Holistic Approaches to Remediation: The Rocky Flats Example

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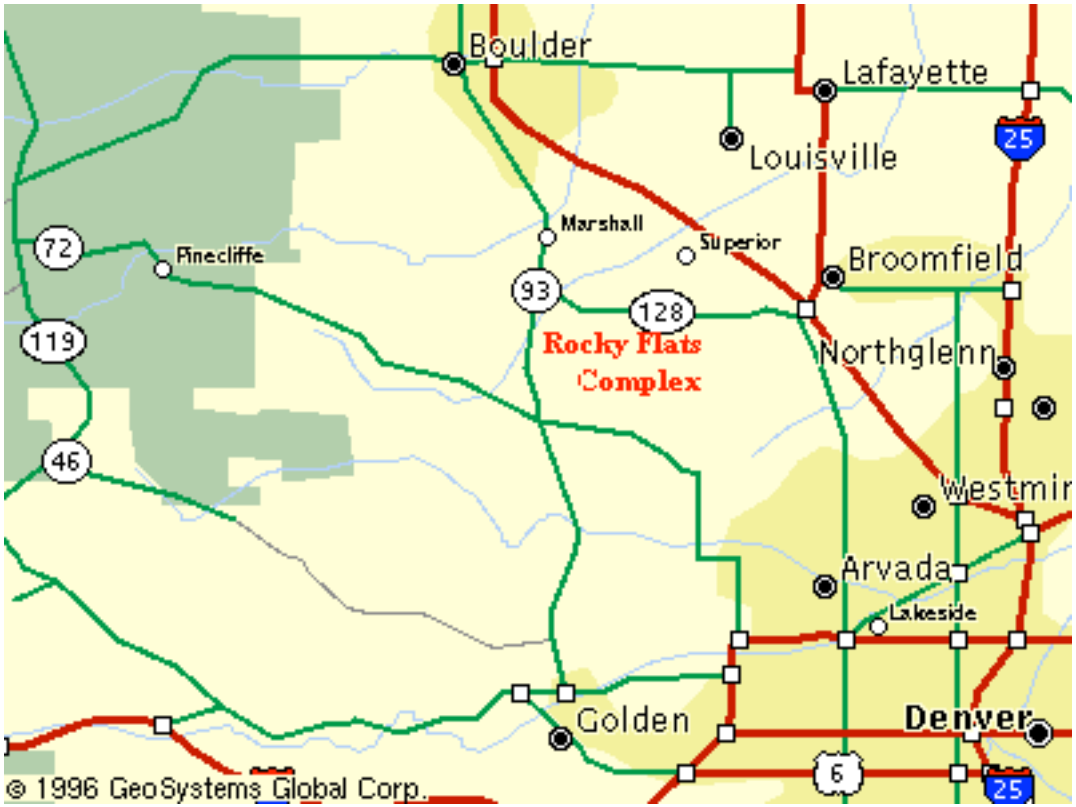
Outline

I. Rocky Flats
II. From CERCLA to Risk-Based End States
III. The Meanings of Sustainability
IV. Three Approaches to Alternative End States

Rocky Flats

- Function and facilities
- History
- Clean-up issues
- Refuge Act
- Risk-Based End State
- Current Status


