AR TARGET SHEET

The following document was too large to scan as one unit, therefore it has been broken down into sections.

DOCUMENT # DOE/EIS-0222D

EDMC # 45015

SECTION 1 **OF** 3

START 9613459.1876

0045015

DOE/EIS-0222D

1 of 5

Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

Summary

August 1996
U.S. Department of Energy
Washington, D.C.

9613459.1877

Cover Sheet

Responsible Agencies: Lead Federal Agency: U.S. Department of Energy

Title: *Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan*

Contacts: For further information on this Environmental Impact Statement call or contact:

Thomas W. Ferns, NEPA Document Manager
Hanford Remedial Action
Environmental Impact Statement
U.S. Department of Energy,
Richland Operations Office
P.O. Box 550, MSIN HO-12
Richland, Washington 99352
(509) 372-0649 or Thomas_W_Ferns@RL.gov

Paul J. Krupin, Project Manager
Comprehensive Land Use Plan
U.S. Department of Energy,
Richland Operations Office
P.O. Box 550, MSIN A5-15
Richland, Washington 99352
(509) 372-1112 or Paul_J_Krupin@RL.gov

For general information on the U.S. Department of Energy's *National Environmental Policy Act* (NEPA) process call 1-800-472-2756 to leave a message or contact:

Carol Borgstrom, Director
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585
(202) 586-4600

Abstract: This document analyzes the potential environmental impacts associated with establishing future land-use objectives for the U.S. Department of Energy's Hanford Site. Impact analysis is performed by examining the consequences (primarily from remediation activities) of the actions determined necessary to achieve a desired future land-use objective. It should be noted that site-specific decisions regarding remediation technologies and remediation activities would not be made by this document, but rather by processes specified in the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* and the *Resource Conservation and Recovery Act of 1976*.

To facilitate the establishment of future land-use objectives, the Hanford Site was divided into four geographic areas: (1) Columbia River, (2) Reactors on the River, (3) Central Plateau, (4) All Other Areas. The future land-use alternatives considered in detail for each of the geographic areas are as follows:

- Columbia River--Unrestricted and Restricted
- Reactors on the River--Unrestricted and Restricted
- Central Plateau--Exclusive
- All Other Areas--Restricted.

A No-Action Alternative also is included to provide a baseline against which the potential impacts of the proposed action can be assessed.

Public Comments: The Draft Environmental Impact Statement is available for review and comment on the internet at http://www.hanford.gov/eis/hraeis/hraeis.htm. A Public Hearing on the Draft Environmental Impact Statement will be announced in August of 1996. Written and oral comments on the Draft Environmental Impact Statement will be accepted until November 1, 1996, at the Washington State addresses or internet address provided above. The U.S. Department of Energy will consider these public comments in preparing the Final Environmental Impact Statement.

This page intentionally left blank.

9613459.1878

Reader's Guide

The U.S. Department of Energy's *Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (DOE-EIS-0222D) is divided into four volumes.

Volume 1 of the Environmental Impact Statement (EIS) includes Chapters 1 through 8, in addition to a section containing helpful information to assist the reader in understanding acronyms, technical terms, and concepts presented in the document. The five key chapters of Volume 1 provide (1) an introduction to the EIS, including a description of the scope of the document and the relationship of the EIS to other *National Environmental Policy Act of 1969* documents, (2) the purpose and need for the EIS, (3) a description of the proposed action and alternatives, (4) a description of the affected environment at Hanford, and (5) potential environmental consequences that would occur from implementation of each alternative, as well as any potential mitigation measures. Additional Chapters in Volume 1 provide a description of the consultations, laws, and requirements related to implementation of EIS alternatives (6), a list of preparers (7), and references (8) to enable the reader to further review and research selected topics.

Volume 2 of the EIS contains two appendices. These appendices present detailed information on and analysis of (A) the scope of the document, including identification of waste sites considered in the impact analysis, (B) the human health risk assessment methodology and calculations.

Volume 3 of the EIS contains ten appendices. These appendices present (C) the ecological risk assessment methodology and calculations, (D) the strategy for remediation of contaminated groundwater, (E) a description of the reference barrier and potential quarry sites that could be used to supply materials for barriers, (F) the methodology for estimating socioeconomic impacts, (G) the methodology for evaluation of air quality impacts, (H) an assessment of costs and physical impacts, (I) the calculation of estimated industrial health and safety occupational losses, (J) a floodplains and wetlands impact assessment, (K) information about Hanford waste sites, and (L) U.S. Environmental Protection Agency guidance on using land-use decisions in remediation.

Volume 4 of the EIS contains Appendix M, "Hanford Site Comprehensive Land Use Plan."

This page intentionally left blank.

9613459.1879

Contents

Introduction 1
- National Environmental Policy Act Process 1
- Hanford Future Site Uses Working Group 1
- Scope of the Environmental Impact Statement 2
- Columbia River 3
- Reactors on the River 3
- Central Plateau 3
- All Other Areas 3
- Facilities and Waste Sites Excluded from Impact Analysis 4
- Waste Types and Environmental Contaminants 6
- The U.S. Department of Energy's Planning Process 7
- Hanford Site Comprehensive Land Use Plan 9

Purpose and Need 13

Alternatives 15
- Development of the Alternatives 15
- Potential Future Land Use Alternatives 16
- Screening for Reasonable Alternatives 16
- Alternatives Analyzed in Detail 17
- Description of Alternatives 19
  - No-Action Alternative 19
  - Columbia River Alternatives 21
  - Reactors on the River Alternatives 22
  - Central Plateau Alternatives 22
  - All Other Areas Alternatives 22

Affected Environment 25
- Geology and Soils 25
- Surface Water 25
- Groundwater 25
- Climate 26
- Ecology 26
- Cultural Resources 26
- Socioeconomic 26
- Visual Resources 27
- Contaminants 27

Environmental Consequences 29
- Impacts to Soils and Geologic Resources 29
- Impacts to Water Resources 30
- Impacts to Air Resources 30
- Human Health Risks 30
- Impacts to Ecological Resources 34
- Impacts to Cultural Resources 34
- Socioeconomic Impacts 35
- Cumulative Impacts 35

Unavoidable Adverse Impacts 36
Irreversible and Irretrievable Commitments of Resources 37
Potential Mitigation Measures 38
Conflict with Land Use Plans of Other Federal and State Agencies and Tribal Governments 39
Environmental Justice 39
Relationship Between Near-Term Use and Long-Term Productivity 39
Consultations and Environmental Requirements 40

List of Figures

Figure S-1. Hanford Site Existing Land Use Map - 1996 10

Figure S-2. Hanford Site Proposed Comprehensive Land Use Plan Map - 1997 11

Figure S-3. Hanford Site Projected Land Use Map - 2046 12

List of Tables

Table S-1. Comparison of U.S. Department of Energy Planning Efforts for Future Land Uses at the Hanford Site 8

Table S-2. Relationship Between the Hanford Future Site Uses Working Group Land-Use Options, Cleanup Scenarios, and Environmental Impact Statement Future Land-Use Alternatives. 18

Table S-3. Future Land-Use Alternatives for the Columbia River Geographic Area 21

Table S-4. Future Land-Use Alternatives for the Reactors on the River Geographic Area 23

Table S-5. Future Land-Use Alternatives for the Central Plateau Geographic Area 24

Table S-6 Future Land-Use Alternatives for the All Other Areas Geographic Area. 24

Table S-7. Future Exposed Populations and Estimated Cancer Incidences for Each Geographic Area and Future Land-Use Alternative (assuming loss of institutional controls at the Hanford Site 33

Table S-8 Agency Consultations. 41

9613459.1880

National Environmental Policy Act Process

The U.S. Department of Energy (DOE) is proposing to establish future land-use objectives for the Hanford Site, which is an area of about 1,450 km^2 (~560 mi^2) of government land located in southeastern Washington State. These objectives would guide the process of remediating the radioactive and hazardous wastes that were generated during the Site's defense nuclear materials production mission. This proposed action would facilitate the development of a coordinated, cost-effective strategy for remediation of Hanford's hazardous and radioactive waste sites by integrating established future land uses into remediation decisions. The designation of future land uses would help ensure that the DOE makes effective use of the public's resources while providing protection of human health and the environment during remediation.

The *National Environmental Policy Act of 1969* (NEPA) requires the consideration of environmental impacts from federal agency actions, and greatly increases public involvement in the decisionmaking process. In accordance with the spirit of NEPA, the DOE has prepared the Environmental Impact Statement (EIS) to (1) assess various alternatives for establishing future land-use objectives for the Hanford Site and (2) provide the necessary background data and analyses to help decisionmakers and the public understand the potential environmental impacts of each alternative. Following consideration of public comments on the EIS, the DOE will modify the document, as appropriate, and then issue the final EIS. After preparation of the final EIS, the DOE will issue a Record of Decision (ROD). This ROD will document the DOE's selection of the land-use alternatives to be implemented at the Hanford Site.

National Environmental Policy Act

National Environmental Policy Act of 1969: A law that requires federal agencies to consider the potential environmental effects of proposed actions and measures to avoid or minimize the adverse effects of the proposed actions in the decisionmaking process.

Alternatives: The range of reasonable options, including the No-Action Alternative, considered in selecting an approach to meeting the objectives of the proposed action.

Environmental Impact Statement: A detailed environmental analysis for a proposed major federal action that could significantly affect the quality of the human environment. A tool to assist in decisionmaking; it describes the positive and negative environmental effects of the proposed action, and alternatives to the proposed action.

Record of Decision: A concise public record of the decisionmaking process, which discusses the decision, identifies the alternatives, and indicates whether all practicable means to avoid or minimize environmental harm from the selected alternative were adopted (and if not, why not).

Hanford Future Site Uses Working Group

As part of the public scoping process for the EIS, and in an attempt to foster participation by interested stakeholders, the Hanford Future Site Uses Working Group (Working Group) was established in 1992. The Working Group included representatives from labor, environmental, governmental, Tribal, agricultural, economic development, and citizen-interest groups.

The Working Group had three primary objectives.

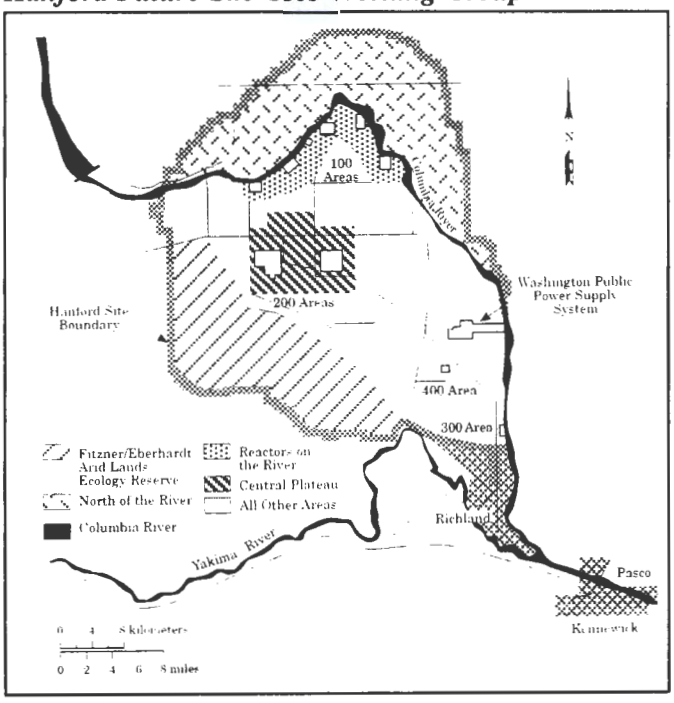
- Identify a range of potential future uses for the Hanford Site.
- Select cleanup scenarios enabling the future uses in light of potential exposure to contaminants, if any, after cleanup.
- Probe for convergence among the cleanup scenarios to identify priorities or criteria that could prove useful in focusing or conducting the cleanup.

The efforts of the Working Group were based on the assumption that remediation activities at the Hanford Site would benefit from having a better understanding of the potential future uses of Hanford lands. This understanding could focus the efforts of the DOE, state and federal regulators, Congress, and the public, on the manner of remediation needed and the most important objectives to accomplish over time. The DOE, the Washington State Department of Ecology, and the U.S. Environmental Protection Agency (EPA) made a commitment to use the findings of the Working Group to guide relevant aspects of remediation decisions.

Scope of the Environmental Impact Statement

The EIS presents an assessment of the potential environmental impacts, primarily from remediation activities, associated with establishing future land-use objectives for the Hanford Site.

Six Geographic Areas Established by the Hanford Future Site Uses Working Group



The EIS has adopted the geographic areas and levels of access concepts developed by the Working Group. The Working Group divided the Hanford Site into six distinct geographic areas and considered various levels of access for each geographic area. The four geographic areas included within the scope of the EIS include:

- Columbia River (Hanford Reach)
- Reactors on the River (100 Areas)
- Central Plateau (200 Areas)
- All Other Areas (300, 400, 600, 1100, and 3000 Areas).

Waste sites on the remaining two geographic areas, North of the River (North Slope) and the Fitzner/Eberhardt Arid Lands Ecology (ALE) Reserve have been remediated, and are not included in the scope of the EIS.

