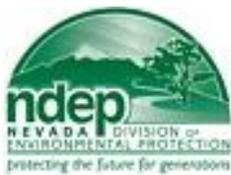


Nevada Quality Assurance Program Plan for Surface Water Sampling

January 2014



Prepared by:

Nevada Division of Environmental Protection
Bureau of Water Quality Planning
901 South Stewart Street, Suite 4001
Carson City, NV 89701

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APPROVALS:

**Kathy Sertic, Chief
Nevada Division of Environmental Protection
Bureau of Water Quality Planning**

Date:

Kathy Sertic

01/09/14

**John Heggeness, Quality Assurance Officer
Supervisor Monitoring Branch
Nevada Division of Environmental Protection
Bureau of Water Quality Planning**

Date:

John C. Heggeness

1/9/14

**Stephanie L. Wilson, Project Manager
Tribal Office
U.S. Environmental Protection Agency
Region IX**

Date:

Stephanie L. Wilson

1/27/2014

**Eugenia E. McNaughton, Ph.D., Manager
Quality Assurance Office
U.S. Environmental Protection Agency
Region IX**

Date:

Eugenia McNaughton

2/5/2014

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TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS	7
1.0 Mission and Policy	1
2.0 BWQP Program Descriptions, Organization and Management	2
2.1 <i>Program Descriptions</i>	2
2.1.1 Water Quality Monitoring	2
2.1.2 Water Quality Standards	3
2.1.3 Waterbody Assessments	3
2.1.4 Total Maximum Daily Loads	3
2.1.5 Water Quality Protection and Improvement Strategies	3
2.2 <i>BWQP Organization and Management</i>	4
2.3 <i>Certified Analytical Laboratory</i>	5
2.4 <i>Special Training Requirements/Certifications</i>	6
3.0 Water Quality Monitoring Program Objectives and Monitoring Strategy	6
3.1 <i>Program Objectives</i>	6
3.2 <i>Monitoring Strategy</i>	7
3.2.1 Long Term Monitoring	7
3.2.2 Rotational Focus Basin Monitoring	12
3.2.3 Special Projects Monitoring	14
3.2.4 Bioassessment Monitoring	14
3.2.5 Probabilistic Monitoring	14
4.0 Data Generation and Acquisition	14
4.1 <i>Water Quality Parameters and Analytical Methods</i>	14
4.2 <i>Surface Water Chemistry Sampling Methods</i>	18
4.3 <i>Field Documentation and Records</i>	18
4.3.1 Field Sheets	19
4.3.2 Instrument/Equipment Logbooks	19
4.3.3 Photographs	19
4.3.4 Labeling	19
4.3.5 Sample Chain-of-Custody Forms and Custody Seals	19
4.3.6 Sample Handling and Custody	19
4.3.7 Laboratory Analytical Methods	23
5.0 Instrument/Equipment Testing, Inspection and Maintenance	23
5.1 <i>Field Measurement Instruments/Equipment</i>	23
5.2 <i>Laboratory Analysis Instruments/Equipment (Off-Site)</i>	23
5.3 <i>Instrument/Equipment Calibration and Frequency</i>	24
5.3.1 Field Measurement Instrument/Equipment	24
5.3.2 Laboratory Analysis Instruments/Equipment	24

6.0 Quality Objectives and Criteria for Measurement Data	24
6.1 Data Quality Objectives.....	24
6.2 Measurement Performance Criteria/Acceptance Criteria.....	24
6.2.1 Precision.....	25
6.2.2 Accuracy/Bias.....	25
6.2.3 Representativeness.....	25
6.2.4 Comparability.....	25
7.0 Quality Control Requirements	26
7.1 Field Procedures Quality Control.....	26
7.2 Field Sampling Quality Control.....	26
7.2.1 Field Replicate Samples.....	26
7.2.2 Equipment Blanks.....	27
7.3 Laboratory Analyses Quality Control (Off-Site).....	27
8.0 Inspection and Acceptance of Supplies and Consumables	27
8.1 Field Sampling Supplies and Consumables.....	27
8.2 Field Measurement Supplies and Consumables.....	28
8.3 Laboratory Analyses (Off-Site) Supplies and Consumables.....	28
9.0 Field Assessment and Oversight	28
9.1 Readiness Reviews.....	28
9.2 Field Audits.....	28
9.3 Post Sampling Event Review.....	29
10.0 Laboratory Assessment and Oversight	29
11.0 Data Management	29
12.0 Data Usability	29
13.0 Documents and Records	31
13.1 Laboratory Documentation and Records.....	31
13.2 Technical Reviews and Evaluations.....	32
13.3 Quarterly Reports.....	32
REFERENCES	33
APPENDICES	34
APPENDIX A: FIELD STANDARD OPERATING PROCEDURES.....	35
Appendix A-1: Standard Operating Procedures for Field Meter Calibration and Maintenance.....	36
Appendix A-2: Standard Operating Procedures.....	43
for Collecting Stream Samples.....	43
and Field Measurements.....	43

Appendix A-3: Standard Operating Procedures for Collecting Lake/Reservoir Samples and Field Measurements	53
Appendix A-4: Standard Operating Procedures for Transporting and Operating Boats	64
Appendix A-5: Standard Operating Procedures for the Deployment of Temperature Loggers	76
Appendix A-6: Standard Operating Procedures for the Unattended Deployment of Data Sondes	87
Appendix A-7: Standard Operating Procedures for Stream flow Measurements of Wadeable Streams	100
Appendix A-8: Standard Operating Procedures for Transporting and Operating All-Terrain Vehicles	111
Appendix A-9: Standard Operating Procedures for Decontamination of Field Equipment to Limit the Spread of Invasive Species.....	120
<i>APPENDIX B: HEALTH AND SAFETY PLAN</i>	<i>129</i>
<i>APPENDIX C: NEVADA STATE PUBLIC HEALTH LABORATORY QUALITY ASSURANCE MANAGEMENT PLAN</i>	<i>135</i>

FIGURES

Figure 1: Fundamental Water Quality Programs.....	2
Figure 2: BWQP Organizational Chart	4
Figure 3: Nevada’s Long Term Monitoring Sites	8
Figure 4: Nevada's 14 Hydrographic Regions and Basins	13

TABLES

Table 1: Long Term Monitoring Sites	9
Table 2: Parameters Commonly Analyzed for Monitoring Purposes.....	16
Table 3: Analytical Methods, Containers, Preservation, & Holding Time Requirements	21
Table 4: Elements of Laboratory Results	31

ABBREVIATIONS AND ACRONYMS

The following abbreviation and acronyms appear throughout this document:

ATV	All-Terrain Vehicle
BMP	Best Management Practice
BWQP	Bureau of Water Quality Planning
CPP	Nevada's Continuing Planning Process
CWA	Clean Water Act
DIW	Deionized Water
DO	Dissolved Oxygen
DQI	Data Quality Indicator
<i>E. coli</i>	<i>Escherichia coli</i>
EPA	United States Environmental Protection Agency
GPS	Global Positioning System
IR	303(d)/305(b) Integrated Report
LRP	Bureau of Water Quality Planning – Long Range Plan
mg/L	Milligrams per Liter
µg/L	Micrograms per Liter
mL	Milliliter
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NIST	National Institute of Standards and Technology
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRS	Nevada Revised Statutes
QA	Quality Assurance
QAPrP	Quality Assurance Program Plan
QC	Quality Control
RPD	Relative Percent Difference
SpC	Specific Conductance
SM	Standard Method
SOP	Standard Operating Procedure
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WQS	WQS
WQSAM	Water Quality Standards, Assessment, and Monitoring

1.0 Mission and Policy

The mission of the Nevada Division of Environmental Protection (NDEP) is to protect and enhance the environment of the State of Nevada in order to protect public health, sustain healthy ecosystems, and contribute to a vibrant economy. To accomplish this mission, the Bureau of Water Quality Planning (BWQP) implements programs to meet requirements of the Clean Water Act (CWA) and State water quality laws and regulations contained in the Nevada Revised Statutes (NRS) 445A.300 – 445A.730 and Nevada Administrative Code (NAC) 445A.070 – 445A.2234 and NAC 445A.305 – 445A.340. Specific programs include surface water quality monitoring, water quality standards (WQS), total maximum daily loads (TMDLs), waterbody assessments such as the CWA Section 303(d)/305(b) Integrated Report (IR), watershed planning, nonpoint source (NPS) pollution management, and environmental education.

The overall quality policy of NDEP and BWQP is to ensure activities are conducted according to adequate quality management principles and practices, and to provide a reasonable assurance that environmental data generated are of sufficient quality and quantity for the intended use.

The Nevada Quality Assurance Program Plan (QAPrP) for Surface Water Sampling establishes specific quality requirements for the collection and management of surface water quality data which are used to support other BWQP water quality management programs for example, expanding water quality standard coverage, TMDL development and monitoring, and assessment requirements for 303(d)/305(b) reports. The QAPrP contains elements of overall surface water quality monitoring program management, data quality objectives, measurement and data acquisition, and information management. The QAPrP specifically describes procedures for field data collection, sample chain-of-custody, laboratory analysis, and reporting. The policies and procedures contained in the QAPrP ensure that water quality data collected by BWQP will be of known quality and acceptable value to provide a solid foundation for wise and effective management of Nevada's surface water resources.

BWQP staff have access to and must comply with the requirements described in the QAPrP. The approved QAPrP is available on the BWQP website at <http://ndep.nv.gov/bwqp/monitor.htm>. Contractors that collect water quality data must follow the procedures described in this document or otherwise provide sufficient quality assurance/quality control (QA/QC) information to ensure that the data they collect meet the BWQP's QA/QC requirements.

2.0 BWQP Program Descriptions, Organization and Management

2.1 Program Descriptions

As illustrated in [Figure 1](#) and described below, BWQP implements a variety of interrelated programs to assess, protect, and restore water quality.

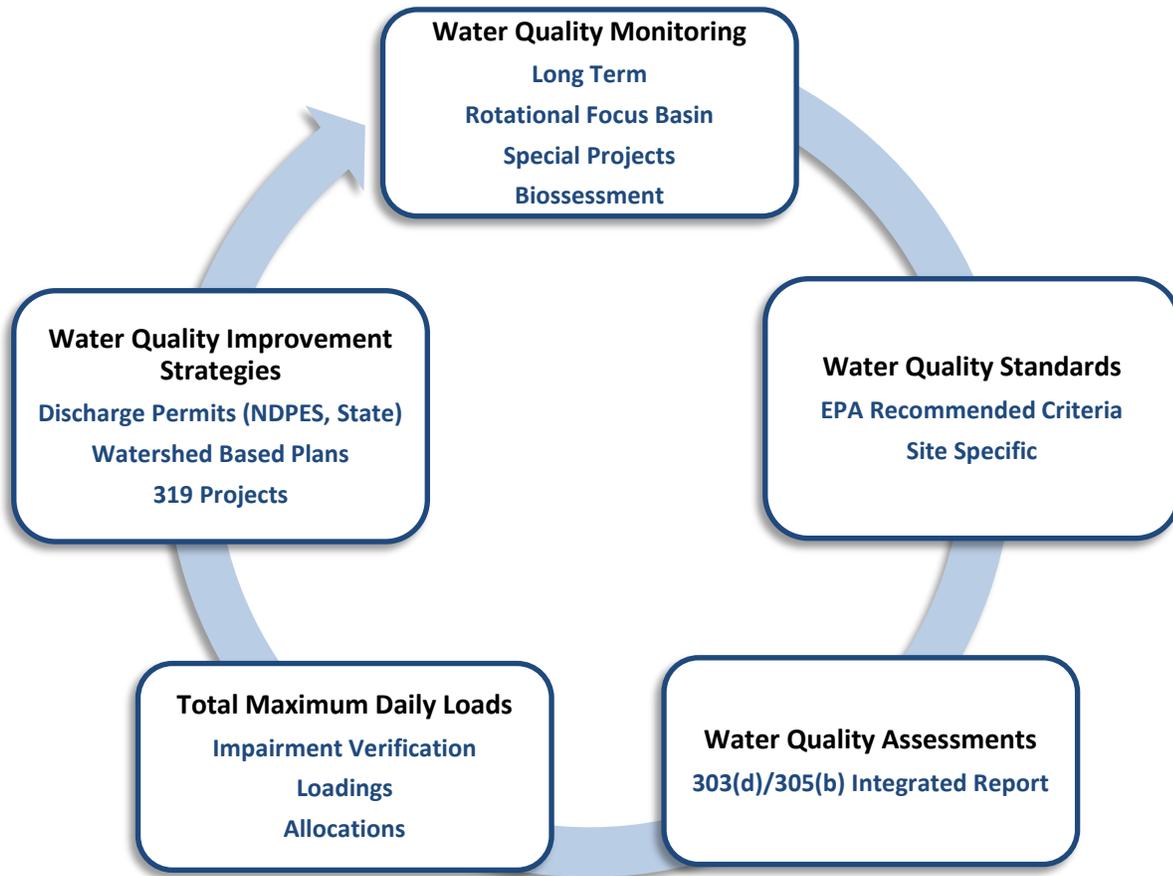


Figure 1: Fundamental Water Quality Programs

2.1.1 Water Quality Monitoring

Water quality monitoring is conducted to collect biological, chemical, and physical data and information to support other BWQP water quality management programs. Monitoring activities are generally characterized in the following categories: long term, rotational focus basin, special projects, bioassessment, and U.S. Environmental Protection Agency's (EPA) National Aquatic Resource Surveys. These monitoring efforts are described in more detail in [Section 3](#). The data are used to determine ambient water quality and water quality trends, establish WQS, evaluate if WQS are being met, and develop TMDLs.

All water quality data generated by BWQP is entered in to the BWQP Water Quality Database. A web-based application to make all BWQP's water quality data available to other agencies and the public is under development. The website is expected to be launched in 2014. BWQP data is also regularly uploaded to the EPA STORET Data Warehouse through the Water Quality Exchange framework.

2.1.2 Water Quality Standards

WQS are the scientific and regulatory foundation of water quality protection programs under the Clean Water Act and state statutes and regulations. Appropriate standards are needed to ensure that subsequent actions such as water quality assessments, TMDLs, watershed plans, NPS implementation projects, and discharge permits are adequate to protect and restore water quality. A WQS defines the water quality goals for a waterbody by designating beneficial uses of the water and setting narrative or numeric criteria to protect the uses. Additional protection is provided for high quality waters through antidegradation provisions. Numeric criteria are usually based on EPA's National Recommended Water Quality Criteria, but site specific criteria may be developed to reflect local or regional conditions. In addition to narrative standards applicable to all waters, NDEP has established standards for more than 300 individual reaches of rivers, streams, lakes, and reservoirs. Many waterbodies not specifically identified in the NAC are protected by the "Tributary Rule" (NAC 445A.1239). Nevada's WQS are contained in NAC 445A.11704 – 445A.2234 (available at <http://leg.state.nv.us/NAC/CHAPTERS.HTML>).

EPA has promulgated water quality standards for Nevada for certain parameters and beneficial uses which are contained in the Code of Federal Regulations (40 CFR Part 131.36(d)(11)).

During the WQS development process, water quality data are used to determine if the proposed beneficial uses are appropriate or attainable and to determine site specific criteria. Specific information and procedures for the development of WQS are described in Nevada's Continuing Planning Process (CPP) (available at <http://ndep.nv.gov/bwqp/cpp.htm>) and the BWQP Long Range Plan (LRP) (available at http://ndep.nv.gov/bwqp/file/5-year_plan-2006-2011.pdf).

2.1.3 Waterbody Assessments

The primary waterbody assessment prepared by the BWQP is the 303(d)/305(b) IR. The 305(b) portion evaluates the water quality and beneficial attainment of all surface waters of the state for which data is readily available. The 303(d) portion is a list of waters that are not meeting WQS and are classified as impaired. TMDLs are required to be developed for waters on the 303(d) List. To develop the IR, water quality data are compared to the WQS according to an established methodology described in the IR document. The most current IR is available on the BWQP website (<http://ndep.nv.gov/bwqp/303dlist.htm>).

2.1.4 Total Maximum Daily Loads

TMDLs are an assessment of the amount pollutants a waterbody can receive and still meet WQS. TMDLs provide a means to integrate the management of both point and nonpoint sources of pollution through the establishment of waste load allocations for point source discharges and load allocations for nonpoint sources. Water quality data are used to evaluate if beneficial use impairment really exists, determine sources of pollution, and establish pollutant load allocations. Specific information and procedures for the development of TMDLs are described in Nevada's CPP and the BWQP LRP.

2.1.5 Water Quality Protection and Improvement Strategies

National Pollutant Discharge Elimination System (NPDES) permits and CWA §401 certifications are issued to ensure that any surface water discharges meet all applicable WQS and TMDLs. The Nevada NPS program implements TMDLs, watershed based plans, and other NPS control projects to restore impaired waters. NPS 319 funding is provided to other agencies and organizations for water quality improvement and environmental education projects. Water quality data may be used to assess the

effectiveness of permits and water quality improvement projects. More information on the Nevada NPS Program is available at <http://ndep.nv.gov/bwqp/NPSGWP.htm>.

2.2 BWQP Organization and Management

The major BWQP staff activities and responsibilities are illustrated in the BWQP organization chart shown in [Figure 2](#) and described below.

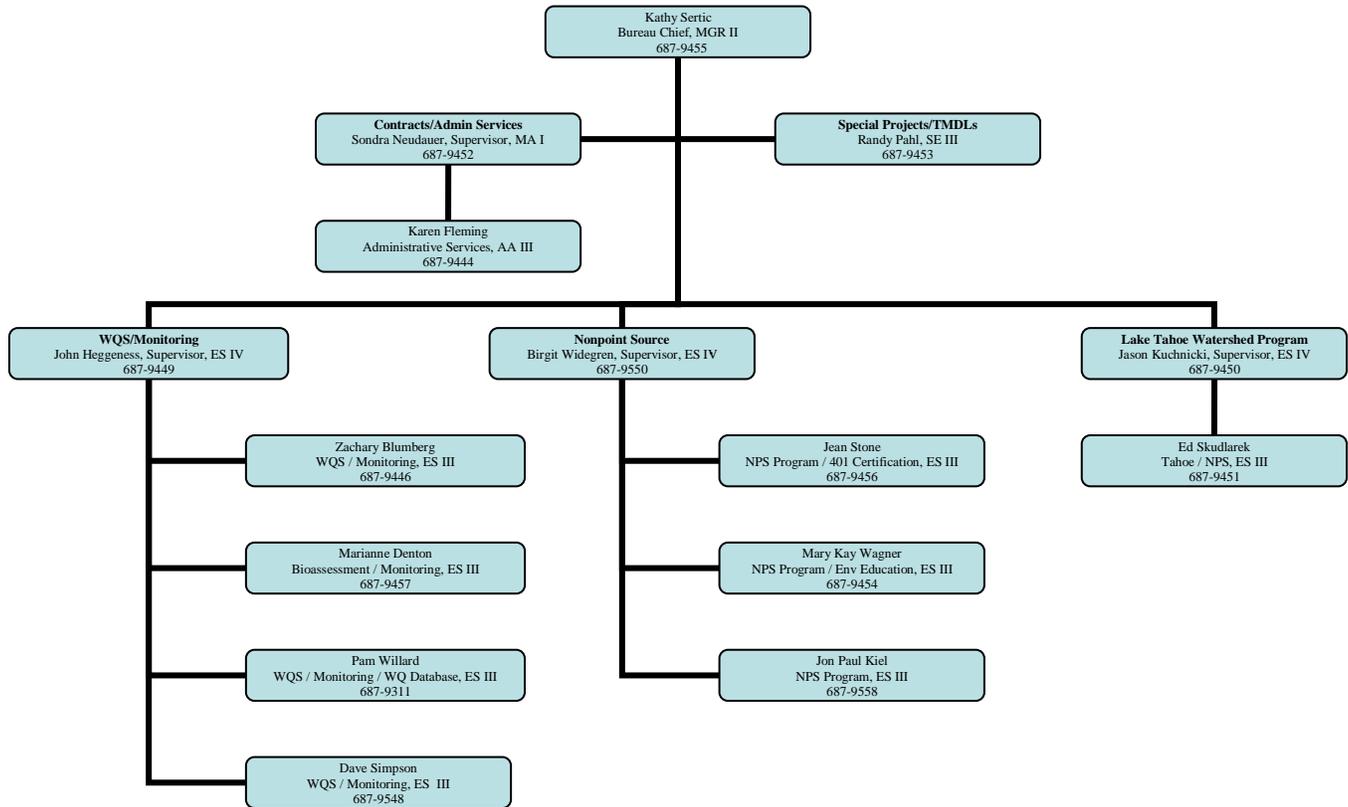


Figure 2: BWQP Organizational Chart

The Bureau Chief is responsible for overall management, direction, coordination and guidance for all BWQP programs.

The Administrative Assistant and Contract Manager are responsible for budget tracking, day-to-day office operations, contract preparation, and invoice processing.

The TMDL and Special Projects Coordinator oversees TMDL development and CWA §208 planning; reviews NPDES permits; assists with waterbody monitoring and assessments; assists with development of WQS; participates in inter-program and inter-agency coordination; and provides technical assistance.

The WQS, Assessment, and Monitoring (WQSAM) Branch staff develop WQS; conduct chemical, physical, and biological monitoring; conduct waterbody assessments including the 303(d)/305(b) IR; participate in inter-program and inter-agency coordination; provide technical assistance; maintain water quality and bioassessment databases; and provide data to EPA, other agencies, and the public.

The WQSAM Branch Supervisor (WQSAM Supervisor) is responsible for overseeing the entire surface

water monitoring program and budget. The WQSAM Supervisor is also responsible for overall development of the sampling design and protocols discussed in this QAPrP, as well as ensuring protocols are followed. On a routine basis, the WQSAM Supervisor coordinates with the branch staff and the manager of the certified laboratory to review field and laboratory roles and responsibilities, sampling and field measurement requirements, analytical requirements, sampling schedule, courier logistics (for sample transfer to the laboratory), and requirements for field and laboratory documentation to minimize potential problems that could occur as part of the surface water quality monitoring program. The WQSAM Supervisor is also responsible for ensuring that any amended versions of the QAPrP are provided to the EPA for approval and then distributed to the appropriate individuals and organizations.

The WQSAM Branch Quality Assurance Officer (QA Officer) is responsible for the QA/QC review of all data generated for the samples collected. The QA Officer receives all data reports from the analytical laboratory and is the main contact regarding data quality issues and concerns. Due to the limited staff resources of the BWQP, the WQSAM Supervisor also functions in the role of QA Officer for the BWQP and may delegate the duties to other staff members.

The WQSAM Branch staff perform sample collection and field measurement activities according to policies and procedures established in the QAPrP. The WQSAM Branch staff also communicate with the analytical laboratory regarding sample delivery and schedule.

On occasion, particularly during the intense summer field season, interns are hired to assist with data collection efforts and are directly trained in QA/QC procedures and supervised by WQSAM Branch staff.

BWQP may hire contractors to collect environmental data. Contractors must follow this QAPrP or other QAPrP approved by the BWQP. Contractors will report and provide data to the WQSAM Supervisor.

The NPS Pollution Management Branch staff implement the State NPS Management Plan to improve water quality in waters affected by NPS pollution and restore and maintain healthy aquatic habitats and watersheds. NPS Management Staff oversee contracts with local, state, and federal agencies and environmental organizations for bank stabilization/restoration, best management practice implementation, and environmental education projects; participate in inter-program and inter-agency coordination; provide technical assistance; and issue §401 certifications.

The Lake Tahoe Watershed Program staff provide direct oversight for implementation of the Lake Tahoe TMDL and other Tahoe related activities; conduct monitoring; assist with development of WQS; participate in inter-program and inter-agency coordination; and provide technical assistance.

2.3 Certified Analytical Laboratory

The State of Nevada implements a rigorous laboratory certification program to ensure that environmental samples collected to meet requirements of the CWA, Safe Drinking Water Act, and Resource Conservation and Recovery Act are analyzed according to approved methods and strict QA/QC policies and procedures. To be certified, laboratories must pass an on-site audit at least once every three years, and satisfactorily analyze a set of performance test samples annually.

The majority of water quality samples collected by the BWQP are analyzed by the Nevada State Public Health Laboratory, which is certified by the State of Nevada. However, other laboratories such as those run by the Desert Research Institute (State certified for CWA samples), the United States Geological Survey (USGS), and EPA may also be used. The laboratory is responsible for conducting all sample

preparation and analytical activities, as well as reviewing the analytical data it generates, to ensure consistency with its approved QA/QC program. The Laboratory Manager oversees all laboratory-related activities, serves as the main contact for the WQSAM staff, and has the prime responsibility for the laboratory work. Specific information regarding the Nevada State Public Health Laboratory QA/QC program is contained in the Nevada State Health Laboratory Quality Assurance Management Plan (see [Appendix C](#)).

2.4 Special Training Requirements/Certifications

Proper training of field personnel represents a critical aspect of QA/QC. All BWQP staff responsible for collecting water quality samples will have sufficient training and experience. Additionally, all newly hired personnel undergo a period of apprenticeship and are accompanied by experienced BWQP staff when collecting samples or field measurements until the WQSAM Supervisor determines that the staff person is appropriately trained and qualified.

Prior to conducting monitoring activities, all BWQP staff must complete health and safety training. All personnel participating in field activities are required to be familiar with the BWQP Field Staff Safety Guidance and Recommended Protective Measures (see [Appendix B](#)). Health and safety training records are kept on file at the BWQP office and in personnel files or at the Nevada State Archives.

All BWQP personnel are required to complete the initial State of Nevada Employee Defensive Driving Course and retain a copy of the Defensive Driving training certificate. Refresher training or a repeat of the class is required every four years. All BWQP personnel that use watercraft are required to complete a boater safety course approved by the National Association of State Boating Law Administrators and retain a Nevada Boater Education Card (also known as a Nevada Boating Safety Certificate Card). All BWQP personnel that use all-terrain vehicles (ATVs) are required to complete an ATV safety course approved by the State of Nevada Risk Management Division and retain a certificate of completion. Additional field safety trainings, such as a Cardiac Pulmonary Resuscitation course, are encouraged as time and funds allow.

3.0 Water Quality Monitoring Program Objectives and Monitoring Strategy

Data generated through BWQP's water quality monitoring program provide the fundamental platform for management of Nevada surface water resources.

3.1 Program Objectives

The main objectives for the surface water quality monitoring program include:

- Provide biological, chemical, and physical data to support waterbody assessments, including the 303(d)/305(b) IR, and development of WQS and TMDLs;
- Increase the geographic coverage of waters monitored to expand water quality standards, update assessments of impairments in assessed waters, assess the status of previously unassessed waters and collect baseline ambient monitoring data;
- Maintain long term records for select sites throughout the State to determine trends in pollutant concentrations and/or loads;
- Measure the effectiveness of TMDLs and projects implemented through the Nevada NPS Management Program;
- Support EPA national efforts to broadly assess waters;

- Provide biological, chemical, and physical data to local, state, and federal agencies, Tribes, and the general public; and
- Ensure data quality through the implementation of appropriate QA/QC procedures.

3.2 Monitoring Strategy

To meet program objectives, BWQP implements a multi-pronged approach for collecting water quality data in accordance with the Water Quality Monitoring and Assessment Strategy (available upon request) and LRP. Monitoring activities are generally included in the following categories:

- Long Term;
- Rotational Focus Basin;
- Special Projects;
- Bioassessment; and
- Probabilistic.

3.2.1 Long Term Monitoring

Long term monitoring is conducted to determine ambient water quality conditions and trends in pollutant concentrations and/or loads over time. The data may also be used to develop WQS and TMDLs. Long term sites are maintained on several major rivers and streams, a majority of which are located at USGS streamflow gaging stations in order to have concurrent flow data for statistical trend analyses (see [Figure 3](#) and [Table 1](#) for detailed information regarding the long term sites). Sites are generally sampled quarterly to characterize seasonality unless a more frequent schedule is determined appropriate, or less frequently if weather conditions prevent access or the site is dry. From year to year the BWQP attempts to rotate between months of the quarter to capture varying conditions.

Water quality samples collected at long term monitoring sites are analyzed for bacteria and routine standard pollutants each time and metals biannually (See [Table 2](#)).

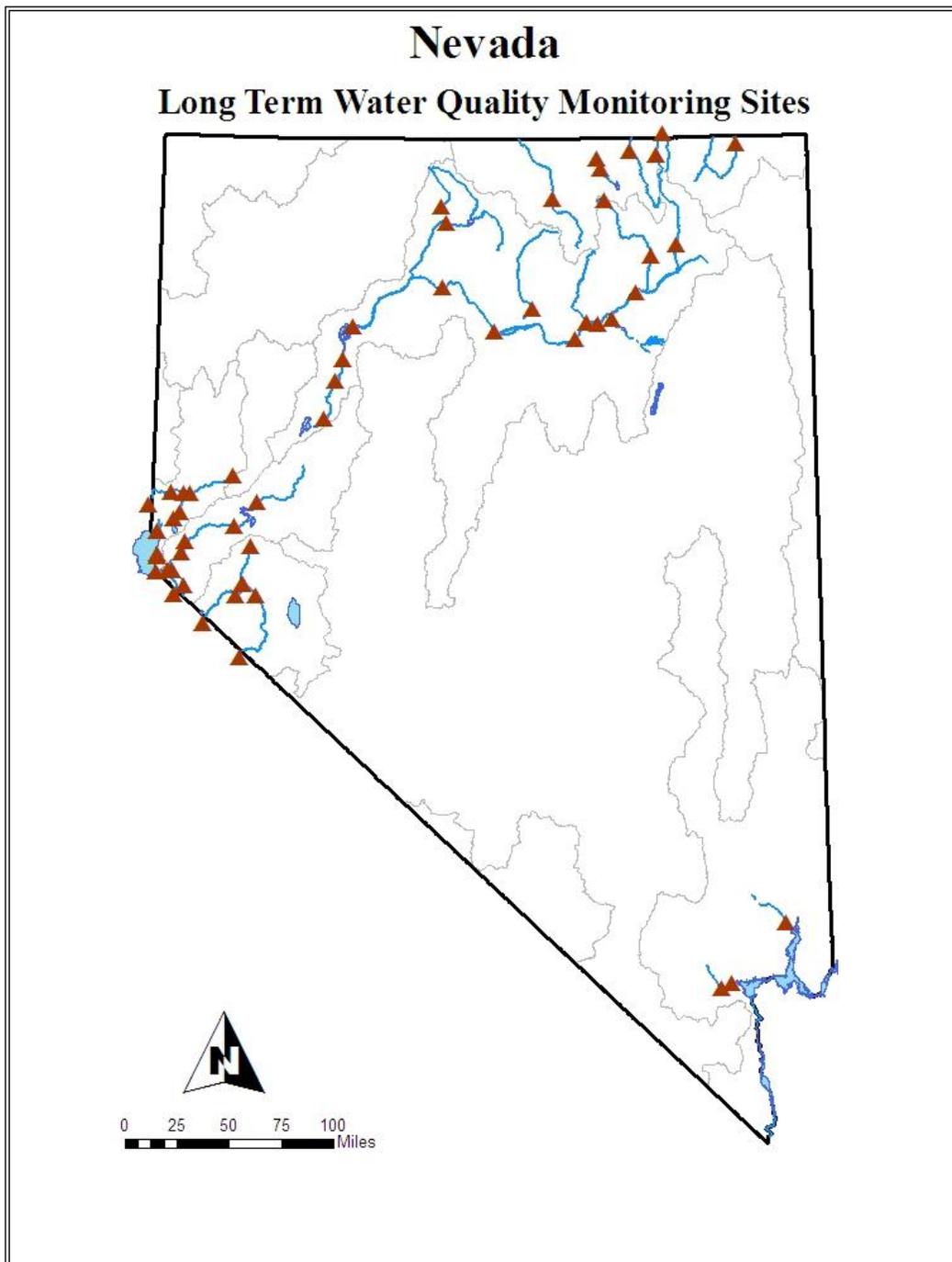


Figure 3: Nevada's Long Term Monitoring Sites

Table 1: Long Term Monitoring Sites

Snake River Basin					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
E5	Bruneau River @ Mink Ranch	NV03-BR-16_00	Bruneau River	4640796	609894
E11	East Fork Jarbidge River Below Murphys	NV03-JR-12_00	Jarbidge River, East Fork	4654530	635143
E6	Jarbidge River below Jarbidge	NV03-JR-14_00	Jarbidge River	4637497	630244
E4	Owyhee River above Mill Creek	NV-OW-18_00	Owyhee River	4626888.9	587214.64
E16	Owyhee River below Slaughterhouse Creek	NV03-OW-19_01	Owyhee River	4634730.1	584174.74
E1A	South Fork Owyhee River @ IL Ranch	NV03-OW-27_00	Owyhee River, South Fork	4603828	551027
E8	Salmon Falls Creek	NV03-SR-02_00	Salmon Falls Creek	4646085	691688

Humboldt River Basin - Upper					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
HS4	Humboldt River @ Osino Cutoff	NV04-HR-01_00	Humboldt River	4531990.6	614530.31
HS5	Humboldt River @ Carlin	NV04-HR-02_00	Humboldt River	4507533.9	585340.61
HS6	Humboldt River @ Palisade	NV04-HR-02_00	Humboldt River	4495685.7	567668.44
HS14	Maggie Creek @ SR 221	NV04-HR-59-C_00	Maggie Creek	4508051	576495.82
HS1	Mary's River	NV04-MR-10-B_00	Mary's River	4568292.9	646093.39
HS15	North Fork Humboldt River @ North Fork Ranch	NV04-NF-17-B_00	Humboldt River, North Fork	4603058.8	590768.08
HS2	North Fork Humboldt River @ Devils Gate Gage	NV04-NF-56-B_00	Humboldt River, North Fork	4559695.8	626435.59
HS3A	South Fork Humboldt River below Dixie Creek	NV04-SF-19-B_02	Humboldt River, South Fork	4511100.9	596283.39

Humboldt River Basin - Lower					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
HS7	Humboldt River @ Battle Mountain	NV04-HR-03_00	Humboldt River	4501885.8	505813.56
HS8	Humboldt River @ Comus	NV04-HR-04_00	Humboldt River	4535782	466394.45
HS9	Humboldt River @ Imlay	NV04-HR-05_00	Humboldt River	4505308.8	397034.44
H6	Humboldt River Below Rye Patch Reservoir	NV04-HR-06_00	Humboldt River	4480541.4	389169.54
HS43	Humboldt River @ Woolsey	NV04-HR-06_00	Humboldt River	4463228.1	383419.63
HS12	Humboldt River Above Humboldt Sink	NV04-HR-08-D_01	Humboldt River	4434563.2	374805.1
RKC-4	Rock Creek @ Gaging Station	NV04-HR-33-C_00	Rock Creek	4519518.8	534883.83
HS70	Little Humboldt River @ Hot Springs Gage	NV04-LH-47-C_00	Little Humboldt River	4597923.3	464880.17
HS67	Martin Creek Below Gage	NV04-LH-51-B_00	Martin Creek	4585006.5	468786.13

Table 1 continued: Long Term Monitoring Sites

Truckee River Basin – Steamboat Creek					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
SB1	Little Washoe Outfall	NV06-SC-40-C_00	Washoe Lakes	4357112	258464
SB5	Steamboat Creek @ Rhodes Road	NV06-SC-41-C_00	Steamboat Creek	4362224.1	263662.58
SB19	Steamboat Creek @ Cleanwater Way	NV06-SC-42-D_00	Steamboat Creek	4377200	266824

Truckee River Basin – Tahoe Tributaries					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
3B	3rd Creek @ Lakeshore Drive	NV06-TB-12_00	Third Creek, EF; Third Creek WF; and Third Creek	4347573.3	245753.06
INCL	Incline Creek @ Lakeshore Drive	NV06-TB-16_00	Incline Creek, EF; Incline Creek, WF; and Incline Creek	4347528.9	245844.75
TAH21	Glenbrook Creek near Glenbrook	NV06-TB-26_00	Glenbrook Creek	4330591.7	245718.84
TAH9	Logan House Creek (Lower) above Highway 50 @ USGS Gage	NV06-TB-28_00	Logan House Creek	4328280	245988
TAH22	Edgewood Creek @ Stateline	NV06-TB-86_00	Edgewood Creek	4316858.6	245065.68

Truckee River Basin – Truckee River					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
T1	Truckee River @ Farad	NV06-TR-01_00	Truckee River	4367918	238935.71
T2	Truckee River @ Idlewild Park	NV06-TR-02_00	Truckee River	4378451	256743.62
T20	Truckee River above Lockwood	NV06-TR-04_00	Truckee River	4376605.2	271313.58
T6	Truckee River @ Wadsworth	NV06-TR-06_00	Truckee River	4390261.4	304112.83

Carson River Basin					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
C8	West Fork Carson River @ Paynesville	NV08-CR-01_00	Carson River, West Fork	4299221	258851
C9	East Fork Carson River @ Riverview	NV08-CR-04_00	Carson River, East Fork	4306472	266635
C15	East Fork Carson River @ Williams Slough	NV08-CR-05_02	Carson River, East Fork	4317263	257499
C13	Carson River @ Mexican Gage	NV08-CR-08_00	Carson River	4331391	264172
C1	Carson River @ New Empire Bridge	NV08-CR-09_00	Carson River	4340355	267136
C10	Carson River @ Weeks Bridge	NV08-CR-11_00	Carson River	4351726	305849
C18	Carson River Below Lahontan Dam	NV08-CR-13-C_00	Carson River	4370272	323173
C5	Brockliss Slough @ Muller Lane	NV08-CR-29_00	Brockliss Slough, including East and West Branches	4317395	254356
C6	East Brockliss Slough @ Muller Lane	NV08-CR-29_00	Brockliss Slough, including East and West Branches	4317373.9	254663.26

Table 1 continued: Long Term Monitoring Sites

Walker River Basin					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
W5	West Fork Walker River @ Topaz Lane	NV09-WR-01_00	Walker River, West Fork	4276576.6	280802.47
W2	West Fork Walker River @ Nordyke West	NV09-WR-04_00	Walker River, West Fork	4306749.1	310982.55
W7	West Fork Walker River @ Hudson Gage	NV09-WR-04_00	Walker River, West Fork	4298008.8	306580.22
EFS	East Fork Walker River @ Stateline	NV09-WR-06_00	Walker River, East Fork	4250631.4	309086.14
W3	East Fork Walker River @ Nordyke East	NV09-WR-08_00	Walker River, East Fork	4306672.5	311970.12
WSG	East Fork Walker River @ Strosnider Gage	NV09-WR-08_00	Walker River, East Fork	4298096.9	322188.54
W4	Walker River @ Wabuska	NV09-WR-09_00	Walker River	4335718.1	318520.79

Colorado River Basin					
Station ID	Station Name	Waterbody ID	Water Name	UTM_N	UTM_W
LVWPR	Las Vegas Wash @ Pabco Road	NV13-CL-05_00	Las Vegas Wash	3995570.5	681359.31
CL3	Las Vegas Wash @ Northshore Drive	NV13-CL-06_00	Las Vegas Wash	3999536.7	688538.92
MR8.0	Muddy River @ Lewis Avenue	NV13-CL-12_02	Muddy River	4046405.6	730155.59

3.2.2 Rotational Focus Basin Monitoring

Rotational focus basin monitoring is conducted to determine ambient conditions, increase the geographic coverage of assessed waters, and support development of WQS or TMDLs.