Boulder
Lafayette
Louisville
25
Marshall
Superior
Broomfield
72
Pinecliffe
93
128
119
Rocky Flats
Complex
Northglenn
46
Westmir
Arvada
Lakeside
Golden
Denver
6
25
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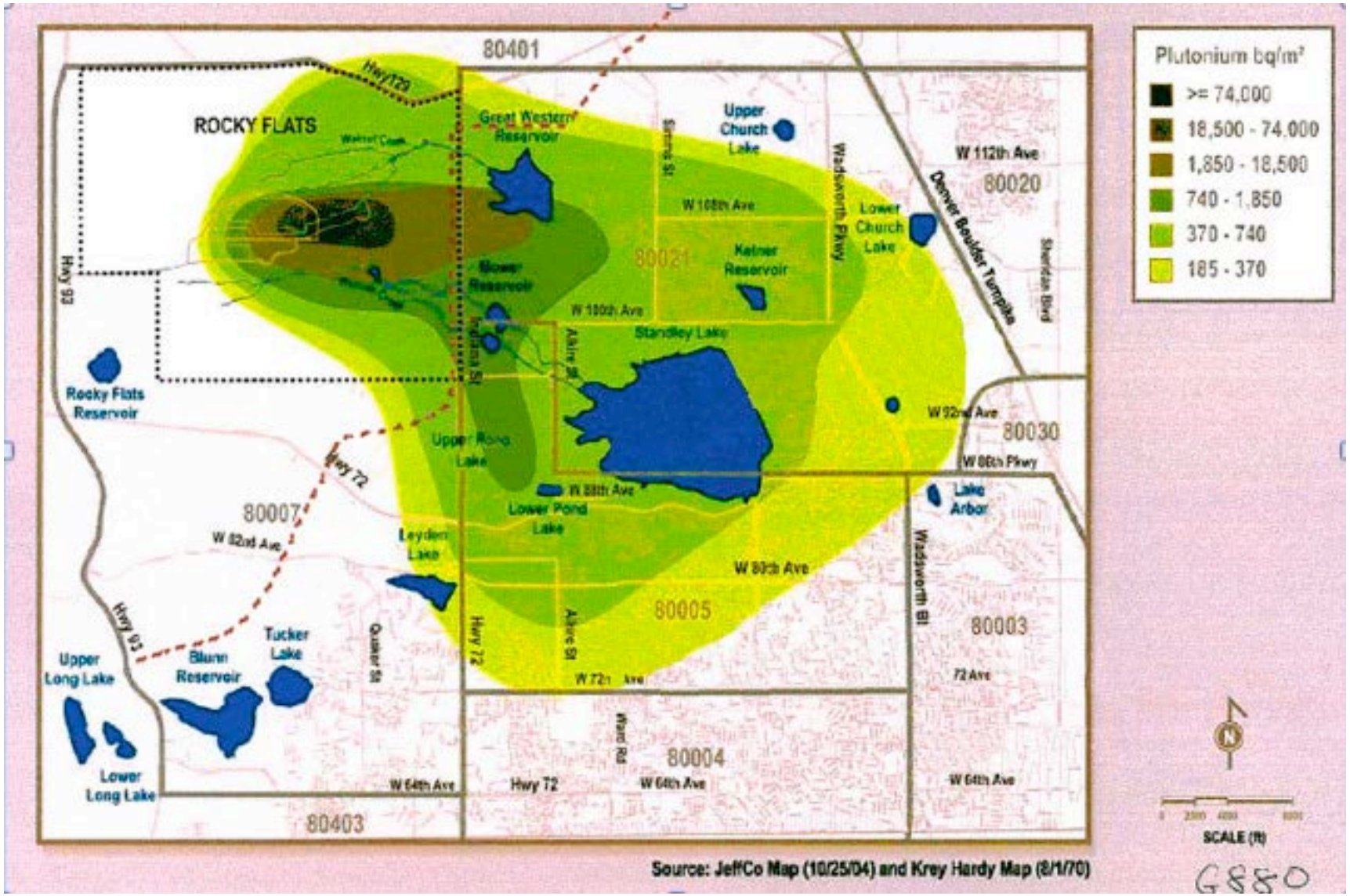
The Weapons Production Process

