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Contaminant Monitoring Strategy for Henrys Lake, Idaho

J. S. Irving
R. C. Rope
R. P. Breckenridge

December 1992

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Idaho National Laboratory
Idaho Falls, Idaho 83415

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Prepared for the
Division of Environmental Quality
Idaho Department of Health & Welfare
and for the
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FINAL DRAFT

CONTAMINANT MONITORING STRATEGY

FOR HENRYS LAKE, IDAHO

J. S. Irving
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Center for Environmental Monitoring and Assessment
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ACRONYMS

AOI	Area of Interest
BLM	Bureau of Land Management
CAA	*Contaminant Assessment Area*
CEMA	Center For Environmental Monitoring and Assessment
CMA	Contaminant Monitoring and Assessment
DEQ	Department of Environmental Quality
DOE-ID	Department of Energy Idaho Operations Office
FWS	U. S. Fish and Wildlife Service
GPS	Global Position System
IDFG	Idaho Department of Fish and Game
INEL	Idaho National Engineering Laboratory
IRC	Idaho National Engineering Laboratory Research Center

ACKNOWLEDGMENTS

We thank those individuals who participated in the Workshop held at the Idaho National Engineering Laboratory Research Center on December 17-18, 1991 (see list of participants, **Appendix A, Table 1-1**, Page 1-3). These individuals contributed their time and knowledge to helping complete the *Henrys Lake Contaminant Workbook* (see Appendix A). It is their knowledge and ideas that form the basis of the long-term monitoring program developed through this process. We also thank the Division of Environmental Quality and the Henrys Lake Steering Committee for their willingness to participate in Workshop and give guidance.

The Idaho Department of Water Resources provided the Geographical Information System coverages that were used to produce the base maps for the report. Randy Lee was instrumental in putting together the information used to generate the Area of Interest, Contaminant Source and Bathymetric maps.

Finally, we thank the Department of Energy Idaho Operations Office (DOE-ID) for their support. The portion of the study conducted by the Center For Environmental Monitoring and Assessment was funded by the DOE-ID Office through their Laboratory Directed Research and Development Program.

EXECUTIVE SUMMARY

Introduction

Background

Henrys Lake, located in southeastern Idaho, is a large, shallow lake (6,600 acres, ≈ 17.1 ft. maximum depth) located at 6,472 ft. elevation in Fremont Co., Idaho at the headwaters of the Henrys Fork of the Snake River. The upper watershed is comprised of high mountains of the Targhee National Forest and the lakeshore is surrounded by extensive flats and wetlands, which are mostly privately owned. The lake has been dammed since 1922, and the upper 12 ft. of the lake waters are allocated for downriver use.

Henrys Lake is a naturally productive lake supporting a nationally recognized "Blue Ribbon" trout fishery. There is concern that increasing housing development and cattle grazing may accelerate eutrophication and result in winter and early spring fish kills. There has not been a recent thorough assessment of lake water quality. However, the Department of Environmental Quality (DEQ) is currently conducting a study of water quality on Henrys Lake and tributary streams.

Septic systems and lawn runoff from housing developments on the north, west, and southwest shores could potentially contribute to the nutrient enrichment of the lake. Many houses are on steep hillsides where runoff from lawns, driveways, etc. drain into wetland flats along the lake or directly into the lake. In addition, seepage from septic systems (drainfields) drain directly into the wetlands enter groundwater areas that seep into the lake.

Cattle grazing along the lake margin, riparian areas, and uplands is likely accelerating erosion and nutrient enrichment. Also, cattle grazing along riparian areas likely adds to nutrient enrichment of the lake through subsurface flow and direct runoff. Streambank and lakeshore erosion may also accelerate eutrophication by increasing the sedimentation of the lake.

Approximately nine streams feed the lake (see map), but flows are often severely reduced or completely eliminated due to irrigation diversion. In addition, subsurface flows can occur as a result of severe cattle grazing along riparian areas and deltas. Groundwater and springs also feed the lake, and are likely critical for oxygen supply during winter stratification.

During the winter of 1991, Henrys Lake experienced low dissolved oxygen levels resulting in large fish kills. It is thought that thick ice cover combined with an increase in nutrient loads created conditions resulting in poor water quality. The Idaho Department of Health and Welfare, DEQ is currently conducting a study to determine the water quality of Henrys Lake, the sources contributing to its deterioration, and potential remedial actions to correct problem areas.

Role of the Idaho National Engineering Laboratory (INEL)

In June of 1991 the Department of Energy's Idaho Operation Office (DOE-ID) received a request for Department of Energy's Idaho Operation Office technical assistance from the State of Idaho's DEQ. The DEQ was initiating the development of a lake management plan for Henrys Lake and requested the participation of the INEL. DEQ's proposed *Lake Management Plan* for Henrys Lake includes

- Description of the Basin
- Description of the Hydrologic System
- Identification of Nutrient Sources
- Identification and Evaluation of the Dynamics of Nutrient Removal, Use, and Dispersal
- Identification and Discussion of Water Quality Goals
- Identification of Critical Areas/Activities
- Identification of Preventative or Remedial Actions

The INEL Center For Environmental Monitoring and Assessment (CEMA) agreed to assist DEQ by providing a description of the Henrys Lake Watershed. In addition, the CEMA agreed to conduct contaminant monitoring assessment of Henrys Lake. The methodology used for characterizing the environmental conditions was developed under a Work-for-Others projects with the U. S. Fish and Wildlife Service (FWS). The Contaminant Monitoring and Assessment (CMA) Process is a systematic approach for developing a routine contaminant monitoring program. The process was developed for use on the FWS's 485 National Wildlife Refuges. The types of contaminants routinely sampled include metals, pesticides, herbicides, nutrients, bacteria, etc. In addition, organisms are selected as bioindicators (e.g., benthic invertebrates, aquatic plants).

The objectives of this effort were (1) to develop a long-term contaminant monitoring strategy specifically designed for the Henrys Lake watershed, (2) further test the CMA process, and (3) provide the state and other federal agencies with a consistent approach for developing long-term monitoring strategies.

To initiate the project a Workshop was held at the INEL Research Center in Idaho Falls on December 17-18, 1991. The Workshop brought together many individuals that had a management responsibility or interest in Henrys Lake (see list of participants, **Appendix A, Table 1-1**, Page 1-3). The goal of the Workshop was to complete a Contaminant Monitoring Workbook (**see Appendix A**). The purpose of the Workbook is to provide a short, concise format for developing contaminant monitoring strategies on FWS lands and/or other areas used by trust resources managed by the FWS. This Workbook was modified for use at Henrys Lake by the state and federal agencies.

A summary of the information collected during the Workshop follows. The subsequent sections give an introduction to the CMA process and describe the *Contaminant Assessment Area* (CAA) and the *Monitoring Strategy*. This includes specific strategy developed for air, groundwater, surface water, lake sediment, and biological monitoring. The Workbook (**see Appendix A**) contains the information collected and used to develop the long-term monitoring strategies.

Contaminant Monitoring Strategy Development

The purpose of this section is to discuss a standard approach for developing contaminant monitoring strategies. Its application will provide a consistent contaminant monitoring approach. The Workbook is intended to guide personnel from state and federal agencies, local governments, and special groups in developing a contaminant monitoring strategy for Henrys Lake (**see Appendix A**). It provides the steps and considerations that should be incorporated into routine contaminant monitoring activities and will provide data to assess the current status and evaluate trends of contaminant concentrations. This Workbook establishes an *institutional memory* of previous monitoring efforts and this new effort.

The approach to designing contaminant monitoring activities must be based on scientific understanding and should be applied consistently across all areas. This will help ensure that all concerns are addressed and the appropriate decisions are made in accordance with the management agencies goals and objectives. The design of contaminant monitoring activities should use the same scientific approach regardless of the area's location and characteristics. However, this approach remains flexible to adequately address the variety of conditions that exist across the country.

The major components of the contaminant monitoring approach and management objectives are illustrated in **Figure 1**. During the Workshop, the first three steps were completed by the Workshop participants. Scientists at the INEL completed step 4 based on the information provided by the Workshop participants. The remaining steps depend upon the individual needs and resources of the agencies conducting the monitoring program.

Contaminant Assessment Area

Description of Basin

One of the first tasks of the Workshop was to define the Area of Interest (AOI). For the purpose of this report the AOI was defined as the ***Henrys Lake Watershed*** (including all tributaries, springs, and Henrys Lake proper above the dam. Henrys Lake Outlet, below the dam is not included in the area of interest. However, the Tygee Creek drainage, which normally empties into the outlet, is included in the AOI because during high flow the creek is diverted and empties into Henrys Lake near the dam.

The AOI includes the entire Henrys Lake watershed which contains 64,147 acres, including about 156 mi. of stream and a 6,600 acre lake (**Figure 2**). It is bordered on the west and north by the Continental Divide, with elevations of 10,237 ft. MSL (Black Mtn.). To the immediate east, the lake is bordered by the northern part of Henrys Lake Flat, a large relatively flat area. To the south Bootjack Pass and Sawtell Peak (9,866 ft. MSL). The largest sub drainage is Targhee Creek, located in the northeastern part of the Basin. Targhee Creek is the longest tributary at 11.5 mi. Stream lengths for other major tributary streams are given in **Table 1**.

Land use within the basin is mostly managed by the U.S. Forest Service, with Targhee National Forest accounting for $\approx 70\%$ (40, 472 acres) of the total basin area. The next major land use is by

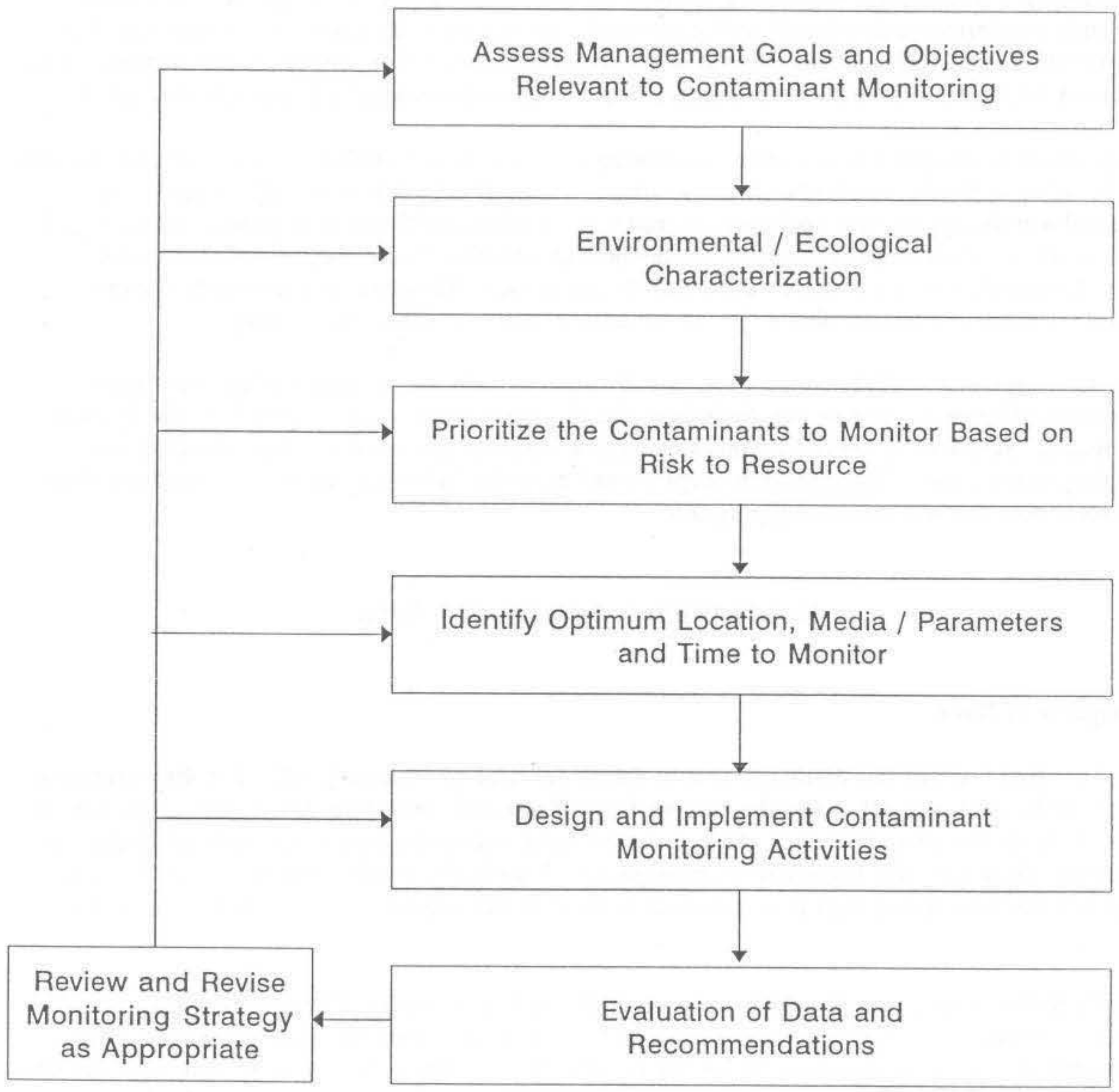

Figure 1. Diagram of the major components of the contaminant monitoring strategy.

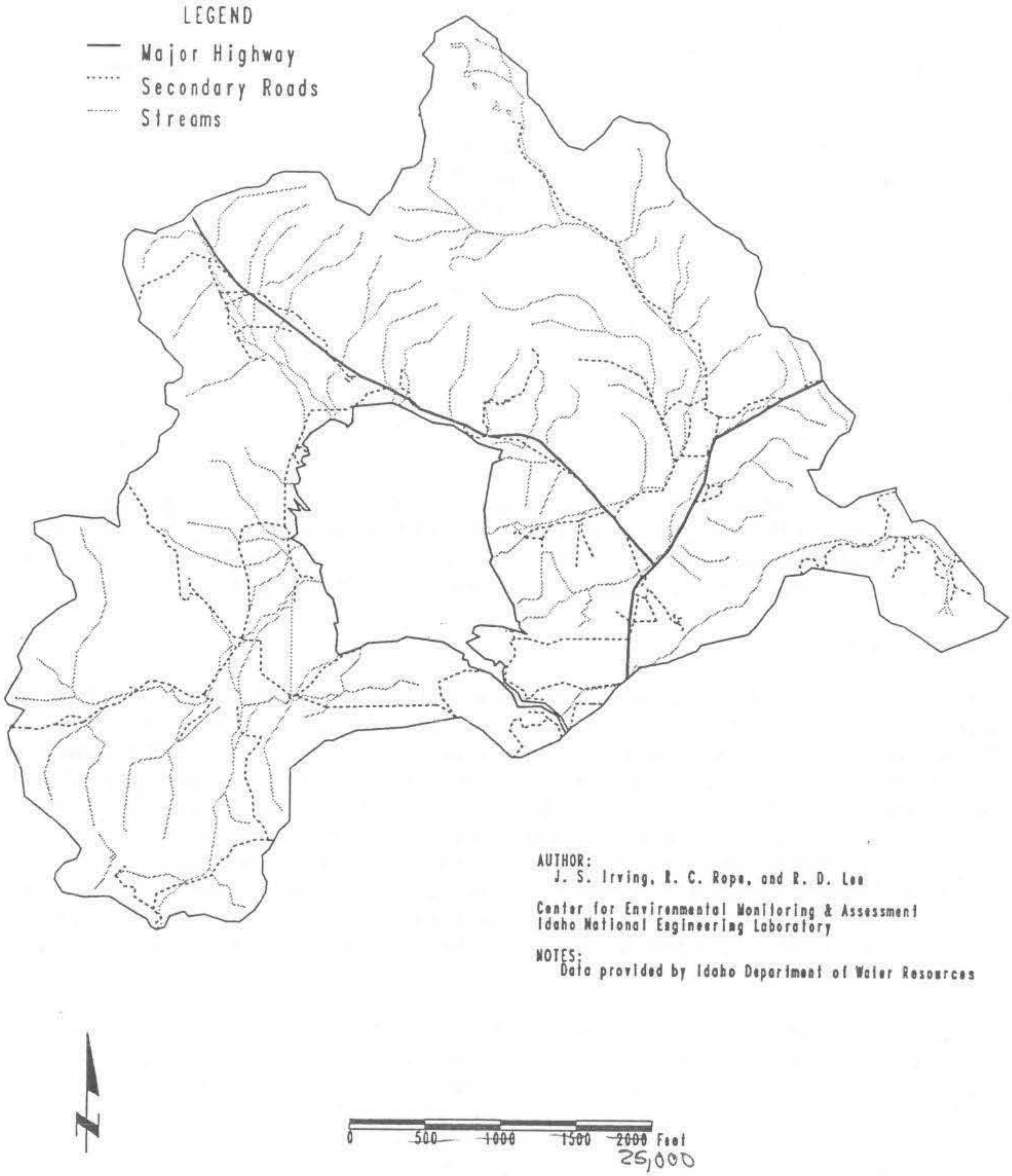

Figure 2. Area of Interest (AOI) for Henrys Lake, Idaho.

Table 1. Land use in the Henrys Lake watershed.[a]

Land Use	Acres	Percentage
U.S. Forest Service	40,472	69.7
Private	12,369	21.3
State	1,683	7.1
BLM	433	1.8
Total	58,070	100.0

a Source:

private interests accounting for 21% (12,369 acres) of the total basin. The remaining 9% (5,229 acres) is managed by the State of Idaho and Bureau of Land Management (BLM) (**Table 2**)December 11, 1992. Most of the area adjacent to the lake is owned by private interests (**Figure 3**). The BLM and State manage small parcels of land along the shoreline, including Henrys Lake State Park.

Depth Contours

Henrys Lake depth sampling was conducted on August 7, 1992. As a result of this field analysis, an average and maximum depths of 15.2 ft. and 24.9 ft., respectively were calculated for the lake. Henrys Lake volume was estimated using this data at about 91,500 acre-ft. Depth and locations were plotted using a depth echo chart recorder and Global Position System (GPS), provided by the Idaho Department of Fish and Game (IDFG) and INEL, respectively. Depths recorded on the chart were correlated with longitude and latitude data points provided by the GPS. These locations were corrected for positioning error using a base station located at the Idaho National Engineering Laboratory Research Center (IRC) in Idaho Falls (base station). Correction were also made for pool elevation, 6,467.5 ft. (4.5 ft. below full pool) and the depth of the transducer (8 in.). All data was collected between 8:00 am and 8:00 pm on August 7, 1992. At least three satellites were available for triangulation during that time period.

Transects were oriented North-South and West-East over the lake, and were 250 m ($\approx$820 ft.) apart. The potential relative precision of depth contours was estimated using an old map of Henrys Lake depth contours and a statistical procedure to produce variogram models. Transect distances of 250 m ($\approx$820 ft.) and 1000 m (3,281 ft.) would give relative precision of 10% and 20%. Because of time constraints a transect distance of 500 m ($\approx$1,641 ft.) was used to obtain this depth information. A between transect distance of 500 m will give results with about 13-14% relative precision (that is, the standard deviation should be about 13-14% of the true depth). Additional transects were used in areas of the lake with steep drop-offs (southwest and northeast).

Table 2. Stream mileage for major tributaries.[a]

Stream		Miles
Major Tributary Streams		
Tygee		6.6
Duck		4.8
Targhee		11.5
Howard		5.9
Timber		7.0
Hope		2.9
Rock		5.2
	Total	43.9[b]

a Source: GIS Database.
b Total length of all streams is about 150 miles.

Transect lines and data points are plotted in **Figure 4**. Each point corresponds to a depth measurement and GPS location. New depth contours are plotted for Henrys Lake in **Figures 5 and 6**. **Figure 6** is a 3-dimensional plot of the depth contours. A maximum depth of 24.9 ft. was calculated for a point in the northeastern part of the lake. This information has not been field verified.

Henrys Lake Monitoring Strategy

Monitoring Preface

The contaminant monitoring approach presented in the Workbook is based on multimedia monitoring and an ecosystem approach derived from numerous years of monitoring and research experience at areas including U.S. National Parks, Biosphere Reserves (Wiersma et al. 1984, 1985; Wiersma and Otis 1986), and U. S. Wilderness Areas (Bruns et al. 1982, 1984).

Components of an ecosystem approach (Wiersma et al. 1986; Bruns and Wiersma 1988) to environmental monitoring include (see **Figure 7**):

- Evaluation of source-receptor relationships
- Assessment of contaminant transport mechanisms/pathways

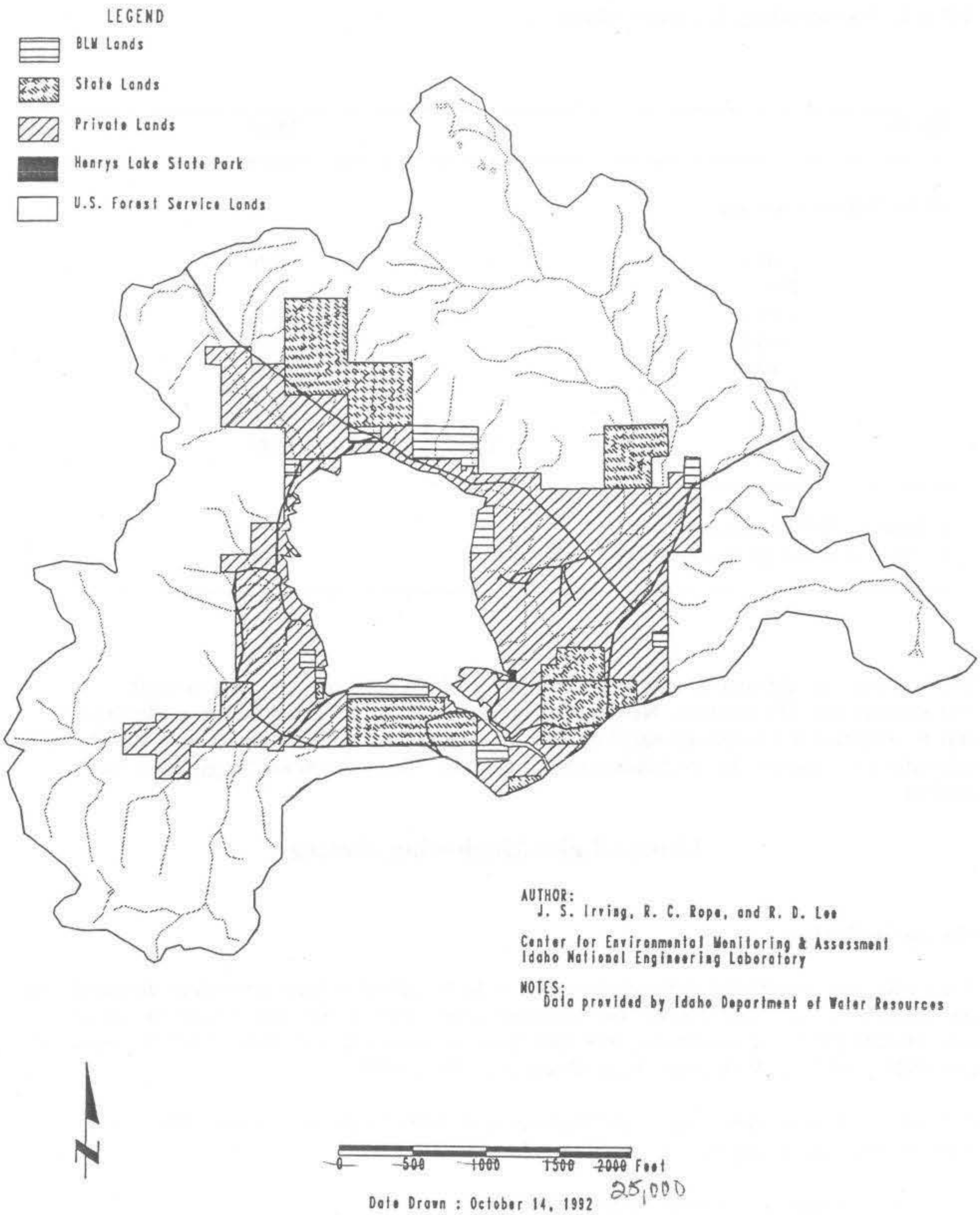

Figure 3. Land use in Henrys Lake watershed basin.

