



Second Periodic Review

Minnie Mine Millsite
Facility/Site ID #: 426
Cleanup Site ID #: 4356
Leecher Canyon
Carlton, WA 98814

Prepared by:
Washington State Department of Ecology
Central Regional Office
Toxics Cleanup Program

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1.0 INTRODUCTION

This document is the Department of Ecology's second periodic review of post-cleanup site conditions and monitoring data to assure that human health and the environment are being protected at the Minnie Mine site (Site). The cleanup at this Site was implemented under the Model Toxics Control Act (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC). The first periodic review for this Site was completed in March 2010. This periodic review will evaluate the period from March 2010 through July 2015.

Cleanup activities at this Site were completed by the United States Department of Agriculture Forest Service (USFS) through a series of enforcement orders issued by Ecology. The cleanup actions resulted in concentrations of arsenic, barium, cadmium, copper, selenium, vanadium, and zinc in soil exceeding MTCA Method A cleanup levels. The MTCA Method A cleanup levels for soil are established under WAC 173-340-740. It was determined that institutional controls would be required for the Site because the remedy included onsite capping of hazardous materials. WAC 173-340-420(2) requires that Ecology conduct a periodic review of a site every five years under the following conditions:

- (a) Whenever the department conducts a cleanup action
- (b) Whenever the department approves a cleanup action under an order, agreed order or consent decree
- (c) Or, as resources permit, whenever the department issues a no further action opinion
- (d) And one of the following conditions exists:
 - 1. Institutional controls or financial assurance are required as part of the cleanup
 - 2. Where the cleanup level is based on a practical quantitation limit
 - 3. Where, in the department's judgment, modifications to the default equations or assumptions using site-specific information would significantly increase the concentration of hazardous substances remaining at the site after cleanup or the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When evaluating whether human health and the environment are being protected, the factors the department shall consider include [WAC 173-340-420(4)]:

- (a) The effectiveness of ongoing or completed cleanup actions;
- (b) New scientific information for individual hazardous substances or mixtures present at the Site;
- (c) New applicable state and federal laws for hazardous substances present at the Site;
- (d) Current and projected Site use;
- (e) Availability and practicability of higher preference technologies; and
- (f) The availability of improved analytical techniques to evaluate compliance with cleanup levels.

The department shall publish a notice of all periodic reviews in the Site Register and provide an opportunity for public comment.

2.0 SUMMARY OF SITE CONDITIONS

2.1 Site History

The Minnie Mine property is located in Leecher Canyon 2.3 miles east of the town of Carlton in Okanogan County, Washington. As part of the Okanogan National Forest, the land is owned by the USFS. The Site is located in an undeveloped drainage and is surrounded by undeveloped National Forest land on all sides, and an agricultural field is located approximately ½-mile downgradient from the Site. The capped portion of the Site is covered by native grasses and shrubs, and generally surrounded by steep hillsides covered in similar vegetation, with the exception of a forested area located downgradient to the south.

Mining claims associated with the facility were staked by Fred Higby, who operated a small cyanide leach plant until 1982. The cyanide heap leach operation was later operated by Cordilleran Development, Inc., which ceased mining in 1986.

During operation, the plant consisted of three process ponds, two leach pad liners, a process plant building, and the open pit mine itself. The process ponds consisted of a pregnant pond containing dissolved ore, a barren pond containing the leaching solution, and a freshwater pond. Approximately 8,000 short tons (3,400 cubic yards) of gold-bearing ore were mined from the open pit.

A vicinity map is available as Appendix 6.1 and a Site plan is available as Appendix 6.2.

2.2 Site Conditions

Prior to remedial actions, small amounts of cyanide remained in the ore heap and to some extent in the contents of the process ponds. Analysis of composite grab samples indicated that the concentration of cyanide in the ore heap solids was between 1 milligram per kilogram (mg/kg) and 10 mg/kg Weak Acid Dissociable cyanide (WAD CN).

