 Sample #7 HEIS # B2FXJ9		Sample Area S8 Sample #8 HEIS # B2FXKO		Sample Area S9 Sample #9 HEIS # B2FXK1		Sample Area S10 Sample #10 HEIS # B2FXB5		Sample Area S11 Sample #11 HEIS # B2FXB6		Sample Area S12 Sample #12 HEIS # B2FXB7	
	(mg/kg) UDNJ 0.48 (pCi/g)	(mg/kg) UDNJ 0.46 (pCi/g)	(mg/kg) UDNJ 0.46 (pCi/g)	(mg/kg) UDNJ 0.46 (pCi/g)	(mg/kg) UDNJ 0.5 (pCi/g)	(mg/kg) UDNJ 0.5 (pCi/g)	(mg/kg) UDNJ 0.5 (pCi/g)	(mg/kg) UDNJ 0.5 (pCi/g)	(mg/kg) UDNJ 0.51 (pCi/g)	(mg/kg) UDNJ 0.51 (pCi/g)	(mg/kg) UDNJ 0.48 (pCi/g)	(mg/kg) UDNJ 0.48 (pCi/g)
Metals												
Chromium VI	0.48	0.34	0.79	0.36	0.26	0.31	0.26	0.31	0.26	0.31	0.31	0.31
Cesium-137	U 0.014	U -0.0014	U 0.013	U 0.012	U 0.0089	U 0.017	U 0.0089	U 0.017	U 0.0089	U 0.017	U 0.017	U 0.017
Cobalt-60	U 0.043	U 0.1	0.4	U 0.11	0.19	0.33	0.19	0.33	0.19	0.33	0.33	0.33
Europium-152	U 0.0033	U -0.075	U 0.089	U 0.016	U -0.017	U -0.009	U -0.017	U -0.009	U -0.017	U -0.009	U -0.009	U -0.009
Europium-154	U 0.1	0.2	U 0.052	U 0.14	U 0.14	U 0.092	U 0.14	U 0.092	U 0.14	U 0.14	U 0.092	U 0.092
Europium-155	J 0.62	U -0.18	U 0.062	U -0.066	U 0.3	U -0.32	U -0.066	U 0.3	U 0.3	U 0.3	U -0.32	U -0.32
Strontium-90												

D - Analyte was reported at a secondary dilution factor.
 J - Sample estimated and less than the reporting limit
 HEIS = Hanford Environmental Information System

N - MS and/or MDS recovery outside control limits.
 U - Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S13	Sample Area S14	Sample Area S15	Sample Area S16	Sample Area S17	Sample Area S18
	Sample #13 HEIS # B2FXB8	Sample #14 HEIS # B2FXB9	Sample #15 HEIS # B2FXC0	Sample #16 HEIS # B2FXC1	Sample #17 HEIS # B2FXC2	Sample #18 HEIS # B2FXC3
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UDNJ 0.51	UDNJ 0.52	UDNJ 0.48	UDNJ 0.49	UDNJ 0.5	UDNJ 0.49
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.21	0.39	0.34	0.59	0.29	0.4
Cobalt-60	U 0.013	U 0.016	U 0.016	U 0.016	U 0.011	U -0.01
Europium-152	0.13	0.26	0.27	0.65	0.23	U 0.074
Europium-154	U 0.015	U 0.0011	U 0.046	0.16	U -0.0017	U -0.001
Europium-155	U -0.024	U 0.023	U 0.15	U 0.12	U 0.54	U 0.046
Strontium-90	U 0.42	0.59	U 0.47	U -0.27	0.61	U -0.096

D – Analyte was reported at a secondary dilution factor.
J – Sample estimated and less than the reporting limit
HEIS = Hanford Environmental Information System

N – MS and/or MDS recovery outside control limits.
U – Analyzed for but not detected above limiting criteria

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Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S19	Sample Area S20	Sample Area S21	Sample Area S22	Sample Area S23	Sample Area S24
	Sample #19 HEIS # B2FXC4	Sample #20 HEIS # B2FXC6	Sample #21 HEIS # B2FXC7	Sample #22 HEIS # B2FXC8	Sample #23 HEIS # B2FXC9	Sample #24 HEIS # B2FXD0
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UD 0.5	U 0.155	U 0.155	U 0.155	0.209	U 0.155
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.31	0.81	0.12	0.53	0.32	0.61
Cobalt-60	U 0.0018	U 0.0081	U -0.0084	U 0.02	U 0.006	U 0.0059
Europium-152	0.27	0.35	U 0.023	U 0.17	U 0.035	0.22
Europium-154	U 0.047	U -0.016	U 0.014	U -0.068	U 0.027	U 0.00061
Europium-155	U 0.058	U 0.019	U 0.048	U 0.063	U 0.18	U -0.00083
Strontium-90	0.51	U 0.121	U 0.000894	U 0.121	U 0.0663	U 0.113

D – Analyte was reported at a secondary dilution factor.
HEIS = Hanford Environmental Information System

U – Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S25	Sample Area S26	Sample Area S27	Sample Area S28	Sample Area S29	Sample Area S30
	Sample #25 HEIS # B2FXD1	Sample #26 HEIS # B2FXD2	Sample #27 HEIS # B2FXD3	Sample #28 HEIS # B2FXD4	Sample #29 HEIS # B2FXD5	Sample #30 HEIS # B2FXD7
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	U 0.155					
Radionuclides						
	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.12	0.22	0.23	0.14	0.062	0.19
Cobalt-60	U -0.0037	U -0.007	U 0.002	U -0.0051	U 0.0021	U 0.0024
Europium-152	U 0.033	0.11	U 0.02	U 0.015	U 0.051	U 0.036
Europium-154	U 0.013	U 0.037	U 0.047	U 0.025	U 0.0019	U -0.039
Europium-155	U 0.051	U 0.015	U 0.033	U 0.031	U 0.017	U 0.058
Strontium-90	U 0.107	U 0.0791	U 0.115	U 0.141	U 0.107	U 0.0565

HEIS = Hanford Environmental Information System U - Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S31	Sample Area S32	Sample Area S33	Sample Area S34	Sample Area S35	Sample Area S36
	Sample #31 HEIS # B2FXD8	Sample #32 HEIS # B2FXD9	Sample #33 HEIS # B2FXF0	Sample #34 HEIS # B2FXF1	Sample #35 HEIS # B2FXF2	Sample #36 HEIS # B2FXF3
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	U 0.155	J 0.201				
Radionuclides						
	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.19	0.16	0.13	0.2	0.19	0.33
Cobalt-60	U -0.01	U 0.019	U -0.0052	U 0.0021	U 0.0003	U -0.0033
Europium-152	U 0.043	U 0.046	U 0.023	0.081	U 0.028	0.2
Europium-154	U 0.02	U -0.032	U 0.04	U 0.02	U 0.021	U 0.0069
Europium-155	U -0.035	U 0.057	U 0.094	U 0.036	U 0.011	U 0.058
Strontium-90	U 0.0441	U 0.0917	U 0.0405	U 0.0513	U 0.0884	U 0.0108

J - Sample estimated and less than the reporting limit U - Analyzed for but not detected above limiting criteria

HEIS = Hanford Environmental Information System

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S37	Sample Area S38	Sample Area S39	Sample Area S40	Sample Area S41	Sample Area S42
	Sample #37 HEIS # B2FXF4	Sample #38 HEIS # B2FXF5	Sample #39 HEIS # B2FXF6	Sample #40 HEIS # B2FXF8	Sample #41 HEIS # B2FXF9	Sample #42 HEIS # B2FXH0
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	J 0.379	J 0.313	UJ 0.155	J 0.185	J 0.358	UJ 0.155
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.37	0.21	0.16	0.26	0.19	0.16
Cobalt-60	U 0.011	U -0.00038	U 0.0068	U 0.0066	U 0.013	U 0.01
Europium-152	0.36	0.2	0.29	0.67	0.11	0.13
Europium-154	U -0.015	U -0.0014	U -0.0015	U 0.017	U -0.014	U 0.0084
Europium-155	U 0.018	U 0.023	U 0.089	U 0.096	U 0.042	U -0.01
Strontium-90	0.273	U 0.0428	U 0.084	U 0.0372	U 0.0563	U 0.125

J - Sample estimated and less than the reporting limit
HEIS = Hanford Environmental Information System
U - Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S43	Sample Area S44	Sample Area S45	Sample Area S46	Sample Area S47	Sample Area S48
	Sample #43 HEIS # B2FXH1	Sample #44 HEIS # B2FXH2	Sample #45 HEIS # B2FXH3	Sample #46 HEIS # B2FXH4	Sample #47 HEIS # B2FXH5	Sample #48 HEIS # B2FXH6
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UJ 0.155					
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.24	0.23	0.35	0.32	0.15	0.19
Cobalt-60	U 0.0038	U 0.016	U 0.0047	U 0.011	U 0.03	U -0.0024
Europium-152	0.39	0.58	0.19	0.47	0.2	0.2
Europium-154	U 0.065	U 0.058	U 0.044	U 0.019	U 0.013	U 0.018
Europium-155	0.2	U 0.038	U 0.032	U 0.11	U 0.054	U 0.04
Strontium-90	U 0.0707	U 0.0759	U 0.0862	U 0.112	U 0.109	U 0.0383

J - Sample estimated and less than the reporting limit
HEIS = Hanford Environmental Information System
U - Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S49	Sample Area S50	Sample Area S51	Sample Area S52	DUP of #4	Equipment Blank
	Sample #49 HEIS # B2FXH7	Sample #50 HEIS # B2FXH9	Sample #51 HEIS # B2FXJ0	Sample #52 HEIS # B2FXJ1	Sample #53 HEIS # B2FXJ2	Sample #54 HEIS # B2FXJ3
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	J 0.202	UJ 0.155	UJ 0.155	U 0.155	UDNJ 0.48	UNJ 0.096
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.26	0.14	0.45	0.16	0.35	U -0.0032
Cobalt-60	U -0.012	U -0.0067	U -0.0012	U 0.0067	U -0.0068	U 0.0036
Europium-152	U 0.038	U 0.031	0.28	0.13	0.15	U -0.033
Europium-154	U 0.07	U -0.025	U 0.098	U 0.0019	U -0.011	U -0.035
Europium-155	U 0.068	U 0.057	U -0.013	U -0.0016	U 0.0039	U 0.012
Strontium-90	U 0.0478	U -0.0248	U 0.147	U 0.125	J 0.61	J 0.52

