Los Alamos National Laboratory

Risk Reduction and Environmental Stewardship

Water Quality and Hydrology Group

Quality Assurance Project Plan

for the

Groundwater, Surface Water, and Sediment Monitoring Program

Signatures

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General information about this procedure

In this procedure

History of revisions

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description of Changes
0	6/03	New document.
1	8/04	Annual review.

Attachments

This plan has the following attachments:

Section	Topic	No. of Pages
1	Approach to Groundwater and Surface Water Monitoring Network Design	8
2	Data Quality Objectives	11

SECTION 1

Quality Program

Organization

Policy

The Groundwater, Surface Water, and Sediment (GSWSED) Monitoring Program supports RRES Division and its Environmental Protection Program in efforts to protect:

- public health and environment by implementing rigorous compliance programs designed to assure institutional compliance with state and federal environmental protection regulations
- human health and the environment during emergencies by assuring technical capabilities are available to measure and evaluate unplanned release of hazardous materials into the environment.
- public health and environment by the measurement, assessment and reduction of risks caused by exposure to LANL derived hazardous materials.

LANL will comply with the requirements for environmental monitoring of groundwater, surface water, and sediment contained in the Laboratory's Hazardous Waste Facility Permit, Module II, and DOE Orders 450.1 (DOE 2003), 5400.5 (DOE 1990), DOE Order 435.1 (DOE 2001), and DOE Order 231.1 (DOE 1996). The program satisfies the commitment to conduct environmental testing of Pueblo of San Ildefonso lands under a Memorandum of Understanding between the DOE, the Pueblo, and the Bureau of Indian Affairs. Compliance will be demonstrated through the successful implementation of this project plan and applicable procedures.

Organization, continued

Purpose of the program

This ongoing GSWSED Monitoring Program part of the Environmental Surveillance Program, allows the Laboratory to evaluate compliance with Federal (including DOE) and State standards for radiation protection of the public and quality of drinking water, groundwater, surface water and sediment. Some of the objectives of the groundwater, surface water, and sediment monitoring program are to:

- establish baselines of environmental quality for Laboratory site-specific radionuclides and other chemical constituents in groundwater, surface water, and sediment;
- determine the Laboratory contribution to levels of radionuclides and other chemical constituents in groundwater, surface water, and sediment collected from on-site and perimeter areas;
- characterize and define trends, if any, of radionuclides and other chemical constituents in groundwater, surface water, and sediment;
- verify compliance with applicable environmental laws and regulations;
- identify and quantify new or existing environmental quality problems;
- provide data for estimating public radiation doses related to the consumption of or exposure to groundwater, surface water, and sediment;
- verify compliance with the effective dose equivalents in DOE Order 5400.5 (DOE 1990); and
- publish the results of groundwater, surface water, and sediment Environmental Surveillance Program monitoring activities in the Laboratory annual environmental surveillance report (in compliance with DOE Order 231.1 (DOE 1996)) and other public and scientific forums.

The drivers for the development and implementation of this monitoring project are:

- DOE Order 450.1, Environmental Protection Program
- DOE Order 5400.5, Radiation Protection of Public and Environment
- DOE Order 231.1, Environment, Safety, and Health Reporting
- DOE Order 435.1, Radioactive Waste Management
- Hazardous Waste Facility Permit
- RCRA Facility Permit
- San Ildefonso MOU
- Accord Pueblo Agreements

Organization, continued

Purpose of this plan

This QA Project Plan describes the policies and requirements that ensure the GSWSED Monitoring Program part of the Environmental Surveillance Program processes are conducted in a consistent, agreed-upon manner. Drivers for the quality plan include:

- DOE O 414.1A, Quality Assurance
- RRES-EPP-IMP, Integrated Management Plan for the Environmental Protection Programs

Structure of the quality program

The QA Project Plan, including implementing procedures, is a sub-tier document to the RRES-WQH Quality Management Plan. The following documents provide requirements to ensure that the GSWSED Monitoring Program, part of the Environmental Surveillance Program, is operated in accordance with established plans and procedures.

- RRES-WQH Quality Management Plan
- QA Project Plan for GSWSED Monitoring Program (this document)
- Implementing procedures

Group organization

The RRES-WQH Group is responsible for the GSWSED Monitoring Program, part of the Environmental Surveillance Program. See the WQH Quality Management Plan for a description of the group organization, level of authorities, and lines of communication. The group is organized by teams under the line management direction of the group leader. Teams are cross-functional and focus on specific LANL water quality responsibility, deliverables, or products. Teams are supervised by team leaders, who have the responsibility to assure the project is completed. Projects within teams are managed by project leads.

Organization, continued

Program organization

The Environmental Surveillance Team Leader (ES Team Leader) is responsible for this monitoring effort. Project Leads are responsible for their assigned monitoring efforts for groundwater, surface water, or sediments.

- The Environmental Surveillance Team Leader manages the project and works with the Watershed Management Program Project Leader, Environmental Protection Program Manager, and the Groundwater Protection Program Manager to make sure it meets needs of those programs.
- The ES Team Leader reports to the WQH Group Leader.
- A group QA specialist is assigned to work for the ES Team Leader and assigned Project Leads to provide quality assurance assistance, advice, and review.
- The Environmental Surveillance Team Leader assigns staff members and works with other team leaders to evaluate and oversee or implement data collection, data quality, data base aspects, interpretation, and reporting for portions of the program.
- In addition, representatives from other groups may participate and contribute to this team.
- The WQH Operations Team Leader oversees sampling activities.

Applicable regulatory quality criteria

- LANL Quality Assurance Management Plan (PRD-110-01)
- DOE O 414.1A, *Quality Assurance*
- LPR 308-00-00, *Integrated Quality Management*
- LPR 404-00-00, *Environmental Protection*
- LIR 404-50-01, *Water Pollution Control*
- DOE Order 450.1, *Environmental Protection Program*
- DOE Order 5400.5, *Radiation Protection of Public and Environment*
- DOE/EH-0173, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*

Organization, continued

Implementation

The following table lists specific responsibilities:

Who	What
WQH Group Leader	Assure that qualified staff properly gather and evaluate information required by the GSWSED Monitoring Program. Ensure that information is accurate and complete.
ES Team Leader	Ensure that monitoring data collection and reporting are performed in accordance with the requirements specified in this plan.
WQH Staff, Operations Team Leader	Oversee or implement data collection, data quality, data base aspects, interpretation, and reporting for portions of the program

SECTION 2

Personnel Development

Personnel Training and Qualification

Personnel qualification requirements

Personnel selection, training, and qualification requirements will be established for each function. These will include the minimum applicable requirements for education, experience, skill level, and physical condition.

All personnel will be qualified through a combination of education, experience and training to perform their assigned tasks. The LANL Human Resources Division maintains documentation of education and qualification. The GSWSED Monitoring Program requires personnel with the following skills:

- Hydrology
- Geochemistry
- Geology
- Advanced scientific data analysis and interpretation skills
- Superior writing skills
- Outreach/communication

Training of personnel

All personnel performing GSWSED Monitoring Program work are required to obtain appropriate orientation and training prior to performing job assignments. Training for personnel will be performed and documented according to RRES-WQH-QP-031, Orienting New Employees and RRES-WQH-QP-024, Training.

Training effectiveness

Training effectiveness will be monitored. Worker performance will be evaluated to ensure that the training program conveys all required knowledge and skills.

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader	Ensure program personnel working under their authority have the appropriate level of training, and maintain documentation of that training.

SECTION 3

Quality Improvement

Improving Quality

Policy

The GSWSED Monitoring Program subscribes to the WQH Quality Management Program principles of problem prevention and continuous improvement. The ES Team Leader is committed to evaluating improvement opportunities identified by trending and reporting.

Performance monitoring and reporting

The purpose of this section is to describe how WQH will monitor and improve the quality of the process for the GSWSED Monitoring Program.

The ES Team Leader collects periodic updates from project leaders, either verbal or written. These updates are used to keep group management apprised of the focus of the GSWSED Monitoring Program activities and to identify any shortcomings that may be identified.

The QA Specialist will prepare (or direct personnel to prepare) performance reports annually or as needed. These performance reports will address items such as:

- System performance
- System modifications/upgrades
- Problems or deficiencies identified during assessment activities or during routine performance of work

Performance report distribution

The following receive copies of project performance reports:

- ES Team Leader
- RRES-WQH Group Leader
- RRES-WQH QA Specialist
- GSWSED Monitoring Program personnel working on project activities

Corrective actions within WQH

Corrective actions for all WQH projects are initiated, tracked, corrected, and documented according to the RRES-WQH Quality Management Plan and group procedure RRES-WQH-QP-033, *Issues Reporting and Action Tracking* .

Improving Quality, continued

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader	Monitor and trend program performance and ensure deficiences are corrected in a timely manner.
QA Specialist	Prepare and distribute performance reports.
WQH personnel	Identify opportunities for process improvement, health and safety enhancement, environmenal protection, or other improvements of the program's operations. Ensure deficiencies are reported and corrected in a timely manner.

SECTION 4

Documents and Records

Program Documents

Revising this plan

This plan will be controlled through the WQH procedure RRES-WQH-QP-021, *Document Control*. The ES Team Leader, at least one reviewer, and the group leader will approve all revisions to this plan. Revisions to the plan will be provided to the QA Specialist.

Document control

This document will be controlled under the organization's document control system (RRES-WQH-QP-021, *Document Control*) to ensure that those performing work for the system will receive a controlled copy and all revisions. Those who will receive or have nearby access to a controlled copy include:

- WQH Group Leader
- WQH QA Specialist
- WQH GSWSED Monitoring Program staff members
- WQH GSWSED Monitoring Program technicians
- Assistant Area Manager, Office of Environment and Projects, DOE Los Alamos Area Office

Procedures

Procedures will be developed as necessary and in accordance with the policy in the RRES-WQH QMP.

