

# Quality Assurance Plan

December 16, 2010

**NPDES Permit Number IDG-13-0004**

**Effective: January 1, 2010 – November 30, 2012**

**Hagerman National Fish Hatchery  
U.S. Fish and Wildlife Service  
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Position: Supervisory Fish Biologist and Project Leader

QA Manager Signature: \_\_\_\_\_

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Position: Supervisory Fish Biologist, Assistant Project Leader

EPA Approval Signature: \_\_\_\_\_

Name (printed) /Title/Date: \_\_\_\_\_

## A. Project Management

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### ***A3. Distribution List***

**Table 1. Individuals who are to receive a copy of the QA Project Plan.**

<b>Name</b>	<b>Title/Affiliation</b>	<b>Role</b>
Rich Johnson	Fisheries Supervisor, USFWS Portland, OR	Informational
Julie Collins	Field Support Manager, USFWS Portland, OR	Informational
Don Campton	Science Support Advisor Portland, OR	Informational
Bryan Kenworthy	Project Leader, USFWS Hagerman NFH, Hagerman, ID	QA Project Officer
Nate Wiese	Assistant Project Leader, USFWS Hagerman NFH, Hagerman, ID	QA Project Manager
Jeremy Trimpey	Fish Biologist, USFWS Hagerman NFH, Hagerman, ID	Carry out QA Project Plan
Brian Clifford	Motor Vehicle Operator, USFWS Hagerman NFH, Hagerman, ID	Carry out QA Project Plan
Eric Willet	Motor Vehicle Operator, USFWS Hagerman NFH, Hagerman, ID	Carry out QA Project Plan
Adam Leija	Animal Caretaker, USFWS Hagerman NFH, Hagerman, ID	Carry out QA Project Plan
Andy Eiman	Temporary Animal Caretaker, USFWS Hagerman NFH, Hagerman, ID	Carry out QA Project Plan

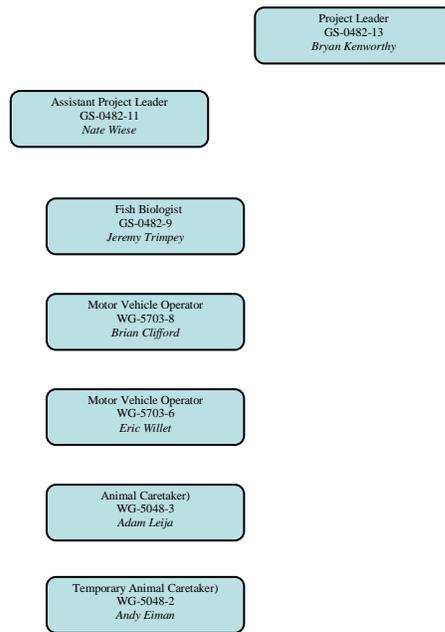
## A4. Project/Task Organization

### 1. Project staff and responsibilities

**Table 2. USFWS personnel responsible for implementation of the QA Plan.**

Personnel	Position	Contact Information	QA Plan Responsibilities
Bryan Kenworthy	Project Leader	<a href="mailto:bryan_kenworthy@fws.gov">bryan_kenworthy@fws.gov</a> TEL: 208-837-4896 FAX: 208-837-6225	QA Project Officer, Chief Supervisor
Nate Wiese	Assistant Project Leader	<a href="mailto:nathan_wiese@fws.gov">nathan_wiese@fws.gov</a> TEL: 208-837-4896 FAX: 208-837-6225	<p>QA Project Manager</p> <ul style="list-style-type: none"> <li>• Direct supervision to crew</li> <li>• Alternate for collecting water quality samples</li> <li>• Alternate for preparing DMRs</li> </ul>
Jeremy Trimpey	Fish Biologist	<a href="mailto:jeremy_trimpey@fws.gov">jeremy_trimpey@fws.gov</a> TEL: 208-837-4896 FAX: 208-837-6225	<ul style="list-style-type: none"> <li>• Prepares monthly DMRs,</li> <li>• Collects water quality samples,</li> <li>• Implements BMP's on daily basis</li> </ul>
Brian Clifford	Motor Vehicle Operator	<a href="mailto:brian_clifford@fws.gov">brian_clifford@fws.gov</a> TEL: 208-837-4896 FAX: 208-837-6225	<ul style="list-style-type: none"> <li>• Implements BMP's on daily basis</li> <li>• Alternate for collecting water quality samples</li> <li>• Alternate for preparing DMRs</li> </ul>
Eric Willet	Motor Vehicle Operator	<a href="mailto:eric_willet@fws.gov">eric_willet@fws.gov</a> TEL: 208-837-4896 FAX: 208-837-6225	<ul style="list-style-type: none"> <li>• Implements BMP's on daily basis</li> <li>• Alternate for collecting water quality samples</li> <li>• Alternate for preparing DMR</li> </ul>
Adam Leija	Animal Caretaker	<a href="mailto:adam_leija@fws.gov">adam_leija@fws.gov</a> TEL: 208-837-4896 FAX: 208-837-6225	<ul style="list-style-type: none"> <li>• Implements BMP's on daily basis</li> <li>• Alternate for collecting water quality samples</li> <li>• Alternate for preparing DMR</li> </ul>
Andy Eiman	Temporary Animal Caretaker	TEL: 208-837-4896 FAX: 208-837-6225	<ul style="list-style-type: none"> <li>• Implements BMP's on daily basis</li> <li>• Alternate for collecting water quality samples</li> <li>• Alternate for preparing DMR</li> </ul>
Anna Ray	Fisheries Program Assistant	<a href="mailto:anna_ray@fws.gov">anna_ray@fws.gov</a> TEL: 208-837-4896 FAX: 208-837-6225	<ul style="list-style-type: none"> <li>• Implements BMP</li> <li>• Sends DMR's to EPA</li> </ul>
Steve Money	Maintenance Mechanic	<a href="mailto:steve_money@fws.gov">steve_money@fws.gov</a> TEL: 208-837-4896 FAX: 208-837-6225	<ul style="list-style-type: none"> <li>• Implements BMP</li> </ul>

**Figure 1. Organization chart for USFWS personnel responsible for implementation of the QA Plan.**



**2. Contractors**

**Table 3. Contractors directly involved with implementation of the QA Plan.**

Contractor	Address	Responsibilities
Rangen Aquaculture Research Center	2928 South 1175 East Hagerman, ID 88832	<ul style="list-style-type: none"> <li>Estimate Total Suspended Solids, Total Phosphorus, and Total Ammonia as N</li> </ul>
Pacific Equipment	301 South Kings Road Nampa, ID 83651	<ul style="list-style-type: none"> <li>Vendor for Sigma Flow Meter for Flow measurement through Off-Line Settling Basin</li> </ul>

## **A5. Problem definition and background**

### **1. Description of current facility and infrastructure**

The Hagerman National Fish Hatchery (Hatchery) is located along the Snake River, about 30 miles west of Twin Falls, Idaho at a point three miles south and two miles east of Hagerman, Idaho.

Relevant facilities which comprise the Hagerman NFH are:

- 1 Intake structure on the Brailsford Ditch
- 1 Pump Back Structure
- 1 Pollution Abatement Pond
- 1 New Hatchery Building (40 start tanks)
- 1 Old Hatchery Building (20 start tanks)
- 66 - 10' x 103' Raceways
- 12 - 8' x 70' Raceways
- 1 Display Pond

The water supply for the Hatchery emanates from the Eastern Snake Plain Aquifer (Aquifer) through a complex of springs diverted for Hatchery operations. Under the administration of the Idaho Department of Water Resources, the U.S. Fish and Wildlife Service has surface water rights for 109.74 cubic feet per second (cfs) flow for fish propagation, irrigation, domestic use and stock water. However, this is not a cumulative total due to the fact that there are multiple rights to several spring diversions with different priority dates, seasons of use, and for different types and places of use or, in the case of Spring 16 (Len Lewis Spring), subordinate to a senior user during the irrigation season (February 15 to November 30). Moreover, not all water sources can be diverted to all outside rearing units. Spring 17 is only plumbed to the Trout Raceways; Riley Creek and Bickel springs are only plumbed to the Steelhead Raceways. The priority dates for the Hatchery's water rights range from 1889 to 2002, the majority of which are in the early 1930's to 1950. Assuming all the Springs were flowing at the full water right, of the total, 84.59 cfs could be diverted for fish production at the Hatchery; another 4.6 cfs could be diverted to operations at the Hagerman Fish Culture Experiment Station (HFCES). The Fish and Wildlife Service provides water to the HFCES under a Memorandum of Understanding with the University of Idaho.

Effluent water from raceways is normally discharged directly to Riley Creek or pumped to the Hagerman Wildlife Management Area, but the cleaning water from each raceway is diverted into the settling pond prior to release into Riley Creek.

## **2. History of facility and programs**

The Hatchery was authorized by 46 Sta. 371 on May 31, 1930 and was established in 1931. Construction of physical facilities commenced in 1932 and the first trout eggs were received for incubation in 1933. Expansion and modernization has occurred on several occasions, most notably in 1951, 1982, 2001, and 2006. The storage barn is the only remaining building from the 1932 construction. Remaining structures from the 1951 construction include four residences, office, garage-shop, and oil-paint storage buildings. The 1983 expansion added Hatchery Building II, Administration Building, Water Service Building, Brailsford Intake, and raceways 1-12, and 37-102. A new Hatchery I building was constructed in 2001 replacing the old Hatchery I building which was demolished in 2006. Also in 2006, a set of 24 old 8 X 80 concrete raceways (13 -36) were demolished and a new building was constructed to house the water chiller which is used during fish distribution. Other projects included several pipe line replacements, improvements to water diversions, and completion of the Riley Creek Pump-back system.

Principal production from 1933 to 1979 was rainbow trout for stocking in Idaho, eastern Oregon and northern Nevada. Lahontan cutthroat trout were also reared for release into Pyramid Lake, Nevada.

A major change in the production occurred in 1979 with phased-out elimination of the resident rainbow trout program in favor of anadromous species. The Hatchery became a steelhead mitigation project under the Lower Snake River Fish and Wildlife Compensation Plan (LSRCP). The 1983 construction, costing \$6.5 million, was funded by the Corps of Engineers as part of the Lower Snake project. Current steelhead production is 1.4 million steelhead smolts at 4 to 5 fish per pound. The hatchery also raises 140,000 resident rainbow trout as part of the Dworshak Reservoir Program.

## **3. Regulatory information and legal mandates for programs**

Legal authorization of the Hagerman NFH falls under the Lower Snake River Fish and Wildlife Compensation Plan (LSRCP) which was authorized by the Water Resources Development Act of 1976, Public Law 94-587 and U.S. vs. Oregon tribal treaty agreements.

#### **4. Summer steelhead program**

**Program Goals:** The primary goal of the summer steelhead program is mitigation (commercial, tribal, and sport) for fish habitat lost due to the construction of Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Dams on the Lower Snake River. The secondary goal of the program is conservation of ESA listed summer steelhead in the East Fork of the Salmon River.

**Program Summary:** The current production goal is 1.36 million juvenile summer steelhead to the Salmon River at Sawtooth Fish Hatchery, Yankee Fork Acclimation Ponds, and East Fork trap site at a size of 4.5 fish per pound (average total weight of 300,000 pounds annually). Production goals are set annually by the Salmon River Annual Operating Plan. The Hatchery receives eyed eggs annually from Sawtooth Fish Hatchery in order to fulfill this production goal. Broodstock is collected using a fish trap and adult holding pond at Sawtooth Fish Hatchery. Spawning out carcasses are donated to tribal members, the general public, and food banks.

#### **5. Rainbow trout program**

**Program Goals:** The primary goal of the rainbow trout program is mitigation for fish habitat lost due to the construction of Dworshak Dam.

**Program Summary:** The current production goal is to release 90,000 juvenile and 40,000 catchable rainbow trout to reservoirs in southern Idaho annually as an in-kind exchange with the Idaho Department of Fish and Game (IDFG). IDFG releases trout in Dworshak Reservoir and the Hatchery releases trout in southern Idaho in exchange. Juvenile trout are released at a size of 17 fish per pound (average total weight of 5,000 pounds annually). Catchable rainbow trout are released at a size of 2.9 fish per pound (average total weight 19,000 pounds). Eggs for the program are received from Hayspur State Fish Hatchery. Broodstock is maintained by Hayspur State Fish Hatchery and mortalities are disposed of according to their standard operating procedures.

## 6. Fish production and feed use

**Table 4. Pounds (lbs.) of fish produced and pounds of feed used at Hagerman NFH, 2005-2009.**

Fiscal Year	Total no. of lbs. of fish produced	Total no. of lbs. of feed used	Max. no. of lbs. of feed/month	Maximum feed month
2005	335,439	331,201	68,219	March
2006	310,261	321,606	66,867	March
2007	358,177	365,011	61,304	April
2008	353,937	381,323	87,229	March
2009	340,864	357,298	72,413	March

Fiscal Years are from October 1 to September 30<sup>th</sup>. Data taken from Hatchery Production Summaries, 2004-2009.

## 8. Chemicals used

**Table 5. Chemicals used at Hagerman NFH, 2004-2009. See page 38 and Appendix G of General Permit for maintaining records of use.**

Chemical	Purpose	Frequency of use <sup>1</sup>	Date last used
Argyntyne	Disinfectant, eggs	occasionally	6/17/08
Bleach	Disinfectant, tools and equipment	occasionally	3/15/08
Cond Calibration Sol	Calibrate meters	occasionally	12/15/08
Electrode Clean Sol	Clean meters	occasionally	11/13/08
Formalin	Parasite control, juvenile fish	rarely	7/2/07
Iodine	Disinfectant, eggs and equipment	rarely	6/17/06
K-cide	Disinfectant, footbath and equipment	occasionally	8/14/08
MS 222	Fish Anesthetic	occasionally	11/19/09
Nesslers Solution	Fish Health	rarely	3/12/09
pH Calibration Sol	Calibrate meters	occasionally	1/8/08
Rochelle Salt	Fish Health	rarely	3/12/09
Starch Indicator	Fish Health	rarely	3/12/09
Sodium Thiosulfate	Neutralize disinfectants	occasionally	9/2/08
Vidalife	Water Conditioner	rarely	8/18/09

<sup>1</sup>Daily, weekly, monthly, occasionally, or rarely.

## 9. Therapeutants and drugs used

**Table 6. Therapeutants used at Hagerman NFH, 2004-2009. See page 38 and Appendix G of General Permit for maintaining records of use.**

Therapeutant/drug	Purpose	Frequency of Use <sup>1</sup>	Date last used
Florfenicol – med feed	Treatment of cold water disease	rarely	11/6/09
Sulfadimethoxine – med feed	Treatment of furunculosis	rarely	12/31/09
Ormetoprim – med feed	Treatment of furunculosis	rarely	12/31/09

<sup>1</sup>Daily, weekly, monthly, occasionally, or rarely.

## 10. Monitoring needs.

Hagerman NFH rears more than 20,000 pounds of fish per calendar year and/or feeds more than 5,000 pounds of feed in one or more calendar months. As a result, Hagerman NFH is required to have a site-specific NPDES discharge permit for effluent discharged into public waters of the state of Idaho, in accordance with General Permit No. IDG-13-0004. The required water quality monitoring program is summarized in section A6 below.

## A6. Project/Task Description

### 1. Water quality parameters to be monitored

**Table 7. Water quality parameters to be monitored at Hagerman NFH.**

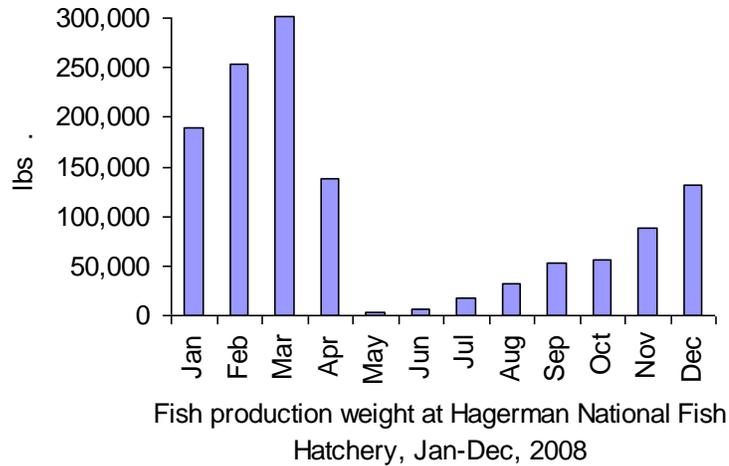
Parameter	Required? (Y or N)	Measured Units	Sample Type	Sample Frequency	Water Source of samples
<b>Raceways</b>					
1. Flow	Yes	cfs	Approved Method	Monthly	Effluent
2. Total suspended solids	Yes	lbs/day mg/L	Composite	Quarterly	Influent and Effluent
3. Total phosphorus	Yes	lbs/day mg/L	Composite	Quarterly	Influent and Effluent
4. Temperature	Yes	°Celsius	Grab	Quarterly	Influent and Effluent
<b>OLSB</b>					
1. Flow	Yes	cfs	Approved Method	Monthly	Effluent
2. Total suspended solids	Yes	lbs/day mg/L % Removal	Composite	Quarterly	Influent and Effluent
3. Total phosphorus	Yes	lbs/day mg/L	Composite	Quarterly	Influent and Effluent
4. Temperature	Yes	°Celsius	Grab	Quarterly	Influent and Effluent
5. pH	Yes	s.u.	Grab	Quarterly	Effluent
6. Total ammonia as N	Yes	mg/L	Composite	Quarterly	Effluent
<b>Receiving Waters</b>					
1. Temperature	Yes	°Celsius	Grab	Quarterly	Riley Creek
2. pH	Yes	s.u.	Grab	Quarterly	Riley Creek
3. Total ammonia as N	Yes	mg/L	Grab	Quarterly	Riley Creek

### 2. Water monitoring schedule

Flow to the raceways is monitored monthly from total spring discharge diverted to fish rearing units. Flow from the OLSB is measured from insert-style flow sensors/meters. Total suspended solids, total phosphorus, total ammonia as N, temperature, pH, and receiving water conditions are monitored quarterly. These parameters are monitored quarterly because facilities that produce between 100,000 and 500,000 pounds annually are required to report once per calendar quarter as stated on page 31 (footnote 16) of the permit. If any chelated copper or copper sulfate compounds are used, total recoverable copper and hardness will also be measured. All water quality parameters will be measured during normal Hatchery raceway cleaning practices.

Sampling will occur in March (first quarter), April (second quarter), September (third quarter), and December (fourth quarter). These months represent the greatest anticipated fish (steelhead and trout) production during their respective quarters. DMR sampling generally occurs on raceway cleaning days to correlate with the highest expected

phosphorus discharge from the facility. Additional monitoring may be conducted on alternate days depending on variations in the feeding/cleaning schedules.