However, for cohesive land-use planning purposes, the North Slope and the ALE Reserve are included in Appendix M, "Hanford Site Comprehensive Land Use Plan," and their future land uses will be addressed in the ROD.

Columbia River. An 82-km (51-mi) stretch of the Columbia River, known as the Hanford Reach of the Columbia River (Hanford Reach), borders or flows through the Hanford Site. This stretch of the river offers a unique example of the riparian (riverside) ecology characteristics of the Columbia Basin ecosystem that existed before construction of hydroelectric dams on the river. The Columbia River is a valuable regional resource. River water downstream from the Hanford Site is used by both Washington and Oregon residents for drinking water, agriculture, industry, transportation, and recreation.

As indicated in environmental monitoring reports and site investigations, groundwater contamination from the Hanford Site reaches the Columbia River (through springs and seeps) at several locations. Potential contamination sources in the river include reactor effluent lines that protrude into the river, and river sediment contaminated by past waste disposal practices. However, the Hanford Reach is classified as a Class A river (suitable for essentially all uses, including drinking water, wildlife habitat, and recreation), and the U.S Department of the Interior has been recommended it for protection as a Wild and Scenic River.

Reactors on the River. This geographic area occupies approximately 68 km^2 (26 mi^2) along the southern shoreline of the Columbia River, and contains all the facilities in the 100 Areas (including the nine plutonium production reactors and associated facilities). Extensive contamination exists in some portions of the Reactors on the River surface soils, subsurface soils, and groundwater. Some concentrations of groundwater contaminants exceed EPA drinking water standards. Contamination has reached the Columbia River from the 100 Areas through groundwater seepage.

Central Plateau. The Central Plateau geographic area occupies approximately 115 km^2 (44 mi^2) in the central region of the Hanford Site. Facilities in the Central Plateau, which are situated in the 200 East and 200 West Areas, were built to process irradiated fuel from the production reactors in the 100 Area. The operation of these facilities resulted in the storage, disposal, and unplanned releases of radioactive and nonradioactive waste. Current operations on the Central Plateau are associated with the management and disposal of waste. Extensive contamination exists in surface soils, subsurface soils, and groundwater. Contaminated groundwater has moved out of the Central Plateau into adjoining areas of the Hanford Site.

All Other Areas. The All Other Areas geographic area comprises approximately 624 km^2 (241 mi^2) in the 300, 400, 600, 1100, and 3000 Areas.

The 300 Area is located immediately north of the City of Richland, and covers 1.5 km^2 (0.6 mi^2). Reactor fuel fabrication facilities were located in this area. The 300 Area is the principal location of nuclear research and development facilities serving the Hanford Site. Wastes in this area have resulted primarily from fuel-fabrication processes and various research and development projects. Some of these wastes have entered the groundwater.

The 400 Area, located southeast of the 200 East Area, is the site of the Fast Flux Test Facility (FFTF). The DOE has announced plans to close the FFTF and its associated support facilities; a consortium of private companies has expressed an interest in purchasing and operating the facility. Much of the 400 Area overlies groundwater contaminant plumes that originated in the Central Plateau.

The 600 Area includes all of the lands within the Hanford Site not occupied by the 100, 200, 300, 400, 1100, and 3000 Areas. Lands within the ALE Reserve and the North Slope (also known as the Wahluke Slope) are part of the 600 Area. However, since these areas were recognized as distinctly separate geographic entities by the Working Group, they are excluded from the All Other Areas geographic area in the EIS. Extensive groundwater contamination underlies most of the 600 Area, most of which originated in the Central Plateau. Nitrate plumes are entering this geographic area from offsite non-Hanford sources.

The 1100 Area, located immediately north of the City of Richland, serves as the central warehousing, vehicle maintenance, and transportation operations center for the Hanford Site. Hazardous waste in this area resulted from the disposal of batteries, paints, solvents, and antifreeze. These sites have been remediated.

The 3000 Area, located northeast of the 1100 Area, accommodates engineering and construction support facilities. The 3000 Area is relatively uncontaminated, and discussions are underway to turn this property over to other government entities that have a need for the facilities.

Within the four geographic areas, the EIS addresses the waste sites regulated under *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and *Resource Conservation and Recovery Act of 1976* (RCRA) past practices. Decommissioning of surplus facilities for which the DOE is ready to make decommissioning decisions is addressed, along with the closure of RCRA waste treatment, storage, and/or disposal (TSD) units located in or near past-practice waste sites. All chemical and radiological contaminants associated with these waste sites, TSD units, and surplus facilities also are included within the scope of the EIS.

Facilities and Waste Sites Excluded from Impact Analysis

The following facilities and waste sites are excluded from impact analysis in the EIS. However, for comprehensive land-use planning purposes, the geographic areas where the wastes are located are within the scope of the EIS. Some of the impacts associated with these activities are analyzed cumulatively in the EIS; other associated impacts are or will be more extensively analyzed in other environmental documents.

- Wastes and the associated environmental impacts from future land uses implemented after remediation is complete.

- The 149 single-shell tanks (SST), 28 double-shell tanks (DST), and their associated piping, structures, and contaminated soils. The management of SST and DST waste is the subject of an EIS that is under preparation for the Tank Waste Remediation System.

- The waste sites included in the Hanford Site's 1100 Area CERCLA National Priorities List operable units. CERCLA remedial actions for these sites have been categorically excluded from documentation requirements under the provisions of NEPA. The selected remedies include (1) leaving the materials in place and landfill capping, and (2) natural attenuation and monitoring of groundwater plumes for compliance.

- The Environmental Restoration Disposal Facility, which has a separate regulatory package that consists of a CERCLA Remedial Investigation/Feasibility Study, a NEPA roadmap, and a CERCLA ROD.

- The major facilities, including associated wastes, scheduled for decommissioning as part of the *Richland Environmental Restoration Project Plan*. These facilities include B Plant, T Plant, U Plant, the Reduction Oxidation Plant, the Plutonium-Uranium Extraction Plant, the Plutonium Finishing Plant, the Waste Encapsulation and Storage Facility, the 105-N Reactor (N Reactor), and the Fast Flux Test Facility. These facilities would receive appropriate levels of environmental reviews under NEPA or CERCLA before any action is taken.

- Current or planned actions covered in the *Final Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes* (e.g., the Hanford Waste Vitrification Plant, the Waste Receiving and Processing Facility, pre-1970 suspect transuranic [TRU] waste, and retrievably stored and newly generated TRU waste).

- Current or planned actions covered in the *Environmental Impact Statement: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (e.g., B, C, D, DR, F, H, KE, and KW reactors).

- Liquid wastes from the 200 Area Effluent Treatment Facility that are disposed of in the state-approved land disposal site located north of the 200 West Area.

Types of Waste at the Hanford Site

Low-Level Waste: Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic elements is less than 100 nCi/gram.

High-Level Waste: The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly from reprocessing and any solid waste derived from the liquid that contains a combination of transuranic and fission product nuclides in quantities that require permanent isolation. High-level waste may include other highly radioactive material that the U.S. Nuclear Regulatory Commission, consistent with existing law, determines by rule to require permanent isolation.

Transuranic Waste: Waste containing more than 100 nCi of alpha emitting transuranic isotopes with half lives greater than 20 years/gram of waste except for (a) high-level radioactive waste, (b) waste that the DOE has determined, with concurrence of the Administrator of the U.S. Environmental Protection Agency, does not need the degree of isolation required by 40 CFR 191, and (c) waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61. Transuranic radionuclides are neptunium, plutonium, americium, californium, curium, and berkelium. Other non-transuranic elements can be included by agreement with the Office of Environmental Management.

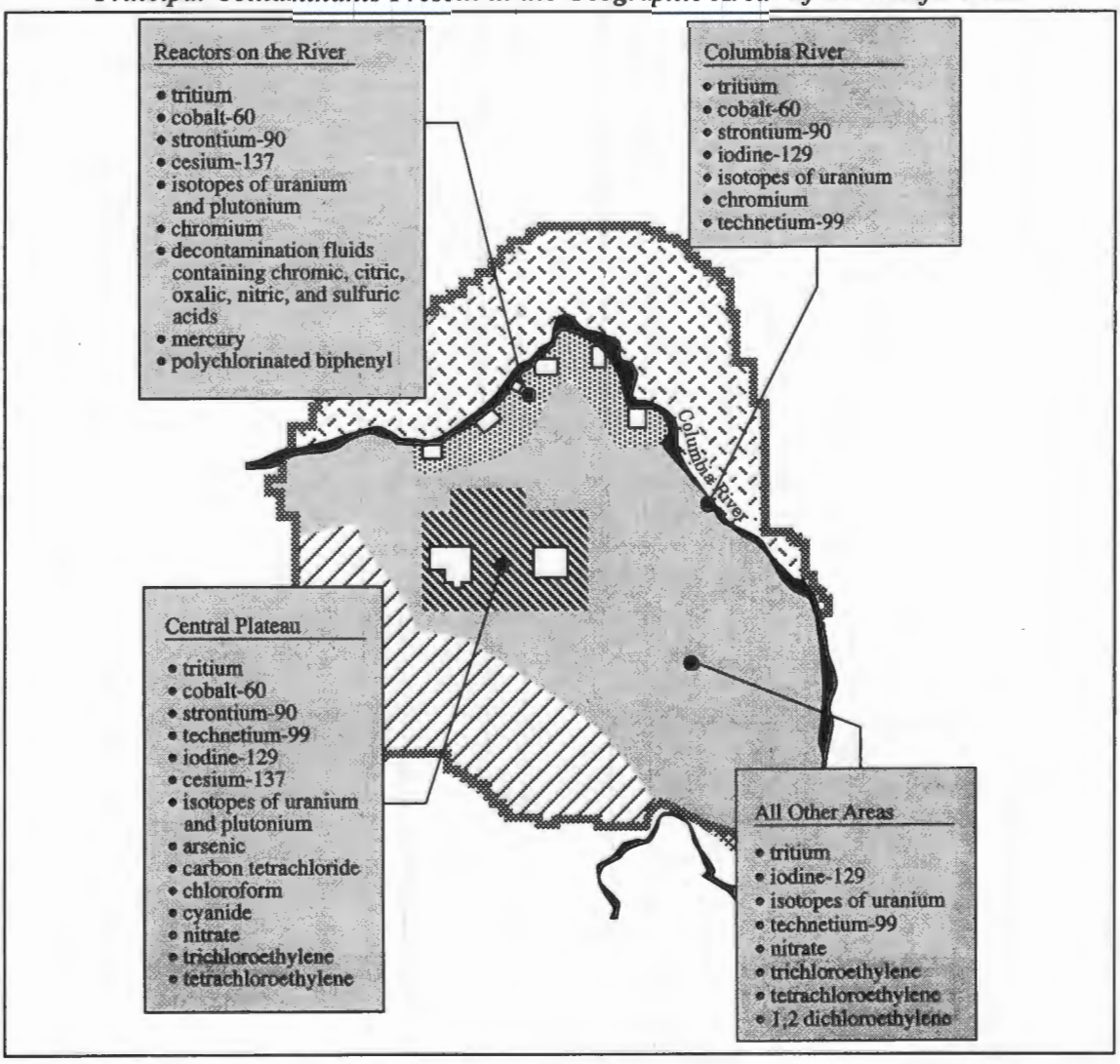
Hazardous Waste: Under the *Resource Conservation and Recovery Act of 1976*, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Source, special nuclear material, and byproduct material, as defined by the *Atomic Energy Act of 1954*, are specifically excluded from the definition of solid waste.

Mixed Waste: Waste that contains both hazardous waste under the *Resource Conservation and Recovery Act of 1976* and source, special nuclear, or byproduct material subject to the *Atomic Energy Act of 1954*.

Waste Types and Environmental Contaminants

Radioactive and hazardous wastes are found in individual sites throughout the Hanford Site. Many sites contain waste contaminated with a combination of radioactive and hazardous materials. Wastes containing both radioactive and hazardous constituents are termed mixed wastes and pose complex exposure, management, and regulatory problems. Under the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), these individual waste sites are organized into operable units, based on geographic proximity or similarity of waste disposal history. The operable units are located primarily in the operating areas of the Hanford Site. However, for the purposes of the EIS, the waste sites are discussed in the context of the geographic areas concept established by the Working Group.

Principal Contaminants Present in the Geographic Areas of the Hanford Site



9613459.1883

The U.S. Department of Energy's Planning Process

Several DOE future land-use initiatives that make future land use assumptions or identify broad goals for future land uses are being prepared. Table S-1 presents a comparison of the potential land use assumptions or goals of the *Baseline Environmental Management Report* (BEMR), the *Hanford Strategic Plan* (Strategic Plan), and the EIS (including Appendix M, 'Hanford Site Comprehensive Land Use Plan') (Comprehensive Plan).