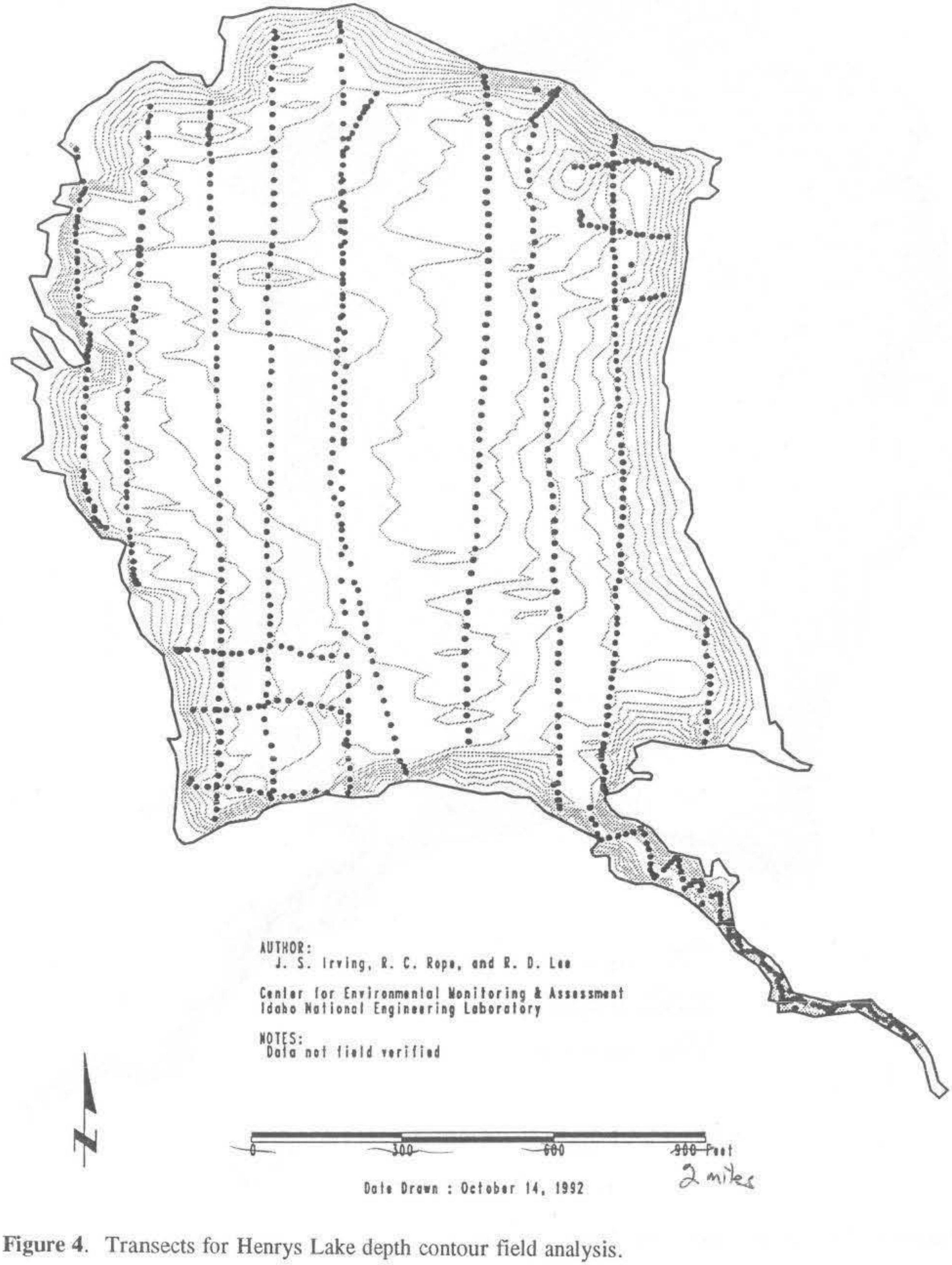

Figure 4. Transects for Henrys Lake depth contour field analysis.

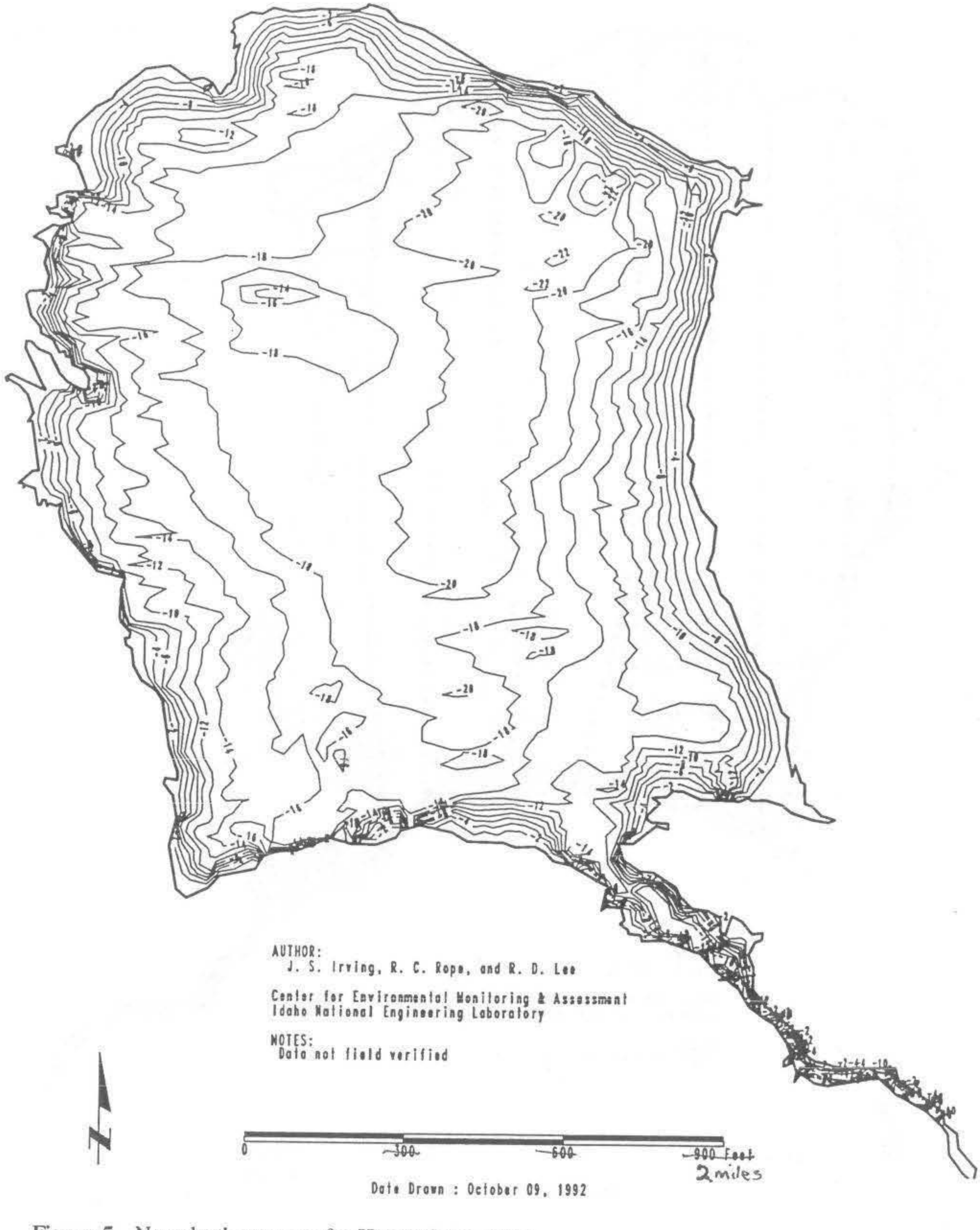

Figure 5. New depth contours for Henrys Lake, Idaho.

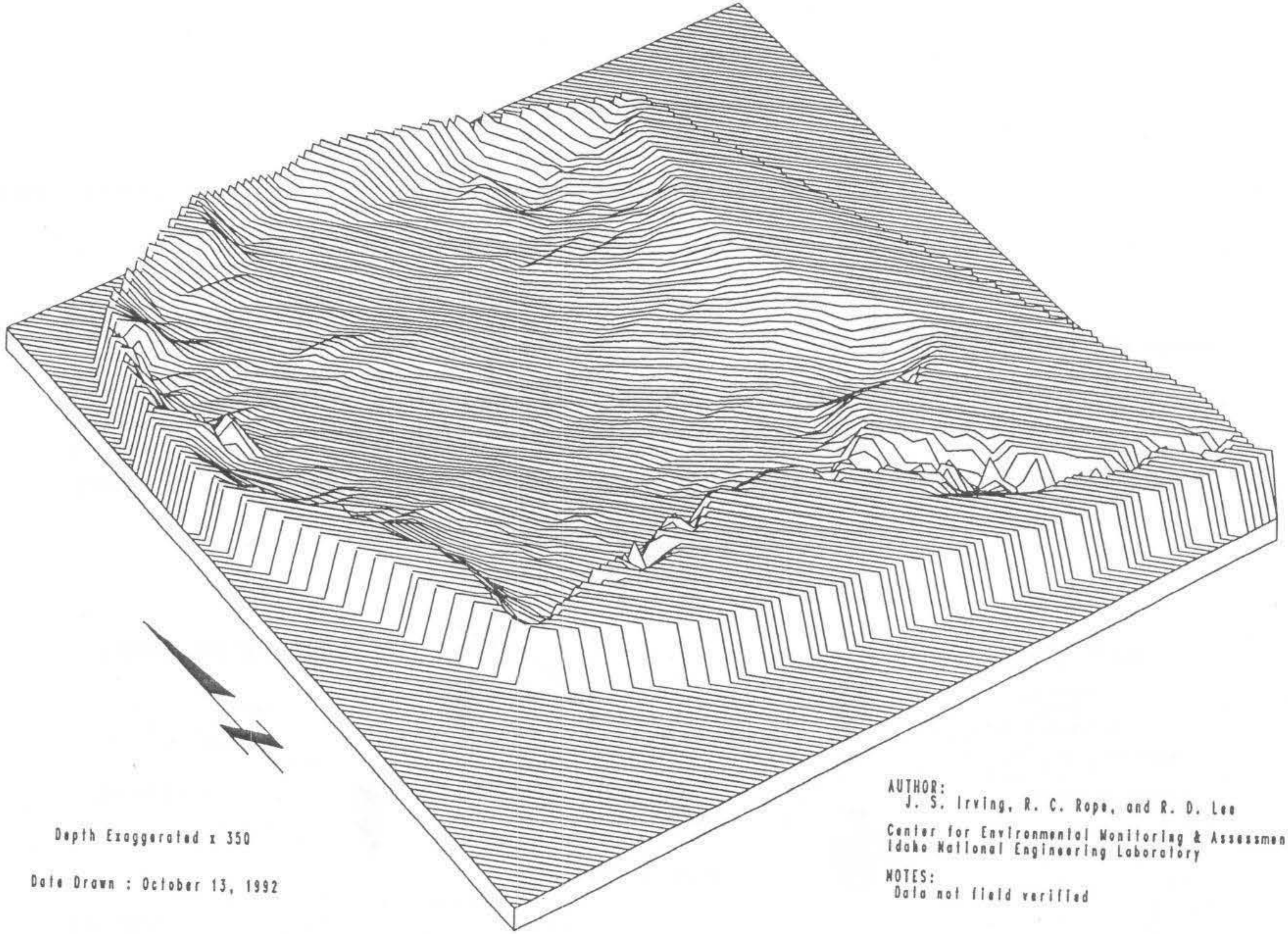

Figure 6. 3-Dimensional View of Henrys Lake Depth Contours.

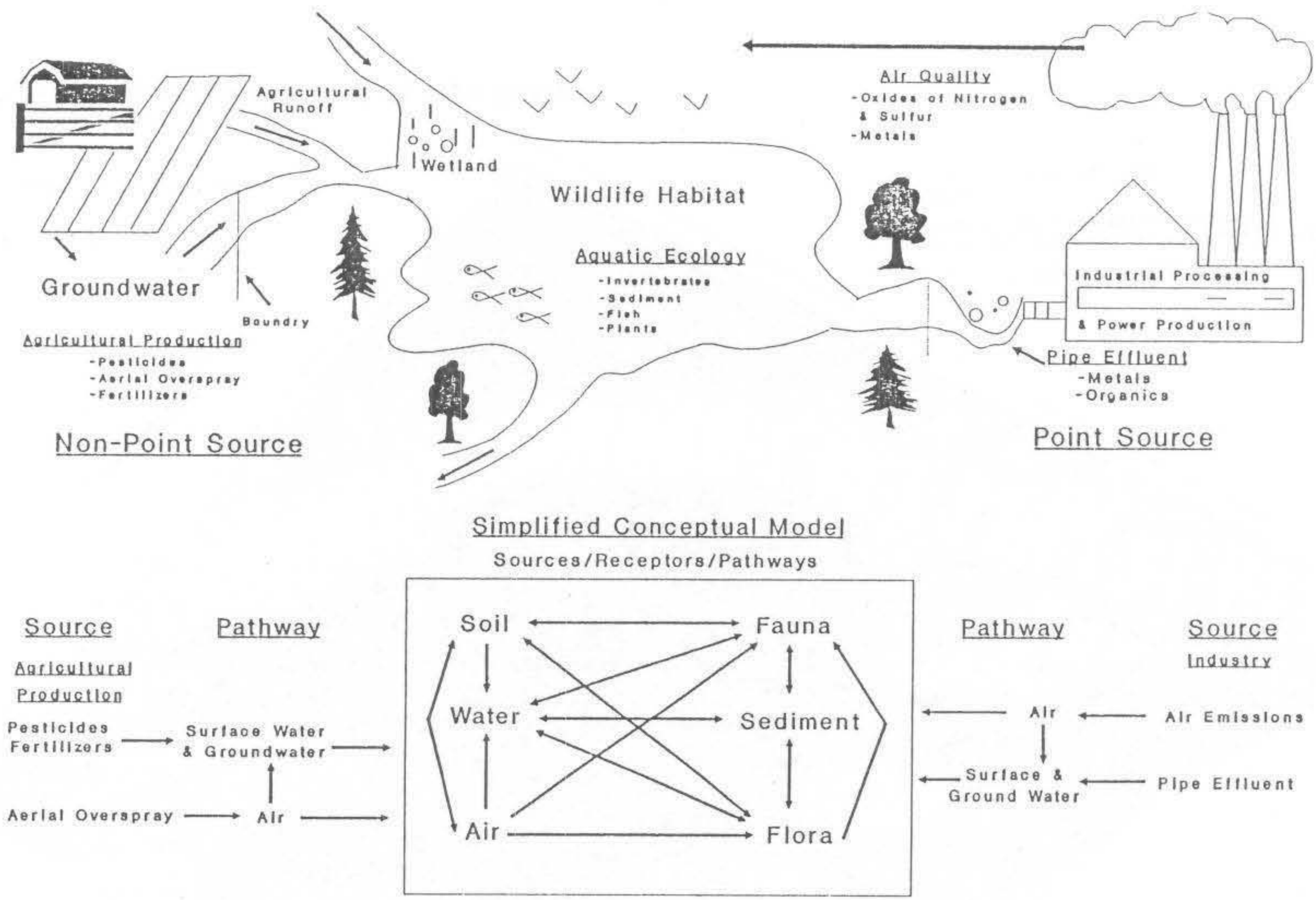

Figure 7. Illustration of the Components of the Ecosystem Approach to Contaminant Monitoring.

- Multimedia monitoring (i.e., air, water, soil, biota, sediment) of key contaminant pathways within the environment
- Use of selected ecosystem parameter measurements to detect anthropogenic effects
- Development of a conceptual diagram of the system.

The ecosystem approach begins with a general conceptualization of the system to be monitored and is translated into a schematic as shown in **Figure 8**. Such a diagram is intended as a tool for identifying ecological compartments of concern, delineating potential contaminant pathways through the system, and identifying potential important receptors. This allows one to view the monitoring problem as one of contaminant sources and pathways to critical receptor components of the ecosystem. For example, certain contaminants (e.g., lead) may be expected to reach high levels of accumulation in forest litter (Wiersma and Otis, 1986). Evaluation of contaminant sources relative to sensitive receptors is critical in the selection of sampling locations appropriate to monitoring objectives.

This approach to environmental monitoring design allows for reevaluation of data sets based on the conceptual diagram and, possibly, model calculations. Often this results in the ability to modify the monitoring design in a way that will allow for more effective monitoring and potential cost-saving.

The ecosystem approach to monitoring design for both contaminant and ecosystem measurements is based on a watershed/drainage basin (Likens 1985; Minshall et al. 1985) and airshed perspective, and links together key aspects of the atmosphere, forest, soils, stream, and lake components along selected ecological pathways within the system (Wiersma et al. 1986).

For example, the forest canopy is viewed as a major interceptor for deposition of atmospheric contaminants. Contaminants (and nutrients) may move to the soil component as *litterfall* or *throughfall* where they may be stored, taken up by organisms, leached to groundwaters, or transported to surface flow in runoff, streams, and lakes. Similar processes (e.g., storage, biological cycling, transport) may occur in these aquatic systems. The crucial aspect in this part of the monitoring design reflects the linkages between terrestrial and aquatic components and the storage, cycling, and transport of materials (and contaminants) through the system.
Atmospheric contaminants are also monitored as inputs to study areas because the atmosphere is an important contaminant exposure pathway to ecosystems in remote areas, far from local sources of pollution (Bruns et al. 1987, 1987a; Bruns and Wiersma 1988). This may include measurements of ambient levels of contaminants like trace metals, nitrates, sulfates, ozone, and oxides of nitrogen and sulfur (Bruns and Wiersma 1988). Also, as part of the multimedia ecosystem approach to environmental monitoring, contaminant levels (e.g., trace metals) may be measured in vegetation, soils, litter, and water.

In summary, the monitoring design discussed in this Workbook is based on an ecosystem view of environmental contamination and potential effects on ecosystems. Contaminant sources (local, regional, global) are identified along with critical receptors in the ecosystem; contaminants are monitored on a multimedia basis; key ecosystem parameters are utilized to assess impacts to both terrestrial and aquatic components of the system; and linkages between the terrestrial and aquatic compartments are delineated for important environmental pathways on a conceptual basis. Thus, an ecosystem approach integrates biogeochemical (including contaminants), meteorological, and ecological monitoring.

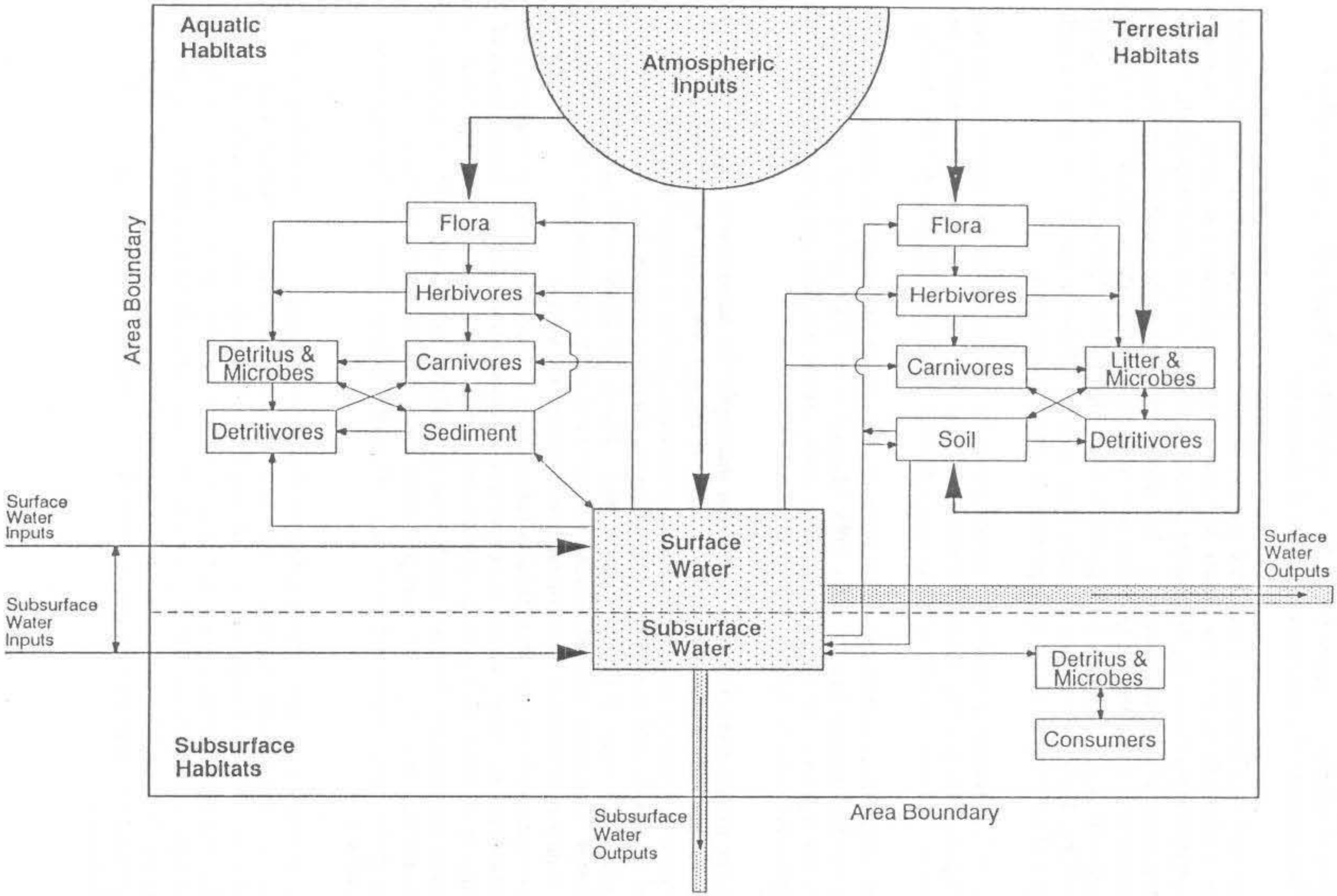

Figure 8. Conceptual Diagram of Contaminant Transport Pathways.

