Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLAN)*: Silver Mountain Mine		
EPA ID *(from WasteLAN)*: WAD980722789		
Region: 10	**State:** WA	**City/County:** Okanogan County

SITE STATUS

NPL STATUS: Deleted	
Remediation status (choose all that apply): Complete	
Multiple OUs?* No	**Construction completion date?** 11/6/1992
Has site been put into reuse? No	

REVIEW STATUS

Lead agency: Washington State	
Author name: Norman Hepner	
Author title: Environmental Engineer	**Author affiliation:** Washington State Department of Ecology
Review period:** 4/1/2002 to 9/15/2002	
Date(s) of site inspection: 4/26/2002	
Type of review: NPL State/Tribe-lead	
Review number: 2 (second)	
Triggering action: Previous Five-Year Review Report	
Triggering action date *(from WasteLAN)*: 7/16/97	
Due date *(five years after triggering action date)*: 2002	

*["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd

Issues:

Annual State Inspections & Evaluations: Annual state inspections and maintenance of the site has not occurred since transfer of the site from EPA to Ecology in 1997.

Background Arsenic Concentrations Not Adequately Established: Background arsenic concentrations in the soil were not adequately established during the remedial action phase for this site. Only four samples were taken to delineate background variability; composite confirmational sampling relied upon background soil data to set a background concentration of approximately 86 mg/kg arsenic in the soil. The background variability based on the four soil samples was a low of 3.9 mg/kg to a high of 428 mg/kg arsenic.

Composite confirmational sampling requires an established background soil arsenic concentration. Discrete confirmational sampling could have definitely demonstrated that soil was cleaned up to below 200 mg/kg arsenic provided natural background is below this value. It is generally believed that natural background arsenic variability at this site is great and can exceed the arsenic cleanup goal in certain locations.

Recommendations and Follow-up Actions:

Conduct annual inspections and maintenance of the cap will ensure continued protection of human health and the environment at this site.

Protectiveness Statement:

The remedial action cleanup activities taken at the Silver Mountain Mine site are consistent with the objectives of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and provide protection of human health and the environment. The cap remains in excellent condition and institutional controls remain in-place and appear to be effective. The cleanup standards for the heap pile and mine dump materials and the surrounding soils are 200 mg/kg for arsenic and 95 mg/kg for total cyanide. These protective levels reduce the risks to levels below the 1.0 Hazard Index or health based levels; and for arsenic, a human carcinogen, the cancer risk factor will be reduced below one in ten thousand.

Other Comments:

None

Second 5-Year Review of the Silver Mountain Mine Superfund Site, Okanogan County, Washington

Prepared by: Date:

_____ _____

Norman T. Hepner, P.E.
Washington State Department of Ecology

Approved by: Date:

_____ _____

Michael F.Gearheard, Director
Environmental Cleanup Office
USEPA Region 10

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Executive Summary

The Silver Mountain Mine Site is in a remote location in Okanogan County. The cleanup consisted of consolidating and capping contaminated arsenic- and cyanide-laden soils. The cleanup was complicated by high levels of naturally occurring arsenic in the surrounding soils and rocks. Background arsenic concentrations were not adequately defined for the site during the investigation or remedial action phases. Definitive site confirmational sampling did not occur and visual methods were used to differentiate naturally occurring materials from mine waste.

Since the last 5-year review, the Central Regional Office of the Washington State Department of Ecology was unaware of their responsibilities and failed to perform annual inspections and maintenance of the cover. Ecology Headquarters negotiated an agreement with EPA Region 10 and this agreement was not conveyed adequately to regional office staff. This failure did not result in a less protective site and the cap remains in excellent condition.

Overall, the remedy is performing as designed and no additional actions are required. The Washington State Department of Ecology will be conducting annual inspections and maintenance of the site.

Acronyms

Applicable or Relevant and Appropriate Requirements (ARARs)
Code of Federal Regulations (CFR)
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
Environmental Protection Agency (EPA)
Explanation of Significant Differences (ESD)
Feasibility Study (FS)
Institutional Controls Program (ICP)
micrograms per liter (ug/L)
milligrams per kilogram (mg/kg)
National Contingency Plan (NCP)
National Priority List (NPL)
Quality Assurance and Quality Control (QA/QC)
Record of Decision (ROD)
Remedial Actions (RA)
Remedial Action Objectives (RAOs)
Remedial Investigation and Feasibility Study (RI/FS)
State Superfund Contract (SSC)
to be considered (TBC)
U.S. Bureau of Land Management (BOM)
Washington State Department of Ecology (Ecology)

I. Introduction

This report summarizes the second 5-year review of remedial actions implemented by the Environmental Protection Agency (EPA) Region 10 and the State of Washington at the Silver Mountain Mine Superfund Site in Okanogan County, Washington. This 5-year review of remedial actions has been prepared to meet the federal statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

At the time of this 5-year review, full implementation of the site remedy had been completed and one 5-year review had been completed in July 1997. The site was delisted on September 22, 1997. The purpose of this 5-year review is to assess whether the remedy at the Silver Mountain Mine Superfund site is protective of human health and the environment. EPA documents that define the selected remedy for the Silver Mountain Mine Superfund Site include:

- Record of Decision, Silver Mountain Mine Superfund Site, Okanogan County, Washington, March 27, 1990
- Explanation of Significant Differences (ESD) at the Silver Mountain Mine Superfund Site, Okanogan County, Washington, October 12, 1994

II. Site Background & Chronology

1) Site Description and History

The Silver Mountain Mine Superfund site is located in Okanogan County, in north-central Washington State, about six air miles northwest from the town of Tonasket. See attachment 1 for a diagram showing the location of the Silver Mountain Mine site. The five-acre site lies in a north-south running valley known as Horse Springs Coulee and is currently owned by Mr. Jim McDaniel of Loomis, Washington. The area around the site is semi-arid with scrub vegetation, and is primarily used for cattle grazing.