The BEMR is the first of a series of annual reports on the activities and potential costs required to address the waste, contamination, and surplus nuclear facilities across the country that are the responsibility of the DOE's Office of Environmental Management. The BEMR provides life-cycle cost estimates, tentative schedules, and projected activities necessary to remediate DOE sites. Many broad assumptions were required to estimate the long-range costs and schedules, including assumptions regarding future land uses, remediation levels, and priority rankings. The BEMR should not be interpreted as final DOE policy or long-term plans; instead, it is a tool to help guide overall policy development for the DOE complex.

The Strategic Plan establishes the top level operational direction for Hanford, and provides a measurable path to achieve Hanford missions. The Strategic Plan, and its associated mission-direction document, define the guidance and requirements needed to develop detailed project plans and performance measures that are necessary for fulfillment of Hanford's missions. The Strategic Plan reflects NEPA and CERCLA RODs and is currently being revised; it is expected to be completed during the fall of 1996.

The EIS presents information to the decisionmaker on potential future land uses for the Hanford Site and provides an assessment of the impacts (primarily from remediation activities) associated with achieving the future land-use objectives. The function of the EIS is to obtain input from the public and stakeholders, document the process of developing future land-use objectives, and determine the environmental costs and benefits associated with remediating the Site to achieve the land-use objectives. The EIS identifies irreversible and irretrievable commitments of resources pursuant to NEPA and CERCLA in order to fulfil the DOE's congressionally mandated missions.

The comprehensive planning process presented in Appendix M of the EIS utilizes the environmental analysis developed in the EIS, and designates site-specific land uses required to support all the missions identified in the Strategic Plan through the evaluation of land use opportunities and constraints posed by natural, cultural, and socioeconomic factors. The DOE is coordinating planning efforts with Tribal and local governments to consider the long-term goals and objectives of Hanford Site stakeholders during development of the Comprehensive Plan.

Early community involvement in the preparation of the EIS and the Comprehensive Plan should result in a more participatory and better-informed decisionmaking process; greater community support for remediation remedies selected as a result of this process; and more expedited remediation. The DOE, EPA, and Ecology will be able to rely on the future land uses identified in the EIS and Comprehensive Plan during development of remedial alternatives.

Table S-1. Comparison of U.S. Department of Energy Planning Efforts for Future Land Uses at the Hanford Site.

Geographic Areas	Baseline Environmental Management Report Future Use Assumptions	Strategic Thinking Preliminary Goals	EIS Future Land-Use Alternatives	Comprehensive Plan Land-Use Designations
Columbia River	Recreational	Pending Congressional action on the Wild and Scenic River designation, use would continue to be restricted; sensitive ecological, cultural, and Native American resources would be protected	Unrestricted Use Restricted Use No Action	Wildlife Habitat and Management Controlled Access and Recreation Special Use Areas
Reactors on the River	Open Space Wildlife Management	Remove and/or stabilize spent fuel, surplus facilities, and waste sites to eliminate the potential for future contamination of groundwater and the Columbia River and to ensure protection of people, the environment, and natural/cultural resources. The DOE would retain control of this land throughout the remediation mission and would protect archaeological, cultural, and environmental resources.	Unrestricted Use Restricted Use No Action	Environmental Restoration Open Space Restricted Controlled Access and Recreation Special Use Areas
Central Plateau	Industrial Commercial	The 200 Area and the Central Plateau would be used for management of nuclear materials, collection and disposal of waste materials that remain onsite, and other related and compatible uses. Remediation levels and disposal standards that are consistent with these long-term uses would be established.	Exclusive Use No Action	Waste Management
All Other Areas - Central Core	Open Space Wildlife Management	This area would remain in federal ownership, which is consistent with safety analysis boundaries and continued waste management operations in the 200 Area. These areas would be available for other federal programs or leased for nonfederal uses, consistent with appropriate recognition of cultural and ecosystem values.	Restricted Use No Action	Open Space Restricted Special Use Zone
All Other Areas - South 600 Area	Industrial Commercial	The 300 Area waste sites, materials, and facilities would be remediated to allow industrial and economic transition opportunities. The Federal Government would retain ownership of land in and adjacent to the 300 Area, but would lease land for private and public uses to support regional industrial and economic development. Excess land within the 1100 and 3000 Areas would be targeted for transition to nonfederal ownership.		Potential Economic Development Zone Industrial

Hanford Site Comprehensive Land Use Plan

The Comprehensive Plan is integrated with the EIS as Appendix M, to guide land- and facility-use decisions through an analysis of potential land-use opportunities and constraints. In a manner consistent with CEQ guidance, the Comprehensive Plan relies on the evaluation of environmental impacts presented in the EIS. The ROD issued for the EIS will document the decisions relating to finalization and adoption of the Comprehensive Plan. The EIS, which includes the Comprehensive Plan, is expected to outline a strategy for the Hanford Site over the next 50 years.

To perform the Comprehensive Plan analysis and determine future land uses, a series of constraint tables and maps were prepared to depict the relevant site characteristics that pose issues to land-use activities. Based on this information, maps of existing (Figure S-1), proposed (Figure S-2), and projected (Figure S-3) land-uses were prepared for the Hanford Site. The development of the proposed and projected land-use maps considered values important to land-use planning.

Land-Use Designations and Definitions used in Figures S-1, S-2, and S-3

Waste Management (WM): Areas used primarily for treatment, storage, and disposal of hazardous, radioactive, and nonradioactive wastes. Includes environmental restoration, industrial and commercial, and business land-use activities.

Environmental Restoration (ER): Areas used primarily for characterization and remediation of reactor operation sites, land, facilities, and groundwater. Includes compatible industrial and commercial land-use activities.

Industrial and Commercial (IC): Areas used primarily for a wide range of industrial and commercial activities. Includes required environmental restoration and business land-use activities.

Business (B): Areas used for a wide range of administration and office activities.

Wildlife and Habitat Management (WHM). Areas used primarily for protection and management of diverse biological resources, including both plant and animal communities. May include areas for special use or controlled access and recreation land-use activities, and environmental restoration activities.

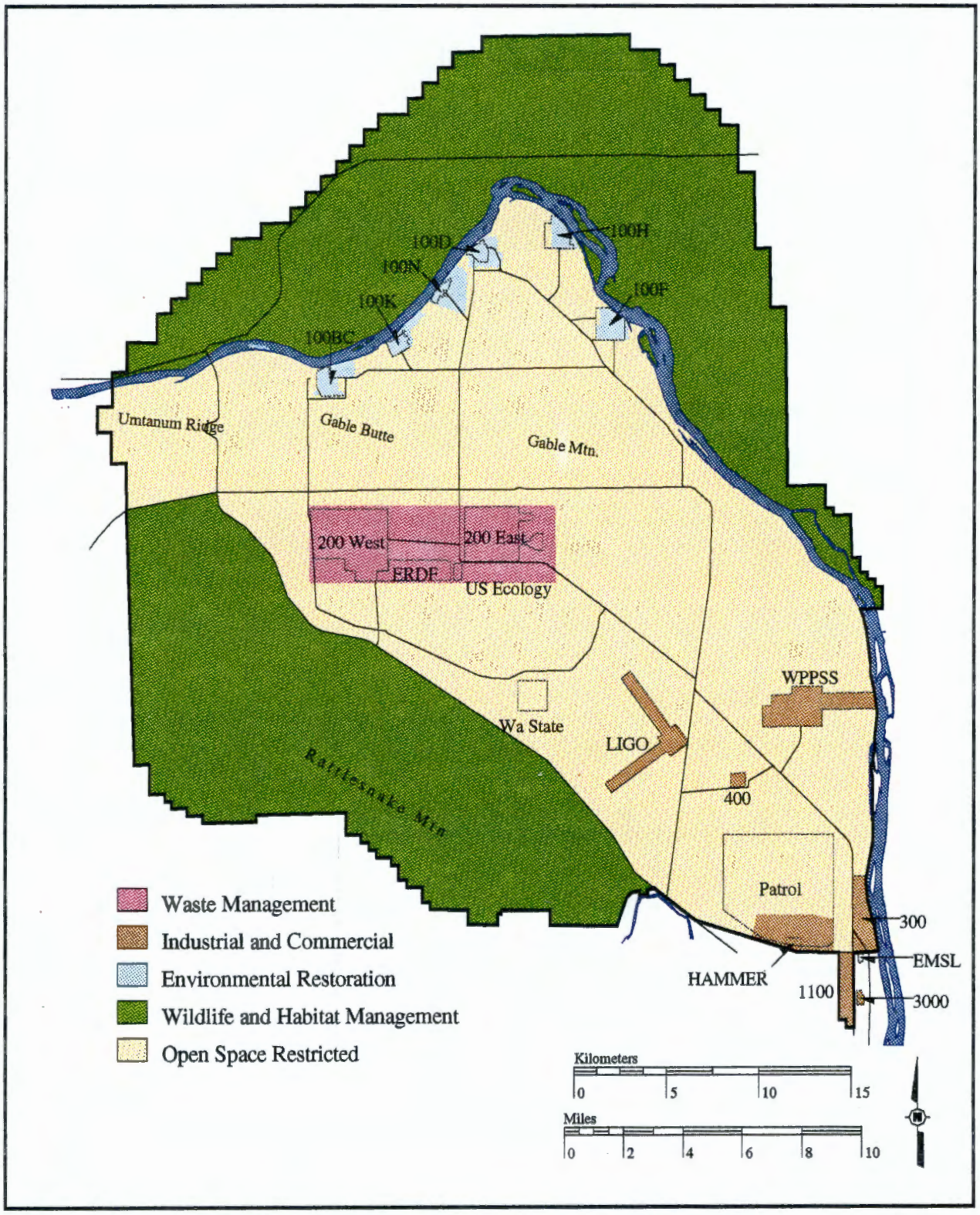
Open Space Restricted (OSR): Areas restricted from access, based on constraints and implementation requirements, to support existing missions. Includes areas identified for potential compatible development to meet future projects and mission needs. Includes use of an area for environmental restoration activities, wildlife and habitat management, and approved Tribal activities.

Special Use Areas (SUA): Areas identified as unique and limited resources that require protection for a specific use or uses.

Potential Economic Development Zone (PEDZ): Identifies a geographic zone north and west of the 300 Area where a significant number of potentially compatible economic development activities or proposals have been identified. This is not an industrial or commercial land-use designation, but rather an identification of a contiguous geographic area in which the majority of potentially viable economic development proposals received, by the DOE to date, tend to be located.

Controlled Access and Recreation (CAR): Potential range of uses to areas identified for tourism, visitor, fishing, boating, hiking, wildlife viewing, and biking activities, based on constraints and implementation requirements. Controlled access, at a minimum, entails approved Tribal usage, and escorted day trips.

Figure S-1. Hanford Site Existing Land Use Map - 1996.



9613459.1885

Figure S-2. Hanford Site Proposed Comprehensive Land Use Plan Map - 1997.