### 3. Water monitoring locations

Appendix A illustrates all water sampling and flow measurement locations as described below:

- Sample Site 1:** Steelhead Influent located where mixing chamber empties into headbox.
- Sample Site 2:** Steelhead Effluent located in tailbox in front of blue pumps.
- Sample Site 3:** Display Pond Influent located at head end of raceway.
- Sample Site 4:** Display Pond Effluent located at tail end of raceway.
- Sample Site 5:** Trout Influent located where spring 17 discharges into head box.
- Sample Site 6:** Trout Effluent located in tailbox prior to discharge into Riley Creek.
- Sample Site 7:** Hatch I Influent located in Hatch I at first hose bib.
- Sample Site 8:** Hatch I Effluent located in manhole in Admin Building back lawn.
- Sample Site 9:** OLSB Influent located at head end of cell 2.
- Sample Site 10:** OLSB Effluent located in tailbox at discharge site into Riley Creek.
- Sample Site 11:** Receiving Water Site located at electric weir.

### 4. Resource and time constraints

N/A

## A7. Quality objectives and criteria

### 1. Seasonal effluent limitations.

**Table 8. Seasonal Effluent Limitations from Table 3 from the Permit**

Facility Name	Season	Limitations (lbs/day)			
		Net TSS		Net Total Phosphorus	
		Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
Hagerman Natl. (USFWS)	Jan. – Apr.	2068.2	3929.5	17.8	26.3
	May – Aug.	697.4	1325.1	6.0	8.9
	Sep. – Dec.	1487.0	2825.3	12.8	18.9

### 2. Off-line settling basin effluent limitations.

**Table 9. Off-Line Settling Basin Effluent Limitations from Table 11 from the Permit**

Parameter	Average Monthly	Maximum Daily
Total Suspended Solids	67 mg/L*	100 mg/L* & ≥90% Removal

\* Limit is *Net*: OLSB effluent – facility influent

### 3. Required sensitivity detection limits

**Table 10. Method Detection Limits from Table 15 from the Permit**

Parameter	Method Detection Limit (MDL)
Total Phosphorus	0.005 mg/l
Total Suspended Solids	2 mg/l
Ammonia Nitrogen as N	0.01 mg/l
Nitrate	0.1 mg/l
Nitrite	0.01 mg/l
Total Kjeldahl Nitrogen (TKN)	0.03 mg/l
pH	0.1 S.U.
Temperature	0.1°C
Copper	3µg/l
Hardness	10 mg/l

### 4. Bias, precision, completeness, representativeness, comparability, and sensitivity of measurements

See Section B (Data Generation and Acquisition) for discussion of specific methods for each measured parameter.

### ***A8. Special training/certifications***

Personnel training for water sample collection and data recording (e.g., water flow measurements) are conducted on the job as needed. The Assistant Project Leader is responsible for certifying that this training is obtained. All analytical chemical analyses are performed by a certified water quality laboratory via contract with the USFWS (Table 3).

### ***A9. Documentation and records***

Water flow measurements are recorded in blue water measurement books and transferred to water spreadsheets. Other pertinent information is recorded in a Rite in the Rain notebook which is kept in the EPA file drawer. Hard copies of lab test results, discharge monitoring reports, and water sampling spreadsheets are kept in the EPA file drawer located in the biologist/motor vehicle operator office. Electronic copies are maintained on the Biologist's computer.

The Assistant Project Leader is responsible for ensuring that the collection of all water flow data and water samples at Hagerman NFH comply with the required criteria of the NPDES permit. The Assistant Project Leader is also responsible for ensuring that all hatchery personnel involved with implementation of the QA Plan have access to a copy of the Plan.

## **B. Data Generation and Acquisition**

### **Parameter 1: Flow discharging directly to receiving water**

#### **B1. Sampling process design**

1. **Receiving water:** Riley Creek.
2. **Sample locations:**
  - a. Steelhead Raceways

Steelhead Raceway (SST) flow (cfs) is calculated by adding the flows passing through the Main Spring Flume (M) and over the Bickle (B) and Riley (R) broad-crested weirs and subtracting flows passing through the Hatchery 1 flume (H1), gravity fed to the Bickle Ditch (BD), through the Display Pond flume (DP), and diverted from Main Spring to the Rainbow Trout Raceways (MR).

$$\text{SST Flow} = (M + B + R) - (H1 + BD + DP + MR)$$

Individual site descriptions:

Main Spring (M) : Location No. 3, Site No. 423003

At location No. 3 there is a 4 foot concrete Parshall Flume approximately 25 feet north of the domestic water service building and above the screen chamber. A staff gauge is located in the stilling well beside the Parshall Flume. The rating table for location No. 3 is attached in Appendix A. The rating formula is:

$$Q = 4W(Ha^{1.522})(W^{0.026})$$

Bickle Lake (B) : Location No. 11, Site No. 423011

At location No. 11 there is a 15 foot Cipoletti weir located at the screen chamber and outlet of Bickle Lake. A staff gauge is located above the weir. The rating table for location No. 11 is attached in Appendix B. The rating formula is:

$$Q = 3.367LH^{(3/2)}$$

Riley Lake (R) : Location No. 8, Site No. 423008

At location No. 8 there is a 7 foot Cipoletti weir located at the screen chamber and outlet of Riley Lake. A staff gauge is located above the weir. The rating table for location No. 8 is attached in Appendix C. The rating formula is:

$$Q = 3.367LH^{(3/2)}$$

Hatchery 1 (H1) : Location No. 6, Site No. 423006

At location No. 6 there is a 9” fiberglass Parshall Flume located in a metering manhole approximately fifty feet from the west corner of the Hatchery 1 Building. A staff gauge is located on the side of the Parshall Flume. The rating table for location No. 6 is attached in Appendix D. The rating formula is:

$$Q = 3.07H^{(1.53)}$$

Bickle Ditch (BD) : Location No. 12, Site No. 423012

At location No. 12 there is a 15 foot Cipoletti weir on the Bickel Ditch located approximately 370 yards downstream from the Hatchery entrance sign. The ditch is either supplied by gravity feed water from Main Spring or from a pump system on the bottom deck of Steelhead raceways. Location No. 12 is only used for Steelhead raceway flow calculations when it is supplied with gravity feed water from Main Spring. A staff gauge is located above the weir. The rating table for location No. 12 is attached in Appendix B. The rating formula is:

$$Q = 3.367LH^{(3/2)}$$

Display Pond (DP) : Location No. 5, Site No. 423005

At location No. 5 there is a 2 foot concrete Parshall Flume located approximately 50 feet upstream of the Display Pond. Water is maintained to the Display Pond from overflow from the Main Spring diversion. A staff gauge is located on the side of the Parshall Flume and a rating table is provided in Appendix E.

$$Q = 4W(Ha^{(1.522)})(W^{(0.026)})$$

Main Spring to Rainbow Trout Raceways (MR)

Water can be diverted to the Rainbow Trout Raceways via a 20” supply line from the 24” supply line to Bickle Ditch and Hatchery 1 from Main Spring. The amount of water flowing through the 20” supply line is calculated by measuring the staff gauge height at

Location No. 5 as water is diverted to the Rainbow Trout Raceways. After the gauge height has stabilized, a difference in water volumes is calculated and this process is repeated until the desired water volume is attained.

b. Rainbow Trout Raceways

Flow (cfs) in the Rainbow Trout Raceways is automatically calculated using Spring 17 (S17) measurements and an estimate of water diverted from Main Spring to the Rainbow Trout Raceways (MR).

$$\text{RBT Flow} = \text{S17} + \text{MR}$$

Spring 17 (S17) : Location No. 17, Site No. 423017

At location No. 17 there is an in line ultrasonic meter with permanent ports for wetted transducers located approximately 200 feet from the location No. 17 collection box. Measurements are taken with a Panametrics Transport Model PT868 in-line ultrasonic meter.

Main Spring to Rainbow Trout Raceways (MR)

Water can be diverted to the Rainbow Trout Raceways via a 20" supply line from the 24" supply line to Bickle Ditch and Hatchery 1 from Main Spring. The amount of water flowing through the 20" supply line is calculated by measuring the staff gauge height at Location No. 5 as water is diverted to the Rainbow Trout Raceways. After the gauge height has stabilized, a difference in water volumes is calculated and this process is repeated until the desired water volume is attained.

c. Hatchery 1 (H1) : Location No. 6, Site No. 423006

At location No. 6 there is a 9" fiberglass Parshall Flume located in a metering manhole approximately fifty feet from the west corner of the Hatchery 1 Building. A staff gauge is located on the side of the Parshall Flume. The rating table for location No. 6 is attached in Appendix D. The rating formula is:

$$Q = 3.07H^{(1.53)}$$

d. Display Pond (DP) : Location No. 5, Site No. 423005

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Hagerman National Fish Hatchery, January 1, 2010  
Edited December 14, 2010

At location No. 5 there is a 2 foot concrete Parshall Flume located approximately 50 feet upstream of the Display Pond. A staff gauge is located on the side of the Parshall Flume and a rating table is provided in Appendix E.

$$Q = 4W(Ha^{1.522})(W^{0.026})$$

3. **Sample type:** Composite
4. **Sampling frequency:** Monthly. Spring discharged is measured weekly.
5. **Number of samples:** One measurement at each location per spring that is used for fish production.
6. **Sample representation:** The measured quantities estimate the mean volume of water discharged (cubic feet per second) directly to Riley Creek.
7. **Sources of variability:** Incorrectly reading staff gauges, incorrectly converting staff gauge readings to cfs, and/or a non-functioning meter can result in inaccurate flow estimation, although this has been uncommon.

## ***B2. Sampling methods***

Flow readings are recorded in the blue water readings books and entered into the water spreadsheet. Steelhead (SST), Display Pond (DP), Rainbow Trout (RBT), and Hatchery 1 (H1) flows are entered into the Discharge Monitoring Report spreadsheet. This spreadsheet also calculates the proportion of each sample to mix a 5000 ml aliquot for water quality samples of raceway influent and effluents by the following:

Total Flow (TF) = SST + DP + RBT + H1

SST proportion = (SST/TF)\*5000 ml

DP proportion = (DP/TF)\*5000 ml

RBT proportion = (RBT/TF)\*5000 ml

H1 proportion = (H1/TF)\*5000 ml

## ***B3. Sample handling and chain of custody***

1. **Sample preservation and holding methods:** Not applicable.
2. **Sample Chain-of-Custody procedure:** Not applicable.
3. **Sample shipment procedure:** Not applicable.

**B4. Analytical methods**

1. **Data collecting procedure:** Staff gauges in springs or permanent inline water flow meters.
2. **Person/laboratory responsible for collecting data:** Hagerman National Fish Hatchery Staff.

**B5. Quality control**

Any unusual readings should be easily recognized during weekly water readings.

**B6. Instrument / Equipment: testing, inspection, and maintenance**

All maintenance will be carried out by the manufacturer, which is performed on an “as needed” basis.

**B7. Instrument / Equipment: calibration and frequency**

Calibration procedures are described in the flow meter manual.

**B8. Inspection / Acceptance of supplies and consumables**

Not applicable.

**B9. Non-direct measurements**

Not applicable.

**B10. Data management**

1. **Data storage methods:** Data is recorded on electronic forms provided by EPA and filed as paper copies on site with originals mailed to EPA monthly.
2. **Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
3. **Person/laboratory/office responsible for data analysis:** Assistant Project Leader, Hagerman NFH

## ***Parameter 2: Flow passing through off-line settling basin (OLSB)***

### ***B1. Sampling process design***

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Site 10. See facility map in Appendix A.
3. **Sample type:** Meter.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** One sample consisting of two readings (one reading at the beginning and one reading at the end of a 24 hour period).
6. **Sample representation:** Total flow passing through the OLSB during a 24 hour period during normal cleaning operations.
7. **Sources of variability:** Malfunctioning meter.

### ***B2. Sampling methods***

(Use the Rite in the Rain notebook). Flow is measured with a Sigma Model 950 Flow meter. Record the flow meter reading (cumulative gallons x 100), and the date and time. Record the cumulative volume again at the end of a 24 hour period in the previously mentioned Rite in the Rain notebook. Enter this data into the DMR computer spreadsheet. The spreadsheet determines daily flow (gallons per day) by subtracting the starting volume from the ending volume.

### ***B3. Sample handling and chain of custody***

1. **Sample preservation and holding methods:** Not applicable.
2. **Sample Chain-of-Custody procedure:** Not applicable.
3. **Sample shipment procedure:** Not applicable.

### ***B4. Analytical methods***

1. **Data collecting procedure:** Date, time, and flow are recorded at both ends of a 24 hour period and readings are entered into DMR computer spreadsheet.
2. **Person/laboratory responsible for collecting data:** Hagerman National Fish Hatchery Staff.

### ***B5. Quality control***

Any unusual readings should easily be recognized during sampling periods.

### ***B6. Instrument / Equipment: testing, inspection, and maintenance***

All maintenance will be carried out by the manufacturer. This is done on an as needed basis.

***B7. Instrument / Equipment: calibration and frequency***

Calibration procedures are described in the instrument manual and can be completed on site.

***B8. Inspection / Acceptance of supplies and consumables***

Not applicable.

***B9. Non-direct measurements***

Not applicable.

***B10. Data management***

- 1. Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly.
- 2. Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
- 3. Person/laboratory/office responsible for data analysis:** Pacific Equipment (Table 3); Assistant Project Leader, Hagerman NFH

### ***Parameter 3: Total suspended solids (TSS) discharging directly to receiving water***

#### ***B1. Sampling process design***

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Sites 1 – 8. See facility map in Appendix A.
3. **Sample type:** Composite.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** Must consist of four or more discrete samples taken at one-half hour intervals or greater over a 24-hour period.
6. **Sample representation:** Mean suspended solids (mg/L) generated by the Hatchery during normal cleaning practices.
7. **Sources of variability:** Sampling error.

#### ***B2. Sampling methods***

The following describes how to collect samples for determination of raceway influent TSS. These procedures are followed for collection of samples for determination of raceway effluent TSS, the only difference being the sampling locations. These procedures assume that all raceways are in use.

Flow is determined as outlined in Parameter 1 for each set of raceways (trout raceways and steelhead raceways) and the Display Pond. Flow proportions are calculated by methods specified in Parameter 1 B2.

Four grab samples are taken throughout the day at each location. Each sample is taken at least a half hour apart from each other. Each sample is gathered with a long handled sampling can and a bucket (there is a separate bucket for each sampling location). The can is first rinsed thoroughly (3x) with the water to be sampled. Then one full can of sample water is poured into the bucket, rinsed, and repeated two more times. Then one full can of sample water from the rinsed can is poured into the rinsed sample bucket. For additional grab samples, the sample can is rinsed thoroughly (3x), but not the sample bucket that already contains the previous grab samples. The samples are cooled to and maintained at 4 degrees Celsius throughout the day using a cooler with ice surrounding the sample bucket. Throughout the sampling day, samples from the Display Pond and from Hatchery Building 1 are kept in the old maintenance office refrigerator that is maintained at 4 degrees Celsius.

Each sample is segregated until the flow proportion of the final solution for delivery to the lab.

To flow proportion the composite samples: First determine the percentage of the total flow from each of the locations. Apply each percentage to a volume sufficient to cover all needed samples. For example, 5-liters of composited sample water should be enough to get 1-liter samples for TSS and TP. Say the steelhead raceways have 75% of the total

flow passing through them. 75% of 5 liters is 3.75-liters. First, rinse the bucket labeled *Raceway Influent Mixing Bucket*, three times with sample water. Then, place 3.75-liters of steelhead raceway influent water in the *Raceway Influent Mixing Bucket*. Determine the correct volumes for each of the other two locations and place representative samples from these locations into this mixing bucket. Swirl the mixing bucket gently, and then rinse a single 1-liter sample bottle with the sample three times. Finally, measure one liter of the sample into the rinsed 1-liter sample bottle.

Do not discard the remaining solution, as it will be used for testing of other water quality parameters.

### ***B3. Sample handling and chain of custody***

- 1. Sample preservation and holding methods:** Samples are kept in a refrigerated state until delivery to the Rangen Aquaculture Research Center. Samples are delivered to the lab at the end of the sampling day.
- 2. Sample Chain-of-Custody procedure:** One sample chain of custody form is attached to this Quality Assurance Plan. Sample bottles are clearly labeled with the following information:
  - Hagerman National Fish Hatchery
  - Date of sample collection
  - Location of sample collection (for example, raceway effluent)
  - Analysis to be done (for example, total suspended solids)
- 3. Sample shipment procedure:** Samples are placed in a cooler with ice and delivered to Rangen Aquaculture Research Center by Hatchery staff.

### ***B4. Analytical methods***

- 1. Data collecting procedure:** The RARC uses Methods for Chemical Analysis of Water and Waste, U.S. EPA, 1983, TSS Method 160.2. This has a Method Detection Limit, or MDL, of 1.0 ppm.
- 2. Person/laboratory responsible for collecting data:**
  - Rangen Aquaculture Research Center
  - 2928 South 1175 East
  - Hagerman, ID 83332
  - TEL: 208-837-6192
  - FAX: 208-837-4565

### ***B5. Quality control***

Certified laboratory. Duplicate samples will occasionally be delivered to the lab for quality assurance purposes.

### ***B6. Instrument / Equipment: testing, inspection, and maintenance***

Not applicable.

***B7. Instrument / Equipment: calibration and frequency***

Not applicable.

***B8. Inspection / Acceptance of supplies and consumables***

Not applicable.

***B9. Non-direct measurements***

Not applicable.

***B10. Data management***

- 1. Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly. Copies of all results from Rangen Aquaculture Research Center are also mailed to EPA and copies kept on site.
- 2. Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
- 3. Person/laboratory/office responsible for data analysis:** Rangen Aquaculture Research Center; Assistant Project Leader, Hagerman NFH

## ***Parameter 4: Total suspended solids passing through OLSB***

### ***B1. Sampling process design***

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Site 9 and 10. See facility map in Appendix A.
3. **Sample type:** Composite.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** Must consist of four or more discrete samples taken at one-half hour intervals or greater over a 24-hour period.
6. **Sample representation:** Total suspended solids passing through OLSB.
7. **Sources of variability:** ISCO malfunction.

### ***B2. Sampling methods***

***Influent sampling:*** OLSB influent is sampled with a plastic hand pump, as this water can only be accessed through a pipe of relatively small diameter. This sampling occurs during rearing unit cleaning.

Place the pump intake hose in the access pipe. Rinse pump and sample bucket with sample water. Next, pump twenty-two compressions into a sample bucket.

Maintain the sample water at 4<sup>0</sup> C throughout the day using a cooler with ice surrounding the sample.

After the fourth sample has been added to the container, swirl gently and fill a labeled 1-liter sample bottle. Do not discard remaining solution, as it will be used for testing of other parameters.

***Effluent sampling:*** OLSB effluent is sampled using an ISCO Model 1580 waste water sampling device. Samples are taken every 15 minutes. This device should be on for the duration of other grab samples. Specific operation and maintenance instructions can be found in the factory-supplied instruction manual, on file in the EPA file drawer in the hatchery lab / office.