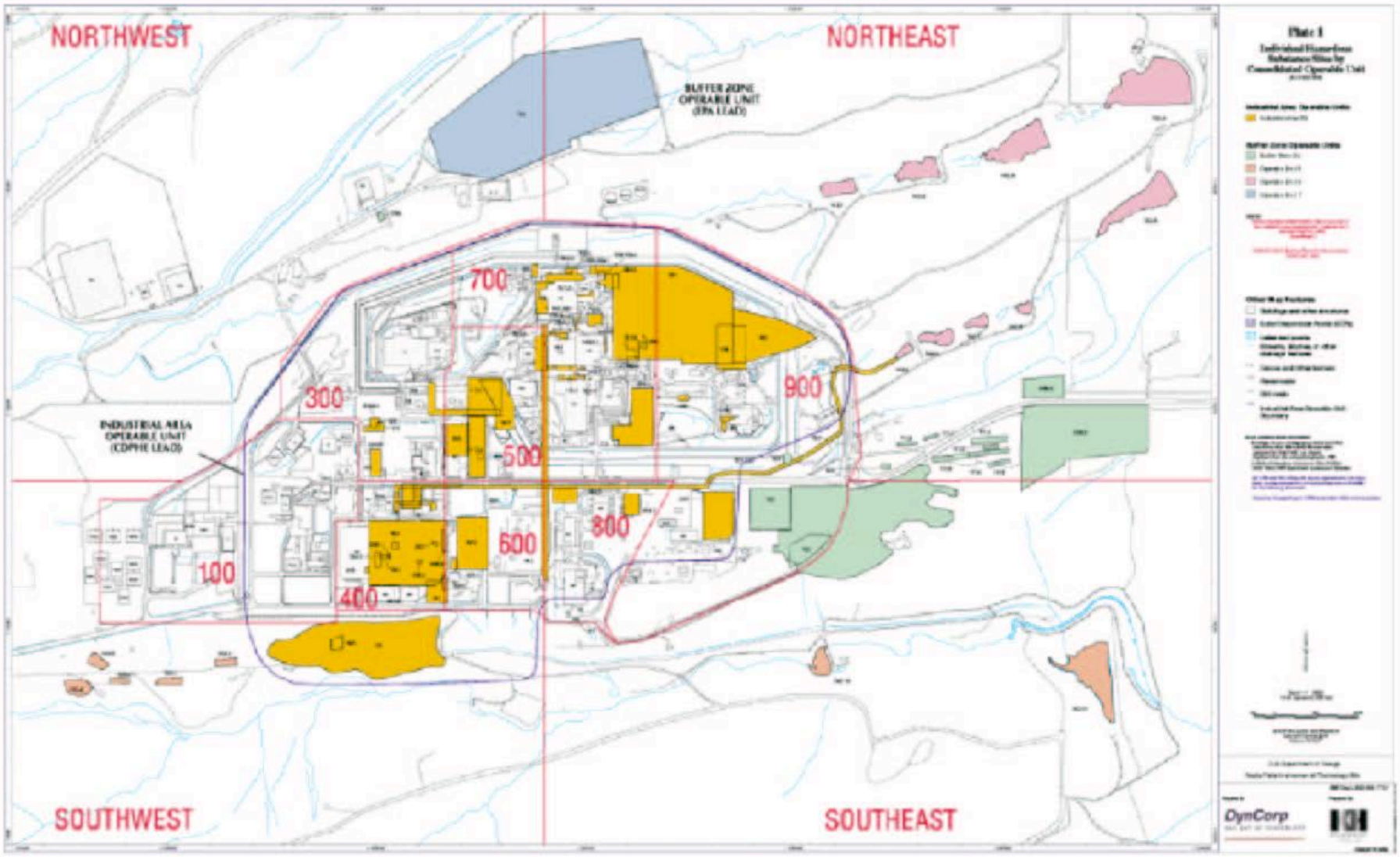
Uranium mining and milling
Uranium refining
Uranium enrichment
Uranium foundry
Fuel target fabrication
Plutonium production reactors
Reprocessing to separate plutonium
Nuclear components fabrication
Nonnuclear components
Weapons design and testing
Weapons assembly



Source: JeffCo Map (10/25/04) and Krey Hardy Map (8/1/70)

G&O

Appendix A, Map 1, Remedial Investigation Locations As Of 2002



From CERCLA to Risk-Based End States

1. The once-and-for-all assumption
2. The risk critique
3. Future use
4. The physical realities of clean-up
5. DOE's risk-based end states directive
6. Long-term stewardship

Long-Term Stewardship

- Waste configurations for long-term stewardship
- Qualities of a long-term stewardship program
- Institutional controls
  - Active institutional controls
  - Passive institutional controls
- Procedures and institutions

The Meanings of Sustainability

- Temporal Concern
- Environmental Consideration
- Inclusive Process

Sustainability as Temporal Concern

- Literally and originally
- Accept some degree of usage
- Intergenerational equity
  - Conservation of options
  - Conservation of quality
  - Conservation of access
- Balancing across generations

The Remediation Time Line

Pre-Industrial Use	Uncontrolled Past	Polluted Present	Remediation	Foreseeable Future(s) ("End State")	Long-Term Stewardship
Background Risk (Pristine)	*Increasing Risk*	*Baseline Risks*	*Transition Risks*	*Target or Residual Risks*	*Long-Term Risks*

Sustainability as Environmental Considerations

- Equality of the environment
- Acceptance of limits
- Capacity of natural systems as a key constraint on scale
- Precautionary approach

Sustainability as Process

- Integration of sustainability into development decisionmaking
- Environmental assessment
- Inclusive participation
  - Stakeholders
  - Education and deliberation
- More governance than formula
- Role of law

Risk-Informed Decisionmaking

1. Identify viable options and potential decisions
2. Scope information and analysis
3. Collect data and refine models
4. Prepare a refined risk assessment
5. Conduct additional analyses and data collection to support decisions
6. Finalize the decision

Sources: NRC, Tank Waste Retrieval 2006; NRC, Risk and Decisions, 2005

Three Approaches to Alternative End States

- Rocky Flats
- Idaho National Laboratory
- Oak Ridge Reservation

Rocky Flats (reprise)