Underground, hard rock mining for silver and gold began at the site in 1902. By 1956, the sporadic development of the mine produced about 2000 feet of underground workings and several tailings piles in a mine dump consisting of waste and mineralized rock. A 400-ton per day mill was constructed in 1952, but was never used. The mill had been removed prior to the Superfund investigations.

From 1980 to 1981, Precious Metals Extraction, Ltd., constructed a cyanide heap leach pile and attempted to extract silver and gold from the previously mined tailings. The heap consisted of about 5,300 tons of mineralized rock in a 100 by 105 by 14 foot pile on top of a 20 mil plastic liner. About 4,400 pounds of sodium cyanide was mixed with water and sprayed on the top of the heap. The cyanide-laden solution was then collected in a leachate pond at the base of the heap.

In July 1981, the site was abandoned without cleanup or treatment of chemicals on the site.

Cyanide solution remained in the leachate collection pond and in the heap pile. Several empty cyanide drums and large containers of carbon also were abandoned onsite.

In November 1981, the Washington Department of Ecology (Ecology) investigated the site, and in 1982, took an emergency action to neutralize the cyanide solution with sodium hypochlorite. After two applications and recirculating the hypochlorite solution through the heap and collection trench, the cyanide levels dropped from 1,100 mg/l total cyanide, to less than 1 mg/l total cyanide in the collection trench. Some residual material, however, remained in the heap material and continued to leach as the concentration of cyanide was measured at 173 mg/kg in the heap pile in 1989. Some natural degradation did occur, because there was no cyanide detected in the soil or heap pile during site cleanup in 1992.

Ecology recommended the site for the National Priorities List (NPL) in 1982. In October 1984, the site was added to the NPL list by the U.S. Environmental Protection Agency (EPA).

Initial remedial planning activities were done by Ecology starting in 1981. The state provided immediate reduction of risks at the site by neutralizing the cyanide solution, and again in 1985 by removal of the drums of hazardous materials left on-site when the site was abandoned in 1981.

2) Studies Conducted at the Site

In 1988, EPA started the Remedial Investigation and Feasibility Study (RI/FS) by contracting with the U.S. Bureau of Mines (BOM). BOM conducted the site investigation which obtained the data necessary to determine the nature and extent of contamination. The physical and chemical characteristics of the site were evaluated by field mapping and analysis of site materials. The hydrogeologic investigation incorporated four monitoring wells, three off-site water supply wells, and two on-site surface seeps. Thirty-four samples from the heap leach pile and mine dump material; twenty samples of nearby soils; and three rounds of water samples from the seven wells and the two surface water seeps were collected and analyzed.

The investigation identified and evaluated the following three potential sources of contaminants identified at the site:

- the heap leach
- the unprocessed rock
- the mine drainage water

Potential exposure pathways for contaminants were identified as:

- on-site soils
- on-site surface water
- on-site ground water in a shallow aquifer
- off-site ground water in the region.

The risk assessment identified arsenic and cyanide as the primary contaminants of concern. Arsenic is a component of the native rock in the area. The concentration of arsenic in the soil is related to the amount of arsenic in the native rock and whether it is oxidized in the native rock. The oxidized arsenic is more soluble which in turn can increase the concentration in the soils from all of the mined materials, the heap pile, and the mine dump. The highest arsenic levels found during the RI/FS were in the mined material (1,080 mg/kg) and in mine drainage water sampled from the stock water tank (95 ug/l).

Cyanide was brought to the site and spread on the prepared heap of previously mined materials. Cyanide concentrations in the heap were reduced during the 1982 removal action taken by Ecology. The cyanide in the leachate pond was measured at a high of 1,100 mg/l prior to the Ecology actions, and only about 1 mg/l was measured in the leachate after the Ecology removal. Soil samples prior to the removal ranged from 480 mg/kg total cyanide in the heap to 50 mg/kg just one foot away. During the RI/FS investigation in 1989, the cyanide concentration was measured as 173 mg/kg in the heap samples.

Both arsenic and cyanide were found in the perched shallow aquifer just at the edge of the heap pile. During the RI/FS, the concentrations were found to be elevated above the background (< 1.0 mg/l) in on-site monitoring wells. Concentrations of arsenic were 14 ug/l and cyanide was 122 ug/l in the monitoring wells. Because of the low yield in the aquifer under the site and diversion of the surface seeps away from the site, natural attenuation is expected to result in a gradual decrease in these groundwater values.

Although elevated levels of arsenic were found in the mine drainage, it was anticipated that blocking the mine entrance would divert surface water runoff and eliminate this exposure route. As part of a subsequent risk assessment, the mine drainage was determined to pose no ecological threat.

The Feasibility Study screened 23 various methods of cleaning up the site. From this list, 8 alternatives were developed and evaluated against the 9 criteria listed in the National Contingency Plan (NCP).

In the Record of Decision (ROD), there were three primary contamination sources. Arsenic (maximum of approximately 1,000 mg/kg) and cyanide (maximum of approximately 1,100 mg/kg) contaminants were found in the heap leach pile of mined material and in the trench remaining from the abandoned cyanide heap leaching operation. West of the heap pile was a larger pile of unprocessed rock from which the material was taken for the heap leaching operation. The rock also contained the same high levels of arsenic. Mine drainage water from the open mine entrance (adit, portal), also containing high levels of arsenic (approximately 90 ug/l), was piped from within the adit to a cattle watering trough adjacent to the heap leach trench. Water from the trough overflowed and ponded on the site.

On March 27, 1990, the ROD was signed by EPA requiring implementation of the following cleanup actions:

- Consolidation of the arsenic and cyanide contaminated soil and mined rock.