Place the ISCO near the flow meter station at the downstream end of the OLSB and rinse sample hose three times. Allow it to sample throughout the day in the tailrace of the OLSB. At the end of the sampling period, bring the ISCO to the office. Swirl the water in the ISCO carboy and rinse a 1-liter sample bottle three times with the sample water. Then fill the 1-liter sample bottle with 1 liter of the sample. Do not discard remaining solution, as it will be used for testing of other parameters.

### ***B3. Sample handling and chain of custody***

- 1. Sample preservation and holding methods:** Samples are kept in a refrigerated state until delivery to the RARC. Chilling is accomplished with the placement of ice around the ISCO carboy at the start of the day. Influent sample water is kept in a water cooler on ice. Samples are delivered to the RARC at the end of the sampling day.
- 2. Sample Chain-of-Custody procedure:** One sample chain of custody form is attached to this Quality Assurance Plan. Sample bottles are clearly labeled with the following information:
  - Hagerman National Fish Hatchery
  - Date of sample collection
  - Location of sample collection (for example, raceway effluent)
  - Analysis to be done (for example, total suspended solids)
- 3. Sample shipment procedure:** Samples are placed in a cooler with ice and delivered to Rangen Aquaculture Research Center by Hatchery staff.

### ***B4. Analytical methods***

- 1. Data collecting procedure:** The RARC uses Methods for Chemical Analysis of Water and Waste, U.S. EPA, 1983, TSS Method 160.2. This has an MDL of 2.0 ppm. Blank or spiked samples will be sent to the laboratory at random times.
- 2. Person/laboratory responsible for collecting data:**
  - Rangen Aquaculture Research Center
  - 2928 South 1175 East
  - Hagerman, ID 83332
  - TEL: 208-837-6192
  - FAX: 208-837-4565

### ***B5. Quality control***

Certified laboratory. Duplicate samples will occasionally be delivered to the lab for quality assurance purposes.

### ***B6. Instrument / Equipment: testing, inspection, and maintenance***

Routine maintenance is described in the ISCO instruction manual. The ISCO water sampler will be sent back to the manufacturer for repairs.

### ***B7. Instrument / Equipment: calibration and frequency***

Not applicable.

### ***B8. Inspection / Acceptance of supplies and consumables***

Not applicable.

### ***B9. Non-direct measurements***

Not applicable.

**B10. Data management**

- 1. Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly. Copies of all results from Rangen Aquaculture Research Center are also mailed to EPA and copies kept on site.
- 2. Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
- 3. Person/laboratory/office responsible for data analysis:** Rangen Aquaculture Research Center; Assistant Project Leader, Hagerman NFH

## **Parameter 5: Total phosphorus discharging directly into receiving water**

### **B1. Sampling process design**

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Site 1 - 8. See facility map in Appendix A.
3. **Sample type:** Composite.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** Must consist of four or more discrete samples taken at one-half hour intervals or greater over a 24-hour period.
6. **Sample representation:** Total phosphorus discharged directly into receiving water.
7. **Sources of variability:** Sampling error.

### **B2. Sampling methods**

The total phosphorus discharge into receiving water is sampled from the remaining sample water that was collected for determination of total suspended solids discharging directly to receiving water. See instructions in Parameter 3 for direction on sample collection and flow proportioning. A single 1-liter sample will be hand delivered to the RARC for determination of all of the above parameters.

### **B3. Sample handling and chain of custody**

1. **Sample preservation and holding methods:** Samples are kept in a refrigerated state until delivery to the RARC. Samples are not held on site. Samples are delivered to the RARC at the end of the sampling day. Samples are kept on ice throughout the sampling day. Sulfuric acid preservative is not used and is noted on the bottle labels (for total phosphorus samples, and for total ammonia, nitrate - nitrite, and total Kjeldahl nitrogen samples) and on the Chain of Custody form.
2. **Sample Chain-of-Custody procedure:** One sample chain of custody form is attached to this Quality Assurance Plan. Sample bottles are clearly labeled with the following information:
  - Hagerman National Fish Hatchery
  - Date of sample collection
  - Location of sample collection (for example, raceway effluent)
  - Analysis to be done (for example, total suspended solids)
3. **Sample shipment procedure:** Samples are placed in a cooler with ice and delivered to Rangen Aquaculture Research Center by Hatchery staff.

### **B4. Analytical methods**

1. **Data collecting procedure:** The RARC uses Methods for Chemical Analysis of Water and Waste, U.S. EPA, 1983, Total Phosphorus Method 365.2. This has a MDL of 0.005 ppm. Blank or spiked samples will be sent to the laboratory at random times.

**2. Person/laboratory responsible for collecting data:**

Rangen Aquaculture Research Center  
2928 South 1175 East  
Hagerman, ID 83332  
TEL: 208-837-6192  
FAX: 208-837-4565

***B5. Quality control***

Certified laboratory. Duplicate samples will occasionally be delivered to the lab for quality assurance purposes.

***B6. Instrument / Equipment: testing, inspection, and maintenance***

Not applicable.

***B7. Instrument / Equipment: calibration and frequency***

Not applicable.

***B8. Inspection / Acceptance of supplies and consumables***

Not applicable.

***B9. Non-direct measurements***

Not applicable.

***B10. Data management***

- 1. Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly. Copies of all results from Rangen Aquaculture Research Center are also mailed to EPA and copies kept on site.
- 2. Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
- 3. Person/laboratory/office responsible for data analysis:** Rangen Aquaculture Research Center; Assistant Project Leader, Hagerman NFH

## **Parameter 6: Total phosphorus passing through OLSB**

### **B1. Sampling process design**

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Site 9 - 10. See facility map in Appendix A.
3. **Sample type:** Composite.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** Must consist of four or more discrete samples taken at one-half hour intervals or greater over a 24-hour period.
6. **Sample representation:** Total phosphorus passing through OLSB.
7. **Sources of variability:** Sampling error.

### **B2. Sampling methods**

The total phosphorus discharge passing through the OLSB is sampled from the remaining sample water that was collected for determination of total suspended solids passing through the OLSB. See Parameter 4 instructions for direction on sample collection.

### **B3. Sample handling and chain of custody**

1. **Sample preservation and holding methods:** Samples are kept in a refrigerated state until delivery to the RARC. Samples are not held on site. Samples are delivered to the RARC at the end of the sampling day. Samples are kept on ice throughout the sampling day. Sulfuric acid preservative is not used and is noted on the bottle labels (for total phosphorus samples, and for total ammonia, nitrate - nitrite, and total Kjeldahl nitrogen samples) and on the Chain of Custody form.
2. **Sample Chain-of-Custody procedure:** One sample chain of custody form is attached to this Quality Assurance Plan. Sample bottles are clearly labeled with the following information:
  - Hagerman National Fish Hatchery
  - Date of sample collection
  - Location of sample collection (for example, raceway effluent)
  - Analysis to be done (for example, total suspended solids)
3. **Sample shipment procedure:** Samples are placed in a cooler with ice and delivered to Rangen Aquaculture Research Center by Hatchery staff.

### **B4. Analytical methods**

1. **Data collecting procedure:** The RARC uses Methods for Chemical Analysis of Water and Waste, U.S. EPA, 1983, Total Phosphorus Method 365.2. This has a MDL of 0.005 ppm. Blank or spiked samples will be sent to the laboratory at random times.
2. **Person/laboratory responsible for collecting data:**
  - Rangen Aquaculture Research Center

QA Plan, NPDES General Permit No. IDG-13-0004,  
Hagerman National Fish Hatchery, January 1, 2010  
Edited December 14, 2010

2928 South 1175 East  
Hagerman, ID 83332  
TEL: 208-837-6192  
FAX: 208-837-4565

**B5. Quality control**

Certified laboratory. Duplicate samples will occasionally be delivered to the lab for quality assurance purposes.

**B6. Instrument / Equipment: testing, inspection, and maintenance**

Not applicable.

**B7. Instrument / Equipment: calibration and frequency**

Not applicable.

**B8. Inspection / Acceptance of supplies and consumables**

Not applicable.

**B9. Non-direct measurements**

Not applicable.

**B10. Data management**

- 1. Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly. Copies of all results from Rangen Aquaculture Research Center are also mailed to EPA and copies kept on site.
- 2. Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
- 3. Person/laboratory/office responsible for data analysis:** Rangen Aquaculture Research Center; Assistant Project Leader, Hagerman NFH

## ***Parameter 7: Total ammonia as N passing through OLSB***

### ***B1. Sampling process design***

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Site 10. See facility map in Appendix A.
3. **Sample type:** Composite.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** Four or more grab samples taken at one-half hour intervals or greater over a 24-hour period.
6. **Sample representation:** Total ammonia as N passing through OLSB.
7. **Sources of variability:** Sampling error.

### ***B2. Sampling methods***

Four grab samples are taken throughout the day in the OLSB effluent channel. Samples are taken at least a half hour apart from each other. Each sample is gathered with a long handled sampling can and a bucket (there is a separate bucket for each sampling location). The can is first rinsed thoroughly (3x) with the water to be sampled. Then one full can of sample water is poured into the bucket, rinsed, and repeated two more times. Then one full can of sample water from the rinsed can is poured into the rinsed sample bucket. For additional grab samples, the sample can is rinsed thoroughly (3x), but not the sample bucket that already contains the previous grab samples. The samples are cooled to and maintained at 4 degrees Celsius throughout the day using a cooler with ice surrounding the sample bucket.

### ***B3. Sample handling and chain of custody***

1. **Sample preservation and holding methods:** Samples are kept in a refrigerated state until delivery to the RARC. Samples are not held on site. Samples are delivered to the RARC at the end of the sampling day. Samples are kept on ice throughout the sampling day. Sulfuric acid preservative is not used and is noted on the bottle labels (for total phosphorus samples, and for total ammonia, nitrate - nitrite, and total Kjeldahl nitrogen samples) and on the Chain of Custody form.
2. **Sample Chain-of-Custody procedure:** One sample chain of custody form is attached to this Quality Assurance Plan. Sample bottles are clearly labeled with the following information:
  - Hagerman National Fish Hatchery
  - Date of sample collection
  - Location of sample collection (for example, raceway effluent)
  - Analysis to be done (for example, total suspended solids)
3. **Sample shipment procedure:** Samples are placed in a cooler with ice and delivered to Rangen Aquaculture Research Center by Hatchery staff.

#### ***B4. Analytical methods***

- 1. Data collecting procedure:** The RARC uses Methods for Chemical Analysis of Water and Waste, U.S. EPA, 1983, Total Ammonia Method 350.3. This has a MDL of 0.01 ppm. Blank or spiked samples will be sent to the laboratory at random times.
- 2. Person/laboratory responsible for collecting data:**  
Rangen Aquaculture Research Center  
2928 South 1175 East  
Hagerman, ID 83332  
TEL: 208-837-6192  
FAX: 208-837-4565

#### ***B5. Quality control***

Certified laboratory. Duplicate samples will occasionally be delivered to the lab for quality assurance purposes.

#### ***B6. Instrument / Equipment: testing, inspection, and maintenance***

Not applicable.

#### ***B7. Instrument / Equipment: calibration and frequency***

Not applicable.

#### ***B8. Inspection / Acceptance of supplies and consumables***

Not applicable.

#### ***B9. Non-direct measurements***

Not applicable.

#### ***B10. Data management***

- 1. Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly. Copies of all results from Rangen Aquaculture Research Center are also mailed to EPA and copies kept on site.
- 2. Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
- 3. Person/laboratory/office responsible for data analysis:** Rangen Aquaculture Research Center; Assistant Project Leader, Hagerman NFH

## ***Parameter 8: Temperature and pH passing through OLSB***

### ***B1. Sampling process design***

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Site 10. See facility map in Appendix A.
3. **Sample type:** Meter.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** Four or more grab samples taken at one-half hour intervals or greater over a 24-hour period in conjunction with the grab samples taken for the composite ammonia samples.
6. **Sample representation:** Temperature and pH passing through OLSB.
7. **Sources of variability:** Meter error.

### ***B2. Sampling methods***

This will be a grab sample using the Hanna Instruments Model 98127 handheld pH and temperature meter. The sample will be taken in conjunction with the total ammonia as N passing through OLSB sample before the sample is added to the composite bucket.

### ***B3. Sample handling and chain of custody***

1. **Sample preservation and holding methods:** Not applicable.
2. **Sample Chain-of-Custody procedure:** Not applicable.
3. **Sample shipment procedure:** Not applicable.

### ***B4. Analytical methods***

1. **Data collecting procedure:** The operations manual for the Hanna Instruments Model 98127 handheld pH and temperature meter reports that this meter should be accurate to within +/- 0.5°C and +/- 0.1pH.
2. **Person/laboratory responsible for collecting data:** Hagerman National Fish Hatchery Staff.

### ***B5. Quality control***

The meter will test blanks sent by EPA approved lab.

### ***B6. Instrument / Equipment: testing, inspection, and maintenance***

Storage and cleaning solution will be kept with the meter. If the electrode is changed it will be recorded by date and logged which is kept with the meter.

### ***B7. Instrument / Equipment: calibration and frequency***

Meter will be calibrated before use.

**B8. Inspection / Acceptance of supplies and consumables**

Not applicable.

**B9. Non-direct measurements**

Not applicable.

**B10. Data management**

1. **Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly.
2. **Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
3. **Person/laboratory/office responsible for data analysis:** Assistant Project Leader, Hagerman NFH

## **Parameter 9: Total ammonia as N receiving water upstream from outfall**

### **B1. Sampling process design**

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Site 11. See facility map in Appendix A.
3. **Sample type:** Grab.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** One during the same time that effluent composite samples are being taken.
6. **Sample representation:** Total ammonia as N receiving water upstream from outfall.
7. **Sources of variability:** Sampling error.

### **B2. Sampling methods**

A sample will be collected with 1-liter sampling bottle.

### **B3. Sample handling and chain of custody**

1. **Sample preservation and holding methods:** Samples are kept in a refrigerated state until delivery to the RARC. Samples are not held on site. Samples are delivered to the RARC at the end of the sampling day. Samples are kept on ice throughout the sampling day. Sulfuric acid preservative is not used and is noted on the bottle labels (for total phosphorus samples, and for total ammonia, nitrate - nitrite, and total Kjeldahl nitrogen samples) and on the Chain of Custody form.
2. **Sample Chain-of-Custody procedure:** One sample chain of custody form is attached to this Quality Assurance Plan. Sample bottles are clearly labeled with the following information:
  - Hagerman National Fish Hatchery
  - Date of sample collection
  - Location of sample collection (for example, raceway effluent)
  - Analysis to be done (for example, total suspended solids)
3. **Sample shipment procedure:** Samples are placed in a cooler with ice and delivered to Rangen Aquaculture Research Center by Hatchery staff.

### **B4. Analytical methods**

1. **Data collecting procedure:** The RARC uses Methods for Chemical Analysis of Water and Waste, U.S. EPA, 1983, Total Ammonia Method 350.3. This has a MDL of 0.01 ppm. Blank or spiked samples will be sent to the laboratory at random times.
2. **Person/laboratory responsible for collecting data:**
  - Rangen Aquaculture Research Center

2928 South 1175 East  
Hagerman, ID 83332  
TEL: 208-837-6192  
FAX: 208-837-4565

***B5. Quality control***

Certified laboratory. Duplicate samples will occasionally be delivered to the lab for quality assurance purposes.

***B6. Instrument / Equipment: testing, inspection, and maintenance***

Not applicable.

***B7. Instrument / Equipment: calibration and frequency***

Not applicable.

***B8. Inspection / Acceptance of supplies and consumables***

Not applicable.

***B9. Non-direct measurements***

Not applicable.

***B10. Data management***

- 1. Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly. Copies of all results from Rangen Aquaculture Research Center are also mailed to EPA and copies kept on site.
- 2. Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
- 3. Person/laboratory/office responsible for data analysis:** Rangen Aquaculture Research Center; Assistant Project Leader, Hagerman NFH

## ***Parameter 10: Temperature and pH receiving water upstream from outfall***

### ***B1. Sampling process design***

1. **Receiving water:** Riley Creek.
2. **Sample locations:** Site 11. See facility map in Appendix A.
3. **Sample type:** Meter.
4. **Sampling frequency:** Quarterly.
5. **Number of samples:** One during the same time that effluent composite samples are being taken.
6. **Sample representation:** Temperature and pH of receiving water upstream from outfall.
7. **Sources of variability:** Meter error.

### ***B2. Sampling methods***

Grab sample using the Hanna Instruments Model 98127 handheld pH and temperature meter. The sample is taken in conjunction with the total ammonia as N from receiving water upstream from outfall.

### ***B3. Sample handling and chain of custody***

1. **Sample preservation and holding methods:** Not applicable.
2. **Sample Chain-of-Custody procedure:** Not applicable.
3. **Sample shipment procedure:** Not applicable.

### ***B4. Analytical methods***

1. **Data collecting procedure:** The operations manual for the Hanna Instruments Model 98127 handheld pH and temperature meter reports that this meter should be accurate to within +/- 0.5°C and +/- 0.1pH.
2. **Person/laboratory responsible for collecting data:** Hagerman National Fish Hatchery Staff.

### ***B5. Quality control***

The meter will test blanks sent by EPA approved lab.

### ***B6. Instrument / Equipment: testing, inspection, and maintenance***

Storage and cleaning solution will be kept with the meter. If the electrode is changed it will be recorded by date and logged which is kept with the meter.

### ***B7. Instrument / Equipment: calibration and frequency***

Meter will be calibrated before use.

**B8. Inspection / Acceptance of supplies and consumables**

Not applicable.

**B9. Non-direct measurements**

Not applicable.

**B10. Data management**

1. **Data storage methods:** Data is recorded in Rite in the Rain notebook and transcribed into the DMR spreadsheet on the biologist's computer. Paper copies are kept on site with copies mailed to EPA and IDEQ monthly.
2. **Person/laboratory/office responsible for data storage:** Fish Biologist, Hagerman NFH
3. **Person/laboratory/office responsible for data analysis:** Assistant Project Leader, Hagerman NFH

## C. Assessment and Oversight

### **C1. Assessments and response actions**

1. **Frequency and type of assessments of water quality data:** Data will be reviewed monthly to assess compliance and any potential corrective actions that may need to be implemented at the facility.
2. **Individuals responsible for assessments:** Hatchery Project Leader and/or Assistant Project Leader (Table 2).