Monitoring Strategy

The following Monitoring Objectives were developed for Henrys Lake based on information provided in the Workshop:

1. Monitor nitrogen and phosphorus concentrations at the mouth of tributary streams and within the lake and groundwater at various location around the lake. Nitrogen and phosphorus inputs from septic systems and tributary streams could be contributing to increased macrophyte growth and resulting in potential winter oxygen deficits.

2. Establish transects to monitor the abundance and trends in macrophytes. Macrophytes can be an indicator of nutrient concentrations and potential winter oxygen deficit problems.

3. Monitor water quality parameters affected by nitrogen and phosphorus inputs (e.g., dissolved oxygen, *E. coli*). Water quality parameters such as dissolved oxygen & bacteria counts could be indicators of nutrients, septic system, and sediment input from various sources.

4. Monitor lake shoreline and tributary stream banks for erosion and sediment input. Sediment input contributes to the eutrophication of the lake and potentially could contain contaminants such as pesticides, PCB's, etc.

5. Establish baseline information on areas susceptible to *accidental* spills of petroleum products, chemicals, etc. Purpose is to identify and characterize areas susceptible to hazardous chemical spills. Initial study and monitoring is short-term, then updated as necessary.

6. Identify potential unknown contaminants from old landfills or dumps located in the basin (e.g., like the one located along the dry creek canal). Unknown hazardous chemicals, etc. may be entering the tributaries and lakes from old landfills or dumps. Initial monitoring to determine existence of problem. Follow up monitoring to determine the extent of the problem, if warranted.

7. Monitor east side tributaries for pesticide/herbicide contamination. Agricultural practices on the east side (hayfields) could be contributing pesticides/herbicides and nutrients (fertilizer) to the system. Initial monitoring to determine extent of problems.

The location of contaminant sources is an important factor to consider when developing a monitoring strategy (**Figure 9**). Information compiled during the Workshop was used to develop a list of potential contaminant sources (**Tables 3**). Separate monitoring strategies have been developed for (a) air, (b) groundwater, (c) surface water, (d) sediment, and (e) biological transport pathways. While each strategy can be independent, they have been integrated with the above monitoring objectives.

Air Monitoring. Wind rose information for Henrys Lake is not available, however, the regional wind patterns are generally from the southwest. The immediate wind borne contaminant sources around Henrys Lake (<50 km) include hydrocarbon (car emissions), particluates (trace metals, etc. adhering to soil particles), organophosphate pesticides, etc. Regional input (<160 km)

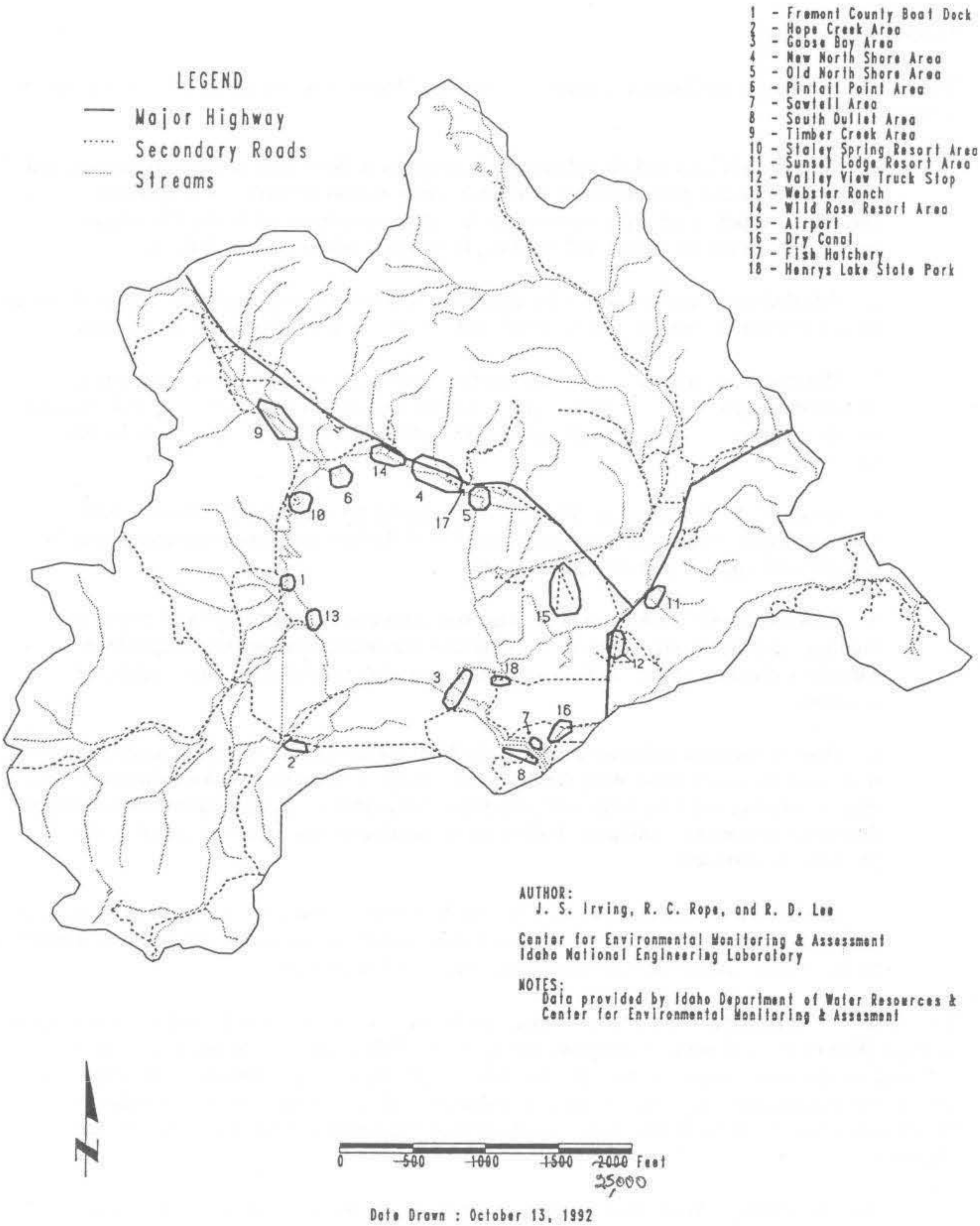

Figure 9. Potential Contaminated Assessment Areas (CAA) for Henrys Lake, Idaho.

Table 3. List of contaminant sources surrounding Henrys Lake, Idaho

Contaminant No.	Potential Contaminant Source
1	Fremont County boat dock
2	Hope Creek area
3	Goose Bay area
4	New North Shore area
5	Old North Shore area
6	Pintail Point area
7	Sawtell area
8	South Outlet area
9	Timber Creek area
10	Staley Spring Resort area
11	Sunset Lodge Resort area
12	Valley View Truck Stop
13	Webster Ranch
14	Wild Rose Resort area
15	Airport
16	Dry Canal
17	Fish Hatchery
18	Henrys Lake State Park

a Source: Workbook, see Appendix A.

would include the local sources as well as metals, SO_2 NO_x, radionuclides, etc. from ore smelters near Butte, MT, FMC near Pocatello, ID, and the INEL west of Idaho Falls, ID. Global inputs, may include gases (e.g., CO_2, H_xS), particulates, and trace metals (e.g., Hg, Pb, Cu), sulfates, nitrates, etc.

Atmospheric transport of contaminants is important in remote areas, therefore periodic air sampling should be conducted in the area. The air monitoring strategy for Henrys Lake consists of an initial sampling period to establish baseline contaminant levels of gases (CO_2, O_3, NO_x, SO_x, etc.) metals, and salts. Periodic sampling for gases, metals, etc. (e.g., every 5 years) should be done to check for changes in baseline conditions.

Groundwater Monitoring. Groundwater is potentially a significant pathway for contaminants to enter Henrys Lake. Springs within the lake and seeps along the lakeshore may act as groundwater transport pathways for nutrients and bacteria from septic system drainage. Tributary streams receiving groundwater input could also contribute contaminants via surface flow. Contaminated sources could include septic drainage from residential or resort areas or seepage from areas of heavy cattle grazing.

The groundwater monitoring strategy consists of establishing sampling sites at major springs (e.g., Staley Springs) seep areas around the lake, and wells. Septic drainfields of resorts and residential developments should be monitored for nutrient and bacteria . Initially samples should be collected monthly, increasing during the heavy summer use periods to bi-weekly.

Monitoring parameters should include:

Water level/flow	NO_2-N
Dissolved Oxygen	NO_3-N
pH	NH_3-N
Alkalinity	Chloride
Total Phosphorus	Fecal Coliform
Ortho-PO_4	Fecal Strep.

Initial sampling should cover a small area to determine if nutrient and bacteria contamination are a problem. If problem exists, expand sampling to determined the extent or magnitude. In the long-term, fewer samples, at key locations, would be required to monitor for contaminants entering Henrys Lake through the groundwater pathway.

Surface Water Monitoring (Tributaries and Lake). Surface water enters Henrys Lake primarily through the many tributary streams. Other sources of surface water transport include overland flow (e.g., from surrounding land, boat docks, roadbed, parking lots). In addition, the lake itself can act as a surface water pathway, transporting contaminants to lake sediments, flora, and fauna. Tributary streams could transport contaminants such as sediment, pesticides, nutrients, hydrocarbons, metals from atmospheric deposition, etc.

The surface water monitoring strategy has two components. The first components involves monitoring nutrients, sediments, pesticides, dissolved oxygen, and bacteria at the mouth of major tributaries or those tributaries where potential contaminant sources exist. Monitoring parameters should include:

Discharge	NO_2-N
Temperature	NO_3-N
Dissolved Oxygen	NH_3-N
pH	Total suspended solids
Alkalinity	Fecal Coliform
Total Phosphorus	Fecal Strep.
Ortho-PO_4	

Epizodic events such as spring run-off and rainstorms should be sampled to determine their contribution (of contaminants) to Henrys Lake.

The second component consist of monitoring locations within Henrys Lake for the same parameters monitored in the tributaries. Key areas in Henrys Lake include nearshore around residential or recreational developments (e.g., subdivisions, resorts). In addition, hydrocarbon levels should be monitored around recreational areas (e.g., marinas, boat loading/unloading ramps.

Monitored parameters should include:

Temperature	NO_2-N
Dissolved oxygen	NO_3-N
Secchi disk depth	NH_3-N
pH	Total suspended solids
Alkalinity	Fecal coliform
Total phosphorus	Fecal strep.
Ortho-PO_4	

In addition to the monitoring of surface water, areas that are susceptible to accidental spills (e.g., wetlands and streams along roads, bridge crossings, near parking lots, marinas) of petroleum products, chemical, etc. should be characterized. Proper characterization of these areas would provide a basis for determining damages caused by accidental spills or releases on contaminants. Many of the parameters mentioned in this section could be used to help characterize these areas. In addition, knowing where these areas are in advance may help to respond to an emergency more efficiently. As a result, the more important or higher quality habitats could be protected first.

Sediment Monitoring. Because of the surrounding land use (e.g., timber harvest, farming, grazing) sediment loads to Henrys Lake may be relatively high. While Henrys Lake is not a closed basin, lake sediments could still act as a significant sink for salts, and other contaminants (e.g., Hg from atmospheric deposition) which could increase over time. The transport of contaminants by sediments could be a significant pathway to Henrys Lake and biological organisms. The monitoring strategy includes initial sampling throughout the lake to determine current levels of contaminants in the sediments. Further sampling should occur every 2-5 years depending on the initial sampling results. Monitored parameters include: Total P, Ortho-PO_4, and trace metals (Hg).

Biological Monitoring. While not directly mentioned in the Workbook, monitoring of the biological component is an important part of the overall monitoring strategy. The biological components of an ecosystem serve as excellent indicators of biological integrity. The classic example is egg shell thinning as a result of DDT contamination. Aquatic macrophyte growth and distribution may indicate trophic status of the lake and point to problem areas. Changes in fish populations species composition and population numbers may indicate water quality problems. Lastly, riparian condition indicates grazing intensity.

Aquatic macrophyte transects should be established in the lake and monitored during the late Summer and early Fall. Fish should be sampled to determine their general health, condition, and numbers. In addition, habitat in tributary streams should be monitored to assess spawning success, fingerling survival, recruitment, etc. Macroinvertebrates are an important link in the food chain and should be monitored using benthic samples at various locations throughout the lake.

Many of these "biological" indicators could be monitored during the collection of creel census data. Others will require transects, electrofishing, etc. (e.g., aquatic macrophytes, population numbers, spawning success).

Summary. These monitoring strategies are designed to identify the presence and magnitude of contaminant problems within the Henrys Lake watershed. While most monitoring occurs near or in the lake, information collected could indicate potential problems throughout the watershed. For example, high level of suspended sediment or nitrate levels detected at the mouth of a tributary stream may indicate problems within that particular drainage. Additional monitoring may be required to identify the conditions contributing to the elevated levels of specific parameters. Strategies are designed to help establish trend information for important chemical, physical, and biological parameters. The long-term monitoring goal would be to decrease the number of parameters and frequency of sampling needed to monitor the condition of Henrys Lake. Much of the initial sampling has been completed during November 1991 - November 1992 by the DEQ. The results from this initial work should be used to further develop the long-term monitoring strategies described in this report. In practice, resources (e.g., money, labor, equipment) govern the development of monitoring strategies. Section 6 of the Workbook, *Designing And Implementing Contaminant Monitoring Activities*, should be completed to help determine the priority parameters, sampling locations, and sampling frequencies.

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APPENDIX A

CONTAMINANT MONITORING STRATEGY FOR HENRYS LAKE, IDAHO WORKBOOK

CONTAMINANT MONITORING STRATEGY FOR HENRYS LAKE, IDAHO

WORKBOOK

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December 14, 1992

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The opinions, findings, conclusions or recommendations expressed in this document are those of the authors and do not necessarily reflect the views of Research and Development, State and Federal Agencies or the Henrys Lake Steering Committee. The mention of trade names or commercial products is for illustrative purposes only and does not constitute endorsement or recommendation for use by the Federal Government.

PREFACE

The original Workbook was designed to facilitate the development of contaminant monitoring strategies for U.S. Fish and Wildlife Service (FWS) lands. This Workbook has been modified for use by a State agency. The Workbook is one component of the FWS Lands Contaminant Monitoring Operations Manual (OM). All the documents included in the OM are listed below. This document may be updated in the future to accommodate changes in contaminant sampling and monitoring strategies.

<u>Volume I</u>

A. Legislative Background and Key to Relevant Legilation
B. Contaminant Monitoring Strategy Development Workbook
C. Air Monitoring - An Introduction
D. Instroduction to the Flora and Fauna for Contaminant Monitoring

    D.1 Benthic Macroinvertebrates
    D.2 Birds
    D.3 Fish
    D.4 Flora
    D.5 Herpetiles
    D.6 Mammals

E. Decontamination
F. Documentation Guidance, Sample Handling, and Quality Assurance/Quality Control Standard Operating Procedures
G. Field Instrument Measurements
H. Ground Water Sampling
I. Sediment Sampling
J. Soil Sampling
K. Surface Water

<u>Volume III - Summary Sheets for the Research Field Methods</u>

BM Benthic Macroinvertebrates
BRD Birds
FSH Fish
FL Flora
HPT Herpetiles
MAM Mammals
DEC Decontamination
DOC Documentation Guidance, Sampling Handling, and Quality Assurance/Quality Control Standard Operating Procedures
FIM Field Instrument Measurements
GW Ground Water Sampling
SED Sediment Sampling
SO Soil Sampling
SW Surface Water Sampling

Document Revision Worksheet

Use this worksheet to document suggested revisions and updates to this Workbook and send it to:

Center For Environmental Monitoring and Assessment, MS-2213
EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415-2213

Commentor's Name:____ Phone______________
Address: ____
Section to be Revised:______________________________________ Page(s)____________
Paragraph number (1 = paragraph at very top of page): _____ Line number _______________
Suggested Revision (attach additional pages if more space is needed):

References (if applicable):

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HENRYS LAKE
CONTAMINANT MONITORING STRATEGY
DEVELOPMENT WORKBOOK

1. INTRODUCTION

The purpose of this Workbook is to provide a short, concise format for developing contaminant monitoring strategies for Henrys Lake. The goal is to monitor contaminant status and trends and to determine if contaminants exist that could affect fish & wildlife, recreation, and other resources at Henrys Lake. When this Workbook is complete, much of the information required and decisions necessary to design contaminant monitoring activities for this area will be addressed. Another goal is to monitor the general health of the system and associated resources.

This Workbook is designed to be a working document, once completed it can be referred to as necessary to support contaminant monitoring decisions. This Workbook and the associated monitoring program should be reviewed each year. It should be revised as necessary to meet monitoring and management goals and to address questions resulting from monitoring or other related activities. Periodic review and evaluation of the monitoring activities and results are critical to a successful monitoring program.

1.1 Description of Study Area

For this document the *Area of Interest* (AOI) includes the Henrys Lake ecosystem which includes the surrounding land and water that could have contaminant sources affecting the lake and its biota. The boundary of the AOI is determined by the tranport mechanisms (e.g., air, surface waters, ground water) that could transport contaminants from their sources to Henrys Lake. These area boundaries will vary between tranport mechanisms. For instance, the "airshed" boundary may be a 50 mi. radus around Henrys Lake, while the "surface water" boundary may be the watershed (or drainage area). The AOI is divided into (1) the *Study Area* (SA), which includes the Henrys Lake aquatic ecosystem (to the high water line), the immediate shoreline (adjacent riparian and wetlands), and tributary streams (to the extent important to the trout populations of the lake) and (2) the *Off-Site Study Area* (OSSA), which includes areas within the AOI, but not directly associated with the SA. OSSA may contian resources generally not confined to the SA. See Section 3.1, *Establish the Area of Interest (AOI) and Potential Contaminat Tranport Pathways* for more information regarding the selection of an AOI, and potential contaminant sources and pathways.

1.2 Interested Agencies & Organizations

Several federal and state agnecies, local governments, and sportsman groups have a responsiblity or interest in the management of Henrys Lake. The North Fork Reservoir Company (NFRC) and Idaho Department of Fish and Game (IDFG) have a direct responsiblity for Henrys Lake water and recreastional uses. The NFRC controls the use of water for irrigation. The IDFG manages the fish populations. Other State and Federal agencies have indirect responsibilities/interests for Henrys Lake and its resources. The Idaho Department of Parks and Recreation, U.S. Forest Service, and Brueau of Land Management manage public land surrounding Henrys Lake. Listed in Table 1-1 are individuals who attended the *Henrys Lake Contamianat Workshop* held at the Idaho National Engineering Research Center located in Idaho Falls, Idaho on December 17-18, 1991. Participants represent most of the agencies with management responsibilities for Henrys Lake and nearby areas.

Table 1-1. Henrys Lake Workshop Participants, Affiliation, Address, Phone Number, and Management Reponsibility / Interest.

Participant	Agency Affiliation	Address	Phone	Management Responsibilities / Interest
Bruce Arnell	District 7 Health & Welfare	150 Shoup Ave., Idaho Falls, ID 83402	208/528-5799	Water Quality
Ken Beckmann	Soil Conservation Service	315 E. 5th N., St. Anthony, ID 83445	208/624-3341	Argicultural Practices (including timber harvest)
Lou Benedict	Idaho Department of Lands	3563 Ririe Highway, Idaho Falls, ID 83401	208/523-5390	State Lands
Robert Breckenridge	EG&G Idaho, Inc.	POB 1625, MS-2213, Idaho Falls, ID 83415	208/526-0757	Workshop Facilitator
Janice Brown	Henrys Fork Foundation	Lucky Dog Retreat POB 128, Island Park, ID 83429	208/558-7458	Protection of wildlife & recreation resources
Gene Eyraud	Idaho Department of Prks and Recreastion	HC 66, POB 33, Island Park, ID 83429	208/558-7368	State Park
Carla Fromm	Division of Environmental Quality, Idaho Department of Health and Welfare	1410 N. Hilton, Boise, ID 83701-1253	208/334-5860	Lake Management Studies Coordinator for Henrys Lake
Jerry Funke	Fremont County Planning / Zoning	POB 773, Ashton, ID 83420	208/652-3385	County Planning & Zoning Regulations
Mark Gamblin	Idaho Department of Fish and Game	1515 Lincoln Rd., Idaho Falls, ID 83401	208/525-7290	Henrys Lake Fish Resources and Fishery

Participant	Agency Affiliation	Address	Phone	Management Responsibilities / Interest
Kevin Greenwood	U.S. Forest Service, Targhee National Forest	POB 220, Island Park, ID 83429	208/558-7301	Forest Service Lands in watershed
Tom Herron	Idaho Department of Fish and Game	HC 66, POB 150, Island Park, ID 83429	208/558-7202	Fish Hatchery
Dave Hull	Division of Environmental Quality, Idaho Department of Helath and Welfare	Pocatello Field Office, 224, S. Arthur, Pocatello, ID 83440	208/236-6160	Water Qulaity of Henrys Lake and Tributaries
John Irving	EG&G Idaho, Inc.	POB 1625, MS-2213, Idaho Falls, ID 83415	208/526-8745	Workshop Coordinator
Pat Koelsch	Bureau of Land Management	940 Lincoln Rd., Idaho Falls, ID 83401	208/524-7528	BLM Land (e.g., roadless area)
Brian Liming	James M. Montgomery, Counsulting Energineers, Inc.	161 Mall Dr., Boise, ID 83706-3974	208/345-5865	Consultant to DEQ
Paul Meyer	Idaho Department of Water Resources	150 Shoup Ave., Idaho Falls, ID 83402	208/525-7161	Water Resources (surface water & groundwater)
Gail Olson	EG&G Idaho, Inc.	POB 1625, MS-2213, Idaho Falls, ID 83415	208/526-1870	Workshop Facilitator
Ron Rope	EG&G Idaho, Inc.	POB 1625, MS-2213, Idaho Falls, ID 83415	208/526-9491	Workbook Coordinator
Dave Rydalch	North Fork Reservoir Company	POB 250, Rexburg, ID 83440	208/356-6140	Irrigation

Participant	Agency Affiliation	Address	Phone	Management Responsibilities / Interest
George Spinner	Division of Environmental Quality, Idaho Department of Helath and Welfare	Pocatello Field Office, 224, S. Arthur, Pocatello, ID 83440	208/236-1660	Water Quality of Henrys Lake and Tributaries
Byron White	EG&G Idaho, Inc.,	POB 1625, MS-2208, Idaho Falls, ID 83415	208/526-0484	Member of Henrys Lake Foundation

2. ASSESSING THE LAND MANAGEMENT GOALS AND OBJECTIVES OF HENRYS LAKE RELEVANT TO CONTAMINANT MONITORING

✓ 2.1 Management Goals for Henrys Lake

Why is Henrys Lake being managed by the State and what are the State's priorities for Henrys Lake? Identify the management goals for Henrys Lake in the space provided below (add pages/lines as necessary):

No.	Management Goals
1	Protect and conserve the Henrys Lake aquatic ecosystem
2	Maintain and enhance sustainable economic activity
3	Protect and maintain recreational resources
4	Protect beneficial uses of water

These management goals underscore the importance placed on the well being of the Henrys Lake ecosystem. Econonmic activity, recreational resources, and benefical uses of water rely on a healthy Henrys Lake. Protection and conservation of the aquatic ecosystem is vital if the other goals are to be realized. However, not all these goals are completely compatable. For instance, it may not be possible to satisfy goal No. 5 (protect beneficial uses of water) and achieve goal No. 3 (protect and maintain recreational resources). In the development of specific objectives, trade-offs will have to be made among the above goals.