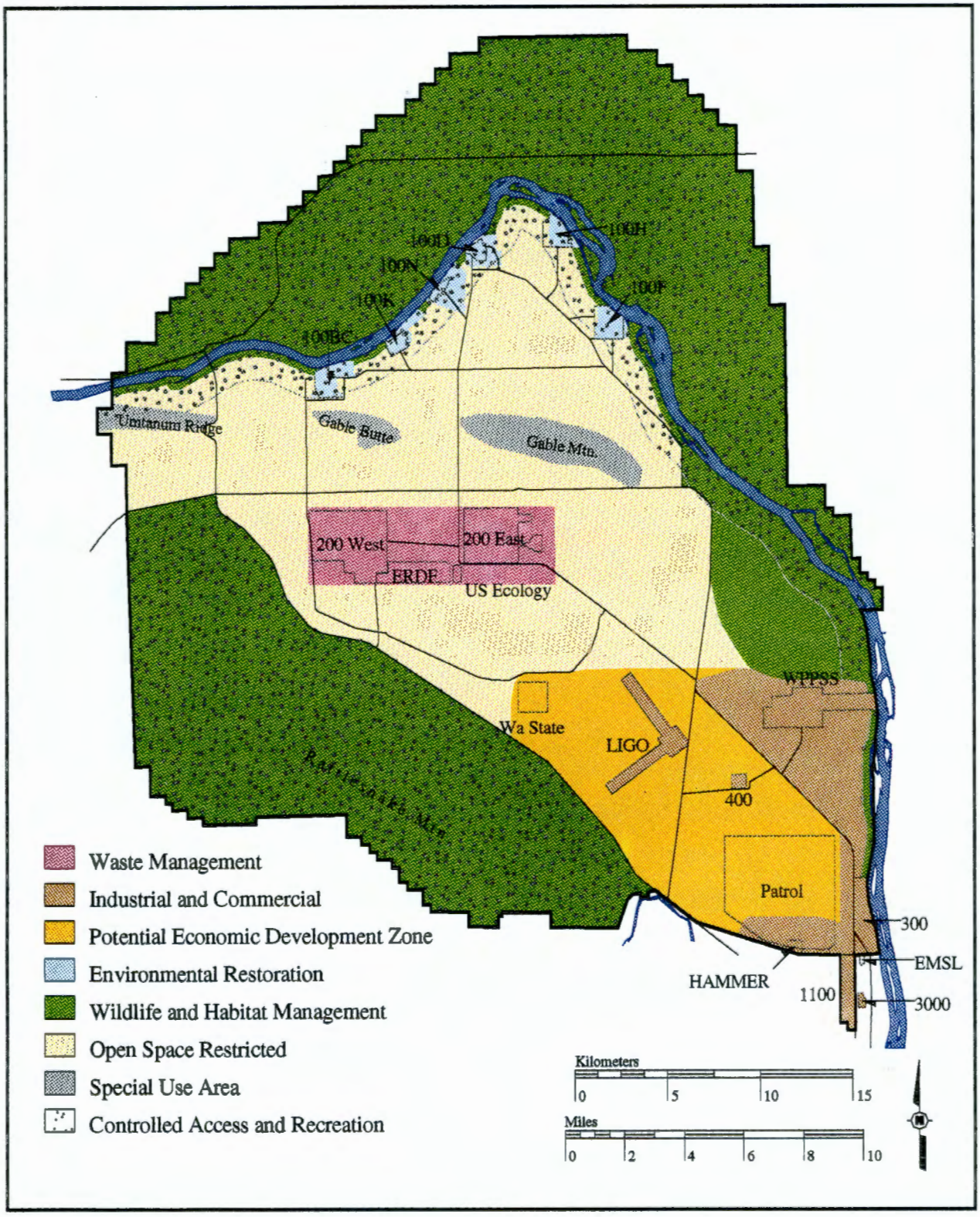
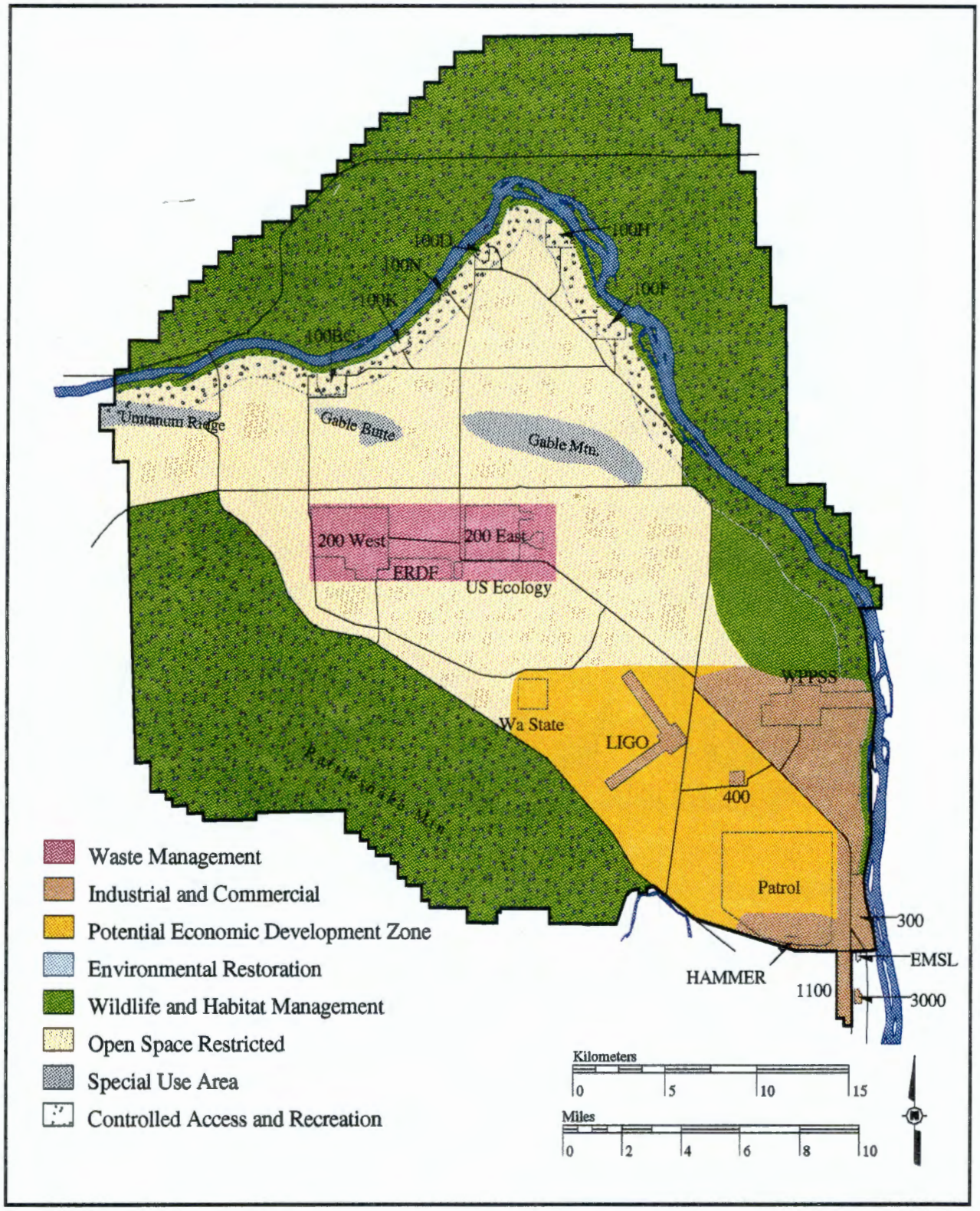


Figure S-3. Hanford Site Projected Land Use Map - 2046.



9613459.1886

Purpose and Need

The DOE needs to establish future land-use objectives to develop a coordinated, cost-effective, and technically sound remediation strategy for the Hanford Site. By establishing these objectives, the decisionmaking process would be streamlined, and the DOE could realize significant cost and time savings in future remediation activities.

The underlying purpose of this action is to facilitate the change in Hanford's primary mission from production of nuclear materials for national defense to environmental restoration and long-term management of wastes. As part of this transition, the DOE must determine the optimum use of Hanford Site lands, facilities, and resources and how these lands and facilities should be remediated to allow for beneficial future uses. As a transition to the new mission, the *Richland Environmental Restoration Project Plan* was developed to provide information about the mission needs and objectives, technical planning, project schedule, and resource planning necessary for remediation of past-practice waste sites and surplus facilities.

The role of this EIS is to document, in the public forum, the process of determining the best combination of potential land uses, remediation benefits, and remediation costs. Through this EIS, the DOE is responding to the need to:

- Evaluate the potential overall cumulative impacts from implementing the *Richland Environmental Restoration Project Plan*, including costs.
- Ensure that sitewide future land-use objectives are considered during the selection of remediation methods.
- Develop a comprehensive land use plan for the Hanford Site in accordance with DOE Order 430.1, *Life-Cycle Asset Management*.
- Identify the irreversible and irretrievable commitment of natural resources necessary to implement the *Richland Environmental Restoration Project Plan*.

The goal of the EIS is to provide decisionmakers with the information necessary to make an informed decision about the environmental impacts associated with Hanford Site remediation. The EIS provides the information needed to balance environmental impacts with (1) programmatic needs, and (2) the wishes of the public, in determining future land-use objectives for the Hanford Site. By integrating these land-use objectives in remediation decisions, the DOE will help Hanford regulators develop a coordinated, cost-effective remediation strategy. The comprehensive land-use planning process presented in the EIS designates the site-specific land uses required to support Hanford Site missions.

In June 1994, the Secretary of Energy issued the "Secretarial Policy Statement on the National Environmental Policy Act," which provides that the Department normally will rely on the CERCLA process for reviewing actions to be taken under CERCLA and primarily will address NEPA values and public involvement procedures through the CERCLA process. The policy also contemplates, however, that NEPA reviews may be undertaken in consultation with stakeholders and as a matter of policy for specific proposed actions. Since the proposed action to be taken under the EIS (i.e., to establish broad land use objectives) serves programmatic purposes in addition to supporting CERCLA actions, and in recognition of the support expressed by the Department's stakeholders for the preparation of the EIS, the Department has determined to prepare the EIS consistent with the 1994 NEPA policy statement.

9613459.1887

Development of the Alternatives

Future land-use alternatives were developed using input from the EIS scoping process. A report produced by the Working Group, entitled *The Future for Hanford: Uses and Cleanup, A Final Report of the Hanford Future Site Uses Working Group,* formed the basis for developing a range of alternatives by defining the geographic areas and identifying the levels of access for each geographic area. For the purposes of the EIS, the Working Group's levels of access were adopted and modified to reflect the needs of the DOE's continuing missions at the Hanford Site. The future land-use alternatives used in the EIS are described as follows:

- **Unrestricted Land Use.** Residual contamination does not preclude any human uses; however, access or certain uses might be controlled for other reasons, (e.g., physical hazards, cultural resource protection, habitat protection).

- **Restricted Land Use.** Residual contamination precludes some human uses; restrictions could apply to the use or disturbance of surface soils, subsurface soils, surface water, or groundwater.

- **Exclusive Land Use.** Potential health risks due to residual contamination would limit use and require strict controls on access. Use of the area would be limited to (1) the management of radioactive and hazardous materials and (2) similar and compatible uses. Control of the area would be maintained by the DOE. Exclusive-use areas would include buffer zones around active facilities.

Under each of the future land-use alternatives, remediation would result in risk reductions to levels protective of human health and the environment. However, the means by which risks would be reduced differ. In developing the alternatives, risk was assumed to be lowered to acceptable levels for unrestricted use primarily through the removal of waste. For the restricted and exclusive use scenarios, the analyses assumed that risk would be lowered through continued access restrictions, removal of waste, and/or other engineering and institutional controls.

The DOE is currently undecided about which combination of potential future land-use alternatives would make the best use of public resources. The information in this EIS is being presented to the public with the intent that the public will assist the DOE in formulating a long-term land use plan for the Hanford Site. After this EIS has been released to the public, and comments have been received, a preferred alternative will be developed and presented in the Final EIS, which should be available in late 1996.

Potential Future Land Use Alternatives

The levels of access were applied to each of the four geographic areas of the Hanford Site to develop a range of potential future land-use alternatives.

The full range of future land-use alternatives were considered for each geographic area with one exception. The exclusive future land-use alternative for the Columbia River geographic area was not considered viable because the DOE does not control the river and cannot impose exclusive use restrictions on the Columbia River.

Potential Future Land-Use Alternatives

Geographic Area	Levels of Access		
Columbia River	U	R	NA
Reactors on the River	U	R	E
Central Plateau	U	R	E
All Other Areas	U	R	E

E = Exclusive Land Use.
NA = Not Applicable.
R = Restricted Land Use.
U = Unrestricted Land Use.

The future land-use designation would determine the level and type of remediation required for each geographic area. Although much of the land surface within the geographic areas is uncontaminated (i.e., the undeveloped lands located between the operations areas), future uses within each geographic area would be bounded by the amount of remediation achieved at waste sites rather than by the condition of surrounding uncontaminated areas. The DOE would focus on remediation of contaminants to levels that allow the designated future land-use across the entire geographic area.

Screening for Reasonable Alternatives

Although all of the potential future land-use alternatives are possible, some alternatives might be unreasonable or impractical to implement. The CEQ considers reasonable alternatives to be those that are practical or feasible from a common sense, technical, and economic standpoint. Using the CEQ guidance, three criteria were developed and used to screen the alternatives, to eliminate from further consideration those alternatives determined to be unreasonable. The screening criteria were:

1. The alternative should be technically feasible.
2. The alternative should be economically feasible.
3. The alternative should be feasible from a common sense standpoint.

Screening of Potential Future Land-Use Alternatives

Geographic Area	Future Land-Use Alternatives			
Columbia River	U	R	NA	No Action
Reactors on the River	U	R	E	No Action
Central Plateau	U	R	E	No Action
All Other Areas	U	R	E	No Action

E = Exclusive.
NA = Not Applicable.
R = Restricted.
U = Unrestricted

Using these screening criteria, the list of potential future land-use alternatives was reduced to 6. The shaded areas identify the alternatives determined to be unreasonable based on failure to meet one or more of the screening criteria. These alternatives were eliminated from further consideration.

Alternatives Analyzed in Detail

As a result of the screening process, a list of future land-use alternatives determined suitable for detailed analysis was compiled and includes:

- Columbia River
  - Unrestricted Future Land Use
  - Restricted Future Land Use
  - No Action

- Reactors on the River
  - Unrestricted Future Land Use
  - Restricted Future Land Use
  - No Action

- Central Plateau
  - Exclusive Future Land Use
  - No Action

- All Other Areas
  - Restricted Future Land Use.
  - No Action

With the exception of the No-Action Alternative, these alternatives would allow land uses similar to those envisioned by the Working Group, while allowing the DOE's continuing missions at the Hanford Site to be fulfilled.

Table S-2 identifies the relationships between the potential land-use options and cleanup scenarios established by the Working Group, and the EIS future land-use alternatives and for each geographic area. The DOE used the Working Group's potential land-use options and cleanup scenarios to identify which *Hanford Site Risk Assessment Methodology* exposure scenarios best fit the EIS future land-use alternatives. Exposure scenarios are assumptions that establish all of the potential ways (pathways) contaminants could injure a receptor. The general intent when developing exposure scenarios is to overestimate exposures to have some degree of certainty that the true exposure will be lower than the estimated exposure. Similarly, the intent is not to precisely estimate exposure, but to ensure that all relevant and important aspects of a person's lifestyle have been incorporated into high-end exposure scenarios so that the same degree of conservativeness is applied to both the suburban and the subsistence/traditional scenarios. Although the exposure scenarios are labeled with land-use names, they actually are based on activities instead of land uses. The exposure parameters associated with these scenarios (i.e., groundwater accessibility or exposure duration) are determined during the CERCLA process through discussions between the DOE and the regulators. The analyses contained in the EIS would be used during these discussions to establish reasonably foreseeable land uses within the remediation areas.