**Procedures to be followed if NPDES permit maxima are exceeded:** The Hatchery Project Leader and/or Assistant Project Leader will report the following occurrences of noncompliance by telephone to the EPA (206-553-1846) as soon as possible, but no later than 24 hours from the time hatchery personnel become aware of the circumstance (for noncompliance that endangers listed Snake River snail species, a permittee also must report within 24 hours to the U.S. Fish and Wildlife Service at 208-378-5243):

- a. Any unanticipated bypass that exceeds an effluent limitation in the Permit;
- b. Any upset that exceeds an effluent limitation in the permit;

Unless EPA waives the requirement over the phone, a written report must also be submitted within 5 days after the permittee becomes aware of the circumstances. The written submission must contain:

- a. Description of the noncompliance and its cause;
- b. The period of noncompliance, including exact dates and times;
- c. If the noncompliance has not been corrected, the anticipated time it is expected to continue; and
- d. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

The Hatchery biologist will report all instances of noncompliance, not required to be reported within 24 hours, at the time that monitoring reports are sent in.

### **C2. Reports to management**

[Note: An annual report of the previous year's operations must be prepared and submitted to EPA by January 20<sup>th</sup> of each year (see page 40 of General Permit).]

1. **Required reports:** See Sections IV and V of the General Permit, pages 38-43.
2. **Individuals responsible for preparation and submission of oral and written reports as required under Sections IV and V of the General Permit:** See section A4, Table 2 of this document. Current personnel responsible for reporting include the Project Leader, Assistant Project Leader, and Fish Biologist.
3. **Individuals to whom oral and written reports, as required in Sections IV and V of the General Permit are to be submitted:** Sharon Wilson, EPA, Seattle, WA.

## **D. Data Validation and Usability**

### ***D1. Data review, verification, and validation***

Data will be reviewed and verified on a monthly basis by the Project Leader and/or Assistant Project Leader.

### ***D2. Verification and validation of methods***

Since the facility operations are similar on an annual basis, data will be compared with historical data from previous years (during the same time period) of sampling to evaluate consistency in the data and consistency in sampling methods.

### ***D3. Reconciliation with user requirements***

The Hatchery will collect additional samples at the appropriate outfall whenever discharge occurs that may reasonably be expected to cause or contribute to a violation that is unlikely to be detected by a routine sample.

Certification of Completion and Implementation  
of the Quality Assurance Plan

Hagerman National Fish Hatchery  
NPDES Permit Number IDG-13-0004

I have read and been trained in the proper execution of this Quality Assurance Plan.

\_\_\_\_\_  
Bryan Kenworthy                      Date  
Project Leader

\_\_\_\_\_  
Nate Wiese                              Date  
Assistant Project Leader

\_\_\_\_\_  
Jeremy Trimpey                      Date  
Fish Biologist

\_\_\_\_\_  
Brian Clifford                      Date  
Motor Vehicle Operator

\_\_\_\_\_  
Eric Willet                              Date  
Motor Vehicle Operator

\_\_\_\_\_  
Adam Leija                              Date  
Animal Caretaker

\_\_\_\_\_  
Andy Eiman                              Date  
Temporary Animal Caretaker

\_\_\_\_\_  
Anna Ray                                  Date  
Fisheries Program Assistant

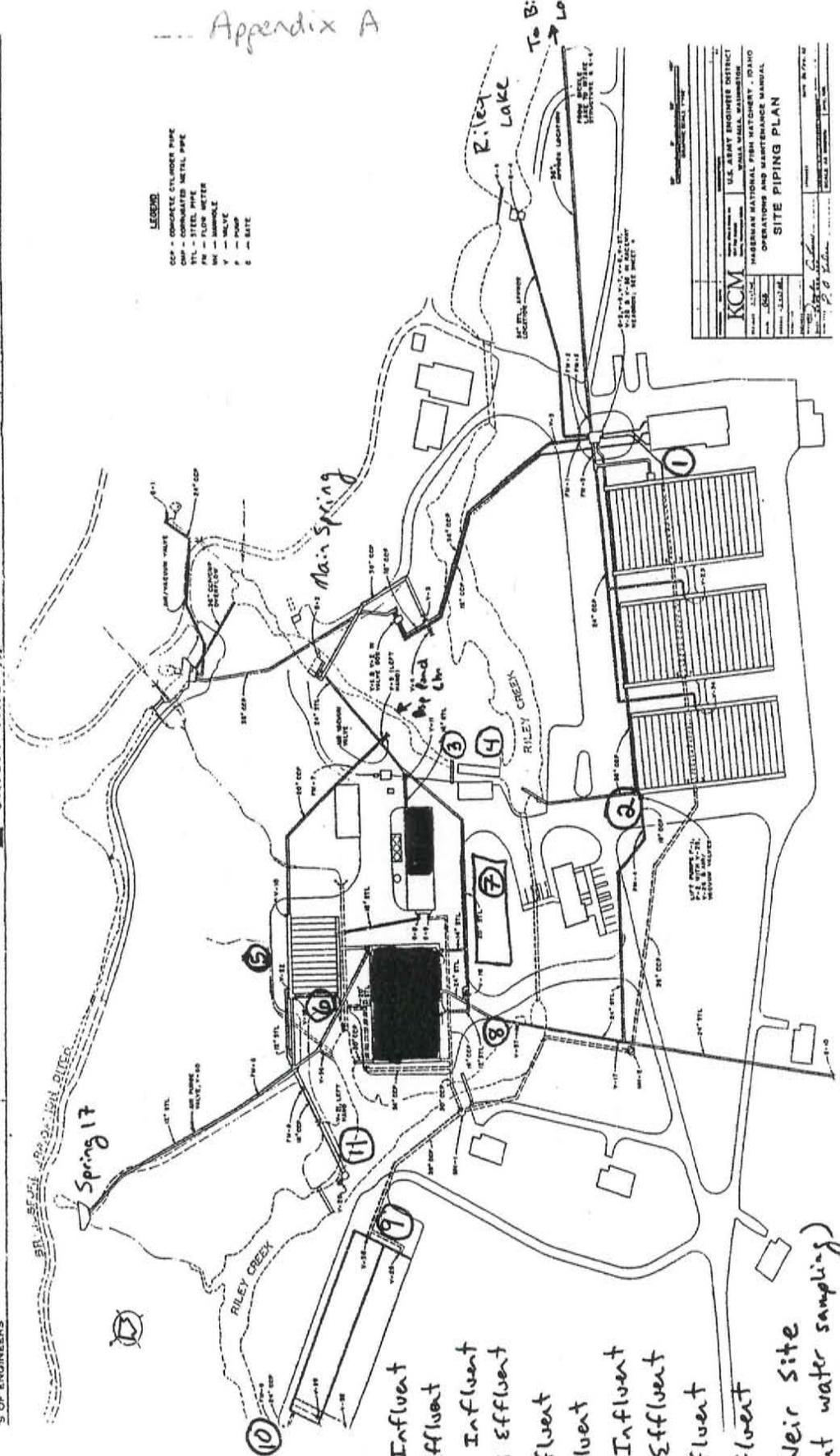
\_\_\_\_\_  
Steve Money                              Date  
Maintenance Mechanic

## Appendix

- A. Site Plan Map
- B. Chain of Custody Form
- C. Rating Table for 4 ft Parshall flume at Main Spring
- D. Rating Table for 15 ft Cipoletti Weir at Bickle Lake and State Wildlife Management Area (Bickle Ditch)
- E. Rating Table for 7 ft Cipoletti Weir at Riley Lake
- F. Rating Table for 9" Parshall flume at Hatchery 1
- G. Rating table for 2 ft Parshall flume at Display Pond
- H. Rangen Research Method Detection Limits and Quality Assurance Plan
- I. Training Certificates and Additional Attachments

Appendix A

- LEGEND**
- CCP - CONCRETE CULVERT PIPE
  - OMP - CORRUGATED METAL PIPE
  - STL - STEEL PIPE
  - FP - FLOW METER
  - W - WEIR
  - W - WEIR
  - W - WEIR
  - W - WEIR
  - W - WEIR



KCM		U.S. ARMY ENGINEERS DISTRICT	
KCM		WALLA WALLA, WASHINGTON	
KCM		HAGERMAN NATIONAL FISH HATCHERY - IDAHO	
KCM		OPERATIONS AND MAINTENANCE MANUAL	
KCM		SITE PIPING PLAN	
KCM		DATE: 11/1/68	
KCM		DRAWN BY: [Signature]	
KCM		CHECKED BY: [Signature]	
KCM		SCALE: AS SHOWN	

- ① Steelhead Influent
- ② Steelhead Effluent
- ③ Display Pond Influent
- ④ Display Pond Effluent
- ⑤ Trout Influent
- ⑥ Trout Effluent
- ⑦ Hatch 1 Influent
- ⑧ Hatch 1 Effluent
- ⑨ OLSB Influent
- ⑩ OLSB Effluent
- ⑪ Electric Weir Site  
(Ambient water sampling)

RANGEN AQUACULTURE RESEARCH CENTER  
CHAIN OF CUSTODY

Description of Sample: \_\_\_\_\_

Name of Person Taking Sample: \_\_\_\_\_

Initial Storage Location: \_\_\_\_\_

Date Sample Taken: \_\_\_\_\_

\_\_\_\_\_

SAMPLE INITIALLY IN CUSTODY OF:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Time

TRANSFERRED TO:

Name: \_\_\_\_\_  
Signature

Location: \_\_\_\_\_

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Name: \_\_\_\_\_  
Signature

Location: \_\_\_\_\_

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Name: \_\_\_\_\_  
Signature

Location: \_\_\_\_\_

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Name: \_\_\_\_\_  
Signature

Location: \_\_\_\_\_

Date: \_\_\_\_\_

Time: \_\_\_\_\_

**Lab Personnel:** Please add  $H_2SO_4$  to lower the pH of the total phosphorus samples to less than pH 2 upon receipt of the samples.

## HAGERMAN NATIONAL FISH HATCHERY

## RATING TABLE FOR 4 FT PARSHALL FLUME

MAIN SPRING - WEIR LOCATION # 3

FORMULA USED -  $Q = 4w(Ha^{(1.522)})^{(w^{(0.026)})}$ 

GAGE HEIGHT IN FEET	DISCHARGE CFS	DISCHARGE GPM	GAGE HEIGHT IN FEET	DISCHARGE CFS	DISCHARGE GPM
1.21	21.61	9701	1.71	37.30	16742
1.22	21.90	9827	1.72	37.65	16897
1.23	22.18	9955	1.73	37.99	17052
1.24	22.47	10083	1.74	38.34	17208
1.25	22.75	10211	1.75	38.69	17364
1.26	23.04	10341	1.76	39.04	17521
1.27	23.33	10470	1.77	39.39	17678
1.28	23.62	10601	1.78	39.74	17836
1.29	23.91	10732	1.79	40.09	17994
1.30	24.21	10863	1.80	40.45	18153
1.31	24.50	10995	1.81	40.80	18313
1.32	24.80	11128	1.82	41.16	18473
1.33	25.09	11261	1.83	41.52	18633
1.34	25.39	11395	1.84	41.88	18794
1.35	25.69	11530	1.85	42.24	18955
1.36	25.99	11665	1.86	42.60	19117
1.37	26.29	11800	1.87	42.96	19280
1.38	26.60	11937	1.88	43.32	19443
1.39	26.90	12073	1.89	43.69	19606
1.40	27.21	12211	1.90	44.05	19770
1.41	27.51	12349	1.91	44.42	19934
1.42	27.82	12487	1.92	44.78	20099
1.43	28.13	12626	1.93	45.15	20265
1.44	28.44	12766	1.94	45.52	20431
1.45	28.76	12906	1.95	45.89	20597
1.46	29.07	13047	1.96	46.27	20764
1.47	29.38	13188	1.97	46.64	20931
1.48	29.70	13330	1.98	47.01	21099
1.49	30.02	13472	1.99	47.39	21268
1.50	30.34	13615	2.00	47.76	21437
1.51	30.66	13759	2.01	48.14	21606
1.52	30.98	13903	2.02	48.52	21776
1.53	31.30	14047	2.03	48.90	21946
1.54	31.62	14192	2.04	49.28	22117
1.55	31.95	14338	2.05	49.66	22288
1.56	32.27	14484	2.06	50.04	22460
1.57	32.60	14631	2.07	50.43	22632
1.58	32.93	14778	2.08	50.81	22805
1.59	33.26	14926	2.09	51.20	22978
1.60	33.59	15075	2.10	51.59	23152
1.61	33.92	15224	2.11	51.97	23326
1.62	34.25	15373	2.12	52.36	23501
1.63	34.59	15523	2.13	52.75	23676
1.64	34.92	15674	2.14	53.15	23852
1.65	35.26	15825	2.15	53.54	24028
1.66	35.60	15976	2.16	53.93	24204
1.67	35.94	16128	2.17	54.33	24381
1.68	36.28	16281	2.18	54.72	24559
1.69	36.62	16434	2.19	55.12	24737
1.70	36.96	16588	2.20	55.52	24915

B: FLOWS#11  
B: FLOWS#12

9/16/91

## HAGERMAN NATIONAL FISH HATCHERY

## RATING TABLE FOR 15 FT CIPOLETTI WEIR

BICKLE LAKE - WEIR LOCATION # 11  
STATE WILDLIFE MANAGEMENT AREA - WEIR LOCATION # 12FORMULA USED -  $Q = 3.367LH^{(3/2)}$ 

GAGE HEIGHT IN FEET	DISCHARGE CFS	DISCHARGE GPM	GAGE HEIGHT IN FEET	DISCHARGE CFS	DISCHARGE GPM
0.10	1.60	717	0.38	11.83	5310
0.11	1.84	827	0.39	12.30	5521
0.12	2.10	942	0.40	12.78	5734
0.13	2.37	1062	0.41	13.26	5951
0.14	2.65	1187	0.42	13.75	6170
0.15	2.93	1317	0.43	14.24	6391
0.16	3.23	1451	0.44	14.74	6616
0.17	3.54	1589	0.45	15.25	6842
0.18	3.86	1731	0.46	15.76	7072
0.19	4.18	1877	0.47	16.27	7304
0.20	4.52	2027	0.48	16.80	7538
0.21	4.86	2181	0.49	17.32	7775
0.22	5.21	2339	0.50	17.86	8014
0.23	5.57	2500	0.51	18.39	8255
0.24	5.94	2665	0.52	18.94	8499
0.25	6.31	2833	0.53	19.49	8746
0.26	6.70	3005	0.54	20.04	8995
0.27	7.09	3180	0.55	20.60	9246
0.28	7.48	3358	0.56	21.16	9499
0.29	7.89	3540	0.57	21.73	9754
0.30	8.30	3725	0.58	22.31	10012
0.31	8.72	3912	0.59	22.89	10272
0.32	9.14	4103	0.60	23.47	10535
0.33	9.57	4297	0.61	24.06	10799
0.34	10.01	4494	0.62	24.66	11066
0.35	10.46	4693	0.63	25.25	11334
0.36	10.91	4896	0.64	25.86	11605
0.37	11.37	5101	0.65	26.47	11878

B: FLOWS#8

9/18/91

## HAGERMAN NATIONAL FISH HATCHERY

## RATING TABLE FOR 7 FT CIPOLETTI WEIR

RILEY LAKE - WEIR LOCATION # 8

FORMULA USED -  $Q = 3.367LH^{(3/2)}$  ,

GAGE HEIGHT IN FEET	DISCHARGE CFS	DISCHARGE GPM
0.20	2.11	946
0.21	2.27	1018
0.22	2.43	1092
0.23	2.60	1167
0.24	2.77	1244
0.25	2.95	1322
0.26	3.12	1402
0.27	3.31	1484
0.28	3.49	1567
0.29	3.68	1652
0.30	3.87	1738
0.31	4.07	1826
0.32	4.27	1915
0.33	4.47	2005
0.34	4.67	2097
0.35	4.88	2190
0.36	5.09	2285
0.37	5.30	2381
0.38	5.52	2478
0.39	5.74	2576
0.40	5.96	2676
0.41	6.19	2777
0.42	6.42	2879
0.43	6.65	2983
0.44	6.88	3087
0.45	7.11	3193
0.46	7.35	3300
0.47	7.59	3408
0.48	7.84	3518
0.49	8.08	3628
0.50	8.33	3740
0.51	8.58	3853
0.52	8.84	3966
0.53	9.09	4081
0.54	9.35	4197
0.55	9.61	4315

# Hatchery 1 outfall

## PARSHALL FLUME GENERAL FLOW RANGE

Following is a list of general flow ranges and equations for the most common sizes of Parshall flumes. The actual capability of the flume may reach somewhat higher or lower than listed below.

To: Hasserman Nat'l  
Fish Hatchery

Attn: Wayne

FAX: 208-837-6228

COMPOSITES ONE  
www.compositesone.com

Conversions:

MGD x 694.4 = GPM

MGD x 1.55 = CFS

GPM ÷ 694.4 = MGD

CFS x 0.646 = MGD

Parshall	Flow Range - GPM	Equation: Q = CFS (H = Head in Feet)
1" *	2 - 90	$Q = .338 H^{1.55}$
2" *	5 - 175	$Q = .676 H^{1.55}$
3"	15 - 830	$Q = .992 H^{1.547}$
6"	25 - 1,750	$Q = 2.06 H^{1.56}$
9"	45 - 3,900	$Q = 3.07 H^{1.53}$
12"	160 - 7,200	$Q = 4. H^{1.522}$
18"	230 - 11,000	$Q = 6. H^{1.538}$
24"	295 - 14,800	$Q = 8. H^{1.55}$
30"	365 - 18,700	$Q = 10. H^{1.559}$
36"	435 - 22,600	$Q = 12. H^{1.566}$

\*1" & 2" Parshall may clog and are not recommended for sanitary waste.