D - Analyte was reported at a secondary dilution factor.
J - Sample estimated and less than the reporting limit
HEIS = Hanford Environmental Information System

N - MS and/or MDS recovery outside control limits.
U - Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	DUP of #25	Equipment Blank	DUP of #49	Equipment Blank	Sample Area S59	Sample Area S60
	Sample #55 HEIS # B2FXJ4	Sample #56 HEIS # B2FXJ5	Sample #57 HEIS # B2FXJ6	Sample #58 HEIS # B2FXJ7	Sample #59 HEIS # B2H560	Sample #60 HEIS # B2H561
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	U 0.155	U 0.155	J 0.332	UJ 0.155	U 0.155	U 0.155
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.079	U -0.0021	0.15	U 0.00029	0.22	0.2
Cobalt-60	U -0.0031	U -0.0085	U 0.014	U 0.0041	U 0.0096	U 0.00056
Europium-152	U -0.0093	U 0.003	U 0.027	U 0.024	0.15	0.13
Europium-154	U 0.042	U -0.015	U -0.0043	U 0.02	U 0.066	U 0.025
Europium-155	0.092	U 0.019	U 0.023	U 0.0096	U 0.094	U -0.006
Strontium-90	U 0.0636	U 0.0795	U 0.157	U 0.0454	U 0.0965	U 0.113

J - Sample estimated and less than the reporting limit
HEIS = Hanford Environmental Information System

U - Analyzed for but not detected above limiting criteria

Table B-2. 100-K-63 Unexcavated Area Verification Sample Results

Contaminants of Concern	Sample Area S61		Sample Area S62	
	Sample #61 HEIS # B2H562	(mg/kg) U 0.155	Sample #62 HEIS # B2H563	(mg/kg) U 0.155
Metals				
Chromium VI		U 0.155		U 0.155
Radionuclides		(pCi/g)		(pCi/g)
Cesium-137		0.13		0.13
Cobalt-60		U 0.0015		0.023
Europium-152		U 0.049		0.23
Europium-154		U 0.0013		U 0.046
Europium-155		U -0.054		0.07
Strontium-90		U 0.0252		U 0.0799
HEIS = Hanford Environmental Information System U – Analyzed for but not detected above limiting criteria				

**Analytical Data for In-Process Excavation
Soil Sampling at 100-K-63,
Tables B-3**

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Table B-3. 100-K-63 Excavation Area In-Process Sample Results

Contaminants of Concern	Soil Sample 1	Soil Sample 2	Soil Sample 3	Soil Sample 4	Soil Sample 5	Soil Sample 6
	B27144	B27145	B27146	B27147	B27148	B27149
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	U<0.100	U<0.100	U<0.100	B 0.173	U<0.10	U<0.10
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	U 2.82E-03	U -6.22E-3	U -9.2E-3	U 8.8E-3	0.049	0.12
Cobalt-60	U -0.0190	U -1.93E-03	U -0.0123	U 0.0060	U -1.7E-3	U 6.7E-3
Europium-152	U 0.0408	U 0.0404	U 0.106	U -0.010	U 8.9E-3	0.14
Europium-154	U -3.06E-03	U 3.68E-03	U -0.0328	U -0.049	U 5.2E-3	U -0.042
Europium-155	U 0.116	U 0.0394	U 0.0833	U 0.13	U 0.052	U 0.0090
Strontium-90	U 0.150	U -1.40	U -0.580	U -1.1	U -0.54	U -0.97

B - Analyte < the PQL (or Estimated Quantitation Limit) but >= the IDL/MDL (inorganic)

U - Analyzed for but not detected above limiting criteria

Table B-3. 100-K-63 Excavation Area In-Process Sample Results

Contaminants of Concern	Soil Sample 7	Soil Sample 8	Soil Sample 9	Soil Sample 10	Soil Sample 11	Soil Sample 12
	B27150	B27151	B27152	B27153	B27154	B27155
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	U<0.10	U <0.10	U<0.10	U<0.10	U<0.10	U<0.10
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	U 0.013	U 0.014	U -9.9E-3	U -3.3E-3	0.061	U -0.026
Cobalt-60	U 2.3E-4	U -4.2E-3	U 8.7E-3	U 8.8E-3	U -9.2E-3	U -2.8E-3
Europium-152	U 0.017	U 0.023	U -8.6E-4	U -2.9E-3	U 0.086	U 0.056
Europium-154	U -0.024	U -0.055	U 0.011	U 0.015	U 2.5E-4	U -6.3E-3
Europium-155	U 0.022	U 0.055	U 0.027	0.12	U 0.11	U -0.083
Strontium-90	U -0.84	U -0.72	U -1.4	U -0.51	U 0.12	U -0.84

