Red Fleet Rapid Response Plan
Draft

Guidance for containing and controlling Aquatic Invasive Species (AIS) within the Red Fleet and Steinaker Complex

March 11, 2009

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Background

Quagga (*Dreissena bugensis)* and zebra mussels (*Dreissena polymorpha)* are not native to North America; they first found their way to the Great Lakes area in the ballasts of transoceanic ships during the mid 1980s. Since their introduction, they have spread widely across midwest and eastern states, creating a wake of destruction everywhere they invade.

Quagga mussels and their close relative zebra mussels (both *Dreissenid spp*.) have cost billions of dollars in damages by clogging water pipes, degrading water quality, and competing with fish populations. Western states have observed all of this from a distance hoping that somehow these troublesome mussels would never reach western waters. Unfortunately, in January of 2007, quagga mussels were found in Lake Mead and shortly after they were found in reservoirs of the lower Colorado River, including Lakes Mohave and Havasu. Dreissenid mussels have also been detected in various waters in Colorado, (Lake Pueblo, Lake Granby, Shadow Mountain, Jumbo Reservoir also known as Julesburg Reservoir, and Tarryall Reservoir) Lake Pleasant Arizona, and San Justo California.

Taking a proactive approach the Utah Division of Wildlife Resources (UDWR) and its partners worked diligently to keep quagga and zebra mussels out of Utah during the 2008 boating season. During the 2008 boating season, Utah's Aquatic Invasive Species (AIS) program interdicted 71,317 pre-launch boaters at 38-43 high use waters, which resulted in 818 professional decontaminations using 140 degree F water. Survey of nearly 8,000 boaters showed that 89% are aware of the *Dreissenid* mussel threat to Utah and that they need to decontaminate.

In 2008 UDWR began sampling water bodies throughout the state. The sampling allowed the DWR to detect *Dreissenid* mussel presence prior to finding any adult populations (early detection monitoring). Of the thirty-two waters sampled in 2008, two waters have come back as “infested” or “detected”. Five other waters throughout the state of Utah have come back “inclusive”. (Appendix A)

This Rapid Response plan has been created by a group of individuals with vested interests in Red Fleet State Park, Steinaker State Park and their influent/effluent structures.

Decontamination protocol

If a boater completes the do-it-yourself decontamination they are deemed clean and free to launch (see below). If they have been in an infested water body more recently than the recommended drying time, and have not self decontaminated, then the law requires them to have their boat professionally cleaned. This is why the UDWR technician’s man boat ramps asking people where they have been boating in the last 30 days. If a boater is found

to be in need of a professional decontamination UDWR can do that for them at the lake (free of charge) and then allow them to launch.

Do-it-Yourself Decontamination: Boat owners must clean and drain their boat and equipment as they leave a water body, then dry it for an appropriate amount of time between boating trips at home.
· Clean mud, plants, animals or other debris from boat or equipment;
· Drain the ballast tanks, bilge, livewells, and motor;
· Dry boat and equipment for 7 days summer, 18 days spring or fall, or freeze the boat and equipment in winter for 3 days;

OR

Professional Decontamination: Utah Division of Wildlife Resources' staff, including authorized volunteers, Utah Peace Officers, which includes Conservation Officers and state Park Rangers, and Utah Department of Transportation Port of Entry Agents, under authority of the Utah Aquatic Invasive Species Interdiction Act, and other properly trained persons, will decontaminate boats and equipment infested with AIS as per established protocols. (Wash the trailer and boat inside and out, including flush ballast tanks, bilge, livewells and motor with high pressure, 140 degree scalding water).

Early detection monitoring

Early-detection monitoring was a large part of Utah's AIS program effort.
After sampling water in lakes and reservoirs statewide, the UDWR sent 54 samples to an independent lab for microscopic analysis. Initially 32 water bodies were samples, some of the 54 samples sent to the lab were duplicate samples taken from water bodies and sent to the lab at different times. Preliminary test results indicated several waters might contain microscopic veligers, which are the early-life stages of zebra and quagga mussels.