## 9 inch Parshall Flume Free Flow Discharge

Head (feet)	MGD	CFS	GPM
0.06			
0.07			
0.08			
0.09			
0.10	0.05845	0.09060	40.662
0.11	0.06763	0.10483	47.046
0.12	0.07726	0.11975	53.745
0.13	0.08733	0.13535	60.747
0.14	0.09781	0.15161	68.040
0.15	0.10870	0.16848	75.616
0.16	0.11998	0.18597	83.463
0.17	0.13164	0.20404	91.575
0.18	0.14367	0.22269	99.944
0.19	0.15606	0.24190	108.56
0.20	0.16880	0.26165	117.43
0.21	0.18189	0.28193	126.53
0.22	0.19531	0.30272	135.86
0.23	0.20905	0.32403	145.42
0.24	0.22312	0.34583	155.21
0.25	0.23750	0.36812	165.21
0.26	0.25218	0.39088	175.43
0.27	0.26717	0.41412	185.86
0.28	0.28246	0.43781	196.49
0.29	0.29804	0.46196	207.33
0.30	0.31391	0.48656	218.37
0.31	0.33006	0.51159	229.60
0.32	0.34649	0.53705	241.03
0.33	0.36319	0.56294	252.65
0.34	0.38016	0.58925	264.46
0.35	0.39740	0.61597	276.45
0.36	0.41491	0.64310	288.63
0.37	0.43267	0.67064	300.98
0.38	0.45069	0.69857	313.52
0.39	0.46896	0.72689	326.23
0.40	0.48748	0.75560	339.11
0.41	0.50625	0.78469	352.17
0.42	0.52526	0.81416	365.40
0.43	0.54452	0.84401	378.79
0.44	0.56401	0.87422	392.35
0.45	0.58374	0.90480	406.08

Head (feet)	MGD	CFS	GPM
0.46	0.60371	0.93575	419.96
0.47	0.62390	0.96705	434.01
0.48	0.64433	0.99871	448.22
0.49	0.66498	1.0307	462.58
0.50	0.68585	1.0631	477.11
0.51	0.70695	1.0958	491.78
0.52	0.72827	1.1288	506.61
0.53	0.74981	1.1622	521.59
0.54	0.77156	1.1959	536.73
0.55	0.79353	1.2300	552.01
0.56	0.81571	1.2643	567.44
0.57	0.83810	1.2991	583.02
0.58	0.86070	1.3341	598.74
0.59	0.88351	1.3694	614.60
0.60	0.90652	1.4051	630.61
0.61	0.92974	1.4411	646.76
0.62	0.95316	1.4774	663.06
0.63	0.97678	1.5140	679.49
0.64	1.0006	1.5509	696.06
0.65	1.0246	1.5882	712.77
0.66	1.0488	1.6257	729.61
0.67	1.0733	1.6635	746.60
0.68	1.0979	1.7017	763.71
0.69	1.1227	1.7401	780.96
0.70	1.1476	1.7788	798.35
0.71	1.1728	1.8179	815.86
0.72	1.1982	1.8572	833.51
0.73	1.2237	1.8968	851.29
0.74	1.2495	1.9367	869.19
0.75	1.2754	1.9769	887.23
0.76	1.3015	2.0174	905.39
0.77	1.3278	2.0581	923.68
0.78	1.3543	2.0991	942.10
0.79	1.3809	2.1405	960.64
0.80	1.4078	2.1821	979.31
0.81	1.4348	2.2239	998.10
0.82	1.4620	2.2661	1,017.0
0.83	1.4893	2.3085	1,036.0
0.84	1.5169	2.3512	1,055.2
0.85	1.5446	2.3941	1,074.5

Although the flume can perform satisfactory at flow ranges beyond those shown here as reported in other published flow charts, we chose flow ranges based on motor capability, freeboard allowances and published studies.

9 inch Parshall Flume Free Flow Discharge

Head (feet)	MGD	CFS	GPM
0.86	1.5725	2.4374	1,093.9
0.87	1.6006	2.4809	1,113.4
0.88	1.6288	2.5243	1,133.1
0.89	1.6572	2.5687	1,152.8
0.90	1.6858	2.6129	1,172.7
0.91	1.7145	2.6575	1,192.7
0.92	1.7434	2.7023	1,212.8
0.93	1.7725	2.7474	1,233.0
0.94	1.8017	2.7927	1,253.4
0.95	1.8311	2.8383	1,273.8
0.96	1.8607	2.8841	1,294.4
0.97	1.8905	2.9302	1,315.1
0.98	1.9204	2.9766	1,335.9
0.99	1.9504	3.0232	1,356.8
1.00	1.9806	3.0700	1,377.8
1.01	2.0110	3.1171	1,399.0
1.02	2.0416	3.1644	1,420.2
1.03	2.0723	3.2120	1,441.6
1.04	2.103	3.260	1,463.027
1.05	2.1342	3.3079	1,484.6
1.06	2.1653	3.3563	1,506.3
1.07	2.1967	3.4048	1,528.1
1.08	2.2282	3.4533	1,550.0
1.09	2.2598	3.5027	1,572.0
1.10	2.2916	3.5520	1,594.1
1.11	2.3235	3.6015	1,616.3
1.12	2.3556	3.6513	1,638.7
1.13	2.3879	3.7012	1,661.1
1.14	2.4203	3.7515	1,683.7
1.15	2.4529	3.8019	1,706.3
1.16	2.4856	3.8526	1,729.1
1.17	2.5184	3.9036	1,751.9
1.18	2.5514	3.9547	1,774.9
1.19	2.5846	4.0061	1,798.0
1.20	2.6179	4.0578	1,821.1
1.21	2.6514	4.1093	1,844.4
1.22	2.6850	4.1617	1,867.8
1.23	2.7187	4.2140	1,891.2
1.24	2.7526	4.2665	1,914.8
1.25	2.7866	4.3193	1,938.5

Head (feet)	MGD	CFS	GPM
1.26	2.8208	4.3723	1,962.3
1.27	2.8551	4.4255	1,986.1
1.28	2.8896	4.4789	2,010.1
1.29	2.9242	4.5325	2,034.2
1.30	2.9590	4.5864	2,058.4
1.31	2.9939	4.6405	2,082.7
1.32	3.0289	4.6948	2,107.0
1.33	3.0641	4.7493	2,131.5
1.34	3.0994	4.8041	2,156.1
1.35	3.1349	4.8590	2,180.7
1.36	3.1705	4.9142	2,205.5
1.37	3.2062	4.9696	2,230.4
1.38	3.2421	5.0252	2,255.3
1.39	3.2781	5.0810	2,280.4
1.40	3.3142	5.1371	2,305.5
1.41	3.3505	5.1933	2,330.8
1.42	3.3869	5.2498	2,356.1
1.43	3.4235	5.3064	2,381.5
1.44	3.4602	5.3633	2,407.1
1.45	3.4970	5.4204	2,432.7
1.46	3.5340	5.4777	2,458.4
1.47	3.5711	5.5352	2,484.2
1.48	3.6083	5.5929	2,510.1
1.49	3.6457	5.6508	2,536.1
1.50	3.6832	5.7090	2,562.2
1.51	3.7208	5.7673	2,588.4
1.52	3.7586	5.8258	2,614.6
1.53	3.7965	5.8846	2,641.0
1.54	3.8345	5.9435	2,667.5
1.55	3.8727	6.0027	2,694.0
1.56	3.9110	6.0620	2,720.6
1.57	3.9494	6.1216	2,747.4
1.58	3.9880	6.1814	2,774.2
1.59	4.0267	6.2413	2,801.1
1.60	4.0655	6.3015	2,828.1
1.61	4.1044	6.3618	2,855.2
1.62	4.1435	6.4224	2,882.4
1.63	4.1827	6.4831	2,909.6
1.64	4.2220	6.5441	2,937.0
1.65	4.2614	6.6052	2,964.4

Although the flume can perform satisfactory at flow ranges beyond those shown here as reported in other published flow charts, we chose flow ranges based on meter capability, freeboard allowances and published studies.

9 inch Parshall Flume Free Flow Discharge

Head (feet)	MGD	CFS	GPM
1.66	4.3010	6.6666	2,992.0
1.67	4.3407	6.7281	3,019.6
1.68	4.3806	6.7899	3,047.3
1.69	4.4205	6.8518	3,075.1
1.70	4.4606	6.9139	3,103.0
1.71	4.5008	6.9763	3,130.9
1.72	4.5411	7.0388	3,159.0
1.73	4.5816	7.1015	3,187.1
1.74	4.6222	7.1644	3,215.4
1.75	4.6629	7.2275	3,243.7
1.76	4.7037	7.2908	3,272.1
1.77	4.7447	7.3542	3,300.6
1.78	4.7857	7.4179	3,329.2
1.79	4.8269	7.4818	3,357.8
1.80	4.8683	7.5458	3,386.6
1.81	4.9097	7.6100	3,415.4
1.82	4.9513	7.6745	3,444.3
1.83	4.9929	7.7391	3,473.3
1.84	5.0348	7.8039	3,502.4
1.85	5.0767	7.8688	3,531.5

Head (feet)	MGD	CFS	GPM
1.86	5.1187	7.9340	3,560.8
1.87	5.1609	7.9994	3,590.1
1.88	5.2032	8.0649	3,619.5
1.89	5.2456	8.1306	3,649.0
1.90	5.2881	8.1966	3,678.6
1.91	5.3307	8.2627	3,708.3
1.92	5.3735	8.3289	3,738.0
1.93	5.4164	8.3954	3,767.9
1.94	5.4594	8.4620	3,797.8
1.95	5.5025	8.5289	3,827.8
1.96	5.5457	8.5959	3,857.8
1.97	5.5891	8.6631	3,888.0
1.98	5.6325	8.7304	3,918.2
1.99	5.6761	8.7980	3,948.5
2.00	5.7198	8.8657	3,978.9

Although the flume can perform satisfactory at flow ranges beyond those shown here as reported in other published flow

HAGERMAN NATIONAL FISH HATCHERY

RATING TABLE FOR 2 FT PARSHALL FLUME

DISPLAY POND - WEIR LOCATION # 7

(w^(0.026))

FORMULA USED - Q = 4W(Ha^(1.522))

GAGE HEIGHT IN FEET	DISCHARGE CFS	DISCHARGE GPM	GAGE HEIGHT IN FEET	DISCHARGE CFS	DISCHARGE GPM	GAGE HEIGHT IN FEET	DISCHARGE CFS	DISCHARGE GPM
0.20	0.66	296	0.68	4.40	1975	1.16	10.07	4519
0.21	0.71	320	0.69	4.50	2020	1.17	10.20	4579
0.22	0.77	344	0.70	4.60	2066	1.18	10.34	4640
0.23	0.82	368	0.71	4.71	2112	1.19	10.48	4701
0.24	0.88	393	0.72	4.81	2158	1.20	10.61	4763
0.25	0.93	419	0.73	4.91	2205	1.21	10.75	4824
0.26	0.99	445	0.74	5.02	2252	1.22	10.89	4886
0.27	1.05	472	0.75	5.12	2299	1.23	11.03	4948
0.28	1.11	499	0.76	5.23	2347	1.24	11.17	5011
0.29	1.17	527	0.77	5.34	2395	1.25	11.30	5074
0.30	1.24	556	0.78	5.44	2443	1.26	11.45	5137
0.31	1.30	585	0.79	5.55	2492	1.27	11.59	5200
0.32	1.37	614	0.80	5.66	2541	1.28	11.73	5264
0.33	1.44	644	0.81	5.77	2590	1.29	11.87	5327
0.34	1.50	675	0.82	5.88	2640	1.30	12.01	5392
0.35	1.57	706	0.83	5.99	2690	1.31	12.16	5456
0.36	1.64	737	0.84	6.11	2740	1.32	12.30	5521
0.37	1.71	769	0.85	6.22	2791	1.33	12.45	5586
0.38	1.79	802	0.86	6.33	2842	1.34	12.59	5651
0.39	1.86	834	0.87	6.45	2893	1.35	12.74	5716
0.40	1.93	868	0.88	6.56	2945	1.36	12.88	5782
0.41	2.01	902	0.89	6.68	2997	1.37	13.03	5848
0.42	2.09	936	0.90	6.79	3050	1.38	13.18	5914
0.43	2.16	971	0.91	6.91	3102	1.39	13.33	5981
0.44	2.24	1006	0.92	7.03	3155	1.40	13.48	6048
0.45	2.32	1042	0.93	7.15	3208	1.41	13.62	6115
0.46	2.40	1078	0.94	7.27	3262	1.42	13.77	6182
0.47	2.48	1114	0.95	7.39	3316	1.43	13.93	6250
0.48	2.57	1151	0.96	7.51	3370	1.44	14.08	6318
0.49	2.65	1189	0.97	7.63	3425	1.45	14.23	6386
0.50	2.73	1226	0.98	7.75	3480	1.46	14.38	6454
0.51	2.82	1265	0.99	7.88	3535	1.47	14.53	6523
0.52	2.90	1303	1.00	8.00	3590	1.48	14.69	6592
0.53	2.99	1342	1.01	8.12	3646	1.49	14.84	6661
0.54	3.08	1382	1.02	8.25	3702	1.50	15.00	6730
0.55	3.17	1422	1.03	8.37	3759	1.51	15.15	6800
0.56	3.26	1462	1.04	8.50	3815	1.52	15.31	6870
0.57	3.35	1503	1.05	8.63	3872	1.53	15.46	6940
0.58	3.44	1544	1.06	8.76	3930	1.54	15.62	7010
0.59	3.53	1585	1.07	8.88	3987	1.55	15.78	7081
0.60	3.62	1627	1.08	9.01	4045	1.56	15.94	7152
0.61	3.72	1669	1.09	9.14	4103	1.57	16.09	7223
0.62	3.81	1712	1.10	9.27	4162	1.58	16.25	7295
0.63	3.91	1755	1.11	9.40	4221	1.59	16.41	7366
0.64	4.01	1798	1.12	9.54	4280	1.60	16.57	7438
0.65	4.10	1842	1.13	9.67	4340	1.61	16.73	7510
0.66	4.20	1886	1.14	9.80	4400	1.62	16.90	7583
0.67	4.30	1930	1.15	9.95	4460	1.63	17.06	7655

# Rangen Aquaculture

## HATCHERY & RESEARCH CENTER

RECEIVED

DEC 17 2007

2928 B S. 1175 E.  
Hagerman, ID 83332  
(208) 837-6191  
Fax: (208) 837-4585

E-Mail: [dramsey@ranger.com](mailto:dramsey@ranger.com)

17 December 2007

HAGERMAN NAT'L FISH HATCHERY  
HAGERMAN, IDAHO

Dear Aquaculture NPDES Permittee;

The following provides assurance that the Rangen Aquaculture Research Center (RARC) fulfills laboratory-specific quality assurance requirements for testing your water samples as described in the 2007 Idaho Aquaculture NPDES General Permit and *Requirements for Quality Assurance Project Plans (EPA/QA/R 5)* and *Guidance for Quality Assurance Project Plans (EPA/QA/G-5)*<sup>2</sup>.

RARC personnel are qualified and trained to perform the water quality tests required in the permit. Curriculum vitae and training records are on file at RARC. A complete and current set of standard operating procedures (SOPs) are maintained at RARC and followed during each respective test which addresses proper sample collection, preservation, and storage; testing methods for each required parameter; calibration, operation, maintenance, and repairs of necessary equipment; accurate entry, correction, storage, and transfer of data to customer forms; and quality assurance for each of these to ensure high data quality. RARC incorporates internal quality control samples into every "batch" of samples tested, as prescribed in *Standard Methods, 1998*<sup>3</sup>. External standards are obtained from EPA-approved suppliers and analyzed annually.

The following methods [from 40CFR Part 136.3 (2007)<sup>4</sup>, and described in EPA, 1983<sup>5</sup>] are used by RARC to analyze water samples for the tests shown. The minimum detectable levels (MDLs) achieved at RARC are less than or equal to the MDLs shown below.

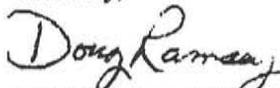
Test	EPA Method No.	MDL (mg/L)
Total Suspended Solids	160.2	2.00
Total Phosphorus	365.2	0.005
Total Ammonia Nitrogen	350.2/350.3	0.010
Total Kjeldahl Nitrogen	351.3/350.3	0.030
Nitrate Nitrogen	353.3	0.010
Nitrite Nitrogen	353.3	0.005

The following are references cited above:

- (1) <http://www.epa.gov/quality/qs-docs/rs-final.pdf>
- (2) <http://www.epa.gov/quality/qs-docs/q5-final.pdf>
- (3) *Standard Methods for the Examination of Water and Wastewater*. 1998. Lenore S. Clesceri, Chair, Joint Editorial Board, prepared and published by the American Public Health Association, American Water Works Association, and Water Environment Federation. 20<sup>th</sup> Edition., pp 1-6, 1-7, Washington, D.C.
- (4) Code of Federal Regulations, 2007. In: *Protection of Environment*, 40 CFR 136.3, Office of the Federal Register, National Archives and Records Administration.
- (5) EPA (U.S. Environmental Protection Agency). 1983. In: *Methods for Chemical Analysis of Water and Wastes*, (ed. by J.F. Kopp & G.D. McKee), 3<sup>rd</sup> Edition, U.S. Department of Commerce, National Technical Information Service, Springfield, VA.

Appropriate sample bottles and chain of custody forms are available at RARC. Please call if you have questions.

Sincerely,



Doug Ramsey, RARC Research Scientist

## Rangen Aquaculture Research Center

### Fish, Water, & Feed Analysis Fees

January 2011

<u>Fish Disease Diagnostics (Per Group)</u>	<u>Price (\$)</u>
*Complete Clinical Examination	39.00
*Partial Clinical Examination (external examination)	30.00
Gram or Leishman/Giemsa Stain (per slide)	21.00
Bacterial Isolation (primary)	23.00
Bacterial Identification (biochemical, per isolate)	34.00
Bacterial Identification (serological, per isolate)	14.00
Antibiogram (per isolate)	13.00
Virology – Screen (1 or 2 pools)	57.00
Virology – Serum Neutralization (per isolate)	76.00
Fluorescent Antibody Technique (per slide)	38.00
Hematocrit	13.00
Histology	32.00
*Diagnostic Package (includes complete clinical examination, 1 Gram or L/G stained slide, and bacterial isolation)	74.00
*Diagnostic Package with Virology Screen (1 or 2 pools)	122.00

**Note:** An additional \$16.00 fee will be added for consultation/documentation for each test listed above that is performed individually. Exceptions to this additional charge are noted with \*.

<u>Water Analysis (Per Sample)</u>	<u>Method</u>	<u>Price (\$)</u>
Total Suspended Solids	USEPA 160.2	8.00
Total Phosphorus	USEPA 365.2	13.00
Ammonia Nitrogen (with distillation)	USEPA 350.2/350.3	19.00
Total Kjeldahl Nitrogen	USEPA 351.3/350.3	19.00
Nitrate/Nitrite Nitrogen	USEPA 353.3	13.00
Nitrate Nitrogen	USEPA 353.3	13.00
Nitrite Nitrogen	USEPA 353.3	8.00
Total Coliforms	(Presence/Absence)	13.00
Total Copper	St. Methods 3500-Cu-B (20 <sup>th</sup> Ed.)	21.00
Total Hardness	USEPA 130.2	8.00
<u>Feed Analysis (Per Sample)</u>	<u>Method</u>	<u>Price (\$)</u>
Peroxide	AOAC 965.33	19.00
Ascorbic Acid		32.00
NaCl		8.00

Other tests may be available as determined on a case-by-case basis.

# RANGEN AQUACULTURE RESEARCH & HATCHERY SERVICE CENTER

## SOP #106/2 - Laboratory Activity Quality Assurance/Quality Control

The following SOP describes the quality assurance plan followed by all RARC laboratory personnel to ensure that data of known and defensible quality are produced. It also describes the quality control plan in operation. See specific equipment and procedural SOPs for detailed QA descriptions.

### Quality Assurance Plan:

Each laboratory activity will be performed by qualified personnel following all established SOPs involved with that activity. Appropriate SOPs will be reviewed prior to beginning a procedure or operating equipment. Training logs will be maintained to document training received by lab personnel which will qualify them to participate in those activities. Listed below are the general areas for which specific SOPs have been developed to assure that quality data is obtained and recorded:

#### 1. Analytical procedures or operations performed in the laboratory.

Assign a water quality or diagnostic account number to samples upon submittal to the lab. Write the account number on the sample container with a permanent marker before preserving or storing.