- Function and facilities
- History
- Clean-up issues
- Refuge Act
- Risk-Based End State
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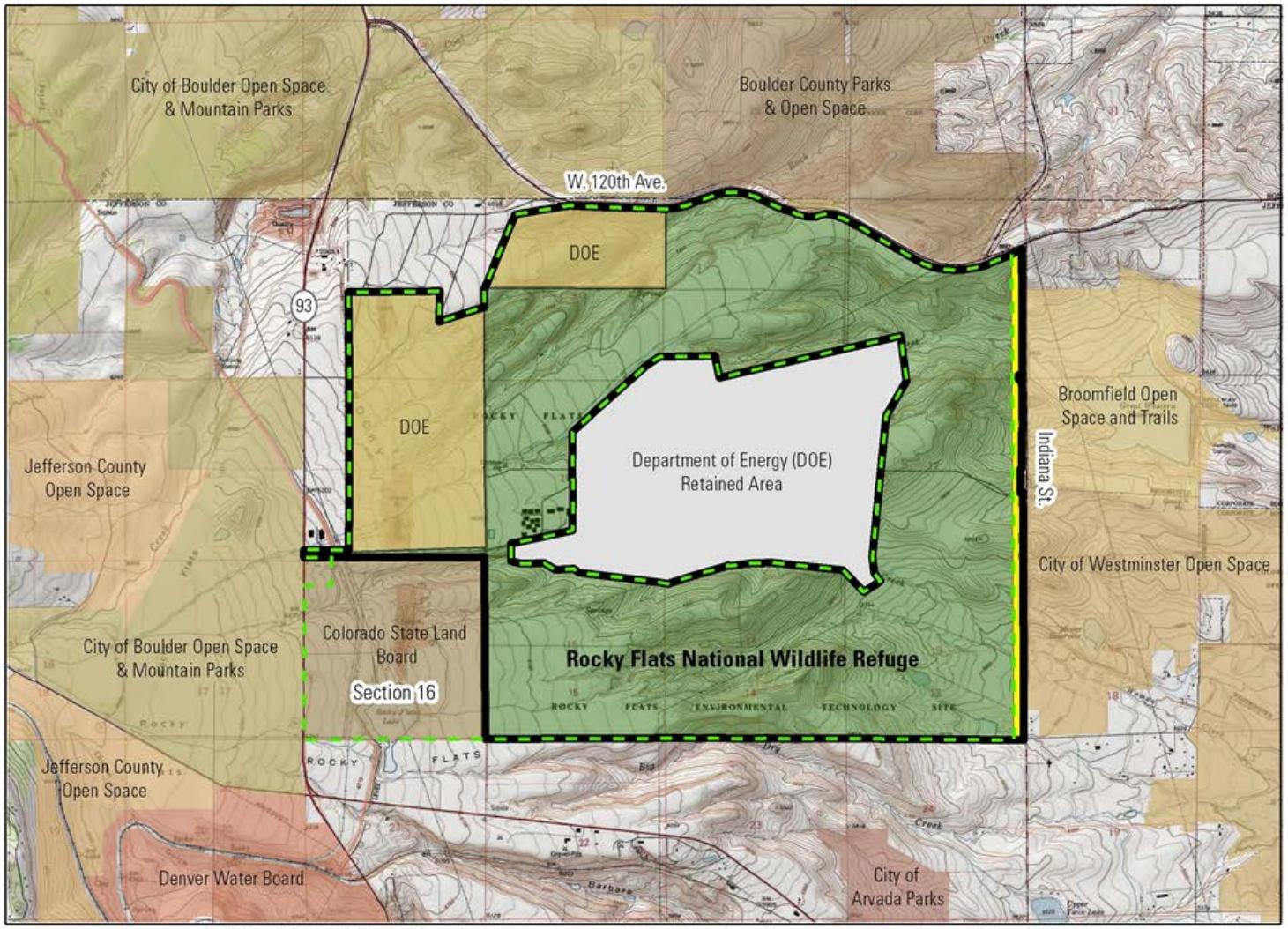
U.S. Fish & Wildlife Service