In the bottom of the ponds, sludge remained which consisted of precipitates from the neutralization process. Interim analysis of the grab samples from both the pregnant and barren ponds indicated that the sludge potentially contained concentrations of heavy metals near or above the levels necessary for classification as dangerous wastes under Federal and State of Washington regulations.

Water collected from precipitation exceeded loss from evaporation at the Site and this led to the ponds refilling about every two years. In order to maintain safe pond levels, cyanide solutions were neutralized with calcium hypochlorite and then sprinkled out onto the adjacent ground surface with review and approval by the Washington State Department of Ecology.

2.3 Remedial Actions

2.3.1 Pond Fluid and Sludge Removal

In 1993, Ecology issued Enforcement Order No. DE 93TC-C418 to the USFS. This Order required immediate facility control, the removal of pond fluids, and that a remedial investigation/feasibility study (RI/FS) be conducted. In 1993, the USFS contracted E.T. Technologies, Inc. to pump the remaining sludge and fluid from the ponds. The sludge and fluid was pumped into tanker trucks and transported to a licensed disposal facility. The remaining liners were removed to prevent the additional collection of precipitation.

Later in 1993, Ecology issued Enforcement Order No. DE 93TC-C528 to the USFS. This Order recognized that the emergency removal actions had been accomplished and called for the completion of the RI/FS.

2.3.2 Site Capping

In 1994, the USFS presented a RI/FS to Ecology. Ecology then issued Enforcement Order No. DE 94TC-C433. This Order required remedial action at the Site in accordance with the Cleanup Action Plan (CAP), which resulted from the RI/FS.

The CAP selected soil capping as the preferred cleanup option for the Site in accordance with MTCA regulations and with the approval of Ecology. It was determined that capping would effectively block the direct contact and ingestion pathways, while monitoring associated with the cap design will evaluate potential threats to ground water.

The CAP called for covering three arsenic-impacted areas of the Site with 1.5 feet of clean (i.e., arsenic concentrations less than 20 mg/kg) native soils. The soils were to be loosely packed and vegetated with shallow-rooting native grasses and designed to encourage natural evapotranspiration of rainwater on the Site.

The Site contained sufficient quantities of native soils which were physically and chemically suitable for capping material. Soils in the on-site borrow area were sampled and found to meet the Site cleanup goal for arsenic (20 mg/kg).

The CAP called for placement of the majority of unprocessed ore in the process ponds. To reduce the likelihood of groundwater contacting the unprocessed ore, the ponds were filled with clean soil from the on-site borrow area to raise the grade of the pond bottom above the saturated level. A front-end loader was used to place the clean fill in the pond. The grade of the pond bottoms were raised approximately three feet.

The stockpile of unprocessed ore was loaded and hauled by dump truck to the process ponds. Once the unprocessed ore was placed in the process ponds, the soil cap was constructed. Approximately 1.5 feet of soil was placed over the process ponds, the area where precipitation collected in the ponds was land applied, and the processed ore heap.

Following the completion of the soil caps, the temporary haul roads leading to the processed ore heap were filled in and graded to provide drainage, and the northern borrow area was smoothed out and graded. The swale created by excavating cap material was extended southward past the process pond cap to provide drainage and divert surface runoff away from the cap. Riprap was placed in the drainage ditch adjacent to the north (upstream) end of land application area. The purpose of the riprap was to protect the cap against erosion by surface water runoff. Slopes of the three caps were measured to verify that they were less than the required 10 percent.

2.4 Ground Water Monitoring

Early sampling results were described and evaluated in the Minnie Mine Millsite Construction Report. Analysis indicated background soil moisture contained arsenic concentrations at 11.35 micrograms per liter (ug/L), greater than the MTCA Method A cleanup level of 5.0 ug/L. Limited sampling data for down-gradient suction lysimeter and groundwater monitoring wells indicated qualitatively, arsenic concentrations less than the apparent background of 11.35 ug/L. Because arsenic was elevated in cap lysimeter L-4 monitoring was to continue until a statistical comparison could be made between the arsenic data from the down-gradient compliance monitoring wells and suction lysimeter could be compared to background concentrations.