UDWR's current protocol for determining an infested water requires three steps:

1. Visual observation of the mussel, which can include cross-polarized light microscopy for veligers; followed by positive findings via tissue analysis through two independent PCR methods.
2. UDWR uses the Wood/Kelly ribozomal DNA method, assessing the ITS I region.
3. The DeLeon/Rochell mitochrondrial DNA method, assessing the COX I region.

Once a visual observation of a Dreissenid mussel occurs, including microscopic, or a single PCR indication of a positive finding occurs, or both, the water body is held in the "inconclusive, needing more testing" classification until verification by the above

protocol. If results from observation and PCR analysis remain negative for an entire second field season, the water can be considered for release from the "inconclusive, needing more testing" classification. A final process for release from that classification is still being formulated through discussion with other states and Dreissenid mussel experts.

UDWR management protocol for waters classified as "infested" or "inconclusive, needing more testing" will be to interdict all departing boats and make sure that education and decontamination occurs. We will continue to interdict arriving boats and provide an educational message and inspect those watercraft, but a focus on departing boats is important so Dreissenids are not spread. Waters defined as “inconclusive, needing more testing” are also referred to as watch waters, meaning that microscopic young have been identified under a microscope but have not been confirmed by two independent DNA tests. (See Appendix A for state wide sampling results)

December, 08 2008 the Utah Wildlife Board acted to list Electric Lake, situated in Emery County, Utah about 22 miles west of Huntington City at the headwaters of the Right Fork of the Huntington River as the State's first water infested with Dreissenid mussels. Zebra mussels have been confirmed via observation of veligers by cross-polarized microscopy followed by molecular PCR analysis using two independent methods, of which one assesses nuclear DNA and the other assesses mitochondrial DNA.

Most recently, UDWR's contracted lab has now confirmed via two independent PCR tests that the veligers earlier viewed under the microscope at Red Fleet Reservoir are quagga mussels. UDWR will soon present this information to the Utah Wildlife Board for a formal change to Rule R657-60 to include Red Fleet Reservoir in Uintah County as a Dreissenid infested water body.

In 2008, the Utah legislature unanimously passed the state rule R657-60-1. The purpose of this rule is to define procedures and regulations designed to prevent and control the spread of aquatic invasive species within the State of Utah. R657-60-1 bestows a legal responsibility on the boat owner stating that “A person shall not place any equipment or conveyance that has been in an infested water in the previous 30 days into any other water body or water supply system in the state without first decontaminating the equipment or conveyance”.

The Utah Aquatic Invasive Species Act, codified as Chapter 27 of Section 23 in the Utah Code and Rule R657-60 provides authority to Utah Division of Wildlife Resources in the event of infestation by a *Dreissena* species in part as follows:

1. To close ingress and/or egress at a water body, facility or water supply system to terrestrial or aquatic vehicles and equipment capable of moving *Dreissena* species for protection of Utah from their spread; and
2. To maintain the closure until an acceptable plan for containment and/or control of the *Dreissena* species is developed and implemented by the water body operator.

Forming a Response Team/ Scoping

In accordance with state rule R657-60-8 a plan which has been given the term "rapid response plan" must be implemented in order to control and contain the quagga mussel infestation at Red Fleet State Park. It was decided early in the process that Red Fleet State Park and Steinaker State Park would be grouped together and the response plan will cover both drainages. Steinaker State Park does not have a direct connection with Red Fleet, however, water from Red Fleet can be pumped, indirectly and enter Steinaker via Ashley Creek. Raw Water from Red Fleet is released into the Brush Creek Drainage and enters the Green River approximately two miles above the Jensen Bridge.

A scoping process conducted by the UDWR identified numerous partners that would have a vested interest in participating in the development of a rapid response plan. Appendix B is a list of the agencies and individuals that were invited to participate in the first meeting held on February 9, 2009.

With help from the Uintah Water Conservancy District (UWCD), Utah Division of Wildlife was able to select individuals with vested interests in Red Fleet and Steinaker State Parks. The first meeting of the Red Fleet Rapid Response Team meeting was held at the Uintah Water Conservancy District office on February 9, 2009. For future reference a list of individuals present at the first meeting is included in Appendix B.