Table S-2. Relationship Between the Hanford Future Site Uses Working Group Land-Use Options, Cleanup Scenarios, and Environmental Impact Statement Future Land-Use Alternatives.

WORKING GROUP LAND-USE OPTIONS	WORKING GROUP CLEANUP SCENARIOS	ENVIRONMENTAL IMPACT STATEMENT FUTURE LAND-USE ALTERNATIVES
COLUMBIA RIVER		
1. Wildlife and Recreation 2. Recreational and Related Commercial, Scenic and Economic Uses 3. Native American Uses	Unrestricted (All Options)	Unrestricted (Agricultural)*
		Restricted (Recreational, Industrial, or Residential)*
REACTORS ON THE RIVER		
1. Native American Uses 2. Wildlife and Recreation 3. Limited Recreation, Recreation-Related Commercial Uses, and Wildlife 4. B Reactor as a Museum/Visitor Center	All Unrestricted	Unrestricted (Agricultural)*
	Clean Enough for Land Use Option 3 (Option 3) Unrestricted; B Reactor Restricted (Option 4)	Restricted (Residential Industrial, or Recreational)*
CENTRAL PLATEAU		
1. Onsite Waste and Existing Obligations for Disposal 2. Option 1 plus Offsite DOE Waste for Treatment Only 3. Option 2 plus Offsite Commercial Waste for Treatment Only 4. Option 3 plus Offsite DOE Waste: long-term storage of TRU and HLW, and Disposal of LLW 5. Option 4 plus Commercial SNF for long-term MRS 6. Option 5 plus Compatible Commercial or Industrial Activity	Exclusive Use with Buffer (All Options)	Exclusive (Industrial)* (within the squared-off area between and including the 200 West and 200 East Areas and the industrial region located east of the 200 East Area)
ALL OTHER AREAS		
1. Focus on Economic Development 2. Focus on Wildlife 3. Native American Uses 4. Agricultural Use	Cleanup for Economic Development Wildlife (Options 1, 2, and 3) Cleanup for Agricultural and Native American uses outside the 300 Area (Options 3 and 4)	Restricted (Recreational Residential, or Industrial)*

*Exposure scenarios from the *Hanford Site Risk Assessment Methodology* associated with the EIS future land-use alternatives.

HLW = high-level waste.
LLW = low-level waste.
MRS = monitored retrievable storage.
SNF = spent nuclear fuel.
TRU = transuranic.

9613459.1889

Description of Alternatives

In order to achieve the future land-use objectives, a series of remediation activities would need to occur. These activities are discussed in a generic fashion throughout the EIS. Specific remediation activities, technologies, strategies, cleanup standards, and costs would be addressed through the CERCLA and/or RCRA processes on a case-by-case basis. The general discussion presented in the EIS allows evaluation of potential environmental consequences associated with remediation and allows for the development and use of innovative technologies.

No-Action Alternative

Consideration of the No-Action Alternative is required by the DOE, and the CEQ regulations implementing NEPA, to provide a basis for comparison of impacts from the other alternatives. In the EIS the term "no action" does not mean that the DOE would take no further action of any kind at the Hanford Site; instead,"no action" is defined to mean that the DOE would conduct a long-term monitoring and maintenance program instead of continuing with the current program of TSD unit closures, past-practice waste site remedial actions, and surplus facility decommissioning actions. Surveillance and maintenance activities would consist of (1) surveillance and maintenance of surplus facilities, (2) stabilization of waste sites, and (3) maintaining a program of safeguards and security to prevent unauthorized access. The No-Action Alternative is common to all of the geographic areas, but the specific monitoring and maintenance activities would vary depending on the types of waste sites and facilities found in each area.

Although the activities to be conducted under the No-Action Alternative provide a measure of containment and control of contaminants, they do not constitute permanent remedial actions or complete decommissioning actions. The DOE recognizes that actual implementation of the No-Action Alternative for the Hanford Site as a whole might be contrary to the provisions of the Tri-Party Agreement. A decision to implement the No-Action Alternative at any particular area of the Hanford Site would be made in accordance with the site-specific decisionmaking process specified by the Tri-Party Agreement.

The No-Action Alternative is not expected to pose unacceptable risks to human health or the environment as long as the monitoring and maintenance program is in place. However, evaluation of long-term risks under the No-Action Alternative requires consideration of the eventual loss of DOE management and control. For

Exposure Controls Under the No-Action Alternative

Under the No-Action Alternative, administrative controls that regulate allowable worker and public exposure to radioactive and hazardous materials would remain in place. These controls include:

- 10 CFR 835, "Occupational Radiation Protection," which provides exposure guidelines, training requirements, monitoring requirements, access restrictions, and design and control requirements. These controls are designed to minimize radiation exposure at DOE facilities.
- As Low As Reasonably Achievable (ALARA) principles implemented at DOE facilities. ALARA provides an approach to be used in managing and controlling exposures to hazardous or radiological materials. ALARA is not a dose limit, but a process that has the objective of attaining doses as far below the applicable limits as is reasonably achievable.
- DOE Orders 5480.4, *Environmental Protection, Safety and Health Protection Standards,* and 5400.5, *Radiation Protection of the Public and the Environment,* which identify mandatory environmental, safety, and health standards applicable to construction, operation, and decommissioning activities for DOE facilities. These standards identify ALARA exposure levels and procedures to ensure that exposures are minimized.

purposes of the analysis, the monitoring and maintenance activities conducted under the No-Action Alternative are assumed to continue for 100 years. After 100 years, it is assumed that active institutional control would cease. After that time, for purposes of the analysis, it is assumed that safeguards associated with monitoring and maintenance activities would no longer control the release of radiological and chemical contaminants from the Hanford Site. The 100 years is assumed to represent the period of active institutional control, and is an assumption made without reference to legal requirements[1]. This assumption allows the analysis of human health risks associated with the loss of institutional controls.

[1]Loss of institutional control after 100 years is referenced in U.S. Nuclear Regulatory Commission regulations (10 CFR 61.59), which are not applicable to the DOE, but are helpful in this context.

Columbia River Alternatives

The Columbia River geographic area encompasses 82 km (51 mi) of the Columbia River, which flows through or borders the Hanford Site, and includes the river islands and island sediments, riverbottom and riverbank sediments, and the area approximately 0.4 km (0.25 mi) inland on both shores of the river. The delineation of this geographic area is consistent with the scope of a 1994 National Park Service EIS entitled *Hanford Reach of the Columbia River, Comprehensive River Conservation Study and Environmental Impact Statement - Final June 1994*. Contamination has occurred at several locations along the Hanford Reach as a result of Hanford Site operations. Table S-3 identifies the future land-use alternatives analyzed in detail for this geographic area, including associated actions to be implemented, exposure scenarios, and potential land-use restrictions.

Table S-3. Future Land-Use Alternatives for the Columbia River Geographic Area.

Alternatives	Actions to be Implemented	Exposure Scenario[a]	Land-Use Restrictions
No-Action	• Continue environmental monitoring • Continue safeguards and security program • Continue institutional controls • Stabilize contaminated sediments as necessary with riprap	Not Applicable	• Maintain restrictions on sediment disturbance • Maintain current use of the river by recreational users
Unrestricted Future Land Use	• Excavate contaminated riverbank, riverbottom, and island sediments • Remove river discharge pipelines through use of cofferdams and sediment dewatering • Transport contaminated materials to an onsite disposal facility • Establish and maintain upgradient control of groundwater plumes to avoid recontaminating sediments • Perform site reclamation • Recontour riverbottom and shoreline, where necessary • Continue environmental monitoring • Continue institutional controls	Agricultural	• Remove access and activity restrictions after remediation • Eliminate restrictions on public access because of contaminants; access might continue to be restricted because of physical hazards or environmental sensitivity
Restricted Future Land Use	• Stabilize river discharge pipelines in place; seal ends with grout • Remove any detached pipeline segments, if found; leave associated tie-down structures in place • Perform limited excavation of contaminated sediments, as necessary, consistent with the recreational, residential, or industrial exposure scenario • Transport contaminated materials to onsite disposal facility • Recontour riverbottom and shoreline, where needed • Continue environmental monitoring • Continue institutional controls	Recreational Residential Industrial	• Maintain restrictions on sediment disturbance • Maintain current use of river by recreational users

[a]Exposure scenarios such as these would be negotiated in the CERCLA process, and would be used to establish cleanup levels.

Reactors on the River Alternatives

The Reactors on the River geographic area encompasses approximately 68 km^2 (26 mi^2) and includes past-practice waste sites, TSD units, and surplus facilities in the 100 Areas, including effluent lines running from reactor facilities to the outfall structures near the river. The boundaries of this geographic area correspond to the area that includes all of the 100 Area Operable Units. Extensive contamination exists in some areas of surface soils, subsurface soils, and groundwater within this geographic area, primarily associated with the production reactors. Table S-4 identifies future land-use alternatives that were analyzed in detail, associated actions to be implemented, exposure scenarios, and potential land-use restrictions for the Reactors on the River geographic area.

> The Restricted Future Land-Use Alternative is subdivided into two alternatives (R1 and R2) for the Reactors on the River and All Other Areas geographic areas. Each alternative achieves protection of human health and the environment to a degree consistent with restricted future uses, but the remediation approaches of the alternatives are different. The Restricted Future Land-Use Alternative (R1) focuses on limited excavation, removal, and disposal of surface and subsurface waste site contaminants, while the Restricted Future Land-Use Alternative (R2) focuses on construction of protective surface caps, or barriers, over surface and subsurface waste sites to prevent exposures and surface water intrusion.

Central Plateau Alternatives

The Central Plateau geographic area encompasses approximately 115 km^2 (44 mi^2). Facilities in this geographic area have been used for fuel reprocessing and waste management and disposal activities. This geographic area is the most extensively contaminated area of the Hanford Site. Future land-use alternatives analyzed in detail, associated actions to be implemented, exposure scenarios, and potential land-use restrictions are listed in Table S-5.

> ***Central Plateau Buffer Zone***
>
> The Working Group proposed a protective buffer zone around the borders of the 200 Area waste management zone to minimize human exposure to radioactive and chemical substances. Waste management activities, other than those associated with environmental restoration, would not occur within the buffer zone.
>
> Remediation of the Central Plateau geographic area would reduce risk to levels sufficient to minimize the size of the buffer zone. As the size of the buffer zone shrinks, the excess lands would no longer be classified as exclusive use and could be used for other purposes; however, DOE controls for emergency preparedness might still apply.

All Other Areas Alternatives

Portions of the All Other Areas geographic area have been used for research and development, fuel fabrication, an experimental breeder reactor, physical plants, and commercial power facilities. This geographic area contains large tracts of undeveloped land interspersed with contaminated sites. Alternatives selected for detailed analysis, associated actions to be implemented, exposure scenarios, and potential land-use restrictions are listed in Table S-6.

Table S-4. Future Land-Use Alternatives for the Reactors on the River Geographic Area.

Alternatives	Actions to be Implemented	Exposure Scenario[a]	Land-Use Restrictions
No-Action	• Stabilize waste sites • Continue environmental monitoring • Continue institutional controls • Continue safeguards and security program	Not Applicable	• Maintain restrictions on access • Maintain restrictions on use of groundwater • Maintain restrictions on soil disturbance
Unrestricted Future Land Use	• Excavate contaminated soils and materials; treat as necessary • Close TSD units • Decommission surplus facilities and reactor effluent lines • Remove any TRU waste discovered to storage in the 200 Areas • Transport contaminated materials to onsite disposal facility • Perform groundwater remediation to allow unrestricted future use and to protect the river • Perform site reclamation • Continue environmental monitoring	Agricultural	• Remove access restrictions after remediation • Eliminate restrictions on access because of contaminants; access might continue to be restricted because of physical hazards or environmental sensitivity
Restricted Future Land Use (R1)	• Perform limited excavation, and treatment, as necessary, of contaminated soils and materials, consistent with the recreational, residential, or industrial exposure scenario • Transport the residual contaminated materials to onsite disposal facility • Remove any TRU waste to storage in the 200 Areas • Perform groundwater remediation to protect uncontaminated groundwater and the river • Perform site reclamation • Continue environmental monitoring • Continue institutional controls	Recreational Residential Industrial	• Maintain restrictions on use of groundwater • Maintain restrictions on subsurface disturbance
Restricted Future Land Use (R2)	• Construct barriers over waste sites and TSD units • Perform groundwater sampling to monitor barrier performance • Perform groundwater remediation to protect uncontaminated groundwater and the river • Perform site reclamation • Continue environmental monitoring • Continue institutional controls	Recreational Residential Industrial	• Maintain restrictions on use of groundwater • Maintain restrictions on subsurface disturbance

[a]Exposure scenarios such as these would be negotiated in the CERCLA process, and would be used to establish cleanup levels.