Properly preserve samples upon receipt and store appropriately, or analyze as soon as possible if preservation is not possible. Refrigeration is appropriate storage for most samples-check with laboratory supervisor or study director if questions arise.

Check expiration date before each use to ensure that the chemical has not expired.

Promptly dispose expired chemicals.

Record pertinent information in chemical log upon receipt of new chemical lot.

Test each new lot of chemical against the current lot to ensure proper performance.

Take measurements and observations in a consistent manner to minimize independent variables.

Rinse water sample bottles destined for reuse 2-3 times in each of spring water then nanopure. Drain upside down until dry. Remove the account number from the bottle with a scrub pad.

#### 2. Operation of equipment, including calibration, maintenance, and repair procedures.

Unless stated otherwise in the specific equipment SOP, turn on analytical equipment at least 1 hr before use to warm up.

Ensure equipment is maintained and calibrated according to manufacturer instructions.

Record the use, cleaning, maintenance, etc. of equipment on appropriate logs.

#### 3. Data entry, corrections, and significant figure/number rounding.

Check data for accuracy. Enter original raw data directly into specially designated permanent lab notebooks following data entry and correction SOP #101.2 and significant figure/number rounding SOP #101.3.

Reports must be reviewed by at least one RARC Research Scientist before submitting to the respective client.

4. Archival of printed/photographic materials and samples (biological and chemical).

Permanent and perishable materials will be archived as described in the study protocol and protocol amendments, Federal Register, and/or specific SOPs (see also SOP #104.2).

Quality Control Plan:

The quality control plan has six elements: certification of research technician, equipment calibration with standards, reagent purity analyses with reagent blanks, recovery of known additions, analysis of duplicates, and analysis of externally supplied standards.

1. Certification of the research technician in laboratory methods in an Idaho Department of Environmental Quality-approved program will be actively pursued or obtained. An example of this is the program sponsored by the Idaho Water and Wastewater Operators Certification Boards, Inc., Lewiston ID, and administered by Environmental Training Consultants, Nampa, ID.

2. A minimum of three dilutions of a certified standard will be used each time analytical instruments are calibrated prior to measurement of unknown samples. Reportable results are those within the range of the concentrations used for calibration. The lowest reportable value is the minimum detectable level (MDL) since the lowest calibrating concentration is less than 10 times the MDL. When blanks are subtracted, negative values are reported when they occur.

3. Reagent blanks will be analyzed at a minimum of 5% of the number of samples being analyzed to monitor reagent purity (particularly when new reagents are used) and overall background levels of analyte. Analyze a reagent blank after a sample which possesses a concentration higher than the highest calibrating standard or presents a possibility of significant carryover to the next sample.

4. Known additions (spikes) will be analyzed at a minimum of 10% of the number of samples being analyzed. Acceptable limits for recovery of known additions and differences in duplicates are listed in Table 1020.1 (Standard Methods, 18th Ed., 1992).

5. Duplicates will be analyzed at a minimum of 5% of the number of samples being analyzed. This allows assessment of precision from sample collection and storage to analysis.

6. Analysis of externally supplied standards (supplied by the Environmental Protection Agency or sponsored laboratory) will be performed annually and reported to the cooperating facility. Internal reference solutions will be prepared independently from calibrating standards and analyzed each time a set of unknown samples are tested.

Prepared by: \_\_\_\_\_

Approved by: \_\_\_\_\_

Effective Date: \_\_\_\_\_

Revision: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

# RANGEN AQUACULTURE RESEARCH & HATCHERY SERVICE CENTER

## SOP #509/2 - TOTAL SUSPENDED SOLIDS ASSAY (RESIDUE, NONFILTERABLE)

### SCOPE & PURPOSE

The following procedure describes the laboratory methods used to determine Total Suspended Solids (TSS) in ground and surface freshwater samples. This procedure may be used for production and experiment-related samples. The useable range for this method is 4-20,000 mg/L TSS.

Reference: Method 160.2 (Storet No. 00530) IN: U. S. Environmental Protection Agency (EPA), 1983, Methods for Chemical Analysis of Water and Wastes (MCAWW), Pp. 43-45.

SOP #106/2 - Laboratory Activity Quality Assurance/Quality Control

### TSS ASSAY

#### Sampling Procedure:

Collect an aliquot of water (500-1000 mL) in a clean glass or plastic bottle. Assay immediately or refrigerate at 4°C up to 7 days. Sample can not be chemically preserved.

Reagents: (Use product listed or equivalent. Record reagent codes in appropriate lab notebook).

Glass Fiber Filters: Gelman 61631

Nanopure water: Prepared in lab, resistivity at 10-18 megohm-cm.

MDL Standard Preparation: Sigma S-3504 (SigmaCell). Add 20 mg of SigmaCell to 1 L of nanopure water in a graduated cylinder. Stir with a large stir bar for several minutes. While stirring, pipette 10 ml out and combine with 990 ml nanopure water in another graduated cylinder and mix with a stir bar for several minutes. This results in 1 L of a 2 ppm solution.

#### Quality Assurance

Quality assurance samples will be composed of blanks (filtered nanopure water) at a minimum of 5% of the total number of samples to be assayed and duplicates and spiked unknowns at a minimum of 10% of total samples. The spiked unknowns will be prepared by adding 20-60 mg of SigmaCell to 500-1000 ml of unknown sample and analyzed. The spiked sample is generally settling pond effluent. The concentration of the duplicates and spiked samples will be unknown to the analyst.

## TSS Determination

- (1) Filter prewash/dry to constant weight: Insert a 47 mm Gelman glass fiber filter (see above) with forceps (wrinkled side up) onto the filtration apparatus for each sample. Turn on the vacuum and wash the filter with 60 mL fresh nanopure water (double-deionized, filtered, RARC spring water). Continue suction to remove all traces of water. Remove filter with forceps and place in a numbered, aluminum weighing dish. Dry in Stab-Therm drying oven (see SOP #317 for operation) at 103° - 105°C for one hour (set timer).
- (2) Remove weighing dishes from the oven with forceps and place in a desiccator to stabilize moisture and temperature (2-15 min), then weigh each dish in grams on an analytical balance to 4 decimal places and record the weight in the lab notebook.
- (3) Return the dishes to the oven for an additional 15 minutes of drying, remove and place in desiccator to equilibrate with room temperature, and reweigh each dish. Weight should be within 0.5 mg of previous weight. If not, dry another 15 minutes and reweigh. (If unable to assay immediately, store dishes in the desiccator at room temperature until ready to use. On day of assay, re-dry for an additional 15 minutes and reweigh. The previous constant weight must be obtained.) Consistent desiccation time is critical. If the first desiccation time is greater than the 2-15 min period, either re-dry and desiccate for no more than 15 min or change all subsequent desiccation times to match.
- (4) Using forceps, remove each filter from its weigh dish and place on the filtration apparatus (smooth side up). Wet each filter with a small amount of nanopure water to make a firm seal, attach the vacutainer, and turn on the vacuum pump.
- (5) Remove the sample to be assayed from the 4°C refrigerator. Invert the sample three times to make sure it is well homogenized and filter a measured volume. Use a 10, 100, 200, 500, or 1000 mL graduated cylinder which most closely matches the volume to be analyzed. Suggested volumes for various sample types include 200-1000 mL for hatchery influents and effluents; 5-50 mL for turbid waste pond influent samples; and 100 to 200 mL for waste pond effluent samples). Filter enough sample to obtain at least a 1 mg increase over constant filter weight or filter 1 L. Note: Filter the entire 1 L volume of 2ppm MDL standard. Rinse graduated cylinder thoroughly to transfer all material to filter. After the measured sample has been drawn through the filter, wash the sides of vacutainer with nanopure water, remove vacutainer, and wash the filter with 30 mL of nanopure water allowing complete drainage and continue suction for two minutes after the filtration procedure is completed. After filtering a turbid waste pond sample, thoroughly brush and rinse graduated cylinders, vacutainer, and filtration device before using on next sample. After filtering, always rinse graduated cylinders and vacuainers before filtering next sample.
- (6) Carefully remove the filter from the filtration device using forceps and transfer back to the appropriately-numbered aluminum weigh dish.

- (7) Dry the filters for one hour in the Stabil-Therm drying oven at 103-105°C. Remove the weigh dishes from the oven using forceps and place them in the desiccator to cool, weigh them on the analytical balance, and record the weights in a lab notebook as per step (2) and (3).
- (8) Calculation: Determine weight of total suspended solids using the following equation and record in lab notebook:

$$\frac{\text{mg total suspended solids}}{\text{liter}} = \frac{(A-B) \times 10^6 *}{\text{sample volume (mL)}}$$

A = weight of filter/dish and dried residue (g)

B = weight of filter (g)

\* Multiply by 1000 to convert g to mg and by another 1000 to convert to liter.

Prepared by: \_\_\_\_\_ Date: \_\_\_\_\_

Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

Effective Date: \_\_\_\_\_

Revision:



SOP #507.2/3 - TOTAL KJELDAHL NITROGEN (Digestion, Distillation, mV-ISE)

SCOPE AND PURPOSE

The following procedure describes laboratory methods used to sample and determine Total Kjeldahl Nitrogen (TKN) in ground and surface freshwater samples. The procedures described below for operation of the Jenco pH meter model 671P and Orion model 95-12 or VWR model 34105-120 ammonia electrodes are to be used in conjunction with the Jenco and Orion owners manuals for those instruments (see SOP #328.3 and #329.1, respectively, for additional operating instructions-the Orion instructions apply to the VWR electrode as well). Note that the mercury digestion reagent (in MCAWW) has been replaced by the copper sulfate digestion reagent (in SMEWW) due to the level of toxicity and legal disposal problems associated with mercury. The useable range for this method is 0.03-25 mg/L TKN.

Reference: Digestion and Distillation: Method 351.3 (Storet No. 00625) IN: U. S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes (MCAWW)1983 , pp 351.3-1 through 351.3-6.

Digestion and Distillation: Method 4500-N<sub>org</sub> and 4500-NH<sub>3</sub> B. IN: Standard Methods for the Examination of Water and Wastewater. (SMEWW) 1995. Andrew D. Eaton, Chair, Joint Editorial Board, prepared and published by the American Public Health Association, American Water Works Association, and Water Environment Federation. 19th ed., pp. 4-76, 4-77, and 4-93.

Potentiometric, Ion Selective Electrode: Method 350.3 (Storet No. 00610) IN: MCAWW, pp. 350.3-1 through 350.3-2.

SOP #106/2 - Laboratory Activity Quality Assurance/Quality Control

PPE Required: EYE PROTECTION. See SOP #108 for additional safety recommendations.

Sampling Procedure:

Collect a 500-1000 mL water sample in a clean plastic or glass bottle and either run the assay immediately or preserve the sample with 2 mL concentrated sulfuric acid/L and store up to 28 days at 4°C.

Reagents: Use products listed or equivalent. For traceability, record chemical code number in appropriate lab notebook.

**Digestion (Day 1)**

Distilled Water: Western Family Distilled Water-Freshly opened 1 gallon jug (no more than 48 h since opening).

Digestion Reagent (SMEWW Reagent 3a, page 4-93): Dissolve 268 g K<sub>2</sub>SO<sub>4</sub> (EM Science PX1595-6) and 14.6 g Cu SO<sub>4</sub> (Hach 127-01) in about 1600 ml distilled water. Carefully add 268 ml conc H<sub>2</sub>SO<sub>4</sub> (EM Science SX1244-14). When it has cooled to room temperature, dilute the solution to 2 L with distilled water. Mix well. Keep at a temperature close to 20° C to prevent crystallization.

Distillation (Day 2)

10N NaOH: Dissolve 80 g NaOH (EM Science SX0605-3) in 200 ml distilled water.

Borate Buffer (MCAWW Reagent 6.Z): Combine 0.44 ml 10N NaOH, ≈300 ml nanopure water, and 4.75 g sodium borate ( $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ ). Bring to 500 ml volume with nanopure.

Boiling chips: Chemware Teflon PTFE Boiling Stones, Norton Performance Plastics, 26397-103.

Sodium Hydroxide-Sodium Thiosulfate (MCAWW Reagent Z4): Dissolve 1000 g NaOH (EM Science, SX0605-3) and 50 g  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  (Mallinckrodt 8100) and dilute to 2 L in distilled water.

Boric Acid (2%)(MCAWW Reagent Z6): Dissolve 20 g  $\text{H}_3\text{BO}_3$  (Mallinckrodt 2549) and dilute to 1 L in distilled water.

1N HCL: Combine 8.25 ml conc HCL (EM Science HX0603TP-2) and distilled water to 100 ml.

TKN Measurement (Day 3)

Standard Preparation: Prepare a series of standard concentrations by serially diluting a freshly opened 100 ppm Hach  $\text{NH}_3\text{-N}$  viallette ampule (equivalent to Hach 21284-10) with distilled water. Suggested concentrations to create the standard curve for ground and surface water samples are 0.10, 0.25, 0.50, and 1.00 ppm TKN. Prepare fresh for each standard curve.

1.0 ppm  $\text{NH}_3\text{-N}$  = 10.0 ml of 100 ppm and QS to 1000 ml with distilled water  
0.5 ppm  $\text{NH}_3\text{-N}$  = 500 ml of 1.00 ppm and QS to 1000 ml with distilled water  
0.25 ppm  $\text{NH}_3\text{-N}$  = 500 ml of 0.5 ppm and QS to 1000 ml with distilled water  
0.1 ppm  $\text{NH}_3\text{-N}$  = 400 ml of 0.25 ppm and QS to 1000 ml with distilled water  
0.05 ppm  $\text{NH}_3\text{-N}$  = 100 ml of 0.1 ppm and QS to 200 ml with distilled water

MDL Standard Preparation (0.075 ppm  $\text{NH}_3\text{-N}$ ):

0.075 ppm  $\text{NH}_3\text{-N}$  = 7.5 ml of 0.10 ppm (distilled) and QS to 10 ml with Western Family distilled water.

Ammonia Standard (1000 ppm  $\text{NH}_3\text{-N}$ )-for electrode slope determination: Hach 23541-53.

ISA Ammonia pH-Adjusting Solution: Orion 951211.

Standard Sodium Hydroxide (NaOH) solutions: Standard lab concentrations ranging from 10 N to 1 N NaOH; ie. 10 N, 5 N, and 1 N NaOH (EM Science SX0605-3).

Concentrated Sulfuric acid ( $\text{H}_2\text{SO}_4$ ): Analytical reagent grade only to be used, ie. EM Science SX1244-14.

Quality Assurance:

Quality assurance samples will be composed of blanks (a minimum of 5% of the total number of samples to be assayed as distilled water plus reagent) and 10% will be duplicates and spiked unknowns (unknown with a known addition of a standard concentration). The concentration of the duplicates and spiked samples will be unknown to the analyst and the quality assurance sample concentrations will fall within the range of concentrations used to develop the standard curve.

Digestion (Day 1):

1. Remove unknown samples from the refrigerator, inverting three times to mix. Transfer 200 mL aliquots of standards, unknowns, blank, blind, and spiked unknown samples into 500 ml Kjeldahl flasks.
2. Add 40 mL of digestion reagent and 8-10 boiling chips. Place flasks on Unimantle (positioned on base of fume hood) or hot plate burners and boil samples down to approximately 50 mls.
3. Transfer contents to a clean 100 ml Kjeldahl flask, continue digestion on "6 burner" until thick white fumes appear, and then turn burners to "high" for an additional 30 min. Operate hood fan during entire digestion process.
4. Allow to cool, during which the color turns from pale green to blue.
5. After cooling, add a squirt of distilled water to the digestate and swirl. Transfer the digestate to a clean 250 ml graduated cylinder. Rinse the 100 ml Kjeldahl flask several times with distilled water and add the rinsings to the cylinder. Ensure that all residue is transferred to the cylinder.
6. Finally, adjust the volume to 120 mL with distilled water, transfer the entire 120 ml volume to a clean 125 ml Erlenmeyer flask, (rinse with portions of the 120 ml to ensure all residue is transferred), cover with parafilm, and store overnight at 4° C.

Distillation (Day 1)

1. Connect cooling water hose to tubing of distillers and turn water on to allow the stream to reach the back side of the condenser.
2. Steam out residual  $\text{NH}_3$  from distillers by combining 500 ml nanopure, 20 ml borate buffer, 5 drops 10N NaOH (pH must be  $\geq 9.5$ ) and boiling chips, connect to the distiller with a small amount of silicone at the joint to ensure a complete seal, and check all other connections for proper sealing. Keep tips of condenser outlets above distillate during steam out.
3. Distill  $\approx 150$  ml of the solution and then turn off burners. Allow to cool (about 30 min), and put tips of condenser outlets under surface of distillate. Leave system connected and water running.
4. Connect the main electrical cord of the unimantles to a timer set to come on at approximately 6:00 AM the next morning.

Distillation (Day 2):

1. At 7:30 AM the distilling flasks operating unattended should still have some solution left, at which time the analyst should be present to pull tips of condenser outlets out of the distillate and check remaining operations. Approximately 150 ml are collected (total of 300 ml distilled during steamout).
2. Add 15 ml 2% boric acid to plastic cup, put condenser outlet tip into acid, and collect =30 ml distillate from each distiller.
3. Check mV reading on: Nanopure water, Western Family Distilled Water, and the 30 ml distillate from each of distillers A, B, C, D, E. The mV readings should be  $\geq 190$ .
4. Transfer 120 ml digestate (standards and unknowns) to distillation flask, add 8-10 boiling chips, and connect to distiller with a small amount of silicone at the joint to ensure a complete seal.
5. Add 50 ml boric acid (7.6) to collection flask and submerge tip of distiller tube under surface of boric acid.
6. Add 40 ml sodium hydroxide/sodium thiosulfate (7.4)(without mixing) through top hole of distiller with 50 ml syringe connected to Tygon tubing and the end of the tubing reaching below the neck of the flask, then close hole immediately.
7. Distill 75 ml then pull condenser tip out of distillate and distill another 25 ml to clean tip between samples (must distill  $\geq 40\%$  of sample to ensure all  $\text{NH}_3\text{-N}$  has been distilled over).
8. After distilling a total of =100 ml, measure and record volume of unknowns. Add 1.25 ml 1N HCl to all unknowns and standards, dilute standards to highest standard distillate volume, and refrigerate all immediately.
9. Cover condenser inlets after cooling with parafilm to prevent contamination during nonuse.
10. Prepare the inner body of the ammonia electrode by soaking in filling solution (Orion 95-12-02 or Hach 4472-26) overnight before use.