The state of Nevada is comprised of 14 hydrographic regions for water planning and management purposes (see [Figure 4](#)). As part of a rotational design, the BWQP selects one or more of the regions or basins in which to focus water quality monitoring efforts for a 2-3 year period or until it is determined that sufficient data is collected to fulfill the purpose of the sampling.

Objectives of a Focus Basin review include:

- A review and update of existing water quality standards (this includes updating current water quality standards to new EPA criteria);
- A review and addition of water quality standards to waters lacking some of standards necessary for the protection of existing beneficial uses;
- The addition of new waters and water quality standards for waterbodies that NDEP determines need beneficial use protection, for example new waterbodies that need protection for cold water species;
- Collection of ambient water quality data on waters that have never been sampled.

Many factors are evaluated and considered when selecting a focus basin including:

- Time since the water quality standards within the basin were last reviewed;
- Input from the public, Tribes, and local, state, and federal agencies;
- BWQP's Triennial WQS Review public process;
- Age or lack of water quality data; for example, basins that contain waterbodies that have been assigned WQS but have never been sampled or the existing data is limited, out-of-date, or of poor quality;
- The potential for water quality degradation (both natural and anthropogenic).

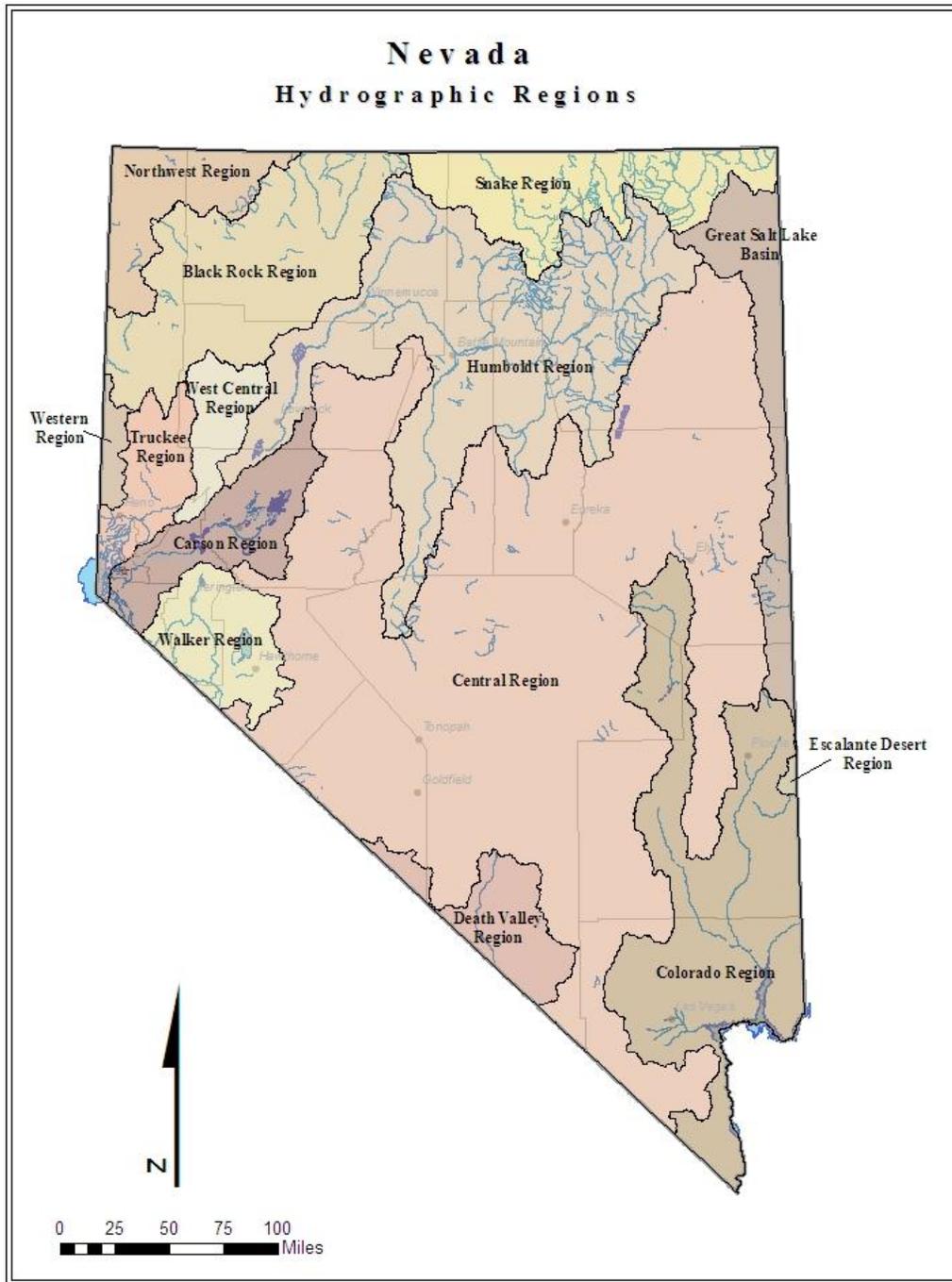
The waterbodies sampled within a focus basin depend on many factors including but not limited to:

- The number of waterbodies that exist within the basin;
- Waterbodies lacking sufficient protection, for example protection for cold water species;
- Funding;
- Staff resources;
- Travel time to the focus basin;
- Travel time between monitoring sites;
- Capability of the certified laboratory to handle the analytical load;
- Potential for water quality degradation by natural or human causes; and
- Best professional judgment.

Sample site selection on a waterbody is based on a targeted approach considering factors including but not limited to sub-basin size, site access, hydrologic gradient change, resource value, land use, fish assemblage, location of point source(s) of pollution, and existing data.

Waterbodies are generally sampled quarterly; however sampling frequency may vary depending upon the waterbody and may be influenced by current site specific conditions. For example, access to monitoring sites during the winter is often impeded by snow-covered roads or waterbodies may be frozen. Conversely, sample collection may be precluded during the summer and fall because

Figure 4: Nevada's 14 Hydrographic Regions



waterbodies may cease to flow or dry completely due to the arid nature of Nevada. From year to year the BWQP attempts to rotate between months of the quarter to capture varying conditions.

Water quality samples collected at focus basin sites are analyzed for bacteria and routine standard pollutants each time and metals biannually (See [Table 2](#)).

Specific information on the current focus basin is provided in the CWA §106 annual workplan which is available upon request.

3.2.3 Special Projects Monitoring

Special project monitoring is conducted to support waterbody assessments and development of WQS or TMDLs. Examples include:

- Coordinating with the Nevada Department of Wildlife and the Nevada Division of State Parks for water quality monitoring of lakes and reservoirs throughout the state;
- Installing temporary thermologger devices (HOBOS) to assess temperature conditions and develop more appropriate temperature WQS;
- Conducting nutrient assessments which range from Level I visual estimates of algal cover to detailed Level II quantitative algal and water quality monitoring in order to more holistically determine nutrient impairment. Information regarding procedures for Level I and II assessments is contained in Nevada's Nutrient Criteria Strategy – Version 2 (February 2009) which is available upon request. Water quality monitoring conducted in conjunction with either Level I or II assessments conforms to procedures contained in this QAPrP.

The BWQP will develop project-specific QA project plan(s) for special water quality monitoring projects as deemed necessary in consultation with the EPA Project Manager. If a QA project plan is required, the document will be developed according to EPA guidance and requirements described at <http://www.epa.gov/quality/qu-docs/g5-final.pdf>, and submitted to the EPA for approval. The format of QA project plans will generally reflect EPA's example of a fully prepared quality assurance project plan for a fictitious stream sampling location - Quality Assurance Project Plan for Monitoring of Surface Water Eagle Valley Reservation at <http://www.epa.gov/region9/qa/pdfs/module3.pdf>.

3.2.4 Bioassessment Monitoring

Bioassessment monitoring is conducted to measure the condition of resident aquatic biota and physical habitat characteristics of rivers and streams. Samples are collected for water chemistry, benthic macroinvertebrates, periphyton, and fish (at some sites). The information and data are used to determine the ecological integrity of waterbodies and support the development of WQS and TMDLs. Indices of biological integrity, other biological evaluation tools, and a QAPrP for collecting biological samples are currently under development. Water quality monitoring conducted in conjunction with bioassessment monitoring conforms to procedures contained in this QAPrP.

3.2.5 Probabilistic Monitoring

Probabilistic monitoring is conducted to broadly assess the condition of waters through statistically valid surveys. BWQP implements a state-scale statistical monitoring program and also participates in EPA's National Aquatic Resource Surveys for rivers, streams, lakes/reservoirs, and wetlands. State-scale statistical water quality monitoring is conducted according to this QAPrP. National Aquatic Resource Surveys sampling is conducted according to procedures developed by EPA.

4.0 Data Generation and Acquisition

4.1 Water Quality Parameters and Analytical Methods

During each sampling event at each site samples are collected for the analyses of routine parameters such

as chloride, nitrate, nitrite, phosphorus, sulfate, hardness, total dissolved solids (TDS), alkalinity, total coliform, fecal coliform, and *Escherichia coli* (*E. coli*). Samples are collected for total and dissolved metals analyses at most sites biannually. Chlorophyll-*a* may be collected at some sites. A list of parameters, applicable analytical method and reporting limits are provided in [Table 2](#).

At each sampling location the water is field tested for temperature, pH, and dissolved oxygen (DO). Field measurements are taken at each location simultaneously with sample collection for laboratory analysis. Calibration of field instruments/equipment is performed according to the manufacturer's instruction manual for each instrument. The criteria for field instrument calibration (frequency, acceptance criteria, and corrective actions associated with exceeding the acceptance criteria) are provided in BWQP's Standard Operating Procedures (SOPs) (see [Appendix A-1](#)). Calibration information and sample measurement data is recorded on standardized BWQP field sheets. Stream discharge measurements may be conducted at selected sampling locations.

Qualitative information is also collected at all monitoring sites to assess NAC 445A.121 - Standards applicable to all surface waters. At a minimum, BWQP staff note whether or not the water contains substances attributable to domestic or industrial waste or other controllable sources including settleable solids that form bottom or sludge deposits; floating debris, oil, grease, scum, and other floating materials; odor, color, turbidity, or other conditions. Qualitative information is recorded on the standardized BWQP field sheets.

Parameters are evaluated on an annual basis to determine if continued analysis is warranted or if new parameters should be added. Factors that may influence such decisions include funding, specific WQS or TMDL development, emerging issues, or new EPA recommended criteria.

Table 2: Parameters Commonly Analyzed for Monitoring Purposes

Analytical Parameter ¹	Analytical Method Number ²	Laboratory Reporting Limits ³
BACTERIA:		
Fecal Coliform	Membrane Filter 9222 D	10 cfu/100 mL
Fecal Streptococci	SM 9230 C	10 cfu/100 mL
Total Coliform	Quanti-Tray 9223 B	10 MPN/100 mL
<i>E. Coli</i>	Quanti-Tray 9223 B	10 MPN/100 mL
ROUTINE PARAMETERS:		
Alkalinity	SM 2320 B	20 mg/L
Ammonia-N	SM 4500 NH ₃ D	0.1 mg/L
Bicarbonate as CaCO ₃	SM 2320 B	20.5 mg/L
Bicarbonate as HCO ₃	SM 2320 B	25 mg/L
Biochemical Oxygen Demand (BOD)	SM 5210 B	2 mg/L
Carbonate as CaCO ₃	SM 2320 B	20 mg/L
Carbonate as CO ₃	SM 2320 B	12 mg/L
Chloride, Cl ⁻	EPA 300.0	5 mg/L
Chlorophyll- <i>a</i>	SM 10200 H	0.5 µg/L
Color	SM 2120 B	5 PCU
Electrical Conductivity	SM 2510	10 µS/cm
Hydroxide, OH ⁻	SM 2320 B	7 mg/L
Orthophosphate, PO ₄ ³⁻	SM 4500 P E	0.01 mg/L
pH	SM 4500 H B	N/A
Sulfate, SO ₄ ²⁻	EPA 300.0	5 mg/L
Total Coliform	Quanti-Tray 9223 B	10 cfu/100 mL
Total Dissolved Solids	SM 2540 C	25 mg/L
Total Kjeldahl Nitrogen (TKN)	SM 4500 N B, 4500 NH ₃ D	0.1 mg/L
Nitrate+Nitrite	EPA 300.0	0.1 mg/L
Total Phosphorus	SM 4500 P E	0.01 mg/L
Total Suspended Solids	EPA 160.2	10 mg/L
Turbidity	EPA 180.1	0.4 NTU

Table 2 continued: Parameters Commonly Analyzed for Monitoring Purposes

Analytical Parameter ¹	Analytical Method Number ²	Laboratory Reporting Limits ³
METALS:		
Antimony, Sb	EPA 200.8	5 µg/L
Arsenic, As	EPA 200.8	3 µg/L
Barium, Ba	EPA 200.7	20 µg/L
Beryllium, Be	EPA 200.8	2 µg/L
Boron, B	EPA 200.7	100 µg/L
Cadmium, Cd	EPA 200.8	1 µg/L
Calcium, Ca	EPA 200.7	5 mg/L
Chromium (total), Cr	EPA 200.8	2 µg/L
Copper, Cu	EPA 200.8	2 µg/L
Fluoride, F ⁻	EPA 300.0	100 µg/L
Iron, Fe	EPA 200.7	50 µg/L
Lead, Pb	EPA 200.8	1 µg/L
Magnesium, Mg	EPA 200.7	5 mg/L
Manganese, Mn	EPA 200.7	20 µg/L
Mercury, Hg	EPA 245.2	0.2 µg/L
Molybdenum, Mo	EPA 200.8	10 µg/L
Nickel, Ni	EPA 200.8	5 µg/L
Selenium, Se	EPA 200.8	2 µg/L
Silver, Ag	EPA 200.8	2 µg/L
Sodium, Na	EPA 200.7	5 mg/L
Thallium, Tl	EPA 200.8	1 µg/L
Zinc, Zn	EPA 200.8	10 µg/L

Footnotes:

- ¹ In addition to the analyzed parameters, the following parameters are calculated from laboratory analysis data: Total Nitrogen, Hardness, and Sodium Adsorption Ratio (SAR).
- ² Analytical methods may change. Tables will be updated accordingly.
- ³ Reporting limits may differ depending on the waterbody. Reporting limits in [Table 2](#) were provided by the Nevada State Public Health Laboratory.

4.2 Surface Water Chemistry Sampling Methods

Methods of sample collection, preservation, and handling conducted under this QAPrP are in accordance with methods described in the following references or otherwise approved by the EPA:

- “Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act,” 40 CFR Part 136 or any test procedure approved or accepted by the EPA using procedures provided in 40 CFR Parts 136.3(d), 136.4 and 136.5;
- Standard Methods for the Examination of Water and Wastewater, latest edition, American Public Health Association;
- Methods for Chemical Analysis of Water and Waste, and other methods published by the EPA Office of Research and Development or Office of Water;
- Techniques of Water Resource Investigations of the USGS;
- Annual Book of American Society for Testing and Materials (ASTM) Standards. Volumes 11.01 and 11.02, Water (I) and (II), latest edition, ASTM International;
- Federal Register, latest methods published for monitoring pursuant to Resource Conservation and Recovery Act regulations;
- National Handbook of Recommended Methods for Water-Data Acquisition, latest edition, prepared cooperatively by agencies of the U.S. Government under the sponsorship of the USGS; or
- Federal Register, latest methods published for monitoring pursuant to the Safe Drinking Water Act regulations.

Detailed procedures for collecting environmental data are provided in the most current BWQP SOPs (see [Appendix A](#)). All field activities are conducted in accordance with the SOPs; however, site conditions or project-specific data collection objectives may necessitate the use of alternative field procedures not included in the SOPs. The use of field methods other than those presented in the SOPs must be approved by the WQSAM Supervisor and documented properly.

4.3 Field Documentation and Records

Information and data are documented in the field in several ways, including standardized BWQP field sheets, photographs, and pre-printed forms (e.g., chain-of-custody forms). Field activities are conducted according to the appropriate SOPs (see [Appendix A](#)). It is the responsibility of the WQSAM Supervisor/QA Officer to maintain updated SOPs at all times and to distribute updated SOPs to the BWQP Staff, as appropriate. All documentation generated by the sampling program is kept on file in the BWQP office or at the Nevada State Archives. Data or records are transferred to the State Archives according to the State of Nevada, NDEP, and BWQP records management and retention policies which are available upon request.

Field documentation and records are made in indelible ink or extra fine point permanent marker. There will be no omissions in the data. Errors are kept to a minimum by exercising caution when recording and transcribing data. Erasing, “white-outs,” removal of pages, and multiple crossovers are not used to correct errors. When errors do occur, they will be corrected according to the following procedures:

1. A single line is drawn through the incorrect entry; the correct entry is inserted into the closest space available; the correction is initialed and dated.
2. Groups of related errors on a single page will have one line through the entries and initialed and dated with a short comment supplied explaining the reason of data deletion.

4.3.1 Field Sheets

Standardized BWQP field sheets are used to record field observations, sampling site conditions, field instrument calibration information, and on-site field measurements. These sheets are maintained in a permanent file in the BWQP office or at the Nevada State Archives.

4.3.2 Instrument/Equipment Logbooks

Instrument/equipment logbooks are maintained for each instrument or piece of equipment. Each logbook includes the name, manufacturer, and serial number of the instrument/equipment, as well as dates and details of all maintenance activities.

4.3.3 Photographs

Digital photographs may be taken at a sampling location and at other areas of interest near the sampling area. The photographs serve to verify information entered onto the field sheet. Digital photographs are archived in a permanent digital file and maintained on the NDEP server.

4.3.4 Labeling

All samples are labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples have identifiable and unique numbers. Each sample location has a unique sample identification number.

Field QC samples (equipment blanks and field replicates) are labeled as such on the field sheets (see [Section 7.2](#)). They are given unique (fictitious) sample identification numbers and are submitted “blind” to the laboratory (i.e., only the field sheet entry documents their identification and the laboratory will not know these are QC samples). QC samples are entered into the BWQP database as equipment blanks or field replicates.

4.3.5 Sample Chain-of-Custody Forms and Custody Seals

All sample deliveries/shipments are accompanied by a chain-of-custody form. The original form is included with the samples and delivered to the laboratory. Copies are provided to the WQSAM Supervisor/QA Officer and maintained in BWQP files.

If the samples must be shipped, custody seals are affixed across the openings of the cooler both front and back to ensure that samples are not tampered with during transport. The sample packer’s initials and the date are included on the custody seals.

4.3.6 Sample Handling and Custody

BWQP ensures that each sample collected retains its original physical form and chemical composition from time of collection through analysis by the laboratory. Details of sample handling are found in the BWQP’s most current SOPs (see [Appendix A](#)).

4.3.6.1 Sample Containers and Preservatives

The WQSAM Supervisor or designated BWQP staff work directly with the Laboratory Manager to determine the number of sample containers, and associated sizes/volumes and materials, needed for this monitoring program. The containers for bacteria and metals are provided pre-cleaned and pre-preserved from the laboratory and require no washing or rinsing by the field samplers prior to sample collection. The containers for routine parameters are purchased from an outside vendor and are rinsed with water from the sampling location twice by the field samplers prior to sample

collection. In addition, the preservative for the preserved routine parameters sample is added to the sample container by the field team immediately following sample collection.

All samples taken, except for bacteria, are immediately stored in ice chests filled with ice until delivered to the laboratory. Bacteria samples are immediately stored in a thermoelectric refrigerator until delivered to the laboratory. Upon delivery of the samples to the laboratory, laboratory staff check that the samples arrived on ice. The laboratory staff note whether or not the samples arrived on ice on the chain-of-custody form.

Information regarding sample containers and preservatives is provided in [Table 3](#).

Table 3: Analytical Methods, Containers, Preservation, & Holding Time Requirements

Analytical Parameter	Analytical Method Number ¹	Container	Preservation Requirements	Maximum Holding Times ²
BACTERIA:				
<i>E. Coli</i>	Quanti-Tray 9223 B	120 mL sterilized polystyrene bottle	Bottle is refrigerated to 4° C. Bottle contains sodium thiosulfate.	6 hours (collection to lab receipt); 2 hours (lab receipt to analysis)
Fecal Coliform	Membrane Filter 9222 D			
Total Coliform	Quanti-Tray 9223 B			
CHLOROPHYLL-<i>a</i>				
Chlorophyll- <i>a</i>	SM 10200 H	500 mL opaque HDPE bottle	Protect from exposure to light. Filtered as soon as practicable. Filter is frozen immediately.	Water sample must be filtered within 24 hours. 28 days after filter is frozen.
PRESERVED ROUTINE PARAMETERS				
Ammonia-N	SM 4500 NH ₃ D	0.5 gallon HDPE bottle	Bottle is chilled to 4° C.	28 days
Nitrate+Nitrite	EPA 300.0		Bottle is preserved with 5.0 mL of 96% H ₂ SO ₄ .	28 days
Total Kjeldahl Nitrogen	SM 4500 N B		Preserve immediately after collection.	28 days
Total Phosphorus	SM 4500 P E			28 days

¹ SOPs are based on information presented in the analytical methods listed that are referenced from:

EPA (various)

- 160.1 – Methods for Chemical Analysis of Water & Wastes, EPA/600/4-79-020, Revised March 1983.

- 200 Series - Methods for the Determination of Metals in Environmental Samples - Supplement I, EPA/600/R-94/111, May 1994.

- 300.0 - Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, October 1993.

SM Standard Methods for the Examination of Water & Wastewater, 20th Edition, 1998

(NOTE: Information regarding containers, preservation, and holding time requirements for the various analytical methods are referenced from: 40 CFR Part 136.3, Table II on page 34.)

² All holding times are based on time from sample collection to analysis.

Table 3 continued: Analytical Methods, Containers, Preservation, & Holding Time Requirements

Analytical Parameter	Analytical Method Number	Container	Preservation Requirements	Maximum Holding Times
UNPRESERVED ROUTINE PARAMETERS				
Alkalinity	SM 2320B	0.5 gallon HDPE bottle	Bottle is chilled to 4° C.	14 days
Cl ⁻ , F ⁻ , NO ₃ ⁻ , and SO ₄ ²⁻	EPA 300.0			28 days
Color	SM 2120 B			48 hours
Electrical Conductivity	SM 2510			28 days
Nitrite	SM 4500 NO ₂ B			48 hours
Orthophosphate	SM 4500 P E			48 hours
pH	SM 4500 H B			24 hours
pH Temperature	SM 4500 H B			None
Sulfate	EPA 300.0			28 days
Total Dissolved Solids	SM 2540 C			7 days
Total Suspended Solids	EPA 160.2			7 days
Turbidity	EPA 180.1			48 hours
TOTAL METALS				
Ba, B, Fe, Mn, and K	EPA 200.7	500 mL HDPE bottle	Bottle contains 15% HNO ₃ before addition of the water sample, 0.15% HNO ₃ after. Chill within 15 minutes of collection.	6 months
Sb, As, Be, Cd, Cr, Cu, Mo, Ni, Pb, Se, Tl, and Zn	EPA 200.8			6 months
Hardness	EPA 200.7 ³			6 months
Mercury	EPA 245.2			28 days
DISSOLVED METALS				
Ca, K, Mg, and Na	EPA 200.7	500 mL HDPE bottle	Bottle contains 15% HNO ₃ before addition of the water sample, 0.15% HNO ₃ after. Filter and chill sample within 15 minutes of collection.	6 months
Ag, As, Cd, Cr, Cu, Pb, Ni, Se, and Zn	EPA 200.8			6 months
Mercury	EPA 245.2			28 days

³ No separate sample is collected to determine hardness. Hardness is calculated from results of calcium and magnesium analyses determined from EPA 200.7. SM2340B provides the calculation.

4.3.6.2 Sample Custody

The BWQP Staff are responsible for custody of the samples until they are delivered to the laboratory or picked up for shipping. As few people as possible will handle the samples to ensure sample custody. Chain-of-custody forms are completed in the field. Each time one person relinquishes control of the samples to another person, both individuals complete the appropriate portions of the chain-of-custody form by filling in their signature as well as the appropriate date of the custody transfer.

During transport by a commercial carrier, the air-bill serves as the associated chain-of-custody. Once at the laboratory, the sample receipt coordinator opens the ice chests and signs and dates the chain-of-custody form. The laboratory personnel are then responsible for the care and custody of samples. The laboratory tracks sample custody through their facility using a separate sample tracking form.

A sample is considered to be in one's custody if:

- The sample is in the sampler's physical possession;
- The sample has been in the sampler's physical possession and is within sight of the sampler;
- The sample is in a designated, secure area; and/or
- The sample has been in the sampler's physical possession and is locked up.

4.3.6.3 Sample Packaging and Delivery

The BWQP Staff deliver the samples as soon as possible to the chosen certified laboratory.

4.3.7 Laboratory Analytical Methods

Analyses are performed following either EPA-approved methods or methods from Standard Methods for the Examination of Water and Wastewater, 20th Edition, as summarized in [Table 2](#).

The certified laboratory summarizes the data and associated QC results in a data report, and provides this report to the WQSAM Supervisor/QA Officer or designated staff. The WQSAM Supervisor/QA Officer reviews the data report and associated QC results to make decisions on data quality and usability in addressing the program objectives.

5.0 Instrument/Equipment Testing, Inspection and Maintenance

5.1 Field Measurement Instruments/Equipment

All field equipment is inspected and maintained as necessary prior to each sampling trip. Any deficiencies in equipment is noted in the instrument/equipment logbook and reported immediately to the appropriate person who will recheck the equipment and arrange for repair by the manufacturer or replacement. BWQP staff do not use equipment if the working condition of the equipment is in doubt. Complete procedures for operating and maintaining equipment used for collecting environmental measurements are contained in the manufacturer's instruction manual for each instrument.

5.2 Laboratory Analysis Instruments/Equipment (Off-Site)

Inspection and maintenance of laboratory equipment is the responsibility of the certified laboratory and is described in the laboratory's QA Management Plan (see [Appendix C](#)).

5.3 Instrument/Equipment Calibration and Frequency

5.3.1 Field Measurement Instrument/Equipment

Calibration of field instruments/equipment is performed according to the manufacturer's instruction manual for each instrument. Calibration information is recorded on standardized BWQP field sheets. The criteria for calibration (frequency, acceptance criteria, and corrective actions associated with exceeding the acceptance criteria) are provided in BWQP's SOPs (see [Appendix A-1](#)).

5.3.2 Laboratory Analysis Instruments/Equipment

Laboratory instruments are calibrated according to the appropriate analytical methods. Acceptance criteria for calibrations are found in the certified laboratory's calibrations procedures that are contained in the laboratory's QA Management Plan (see [Appendix C](#)).

6.0 Quality Objectives and Criteria for Measurement Data

Data quality objectives (DQOs) are quantitative statements that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors. All water quality generated by BWQP will be of known and documented quality as defined by pre-established DQOs.

6.1 Data Quality Objectives

The establishment of DQOs ensures that programmatic decisions related to water quality management are consistent with the mission, goals and objectives of the NDEP and BWQP; are based on proper application of policy and guidance; and encompass all available pertinent information of known and acceptable quality.

BWQP conducts surface water quality monitoring to support development of WQS and TMDLs, assess the health of waterbodies and determine if WQS are being met, and determine long term water quality trends. Detailed information regarding BWQP study objectives and the appropriate types to data needed to meet the objectives is provided in Sections [3](#) and [4](#).

6.2 Measurement Performance Criteria/Acceptance Criteria

Tolerable levels of potential analytical or decision errors must be determined as the quantitative measurements that estimate the true value or true concentration of a physical or chemical property always involve some level of uncertainty. This uncertainty results from 1) the variability of sample collection, 2) sample handling and the conditions associated with the specific samples, and 3) analytical variability.

Specific procedures used for sampling, chain-of-custody, instrument calibration, reporting, QC, audits, preventive maintenance, and corrective actions are provided in other sections of the QAPrP.

Data quality indicators including precision, accuracy/bias (as related to contamination), representativeness, and comparability are used to ensure water quality data is of known and acceptable quality.

Most water quality samples are analyzed by the Nevada State Public Health Laboratory. The laboratory's QA Management Plan (see [Appendix C](#)) and analytical SOPs have been reviewed and certified by the NDEP Laboratory Certification Program. Accordingly, associated laboratory QC (types & frequencies of QC samples and QC acceptance limits) have been determined to be adequate to meet the data quality

needs of BWQP's water quality management programs.

Other analytical Laboratories that BWQP uses include the USGS, the Desert Research Institute and the Truckee Meadows Water Reclamation Facility. The associated laboratory QC (types & frequencies of QC samples and QC acceptance limits) have been determined to be adequate to meet the data quality needs of BWQP's water quality management programs.

6.2.1 Precision

Precision is the measure by which multiple measurements of a singular property on a discrete body differ from each other. Precision is expressed as maximum allowable relative percent difference (RPD) between replicate recovery values. Precision will be assessed quantitatively with replicate samples and expressed as RPD by the following equation:

$$\text{RPD (\%)} = \frac{|\text{X}_1 - \text{X}_2|}{\frac{\text{X}_1 + \text{X}_2}{2}} \times 100$$

where,

RPD (%) = relative percent difference

X₁ = Original sample concentration

X₂ = Replicate sample concentration

|X₁ - X₂| = Absolute value of X₁ - X₂

If deemed necessary, field replicate samples will be collected and analyzed to assess precision associated with all steps of the program (from sample collection through analysis) (see [Section 7.2.1](#)).

6.2.2 Accuracy/Bias

Accuracy is the degree by which measurements compare to generally accepted, well defined standards. Accuracy/bias will be assessed as related to potential contamination sources and will be evaluated quantitatively.

Accuracy/bias as related to contamination involves both a field sampling and laboratory component. To assess all steps of the program (from sample collection through analysis), equipment blanks will be collected and analyzed (see [Section 7.2.2](#)).

6.2.3 Representativeness

Representativeness is the ability of a sample to characterize the environmental conditions at the time of collection. The procedures identified throughout this QAPrP optimize the potential for obtaining samples that reflect the true state of the environment within practical limits. Detailed sample collection and data measurement procedures are described in the respective SOPs included in the Appendices.

6.2.4 Comparability

Comparability, or the degree to which data from different studies or methodologies agree, is assessed qualitatively.

Comparability expresses the confidence with which one data set can be compared to another. It

describes the ability and appropriateness of making collective decisions with two or more data sets. Many variables may affect the descriptive value of the data. These include:

- Variables of interest in each data set
- Use of common units
- Similarity of methods and QA/QC
- Timeframes
- Season
- Weather
- Equipment

These variables are addressed by describing the program objectives and activities planned under the program.

The analytical methods to be used by the chosen certified laboratory will be EPA Methods or Standard Methods, both well-documented and published methods for surface water analyses. In addition, the analytical reports will be in consistent units of measure, such as milligrams per liter (mg/L) or micrograms per liter ($\mu\text{g/L}$). [Table 2](#) lists the analytical parameters to be sampled and the methods to be used for the analysis.

7.0 Quality Control Requirements

This section identifies the QC checks that are in place for the sample collection, field measurement, and laboratory analysis activities that will be used to assess the quality of the data generated from this program. To properly interpret water quality sampling data, it is necessary to have information about the sources of variability and possible contamination associated with sample collection, processing, and analysis.

7.1 Field Procedures Quality Control

The BWQP controls the quality of collected data by using standardized methods that are documented in BWQP's most current SOPs (see [Appendix A](#)). All BWQP Staff must be familiar with these protocols and collect data in accordance with the procedures as they are defined in the SOPs and in this QAPrP. Newly hired BWQP Staff will learn sampling procedures through training and apprenticeship with experienced BWQP personnel.

The quality of field activities is checked via periodic field audits. The field audits are performed periodically as resources allow. BWQP Staff to be audited will be randomly selected and the field audits will be performed by the WQSAM Supervisor/QA Officer or designated staff.

7.2 Field Sampling Quality Control

The collection of field QC samples is an important part of the continuing effort to improve the quality of the resultant data by assessing and possibly refining the collection, handling, and transportation techniques used by the BWQP. QC samples include field replicate samples and equipment blank samples. QC samples will be collected at a frequency of approximately 10% for samples collected for laboratory analysis.

7.2.1 Field Replicate Samples

Field replicate samples provide a measure of the variability introduced during sample processing and

analysis. BWQP will collect a minimum of one replicate sample during each sampling event.

Replicate samples consist of two or more samples collected or processed so that the samples are considered to be essentially identical in composition, and are prepared by dividing a single volume of water into multiple samples. Replicate samples are preserved, packaged, and sealed in the same manner described for the surface water samples. A separate sample number and station number is assigned to each field replicate sample. Field replicate samples are submitted blind to the laboratory for analysis (i.e., not identified as field replicates).

Field replicate samples will be collected at random locations for each sampling event. If criteria are exceeded, field sampling and handling procedures will be evaluated, and problems corrected through greater attention to detail, additional training, revised sampling techniques, or other appropriate means to correct the problems.

7.2.2 Equipment Blanks

The BWQP may collect equipment blanks as needed. Equipment blanks are prepared in the field and used to demonstrate that: (1) equipment has been adequately cleaned to remove contamination introduced by samples obtained at previous sites, (2) sample collection and processing have not resulted in contamination, and (3) sample handling and transport have not introduced contamination. In addition, because the equipment blank is treated like an environmental sample at the laboratory, potential contamination introduced during laboratory handling and analysis will be evaluated.

Equipment blanks are collected by running analyte-free water through the sample collection equipment after decontamination and before sample collection. The equipment blank is then collected in the appropriate sample container with the proper preservative, identical to the regular samples. Equipment blanks are preserved, packaged, and sealed in the same manner described for the surface water samples. A separate sample number and station number are assigned to each equipment blank. Equipment blanks are submitted blind to the laboratory for analysis.

If target analytes are found in equipment blanks, sampling and handling procedures will be reevaluated and corrective actions taken. These may consist of, but are not limited to, obtaining sampling containers from new sources, additional training of personnel, discussions with the laboratory, invalidation of results, greater attention to detail during the next sampling event, or other appropriate procedures.

7.3 Laboratory Analyses Quality Control (Off-Site)

Laboratory QC is the responsibility of the personnel and QA/QC department of laboratories used by the BWQP for water quality analyses. Most water quality samples are analyzed by the Nevada State Public Health Laboratory. The laboratory's QA Management Plan and analytical SOPs have been reviewed and certified by the NDEP Laboratory Certification Program. Accordingly, associated laboratory QC (types & frequencies of QC samples and QC acceptance limits) have been determined to be adequate to meet the data quality needs of BWQP's water quality management programs (see [Appendix C](#)).