It is not necessary, for the purpose of this Workbook, to define specific management objectives for each goal or to have them completly compatable. The main function of these Management Goals is to serve as guidance for developing Monitoring Goals and Objectives (see Section 2.5.2)

✓ 2.2 Assessment Considerations

Are there specific characteristics of Henrys Lake that should be considered while developing a monitoring strategy? Complete the Assessment Consideration categories in Worksheet 1A below and rank them 1, 2, or 3 according to the priority given them at this area (1 = highly important, 2 = moderate importance, 3 = low importance, and NA = not applicable). Provide a brief comment regarding the specific reasons it should be considered when developing the monitoring strategy for the area (add additional lines if necessary).

NOTE: If specific habitats, animal, or plant species/communities are necessary to maintain the system, or are indicators of system health, they should be included in the monitoring program. This is true even if they are not ranked highly as a management goal or objective for the area. These monitoring activities could include conducting community composition studies, monitoring extent and condition of plant communities, and/or monitoring individual indicator organisms. Discussion regarding these monitoring options should be included in the table below.

Worksheet 1A. Resources important to or dependent upon the Study Area (Henrys Lake Aquatic Ecosystem).

RANK	ASSESSMENT CONSIDERATIONS	GROUP CODE*	DESCRIPTION AND COMMENT REGARDING IMPORTANCE TO MONITORING ACTIVITIES
1	**Federally listed threatened & endangered, or candidate species (including research)**	**ES**	**Bald Eagle (nesting by outlet), Trumpeter Swan.**
1	**State listed or candidate species**	**SL**	**Yellowstone Cutthroat Trout, Trumpeter Swan (nesting on outlet & Howard Slough), White Pelican (200-250 birds), Sandhill Cranes, Upland Sandpiper, Common Loon, Harlequin Ducks.**
2	**Waterfowl**	**WF**	**Harlequin Duck (some nesting activity may occur on lake), Canada Geese, Snow Geese, Tundra Swan, Grebes, Common Loon, Merganser, "ducks".**
3	**Other aquatic birds**	**QB**	**Gulls, terns, cormorants, variety of shorebirds, sandpipers, egrets, herons -- note: Henrys Lake is likely not the only feeding, nesting, etc. resource in area for these species.**
N/A	**Other migratory birds**	**MB**	**Henrys Lake is not a staging ground for migratory birds because it is too high in elevation and too far north.**
2	**Raptors**	**RA**	**Bald Eagle, Osprey, Most raptors do not depend on Henrys Lake for food.**
N/A	**Other resident birds**	**RB**	**See *Waterfowl, Other Aquatic Birds, Raptors,* and *Other Migratory birds.***
N/A	**Anadromous fishes**	**AF**	**No anadromous fish occur in the drainage, however, Henrys Lake water levels and storage could be affected by operation "fish flush" on the Lower Snake River.**
1	**Other freshwater species (including invertebrates)**	**FW**	**Yellowstone Cutthroat, Hybrid, & Brook Trout; red-side shiner, damsel flies, gammerus, Tubidicid (worms). Some macroinvertebrates may be good indicator organisms**
1	**Herpetofauna**	**HT**	**Leopard & Wood Frog, Salamanders, Water Snakes (amphibian data of interest to USFS because of trends in declining numbers worldwide. Frogs and salamanders may be good indicator organism**
3	**Mammals**	**MA**	**Moose, Muskrate, Beaver, Weasel, Mink. If lake continues to become more eutrohpic, additional marsh lands will be added, increasing habitat for some aquatic related mammals**
N/A	**Other marine organisms (Including invertebrates)**	**MR**	
1	**Terrestrial Plants (food/cover, native habitats, etc.)**	**TP**	**Riparian habitat, vegetation important for spawning grounds, water quality & temperature, protection of riparian area and shoreline**
1	**Aquatic Plants (food/cover, native habitats, etc.)**	**AP**	**Algae, pondweed, watercress, reeds (Potamogetom, Elodea). Wetland vegetation for sediment filtering mechanisms**
3	**Exotic/Pest Species**	**XS**	**Eurasian milfoil (not seen at Henrys Lake)**

* See codes in Table 1, Appendix

RANK	ASSESSMENT CONSIDERATIONS	GROUP CODE*	DESCRIPTION AND COMMENT REGARDING IMPORTANCE TO MONITORING ACTIVITIES
1	**Documented or suspected contaminant concerns**		Nutrients, septic tank discharge, sediment load (lake shore erosion and tributary load) agricultural chemicals (weeds, hay fields), potential spills (petrochemicals)
1	**Geographic location of the area (feeding or staging area, good climatic conditions, breeding area, etc.)**		Headwaters of Henrys Fork of Snake River, hard winter with thick ice cover, long winter stagnation. Part of Greater Yellowstone Ecosystem. Breeding grounds for birds (e.g., eagles, waterfowl), staging ground for sandhill crane. Multiple passes (corridor area), Continental Divide rings the lake.
1	**Recreational activities (consumptive and nonconsumptive)**		Fishing extremely important, hunting, water skiing, limited swimming, picnicking, sightseeing, hiking, boating, jet skiing, bird/wildlife watching
3	**Research (for other than T&E species)**		Range/Riparian impact study on the North Fork of Duck Creek, Targhee Creek RNA (rare plants), Dr. Clark's research on algae blooms on lake in past.
1	**Economic uses (grazing, haying, mining, logging, oil)**		Grazing, haying, logging, irrigation use and storage of water, retail sales (lodging, food), commercial guide (fishery), summer home development area, recreation. Oil exploration (oil lease at one time proposed under the lake), no major timber sales, but always possible.
2	**Other (e.g. wilderness, subsistence, military)**		National Resource Lands (BLM); Bureau of Lands & Parks, Proposed Wilderness (roadless area) near north side of Henrys Lake (Lionshead, Centennials), Nez Perce National Historic Trail. Sawtell Radar Station (FAA) BLM has taken area on east side of Henrys Lake out of grazing, may do something with shores (e.g., restore wetlands)
2	**Pest Management Activities**	PM	Noxious weed and insect control (e.g., spraying)

* See codes in Table 1, Appendix

RANK	ASSESSMENT CONSIDERATIONS	GROUP CODE*	DESCRIPTION AND COMMENT REGARDING IMPORTANCE TO MONITORING ACTIVITIES
	Other comments		Geothermal influence?, Groundwater around Wild Rose Ranch?, Springs along North Shore. Contamination from leaky gas/oil tanks (above and below ground). Potential conflicts over water use between competing uses -- irrigation and recreation. Potential spills from highway.

* See codes in Table 1, Appendix

MANAGEMENT GOALS FOR HENRY'S LAKE

- Protect and conserve the Henry's Lake aquatic ecosystem
- Maintain and enhance sustainable economic activity
- Protect and maintain recreational resources
- Protect beneficial uses of water

MONITORING GOALS FOR HENRYS LAKE

- Determine nutrient levels in lake and tributaries to help establish baseline conditions and to monitor existing conditions.
- Identify potential and unknown sources of nutrients and estimate their contribution to Henry's Lake water quality.
- Determine the risk to the public from primary and secondary contact with pathogens (e.g., *E. coli*).
- Monitor dissolved oxygen levels to estimate impacts to Henry's Lake resources (e.g., trout).
- Identify and monitor indicators of ecological conditions within Henry's Lake (e.g., Index of Biotic Integrity, aquatic plant surveys, fish counts).

2.3 Assessing Off-Site Study Areas Important to Henrys Lake Resources

✓

Resources are generally not confined to managed lands or waters. Using Worksheet 1B, identify Off-Site Study Areas (OSSA) away from Henrys Lake and the immediate shoreline that should be considered when developing the monitoring strategy.

What are the specific characteristics of these areas that should be considered while developing a contaminant monitoring strategy for Henrys Lake? For each OSSA, provide information for the relevant categories and rank them 1, 2, or 3 according to their importance to trust resources (1 = highly important, 2 = moderately important, 3 = low importance, and NA = not applicable). Provide a brief comment regarding its relevancy to the State and why it should be considered as a part of the monitoring strategy for Henrys Lake (Worksheet 1B should be copied and completed for each area being considered).

If the OSSA will be a component of the monitoring strategy, procedures similar to those used for Henrys Lake and the immediate shoreline should be used to implement contaminant monitoring activities for these areas. If they are located a significant distance from the Henrys Lake and/or have different contaminant sources, transport pathways, or receptors, a separate Workbook should be completed for these areas.

A comprehensive ecosystem approach to contaminant monitoring would include looking at the flora and fauna occurring within the entire Henrys Lake Watershed. However, for the purpose of this exercise, only those flora and fauna directly associated with the aquatic environment of Henrys Lake are considered. Hence, no specific OSSAs within the AOI have been identified as important to the Henrys Lake aquatic ecosystem. Therefore species such as elk, grizzle bear, etc. are not considered in this exercise. Exception are terrestrial species that have a direct connection to Henrys Lake, (e.g., Bald eagle, osprey). For these reasons, Worksheet 1B has been left blank.

Worksheet 1B. Assessing Off-site Study Areas Important to Henrys Lake Resources.

Location			County		State	
Investigator's Name				Date		
Area Name/Location						
Raionale for Selection						
UTM Coordinates (centroid)	UTM Zone		X (Long.)			
			Y (lat.)			
General Description						
Contact or Agency			Phone #			
Current Monitoring Activities Relevant to this Area						

RANK	ASSESSMENT CONSIDERATIONS	GROUP CODE*	DESCRIPTION AND COMMENT REGARDING IMPORTANCE TO MONITORING ACTIVITIES
1	Federally listed threatened & endangered, or candidate species (including research)	ES	
	State listed or candidate species	SL	
	Waterfowl	WF	
	Other aquatic birds	QB	
	Other migratory birds	MB	
	Raptors	RA	

* See codes in Table 1, Appendix.

Location		County		State	
Investigator's Name			Date		
Area Name/Location					

	Other resident birds	RB	
	Anadromous fishes	AF	
	Other freshwater species (including invertebrates)	FW	
	Herpetofauna	HT	
	Mammals	MA	
	Other marine organisms (including invertebrates)	MR	
	Terrestrial Plants (food/cover, native habitats, etc.)	TP	
	Aquatic Plants (food/cover, native habitats, etc.)	AP	
	Biodiversity		

* See codes in Table 1, Appendix.

Location		County		State	
Investigator's Name			Date		
Area Name/Location					

	Exotic/Pest Species	XS	
	Documented or suspected contaminant concerns		
	Geographic location of the area (feeding or staging area, good climatic conditions, breeding area, etc.)		
	Recreational activities (consumptive and nonconsumptive)		
	Research (for other than T&E species)		
	Economic uses (grazing, haying, mining, logging, oil)		
	Baseline or Reference Monitoring		
	Other (e.g. wilderness, subsistence, military)		
	Other comments		

* See codes in Table 1, Appendix.

✓ ## 2.4 Regulatory Requirements Relevant to Monitoring

Regulatory requirements may mandate that certain contaminants and/or media be monitored and that specific procedures or techniques be used. Regulations also provide the State with certain legal authority regarding actions that may be taken to protect fish and wildlife resources.

Are there federal, state, or local regulations that might affect or direct contaminant monitoring on these lands? Place an X in front of the specific federal regulations that should be considered and comment on applicable requirements. Identify state and local laws and regulations on the blank table. NOTE: see Appendix A for relevant federal laws and potential applications to State and local agencies. Confer with the appropriate state/local agency(ies) regarding relevant regulations.

Federal Laws:

Federal Laws	Comments/Rationale
Clean Air Act (CAA) - 1970	Wilderness Study Areas located in the watershed could require the area to be classified as a "Class 1 Airshed"
Endangered Species Act - 1973	The Bald Eagle winters and nests in the area.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) - 1947	Fungicide is used at the hatchery to control disease and fungi.
Federal Water Pollution Control Act (FWPCA) - 1977 & Clean Water Act	Development along the lake shore and tributary streams is a concern. Protection of wetlands and riparian area is addressed in Section 401, 402, and 404 (Wetlands) of the Clean Water Act
Fish and Wildlife Act - 1956	
Fish and Wildlife Coordination Act (FWCA) - 1934	Henrys Lake water is used as irrigation.
Migratory Bird Treaty Act (MBTA) - 1918	Sandhill Cranes & Waterfowl
National Environmental Policy Act (NEPA) - 1970	The Forest Service, Soil Conservation Service, and Brueau of Land Management are required to conduct an environmental impact statement whenever a major federal action is considered.
Oil Pollution Act - 1990	Potential pollution of Henrys Lake from above ground petroleum storage tanks and car and boat fuel. Potential spills from surrounding highways.
Resource Conservation and Recovery Act (RCRA) - 1976	Potential landfill sites near Henrys Lake outlet and south of Staley Springs. Additional landfills may be located on private lands around the lake.
River and Harbor Act - 1899	See CWA above.

Federal Laws	Comments/Rationale
Surface Mining Control and Reclamation Act - 1977	Mining in upper drainages of tributary streams.
Toxic Substances Control Act (TSCA) - 1976	Fungicides and other medicines related to fish culture (fish hatchery on North Shore of Henrys Lake.
Water Quality Act - 1987	
Wilderness Act	Wilderness Study Areas located in the watershed (north of Henrys Lake).
Indian Treaty (Stevens Treaty)	Tribal rights exist within the watershed.
Safe Drinking Water Act (SDWA)	Water supplies meeting Federal requirements.

State/Local Laws:

State/Local Laws	Comments/Rationale
Fremont Co. Planning & Zonning Ordianance	Controls development around Henrys Lake.
State Forest Practices Act	BMP's for forest harvest practices
State Lake Encroachment Act	
District 7 Board of Health Building Moratorium	Restricts the building of residential housing in certain areas around the lake.
Idaho Water Quality Standards	
Anti-Degradation Policy	Henrys Lake is a "Stream Segment of Concern"
State Water Plan	Stream channel alteration Act (Basin Planning)
State Agricultureral Water Quality Program	
State Land Use Planning Act	County - Comprehensive Planning and Development Code
State Surface Mining Act	
Water Rights Adjudication	
Department of Water Resources Regulations	Provides information on wells.
Well Contruction Regulations (Idaho Code 42-238).	
Septic Tank Requirements	See pages 50-1326, 39-117, 39-3609
Nutrient Management Act	
Idaho Subsurface Sewage Regulations	Local, individual, and community systems for treatment / disposal of waste water.
Water Rights / Water Storage	North Fork Reservoir Co. -- 12 ft. storage

✓

2.5 Monitoring Goals for Henrys Lake

2.5.1 Purpose and Definition of Monitoring Goals

The purpose of this section is to develop monitoring goals that will be used to develop specific monitoring objectives. Monitoring goals are used to guide the design of monitoring programs. The purpose for developing monitoring objectives is to provide a manageable topic for a monitoring program. The objectives provide: a purpose for data collection, a format for data interpretation, and are specific enough to provide direction for the development of testable hypotheses and a statisitcally-relevant sampling plan. Specific definitions of monitoring goals and objectives are:

Monitoring goals are statements that support the management goals and objectives and provide focus for developing monitoring objectives. Goals are not specific enough to design a monitoring program. Details of the monitoring program stem from a set of specific monitoring objectives that will be developed later after contaminant or other monitoring issues have been identified.

Monitoring objectives are specific subsets of the monitoring goals. They are developed with the idea of quantifying or characterizing environmental status and trends, and lay the groundwork for monitoring program design. Testable hypotheses may be developed from monitoring objectives. They can be developed after the site characteristics are understood (e.g., geomorphology and hydrology), and contaminant sources, key species or receptors, and relevant pathways have been identified and prioritized (i.e., after completing Sections 2 - 4 of the Workbook). More will be discussed about monitoring objectives in Section 5, which follows environmental characterization of Henrys Lake and identification of contaminant issues.

Monitoring goals should be responsive to the management goals established for specific locations. These goals help give focus to future Workbook activities and provide detail to formulate testable hypotheses.. In addition to monitoring goals, it is necessary to define the specific characteristics, ecology, and problems of the specific location.

If monitoring goals are not supportive of the management goals and objectives, the resulting monitoring program will not be able to verify whether the State or Federal Agencies are effectively managing the resources. Furthermore, the resulting program will not provide the information necessary to inspire enlightened management decisions or modifications. If monitoring objectives are inappropriate, the program will provide irrelevant information. Most frequently, the objectives are too general or vague to develop a statisitcally sound program within budgetary constraints. Data gathered from a program this is not statistically based are difficult to interprest, if not meaningless.

2.5.2 Process For Developing Monitoring Goals

Management plans, if available, should be reviewed to give guidance on the general management goals and objectives of State or Federal Agencies. Monitoring goals are developed that support the goals and objectives of a management plan. These objectives need to address specific contaminant issues.

Given the stated management goals (see Management Goals for Henrys Lake, Section 2.1) and regulatory compliance issues (see Regulatory Compliance, Section 2.3) for Henrys Lake, list below the monitoring goals for Henrys Lake. These should be based on the stated Management Goals and Objectives of Henrys Lake and compliance issues. These goals will be used to develop specific monitoring objectives in a later section of the Workbook. Add additional lines as necessary.

Monitoring Goals for Henrys Lake	
1	Determine nutrient levels in lake and tributaries to help establish baseline conditions and to monitor existing conditions.
2	Identify potential and unknown sources of nutrients and estimate their contribution to Henrys Lake water quality.
3	Determine the risk to the public from primary and secondary contact with pathogens (i.e., *E. coli*).
4	Monitor dissolved oxygen levels to estimate impacts to Henrys Lake resources (e.g., trout).
5	Identify and monitori indicators of ecological conditions within Henrys Lake (e.g., Index of Biotic Integrity, aquatic plant surveys, fish counts).

3. ECOLOGICAL CHARACTERIZATION OF HENRYS LAKE

✓

3.1 Establish the Area of Interest (AOI) and Potential Contaminant Transport Pathways

1. The AOI defines the area to look for contaminant sources and will be used to evaluate the potential for contaminants to reach Henrys Lake. It also helps define the area for establishing baseline or reference monitoring sites.

   NOTE: The Air AOI boundary should be a 100 Km radius circle centered on Henrys Lake.

   Has an AOI been established for each of the relevant contaminant transport mechanisms for Henrys Lake? Check, if yes, or comment if not applicable.

	Transport Mechanism	Comment
✓	Surface Water	Follows drainage basin boundary
✓	Subsurface Water	Surrounding shoreline, Staley Springs
✓	Air	100 km surrounding Henrys Lake
✓	Biota	Shoreline and tributary streams

2. Has there been an assessment of contaminant sources on Henrys Lake and the associated transport mechanisms to Henrys Lake resources? Check, if yes, or comment if not applicable.

	Transport Mechanism	Comment
✓	Surface Water	On going efforts and past information
✓	Subsurface Water	On going efforts
✓	Air	INEL reports regarding radionuclide transport
✓	Biota	None specific to Henrys Lake

3. In Worksheet 2 identify the names and locations of **ALL** the transport pathways for each of the AOIs (see No. 1 above) and indicate where they enter Henrys Lake. Also describe or provide general comments regarding the pathway (e.g., river or watershed size [Sm, Med, Lrg], contaminant sources exist/don't exist [few or many sources], pathway provides baseline or reference monitoring opportunities, importance to Henrys Lake and its resource, etc.). For the biotic transport pathway indicate where the exposure to contaminants most likely occurs.

Worksheet 2. Surface Water, Subsurface Water, Air, and Biotic Transport Pathways.

Surface Water Transport Pathways			
WATERCOURSE NAME	CORRDINATES		Description/Comments
	X (LONG)	Y (LAT)	
Timber Creek	111°25'31.1"	44°39'55.9"	Enters Henrys Lake at two separate locations. Near Staley Springs and Northeast of Staley Springs. The one near Staley Springs is probably a diversion. Relative drainage size = Medium.
Gillan Creek	111°26'2.3"	44°38'18.6"	Intermittent stream that enters Henrys Lake on the West shore. Relative drainage size = Small
Duck Creek	111°25'29.6"	44°37'50.3"	Enters Henrys Lake on West shore. Relative drainage size = Large.
Hope Creek	111°25'22.6"	44°36'51.5"	Enters Henrys Lake on Southwest shore. Relative drainage size = Large.
Tygee Creek	111°21'19.2"	44°35'58.8"	During high flows Tygee Creek is diverted (R43E, T15N, S24, W-1/2) down a drainage ditch and enters Henrys Lake on the north side of the outlet arm near the dam. When not diverted Tygee Creek enters Henrys Lake Outlet below the dam. Relative drainage = Moderate
Howard Creek	111°22'1.7"	44°37'17.8"	Enters Henrys Lake on the Southeast shore across small bay from the State Park. Relative drainage size = Moderate. Part of Howard Creek is diverted (R43E, T15N, S14, NW-1/4) north to join another diversion from Targhee Creek. This diversion enters Henrys Lake on the East Side, north of the mouth of Howard Creek.
Targhee Creek	111°25'31.1"	44°38'26.8"	Enters Henrys Lake on the East side. Relative drainage size = Large. Probably the largest tributary of Henrys Lake. See description of diversion above under Howard Creek.
Unnamed Creek (A)	111°25'28.3"	44°39'58.0"	Intermittent stream entering Henrys Lake on Northwest Shore just East of the mouth of Timber Creek. Relative drainage size = Small.
Unnamed Creek (B)	111°24'26.0"	44°40'12.2"	Intermittent stream entering Henrys Lake on North Shore just west of Wild Rose Ranch. Relative drainage size = Small
Unnamed Creek (C)	111°24'17.5"	44°40'8.1"	Intermittent stream entering Henrys Lake on North Shore just west of Wild Rose Ranch. Relative drainage size = Small
Unnamed Creek (D)	111°23'18.1"	44°39'51.9"	Intermittent stream entering Henrys Lake on North Shore near Fish Hatchery. Relative drainage size = Small
Unnamed Creek (E)	111°22'52.6"	44°39'39.7"	Enters Henrys Lake on Northeast Shore. Relative drainage size = Small
Unnamed Creek (F)	111°22'35.7"	44°39'35.7"	Intermittent stream entering Henrys Lake on Northeast Shore. Relative drainage size = Small.
Unnamed Creek (G)	111°22'27.2"	44°39'25.5"	Intermittent stream entering Henrys Lake on East Shore. Relative drainage size = Small
Unnamed Creek (H)	111°23'15.3"	44°36'45.4"	Intermittent stream entering Henrys Lake on South Shore of Outlet Arm. Relative drainage size = Small.