At the first meeting all relevant background information was presented on the AIS program and the findings at Red Fleet State Park. One of the major tasks of this first meeting was to identify a sub team that would be the actual group of writers. It was agreed that this sub team would represent the larger group and once a draft was completed the plan would be submitted to the whole group for a review and comment period. The process of writing a draft, submitting it for review, and incorporating any needed changes will be completed as many times as necessary until the sub team comes to a consensus on the completion of the plan. The individuals that where selected to represent their agency or industry are listed below. For the rest of the plan the sub team will be referred to as the Red Fleet Rapid Response Team. It was also decided the plan needs to be finished by the end of March, 2009 in order to hit the ground running before the ice comes off our lakes and reservoirs.

Red Fleet Response Team

1. Scott Ruppe	Uintah Water Conservancy District (UWCD)
2. Larris Hunting	Ashley Creek Irrigation
3. Mike Murray	State Parks and Recreation
4. W. Russ Findlay	Reclamation
5. Brad Grammer	Central Utah Water Conservancy District (CUWCD)
6. Monica Hoyt	Central Utah Water Conservancy District (CUWCD)
7. Devin Mckee	Uintah Water Conservancy District (UWCD)
8. Reed Oberndorfer	CUWCD
9. John Hunting	UWCD
10. Mark Fuller	USFWS

Under state rule the UDWR is given the responsibility for leading the collaborative effort of writing the rapid response plan. Natalie Muth, Aquatic invasive Species Biologist will represent the team leader.

At the first meeting of the Red Fleet response team all members were asked to convey concerns. From our discussion the following list was created by the team.

Concerns Identified by the Red Fleet response team:

1. Drinking Water Source Protection **
2. Irrigation
3. Dam operations/ System operations
4. Monitoring protocol/ duration and intensity
5. Control and containment
6. Water rights and existing contracts
7. Fish and aquatic resources
8. Water Quality
9. Funding
10. Closure of waters
11. Availability of technical resources
12. Research
13. Pumping Plants Fire fighting operations (potential vector of spread)
14. Construction, oil & gas trucks (potential vector of spread)
15. Dust abatement (potential vector of spread)
16. Float tubes, small watercraft (potential vector of spread)
17. Law enforcement
18. Communications
19. Containment of water used by decontamination unit

** Source Water Protection Plan is in place for Red Fleet State Park

Many of the concerns can be grouped under more general categories. The eight categories below show how all the concerns generated by the team can be combined and will be addressed in this plan.

Combined categories:

1. Containment (fire fighting, construction water trucks, dust abatement water trucks, float tubes, small watercraft, closure of waters, involvement of law enforcement)

2. Affected systems & Resources, (drinking water protection, irrigation, dam operation, system operations, pumping plants, pipeline delivery systems, water quality, economy, fish and aquatic resources, water rights and existing contracts)

3. Control

4. Funding

5. Research

6. Monitoring Protocol

7. Communications

8. Availability of technical resources

A document created by Larry Dalton (Utah's AIS program coordinator) was created to act as a guideline for the development of a rapid response plan. The Red Fleet rapid response plan will be created by following the guidelines set up in the fore mentioned document while incorporating the specific concerns identified by the response group.

The following protocols, which are objectives of the rapid response strategy, outline a reasonable response process; they were adapted in-part from Idaho's 2007 Aquatic Nuisance Species Plan and modified to suit Utah's needs and purposes.

Protocols for Rapid Response Strategy

• Immediately verify a reported AIS detection
• Upon verification for the presence of an AIS, immediately notify relevant local natural resource managers, pulling their technical personnel together as a "response team," and notify Utah's AIS Task Force
• The response team must immediately begin surveys to define the extent of an AIS infestation
• As the extent of infestation is being determined, set-up an appropriate command structure to guide continuing response team activities for determining and implementing containment and/or control methods for the AIS infestation
• Establish internal and external communication systems
• Organize available resources (personnel, equipment, funds, etc.), including compliance with laws and permitting requirements
• Prevent further spread using quarantine and pathway management
• Apply available, relevant and legally defendable eradication, control and/or containment actions and implement mitigation
• Institute long-term monitoring
• Evaluate response effectiveness, modify the Rapid Response Strategy as needed, and pursue long-term funding for AIS management

<u>Rapid Response Objective 1</u>: Immediately verify a reported AIS detection.