U - Analyzed for but not detected above limiting criteria

Table B-3. 100-K-63 Excavation Area In-Process Sample Results

Contaminants of Concern	Sample 13 B29BF6	Sample 14 B29BF7	Sample 15 B29BF8,	Sample 16 B29BF9	Sample 17 B29BH0	Sample 18 B29BH1
	(mg/kg) UN<0.11	(mg/kg) UN<0.11	(mg/kg) UN<0.11	(mg/kg) UN<0.11	(mg/kg) UN<0.11	(mg/kg) UN<0.12
<i>Metals</i>	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Chromium VI	U -4.7E-4	U -0.011	U 2.7E-3	0.094	U -2.2E-4	0.043
<i>Radionuclides</i>	U -0.012	U 5.7E-3	U 8.2E-3	U 6.9E-4	U 4.7E-3	U -0.013
Cesium-137	U -0.019	U -0.020	U 0.068	U 0.15	U -0.019	U 0.033
Cobalt-60	U -0.087	U -0.025	U -0.089	U -9.9E-3	U -0.026	U 0.014
Europium-152	U 0.098	U 0.082	U -0.067	U 0.061	U 2.9E-3	U 0.044
Europium-154	U -1.2	U -1.1	U -1.9	U -2.2	U -1.7	U -2.1
Europium-155	U - Analyzed for but not detected above limiting criteria					
Strontium-90	U - Analyzed for but not detected above limiting criteria					

Table B-3. 100-K-63 Excavation Area In-Process Sample Results

Contaminants of Concern	Sample 19 B29BH2	Sample 20 B29BH3	Sample 21 B29BH4	Sample 22 B29BH5	Sample 23 B29BH6	Sample 24 B29BH7
	(mg/kg) UN<0.11	(mg/kg) UN<0.11	(mg/kg) UN<0.11	(mg/kg) UN<0.11	(mg/kg) UN<0.11	(mg/kg) UN<0.11
<i>Metals</i>	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Chromium VI	U 0.017	0.13	0.15	U 6.5E-3	U 0.015	U 3.6E-4
<i>Radionuclides</i>	U -5.0E-6	U 6.8E-3	U -0.013	U -3.1E-3	U -6.7E-3	U 0.046
Cesium-137	U -8.1E-3	U 0.074	U 0.16	U -0.077	U -0.084	U 0.063
Cobalt-60	U -0.0070	U -0.089	U 0.059	U -0.035	U -0.026	U -0.062
Europium-152	U 0.061	U -0.062	U -0.040	U 0.13	U -0.026	U -0.17
Europium-154	U -0.83	U -2.8	U -2.3	U -2.0	U -0.97	U -0.54
Europium-155	N - MS and/or MDS recovery outside control limits.					
Strontium-90	U - Analyzed for but not detected above limiting criteria					

Table B-3. 100-K-63 Excavation Area In-Process Sample Results

Contaminants of Concern	Sample 25	Sample 26	Sample 27	Sample 28	Sample 29	Sample 30	Sample 31
	B29BH8	B29BH9	B29BJ0	B29BJ1	B29BJ2	B29BJ3	B29BJ4
Metals	(mg/kg)						
Chromium VI	UN<0.11	UN<0.11	UN<0.11	UN<0.11	UN<0.10	UN<0.11	UN<0.11
Radionuclides	(pCi/g)						
Cesium-137	U 9.7E-3	0.27	0.31	U -5.6E-3	4.5	1.6	0.11
Cobalt-60	U 0.025	U 8.7E-3	U -7.3E-3	U -8.7E-3	U -7.4E-3	U 0.014	U 6.8E-3
Europium-152	U -0.086	0.15	0.15	U -9.1E-3	0.41	0.60	U 0.013
Europium-154	U -0.014	U 0.040	U 0.0060	U -7.7E-3	U -7.5E-3	0.13	U -0.026
Europium-155	U 0.013	U 0.021	U 0.072	U 0.23	U 0.10	U 0.045	U 4.6E-3
Strontium-90	U -0.99	U -1.6	U -1.1	U -2.4	U -2.1	U -0.23	U -0.98

N – MS and/or MDS recovery outside control limits.

U – Analyzed for but not detected above limiting criteria

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Analytical Data for In-Process Pothole Soil Sampling at

100-K-63, Tables B-4

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Table B-4 100-K-63 In-Process Pothole Soil Sample Results