Program Records

Records resulting from this program

The number, type, and detail of all records to be kept will provide sufficient information to allow an individual with equivalent education and training to verify or reconstruct the results. Implementing procedures specify the records, forms, logbook entries, or other information to be kept as documentation of the performance of the procedure.

Records to be kept in the WQH records system (RRES-WQH-QP-025, *Records Management*) include the following:

- logbook entries and/or field forms to record station repairs and maintenance
- equipment and instrument calibration and maintenance records
- general correspondence that affects the project
- supporting analytical data reports

Records final disposition and retention period

All records will be maintained and available (after the deadline for submittal as given in applicable procedures) for auditing in the records center at the WQH group office (RRES-WQH-QP-025, *Records Management*). Records will be archived in compliance with Laboratory and DOE requirements for records retention, storage, and management. These requirements specify the protection of records from damage due to fire, flood, or rodents; monitored access to the records; and maintenance of the records for up to 200 years (DOE/HQ DRAFT document, "DOE Records Schedule for Environmental Records," November 1996).

Electronic Media

Policy

The project will utilize electronic means as necessary to maintain data and perform calculations on these data. Electronic means will not replace paper copy. All records that must be maintained to meet regulatory requirements will be kept in hard copy as the official record.

Data will be made available for review to organizations external to RRES-WQH and external to the Laboratory on the Water Quality Database (WQDB). The WQDB is located at http://wqdbworld.lanl.gov/.

Proprietary data collected from other political entities (San Ildefonso Pueblo, Los Alamos County, City of Santa Fe) will be released after review by those organizations.

Databases

Analytical data are submitted in electronic form by the analytical laboratories and added to the Water Quality Database. The Water Quality Database is the primary data archive and source for project reports.

Backups -- All databases used to hold data and generate reports to be used in demonstrating compliance will be maintained on a common drive of a server. These databases will be backed up daily to minimize potential losses of data.

Verification of data –All data uploaded into a database will be verified to be accurate against the original paper copy. Data that are uploaded through electronic means will undergo 10% verification. Data that are uploaded through manual means will undergo 100% verification. Someone other than the data entry person must perform the 100% review. This review will be documented and forwarded to the appropriate record series.

Verification of calculations -- A person other than the person who generated the query will review for accuracy all calculations performed in a database through queries. This review will be documented and forwarded to the appropriate record series.

Software control -- The integrity of the WQDB database will be ensured by maintaining them on a common server. This will enable the database administrator to control access to these database, allowing only trained authorized persons access to the database.

Spreadsheets

Backups -- All spreadsheets used to hold data and generate reports will be maintained in a secure location. Backup options include the group server, TSM (see http://storage.lanl.gov/), or tape storage. Spreadsheets will be backed up at least weekly.

SECTION 5

Work Processes

Planning and Performing Work

Policy

Work that contributes to achieving the quality specifications of the GSWSED Monitoring Program deliverables will be planned and documented as described in this plan and appropriate implementing procedures (see WQH QMP, section 5). Work will be performed according to applicable plans and implementing procedures. The ES Team Leader will provide first line supervision of personnel assigned to program tasks to ensure work is performed to achieve program quality specifications. Before changing a work process that affects the program quality specifications, the ES Team Leader will ensure the same level of planning and review as used in the initial program planning steps.

Work processes

All work should be regarded as a process. Each process consists of a series of actions and is planned and carried out by qualified workers using specified work processes and equipment under administrative, technical, and environmental controls established by management to achieve an end result. Workers are the best resource for contributing ideas for improving work processes and will be involved in work process design, process evaluation, and provision of feedback necessary for improvement.

All work is planned using the principles of Integrated Safety Management and in compliance with applicable LIRs and the WQH QMP, as appropriate.

Work performance

Management should ensure that the following are clearly identified and conveyed to workers prior to beginning work:

- Customer and data requirements for the work and final product
- Acceptance criteria applicable to work and final product
- Hazards associated with the work
- Technical standards applicable to work and final product
- Safety, administrative, technical, and environmental controls to be employed during the work

Planning and Performing Work, continued

Description of work processes

The work processes used to meet the regulatory requirements and the requirements of this plan can be divided as follows:

- Groundwater/Surface Water/Sediment Sampling Plan
- Groundwater/Surface Water/Sediment Monitoring
- Routine Data Reports
- Supporting operations (sample analysis and tracking, results of concern, and process verification and peer review)

Groundwater/Surface Water/Sediment Sampling Plan

Development

Groundwater/Surface Water/Sediment Sampling Plan development and implementation is required for efficient monitoring for potential Laboratory-derived contamination of the water environment near Los Alamos. The plan is reviewed annually and modifications made based upon review and analysis of previous years' data and the annual Environmental Surveillance report.

What are DQOs?

Data quality objects (DQOs) are statements of the uncertainty level a decision maker is willing to accept in results derived from environmental data. As such, they are a management tool used to limit the change of data leading to an incorrect conclusion. The DQO process must also define the required level of data defensibility and hence the level of documentation desired. DQOs must strike a balance between time, money, and data quality. The DQOs for the Groundwater, Surface Water, and Sediment Monitoring Program were developed in accordance with EPA QA/G-4, *Guidance for the Data Quality Objectives Process*, 1994.

Program DQOs

DQOs for the GSWSED Monitoring Program are discussed in Attachments 1 and 2 of this document.

Monitoring Network Design

The groundwater and surface water monitoring network design was addressed by developing a series of decision flow charts. The decision flow charts depict the process by which locations, frequency, measurements, and analyses are determined. The decision flow is then applied to individual watersheds to develop the monitoring plan specific to the watershed but consistent on a site-wide basis. For further explanation of the approach used to develop the monitoring network for groundwater and surface water monitoring, reference Attachment 1, Approach to Groundwater and Surface Water Monitoring Network Design.

Review and assessment of DQOs

An annual review of DQOs and reiteration, if necessary, will be conducted to determine that the collected data met the performance criteria specified in the established DQOs.

Failure to meet specified DQOs

When differences are identified between specified and measured values for completeness, a deficiency report will be generated (reference the WQH procedure for deficiency reporting), and the causes of the differences will be investigated, reported to management, and corrected where possible.

Groundwater/Surface Water/Sediment Sampling Plan, continued

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader	Oversee development and update of monitoring data collection plans and procedures. Conduct DQO process to assure that GSWSED sampling supports monitoring requirements, including detecting, characterizing, and responding to releases from DOE activities.

Groundwater/Surface Water/Sediment Monitoring

Routine GSWSED Monitoring

Routine monitoring of groundwater, surface water, and sediment is the required mechanism for identifying the presence of potential Laboratory-derived contaminants in the water environment. Monitoring of all three media are necessary because water-borne contaminants can impact each. Monitoring is conducted at sites both on and off the Laboratory, with off-site sampling permission from the property owner. Participation in the off-site sampling event by the property owner is voluntary and at the owner's discretion.

Field Parameters

Field parameters, including turbidity, conductivity, temperature, and pH, may be collected during a water sampling event as prescribed by sampling procedures. Results are documented in the sampler's log book with electronic copy to the Water Quality Database (WQDB) data manager.

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader	Ensure that current sampling strategies meet the requirements of the GSWSED Monitoring Program by reviewing the following annually: • WQH's Groundwater, Surface Water, and Sediment Sampling Plan, • RRES-WQH-SOP-048 *Groundwater Sampling using Bladder Pumps*, • RRES-WQH-SOP-049, *Groundwater Sampling using Submersible Pumps,* • RRES-WQH-SOP-050, *Groundwater Sampling using Westbay System,* • RRES-WQH-SOP-047, *Spring and Surface Water Sampling,* • RRES-WQH-SOP-012, *Sediment Sampling*

Continued on next page.

Groundwater/Surface Water/Sediment Monitoring, continued

Implementation (continued)

Who	What
WQH Operations Team	Conduct sampling activities according to: • GSWSED Sampling Plan, • RRES-WQH-SOP-048 *Groundwater Sampling using Bladder Pumps*, • RRES-WQH-SOP-049, *Groundwater Sampling using Submersible Pumps,* • RRES-WQH-SOP-050, *Groundwater Sampling using Westbay System,* • RRES-WQH-SOP-047, *Spring and Surface Water Sampling,* • RRES-WQH-SOP-012, *Sediment Sampling.*

Routine Data Reports

Data Availability

Analytical data for this program are stored on the WQDB and are generally available to the public as soon as they are received by RRES-WQH. Proprietary data collected from other political entities (San Ildefonso Pueblo, Los Alamos County, City of Santa Fe) will be released after review by those organizations.

Data Reporting

RRES-WQH reports monitoring results from this program through the annual Environmental Surveillance Report (ESR). The ESRs contain the following information:

- Contract analytical laboratory results of the groundwater, surface water and sediment sampling.
- Data tables that summarize data
- Report text that communicates RRES-WQH interpretations of the data.

Data tables are created from the WQDB. The ES Team Leader or assigned project lead evaluates the data and interprets the results. The ES Team Leader reviews the draft ESR before publication.

The program's goals are (1) to electronically post analytical results within 60 days of sampling, and (2) to meet DOE publishing deadlines for the ESR. Receipt of analytical reports from the RRES-WQH contract laboratory requires about 30 days (reference specific contract analytical laboratory statement of work). Under some circumstances delays in data reporting can result in the delay of data posting on the web beyond the 60-day time frame.

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader or Project Lead	Ensure that data are provided to off-site landowners, as requested, before publication of the Environmental Surveillance Report. Ensure data tables and accompanying text for ESR are prepared. Provide technical and editorial review support to assigned project leads in the preparation of the routine data reports.