- Cleanup standards were 200 mg/kg for arsenic and 95 mg/kg for cyanide.
- Construction of a soil/clay cap over the consolidated soil and rock.
- Closure of the mine entrance to divert the flow of mine drainage away from the site and for safety reasons.
- Fence the site to protect the cap.
- Place deed restrictions on the property to prevent future disturbance and to make future owners aware of the site.
- Installation of a new well in the Horse Springs Coulee aquifer to provide an alternate stock water supply.
- Installation of new ground water monitoring wells.

The March 1990 ROD was followed in October 1994 by an ESD to address conditions which were not predicted when the ROD was developed. This is discussed in greater detail below.

3) Remedial Construction Activities

EPA contracted with Roy F. Weston (Weston) to design and construct the remedy. The design was completed in late 1990, and a soil hauling subcontract was awarded on September 30, 1991. During December 1991 and January 1992, top soil for the cover over the cap was blended on-site and stockpiled. On April 3, 1992, Weston awarded the subcontract for consolidation, capping, and fencing the site. The construction work was completed during the summer of 1992:

- ✓ Mobilization and initial clay stockpiling (cap material) started June 29, 1992.
- ✓ Consolidation of mined material completed July 31, 1992.
- ✓ Closure of the mine entrance completed August 11, 1992.
- ✓ Cap and cover completed August 12, 1992.
- ✓ Site fenced August 15, 1992.
- ✓ Site hydroseeded November 6, 1992.

The four monitoring wells that were placed during the RI/FS were not damaged during the construction. (It was anticipated that at least two wells would have to be abandoned to consolidate the mined materials and construct the cap.) Therefore, no new monitoring wells were constructed. The four existing wells were considered sufficient to provide long-term monitoring.

The consolidation action removed contaminated mine dumps from four areas around the site and collected them in a single location. The site consolidation met the ROD performance goals of 200 mg/kg arsenic in exposed soils remaining at the site. The cyanide levels in all of the soil samples taken were all non-detectable (*0.5* mg/kg detection limit).

Two background samples were taken from the soils sloughing off the hillside and onto the site during the remedial action. One of the samples indicated arsenic concentrations of over 400 mg/kg. The project managers were convinced that some native soils had higher arsenic concentrations than the cleanup levels onsite and it appeared that there was a distinct difference between the soil samples taken from the valley floor (less than 40 mg/kg arsenic). The site is located at the intersection of the valley floor where the heap leach pile was located and the mine portal which was excavated into the side of the mountain.

One of the past actions that occurred at the site was the construction of an aqueduct across the site along the edge of the valley. Rock rubble from the aqueduct construction was dumped over the edge of the cut and in several places commingled with the mine waste in the mine dumps. It was determined by the project managers that visual observation was an adequate method of distinguishing between the two types of waste material (size, fracturing, and color). Where the two different activities commingled the rock, all the material was consolidated under the cap.

Following construction activities, surface water continued to enter the site at a slow rate from a new seep coming from the blocked mine entrance. This flow was diverted away from the capped landfill area towards an area offsite and infiltrates into the ground before reaching the site fence.

The installation of the groundwater monitoring wells and stock water supply well, as dictated by the ROD, was attempted. These remedial construction activities did not come to completion because the two test wells that were drilled did not locate water prior to hitting bedrock. The well locations were selected using the best available information. The resolution of this unforeseen development is further discussed in the "Explanation of Significant Differences" section below.

4. Explanation of Significant Differences

In October 1994, EPA completed an ESD to describe changes in the remedial action due to unforeseen conditions encountered at the site during implementation of the ROD. Changes found in the conditions at the Silver Mountain Mine Site required EPA to modify the remedial actions that were described in the March 27, 1990 ROD. These changes were made as result of new information about the groundwater in proximity to the site. The two changes in site the selected remedy that EPA made are:

- To allow the stock water tank to be reestablished, if needed, using the mine drainage, as had historically occurred; and
- Not to monitor the groundwater.

The ROD stated that an alternate water supply would be provided to replace the mine drainage as stock water source, assuming that the Horse Springs Coulee aquifer was a reasonable source in terms of quantity, quality, and depth of water. Two attempts were made to locate a groundwater source to replace the mine drainage as a water supply for livestock. Neither of the attempts was productive and water was not found despite drilling locations that were determined to be prime locations. Since stock water is key to the usefulness of the land and water resources are very limited in the vicinity of the site, the evaluation of other sources necessarily focused on whether the mine drainage could still be used. Although the baseline risk assessment qualitatively noted an "enhanced" ecological risk from the stock tank, a more recent assessment by EPA's contractor, Roy F. Weston, indicates that no significant ecological risk concerns arise from the presence of the stock tank. By allowing the mine drainage to be used as a source of stock water, (e.g., by reestablishing the stock tank), EPA will be able to fulfill the intent of the ROD. EPA left the property owner with a stock water supply despite groundwater conditions which prevented establishing an alternative groundwater well for stock watering as originally planned.

The ROD stated that monitoring the groundwater to assure that it does not become contaminated would occur. Three wells were installed in October 1988 and fourth well in June 1989. Although the wells were protected during construction in 1991 and 1992, they were discovered to be inoperable in August 1993. It was not determined how the wells were damaged, though vandalism and structural failure were considered. Following review of the monitoring well status, depths, and considering the lack of useable groundwater near the site, it was determined that the site conditions did not warrant reestablishment of a groundwater monitoring network for the site. After consultation with Ecology, EPA determined that cleanup actions diminished the threats to the groundwater aquifer; the shallow groundwater aquifer was not found above the bedrock formation at the site where water was previously thought to be located; and monitoring wells constructed during site studies were damaged beyond use. Hence, the remedy was modified to not require groundwater monitoring at the site.