TKN Measurement (Day 3):

1. Pull all samples and standards from refrigerator to warm up to room temperature.

Electrode Preparation:

1. Replace the membrane (if necessary) on the outer body of the electrode and finger tighten the end cap. To ensure proper operation, there must be no wrinkles in the membrane.
2. Add approximately 2.5 mL of filling solution to the outer body and screw the outer body onto the threaded end of the cable. Shake the electrode like a thermometer to remove bubbles through the access hole of the electrode. Gently pulling the cable at the end of the electrode can also dislodge bubbles and circulate the filling solution inside to provide better performance.

pH Meter Preparation:

1. Calibrate pH meter with pH electrode and two buffers (pH 7 and pH 10) according to manufacturer instructions (see appendix A). Connect ammonia electrode by locking BNC connector of cable into pH meter. Place the sample container on a stir plate set at low speed keeping stir speed constant throughout entire procedure.
2. Perform electrode slope check according to manufacturer instructions. The slope should be 54-60.
3. Measure and record millivolts (mV) of 0.1 ppm nondistilled standard four times or until a stable mV reading is obtained.
4. Measure and record mV of 0 ppm nondistilled nanopure water (once).
5. Measure and record mV of 0 ppm Western Family Distilled Water (once).
6. Measure and record mV of 0 ppm RARC-distilled standard (once).
7. Measure and record mV of 0.05-1.0 ppm distilled standards (once each) by combining 10 ml standard and 0.2 ml ISA. Rinse the electrode, stirrer, and beaker with nanopure water between samples.
8. Recheck with 1 distilled standard (0.1 ppm) for accuracy then measure the 0.075 ppm standard for minimum detectable level (MDL) determination.
9. If the standard recheck is off by  $\geq 15\%$ , remeasure standards.
10. Measure a blank (ammonia-free nanopure water) and record.

Assay Procedure:

1. Combine a 25 mL of sample with 0.5 mL ISA in a 30 ml plastic cup and position the ammonia electrode/stirrer in the solution so that the membrane is below the surface.
2. In the mV mode, allow the reading to stabilize (reading must be stable for at least one minute) and record in notebook.
3. Rinse the electrode/stirrer between each sample.
4. Enter the mV readings of the standard concentrations into the Sharp calculator (statistics program) to produce a standard curve and linear regression equation. (Refer to the owners manuals of the calculator and the current TKN notebook for operation details.) Using this regression equation, determine the TKN concentration to nearest 0.01 mg/L in blind, spike, and unknown samples. If a sample concentration exceeds that of the highest standard, the sample must be diluted and remeasured. Record all results (including mV readings, dilution factors, etc.) in black ink in the appropriate lab notebook. Check all calculations at least once. Record results on client report form and check all transcriptions at least once.





- Notes:
1. Measure up to 10 samples and check again with a known standard. If the reading is not within 15% of the calculated concentration, rerun the standard. If the reading still does not fall within 15% of the expected value, recalibrate with standards as before.

2. If a sample reading is below the reading of the highest standard (mV reading for 1.0 ppm NH<sub>3</sub>-N), rinse the electrode with 1N HCl, dilute another aliquot of pH-adjusted sample and remeasure. Be sure to include the dilution factor when calculating the final concentration.

3. For spiked unknown samples, add 3-4 mL of 150 ppm NH<sub>3</sub>-N and record amounts.
4. Assign superscripts to distiller identification letters in notebook to match with samples and show order of sample distillation. Use this information for troubleshooting individual distillers.
5. Higher mV readings = lower TKN concentrations.

Prepared by: \_\_\_\_\_

Date: \_\_\_\_\_

Approved by: \_\_\_\_\_

Date: \_\_\_\_\_

Effective Date: \_\_\_\_\_

Revision: \_\_\_\_\_

# RANGEN AQUACULTURE RESEARCH & HATCHERY SERVICE CENTER

## SOP #508/3 - TOTAL PHOSPHORUS ASSAY

### SCOPE AND PURPOSE

The Total Phosphorus Analysis of Water SOP outlines the procedures for sampling and determining all forms of phosphorus (P) in ground and surface freshwater samples. The procedures described below for operation of the LKB Model 4050 spectrophotometer are used in conjunction with the owners manual for that instrument (see SOP #342 for additional operating instructions). The useable range for this method is 0.01-0.5 mg/L total P.

Reference: Method 365.2 (Storet No. 00665) IN: U. S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes (MCAWW), 1983, Pp. 365.2-1 through 365.2-6.  
SOP #106/2 - Laboratory Activity Quality Assurance/Quality Control  
PPE Required: EYE PROTECTION. see SOP #108 for additional safety recommendations.

### TOTAL PHOSPHORUS ASSAY

#### Sampling Procedure:

Collect an aliquot of water (500-1000 mL) in a clean plastic or glass bottle. Assay immediately or preserve by adding 2 mL of concentrated sulfuric acid/L of sample and store at 4°C up to 28 days.

Reagents: Use product listed or equivalent. For traceability, record chemical code numbers in appropriate lab notebook.

Phosphate Standard (50 ppm): Ricca 5830-16

Sulfuric Acid: J. T. Baker 9681-05

Potassium Antimonyl Tartrate: Hach 2549-26

Ammonium Molybdate Tetrahydrate: Aldrich 22,123-6

Ascorbic Acid: Aldrich 25,556-4

Ammonium Persulfate: Hach 112-01

Boiling Chips: Chemware Teflon PTFE Boiling Stones, Norton Performance Plastics, 26397-103.

Nanopure water: Prepared in lab, resistivity at 10-18 megohms-cm.

Standard Preparation: Prepare a series of standard concentrations by serially diluting a freshly opened 50 ppm Hach 21284-10 phosphorus voluette ampule with nanopure water in volumetric flasks and mixing thoroughly. Prepare fresh for each standard curve. Suggested standard curve concentrations for ground and surface water samples are 0.01, 0.02, 0.04, and 0.10, 0.25, and 0.50 ppm P as PO<sub>4</sub>.

0.5 ppm P as PO<sub>4</sub> = 5.0 ml of 50 ppm and qs to 500 ml with nanopure water then transfer to a 1 L bottle, cap opening with parafilm, and shake vigorously.

0.25 ppm P as PO<sub>4</sub> = 50 ml of 0.5 ppm and qs to 100 ml with nanopure water then transfer to a 125 ml flask, cap opening with parafilm, and shake vigorously.

0.10 ppm P as PO<sub>4</sub> = 40 ml of 0.25 ppm and qs to 100 ml with nanopure water

0.04 ppm P as PO<sub>4</sub> = 40 ml of 0.1 ppm and qs to 100 ml with nanopure water

0.02 ppm P as PO<sub>4</sub> = 50 ml of 0.04 ppm and qs to 100 ml with nanopure water

0.01 ppm P as PO<sub>4</sub> = 25 ml of 0.02 ppm and qs to 50 ml with nanopure water then transfer to a 100 ml flask, cap opening with parafilm, and shake vigorously.

MDL Standard Preparation:  
(0.04 ppm P) = 40 ml of 0.1 ppm P solution and qs to 100 ml with nanopure.

Ammonium Persulfate: Dissolve 20 g ammonium persulfate in 30-40 ml nanopure water and qs to 50 ml with nanopure. Make fresh daily.

5 N Sulfuric Acid solution (MCAWW reagent 7.1): Dilute 70 ml concentrated  $H_2SO_4$  to 500 ml with nanopure water. Store up to 3 months at room temperature in glass bottle.

Antimony Potassium Tartrate solution (MCAWW reagent 7.2): Dissolve 0.2743 g  $K(SbO)C_4H_4O_6 \cdot 1/2 H_2O$  in 80 ml nanopure water in a 100 mL volumetric flask. Dilute to volume. Refrigerate up to 3 months at 4°C in a dark glass stoppered bottle.

Ammonium Molybdate solution (MCAWW reagent 7.3): Dissolve 12 g  $(NH_4)_6MO_7 \cdot 24 \cdot 4H_2O$  in 300 mL nanopure water. Refrigerate up to 3 months at 4°C in a plastic bottle.

0.1 M Ascorbic Acid solution (MCAWW reagent 7.4): Dissolve 0.88 g ascorbic acid in 50 mL nanopure water. Store at 4°C. Make fresh daily.

Combined Reagent (MCAWW reagent 7.5): Add the following room temperature solutions in order, dissolving completely between additions:

- (1) 50 mL Sulfuric Acid solution (7.1),
- (2) 5 mL Antimony Potassium Tartrate solution (7.2),
- (3) 15 mL Ammonium Molybdate solution, and
- (4) 30 mL 0.1M Ascorbic Acid solution (7.4).

To subtract background readings from turbid samples, combine 50 ml sulfuric acid solution (7.1), 15 ml ammonium molybdate (7.3), and 35 ml nanopure water. Measure the optical density of this solution on the spectrophotometer and subtract this value from reading of turbid sample.

11 N Sulfuric acid solution (MCAWW reagent 7.6): Add 62 mL concentrated  $H_2SO_4$  to 100 mL nanopure. Cool and dilute to 200 mL. Store up to 3 months at room temperature in glass bottle.

### Spectrophotometer Preparation:

Turn on the LKB Model 4050 spectrophotometer and allow it to warm up for a minimum of 15 min prior to reading a sample. The instrument must successfully perform the eight step wavelength calibration sequence before any work can be initiated (see SOP #342 for additional operating instructions). Set the spectrophotometer wavelength at 880 nm. Fill 10 cm cuvette with nanopure water and soak-use fresh cotton swab to clean.

### Quality Assurance

Quality assurance samples will be composed of blanks (a minimum of 5% of the total number of samples to be assayed as nanopure water plus reagent) and 10% will be duplicates and spiked unknowns (unknown with a known addition of a standard concentration). The concentration of the duplicates and spiked samples will be unknown to the analyst and the quality assurance sample concentrations will fall within the range of concentrations used to develop the standard curve.

Procedure for Total Phosphorus Determination

(1) Digestion (1st Batch): Remove unknown samples from the refrigerator, inverting three times to mix, and transfer 50.0 mL samples to 125 Erlenmeyer flasks. Digest standards using a 50 mL volume of the 0 (blank) and 50 ml volumes of 0.01, 0.02, 0.04, 0.10 and 0.25 ppm solutions. Add 1.0 mL of 11 N H<sub>2</sub>SO<sub>4</sub>, then add 1.0 ml ammonium persulfate and 2-3 boiling chips. Cover flasks with Duraseal and arrange in Pelton Crane autoclave. The autoclave will hold 25 sample flasks, one flask containing 50 ml nanopure with a Diack temperature monitor (121°C), and the maximum thermometer. Fill autoclave with deionized water, turn autoclave to "sterilize", and set a timer for 25 minutes. After reaching 121°C (15-20 psi), set timer for 30 minutes and autoclave samples. Then vent for 5 minutes and turn off for 20 minutes. Open door slowly over 5 minutes, remove flasks, and cool in water. Add nanopure water to digested sample and bring volume up to 50.0 mL. Repeat procedure with spiked samples.

Digestion (Additional Batches): Follow protocol as described for 1st batch except set timer for 20 minutes to bring autoclave up to temperature.

Note that settling pond samples should be diluted 1:20 for digestion, then 1:10 to 1:20 after adjusting pH (total dilution=1:200 to 1:400).

- (2) pH adjustment: Measure 30 ml into 30 ml sample cup (all samples) and pH as indicated below. Check pH of unknown and spiked unknown digested samples. Adjust pH between 6.8 and 7.2 with NaOH (10N, 5N, and 1N), countering with H<sub>2</sub>SO<sub>4</sub> (5N) if pH exceeds 7.2. Record pH and drops of acid or base added (1 drop = 0.05 mL) to determine dilution factor.\*\* Aliquot 15 ml of each unknown and QA samples into another 30 ml cup.
- (3) Set all sample cups in tray with a wet paper towel under cups. Put tray on Thermolyne Roto Mix and agitate by voltage control knob on regulator E1010V. Set speed so fluid swirls in sample cups. Add 2.4 mL of Combined Reagent to each and mix (automatic stir plate) for at least 10 min. The Eppendorf repetitive pipetter fitted with a 12.5 ml Eppendorf Combipip, set at 5, and squirted twice into each sample provides 2.4 ml of combined reagent. Fill the 10 cm cuvette with a sample, place it in the LKB spectrophotometer, and record the optical density. Rinse cuvettes with nanopure water prior to use and between samples.
- (4) Enter the absorbances of the standard concentrations into the Sharp calculator (statistics program) to produce a standard curve and linear regression equation. (Refer to the owners manual of the calculator and the current total phosphorus notebook for operation details.) Using this regression equation, determine the total phosphorus concentration to nearest 0.001 mg/L in blind, spike, and unknown samples. If a sample concentration exceeds that of the highest standard, the sample must be diluted and remeasured. Record all results (including spectrophotometric readings, dilution factors, etc.) in black ink in the appropriate lab notebook. Check all calculations at least once. Record results on client report form and check all transcriptions at least once.

\*\*Dilution Factor =  $\frac{(\text{unknown total volume} + \text{volume added to pH})}{(\text{Std total volume} + \text{volume added to pH})}$

Example:  $\frac{(25 \text{ mL} + 1.30 \text{ mL})}{(25 \text{ mL} + 1.05 \text{ mL})} = \frac{26.30}{26.05} = 1.01$

Prepared by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Approved by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Effective Date: \_\_\_\_\_  
 Revision: \_\_\_\_\_



## RANGEN AQUACULTURE RESEARCH & HATCHERY SERVICE CENTER

### SOP #502.2/2 - Ammonia-Nitrogen Assay (mV-Ion Specific Electrode Method)

#### SCOPE AND PURPOSE

The Ammonia-Nitrogen Assay SOP outlines the procedures for sampling and determination of ammonia-nitrogen in ground and surface fresh water samples. The procedures described below for operation of the Jenco pH meter model 671P and Orion model 95-12 or VWR model 34105-120 ammonia electrodes are to be used in conjunction with the Jenco and Orion owners manuals for those instruments (see SOP #328.3 and #329.1, respectively, for additional operating instructions-the Orion instructions apply to the VWR electrode as well). The useable range for this method is 0.03-1400 mg/L NH<sub>3</sub>-N.

Reference: Distillation: Method 350.2 (Storet No. 00610) IN: U. S. Environmental Protection Agency (EPA), Methods for Chemical Analysis of Water and Wastes (MCAWW)1983 , pp 350.2-1 through 350.2-5.

Distillation: Method 4500-NH<sub>3</sub> B IN: Standard Methods for the Examination of Water and Wastewater. (SMEWW) 1995. Andrew D. Eaton, Chair, Joint Editorial Board, prepared and published by the American Public Health Association, American Water Works Association, and Water Environment Federation. 19th ed., pp. 4-76, 4-77.

Potentiometric, Ion Selective Electrode: Method 350.3 (Storet No. 00610) IN: MCAWW, pp. 350.3-1 through 350.3-2.

SOP #106/2 - Laboratory Activity Quality Assurance/Quality Control.

PPE Required: EYE PROTECTION. see SOP #108 for additional safety recommendations.

#### AMMONIA-NITROGEN ASSAY (Distillation/ISE METHOD)

##### Sampling Procedure:

Collect a 500-1000 mL water sample in a clean polyethylene plastic bottle and either run the assay immediately or preserve the sample with 2 mL concentrated sulfuric acid/L and store up to 28 days at 4°C.

Reagents: Use products listed or equivalent. For traceability, record chemical code numbers in appropriate lab notebook.

Distilled Water: Western Family Distilled Water-Freshly opened 1 gallon jug (no more than 48 h since opening).

Borate Buffer (MCAWW Reagent 6.7): Combine 0.44 ml 10N NaOH, =300 ml distilled water, and 4.75 g sodium borate (Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>•10H<sub>2</sub>O). Bring to 500 ml volume with distilled water.

Boiling Chips: Chemware Teflon PTFE Boiling Stones, Norton Performance Plastics, 26397-103

0.1N NaOH: Add 0.44 ml 10N NaOH to distilled water for a 44 ml volume.

1N NaOH: Add 10 ml 10N NaOH to distilled water for a 100 ml volume. (pH adjuster)

Boric Acid Solution 2% (20g/L) (MCAWW Reagent 6.4): Dissolve 20 g H<sub>3</sub>BO<sub>3</sub> (Mallinckrodt 2549) in distilled water and dilute to 1 L in distilled water.

0.1N HCL: Add 5 ml 1N HCL to distilled water for a 50 ml volume.

1N HCL: Add 8.25 ml concentrated HCL to distilled water and qs with distilled water to 100 ml. (pH adjuster)

ISA: Ammonia-adjusting solution, Orion 951211.

Concentrated Sulfuric acid (H<sub>2</sub>SO<sub>4</sub>): Analytical reagent grade only to be used, ie. J.T. Baker 9681-05.

Standard Preparation: Prepare a series of standard concentrations by serially diluting a freshly opened 100 ppm Hach NH<sub>3</sub>-N voluette ampule (equivalent to Hach 21284-10) with distilled water. Suggested standard concentrations to create the standard curve for ground and surface water samples are 0.1, 0.25, 0.5, 1.0, and 2.0 ppm NH<sub>3</sub>-N.

Prepare fresh for each standard curve.

0.5 ppm NH<sub>3</sub>-N = 5.0 ml of 100 ppm and QS to 1000 ml with distilled water

0.25 ppm NH<sub>3</sub>-N = 500 ml of 0.5 ppm and QS to 1000 ml with distilled water

0.1 ppm NH<sub>3</sub>-N = 400 ml of 0.25 ppm and QS to 1000 ml with distilled water

0.05 ppm NH<sub>3</sub>-N = 500 ml of 0.1 ppm and QS to 1000 ml with distilled water

0.025 ppm NH<sub>3</sub>-N = 500 ml of 0.05 ppm and QS to 1000 ml with distilled water

MDL Standard Preparation:

0.075 ppm NH<sub>3</sub>-N = 7.5 ml of 0.10 ppm (distilled) and QS to 10 ml with Western Family distilled water.

Quality Assurance:

Quality assurance samples will be composed of blanks (a minimum of 5% of the total number of samples to be assayed as distilled water plus reagent) and 10% will be duplicates and spiked unknowns (unknown with a known addition of a standard concentration). The concentration of the duplicates and spiked samples will be unknown to the analyst and the quality assurance sample concentrations will fall within the range of concentrations used to develop the standard curve.

pH Meter Preparation:

(1) Calibrate pH meter with pH electrode and two buffers (pH 7 and pH 10) according to manufacturer instructions (see appendix A): Connect ammonia electrode by locking BNC connector of cable into pH meter. Place the sample container on a stir plate set at low speed keeping stir speed constant throughout entire procedure.

Ammonia Measurement:

The overall procedure involves four steps: (a) preparing electrode the night before analyses are run, (b) preparing standard solutions (adjust pH, add ISA) and calibrating meter on day of assay, (c) preparing blank, blind, unknown, and spiked unknown samples, and (d) measuring ammonia in all samples (adjust pH, add ISA, and record measurement).