Contaminants of Concern	Location 1	Location 1	Location 1	Location 2	Location 2	Location 2	Equipment
	B27M35, Surface	B27MB5, 5ft bgs	B27MJ8, 10ft bgs	B27M36 Surface	B27MB6 5ft bgs	B27MJ9 10ft bgs	Blank B27MR7
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Chromium VI	U<0.10	U<0.10	U<0.10	U<0.10	U<0.10	U<0.11	UR<0.002
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/L)
Cesium-137	0.13	U -0.0030	U -6.4E-3	U -3.8E-3	U -0.018	U -0.024	U -1.0
Cobalt-60	U -1.4E-3	U 9.7E-3	U 0.0030	U -1.1E-3	U -0.019	U 0.011	U -0.12
Europium-152	U -0.071	U -0.014	U 0.061	U 0.022	U 0.030	U -0.095	U 19
Europium-154	U -7.5E-3	U -0.014	U -0.017	U -4.9E-4	U -0.036	U 0.026	U 12
Europium-155	U 0.11	U 0.035	U 0.062	U -7.5E-3	U 8.2E-3	U 0.077	U -2.1
Strontium-90	U -1.1	U 0.094	U -1.5	U -0.73	U -1.7	U -1.8	U -1.7

bgs – below ground surface

U – Analyzed for but not detected above limiting criteria

R – Rejected per data validation due to exceeding the sample holding time

Table B-4 100-K-63 In-Process Pothole Soil Sample Results

Contaminants of Concern	Location 3	Location 3	Location 3	Location 4	Location 4	Location 4	Location 4	Location 4
	B27M37 Surface	B27MB7 5ft bgs	B27MK0 10ft bgs	B27M38 Surface	B27MB8 5ft bgs	B27MK1 10ft bgs	B27MP3 12ft bgs	B27MP4 12ft bgs
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UNR<0.10	UNR<0.10	UNR<0.11	UNR<0.10	UNR<0.10	UNR<0.10	UNR<0.10	UNR<0.10
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	U 1.7E-3	U -0.010	U -8.6E-3	U -2.3E-3	-0.0070	9.6E-3	U 6.5E-3	U -1.9E-4
Cobalt-60	U 9.9E-3	U -0.0070	U 9.6E-3	U 0.016	U -0.010	U -8.6E-3	U -0.01	U 6.1E-3
Europium-152	U -0.051	U -0.017	U -0.0010	U -0.036	U -0.017	U -0.0010	U -0.076	U -0.021
Europium-154	U -3.5E-3	U -0.015	U 0.017	U 0.011	U -0.015	U 0.017	U -0.06	U -0.01
Europium-155	U 7.4E-3	U 0.011	U 0.037	U 4.9E-4	U 0.011	U 0.037	U 0.057	0.076
Strontium-90	U -0.93	U -1.6	U -0.61	U -0.44	U -1.6	U -0.61	U -0.24	U -0.95

bgs – below ground surface

R – Rejected per data validation due to exceeding the sample holding time

U – Analyzed for but not detected above limiting criteria

Table B-4 100-K-63 In-Process Pothole Soil Sample Results

Contaminants of Concern	Location 5	Location 5	Location 5	Location 5	Location 6	Location 6	Location 6
	B27M39 surface	B27MB9 5ft bgs	B27MK2 10ft bgs	B27MP5 13ft bgs	B27M40 surface	B27MC0 5ft bgs	B27MK3 10ft bgs
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UNR<0.10	UNR<0.10	UNR<0.10	UNR<0.10	U<0.10	UNJ<0.10	U<0.11
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	U -8.8E-4	U 0.016	U 1.5E-3	U -7.1E-3	U -0.011	7.9E-3	U 0.021
Cobalt-60	U 5.5E-3	U 5.5E-3	U -3.4E-3	U 4.8E-3	U 1.4E-3	7.7E-3	U 1.3E-3
Europium-152	U 0.025	U -0.058	U -0.012	U -0.11	U 7.4E-3	0.020	U -0.045
Europium-154	U 0.063	U -0.033	U -0.018	U -0.017	U -0.025	-0.019	U -0.059
Europium-155	U -0.014	U 0.10	U 0.044	U 0.031	U -0.017	0.083	U -0.040
Strontium-90	U -1.0	U -0.86	U -0.56	U -0.51	U -1.3	-0.34	U -0.48

bgs – below ground surface
N – MS and/or MDS recovery outside control limits.
R – Rejected per data validation due to exceeding the sample holding time
U – Analyzed for but not detected above limiting criteria

Table B-4 100-K-63 In-Process Pothole Soil Sample Results

Contaminants of Concern	Location 7	Location 7	Location 7	Location 7	Location 8	Location 8	Location 8
	B27M41 surface	B27MC1 5ft bgs	B27MK4 10ft bgs	B27MP7 12ft bgs	B27M42 surface	B27MC2 5ft bgs	B27MK5 10ft bgs
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	U<0.11	U<0.11	U<0.11	U<0.10	UN<0.10	UN<0.10	BN 0.133
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.016	3.7E-3	U 0.012	U -0.017	U -4.5E-3	U -4.9E-3	U 7.4E-4
Cobalt-60	U 0.64	U 0.098	U -9.4E-3	U -0.022	U -0.010	U -8.3E-3	U 4.0E-4
Europium-152	1.1	0.18	U 0.086	U -0.062	U 1.3E-3	U -9.1E-3	U -8.9E-4
Europium-154	U 0.056	U -0.013	U -9.6E-3	U -0.059	U -3.9E-3	U -2.7E-3	U 0.010
Europium-155	U -0.018	U 0.027	U 0.098	U 0.049	U 0.078	U 0.049	U 0.032
Strontium-90	U -1.1	U -0.68	U -1.4	U -1.3	U -1.3	U -1.8	U -0.99

bgs – below ground surface
B – Analyte < the PQL (or Estimated Quantitation Limit) but >= the IDL/MDL (inorganic)
N – MS and/or MDS recovery outside control limits.
U – Analyzed for but not detected above limiting criteria