8.0 Inspection and Acceptance of Supplies and Consumables

8.1 Field Sampling Supplies and Consumables

Containers and preservatives for bacteria and metals samples are provided by a laboratory certified by the

State of Nevada. Containers are inspected for breakage and proper sealing of caps. Containers and preservatives that are not provided by a certified laboratory will be approved by a certified laboratory.⁴ All bottles are stored out of direct sunlight. Other equipment such as sample coolers and safety equipment will be acquired by the BWQP. Materials/supplies necessary for equipment decontamination will also be purchased by the BWQP. Any equipment deemed to be in unacceptable condition will be repaired or replaced.

8.2 Field Measurement Supplies and Consumables

Field measurement supplies, such as calibration solutions, are acquired from standard sources, such as the instrument manufacturer or reputable suppliers. Chemical supplies will be American Chemical Society reagent grade or higher. The expiration date on standards and reagents is checked prior to use. Expired solutions are properly discarded and replaced.

8.3 Laboratory Analyses (Off-Site) Supplies and Consumables

Supplies and consumables required by the chosen certified laboratory are the responsibility of the QA/QC department of the laboratory.

9.0 Field Assessment and Oversight

This section describes how field activities are checked to ensure that they are completed correctly and according to procedures outlined in this QAPrP. It is important to assess the program's activities to ensure that this QAPrP is being implemented as planned. This helps to ensure that everything is on track and serves to minimize learning about critical deviations when it may be too late to remedy the situation.

9.1 Readiness Reviews

Sampling personnel are properly trained by qualified personnel before conducting monitoring activities. The BWQP Staff will review all field equipment, instruments, containers, and paperwork to ensure that all is in readiness prior to the first day of each sampling event. Any problems that are noted are corrected before the sampling team departs the BWQP's facilities.

9.2 Field Audits

The WQSAM Supervisor/QA Officer or designated staff accompany each field personnel at least once per year to assess the sample collection methodologies, field measurement procedures, and record-keeping to ensure activities are being conducted as planned (and as documented in this QAPrP). Any deviations that are noted will be corrected immediately to ensure all subsequent samples and field measurements collected are valid. (Note: If the deviations are associated with technical changes and/or improvements made to the procedures, the WQSAM Supervisor/QA Officer or designated staff verifies that the changes have been documented by the BWQP Staff on the field sheets and addressed in an amendment to this QAPrP.) The WQSAM Supervisor/QA Officer or designated staff may stop any sampling activity that could potentially compromise data quality.

The WQSAM Supervisor/QA Officer or designated staff will document any noted issues or concerns and discuss these items informally and openly with the BWQP Staff while on site. Once back in the office, the WQSAM Supervisor/QA Officer or designated staff will formalize the audit findings in a Field Audit

⁴ The containers and preservatives for routine parameters are purchased from an outside vendor.

Report which is submitted to the BWQP Bureau Chief and the BWQP Staff.

9.3 Post Sampling Event Review

Following each sampling event, BWQP Staff will complete a review of the field activities. This review of field sampling and field measurement documentation helps ensure that all information is complete and any deviations from planned methodologies are documented. This review is conducted in the office, not in the field. The results of this review, as well as comments associated with potential impacts on field samples and field measurement integrity may be used to prepare a report for the sampling event. This report will be used as a guide to identify areas requiring improvement prior to the next sampling event.

10.0 Laboratory Assessment and Oversight

The certified laboratory is responsible for its own internal data review and verification prior to submitting the associated data results package to the WQSAM Supervisor/QA Officer or designated staff. Most water quality samples are analyzed by the Nevada State Public Health Laboratory. The laboratory's QA Management Plan details data review procedures (including checking calculations, reviewing for transcription errors, ensuring the data package is complete, etc.) (see [Appendix C](#)).

If any of the QC criteria and/or the program requirements are exceeded, the associated data is qualified as estimated and flagged. If grossly exceeded, the associated data is rejected and the need for resampling will be considered.

11.0 Data Management

All data collected by the BWQP is maintained in binders and electronic databases. The hard copy and electronic results are compared to ensure that no errors occur in either format. If discrepancies are noted, the laboratory will be contacted to resolve the issues.

12.0 Data Usability

Water quality data is collected to support numerous BWQP programs including development of WQS and TMDLs and assessment of water quality conditions. [Table 4](#) shows the Elements of Laboratory Results that are included in the laboratory analysis documents. Prior to utilizing data to make program decisions, the quality of the data is reviewed and evaluated to determine whether the data satisfy the program's objectives. This process involves technical evaluation of the off-site laboratory data, as well as review of the information collected during the field sampling and field measurement activities. The latter more qualitative review provides a clear understanding of the overall usability of the data and potential limitations on their use.

Once all the data from the field and laboratory have been evaluated, the WQSAM Supervisor/QA Officer or designated staff makes an overall assessment concerning the final usability of the data (and any limitations on its use) in meeting the program's needs. The initial steps of this assessment include, but are not necessarily limited to:

- Discussions with the BWQP Staff;
- Review of deviations from this QAPrP or associated SOPs to determine whether these deviations may have impacted data quality (and determining whether any impacts are widespread or single

incidents, related to a few random samples or a batch of samples, and/or affecting a single or multiple analyses);

- Evaluation of the field and laboratory results and QC information;
- Review of any other external information which might influence the results, such as out-of-state activities upstream, meteorological conditions (e.g., storm events proceeding sampling that might contribute to high turbidity readings), and data from other sources;
- Examination of any assumptions made when the program was planned, if those assumptions were met, and, if not, how the program's conclusions are affected; and
- Evaluating the data to determine if it is adequate for the objectives of the planned program.

After all this information has been reviewed, the WQSAM Supervisor/QA Officer or designated staff will incorporate his or her perspective on the critical nature of any problems noted and, ultimately, identify data usability and/or limitations in supporting program objectives and decision making.

In addition, the WQSAM Supervisor/QA Officer or designated staff will assess the effectiveness of the monitoring program and data collection at the end of each calendar year. Sampling locations, frequency, list of analytical parameters, field measurement protocols, choice of the analytical laboratory, etc. will be modified as needed to reflect the changing needs and program objectives of the BWQP. This QAPrP will be revised and/or amended accordingly.

Table 4: Elements of Laboratory Results

Laboratory Field	Explanation
Accession No	Lab ID number
Client	Nevada Division of Environmental Protection
Client Address	901 S. Stewart Street
Client City	Carson City
Client State	Nevada
Client Zip	98701
Date Time Collected	Date and Time Sample Collected
Sampled By	Sampler(s) Name
Date Time Received	Date and Time received by Laboratory
Report Date Time	Time and Date of Report
Analysis Type	What environmental Act is this analysis done under: CWA or SDWA or RCRA. BWQP's analyses are always CWA.
General Location	BWQP Control Point name
Source Address	Station ID
Sample City	General Location (City, Basin)
Sample State	Nevada
Sample County	County
Report To Contact	NDEP Contact
Report To	Nevada Division of Environmental Protection
Report Address	901 S. Stewart Street
Report City	Carson City
Report State	Nevada
Report Zip	98701
Comments	Comment on sample, e.g., out of holding time
Test	Parameter
Test Method	Analysis Method
Sign	Qualifier (<, >, etc.)
Result	Value if detected, reporting limit if non-detect, quantification high limit if greater than able to read
Units	Generally mg/L or µg/L
Sample Reporting Limit	Reporting limit
Analysis Date	Date Sample analyzed
Analyst	Chemist Name

13.0 Documents and Records

13.1 Laboratory Documentation and Records

Most water quality samples are analyzed by the Nevada State Public Health Laboratory. The laboratory's QA Management Plan details documentation and record keeping requirements (see [Appendix C](#)).

13.2 Technical Reviews and Evaluations

As part of the QA efforts for the program, on-going technical reviews will be conducted and documented. These reviews are associated with both field activities and the data generated by the off-site laboratory.

13.3 Quarterly Reports

Once each quarter, the WQSAM Supervisor will prepare and submit a report on that quarter's sampling activities. This report will be submitted to the BWQP Bureau Chief for approval. After approval, the report will be submitted to the EPA Grants Project Officer.

REFERENCES

- Environmental Protection Agency, 1991. *Office of Emergency and Remedial Response (OERR) Directive 9345.302*, May 1991.
- Environmental Protection Agency, 2000. *EPA Guidance for the Data Quality Objectives Process*, EPA QA/G-4, EPA/600/R-96/005, October 2000.
- Environmental Protection Agency, 1991. *EPA Management of Investigation-Derived Wastes During Site Inspections*, EPA Office of Emergency and Remedial Response (OERR) Directive 9345.3-02, May 1991.
- Environmental Protection Agency, 2001. *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, EPA/240/B-01/003, March 2001.
- Environmental Protection Agency, 2002. *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/240/R-02/009, December 2002.
- Environmental Protection Agency, 2002. *EPA Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan*, QA/G-5sS, EPA/240/R-02/005, December 2002.
- Environmental Protection Agency, 2002. *Guidance on Environmental Data Verification and Data Validation*, EPA QA/G-8, EPA/240/R-02/004, November 2002.
- Environmental Protection Agency, 2005. *Quality Assurance Project Plan for Monitoring of Surface Water –Eagle Valley Reservation*, September 2005.

APPENDICES

APPENDIX A: FIELD STANDARD OPERATING PROCEDURES

[Appendix A-1: Standard Operating Procedures for Field Meter Calibration and Maintenance](#)

[Appendix A-2: Standard Operating Procedures for Collecting Stream Samples and Field Measurements](#)

[Appendix A-3: Standard Operating Procedures for Collecting Lake/Reservoir Samples and Field Measurements](#)

[Appendix A-4: Standard Operating Procedures for Transporting and Operating Boats](#)

[Appendix A-5: Standard Operating Procedures for the Deployment of Temperature Loggers](#)

[Appendix A-6: Standard Operating Procedures for Unattended Deployment of Data Sondes](#)

[Appendix A-7: Standard Operating Procedures for Streamflow Measurements of Wadeable Streams](#)

[Appendix A-8: Standard Operating Procedures for Transporting and Operating All-Terrain Vehicles](#)

[Appendix A-9: Standard Operating Procedures for Decontamination of Field Equipment to Limit the Spread of Invasive Species](#)

Appendix A-1: Standard Operating Procedures for Field Meter Calibration and Maintenance

**Standard Operating Procedures
for
Field Meter Calibration and Maintenance**

**Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada**

January 2014

APPROVALS:

**Kathy Sertic
NDEP BWQP Chief:**

Kathy Sertic

Date: *01/09/14*

**John Heggeness
NDEP BQWP Quality Assurance Officer:**

John D. Heggeness

Date: *1/9/14*

Field Meter Calibration and Maintenance Summaries

BECKMAN COULTER Φ 255 pH METER			
<p>MAINTENANCE AND STORAGE: The Beckman Coulter Φ 255 pH meter is maintained and stored per manufacturer's instructions.</p>			
<p>CALIBRATION PROCEDURES: The Beckman Coulter Φ 255 pH meter is calibrated per manufacturer's instructions.</p>			
pH			
Calibration Activity	Frequency	Acceptance Criteria	Corrective Action
Two-point calibration bracketing expected field sample range (using 7.0 and 10.01 pH buffer).	Beginning of each day.	Two-point calibration done electronically. Calibration slope must be between 90 and 110%.	Recalibrate.
Analysis check of 7.0 pH buffer.	After initial calibration	Within ± 0.1 pH units of true value (7.0)	Recalibrate.
Analysis check of 7.0 and 10.01 pH buffers.	End of each day.	Within ± 0.2 pH units of true value at both end points (7.0 and 10.01).	Qualify data.
Side by side comparison of the Beckman Coulter Φ 255 pH meters in a laboratory setting.	Quarterly.	± 0.2 pH units.	Recalibrate. Return inaccurate meter to manufacturer or official repair company for refurbishment.

HYDROLAB DATA SONDES

MAINTENANCE AND STORAGE:

The HYDROLAB DS5 DATA SONDES are maintained and stored per manufacturer's instructions.

CALIBRATION PROCEDURES:

The HYDROLAB DS5 DATA SONDES are calibrated per manufacturer's instructions.

DISSOLVED OXYGEN

Calibration Activity	Frequency	Acceptance Criteria	Corrective Action
One-point calibration with saturated air.	Beginning of each day.	One-point calibration done electronically.	Recalibrate. Return inaccurate probe to manufacturer or official repair company for refurbishment.
Side by side comparison of the Hydrolab Data Sondes in a laboratory setting.	Quarterly.	± 0.3 mg/L.	Recalibrate. Return inaccurate probe to manufacturer or official repair company for refurbishment.

pH

Calibration Activity	Frequency	Acceptance Criteria	Corrective Action
Two-point calibration bracketing expected field sample range (using 7.0 and 10.01 pH buffer).	Beginning of each day.	Two-point calibration done electronically.	Recalibrate. Return inaccurate probe to manufacturer or official repair company for refurbishment.
Analysis check of 7.0 pH buffer.	After initial calibration	Within ± 0.1 pH units of true value (7.0)	Recalibrate.
Analysis check of 7.0 and 10.01 pH buffers.	End of each day.	Within ± 0.2 pH units of true value at both end points (7.0 and 10.01).	Qualify data.
Side by side comparison of the Hydrolab Data Sondes in a laboratory setting.	Quarterly.	± 0.2 pH units.	Recalibrate. Return inaccurate probe to manufacturer or official repair company for refurbishment.

HYDROLAB DATA SONDES continued

SPECIFIC CONDUCTANCE

Calibration Activity	Frequency	Acceptance Criteria	Corrective Action
Two-point calibration. Calibrate the sensor to zero and then to the slope buffer.	Beginning of each day.	Two-point calibration done electronically.	Recalibrate. Return inaccurate probe to manufacturer or official repair company for refurbishment.
Analysis check of zero and slope buffer.	After initial calibration	Within $\pm 5 \mu\text{S/cm}$ of true value at zero and slope buffer.	Recalibrate.
Analysis check of zero and slope buffer.	End of each day.	Within $\pm 5 \mu\text{S/cm}$ of true value at zero and slope buffer.	Qualify data.
Side by side comparison of the Hydrolab Data Sondes in a laboratory setting.	Quarterly.	$\pm 5 \mu\text{S/cm}$.	Recalibrate. Return inaccurate probe to manufacturer or official repair company for refurbishment.

TEMPERATURE

Calibration Activity	Frequency	Acceptance Criteria	Corrective Action
Check of endpoints of desired temperature range versus a National Institute of Standards and Technology (NIST) certified thermometer.	Quarterly.	$\pm 0.3^\circ \text{C}$ of true value at both endpoints (i.e., manufacturer's listed accuracy for the sensor).	Return inaccurate probe to manufacturer or official repair company for refurbishment.

YSI 550A DISSOLVED OXYGEN METER

MAINTENANCE AND STORAGE:

The YSI 550A DO meter is maintained and stored per manufacturer's instructions.

CALIBRATION PROCEDURES:

The YSI 550A DO meter is calibrated per manufacturer's instructions.

DISSOLVED OXYGEN

Calibration Activity	Frequency	Acceptance Criteria	Corrective Action
One-point calibration with saturated air.	Beginning of each day.	One-point calibration done electronically. Record elevation and Calibration Value.	Recalibrate. Change membrane then recalibrate. Return inaccurate meter to YSI-approved repair company.
Calibration check.	At each site.	Within $\pm 2\%$ of original Calibration Value (read in Percent Saturation mode).	Recalibrate.
Side by side comparison of the YSI 550A DO meters in a laboratory setting.	Quarterly.	± 0.3 mg/L.	Recalibrate. Change membrane then recalibrate. Return inaccurate meter to YSI-approved repair shop.

TEMPERATURE

Calibration Activity	Frequency	Acceptance Criteria	Corrective Action
Check of endpoints of desired temperature range versus a NIST certified thermometer.	Quarterly.	$\pm 0.3^{\circ}$ C of true value at both endpoints (i.e., manufacturer's listed accuracy for the sensor).	Return inaccurate meter to YSI-approved repair shop.

TEMPERATURE LOGGERS

MAINTENANCE AND STORAGE:

The TEMPERATURE LOGGERS are maintained and stored per manufacturer's instructions.

CALIBRATION PROCEDURES:

The TEMPERATURE LOGGERS are calibrated per manufacturer's instructions.

TEMPERATURE

Calibration Activity	Frequency	Acceptance Criteria	Corrective Action
Check of endpoints of desired temperature range versus a NIST certified thermometer.	Pre- and post-deployment	$\pm 0.5^{\circ}$ C of a NIST certified thermometer at both endpoints (i.e., manufacturer's listed accuracy for the sensor).	Return inaccurate temperature loggers to manufacturer or official repair company for refurbishment.

Appendix A-2: Standard Operating Procedures for Collecting Stream Samples and Field Measurements

**Standard Operating Procedures
for
Collecting Stream Samples and Field Measurements**

**Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada**

January 2014

APPROVALS:

Kathy Sertic
NDEP BWQP Chief: *Kathy Sertic* **Date:** *01/09/14*

John Heggeness
NDEP BQWP Quality Assurance Officer: *John O. Heggeness* **Date:** *1/9/14*

Stream Sampling Equipment and Supply Checklist

Bottles	
<p><u>Bacteria</u></p> <p><input type="checkbox"/> ___ 120 mL Bacteria bottle(s)⁵, 1 per sample site</p> <p><u>Routine Parameters</u></p> <p><input type="checkbox"/> ___ Blue lid ½ gal. bottle(s), 1 per sample</p> <p><input type="checkbox"/> ___ Red lid ½ gal. bottle(s), 1 per sample</p> <p><input type="checkbox"/> ___ 5.0 mL ampoule(s) of 96% H₂SO₄, 1 per red lid bottle⁶</p> <p><input type="checkbox"/> Container for empty acid ampoules</p>	<p><u>Metals</u></p> <p><input type="checkbox"/> ___ Trace metals 500 mL bottles, 2 per sample⁷</p> <p><input type="checkbox"/> ___ Filter(s), 1 per sample</p> <p><input type="checkbox"/> Pump to filter</p> <p><input type="checkbox"/> Filter transfer vessel</p>
Equipment	
<p><input type="checkbox"/> Thermoelectric cooler</p> <p><input type="checkbox"/> ___ Ice chest(s)/Ice</p> <p><input type="checkbox"/> Maps</p> <p><input type="checkbox"/> GPS</p> <p><input type="checkbox"/> Beckman Coulter Φ255 pH Meter</p> <p><input type="checkbox"/> 2 – 250 mL pH Cups</p> <p><input type="checkbox"/> pH buffers (7 & 10.01)</p> <p><input type="checkbox"/> YSI 550A DO Meter</p>	<p><input type="checkbox"/> Deionized water (DIW) squirt bottle</p> <p><input type="checkbox"/> Churn splitter</p> <p><input type="checkbox"/> Dipper</p> <p><input type="checkbox"/> 50 foot rope</p> <p><input type="checkbox"/> Waders</p> <p><input type="checkbox"/> Bag of nitrile gloves</p> <p><input type="checkbox"/> Extra batteries</p> <p><input type="checkbox"/> Satellite phone</p>
Paperwork	
<p><input type="checkbox"/> Clipboard</p> <p><input type="checkbox"/> Chain of custody</p> <p><input type="checkbox"/> ___ Bacteria slip(s), 1 per sample</p>	<p><input type="checkbox"/> ___ Field sheet(s), 1 per 3 samples</p> <p><input type="checkbox"/> Pens</p> <p><input type="checkbox"/> Sharpies</p>
Decontamination Equipment	
<p><input type="checkbox"/> Eye Protection</p> <p><input type="checkbox"/> Portable eyewash bottle</p> <p><input type="checkbox"/> Stiff-bristled brush</p> <p><input type="checkbox"/> Paper towels</p>	<p><input type="checkbox"/> One pump sprayer containing 5% bleach solution</p> <p><input type="checkbox"/> One pump sprayer containing clean rinse water</p>

⁵ 120 mL Bacteria bottle is pre-prepared with sodium thiosulfate. Place bacteria bottles in thermoelectric cooler.

⁶ The 5.0 mL of H₂SO₄ is added to the bottle after it is filled with the water sample.

⁷ Bottles contain 15% HNO₃ before addition of the water sample, 0.15% HNO₃ after. 1 sample is filtered.

Standard Operating Procedures for Collecting Stream Samples and Field Measurements

1 PURPOSE AND APPLICABILITY

This document describes the procedure for: (1) collection and transportation of stream water quality samples and (2) collection of field measurements.

2 FIELD EQUIPMENT PREPARATION

Prior to going to the field, make sure that the Beckman Coulter Φ 255 pH Meter (pH meter) and the YSI 550A Dissolved Oxygen Meter (DO meter) are working properly and the batteries have sufficient charge. **If batteries are needed for these instruments, do not mix depleted and fresh batteries together or serious injury and instrument damage may occur.**

3 DATA AND SAMPLE COLLECTION

If possible, sites should be sampled in the order of least to greatest potential for equipment fouling or contamination. If possible, sites should be sampled in the order of least to greatest potential for infestation of invasive species. If it is not possible to sample in the order of least to greatest potential for infestation of invasive species then follow the instructions in the SOP for Decontamination of Field Equipment to Limit the Spread of Invasive Species (Appendix A-9).

In order to collect stream samples, the stream must have sufficient flow. Best professional judgment is used to determine if conditions are acceptable for sample collection.

3.1 AT THE BEGINNING OF THE SAMPLING DAY

Turn on the DO meter at least 15 minutes before use to give the meter time to stabilize before calibration. Leave the DO probe in the calibration/storage chamber.

Calibrate the DO meter and record the DO Meter #, Date, Time, Elevation (feet), and Calibration Value (%) on the Field Sheet. See Appendix A-1 for calibration instructions.

Calibrate the pH meter and record the pH Meter #, Date, Time, E_0 (mV), Slope (%), and pH value of the buffer analysis check on the Field Sheet prior to collecting the water sample. See Appendix A-1 for calibration instructions.

3.2 PRIOR TO COLLECTING THE FIELD MEASUREMENTS AND WATER SAMPLE

Fill out the Date, Time, Collected by, Basin, Control Point, Station ID, Weather, and Air Temp fields on the NDEP Stream Sampling Field Sheet (Field Sheet).

If this is not the first sample site of the day, confirm that the DO meter is reading within $\pm 2\%$ of the Calibration Value from the most recent calibration. If the DO meter is not reading within $\pm 2\%$ of the Calibration Value from the most recent calibration then recalibrate the DO meter and record the Time of Calibration, Elevation (feet), and Calibration Value (%) in the Comments section of the Field Sheet.

Properly label all the sample containers.

3.3 TAKING DO/WATER TEMPERATURE MEASUREMENTS AND COLLECTING THE WATER SAMPLE

If possible, DO/water temperature measurements and water samples are to be collected from a representative portion of the stream, typically the centroid of flow.

Remove DO probe from calibration/storage chamber. Gently lower the DO probe into the stream. Make sure that the DO probe is not in an area where bottom deposits cover the DO probe.

Lower the collection dipper into the stream and then discard the water downstream of where you will collect the water sample. Repeat.

After the DO and water temperature readings have stabilized, record these measurements from the DO meter on the Field Sheet. Remove the DO probe from the water and place it in the calibration/storage chamber.

Open the top of the churn splitter. With the dipper, pour some water into the churn splitter to field rinse the churn splitter. Close the lid to the churn splitter and move the agitator up and down to rinse all inside parts of the churn splitter. Open the nozzle and let water run through the spigot. Once done rinsing the inside of the churn splitter, discard the water downstream of where you will collect the water sample. Repeat.

Open the top of the churn splitter once again. Use the collection dipper to fill the churn splitter with enough water to fill the sample bottles. Close the lid.

3.4 TAKING THE pH MEASUREMENT

Don clean nitrile gloves.

Before filling the pH cup, gently pump the handle of the churn splitter ten times at an even rhythm making sure the disk hits the bottom of the container and the stroke length should be as long as possible without breaking the water surface. The churning must be continuous during the withdrawals.

While filling the pH cup keep pumping the churn splitter at an even rhythm, approximately 1 stroke every 3 seconds.

Rinse the pH cup with water from the churn splitter. Rinse the churn splitter spigot by pouring the water from the pH cup over it. Repeat. Fill the pH cup with water from the churn splitter. Put the pH meter probe into the water in the pH cup and place in the shade. Hit the "Read" button on the pH meter. Record the pH value on the Field Sheet. Turn off the pH meter. Rinse the pH meter probe with DIW.

3.5 FILLING THE SAMPLE BOTTLES

Clean nitrile gloves remain on hands while filling all sample bottles.

Sample bottles should remain closed until bottle is to be filled. Remove lid from the sample bottle to be filled.

While filling the sample bottles keep pumping the churn splitter at an even rhythm, approximately 1 stroke every 3 seconds.

Bacteria:

Fill the 120 mL bacteria bottle to the shoulder/neck of the bottle. Make sure not to overfill because the bottle is prepared with sodium thiosulfate. Cap the bottle immediately after filling it. Upend the bottle several times to mix the sodium thiosulfate in the water sample. Immediately place the bacteria sample in the thermoelectric cooler. *Do not field rinse the bacteria bottle as it contains sodium thiosulfate in it already.*

Dissolved Metals:

If taking a dissolved metals sample, drain approximately 10-15 mL of the water sample from the churn splitter into the filter transfer vessel. Screw the filter transfer vessel cap onto the filter transfer bottle. Rinse the filter transfer vessel and cap and discard the rinse water. Repeat. Fill the filter transfer vessel with enough water to fill the 500 mL dissolved metals bottle. Attach the pump and the filter, making sure not to touch the inlet and the outlet of the filter. Slowly pump the water from the filter transfer vessel through the filter into the 500 mL dissolved metals bottle to the shoulder/neck of the bottle. Make sure not to overfill because the bottle is prepared with nitric acid. Cap the bottle immediately after filling it. Upend the bottle several times to mix the nitric acid in the water sample. Immediately place the dissolved metals sample in an ice chest and cover with wet ice. *Do not field rinse the dissolved metals bottle as it contains nitric acid in it already.*

Total Metals:

If taking a metals sample, fill the 500 mL total metals bottle from the churn splitter to the shoulder/neck of the bottle. Make sure not to overfill because the bottle is prepared with nitric acid. Cap the bottle immediately after filling it. Upend the bottle several times to mix the nitric acid in the water sample. Immediately place the total metals sample in an ice chest and cover with wet ice. *Do not field rinse the total metals bottle as it contains nitric acid in it already.*

Routine Parameters:

Drain approximately 10-15 mL of the water sample from the churn splitter into the 0.5 gallon routine parameters bottle with the blue cap. Place the cap on the bottle but do not seal it. Rinse the bottle and blue cap and discard the rinse water. Repeat. Then fill the bottle from the churn splitter to the shoulder/neck of the bottle. Seal the blue cap onto the bottle. Immediately place the blue cap bottle into an ice chest and cover with wet ice.

Drain approximately 10-15 mL of the water sample from the churn splitter into the 0.5 gallon general parameters bottle with the red cap. Place the cap on the bottle but do not seal it. Rinse the bottle and red cap and discard the rinse water. Repeat. Then fill the bottle from the churn splitter to the shoulder/neck of the bottle. After filling the bottle, add 5.0 mL of 96% sulfuric acid and seal the red cap on the bottle. Upend the bottle with the red cap several times to mix the sulfuric acid in the water sample. Immediately place the red cap bottle into an ice chest and cover with wet ice. Discard the empty acid ampoule in the ampoule container.

3.6 FIELD SHEET COMPLETION/REVIEW

Prior to leaving the sampling site, write any comments on the Field Sheet and fill out the Narratives section (Settleable solids that form bottom or sludge deposits; Floating debris; Oil, grease, scum, and other floating materials; Odor; and Color, turbidity, or other conditions).

Review the Field Sheet to ensure completeness, and have the second field person (i.e. a person other than the one who filled out the form) check over the form before leaving the site.

3.7 DECONTAMINATION OF FIELD EQUIPMENT TO LIMIT THE SPREAD OF INVASIVE SPECIES

After sampling streams that are suspected or known to contain invasive species, clean and decontaminate all sampling equipment prior to the leaving the sampling site. For further information read the SOP for Decontamination of Field Equipment to Limit the Spread of Invasive Species (see Appendix A-9).

3.8 SAMPLE DELIVERY

Samples must remain under the samplers' control until the samples are delivered to the laboratory.

Attachments

NEVADA STATE HEALTH LABORATORY
CHAIN OF CUSTODY FORM FOR WATER CHEMISTRY ANALYSIS
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

University of Nevada School of Medicine
 1660 North Virginia Street, Reno, NV 89503-1738
 Phone: (775) 688-1335 Fax: (775) 688-1460

FOR COMPLIANCE

NOT FOR COMPLIANCE

OWNER INFORMATION				REPORT TO INFORMATION		DELIVERED ON ICE		BILL TO INFORMATION		Routine Pollution	NDEP Trace Metals	NDEP Total Recoverable Metals	NDEP Dissolved Metals	COD	BOD	Other
Owner: Bureau of Water Quality Planning Address: 901 S. Stewart St. City, St, Zip: Carson City NV 89701 Phone: 687-9444 FAX: 687-5856				Owner: BWQP ATTN: John Heggeness Address: 901 S. Stewart St. City, St, Zip: Carson City, NV. 89701 Phone: 687-9444 Fax: 687-5856		<input type="checkbox"/> Yes <input type="checkbox"/> No Initials (Lab) <input type="text"/> Shipped Samples: Temp Blank <input type="text"/> °C		Owner: BWQP Address: 901 S. Stewart St. City, St, Zip: Carson City, NV. 889701 Phone: 687-9444 Fax: 687-5856								
SOURCE OF WATER <input type="checkbox"/> Spring <input type="checkbox"/> Filter <input checked="" type="checkbox"/> Surface <input type="checkbox"/> Well <input type="checkbox"/> Depth (ft)				SAMPLE TYPE <input type="checkbox"/> SDWA <input checked="" type="checkbox"/> CWA <input type="checkbox"/> Other		REASON FOR ANALYSIS <input type="checkbox"/> Public Water Supply <input type="checkbox"/> Private Residence <input checked="" type="checkbox"/> Other <u>State Surface Water</u>		USE OF WATER <input type="checkbox"/> Domestic Drinking Water <input type="checkbox"/> Geothermal <input type="checkbox"/> Irrigation <input type="checkbox"/> Industrial or Mining <input checked="" type="checkbox"/> Other: <u>Various Uses</u>								
RIVER BASIN:																
Line Item	Date Collected	Time	Station ID	Control Point	State	County	Remarks									
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																

Collected By: _____ Sampler Signature: _____

FOR LAB USE ONLY:

How sample was delivered: _____ Courier _____ Drop Off _____ Fed Ex _____ UPS _____ U.S. Postal _____ Campus Mail _____

Delivered By _____ Date _____ Received By _____ Date _____

Sample is tested as received. Analytical results associated with this requisition and generated by NSHL are representative only of the sample submitted to this laboratory.

NOTE: This document will be destroyed at NSHL after 12 years, unless Client requests otherwise

Page ___ of ___

NDEP STREAM SAMPLING FIELD SHEET

pH Meter #:			DO Meter #:				
pH	<input type="radio"/>	Date	Time:	Buffers: 7.0 /	E _o : mV	Slope %	7.0 =
pH Post-	<input type="radio"/>	Date	Time:	7.0 =		10.01 =	
DO	<input type="radio"/>	Date	Time:	Elevation:	ft	Calibration	%

Date _____		Tim _____		Collected _____		Basi _____		
Control _____				Station ID: _____				
DO within ± 2% of Calibration		<input type="radio"/>	YES	<input type="radio"/>	Flo _____	cfs	Weathe _____	
Air _____	°F	Water _____	°C	DO _____	mg/L	pH: _____		
Comment _____								
Waters Contain Substances Attributable to Domestic or Industrial Waste or Other Controllable								
Settleable solids that form bottom or sludge		<input type="radio"/>	YES	<input type="radio"/>				_____
Floating debris:		<input type="radio"/>	YES	<input type="radio"/>				_____
Oil, grease, scum, and other floating		<input type="radio"/>	YES	<input type="radio"/>				_____
Odor:		<input type="radio"/>	YES	<input type="radio"/>				_____
Color, turbidity, or other conditions:		<input type="radio"/>	YES	<input type="radio"/>				_____

Date _____		Tim _____		Collected _____		Basi _____		
Control _____				Station ID: _____				
DO within ± 2% of Calibration		<input type="radio"/>	YES	<input type="radio"/>	Flo _____	cfs	Weathe _____	
Air _____	°F	Water _____	°C	DO _____	mg/L	pH: _____		
Comment _____								
Waters Contain Substances Attributable to Domestic or Industrial Waste or Other Controllable								
Settleable solids that form bottom or sludge		<input type="radio"/>	YES	<input type="radio"/>				_____
Floating debris:		<input type="radio"/>	YES	<input type="radio"/>				_____
Oil, grease, scum, and other floating		<input type="radio"/>	YES	<input type="radio"/>				_____
Odor:		<input type="radio"/>	YES	<input type="radio"/>				_____
Color, turbidity, or other conditions:		<input type="radio"/>	YES	<input type="radio"/>				_____

Date _____		Tim _____		Collected _____		Basi _____		
Control _____				Station ID: _____				
DO within ± 2% of Calibration		<input type="radio"/>	YES	<input type="radio"/>	Flo _____	cfs	Weathe _____	
Air _____	°F	Water _____	°C	DO _____	mg/L	pH: _____		
Comment _____								
Waters Contain Substances Attributable to Domestic or Industrial Waste or Other Controllable								
Settleable solids that form bottom or sludge		<input type="radio"/>	YES	<input type="radio"/>				_____
Floating debris:		<input type="radio"/>	YES	<input type="radio"/>				_____
Oil, grease, scum, and other floating		<input type="radio"/>	YES	<input type="radio"/>				_____
Odor:		<input type="radio"/>	YES	<input type="radio"/>				_____
Color, turbidity, or other conditions:		<input type="radio"/>	YES	<input type="radio"/>				_____

Appendix A-3: Standard Operating Procedures for Collecting Lake/Reservoir Samples and Field Measurements

**Standard Operating Procedures
for
Collecting Lake/Reservoir Samples and Field
Measurements**

**Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada**

January 2014

APPROVALS:

**Kathy Sertic
NDEP BWQP Chief:**

Kathy Sertic

Date: *01/09/14*

**John Heggeness
NDEP BQWP Quality Assurance Officer:**

John O. Heggeness

Date: *1/9/14*

Lake/Reservoir Sampling Equipment and Supply Checklist

Bottles	
<u>Bacteria</u>	
<input type="checkbox"/> ___ 120 mL Bacteria bottle(s) ⁸ , 1 per sample site	
<u>Routine Parameters</u>	
<input type="checkbox"/> ___ Blue lid ½ gal. bottle(s), 1 per sample	
<input type="checkbox"/> ___ Red lid ½ gal. bottle(s), 1 per sample	
<input type="checkbox"/> ___ 5.0 mL ampoule(s) of 96% H ₂ SO ₄ , 1 per red lid bottle ⁹	
<input type="checkbox"/> Container for empty acid ampoules	
<u>Metals</u>	
<input type="checkbox"/> ___ Trace metals 500 mL bottles, 2 per sample ¹⁰	
<input type="checkbox"/> ___ Filter(s), 1 per sample	
<input type="checkbox"/> Pump to filter	
<input type="checkbox"/> Filter transfer vessel	
<u>Chlorophyll-a</u>	
<input type="checkbox"/> ___ 500 mL opaque HDPE bottle(s) with tape, 1 per sample	
<input type="checkbox"/> ___ Chlorophyll-a filter(s), 1 per sample	
<input type="checkbox"/> ___ Small bottle(s) for Chlorophyll-a filter, 1 per sample	
<input type="checkbox"/> Chlorophyll-a filter press	
<input type="checkbox"/> Tweezers	
<input type="checkbox"/> Aluminum foil	
<input type="checkbox"/> Freezer	
Equipment	
<input type="checkbox"/> Personal Floatation Devices	<input type="checkbox"/> ___ Ice Chest(s)/Ice
<input type="checkbox"/> Large churn splitter	<input type="checkbox"/> Deionized water (DIW) squirt bottle
<input type="checkbox"/> Secchi disk/marked rope	<input type="checkbox"/> Extra batteries
<input type="checkbox"/> Hydrolab DS5 data sonde, cable, rope, and weight	<input type="checkbox"/> GPS
<input type="checkbox"/> Surveyor or Laptop/connection cable	<input type="checkbox"/> Bag of nitrile gloves
<input type="checkbox"/> Discrete Depth Sampler (Kemmerer)	<input type="checkbox"/> Satellite phone
	<input type="checkbox"/> Decontamination Equipment
Paperwork	
<input type="checkbox"/> Chain of custody	<input type="checkbox"/> ___ Bacteria slip(s), 1 per sample
<input type="checkbox"/> ___ Lake profile sheet, 1 per station	<input type="checkbox"/> Clipboard/Pens/Sharpies

⁸ 120 mL Bacteria bottle is pre-prepared with sodium thiosulfate.