III. Responsibilities for Remedy Implementation and Long-Term Operations and Maintenance

On January 4, 1991, EPA and Ecology entered into a State Superfund Contract (SSC) to provide for the State of Washington matching funds for cleanup of the site. The construction estimate was $750,000 at that time. It was agreed in the SSC that EPA would implement the cleanup and pay 90 percent of the costs and that Ecology would pay the required 10 percent. Ecology also agreed to take over the operation and maintenance of the site once the vegetative cover was established. The SSC has been amended once to increase the total cost to $1 million with the State's share still remaining at 10 percent.

EPA implemented the remedy in 1992 and oversaw operations and maintenance until July 10, 1997, at which time, Ecology agreed to accept long-term operations and maintenance.

IV. Progress since the Last Five-Year Review

This is the second five-year review; the first five-year review was completed by EPA Region 10 in July 1997. Several spray applications for weed control occurred during the summer of 1997. Prior to this five-year review inspection, there has been no regulatory inspection or cleanup activity on this site since the site inspection on May 27, 1997. The site was deleted from the NPL effective September 22, 1997.

V. Five-Year Review Process

Administrative Components:

The current landowner [Mr. Jim McDaniel] was contacted and interviewed both pre and post site inspection. Anne Daily, EPA Region 10, was contacted and provided information concerning the previous five year review.

Community Involvement:

The local Health Department was contacted to determine their interest in accompanying Ecology on our site inspection. Additionally, the surrounding landowner was notified via phone message of our intent to conduct a five-year review at Silver Mountain Mine. No other community involvement was deemed necessary for this remote site.

Document Review:

This five-year review consisted of a review of relevant documents in the Ecology's Central Regional Offices file including background and historical data, correspondence from 1982 to the present, remedial investigation, feasibility study, record of decision, remedial action report, ESD, maintenance plan, and first five-year review. In addition, Sherry Evenson, Okanogan County Auditor's Office, was contacted on September 11, 2002 to verify that the deed restriction was recorded. The deed restriction is Okanogan County document number 847844 and located in Volume 150, Pages 0191 & 0192.

Data Review:

Ecology reviewed the soil analytical data in the remedial action report and mine seep samples from 1997 and 2002. The limited data available provides little insight into increasing or decreasing trend concentrations. It appears that contaminant concentrations are increasing; however, contaminant flow was not measured during any of the sampling events and no mass contaminant movement into the soil column is known at this time. It is not clear if flow rates from the mine seep vary from season to season or year to year. Overall concentrations remain below regulatory concern as explained in the ESD.

Site Inspection:

On April 26, 2002, I conducted a site inspection of the Silver Mountain Mine. The site inspection included all elements of the Silver Mountain Mine Maintenance Checklist as developed in December 1994 and amended July 8, 1997 [see attached completed checklist and site inspection pictures]. The cap continues to maintain good grass cover; however, cattle tramplings were noticed and have the potential to begin rill erosion on the side slopes if a large rainstorm or snowmelt event occurs. Weeds are very limited (6 woody weeds) on the cover. The EPA site fence is in disrepair; however, a newer fence placed by the adjacent property owner adequately controls access to the site. The newer fence still provides for access to the watering hole near the mine adit. Access to the watering hole by cattle was evident; however, there was little evidence that cattle routinely frequented the cap. One water sample from the seep was collected and sent to Cascade Analytical in Wenatchee, Washington for analysis. The water analysis indicated an arsenic concentration of 116 ug/l.

Interviews:

The site landowner was interviewed in several phone calls pre and post site inspection to clarify elements of this report. The site landowner divided the parcel into two parts, the 5-acre NPL site

and the remainder of the property. The landowner sold the non-NPL parcel to the adjacent landholder approximately 3 years ago. The landowner maintains that cattle may still be using the water source although a water trough is not present and flows at the time of the inspection were minimal. The landowner does not visit the site routinely.

Technical Assessment

Question: Is the remedy functioning as intended by the decision documents?

The remedy consolidated and capped soil contamination and restricted access to contaminated water for livestock and wildlife purposes only through a deed restriction; human consumption of the seep water or drilling of a water well in the vicinity of the site is not allowed. Based on the 2002 site inspection, the cap remains in excellent condition and no new uses of surface or groundwater in the vicinity has occurred. The deed restriction appears to be working with the current landowner knowledgeable and understanding of the purpose of the restriction. Although the site fence is in disrepair, a newer adjacent landowner-owned fence in excellent condition surrounds and restricts access to the site.

Annual site inspections have not occurred at the site since 1997. Failure to inspect and correct deficiencies annually could have permitted site deficiencies to go unnoticed for an extended length of time. Cap erosion can worsen significantly in ensuing years once started and woody weeds can become established and breach the clay cover. It does not appear that these conditions have occurred; however, annual inspections should commence to prevent the potential for harm to the remedy.

Question: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. It should be noted that the stock water tank has not been replaced; the water pools in the drainage ditch near the mine adit. Additionally, a second perimeter fence has been installed by the adjacent landowner restricting easy access to the site. Access to the site may still occur and is permitted for purpose of livestock watering as explained in the ESD.

Changes in Standards and TBCs

In 2001, EPA promulgated a more stringent arsenic drinking water standard. The standard is not applicable to this site as the site has a deed restriction preventing the use of the mine seeps and the drilling of water wells for the purpose of human consumption. The mine seep concentration remains below regulatory concern as discussed in the ESD.

Changes in Exposure Pathways, Toxicity, and other Contaminant Characteristics

The exposure assumptions used to develop the human health and ecological risk assessments remain valid. There has been no change in the toxicity factors for the contaminants of concern. The assumptions in the analysis are considered reasonable in developing risk-based cleanup

levels. It is anticipated that there will be a change in the toxicity factor for arsenic in water for human consumption.