Arsenic concentrations in all down-gradient groundwater monitoring stations were below the calculated background standard of 12.69 ug/L. Monitoring of the Barnett well, a domestic well at the mouth of Leecher Canyon, as well as Site monitoring wells, was discontinued in 2003 after multiple consecutive quarters of arsenic values below Site background levels.

Groundwater monitoring was conducted until 2003.

2.5 Institutional Controls

It was determined that institutional controls would be required at the Site because the remedy relied on capping contamination at concentrations exceeding MTCA Method A cleanup levels. Due to the challenges in recording environmental covenants on federally-owned property, institutional controls were implemented through internal USFS Official Land Status Records.

The restrictions for the property are as follows:

- (a) The Forest Service or its permittees shall not compromise or otherwise impair the engineered Minnie Millsite soil cap or associated facilities.
- (b) The Forest Service will not convey or relinquish title, easement, leasehold, or other interest in any portion of the Site without serving notice upon the prospective purchaser, lessee, transferee, assignee, or other successor as contemplated by Washington Department of Ecology Enforcement Order DE94TC-C433 and 42 U.S.C. 9620(h).

Screen images from the USFS Land Status Record Database are available as Appendix 6.3.

The Site currently remains on the Washington State Hazardous Sites List.

3.0 PERIODIC REVIEW

3.1 Effectiveness of completed cleanup actions

3.1.1 Direct Contact Pathway

Based upon the Site visit conducted on June 2, 2015, the engineered cap at the Site continues to eliminate exposure pathways (ingestion, contact) to potentially hazardous materials contained at the Site. A wildfire passed through the area in the summer of 2014. There was evidence of burnt vegetation on the cap, and burnt trees to the south of the cap; but the cap appears in satisfactory condition with no evidence of erosion or other damage. No repairs or modifications have been required. The Site remains vacant and is not easily accessible by the public. A photo log is available as Appendix 6.4.

3.1.2 Institutional Controls

Due to remaining soil contamination at concentrations exceeding MTCA Method A cleanup levels, institutional controls in the form of a USFS Land Status Record Restrictions were implemented at the Site. These restrictions assure that the contaminated area remains covered with a soil cap so that hazardous materials are not released to the environment.

3.1.3 Protection of Groundwater

Arsenic was detected in a lysimeter adjacent to the capped area at concentrations approximately twice the MTCA Method A cleanup level, but below the calculated background concentration of 12.69 ug/L. Down-gradient monitoring wells and a domestic well located further downgradient from the Site did not detect arsenic above the MTCA Method A cleanup level. These concentrations indicate that groundwater quality at the Site is not being negatively impacted by contaminants contained at the Site following the remedial action.

3.2 New scientific information for individual hazardous substances for mixtures present at the Site

There is no new pertinent scientific information for the contaminants related to the Site. Cleanup levels at the Site were based on regulatory standards and background concentrations rather than calculated risk for chemicals and/or media. These standards continue to be protective of Site-specific conditions.

3.3 New applicable state and federal laws for hazardous substances present at the Site

WAC 173-340-702(12) (c) [2001 ed.] provides that,

“A release cleaned up under the cleanup levels determined in (a) or (b) of this subsection shall not be subject to further cleanup action due solely to subsequent amendments to the provision in this chapter on cleanup levels, unless the department determines, on a case-by-case basis, that the

previous cleanup action is no longer sufficiently protective of human health and the environment.”

Cleanup levels have not changed since Site closure took place in 1995.

3.4 Current and projected Site use

The Site remains unoccupied and is not easily accessible to the public. There have been no changes in current or projected future Site or resource uses.