Sample Analysis

Purpose

To ensure the accuracy of all required analytical results, WQH has an analytical quality control program and requires contract analytical laboratories to follow the DOE Model Statement of Work.

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader, Project Leads, and Operations Team Leader	Ensure implementing procedures for sample analyses are used.
WQH Analytical Chemistry Coordinator	Ensure analytical laboratories comply with the DOE Statement of Work.

Sampling Tracking

Purpose

Any persons involved in the preparation, retrieval, and analysis of samples must maintain positive control of samples at all times until sample shipping. WQH personnel will follow guidance in RRES-WQH-QP-029, *Generating and Maintaining Chain of Custody.*

Chain of custody

Chain of custody is maintained during:

When	How
Sample preparation and retrieval	All persons (other than analytical personnel) performing sample preparation and collection will be trained to sample collection procedures and must adhere to the chain of custody requirements therein.
Analysis	Analytical laboratories performing sample analysis will maintain sufficient procedures to ensure positive control of samples.
Storage/disposal	Analytical laboratories will maintain retained samples or sample portions under chain of custody by the analytical laboratory until reanalysis, return to WQH, or ultimate disposal.

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader and Operations Team Leader	Ensure procedures for sample handling and control during sample preparation and retrieval are followed.
Analytical Chemistry Coordinator	Ensure chain of custody requirements are addressed in statements of work. Ensure analytical laboratories adhere to requirements for chain of custody.
Analytical Laboratories	Maintain positive control of samples as required by statements of work and as described in internal procedures.

Results of Concern

Identifying Results of Concern

The results will be compared against historical levels measured at that particular station. For each of these media, the appearance of analytical data above the usual range of values for that location would trigger an action. The usual range is considered to be the range of values that have been measured in samples collected from that station (or proximity) to date.

Results of concern will be flagged if:

- the historical maximums are exceeded,
- if the most recent result is significantly elevated, say 5 - 10 times, above the previous measurement for that station, or
- an upward trend in the data is indicated in the most recent results.

For groundwater, particular attention will be focused on monitoring results from the regional aquifer for non-natural constituents like fallout radionuclides, volatile organic constituents, perchlorate, or high explosives. In general, any detectable level of these non-natural constituents will be considered anomalous.

Response to Results of Concern

If a result of concern is identified, the following steps are taken:

Step	Action
1	A more thorough evaluation is conducted to confirm the reliability of the data. The evaluation will occur on two simultaneous paths: • First path involves a review of available information such as the analytical data packages, field notes, or submittal of additional samples for verification. • Second path is intended to assure the safety of public and environmental health. The measured concentration will be compared to appropriate standards or other regulatory limits (e.g. health advisory concentrations). Screening criteria for sample results are as follows:

Medium	Screened against
Groundwater	At a minimum, NM Water Quality Control Commission Groundwater Human Health Standards, EPA Safe Drinking Water Act Primary Maximum Contaminant Levels, and DOE Derived Concentration Guides (4 mrem dose) for drinking water.

Results of Concern (continued)

Response to Results of Concern (continued)

Step	Action
	Medium / **Screened against** Surface water: NM Water Quality Control Commission stream standards and DOE Derived Concentration Guides (100 mrem dose) for Public Dose. Sediment: ER Screening Action Levels or EPA Region VI Residential Soil Screening Levels.
2	Once the reliability of the data is confirmed, WQH Group management will be notified.
3	A decision will be made by WQH management at that point about possible next steps, including formal notification of LANL/DOE/stakeholders, re-sampling, or planning of detailed field studies to further identify likely contaminant sources.

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader and Project Leads	Assure that analytical data are reviewed and accurate. Assure development of a corrective action plan, if required. Follow up with corrective actions if required. Track corrective actions. Initiate re-sampling, if required. Notify WQH Group Leader of suspect/anomalous results.
Facility Management	Review analytical data with ES Team Leader and provide input into a possible corrective action necessary to improve water quality where needed.
QA Specialist	Validate analytical data.
Analytical Laboratory Contractors	Evaluate and improve processes in accordance the DOE Model Analytical Statement of Work.

Process Verification and Peer Review

Purpose

Monitoring Program activities will be reviewed and verified by qualified persons to ensure that program requirements are met.

Verification and peer review methods

Through a process of peer review and verification, LANL helps ensure that these activities meet program requirements. These methods are described below for each process.

What	How
Data Quality Objectives	ES Team Leader and Environmental Surveillance technical staff will approve the initial DQOs and will approve any modifications to these DQOs. At least annually, RRES-WQH will determine adherence to the DQOs. Failure to meet any of the DQOs will be addressed as deficiencies according to RRES-WQH-QP-033, *Issues Reporting and Action Tracking*.
Sample collection	Reference: • RRES-WQH-SOP-048 *Groundwater Sampling using Bladder Pumps*, • RRES-WQH-SOP-049, *Groundwater Sampling using Submersible Pumps,* • RRES-WQH-SOP-050, *Groundwater Sampling using Westbay System,* • RRES-WQH-SOP-047, *Spring and Surface Water Sampling,* • RRES-WQH-SOP-012, *Sediment Sampling.*
Sample analysis	Reference DOE Analytical Laboratory Statement of Work.
Sample tracking	Reference RRES-WQH-QP-029, *Generating and Maintaining Chain of Custody*

SECTION 6

Design

Design

Identify design requirements No design activity for this program.

SECTION 7

Procurement

Procurement

Procurement of items and services

Procurement of items and services used in this project will follow the Laboratory procurement process and the requirements in the WQH QMP. Most items and services required for this project are commercial grade in nature and no special procurement requirements or needs are necessary. The ES Team Leader and project members will identify such items or services for which special requirements are necessary.

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader	Recommend to Group Leader contracting items and services. Develop acceptance criteria.

SECTION 8

Inspection and Acceptance Testing

Inspection and Acceptance Testing

Policy

Any materials or services will be inspected and/or tested prior to acceptance for use in this program. Most supplies used during performance of program activities are commercial grade in nature and require no special acceptance practices or procedures.

Implementation

The following table lists specific responsibilities:

Who	What
ES Team Leader	Verify that all materials and services meet acceptance criteria.

SECTION 9

Management Assessment

Program Management Assessments

Internal assessment

The WQH Group conducts internal management assessments of all projects and programs in the group in accordance with requirements in RRES-WQH-QP-028, *Management Assessments*. Assessments of the project are documented and filed as records.

Responding to assessments

When violations of requirements are found during a management assessment, a deficiency report is initiated to document the violation. Corrective actions are tracked and documented in accordance with RRES-WQH-QP-033, *Issues Reporting and Action Tracking.*

Implementation

The following table lists responsibilities:

Who	What
ES Team Leader	Ensure program management assessments are conducted.

SECTION 10

Independent Assessment

Program Assessments

Policy

Independent assessments are those assessments conducted by organizations external to WQH. As required by the WQH QMP, this project may include assessments by outside organizations.

LANL-required audits

LANL audit groups external to WQH may be delegated responsibility for assessments of the GSWSED Program.

Implementation

External audits and assessments will be conducted periodically, with input from the ES Team Leader.

The following table lists responsibilities:

Who	What
ES Team Leader	Provide input to LANL audit team as required. Review audit reports for factual accuracy. Address all findings and implement corrective actions as appropriate.
WQH staff	Cooperate with auditors by providing information, data, etc. Implement corrective actions as directed by the ES Team Leader.

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APPROACH TO GROUNDWATER AND SURFACE WATER MONITORING NETWORK DESIGN

A series of decision flowcharts has been developed to show the process by which locations, frequency, measurements, and analysis for groundwater and surface water monitoring are determined. The decision flow is then applied to individual watersheds to develop the monitoring plan specific to the watershed but consistent on a site-wide basis. Figure 1 illustrates the overall decision flow from conceptual model to watershed monitoring plan.

Each decision flow diagram starts with the conceptual model for the watershed. The conceptual model documents the physical and chemical conditions of water (surface water, alluvial, intermediate, regional aquifer groundwater, and springs) and potential contaminant sources in the watershed.

Watershed Analyte List Decision Flow Detail:

Figure 2 shows the decision flow diagram used to develop the watershed analytes lists. General chemical analytes are included in every analyte list to ensure that unexpected releases, such as spills or broken pipes can be detected. Changes in general chemical analytes, such total dissolved solids or chloride, will alert the Los Alamos National Laboratory (Laboratory) that a change has occurred that should be investigated.

This decision flow diagram calls for using the information in the conceptual model to understand the potential contaminants, their characteristics, and transport pathways. The next decision involves evaluation of the historical data set to determine how well it represents the water chemistry in terms of number of samples, time period, and analytes. If the historical data set is adequate, a screening step is employed to establish what constituents have been detected in water at a specified level of significance. The level of significance is defined as the detection of the constituent at a concentration greater than 25% of the regulatory standard more than 5% of the time. The constituents that are detected at this level of significance are evaluated for source, e.g. naturally occurring or released from the Laboratory. If the source is evaluated as a potential Laboratory release, the constituent is added to the analyte list for the watershed.

The next set of decisions in the flow diagram is used to evaluate additional candidates for the analyte list. These decisions look at analytes reported for the potential release sites (PRSs) in the watershed, analytes with detection limits that are near screening levels, analytes with regulatory monitoring requirements, and analytes from base flow that have not been detected in groundwater.