When AIS are suspected within the Red Fleet/ Steinaker complex the first point of contact will be Natalie Muth of the Utah Division of Wildlife. The second point of contact if Natalie Muth is unavailable will be Scott Ruppe of the Uintah Water Conservancy District. The UDWR (Natalie Muth) in cooperation with the Red Fleet

response team will ensure that the three tasks descried below are accomplished in a timely manner. (Appendix C, contacts list for Red Fleet Team)

Note: In regards to *Dreissena* mussels, this strategy is required by law (R657-60-4).

Task 1: Immediately interview the reporter(s), which may be anyone from the public, or a microscopy lab, and/or a lab that conducts deoxyribonucleic acid polymerase chain reaction tests (PCR) on plankton or tissue samples received from a Utah Aquatic Invasive Species Task Force partner agency, to begin validation of the alleged AIS detection.

• A microscopy report from a lab, based upon morphological or histological characters of a suspect specimen living in nature, is considered as preliminary for the presence of *Dreissena*. Such a report must only be provided to Utah Division of Wildlife Resources' AIS Coordinator.

• Following a microscopy report, Utah Division of Wildlife Resources' AIS Coordinator will request that the microscopy lab forward a portion of the original sample for two different and independent molecular deoxyribonucleic acid polymerase chain reaction tests (PCR) for confirmatory assessment regarding the presence of *Dreissena*. Again, reports for findings from PCR labs must only be provided to Utah Division of Wildlife Resources' AIS Coordinator.

Note: Security regarding any lab report results from a need to control release of the information, minimizing speculation by the media, public and others about environmental or economic impacts, and eventual containment and control methods prior to full assessment of the finding. Additionally, action by the Utah Wildlife Board is required in order to list any water in Rule R657-60-2(2)(g) as infested with a *Dreissena* species.

• Record details of the AIS find location, such as GPS delineation, name of the water body or stream length number, prominent landmarks, highway mile marker, or other information about where the suspect species was found.

• Collect pertinent contact information for the reporter(s)--name, address, telephone (home, work and cellular), and email.

• Secure an estimate of the number of individuals or colonies, density and extent (e.g. acreage or linear miles of stream) for infestation of the species found.

• Document the date and time of sighting(s).

• Note other relevant site conditions (access limitations, etc.)

Task 2: When Utah Division of Wildlife Resources' AIS Coordinator first receives notification from either a microscopy lab or a PCR lab regarding a *Dreissena* finding, the AIS Coordinator will immediately contact the Director's office at Utah Division of Wildlife Resources' and the Fishery Chief. This group will immediately meet to make a decision about release of the information to appropriate partners (water body operators and the Utah AIS Task Force). Any release of information by the AIS Coordinator to partner groups must consider need and value for a coordinated release of information to the media. And, media advisories will be orchestrated and coordinated amongst the water body operators and the Utah AIS Task Force by Utah Division of Wildlife Resources' Outreach Chief.

Task 3: Validate AIS identification as soon as possible via a physical sample as follows:

• Obtain a digital or other photograph (with scale indicator), if possible.
• Secure and preserve dead samples of the species, if possible, for confirmation.
• Arrange an immediate site visit, when feasible, by a team of recognized experts.
• If recognized experts cannot feasibly reach the site within 24 hours, arrange to ship samples and other evidence (e.g., photographs) via Express Mail Service. In the case of photographs, use a digital camera or scan (digitize) 35 mm or printed photos and email them to the experts.

Note: Prior to shipping samples, obtain guidance from recognized experts, seeking existing protocols regarding handling of the sample (e.g. desired quantity, where and how to collect and deliver the sample, preservatives, refrigeration, etc.).

Rapid Response Objective 2: Upon verification for the presence of an AIS, and with concurrence of Utah Division of Wildlife Resources' Director, immediately notify relevant natural resource managers (local natural resource managers, Utah's AIS Task Force, and AIS Coordinators in adjoining states), pulling appropriate technical personnel together as a "response team."

The UDWR (Natalie Muth) accepts responsibility for handling the initial report for the presence of an AIS within the Red Fleet/Steinaker State Parks and upon verification for the presence of an AIS, UDWR will immediately ensure that all parties having local jurisdiction and interest in response decisions or having technical support capabilities are quickly engaged as a "response team". The Red Fleet response team will act as the local experts to coordinate response activities.