3.5 Availability and practicability of higher preference technologies

The remedy implemented included containment of hazardous substances and it continues to be protective of human health and the environment. While higher preference cleanup technologies may be available, they are still not practicable at this Site.

3.6 Availability of improved analytical techniques to evaluate compliance with cleanup levels

The analytical methods used at the time of the remedial action were capable of detection well below MTCA Method A cleanup levels. The presence of improved analytical techniques would not effect decisions or recommendations made for the Site.

4.0 CONCLUSIONS

- The cleanup actions completed at the Site are protective of human health and the environment.
- Soil cleanup levels have not been met at the Site; however, the cleanup action for the Site is determined to comply with cleanup standards under WAC 173-340-740(6) (f), since the long-term integrity of the containment system is ensured and the requirements for containment technologies have been met.
- The institutional control for the Site is in place and continues to be effective in protecting public health and the environment from exposure to hazardous substances and protecting the integrity of the cleanup action.

Based on this periodic review, the Department of Ecology has determined that the requirements of the institutional controls are being satisfactorily followed. No additional remedial actions are required by the property owner. It is the property owner's responsibility to continue to inspect the Site to assure that the integrity of the cap is maintained.

4.1 Next Review

The next review for the Site will be scheduled five years from the date of this periodic review. In the event that additional cleanup actions or institutional controls are required, the next periodic review will be scheduled five years from the completion of those activities.

5.0 REFERENCES

Ecology. *Enforcement Order No. DE 93TC-C418*. July 29, 1993.

United States Department of Agriculture. *Removal Decision Document*. October 7, 1993.

Ecology. *Enforcement Order No. DE 93TC-C528*. November 16, 1993.

Olympus Environmental. *Phase II Remedial Investigation/Feasibility Study*. August 2, 1994.

Ecology. *Enforcement Order No. DE 94TC-C433*. October 3, 1994.

Olympus Environmental, Inc. *Minnie Mine Millsite CAP Engineering Report*. November 8, 1994.

Olympus Environmental Inc. *Minnie Mine Millsite Cleanup Action Plan Construction Report*. October 26, 1995.

United States Department of Agriculture. *Minnie Mine Millsite Cleanup Action Plan Monitoring Report*. December 15, 2003.