The final analyte list for each watershed includes some or all of the following:

- General chemical analytes
- Analytes for which analysis has not been previously conducted or for which data are insufficient
- Analytes detected at concentrations above 25% of regulatory standard more than 5% of the time
- Analytes identified by the evaluation of source, detection limit, or other consideration
- Analytes recommended for inclusion from a base flow analytical list

Figure 1. Watershed Conceptual Model

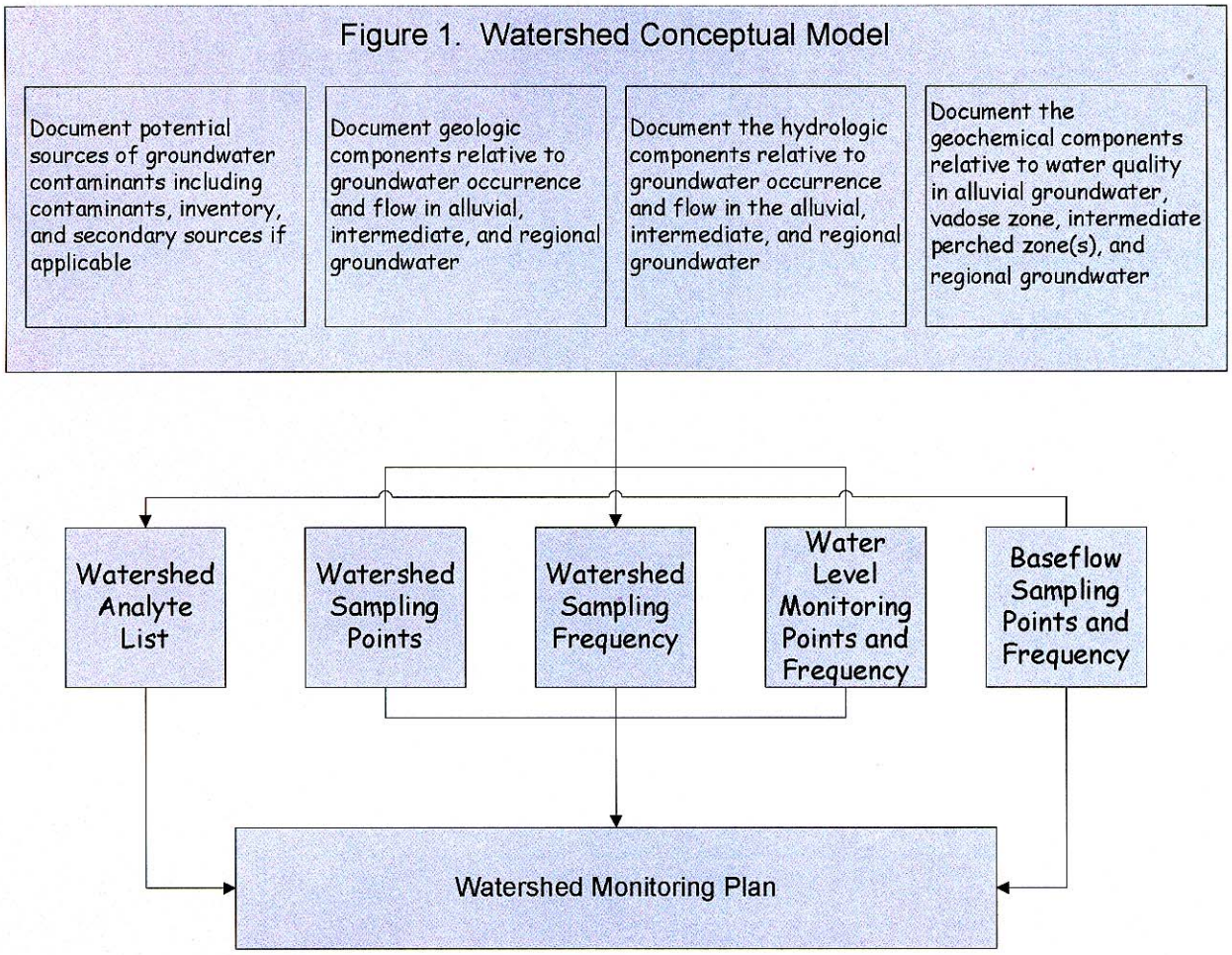
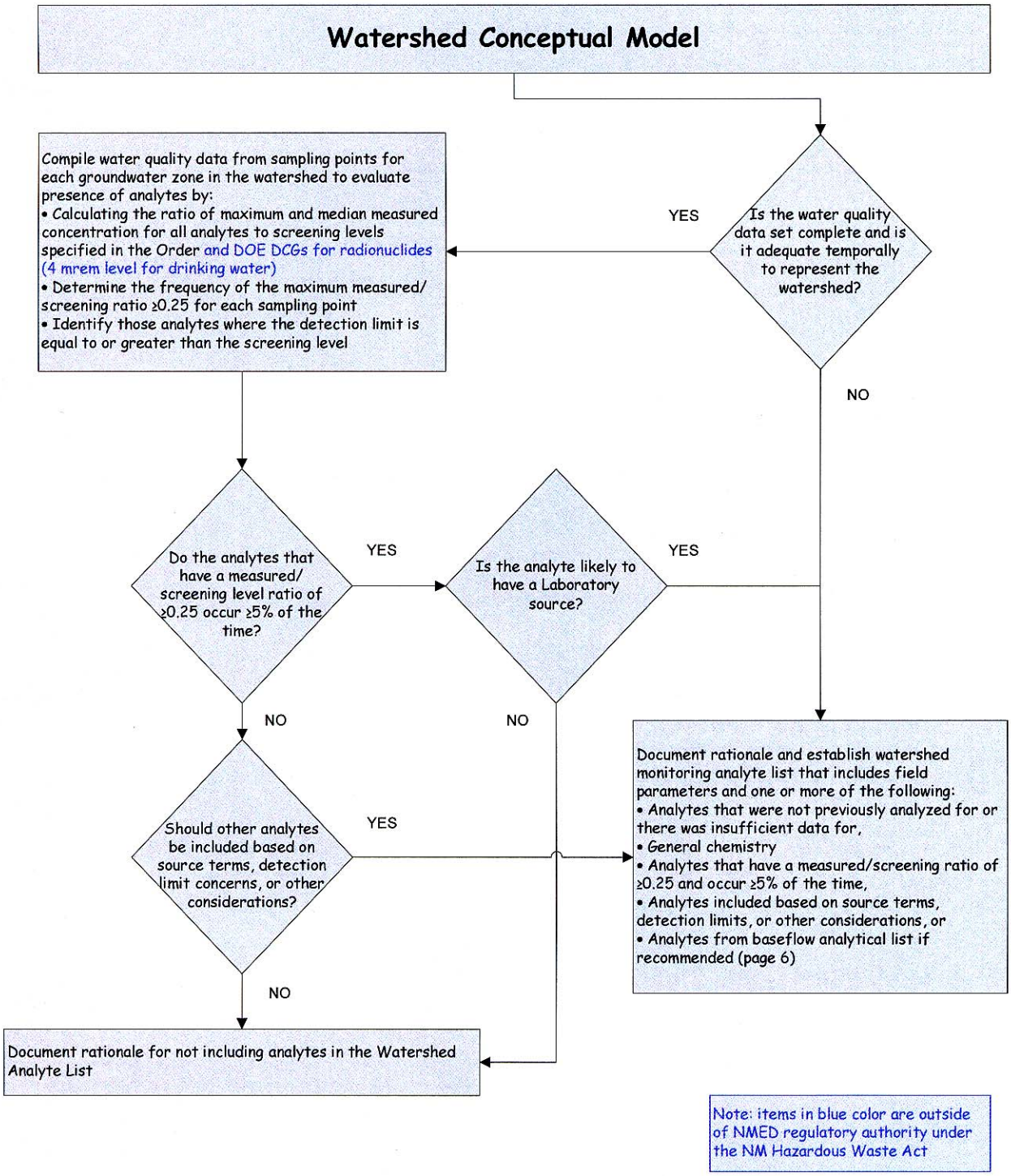


Figure 2. Watershed Analyte List Decision Flow Detail



Watershed Sampling Point Decision Flow Detail:

Figure 3 shows the decision process that is applied to select monitoring locations. The goal of this decision process is to select locations that are physically possible to sample and that produce water representative of the *in situ* conditions. The monitoring points that are selected are useful for monitoring ambient conditions for regulatory compliance and for the efficacy of corrective actions. Monitoring points may also be selected to honor existing agreements, such as the Laboratory's agreement with the Pueblo of San Ildefonso to monitor specific wells. The sample points that are selected are then evaluated for possible redundancy before the final set of monitoring points is established. If, in the process of identifying monitoring locations, it becomes apparent that the watershed does not have enough monitoring points to adequately represent the groundwater zones or areas of base flow in the watershed, additional monitoring points will be recommended for installation in conjunction with corrective action investigations.

Watershed Sampling Frequency Decision Flow Detail:

The decision flow shown in Figure 4 is used to determine the sampling frequency, with the goal of ensuring that sampling results will be reflective of systematic variation in water quality and water levels. For sampling points where there is sufficient data to recognize systematic variability or where no systematic variation exists, the sampling frequency is set to represent the complete range of the variation. Where there is inadequate data to recognize systematic variation, seasonal sampling is proposed. In no case is the sampling frequency less than annual.

Water Level Monitoring Points and Frequency Decision Flow Detail:

The decision flow process for determining water level measurement frequency is shown in Figure 5. The selected wells or screens in wells in the alluvial, intermediate, and regional groundwater zones are in locations necessary to evaluate

- Water level changes
- Groundwater flow rates and direction
- Effects of pumping
- Location and the amount of recharge

Water level measurements for the regional aquifer are determined by a single team because the regional aquifer is relatively unaffected by the watershed topography. Water level measurements for alluvial and intermediate perched groundwater zones are determined on a watershed basis, taking into account the degree of connection between base flow, alluvial, and intermediate perched water.