Note[1]: The Red Fleet response team is comprised of technical personnel from Utah Division of Wildlife Resources (AIS biologist); water body operator interests (local irrigation company's water master, water conservancy district and/or Reclamation); local land management authority (private owners) and Utah State Parks & Recreation

Note[2]: In the case of an interdiction where rapid response by a professionally trained responder results in complete destruction of the AIS (e.g. apprehension for unlawful transport of a live AIS); and when possible, a successful decontamination of the introduction vector (e.g. boat or equipment) ensues, file pertinent reports notifying the response team and the Utah AIS Task Force. No further coordination is needed.

Note[3]: Routine day-to-day operations for interdictions of boaters at water bodies and resultant decontaminations do not require notification of the "response team," although summary reports for seasonal activity must be prepared, filed and shared with the team and Utah's AIS Task Force.

Task 1: Within the first 24 hours or as soon as practical after a physical sample is visually confirmed to be an AIS by a recognized expert, notify Utah Division of Wildlife Resources (Natalie Muth) (in the case of a *Dreissena* species this notification is required by Rule R657-60-4); notify and pull together the Red Fleet response team; involve other relevant natural resource managers and interested

publics to participate as determined by the team; advise Utah's AIS Task Force of the determination and planned future action.
Note: A local notification list will be maintained by Utah Division of Wildlife Resources (Natalie Muth) and be updated at least twice annually. Utah Division of Wildlife Resources' AIS coordinator in Salt Lake City will be notified about any AIS finds; they will immediately notify the Utah AIS Task Force.

Task 2: Within the first 24 hours or as soon as practical inform any other interested parties (e.g. elected officials; organized, local recreational user groups; media via the Outreach Section as determined necessary by Utah Division of Wildlife Resources Director; etc.).
Task 3: Make verification of notifications to confirm that parties on the contact list, did in fact, receive notification (e.g., use Internet list server response confirmation or phone call-backs).

Rapid Response Objective 3: The response team must immediately begin surveys to define the extent of an AIS infestation

The Red Fleet response team will initiate a combined monitoring effort in 2009. The purpose of the surveys is to define the extent of the AIS infestation at Red Fleet State Park and all other threatened water bodies within the drainage. Evidence indicates that the infestation of Red Fleet occurred quite recently or perhaps the population in the lake has been present for some time but is limited by environmental conditions (only microscopic veligers have been detected, no adults). Red Fleets elevation and diverse climate allows the lake temperatures to drop below the ideal reproduction temperatures of 55ºF. Freezing of the lake allow vectors of spread (boats) to be eliminated in the winter months. Quagga mussels are more reziliant then their cousins the zebra mussels. Quagga's have been discovered in depths of over 400 ft. However, it is important to note that ever since both zebra and quagga mussels invaded the U.S. they have shown an incredible ability to adapt to new environmental conditions. For this reason, we should assume that given enough time, the mussel population in Red Fleet will grow exponentially and cause economic and environmental damage.

Determining the extent of colonization of *Dressinid* mussels at Red Fleet will be given due precedence in our rapid response strategy to guide subsequent management decisions regarding containment and/or control. Natalie Muth of UDWR will act as monitoring coordinator for the Red Fleet response team.

Starting in the spring of 2009 the Red Fleet response team will begin surveys to determine the geographic extent and population demographics of Quagga mussels in Red Fleet including influent and effluent structures of the lake, connected water bodies, and nearby water bodies having potential vulnerability to spread will be surveyed. The monitoring protocol for the Red Fleet/Steinaker drainage is set up to be multilayered and all available resources will be pooled together to make a very concerted effort.

UDWR will ensure that surveys are completed as soon as possible and that results are reported to the entire response team, other interested parties, and the Utah AIS Task Force.

Monitoring Strategy

The monitoring process for each life stage is different. Adults are recognizable by their dark, zebra-like rays; very young quagga and zebra mussels, though barely visible, feel grainy to the touch. The veligers (planktonic larval stage) are visible only under a microscope. The process necessary to detect the planktonic larval (veliger) stage requires the most specialized procedures. Veligers must be collected using a 64 micron plankton net. A dissecting microscope with a crosspolarized light system is necessary to detect larval quagga mussels.