Table S-5. Future Land-Use Alternatives for the Central Plateau Geographic Area.

Alternatives	Actions to be Implemented	Exposure Scenario[a]	Land-Use Restrictions
No-Action	• Stabilize waste sites • Continue environmental monitoring • Continue institutional controls • Continue safeguards and security program	Not Applicable	• Maintain restrictions on access • Maintain restrictions on the use of groundwater • Maintain restrictions on soil disturbance
Exclusive Future Land Use	• Perform limited excavation of contaminated soils and materials • Transport contaminated soils and materials to a common area for consolidation • Construct barriers over waste sites and TSD units • Perform groundwater sampling to monitor barrier performance • Perform groundwater remediation to protect uncontaminated groundwater and the Columbia River • Perform site reclamation • Continue environmental monitoring • Continue institutional controls	Industrial	• Maintain restrictions on access • Maintain restrictions on the use of groundwater • Maintain restrictions on soil disturbance

[a]Exposure scenarios such as these would be negotiated in the CERCLA process, and would be used to establish cleanup levels.

Table S-6. Future Land-Use Alternatives for the All Other Areas Geographic Area.

Alternatives	Actions to be Implemented	Exposure Scenario[a]	Land-Use Restrictions
No-Action	• Stabilize waste sites • Continue environmental monitoring • Continue institutional controls • Continue safeguards and security program	Not Applicable	• Maintain restrictions on access • Maintain restrictions on use of groundwater • Maintain restrictions on soil disturbance
Restricted Future Land-Use (R1)	• Perform limited excavation of contaminated soils and material, consistent with the recreational, residential, or industrial exposure scenario • Transport contaminated materials to onsite disposal facility • Perform groundwater remediation to protect uncontaminated groundwater and the river • Perform site reclamation • Continue environmental monitoring • Continue institutional controls	Recreational Residential Industrial	• Maintain restrictions on use of groundwater • Maintain restrictions on subsurface disturbance
Restricted Future Land-Use (R2)	• Construct barrier over waste sites and TSD units • Perform groundwater sampling to monitor barrier performance • Perform groundwater remediation to protect uncontaminated groundwater and the river • Perform site reclamation • Continue environmental monitoring • Continue institutional controls	Recreational Residential Industrial	• Maintain restrictions on use of groundwater • Maintain restrictions on subsurface disturbance

[a]Exposure scenarios such as these would be negotiated in the CERCLA process, and would be used to establish cleanup levels.

9613459.1892

The Hanford Site occupies an area of approximately 1,450 km^2 (560 mi^2) within the semiarid Pasco Basin of the Columbia Plateau in southeastern Washington State. This land, with restricted public access, provides a protective buffer for the smaller areas that were formerly used for production of nuclear materials and are currently used for waste management activities. The Columbia River flows through the northern part of the Hanford Site and, turning south, forms part of the eastern boundary of the Hanford Site. The Yakima River runs along part of the southern boundary and joins the Columbia River below the City of Richland, which bounds the Hanford Site on the southeast. The cities of Richland, Kennewick, and Pasco (known as the Tri-Cities) constitute the nearest population centers and are located southeast of the Hanford Site.

Geology and Soils

The Hanford Site lies within the Columbia Intermontane physiographic province, which is bordered on the north and east by the Rocky Mountains and on the west by the Cascade Range. The dominant geologic characteristics of this province are the thick accumulations of basaltic lava flows. The Columbia Intermontane Province is subdivided into four subprovinces, with the Hanford Site contained within the Columbia Basin subprovince. Much of this subprovince was affected by cataclysmic flooding associated with the sudden release of water from glacial Lake Missoula. Geomorphological features caused by cataclysmic flooding are evident on the Hanford Site. Fifteen different soil types varying from sand to silty and sandy loam are present on the Hanford Site and overlie the basalt and gravels at varying thicknesses.

Surface Water

The primary surface water features associated with the Hanford Site are the Columbia and Yakima Rivers. In addition, several surface ponds and ditches are associated with Hanford Site operations. Cold Creek and its tributary, Dry Creek, are ephemeral springs within the Yakima River drainage along the southern boundary of the Hanford Site. Rattlesnake Springs, located on the western portion of the Site, forms a small surface stream that flows for about 3 km (1.9 mi) before disappearing into the ground. West Lake lies between Gable Mountain and Gable Butte.

Groundwater

From recharge areas to the west, groundwater flows downgradient through the Hanford Site to discharge areas, primarily along the Columbia River. This general west to east flow pattern is interrupted locally by groundwater mounds in the 200 Area. These mounds are associated with operational discharges of wastewater from Hanford Site facilities. Local aquifer flow directions are dynamic and respond to changes in natural and artificial recharge.

Climate

The climate at the Hanford Site is semi-arid with an average annual precipitation of 16 cm (6.3 in). Large diurnal temperature variations result from intense solar heating during the day and radiational cooling at night. Prevailing wind directions are from the northwest during all months of the year. Air quality in the vicinity of the Hanford site is generally good, although air quality is sometimes affected by wind-eroded dust from agricultural fields and disturbed terrain with sparse vegetation.

Ecology

The Hanford Site is a relatively large, mostly undisturbed area of shrub-steppe habitat containing numerous plant and animal species adapted to the semiarid environment of the region. Upland shrub-steppe habitat is characterized by a sagebrush-dominated overstory with grasses composing the understory. Other plant communities include: trees, which were planted by homesteaders in association with agricultural areas; riparian areas with wetland vegetation, including sloughs, backwaters, shorelines, and islands associated with the Columbia River; and relatively specialized plant communities associated with unique topographic features (e.g., basalt outcrops, alluvial fans, cliffs, talus slopes, and sand dunes).

The Hanford Site supports a variety of terrestrial and aquatic wildlife species, including federal- and state-listed threatened and endangered species such as the bald eagle. In addition, species of concern include the fall chinook salmon, considered by tribal governments to be one of the most significant natural resources on the Hanford Site; American white pelican; loggerhead shrike; long-billed curlew; and sage sparrow. As unfragmented habitat continues to disappear elsewhere in the Columbia Basin, the relatively undisturbed ecosystems at the Hanford Site have become increasingly valuable from a regional perspective.

Cultural Resources

Hanford Site cultural resources include Native American historic and prehistoric sites, historic properties representing early Euro-American settlements, and more recent structures associated with the Manhattan Project and Cold War eras. Because of the construction of dams, and the resulting development elsewhere along the Columbia River, much of the regional cultural resources have been destroyed or are under water. The Hanford Site is one of the few remaining archaeologically rich areas in the western Columbia Plateau. Locations along the Columbia River played a central role in the development of the Washane religion, which is still practiced by Native Americans in the region. The Hanford Site is considered to be culturally important by many Native American people.

Socioeconomic

Benton and Franklin counties experience most of the economic and social consequences of activities at the Hanford Site. The counties, which contain the Tri-Cities, are very dependent on Hanford Site operations for employment and revenue. Population growth in the counties is also influenced considerably by actions at the Hanford Site. In addition to the Hanford Site, agriculture and agriculture-related industries are an important sector of the local economy.

9613459.1895

Visual Resources

Prominent features at the Hanford Site include Rattlesnake Mountain, which rises to 1,060 m (3,477 ft) above mean sea level and forms the southwestern boundary of the Hanford Site; and Gable Mountain and Gable Butte, which are the highest land forms within the Hanford Site. The Columbia River, flowing across the northern part of the Hanford Site and forming the eastern boundary, is considered scenic, with its contrasting blue color against a background of black and brown basaltic rocks and desert sagebrush. The White Bluffs, which are steep, light-colored bluffs adjacent to the north and east side of the Columbia River, also are a prominent visual feature of the landscape.

Contaminants

Movement of contaminants through groundwater, soils, and other environmental media is monitored routinely to evaluate impacts to the public, workers, and the environment. The *Hanford Site Environmental Report for Calendar Year 1994* summarizes recent data collected through effluent monitoring and environmental surveillance. Wastewaters discharged on the Hanford Site have reached groundwater and surface waters. Constituents detected in groundwater include tritium, iodine-129, technetium-99, uranium, nitrate, carbon tetrachloride, and chromium. Columbia River water quality monitoring shows higher concentrations of tritium, iodine-129, and uranium downstream from the Hanford Site than concentrations found at upstream monitoring locations. However, concentrations of these radionuclides in the Columbia River remain well below applicable drinking water standards, and the Columbia River remains a Class A river.

This page intentionally left blank.

9613459.1894

The EIS analyzes potential consequences of each alternative on resources such as soils, water, air, ecology, cultural resources, noise, and socioeconomics. The following sections summarize the environmental impacts, and provide general observations and comparisons among the alternatives being considered.

Impacts to Soils and Geologic Resources

Impacts to soils probably would occur regardless of the future land-use alternative that is selected. Remediation activities, including stabilization of waste sites under the No-Action Alternative; partial and full excavation of waste sites; capping of waste sites; and groundwater remediation activities would disturb varying amounts of soil. Additional soil disturbance would occur as a result of soil compaction caused by heavy equipment during remediation. Soil compaction and other forms of soil disturbance could result in an increased potential for erosion. Ecological impacts also could result from soil disturbance. Invasive nonnative plant species (e.g., cheatgrass) could colonize new disturbed areas. Furthermore, soil compaction and erosion could adversely affect efforts to revegetate disturbed areas. Mitigation measures (e.g., restricting heavy equipment to trample zones; using established transportation routes to minimize damage to undisturbed soil and vegetation; using silt fences and dust control measures to reduce soil erosion; and reseeding disturbed areas with native vegetation to reduce long-term soil loss from wind and water erosion) could help reduce the environmental impacts associated with soil disturbance.

Potential impacts to geologic resources include destruction of unique geologic features during remediation; continued restrictions on access to unique geologic features; depletion or exhaustion of geologic resources at borrow areas and quarry sites; and restrictions on future public access to geologic resources. Capping waste sites could require substantial volumes of geologic materials (i.e., soil, sand, gravel, and basalt). Requirements for cap materials could significantly deplete available geologic materials.

Estimated Volumes of Materials Required to Implement Capping Alternatives from Three Primary Sources of Geologic Materials.[a]

Geographic Area	Alternative	McGee Ranch[b] (million m^3 [yd^3])	Pit 30[c] (million m^3 [yd^3])	Basalt Quarry[d] (million m^3 [yd^3])
Columbia River	Restricted	0.1 (0.2)	0.04 (0.05)	0.2 (0.2)
Reactors on the River	Restricted (R2)	7.3 (9.6)	2.1 (2.8)	9.4 (12.3)
Central Plateau[e]	Exclusive	13.7 (18.1)	2.5 (3.2)	2.4 (2.8)
All Other Areas	Restricted (R2)	3.4 (4.4)	1.0 (1.3)	4.3 (5.7)
Total		24.5 (32.3)	5.64 (7.35)	16.3 (21.0)

[a]Based on volumes presented in Appendix H of the EIS.
[b]Assumed source of fine grained materials (silt) required for caps.
[c]Assumed source of gravel and sand.
[d]Assumed source of basalt used in caps, asphalt base, and asphalt.
[e]Based on Modified RCRA cap design.

Impacts to geologic resources could be mitigated, but not eliminated, through the use of alternate cap designs. For example, the requirement for basalt would be reduced substantially if a modified RCRA cap was implemented instead of the reference cap design.

Impacts to Water Resources

Potential impacts to the Columbia River could occur under any of the Columbia River geographic area alternatives. Under the No-Action Alternative, contaminant releases could occur from natural scouring and erosion. Conducting remedial activities within the river also could potentially release radiological and chemical contaminants. Use of cofferdams within the river to remove river discharge pipelines could temporarily increase the river stage and velocity, potentially leading to increased erosion, destruction of spawning areas, and contaminant releases.

Potential impacts to groundwater include continued transport of contaminants from waste sites into the groundwater and continued expansion of contaminant plumes under the No-Action Alternative. Capping of wastes sites or removal of contaminants from the vadose zone would prevent migration of contaminants to the groundwater. Groundwater treatment strategies under the future land-use alternatives would be used to manage the migration of contaminated groundwater to the Columbia River. Long-term impacts to groundwater from remedial activities could be beneficial.

Impacts to Air Resources

Impacts to air resources from the implementation of the future land-use alternatives would consist primarily of generation of potentially contaminated fugitive dust, and emissions from fuel combustion by heavy equipment. Remediation activities that could impact air resources include waste site stabilization; partial and full excavation of waste sites; capping of waste sites; waste transport; and groundwater remediation activities. Ambient air quality standards probably would not be exceeded in the long term, but short-term impacts could be significant. Mitigation measures that could be implemented to minimize emissions of fugitive dust include using water or surfactants to minimize releases from storage piles, gravel roads, and disturbed areas; containerizing all loads for hauling; and constructing temporary enclosures over excavation sites.