Question: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no new information to question the protectiveness of the remedy. The September 1993 Remedial Action Report, Section 4.5.2, addresses the lack of background soil data and the inappropriateness of composite sampling in determining whether cleanup was achieved at this site. In all, four background samples were taken [3.9, 13.9, 33.7, and 428 mg/kg] with a range of 3.9 mg/kg to 428 mg/kg arsenic. Based on correspondence in the file, the project managers concurred that the cleanup action level should be raised to 100 mg/kg with no subsequent change in sampling methodology. The change in action level is contrary to the Final Sampling and Analysis Quality Assurance Project Plan, dated April 1992, for the site. Based on my analysis, the project managers assumed a natural background concentration of approximately 86 mg/kg to meet the arsenic cleanup goal of 200 mg/kg. See Weston memo dated July 28, 1992 for project manager's supporting rationale for the change.

Technical Assessment Summary: Based on my review and investigation of the site, the remedy is functioning as intended by the decision documents. Physical hazards do remain on this remote site, specifically, steep drop-offs and pits from the mill's foundation walls and interior pits. Cellular phone service is not currently provided to the area.

Annual inspections and evaluations by the State have not occurred since the last five-year review conducted by EPA; however, based on my assessment and the lack of access to the site, the lack of annual evaluations did not impact site protectiveness. This issue is further discussed in Section VI, Issues.

A recent change in the arsenic drinking water MCL has not affected the exposure assumptions. During the RI/FS, a human drinking water well was not considered a potential pathway. The ecological evaluation (mine drainage used as stock water) is unaffected by the new standard and the ecological risk assessment remains current. The property remains open rangeland with no foreseeable change in use.

During the file review of the remedial action, it was noted that the confirmational composite sampling [8 discreet locations composited into 1 sample with natural background at approximately 86 mg/kg and a cleanup action level of 100 mg/kg for arsenic] conducted during the remedial action phase could not definitely conclude that arsenic concentrations are below 200 mg/kg as determined protective in the ROD. However, it is generally agreed that natural background concentrations for this area can be significantly higher than 200 mg/kg. This issue is further discussed in Section VI, Issues.

VI. Issues

Two issues are raised as part of the evaluation and elaborated below:

1) State Inspections & Evaluations

Annual state inspections and maintenance of the site has not occurred since transfer of the site from EPA to Ecology in 1997. Ecology regional field office personnel were unaware of the annual inspection and maintenance requirement. Ecology regional field office personnel are now aware and have placed the annual inspection requirement on the required actions to be taken each year.

Background Arsenic Concentrations

Background arsenic concentrations in the soil were not adequately established during the remedial action phase for this site. Only four samples were taken to delineate background variability; composite confirmational sampling relied upon background soil data to set a background concentration of approximately 86 mg/kg arsenic in the soil. The background variability based on the four soil samples was a low of 3.9 mg/kg to a high of 428 mg/kg arsenic. A background arsenic concentration was not properly established for this site.

Composite confirmational sampling requires an established background soil arsenic concentration. Discrete confirmational sampling could have definitely demonstrated that soil was cleaned up to below 200 mg/kg arsenic provided natural background is below this value. It is generally believed that natural background arsenic variability at this site is great and can exceed the arsenic cleanup goal in certain locations.

ISSUES	**Affects Protectiveness (Y/N)**	
	Current	Future
Annual State Inspections	Y	Y
Background Arsenic Concentrations	N	N

VII. Recommendations and Follow-up Actions

As part of this five-year review, a single recommendation is being identified in the table below to improve remedy performance or protectiveness in alignment with the Remedial Action Objectives and performance standards of the Site. Conducting annual inspections and maintenance of the cap will ensure continued protection of human health and the environment at this site.

Recommendations/ Follow-up Actions	**Party Responsible**	**Oversight Agency**	**Milestone Date**	**Follow-up Actions: Affects Protectiveness (Y/N)**	
				Current	**Future**
Conduct Annual Inspections	Ecology's Central Regional Office	EPA Region 10	September of every year	Y	Y

VIII. Protectiveness Statement

The remedial action cleanup activities taken at the Silver Mountain Mine site are consistent with the objectives of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and provide protection of human health and the environment. The cap remains in excellent condition and institutional controls remain in-place and appear to be effective. The cleanup standards for the heap pile and mine dump materials and the surrounding soils are 200 mg/kg for arsenic and 95 mg/kg for total cyanide. These protective levels reduce the risks to levels below the 1.0 Hazard Index or health based levels; and for arsenic, a human carcinogen, the cancer risk factor will be reduced below one in ten thousand.

According to the data obtained during the construction work, the cyanide in the soils is below detection (0.5 mg/kg), and the concentrations of arsenic that remain in the areas that were cleaned up are believed to be less than 200 mg/kg unless natural background is higher.

The major source of contaminants identified in the ROD, the rock material from the mining operations (heap and mine dump), has been addressed. The mine drainage was reevaluated in the ESD and it was determined that the acid mine drainage did not pose an ecological threat. According to the risk assessment and amended assessment, the inhalation and ingestion of the contaminated soils were the major routes of exposure. The arsenic laden waste rock from the mine was contained and capped. The cleanup also reduces the impacts to the groundwater by diverting the run on water away from the capped mine waste and by controlling leachate generation by capping which reduces infiltration.

IX. Next Five-Year Review

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) requires a five-year review of all sites with hazardous substances remaining above the health-based levels for unrestricted use of the site. The cleanup of the Silver Mountain Mine site utilized containment of the hazardous materials as the method to reduce the risk.

The five-year review process will be used to ensure that the cap is still intact and blocking exposure pathways for human health and the environment. As noted in the ESD discussion above, groundwater monitoring will not be conducted.