Since predicting which type of sampling will produce the first evidence of quagga mussels is impossible, a combination of plankton sampling, placement of substrate samplers (Figure 1) and regular examination of surfaces for settled adults will be used at Red Fleet and all other watch waters. These inspections will be made at least every two weeks, or more frequently at our watch waters or if we suspect water or equipment from a contaminated source may have entered the water body.

The following groups were given the assignment to develop a monitoring protocol that would be implemented in 2009.

1. State Parks (Red Fleet and Steinaker State Parks)
2. Irrigation companies
3. BOR
4. Uintah Water Conservancy District (UWCD)
5. UDWR
6. Central Utah Water Conservancy District (CUWCD)
7. USFWS

Monitoring Protocol

1. **Monitoring protocol for State Parks will be reviewed. The lead for both Red Fleet and Steinaker State Parks will be Mike Murray.**

RAPID PESPONSE PLAN OF ACTION for Red Fleet and Steinaker State Parks

OBJECTIVE: Monitor Red Fleet and Steinaker reservoirs for Quagga/Zebra mussel presence and submit a report as required.

STRATEGY:

1) Learn to identify mussels-this will require a mandatory in-house training program at all three parks for park staff including summer seasonals. All staff will be

required to watch the training video "Don't Move A Mussel" and learn to identify Quagga/Zebra mussels.

2) The park will identify critical control points on the reservoirs and will inspect these sites once a week. These CCP's will include:
   - Docks.
   - State boats (moored during the summer on the water).
   - Concrete structures that are accessible.
   - Buoys.
   - As water recedes, shoreline areas, rocks, and other attachable structures will be checked for presence and absence.
3) Inspection form will be created for weekly monitoring.
4) Reports submitted as required.

2. Irrigation companies: Monitoring

a. Visual inspection of pipes, canals, and structures with in the system.
b. Conduct on a monthly basis (revisions will be made if adult populations are verified in Red Fleet)
c. Report any suspicious finding to AIS biologists or Scott Ruppe upon discovery**.**

3. BOR (BOR is working on future funding to help with monitoring and possible personnel)

4. Uintah Water Conservancy District

a. UWCD employees have been asked to conduct visual inspections of equipment and facilities belonging to UWCD.
b. Conduct inspection on a Bi-monthly basis at Red Fleet and monthly inspection at Steinaker.
c. Report any findings to AIS biologist (Natalie Muth) or Scott Ruppe upon discovery**.**

5. Central Utah Water Conservancy District

a. Help DWR biologist with veliger sampling when possible.
b. Use of the CUWCD microscope and lab in Vernal
c. Bio-Box visual inspection Bi-monthly (keep records of finding**)**

6. US Fish and Wildlife Service

a. Provide assistance in monitoring and decontaminations
b. Help identify funding sources for AIS monitoring and sampling

7. UDWR

Plankton Sampling Protocols

a. Infested waters will be sampled every two weeks.
b. Watch waters will be sampled every two weeks.
c. All other waters that were sampled in 2008 will be sampled one time in 2009.
(Exclusion: Big Sand Wash, Calder, Crouse, Matt Werner were all paid for by regional DWR funds no longer available for 2009)

Specific sampling protocol for Red Fleet and watch waters are still being developed (number of sample sites, volume of water to filter, etc.)

The number of waters sampled in 2009 can be increased if alternate funding sources are made available to the UDWR. Agencies or companies that are interested in monitoring water bodies to protect their interests may set up a MOU with the UDWR to schedule additional sampling efforts

Note[1] :

1. Preserve with 25% ethanol (be prepared to up the preservation to 70%) if instructed;
2. Keep ½ of alloquat at region
3. Infested waters—send ½ of alloquat to Pisces Molecular for PCR;
4. Watch waters—send ½ of alloquate to BOR microcospy lab (positive finds will be forwared to Pisces for PCR);
5. All Other waters—send ½ of alloquate to BOR microcospy lab (positive finds will be forwared to Pisces for PCR);

Note[2]: Peak spawn occurs between 15-17 degrees Celsius and waters will not be sampled until temperatures reach 15 degrees.