Table B-4 100-K-63 In-Process Pothole Soil Sample Results

Contaminants of Concern	Location 10 B27M44 surface (mg/kg) UN<0.10	Location 10 B27MC4 5ft bgs (mg/kg) BN 0.133	Location 10 B27MK7 10ft bgs (mg/kg) BN 0.132	Location 10 B27MR0 13ft bgs (mg/kg) BN 0.133	Location 11 B27M45 surface (mg/kg) UN<0.099	Location 11 B27MC5 5ft bgs (mg/kg) UN<0.10	Location 11 B27MK8 10ft bgs (mg/kg) BN 0.121	Location 11 B27MRI 13ft bgs (mg/kg) BN 0.120
Metals								
Chromium VI	U 9.8E-3	U -6.7E-3	U 0.018	U 0.013	U 0.031	U -5.1E-3	U -1.1E-3	U -0.015
Radionuclides								
Cesium-137	U 1.5E-3	U -4.7E-3	U 3.2E-3	U 4.1E-3	U 0.013	U -4.1E-4	U -8.9E-3	U -7.8E-3
Cobalt-60	U -0.012	U 1.9E-3	U 9.9E-3	U -0.033	U -0.041	U 5.5E-3	U 0.013	U -0.075
Europium-152	U -0.026	U 6.7E-3	U -0.032	U 0.022	U -3.8E-3	U -0.015	U 0.020	U -0.091
Europium-154	U 0.037	U -0.040	U 0.014	U -0.023	U 0.15	U -7.9E-3	U -1.8E-3	U 0.050
Europium-155	U -1.9	U -1.6	U -1.2	U -1.3	U -2.0	U -1.7	U -1.2	U -1.1
Strontium-90								

B – Analyte < the PQL (or Estimated Quantitation Limit) but >= the IDL/MDL (inorganic) N – MS and/or MDS recovery outside control limits.

bgs – below ground surface U – Analyzed for but not detected above limiting criteria

Table B-4 100-K-63 In-Process Pothole Soil Sample Results

Contaminants of Concern	Location 12 B27M46 surface (mg/kg) UN<0.098	Location 12 B27MC6 5ft bgs (mg/kg) UN<0.099	Location 12 B27MK9 7ft bgs (mg/kg) UN<0.10	Location 13 B27M47 surface (mg/kg) UN<0.10	Location 13 B27MC7 5ft bgs (mg/kg) UN<0.10
Metals					
Chromium VI	U 0.015	U -9.3E-3	U -0.021	0.15	U 0.043
Radionuclides					
Cesium-137	U 0.012	U 6.7E-3	U 8.9E-3	U 5.3E-3	U -7.6E-3
Cobalt-60	U -0.038	U -0.045	U -0.015	0.56	0.26
Europium-152	U 0.029	U 9.3E-3	U 0.031	U 4.6E-3	U 0.050
Europium-154	U 0.071	U -0.037	U 0.16	U 0.036	U 0.088
Europium-155	U -1.8	U -1.3	U -1.0	U -2.2	U -1.6
Strontium-90					

bgs – below ground surface

N – MS and/or MDS recovery outside control limits.

U – Analyzed for but not detected above limiting criteria

Table B-4 100-K-63 In-Process Pothole Soil Sample Results

Contaminants of Concern	Location 15	Location 15	Location 15	Location 15	Location 16	Location 16	Location 17	Location 17
	B27M49 surface	B27MC9 5ft bgs	B27ML2 10ft bgs	B27MR5 14ft bgs	B27MS0 surface	B27MD0 5ft bgs	B27M51 surface	B27MD1 5ft bgs
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UN<0.098	UN<0.10	UN<0.10	UNJ<0.096	BN 0.103	UN<0.11	UN<0.097	UN<0.10
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	U -3.5E-3	U 4.8E-3	U 5.7E-3	U -0.023	U -8.6E-3	U -0.015	U -8.4E-3	U 3.4E-3
Cobalt-60	U -6.3E-3	U 2.8E-3	U -7.3E-4	U 0.0040	U -1.1E-3	U -0.012	U -4.6E-3	U -2.7E-3
Europium-152	U 0.030	U -3.0E-4	U 0.030	U -0.025	U -0.062	U 0.017	U -0.033	U 0.022
Europium-154	U -0.028	U -0.012	U -0.027	U -0.012	U -8.9E-3	U 0.013	U 0.013	U -0.071
Europium-155	U 0.031	U 0.010	U 0.055	U 0.081	U 0.014	U 0.038	U 0.057	U 0.092
Strontium-90	U -1.8	U -1.7	U -2.0	U -0.79	U -1.1	U -0.40	U -1.4	U -0.75

bgs – below ground surface

J – Sample estimated and less than the reporting limit

N – MS and/or MDS recovery outside control limits.