Surface Water Transport Pathways			
WATERCOURSE NAME	CORRDINATES		Description/Comments
	X (LONG)	Y (LAT)	
Unnamed Creek (I)	111°25'0.0"	44°36'57.6"	Intermittent stream entering Henrys Lake on South Shore. Relative drainage size = Small.
Unnamed Creek (J)	111°26'13.6"	44°38"24.7"	Intermittent stream entering Henrys Lake on West Shore just North of Gillan Creek. Relative drianage size = Small
Unnamed Creek (K)	111°26'10.8"	44°39'7.3"	Intermittent stream entering Henrys Lake on West Shore just south of Staley Springs. Relative drainage size = Small

Subsurface Water Transport Pathways			
Subsurface Watershed Name	COORDINATES		Description/Comments
	X(LONG)	Y(LAT)	
Staley Springs	111°26'7.9"	44°39'35.7"	
North Shore Seeps	111°23'23.8"	44°39'55.9"	

Air Transport Pathways		
Wind Direction	General Area Where Inputs Enter Henrys Lake	Description/Comments (common contaminants from atmospheric inputs)
Global/Regional Inputs (sources > 160 km) - all wind directions	Throughout the Henrys Lake; inputs would also be transported to Henrys Lake via SW runoff	Gases - CO_2, H_2S, CH_3SCH_3, COS, NH_3/N_20, HNO_3/NO_3 Particulates - trace metals (e.g., Hg, Pb, Cu, Cr, Fe), sulfates, nitrates, benzene-soluble organics, radioactive fallout
Regional Inputs (sources > 50 km, but < 160 km distance) - most wind directions	Throughout the Henrys Lake; inputs would also be transported to Henrys Lake via SW runoff	As above plus: Gases - SO_2 Chlorinated hydrocarbons (pesticides and others) Organophosphate pesticides
In the Space to the Right Identify Specific Regional Sources and Potential Contaminants		INEL - Radionulcides & NO_x Ore smelter near Butte, Montana - Metals, SO_2, etc.
Local Inputs (sources < 50 km distance)	Likely throughout Henrys Lake, however, some areas might be more affected than others; SW runoff in some drainages might receive more input than others	As above plus: Gases - CO, NO/NO_2, Ozone Halogens Hydrocarbons Particulates - specific local inputs (note what could be carried on dust/soil particles) Organophosphate pesticides from farming and road side spraying activities
	NA for Not Applicable	**Identify Local Inputs from Each Wind Direction**
N		Forest fire, vehicle combustion, wood stoves,
NE		Forest fire, vehicle combustion, wood stoves
E		Forest fire, pesticides
SE		Forest fire, wood stoves
S		Forest fire
SW		Forest fire
W		Forest fire
NW		**Forest fire, vehicle combustion, wood stoves**

Biotic Transport Pathways					
Species or Species Group Name	**Habitats/Locations Used Extensively on Henrys Lake**	**Where Exposed** L	R	G	**Description/Comments** (likely locations of exposure)
Trout (Rainbow, Cutthroat, Brok, & Hybrid)		✓			Trout near spawning areas around mouths of creeks to bald eagle, osprey, pelican
Invertebrates (including zooplankton)		✓			Invertebrates to trout and other fish species to bald eagle, osprey, pelican
Plankton		✓			Plankton to invertebrates to trout and other fish species to bald eagle, osprey, pelican
Sediment		✓			Invertebtates to trout to bald eagle, osprey, pelican

G = Global/Regional exposure; occurs futher than 160 km from Henrys Lake Watershed
R = Regional exposure; occurs between 50 km and 160 km from Henrys Lake Watershed
L = Locacal exposure; occurs within 50 km of Henrys Lake Watershed

Note: These decriptions are for guidance to provide an approximate location (distance) where exposure might occur.

✓

3.2 Preliminary Assessment

The purpose of the preliminary assessment is to identify existing data, become familiar with previous contaminant studies, assess the AOI relative to contaminant issues, and identify data gaps. The preliminary assessment proceeds in two stages: 1) compile existing data; and 2) conduct limited field reconnaissance studies.

✓ 1. Conduct a literature search and compile existing data and data sources for the AOI that are relevant to contaminant sources, contaminants, receptors, contamination events, etc. Worksheet 3 is provided to document this effort and/or attach similar material that has already been compiled.

Identify the available information regarding: (check those that apply to this area)

- ✓ • Previous die-offs and suspected causes
- ✓ • Previous notable population effects (e.g., population declines, malformations, egg hell thinning)
- ✓ • Previous notable abiotic effects (suspended solids, water temperature, pH, nitrification, air pollution. etc.)
- ✓ • Previous contaminant events, contaminant sources, specific contaminants, species ffected, etc.
- ✓ • Activities at Henrys Lake could potentially cause contamination problems (livestock, weed eradication, crops, recreation, etc.)
- ✓ • Results from previous surveys
- ✓ • Potential baseline or reference site locations or data
- ✓ • Other ____________________

✓ 2. Visit areas in and out of the Henrys Lake Watershed that might provide useful information, and/or a perspective that will assist in the characterization process. Table 1 (at the end of the Workbook) provides a list of potential contaminant source types and contaminant categories that should be considered during the reconnaissance. Worksheet 4 is provided to record information gathered from this reconnaissance. For important areas record UTM coordinates. Check each activity completed or mark "NA" if not applicable. The reconnaissance should be conducted in accordance with safety standards and permission from the landowners if applicable.

Within the Watershed (This was done during the Workshop using maps)

- ✓ • Visit previous/current contaminant problem areas
- ✓ • Visit suspected contaminated areas
- ✓ • Visit important habitats (based on management goals for Henrys Lake)
- ✓ • Visit areas where surface water is entering Henrys Lake
- ✓ • Visit areas with sensitive habitats and/or key species
- ✓ • Visit areas that might be reference or comparison sites
- ✓ • Visit potential or current monitoring locations (Air,GW,SW)

____ • Other ____

____

Outside the Henrys Lake Watershed

____ • Visit local areas important to trust resources; consider seasonal and daily variability
____ • Visit previous and/or current problem areas
____ • Visit surface water and runoff areas that supply Henrys Lake
____ • Visit areas where fertilizer/pesticides are used
____ • Visit areas where potential contaminant sources are located
____ • Visit areas that might be reference or comparison sites
____ • Visit potential or current monitoring locations (Air,GW,SW)
____ • Other ____

____

Worksheet 3. Existing Contaminant Information.

Site Name	Henrys Lake			County	Fremont	State	Idaho
Investigator's Name		INEL Workshop				Date	December 1991
NO.	CONTACT/REFERENCE	CONTAMINANT SOURCE TYPE*	CONTAMINANT TYPE*	BRIEF DESCRIPTION OF INFORMATION		RELEVANCE TO CONTAMINANT MONITORING (LOCATION, SPECIES, REFERENCE SITE, TIME OF YEAR, ETC.)	
1	Idaho Dept. Water Resources Report		NU	Tributaries & Lake information on PO_4, NO_3 1974-75 High Nitrites & Phosphates		Provides information on previous nutrient levels in Henrys Lake.	
2	Targhee National Forest		SD	Soil types for watershed, TSS			
3	Fremont County Rpts.	Septic Tank OT	MC	Bacteria Contaminantion near developments			
4	Idaho Dept. Water Resources Report, p. 41		MC	Algae blooms, 1974 & 1975 data		Provides information on previous algal numbers & species.	
5	Idaho Dept. Water Resources Report, p. 37		OI	Dissolved Oxygen; proflie shows bottom depletion			
6	Idaho Dept. of Fish & Game Rpts.		SD	Fishery management evaluation, Tributary conditions		Several reports on fishery and fish popuations, some basic limnological data.	
7	Bureau of Land Management			Grazing allotments & conditions		Identifies grazing alottments	
8	District 7 Health & Welfare (documents on septic tank)	OT	NU, MC			Location of approved septic tanks	
9	District 7 Health & Welfare	OT	NU, MC	Boat docks & landings		Selected water quality information on various areas.	

* Use codes from Table 1, see Appendix

Worksheet 4. Field Reconnaissance data.

Site Name	Henrys Lake				County: Fremont	State: Idaho
Investigator's Name	INEL Workshop					Date: December 1991
AREA VISITED (NAME/SPECIFIC LOCATION)	COORDINATES		HABITAT TYPE/LAND USE	FLORA/FAUNA PRESENT	COMMENTS PHYSICAL CHARACTERISTICS	COMMENTS RELEVANT TO CONTAMINANT MONITORING
	X (LONG)	Y (LAT)				
Residential Developments			Varies from open scrubland, heavily forested, wetland and riparian / Residential development	Rabbitbrush, willow, lodgepole pine / bald eagle, osprey, pelicans, trout species		
Fremont County Boat Dock Area	111°26'13.6"	44°38'22.7"	Also, public boat access, swimming		Shoreline Development; Septic Tank & fields may be inadequate or not functional. Sewage dumping from boat and petroleum leaks from boats	Monitor area around shoreline for nutrients & bacteria
Hope Creek	111°25'59.4"	44°36'13.0"			Septic tank & fields may be inadequate or not functional	Monitor Hope Creek downstream from development for nutrients & bacteria
Goose Bay	111°22'47"	44°37"3.6"			Shoreline Development; septic tank & fields may be inadequate or not functional	Monitor area around shoreline for nutrients & bacteria
New Development on North Shore	111°23"23.8"	44°39'55.9"			Shoreline Development; septic tank & fields may be inadequate or not functional	Nutrient input from septic system
Old Development on North Shore	111°22'32.8"	44°39'39.7"			Shoreline Development; septic tank & fields may be inadequate or not functional	Nutrient input from septic system
Pintail Point	111°25'11.3"	44°39'55.9"	Wetlands		Shoreline Development; septic tank & fields may be inadequate or not functional	Nutrient input from septic system
Sawtell Recreation Area	111°21"22.1"	44°36'6.9"			Shoreline Development; septic tank & fields may be inadequate or not functional	Nutrient input from septic system
South Outlet	111°21'22.1"	44°35'58.8"	Lodgepole Pine		Shoreline Development; septic tank & fields may be inadequate or not functional	Nutrient input from septic system
Timber Creek Estates	111°26'39.1"	44°40'50.7"	Riparian		Septic tank & fields may be inadequate or not functional	Nutrient input from septic system and livestock Grazing

Site Name	Henrys Lake				County	Fremont	State Idaho
Investigator's Name	INEL Workshop						Date December 1991
AREA VISITED (NAME/SPECIFIC LOCATION)	COORDINATES X (LONG)	COORDINATES Y (LAT)	HABITAT TYPE/LAND USE	FLORA/FAUNA PRESENT	COMMENTS PHYSICAL CHARACTERISTICS		COMMENTS RELEVANT TO CONTAMINANT MONITORING
Lodges/Ranches/Commercial Development			Commerically developed areas, highly disturbed (roads, buildings, docks, cabins)				
Staley's Spring	111°26'7.9"	44°'4.5"			Above ground storage tanks; septic system		Determine if tanks are causing contamination
Sunset Lodge	111°19'20.4"	44°38'4.5"					
Valley View / Gas Station & Truck Stop	111°19'57.2"	44°37'38.1"			Underground storage tanks		Determine if tanks are causing contamination
Webster Ranch	111°25'45.3"	44°37'50.3"					Nutrient input from septic system
Wild rose	111°24'0.6"	44°38'0.4"			Above ground storage tanks; septic tank problems		Determine if tanks are causing contamination
Misc. Developments							
Airport	111°20'39.6"	44°38'0.4"	Private air traffic use				Check for possible contaminant sources from gas storage and pesticide use runoff
Dry Canal Dump site (Tygee Creek Diversion	111°20'53.8"	44°36'25.1"	Riparian		Old landfill area near Tygee Creek Diversion.		Potential source of unknown contaminants from residential and agricultural refuge.
Fish Hatchery	111°23'6.8"	44°39'49.9"	State Fish Hatchery, propagates cutthroat and hybrid trout		Development on lake shore; hatchery discharges into the lake.		Potential source of chemical to treat diseased fish. Not a production hatchery, therefore little, if any impact from nutrients.
Henrys Lake State Park / Park & Boat Dock	111°22'18.7"	44°37'13.8"			Recreational area, public access, boat dock, toilet facilites (speptic tanks), Sewage dumping from boat		Nutrient input from from septic system; bacteria from beach activity, petroleum from boat dock.Nutrient input from septic system, bacteria

Site Name	Henrys Lake				County	Fremont	State	Idaho
Investigator's Name	INEL Workshop						Date	December 1991

AREA VISITED (NAME/SPECIFIC LOCATION)	COORDINATES		HABITAT TYPE/LAND USE	FLORA/FAUNA PRESENT	COMMENTS PHYSICAL CHARACTERISTICS	COMMENTS RELEVANT TO CONTAMINANT MONITORING
	X (LONG)	Y (LAT)				
Tributary Streams	To Mouth of Stream, refer to Worksheet 4 for Coordinates		Riparian	Willow, Trout, Aquatic Insects, Amphibians	Runoff flows in spring, irrigation demand	Sediment input during peak flows & nutrient input during flows..
Duck Creek						Sedimentation; Livestock Grazing; Septic System
Gillian / Kelly Creeks						
Hope Creek						Sedimentation; Livestock Grazing
Howard Creek						Sedimentation; Livestock Grazing
Targhee Creek						Sedimentation; Livestock Grazing
Timber Creek			Riparian			Septic System; Livestock Grazing
Tygee Creek or Dry Creek Canal						Toxins
Unnamed Creek A						
Unnamed Creek B						
Unnamed Creek C						
Unnamed Creek D						
Unnamed Creek E						
Unnamed Creek F						
Unnamed Creek G						
Unnamed Creek H						
Unnamed Creek I						
Unnamed Creek J						

Site Name	Henrys Lake				County	Fremont	State	Idaho
Investigator's Name	INEL Workshop						Date	December 1991

AREA VISITED (NAME/SPECIFIC LOCATION)	COORDINATES		HABITAT TYPE/LAND USE	FLORA/FAUNA PRESENT	COMMENTS PHYSICAL CHARACTERISTICS	COMMENTS RELEVANT TO CONTAMINANT MONITORING
	X (LONG)	Y (LAT)				
Unnamed Creek K						
Misc. Areas or Concerns						
Gravel Pits			Highly disturbed / gravel source			
Hay Fields			Cultivated lands / agricultural		Irrigation diversions and inflitration	
Lake Sediments			Lake bottom		How much nutrients are stored in bottom sediments	
Raynolds Pass			Undisturbed in most areas, open scrubland, grazing		Geologic sources of phosphorus	No sources known; important to sample above grazing to get at background levels
Red Rock Pass			Undisturbed in most areas, logged, grazing		Geologic sources of phosphorus	No sources known; important to sample above grazing to get at background levels
Shoreline Erosion			Riparian / Wetland, Landuse ranges from natural, agriculture, commerical, state use			Shoreline erosion; rate, amount, nutrient, sediment load from shoreline erosion relative to other sources

3.3 Identify the Contaminant Sources and Associated Contaminants

Identify **ALL** the contaminant sources within the AOI for each transport mechanism and the contaminants associated with each source. Mark the sources' locations on the map and determine their coordinates. Document this information on Worksheet 5. This is one of three Summary Data Sheets that will be used for making contaminant monitoring decisions.

The initial attempt at this task for Henrys Lake will require considerable time and effort to complete. Recognize that several iterations may be necessary to complete this information in the detail required for a comprehensive data base from which informed decisions can be made. A significant effort will also be required to keep the data base current.

Section 3.3.3 in Volume 1 of the Manual provides suggested contacts to help identify contaminant sources and associated contaminants. Worksheet 6 is provided as a convenience to record useful information resources contacted in this procedure for future reference.

✓ 1. Place an "X" next to each contaminant source category relevant to the AOI.

____	Indust. air pollution	IA	____	Other ____________	OT
✓	Other air pollution	AP	____	Mil. firing range/target	MF
____	Agr. drainwater	AD	____	Other military	MO
✓	Agr. runoff	AR	____	Contam. buildings	CB
✓	Agr. aerial spray	AA	____	Petrol. explr/prod/refin	PP
____	Indust. wastewater/disch	IW	✓	Underground tanks	UT
____	Muni. wastewater/disch	MW	✓	Aboveground tanks	AT
✓	Septic tank disch	SP	✓	Accident ("spill")	AC
____	Indust. lndfl/dump/drums	ID	✓	Mining - current	MC
____	Muni. lndfl/dump/drums	MD	✓	Mining - abandoned	MA
____	Military lndfl/dump/drums	ML	✓	Forestry/Silviculture	FS
✓	Other lndfl/dump/drums	OD	____	Contaminated Sediments	CS
✓	Urban/airport/hiwy runoff	UR	✓	Nuclear Facilities	NF
____	Rural Subdivision runoff	RD	✓	Recreation	RC
✓	Aquaculture	AQ	✓	Pest Management	PM

✓ 2. On Worksheet 5, identify the following and check only when completed. Attach additional pages of the worksheet as necessary.

✓ A. All contaminant sources and contaminant source type code for each category identified in #1 above. For agricultural sources, identify crops associated with them. Locate these sources on the map using a stick pin or mark.

✓ B. The location of each contaminant source identified on Worksheet 5 and the map. Use a centroid location for the coordinates if it is an area rather than a single point.

✓ C. The specific contaminants and/or affected water quality parameters (and contaminant type codes from Table 1) associated with each source. Table 2 (at the end of the Workbook) provides some general contaminant types that might be associated with the contaminant sources identified. Use this information if you have no other information available.

✓ D. The mechanism(s) transporting the contaminants to Henrys Lake from the source.

✓ E. Key contacts that might be able to answer questions regarding the contaminant source, associated contaminants, or transport pathways. Worksheet 6 is also provided to record this information.

✓ 3.4 Identify Specific Location(s) where the Transport Pathway Enters Henrys Lake

✓ A. Using the AOI map(s), identify on Worksheet 5 the location (and name) for each specific transport pathway where it enters Henrys Lake. For air transport, identify the wind direction that would carry contaminants to Henrys Lake (e.g., SW winds). For biotic transport identify the carrier species or species group. Refer to the transport pathway tables in Section 3.1 of the Workbook for guidance.

✓ B. Identify the "key" species groups (use species group codes on Table 1, back of Workbook) that are sensitive to the contaminants recorded. Refer to the comments on important species groups for Henrys Lake identified in Section 2.1 of the Workbook.

Worksheet 5. Contaminant Source Documentation (summary data sheet).

Site Name	Henrys Lake					County	Fremont	State	Idaho
Investigator's Name	INEL Workshop							Date	December 1991
CONTAMINANT SOURCE NAME, LOCATION AND/OR ADDRESS	COORDINATES (CENTROID) X (LONG)	COORDINATES (CENTROID) Y (LAT)	CONT. SOURCE TYPE	ASSOCIATED CONTAMINANTS, AFFECTED WATER QUALITY PARAMETERS (BE SPECIFIC)	CONT. TYPE	TRANSPORT MECHANISM(S) (A, SW, GW, B)	SPECIFIC PATHWAY(S) TO HENRYS LAKE	SENSITIVE KEY SPP. GROUP See Table 1 in Appencix	KEY CONTACTS
Fremont County Boat Dock & Residential Development	Refer to Worksheet 4 for Coordinates		RD	NO_3, NO_2, PO_4, Bacteria	SG	GW	GW Seeps to Spring in Lake	AP, FW, SL	
Hope Creek Residential Development			RD	NO_3, NO_2, PO_4, Bacteria	SG	GW, SW	GW Seeps to Hope Creek to Lake	AP, SL FW	Sterling Magelby
Goose Bay Residential Development			RD	NO_3, NO_2, PO_4, Bacteria	SG	None Identified		AP, FW, SL	
New North Shore Residential Developments			RD	NO_3, NO_2, PO_4, Bacteria	SG	GW, Some SW	Hatchery Creek, Pittsburgh Creek	SL, AP, FW	George Lange, Bill Schiess
New North Shore Residential Developments			RC	Hydrocarbons	PT	GW, DC	Boat to Lake & Nonpoint sources		
Old North Shore Residential Developments			RD	NO_3, NO_2, PO_4, Bacteria	SG	GW, Some SW	Hatchery Creek, Pittsburgh Creek	SL, AP, FW	George Lange, Bill Schiess
Old North Shore Residential Developments			RC	Hydrocarbons	PT	GW, DC	Boat to Lake & Nonpoint sources		

* See code in Table 1, Appendix.

Site Name	Henrys Lake					County	Fremont	State	Idaho
Investigator's Name	INEL Workshop							Date	December 1991
CONTAMINANT SOURCE NAME, LOCATION AND/OR ADDRESS	COORDINATES (CENTROID)		CONT. SOURCE TYPE	ASSOCIATED CONTAMINANTS, AFFECTED WATER QUALITY PARAMETERS (BE SPECIFIC)	CONT. TYPE	TRANSPORT MECHANISM(S) (A, SW, GW, B)	SPECIFIC PATHWAY(S) TO HENRYS LAKE	SENSITIVE KEY SPP. GROUP See Table 1 in Appencix	KEY CONTACTS
	X (LONG)	Y (LAT)							
Pintail Point Residential Developments			RD	NO_3, NO_2, PO_4, Bacteria	SG	GW	GW Seeps to Lake	AP, SL, FW	
Sawtell Residential Developments			SG	NO_3, NO_2, PO_4, Bacteria	SG	GW	GW Seeps to Lake	AP, SL, FW	
South Outlet Residential Developments			RD	NO_3, NO_2, PO_4, Bacteria	SG	GW	GW Seeps to Lake	AP, SL, FW	
Timber Creek Residential Developments			RD	NO_3, NO_2, PO_4, Bacteria	SG	SG to SW	Timber Creek to Lake	SL, AP, FW	Rich Lewis
Staley's Spring Resort Area			RC	Hydrocarbons	PT	DC	Boats to Lake	FW	Henrys Lake Foundation
Staley's Spring Resort Area			RC	NO_3, NO_2, PO_4, Bacteria	SG	GW	Nonpoint to Lake	AP, SL, FW	Henrys Lake Foundation
Staley's Spring Resort Area			RD	NO_3, NO_2, PO_4, Bacteria	SG	GW	Nonpoint to Springs	SL, FW, AP	
Sunset Lodge Resort Area			RD	NO_3, NO_2, PO_4, Bacteria	SG	SW, GW	Howard Creek	SL, FW, AP	Gene Jones (Mrs. Jones)
Valley View Truck Stop			IW	Hydrocarbons	PT	GW	Howard Creek to Lake	AP, SL, FW	Mr. tom Savage
Webster Ranch			RD	NO_3, NO_2, PO_4, Bacteria	SG	GW	GW Seeps to Lake	AP, SL, FW	

* See code in Table 1, Appendix.