Base Flow Sampling Points and Frequency Decision Flow Detail:

Figure 6 illustrates the decision flow to determine base flow sampling locations analytes, and frequency. The decision points and screening levels are the same as those for groundwater. All analytes identified in the base flow must be included in the alluvial groundwater analyte list and the frequency of sampling alluvial and base flow should be the same.

Figure 3. Watershed Sampling Point Decision Flow Detail

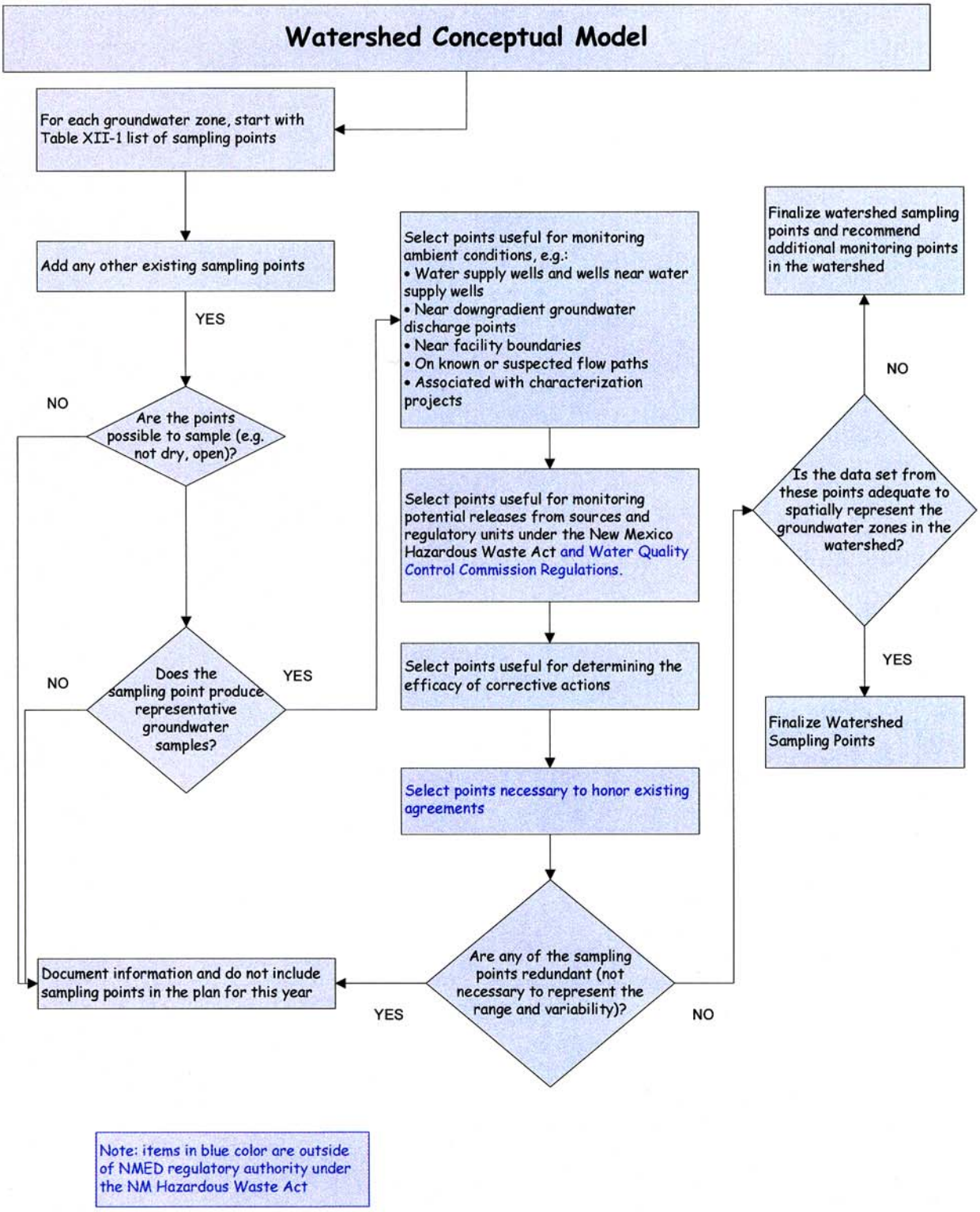
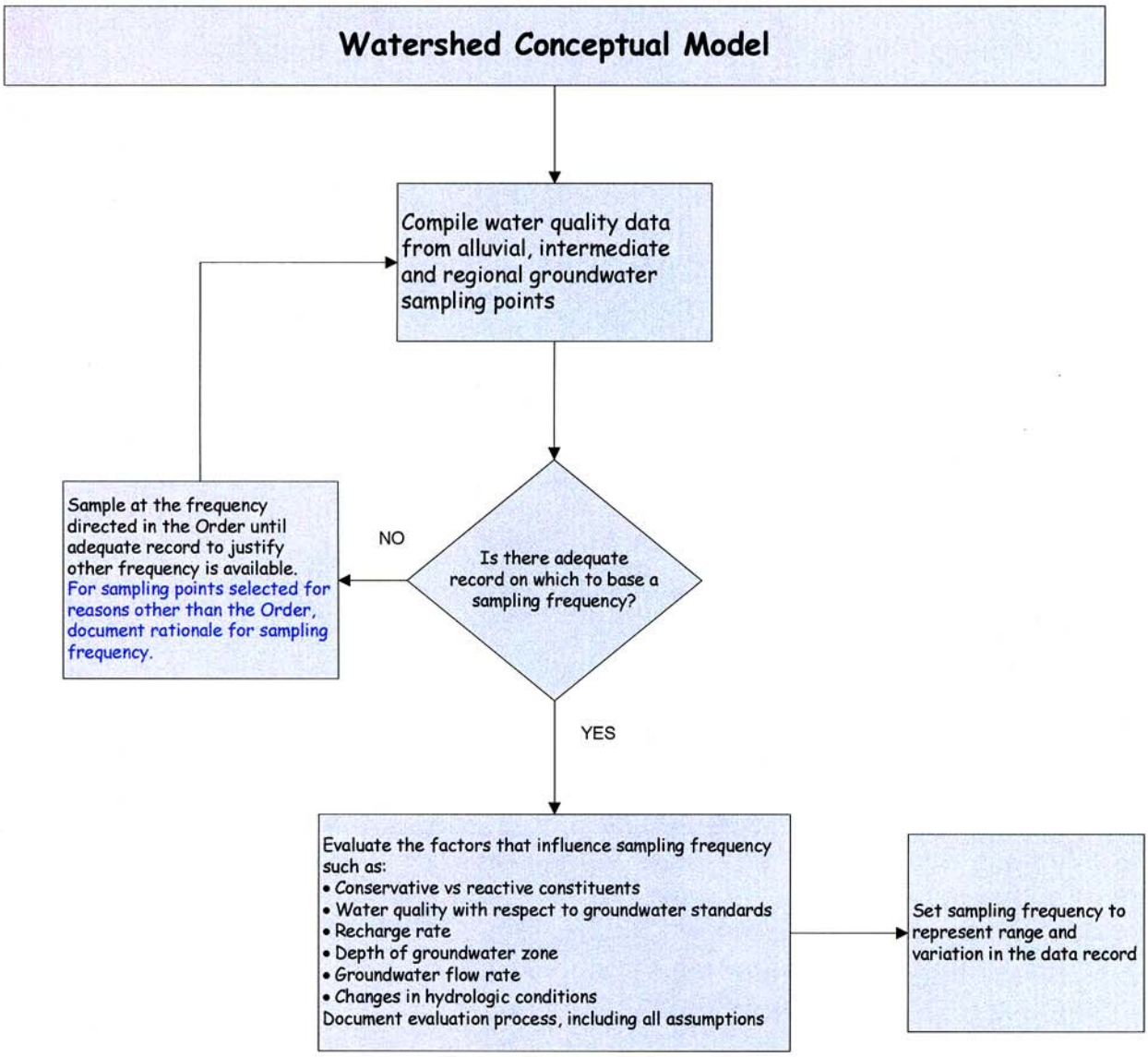


Figure 4. Watershed Sampling Frequency Decision Flow Detail



Note: items in blue color are outside of NMED regulatory authority under the NM Hazardous Waste Act