⁹ The 5.0 mL of H₂SO₄ is added to the bottle after it is filled with the water sample.

¹⁰ Bottles contain 15% HNO₃ before addition of the water sample, 0.15% HNO₃ after. 1 sample is filtered.

Standard Operating Procedures for Collecting Lake/Reservoir Samples and Field Measurements

1 PURPOSE AND APPLICABILITY

This document describes the procedure for: (1) calibration and operation of the Hydrolab DS5 data sonde for the collection of depth, dissolved oxygen (DO), temperature, pH, and specific conductance (SpC) data in lakes and reservoirs, (2) operation of the Secchi disc to measure water clarity, (3) collection and transportation of water samples, and (4) preparation of Chlorophyll-*a* samples.

2 HYDROLAB DS5 DATA SONDE PREPARATION

The following equipment is used for calibration of the Hydrolab DS5 data sonde (Hydrolab):

- Hydrolab
- Surveyor handheld datalogger (Surveyor) or laptop computer loaded with Hydras 3 LT software.
- Interface cable
- Interface cable to USB adapter (if using laptop computer)
- Calibration standards (pH and conductivity)
- DIW squirt bottle

Prior to going to the field, make sure that the Hydrolab and Surveyor (or laptop computer) are working properly and the batteries have sufficient charge. To check the Hydrolab and Surveyor battery levels, connect the two instruments and turn on the Surveyor. The display has been initially set up to display the following:

Surveyor Data

D/T	Date/Time
IBV	Internal battery voltage
BP	Barometric pressure

Hydrolab Data

Temp	Temperature in Celsius
pH	pH
LDO	DO in milligrams per liter (mg/L)
LDO%	DO in percent saturation
IBa	Internal battery voltage
SpC	Specific conductance
D/T	Date/Time

If the Surveyor battery voltage (IBV) is less than 6.5 volts, it is recommended that the battery pack be recharged. **If batteries are needed for the Hydrolab, do not mix depleted and fresh batteries together or serious injury and instrument damage may occur.**

If you wish to change the parameters on the Surveyor display, do the following

Select Setup/Cal
Select Setup

Select Display: Tabular
Remove or add any new parameters as desired

Before heading out into the field, calibrate the DO, pH, and SpC probes per manufacturer's recommendations. Calibration can be performed with either the Surveyor or a laptop computer loaded with Hydras 3 LT software attached to the Hydrolab DS5 Data Sonde. Fill out the Instrument, Calibration Date, and Calibration Time fields on the attached Lake Profile field sheet (Profile Sheet).

3 BOAT LAUNCH AND OPERATION

For further information read the SOP for Transporting and Operating Boats (see Appendix A-4).

4 DATA AND SAMPLE COLLECTION

If possible, sites should be sampled in the order of least to greatest potential for equipment fouling or contamination. If possible, sites should be sampled in the order of least to greatest potential for infestation of invasive species. If it is not possible to sample in the order of least to greatest potential for infestation of invasive species then follow the instructions in the SOP for Decontamination of Field Equipment to Limit the Spread of Invasive Species (Appendix A-9).

4.1 SAMPLE LOCATION SETUP

Navigate with a GPS to the identified sample location. Properly anchor pursuant to the SOP for Transporting and Operating Boats (see Appendix A-4). Establish working zones on the boat and set-up equipment for data collection.

One staff member will collect profile data, measure the secchi depth, and fill out the Profile Sheet while the other collects the water sample.

Fill out the Date; Time; Collected by; Lake; Station ID; Air Temperature (°C); Weather; Surface Conditions; Floating Debris; Oil, grease, scum, etc.; Odor; and Color, turbidity, or other conditions fields on the Profile Sheet.

4.2 COLLECT PROFILE DATA AND SECCHI DEPTH

Lower the Secchi disc down the shady side of boat to the point where it is no longer visible, counting the 1.0-meter marks on the rope while you lower it. Record the number of meters, measuring between the 1.0-meter marks, on the Profile Sheet.

Remove the Hydrolab cup and install the weighted probe guard. Lower the Hydrolab sensors to the water surface and calibrate the depth to zero. Record Water Temperature (°C), pH, SpC ($\mu\text{S}/\text{cm}$), and DO (mg/L) data from the surface to the lake bottom at one meter increments on the Profile Sheet. Record the bottom depth (m) on the Profile Sheet. Prior to removing the Hydrolab sensors from the water, record Water Temperature (°C), pH, SpC ($\mu\text{S}/\text{cm}$), and DO (mg/L) data at the surface again for QA/QC purposes.

4.3 COLLECT WATER SAMPLES

Prior to collecting the water sample properly label all the sample containers.

Sample collection is dependent on the sampling scheme established for the water body. In general, three samples are collected along the lake profile: (1) epilimnion (surface), (2) metalimnion, and (3)

hypolimnion (bottom). The depth of the metalimnion sample is determined by examining the lake profile data for large changes in either one or all of the recorded parameters. For example, a metalimnion exists where water temperature changes at least 1° C per meter. If large changes in recorded parameters do not exist, then the middle of the lake profile can be substituted. Hypolimnion samples are only collected on lakes that are greater than or equal to 5 meters deep, unless determined otherwise. Metalimnion (or middle) samples are only collected on lakes that are greater than or equal to 8 meters deep, unless determined otherwise.

Collect the epilimnion sample by dipping the churn splitter directly in the lake from the front side of boat. Rinse splitter by closing the lid to the churn splitter and moving the agitator up and down to rinse all inside parts of the splitter. Open the nozzle and let water run through the spigot. Repeat. Collect sample. Fill out the Time field on the Profile Sheet.

Collect the hypolimnion sample using the discrete depth sampler (e.g., the Kemmerer sampler). Lower the discrete depth sampler down to one meter above the bottom to limit contamination from the disturbance of bottom sediments. Send the messenger down to close the discrete depth sampler and collect the water sample. Raise the discrete depth sampler and empty into the churn splitter to rinse. Repeat. On the second rinse cycle rinse the appropriate sample bottles from the churn splitter as described below. Collect sample and empty the discrete depth sampler into the churn splitter. Close the churn splitter to prepare for filling bottles. Fill out the Depth and Time fields on the Profile Sheet.

Collect the metalimnion (or middle) sample in the same way as the hypolimnion sample. Sample at the determined depth. Fill out the Depth and Time fields on the Profile Sheet.

4.4 FILLING THE SAMPLE BOTTLES

Don clean nitrile gloves.

Before filling the bottles, gently pump the handle of the churn splitter ten times at an even rhythm making sure the disk hits the bottom of the container and the stroke length should be as long as possible without breaking the water surface. The churning must be continuous during the withdrawals.

While filling bottles keep pumping the churn splitter at an even rhythm, approximately 1 stroke every 3 seconds.

Sample bottles should remain closed until bottle is to be filled. Remove lid from the sample bottle to be filled.

Bacteria:

Fill the 120 mL bacteria bottle to the shoulder/neck of the bottle. Make sure not to overfill because the bottle is prepared with sodium thiosulfate. Cap the bottle immediately after filling it. Upend the bottle several times to mix the sodium thiosulfate in the water sample. Immediately seal the bacteria sample in a plastic bag and place in an ice chest and cover with wet ice. *Do not field rinse the bacteria bottle as it contains sodium thiosulfate in it already.*

Chlorophyll-a:

Drain approximately 10-15 mL of the water sample from the churn splitter into the 500 mL brown chlorophyll-a bottle. Screw the cap on the bottle. Rinse the bottle and the cap and discard the rinse

water. Repeat. Then fill the bottle to the top from the churn splitter. Place the cap on the bottle and immediately place the bottle into an ice chest and cover with wet ice.

Dissolved Metals:

If taking a dissolved metals sample, drain approximately 10-15 mL of the water sample from the churn splitter into the filter transfer vessel. Screw the filter transfer vessel cap onto the filter transfer bottle. Rinse the filter transfer vessel and cap and discard the rinse water. Repeat. Fill the filter transfer vessel with enough water to fill the 500 mL dissolved metals bottle. Attach the pump and the filter, making sure not to touch the inlet and the outlet of the filter. Slowly pump the water from the filter transfer vessel through the filter into the 500 mL dissolved metals bottle to the shoulder/neck of the bottle. Make sure not to overfill because the bottle is prepared with nitric acid. Cap the bottle immediately after filling it. Upend the bottle several times to mix the nitric acid in the water sample. Immediately place the dissolved metals sample in an ice chest and cover with wet ice. ***Do not field rinse the dissolved metals bottle as it contains nitric acid in it already.***

Routine Parameters:

Drain approximately 10-15 mL of the water sample from the churn splitter into the 0.5 gallon routine parameters bottle with the blue cap. Place the cap on the bottle but do not seal it. Rinse the bottle and blue cap and discard the rinse water. Repeat. Then fill the bottle from the churn splitter to the shoulder/neck of the bottle. Seal the blue cap onto the bottle. Immediately place the blue cap bottle into an ice chest and cover with wet ice.

Total Metals:

If taking a metals sample, fill the 500 mL total metals bottle from the churn splitter to the shoulder/neck of the bottle. Make sure not to overfill because the bottle is prepared with nitric acid. Cap the bottle immediately after filling it. Upend the bottle several times to mix the nitric acid in the water sample. Immediately place the total metals sample in an ice chest and cover with wet ice. ***Do not field rinse the total metals bottle as it contains nitric acid in it already.***

Drain approximately 10-15 mL of the water sample from the churn splitter into the 0.5 gallon general parameters bottle with the red cap. Place the cap on the bottle but do not seal it. Rinse the bottle and red cap and discard the rinse water. Repeat. Then fill the bottle from the churn splitter to the shoulder/neck of the bottle. After filling the bottle, add 5.0 mL of 96% sulfuric acid and seal the red cap on the bottle. Upend the bottle with the red cap several times to mix the the sulfuric acid in the water sample. Immediately place the red cap bottle into an ice chest and cover with wet ice. Discard the empty acid ampoule in the ampoule container.

4.5 PROFILE SHEET COMPLETION/REVIEW

Write any Comments on the Profile Sheet.

Review the Field Sheet to ensure completeness, and have the second field person (i.e. a person other than the one who filled out the form) check over the form before leaving the site.

4.6 CHLOROPHYLL-*a* SAMPLE PREPARATION

Prepare chlorophyll-*a* samples as soon as possible in an area out of direct sunlight and protected from wind to prevent sample contamination.¹¹ Rinse the entire chlorophyll-*a* filter press and tweezers with DIW. Place one chlorophyll-*a* filter on the filter press stage and assemble the filter press. Upend the sample bottle several times to mix sample and pour an appropriate amount of sample water into the upper chamber of the filter press to optimize the sample collected on the filter. Slowly draw the sample water through the filter. Take care not to exceed 7 inches of Hg on the filtration pump's vacuum gauge. After all the sample water has passed through the filter then check the color of the filter.¹² If no color is visible then pour additional sample water into the upper chamber of the filter press. Ultimately, the filter should be pale yellow/green to green in color. Once the filter is the appropriate color, record the amount of sample water filtered on the bottle label. Then rinse the inside of the upper chamber of the filter press with DIW to dislodge any chlorophyll-*a* remaining on the walls. After the rinse water has passed through the filter, carefully remove the filter from the filter press stage with tweezers. Fold the filter into quarters (colored side on the inside) and immediately wrap in aluminum foil. Place aluminum foil-wrapped filter in the labeled bottle and place in a freezer immediately. Keep frozen until delivery to the laboratory.

4.7 DECONTAMINATION OF FIELD EQUIPMENT TO LIMIT THE SPREAD OF INVASIVE SPECIES

After sampling lakes/reservoirs that are suspected or known to contain invasive species, clean and decontaminate all sampling equipment (including boat and trailer) prior to the leaving the sampling site. For further information read the SOP for Decontamination of Field Equipment to Limit the Spread of Invasive Species (see Appendix A-9).

4.8 SAMPLE DELIVERY

Samples must remain under the samplers' control until the samples are delivered to the laboratory.

REFERENCES

Hydrolab DS5X, DS5, and MS5 Water Quality Multiprobes - User Manual, Hach Environmental.

Surveyor 4a 0 User Manual. Hach Environmental.

Hach LDO Sensor Instruction Sheet. Hach Environmental.

Hydras 3 LT Software Manual. Hach Environmental.

¹¹ Chlorophyll-*a* filtration must be completed within 24 hours of sample collection.

¹² If all the water in the filter press cannot be drawn through the filter then the remaining water in the filter press and the filter must be discarded. The filter press must be cleaned and the processing will start over from the beginning with less sample water.

Attachments

FOR COMPLIANCE

XXX NOT FOR COMPLIANCE

NEVADA STATE HEALTH LABORATORY
CHAIN OF CUSTODY FORM FOR WATER CHEMISTRY ANALYSIS
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

University of Nevada School of Medicine
 1660 North Virginia Street, Reno, NV 89503-1738
 Phone: (775) 688-1335 Fax: (775) 688-1460

OWNER INFORMATION				REPORT TO INFORMATION				DELIVERED ON ICE		BILL TO INFORMATION				Routine Pollution	NDEP Trace Metals	NDEP Total Recoverable Metals	NDEP Dissolved Metals	COD	BOD	Chlorophyll	Other
Owner: Bureau of Water Quality Planning Address: 901 S. Stewart St., Suite 4001 City, St, Zip: Carson City NV 89701 Phone: 687-9444 FAX: 687-5856				Owner: BWQP ATTN: John Heggeness Address: 901 S. Stewart St., Suite 4001 City, St, Zip: Carson City, NV 89701 Phone: 687-9444 Fax: 687-5856				<input type="checkbox"/> Yes <input type="checkbox"/> No Initials (Lab) <input type="text"/> Shipped Samples: <input type="text"/> Temp Blank <input type="text"/> °C		Owner: BWQP Address: 901 S. Stewart St., Suite 4001 City, St, Zip: Carson City, NV 89701 Phone: 687-9444 Fax: 687-5856											
SOURCE OF WATER <input type="checkbox"/> Spring <input type="checkbox"/> Filter <input checked="" type="checkbox"/> Surface <input type="checkbox"/> Well <input type="checkbox"/> Depth (ft)				SAMPLE TYPE <input type="checkbox"/> SDWA <input checked="" type="checkbox"/> CWA <input type="checkbox"/> Other				REASON FOR ANALYSIS <input type="checkbox"/> Public Water Supply <input type="checkbox"/> Private Residence <input checked="" type="checkbox"/> Other <u>State Surface Water</u>		USE OF WATER <input type="checkbox"/> Domestic Drinking Water <input type="checkbox"/> Geothermal <input type="checkbox"/> Irrigation <input type="checkbox"/> Industrial or Mining <input checked="" type="checkbox"/> Other: <u>Various Uses</u>											
RIVER BASIN:																					
Line Item	Date Collected	Time	Station ID	Control Point	State	County	Remarks														
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					
18																					
19																					
20																					

Collected By: _____ Sampler Signature: _____

FOR LAB USE ONLY:
 How sample was delivered: _____ Courier _____ Drop Off _____ Fed Ex _____ UPS _____ U.S. Postal _____ Campus Mail _____
 Delivered By: _____ Date: _____ Received By: _____ Date: _____

Sample is tested as received. Analytical results associated with this requisition and generated by NSHL are representative only of the sample submitted to this laboratory.

NOTE: This document will be destroyed at NSHL after 12 years, unless Client requests otherwise

NDEP LAKE PROFILE FIELD SHEET

Date:	Time:	Collected by:	
Lake:		Station ID:	
Instrument:	Calibration Date:	Calibration Time:	
Air Temperature (°C):		Weather:	
Surface Conditions: <input type="radio"/> FLAT <input type="radio"/> RIPPLES <input type="radio"/> CHOPPY <input type="radio"/> WHITECAPS			
Floating debris: <input type="radio"/> YES <input type="radio"/> NO		Oil, grease, scum, etc.: <input type="radio"/> YES <input type="radio"/> NO	
Odor: <input type="radio"/> YES <input type="radio"/> NO		Color, turbidity, or other conditions: <input type="radio"/> YES <input type="radio"/> NO	
Secchi Depth (m):		Bottom Depth (m):	

Depth (m)	Temp (°C)	pH (Std.)	SpC (µS/cm)	DO (mg/L)
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Depth (m)	Temp (°C)	pH (Std.)	SpC (µS/cm)	DO (mg/L)
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
<i>DUP 0</i>				

Epilimnion Sample? <input type="radio"/> YES <input type="radio"/> NO	Depth: 0 m	Hypolimnion Sample? <input type="radio"/> YES <input type="radio"/> NO	Depth: m
Metalimnion Sample? <input type="radio"/> YES <input type="radio"/> NO	Depth: m	Middle Sample? <input type="radio"/> YES <input type="radio"/> NO	Depth: m

Comments:

Appendix A-4: Standard Operating Procedures for Transporting and Operating Boats

Standard Operating Procedures for Transporting and Operating Boats

Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada

January 2014

APPROVALS:

Kathy Sertic

NDEP BWQP Chief:

Kathy Sertic

Date:

01/09/14

John Heggeness

NDEP BQWP Quality Assurance Officer:

John O. Heggeness

Date:

1/9/14

Boat Equipment and Supply Checklist

Boat Transport Equipment

- Proper sized trailer
- Proper sized ball hitch
- Locking hitch pin
- Lock for trailer coupler
- Proper sized spare tire
- Lug wrench for trailer
- Jack for trailer

Boat Equipment

- Bow and stern lines
- Ground tackle
- Paddles
- United States Coast Guard approved Personal Floatation Devices for each individual
- Gasoline motor/fuel line or electric trolling motor
- Full gasoline tank or fully charged battery for electric trolling motor
- Drain plug
- Bailer
- Fire extinguisher
- GPS
- Depth finder
- Satellite phone

Standard Operating Procedure for Transporting and Operating Boat

1 PURPOSE AND APPLICABILITY

This Standard Operating Procedure (SOP) is intended to standardize procedures for transporting and operating boats for use in sampling and monitoring activities. However, this SOP is not intended as a substitute for information on local, state, and federal regulations concerning boat operation and transport.

2 TRAINING

All Nevada Division of Environmental Protection – Bureau of Water Quality Planning (BWQP) personnel that will use boats are required to complete a boater safety course approved by the National Association of State Boating Law Administrators and retain a Nevada Boater Education Card (also known as a Nevada Boating Safety Certificate Card). All BWQP personnel that will use boats must also be familiar with the owner's manual for the particular boat and this SOP.

3 HEALTH AND SAFETY CONSIDERATIONS

A minimum of two individuals are required to be on board at all times during boat operation. All individuals on board a boat will wear Type III U.S.C.G. approved personal floatation devices at all times. If conditions require further protection, Type I or II personal floatation devices will be used.

BWQP staff will comply with all waterbody speed limits and restrictions.

4 PREPARING TRAIERED BOATS FOR TRANSPORT

See attachments for Checklist for Preparing Trailered Boats.

5 TRANSPORT OF BOATS

All boats will be transported in accordance with local, state, and federal regulations.

6 LAUNCHING BOATS

See attachments for Checklist for Launching Trailered Boats.

7 OPERARTION OF BOATS

All boats will be operated in accordance with local, state, and federal regulations. The following highlights critical procedures for operating boats:

- Obey all posted signs and signals such as but not limited to, "No Wake Zone", Posted Speed Limits, Draw Bridge Signs, etc.
- Take extra care when operating boats around sailboats or human powered watercrafts (e.g. rowing shells, kayaks, or canoes). Give these watercrafts a wide berth when overtaking or meeting, and reduce speed of the boat to produce as little wake as possible.
- When approaching another watercraft from any direction, make your intentions known early and clear to the other watercraft as to how you will pass them. This may be done by signaling and then making course corrections deliberately and in an obvious manner.
- When operating boats in heavy boat traffic areas, monitor appropriate marine radio channels.
- Remember the phrase "Red, Right, Returning." When traveling in a channel or a shipping lane returning to a harbor or landing, red colored "cans" mark the right hand side of the channel or shipping lane, green or black colored "cans" mark the left hand side of a channel or shipping lane. Keep the appropriate navigation aid on your right when entering or leaving.

- When crossing areas of heavy traffic, cross at right angles to the channel lanes. When traveling with heavy traffic, if possible stay to the edge of the marked channel.

For additional information see attachment for Checklist for Operation of Boats.

8 LOADING OF BOAT ONTO TRAILER

See attachments for Checklist for Loading of Boat onto Trailer.

9 DECONTAMINATION OF FIELD EQUIPMENT TO LIMIT THE SPREAD OF INVASIVE SPECIES

For further information read the SOP for Decontamination of Field Equipment to Limit the Spread of Invasive Species (Appendix A-9).

10 STORING BOATS AFTER USE

The boat should be stored in a secured area whenever possible. If it is not possible to store the boat in a secured area, lock the trailer coupler latch.

See attachments for Checklist for Storing Trailered Boats.

10 BOAT MAINTENANCE

The boat motor(s) is maintained and stored per manufacturer's instructions. The boat motor and trailer will get a professional tune-up prior to the start of every field season.

REFERENCES

Federal Requirements for Recreational Boats, (2001) United States Coast Guard,
<http://www.uscgboating.org/fedreqs/default.html>.

Reference Guide to State Boating Laws, 6th Edition, (2000) (Chris Moore and Ron Sarver, Editors),
National Association of State Boating Law Administrators, Lexington, KY, 90pp.

Navigational Rules and Regulations (1995), United States Coast Guard, United States Government
Printing Office, Pittsburgh, PA, 214pp.

100th Meridian Initiative, <http://www.100thmeridian.org/decon.asp>.

Attachments

CHECKLIST FOR PREPARING TRAIERED BOATS

BOAT:

- Safety chain and cable attached and snugged to bow roller.
- Belly strap attached and snugged, visually inspected.
- Bow and stern line on board.
- Ground tackle on board and visually inspected.
- Electronics working (depth finder, etc.).
- Drain plug inserted.
- Oil reservoir in motor full.
- Gasoline tank full.
- Motor starts and runs (locked in upright position for travel).
- Paddles on board.
- U.S.C.G. approved Personal Floatation Devices for each individual on board plus one additional.
- Properly stow everything for transport.

TRAILER:

- Inspect trailer tires (including spare) to make sure they are properly inflated.
- Check padlock on the spare tire, make sure that key works.
- Make sure lug wrench and jack for trailer are in the truck.
- Lock trailer hitch assembly onto vehicle.
- Attach trailer to vehicle.
- Check to make sure trailer coupler is secure on the ball hitch by pulling up on trailer.
- Lock the trailer coupler.
- Check trailer safety chains for wear and tear.
- Attach trailer safety chains in crisscrossed fashion.
- Check for wear and tear on trailer electrical connection wires and plugs.
- Connect trailer electrical connection to vehicle electrical plug.
- Confirm that the trailer's brake lights, turn signals, running lights, and reverse lights are functional.

CHECKLIST PRIOR TO LAUNCHING TRAILERED BOATS

Prior to Moving the Vehicle to Boat Ramp:

- Prior to and during operation of boats, monitor both weather forecasts and current weather conditions.
- Attach bow and stern lines to boat. Make sure length of lines is such that the lines reach the dock or shore where the boat will be placed.
- Remove the belly strap from the boat and trailer.
- Disconnect trailer lights from vehicle.
- Determine one individual who will assist driver in backing boat down ramp. Work out audio and visual signals to assist driver in unloading process.
- Check to make sure drain plug is inserted in the boat.

At the Boat Ramp:

- Before backing vehicle and trailer down boat ramp, make sure the trailer and vehicle are in a straight line.
- Check to make sure that boat ramp is clear of personnel, vehicles, or boats before proceeding. Individual assisting driver in backing up should stand to the driver's side of vehicle and well clear of trailer.
- Back trailer down boat ramp to edge of water and stop. The driver's assistant should disconnect safety chain and cable from boat, and roll up excess cable on trailer winch (**ONLY disconnect safety chain and cable if located on a LEVEL surface, otherwise leave cable and safety chain attached until the boat is floated off the trailer**). The driver's assistant should take bow and stem lines in hand, and then move clear of trailer and vehicle.
- Once all personnel are clear of vehicle, back trailer into water until wheels are covered or boat begins to float on its own. The backing momentum will push boat away from trailer. Once boat is clear of trailer, the trailer can be pulled out of the water. The boat should be pulled to the dock or shore and secured using bow and stern lines.

CHECKLIST FOR OPERATION OF BOATS

Starting the Motor:

- Lower the motor into the water. If starting in a shallow area, make sure that the motor is at least lowered to the point where the cooling water intake is below the waterline.
- Check to make sure the fuel line is properly attached, prime the fuel line by squeezing the fuel "bulb" until it becomes firm and open the air vent on the top of the gas can cap.
- Make sure throttle position is in neutral and turn choke on (if necessary).
- Turn switch to "Run" if the motor is so equipped.
- Pull starter rope to start motor. Inspect motor to make sure that coolant system is working (i.e. a stream of water is flowing from motor compartment). If coolant system is not working, stop motor immediately and make sure water intake and exit ports are clear.
- Allow motor to warm up at idle speed. Once motor is warmed up, turn choke off before leaving dock or shore.

Leaving Dock or Shore:

- Make sure all personnel on board have PFDs on.
- Untie bow and stern lines, the individual shoving off the boat will keep one line in hand.
- If leaving from a dock, walk boat to end of dock.
- Prior to leaving shore or dock, driver will look around to determine if there are any oncoming boats or other hazards.
- Once clear, the driver should indicate when the line tender should board.
- Once all personnel are on board and in position, the driver make way.

Anchoring:

- Select an area that offers maximum shelter from wind, current, and boat traffic.
- Determine depth of water and type of bottom (preferably sand or mud). Calculate the amount of anchor line you will need. General rule: 6 times as much anchor line as the depth of water plus the distance from the water to where the anchor will attach to the bow. For example, if the water depth is 8 feet and it is 2 feet from the top of water to your bow cleat, you would multiply 10 feet by 6 to get the amount of anchor line to put out.
- Secure the anchor line to the bow cleat at the point you want it to stop; make a couple wraps around the cleat prior to "cleating off."
- Bring the bow of the vessel into the wind or current. When you get to the spot you want to anchor, place the motor in neutral. When the boat comes to a stop, slowly lower the anchor. Do not throw the anchor over, as it will tend to entangle the anchor.
- When all anchor line has been let out, back down on the anchor with motor in idle reverse to help set the anchor. If the holding ground is questionable, "cleat off" and then back down on the anchor to get a good "bite" into the bottom.
- When anchor is firmly set, use reference points (landmarks) in relation to the boat to make sure you are not drifting. Check these points frequently.

CHECKLIST FOR OPERATION OF BOATS continued

Returning to Dock or Shore:

- Before approaching dock or shore, determine which personnel will be in charge of bow and stern lines. Notify line tender(s) not to "pull" the boat in by the line while docking causing loss of control by the driver.
- Approach dock or shore at low speed. Place throttle in neutral position when arriving at dock, if the boat is still moving forward when at the dock apply a quick burst of reverse throttle to stop forward motion of boat.
- When the boat has stopped its forward motion, have the bow and stern personnel disembark to secure the lines. Shut off motor. If necessary, secure fenders to the side of the boat next to the dock prior to landing.

CHECKLIST FOR LOADING OF BOAT ONTO TRAILER

Prior to Loading Boat:

- Determine job assignments for personnel, one person will have to drive the boat onto the trailer and one person will have to attach the safety cable, reel the winch, and drive the vehicle.

Loading Boat onto Trailer:

- Back the vehicle and trailer down the boat ramp, stopping when the tires of the trailer are submerged. Apply the parking brake and the emergency brake on the vehicle.
- Back the boat away from the dock, and approach the trailer at a very slow speed. The driver of the boat should aim the bow of the boat for the bow roller. Place the throttle of the boat in neutral just before arriving at the trailer.
- When the boat comes to a complete stop, the shore person attaches the safety cable to the boat and begins to reel in the cable. As the boat is being reeled in, care should be taken to keep the boat in line with the trailer.
- Once the bow of the boat is snug with the bow roller, the boat driver disconnects gas from motor to let it run out of gas (**the intake for the motor's coolant system must remain in the water**). Once engine quits, raise the motor and lock it for transport.
- The driver can then climb out of the boat. Care should be taken when climbing out of the boat.
- Once all personnel are clear of the boat and trailer, the vehicle driver places the vehicle in drive and slowly begins to apply the accelerator. As this is being done, the emergency brake is released and the trailer is pulled from the water. Once the trailer is completely out of the water, stop the vehicle on a level surface. Make sure the boat is resting on all of the trailer rollers in an even manner. If this is not the case, then back the trailer into the water, loosen the safety cable and reposition the boat.
- Move the trailer from the boat ramp.

After Loading Boat onto Trailer:

- Removal all equipment from boat and secure any compartments anchors, etc.
- Re-attach belly strap on the boat to the trailer.
- Remove boat drain plug.
- Follow directions in Checklist for Preparing Trailered Boats.

CHECKLIST FOR STORING TRAIERED BOATS

Trailer:

- Reinspect the trailer to ensure that it has been properly decontaminated.
- Before disconnecting trailer electronics check to make sure that the trailer lights are working (turn signals, brake lights, running lights).
- If the trailer has brakes, check the brakes for proper operation.
- Chock the trailer wheels and elevate trailer tongue to a height where any water entering the boat will drain out. Remove the drain plug and leave next to the transom.
- If any problems are encountered during use of trailer or boat, notify personnel in charge of boat operations immediately upon return.

Boat:

- Reinspect the boat to ensure that it has been properly decontaminated.
- Safety chain and cable attached and snugged to bow roller.
- Belly strap attached and snugged.
- Bow and stem line on board and stowed.
- Anchor and tackle on board and stowed.
- Remove gas from motor. Motors down for storage.
- Electric trolling motor battery connected to trickle charger.
- Remove drain plug.
- Return equipment to boat room, if equipment is still wet, let dry then store.
- Return boat keys to key storage area.

Appendix A-5: Standard Operating Procedures for the Deployment of Temperature Loggers

Standard Operating Procedures for the Deployment of Temperature Loggers

Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada

January 2014

APPROVALS:

Kathy Sertic
NDEP BWQP Chief:

Kathy Sertic

Date: *01/09/14*

John Heggeness
NDEP BQWP Quality Assurance Officer:

John O. Heggeness

Date: *1/9/14*

Temperature Logger Equipment and Supply Checklist

Calibration Equipment

- NIST-certified thermometer – an accuracy of $\pm 0.2^{\circ}$ C or better
- Insulated coolers
- Ice

Equipment

- GPS
- Laptop
- Connection cable from laptop to Hobo
- HOBO® Optic USB Base Station with coupler for Water Temp Pro v2 Logger(s)
- HOBO® Waterproof Shuttle with USB cable and coupler for Water Temp Pro v2 Logger(s)
- ___ HOBO® Water Temp Pro v2 Logger(s)
- ___ White, opaque PVC shade device (1 ½ inch Sch. 40 PVC, ~6 inches long)
- ___ Onset Solar Radiation Shield - RS1 (for air temperature loggers)
- ___ Rebar of various lengths and pounder
- ___ Sandbags (14" x 26" <http://www.mcmaster.com> product #4540T4)
- ___ 36" zip ties (<http://www.drillspot.com> product #131995)
- ___ Onset Water Detection TidbiT(s) (Electrical Resistance Sensor)
- Sledge hammer
- Securing material such as zip ties, cable clamps, hose clamps
- Camera
- Flagging tape
- Wire cutters, pliers, and other tools as needed
- Maps

Personal Equipment

- Waders
- Work Gloves

Paperwork

- Clipboard
- ___ Temperature Logger Field Sheets, 1 per site
- Pencils, pens, sharpies

Standard Operating Procedures for the Deployment of Temperature Data Loggers

1 APPLICABILITY

This standard operating procedure (SOP) applies to the collection and analysis of continuous water temperature data from rivers and streams in Nevada using a HOBO® Water Temp Pro v2 Logger from Onset Computer Corporation which requires HOBOWare Pro® software.

2 PURPOSE

The purpose of this SOP is to provide standardized methods for collecting and processing continuous water temperature data from rivers and streams in Nevada.

3 DEFINITION

Continuous water temperature data are those that are collected at certain time intervals (e.g., every 30 or 60 minutes) for an extended period of time (typically 8 weeks to 1 year) using an electronic temperature logger deployed in a river or stream.

4 RESPONSIBILITIES

4.1 TRAINING:

It is the responsibility of the Standards and Monitoring Supervisor to ensure that the field staff using the loggers are familiar with this SOP.

4.2 TRACKING OF TEMPERATURE LOGGER USAGE:

The disposition of each temperature logger will be recorded. The record includes the temperature logger serial number, current status of each temperature logger (available for use, launched and awaiting deployment, deployed, or retrieved and awaiting upload), deployment location, person responsible for the temperature logger (e.g., survey lead), date of checkout, and any other pertinent information. The disposition of all temperature logger-related accessories, such as optic shuttles and base stations will also be recorded.

It is the responsibility of the field staff launching, deploying, or retrieving a logger to note these activities on the relevant tracking forms and/or field sheet. It is the responsibility of the field staff to place completed tracking forms and/or field sheet in the appropriate folder located in the BWQP office.

4.3 DATA RETRIEVAL AND PROCESSING:

It is the responsibility of the staff member retrieving/processing the data to note these activities on the relevant tracking forms. When all data have been processed, these forms will be stored electronically on the BWQP server.

5 GUIDELINES AND PROCEDURES

5.1 MEASUREMENT PERIOD:

The time period of data collection varies depending upon the purposes of the particular study. In some cases, the deployments will be temporary in nature and typically targeted at characterizing summer temperatures. Other deployments will be longer term to characterize year-round conditions. Year-round sites will generally require more involved installations to withstand high flow and frozen conditions.

5.2 PRECAUTIONS AND LIMITATIONS:

The HOBO Water Temp Pro is only suitable for temperature measurements in water in the range of 0° C to 50° C (32° F to 122° F).

5.3 PROCEDURES:

5.3.1 PRE-DEPLOYMENT LOGGER LAUNCH:

- (a) Prior to deploying loggers, check the battery and accuracy of the data loggers as described in Section 6.
- (b) Before leaving for the field, launch each logger with the desired start date and logging interval. To launch, connect each data logger to the computer using the HOBO Optic USB Base Station and appropriate coupling. **Set computer clock to Standard Time (unclick “Automatically adjust clock for daylight saving changes”)**. Using HOBOWare Pro software, set the data logger to begin collecting data at a delayed start time (typically on top of the hour) and date prior to the anticipated actual installation in the field. The logger interval can vary depending upon the needs of the study. However, the more frequent the readings, the sooner the memory capacity of the logger will be used up. It is recommended that readings be taken at least every hour, if not more frequent.
- (c) To ensure that the loggers are set to launch, look for the red LED light on the logger to be blinking about every 5 seconds.

5.3.2 LOGGER DEPLOYMENT:

- (a) Do not wade a stream to deploy a logger if conditions are unsafe. Site conditions or project-specific data collection objectives may necessitate the use of alternative field procedures not included in this SOP. The use of field methods other than those presented in this SOP must be approved by the Standards and Monitoring Supervisor and alternative methods must be accurately documented.
- (b) Determine a suitable site for deployment in line with the program’s objectives. In general, the logger should be deployed near the sample location in an area that is well mixed and is likely to stay inundated throughout the sampling period. Select locations representative of ambient conditions. Deploy the temperature logger in water with a consistent flow. Avoid locations in shallow riffles or in deep pools with poor circulation. Ensure that under expected flow conditions, the temperature logger will be continually submerged but not buried in sediment. Also, locate in shaded areas if possible.
- (c) Attach logger inside a white, opaque PVC pipe with a zip tie and then attach that assembly to a suitable deployment point, for example:
 - i. a sturdy structure such as a large tree root;
 - ii. a rebar stake driven into the stream bed; or
 - iii. sandbag filled with soil and/or rocks.
- (d) The Hobo Water Temp Pro loggers tend to float and steps must be taken to ensure the logger remains completely submerged throughout the sampling period.
- (e) Fill out the Temperature Logger Deployment Form (see Attachments).

5.3.3 MID-DEPLOYMENT CHECK:

- (a) It is recommended that the logger installations be checked periodically throughout the deployment period to ensure that the logger is still in well mixed flow conditions. If necessary, the logger should be moved to a more suitable location with the changes noted on the Temperature Logger form.

- (b) Data collected can be retrieved from the temperature logger using the HOBO Waterproof Shuttle. Use of the shuttle allows for the available data to be retrieved without a laptop. Before using the HOBO Waterproof Shuttle, make sure its clock is synchronized with the Standard Time clock of the computer originally used to launch the loggers.

5.3.4 LOGGER RETRIEVAL:

- (a) Do not wade a stream to retrieve a logger if conditions are unsafe.
- (b) Locate the logger utilizing drawing, notes, flagging, marking, or GPS coordinates as available/necessary. Retrieve logger and fill in the Logger Retrieval section.
- (c) Keep logger in a safe location and return it to the BWQP office for data retrieval and processing.