<u>Rapid Response Objective 4</u>: As the extent of infestation is being determined, set-up an appropriate command structure to guide continuing response team activities for determining and implementing containment and/or control methods for the AIS infestation.

As the extent of AIS infestation is investigated, supervisory leadership for the response team members will immediately meet, making assignment amongst their staffs for a continuing response and commitments for other needed resources.

The Incident Command System (ICS) is a management protocol originally designed for emergency management agencies and later federalized. ICS is based upon a flexible, scalable response organization providing a common framework within which people can work together effectively. These people may be drawn from multiple agencies that do not routinely work together, and ICS is designed to give standard response and operation procedures to reduce the problems and potential for miscommunication on such incidents.

Efforts to contain and/or control AIS within the Red Fleet/Steinaker Complex will follow the framework of ICS to facilitate command and decision-making processes. Concurrence amongst the supervision for the response team members must be achieved about how to proceed in order to expedite conduct of work, avoid duplication of effort, facilitate public outreach and information sharing between agencies, minimize authority conflicts, while preserving flexibility for adaptive management.

Note[1]: On February 17, the Red Fleet response team agreed that Natalie Muth will be the incident command leader. This appointment is in regards to the conformation of quagga mussel veligers by PCR in Red Fleet. In the event of a future discovery of AIS the Red Fleet response team will meet and decide to either keep the command structure or appoint a new incident commander.

Note[2]: Where multiple agencies have shared jurisdiction over a water body (e.g. Bureau of Reclamation water management operations and State Parks), a unified command structure with co-lead incident commanders may be used.

Note[3]: Likely an incident commander will originate from a state or federal natural resource management agency having jurisdiction over the infested water and surrounding recreation area. An incident commander should currently hold a leadership position allowing for the necessary time commitment and experience to lead a multi-agency response team.

Note[4]: The incident commander will be the voice to represent the response team, and will direct and coordinate development and implementation of a rapid response to contain and/or control an AIS infestation.

Note[5]: In the event there is no initial consensus on the incident command role, this role will default to the UDWR statewide AIS Coordinator and/or the appropriate U.S. Fish and Wildlife Service Regional AIS Coordinator until the relevant water body/recreation area operation authorities achieve concurrence on incident command.

Key concepts listed below were taken from ICS and will be applied to the command structure of the Red Fleet response team.

- Each individual participating in the Red Fleet response team will report to only one supervisor (incident commander) this eliminates the potential for individuals to receive conflicting orders from a variety of supervisors, thus increasing accountability, improving the flow of information, and helping with the coordination of response efforts.
- The Red Fleet response team will be based on a "first-on-scene" structure, where the first responder of a scene has charge of the scene until the incident has been declared resolved, or the incident commander arrives and assumes control.
- When different organizations are required to work together, the use of common terminology is an essential element in team cohesion and communications, both internally and with other organizations responding to the incident. The glossary of terms (Appendix F) will help bring consistency to position titles, the description of biological terms, and a host of other subjects.

<u>Rapid Response Objective 5</u>: Establish internal and external communication systems.

Strategy: In the event of new AIS findings within the Red Fleet/Steinaker complex the Incident Commander and the response team will develop an information dissemination process to ensure consistent and effective communication to interested internal and external stakeholders, including the media and public.

<u>Task 1</u>: Notify and educate affected landowners, and where appropriate, gain their written permission to access property for response team activities.

Task 2: Notify and educate potentially affected water users and water-rights holders.
Task 3: Develop a public information strategy, press packets, press release processes, and press conferences.
Task 4: Develop and implement general public education and outreach.

Note [1]: (In the process of developing signs and securing funding for 2-3 signs at Red Fleet to advise boaters and water uses of the infestation)

Note[2]: Regarding tasks 3 & 4, assistance from a professional outreach staff member from one of the response team agency's should be sought, since they have expertise and previously established liaison with local and statewide media resources and personalities.

Rapid Response Objective 6: Organize available resources (personnel, equipment, funds, etc.), including compliance with laws and permitting requirements.

Strategy: The Incident Commander and the response team must identify and secure sufficient resources to affect AIS eradication, control and/or containment actions, including recognition for need to comply with a broad array of local, state and federal laws and permitting processes.