Figure 5. Water Level Monitoring Points and Frequency Decision Flow Detail

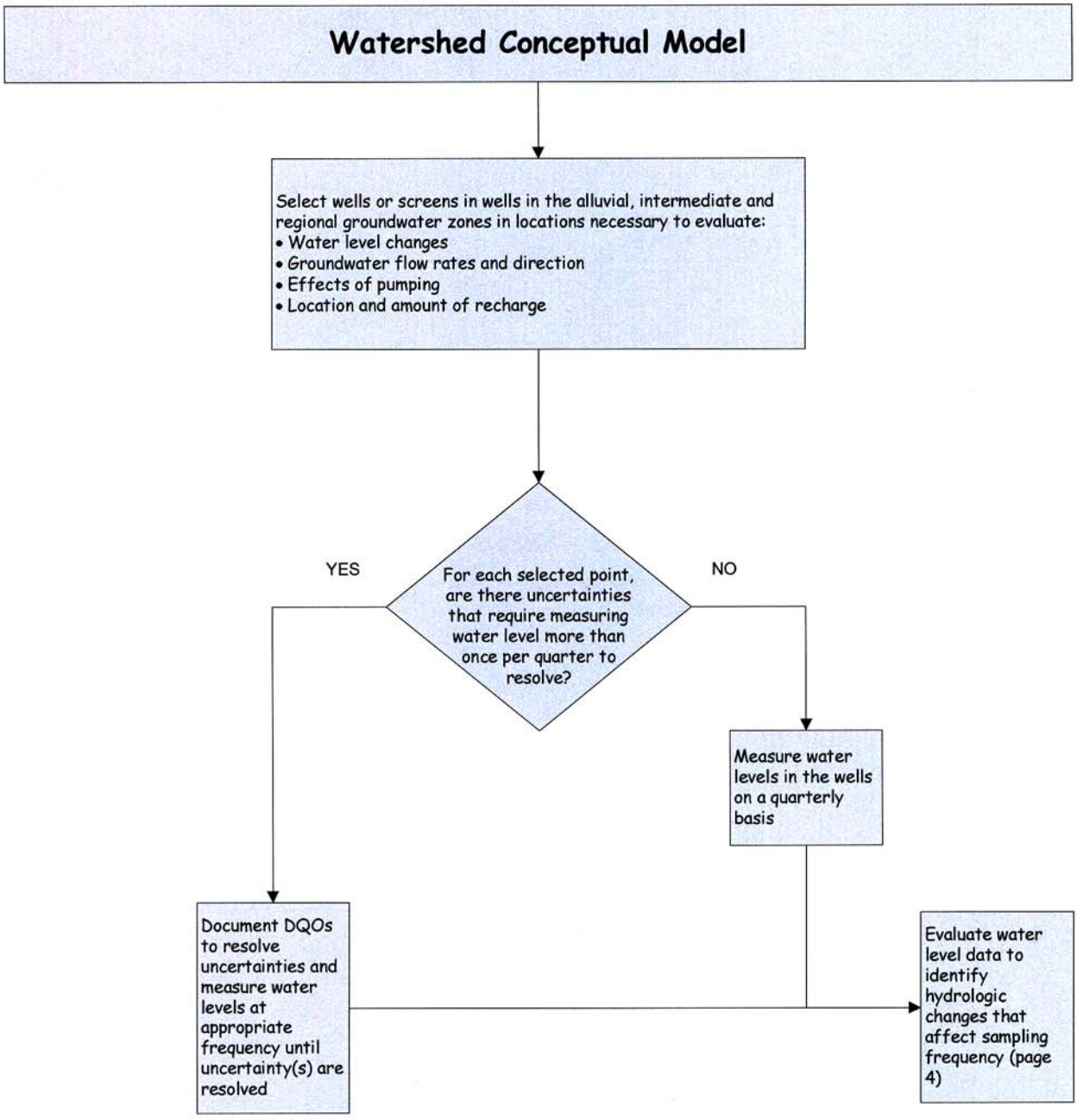
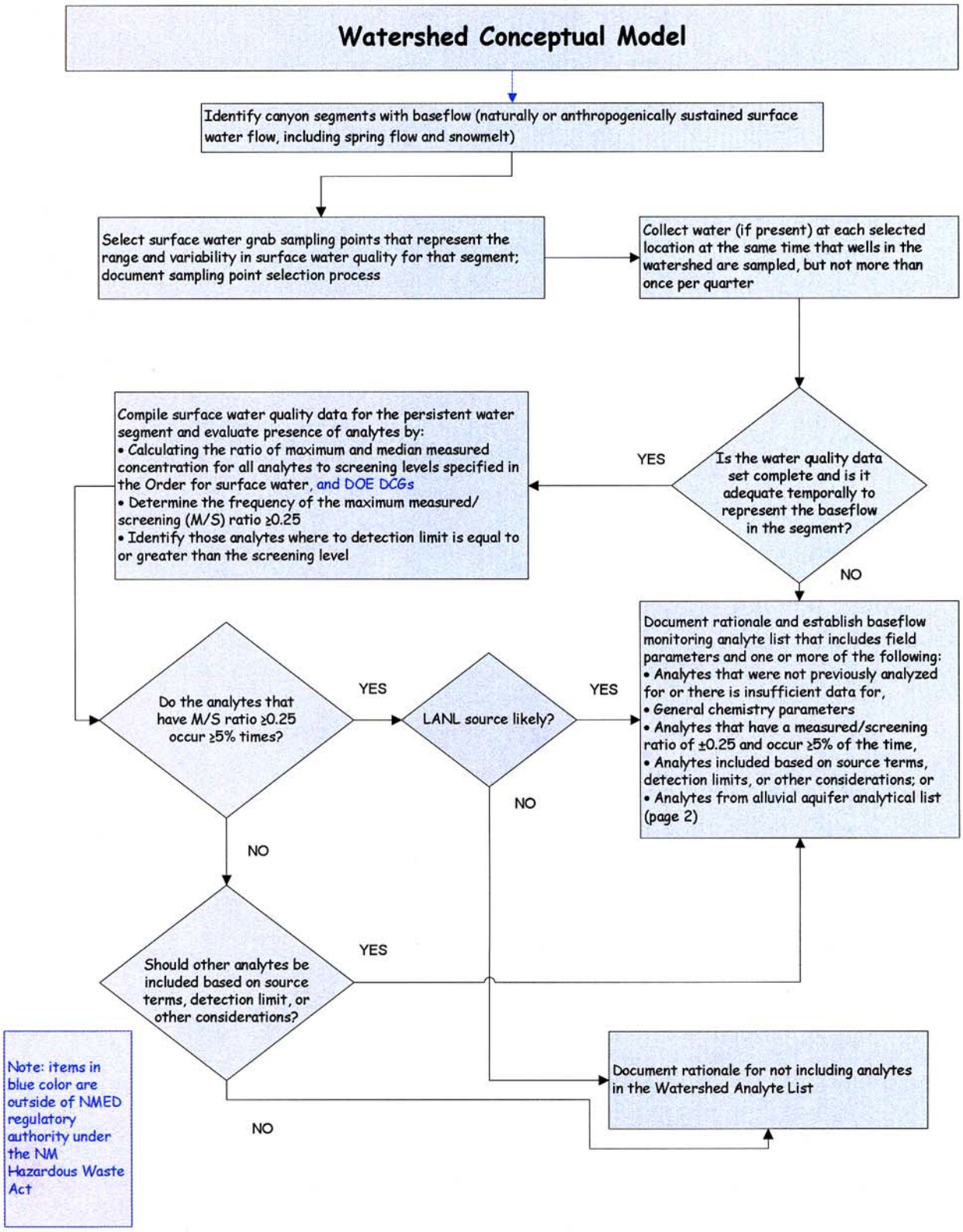


Figure 6. Baseflow Sampling Points and Frequency Decision Flow Detail



Data Quality Objectives

Policy

The Data Quality Objectives (DQO) process is the fundamental tool for planning the Groundwater, Surface Water, and Sediment Monitoring (GSWSED) Program direction and operation. Use of the DQO process helps Laboratory managers strike an appropriate balance among time, money, and data quality. DQOs for the GSWSED Program will be developed using guidance from EPA QA/G-4, *Guidance for the Data Quality Objectives Process*, 1994.

Introduction

LANL monitors groundwater, surface water, and sediment because these media represent possible pathways for movement of contaminants produced by Laboratory operations. Surface water monitoring here applies to base flow; monitoring of storm runoff satisfies special regulatory requirements and is covered by separate monitoring plans. The GWSED Monitoring Program is designed to:

- Characterize baseline levels of chemical quality for these media,
- Detect and characterize the general extent and impact of Laboratory releases on these media, and
- Comply with specific monitoring requirements such as the MOU with San Ildefonso Pueblo.
- Meet requirements of LANL's Hazardous Waste Facility Permit and RCRA Facility Permit, and DOE Orders 450.1, *Environmental Protection Program*; 5400.5, *Radiation Protection of Public and Environment*; 435.1, *Radioactive Waste Management*; and 231.1, *Environment, Safety, and Health Reporting*.

The variety of media, geography, and contaminants dictate a complex implementation for the Groundwater, Surface Water, and Sediment (GWSED) Monitoring Program. The following discussion covers the monitoring needs for each geographic area of the Laboratory and its surroundings. For the Laboratory, the discussion is organized by major watershed.

Station Locations and Monitoring Constituents

The choice of station locations and constituents for which LANL monitors groundwater, surface water, and sediment depends on several factors:

- Proximity of a station to a known contaminant source,
- Need to detect contaminant releases or evaluate trends in contamination at a station,
- Proximity to receptors such as water supply wells,
- Need for baseline or boundary monitoring for the contaminant,
- Need to establish background contaminant levels, or
- Need for basic chemical information or analytical quality control measurements.

Examples of basic chemical information include characterizing baseline water chemistry beyond analyzing samples only for possible contaminants. General inorganic chemistry information for water samples provides additional information on how other compounds travel in water. Analyzing samples for a suite of metals or organic compounds provides information on analytical method reliability and on other compounds present that affect analytical results. Analytical quality control is provided by having a large group of samples from stations with varying concentrations and known concentration histories for analytes of interest. These data help identify problems resulting from analytical problems or changes in analytical methods.

Sediment is sampled for radionuclides, metals, semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and high explosive compounds (HE). Groundwater and surface water are sampled for radionuclides, general inorganic compounds (major anions and cations, nutrients, fluoride, cyanide, perchlorate, and parameters like pH, total dissolved solids, total suspended solids, electrical conductance, temperature, and turbidity), metals, volatile organic compounds (VOCs), SVOCs, PCBs, and HE. HE is analyzed for most sediment and water stations south or downstream of the central portion of the Laboratory, for many regional aquifer wells, and for a few boundary monitoring stations.

Surface water and groundwater have different analyte lists and collection methods. Collection of filtered vs. unfiltered samples for a chemical suite depends on regulatory standards for the media as well as goals for evaluating the constituents. For example, spring samples for radionuclides are filtered to lessen impact of spring water contamination by surface soils. Surface water is sampled for dissolved and total mercury and selenium to evaluate against New Mexico surface water standards. Low-detection limit tritium is collected for some groundwater samples to use as a tracer evaluating recharge pathways and potential future impacts of Laboratory contaminants.