Human Health Risks

An evaluation of human health impacts must consider the tradeoffs involved in remediating to the degree required to allow unrestricted future uses, and the estimated risks posed by the No-Action Alternative, risks associated with potential worker exposures and remediation accidents, and the residual risks that might remain after remediation. The EIS assumes the target risk range (10^{-4} to 10^{-6}) would be met under CERCLA regardless of selected combinations of remedial technologies and future land-use objectives. A baseline risk assessment was performed to assess the potential human health risks in the

Why is a Risk Range Used?

The 10^{-4} to 10^{-6} risk range provides flexibility in determining appropriate remediation levels for contaminated sites. The 10^{-6} risk level is provided as a "point of departure," that is, the starting point for acceptable exposure levels. After consideration of factors such as uncertainty, population sensitivities, and technical limitations to remediation, the target risk may be revised upward within the risk range.

absence of any remedial action (i.e., risk conditions under the No-Action Alternative). For purposes of the analyses in the baseline risk assessment, it was assumed that institutional controls were no longer in effect at the Hanford Site. Potential risks were estimated for the four geographic areas of the Hanford Site using the available *Hanford Site Risk Assessment Methodology* agricultural, industrial, residential, and recreational exposure scenarios.

Three types of potential health risks were assessed: cancers caused by radionuclides, cancers caused by chemical carcinogens, and noncancerous toxic effects. Incremental lifetime cancer risks (ILCR) were estimated for cancer-causing radionuclides and chemicals. The total cancer risk in the EIS was determined by summing the radionuclide and chemical carcinogen risk. Noncancer risks were estimated using the hazard quotient, which is the ratio of the estimated exposure to a threshold value below which toxic effects would not be expected, and the hazard index, which is the sum of hazard quotients for individual chemicals. The risk to human health is considered acceptable if the ILCR to an individual is no greater than 10^{-4}, or if the hazard index is less than 1.0.

The greatest estimated risks are posed by the agricultural and residential scenarios, with lower risks posed by the industrial scenario, and the lowest risks posed by the recreational scenario. These differences are a function of the importance of groundwater and residence time in contributing to health risks at the Hanford Site. The hypothetical farmer and resident consume the most contaminated groundwater, followed by the industrial worker and recreational user.

These observations suggest that to ensure protection of human health, continued control of access and use of the Hanford Site must be maintained (particularly access to groundwater). Otherwise, contamination at the Hanford Site must be removed or isolated. However, because of the potential for worker exposure to contaminants and accidents during remediation, the remedial activities necessary to remove and/or isolate contamination are themselves not without risk. The accident issue was addressed by estimating the potential consequences of several types of accidents that could occur during remediation (i.e., a shoreline excavation accident, a range fire, a soil dispersion accident, and a fire in a groundwater treatment unit). A shoreline excavation accident could occur during remediation of the Columbia River, releasing contaminants to the river. A range fire, which could occur under any alternative for the other three geographic areas, would release contaminants taken up by plants. A soil dispersion accident, caused by the ignition of reactive material in a container encountered during the excavation of a waste site, would disperse contaminants through the air. Similarly, a fire in a groundwater treatment unit would release contaminants to the air.

Accident analyses indicate that estimated cancer risks (in the form of latent cancer fatalities) to the maximally exposed individual from a shoreline excavation accident or a range fire would be within or below the target risk range of 10^{-4} to 10^{-6}. Estimated risk caused by the groundwater treatment accident would result in exposures to the onsite maximum exposed individual that exceed the target risk range for the three geographic areas (Central Plateau, Reactors on the River, and All Other Areas) for which this accident was evaluated.

Radiological exposure and associated health effects were calculated for personnel involved in remediation activities under each future land-use alternative. Noninvolved workers (i.e., management and professional workers) are not anticipated to be exposed to significant radiation from remedial activities.

Risk to Workers from Radiation Exposure Under Routine Conditions.

Geographic Area	Future Land-Use Alternative	Directly Involved Workers (Crafts and Subcontractors)			Professional Workers (Managers and Professional)		
		Labor Hours	Collective Dose (person-rem)	LCFs	Labor Hours	Collective Dose (person-rem)	LCFs
Columbia River	Unrestricted	10,233,386	1,310	0.52	3,183,597	25	0.01
	Restricted	213,396	27	0.01	28,065	0.2	0.00
Reactors on the River	Unrestricted	8,886,850	1,138	0.46	4,429,611	35	0.01
	Restricted (R1)	6,414,602	821	0.33	3,464,449	28	0.01
	Restricted (R2)	12,054,899	1,543	0.62	1,841,379	15	0.01
Central Plateau	Exclusive	6,339,920	812	0.32	640,030	5	0.00
All Other Areas	Restricted (R1)	2,161,073	277	0.11	1,682,551	13	0.01
	Restricted (R2)	5,487,262	702	0.28	1,611,205	13	0.01

LCF = latent cancer fatality.

Radiation exposure of the general public is expected to remain comparable to exposure rates reported in recent Hanford Site annual environmental monitoring reports. In 1994, the total potential radiation dose to the hypothetically maximally exposed individual of the public (located across the Columbia River from the 300 Area) was calculated to be 0.05 mrem per year, which is far below applicable exposure standards.

An assessment of the risk and associated cancer incidence to future Hanford Site users was conducted for each future land-use alternative. Cancer incidence for these future populations are presented in Table S-7. The groundwater plume emerging from the Central Plateau geographic area was determined to contribute significantly to future risk in the Reactors on the River and All Other Areas geographic areas. For comparative purposes, cancer incidences also were estimated assuming institutional controls were maintained in perpetuity for the Central Plateau geographic area. In cases where institutional controls were assumed to be maintained in the Central Plateau, it was determined that risk and associated cancer incidences would be significantly lower in the other geographic areas.

In addition to information presented in Tables S-8, a recreational exposure scenario was evaluated for the Columbia River geographic area. The exposed population for the recreational exposure scenario was determined to be 163,800 and 1,714,128 people over the time periods from 140 to 1,000 years and 1,000 to 10,000 years, respectively. Cancer incidence from this exposure scenario was determined to be 15 cancers within the period from 140 to 1,000 years and 145 cancers in the period from 1,000 to 10,000 years. Because the calculation assumed no remediation, these estimates are believed to be high. During the period from 140 to 1,000 years, the majority of risk is the result of exposure to contaminants associated with the 100 Areas. Assuming these areas are remediated, cancer incidence during this period is 1 or fewer. During the period from 1,000 to 10,000 years, risk results from the groundwater plumes emanating from the Central Plateau and the 100-N Area. If the 100-N Area is remediated, and the plume from the Central Plateau is remediated or controlled, risk throughout the area would be less than 10^{-6}, and cancer incidence would be less than 2.

Table S-7. Future Exposed Populations and Estimated Cancer Incidences for Each Geographic Area and Future Land-Use Alternative (assuming loss of institutional controls at the Hanford Site).

Geographic Area Future Land-Use Alternative	Residential Exposure Scenario		Agricultural Exposure Scenario		Industrial Exposure Scenario	
	140 to 1,000 yrs	1,000 to 10,000 yrs	140 to 1,000 yrs	1,000 to 10,000 yrs	140 to 1,000 yrs	1,000 to 10,000 yrs
Reactors on the River						
Total Exposed Population	125,358	1,311,414	4,154	46,831	48,739	510,000
No Action	63	3,124	0	104	487	5,100
Unrestricted Future Land Use	3	2,658	0	88	0	5,100
Restricted Future Land Use (R1)	7	2,659	0	88	5	5,100
Restricted Future Land Use (R2)	63	3,124	0	104	487	5,100
Central Plateau						
Total Exposed Population	212,003	2,217,833	7,024	73,484	48,739	510,000
No Action	632	2,532	19	141	487	5,100
Exclusive Future Land Use	632	2,532	19	141	487	5,100
All Other Areas						
Total Exposed Population	1,150,344	12,034,152	38,115	398,732	48,739	510,000
No Action	114	2,984	6	92	49	5,100
Restricted Future Land Use (R1)	89	2,984	5	92	49	5,100
Restricted Future Land Use (R2)	114	2,984	6	92	49	5,100

[a]An industrial complex of 1,700 workers was assumed to be located above the portion of the geographic area with the highest risk.

9613139.1896

Impacts to Ecological Resources

Potential impacts on ecological resources at the Hanford Site present tradeoffs similar in nature to those for human health. Monitoring data indicate that current Hanford Site activities have a minimal impact on ecological receptors, with the exception of those plants and animals found near the waste sites. Potential long-term radiological and chemical risks to ecological receptors were estimated using a methodology analogous to that used for estimation of human health risk. The calculated radiation doses and hazard indices suggest that potential future radiological and chemical hazards might exist for ecological receptors in the Reactors on the River, Central Plateau, and All Other Areas geographic areas, but not in the Columbia River geographic area.

Conversely, potential ecological impacts from remedial activities could be significant. Major potential remediation impacts include physical destruction of habitat by waste removal and construction activities, soil or sediment erosion and compaction, noise, disturbance of wildlife caused by increased human presence, and potential contaminant releases during remediation. Impacts to biodiversity at the Hanford Site could occur from habitat destruction and fragmentation. Restoration of remediated waste sites would reduce impacts, but probably could not return disturbed habitats to their original function and condition in the short term. Release of currently controlled areas of the Hanford Site following remediation for other uses could lead to additional habitat destruction through alteration of land use patterns.

Habitat Areas Disturbed under Each Future Land-Use Alternative, for Each Geographic Area.

Geographic Area	No Action	Unrestricted	Restricted (R1)	Restricted (R2)	Exclusive
Columbia River	None	23 ha (57 ac) wetlands 20 ha (50 ac) aquatic 36 ha (90 ac) shrub-steppe	<0.4 (1 ac) of each habitat	NA	NA
Reactors on the River	3 ha (7 ac) shrub-steppe	5 ha (12 ac) wetlands 40 ha (101 ac) shrub-steppe	4 ha (11 ac) wetlands 39 ha (98 ac) shrub-steppe	3 ha (7 ac) wetlands 38 ha (94 ac) shrub-steppe	NA
Central Plateau	280 ha (692 ac) shrub-steppe	NA	NA	NA	475 ha (1,173 ac) shrub-steppe
All Other Areas	5 ha (12 ac) shrub-steppe	NA	115 ha (287 ac) shrub-steppe	134 ha (329 ac) shrub-steppe	NA

NA = Not Applicable.

Impacts to Cultural Resources

Remedial activities undertaken to achieve the various future land-use alternatives could have adverse impacts on cultural resources. Ground disturbances associated with remediation could destroy known and presently undiscovered cultural artifacts, as well as biological resources important to tribal cultures. Conversely, removal or isolation of contamination could permit tribal members safe access to traditional-use areas currently not available. Similarly, decommissioning of structures would remove the associated radiological and chemical hazards from the Hanford Site, but could adversely affect

9613459.1897

certain structures with potential historical significance in the context of the Manhattan Project and Cold War eras. Mitigation measures could reduce, but not eliminate completely, adverse impacts to cultural resources from remediation activities.

Socioeconomic Impacts

Quantitative analyses were prepared for the potential impacts on employment, population, housing starts and prices, and taxable retail sales. The No-Action Alternative assumed that Hanford employment levels would remain at current levels, which is equivalent to the baseline condition used for comparison of the future land-use alternatives. Analyses indicate that, for the most part, remediation activities associated with Future Land-Use Alternatives would cause only minimal impacts to employment, population, housing, public services, infrastructure, and utilities. However, implementation of the Restricted Future Land-Use Alternative (R2) for the All Other Areas geographic area would be a short-term, labor-intensive effort, which has the potential to directly affect regional nonagricultural employment, population, and home prices. Maximizing the use of the existing workforce to supply employment needs would reduce the impacts associated with an influx of workers. The extent of socioeconomic impacts is largely dependent on the timing of remediation and the degree to which concurrent remediation activities occur across the Hanford Site.

Cumulative Impacts

A number of present and reasonably foreseeable future actions at the Hanford Site could cumulatively contribute to the impacts of the remedial actions associated with the future land-use alternatives. These actions include the following:

- Designation of the Hanford Reach and adjacent lands as a Wild and Scenic River and National Wildlife Refuge, which would limit certain intensive uses
- Decommissioning of the eight surplus reactors in the Reactors on the River geographic area
- Operation and possible expansion of the Environmental Restoration Disposal Facility (ERDF) for disposal of waste generated during environmental restoration activities at the Hanford Site
- Continued storage of spent nuclear fuel at the Hanford Site
- Remediation of wastes currently stored in single-shell and double-shell tanks in the Central Plateau geographic area
- Other continued waste management operations in the 200 Areas.

The potential cumulative impacts presented in the EIS are summarized below.

- The need for quarry and borrow materials for remedial actions across the geographic areas could result in significant onsite depletion of these materials.

- The large number of ground-disturbing activities in the Central Plateau and other geographic areas could result in extensive soil compaction and erosion; destruction of near-pristine shrub-steppe habitat; and impacts on species of concern (e.g., sage sparrow, loggerhead shrike, and sage thrasher).

- Increased recreational use of the Columbia River geographic area associated with the proposed Wild and Scenic River designation, combined with unrestricted use of the Columbia River geographic area, could result in future disturbance of native vegetation and wildlife (particularly bald eagles).