5.3.5 DATA RETRIEVAL AND PROCESSING:

- (a) Connect each data logger to the computer using the HOBO Optic USB Base Station and appropriate coupling. Using HOBOWare Pro software, download the temperature data for each logger. HOBOWare Pro automatically assigns filenames for the data files based upon the serial number of the temperature logger.
- (b) Export data to Excel as needed using HOBOWare Pro software. Edit the data to exclude pre-deployment and post-deployment periods where the datalogger was out of the water. Plot the data and inspect for abnormalities caused by dying batteries, sensor de-watering (out of the water), or unit malfunctions. Daily temperature fluctuations of more than 10-15° C could be an indication that the sensor was out of the water.
- (c) After downloading the data, check the post-deployment accuracy of the temperature loggers as discussed in Section 6. If inaccuracies are identified, include descriptive notes in the data file.

6 TEMPERATURE LOGGER ACCURACY VERIFICATION AND QUALITY ASSURANCE

The accuracy of all temperature data loggers will be checked both pre- and post-deployment in a water bath of two different temperatures: ~0° C and ~20° C. Steps in the accuracy verification are as follows:

- 6.1 Prepare a room temperature bath and an ice bath:
 - a. To prepare a room temperature bath, partially fill an insulated cooler with approximately room temperature water and allow about six hours for the water temperature to equilibrate to room temperature.
 - b. To prepare an ice bath, half fill an insulated cooler with ice and add cold water until ice is full immersed in water. Close the lid and let sit for about six hours.
- 6.2 Launch temperature loggers to record at one minute intervals. During the launch process, check battery levels to make sure there is sufficient capacity for the intended use.
- 6.3 Place loggers in the room temperature bath and allow approximately one hour for sensor temperatures to equilibrate with the bath temperatures. Rather than having individual loggers floating loose in the bath, it is most efficient to tape 15-20 loggers together. Make sure the sensor end of the loggers is submerged in the bath.
- 6.4 Using a NIST-certified thermometer, measure the temperature of the bath in close proximity to the location of the sensors. Gently move the cluster of loggers mixing the water bath. If the NIST-certified thermometer temperatures are stable, take three temperature readings (one every minute) close to the location of the sensors in the bath. The NIST-certified thermometer readings should be

taken at times synchronized with the data logger temperature measurements. Record the time and temperatures for later comparison with the loggers' measurements.

- 6.5 Place loggers in the ice bath and allow approximately one hour for sensor temperatures to equilibrate with the ice bath. Using a NIST-certified thermometer, measure the temperature of the bath in close proximity to the location of the sensors. Gently move the cluster of loggers mixing the water bath. If the NIST-certified thermometer temperatures are stable and close to 0° C, take three temperature readings (one every minute) close to the location of the sensors in the bath. The NIST-certified thermometer readings should be taken at times synchronized with the data logger temperature measurements. Record the time and temperatures for later comparison with the loggers' measurements.
- 6.6 Use HOBOWare Pro software and Optic USB Base Station to download the temperature logger data from each logger to file server. HOBOWare Pro automatically assigns filenames for the datafiles based upon the serial number of the temperature logger. For each logger, compare the three NIST thermometer readings to the corresponding three datalogger readings. Record the result of the tests (folder has been established on the file server for this purpose) and include the temperature logger unit's serial number, test date, logger temperature data, NIST temperature readings, temperature discrepancy. If the values are not within within $\pm 0.5^{\circ}$ C of the certified thermometer, repeat accuracy check.
- 6.7 Return any temperature loggers that fall outside the acceptable accuracy range to the manufacturer.

7 CARE AND MAINTENANCE

The temperature loggers will be maintained per manufacturer's recommendations.

- 7.1 After use, clean the temperature loggers using non-abrasive, mild, antibacterial soap and warm water with a non-scratching sponge or cloth. Any scratches on a logger's communication window may impair downloading of data. If necessary a plastic polish may be used for tougher cleaning jobs.

If the temperature loggers were deployed in waterbodies that are suspected or known to contain invasive species, additional decontamination measures must be taken. For further information read the SOP for Decontamination of Field Equipment to Limit the Spread of Invasive Species (see Appendix A-9).

- 7.2 Be sure to keep the temperature logger free from dirt and dust when not in use.

REFERENCES

HOBOWare Pro Software User's Manual, Onset Computer Corporation, Bourne, MA.

HOBO Water Temp Pro User's Manual, Onset Computer Corporation, Bourne, MA.

Attachments

BWQP Temperature Logger Deployment Form

Date:		Time:		Crew:	
Stream:				Site #:	
UTMzon		UTMe:		UTMn:	Elevation ft
Air	°C			H₂O	°C
Hobo #:		Interval:	min	Logger Start	○ PST ○
Tidbit #:		Interval:	min	Tidbit Start	○ PST ○
Location	○ Great	○ OK	○ Poor	Commen	
Bank:	○ Left	○ Middle	○ Right	Anchor:	○ Zip ties ○ ○ Other
Sun	○ YES		○ NO	Flagging:	○ YES ○ NO
Fish:	○ YES		○ NO	Commen	

Sketch/Notes:

Camera:		Photo #:		Description:	
Camera:		Photo #:		Description:	

○ Logger Retrieval			○ 1st Logger Redeployment (revise sketch if		
Date:		Time:		Logger Start	○ PST ○ PDT
Download File					
Comments:					

○ Logger Retrieval			○ 2nd Logger Redeployment (revise sketch if		
Date:		Time:		Logger Start	○ PST ○
Download File					
Comments:					

Appendix A-6: Standard Operating Procedures for the Unattended Deployment of Data Sondes

**Standard Operating Procedures
for the
Unattended Deployment of Data Sondes**

**Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada**

January 2014

APPROVALS:

Kathy Sertic

NDEP BWQP Chief:

Kathy Sertic

Date:

01/09/14

John Heggeness

NDEP BQWP Quality Assurance Officer:

John O. Heggeness

Date:

1/9/14

Unattended Sonde Equipment and Supply Checklist

Calibration Equipment

- NIST-certified thermometer – an accuracy of $\pm 0.2^{\circ}$ C or better
- pH buffers (7.0 & 10.01)
- Appropriate conductivity standard

Equipment

- Hydrolab MS5 sonde with Hach LDO sensor
- Surveyor handheld datalogger (Surveyor)
- YSI 550a handheld DO meter
- Interface cable
- PVC sleeve with holes
- Steel fence posts (with holes to facilitate hanging of Hydrolab within PVC sleeve) and driver
- Pipe clamps
- Clevis pin with padlock
- Small folding table
- GPS unit
- 5-gallon bucket
- Small cooler with calibration standards
- Spare batteries – Hydrolab (8 - AAs), YSI 550a (4 - Cs)
- Kimwipes, Qtips
- Tools – screwdriver, pliers
- Deionized water squirt bottle

Personal Equipment

- Waders
- Work Gloves

Paperwork

- Clipboard
- Continuous Water Quality Monitoring Field Form
- Pencils, pens, sharpies

Standard Operating Procedure for Unattended Deployment of Data Sondes

1.0 PURPOSE

This document describes the procedures for the unattended deployment of the Hydrolab MS5 sonde (Hydrolab) for the continuous collection of dissolved oxygen (DO), temperature, pH, and specific conductance (SpC) data in wadeable rivers and streams.

2.0 MAINTENANCE AND CALIBRATION

Both the Hydrolab and YSI 550a handheld DO probe are to be maintained and calibrated per manufacturer's recommendations. Because pH buffer solutions typically have conductivities higher than conductivity standards or environmental waters, the following calibration order is recommended: 1) SpC, 2) pH, and 3) DO.

3.0 DEPLOYMENT PROCESS

3.1 SITE SELECTION

Whenever possible, find an out-of-the-way location where the Hydrolab is not easily detectable by the general public. The location should be free flowing with adequate water depth to cover the Hydrolab's probes.

3.2 INSTALLATION

Typically an unattended Hydrolab is mounted inside a PVC sleeve with holes that allow for flow across the probes. Ideally, the Hydrolab should be deployed upright in the centroid of flow where the sensors are most likely to remain submerged and off the stream bottom. One method involves the attachment of the Hydrolab and PVC sleeve to one or two steel fence posts driven in to the stream bottom. Pipe clamps can be used to secure the Hydrolab and sleeve to the fence posts. A clevis pin and padlock should be used for hanging the Hydrolab within the sleeve and for securing the equipment (see Figure 1).



Figure 1. Sample Hydrolab Installation for Unattended Deployment

If the Hydrolab and sleeve cannot be placed upright, it may be laid horizontally on the substrate and secured to a stable object. It may be necessary to place rocks, bricks, etc. under the Hydrolab and sleeve to ensure the probes are not directly on the stream bottom.

3.3 INITIATE OPERATION

Prior to going to the field, make sure that the Hydrolab, Surveyor, and YSI 550a handheld DO meter are working properly and the batteries have sufficient charge. To check the Hydrolab and Surveyor battery levels, connect the two instruments and turn on the Surveyor. The display has been initially set up to display the following:

Surveyor Data

D/T	Date/Time
IBV	Internal battery voltage
BP	Barometric pressure

Hydrolab Data

Temp	Temperature in Celsius
pH	pH
LDO	DO in milligrams per liter (mg/L)
LDO%	DO in percent saturation
IBa	Internal battery voltage
SpC	Specific conductance
D/T	Date/Time

If the Surveyor battery voltage (IBV) is less than 6.5 volts, it is recommended that the battery pack be recharged. **If Hydrolab batteries are needed, do not mix depleted and fresh batteries together or serious injury and instrument damage may occur.**

If you wish to change the parameters on the Surveyor display, do the following:

- Select Setup/Cal
- Select Setup
- Select Display: Tabular
- Remove or add any new parameters as desired

Before heading out into the field, calibrate the SpC, pH, and DO probes per manufacturer's recommendations. Calibration can be performed with either the Surveyor or a laptop computer loaded with Hydras 3 LT attached to the Hydrolab. Record information about the deployment on the field sheet.

A log file must be created and then enabled before data can be collected by the Hydrolab and stored for later retrieval. Perform the following steps to establish the log file and initiate the logging process:

1. Connect Hydrolab to Surveyor or laptop computer
2. Start Hydras 3 LT if using laptop computer
3. If using Hydras - Click on Log Files tab
4. If using Surveyor – Select “Files”; Select “Sonde”
5. Click on **CREATE** button
6. Enter the name for the new log file (an empty log file is now created)

7. Enter the start and end time of the logging, the logging interval (should not be longer than 1 hour), the sensor warm-up time before logging, and if audio signals will be used while logging. Set sensor warm up and circulator warm up at 30 seconds. The end time of the logging should be set at a date beyond the next planned visit to lessen the chance of lost data.
8. Select the parameters in the “Parameter in Sonde” list and click the **ADD** button to place them in the “Parameters in log file” list. Change the order of the parameters using the **ARROW** buttons.
9. Click **UPDATE SETTING** to send the configuration to the Hydrolab.
10. Click **ENABLE** to start collecting data. Click **DISABLE** to stop collecting data during logging. A fully completed logging run will automatically disable at the end of the run.

3.4 PERIODIC MAINTENANCE AND DATA RETRIEVAL

During the deployment period, it is necessary to periodically inspect and clean the Hydrolab, check the calibration of the Hydrolab probes, and download the data. Maintenance frequency generally is governed by the fouling rate of the sensors, and this rate varies by sensor type, hydrologic and environmental conditions, and season. The performance of the temperature and SpC sensors tend to be less affected by fouling than the DO and pH sensors. Monitoring sites with nutrient-enriched waters and moderate to high temperatures will likely require more frequent maintenance than at a site with higher quality water. In streams with lots of algae, attached algae have been known to detach from upstream locations and wrap around the Hydrolab.

In addition to fouling problems, the calibration of the probes may drift over time. Periodic checking of the calibration will reduce the need to adjust the data due to drift, and will improve the quality of the data. The results of the fouling and calibration checks are to be recorded on the field sheet.

3.4.1 FOULING CHECK

To check the effect of fouling on the Hydrolab and the associated data, it is necessary to collect Hydrolab readings before and after cleaning of the probes and the protective PVC sleeve. An independent field meter is used to quantify changes of DO, etc. over the time it takes to clean and redeploy the Hydrolab. Use of an independent field meter is most important at sites with rapidly changing conditions.

1. Remove Hydrolab from installation and attach the Surveyor to Hydrolab
2. Return Hydrolab to the installation and record pre-cleaning Hydrolab readings
3. Using an independent field meter, record readings near the Hydrolab
4. Remove Hydrolab from installation and clean sensors, sensor guard, and PVC sleeve
5. Return Hydrolab to the installation and record post-cleaning Hydrolab readings
6. Using an independent field meter, record readings near the Hydrolab

Record results on the field sheet for later use in adjusting the data as needed.

3.4.2 CALIBRATION CHECK

To check the calibration of the probes, remove the Hydrolab from the installation with the Surveyor still attached, and perform the following steps. It is important to maintain temperature stability during the calibration check and recalibration. Care should be taken to keep the Hydrolab out of direct sunlight. To check calibration of SpC, pH, and DO (LDO sensor), prepare calibration cup and sensors in accordance with manufacturer’s calibration recommendations. The following describes conditions for which the sensors need recalibration.

Specific Conductance – If the SpC reading is within 0.005 mS/cm of the standards, there is no need to recalibrate. Otherwise, recalibrate following the manufacturer’s recommendations.

pH - If pH readings are within 0.2 of the buffers there is no need to recalibrate. Otherwise, recalibrate following the manufacturer’s recommendations.

DO (LDO Sensor) – Once equilibrium is reached within the calibration cup, record temperature, barometric pressure, and DO readings from the Hydrolab. Using the DO solubility table in the attachments, estimate the DO level expected in the calibration cup. The difference between this value and the Hydrolab reading is the calibration error. If the DO reading is within 0.3 mg/L of the expected value, there is no need to recalibrate. Otherwise, recalibrate following the manufacturer’s recommendations.

Record the results of the calibration check on the attached field sheet.

3.4.3 DATA RETRIEVAL

To download the Hydrolab data, perform the following steps:

- Attach the Surveyor to the Hydrolab
- Power up the Surveyor
- Select “Files”
- Select “Sonde”
- Select “Download”
- Select the desired file

Upon completion of the data transfer, it is suggested that the existing log file be deleted and a new log file be created as described earlier. To delete the log file:

- Select “Files”
- Select “Sonde”
- Select “Delete”
- Select the desired file

3.4.4 DATA TRANSFER FROM SURVEYOR TO COMPUTER

Perform the following steps to enable a PC to receive data from the Surveyor:

- Connect the Surveyor to PC using a 9 pin connector and a Belkin USB adapter to an available USB port
- Open HyperTerminal

Start>Programs>Accessories>Communication>HyperTerminal
- Enter a name for the connection (can be anything)
- Set “Connect using” to COM1, COM2, or COM3……, whichever port being used

If you don't know which COM port will be used, do the following:

- Connect the Surveyor to PC using 9 pin connector and Belkin USB adapter to an available USB port
 - From Windows START>SETTINGS>CONTROL PANEL>SYSTEM>HARDWARE>DEVICE MANAGER
 - From screen, Expand "Ports (COM & LPT)"
 - Look for "Belkin Serial on USB Port" and the COM port number will be there.
- Set the following
 - "Bits per second" = 19200 (or whatever baud rate the Surveyor is set to).
 - "Data bits" = 8
 - "Parity" = None
 - "Stop bit" = 1
 - "Flow control" = Xon/Xoff
- You should now be connected. At the bottom of the HyperTerminal window, it might say "Connected 0:00:xx" with a clock counting.

Perform the following steps to download data from the Surveyor to a PC:

- From HyperTerminal menu, select the following:
 - Transfer>Receive File
- Set download file destination
- Set "Receiving Protocol" as 1k Xmodem; then hit "Receive" button
- Enter file name with the extension "csv"
- From Surveyor menu, select "Files" then "Transmit"
- Select the file to be transmitted
- Select "SS importable" option for transfer
- Press any button on Surveyor to start download
- When done, close Hyperterminal

For a detailed discussion of techniques for adjusting the data for fouling and calibration drift, refer to USGS's *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting, Techniques and Methods 1-D3*.

3.5 DATA ADJUSTMENT

Prior to use, the retrieved data should be adjusted for fouling and calibration drift effects as described by Wagner and others (2006).

3.6 HYDROLAB STORAGE

Upon retrieving the Hydrolab, clean and store the equipment per the manufacturer's recommendations.

REFERENCES

Hydrolab DS5X, DS5 and MS5 Water Quality Multiprobes - User Manual. Hach Environmental.
Surveyor 4a 0 User Manual. Hach Environmental.

Hach LDO Sensor Instruction Sheet. Hach Environmental.

Hydras 3 LT Software Manual. Hach Environmental.

Wagner, R.J., R.W. Boulger, Jr., C.J. Oblinger and B.A. Smith. 2006. *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting*, US Geological Survey Techniques and Methods 1-D3.

Attachments

Continuous Water Quality Monitoring Field Sheet

Station Name/Number:	Personnel:
Date:	Data Sonde Model:

<i>SpC Calibration</i>				
Date	Standard (mS/cm)	Temperature (°C)	Initial Reading	Final Reading
	0.0			
<i>pH Calibration</i>				
Date	Buffer Value	Temperature (°C)	Initial Reading	Final Reading
	7.0			
	10.01			
<i>DO Calibration</i>				
Date	Barometric Pressure (mmHg)	Temperature (°C)	% DO Saturation	DO (mg/L)
<i>Deployment Information</i>				
Date Logging Initiated:		Time Logging Initiated:	Sampling Interval:	
Date Data Sonde Placed in River:			Time Data Sonde Placed in River:	

<i>Data Sonde Check and Data Download</i>				
Date:				
<i>Fouling Checks</i>				
Parameter	Before Cleaning		After Cleaning	
	Time =		Time =	
	Data Sonde Value	Field Meter Value	Data Sonde Value	Field Meter Value
Temp (°C)				
pH				
DO (mg/L)				
SpC (mS/cm)				
<i>SpC Drift Check</i> (If within ± 0.005 (mS/cm) of Standard or $\pm 3\%$ of Standard (whichever is greater), no need to recalibrate)				
Standard Value	Standard Temperature (°C)	SpC Reading (mS/cm)	Error	
<i>pH Calibration Drift Check</i> (If pH within ± 0.2 of Standard, no need to recalibrate)				
Buffer Value	Buffer Temperature	pH Reading	Error	

	(°C)			
7.0				
10.01				
DO Calibration Drift Check (If DO within ± 0.3 of expected, no need to recalibrate)				
Temperature (°C)	Barometric Pressure (mmHg)	DO (mg/L) at Saturation from Table	DO (mg/L) Reading from Data Sonde	Error
Comments				

Solubility of oxygen in water at various temperatures and pressures
 [In milligrams per liter. Values based on Weiss (1970). C, degrees Celsius;mmHg, millimeters of mercury]

Temp. C	Atmospheric pressure, mmHg																			
	760.0	750.0	740.0	730.0	720.0	710.0	700.0	690.0	680.0	670.0	660.0	650.0	640.0	630.0	620.0	610.0	600.0	590.0	580.0	570.0
0	14.6	14.4	14.2	14.0	13.8	13.6	13.4	13.2	13.0	12.8	12.7	12.5	12.3	12.1	11.9	11.7	11.5	11.3	11.1	10.9
1	14.2	14.0	13.8	13.6	13.4	13.2	13.1	12.9	12.7	12.5	12.3	12.1	11.9	11.7	11.6	11.4	11.2	11.0	10.8	10.6
2	13.8	13.6	13.4	13.3	13.1	12.9	12.7	12.5	12.3	12.2	12.0	11.8	11.6	11.4	11.2	11.1	10.9	10.7	10.5	10.3
3	13.4	13.3	13.1	12.9	12.7	12.5	12.4	12.2	12.0	11.8	11.7	11.5	11.3	11.1	10.9	10.8	10.6	10.4	10.2	10.0
4	13.1	12.9	12.7	12.6	12.4	12.2	12.0	11.9	11.7	11.5	11.3	11.2	11.0	10.8	10.7	10.5	10.3	10.1	10.0	9.8
5	12.7	12.6	12.4	12.2	12.1	11.9	11.7	11.6	11.4	11.2	11.1	10.9	10.7	10.5	10.4	10.2	10.0	9.9	9.7	9.5
6	12.4	12.3	12.1	11.9	11.8	11.6	11.4	11.3	11.1	10.9	10.8	10.6	10.4	10.3	10.1	9.9	9.8	9.6	9.5	9.3
7	12.1	12.0	11.8	11.6	11.5	11.3	11.1	11.0	10.8	10.7	10.5	10.3	10.2	10.0	9.9	9.7	9.5	9.4	9.2	9.1
8	11.8	11.7	11.5	11.3	11.2	11.0	10.9	10.7	10.6	10.4	10.2	10.1	9.9	9.8	9.6	9.5	9.3	9.1	9.0	8.8
9	11.5	11.4	11.2	11.1	10.9	10.8	10.6	10.5	10.3	10.2	10.0	9.8	9.7	9.5	9.4	9.2	9.1	8.9	8.8	8.6
10	11.3	11.1	11.0	10.8	10.7	10.5	10.4	10.2	10.1	9.9	9.8	9.6	9.5	9.3	9.2	9.0	8.9	8.7	8.6	8.4
11	11.0	10.9	10.7	10.6	10.4	10.3	10.1	10.0	9.8	9.7	9.5	9.4	9.2	9.1	9.0	8.8	8.7	8.5	8.4	8.2
12	10.8	10.6	10.5	10.3	10.2	10.0	9.9	9.8	9.6	9.5	9.3	9.2	9.0	8.9	8.7	8.6	8.5	8.3	8.2	8.0
13	10.5	10.4	10.2	10.1	10.0	9.8	9.7	9.5	9.4	9.3	9.1	9.0	8.8	8.7	8.5	8.4	8.3	8.1	8.0	7.8
14	10.3	10.1	10.0	9.9	9.7	9.6	9.5	9.3	9.2	9.0	8.9	8.8	8.6	8.5	8.4	8.2	8.1	7.9	7.8	7.7
15	10.1	9.9	9.8	9.7	9.5	9.4	9.3	9.1	9.0	8.8	8.7	8.6	8.4	8.3	8.2	8.0	7.9	7.8	7.6	7.5
16	9.8	9.7	9.6	9.5	9.3	9.2	9.1	8.9	8.8	8.7	8.5	8.4	8.3	8.1	8.0	7.9	7.7	7.6	7.5	7.3
17	9.6	9.5	9.4	9.3	9.1	9.0	8.9	8.7	8.6	8.5	8.3	8.2	8.1	8.0	7.8	7.7	7.6	7.4	7.3	7.2
18	9.4	9.3	9.2	9.1	8.9	8.8	8.7	8.6	8.4	8.3	8.2	8.0	7.9	7.8	7.7	7.5	7.4	7.3	7.2	7.0
19	9.3	9.1	9.0	8.9	8.8	8.6	8.5	8.4	8.3	8.1	8.0	7.9	7.8	7.6	7.5	7.4	7.3	7.1	7.0	6.9
20	9.1	8.9	8.8	8.7	8.6	8.5	8.3	8.2	8.1	8.0	7.8	7.7	7.6	7.5	7.4	7.2	7.1	7.0	6.9	6.7
21	8.9	8.8	8.6	8.5	8.4	8.3	8.2	8.1	7.9	7.8	7.7	7.6	7.5	7.3	7.2	7.1	7.0	6.9	6.7	6.6
22	8.7	8.6	8.5	8.4	8.2	8.1	8.0	7.9	7.8	7.7	7.5	7.4	7.3	7.2	7.1	7.0	6.8	6.7	6.6	6.5
23	8.6	8.4	8.3	8.2	8.1	8.0	7.9	7.7	7.6	7.5	7.4	7.3	7.2	7.0	6.9	6.8	6.7	6.6	6.5	6.4
24	8.4	8.3	8.2	8.0	7.9	7.8	7.7	7.6	7.5	7.4	7.3	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.3	6.2
25	8.2	8.1	8.0	7.9	7.8	7.7	7.6	7.5	7.3	7.2	7.1	7.0	6.9	6.8	6.7	6.6	6.4	6.3	6.2	6.1
26	8.1	8.0	7.9	7.8	7.6	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.8	6.7	6.5	6.4	6.3	6.2	6.1	6.0
27	7.9	7.8	7.7	7.6	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.7	6.6	6.5	6.4	6.3	6.2	6.1	6.0	5.9
28	7.8	7.7	7.6	7.5	7.4	7.3	7.2	7.1	6.9	6.8	6.7	6.6	6.5	6.4	6.3	6.2	6.1	6.0	5.9	5.8
29	7.7	7.6	7.5	7.3	7.2	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.4	6.3	6.2	6.1	6.0	5.9	5.8	5.7
30	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.4	6.3	6.2	6.1	6.0	5.9	5.8	5.7	5.6

Appendix A-7: Standard Operating Procedures for Stream flow Measurements of Wadeable Streams

**Standard Operating Procedures
for
Streamflow Measurements of Wadeable Streams**

**Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada**

January 2014

APPROVALS:

**Kathy Sertic
NDEP BWQP Chief:**

Kathy Sertic

Date: 01/09/14

**John Heggeness
NDEP BQWP Quality Assurance Officer:**

John O. Heggeness

Date: 1/9/14

Streamflow Measurement Equipment and Supply Checklist

Equipment

- Velocity meter
 - Sontek/YSI FlowTracker Handheld-ADV
 - Pygmy Meter
- Top set wading rod
- 100-foot tape measure
- Pins/stakes
- Stopwatch (if using Pygmy Meter)
- Headphones (if using Pygmy Meter)

Personal Equipment

- Waders or water shoes

Paperwork

- Clipboard
- Streamflow Measurement Field Form
- Pencils, pens, sharpies

Standard Operating Procedure for Streamflow Measurements for Wadeable Streams

1.0 PURPOSE

This document describes the procedure for measuring streamflow in wadeable streams.

2.0 PROCEDURES

2.1 SELECTING A CROSS-SECTION

Select a straight reach where the streambed is uniform and relatively free of boulders and aquatic growth. Avoid stagnant areas or those with irregular bottoms, turbulent flow, standing waves, or strongly sloping bottoms. Depths should be at least 0.3 feet with velocities mostly greater than 0.5 feet/second, if available.

2.2 SETTING THE TAGLINE

String the tape measure across the stream at the chosen cross section and secure the ends using pins, stakes, or vegetation. The tape measure should be perpendicular to the flow and about one foot above the water. Make sure the tape measure is tight, level, and not in contact with the water.

2.3 DETERMINE MEASUREMENT INTERVALS

Before measurements begin, the stream cross section should be divided into measurement intervals. In general, the accuracy of the results increases with the number of measurement intervals. According to USGS protocols, the intervals should be spaced so that no subsection has more than 10 percent of the total discharge. However, the USGS protocols go on to state that the ideal measurement is one in which no measurement subsection has more than 5 percent of the total discharge. Obviously, meeting the 5 percent threshold requires more measurement intervals (more than 20 if the flow is completely uniform, about 25-30 in more realistic situations) than the 10 percent thresholds. However, the 5 percent threshold is likely to be overkill in most situations where NDEP is to be measuring flows. It is recommended that the 10 percent threshold be the target used in most cases.

It is not recommended that all measurement intervals be equally spaced unless the flow is evenly distributed across the stream. The spacing between intervals will need to be closer in those parts of the cross section that have the greater depths and velocities.

It is recommended that the measurement intervals be determined prior to initiating the velocity measurements. Using the tape measure, record the Left Edge of Water (LEW) and Right Edge of Water (REW) on the field sheet and determine the measurement locations needed to approximately meet the 10 percent goal. However, the measurement intervals should be no closer than 0.25 feet.

2.4 MAKING DEPTH AND VELOCITY MEASUREMENTS

The next step is to take depth and velocity measurements at each of the measurement intervals identified above. To measure the depth, the top-setting wading rod is placed in the stream at the predetermined location along the tape measure. Estimate the depth to the nearest 0.01 feet based upon the gradations on the wading rod.

If the depth is less than 2.5 feet, one velocity measurement needs to be taken at the 60% depth point.

To locate the velocity meter at the 60% depth, move the sliding shaft of the wading rod so that the correct one foot line on the sliding rod lines up with the correct tenth foot line on the vernier scale.

For example if the stream depth is 1.4 feet, move the 1 on the sliding rod until it is adjacent to the 4 on vernier scale.

For depths equal to or great than 2.5 feet, velocity measurements are to be taken at both the 20% and 80% depth.

To locate the velocity meter at the 20% depth, double the depth measurement then move the sliding shaft so that the line corresponding to twice the depth lines up with the correct tenth foot line on the vernier scale. For example if the stream depth is 2.8 feet (double the depth = 5.6 feet), move the 5 on the sliding rod until it is adjacent to the 6 on vernier scale.

To locate the velocity meter at the 80% depth, halve the depth measurement then move the sliding shaft so that the line corresponding to half the depth lines up with the correct tenth foot line on the vernier scale. For example if the stream depth is 2.8 feet (half the depth = 1.4 feet), move the 1 on the sliding rod until it is adjacent to the 4 on vernier scale.

When taking the velocity measurements, the wading rod should be kept vertical. When using a FlowTracker, the flow sensor kept perpendicular to the tape measure. When using a Pygmy Meter, the instrument should be lined with up the flow.

Stream velocities in natural conditions tend to pulse over time at the same stage. To average these conditions, allow at least 40 seconds for each velocity measurement with either the FlowTracker or a Pygmy Meter.

2.5 USE OF FLOWTRACKER

Prior to using the FlowTracker, a BeamCheck diagnostic (see FlowTracker user/s manual) should be run before an extended field trip (about once per week). In addition, the temperature sensor should be checked for accuracy as the device uses temperature in calculating velocity. Once in the field, perform a number of field diagnostics as described in the user's manual:

- Recorder Status (2 in System Function Menu)
- Temperature Data (4 in System Function Menu)
- Battery Data (5 in System Function Menu)
- Raw Velocity Data (6 in System Function Menu)
- System Clock (9 in System Function Menu)

Refer to the user's manual for a detailed description of its operation.

2.6 USE OF PYGMY METER

Prior to its use, remove the Shipping Pin beneath the Bucket Wheel that prevents the wheel from rotating while not in use. Install the Pivot Pin in its place. To spin test the meter, hand spin the Bucket Wheel counterclockwise. If it spins less than 90 seconds, clean, lubricate, and adjust the Pivot Pin.

Once the Pygmy Meter is located at the desired location on the tape measure and at the necessary depth, allow a few seconds for the meter to stabilize. For at least 40 seconds, count the number of revolutions the bucket wheel makes during that period. Refer to the rating table in the attachments to determine the number of revolutions needed to easily determine the velocity at that measurement point. In lieu of using

the table, the following equation can also be used to calculate the velocity:

$$Velocity (fps) = 0.9604 * Revolutions/sec + 0.0312$$

Use the forms in the attachments for recording the data collecting and calculating the result flow rate.

REFERENCES

Rantz, S.E. and other. 1982. Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge. USGS Water-Supply Paper 2175.

SonTek/YSI, Inc. 2009. FlowTracker Technical Manual.

Attachments

STANDARD RATING TABLE NO. 2 FOR PYGMY CURRENT METER (6/99)

EQUATION: $V = 0.9604 R + 0.0312$ (R =revolutions per second)

Seconds	VELOCITY IN FEET PER SECOND														
	Revolutions														
	3	5	7	10	15	20	25	30	40	50	60	80	100	150	200
40	0.103	0.151	0.199	0.271	0.391	0.511	0.631	0.752	0.992	1.23	1.47	1.95	2.43	3.63	4.83
41	0.101	0.148	0.195	0.265	0.383	0.500	0.617	0.734	0.968	1.20	1.44	1.91	2.37	3.54	4.72
42	0.100	0.146	0.191	0.260	0.374	0.489	0.603	0.717	0.946	1.17	1.40	1.86	2.32	3.46	4.60
43	0.098	0.143	0.188	0.255	0.366	0.478	0.590	0.701	0.925	1.15	1.37	1.82	2.26	3.38	4.50
44	0.097	0.140	0.184	0.249	0.359	0.468	0.577	0.686	0.904	1.12	1.34	1.78	2.21	3.31	4.40
45	0.095	0.138	0.181	0.245	0.351	0.458	0.565	0.671	0.885	1.10	1.31	1.74	2.17	3.23	4.30
46	0.094	0.136	0.177	0.240	0.344	0.449	0.553	0.658	0.866	1.08	1.28	1.70	2.12	3.16	4.21
47	0.093	0.133	0.174	0.236	0.338	0.440	0.542	0.644	0.849	1.05	1.26	1.67	2.07	3.10	4.12
48	0.091	0.131	0.171	0.231	0.331	0.431	0.531	0.631	0.832	1.03	1.23	1.63	2.03	3.03	4.03
49	0.090	0.129	0.168	0.227	0.325	0.423	0.521	0.619	0.815	1.01	1.21	1.60	1.99	2.97	3.95
50	0.089	0.127	0.166	0.223	0.319	0.415	0.511	0.607	0.800	0.992	1.18	1.57	1.95	2.91	3.87
51	0.088	0.125	0.163	0.220	0.314	0.408	0.502	0.596	0.784	0.973	1.16	1.54	1.91	2.86	3.80
52	0.087	0.124	0.160	0.216	0.308	0.401	0.493	0.585	0.770	0.955	1.14	1.51	1.88	2.80	3.73
53	0.086	0.122	0.158	0.212	0.303	0.394	0.484	0.575	0.756	0.937	1.12	1.48	1.84	2.75	3.66
54	0.085	0.120	0.156	0.209	0.298	0.387	0.476	0.565	0.743	0.920	1.10	1.45	1.81	2.70	3.59
55	0.084	0.119	0.153	0.206	0.293	0.380	0.468	0.555	0.730	0.904	1.08	1.43	1.78	2.65	3.52
56	0.083	0.117	0.151	0.203	0.288	0.374	0.460	0.546	0.717	0.889	1.06	1.40	1.75	2.60	3.46
57	0.082	0.115	0.149	0.200	0.284	0.368	0.452	0.537	0.705	0.874	1.04	1.38	1.72	2.56	3.40
58	0.081	0.114	0.147	0.197	0.280	0.362	0.445	0.528	0.694	0.859	1.02	1.36	1.69	2.51	3.34
59	0.080	0.113	0.145	0.194	0.275	0.357	0.438	0.520	0.682	0.845	1.01	1.33	1.66	2.47	3.29
60	0.079	0.111	0.143	0.191	0.271	0.351	0.431	0.511	0.671	0.832	0.992	1.31	1.63	2.43	3.23
61	0.078	0.110	0.141	0.189	0.267	0.346	0.425	0.504	0.661	0.818	0.976	1.29	1.61	2.39	3.18
62	0.078	0.109	0.140	0.186	0.264	0.341	0.418	0.496	0.651	0.806	0.961	1.27	1.58	2.35	3.13
63	0.077	0.107	0.138	0.184	0.260	0.336	0.412	0.489	0.641	0.793	0.946	1.25	1.56	2.32	3.08
64	0.076	0.106	0.136	0.181	0.256	0.331	0.406	0.481	0.631	0.782	0.932	1.23	1.53	2.28	3.03
65	0.076	0.105	0.135	0.179	0.253	0.327	0.401	0.474	0.622	0.770	0.918	1.21	1.51	2.25	2.99
66	0.075	0.104	0.133	0.177	0.249	0.322	0.395	0.468	0.613	0.759	0.904	1.20	1.49	2.21	2.94
67	0.074	0.103	0.132	0.175	0.246	0.318	0.390	0.461	0.605	0.748	0.891	1.18	1.46	2.18	2.90
68	0.074	0.102	0.130	0.172	0.243	0.314	0.384	0.455	0.596	0.737	0.879	1.16	1.44	2.15	2.86
69	0.073	0.101	0.129	0.170	0.240	0.310	0.379	0.449	0.588	0.727	0.866	1.14	1.42	2.12	2.81
70	0.072	0.100	0.127	0.168	0.237	0.306	0.374	0.443	0.580	0.717	0.854	1.13	1.40	2.09	2.78

Appendix A-8: Standard Operating Procedures for Transporting and Operating All-Terrain Vehicles

**Standard Operating Procedures
for
Transporting and Operating All-Terrain Vehicles**

**Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada**

January 2014

APPROVALS:

**Kathy Sertic
NDEP BWQP Chief:**

Kathy Sertic

Date: *01/09/14*

**John Heggeness
NDEP BQWP Quality Assurance Officer:**

John O. Heggeness

Date: *1/9/14*

All-Terrain Vehicle Equipment and Supply Checklist

All-Terrain Vehicle Transport Equipment

- Proper sized ball hitch
- Locking hitch pin
- Proper sized trailer
- Lock for trailer coupler
- Proper sized spare tire
- Lug wrench for trailer
- Jack for trailer
- Front tie down strap for ATV
- Rear tie down strap for ATV

All-Terrain Vehicle Equipment

- DOT rated motorcycle helmet (supplied by BWQP)
- Eye protection (or helmet face shield)
- Sturdy boots with ankle support
- Gloves
- Long-sleeved shirt or jacket (optional)
- Tool kit – emergency maintenance tools located in rear compartment of ATV
- First Aid kit

All-Terrain Vehicle Storage Equipment

- Trickle charger
- Fuel Stabilizer

Standard Operating Procedure for Transporting and Operating All-Terrain Vehicles

1 PURPOSE AND APPLICABILITY

This Standard Operating Procedure (SOP) is intended to standardize procedures for transporting and operating All-Terrain Vehicles (ATVs) for use in sampling and monitoring activities. However, this SOP is not intended as a substitute for information on local, state, and federal regulations concerning ATV operation and transport.