Station Locations and Monitoring Constituents, continued

Detection limits for analytes are set (where possible) at a value that is 10% or less of risk levels or regulatory standards applicable to the particular media. As an example, measurement of Sr-90 in water should have a detection limit below 0.8 pCi/L, relative to the EPA drinking water MCL of 8 pCi/L.

The basic monitoring frequency for all stations is annual sampling. Stations that are located near contaminant sources or that serve important boundary monitoring roles are monitored for most constituents on an annual basis. For stations in low-contaminated areas certain constituents may not be measured, or may be measured on a triennial basis.

Background Monitoring

LANL monitors background stations to develop a baseline for levels of contaminants at locations outside of Laboratory influence. For example, background stations provide information on base levels of many radionuclides, which are found world wide as a result of reactor accidents and nuclear weapons testing. Continuous monitoring of background provides information on how background levels may change over time and on how interpretation of background levels might change as a result of variation in analytical method over time. Background levels of radionuclides in reservoir or stream sediments might change as a result of a major flood or runoff event; such changes would affect interpretation of LANL's impact on perimeter or downstream locations. An appearance of organic compounds in the Rio Grande drainage might be caused by changes in agricultural practices or urban runoff, so regular monitoring of these compounds helps to observe these changes.

Background Streams

We collect surface water and sediment at stations along the Rio Grande at locations both upstream and downstream of the Laboratory, and from the Rio Chama. These samples provide information on background contaminant concentrations and on the downstream impact of the Laboratory. We also collect samples from the Jemez River, located west of the Laboratory in the Jemez Mountains. All stations are sampled for radioactivity; all surface water for general inorganic compounds; and other suites are assigned depending on location and monitoring function.

Background Reservoirs

We collect reservoir sediments from two upstream reservoirs: Abiquiu Reservoir on the Rio Chama and Rio Grande Reservoir in Colorado. One reservoir below the Laboratory, Cochiti, is sampled. Reservoir sediments provide special information on background contaminant concentrations because the sediment is

Background Monitoring, continued

finer-grained than other river sediments. Because adsorption of radionuclides, metals, and many organic chemicals depends on mineralogy and surface properties of sediment grains, these sediments capture different types and concentrations of contaminants than do larger-grained bed sediments. All stations are sampled for radioactivity, metals, SVOCs, and PCBs, and HE in Cochiti Reservoir.

Perimeter Monitoring

Rio Grande

The Rio Grande borders the Laboratory to the east; as the major drainage in New Mexico it receives flow from all streams crossing the Laboratory and is the major groundwater discharge area for groundwater flowing beneath the Laboratory. The springs that issue along the Rio Grande in White Rock Canyon represent the principal discharge of groundwater that flows beneath the Laboratory. The springs serve a boundary-monitoring role to evaluate the Laboratory's impact on the regional aquifer. LANL samples 22 major springs; larger springs are analyzed on an annual basis, with the remainder sampled biannually. Springs are sampled for radioactivity, general inorganic compounds, metals, VOCs, SVOCs, PCBs, and (depending on location) HE. Two of the springs are sampled as part of the Material Disposal Area (MDA) G PCB disposal authorization.

Streams entering the Rio Grande from Laboratory property are possible pathways for surface water and sediment contamination. LANL samples surface water in streams that enter the Rio Grande along the Laboratory boundary where flow is usually present. Streams are sampled for radioactivity, general inorganic compounds, metals, and (depending on location) VOCs, SVOCs, PCBs, and HE. Sediment is monitored where major drainages enter the Rio Grande, and within the Rio Grande just downstream of these drainages. All stations are sampled for radioactivity, and other suites are assigned depending on location.

San Ildefonso Pueblo

To document the potential impact of Laboratory operations on lands belonging to San Ildefonso Pueblo, DOE entered into a Memorandum of Understanding (MOU) with the Pueblo and the Bureau of Indian Affairs in 1987 to conduct environmental sampling on pueblo land. Springs and sediment stations within the pueblo are discussed in other watershed sections. Eight water supply wells at the pueblo are sampled annually. The wells are sampled for radioactivity and general inorganic compounds, with metals, VOCs, SVOCs, and PCBs analyzed triennially.

Perimeter Monitoring, continued

Buckman Well Field

The City of Santa Fe's Buckman Well Field lies across the Rio Grande from the eastern Laboratory boundary. Three wells in the field are sampled annually for radioactivity and general inorganic compounds.

Guaje Canyon

Guaje Canyon lies north of Laboratory land and has not received any effluents from its activities. One surface water station and three sediment stations are in the canyon. All stations are sampled for radioactivity, and other suites are assigned depending on location. The Guaje well field, located northeast of the Laboratory, contains five water supply wells. Water supply wells, operated by Los Alamos County, are discussed below.

Bandelier National Monument

Bandelier National Monument borders the Laboratory to the south and stations within the Monument serve a boundary monitoring function. Surface water and sediments are sampled near the Monument headquarters, where Frijoles stream enters the Rio Grande (both required by LANL's RCRA permit), and within the Rio Grande just downstream of Frijoles stream. As the stations are important boundary points, the samples are analyzed annually for all suites, except that sediments in Frijoles stream are sampled triennially for SVOCs and PCBs.

On Site Monitoring

Los Alamos Water Supply System

The 12 Los Alamos County water supply wells are sampled annually for radioactivity and general inorganic compounds.

Los Alamos Canyon (includes Bayo, Acid, Pueblo, DP Canyons)

Bayo Canyon

Bayo Canyon has a small drainage area and was the location of firing sites where metals and radioactive materials were used from 1943 to 1961. The canyon has no persistent surface water or shallow groundwater. Sediment is sampled annually at points just downstream from the former firing sites and near where the canyon joins Los Alamos Canyon. Samples are analyzed annually for radioactivity, metals, SVOCs, PCBs, and HE.

On Site Monitoring, continued

Acid and Pueblo Canyons

Pueblo Canyon has a small drainage area that passes through the town of Los Alamos and north of the Manhattan Project main technical area. The canyon receives effluent from the Los Alamos County Bayo sewage treatment plant. Acid Canyon, a tributary, received radioactive industrial effluent from 1943 to 1964. One water supply well, O-1, is located in lower Pueblo Canyon. Maintaining trend information on past radioactive and chemical effluent releases

is a monitoring focus in Pueblo Canyon. Releases from sewage treatment plants complicate the picture, as have chemical effects of the Cerro Grande fire. Groundwater and surface water constituents of concern in Pueblo Canyon include nitrate, perchlorate, and possible radioactivity. LANL monitors surface water at four locations in Pueblo Canyon and one at Acid Canyon for radioactivity (three required by RCRA permit), general inorganic compounds, metals, VOCs, SVOCs, and PCBs. In addition to above-background radioactivity, PCBs and PAHs (polycyclic aromatic hydrocarbon compounds) have been found in sediments in Pueblo Canyon. Sediment is monitored at five locations in Pueblo Canyon and one at Acid Canyon for radioactivity, particularly plutonium-238, plutonium-239, -240, americium-241, and cesium-137. Metals, SVOCs, and PCBs are monitored at several stations. Alluvial groundwater is monitored at one well, intermediate groundwater at two wells, and the regional aquifer at two wells in addition to O-1. Monitoring (non water supply) wells are sampled annually for radioactivity, general inorganic compounds, metals, and (depending on location) VOCs, SVOCs, PCBs, and HE.

Los Alamos and DP Canyons

Los Alamos Canyon begins in the Jemez Mountains west of LANL and extends downstream off Laboratory property, through San Ildefonso Pueblo, to the Rio Grande. The canyon receives contaminated water and sediment from a major tributary, Pueblo Canyon. Los Alamos Canyon received releases of radioactive effluents during the Manhattan Project (1942–1945) and until 1993 from reactors at TA-2. A liquid waste treatment plant discharged effluent containing radionuclides from the old plutonium processing facility at TA-21 into DP Canyons, a tributary to Los Alamos Canyon, from 1952 to 1986. Los Alamos Canyon also received radionuclides and metals in discharges from the sanitary sewage lagoons and cooling towers at the Los Alamos Neutron Science Center (LANSCE) at TA-53. One water supply well, O-4, is located in Los Alamos Canyon.

On Site Monitoring, continued

The monitoring focus for Los Alamos and DP Canyons includes trending of radioactivity movement, effects of the Cerro Grande fire, and distribution of PCBs and PAHs. Contaminants of particular interest monitored in surface water and groundwater include molybdenum, strontium-90; sediments may contain plutonium-238, plutonium-239, -240, americium-241, and cesium-137, PCBs, and PAHs.

Surface water is monitored at five locations (three required by RCRA permit) in Los Alamos and DP Canyons, for radioactivity, general inorganic compounds, metals, and other suites depending on location. Sediment is monitored at ten locations, which extend below the confluence with Pueblo Canyon, through San Ildefonso Pueblo, to the Rio Grande. These sediment stations are used to track movement of plutonium off site. Sediments are analyzed for radioactivity, triennial metals, and (depending on location) SVOCs and PCBs.
Monitoring of alluvial groundwater occurs at eight wells and one spring. Intermediate groundwater is sampled at two wells and one spring, and the regional aquifer at three wells in addition to O-4. Monitoring (non water supply) wells are sampled annually for radioactivity, general inorganic compounds, metals, and (depending on location) VOCs, SVOCs, and PCBs.