Site Name	Henrys Lake					County	Fremont	State	Idaho
Investigator's Name	INEL Workshop							Date	December 1991
CONTAMINANT SOURCE NAME, LOCATION AND/OR ADDRESS	COORDINATES (CENTROID) X (LONG)	COORDINATES (CENTROID) Y (LAT)	CONT. SOURCE TYPE	ASSOCIATED CONTAMINANTS, AFFECTED WATER QUALITY PARAMETERS (BE SPECIFIC)	CONT. TYPE	TRANSPORT MECHANISM(S) (A, SW, GW, B)	SPECIFIC PATHWAY(S) TO HENRYS LAKE	SENSITIVE KEY SPP. GROUP See Table 1 in Appencix	KEY CONTACTS
Wild Rose Resort Area			RD	NO_3, NO_2, PO_4, Bacteria	SG	GW	GW Seeps to Lake	AP, SL, FW	
Wild Rose Resort Area			RC	Hydrocarbons	PT	DC	Boats to Lake	FW	
Airport			UR	Hydrocarbons	PT	GW, SW	GW Seeps & SW Runoff to Howard Creek then to Lake	?	
Dry Canal Dump Site / Tygee Creek Diversion			OD	House hold products, Unknown toxins	SV, PT, PS	GW, SW	GW Seeps to Diversion and SW flow to Lake	?	
Fish Hatchery			AQ	Nutrients	SD, NU	SW	Hatchery Creek	SL, AP, FW	Tom Herron, IDFG
Fish Hatchery			AQ	Fungicides	PS	DC	Raceway to discharge to Lake	FW	Tom Herron, IDFG
Henrys Lake State Park			RC	NO_3, NO_2, PO_4, Bacteria	SG	GW		SL, FW, AP	Gene Eyraud, Idaho State Parks & Recreation
Henrys Lake State Park			RC	Hydrocarbons	PT	DC	In Lake	FW	Gene Eyraud, Idaho State Parks & Recreation

* See code in Table 1, Appendix.

Site Name	Henrys Lake					County	Fremont	State	Idaho
Investigator's Name	INEL Workshop							Date	December 1991
CONTAMINANT SOURCE NAME, LOCATION AND/OR ADDRESS	COORDINATES (CENTROID)		CONT. SOURCE TYPE	ASSOCIATED CONTAMINANTS, AFFECTED WATER QUALITY PARAMETERS (BE SPECIFIC)	CONT. TYPE	TRANSPORT MECHANISM(S) (A, SW, GW, B)	SPECIFIC PATHWAY(S) TO HENRYS LAKE	SENSITIVE KEY SPP. GROUP See Table 1 in Appencix	KEY CONTACTS
	X (LONG)	Y (LAT)							
Duck Creek Drainage			AR	Sediments	SD	SW	Duck Creek	TP, AP, SL, FW	John Magelby
Duck Creek Drainage			AR	NO_3, NO_2, PO_4, Bacteria	NU	GW to SW	Nonpoint sources to Duck Creek to Lake	AP, SL, FW	John Magelby
Gillian / Kelly Creek Drainage			AR	Sediments	SD	SW	Gillian / Kelly Creek	TP, AP, SL, FW	
Gillian / Kelly Creek Drainage			AR	NO_3, NO_2, PO_4, Bacteria	NU	GW to SW	Nonpoint sources to Gillian / Kelly Creek to Lake	AP, SL, FW	
Hope Creek Drainage			AR	Sediments	SD	SW	Hope Creek	TP, AP, SL, FW	
Hope Creek Drainage			AR	NO_3, NO_2, PO_4, Bacteria	NU	GW to SW	Nonpoint sources to Hope Creek to Lake	AP, SL, FW	
Howard Creek Drainage			AR	Sediments	SD	SW	Howard Creek	TP, AP, SL, FW	
Howard Creek Drainage			AR	NO_3, NO_2, PO_4, Bacteria	NU	GW to SW	Nonpoint sources to Howard Creek to Lake	AP, SL, FW	

* See code in Table 1, Appendix.

Site Name	Henrys Lake					County	Fremont	State	Idaho
Investigator's Name	INEL Workshop							Date	December 1991
CONTAMINANT SOURCE NAME, LOCATION AND/OR ADDRESS	COORDINATES (CENTROID) X (LONG)	COORDINATES (CENTROID) Y (LAT)	CONT. SOURCE TYPE	ASSOCIATED CONTAMINANTS, AFFECTED WATER QUALITY PARAMETERS (BE SPECIFIC)	CONT. TYPE	TRANSPORT MECHANISM(S) (A, SW, GW, B)	SPECIFIC PATHWAY(S) TO HENRYS LAKE	SENSITIVE KEY SPP. GROUP See Table 1 in Appencix	KEY CONTACTS
Targhee Creek Drainage			AR	Sediments	SD	SW	Howard and Targhee creeks	TP,AP, FW, SL	Walt Frazier, Salisbury Corporation
Targhee Creek Drainage			AR	NO_3, NO_2, PO_4, Bacteria	NU	GW, SW	Nonpoint sources & streams	AP, FW, SL	Walt Frazier, Salisbury Corporation
Timber Creek Drainage			AR	Sediments	SD	SW	Nonpoint Sources to Timber Creek	TP, AP, SL, FW	Ed (?) Stenke, Gorden Hunt
Timber Creek Drainage			AR	NO_3, NO_2, PO_4, Bacteria	NU	GW to SW	Timber Creek to Lake	AP, SL, FW	Ed (?) Stenke, Gorden Hunt
Unnamed Creeks A-K, except D & E			AR	Sediments	SD	SW	Nonpoint Sources to Unnamed Creeks	TP, AP, SL, FW	
Unnamed Creeks A-K, except D & E			AR	NO_3, NO_2, PO_4, Bacteria	NU	GW to SW	Unnamed Creeks to Lake		
Dispersed Recreation			RC	Hydrocarbons	PT	DC	On Lake	FW	
Dispersed Recreation			RC	NO_3, NO_2, PO_4, Bacteria	SG	DC	On Lake	AP, SL, FW	
Lake Sediments			OT	Sediments storing nutrients	SD	DC	In Lake	AP, FW, SL	

* See code in Table 1, Appendix.

Site Name	Henrys Lake					County	Fremont	State	Idaho
Investigator's Name	INEL Workshop							Date	December 1991
CONTAMINANT SOURCE NAME, LOCATION AND/OR ADDRESS	COORDINATES (CENTROID)		CONT. SOURCE TYPE	ASSOCIATED CONTAMINANTS, AFFECTED WATER QUALITY PARAMETERS (BE SPECIFIC)	CONT. TYPE	TRANSPORT MECHANISM(S) (A, SW, GW, B)	SPECIFIC PATHWAY(S) TO HENRYS LAKE	SENSITIVE KEY SPP. GROUP See Table 1 in Appencix	KEY CONTACTS
	X (LONG)	Y (LAT)							
Raynolds Pass			OT	Phosphorus	NU	GW, SW	Raynolds Pass to Timber Creek to Lake	AP, FW, SL	USFS
Red Rock Pass			OT	Phosphorus	NU	GW, SW	Red Rock Pass to Duck Creek to Lake	AP, FW, SL	USFS
Shoreline Erosion			RC	Sediments	SD	DC	Wind, Wave Action on Shore to Lake	TP, AP, FW, SL	

* See code in Table 1, Appendix.

Worksheet 6. Important Contacts For Contaminant Monitoring.

Site Name: Henrys Lake		County: Fremont	State: Idaho
Investigator's Name: INEL Workshop			Date: December 1991
NAME	**PHONE #**	**AFFILIATION**	**COMMENTS**
Tom Herron	208/558-7202	Idaho Department of Fish and Game (Henrys Lake Fish Hatchery)	Fish Hatchery Manager, also involved in water quality sampling (especially DO levels) and fish census.
Steve Elle / Mark Gamblin	208/525-7290	Idaho Department of Fish and Game, Regional Fishery Manager, Idaho Falls	
George Spinner	208/236-1660	Division of Environmental Quality, Idaho Department of Health and Welfare, Pocatello	Water qualtiy inforamtion, septic tank permits & compliance, well information
Jerry Funk	208/652-3385	Fremont County Planning/Zoning	Landuse maps, zoning requirments, spetic tank locations, fish & wildlife planning maps
Carla Fromm	208/334-5860	Division of Environmental Quality, Idaho Department of Health and Welfare, Boise	Project manageer of Lake Management Study
Lou Benedict	208/523-5390	Idaho Department of Lands	Good institutional memory of landuse around Henrys Lake
Ken Bookmann	208/624-3341	Soil Conservation Service	Landuse information (agricultural especially), some information on wetlands.
Walt Grows / Dave Strickland	208/558-7301	Targhee National Forest, District Ranger	Timber and grazing information
Rich Howard	?	U. S. Fish & Wildlife Service	Endangered Species Information
Martin Miller	208/522-1645	U. S. Corps of Engineers	Issues related to wetlands
Dave Rydalch	?	North Fork Reservoir Co.	Management of lake water for irrigation.

Site Name: Henrys Lake		County: Fremont	State: Idaho
Investigator's Name: INEL Workshop			Date: December 1991
NAME	**PHONE #**	**AFFILIATION**	**COMMENTS**
Tom Herron	208/558-7202	Idaho Department of Fish and Game (Henrys Lake Fish Hatchery)	Fish Hatchery Manager, also involved in water quality sampling (especially DO levels) and fish census.
Pat Koclach	208/524-7528	Bureau of Land Management	Landuse issues, roadless area north of Henrys Lake
Byron White	208/526-0424	Henrys Lake Foundation	Volunteer water quality sampling

✓

3.5 Identify Key Species

Identify the key species for Henrys Lake. This list will be used to help prioritize the contaminants, media, and locations to be monitored. The information might also be used to help establish trigger levels for contaminant concentrations. Refer to Worksheet 5 and Section 2 of the Workbook for key species groups or species. Worksheet 7 is provided to document the information gathered in this section. If an appropriate list is already available, it can be used as well.

While many habitat exist around the lake and within the AOI, most critical to key species (mainly trout) of Henrys Lake include: (1) lake environment, including emergent aquatic, (2) riverine, mainly spawning areas and (3) riparian areas. These critical habitats will be used to help prioritize contaminants, media, and locations to be monitored.

1. Obtain a species list for the area and other information regarding predator-prey relationships, species groups, etc. (e.g., benthic macroinvertebrates, fish, rodents).

2. In the table below identify the habitats found in or near Henrys Lake. Use these habitats for Worksheet 7. Place an X infront of each applicable habitat type. Add additional categories if those listed are inappropriate for your area.

HABITATS IMMEDIATELY ADJACENT TO HENRYS LAKE					
X	CODE	UPLAND FORMATIONS	X	CODE	WETLAND/AQUATIC FORMATIONS
X	AG	Agricultural Lands / Grazing		WT	Wet Tundra
	T	Tundra		SF	Swampforest/Riparian
X	F	Forest (>50' trees)	X	SS	Swampscrub/Riparian
X	W	Woodland (<50' trees)	X	FM	Freshwater Marshland
X	S	Scrubland (<31'- multibranched)	X	ST	Strandland (beach)
X	GR	Grassland	X	SA	Submergent Aquatic
	D	Desertland (<12" precip.)		MW	Managed Wetlands
			X	L	Lake/Pond/Impoundment
			X	RS	Riverine
				M	Marine
				E	Estuarine

3. Refer to the management objectives in Section 2.1 of this Workbook and identify all the key species and group code associated with each of the applicable Assessment Considerations. Document the habitat type (from above), ecological compartment (i.e., P = primary producers, 1 = 1st order consumer or herbivore, 2 = 2nd order consumer, 3 = 3rd order consumer or greater, and O = omnivore) the primary food sources, exposure medium, and location of contaminant exposure. Provide any relevant comments for the species.

Considerations should include:

- The management-oriented key species
- The key species in each of the habitats identified in the above table
- The base of the food chain, key predators, reproduction requirements, feeding, and resting habitats, etc.
- Early warning or sentinel indicator species/communities
- The required habitat and food sources for the above species.

3.6 Develop a Conceptual Diagram of the Ecosystem

Conceptual diagrams can be used to illustrate the associations between the contaminant sources and key species. This diagram can help to identify key points within the ecosystem where monitoring will provide the most information for assessing contaminant status and trends and risk to the system. It might be necessary to develop a diagram for each habitat depending on the complexity of the system. This is an important component of the ecosystem approach. Check each item when it is completed.

_✓_ 1. Draw a diagram to illustrate the ecosystem/habitat of concern for Henrys Lake (Figures 3-1 and 3-2).

_✓_ 2. Identify the specific contaminant input pathways for Henrys lake (e.g. Targhee Creek, NE winds).

_✓_ 3. Identify the relevant compartments within each of the habitats for the ecosystem (i.e., P = primary producers, 1 = 1st order consumer or herbivore, 2 = 2nd order consumer, 3 = 3rd order consumer or greater, and O = omnivore).

____ 4. Check Worksheet 7 to see if any species were not included and amend the Worksheet as necessary.

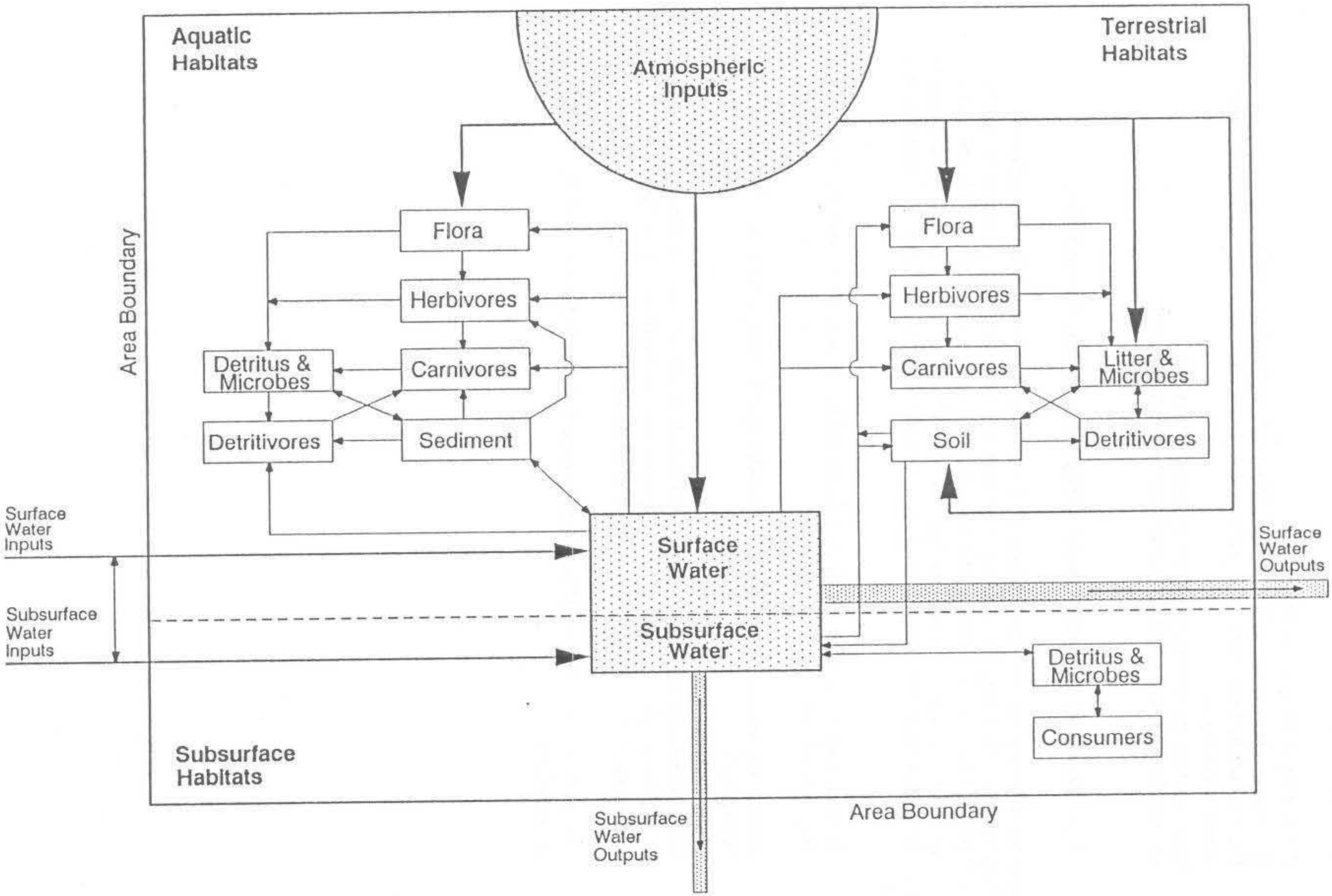

Figure 3-1. Conceptual Diagram of Contaminant Transport Pathways.

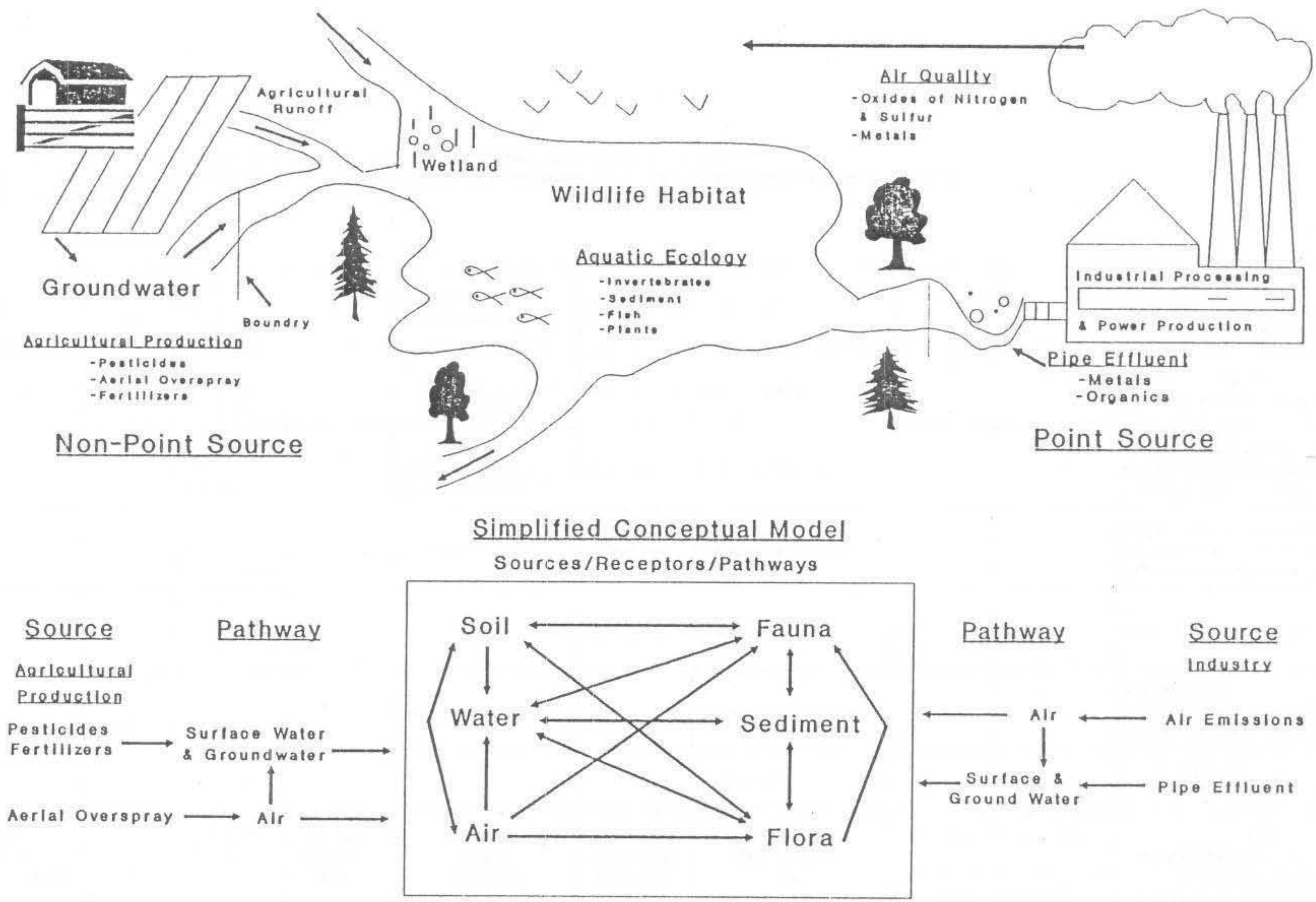

Figure 4. Illustration of the components of the ecosystem approach to contaminant monitoring.

Figure 3-2. Conceptual Diagram of Contaminant Transport Pathways for Simplified Aquatic System.

Worksheet 7. Key Species Identification.

Site Name		Henrys Lake					County	Fremont	State: Idaho
Investigator's Name		INEL Workshop							Date: Decmber 1992
KEY SPECIES OR SPECIES GROUP NAME	SPP. GROUP CODE*	HABITAT TYPE	ECOL. COMPART-MENT**	PRIMARY FOOD SOURCE	PRIMARY EXPOSURE MEDIA***	PRIMARY LOCATIONS OF CONTAMINANT EXPOSURE	COORDINATES		COMMENTS RELATING TO CONTAMINANTS (SENSITIVITY, PATHWAY, TEMPORAL CONSIDERATIONS, EXPOSURE, ETC.)
							X (LONG)	Y (LAT)	
Algae	AP	Lacustrian	P	Light	SE	Whole Lake			Change community structure, density w/ change in Nutrients, etc.
Amphibians	RW	Shoreline, Lacustrian	2	Light, Insects	SW, A, AN	Entire watershed, Lake			May see changes in populations w/ changes in contaminants in AOI; Use as an indicator species
Aquatic Insects	FW	Aquatic macrophytes, Lake bottom	1	Aquatic plants	PL, SE, SW	Lake wide			Use as an indicator species
Bald Eagle	ES	Tall trees near lakes & tributaries	2	Fish, carrion	AN, SW	Goose Bay & Duck Creek			Degradation of fisheries at Henrys Lake; Potential pesticide contamination, egg shell thining indicator of activity level
Brook Trout	SL	Lacustrian, Cold Water Fishery	2	Macroinvertebrates, benthic invertebrates, crustaceans	SW, AN, SE	Lake and tributaries			Potentially killed by low DO; food sources changed by nutrients; Piscivorous therefore a high level of contamination
Cutthroat Trout	SL	Lacustrian, Cold Water Fishery	2	Macroinvertebrates, benthic invertebrates, crustaceans	SW, AN, SE	Lake and tributaries			Potentially killed by low DO; food sources changed by nutrients
Macrophytes	AP	Littoral zone and lake bottom	P	Nutrients from water & sediments	SW, GW, SE	Whole Lake			Use as an indicator species; Change community structure, density w/ change in Nutrients, algal blooms, etc.

* Use Species Group from Table 1.
** P - Primary Producer; 1 - 1st order consumer (herbivore); 2 - 2nd order consumer (carnivore); 3 - 3rd order consumer or greater; 0 - Omnivoir.
*** A = Air; SW = Surface Water; GW = Groundwater; S = Soil, SE = Sediments, AN = Animal; PL = Plant.