2 TRAINING

All Nevada Division of Environmental Protection – Bureau of Water Quality Planning (BWQP) personnel that will use ATVs are required to complete an ATV safety course approved by the State of Nevada Risk Management Division and retain a certificate of completion. All BWQP personnel that will use ATVs must also be familiar with the ATV owner’s manual and this SOP.

3 ATV USAGE

The ATVs will only be used when a site cannot be accessed by truck. The ATV must be transported from site to site on a trailer or truck and cannot be operated on public roads. At the site, the ATV can be used to transport equipment and personnel to, from, and during assigned work. All site speed limits and off-road restrictions apply.

4 PREPARING ATVS FOR TRANSPORT AND USE

See attachments for Checklist for Preparing ATVS for Transport and Use

5 TRANSPORT OF ATVS

The ATV must be transported from site to site on a trailer and cannot be operated on public roads. All ATVs will be transported in accordance with local, state, and federal regulations.

6 PRE-RIDE INSPECTION

See attachments for Pre-Ride Inspection Checklist.

7 UNLOADING/LOADING ATVS

See attachments for Checklist for Unloading/Loading ATVs.

8 OPERATION OF ATVS

8.1 GENERAL PRECAUTIONS

- Do not carry passengers.
- Do not operate an ATV on pavement. The ATVs are not designed to be used on paved surfaces and may be difficult to control.
- Be cautious when operating an ATV, especially when approaching hills, turns, and obstacles and when operating on rough terrain.
- Go at a speed that is appropriate for the terrain, visibility conditions, and your experience.
- Never attempt to do wheelies, jumps, or other stunts.

8.2 RIDING IN REVERSE

- First, bring the vehicle to a complete stop and make sure the transmission is in neutral.
- Depress the knob on the gear shift and maneuver the gear shift into reverse.

- Open the throttle gradually and ride slowly. Do not open the throttle suddenly or make abrupt turns.
- To stop, release the throttle and gradually apply both the front and rear brakes.
Note: Do not abruptly apply the rear brake by itself.
- To shift from reverse to neutral, depress the knob on the gear shift and maneuver the gear shift into neutral.

8.3 TRANSPORTING EQUIPMENT

When carrying a load, ensure that it is properly balanced and secured to a rack that is intended for this purpose. When transporting extra fuel it must be in a Department of Transportation approved container.

Note: Never transport additional personnel on the ATV.

9 DECONTAMINATION OF FIELD EQUIPMENT TO LIMIT THE SPREAD OF INVASIVE SPECIES

For further information read the SOP Decontamination of Field Equipment to Limit the Spread of Invasive Species (Appendix A-9).

10 PREPARING THE ATVS FOR STORAGE

The ATVs must be stored inside a secure location. The ATVs will be stored on the trailer. While the ATVs are in storage, the trickle charger for the ATV batteries will be connected. If the ATVs will not be used for extended periods of time, a fuel stabilizer will be added to the gasoline tank according to the manufacturer's instructions.

11 MAINTENANCE

The ATVs and the ATV trailer are maintained per manufacturer's recommendations.

Attachments

CHECKLIST FOR PREPARING ATVS FOR TRANSPORT AND USE

ATVs:

- Front tie down strap is attached and snugged.
- Rear tie down strap attached and snugged.
- Battery is fully charged.
- Oil reservoir in main engine is full.
- Gasoline tank is full.
- Dashboard indicators working (fuel indicator, oil indicator, etc.).
- Headlights and brake lights working.
- Check steering function.
- Engine starts and runs.
- DOT rated motorcycle helmet for each individual are in the vehicle.

Trailer:

- Inspect trailer tires (including spare) to make sure they are properly inflated.
- Check padlock on the spare tire, make sure that key works.
- Make sure lug wrench and jack for trailer are in the vehicle.
- Lock trailer hitch assembly onto vehicle.
- Attach trailer to vehicle.
- Check to make sure trailer coupler is secure on the ball hitch by pulling up on trailer.
- Lock the trailer coupler.
- Check trailer safety chains for wear and tear.
- Attach trailer safety chains in crisscrossed fashion.
- Check for wear and tear on trailer electrical connection wires and plugs.
- Connect trailer electrical connection to vehicle electrical plug.
- Confirm that the trailer's brake lights, turn signals, running lights, and reverse lights are functional.

PRE-RIDE INSPECTION CHECKLIST

- Set PARKING BRAKE. The parking brake is engaged by pulling the left hand grip and pushing the lever marked Parking Brake.
- Transmission is in NEUTRAL.
- Brakes. The right hand grip and the right foot pedal are the rear wheel brakes. The left hand grip is the front wheel brake. Check operation. Make sure there is no brake fluid leakage. Make sure that brake lights are functioning properly.
- Fuel. Fill the fuel tank with unleaded gas when necessary. Check for leaks.
- Tires and wheels. Check condition and pressure.
- Controls. Check for proper function.
- Lights and switches. Check for proper function.
- Drive shaft and chassis. Check for damage or leaking fluids.
- Steering. Check that the wheels turn properly as you turn the handlebars.
- Cargo. Check that all cargo is properly secured.
- Headlights. Check for proper function.
- Engine oil level. Check the oil level and add oil if required. Check for leaks.
- Throttle. Check for smooth opening and closing in all steering positions.
- Nuts, bolts, and fasteners. Check the wheels to see that the axle nuts are tightened. Check the security of all other nuts, bolts, and fasteners.
- Underbody and exhaust system. Check for, any dirt, vegetation, or other debris that could be a fire hazard or interfere with the proper operation of the vehicle. If necessary, clean the underbody and exhaust system.
- Air cleaner housing drain tube. Check for deposits in the drain tube. If necessary, clean the tube and check the air cleaner housing.
- Confirm that tool kit and owner's manual are in the seat storage box.

CHECKLIST FOR UNLOADING/LOADING ATVs

Trailer:

- Unload/load ATVs on level ground, if possible.
- Make sure trailer is attached to tow vehicle.
- Fold down loading ramp.

Unloading ATVs:

- Remove straps securing ATV to the trailer.
- Don helmet and gloves.
- Make sure gear shift is in neutral and turn choke on (if necessary). Note: starter will not operate unless the transmission is in neutral.
- Lock the parking brake and make sure the transmission is in neutral.
- Turn the fuel valve to RUN.
- Turn the ignition switch to ON.
- Turn the engine stop switch to ON.
- Turn all auxiliary switches on.
- Press the starter button. Let the ATV warm up, if necessary.
- Allow motor to warm up at idle speed. Once motor is warmed up, turn choke off before riding ATV.
- Apply brakes and remove parking brake.
- Shift ATV into gear.
- Slowly ride forward or backward onto ramp.
- Adjust rider weight to compensate for ramp angle.
- Slowly apply brakes as the ATV rolls down the ramp.

Loading ATVs:

- Slowly ride forward or backward onto ramp.
- Adjust rider weight to compensate for ramp angle.
- Slowly apply throttle as the ATV rolls up the ramp.
- Carefully maneuver the ATV into position on the trailer.
- Lock the parking brake and make sure the transmission is in neutral.
- Turn the fuel valve off and let the ATV run until it stops.
- Turn the ignition switch to OFF.
- Turn the engine stop switch to OFF.
- Turn all auxiliary switches off.
- Check for damages and leaks.
- Secure the ATVs to the trailer for transport. Checklist for Preparing ATVs for Transport and Use.

Appendix A-9: Standard Operating Procedures for Decontamination of Field Equipment to Limit the Spread of Invasive Species

**Standard Operating Procedures
for
Decontamination of Field Equipment to Limit the Spread of
Invasive Species**

**Prepared by:
State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Water Quality Planning
Carson City, Nevada**

January 2014

APPROVALS:

Kathy Sertic
NDEP BWQP Chief:

Kathy Sertic

Date: *01/09/14*

John Heggeness

NDEP BQWP Quality Assurance Officer:

John D. Heggeness

Date:

1/9/14

Invasive Species Decontamination Equipment and Supply Checklist

Decontamination of Sampling Equipment and Personal Gear

- Nitrile or rubber protective gloves.
- Eye Protection.
- Portable eyewash bottle containing saline solution.
- Stiff-bristled brush.
- One pump sprayer containing white vinegar.
- One pump sprayer containing clean rinse water.
- Paper towels.

Decontamination of Boats and Associated Equipment

- Nitrile or rubber protective gloves.
- Eye Protection.
- Portable eyewash bottle containing saline solution.
- Stiff-bristled brush.
- One pump sprayer containing 5% bleach solution.
- One pump sprayer containing clean rinse water.
- Outboard motor flushing attachment.
- Hose siphon mixer.
- Paper towels.

Decontamination of Rubber-Tired Land Vehicles

- Nitrile or rubber protective gloves.
- Eye Protection.
- Portable eyewash bottle containing saline solution.
- Stiff-bristled brush.
- One pump sprayer containing 5% bleach solution.
- One pump sprayer containing clean rinse water.
- Flashlight(s).
- Mirror(s).

Standard Operating Procedures for Decontamination of Field Equipment to Limit the Spread of Invasive Species

1.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) provides general guidelines for decontamination of field equipment to limit the spread of invasive species. Limiting the spread of invasive species is important because invasive species can cause serious environmental and economic harm.

Invasive species can be spread in numerous ways. For example, soil and mud accumulated on undersides of vehicles can carry seeds or viable fragments of invasive plants. Lodged material from plants or animals is often not easily recognizable by casual inspection of equipment and vehicles. In addition, foreign material can become lodged in areas of limited sight and access. Also, the use of boats, pumps, in-water equipment, and even waders in waters infested with invasive plants and animals can easily become vectors for spread of invasive species. Therefore, it is vital that BWQP personnel working in areas where invasive species are present (or suspected to be present) have sufficient training in inspecting and decontaminating equipment used in such areas.

2.0 METHOD SUMMARY

This SOP describes the process to preinspect, clean, and reinspect all equipment before moving or placing the equipment into service. Properly conducted inspection and decontamination of equipment prior to entry at a new location limits introduction of invasive species. Generally, equipment of all types should be decontaminated at the location of last use before being moved to a new location. If this is not possible, arrange for cleaning at a facility that is specifically designed for equipment cleaning. Inspection of equipment is the primary tool for preventing the introduction of an invasive organism into an uninfested location.

The following decontamination procedures are followed by all BWQP personnel involved in surface water sampling and monitoring. The required decontamination equipment is carried in our field vehicles and the procedures are understood and implemented by all BWQP field staff. These procedures are consistent with the best available science for managing the risk of spreading invasive species and have been found effective in significantly reducing the survival of some of the most insidious invasive species. Further information can also be obtained by reviewing the reference materials for this SOP.

Field crews must be aware of regional species of concern, and take appropriate precautions to avoid transfer of these species. Prior to going into the field, crews must review the most up-to-date invasive species notifications.

Personnel must be trained to look for problem areas that are not apparent upon casual observation. Effective inspections require good lighting conditions (preferably daylight hours) and training of personnel to use systematic techniques.

When possible, keep several changes of field gear and sampling equipment for use in different aquatic systems (especially within an area of suspected or confirmed infestation). This is the preferred method to limiting the spread of invasive species.

3.0 SAMPLING STRATEGY

Whenever practical, the least infested (or least likely to be infested) sites should be visited first to reduce

the risk of accidentally introducing invasive species a new area during field work. In circumstances when the existence of invasive species is unknown, BWQP samples from upstream to downstream (whenever practical) to avoid carrying invasive species further upstream.

4.0 DECONTAMINATION PROCEDURES

Invasive species can become lodged in or on personal gear, sampling equipment, vehicles, boats, as well as associated equipment and trailers. Rigorous inspection must be used to find problems, and total removal of aquatic invasive species must take place before moving to other aquatic systems. Each equipment type has its own particular requirements for inspection.

Even the most careful inspection of equipment will not guarantee that the equipment is absolutely free of contamination. Successful decontamination is dependent upon many factors, such as the amount of care taken during the decontamination operation, the type of decontamination equipment being used, the level of training of the decontamination operator, the type of equipment being decontaminated, and the particular invasive species.

If equipment is used at a location known or suspected to be infested with a high risk invasive species, the equipment should undergo vigorous inspection, followed by thorough decontamination, and a final reinspection before being moved off the worksite. At the new worksite location, the equipment should be inspected again, preferably by someone other than the original inspector before the equipment is placed into service. If, on reinspection, contamination is found on the equipment, do not allow the equipment entry on the new worksite; either return the equipment to the location of last use for additional decontamination or arrange for decontamination at a location that is specifically designed for equipment decontamination.

Decontamination of field equipment should always occur after each use in areas of suspected or confirmed infestation and before equipment is used if the cleanliness of equipment is unknown.

4.1 DECONTAMINATION OF SAMPLING EQUIPMENT AND PERSONAL GEAR

Clothing, shoes, and waders¹³ can become vectors of spread when personnel leave infested areas that contain soil or mud laden with seed, plant fragments, pathogens, insects, and other animals. Equipment that can be easily inspected and decontaminated should be used.

4.1.1 INSPECTION PROCEDURE

All personal gear (e.g. clothing, waders, hats, socks, shoes, gloves, etc.) and sampling equipment should be thoroughly inspected for seeds, plant material, algae, mud, soil, insects, and other invertebrates such as snails, mussels, and other aquatic species. Particular attention must be given to places where foreign material could become accidentally trapped, such as in the cuffs and folds of clothing, treads of boots or waders, or closures such as zippers or ties. Pockets should be turned inside out to remove debris. Shoelaces and shoe tongues should be checked. In addition, all sampling equipment that was in contact with water must be thoroughly inspected as well.

For in-water equipment, inspect for zebra and quagga mussel infestations. Look for adult mussels and feel by hand for very small veligers (the mussel immature life stage) attached to anything that has

¹³ It is the policy of the BWQP that felt-soled waders and boots will not be used.

made contact with raw water. On a smooth surface, mussel veligers will feel like gritty sandpaper. As the veliger matures, it may become visible to the unaided eye, appearing as a nondescript speck.

4.1.2 DECONTAMINATION PROCEDURE¹⁴

- After exiting the waterbody, immediately remove any personal gear that came in contact with water. Make sure the wetted personal gear and sampling equipment does not come in contact with other equipment.¹⁵
- Thoroughly inspect the wetted personal gear and sampling equipment.
- Before leaving the sample site area, remove conspicuous mud, debris, and plant material from wetted personal gear and sampling equipment using stiff-bristled brush.¹⁶ If any material is removed, either throw it in a trashcan or dispose of it on high, dry ground. Do not put it back into the waterbody or along the waterline.
- If equipment will not be put into immediate use it can be placed out to air-dry in a low-humidity environment for at least 72-hours after all mud and debris has been removed. All surfaces of air-dried equipment should remain free of surface contact, allowing for maximum airflow across all surfaces. Drying is the preferred treatment.
- Alternatively, if gear will be used immediately, thoroughly spray all wetted personal gear and sampling equipment with white vinegar or other approved decontamination solution.
- Re-inspect the personal gear and sampling equipment for attached organisms or propagules, making sure to examine all crevices. If necessary, use a stiff bristled brush to remove any remaining debris and mud.
- After reinspection, spray the personal gear and sampling equipment with clean rinse water. **DO NOT USE WATER FROM THE INFESTED SOURCE.** This may reintroduce invasive species to the personal gear and sampling equipment.
- After personal gear and sampling equipment are decontaminated, ensure that they remain clean when leaving the site.

If adult mussels are found during inspection, the equipment should be washed with hot ($\geq 140^{\circ}\text{F}$), high-pressure water or dipped treated in hot water ($\geq 140^{\circ}\text{F}$), and allowed to dry completely before the next use.

Note: This decontamination procedure does not apply to electronic equipment such as dissolved oxygen and pH meters. Rinse meter probes with clean water between sites, remove all plant fragments and other debris from meters and cables by hand (clean paper towels may be used if needed), and allow equipment to air dry. Meters and data sondes may be disinfected with an appropriate decontamination solution, if deemed necessary by the Standards and Monitoring Branch Supervisor. Alternatively, designated electronic equipment can be used for waterbodies of suspected or confirmed infestation.

¹⁴ Certain species of concern may require more substantial decontamination measures. For example, white vinegar is not effective against *Didymosphenia geminate*.

¹⁵ Invasive species can be transferred to any surface they come in contact with and they could later be transferred back to decontaminated personal gear and sampling equipment.

¹⁶ If there is a nap, brush with the nap rather than against it. Brushing against the nap could further embed small seeds into the weave of fabric.

4.2 DECONTAMINATION OF BOATS AND ASSOCIATED EQUIPMENT

Boats and trailers are major contributors to the spread of invasive aquatic plants and animals. Detailed inspections must be made before the boat, trailer, and associated equipment in contact with water are moved from one waterbody to another.

4.2.1 INSPECTION PROCEDURE

Zebra mussels and quagga mussels are a complex inspection problem. Adult mussels are likely to be visually identified; however, the mussel veliger (the immature life stage) can attach to boat hulls, trailers, anchor ropes, and anything else that contacts an infested water body without being visually identified. Since the veliger is microscopic and cannot be seen without laboratory equipment, do not rely on visual inspection alone. Veligers are detectable only by feeling by hand along all surfaces and inside holes and crevices. On a smooth surface, mussel veligers will feel like gritty sandpaper. As the veliger matures, it may become visible to the unaided eye, appearing as a nondescript speck. Equipment that has been in water for a long period of time can become infested with adult mussels.

4.2.2 DECONTAMINATION PROCEDURE

- Prior to leaving a site, inspect the boat and trailer including running your hands up and down the equipment and feeling all around for any attached organisms.
- Remove any visible mud, plants, invertebrates, or vertebrates from the anchor, boat, motor, and trailer. If any material is removed, either throw it in a trashcan or dispose of it on high, dry ground. Do not put it back into the waterbody or along the waterline.
- Drain the water from your outboard motor¹⁷, bilge, and every other conceivable space or item that can hold water on land before leaving the immediate area of the waterbody. Oily or dirty bilge water must be contained and disposed of properly.

When a boat decontamination facility is available:

- Wash the hull, external areas of motor, and any other exposed surface with hot, pressurized water ($\geq 140^{\circ}\text{F}$).¹⁸ Water temperature used during hot water washing or rinsing must be maintained at $\geq 140^{\circ}\text{F}$ at surface contact for 1-3 minutes exposure time to bring the surface temperature up to $\geq 140^{\circ}\text{F}$ for 30 seconds. In addition, flush the internal water passages of the outboard motor until the water temperature exiting the motor is $\geq 140^{\circ}\text{F}$ for 30 seconds.
- Completely reinspect your boat and trailer, removing any visible mussels, but also feel for any rough or gritty spots on the hull.
- Before leaving to enter another waterbody, check the boat and trailer for plant material or mussels. Remove anything visible. You can be cited for transporting mussels, even if they are dead.

When a boat decontamination facility is not available:

- Wash the hull, external areas of motor, and any other exposed surface with a 5% bleach solution. Flush the internal water passages of the outboard motor with white vinegar or a 5% bleach solution, then rinse with clean water and allow to dry.

¹⁷ Follow factory guidelines for eliminating water from motors.

¹⁸ Using a car wash or home power water sprayer is not adequate to kill and/or remove zebra or quagga mussels. Use a power washer unit that is capable of applying a flow rate of at least 4 gallons per minute with a nozzle pressure of 3,000 psi, and that is able to supply water at 140°F or hotter at the surface point of contact.

- Completely reinspect your boat and trailer, removing any visible mussels, but also feel for any rough or gritty spots on the hull.
- Before leaving to enter another water body, check boat and trailer for plant material or mussels. Remove anything visible. You can be cited for transporting mussels, even if they are dead.

Drying times capable of killing mussels vary according to the month of the year, location, and relative humidity; therefore, no single drying time estimate can ensure a complete kill for all situations. For specific information for a given month and location, refer to the 100th Meridian Quarantine Estimator for Zebra Mussel Contaminated Boats drying schedule at the following Web site:

<http://www.100thmeridian.org/Emersion.asp> (100th Meridian Initiative, 2008).

4.3 DECONTAMINATION OF RUBBER-TIRED LAND VEHICLES

Rubber-tired land vehicles can become vectors of spread when driven out of infested areas that contain soil or mud laden with seed, plant fragments, pathogens, invertebrates, and vertebrates.

4.3.1 INSPECTION PROCEDURE

In the field, all vehicles should be carefully inspected. Invasive species can be deposited on fuel tanks, wheel wells, behind the bumpers of vehicles, among other locations. Particular attention must be given to places where foreign material could become accidentally trapped, such as in cracks and crevices, in undercarriages, and in the treads of tracks or tires. In addition, the interiors of vehicles must be thoroughly inspected for invasive species.

4.3.2 DECONTAMINATION PROCEDURE

Clean vehicles and equipment thoroughly, and ensure that they remain clean when leaving the site. Follow up cleaning operations with final inspections.

All vehicles used for monitoring activities shall be inspected before going into the field and between sites. Any visible mud, plants or animals shall be removed immediately to prevent transfer. Vehicles shall be periodically washed at car wash facilities. Keeping vehicles and equipment clean and free of mud and debris will aid in preventing the spread of invasive species.

If rubber-tired land vehicles come in contact with a waterbody that is known or suspected to be infested with an invasive species, follow decontamination procedures outlined in Section 4.2.2.

REFERENCES

Bureau of Reclamation. 2010. Technical Memorandum No. 86-68220-07-05: Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species, 2010 Edition.

<http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2010.pdf>

California Department of Fish and Game. 2005. Controlling the Spread of New Zealand Mud Snails on Wading Gear. May 16, 2005.

Colorado Division of Wildlife. 2011. "Aquatic Nuisance Species (ANS) Watercraft Decontamination Manual." June 2011.

<http://wildlife.state.co.us/SiteCollectionDocuments/DOW/WildlifeSpecies/AquaticNuisance/ANSWat>

[ercraftDecontamManual.pdf](#)

Schisler, G.J., Vieira, N.K.M, and Walker, P.G. 2008. “Application of Household Disinfectants to Control New Zealand Mudsnaills.” North American Journal of Fisheries Management, 28: 1172-1176.

United State Forest Service. 2011. “Preventing Spread of Aquatic Invasive Organisms Common to the Intermountain Region – 2011 Technical Guidelines for Fire Operations.” May 2011.

http://www.fs.fed.us/r4/resources/aquatic/guidelines/2011techguidelines_fire_AIS.pdf

100th Meridian Initiative. 2008. Cooperative Federal, State, and provincial agency Web site:

<http://www.100thmeridian.org>.

APPENDIX B: HEALTH AND SAFETY PLAN

BUREAU OF WATER QUALITY PLANNING

Field Staff Safety Guidance and Recommended Protective Measures

November 2012

Surface water sampling is conducted regularly by BWQP staff. These monitoring activities are conducted at hundreds of locations under many different conditions. The hazards presented by these work activities vary widely with the site being sampled. **BWQP field staff will use best professional judgment at all times, and at no time allow personal safety to be compromised. In addition, all BWQP field staff are trained in field safety issues, including what to do in the event of an emergency. The “Safety First” principle will be adhered to at all times.**

This document describes some of the hazards which BWQP field staff may be exposed to during monitoring activities. Protective measures are recommended for each of the identified hazards. These hazards and protective measures are only presented as guidelines. Each BWQP field staff and his/her supervisor should evaluate the activities of the field staff to determine which hazards may be of concern at work sites and whether the protective measures recommended here are adequate or appropriate. The field staff and supervisor are required to address any additional worksite hazards in the field staff's job safety analysis.

GENERAL

This guidance is not intended to be a description of the specific hazards or every hazard that could be associated with a particular site or area. Due to the various sites and areas which are within the BWQP's jurisdiction, one should never visit a site without a reasonable understanding of the expected hazards.

All personnel will do the following prior to performing field work:

- 1) A trip schedule will be prepared by the employee who identifies the sites or areas to be visited, the purpose of the trip, and approximate times. The name and phone number of the hotel, if the trip involves staying overnight, will be included;
- 2) The trip schedule will be reviewed by the supervisor. Potential hazards that could be encountered will be discussed by the supervisor and the field staff prior to the trip;
- 3) If there is uncertainty regarding hazards likely to be encountered, the field staff will proceed with best professional judgment to determine potential hazards; and
- 4) If a reasonable understanding of the potential hazards at a site cannot be determined as a result of office file review, etc., the field staff will contact the other responsible agency (Bureau of Land

Management, Forest Service, State Parks, etc.) to obtain additional information.

PHYSICAL HAZARDS

During sampling activities, field staff must wear the appropriate protective clothing when conducting the visit. For most of the sites that BWQP field staff are likely to visit, personal floatation devices, waders, and/or rubber gloves are adequate protective clothing.

Additionally, the field staff must be aware of potential hazards, including but not limited to, the following physical hazards:

- (a) Obstacles, holes, ditches, or uneven walking surfaces which could cause the employee to trip or fall;
- (b) Precariously positioned objects, such as rocks or branches that may fall and strike the field staff;
- (c) Sharp objects, such as nails, metal shards, and broken glass that may cause punctures or cuts;
- (d) Slippery surfaces, such as algae-covered rocks that may cause a fall;
- (e) Steep grades that present a falling hazard; and
- (f) Unstable surfaces, such as streambanks that may collapse or unstable rocks.

Field staff must be alert to and avoid these hazards.

ELECTRICAL HAZARDS

Overhead power lines, downed electrical wires, and buried cables all pose a danger of shock or electrocution if field staff contact or sever them during monitoring activities. Electrical equipment used on site may also pose a hazard to field staff. To help minimize this hazard, low voltage equipment with ground-fault interrupters and water-tight corrosion-resistant connecting cables must be used on site. Additional electrical hazards involve capacitors that may retain a charge.

In addition, lightning is a hazard during outdoor operations, and particularly for field staff handling metal containers or equipment. Weather conditions will be monitored and work will be suspended during electrical storms.

HEAT STRESS

BWQP field staff are rarely required to work strenuously for long periods in hot weather. If such activities are required, however, heat stress is a substantial hazard and must be addressed in the site safety plan. Heat stress is a concern during hot seasons or for field staff that are required to wear protective clothing. Heat stress occurs when there is an imbalance between the heat the body is producing during its work and the heat it can get rid of, through perspiring to the environment. The same protective materials that shield the body from chemical or water exposure also limit the dissipation of body heat and moisture.

Heat stress can impact the human body very rapidly, within as little as 15 minutes of working.

Early symptoms of heat stress include:

- Heavy sweating;
- Extreme weakness or fatigue;
- Clammy skin;
- Pale or flushed complexion or rash;
- Dizziness;
- Nausea; and/or
- Headache.

These symptoms will be treated immediately with rest in a cool place and potable water.

More severe symptoms include:

- Painful muscle spasms;
- Vomiting;
- Convulsions;
- Severe headache;
- Mental confusion or extreme anxiety;
- Loss of consciousness; and/or
- Hot, dry skin (may perspire).

These symptoms require medical attention as soon as possible. Cool the employee down by wetting and fanning until medical treatment is available or he/she can be transported to nearest medical facility.

The following protective measures must be taken when BWQP field staff are required to work strenuously or with protective equipment in hot weather:

- Acclimate to the heat through gradual work load buildup;
- For strenuous work, take frequent rest periods;

- Replace fluids frequently; and
- Monitor employees frequently for symptoms of heat stress.

COLD EXPOSURE

Prolonged exposure to extreme cold can cause injuries such as frostbite or hypothermia. To guard against the effects of extreme cold, appropriate clothing must be worn. Frostbite is temporary or permanent tissue damage from exposure to subfreezing temperature. Frostbite symptoms include:

During exposure

- Gradual numbness, hardness, and paleness in the affected area.

Upon rewarming

- Pain and tingling or burning (sometimes severe) in the affected area, with color change from white to red, then purple;
- Blisters (severe cases);
- Shivering;
- Slurred speech; and/or
- Memory loss.

Frostbite can be prevented by:

- Anticipating sudden temperature changes and carrying a jacket, gloves, socks, hat, and scarf.
- Not drinking or smoking prior to anticipated exposure.
- Continue moving arms and legs.

Hypothermia is a dangerous cooling of the body from exposure to cold air or water. Hypothermia symptoms include:

- Poor muscle coordination;
- Mental confusion;
- Shivering and low body temperature;
- Slow pulse;
- Rigid muscles;
- Purple fingers, toes and nail beds; and/or
- Loss of consciousness.

Hypothermia can be prevented by:

- In cold weather, wearing windproof clothing in many layers, including a scarf, hat and gloves/mittens.
- In rain, changing to dry clothing as soon as possible.
- Continue moving to generate body heat.
- Not conducting field activities during severe winter storms.

- Not walking on frozen bodies of water.

BIOLOGICAL HAZARDS

Biological hazards that BWQP field staff may encounter include poisonous plants, insects, snakes, animals, and indigenous pathogens. Most of these hazards can be avoided by wearing long pants, long sleeved shirts, and boots during sampling activities. When possible, field staff will remain on designated paths and not walk through heavy brush. Always watch carefully where you are stepping. Do not put hands in areas that you cannot see into and take extra precautions when lifting items that snakes may be under.

CHEMICAL HAZARDS

In order to help prevent the spread of invasive species via personal gear and sampling equipment, BWQP field staff may be required to use chemical decontaminants. BWQP field staff are required to wear latex (or rubber) gloves and eye protection when using chemical decontamination agents such as Sparquat 256®. These products are industrial cleaners and standard safety precautions will be followed. In addition, portable eye wash bottles containing saline solution must be readily available when using chemical decontaminants

HOSTILITY

BWQP field staff may be confronted with hostility during sampling activities. If at any time field personnel is threatened with aggression or violence, or believes that the owner or operator may harm him/her, the field staff must immediately leave the site and report to his/her supervisor. The field staff may not re-enter the sampling area until law enforcement personnel accompany them during monitoring activities. The field personnel will provide written documentation of the incident to the supervisor within 5 working days. A Safety Investigation Team will be called and the findings will be provided to the Bureau's Safety Coordinator. The supervisor will be responsible for reporting the incident to the Bureau Chief or the Administrator, as appropriate.

APPENDIX C: NEVADA STATE PUBLIC HEALTH LABORATORY QUALITY ASSURANCE MANAGEMENT PLAN

NEVADA STATE HEALTH LABORATORY
QUALITY ASSURANCE MANAGEMENT PLAN
CHEMISTRY DEPARTMENT

1660 N. VIRGINIA ST.
RENO, NV 89503
(775) 688-1335

December 29, 2010

Vernon Miller Chemistry Supervisor	Date
Vacant Quality Assurance, Manager	Date
Stacey A. Rice Quality Assurance, Manager	Date
Louis Dee Brown, MD MPH Laboratory Director	Date
Stephanie Van Hooser Administrative Director	Date

Table of Contents

CHAPTER 1 - QUALITY ASSURANCE 138

CHAPTER 2 - POLICIES	139
CHAPTER 3 - LABORATORY ORGANIZATION	141
CHAPTER 4 - DOCUMENTATION AND RECORDS	143
CHAPTER 5 - FACILITIES AND ANALYTICAL INSTRUMENTATION	144
CHAPTER 6 - MAINTENANCE	148
CHAPTER 7 - SAMPLE MANAGEMENT	157
CHAPTER 8 - DATA QUALITY OBJECTIVES	164
CHAPTER 9 - CALIBRATION PROCEDURE	167
CHAPTER 10 - CORRECTIVE ACTION AND CONTINGENCY PLANNING	169
CHAPTER 11 - INTERNAL AUDITS	171
CHAPTER 12 - LABORATORY EVALUATION STUDIES	172
CHAPTER 13 - METHODS AND OPERATION	172
CHAPTER 14 - DATA REDUCTION, VALIDATION AND REPORTING	179
CHAPTER 15 - CONTRACTING SAMPLES TO ANOTHER LABORATORY	180

CHAPTER 1 - QUALITY ASSURANCE

QUALITY ASSURANCE POLICY

The Nevada State Health Laboratory offers this Quality Assurance Manual to outline the purpose, policies, organization, responsibilities, and operations related to ensuring high-quality performance in every aspect of activity within the laboratory. It is essential that all laboratory personnel understand the policies, objectives, and procedures that are outlined in this management plan. This will help them to understand the role that they play in the overall Quality Assurance Program.

Regulations and guidelines require the implementation of quality assurance activities and the maintenance of sufficient documentation to demonstrate the generation of legally defensible environmental data. The Nevada State Health Laboratory policies on quality are based on the following concepts:

- As a laboratory we must provide our clients with products and services that are of high quality. The quality that we strive to achieve is a continuous process and has measurable objectives that we monitor.
- Each employee of The Nevada State Health Laboratory is responsible and accountable for the quality of his or her own work.

The Nevada State Health Laboratory provides analytical data reports that meet client and regulatory requirements, are useable for their intended purpose, and are technically correct. It is our policy to improve any aspect of these areas on an on-going basis.

The Nevada State Health Laboratory has specific goals in order to achieve high quality data that is legally defensible and complies with environmental regulations established by local, state, and federal authorities.

The goals include the following:

- Establish the quality assurance objectives for the measurement systems and to assess and monitor analytical data quality in terms of precision, accuracy, representativeness, comparability, completeness, and detectability through the use of proven methods.
- To enable personnel responsible for the production of the data to identify and implement corrective actions necessary to ensure data integrity.
- To ensure adequate document control.
- To establish and maintain systems which identify problems at the earliest stages and provide direction for resolution of such problems.
- To establish and maintain standard operating procedures (SOPs) which govern all laboratory practices, procedures, and analytical methods.
- To couple well-trained personnel with state-of-the-art instrumentation and equipment.

- Development of and strict adherence to principles of good laboratory practice.
- To promote a positive attitude toward quality throughout the laboratory and a commitment of quality from all employees.

The Nevada State Health Laboratory provides service to a broad base of clients. The work that is performed at the laboratory can be broken down into four categories:

- Blood lead analysis
- Nevada Department of Environmental Protection Agency samples
- Clean Water Act samples
- Safe Drinking Water Act samples

Samples can be submitted to the laboratory for analysis for blood lead, CWA or SDWA from individuals, studies or larger groups.

CHAPTER 2 - POLICIES

ETHICS POLICY ON WASTE, FRAUD AND ABUSE

The Nevada State Health Laboratory requires and encourages all associates to report any activity that may be considered wasteful or fraudulent. Any incident reported is subject to a complete investigation. The Nevada State Health Laboratory does not support improper manipulation of analytical data and/or falsification of data or data reports. Annual data integrity training is documented for each chemistry employee and filed in the chemistry office. For details refer to the State Procedures Manual and NAC, NRS and in-house Directors Quality Assurance Manual.

DEVIATIONS FROM WRITTEN LABORATORY POLICY

Departures from documented policies and procedures or from standard specifications must be cleared with the chemistry supervisor. Deviations may be allowed under certain conditions, but any data obtained and/or reported where SOPs are not followed or specifications are not met must be annotated.

COMPLAINTS

All complaints or problems are to be investigated. An incident report detailing the complaint should be filled out and filed as soon as possible. This procedure is detailed in the Nevada State Health Laboratory General Quality Assurance Manual. This is a separate Quality Assurance Manual prepared by management for the laboratory as a whole. This manual describes operational procedures that are to be applied in every department. A problem involving sample data or analysis may be partially resolved, at the chemistry supervisors or Laboratory Director's discretion, by re-analyzing and/or resampling without additional charge.

PROTECTING CONFIDENTIALITY

If a client has a request not to have his sample report forwarded to the Bureau of Health Protection Services then a note is made on the report and that data report is not forwarded. A note is made in the comments section of sample log in the computer database for that sample. As a public agency, data is available and may be provided to the public. Anyone requesting such data must submit a request to the Director of the Nevada State Health Laboratory. The request must state the purpose the data is to be used for. Requests for data will be granted at the Directors discretion. Names of property owners will not be included in data supplied to the public. The data is on public record in hard copy form at the Bureau of Health Protection Services. No one who is not a current employee of Nevada State Health Laboratory is to have unrestricted access to computers or computer records.

INCIDENT REPORT

The laboratory has a form to report incidents concerning laboratory problems including matters of data integrity. Personnel have been directed to fill out the incident report and submit it to management either with or without their name on the report.