Second 5-Year Review of the Silver Mountain Mine Superfund Site, Okanogan County, Washington

Prepared by: Date:

Norman T. Hepner, P.E.
Washington State Department of Ecology

Approved by: Date:

Michael F.Gearheard, Director
Environmental Cleanup Office
USEPA Region 10

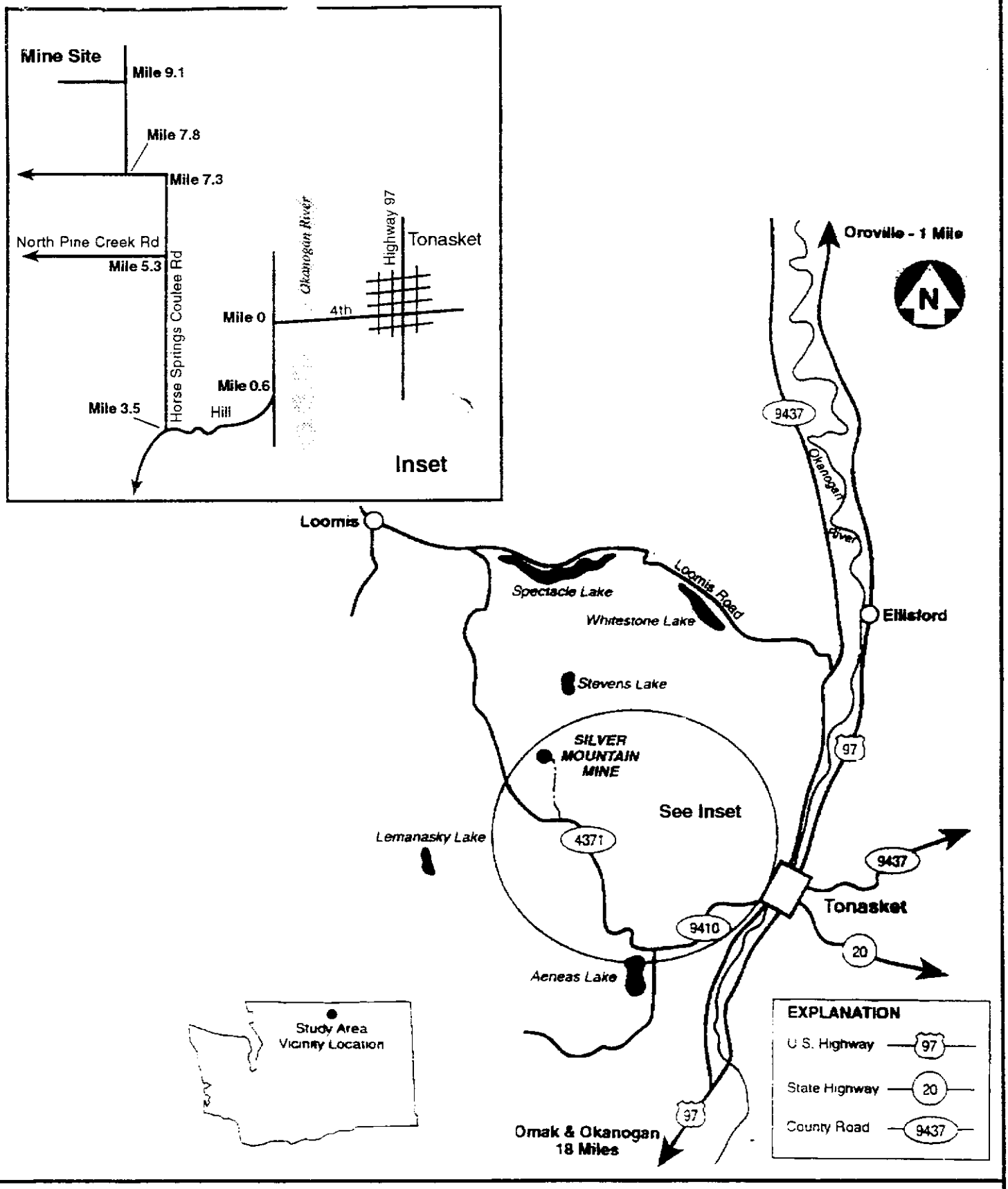
MEMO TO FILE **DATE:** September 16, 2002

FROM: Norman T. Hepner

SUBJECT: Silver Mountain Mine Annual Inspection/5 Year Review Site Visit

The following attachments make up the Silver Mountain Mine Annual Inspection/5 Year Review Site Visit:

- Site Location Map
- Silver Mountain Mine Maintenance Requirements
- Silver Mountain Mine Maintenance Checklist
- Site Pictures
- Laboratory Analysis of mine adit water sample



Site Location Map

FIGURE 1

WESTON MANAGERS DESIGNERS/CONSULTANTS

4000-26-01-7100 October 1994

Table 1—Silver Mountain Mine Maintenance Requirements

Operation and Maintenance Requirements	Corrective Action	Frequency
1) Heap leach cap inspection		
a) Check for cap subsidence	Remove topsoil, fill with clay, compact, replace topsoil and revegetate.	Annually
b) Check for erosion of cap particularly on east-facing wall between mill and south side of heap leach.	Fill with topsoil and revegetate. Areas where continual erosion occurs may need to be covered with riprap.	Annually
2) Vegetative cover inspection		
a) Verify adequate grass coverage.	Reseed areas where grass is not established.	Annually
b) Check for occurrence of knapweed or other weeds.	Spray site with herbicide, such as TORDON® or 2-4D.[a]	Annually
c) Check for holes caused by burrowing animals	Fill bottom of hole with large rock. Fill top of hole (top 8 inches) with clay from stockpile located south of cap. Add moisture to clay if needed to provide plasticity. Compact during and after placement.	Annually
d) Remove woody vegetation from cap cover[b]	Not applicable.	Annually
3) Fence Inspection		
Inspect cap perimeter fence for damaged posts, broken wire and gate damage.	Repair as required to ensure the integrity of the cap.	Annually
4) Mine entrance drainage ditch inspection		
a) Inspect side slopes of ditch for sloughing into ditch.	Round edges of ditch. Remove sloughed material.	Annually
b) Verify ditch drains water beyond cap mound towards mill facility.	Remove ditch material as needed for drainage away from cap.	Annually
c) Check for high spots in ditch bottom and for vegetative growth.	Remove vegetation in ditch. Remove high spots to promote drainage.	Annually
5) Inspect closure of mine vent		
Inspect mine vent closure for subsidence or breakthrough.	Fill with surrounding soil for subsidence. Plug with large rock or concrete rubble if broken through. Backfill with soil.	Annually