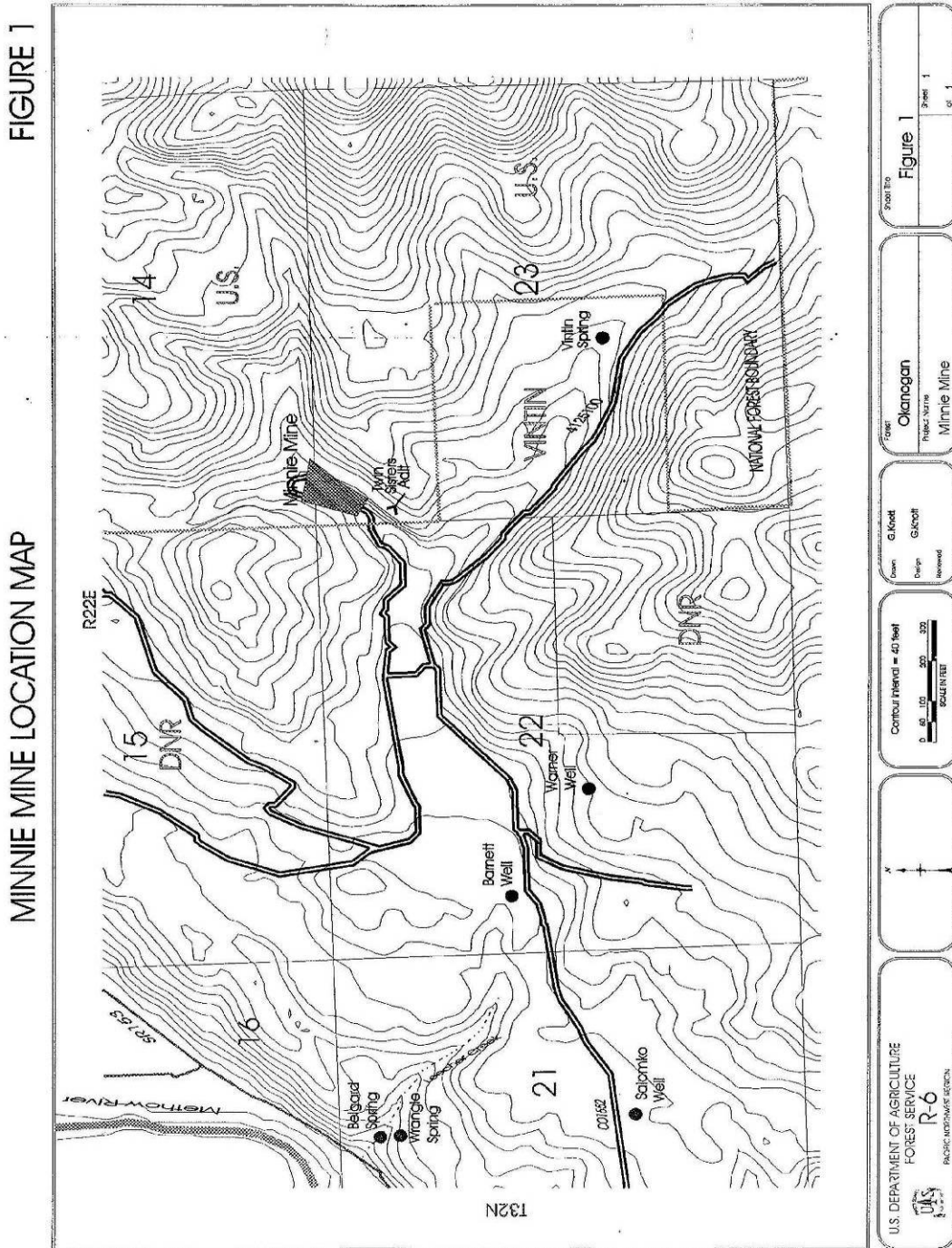
United States Department of Agriculture. *Minnie Mine Millsite Cleanup Action Plan Monitoring Report*. July 11, 2006.

Ecology. *Periodic Review*. March 2010.

Ecology. *Site Visit*. June 2, 2015.