Site Name		Henrys Lake					County	Fremont	State Idaho
Investigator's Name		INEL Workshop							Date December 1992
KEY SPECIES OR SPECIES GROUP NAME	SPP. GROUP CODE*	HABITAT TYPE	ECOL. COMPART-MENT**	PRIMARY FOOD SOURCE	PRIMARY EXPOSURE MEDIA***	PRIMARY LOCATIONS OF CONTAMINANT EXPOSURE	COORDINATES		COMMENTS RELATING TO CONTAMINANTS (SENSITIVITY, PATHWAY, TEMPORAL CONSIDERATIONS, EXPOSURE, ETC.)
							X (LONG)	Y (LAT)	
Osprey	RA	Large snags & trees	2	Fish	AN, SW	North shoreline & Lake			
Waterfowl (Dabblers)	WF	Marshes, Lake edge, Uplands	0	Aquatic macrointertebrates, phytoplankton, other plants	SW, AN, SE, S	Shoreline, Wetlands, Tributaries			
Waterfowl (Divers)	WF	Lake, Bottom	0	Benthos, Crustaceans, Mollusks	SE, SW, AN	Shorelines, Lake			
Willow/Riparian	TP	Wetlands near shore, GW discharge	P	Photosynthetic, nutrients	S, GW, SW, A	East side, Howard, Duck, Targhee, & Timber creeks			Use as an indicator species for grazing intensity
Willow/Sedge	TP	Riparian zones along streams	P	Photosynthesis, nutrients	S, GW, SW, A	Targhee, Timber, & Duck creeks			Use as an indicator species for grazing intensity
Zooplankton	FW	Lacustrian	1, 2	algae	SW, GW, SE	Whole Lake			Change community structure, density w/ change in nutrients, etc.

* Use Species Group from Table 1.

** P - Primary Producer; 1 - 1st order consumer (herbivore); 2 - 2nd order consumer (carnivore); 3 - 3rd order consumer or greater; 0 - Omnivoir.

*** A = Air; SW = Surface Water; GW = Groundwater; S = Soil, SE = Sediments, AN = Animal; PL = Plant.

4. PRIORITIZE THE CONTAMINANTS TO MONITOR

The purpose of this section is to determine what will be monitored. The prioritization process helps identify the most important contaminants and parameters to monitor for Henrys Lake given the management goals & objectives. The information collected during this process is used to support the decisions made concerning what will be monitored.

4.1 Considerations

To prioritize the contaminants to monitor the following should be considered:

- Regulatory requirements (federal and state)
- Risk to personnel and the public
- Relative risk of contaminant to key species that use Henrys Lake
- Contaminant priority level
- The number of key species affected by the contaminant
- Value of the monitoring data for protecting the resource
- Usefulness for baseline monitoring
- Trigger Level values for contaminant concentration vs. known or potential concentrations
- Extent of occurrence - temporal and spatial
- Potential for exposure and availability of exposure media
- Contaminant characteristics
  - persistence
  - potential for biomagnification (octanol/H_2O partitioning coefficient)
  - potential for bioaccumulation
- Historical significance
- State Agency directives
- Toxicity types and effects (direct/indirect)
  - acute-mutagenic
  - chronic/subletha
  - carcinogenic
  - reproductive
  - teratogenic
  - growth
  - tumors
  - enzymatic (ChE, ACAD, other - neurological path lesions)
  - physical (feather, fur - [oil - thermal effects])
- Available sampling/analysis techniques
- Available resources

✓ 4.2 Rapid Contaminant Prioritization Process

The original contaminant prioritization process requests a significant level of effort to complete. Information is requested on toxicity types and effects (e.g., acute, chronic, tumors). Though the information is important to the overall monitoring strategy, a streamlined approach will be used until a database of the information required has been developed. Use the following procedures to complete Worksheet 8.

PROCEDURE:

__✓__ 1. Using Worksheet 5 identify the specific contaminants moving into Henrys Lake or with the potential to do so and list them in the "Contaminant, Water Quality Parameter, or Stressor" column. Also list the water quality parameters that could be affected by the contaminant sources. Use extra worksheets if additional space is necessary or insert more rows into the table if you're working on a computer.

__✓__ 2. List the key plant and animal species (from Worksheet 7) across the top of Worksheet 8. Also identify key habitats or communities that are important to the system or key species. These habitats should also be considered because they could be affected by anthropogenic activities. If additional space is needed for the key species/habitats, use the copies you made in step 1.

__✓__ 3. In columns 2-5 indicate a yes or no to the following:

a. Are there regulatory limits for this contaminant or parameter?
b. Does the contaminant bioaccumulate?
c. Is the contaminant biomagnified through the food chain?
d. Are there known synergistic effects associated with the contaminant?
e. Are there known mutagenic effects associated with the contaminant.

If answers to these questions are unknown, leave the space blank until an answer is known.

__✓__ 4. In the boxes below the key species two factors will be considered:

a. the toxicity of the contaminant to the species, and
b. the probability that the organism will be exposed to the contaminant.

These values will be recorded with the Toxicity Value first followed by a dash then the Potential Exposure Value will be recorded (e.g., H-2 = high toxicity and a moderate probability of the species being exposed to the contaminant.)

Toxicity Value - record one of the following in the box:

H = high toxicity; the species is very sensitive to the contaminant or water quality parameter; toxic effects (chronic or acute) are observed at very low contaminant concentrations or if the water quality parameter deviates slightly from its normal range. The threshold is very low for the species.

M = moderate toxicity; between high and low toxicity

L = low toxicity; the species is not sensitive to the contaminant or water quality parameter; toxic effects (chronic or acute) are only observed at high contaminant concentrations or when the water quality parameter deviates well beyond its normal range. The threshold is very high for the species.

Potential Exposure Value

Using your knowledge of the AOI and the aid of additional expertise as needed, make a professional judgement regarding the probability of exposure for each contaminant or parameter identified. Considerations should include contaminant and source characteristics, transport pathways, and receptor characteristics. Select one of the following probabilities and put its value next to the toxicity ranking:[1]

1 = high probability
2 = moderate probability
3 = low probability

_✓_ 5. Overall Risk - record the highest toxicity value for all the species and the highest Potential Exposure Value for all the species (e.g. H-1 is higher than M-2)

_✓_ 6. Contaminant Priority Level - To prioritize the contaminants and/or water quality parameters requires a professional judgement decision. The two primary components completed in the previous sections must be considered: 1) the Potential Exposure Value and 2) the Overall Risk. Use the levels and definitions provided below and fill in the this box.

The priority levels for this section will be:

H = High Priority -- Contaminant/parameter should be routinely monitored because of its high toxicity and high probability of exposure to key species/habitats or humans (i.e., it presents a high risk situation).

M = Medium Priority -- Contaminant/parameter should be surveyed for and/or baseline data should be obtained. Toxicity and probability of exposure indicate a moderate risk to key species/habitats or humans.

L = Low Priority -- Contaminant/parameter toxicity and probability of exposure is low for key species/habitats and humans, it presents a low risk situation. Baseline data would be useful to establish a benchmark for trend analysis.

---

1 High Probablity = 1

- The contaminant source is relatively close to the Study Area
- A transport mechanism provides easy transport of the contaminant to the Study Area
- The contaminant will not degrade, be neutralized, or sorbed before reaching the Study Area

Moderate Probablitiy = 2 -- (between 1 and 3)

Low Probability = 3

- The contaminat source is not close to the Study Area
- There is no transport mechanism that provides easy transport of the contaminant to the Study Area
- The contaminant will degrade, be neutralized, or sorbed prior to reaching the Study Area

___✓___ 7. Will Monitor - based on all the information in the row (from column 2 on), decide if this contaminant will be monitored. The considerations in Section 4.1 should be addressed when determining which contaminants/parameters to monitor.

___✓___ 8. Overall Sensitivity - record the highest toxicity value in the column for the species (H = the highest)

___✓___ 9. Primary Habitat - if this is important for establishing monitoring locations, record the relevant codes from the" Habitat Types" Table in Section 3.5 of the Workbook.

Worksheet 8. Rapid Contaminant Prioritization.

Location	Henrys Lake	County	Fremont	State	Idaho
Investigator	INEL Workshop		Date	December 1992	

Contaminant, Water Quality Parameter, or Stressor	Reg. Lim. (Y/N)	Bio-accum (Y/N)	Bio-mag. (Y/N)	Syner Eff. (Y/N)	Mutag Eff. (Y/N)	Key Species/Habitats: Zooplankton	Amphibians	Aquatic Insects	Bald Eagle	Osprey	Waterfowl	Macrophytes	Brook Trout	Cutthroat, Rainbow & Hybrid Trout	Willow/Riparian						Overall Risk: Tox = (H,M,L) Expos = (1,2,3)	Cont. Priority Level (H,M,L)	Will Monitor (Y/N)
CONTAMINANT:																							
Nitrates	Y	Y	N	Y	N	H-1	L-1	-	-	-	-	H-1	H-1	H-1	-						H-1	H	Y
Phospahtes	Y	Y	N	Y	N	H-1	L-1	-	-	-	-	H-1	H-1	H-1	-						H-1	H	Y
Unknown Solvents/Toxicants[1]	Y	?	?	?	?	H-2	H-2	H-2	H-2	H-2	H-2	H-2	H-2	H-2	-						H-3	M	Y
Pesticides[2]	Y	Y	Y	Y	?	L-2	M-2	H-2	H-1	H-1	H-3	L-3	M-1	M-1	-						H-1	H	Y
Bacteria (*E. coli*)[3]	Y	N	N	N	N	-	-	-	-	-	-	-	-	-	-							H	Y
Hydrocarbons	Y	N	N	?	N	M3	M-3	M-3	M-3	M-3	M-3	M-3	M-3	M-3	-						M-3	M	Y
Fungicides	Y	N	N	N	N	L-1	L-1	L-1	-	-	-	L-1	L-1	L-1	-						L-1	L	N
WATER QUALITY PARAMETERS:																							
Sediment						-	-	-	-	-	-	-	-	-	-								Y
Dissolved Oxygen						-	-	-	-	-	-	-	H-1	H-1	-								Y

Location	Henrys Lake	County	Fremont	State	Idaho
Investigator	INEL Workshop		Date	December 1992	

Contaminant, Water Quality Parameter, or Stressor	Reg. Lim. (Y/N)	Bio-accum (Y/N)	Bio-mag. (Y/N)	Syner Eff. (Y/N)	Mutag Eff. (Y/N)	Key Species/Habitats: Zooplankton	Amphibians	Aquatic Insects	Bald Eagle	Osprey	Waterfowl	Macrophytes	Brook Trout	Cutthroat, Rainbow & Hybrid Trout	Willow/Riparian						Overall Risk: Tox = (H,M,L) Expos = (1,2,3)	Cont. Priority Level (H,M,L)	Will Monitor (Y/N)
STRESSORS:																							
Cattle Grazing						-	-	-	-	-	-	-	-	-	√								Y
Overall Sensitivity						H	H	H	H	H	H	H	H	H	√								
Primary Habitat						L	FM	L, RS, FM	F	F	L, FM	L	L, RS	L, RS									

[1] Source: old landfill or dump along dry creek canal (potential contaminant area #16.
[2] Specific pesticide unknown.
[3] Primary concern is to recreational users.
[4] Cattle grazing along stream banks directly impacts the Willow/Riparian habitat. Indirect impacts from increased sediment and water temperatures could impact most aquatic organisms.

4.3 Establishing Monitoring Objectives For Henrys Lake

Now that the area of concern has been adequately characterized and the specific contaminant issues threatening the resource have been identified, it is possible to develop specific monitoring objectives. The purpose of developing monitoring objectives is to provide a manageable topic for a monitoring program. Monitoring objectives provide a specific purpose for data collection, a format for data interpretation, and are specific enough to develop a statistically-relevant sampling plan. Workable monitoring objectives help identify specific parameters to measure, locations to focus on, and to determine the frequency and time to sample. Along with existing data (which help to determine natural variability) they also assist a statistician to formulate a workable null hypotheses and to determine how many samples are required to avoid falsely accepting or rejecting the null hypothesis.

An example of an unworkable monitoring objective (but perhaps an appropriate monitoring goal) is "to determine the effect of recreational activities on water quality". A more workable objective would be "to determine the effect of overnight camping on the bacteriological quality of streams draining the XYZ Wilderness Area." (Example from EPA, 1991: "Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska," by Lee McDonald, Alan W. Smart and Robert C. Wissmar).

Using the characteristics of Henrys Lake, establish monitoring objectives for Henrys Lake. The following should be considered:

- management goals and objectives
- monitoring goals
- transport pathways
- contaminant sources and contaminants
- receptors (key species and habitats)
- assessed risk to important resource

Record the monitoring objectives in Worksheet 9 (use the guidance provided in Section 2.5 to help establish objectives). These objectives should support the following monitoring goals for Henrys Lake and should address the contaminant issues identified in the previous sections (see also Section 2.5.2).

1. Determine nutrient levels in lake and tributaries to help establish baseline conditions and to monitor existing conditions.
2. Identify potential and unknown sources of nutrients and estimate their contribution to Henrys Lake water quality.
3. Determine the risk to the public from primary and secondary contact with pathogens (i.e., *E. coli*).
4. Monitor dissolved oxygen levels to estimate impacts to Henrys Lake resources (e.g., trout).
5. Identify and monitori indicators of ecological conditions within Henrys Lake (e.g., Index of Biotic Integrity, aquatic plant surveys, fish counts).

Worksheet 9. Monitoring Objectives For Henrys Lake.

No.	Monitoring Objectives	Contaminant Issue
1	Monitor nitrogen and phosphorus concentrations at the mouth of tributary streams and within the lake and goundwater at various location around the lake.	Nitrogen and phosphours inputs from septic systems and tributary streams could be contributing to increased macrophyte growth and potential winter oxygen deficits.
2	Establish transects to monitor the abundance and trends in macrophytes.	Macrophytes can be an indicator of nutrient concentrations and potential winter oxygen deficit problems.
3	Monitor water quality parameters affected by N & P inputs (e.g., dissolved oxygen, *E. coli*).	Water quality parameters such as DO & bacteria counts could be indicators of nutrients, septic system, and sediment input from various sources.
4	Monitor lake shoreline and tributary stream banks for erosion and sediment input.	Sediment input contributes to the eutrophication of the lake and potentially could contain contaminants such as pesticides, which in term, contaminant lake bottom sediments.
5	Establish baseline information on areas susceptible to *accidental* spills of petroleum products, chemicals, etc.	Purpose is to identify and characterize areas susceptible to hazardous chemical spills. Initial study and monitoring is short-term, then updated as necessary.
6	Identify potential unknown contaminants from old landfills or dumps located in the basin (e.g., like the one located along the dry creek canal).	Unknown hazardous chemicals, etc. may be entering the tributaries and lakes from old landfills or dumps. Initial monitoring to determine extent of problem.
7	Monitor eastside tributaries for pesticide/herbicide contamiantion.	Agricultural practices on the eastside (hayfields) could be contributing pesticides/herbicides to the system. Initial monitoring to determine extent of problems.

5. IDENTIFY THE OPTIMUM LOCATION, MEDIUM/PARAMETERS, AND TIME TO SAMPLE

An iterative process is required to complete this task. To arrive at a final decision regarding where, what, and when to sample requires that all three be considered and evaluated interactively. One is not necessarily more important than another. **The stated objectives of the monitoring effort must be used to guide the decision.** Understanding the characteristics of the contaminant, its source, and the transport mechanisms involved is also necessary.

✓

5.1 Select the Location to Monitor

1. Using the AOI map(s) and Worksheet 5, locate the transport pathway(s) from each source for the contaminant(s) identified on Worksheet 8 "Will Monitor". Identify an optimum location along the transport pathway for collecting samples. This will be the Contaminant Assessment Area (CAA) for these contaminants. Contaminant Assessment areas are identified in Figure 5-1.

   On Worksheet 10, identify the CAA or reference site with a number, identify its location, state the purpose/objectives for monitoring, and list the contaminants to be monitored there. Complete a separate 10 Worksheet for each CAA.

   Considerations for the CAA selection should include:

   - The purpose/objectives of the monitoring effort
   - Is it a likely location for the contaminant to be present in the highest concentration or to observe its effects
   - The appropriate media/parameters to monitor for the contaminant are present
   - There is access to the area
   - Multiple contaminants/parameters can be monitored at this location
   - Key species/habitats are present
   - A low number of samples is adequate to characterize the area (i.e., low spatial variability)

   - The most uncomplicated, least costly sampling methods can be used
   - Availability of historic data.

2. Select an appropriate "Baseline or Reference Monitoring Site". Use the following as guidance:

   Baseline monitoring site - An unimpacted site; pristine; a site unaltered by human activities to the extent possible.

   - Representative of the most pristine areas on earth
   - Examples are Biosphere Observatories and ANWR

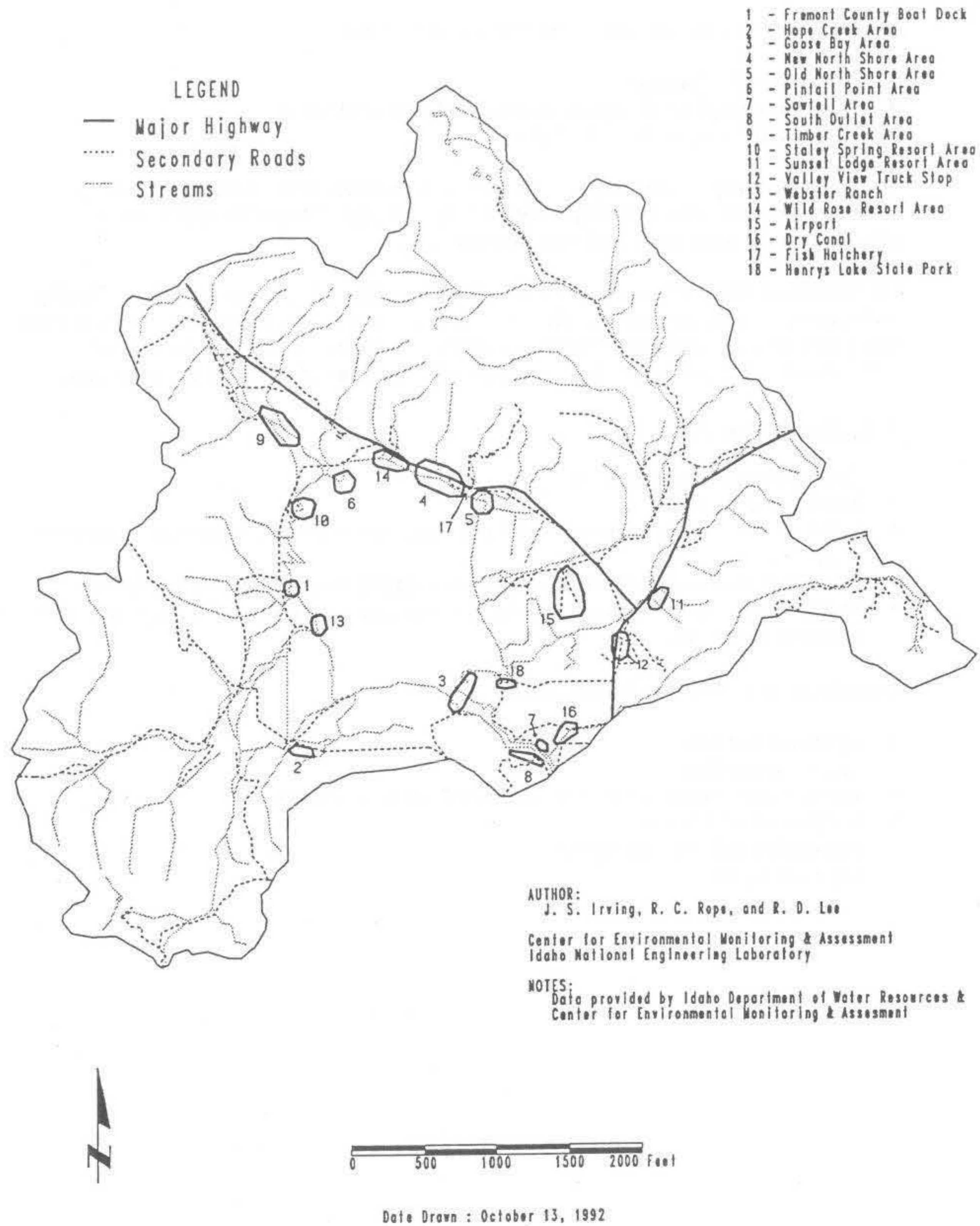

Figure 5-1. Contaminant Assessment Areas for Henrys Lake, Idaho.

Reference site - A site selected for comparison with a CAA

- Not necessarily "pristine"
- Best attainable physical habitat, chemical and biological status
- Ecologically comparable to the CAA

Using the AOI maps, transport pathways tables, and relevant OM1 worksheets, identify locations where baseline or reference data will be collected. These sites will be used to provide data for comparison with data from the CAA's.

On Worksheet 11 identify the baseline or reference monitoring sites with a number, identify its location, state the purpose/objective for monitoring and list the contaminants or parameters being measured or compared. Complete a separate Worksheet 11 for each baseline or reference site. Considerations for a reference site should include some of the above plus:

Selecting a Reference Site

- Consider monitoring objectives
- Select "natural" sites
- Select sites ecologically similar to each other and similar to the Contaminant Assessment Area
- Select sites with reasonable access relative to required frequency of data collection
- Make sure desired parameters (i.e., the same parameters as measured at the CAA) can be measured at the sites

Considerations in Selecting Reference Sites

- vegetation and soils
- species composition
- stream factors (width, depth, velocity, number of pools/riffles)
- composition of substrate
- temperature and moisture regime
- slope and aspect.

Worksheet 10A. Contaminant Assessment Area Monitoring Activities (summary data sheet).

Location	Henrys Lake	**County**	Fremont	**State**	Idaho
Investigator's Name	INEL Workshop			**Date**	Decmber 1992

CAA Number	1,3,4,5,6,7,8,9 10,11,13,14,18	**Location Description**	Refer to Worksheets 2 & 4 and Figure 5-1.			
Project Number	-	**Coordinates**	**X (Long)**	Refer to Worksheets 2 & 4 and Figure 5-1.	**Y (Lat)**	Refer to Worksheets 2 & 4 and Figure 5-1.
Specific Purpose/Objectives	To determine nutrient input from development areas (septic systems)					

Contaminant, Water Quality Parameter, or Stressor to Monitor (from Worksheet 8) Workbook Section →	**Medium/Par. to Sample/ Measure (5.2)**	**When to Sample: Month/Time (5.3)**	**Contaminant Priority Level Worksheet 8**	**Sampling Method (6.2)**	**Frequency: # of Time Sampled/Yr (6.2)**	**Number of Samples per Sample Period (6.2)**	**Sample Plot &/or Sample Location # (6.2)**	**Notes/Other Information**
Nitrates	Surface Water & Groundwater	May - Sept.	H	Resource Dependent	Resource Dependent, suggest 1 / mo.	Resource Dependent	Resource Dependent	In conjunction with water quality samples, map macrophyte distribution and abundance to use as a potential indicator of nutrient enrichment
Phophates	Surface Water & Groundwater	May - Sept.	H	Resource Dependent	Resource Dependent, suggest 1 / mo.	Resource Dependent	Resource Dependent	Same as above
Bacteria (*E. coli*)	Surface Water & Groundwater	Jul. - Aug /. Weekends & Holidays	H	Resource Dependent	Resource Dependent, suggest 1 / mo.	Resource Dependent	Resource Dependent	May use bacteria counts as an indicator of pathway from septic systems to lake.
Dissolved Oxygen	Surface Water	Year round / Late afternoon	-	Resource Dependent	Resource Dependent, suggest 1 / mo.	Resource Dependent	Resource Dependent	The minimum DO readings will be the limiting factor, take readings during the late afternoon when DO is the lowest.