Table 1—Silver Mountain Mine Maintenance Requirements (*Continued*)

Operation and Maintenance Requirements	Corrective Action	Frequency
6) **Mine entrance closure inspection**		
Inspect entrance of mine to verify no openings into mine shaft have developed.	Plug with large stone.	Annually
7) **Sample Mine Drainage Water**		
Collect mine drainage water samples and analyze for total arsenic.	Not applicable.	Annually

[a] For additional information on herbicide application or weed control call Okanogan County Noxious Weed Control Board (509-422-7165) or the Okanogan County Cooperative Extension Office (509-422-7245).

[b] Mowing may be required to kill woody vegetation such as sagebrush, bitterbrush, or rabbit brush, whose deep roots could penetrate the clay cap and increase the potential for infiltration into the heap leach.

Figure 3: Silver Mountain Mine Maintenance Checklist

ACTIVITY	COMPLETED	REPAIRS PERFORMED	COMMENTS
1) Inspect cap a) Subsidence b) Erosion	YES NO YES NO	NONE	NONE LITTLE
2) Inspect cover a) Adequate vegetation, b) weeds, c) holes, and d) minimal woody vegetation on cap [a]	YES NO YES NO YES YES	NONE	GOOD GRASS (1" SOIL) COVERAGE A SMALL WOODY WEEDS ON CAP NONE SEE WEED NET
3) Inspect fence	YES	NONE	EPA SITE FENCE IN DISREPAIR. NEWER FENCE INSTALLED ON 3 SIDES OF 5 ACRE SITE. FENCE REMAINS DOWN ON EAST SIDE.
4) Inspect drainage ditch to ensure water is draining away from cap	YES	NONE	SEE Photo showing drainage course
5) Confirm mine vent is closed	YES	NONE	Remains closed.
6) Confirm mine entrance is closed	YES	NONE	Remains closed.

Figure 3: Silver Mountain Mine Maintenance Checklist (cont.)

ACTIVITY	COMPLETED	REPAIRS PERFORMED	COMMENTS
7) Sample seep drainage	YES	NONE	Results 116 µg/L. Attached.
8) Other (specify)			

[a] Woody vegetation such as sagebrush, bitterbrush, and rabbit brush must be removed to prevent their deep roots from penetrating the clay cap.

Inspection performed by:

on 4/25/02

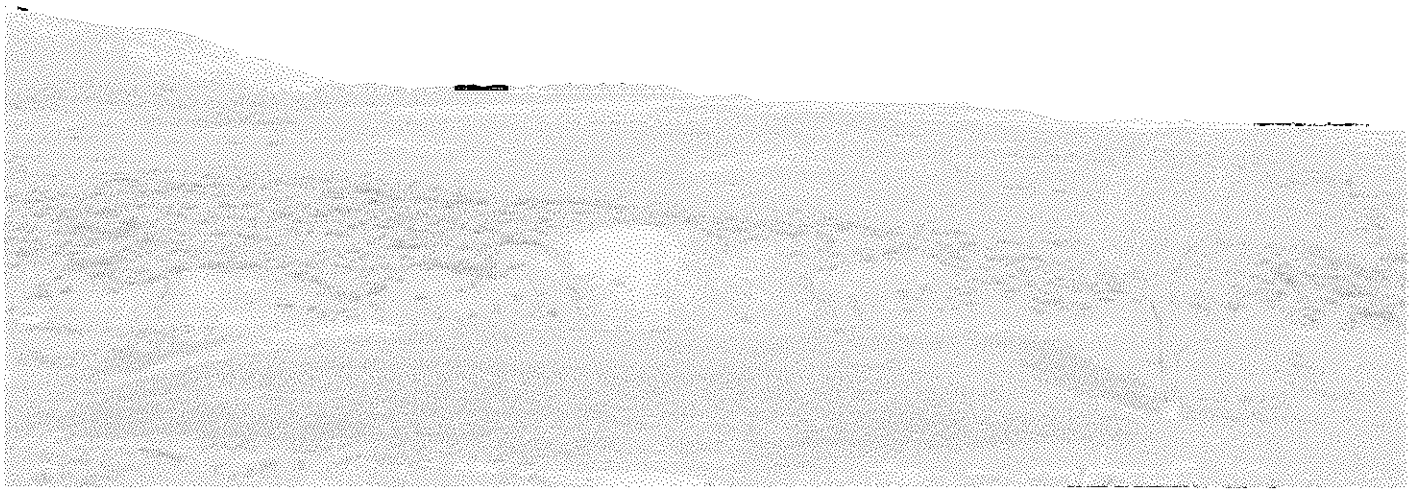
NORMAN HEPNER
PRINT NAME

WA State Dept of Ecology
AGENCY

SIGNED

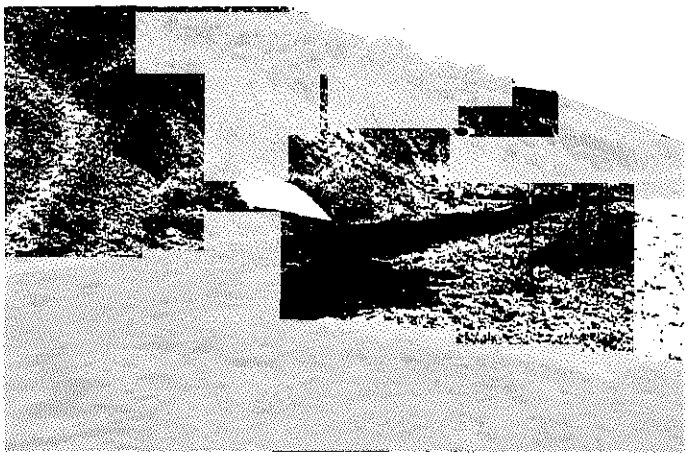
9/11/02
DATE

Figure 3 Revised by U.S. EPA, Region 10, July 8, 1997.