Rocky Flats National Wildlife Refuge

Boulder and Jefferson Counties, Colorado

Connectivity of Rocky Flats With Existing Open Space



300 Foot Right of Way | Existing Approved Acquisition Boundary | Proposed Acquisition Boundary

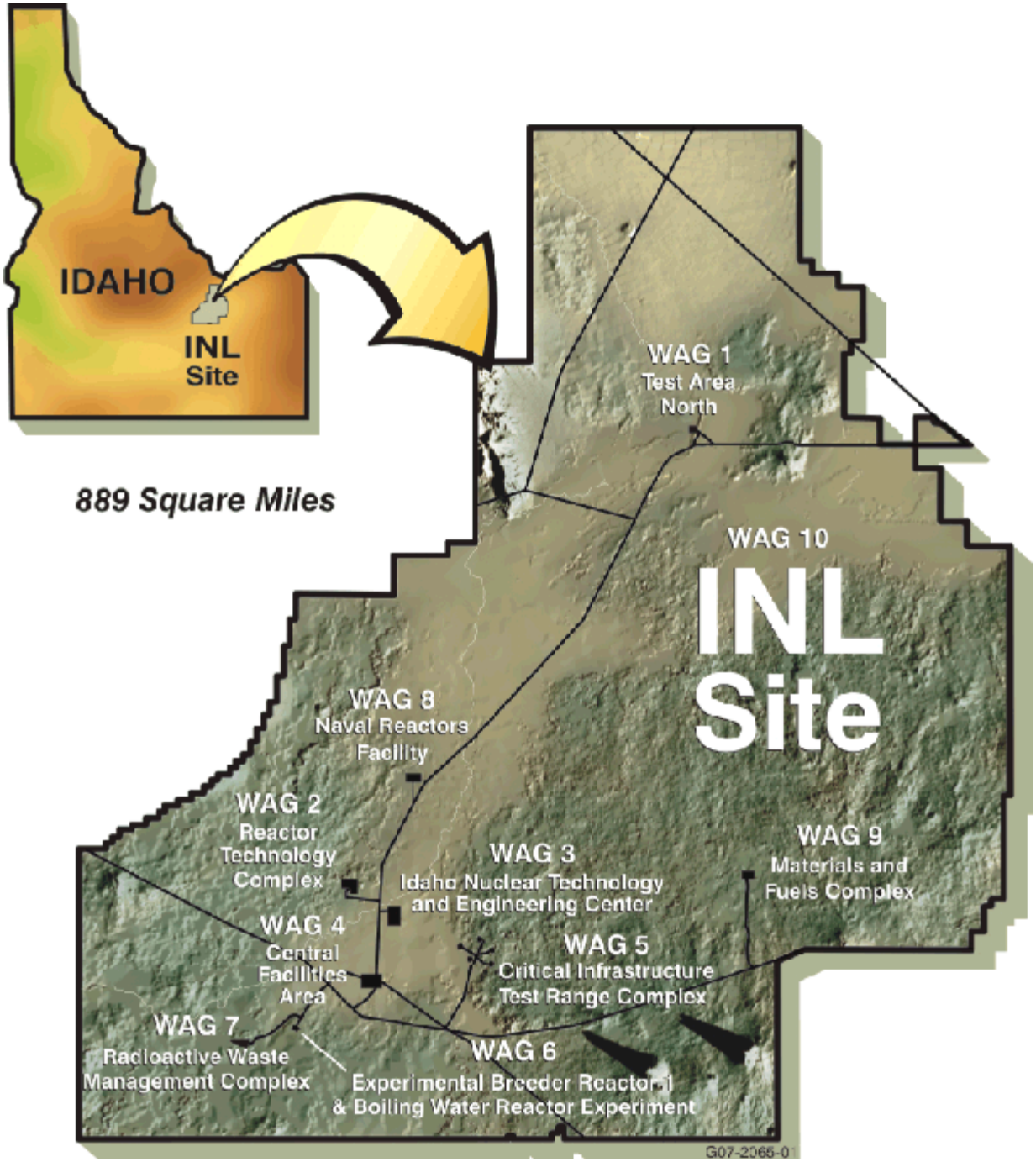
PRODUCED IN THE DIVISION OF REFUGE PLANNING
DENVER, COLORADO
MAP DATE: 07/12/2011
BASEMAP: NGS_TOPO_US_2D
6TH PRINCIPAL MERIDIAN
FILE: W:\CO\RFL\MAPS\RFL_LPPEA_0711\RFL_LANDSTATUS_071111