U – Analyzed for but not detected above limiting criteria

Table B-4 100-K-63 In-Process Pothole Soil Sample Results

Contaminants of Concern	Location 18							
	Location 18 B27M52 surface	Location 18 B27MD2 5ft bgs	Location 18 (DUP) B27MD3 5ft bgs	Location 19 B27M53 surface	Location 19 B27MD4 5ft bgs	Location 20 B27M54 surface	Location 20 B27MDS 5ft bgs	Location 20 B27MDS 5ft bgs
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Chromium VI	UN<0.10	UN<0.11	UN<0.11	UN<0.10	UN<0.12	UN<0.098	UN<0.11	UN<0.11
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.12	U 0.044	0.088	U -8.9E-3	U 2.3E-3	U 0.017	0.32	0.32
Cobalt-60	U -6.5E-3	U 0.012	U 7.4E-3	U 0.0050	U 0.031	U 6.1E-3	U -0.020	U -0.020
Europium-152	U 0.018	U 0.037	U 0.029	U -0.019	U -7.9E-3	U -0.017	0.32	0.32
Europium-154	U 0.015	U 3.3E-3	U 0.13	U -0.016	U -0.075	U 0.026	U 0.024	U 0.024
Europium-155	U -0.031	U 0.070	U 0.11	U 0.030	U -0.058	U 0.066	U 0.16	U 0.16
Strontium-90	U -0.62	U -0.58	U -0.72	U -1.1	U -0.43	U -0.72	U -1.1	U -1.1

bgs – below ground surface

N – MS and/or MDS recovery outside control limits.

U – Analyzed for but not detected above limiting criteria

Appendix C

Direct Exposure Concentrations for Radionuclides

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Table C-1. Comparison of Maximum Post-Remediation Soil Concentration to 100 Area Radionuclide Soil Concentrations Corresponding to an Equivalent Dose of 15 mrem/hr

Radionuclide	Soil Concentration Corresponding to 15 mrem/yr (pCi/g)^a	Maximum Soil Concentration (pCi/g)	Fractions (Maximum/RAG)
Cesium-137	6.2	1.2	0.194
Cobalt-60	1.4 ^b	0.041	0.029
Europium-152	3.3 ^b	0.67	0.203
Europium-154	3.0 ^b	0.16	0.503
Europium-155	125 ^b	0.20	0.0016
Strontium-90	4.5	2.1	0.467
Sum of Fractions			0.948

a. Values are from WDOH/320-015, Rev. 1, *State of Washington Department of Health Interim Regulatory Guidance: Hanford Guidance for Radiological Cleanup*, State of Washington Department of Health, or calculated in RDR/RAWP for the 100 Area (DOE/RL-96-17), Table B-9 using the RESRAD parameters from Table B-8. Values in this table are radionuclide cleanup levels based on the generic site model. Site-specific RAGs will be calculated for site closeout verification using site-specific information, as needed.

b. Radionuclide concentrations for beta/gamma in water corresponding to a 4 mrem/yr dose (4 mrem/yr) from *Soil Screening Guidance for Radionuclides: User's Guide*, EPA/540-R-00-007, U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington D.C.

The sum of the fractions for the detected radionuclides is 0.948, which is <1.0. Therefore, cumulative radionuclide activities are below the 15 mrem/yr dose rate.

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Appendix D

Direct Exposure Concentrations for Nonradionuclides

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Table D-1. Comparison of 100-K-63 Maximum Post-Remediation Soil Concentration to Nonradionuclide Direct Exposure Cleanup Levels

Contaminant	Background (mg/kg)	RDL (mg/kg)	Direct Exposure Cleanup Levels (mg/kg) ^a		Lowest Direct Exposure Cleanup Level (mg/kg)	Maximum Soil Concentration (mg/kg)
			Carcinogen	Noncarcinogen		
Metals						
Chromium VI	NA	0.5	2.1 ^b	240	2.1	0.38

a. Cleanup levels established in the 1995 Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units (EPA/ROD/R10-95/126) or calculated using the appropriate formulas from WAC 173-340, with toxicity values updated through 2/25/09, from the EPA Integrated Risk Information System (IRIS) at <http://www.epa.gov/iris> or from the Risk Assessment Information System (RAIS) database of the Oak Ridge National Laboratory (ORNL 2009) on the Internet at <http://rais.ornl.gov/>.

b. Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3).

NA = not applicable
RDL = required detection limit
WAC = Washington Administrative Code

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Appendix E

Calculation of Hazard Quotients and Excess Cancer Risk

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Calculation of Hazard Quotients and Excess Cancer Risk For Nonradionuclide Contaminants of Concern

Purpose:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess cancer risk values for the residual concentration of non radionuclide COCs for the 100-K-63 Waste Site. The cumulative calculation is not required due to there being only one nonradionuclide COC. In accordance with the remedial action goals (RAGs) in the RDR/RAWP for the 100 Area (DOE/RL-96-17), the following criteria must be met:

- A HQ of <1.0 for all individual noncarcinogens
- An excess cancer risk of $<1.0E-06$ for individual carcinogens

Solution:

- Calculate HQ based on the maximum concentration detected in soil greater than background value. If HQ or sum of HQ <1 the 95% UCL calculation is not required.