Picture 1: **Silver Mountain Mine Cover 4/26/02**

Picture 2: Structural Hazards & Old Graffiti Present



Picture 3: Water course from Mine Adit drainage

Picture 4: Water course descending adjacent to Structure shown in Picture 2.

Picture 5: Isolated location on Cap sidewall showing impact of cattle trampling the cover.

CASCADE ANALYTICAL, INC.
3019 G.S. Center Rd.
Wenatchee, WA 98801
(509) 662-1888
Fax: (509) 662-8183
1-800-545-4206

Batch: 201643
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Norm Hepner
PO Number:

MAY 2002

CENTRAL REGION OFFICE

--- Water Report ---

Report Date: 5/ 8/02

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, WA 98840

Laboratory Number: 02-E004185 Date Received: 4/26/02
Sample Identification: SMM-01 Date Sampled: 4/25/02
Sample Comment: Silver Min Mine

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Total	116.	ug/L	12	SM 3113B	5/ 6/02	
Total Metals Digest Water	Metals Digest				5/ 6/02	

RECEIVED
MAY 08 2002
HEALTH DISTRICT
OKANOGAN COUNTY

Approved By:

WATER ANALYSIS ORDER FORM

CASCADE ANALYTICAL INC.
3019 E. S. Center Rd
Wenatchee, WA 98801
(509) 662-1888
Fax: (509) 662-8153
1-800-545-4206

Batch#

SAMPLE # 1 2 3 4 5

SEND RESULTS TO: 1 Client 2 Client 3 Other

SAMPLE REPRESENTS: 1 Influent 2 Waste Water 3 Other

SAMPLE IS: 1 Grab 2 Comp - Time 3 Comp - Flow 4 Other

Client Acct. #

CLIENT NAME/ADDRESS	BILLING NAME/ADDRESS
CARE of: Doug Hale	Okanogan Health DISTRICT
SAMPLER'S NAME Norm Hepner	PHONE

FORM MUST BE COMPLETED BEFORE ANALYSIS WILL BE PERFORMED.

RELINQUISHED BY: (Signature) 1	DATE	RELINQUISHED BY: (Signature) 2	DATE	RELINQUISHED BY: (Signature) 3	DATE
(Printed) Norm Hepner	TIME 2:50	(Printed)	TIME	(Printed)	TIME
RECEIVED BY: (Signature)	DATE	RECEIVED BY: (Signature)	DATE	RECEIVED FOR LAB BY: (Signature)	DATE 4/26/02
(Printed)	TIME	(Printed)	TIME	(Printed)	TIME

4 Bottles	1	SMM-01 (SILVER MTN MINE)	Sample Date 4/25/02 Sample Time 11:30am
	2		Sample Date / Sample Time
	3		Sample Date / Sample Time
	4		Sample Date / Sample Time
	5		Sample Date / Sample Time

RECEIVED APR 26 2002 BY

***METALS - indicate type of analysis - T=total, D=dissolved**
Total N package = TKN, NO_3, NO_2, NH_3

Sample container received by client was sealed Yes_____ No_____
Sample container received by laboratory was sealed Yes_____ No_____

Disclaimer:
Cascade Analytical, Inc., makes no warranty of any kind, expressed or implied, and customer assumes all risk and liability from the use of Cascade's test results. Cascade neither assumes nor authorizes any person to assume for Cascade any other liability in connection with the testing done by Cascade Analytical, Inc., and there are no other oral agreements or warranties collateral to or affecting this agreement.
Cascade Analytical Inc.'s liability to customer as a result of customers use of Cascade's test results shall be limited to a sum equal to the fees paid by customer to Cascade Analytical, Inc. for the testing work.

Customer Signature _____ Date 4/26/02

This form also serves as "Chain of Custody."

	IRRIGATION WATER	1	2	3	4	5
	Standard					
	GENERAL CHEMISTRY					
1135	pH					
1140	Conductivity					
1200	Solids-Dis. (TDS)					
1230	Solids-Susp. (TSS)					
1240	Tot. Phosphorus					
1250	Orthophosphate					
1260	Kjeldahl Nitrogen (TKN)					
1170	Nitrate/Nitrite					
1280	Ammonia					
1300	Biol. Oxy. Demand					
1310	Chem. Oxy. Demand					
1190	Sulfate (SO4)					
1180	Chloride (Cl)					
1160	Fluoride (F)					
1320	Hexane Ext. Mat.					
1340	Alkalinity					
217	Total N Pkg					
	MICROBIOLOGY					
10040	Total Coliform MF					
10010	Fecal Coliform MF					
10041	Total Coliform MPN					
10011	Fecal Coliform MPN					
	METALS - TOTAL OR DISSOLVED					
	Priority Pollutants					
1397	Antimony (Sb)					
1011	Arsenic (As)	✓				
1025	Barium (Ba)					
1405	Beryllium (Be)					
1031	Cadmium (Cd)					
1045	Chromium (Cr)					
1215	Copper (Cu)					
1065	Iron (Fe)					
1075	Manganese (Mn)					
1081	Mercury (Hg)					
1051	Lead (Pb)					
1335	Nickel (Ni)					
1091	Selenium (Se)					
1105	Silver (Ag)					
1381	Thallium (Tl)					
1226	Zinc (Zn)					
	MINERALS					
1120	Calcium (Ca)					
1130	Magnesium (Mg)					
	Hardness (Ca)					
	Hardness (Ca+Mg)					