0 0.5 1 2 3 4 Miles

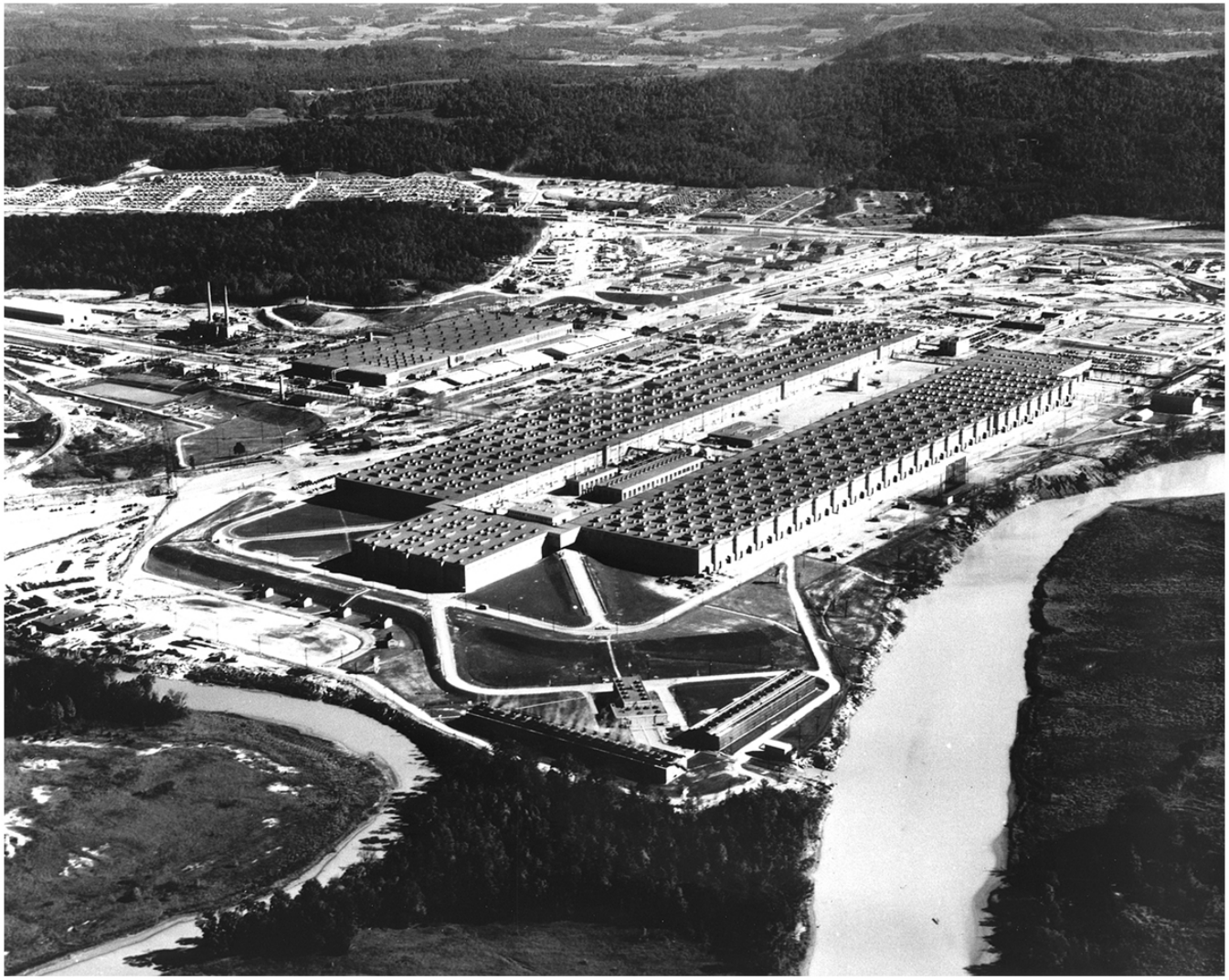
0 0.5 1 2 3 4 Kilometers

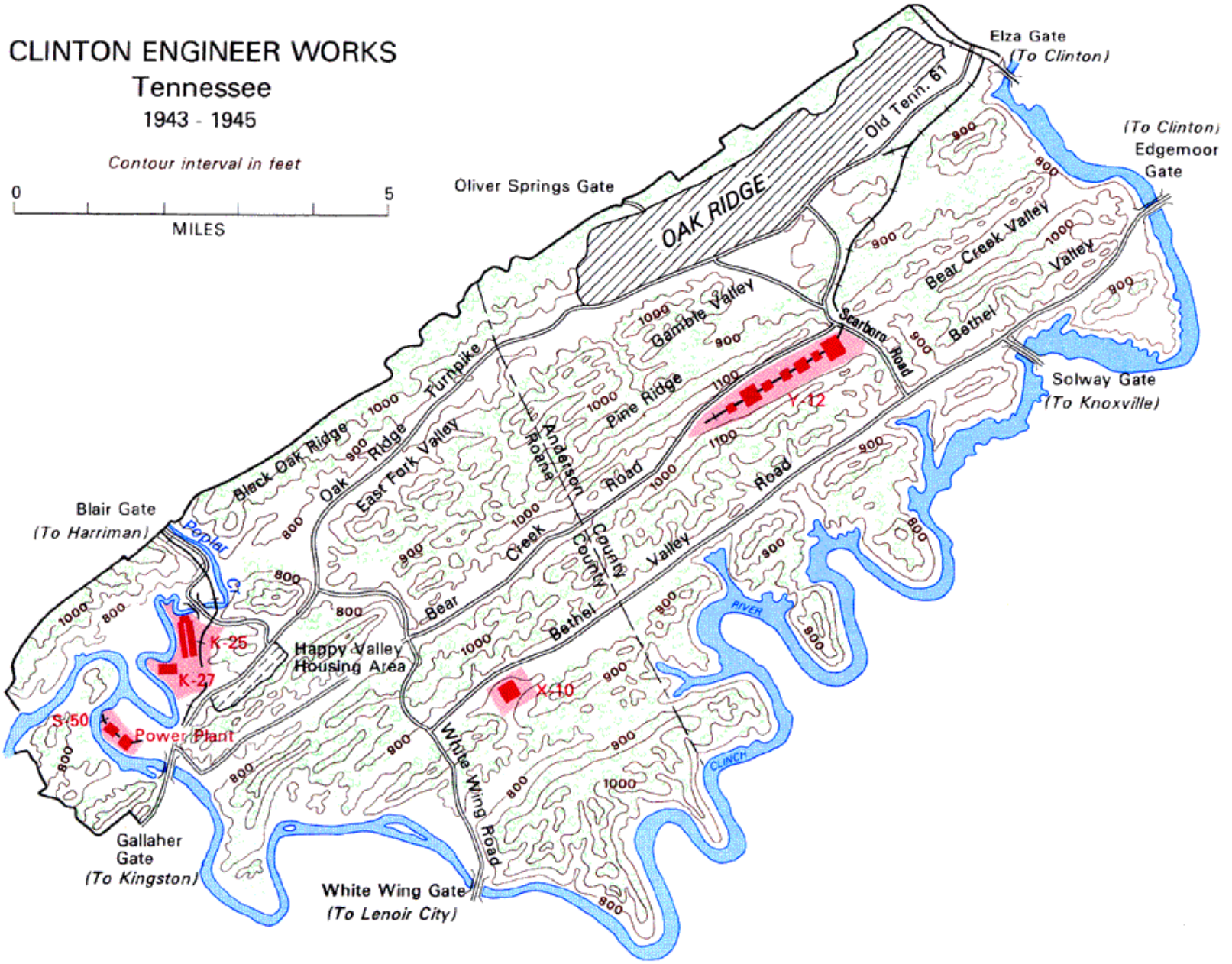
UTM ZONE 13
NAD 83

Idaho National Laboratory


IDAHO
INL Site
889 Square Miles
WAG 1
Test Area North
WAG 10
INL Site
WAG 8
Naval Reactors Facility
WAG 2
Reactor Technology Complex
WAG 3
Idaho Nuclear Technology and Engineering Center
WAG 9
Materials and Fuels Complex
WAG 4
Central Facilities Area
WAG 5
Critical Infrastructure Test Range Complex
WAG 7
Radioactive Waste Management Complex
WAG 6
Experimental Breeder Reactor-I & Boiling Water Reactor Experiment
G07-2066-01