6.0 APPENDICES

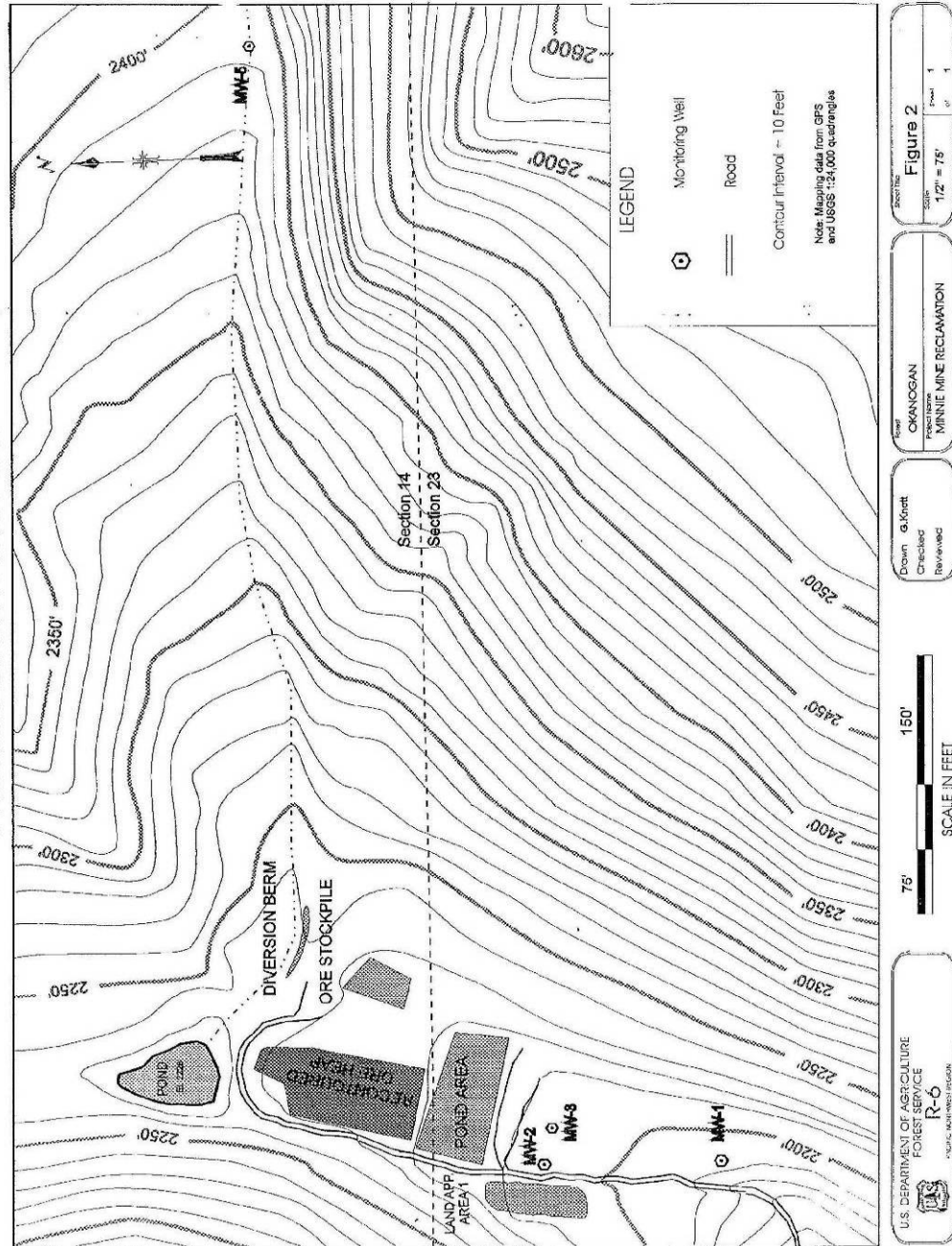
6.1 Vicinity Map



6.2 Site Map

MINNIE MINE
PRE-REMEDIATION SITE PLAN

FIGURE 2



6.3 Environmental Covenant

Automated Lands Project Version: 1

File Edit Field Record Find Help

Manage Status Cases All Documents

spec_int_mgt

Use Restrictions

| UR Name | IR Type | Type Name |
|----------------------|---------|-------------------------------|
| MINNIE MINE CAP AREA | 213 | PROTECTION AREA (ADMINISTRATI |

Authority: 844 Public Law 96-510

Method: []

Official Acres: 4.13

FS Tracts

Comments:

"The Forest Service or its permittees shall not compromise or otherwise impair the soil cap or assoc. facicities..Refer to hard copy 590 Minnie Mine Cap Area Site Restrictions for rest of restrictions."