- Cumulative impacts on historic, cultural, and archaeological resources could be significant in all of the geographic areas. These impacts could be mitigated to the extent that surveys and data recovery constitute mitigation; however, excavation or other disturbance of sites would unavoidably alter their character and potential value to Native Americans and other interested parties.

- Cumulative impacts on visual resources would be directly proportional to the extent of Hanford Site remedial activity in the short term, and to the extent of viewscape alteration in the long term. Potential cumulative visual impacts would be concentrated in the Central Plateau and the Reactors on the River geographic areas, as a result of ERDF operation, reactor decommissioning, and cap construction, if alternatives involving the latter were selected.

- The potential for cumulative socioeconomic impacts is uncertain and depends on the timespan for remedial actions. Short project timespans and large numbers of concurrent actions, followed by rapid shutdown and decommissioning of waste treatment and storage facilities, could have significant adverse cumulative impacts on the Tri-Cities' economy.

Unavoidable Adverse Impacts

The proposed remedial activities could result in the compaction of soils and increased soil erosion in spite of mitigation measures. Excavation in and near the Columbia River could result in increases of downstream siltation and sedimentation, and destruction of salmon spawning areas. The proposed excavation of waste sites could result in the disturbance of currently unknown human remains as well as the loss of potentially significant prehistoric or historic resources that are currently unknown. Permanent loss of habitat could occur for some plant and wildlife species of concern, and could result in potential population decline and listing of these or additional species as endangered or threatened under the *Endangered Species Act of 1973*. Application of the reference cap over multiple waste sites would alter the visual landscape permanently.

9613459.1898

Irreversible and Irretrievable Commitments of Resources

If an alternative using a reference cap design is implemented, irreversible and irretrievable resource commitments would include significant depletion of the total available reserves of natural materials at the McGee Ranch, Pit 30, and basalt quarry sites. Most of the potential basalt quarry areas on the Hanford Site are considered to be of cultural value to Native Americans.

Under the Restricted (R2) and Exclusive Future Land-Use Alternative, the capped areas of the Reactors on the River, Central Plateau, and All Other Areas geographic areas would be irreversibly and irretrievably committed. The caps in several waste sites would irreversibly commit environmental resources (geologic and groundwater) in the Reactors on the River (137 ha [339 ac]), Central Plateau (1,138 ha [2,812 ac]), and All Other Areas (73 ha [180 ac]) geographic areas for long-term disposal of environmental remediation wastes.

Excavation of waste sites could result in permanent destruction of significant cultural sites and sensitive habitat or loss of sensitive species. The upper limit of habitat loss, if the alternative with the greatest potential disturbance was chosen for each geographic area, would be 610 ha (1,507 ac) of shrub-steppe, 28 ha (69 ac) of wetlands, and 20 ha (50 ac) of aquatic habitat.

Large expenditures ($5 to $10 billion) of public funds would be required for remediation of all four geographic areas, depending on the alternatives and transportation options that are selected. Significant expenditures also would be required under the No-Action Alternative (more than $2 billion over a 100-year period, assuming continuation of current Hanford Site surveillance and maintenance practices).

Estimated Expenditures for Each Alternative, Depending on Transportation Option.

Geographic Area	Alternative	Truck Transport (million $)	Rail Transport (million $)
Columbia River	Unrestricted Restricted	3,167 54	3,354 59
Reactors on the River	Unrestricted Restricted (R1) Restricted (R2)	3,536 2,353 2,477	3,654 2,434 2,758
Central Plateau	Exclusive	1,275	--
All Other Areas	Restricted (R1) Restricted (R2)	1,217 1,443	1,245 1,573

Large quantities of fuel would be consumed for operation of construction equipment and transport of capping materials and waste. This quantity could be as high as 600 million L (160 million gal) if the most fuel-intensive alternative is selected for each geographic area.

Estimated Fuel Consumed for Each Alternative With Transportation Options.

Geographic Area	Alternative	Truck Transport million L (gal)	Rail Transport million L (gal)
Columbia River	Unrestricted Restricted	195.0 (51.6) 3.8 (1.0)	135.7 (35.9) 2.3 (0.6)
Reactors on the River	Unrestricted Restricted (R1) Restricted (R2)	157.6 (41.7) 110.8 (29.3) 220.0 (58.2)	120.6 (31.9) 85.1 (22.5) 130.8 (34.6)
Central Plateau	Exclusive	Not available	Not applicable
All Other Areas	Restricted (R1) Restricted (R2)	36.7 (9.7) 100.9 (26.7)	27.7 (7.3) 59.7 (15.8)

Potential Mitigation Measures

Numerous measures to mitigate environmental disturbance have been identified in the EIS. Most of these measures represent good engineering practices. Certain sensitive resource areas require additional mitigation measures. These additional measures are summarized below.

Wildlife and plant species of concern could be protected by conducting surveys to verify the presence or absence of particular species at proposed remediation sites and by prohibiting habitat disturbances during critical times of the year (e.g., nesting and growing periods). Mitigation strategies, which might include compensation, would be planned for activities that would alter or permanently damage sensitive habitats such as sand dune areas, bald eagle roost trees, or mature native shrub communities. In addition, the National Park Service or the U.S. Fish and Wildlife Service would be consulted before taking any actions in the Hanford Reach of the Columbia River (Hanford Reach), pursuant to the *Study of the Hanford Reach of the Columbia River*.

Wetlands and floodplain disturbance would be avoided whenever possible. A review of ground-disturbing activities would be requested from the U.S. Army Corps of Engineers (and other interested agencies) in cases where potential disturbance of wetlands could occur. Potential mitigation measures normally would be identified during the agency's review process, and could vary from completely avoiding the wetlands to restoring disturbed wetlands. The DOE would comply with regulations found in the "Compliance with Floodplain/Wetlands Environmental Review Requirements."

An area of particular concern for the Hanford Site is protection of cultural resources. Disturbance of these resources would be avoided whenever possible. Mitigation measures could include education of remediation personnel, onsite archaeological monitoring, and consultations with the U.S. Department of Energy, Richland Operations Office Cultural Resources Program Manager, the Washington State Historic Preservation Office, and concerned Native American Tribes before conducting remedial actions.

9613459.1899

Conflict with Land Use Plans of Other Federal and State Agencies and Tribal Governments

Some future uses associated with the Restricted Future Land-Use Alternative of the Columbia River geographic area could be inconsistent with the proposed Wild and Scenic River designation. Under this designation, recreational access points would be expanded but not improved, and additional facilities and programs for visitor interpretation and education would be provided. Restrictions posed by residual contamination might require limitations on certain recreational uses.

Some future land-use alternatives (e.g., exclusive use of the Central Plateau) are not consistent with Native American wishes to exercise their asserted treaty rights on the Hanford Site.

Coordination with local planning agencies (i.e., Benton, Franklin, Grant, and Adams counties, and the cities of Richland, West Richland, Pasco, and Kennewick) would be maintained, especially during the updating of the comprehensive plans for each community.

Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires each federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" to the greatest extent practicable and permitted by law. Low-income and minority populations could be disproportionately affected by actions with adverse impacts on fish and wildlife, to the degree that they are more dependent on these resources than are other populations. Native Americans could be disproportionately affected by environmental impacts that would degrade areas associated with traditional cultural and religious uses. The marginal socioeconomic impacts of some alternatives could have a small disproportionate impact on the cost of low-income housing and the availability of social services. Restricted Future Land-Use and Exclusive Future Land-Use Alternatives could result in impacts by denying Native Americans unlimited access to the geographic areas. However, these alternatives also would function to continue to protect cultural and biological resources that are located in the restricted areas. Activities and engineered barriers (caps) on the Hanford Site could disproportionately impact visual resources for Native American populations to the extent that the viewscape from sacred sites, such as Gable Butte or Gable Mountain, is disrupted by actvity or altered permanently by capped waste sites. Other potential impacts identified in the EIS are not expected to result in disproportionate impacts on minority groups or low-income populations.

Relationship Between Near-Term Use and Long-Term Productivity

The near-term uses of the Hanford Site under the No-Action and future land-use alternatives would be consistent with current industrial and waste management uses. The net effect of remediation would be the enhancement of overall long-term productivity of the Hanford Site because of the increase in potential permissible uses. All four of the geographic areas currently have restrictions on some uses. With one exception, all of the future land-use alternatives would permit some of these

restrictions to be relaxed, if not eliminated. The exception is the Exclusive Future Land-Use Alternative for the Central Plateau. This alternative would dedicate the Central Plateau to waste management and other similar, compatible uses and, thus, preclude its long-term use for other purposes.

In addition, some long-term uses of the Hanford Site could be determined by other actions and decisions outside the scope of the EIS, and by future needs and the outcome of the alternatives selected. The optimal alternatives would be those that effectively protect human health and the environment, while using public resources effectively and minimizing environmental consequences.

Consultations and Environmental Requirements

The DOE is committed to operating the Hanford Site in compliance with applicable environmental laws, regulations, Executive Orders, DOE orders, permits, and compliance agreements with regulatory agencies. To ensure compliance with permits and other applicable legal requirements, regulatory agencies routinely conduct inspections at the Hanford Site. In addition, the DOE has a comprehensive program for conducting internal audits and self-assessments, including periodic reviews by interdisciplinary teams of experts. The DOE has prepared and implemented site-specific environmental compliance planning guidance.

NEPA and CEQ Regulations require consultation with federal, tribal, state, and local agencies with jurisdiction or special expertise regarding any environmental impact (Table S-8). Agencies involved include those with authority to issue applicable permits, licenses, and other regulatory approvals, as well as those responsible for protecting significant resources (e.g., endangered species, critical habitats, or historic resources). Federal and state agencies and Native American governments have been, and will continue to be, consulted during the EIS process. Representatives of federal, tribal, state, and local agencies were involved in the development of future land-use alternatives and scoping of the EIS.

9613459.1900

Table S-8. Agency Consultations.

Subject Area	Basis for Consultation	Agency
Endangered Species	*Endangered Species Act of 1973*	USFWS; National Marine Fisheries Service
Migratory Birds	*Migratory Bird Treaty Act of 1918*	USFWS
Eagles	*Bald and Golden Eagle Protection Act of 1972*	USFWS
Archaeological, Historical, and Cultural Resources	*National Historic Preservation Act of 1966*; *Archaeological Resources Protection Act of 1979*; *American Antiquities Preservation Act of 1906*; *American Indian Religious Freedom Act of 1978*; *Native American Graves Protection and Repatriation Act of 1990*	Washington Department of Community Development; Office of Archaeology and Historic Preservation; State Historic Preservation Office; Advisory Council on Historic Preservation; Yakama Indian Nation; Confederated Tribes of the Umatilla Indian Reservation; Nez Perce Tribe; Wanapum People
Discharge of Pollutants to Waters	*Clean Water Act of 1977*; *Safe Drinking Water Act of 1974*	EPA; Ecology
Work in Navigable Waters	*Clean Water Act of 1977*; *Safe Drinking Water Act of 1974*	Corps; EPA
Prime and Unique Farmlands	*Farmland Protection Policy Act of 1981*	Natural Resource Conservation Service; U.S. Department of Agriculture
Floodplains	Executive Order 11988; *Fish and Wildlife Coordination Act of 1934*; 10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements"	USFWS; Corps; Grant, Benton, and Franklin County Planning Departments
Wetlands	10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements;" Executive Order 11990; *Fish and Wildlife Coordination Act of 1934*; *Clean Water Act of 1977*, Section 404	USFWS; Corps; EPA; Ecology
Alterations to Bodies of Water	*Fish and Wildlife Coordination Act of 1934*	USFWS
Columbia River	*Wild and Scenic Rivers Act of 1968*; *Comprehensive Conservation Study of the Hanford Reach of the Columbia River*; *Anadromous Fish Conservation Act of 1965*	U.S. Department of Interior, National Park Service; National Marine Fisheries Service
Air Pollution	*State and Federal Clean Air Acts of 1991 and 1970, respectively*	EPA; Ecology; Benton County Clean Air Authority; Washington State Department of Health
Water Use and Availability	*Water Resources Planning Act of 1965*; *Safe Drinking Water Act of 1974*	EPA; Ecology
Noise Issues	*Noise Pollution and Abatement Act of 1970*; *Noise Control Act of 1972*	EPA; Grant, Benton, and Franklin County Planning Departments
Siting and Planning	*Grant, Benton, and Franklin County Zoning Regulations and Land Use Plans*	Grant, Benton, and Franklin County Planning Departments
Waste Management and Transportation	*Resource Conservation and Recovery Act of 1976*; *Hazardous and Solid Waste Amendments of 1984*; *Comprehensive Environmental Response, Compensation and Liability Act of 1980*; *Emergency Planning and Community Right-to Know Act of 1986*; *Toxic Substances Control Act of 1976*; *Federal Insecticide, Fungicide, and Rodenticide Act of 1975*	EPA; U.S. Department of Transportation; Ecology

Corps = U.S. Army Corps of Engineers.
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
USFWS = U.S. Fish and Wildlife Service.

This page intentionally left blank.