MANAGEMENT AUDITS

Key management will perform management audits on a yearly basis. Including, but not limited to, the following:

- The suitability of policies and procedures
- Reports from managerial and supervisory personnel
- The outcome of recent internal audits
- Corrective and preventive actions
- Assessments by external bodies
- The results of interlaboratory comparisons or proficiency tests

- Changes in the volume and type of the work
- Client feedback
- Complaints
- Other relevant factors, such as quality control activities, resources and staff training
- Customer Satisfaction Survey (every two years)

CHAPTER 3 - LABORATORY ORGANIZATION

LABORATORY ORGANIZATION

The organization structure of the Nevada State Health Laboratory is designed to ensure that analytical operations are effective. All levels of employees are required to implement the Quality Assurance Program that has been established.

The Nevada State Health Laboratory hires qualified and capable personnel to fill their technical staff. They have the education, training, and experience needed to accomplish their assigned duties. There is on going training required to increase the skills that are needed for the individual positions.

ASSOCIATE TRAINING

Training is performed to develop and maintain proficiency, and to promote improvement. Training is performed by qualified individuals that may be internal staff or from external sources.

The Nevada State Health Laboratory employees become qualified based on the experience and training documented in the individual's training file, and is assigned duties within their experience and training. The employees training file may include a resume, initial demonstration of competency with a method, method detection limits, and records of other training they have received. Not all employees will have training records for all areas. It will depend upon their job function or tenure with the Nevada State Health Laboratory.

There are periodic chemistry staff meetings that may include training. Criteria and requirements are discussed at meetings along with other training material. Orientation and training is vital to new employee success and capability. The following includes, but is not limited to, a list of on-the-job training criteria that is used for a new employee:

- Receipt of assigned duties from the Supervisor.
- Observation of assigned duties by an experienced operator/analyst.
- Must read the Safety Manual.
- Must read the Standard Operating Procedure for the assigned methods.
- Performance of sample analysis under direct supervision of experienced personnel.
- Analyzing blind QC samples prepared in-house or by an outside agency.

- Perform initial demonstration of capability and method detection limit studies.

The individual members of the technical staff have key responsibilities for the quality of the data output and for all related laboratory operations.

Technical staff has the first opportunity to detect and correct any malfunctions of the measurement system. They are trained to notice any abnormal fluctuations and deviations.

AUTHORITY AND RESPONSIBILITY

The Nevada State Health Laboratory recognizes that the responsibility for high quality data starts with each individual; however, the ultimate responsibility for data and service quality and reliability resides with the Laboratory Director.

The Chemistry Supervisor is responsible for day-to-day operation associated with the laboratory workload. The Supervisor monitors the production of the analytical work and the process of reporting the results. The Supervisor oversees the programs that are in place to ensure compliance with laboratory environmental and radiation safety and health requirements. This includes preparing the Quality Assurance Manual and providing any training and follow-up with employees to ensure that each employee understands their personal roll in upholding the requirements outlined in the manual.

Currently the Supervisor also has full-time duties as a chemist and is responsible for analyzing samples and reporting data in that capacity.

The Nevada State Health Laboratory has a Quality Assurance Manager at this time. Some of these duties for the Supervisor and the Quality Assurance Manager include, but are not limited to, the following:

- Checking that the analyst and instrument logbooks are filled out correctly and completely, reviewed and signed periodically.
- Verify that proper QC, peer, and Supervisor data-review procedures are performed and documented.
- Maintaining QC records, including corrective action memo files, updates of SOPs, records of calibration and maintenance, and records of analyst qualifications.
- Coordinating a corrective action plan in response to deficiencies, nonconformance, or data identified as exceeding control limits.
- Informing management of system breakdowns or deficiencies, recommending corrective actions to improve the data-generating system and defining the validity of data generated in out-of-control situations.
- Verify compliance to all QC methods including frequency of spikes, blanks and duplicates, that appropriate QC criteria for matrix spike, surrogate and internal standard compounds are used, proper instrument calibrations are performed, that correct stock, working and calibration standards and concentrations are employed and control charts are updated and used.

- Establishing QC procedures, providing control samples and setting warning and action limits for every test or parameter to standardize section operations and quality performance.
- Training analysts in the Laboratory Quality Assurance Program.
- Interact with local, state, and federal agencies in matters pertaining to regulations, certifications, methodologies, audits and performance evaluations.
- Interact with clients on matters pertaining to data integrity and quality.

The resumes of the employees of the Nevada State Health Laboratory are in Appendix A along with the organizational chart for the laboratory.

CHAPTER 4 - DOCUMENTATION AND RECORDS

CONTROLLED/UNCONTROLLED DOCUMENTS

Quality control documents are prepared by the associates and then reviewed by the technical staff assigned to that method. These reviews are indicated by their signature on the last page of the document. These documents are required to be periodically reviewed and revised if necessary. The frequency depends on the type of document and the regulation requirements. They must also be revised when the activity, policy, or procedure they describe changes significantly.

Quality control documents are controlled by initially distributing them to the associates who need to be aware of the contained information or procedures. All subsequent revisions or updates to the document are then given to the associates working in that area. When a new document is given to an associate the old document is collected and permanently disposed of.

Uncontrolled bench copies are made and distributed as well. These are distributed with the understanding that no further revision or updated copy will be given.

RECORDS MANAGEMENT

It is important to the Nevada State Health Laboratory to keep records to demonstrate that all aspects of the laboratory are within required specifications. Some of the examples of the records that are kept are:

- Instrument logbooks
- Equipment monitoring records
- Standard preparation logbooks
- Performance Evaluation sample results
- Laboratory licenses and accreditations

- Waste disposal logbook

CHAPTER 5 - FACILITIES AND ANALYTICAL INSTRUMENTATION

FACILITIES

Nevada State Health Laboratory is a state-of-the-art facility equipped with the latest in analytical chemistry instruments and technology. It is a secure facility, and it is the policy to allow only authorized personnel beyond the reception area, at the front entrance. It is located on the University of Nevada, Reno campus and is part of the School of Medicine-Pathology Department. A new section of the building was added and completed in 1995.

The water that is used for analysis is de-ionized water that is supplied by the large reverse osmosis system located in the glassware cleaning section of the laboratory. Milli-Q (MQ) water is supplied by filtering the de-ionized water through a series of filters; 2 deionization filters, 1 carbon filter and 1 organic extraction filter. The MQ water is available in the digestion laboratory.

Samples and standards are stored in the refrigerators in the sample receiving room or at workstations. The samples are segregated by sample type and are stored independently. Organic standards are stored in the refrigeration units in the VOC lab. Samples are kept in one refrigerator while the various standards are kept in the other refrigerator.

INSTRUMENTATION

Table 5.1 shows the instrumentation in place and operational for analysis of environmental samples. Wherever possible and cost effective, autosamplers are fitted to the instruments in order to improve efficiency and facilitate consistently accurate sample introduction to the instrumental system.

Inorganic Laboratory

The Inorganic Laboratory performs a variety of both instrumental and wet chemistry procedures for inorganic analyses. It is divided into three sections: the Wet Chemistry Lab Area, the Metals Sample Preparation Area and Metals Analysis Room. The Wet Chemistry Lab maintains a full range of instrumentation including UV-VIS Spectrophotometers, Ion Selective potentiometers, Turbidimeters, pH Meters, Conductivity Meters, BOD incubator, Balances, Hamilton Dilutors, as well as other general and specialized preparatory equipment and glassware. The Metals Sample Preparation Area includes hot blocks to digest the samples. The final dilutions and other necessary processes are done in the Wet Chemistry Lab. This room also includes the digestion units for Kjeldahl analysis and an ion selective meter to read the results for Kjeldahl and ammonia analysis. The Metals Analysis Room includes all the instrumentation needed to analyze for

metals. The Dionex Ion Chromatograph is located in the Volatile Laboratory and is used for inorganic analyses pertaining to USEPA method 300.0.

Volatiles Laboratory

The Volatiles Lab analyzes samples containing volatile organic compounds by gas chromatography/mass spectrometry. This lab uses method USEPA 524.2.

Table 5.1 - Instrumentation

<u>TYPE</u>	<u>#</u>	<u>MANUFACTURER</u>	<u>MODEL</u>
UV/VIS SPEC	2	Thermo Scientific	Genesys 6 Vis
	1	Milton Roy	Spectronic 501
INDUCTIVELY COUPLED PLASMA	1	Varian	Vista MPX
ICP/MS	1	Varian	
ION CHROMATOGRAPH	1	Dionex	DX5000
	1	Dionex	ICS2000
GC/MS	1	Agilent	6890 Series MSD P & T
COLD VAPOR MERCURY ANALYZER	1	Cetac	m7500
pH METER	3	Orion	pH/ISE 710A
	1	Fisher	Accumet 25
	2	Corning	125, 150
	1	Beckman	pHI 31
TURBIDITY METER	2	Hach	2100AN
CONDUCTIVITY METER	1	VWR	1054
	1	Amber Science	1052A
	1	Fisher	XL-30
DISSOLVED O2 METER			

	1	Fisher	XL-40
ANALYTICAL BALANCE			
	1	Mettler-Toledo	AG104
	1	Mettler-Toledo	AT200
	1	Mettler	HL32
BALANCE - TOP LOADER			
	1	Mettler	BB2400
	1	Mettler-Toledo	PB3002
	1	Mettler	P162N
	1	Ohaus	Galaxy 400
	1	Sartorius	CP34001-S
MICROWAVE DIGESTION SYSTEM			
	1	QUESTRON	Qwave 3000
AUTOCLAVE			
	2	STERIS	
BOD INCUBATOR			
	1	Precision Scientific	815
	1	Precision Scientific	808
REFRIGERATOR			
	4	True	TWT-27
	1	Silver King	
	2	Superior/True	T-49
	1	True	T-23
FREEZER			
	3	Beverage Air	WFT-27
GAS FLOW PROPORTIONAL COUNTER			
	1	Tennelec	LB1000
	1	Tennelec	LB4110
OVEN			
	1	VWR	1630
	1	Blue M	Stabil Therm
	1	Shel Lab	1370FX
	1	Thermolyne	62700

	1	Fisher Scientific	Isotemp Oven
KJELDAHL DIGESTER			
	1	Buchi	430
	1	Buchi	435
	2	Buchi	K-438
KJELDAHL DISTILLATION			
	1	Buchi	321
CYANIDE DIGESTER			
	1	Kontes	Midi-Vap 2000
METALS DIGESTER			
	4	Environmental Express	Hot Block

CHAPTER 6 - MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance is an ongoing activity required to keep the instrumentation operating within the vendor and method specifications. Proper maintenance includes the following, but is not limited to: periodic instrument calibration, cleaning, periodic changing of oils and filters, and monitoring of known areas of wear or degradation to ensure the timely replacement of worn parts or components. Most of the instruments are under specific service contracts. Some contracts include annual or biannual visits from the servicemen for various maintenance and checks.

Preventative maintenance is scheduled on a daily, weekly, monthly, quarterly, and annual basis. All maintenance work is documented directly into the instrument maintenance log and noted by the person

performing the repair. In the instance where an outside vendor conducts maintenance activities, a copy of the vendor's form is affixed to the instrument's maintenance logbook.

Instrument maintenance and calibration can be performed by qualified service technicians (usually service representatives of the instrument manufacturer). Instrument repair is also performed by these technicians.

A preventative maintenance program for the instrument ensures fewer interruptions of analyses, increases personnel efficiency, and lowers repair costs. It eliminates premature replacement of parts, and reduces discrepancy among test results. It increases reliability of results.

The Nevada State Health Laboratory has incorporated the following preventative maintenance procedures, including, but not limited to:

- Instrument operating manuals are maintained within easy access of the instrumentation.
- Analysts using the instruments are trained operators and can trouble-shoot equipment problems to reduce equipment failure and to reduce dependence on outside service agencies. When necessary, however, outside service agencies will be used.
- Written records are kept to document all equipment inspection, maintenance, trouble-shooting, calibration, or modifications. All equipment maintenance is documented in a logbook kept near the instrument as a means of monitoring the adequacy of maintenance schedules. The records contain the date, description of the maintenance done, the findings, the name of the maintenance person.
- Performance criteria are established for judging when data from instruments performance checks indicate the need to make equipment adjustments.

Gas Chromatographic Instruments

Preventative maintenance includes a daily performance check standard. Parameters such as retention time and response factors are observed and back-checked with prior operational performance.

Other preventative maintenance includes:

- GC detectors are cleaned whenever performance degradation is observed.
- Septa are replaced as needed.
- Columns are checked by performance and operating conditions when in use or prior to use.
- Oven performance is checked daily prior to use by standard retention time verification.

Gas Chromatography/Mass Spectrometer (GC/MS)

- Mechanical pump oil should be changed twice a year. The experience of the operator may yield increased oil change frequency.
- Clean the source as needed.
- Sensitivity analyses through the use of BFB tune criteria daily or every 12 hours.

Atomic Absorption Spectrophotometers/ICP

Preventative maintenance includes the following checks:

- Minimum 30-minute warm-up period.
- Alignment of hollow cathode tube to produce the maximum emitted light to the detector.
- Burner heads, nebulizers, quartz cells, and reduction flasks are cleaned according to manufacturer instructions whenever excessive noise is apparent or whenever indicated by visual inspection.
- Tygon tubing is replaced when deterioration is apparent.
- Optical lenses are cleaned as needed.

The following tables list the scheduled maintenance. It does not include all of the maintenance, but is a general list of what is performed routinely.

Instrument Maintenance Schedule Ion Chromatograph

As Needed	Daily	Weekly	Monthly	Semi-annually
Clean micromembrane suppresser when decreases in sensitivity are observed.	Check plumbing/leaks.	Check pump heads for leaks.	Check all air and liquid lines for discoloration and crimping, if indicated.	Lubricate left hand piston.
Check fuses when power problems occur.	Check gases.	Check filter (inlet).		
Reactivate or change column when peak shape and resolution deteriorate or when retention time shortening indicates that exchange sites	Check pump pressure.			Clean valve.

have become deactivated.				
De-gas pump head when flow is erratic.				

**Instrument Maintenance Schedule
Flame Atomic Absorption Spectroscopy**

Daily	Monthly	As Needed
Verify proper safety precautions are working.		Check drain receptacle.
Verify gas box operates properly and safely.		Check background corrector for alignment.
		Clean nebulizer.
		Check Deuterium lamp.
		Clean all filters and fans.

**Instrument Maintenance Schedule
Inductively Coupled Plasma/Mass Spectrometry (ICP/MS)**

Daily	Weekly	Monthly	Quarterly	Annually	As Needed
Check sample waste container level.	Check peristaltic pump: proper roller pressure, sample introduction tubing, correct pump rotation, and condition of drain tubing.				Check electronic settings for optimum sensitivity, resolution, mass calibration, ion optics, CEM, reflector voltage.
Check recirculation water level.	Check condition of sampler and skimmer cones.	Check quartz torch condition.			Clean all filters and fans.
Measure quartz torch for proper alignment.	Check drain oil mist eliminator on roughing pumps.				Replace oil in roughing pumps.
					Clean spray chamber and nebulizer.
					Check oil level of

					roughing pumps.
					Replace oil in turbo-molecular pump.

**Instrument Maintenance Schedule
ICP**

Daily	As Needed	Semi-Annually	Annually
Check that argon tank pressure is 50-60 psi and that a spare tank is available.	Clean plasma torch assembly to remove accumulated deposits.		Notify manufacturer service engineer for scheduled preventive maintenance service.
Check that cooling water supply system is full and drain bottle is not full. Also, that drain tubing is clear, tight fitting and has few bends.	Clean filters on back of power unit to remove dust.		
Check the nebulizer to make sure that it is not clogged.	Replace when needed: peristaltic pump tubing, sample capillary tubing, autosampler sipper probe.		
Check that capillary tubing is clean and in good condition.	Replace coolant water filter (may require more or less frequently depending on the quality of the water).		
Check that the peristaltic pump windings are secure.			
Check that high voltage switch is on.			
Check that exhaust screens are clean.			
Check that torch,			

glassware, aerosol injector tube, bonnet are clean.			
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**Instrument Maintenance Schedule
Cetac -Cold Vapor Mercury Analyzer**

Daily	Weekly	Quarterly	Annually	As Needed
Check to see if all tubes are clean and free from kinks.	Monitor GLS for cleaning	Check air filter at the rear of the controller.	Install a new air filter.	Replace any tube that may be damaged.
Check waste bottle level.	Check source lamp condition.	Check the non-return valve.		Rinse fluid system after analysis.
Check instrument and work area to make sure they are kept absolutely clean.			Change NaFion cartridge as needed.	Release the tension on the pump tubes when not in use.
Check the nitrogen gas inlet pressure to make sure it is between 100psi.			Replace 2um filter as needed.	Check fuses, when power problems occur.
Check main fume ventilation system to make sure it's functioning properly.				Change source lamp, if lamp fails.
				Check the absorbance of the cell window.
				Clean the inner surface of cell, if there is decrease in sensitivity.

**Instrument Maintenance Schedule
Gas Chromatograph**

Daily	As Needed	Quarterly/Semi-Annually/Annually
Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressure.	Replace front portion of column packing or break off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (i.e. Peak tailing, poor resolution, high backgrounds, etc.) indicates it is required.	Quarterly ELCD: change roughing resin, clean cell assembly.
Check temperatures of injectors and detectors. Verify temperature programs.	Change glass wool plug in injection port and/or replace injection port liner when front portion of column packing is changed or front portion of a capillary column is removed.	Semi-annually ECD: perform wipe test.
Check inlets, septa.	Replace septum.	Annually ELCD: change finishing resin, clean solvent filter.
Check baseline level.	Perform gas purity check (if high baseline indicates that impure carrier gas may be in use).	
Check reactor temperature of electrolytic conductivity detector.	Replace or repair flow controller if constant gas flow cannot be maintained.	
	Replace fuses.	
	Reactivate external carrier gas dryers.	
	Detectors: Clean when baseline indicates contamination or when response is low. FID: clean/replace jet, replace igniter. NPD: clean/replace collector assembly. PID: clean lamp window, replace seals. ELCD: check solvent flow weekly, change reaction tube, replace solvent, change reaction gas, and clean/replace Teflon transfer line. ECD: follow manufacturers suggested maintenance schedule.	
	Reactivate flow controller filter dryers when presence of moisture is suspected.	

**Instrument Maintenance Schedule
Purge and Trap**

Daily	As Needed	Quarterly/Semi- annually/Annually
	Periodic leak checks, replace/condition traps (when poor response or disappearance or reactive or poorly trapped compounds), clean sample lines, valves (if they become contaminated), clean glassware.	
	Autosamplers: leak check system, clean sample lines, valves.	

**Instrument Maintenance Schedule
Mass Spectrometer**

Daily	As Needed	Semi-Annually	Annually
Check for sufficient gas supply. Check for correct column flow and/or inlet pressure.	Check level of oil in mechanical pumps and diffusion pump if vacuum is insufficient. Add oil if needed between service contract maintenance.	Change oil in the mechanical rough pump.	Replace the exhaust filters on the mechanical rough pump.
Check temperatures of injector, detector. Verify temperature programs.	Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required levels.		
Check inlets, septa.	Clean source, including all ceramics and lenses. The source cleaning is indicated by a variety of symptoms including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination.		
Check baseline level.	Replace filaments when both filaments burn out or performance indicates need for replacement.		
Check values of lens voltages, electron multiplier, and relative abundance and mass assignments of the calibration compounds.			

**Instrument Maintenance Schedule
pH Meter**

As Needed	Daily
Clean electrode.	Verify electrodes are properly connected and filled.
Refill reference electrode.	Make sure electrode is stored in buffer.

**Instrument Maintenance Schedule
Fluoride Probe/Meter**

As Needed	Daily
Clean electrode.	Verify electrodes are properly connected and filled.
Refill reference electrode.	Make sure electrode is stored in distilled water with a concentration of fluoride standard.

**Instrument Maintenance Schedule
Ammonia Probe/Meter**

As Needed	Daily
Clean electrode.	Verify electrodes are properly connected and filled.
Refill reference electrode.	Make sure electrode is stored in distilled water.
Change the membrane on the probe.	

**Instrument Maintenance Schedule
BOD Probe/Meter**

As Needed	Daily
Clean electrode.	Verify electrodes are properly connected and filled.
Refill reference electrode.	Make sure electrode is stored above distilled water. Check for color in the water.
Check for battery power and change as needed.	

**Instrument Maintenance Schedule
Turbidity Meter**

As Needed	Daily
Clean lens.	Cover the sample site so that no dust particle get in.

CHAPTER 7 - SAMPLE MANAGEMENT

INTRODUCTION

Sample management is the overall process by which samples are controlled, transferred, handled, and stored from the time of collection through analysis and final disposition.

SAMPLE ATTESTATION

Sample management begins in the field when the sample is collected. The management of the collection process, with the exception of providing sample containers, is not within the jurisdiction of this lab. An attestation statement has been added to each requisition form. The sampler will sign that they attest to the validity and authenticity of the sample being submitted. Also, that they are aware that tampering with or intentionally mislabeling the sample location, date or time is considered fraud and may be grounds for legal action. All other sample management activities, specifically those related to sample shipment, sample containers, sample preservation, sample holding times, and sample preparation and analysis are discussed here.

SAMPLE CUSTODY

All samples received at The Nevada State Health Laboratory are considered to be physical evidence and are handled accordingly. Following are a few considerations in sample custody.

Facility Security

The Nevada State Health Laboratory is a secure facility utilizing perimeter, cardkey access points of entry/exit. Only authorized personnel are allowed beyond the reception area, at the front entrance.

Sample Receipt

Sample shipments are received and brought to the sample accessioning room. Sample control personnel verify that the containers received correlate to the analyses being asked for on the tracking sheets. Any damage to the containers or other discrepancies observed are noted on the tracking sheets and in the database.

After a sample shipment has arrived, personnel perform sample inspection. The following is an example of some of the check-off procedures to follow for sample verification:

- Presence/absence of “Chain of Custody” or Sample Tracking Sheet.
- Completeness of the Sample Tracking Sheet. Are the requested analyses listed correctly?
- Agreement/non-agreement between number of samples received with the Sample Tracking Sheet.
- Are the samples preserved correctly? The SOP for checking sample preservation should be followed when checking samples.
- Is there enough sample to do the requested analyses?

- Were they received cold or at ambient temperature? Temperature blanks are checked for VOC analysis and the sample temperature is checked for all other samples that need to be checked. The SOP for checking sample temperature should be followed when checking samples.
- Were the containers intact or broken and leaking?
- Was there headspace in VOA vials?
- Was the sample holding time exceeded for any of the requested analyses?

The client is notified immediately if any problems are noted during the sample verification process.

SAMPLE LOG-IN AND STORAGE

There are three distinct steps to the process of logging in samples.

The first step is logging the sample into the computer database in the Accessioning Department. At this time, analyses are assigned to each sample.

The second step is reviewing the data entry performed in the Accessioning Department against the requisition, which is performed in the Chemistry logging area.

The last step is the sample storage. After logging in the samples they are stored under refrigeration or are assigned to various workstations.

SAMPLE AND LABORATORY CONTAINERS

Container specifications depend on the analytical method and constituent of interest. Production of quality analytical data requires that the collected sample is representative. Sampling procedures should adhere to the guidelines established by EPA and other regulatory agencies and be appropriate for the sample matrix and types of analytical parameters to be determined. Lab staff can brief clients that collect their own samples by telephone on the proper methods of sample collection.

In general, use the following containers:

- | | |
|--------------------|--------------------------------------------------------------------------------------------------------------------------|
| Volatile Organics: | Standard 40 mL glass screw-cap vials with Teflon-faced silicone septum. They should be trace pure. These are not reused. |
| Inorganic: | Polyethylene bottles with screw caps for aqueous samples to be analyzed. New batches are tested for cleanliness. |
| SOC: | Bottles are provided by the laboratory performing the analysis. They must be certified trace pure bottles. |
| Oil and Grease: | Bottles need to be certified trace pure. |

The client is given instructions for the analysis that they have requested.

A detailed description of container specifications is given in the Sample Preservation and Holding Times section.

SAMPLE PRESERVATION AND HOLDING TIMES

The Nevada State Health Laboratory supplies the appropriate sample containers and preservatives to a client upon request. Sample preservation prevents or retards the degradation and/or reaction of chemicals or biological activity in samples during transit and storage. Efforts to preserve the integrity of the samples are initiated at the time of sampling and continue until analyses are performed. Preservation of aqueous samples are verified prior to the preparation step for metals, cyanide, radiochem, etc. and prior to analysis for volatile organics. The container types, bottle sizes, preservatives, container closures, and holding times are shown in the Holding and Preservation Table.

The maximum time a preserved sample may be held between sample collection and analysis depends on the stability of the constituents of interest. Holding-time limitations are intended to minimize chemical changes in a sample before it is analyzed. Maximum allowable holding times provided in the Holding and Preservation Table apply to aqueous samples when proper preservation procedures are followed. Holding times are measured from time of sample collection to time of analysis, unless otherwise specified by the method.

Table 7.1 - Holding and Preservatives

Constituent	Container	Storage & Preservation	Minimum Sample Quantity	Maximum Holding Time
INORGANICS				
Alkalinity	P,G	Cool, 4°C	200 ml	14 days
Ammonia-N	P,G	H ₂ SO ₄ ,pH<2,Cool, 4°C	400 ml	28 days
Bicarbonate	P	Cool, 4°C	250 ml	14 days
Biochemical Oxygen Demand (BOD)	P,G	Cool, 4°C	1000 ml	48 hours
Boron	P	HNO ₃ ,pH<2	100 ml	6 months
Chemical Oxygen Demand (COD)	P,G	H ₂ SO ₄ ,pH<2,Cool, 4°C	100 ml	28 days
Chloride	P,G	None required	100 ml	28 days
Chlorine Residual	P,G	Cool, 4°C; protect from light	500 ml	2 hours
Color	P,G	Cool, 4°C	500 ml	48 hours
Conductivity	P,G	Cool, 4°C	500 ml	28 days
Cyanide	P,G	NaOH, pH>12; Cool, 4°C	500 ml	14 days
Filterable Residual (TDS)	P,G	Cool, 4°C	100 ml	7 days
Fluoride	P	None required	300 ml	28 days
Hardness, Total	P,G	HNO ₃ , pH<2	100 ml	6 months
MBAS	P,G	Cool, 4°C	500 ml	48 hours
Non-Filterable Residue (TSS)	P,G	Cool, 4°C	500 ml	7 days
pH	P,G	None required	50 ml	2 hours
Total Kjeldahl Nitrogen	P,G	H ₂ SO ₄ , pH<2, Cool, 4°C	500 ml	28 days
Nitrate, as N	P,G	W/o preservative, 4°C	100 ml	48 hours
Nitrate + Nitrite, as N	P,G	H ₂ SO ₄ , pH<2, Cool, 4°C	100 ml	28 days
Nitrite	P,G	Cool, 4°C	100 ml	48 hours
Orthophosphate, as P	P,G	Filter Immediately, Cool, 4°C	100 ml	48 hours
Total Phosphorous, as P	P,G	H ₂ SO ₄ , pH<2,Cool, 4°C	100 ml	28 days
Sulfate	P,G	Cool, 4°C	200 ml	28 days
Turbidity	P,G	Cool, 4°C; protect	100 ml	48 hours

		from light		
METALS				
Mercury	P,G	HNO ₃ ,pH<2, Cool, 4°C	200 ml	28 days
All other metals	P	HNO ₃ ,pH<2	200 ml	6 months
RADIOCHEM				
Gross Alpha/Beta	P,G	HNO ₃ ,pH<2	500 ml	6 months
Radium-226	P,G	HNO ₃ ,pH<2	1000 ml	6 months
Radium-228	P,G	HNO ₃ ,pH<2	1000 ml	6 months
Radon	G	40 ml vial, no air bubbles	40 ml	72 hours
Uranium	P,G	HNO ₃ ,pH<2	1000 ml	6 months
ORGANICS				
Oil and Grease	G	H ₂ SO ₄ ,pH<2,Cool, 4°C	1000 ml	28 days
Volatile Organics	G(VOA) TFE-Septa Cap	Na ₂ S ₂ O ₃ if chlorinated and HCl pH<2;Cool,4°C	3/40 ml vials	14 days
EDB & DBCP	3 X 40 ml Glass Vial	100 ul Na ₂ S ₂ O ₃ , Cool,4°C, No Headspace	25 ml	7 days Extraction
Organohalide Pesticides/PCBs	2 X 1 liter	2.5 ml Na ₂ S ₂ O ₃ , Cool,4°C	1000 ml	7 days Extraction
N & P Containing Pesticides	2 X 1 liter	2.5 ml Na ₂ S ₂ O ₃ , Cool,4°C	1000 ml	7 days Extraction
Chlorinated Pesticides	2 X 1 liter	2.5 ml Na ₂ S ₂ O ₃ , Cool,4°C	1000 ml	7 days Extraction
PCB Screening	2 X 1 liter	Cool,4°C	1000 ml	14 days Extraction
Chlorinated Acids (Herbicides)	2 X 1 liter	2.5 ml Na ₂ S ₂ O ₃ , Cool,4°C	1000 ml	14 days Extraction
Chlorinated Acids (Herbicides)	2 X 1 liter	Na ₂ S ₂ O ₃ if pH<2;Cool,4°C	1000 ml	14 days Extraction
Organic Compounds (Extractable)	2 X 1 liter	10 drops Na ₂ S ₂ O ₃ , pH<2;Cool,4°C	1000 ml	14 days Extraction
n-Methyl Carbamates	3 X 40 ml Glass Vial	100 ul Na ₂ S ₂ O ₃ , pH=3 (1.2 ml MCAA),Cool,4°C	30 ml	28 days
Glyphosate	125 L Amber Glass	300 ul Na ₂ S ₂ O ₃ , Cool,4°C, dark	40 ml	14 days
Endothall	1 Liter Amber Glass	2.5 ml Na ₂ S ₂ O ₃ pH<2;Cool,4°C	500 ml	7 days Extract

Diquat & Paraquat	1 Liter HDPE	2.5 ml Na ₂ S ₂ O ₃ pH<2	250 ml	7 days Extraction
Haloacetic Acids & Dalapon	250 ml Amber Glass	1 ml conc H ₂ SO ₄ , Cool,4°C, 100 mg/L NH ₄ Cl	100 ml	14 days Extraction

SAMPLE STORAGE

The primary considerations for sample storage include the following:

- Keeping the samples at the prescribed temperature, if required and as directed by the SOP.
- Keeping the samples stored away from standards or samples that are known to have high-level concentrations of the analytes of interest.
- Security of samples throughout the laboratory.

SAMPLE PREPARATION

The constituents that are requested for analysis help to determine the type of sample preparation. Sample preparation procedures for organic, inorganic, and radiochem analyses are provided in various method-specific SOPs. Water used in the course of inorganic, organic, and radionuclide analysis (dilutions, preparations of standard and blank samples, etc.) must meet or exceed the standards for purity of ASTM Type II reagent grade water. All digestates and filtered samples are collected and tracked in logbooks. Metal digestates are stored at room temperature in acidic solutions resulting from the digestion process.

For most inorganic analyses, chemical reagents and gases of analytical reagent grade are used. High purity acids are used for trace metals analysis. For radiochemical analyses special ultrapure reagents and gases are required. For methods in which the purity of reagents is not specified, analytical grade reagents and gases are used.

Filtration

The need to filter aqueous samples depends on whether total or dissolved constituents are of interest. Pore size of the filter used is specified in each method and can be found in the SOP for that method.

Digestion

Metals analyses of many aqueous samples requires digestion of the sample. These are outlined in the specific SOP.

SAMPLE ANALYSIS

All samples shall be analyzed within the appropriate calibration range of the instrument. Each sample that exceeds the calibration range shall be diluted and analyzed within the appropriate analytical range or have the calibration range extended. The method of constituent identification and quantitation is specified in the analytical methods.

SAMPLE DISPOSAL

Samples are typically held for 4 weeks after report generation. The report is printed, reviewed and sent to the customer or to the Bureau of Health Protection Services. Routine samples that do not show evidence of contamination are dumped and processed through the sewer system. Preserved samples are dumped into 55-gallon storage containers. The University of Nevada's Campus Hazardous Waste Disposal team is contacted for pick-up when the container is full.

Samples that show evidence of contamination are treated as such, and are disposed of by the University of Nevada's Campus Hazardous Waste Disposal team.

Other chemical waste that needs to be disposed of is also handled by the Hazardous Waste Disposal team of the University of Nevada, Reno.

SAFETY CONSIDERATIONS

Because sample constituents can be toxic or hazardous, take adequate precautions during sample handling. Toxic substances can enter through the skin and, in the case of vapors, through the lungs. Inadvertent ingestion can occur via direct contact with foods or by adsorption of vapors onto foods. Never have food or employee beverages near samples, sampling locations or in laboratories; always wash hands thoroughly before handling food or personal beverages. Other precautions may include wearing gloves or other protective apparel. Always wear eye protection. When toxic vapors might be present, handle sample in well ventilated areas such as a fume hood.

When in doubt as to the level of safety precautions needed, consult UNR Environmental Health and Safety. Samples with radioactive contaminants require other safety considerations; consult UNR Environmental Health and Safety.

CHAPTER 8 - DATA QUALITY OBJECTIVES

INTRODUCTION

Data Quality objectives are the foundation for collecting environmental data that can provide a reliable basis for decisions concerning environmental remediation. The quantitative measurements that estimate the true value or true concentration of a physical or chemical property always involve some level of uncertainty. This uncertainty results from 1) the variability of sample collection, 2) sample handling and the conditions associated with the specific samples, and 3) analytical variability.

These uncertainties must be estimated and compared to standard, quantitative indicators of data quality.

PRECISION AND ACCURACY

Precision is the measure of how well replicate analyses agree. Percent Difference (PD) is used to measure the relationship between the original and duplicate analyses. It is standard practice throughout the laboratory to prepare and analyze one duplicate sample for each batch of samples and each matrix type within the batch, and one duplicate for every ten samples thereafter. This represents a duplicate sample frequency of 10% for each batch of samples analyzed. The relative percent difference in duplicate samples is calculated by:

$$PD = \frac{D - S}{S} \times 100$$

where PD = Percent Difference
 S = First Sample Value (Original)
 D = Second Sample Value (Duplicate)

The precision of the method is expressed as the Relative Standard Deviation (RSD) of the percent recoveries. Percent RSD (%RSD) is calculated as follows:

$$\%RSD = \frac{S}{X_{AVG.}} \times 100$$

where: $X_{AVG.}$ = the arithmetic mean of the recovery values
 S = standard deviation

Accuracy and matrix bias are monitored by the use of spiked samples, and where possible, surrogate additions. It is standard practice throughout the laboratory to prepare and analyze one matrix spike for each batch of ten samples and one spike for every ten samples thereafter. This represents a matrix spike frequency of 10% for each batch of samples analyzed. Where surrogate spiking compounds are available, they will be added to and analyzed with every sample. See the method SOP for specific details.

A measured amount of known concentration of spike/surrogate is added to the sample prior to extraction or preparation. The actual test result is compared to the theoretical result of 100% recovery and the percent recovery is calculated. The sample result is only subtracted from the spike result if it is a significant amount. Follow the SOP of each individual method to determine what amount should be subtracted.

$$\% \text{ Recovery} = \frac{\text{Spike result} - \text{Sample result}}{\text{Amount spiked}} \times 100$$

The percent recovery must fall within specified control limits for the result to be accepted and subsequent data validated. If the recovery is outside of the specified control limits then the data is marked with a qualifier.

The laboratory fortified blank (LFB) percent recovery (% R) is calculated as follows:

$$\text{LFB \% Recovery} = \frac{X}{X} \times 100$$

t

where: X = observed concentration
t = concentration of spike added

QUALITY CONTROL CHARTS

Quality control charts are a graphical representation of analytical accuracy. The charts display the arithmetic mean of a data set, the upper and lower warning limits (2σ) and the upper and lower control limits (3σ).

COMPLETENESS

For the data to be valid it must meet all acceptance criteria including accuracy, precision, and any other criteria specified by the analytical method that is used for analysis. Data validation procedures are employed to prevent the reporting of unacceptable data.

Completeness is the amount of valid data obtained from a measurement system, expressed as a percentage of the expected number of valid measurements to be collected.

$$\% \text{ Complete} = \frac{\text{(number of acceptable parameters)}}{\text{total number of parameters analyzed}} \times 100$$

The influence of the laboratory on completeness involves three areas: appropriate sample handling and storage, conformance to holding time requirements, and data validity as measured by meeting acceptance criteria for the quality control parameters.

REPRESENTATIVENESS

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which depends on proper design of the sampling program: sampling locations must be selected carefully and a sufficient number of samples must be collected.

Representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result (concentration) is representative of the constituent concentration in the sample matrix.

COMPARABILITY

Comparability is a measure of the confidence with which one data set can be compared to another. All laboratory analysts use uniform procedures and a uniform set of units and calculations for analyzing and reporting environmental data.

Data shall be comparable to data sets of similar samples, collected under similar conditions. Evidence of comparability is available through laboratory participation in several Performance Evaluation Sample Programs.

DETECTABILITY

Detectability refers to the minimum concentration of a constituent that can be measured by a measurement system with a stated level of confidence. It is determined by assessing the variability of replicate measurements at zero or near zero constituent concentration, and it is reported in concentration units.