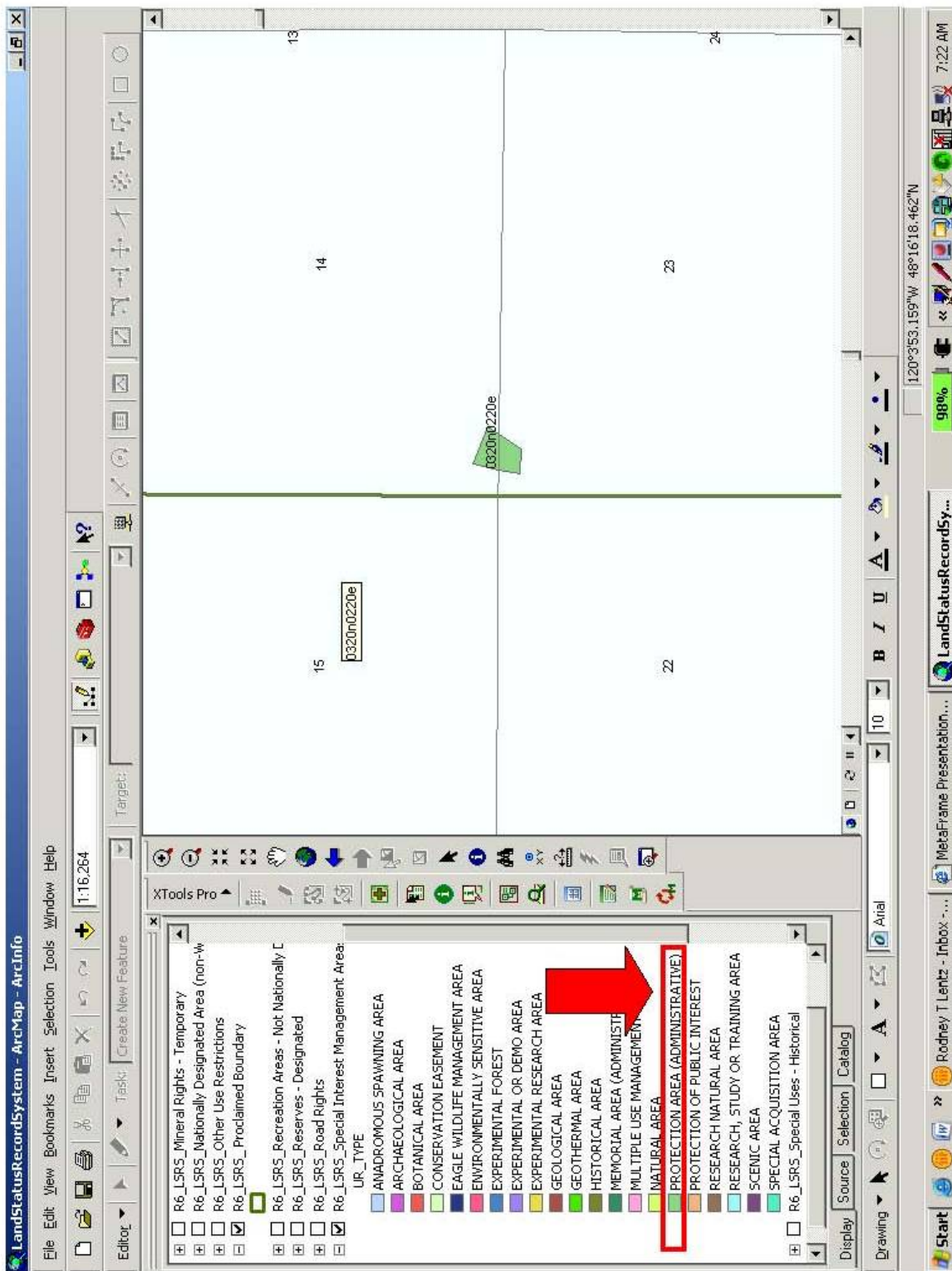
Rights-of-Ways

Route/Road No.: [] Juris.: [] Details

OK Contacts Minerals Withdrawals Cancel

Enter the name of this Use Restriction

Record: 1/1 Inert <OSC> <DBG>



6.4 Photo log

Photo 1: Access to the Site from the South with Burnt Trees Visible to the East



Photo 2: General Cap Condition - from the north



Photo 3: Capped Surface with Burnt Vegetation - from the north



Photo 4: Drainage Entering Site from the Northwest – from the southeast