Oak Ridge Reservation



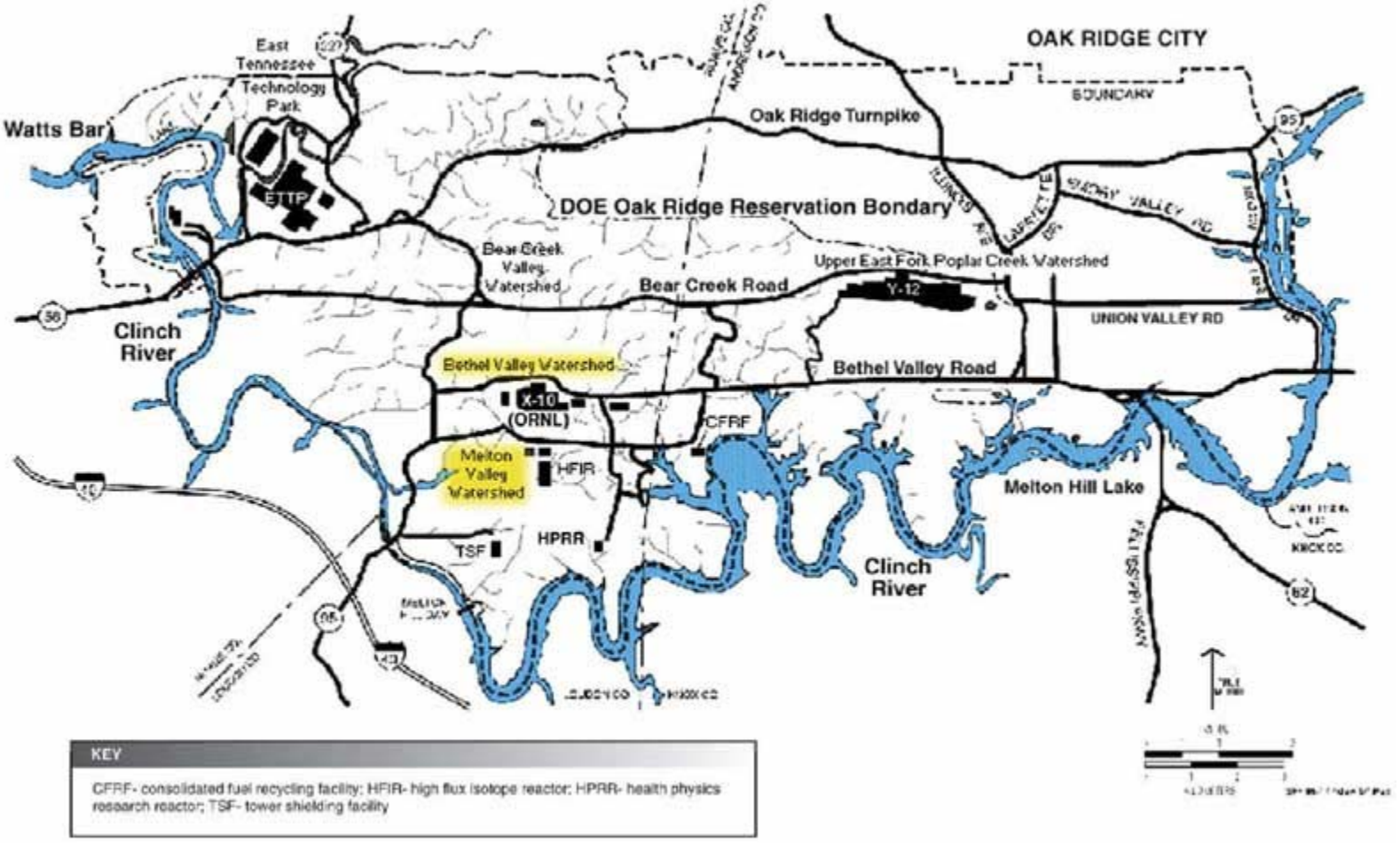

CLINTON ENGINEER WORKS
Tennessee
1943 - 1945
Contour interval in feet
0
5
MILES
OAK RIDGE
Oliver Springs Gate
Elza Gate
(To Clinton)
Old Tenn. 61
(To Clinton)
Edgemoor Gate
Bear Creek Valley
Bethel Valley
Scarboro Road
Solway Gate
(To Knoxville)
Y-12
Gamble Valley
Pine Ridge
Black Oak Ridge
Oak Ridge
East Fork Valley
Turnpike
Blair Gate
(To Harriman)
Poplar Ck
K-25
K-27
S-50
Power Plant
Happy Valley Housing Area
Bear Creek
Bethel Valley Road
Bethel Valley
Roane Anderson County
Y-10
White Wing Road
Gallaher Gate
(To Kingston)
White Wing Gate
(To Lenoir City)
CLINCH RIVER

Oak Ridge Reservation

End Use Category	Surface Use	Depth of Clean Soil	Groundwater Use	Surface Water Use	Ownership
Unrestricted	Unrestricted	Unlimited	Unrestricted	Unrestricted	Government or Private
Uncontrolled Industrial	Industrial	10 feet	Not Allowed	Unrestricted	Government or Private
Recreational	Recreational	2 feet	Not Allowed	Recreational Uses	Government or Private
Controlled Industrial	Industrial with Restrictions	2 feet, additional excavation by permit	Not Allowed	Not Allowed	Government or Private
Restricted Waste Disposal	Limited to monitoring and maintenance	No soil disturbance allowed	Not Allowed	Not Allowed	Government

Source: Oak Ridge Reservation End Use Working Group, July 1998

Figure 9. Map of the Bethel Valley Watershed and the Melton Valley Watershed



Source: Lockheed Martin Energy Systems, Inc. 1998