Methodology:

- HQ equals the maximum concentration detected in soil divided by the noncarcinogenic RAG value. The maximum soil concentration of chromium VI is 0.38 mg/kg divided by 240 mg/kg equals $1.58E-03$. Comparing this value to the requirement <1.0 , this criteria is met.
- Calculate the excess cancer risk by dividing the maximum concentration detected in soil by the carcinogenic RAG value and then multiplied by $1.0E-06$. The maximum value of 0.38 mg/kg for chromium VI, divided by 2.1 mg/kg and multiplied by $1.0E-06$ provides a result of $1.81E-07$. Comparing this value to the requirement of $<1.0E-06$, this criteria is met.

Results:

- List individual noncarcinogens and corresponding HQs >1.0 : None.
- List the cumulative noncarcinogenic HQ >1.0 : None.
- List individual carcinogens and corresponding excess cancer risk $>1.0E-06$: None.
- List the cumulative excess cancer risk for carcinogens $>1.0E-05$: None.

Table E-1. Hazard Quotient and Excess Cancer Risk Results for the 100-K-63 Waste Site

Contaminants of Concern	Maximum Soil Concentration (mg/kg)	Noncarcinogen RAG^a (mg/kg)	Hazard Quotient	Carcinogen RAG^a (mg/kg)	Carcinogen Risk
Chromium VI	0.38	240	1.58E-03	2.1	1.81E-07
Cumulative Hazard Quotient:	NA	NA	1.58E-03	NA	NA
Cumulative Excess Cancer Risk:	NA	NA	NA	NA	1.81E-07

a = Values obtained from Appendix D, Table D-1.

RAG = Remedial Action Goal

NA = Not Applicable

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Conclusion:

This calculation demonstrates that the 100-K-63 Waste Site meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk as identified in the RDR/RAWP for the 100 Area (DOE/RL-96-17).

Appendix F

**Groundwater and Columbia River Protection Soil Concentrations
for Radionuclides**

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Table F-1. Comparison of Maximum Post-Remediation Soil Concentration to Soil Activities Calculated by RESRAD to be Protective of 100 Area Groundwater and Columbia River

Radionuclide	Radionuclide Drinking Water RAG (pCi/L)	Cleanup Level Protective of Groundwater and Columbia River (pCi/g)	Maximum Soil Concentration (pCi/g)
Cesium-137	60	1,465	1.2
Cobalt-60	100	13,900	0.041
Europium-152	200	NA	0.67
Europium-154	60	NA	0.16
Europium-155	600	NA	0.20
Strontium-90	8	27.6	2.1

NA = Not applicable or not available. For calculated soil activities or cleanup levels protective of groundwater, RESRAD predicts these radionuclides will not reach groundwater within 1,000 years assuming that no uncontaminated vadose zone exists between contamination and groundwater.

RAG = Remedial action goal or drinking water maximum contaminant level (MCL) obtained from 40 CFR 141.66 or from EPA/540-R-00-007, Soil Screening Guidance for Radionuclides: User's Guide) as calculated using National Bureau of Standards (NBS Handbook 69) (NBS 1963) maximum permissible concentrations.

RESRAD = Residual Radioactivity

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Appendix G

Groundwater and Columbia River Protection Soil Concentrations for Nonradionuclides

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Table G-1. Summary of Comparison of Maximum Post-Remediation Soil Concentration to 100 Area Nonradionuclide Cleanup Levels for Protection of Groundwater and the Columbia River

Contaminant	Soil Cleanup Levels (mg/kg)^a		Maximum Soil Concentration (mg/kg)
	Protective of Groundwater	Protective of the Columbia River	
Chromium VI	4.8	2	0.38

a. Cleanup levels are established in the 1995 Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington (EPA/ROD/R10-95/126) or calculated per WAC 173-340, Method B, unless otherwise noted. Nonradionuclide soil concentrations protective of groundwater and the river are based upon application of the "100 times" rule (WAC 173-340).

EPA = U.S. Environmental Protection Agency

WAC = Washington Administrative Code

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Appendix H
Ecological Screening Levels

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Table H-1. Maximum Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-K-63 Waste Site^a

Hazardous Substance	2007 WAC 173-340, Table 749-3		EPA Ecological Soil Screening Levels ^b				Maximum Soil Concentration (mg/kg)
	Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian ^c	
Background							
Metals							
Chromium VI	--	--	--	--	--	--	130
							0.38

Note: Shaded cells are exceeded by the maximum of the focused or statistical result. Blank cells indicate that a value was not available.

a. Exceeding limits of screening values does not necessarily indicate the existence of risk to ecological receptors. All exceeding limits 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 <http://www.epa.gov/ecotox/ecoss/>.

c. Wildlife.

-- = Not Available

EPA = U.S. Environmental Protection Agency

WAC = Washington Administrative Code

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