Worksheet 10B. Contaminant Assessment Area Monitoring Activities (summary data sheet).

Location		Henrys Lake			**County**	Fremont	**State**	Idaho
Investigator's Name		INEL Workshop					**Date**	Decmber 1992
CAA Number	--	**Location Description**		Mouth of Timber, Targhee, Hope, and Duck creeks, Refer to Worksheet 2				
Project Number	-	**Coordinates**	**X (Long)**	Refer to Worksheet 2	**Y (Lat)**	Refer to Worksheet 2		
Specific Purpose/Objectives		To determine the contribution of nutrients from "outside" lake sources (e.g., runoff from grazing areas) / Also the amount of sediment input from grazing, timber, road building, etc. activities.						

Contaminant, Water Quality Parameter, or Stressor to Monitor (from Worksheet 8) Workbook Section →	Medium/Par. to Sample/ Measure (5.2)	When to Sample: Month/Time (5.3)	Contaminant Priority Level Worksheet 8	Sampling Method (6.2)	Frequency: # of Time Sampled/Yr (6.2)	Number of Samples per Sample Period (6.2)	Sample Plot &/or Sample Location # (6.2)	Notes/Other Information
Nitrates	Water	May - Aug.	H	Resource Dependent	Resource Dependent suggest 1 / mo.	Resource Dependent	Resource Dependent	Need to sample more often during spring runoff to get a handle on the "shock" load from rapid snowmelt.
Phosphates	Water	May - Aug.	H	Resource Dependent	Resource Dependent, suggest 1 / mo.	Resource Dependent	Resource Dependent	Same as above.
Sediment	Water	May - Aug	H	Resource Dependent	Resource Dependent, suggest 1 / mo.	Resource Dependent	Resource Dependent	Could use as an indicator of drainage condition. Bank cover, stability, embeddedness, invertebrate numbers and composition, etc. could be used as an indicator of riparian and stream condition.

Worksheet 10C. Contaminant Assessment Area Monitoring Activities (summary data sheet).

Location		Henrys Lake			County	Fremont	State	Idaho
Investigator's Name		INEL Workshop					Date	December 1992
CAA Number	3,4,5,6,7,8,9, 10, 11, 13, 14, 15	Location Description		Refer to Figure 5-1 and Worksheets 2 & 4 for key to CAA Numbers. Also included is Targhee and Howard creeks downstream of hayfields, and the lake sediment on the eastside of lake near mouths of tributaries or canals.				
Project Number	-	Coordinates	X (Long)	Refer to Worksheet 2 & 4.	Y (Lat)	Refer to Worksheet 2 & 4.		
Specific Purpose/Objectives		To determine the concentration of pesticides, herbicides, etc. in the tributary streams and lake from agricultural practices on the eastside.						
Contaminant, Water Quality Parameter, or Stressor to Monitor (from Worksheet 8) Workbook Section →	Medium/Par. to Sample/ Measure (5.2)	When to Sample: Month/Time (5.3)	Contaminant Priority Level Worksheet 8	Sampling Method (6.2)	Frequency: # of Time Sampled/Yr (6.2)	Number of Samples per Sample Period (6.2)	Sample Plot &/or Sample Location # (6.2)	Notes/Other Information
Pesticides	Water Sediments	May - Jul.	H	Resource Dependent	Resource Dependent, suggest 1 / mo.	Resource Dependent	Resource Dependent	Short-term study to determine in contamination from agricultural runoff is a problem.

Worksheet 10D. Contaminant Assessment Area Monitoring Activities (summary data sheet).

Location		Henrys Lake				**County**	Fremont	**State**	Idaho
Investigator's Name		INEL Workshop						**Date**	Decmber 1992
CAA Number	1, 10, 11, 12, 14, 15, 18	**Location Description**			Refer to Figure 5-1 and Worksheet 2 & 4				
Project Number	-	**Coordinates**		**X (Long)**	Refer to Worksheets 2 & 4		**Y (Lat)**	Refer to Worksheets 2 & 4	
Specific Purpose/Objectives		To determine if petroleum from boat and veheicle fuel is contaminanting part of the lake or tributaries.							
Contaminant, Water Quality Parameter, or Stressor to Monitor (from Worksheet 8) Workbook Section →	Medium/Par. to Sample/ Measure (5.2)	When to Sample: Month/Time (5.3)	Contaminant Monitoring Level (6.2)	Contaminant Priority Level Worksheet 8	Sampling Method (6.2)	Frequency: # of Time Sampled/Yr (6.2)	Number of Samples per Sample Period (6.2)	Sample Plot &/or Sample Location # (6.2)	Notes/Other Information
Hydrocarbon	Water Sediments	May - Aug.	Resource Dependent	M	Resource Dependent	Resource Dependent, suggest 1 / mo.	Resource Dependent	Resource Dependent	Short-term study to identify any problems with petroleum contamiantion from either recreational boating or vehicle in the surrounding area. The area downstream of CAA 12 should be monitored (lower Targhee and Howard creeks.

Worksheet 10E. Contaminant Assessment Area Monitoring Activities (summary data sheet).

Location		Henrys Lake			**County**	Fremont	**State**	Idaho
Investigator's Name		INEL Workshop					**Date**	December 1992
CAA Number	16	**Location Description**		Near suspected landfill or dump and at mouth of dry creek canal.				
Project Number	-	**Coordinates**	**X (Long)**	Refer to Fgiure 5-1 and Worksheets 2 & 4	**Y (Lat)**	Refer to Figure 5-1 and Worksheets 2 & 4		
Specific Purpose/Objectives		To determine if any unknown toxicants are entering the lake from old landfill and dump sites. The dry creek canal site (CAA #16) is just one site that has been identified. Another potential site is south of Staley Springs along the lakeshore.						
Contaminant, Water Quality Parameter, or Stressor to Monitor (from Worksheet 8) Workbook Section →	Medium/Par. to Sample/ Measure (5.2)	When to Sample: Month/Time (5.3)	Contaminant Priority Level Worksheet 8	Sampling Method (6.2)	Frequency: # of Time Sampled/Yr (6.2)	Number of Samples per Sample Period (6.2)	Sample Plot &/or Sample Location # (6.2)	Notes/Other Information
Toxic Substances	Water Soil Lake Sediment	Spring during runoff	M	Resource Dependent	Resource Dependent, suggest once	Resource Dependent	Resource Dependent	Dry creek canal only flows water during the spring when water from the Tygee Drainage is diverted to Henrys Lake. Water samples should be taken during this period. Soil and lake sediment samples can be taken at other times. One time study to determine if it is a problem. Should attempt to identify other potential landfills or dump sites.

Worksheet 11. Baseline Or Reference Area Monitoring Activities

Location	Henrys Lake	County	Fremont	State	Idaho
Investigator's Name	INEL Workshop			Date	Decmber 1992
Baseline or Reference Site #		Location Description			
Project Number		Coordinates	X (Long)	Y (Lat)	
Specific Purpose/Objectives					

Contaminant or Parameter Being Measured and/or Compared	Medium/Par. to Sample/ Measure	When to Sample: Month/Time (5.3)	Contaminant Monitoring Level	RFM & Method Section # (6.2)	Frequency: # of Time Sampled/Yr (6.2)	Number of Samples per Sample Period (6.2)	Sample Plot &/or Sample Location # (6.2)	Notes/Other Information
		NOTE: Baseline information has already been established by current study being conducted by the Division of Environmental Quality, Idaho Department of Health and Welfare.						

✓ 5.2 Select the Media/Parameters to Monitor

The optimum medium/parameter to monitor is one where the contaminant, or its effects, can be measured or observed soon after its introduction into the system and/or it will be found in the greatest concentration relative to other media in the system. It must also satisfactorily address the objectives of the monitoring effort.

Media are typically sampled for chemical analysis or to assess its physical condition (e.g., water quality or necropsies). Environmental parameters such as productivity, community structure, population numbers, or other biotic indices are also important and should be considered as a part of the monitoring program.

Criteria for a good indicator medium include:

- The contaminant accumulates rapidly
- It has a high concentration of the contaminant relative to other media within the system
- It is associated with a number of species identified as "important" either through the food chain or other form of exposure
- It is relatively easy and inexpensive to sample and analyze
- The contaminant concentration detected is directly correlated with that found in the environment
- It is widespread and/or has an analog in other ecosystems.

Criteria for a good indicator parameter include:

- There is a direct correlation between its value and the contaminant concentration
- Its response to the contaminant is rapid and persists
- It is relatively easy and inexpensive to measure
- It is widespread or has an analog in other ecosystems or species
- Its value is indicative of ecosystem or species health.

✓ Consult Tables 3, 4, or 5 (at the end of the Workbook), to help identify the optimum medium/parameter to monitor for each specific contaminant or parameter and associated transport pathway. Document your results on the appropriate Worksheet 10 or 11.

NOTE: The monitoring location and temporal considerations are also important in selecting the media/parameters to monitor. If the most desirable location or time is not conducive to monitoring the medium/parameter selected, an alternative is needed.

✓ 5.3 Temporal Considerations

For many contaminants and transport pathways, selecting the time to sample is as important as the media and location considerations. Understanding the characteristics of the contaminant source and transport mechanisms is also necessary. It might be necessary to assess temporal considerations for each contaminant and/or contaminant source separately if there are significant differences between their characteristics. Complete a separate 12 Worksheet for each CAA.

✓ 1. For the CAA, list the contaminant(s) or parameter(s) being monitored and its associated transport mechanism and/or exposure medium.

✓ 2. Using Worksheet 12, consider the objectives of this monitoring effort and identify in the appropriate box the five most important temporal considerations for each contaminant or parameter. Also identify the associated transport pathway and medium.

✓ 3. Determine the optimum time to sample for each contaminant or parameter and transport pathway and write this in the space provided. This will depend on the contaminant source, transport mechanism(s), and the media being sampled.

✓ 4. Determine actual time when the samples will be taken and enter in the space provided. This may differ from the optimal time due to logistic constraints.

✓ 5. Provide comments justifying the selected time to sample. Comments should reflect the most important temporal considerations and, if applicable, why a time other than the optimum time was selected for sampling.

✓ 6. Do the decisions made regarding when to sample address the objectives of the monitoring effort and are they compatible with the media and CAA location decisions?

If yes, the next step is to develop a sampling design for each contaminant and location. On Worksheet 10, record the final decisions regarding when to sample for the contaminant(s) or parameter(s) at each CAA.

If no, reevaluate each of the "where, what, and when" considerations, prioritize them based on the monitoring objectives, and select the most compatible solution.

NOTE: If the "most compatible solution" does not adequately address the monitoring objectives, it is not a solution. Don't sacrifice data quality requirements, resolve the problem. This might require additional information (site, contaminant, receptor characteristics, etc.) and/or an increased monitoring effort (increased scope and additional funds/labor).

Worksheet 12. Temporal Considerations For Monitoring

Location		Henrys Lake	County	Fremont	State	Idaho		
CAA #	See Worksheet 10A	Investigator's Name	INEL Workshop				Date	December 1992
Contaminant(s), Water Quality Parameter(s), or Stressor(s) being Monitored		Transport Mechanism or Exposure Medium (A, SW, GW, SO, SE, AN, PL)	Five Most Important Temporal Considerations	Optimum Time to Sample	Selected Time to Sample	Comments - Provide rationale for the optimum and/or selected sampling time		
Nitrates		SW, GW	12, 13	--	--	Sample monthly, more frequently during summer moths when summer homes and recreational areas are in use.		
Phophates		SW, GW	12, 13	--	--	Same as above		
Bacteria (*E. Coli)*		SW, GW	12, 13	--	--	Same as above		
Dissolved Oxygen		SW	3, 5, 9	--	--			

Location		Henrys Lake	County	Fremont	State	Idaho		
CAA #	See Worksheet 10B	Investigator's Name	INEL Workshop				Date	December 1992
Contaminant(s), Water Quality Parameter(s), or Stressor(s) being Monitored		Transport Mechanism or Exposure Medium (A, SW, GW, SO, SE, AN, PL)	Five Most Important Temporal Considerations	Optimum Time to Sample	Selected Time to Sample	Comments - Provide rationale for the optimum and/or selected sampling time		
Nitrates		SW	1, 2, 4	--	--	Sample monthly, important to sample duing epizodic event. Also sample during times of trout spawning.		
Phosphates		SW	1, 2, 4	--	--	Same as above		
Sediment		SW	1, 2, 4	--	--	Same as above		

Location		Henrys Lake	County	Fremont	State	Idaho	
CAA #	See Worksheet 10C	Investigator's Name	INEL Workshop			Date	December 1992
Contaminant(s), Water Quality Parameter(s), or Stressor(s) being Monitored		Transport Mechanism or Exposure Medium (A, SW, GW, SO, SE, AN, PL)	Five Most Important Temporal Considerations	Optimum Time to Sample	Selected Time to Sample	Comments - Provide rationale for the optimum and/or selected sampling time	
Pesticides		SW	1, 2, 4	--	--	Sample irrigation return flows, tributaries near agricultural fields.	

Location		Henrys Lake	County	Fremont	State	Idaho	
CAA #	See Worksheet 10D	Investigator's Name	INEL Workshop			Date	December 1992
Contaminant(s), Water Quality Parameter(s), or Stressor(s) being Monitored		Transport Mechanism or Exposure Medium (A, SW, GW, SO, SE, AN, PL)	Five Most Important Temporal Considerations	Optimum Time to Sample	Selected Time to Sample	Comments - Provide rationale for the optimum and/or selected sampling time	
Hydrocarbon		SW, GW	1, 13	--	--	Sample near resorts, recreational areas (e.g., boat docks). Also sample tributary if source occurs on or near (e.g., Targhee Creek with Valley View Truck Stop.	

Location		Henrys Lake	County	Fremont	State	Idaho	
CAA #	See Worksheet 10E	Investigator's Name	INEL Workshop			Date	December 1992
Contaminant(s), Water Quality Parameter(s), or Stressor(s) being Monitored		Transport Mechanism or Exposure Medium (A, SW, GW, SO, SE, AN, PL)	Five Most Important Temporal Considerations	Optimum Time to Sample	Selected Time to Sample	Comments - Provide rationale for the optimum and/or selected sampling time	
Toxic Substances		SW, GW	1, 4, 16,	--	--	Sample one time to determine extent of problem, if any.	

TEMPORAL CONSIDERATIONS

1 Storm events (pulses of contaminants)
2 Wet vs. dry periods/seasons
3 Temperature affects (DO, respiration, etc.
4 Agricultural activities (fertilizers, amount and type of Pesticides, aerial spraying)
5 Turnover period and stratification of standing water
6 Biotic activities (life cycle, peak population numbers, hormonal cycles, migration, exposure potential, etc.)
7 Wind or storm intensity
8 Wind direction
9 Stagnation events
10 Dryness (resuspension of particulates)
11 Wet deposition vs. dry deposition
12 Seasonal recharge (ground water level fluctuation and water available to sample at seeps or wells
13 Recreational activities, increased tourism (auto emissions, hunting, fishing, etc.)
14 Comparability with another monitoring site or historic data
15 Tidal/sea level rise
16 Contaminant characteristics (persistence, toxicity, variability with temperature, DO, synergistic effects with other contaminants in system, etc.)
17 Estimates regarding inputs from air deposition and subsequent runoff (surface water pathway only)
18 Contaminant source characteristics (discharge pulses, change in the contaminants released)
19 Access to monitoring location
20 Available labor
21 When do other samples need to be collected at this, or other nearby locations
22 Is sample equipment and storage space available
23 Are appropriate funds and capabilities available for sample collection, transportation, and analysis
24 Other

A = Air
SW = Surface water
GW = Groundwater
SO = Soil
SE = Sediments
AN = Animal
PL = Plant

6. DESIGNING AND IMPLEMENTING CONTAMINANT MONITORING ACTIVITIES

6.1 Contaminant Monitoring Design Considerations

NOTE: Section 6 has not been filled out for Henrys Lake. Individual agencies should fill out Section 6 depending on their particular resources and needs. Use the previous 5 sections to help design and implement a contaminant monitoring program.

Specific sampling designs for each contaminant or parameter being monitored at the Contaminant Assessment Site (CAA) should be developed with the assistance of a statistician. They will need to know the objectives of the monitoring activity, the characteristics of the area being monitored, the media/parameters being sampled, how the data is to be used, and the confidence level required for the data. Most of this information will have been considered in earlier steps of the Workbook and may already be documented on a worksheet or in your notes.

Consider the following prior to developing the monitoring design:

- The objective(s) of the monitoring effort and how the data are to be used. (Separate, more specific objectives might be required for different contaminants and/or CAAs.)
- Data Quality Objectives
- The contaminant monitoring level for the contaminant at this location
- Characteristics of the contaminant being assessed
  - temporal variability
  - physical characteristics
  - toxicity to key species
  - potential concentrations
- CAA characteristics for each medium/parameter to be sampled/measured
  - temporal and spatial variability of physical conditions at the CAA
  - temporal and spatial variability of biotic conditions at the CAA
  - physical conditions of the media being considered
- Sampling method(s) being considered
- Available resources for sampling, sample processing, and analysis.
  - availability of funding
  - availability of labor
  - availability of equipment/materials
  - availability of space.

6.2 Contaminant Monitoring Design Development

The information compiled below will assist in writing a proposal for contaminant monitoring activities.

____ 1. Determine the Contaminant Monitoring Level. The contaminant or parameter monitoring level will provide an indication of the level of effort for monitoring a particular contaminant or parameter (e.g., sampling frequency, the number of sample points and associated media/parameters, the types of analyses conducted, etc.). The monitoring level is based on the potential for a contaminant to reach Henrys Lake. Use the definitions in Section 3.7.1 of this Workbook to help determine the Contaminant Monitoring Level for each contaminant or parameters identified on Worksheet 10.

____ 2. On Worksheet 10, fill in the Contaminant Priority Level from Worksheet 8 for each listed contaminant.

____ 3. An important item for developing the sampling design is a scale map of the CAA with physical/biotic conditions, habitat types, orientation, scale, etc. noted.

Obtain, or draw, an appropriate surface features map that provides this information and note specific areas containing the medium/parameter being considered for monitoring at each CAA. This map will be used to identify and document sampling locations for the CAA.

____ 4. Determine the sampling methods to be used. For each medium/parameter identified on Worksheets 10 and 11 to be sampled/measured, identify the sampling method to be used. Fill in the appropriate column on Worksheets 10 and 11. If an alternative method is to be used, mark the space "other" and document the procedures that will be used.

____ 5. Discuss the monitoring design considerations listed above and the information collected in this Workbook with State personnel responsible for management of Henrys Lake, and a statistician to arrive at a final sampling design for each contaminant at each CAA.

____ 6. On Worksheet 10, complete the following for each contaminant being monitored:

- The frequency or number of times the medium/parameter will be sampled/measured per year
- The number of samples required for each sample period

____ 7. Using the map(s) from #4 above, locate the sample plots and/or individual sample locations for each sample type at each CAA. Identify each location with a number and put it in the appropriate space on Worksheet 10.

6.3 Implementing Contaminant Monitoring Activities

In addition to the technical requirements, the logistical requirements associated with monitoring need to be considered. Below are some of the issues that will need to be addressed prior to implementing monitoring activities for Henrys Lake. Worksheet 13 is provided to document some of the funding and personnel requirements for the monitoring program.

6.3.1 Logistic Considerations for Monitoring Activities

Personnel Requirements:

- Are the personnel required to implement the contaminant monitoring activities available?
- Are there plans to hire additional personnel?
- How many additional personnel are needed?
- Estimate costs for additional personnel ($K).
- Are personnel appropriately trained to conduct monitoring activities?
- Are there special requirements for handling highly toxic samples?
- Are personnel trained in handling and shipping procedures?

Sampling/Sample Processing Requirements:

- Equipment/materials requirements
  - Are the required equipment/materials available?
  - Can the equipment be borrowed?
  - Estimate of costs for additional equipment.

- Space and materials for processing samples
  - Is space available for sample processing?
  - Are the necessary materials available for sample processing?
  - Is refrigerator/freezer space available?

- Shipping
  - Are packaging materials available?
  - Are proper labels and tags available?
  - Shipping costs should be considered.

- Sample analysis costs
  - Obtain an initial estimate for all sample analysis costs for the monitoring activities.
  - Are sufficient funds available?

Budget Considerations:

- Total funds available for contaminant monitoring
  - Current FY
  - Next FY
  - Out Years

- Estimated Costs
  - Current FY
  - Next FY
  - Out Years

The information compiled below will assist in writing a proposal for contaminant monitoring activities. Fill in the information requested below in the appropriate columns of Worksheet 13 :

____ 1. List the contaminants to be monitored.

____ 2. List the medium collected for sample analysis for each contaminant.

____ 3. Is training required for collecting/processing these samples?

____ 4. What are the total number of samples per year (from frequency x number of samples per sample period on Worksheet 10)?

____ 5. What is the type of analysis to be conducted?

____ 6. What are the sample analysis costs per sample?

____ 7. Determine the:
____ - Total sample analysis costs
____ - Total materials costs
____ - Total equipment costs
____ - Total training costs
____ - Total costs

Worksheet 13. Logistics And Costs For Contaminant Monitoring Activities.

Location						County		State		
Investigator's Name						CAA #		Date		
Project #	Project Title									
Specific Purpose/Objectives										
Contaminant to Monitor (from Worksheet 10)	Medium to be Collected for Sample Analysis Worksheet 10	Personnel/ Training Needed? (Y/N) (6.3)	Total Number of Samples per Year (6.3)	Type of Analysis (6.3)	Analysis Cost per Sample (6.3)	Total Sample Analysis Costs	Total Materials Costs	Total Equipment Costs	Total Training Costs	TOTAL COSTS
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
						0.00				0.00
Personnel/Training Needs:										
Material/Equipment Needs:										
Other Comments:										

6.4 Additional Information Requirements

This concludes the Workbook activity. The following information should now be documented:

- Management goals and objectives for Henrys Lake
- Monitoring goals for Henrys Lake
- Existing information relevant to contaminant monitoring
- Contaminant sources and associated contaminants within the AOI
- Contaminant transport mechanisms and pathways associated with Henrys Lake
- Important receptors for Henrys Lake
- Key physical and biotic associations between the contaminant sources and important receptors
- A monitoring level ranking for Henrys Lake
- A priority list of contaminants associated with Henrys Lake
- Monitoring objectives for Henrys Lake
- A list of contaminants to monitor, the associated CAA(s), and the appropriate media/parameters and times to monitor them
- A map of each CAA with notes regarding its physical/biotic variability
- The sampling methods to be used and whether equipment, personnel, and resources are available
- Training requirements

It is worthwhile to note information still required to complete this Workbook and other information not addressed by this Workbook that is relevant to implementing contaminant monitoring activities. Space is provided below for some short notes. Attach sheets as necessary.