Distillation-Steam Out (Day 1):

1. Connect cooling water hose to tubing of distillers and turn water on to allow the stream to reach the back side of the condenser.
2. Steam out residual NH<sub>3</sub> from distillers by combining 500 ml distilled water, 20 ml borate buffer, 5 drops 10N NaOH (pH must be ≥ 9.5) and boiling chips, connect to the distiller with a small amount of silicone at the joint to ensure a complete seal, and check all other connections for proper sealing.
3. Distill ≈150 ml of the solution keeping tips of condenser outlets above distillate during steam out. Turn off burners, allow to cool (about 30 min), and put tips of condenser outlets under surface of distillate. Leave system connected and water running.
4. Connect the main electrical cord of the unimantles to a timer set to come on at approximately 6:00 AM the next morning.

Distillation (Day 2):

1. At 7:30 AM the distilling flasks operating unattended should still have some solution left, at which time the analyst should be present to pull tips of condenser outlets out of the distillate and check remaining operations. Approximately 150 ml are collected (total of 300 ml distilled during steamout).
2. Add 1.25 ml 0.04N 0.04N H<sub>2</sub>SO<sub>4</sub> to plastic cup, put condenser outlet tip into acid, and collect ≈30 ml distillate from each distiller.
3. Check mV reading on: Nanopure water, Western Family Distilled Water, and the 30 ml distillate from each of distillers A, B, C, D, E. The mv readings should be ≥ 190.
4. Combine 200 ml sample with 10 ml borate buffer, pH to 9.5 with NaOH (1N for standards and 10N for unknowns) and record pH and drops of base added (1 drop = 0.05 mL) to determine dilution factor.\*\*
5. Submerge tip of condenser outlet into 50 ml of boric acid.
6. Distill 75 ml then pull condenser tip out of distillate and distill another 25 ml to clean tip between samples (must distill ≥40% of sample to ensure all NH<sub>3</sub>-N has been distilled over).
7. After distilling a total of ≈100 ml measure and record volume of unknowns. Add 1.25 ml 1N HCL to all unknowns and standards, dilute standards to highest standard distillate volume, and refrigerate all immediately.
8. Cover condenser inlets after cooling with parafilm to prevent contamination during nonuse.
9. Prepare the inner body of the ammonia electrode by soaking in filling solution (Orion 95-12-02 or Hach 44472-26) overnight before use.

\*\*Dilution Factor =  $\frac{(\text{unknown total volume} + \text{volume added to pH})}{(\text{std total volume} + \text{volume added to pH})}$

Example:  $\frac{(25 \text{ mL} + 1.30 \text{ mL})}{(25 \text{ mL} + 1.05 \text{ mL})} = \frac{26.30}{26.05} = 1.01 = \text{dilution factor}$

NH<sub>3</sub>-N Measurement (Day 3):

1. Pull all samples and standards from refrigerator to warm up to room temperature.

Electrode Preparation:

1. Replace the membrane (if necessary) on the outer body of the electrode and finger tighten the end cap securely. To ensure proper operation, there must be no wrinkles in the membrane.

2. Add approximately 2.5 mL of filling solution to the outer body and screw the outer body onto the threaded end of the cable. Shake the electrode like a thermometer to remove bubbles through the access hole of the electrode. Gently pulling the cable at the end of the electrode can also dislodge bubbles and circulate the filling solution inside to provide better performance.

pH Meter Preparation:

1. Calibrate pH meter with pH electrode and two buffers (pH 7 and pH 10.01) according to manufacturer instructions (see appendix A). Connect ammonia electrode by locking BNC connector of cable into pH meter. Place the sample container on a stir plate set at low speed keeping stir speed constant throughout entire procedure.
2. Perform electrode slope check according to manufacturer instructions. The slope should be 54-60.

3. Measure and record millivolts (mV) of 0.1 ppm nondistilled standard four times or until a stable mV reading is obtained.

4. Measure and record mV of 0 ppm nondistilled nanopure water (once).

5. Measure and record mV of 0 ppm Western Family Distilled Water (once).

6. Measure and record mV of 0 ppm RARC-distilled standard (once).

7. Measure and record mV of 0.025-0.5 ppm distilled standards (once each) by combining 10 ml standard and 0.2 ml ISA. Rinse the electrode, stirrer, and beaker with distilled water between samples.

8. Recheck with 1 distilled standard (0.1 ppm) for accuracy then measure the 0.075 ppm standard mV for minimum detectable level (MDL) determination.

9. If the standard recheck is off by  $\geq 15\%$ , remeasure standards.

10. Measure a blank (ammonia-free distilled water) and record.

Assay Procedure

1. Combine a 25 mL of sample with 0.5 mL ISA in a 30 ml plastic cup and position the ammonia electrode/stirrer in the solution so that the membrane is below the surface.
2. In the mV mode, allow the reading to stabilize (reading must be stable for at least one minute) and record in notebook.
3. Rinse the electrode/stirrer between each sample.
4. Enter the mV readings of the standard concentrations into the Sharp calculator (statistics program) to produce a standard curve and linear regression equation. (Refer to the owners manuals of the calculator and the current NH<sub>3</sub>-N notebook for operation details.) Using this regression equation, determine the NH<sub>3</sub>-N concentration to nearest 0.01 mg/L in blind, spike, and unknown samples. If a sample concentration exceeds that of the highest standard, the sample must be diluted and remeasured. Record all results (including mV readings, dilution factors, etc.) in black ink in the appropriate lab notebook. Check all calculations at least once. Record results on client report form and check all transcriptions at least once.

- Notes:
1. Measure up to 10 samples and check again with a known standard. If the reading is not within 15% of the calculated concentration, rerun the standard. If the reading still does not fall within 15% of the expected value, recalibrate with standards as before.
  2. If a sample reading is below the reading of the highest standard (mV reading for 1.0 ppm NH<sub>3</sub>-N), rinse the electrode with 1N HCl, dilute another aliquot of pH-adjusted sample and remeasure. Be sure to include the dilution factor when calculating the final concentration.
  3. For spiked unknown samples, add 3-4 mL of 150 ppm NH<sub>3</sub>-N and record amounts.
  4. Assign superscripts to distiller identification letters in notebook to match with samples and show order of sample distillation. Use this information for troubleshooting individual distillers.
  5. Higher mV reading=lower NH<sub>3</sub>-N concentration.

Prepared by: \_\_\_\_\_ Date: \_\_\_\_\_

Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

Effective Date: \_\_\_\_\_

Revision:



## RANGEN AQUACULTURE RESEARCH & HATCHERY SERVICE CENTER

### SOP #504.1/2 - NITRATE/NITRITE NITROGEN ASSAY

#### SCOPE AND PURPOSE

The nitrate/nitrite nitrogen assay, SOP #504.1/2, describes the procedures for sampling and determination of nitrate/nitrite nitrogen in various ground and surface freshwater samples. The procedures described below for the LKB Model 4050 spectrophotometer are used in conjunction with the owners manual for that instrument. The useable range of this method is 0.01-1.0 mg/L NO<sub>3</sub>/NO<sub>2</sub>-N. The range may be extended with sample dilution.

References: Method 353.3 (Storet No. 00630) IN: U. S. Environmental Protection Agency (EPA), 1983, Methods for Chemical Analysis of Water and Wastes (MCAWW), pp 353.3-1-5.

SOP #106/2 - Laboratory Activity Quality Assurance/Quality Control

SOP #342/0 - LKB Spectrophotometer

PPE Required: EYE PROTECTION. see SOP #108 for additional safety recommendations.

#### NITRATE/NITRATE NITROGEN (CADMIUM REDUCTION METHOD)

##### Sampling Procedure:

Collect a 100-1000 mL water sample in a clean polyethylene or glass bottle and assay as soon as possible. If storage is required hold the sample at 4°C for up to 24 h. If the sample cannot be assayed within 24 h, add 2 mL per liter concentrated sulfuric acid to lower the pH to 2 or less. Samples preserved with acid are stable for 28 days.

Reagents: Use products listed or equivalent. Record reagent codes in appropriate lab notebook.

Nanopure water: Prepared in lab, resistivity at 10-18 megohms-cm.

Granulated cadmium (MCAWW reagent 6.1): 40-60 mesh Hach cat. 25559-25

Copper-Cadmium (MCAWW 6.2):

6.2.1 Wash cadmium with 6N HCL [50 mL concentrated HCL (Mallinckrodt 5587-500\*NY) added to 100 mL nanopure water] (6.10 MCAWW). Color should be silver. Rinse with nanopure.

6.2.2 Swirl 50 g cadmium in 200 mL portions of 2% solution of copper sulfate (MCAWW 6.11) for 5 min or until brown precipitate forms.

6.2.3 Wash copper-cadmium with nanopure (\*about 20 times) to remove all precipitated copper. The color should be black.

Column Preparation (MCAWW 6.3):

Add sufficient copper-cadmium granules to obtain 6.5 cm length (30 g/column). Wash column with 200 mL of dilute ammonium chloride (MCAWW 6.5). Activate column by passing through column 100 mL solution of 25 mL of 1.0 mg/L NO<sub>3</sub>-N standard and 75 mL ammonium chloride-EDTA solution (MCAWW 6.4). Adjust flow rate to 7-10 mL/min. Preserve column by pouring 50 mL dilute ammonium chloride-EDTA (6.5) through column and storing in same solution. Do not allow the column to dry.

\*If all precipitate is not removed, then column efficiency will be reduced.

Ammonium chloride-EDTA solution (MCAWW 6.4): Dissolve 26 g ammonium chloride (Mallinckrodt 3384) and 3.4 g disodium ethylenediamine tetracetate (Baker 4040) in 1800 mL nanopure. Adjust pH to 8.5 with concentrated ammonium hydroxide (Mallinckrodt 6665) and dilute to 2 L. Save 100 mL for activation. Prepare two 2 L volumes for 35 samples including standards and QA samples. Dilute ammonium chloride-EDTA solution (MCAWW 6.5): Combine 60 mL of (6.4) solution and 40 mL nanopure. Make 2-100 mL volumes each time it's needed.

Sulfanilamide: Sigma S-9251  
N(1-Naphthyl) Ethylenediamine Dihydrochloride: Mallinckrodt 2796  
Concentrated Phosphoric Acid: Mallinckrodt 2796  
Color reagent (MCAWW 6.6): Dissolve 10 g sulfanilamide (Sigma S-9251) and 1 g mixture of 100 mL concentrated phosphoric acid (Mallinckrodt 2796) and 800 mL of nanopure water and dilute to 1 L with nanopure.

Zinc sulfate solution (MCAWW 6.7): Dissolve 100 g  $ZnSO_4 \cdot 7H_2O$  (Mallinckrodt 8880) in nanopure water and dilute to 1 L.  
Sodium hydroxide solution (MCAWW 6.8): Dissolve 240 g NaOH (Mallinckrodt 7708) in 500 mL nanopure, cool and dilute to 1 L.  
Ammonium hydroxide, concentrated (MCAWW 6.9).  
Dilute hydrochloric acid, 6N (MCAWW 6.10): Dilute 50 mL of concentrated HCl to 100 mL with nanopure.

Copper sulfate solution, 2% (MCAWW 6.11): Dissolve 20 g  $CuSO_4 \cdot 5H_2O$  (Hach 127-01) in 500 mL nanopure and dilute to 1 L.  
Sodium Nitrite (1000 ppm): Environmental Resource Associates 053  
Standard Preparation: Prepare a series of standard concentrations by serially diluting freshly opened 250 ppm Hach  $NO_3$  vial ampule (Hach 25577-10) with nanopure water in volumetric flasks and mixing thoroughly. Prepare fresh for each standard curve. Suggested standard curve concentrations for ground and surface water samples are 0 (blank), 0.025, 0.05, 0.10, 0.25, and 0.50 ppm  $NO_3$ . A 0.05 ppm  $NO_2-N$  standard is also prepared with  $NaNO_2$  to compare to a reduced nitrate standard at the same concentration to verify efficiency of the reduction column.

1.0 ppm  $NO_3/NO_2-N$  = 2.0 mL of 250 ppm and qs to 500 mL with nanopure  
0.50 ppm  $NO_3/NO_2-N$  = 50 mL of 1.0 ppm and qs to 100 mL with nanopure  
0.25 ppm  $NO_3/NO_2-N$  = 50 mL of 0.5 ppm and qs to 100 mL with nanopure  
0.10 ppm  $NO_3/NO_2-N$  = 20 mL of 0.50 ppm and qs to 100 mL with nanopure  
0.05 ppm  $NO_3/NO_2-N$  = 50 mL of 0.10 ppm and qs to 100 mL with nanopure  
0.025 ppm  $NO_3/NO_2-N$  = 25 mL of 0.10 ppm and qs to 100 mL with nanopure

#### MDL Standard Preparation

0.05 ppm  $NO_3/NO_2-N$  = 10 mL of 0.5 ppm  $NO_3/NO_2-N$  and qs to 100 mL with nanopure

0.05 ppm Nitrite nitrogen standard preparation with sodium nitrite stock  
1.0 ppm = 1.0 mL of 1000 ppm  $NaNO_2$  stock and qs to 1000 mL with nanopure  
0.05 ppm = 50 mL of 1.0 ppm and qs to 100 mL

Spectrophotometer Preparation:

Turn on LKB Model 4050 spectrophotometer and allow to warm up for a minimum of 15 min prior to reading a sample. The instrument must successfully perform the eight step wavelength calibration sequence before any work can be initiated (see SOP #342 for additional operating instructions). Set the spectrophotometer wavelength at 540 nm. Clean cuvette with nanopure and cotton swab.

Quality Assurance

Quality assurance samples will be composed of blanks (a minimum of 5% of the total number of samples to be assayed as nanopure water plus reagent) and 10% will be duplicates and spiked unknowns (unknown with a known addition of a standard concentration). The concentration of the duplicates and spiked samples will be unknown to the analyst and the quality assurance sample concentrations will fall within the range of concentrations used to develop the standard curve.

Nitrate/Nitrite-Nitrogen Determination:

- ( 1 ) Remove unknown samples from the refrigerator and invert three times to mix. Measure 25 ml and place in plastic cup. [If turbid, filter sample through 0.45 um membrane . Alternatively, add 1 mL zinc sulfate solution (6.7) to 100 mL of sample and mix. Add 0.4-0.5 mL sodium hydroxide solution (6.8) to pH 10.5. Let stand several minutes to allow flocculant to settle then decant and filter supernatant.]
- ( 2 ) Adjust sample pH to 7-9 using HCL or NH<sub>4</sub>OH. This ensures proper pH at step 4.
- ( 3 ) Prepare and wash copper-cadmium (6.2) and activate column (6.3).
- ( 4 ) Combine 25 mL of standards and unknowns and 75 mL of ammonium chloride EDTA solution (6.4) in a 100 mL graduated cylinder, cover with parafilm, and invert 5 times.
- ( 5 ) Pour sample into column and collect at a rate of 7-10 mL/min.
- ( 6 ) Discard first 25 mL then collect 25-30 mL. The remaining steps in 6 must be done immediately after collection. Pipet 10 mL\* of column-run standards into 30 mL plastic cups. Place 9 ml nanopure water and 1 mL sample in 30 mL plastic cup. Add 0.4 mL color reagent and record time on cup. Set sample cups on tray, with a wet paper towel under cups to prevent slipping. Put tray on Thermolyne Roto Mix and agitate by voltage control knob on regulator (1010 V). Set speed to swirl fluid in cups. Visually check unknown reactions against highest standard concentration. If color of unknown is more intense than highest standard, dilute backup and add color reagent in proportions described above. Note: Backup solution must be used within 15 minutes of running through column.
- ( 7 ) After all standards, QA, and unknowns are run through a column, run a blank through the same column used for the QA spike and a 0.50 ppm standard for the other column.
- ( 8 ) After column work is completed, wash columns with diluted ammonium chloride-EDTA (6.5), dismantle, and store cadmium chips in ammonium chloride-EDTA (6.5).

\*Other volumes may be used, provided the proportion of sample to reagent remains the same.

(9) Measure the optical density (OD) as soon as possible after 10 min but within 2 h at 540 nm on the spectrophotometer. Save remaining samples (record time) in case a rerun or dilution is necessary (use within 15 min). For best results, measure OD within 30 min to avoid cloudiness developing in the sample. If cloudiness does occur, perform step 1 on the remaining sample.

(10) Enter the absorbances of the standard concentrations into the Sharp calculator (statistics program) to produce a standard curve and linear regression equation. (Refer to the owners manuals of the calculator and the current nitrate/nitrite nitrogen notebook for operation details.) Using this regression equation, determine the nitrate/nitrite nitrogen concentration to nearest 0.001 mg/L in blind, spike, and unknown samples. If a sample concentration exceeds that of the highest standard, the sample must be diluted and remeasured. Record all results (including spectrophotometric readings, dilution factors\*\*, etc.) in black ink in the appropriate lab notebook. Check all calculations at least once. Record results on client report form and check all transcriptions at least once.

\*\*Dilution Factor = (unknown total volume + volume added to pH) / (std total volume + volume added to pH)

Example: 
$$\frac{(25 \text{ mL} + 1.30 \text{ mL})}{(25 \text{ mL} + 1.05 \text{ mL})} = \frac{26.30}{26.05} = 1.01 = \text{dilution factor}$$

Note: To pH dropwise, 1 drop = 0.05 ml

Prepared by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Approved by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Effective Date: \_\_\_\_\_  
 Revision: \_\_\_\_\_

# CERTIFICATE OF ATTENDANCE

THIS CERTIFIES THAT

Jeremy Timpey

ATTENDED THE UNIVERSITY OF IDAHO EXTENSION WORKSHOP  
ON THE EPA REGION 10 AQUACULTURE NPDES PERMIT, INCLUDING QA/QC AND BMP PLAN IMPLEMENTATION

HAGERMAN FISH CULTURE EXPERIMENT STATION  
NOVEMBER 27, 2007

[Signature]

SIGNATURE

DATE

11-27-07

# CERTIFICATE OF ATTENDANCE

THIS CERTIFIES THAT

Bryan Kenworthy

ATTENDED THE UNIVERSITY OF IDAHO EXTENSION WORKSHOP  
ON THE EPA REGION 10 AQUACULTURE NPDES PERMIT, INCLUDING QA/QC AND BMP PLAN IMPLEMENTATION

HAGERMAN FISH CULTURE EXPERIMENT STATION  
NOVEMBER 27, 2007

E. M. Hill Extension Educator 11-27-07

SIGNATURE

DATE

# CERTIFICATE OF ATTENDANCE

THIS CERTIFIES THAT

Nathaniel J Wiese

ATTENDED THE UNIVERSITY OF IDAHO EXTENSION WORKSHOP  
ON THE EPA REGION 10 AQUACULTURE NPDES PERMIT, INCLUDING QA/QC AND BMP PLAN IMPLEMENTATION

HAGERMAN FISH CULTURE EXPERIMENT STATION  
NOVEMBER 27, 2007

*E. A. Hill*

SIGNATURE

DATE

Extension Educator 11-27-07