Sandia Canyon

Sandia Canyon has a small drainage area that heads at TA-3. The canyon receives water from the cooling tower at the TA-3 power plant. Treated effluents from the TA-46 Sanitary Wastewater Systems (SWS) Facility are rerouted to Sandia Canyon. In addition to effluent monitoring, a particular focus for contaminants monitored is PCBs and PAHs in sediments. Water supply wells PM-1 and PM-3 are located in Sandia Canyon.

Surface water is monitored at three stations (one for the RCRA permit) for radioactivity, general inorganic compounds, metals, and VOCs, SVOCs, and PCBs. Sediments are monitored at five stations extending across San Ildefonso Pueblo to the canyon's confluence with the Rio Grande. Samples are analyzed annually for radioactivity, metals, SVOCs, and PCBs. There is no persistent shallow groundwater in Sandia Canyon, but two wells are checked for water. Regional and intermediate groundwater are monitored at one well, in addition to PM-1 and PM-3. The groundwater (other than supply wells) is analyzed for radioactivity, general inorganic compounds, and metals.

On Site Monitoring, continued

Mortandad Canyon (includes Ten Site Canyon, Cañada del Buey)

Mortandad Canyon

Mortandad Canyon has a small drainage area that heads at TA-3. Its drainage area receives inflow from natural precipitation and a number of NPDES outfalls, including one from the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50. Past discharges into tributary Ten Site Canyon included a previous radioactive effluent treatment plant at TA-35. Trending of radioactivity and other chemicals released in effluent is the monitoring focus in Mortandad Canyon.

Surface water is monitored at two stations below the RLWTF discharge (both for the RCRA permit), and at the canyon's confluence with the Rio Grande. This latter station monitors effluent from the White Rock sanitary treatment plant; surface water flow does not extend to the Laboratory boundary below the RLWTF. Surface water is analyzed for radioactivity, general inorganic compounds, metals, and below the RLWTF for VOCs, SVOCs, and PCBs.

Sediment is sampled at thirteen stations that span the canyon from above the RLWTF outfall, across the Laboratory and San Ildefonso Pueblo, to the Rio Grande. Two stations are upstream of the RLWTF, six stations define the area of major sediment contamination within the Laboratory boundary, and the remaining five cover the region between the Laboratory boundary and the Rio Grande. These stations provide data to evaluate performance of actions taken to stabilize contaminated sediments within the Laboratory boundary. Samples are analyzed for radioactivity, particularly plutonium-238, plutonium-239, -240, americium-241, and cesium-137. Metals, SVOCs, and PCBs are monitored at several stations.

Alluvial groundwater is sampled at nine wells and the regional aquifer at three wells. The wells are sampled annually for radioactivity, general inorganic compounds, metals, with some wells sampled for VOCs, SVOCs, and PCBs. Additional alluvial groundwater sampling occurs for the RLWTF Groundwater Discharge Plan.

On Site Monitoring, continued

Cañada del Buey

The small drainage of Cañada del Buey contains alluvial groundwater of limited extent, and only two observation wells have ever contained water. Because treated effluent from the Laboratory's SWS Facility may at some time be discharged into the Cañada del Buey drainage system, five shallow groundwater monitoring wells were installed during the early summer of 1992. Past discharges included accidental releases from experimental reactors and laboratories at TA-46. MDA L and MDA G, used for disposal of organic solvents and low-level radioactive waste, occupy the mesa south of the lower part of the canyon. Water supply wells PM-4 and PM-5 are on the mesa top just south of Cañada del Buey.

Surface water is sampled at one station (for the RCRA permit) for radioactivity, general inorganic compounds, metals, VOCs, SVOCs, and PCBs. Sediment is sampled at two canyon floor locations for radioactivity, metals, SVOCs, and PCBs. Alluvial groundwater is collected at one or two wells depending on presence of water, with the other four wells checked for water. Groundwater is analyzed for radioactivity, general inorganic compounds, and metals, with one well sampled for VOCs, SVOCs, and PCBs. Additional alluvial groundwater sampling occurs for the SWS Facility Groundwater Discharge Plan.

Material Disposal Areas G and L

MDA G and MDA L occupy the mesa between lower on-site portions of Cañada del Buey and Pajarito Canyon. Monitoring occurs in part to satisfy DOE Orders 435.1 and 5400.5. Up to thirteen sediment stations (including the two in Cañada del Buey) are sampled annually to evaluate any runoff of radioactivity or other constituents in sediment. The stations are located in the individual drainages on the sides of the mesa in order to provide precise detection of releases from different portions of the disposal areas. Performance assessment of MDA G indicates that a major performance uncertainty is the degree of surface erosion from the mesa and its impact on waste disposal. Sediments are sampled for radioactivity, metals, SVOCs, and PCBs

Pajarito Canyon (includes Twomile, Threemile Canyons)

Pajarito Canyon has a drainage that extends into the Sierra de los Valles west of the Laboratory. In lower Pajarito Canyon near the eastern Laboratory boundary, saturated alluvium occurs but does not extend beyond that boundary. Some firing sites border portions of Twomile and Threemile Canyons. A nuclear materials experimental facility at TA-18 occupies the floor of Pajarito Canyon.

On Site Monitoring, continued

MDA L and MDA G occupy the mesa north of the lower part of the canyon. Supply well PM-2 is located in Pajarito Canyon just downstream from TA-18. While no persistent contamination is found in Pajarito Canyon, the nature of surrounding facilities requires regular monitoring. Surface water is sampled at five stations (two for the RCRA permit) and one in Twomile Canyon that span the canyon within the Laboratory and downstream to the Rio Grande. Water samples are analyzed for radioactivity, general inorganic compounds, metals, VOCs, SVOCs, PCBs, and HE. Five sediment stations and two in Twomile Canyon cover the canyon to the Rio Grande and are analyzed for radioactivity, metals, SVOCs, PCBs, and HE.

Alluvial groundwater is sampled at three wells in the lower portion of the on-site canyon. The regional aquifer is sampled in one well in addition to PM-2. This monitoring well is sampled annually for radioactivity, general inorganic compounds, metals, VOCs, SVOCs, PCBs, and HE.

Water Canyon (includes Cañon de Valle, Potrillo, Fence, Indio Canyons)

Potrillo, Fence, and Indio Canyons

The small Potrillo, Fence, and Indio Canyon watersheds contain several open burning and open detonation and firing sites used for open-air testing of weapons systems. No persistent shallow groundwater or surface water occur in the canyons. Monitoring concerns in these canyons include high explosives, metals, and radioactivity. No persistent surface water is sampled in these canyons. Sediment is collected at SR-4 in each canyon, and at an additional station in Fence Canyon below major firing sites. Sediment is analyzed for radioactivity, metals (every three years), SVOCs, PCBs, and HE. One alluvial well in Fence Canyon is dry but checked for water. One regional aquifer monitoring well located between Potrillo and Threemile Canyons is monitored for general inorganic compounds, metals, VOCs, SVOCs, PCBs, and HE. No radioactive constituents have been found in the well and very low tritium levels indicate no influence from surface recharge within the past 50 years.

Water Canyon and Cañon de Valle

Water Canyon and Cañon de Valle (a tributary) begin in the Jemez Mountains and pass through the southern portion of LANL where explosives development and testing occurs. In the past, the Laboratory released wastewater from several high explosives (HE) processing sites in TA-16 and TA-9 into both canyons.

On Site Monitoring, continued

Consolidation of these individual NPDES outfalls to the High Explosives Wastewater Treatment Facility was completed in 1997. High explosives, chlorinated solvents (PERC and TCE) and metals (barium and silver) are particular contaminants of concern.

Surface water is sampled (when present) at one location below the confluence of Water Canyon and Cañon de Valle (for the RCRA permit). Samples are analyzed for radioactivity, general inorganic compounds, metals, VOCs, SVOCs, PCBs, and HE. Sediment is sampled at five stations (and one in Cañon de Valle) that span Water Canyon from west of the Laboratory to the Rio Grande. Sediment samples are analyzed for radioactivity, metals, SVOCs, PCBs, and HE. No persistent alluvial groundwater occurs below the confluence of Water Canyon and Cañon de Valle; three wells located there are dry but checked for water. The intermediate groundwater and the regional aquifer are sampled in one well for radioactivity, general inorganic compounds, metals, VOCs, SVOCs, PCBs, and HE.

Ancho Canyon and MDA AB

The small Ancho Canyon drainage begins within the Pajarito Plateau; MDA AB at TA-49 lies in the upper part of the drainage. MDA AB was the site of underground nuclear weapons component testing from 1959 to 1961 (Purtymun and Stoker 1987; ESP 1988). The tests involved high explosives and fissionable material insufficient to produce a nuclear reaction. Firing sites occupy part of the lower reach of Ancho Canyon. The former tritium facility at TA-33 had small releases into the lower part of the canyon. Radioactivity, metals, and high explosives are contaminants of concern in this watershed. Trending of radioactivity movement from MDA AB is a monitoring focus.

Persistent surface water occurs only in the lower portion of Ancho Canyon near the Rio Grande where it is sampled at one station (included in the RCRA permit). The water is analyzed for radioactivity, general inorganic compounds, metals, VOCs, SVOCs, PCBs, and HE. Sediment around MDA AB is monitored at twelve stations annually for radioactivity and every three years for metals, SVOCs, and PCBs. The stations are located in the individual drainages around the testing area in order to provide precise detection of releases from different parts of the facility. Sediment is also monitored in each of two major forks of Ancho Canyon and at the Rio Grande. These sediment samples are analyzed for radioactivity and metals, and HE, and every three years for SVOCs and PCBs.

No persistent shallow groundwater is found in the Ancho Canyon drainage. Three regional aquifer wells at MDA AB are sampled for radioactivity, general inorganic compounds, metals, and HE, and every three years for VOCs, SVOCs, and PCBs.