The detection limit is defined as the smallest observed signal with the reliability of $1 - \alpha$ (where α is the probability to Type I error) that can be considered a signal caused by the constituent of interest within a 99% confidence level.

METHOD DETECTION LIMITS

The Nevada State Health Laboratory uses the specifications outlined in U.S. EPA 40 CFR Part 136 Appendix B in determining MDLs for analyses. It is required that the MDLs be determined for each analyte of interest within the capability of the primary analytical methods each year or when there are significant changes in the method, instrument conditions or when there is a new operator.

REPORTING LIMITS

The reporting limit that the Nevada State Health Laboratory uses is based on the evaluation of the Practical Quantitation Limits (PQLs) for each method of interest. The PQL is the lowest concentration reliably achievable within limits of precision and accuracy, using a given method.

The PQL can be estimated from the MDL by multiplying the MDL by five (5) to ten (10). Five (or some lower multiplier) is used when a multiplier of ten would cause the PQL to be higher than the lowest calibration standard or for drinking water, the maximum contaminant limit (MCL). The MCL is the enforceable health goal defined as the "maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety".

Reporting limits are reviewed to ensure that the PQL does not exceed the concentration needs of the client.

LABORATORY QUALITY CONTROL CHECKS

Quality assurance consists of general quality control and assessment procedures that are adapted to the specific operating conditions in each section. The elements of quality control are discussed in each method SOP.

CHAPTER 9 - CALIBRATION PROCEDURE

The production of analytical data of known, and documented quality requires adherence to standardized procedures, which cover all aspects of laboratory operation. The following section provides details of the standardized procedures relating to instrumentation calibration.

INSTRUMENTATION CALIBRATION

Prior to use, every instrument must be calibrated according to a specified procedure found in the method specific Standard Operating Procedure (SOP). The SOP should minimally include the following:

- Instrument to be calibrated
- Reference number of standards that are used for calibration
- Acceptable performance tolerances and corrective actions required if specifications are not met
- Frequency of calibration

REAGENTS AND CALIBRATION STANDARDS

A log book is maintained for all stock standards. Each log entry contains at least the following information:

- The date of preparation
- The manufacturers lot number and supplier
- The preparer's initials
- Amount made
- Complete description of how the solution or standard was made.

The expiration date of the working standard must not exceed the expiration date of the original material unless it is checked for accuracy. If the standard is analyzed against a standard that has not expired and proves to be accurate then the standard may be used. A note in the logbook must indicate that it was checked against unexpired standards and include date of verification and standard identification.

Stock standards and working standards are checked regularly for signs of deterioration, such as discoloration, formation of precipitates, or change in concentration. At the sign of any change a new standard is made and the old one is discarded according to the sample disposal policy. Most working standards have an expiration period depending on the methods recommendation.

CALIBRATION POLICY

This is designed to be a guideline to ensure that all data are treated alike, and thus ensuring that data generated on any particular day of analysis are representative of the normal. The policies are not intended to be absolute criteria for the acceptance or rejection of any analytical data.

There is no substitute for the inherent familiarity that each analyst has with his or her specific analysis, and consequently their assessment of the data must be considered in cases where the acceptance criteria outlined in policy or SOPs cannot be achieved.

MINIMUM NUMBER OF CALIBRATION LEVELS

The calibration must include the minimum number of calibration standards plus a blank unless specified otherwise in the specific SOP.

CALIBRATION ANALYSIS SEQUENCE

The calibration must progress from the analysis of the lowest to highest standard unless the instrument does not permit it. A blank must be analyzed after the highest calibration standard.

If the analysis requires an initial high standard to set the gain a blank must be run before starting with the low calibration standard unless the instrumentation does not permit it.

CALIBRATION ACCEPTANCE CRITERIA

In general, the calculated value for standards (using the calibration curve or response factor) must be within 10% of the nominal value. See the SOP for that method for the specific criteria that are acceptable. The calibration must be validated with a second source standard.

CONTINUING CALIBRATIONS

Continuing Calibrations (CC) are allowed for certain methods. Refer to specific SOPs to determine whether this is allowed. The continuing calibration standard must be near the mid-point of the calibration curve. The calculated value for the continuing calibration standard must be within $\pm 30\%$ of the true value for Volatile Organics and 10% for inorganics. If the specific SOP uses different percentages, those stated in the SOP will be used.

CHAPTER 10 - CORRECTIVE ACTION AND CONTINGENCY PLANNING

The primary objective of the corrective action program is to identify, correct, and document any deviation from laboratory policy, standard operating procedures, regulatory methodology or requirements, contractual or internal product requirements. A final objective is to ensure that necessary steps are taken to prevent the reoccurrence of the deviation or nonconformity.

Every employee is responsible to identify and correct deviations regardless of how minor they appear. In this manner, repeated occurrences of what may appear to be isolated incidents can be identified and corrected before a systematic or out-of-control situation develops.

An out-of-control event is defined as any occurrence failing to meet pre-established criteria. Nonconformance is a deficiency in characteristic, documentation, or procedure sufficient to make the quality indeterminate or unacceptable. An out-of-control event is a subcategory of nonconformance.

When nonconformance is recognized, each individual involved with the analysis in question has a role in solving and documenting the problem.

The analyst must be able to recognize nonconformance and immediately notify the laboratory supervisor and work together to solve the problem. Each analyst is responsible for documenting and correcting problems that might affect quality.

The supervisors review the analytical data that is reported. They have the responsibility of noticing anything that might be an error and investigating what might be the cause. They determine if a sample should be reanalyzed and for what parameters.

Whenever the analytical system is out of control, investigation-correction efforts are initiated by all concerned personnel.

If the problem is instrumental or specific only to preparation of a sample batch, any samples prepared after the out-of-control event are reprocessed after the instrument has been repaired and recalibrated, providing holding times have not been exceeded.

If a sample batch is still out of control after reanalysis, all method-related activities shall stop immediately. A detailed investigation shall be conducted to isolate and correct faulty operations.

Investigation of an out-of-control situation could include the following:

1. Check for errors in calculation or transcription/data entry.
2. Check calibration and instrument performance. Prepare new standards if necessary.
3. Check the integrity of the samples.
4. Check the reagents.
5. Check the glassware.
6. Check the laboratory worksheets.

The need for corrective action comes from several sources: equipment malfunction, failure of internal QA/QC checks, failure of follow-up on performance, or noncompliance with QA requirements.

When measurement equipment or analytical methods fail QA/QC requirements, the problems will immediately be brought to the attention of the supervisor. Corrective actions will depend on the type of analysis, the extent of the error, and whether the error is determinable or not.

The corrective actions decided upon will be recorded in the maintenance log or equivalent and may include the following information:

1. What actions were taken to bring the process back into control.
2. What actions were taken to prevent recurrence of the out-of-control situation.
3. What was done with the data obtained while the process was out of control.
4. Nature of the problem.
5. Analytical parameter affected.
6. Sample lot affected.

7. Corrective action measures(s) taken and final disposition/resolution of the problem.
8. Dates (date recognized, date occurred, date corrected).
9. Signature of analyst and persons involved.

CHAPTER 11 - INTERNAL AUDITS

Internal audits will be performed on the current methods performed at the Nevada State Health Laboratory on a yearly basis. The following sheet will be followed when performing the audit.

NEVADA STATE HEALTH LABORATORY

IN-HOUSE AUDIT FORM

TEST NAME/METHOD: _____

AUDITOR: _____

ANALYST INTERVIEWED: _____

AUDIT DATE: _____

	YES	NO	N/A
SOP AVAILABLE			
SOP BEING FOLLOWED			
ANALYST HAS IDC			
MDL CURRENT			
MDL BELOW RL			
REAGENTS LABELED WITH DATES			
STANDARDS TRACEABLE			
STANDARDS NOT EXPIRED			
EQUIPMENT/INSTRUMENT OK			

Problems noted: _____

Comments: _____

Recommendations: _____

Auditor signature: _____ date: _____

Analyst signature: _____ date: _____

QA officer signature: _____ date: _____

Affirmation of Data Integrity:

The Nevada State Health Laboratory does not support improper manipulation of analytical data and/or falsification of data or data reports. Failure to comply may result in disciplinary action, including dismissal. Observation of such behavior anywhere in the laboratory should be immediately reported to management, either verbally or through the incident reporting system.

printed analyst name

analyst signature

date

CHAPTER 12 - LABORATORY EVALUATION STUDIES

Performance evaluations are used to provide a direct evaluation of the ability of the analytical systems to generate data that are consistent with the objective of accuracy and precision.

The Nevada State Health Laboratory, on a regular basis, is part of an ongoing QA program consisting of the analysis of blind samples. As part of the external QC the Supervisor submits a QC sample to the analysts with routine samples in such a way that the analysts do not know which of the sample is the QC sample. These external QC samples, test sample preparation as well as sample analysis. In addition, analysts are typically expected to run internal QC samples that will indicate to them whether the analytical procedures are in control. The external sample is a sample that has already been analyzed, and is re-analyzed, and the data are compared. This is a way of checking the ability to produce precise data.

When possible a past performance evaluation (PE) sample is analyzed with each analysis. The accuracy is checked by comparing the results with the previously set limits established statistically by EPA.

The Nevada State Health Laboratory participates biannually in the Water Pollution (WP) and the Water Supply (WS) evaluations. Quarterly the lab receives a set of samples for the analysis of water pollution and water supply parameters to provide interlaboratory evaluation of data results for reproducibility and comparability. Currently we purchase our studies from a private vendor. We are evaluated and then given certification based on the results achieved.

CHAPTER 13 - METHODS AND OPERATION

STANDARD OPERATING PROCEDURES

Standard Operating Procedures (SOPs) describe step-by-step instructions for performing a method or specific job duty. The SOPs may outline the procedures, methods, corrective action requirements, documentation, review, and verification requirements. They are to be updated every year or sooner if the need arises. If there are changes made to the method they must be noted in the SOP.

ANALYTICAL METHODS

Methods used in sample preparation or analysis are selected to meet the specific needs and requirements of the client. The Nevada State Health Laboratory employs standard, officially approved analytical methods to quantify inorganic, organic, and radionuclide constituents in environmental media. The analytical methods performed are specific for drinking water, waste water, and groundwater. These methods are listed in the following Tables.

**Table 13.1 - DRINKING WATER METHODS
PRIMARY INORGANICS (40 CFR PART 141.23 AND 141.74, JULY 1, 2000)**

<u>ANALYTE</u>	<u>REFERENCE</u>	<u>METHOD</u>	<u>METHOD DESCRIPTION</u>
ANTIMONY	USEPA	200.8	ICP/MS
ARSENIC	USEPA	200.8	ICP/MS
BARIUM	USEPA USEPA	200.7 200.8	ICP ICP/MS
BERYLLIUM	USEPA	200.8	ICP/MS
CADMIUM	USEPA	200.8	ICP/MS
CHROMIUM	USEPA	200.8	ICP/MS
COPPER	USEPA USEPA	200.7 200.8	ICP ICP/MS
LEAD	USEPA	200.8	ICP/MS
MERCURY	EPA	245.2	AUTOMATED, COLD VAPOR
NICKEL	USEPA	200.8	ICP/MS
SELENIUM	USEPA	200.8	ICP/MS
THALLIUM	USEPA	200.8	ICP/MS

**DRINKING WATER METHODS (cont'd.)
PRIMARY INORGANICS (40 CFR PART 141.23 AND 141.74, JULY 1, 2000)**

<u>ANALYTE</u>	<u>REFERENCE</u>	<u>METHOD</u>	<u>METHOD DESCRIPTION</u>
NITRATE-N	USEPA	300.0	ION CHROMATOGRAPH
NITRITE-N	SM	4500-N02-B	SPECTROPHOTOMETRIC

FLUORIDE	USEPA	300.0	ION CHROMATOGRAPH
TURBIDITY	USEPA	180.1	NEPHELOMETRIC
TOTAL CYANIDE	SM	4500-CN-F	DISTILLATION/ colorimetric
RES. CHLORINE	SM	4500-CL-G	COLORIMETRIC

**DRINKING WATER METHODS (cont'd.)
SECONDARY INORGANICS (40 CFR PART 136 or PART 143, JULY 1, 2000)**

<u>ANALYTE</u>	<u>REFERENCE</u>	<u>METHOD</u>	<u>METHOD DESCRIPTION</u>
pH	USEPA	150.1	ISE
SPEC. COND.	SM	2510B	DIRECT READING INST
TDS @ 180C	SM	2540C	GRAVIMETRIC
HARDNESS	USEPA	200.7	CALC FROM CA AND MG
CALCIUM	USEPA	200.7	ICP
MAGNESIUM	USEPA	200.7	ICP
SODIUM	USEPA	200.7	ICP
POTASSIUM	USEPA	200.7	ICP
ALKALINITY	SM	2320B	TITRATION
CHLORIDE	USEPA	300.0	ION CHROMATOGRAPHY
SULFATE	USEPA	300.0	ION CHROMATOGRAPHY
ALUMINUM	USEPA USEPA	200.8 200.7	ICP/MS ICP
IRON	USEPA	200.7	ICP
MANGANESE	USEPA USEPA	200.7 200.8	ICP ICP/MS
SILVER	USEPA	200.8	ICP/MS
ZINC	USEPA	200.7	ICP

	USEPA	200.8	ICP/MS
COLOR	SM	2120B	VISUAL
MBAS	SM	5540C	DIRECT READING
CORROSIVITY	SM	203	CALCULATION

**DRINKING WATER METHODS (cont'd.)
PRIMARY ORGANICS (40 CFR PART 141.24, JULY 1, 2000)**

<u>ANALYTE</u>	<u>REFERENCE</u>	<u>METHOD</u>	<u>METHOD DESCRIPTION</u>
TRihalOMETHANES	USEPA	524.2	P/T GC/MS
VOLATILE ORGANIC COMPOUNDS (INCLUDING VINYL CHLORIDE)	USEPA	524.2	P/T GC/MS

**DRINKING WATER METHODS (cont'd.)
RADIOCHEMISTRY (40 CFR PART 141.25, JULY 1, 2000)**

<u>ANALYTE</u>	<u>REFERENCE</u>	<u>METHOD</u>	<u>METHOD DESCRIPTION</u>
GROSS ALPHA	USEPA	900.0	Gross alpha/beta in water
GROSS BETA	USEPA	900.0	Gross alpha/beta in water
RADIUM-226	USEPA	903.0 precipitation/ Rn ingrowth	Radium in water by
RADIUM-228	-	-	-
RADON	-	-	-
URANIUM	USEPA	908	Note #1 Uranium in drinking water

(NSHL0797.SDW)

Note #1 - USEPA EMSL-LV and Region IX approval/certification letter.

**Table 13.2 - WASTEWATER AND GROUNDWATER METHODS
TRACE METALS**

<u>ANALYTE</u>	<u>REFERENCE</u>	<u>METHOD</u>	<u>METHOD DESCRIPTION</u>
ALUMINUM	USEPA	200.7	ICP
	USEPA	200.8	ICP/MS
ARSENIC	USEPA	200.8	ICP/MS
BARIUM	USEPA	200.7	ICP
	USEPA	200.8	ICP/MS
BERYLLIUM	USEPA	200.8	ICP/MS
BORON	USEPA	200.7	ICP
CADMIUM	USEPA	200.8	ICP/MS
COBALT	USEPA	200.8	ICP/MS
CHROMIUM	USEPA	200.8	ICP/MS
COPPER	USEPA	200.7	ICP
	USEPA	200.8	ICP/MS

IRON	USEPA	200.7	ICP
MERCURY	USEPA	245.2	AUTOMATED, COLD VAPOR
MANGANESE	USEPA	200.7	ICP
	USEPA	200.8	ICP/MS
NICKEL	USEPA	200.8	ICP/MS
LEAD	USEPA	200.8	ICP/MS
SELENIUM	USEPA	200.8	ICP/MS
VANADIUM	USEPA	200.8	ICP/MS
ZINC	USEPA	200.7	ICP
	USEPA	200.8	ICP/MS
ANTIMONY	USEPA	200.8	ICP/MS
SILVER	USEPA	200.8	ICP/MS
THALLIUM	USEPA	200.8	ICP/MS
MOLYBDENUM	USEPA	200.8	ICP/MS
STRONTIUM	USEPA	200.8	ICP/MS
TITANIUM	USEPA	200.8	ICP/MS

**WASTEWATER AND GROUNDWATER METHODS (cont'd.)
NUTRIENTS**

<u>ANALYTE</u>	<u>REFERENCE</u>	<u>METHOD</u>	<u>METHOD DESCRIPTION</u>
AMMONIA-N	SM	4500-NH3-F	ISE W/W/O DISTILLATION
NITRATE-N	USEPA	300.0	ION CHROMATOGRAPHY
ORTHO-P	SM	4500-P-E	ASCORBIC ACID
KJELDAHL-N	SM	4500-NH3-B	DIGESTION-ISE
TOTAL-P	SM	4500-P-E	PERSULFATE-ASCORBIC ACID

**WASTEWATER AND GROUNDWATER METHODS (con'd.)
MINERALS**

<u>ANALYTE</u>	<u>REFERENCE METHOD</u>		<u>METHOD DESCRIPTION</u>
pH	USEPA	150.1	ISE
SPEC. COND.	SM	2510B	DIRECT READING INST
TDS @ 180C	SM	2540C	GRAVIMETRIC
HARDNESS	USEPA	200.7	CALC FROM CA AND MG
CALCIUM	USEPA	200.7	ICP
MAGNESIUM	USEPA	200.7	ICP
SODIUM	USEPA	200.7	ICP
POTASSIUM	USEPA	200.7	ICP
ALKALINITY	SM	2320B	TITRATION
CHLORIDE	USEPA	300.0	ION CHROMATOGRAPHY
FLUORIDE	SM	4500-F-C	ISE
SULFATE	USEPA	300.0	ION CHROMATOGRAPHY

**METHODS WASTEWATER AND GROUNDWATER(cont'd.)
DEMANDS**

<u>ANALYTE</u>	<u>REFERENCE METHOD</u>		<u>METHOD DESCRIPTION</u>
COD	SM	5220C	Closed reflux-Titrametric
TOC	-	-	-
5-DAY BOD	SM	5210B	WINKLER-ISE
C-BOD	SM	5210B	WINKLER-ISE

**WASTEWATER AND GROUNDWATER METHODS (cont'd.)
MISCELLANEOUS**

<u>ANALYTE</u>	<u>REFERENCE METHOD</u>		<u>METHOD DESCRIPTION</u>
COLOR	SM	2120B	VISUAL
CYANIDE	SM	4500-CN-E	Distillation/spectrophotometric

NON-FILTERABLE RESIDUE (TSS)	USEPA	160.2	GRAVIMETRIC
OIL & GREASE	USEPA	1664	GRAVIMETRIC
RES. CHLORINE	SM	4500-CL-F	DPD-FAS TITRITRIC
FIXED/VOLATILE SOLIDS	SM	2540 D,E	GRAVIMETRIC/IGNITION
CHLOROPHYLL	SM	10200	SPECTROPHOTOMETRIC

CHAPTER 14 - DATA REDUCTION, VALIDATION AND REPORTING

INTRODUCTION

The process of transforming raw analytical data into a finished report involves steps, which are generally grouped into the categories of data reduction, data validation, and reporting. It involves mathematical modeling of the standard calibration curves, statistical analysis of the acquired data, calculations to account for preparation steps and dilutions, verification of adherence to quality assurance procedures, and the generation of hard copy output. The method SOP for each analysis should detail these steps as they apply to that method.

DATA REDUCTION

The analyst performing an analysis has the primary responsibility for reducing raw data. This process consists primarily of converting raw data values into final, reportable values by comparing individual sample results to those obtained for calibration purposes, then accounting for any dilutions made on individual samples.

For each method, all raw data results are recorded on method specific worksheets or in a standardized output from each of the various instruments. The SOP for each method provides more detail for how the raw data are handled.

ANALYST DATA REVIEW

Upon completion of each analytical run, the analytical raw data and QC summary sheets are reviewed by the analyst. The analyst will place a hard copy of the raw data into the data sheet book and when there is sufficient raw data it will be bound into book format. The analyst makes sure that all QC passes and that nothing is out of the ordinary. The analyst also enters the processed data into the computer. If there is any question concerning the data in the data book the chemist will investigate the cause of the error and determine if there is need to re-run or confirm the data.

DATA REVIEW POLICY

All analytical data produced for a report are reviewed by at least one chemist. The chemist is responsible for checking to make sure that the data passes all the QA/QC that is necessary to be valid data, and that there are no errors in transcribing the data from the raw data sheets to the computer, and that all the

calculations are correct. Upon generation of the report the chemist will review and sign final report if deemed acceptable.

The first reviewers primary responsibility is to make sure that there are no transcription errors from the analyst's worksheet into the computer. They also review specific methods for calculation errors. The latter duty is shared between the two reviewers. For the analyses that use the *curvefit* program the data are entered again into the program and 10% of the samples are calculated again to check for errors. For analyses not requiring *curvefit* the reviewer looks at the data and checks for completeness and accuracy. For any manual calculations 10% are checked for error.

DATA STORAGE

The data report files from all current and previous years, along with the supporting raw data, are stored either at the State Lab or in a locked medical school storage area. Currently, we are storing data for 12 years.

CHAPTER 15 - CONTRACTING SAMPLES TO ANOTHER LABORATORY

INTRODUCTION

The Nevada State Health Laboratory does not perform the Synthetic Organic Compound (SOC) analyses portion of the required criteria for a water system. Because of this we contract with a laboratory certified to perform the SOCs.

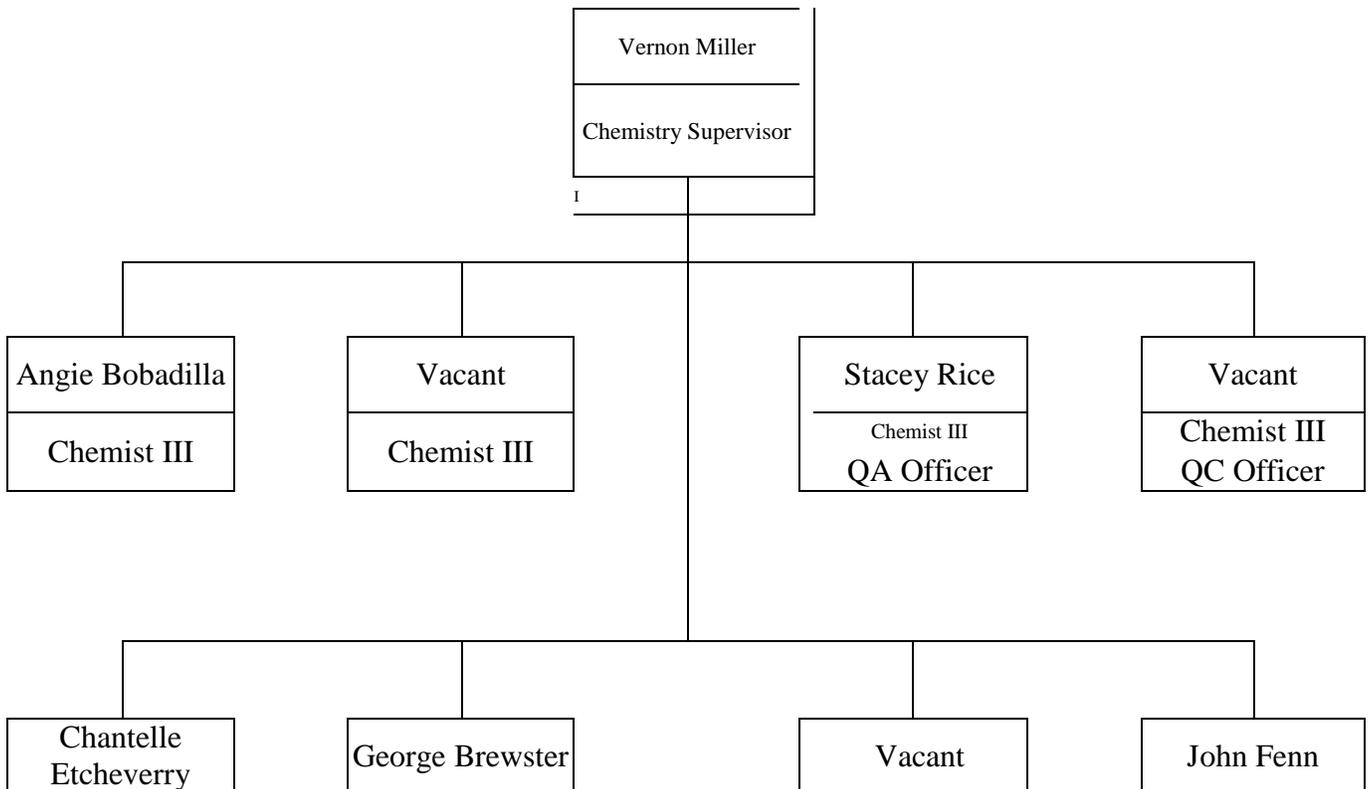
The sampling kits for SOCs are stored at the Nevada State Health Laboratory and then are distributed to the clients that request them. The sampling and holding procedures outlined in Table 7.1 are followed. Once the sample has been taken and the kit returned to the laboratory the accessioning department fills out a chain of custody for the contract laboratory and then the courier delivers the kit to the contract laboratory.

APPENDIX A

ORGANIZATIONAL CHARTS

CHEMISTRY DEPARTMENT

29 December 2010



Lab Tech I

Lab Tech I

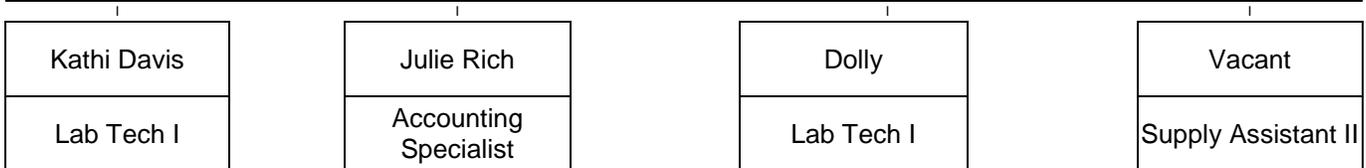
Lab Tech I

Lab Tech I

SUPPORT DEPARTMENTS

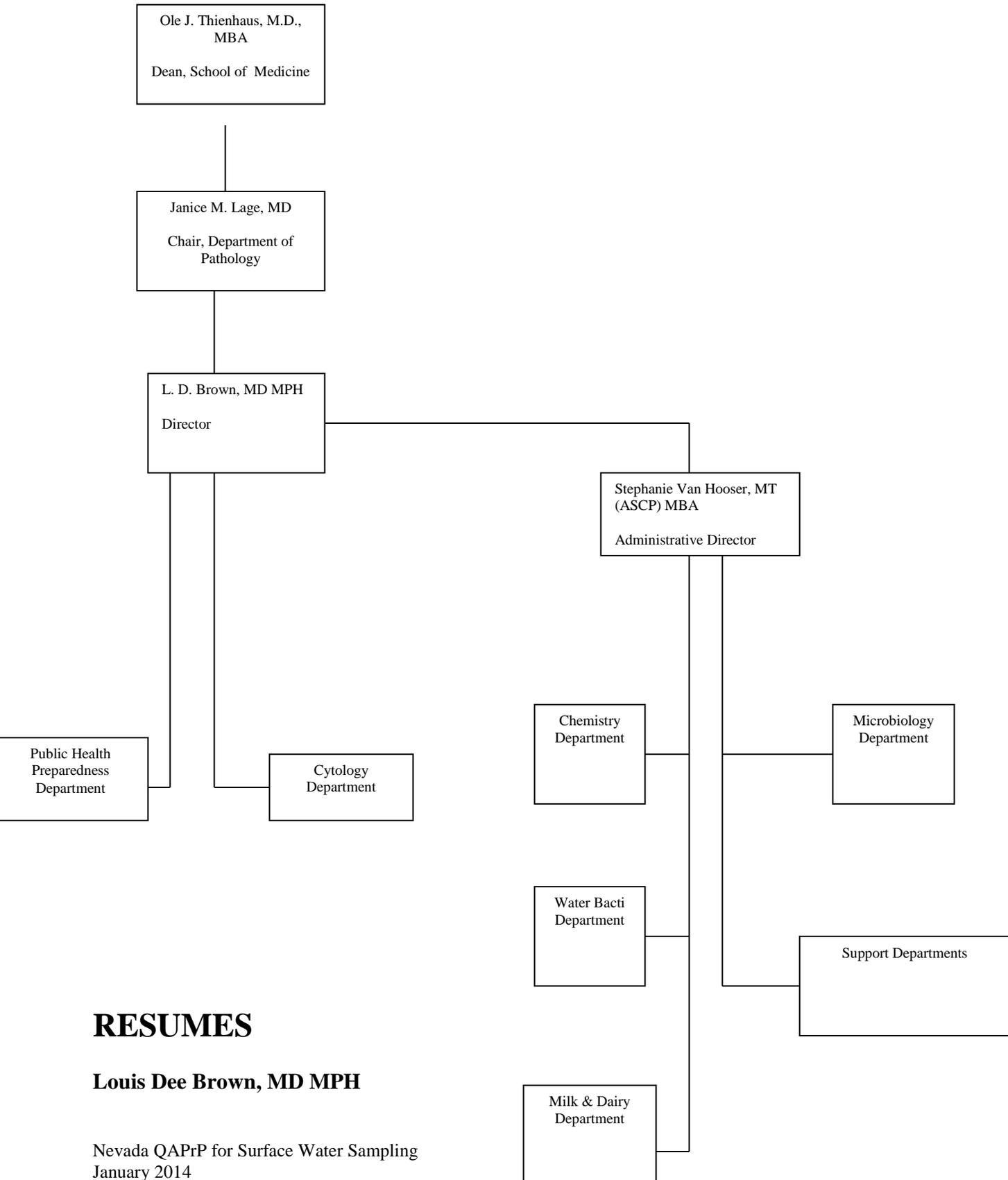
11 March 2009

Stephanie Van Hooser, MT(ASCP), MBA Support Department's Supervisor



NEVADA STATE HEALTH LABORATORY

March 11, 2009



RESUMES

Louis Dee Brown, MD MPH

Nevada QAPrP for Surface Water Sampling
January 2014
Page 185 of 194

Current Responsibilities:

Director, Nevada State Public Health Laboratory
Associate Professor of Pathology and Laboratory Medicine, University of
Nevada School of Medicine

Work Experience:

Nevada State Public Health Laboratory, Associate Director, & Associate Professor of
Pathology and Laboratory Medicine, University of Nevada School of Medicine

Administrative Internship, Kaiser-Permanente, Northwest

Headed project, which assessed electrocardiogram utilization within Kaiser
Northwest, with development of evidence base for ideal utilization practices.

Oregon Health Division DOLPHIN Network Confidentiality and Privacy
Task Force, Research Assistant, Interim Chair.

Developed a statutory and literature based framework for the Task Force, which
developed Health-Division-wide guidelines for release of information maintained
by the Division.

Methodist Hospitals of Dallas

Director, Clinical Chemistry Laboratories, and Associate Surgical Pathologist.

Primary responsibility for consultation with clinical medical staff in areas of
clinical chemistry and continual improvement services, Rotated responsibility with
six anatomic pathology colleagues, signing out over 14,000 surgical cases and
4,000 cytology cases per year, Served as member of College of American
Pathologists accreditation survey teams. Lectured to medical/surgical/ob-gyn and
pathology residents on laboratory tests and theory; presented formal continuing
education lectures to laboratory technical staff, taught pathology residents via one-
on-one sessions. Served on Executive, Patient Care, Medical Staff Credentials,
Institutional Safety and Radiation Safety Committees. Served as liaison with
hospital administration, advising on analytical equipment and laboratory
information systems.

Formal Education:

Masters of Public Health (1997), Portland State University.

M.D. (1977), University of New Mexico.

B.A. in Chemistry (1969), Texas Tech University.

Vernon Miller

Current Responsibilities:

Chemist IV

Responsible for the day-to-day operation of the Nevada State Health Laboratory.
These responsibilities include supervising the inorganic and organic chemistry
sections of the laboratory, maintaining quality assurance and quality control of
analyses, maintaining client relations, personnel assignment, staffing and training.
Active contact with federal and state regulators. Prints and reviews reports as
needed.

Instruments and Equipment Experience:

GC/MS	Microwave Digestor
HPLC	XRF
AutoTrace	Leco C/S Analyzer
Flashpoint	DCP-AES
Viscosity	GC-OFID
GC-FID	IR-SPEC
GC-FPD	LC-MS
GC-TCD	IC
GC-AED	ICP/MS
UV/VIS SPEC	AA

Various Wet Chemistry Techniques and Instrumentation

Professional Experience:

- Senior Petroleum Chemist, Nevada Department of Agriculture
- Petroleum Chemist, Nevada Department of Agriculture
- Pesticide Chemist, Nevada Department of Agriculture
- Associate Scientist, Nevada Environmental Laboratories
- Laboratory Director and Quality Assurance Manager, Advanced Specialty Gases Inc.
- Chemist, Kennametal Inc.

Formal Education:

Bachelor of Science, Biochemistry & Molecular Biology

Stacey A. Rice

Current Responsibilities:

Chemist III

Quality Assurance Manager. Perform ICP/MS and VOC analysis. Responsible for printing the data reports and reviewing before they are sent out. Review the SOC and Radiochemistry reports that are contracted to other laboratories.

Instruments and Equipment:

GC/MS - Hewlett Packard 5972

GC - HP 5890, ECD/NPD

ICP - Varian

ICP/MS - Varian

Other instruments and equipment include - Ion Chromatograph,
UV/VIS Spectrophotometers, pH Meters, Kjeldahl Digester, Kjeldahl distillation, Balance.

Work Experience:

Over a decade of experience in environmental testing for drinking water, wastewater, and petroleum samples.

Formal Education:

B.S. in Chemistry (1988), Southern Utah University

Angie Bobadilla

Current Responsibilities:

Chemist III

Responsible for the analysis of mercury, BOD, CBOD, COD, Residual Chlorine and oil and grease. Prints and reviews reports as needed, checks-in samples, and disposes samples as necessary.

Instruments and Equipment:

FIMS

BOD meter

Other instruments and equipment include - Ion Chromatograph, UV/VIS Spectrophotometers, Turbidity Meter, Conductivity Meter, Kjeldahl Digester, Kjeldahl Distillation, Tennelec

Work Experience:

Sierra Environmental Monitoring

Performed water and soil analyses.

Interscience Research, Inc.

Performed water, petroleum and asbestos analysis.

International Textile Mills, Philippines

Trained and supervised QC staff to maintain quality product.

Formal Education:

Chemical Engineer (1976), Mapua Institute of Technology

Vacant

Current Responsibilities:

Chemist III

Responsible for the analysis of oil and grease and the radiochemistry program.
Prints and reviews reports as needed.

Instruments and Equipment:

Gas Flow Proportional Counter

Other instruments and equipment include - Balance, pH meter, UV/VIS
Spectrophotometers.

Work Experience:

Formal Education:

Vacant

Current Responsibilities:

Chemist III

Quality Assurance Manager. Responsible for the analysis of metals by ICP-MS. Prints and reviews reports as needed. Chemistry department computer support specialist maintaining networks, instruments, instrument data, and ancillary equipment

Instruments and Equipment:

Work Experience:

Formal Education:

George Brewster

Current Responsibilities:

Laboratory Technician

Responsible for the analysis of total suspended solids, total phosphorous, ortho-phosphate, nitrite and IC. Preparing sample bottles for laboratory and clients.
Washing and storing of glassware.

Instruments and Equipment:

pH Meter

Conductivity Meter

Analytical Balance

Spectrophotometer

Tennelec Gas Flow Proportional Counter

Formal Education:

B.S. in Health Science (1994), University of Nevada, Reno

Chantelle Etcheverry

Current Responsibilities:

Laboratory Technician

Responsible for the analysis of ammonia, cyanide, and total Kjeldahl nitrogen.

Responsible for sample management, operating the pH/conductivity/alkalinity auto-titrator, TDS, color, turbidity, MBAS, and other benchtop analyses.

Instruments and equipment:

Kjeldhal digester

Kjeldahl distillation unit

Cyanide Digester

Spectrophotometer

Thermo Orion pH/ISE meter

pH/conductivity/alkalinity auto-titrator

Analytical Balance

Turbidimeter

Formal Education

Bachelor of Science, University of Idaho, Moscow, Biology 2004

John Fenn

Current Responsibilities:

Laboratory Technician

Responsible for sample management, operating the pH/conductivity/alkalinity auto-titrator, TDS, color, turbidity, MBAS, and other benchtop analyses.

Instruments and Equipment

Kjeldhal digester

Kjeldahl distillation unit

Cyanide Digester

Spectrophotometer

Thermo Orion pH/ISE meter

pH/conductivity/alkalinity auto-titrator

Analytical Balance

Turbidimeter

Formal Education

Bachelor of Science, University of Nevada, Reno, Physics