Task 1: Develop estimates and identify potential sources for the response team's needs regarding staff, facilities, equipment and funds.
Task 2: Secure commitment from the response team's home agencies and others for needed staff, facilities, equipment and funds

Note[1]: Funding for 2009 has been established:
BOR funding is pending (future funding will become available)
Central Utah Water Conservancy District will contribute 12,500 in Fy09 and 12,500 in Fy2010 to the ongoing containment of *Dreissena* mussels at Red Fleet. Uintah Water Conservancy will contribute $12,500 in Fy09 to containment of *Dreissena* mussels at Red Fleet. USFWS funding pending (proposal in to Denver office)

Note [2]: Red Fleet State Park falls under the Source Water Protection Plan. Source water impacts such as cattle getting into the reservoir may help with funding of fences and gates around the park.

Task 3: Ensure mechanism for dispersal of funds is in place, and when the funds are needed, that the flow of dollars occurs expeditiously, including inventory control for acquired equipment

Note [1]: MOU will be set up between Uintah Water and UDWR

Task 4: Arrange for the response team to be briefed about the array of local, state and federal laws that pertain to the activities in which they may engage to achieve AIS eradication, control and/or containment (e.g. National Environmental Policy

Act considerations regarding need for environmental statements, assessments and prior approved actions recognized as categorical exclusions, including need for associated mitigation; Endangered Species Act consultations and compliance; etc.).

Task 5: Arrange for the response team to be briefed about the array of local, state and federal permits that may be needed to conduct the activities in which they may engage to achieve AIS eradication, control and/or containment (e.g. pesticide applicator permit; National Pollutant Discharge Elimination System permits administered by the Environmental Protection Agency and the Utah Department of Environmental Quality; etc.).

• Consider any applicable emergency provisions associated with permits (e.g. Federal Insecticide, Fungicide and Rodenticide Act, Federal Crisis Exemption--40 C.F.R. PART 166--can be secured if the known or accepted methods of eradication are not currently permitted);

• Keep in mind that state and national permits under some programs already exist (e.g. state stream alteration permits administered by Utah Division of Water Rights, section 404 Clean Water Act dredge and fill permits administered by the Army Corps of Engineers; etc.) and

• Assess modifying existing agency permits for needed purposes as opposed to securing a new permit

Task 6: If reasonable and necessary, pursue declarations of emergency by elected officials.

Rapid Response Objective 7: Prevent Further Spread Using Quarantine and Pathway Management.

Strategy: The Incident Commander and the response team in coordination with agencies having regulatory authority must minimize all vectors and pathways that might further spread the original infestation.

Task 1: Evaluate risks for dispersal vectors and pathways for further spreading the AIS, including movement by human activity, construction, water-haul and recreational equipment, movement by fish and wildlife, movement via water flow, and other physical processes.

Likely vectors of further spread

Float tubes, canoes, and other small water that jump to water bodies all over the region have been identified as a major vector for further spread. For this reason, increased efforts will be made to target and educate small water craft users as well as traditional boaters. One method that will be encouraged for cleaning float tubes is to use 409 cleaner which can be purchased at most grocery stores. The active chemical in 409 cleaner is quaternary ammonium compounds, which have been

shown to be 100 percent effective in killing AIS such as whirling disease and New Zealand mud snails. Spraying a float tube down with 409 cleaner or a diluted bleach solution would be an effective way for individuals to decontaminate their tubes (0.6 liquid oz Clorox per gallon water). These measures are precautionary and are not a replacement for following the drying recommendations outlined in the self decontamination protocol. Individuals that launch watercraft on a mussel infested water body must either fully self decontaminate or have a professional decontamination. Efforts will be made to have a technician and a decontamination unit available at Red Fleet to wash departing boats during times of peak activity. When resources are not available for a professional decontamination, boaters are required to comply with the self decontamination procedures or contact the UDWR to schedule a hot power wash before they launch their watercraft at another water body.

Water tucks associated with the oil and gas industry or those used in fire fighting operations have been identified as a potential vector of spread. Government agencies are encouraged to take note of the protocol established for disinfecting equipment such as helicopter draft buckets or water tanks that have came in contact with raw water. Appendix E is a document implemented by the U.S. Forest Service that is to be used as a guide for cleaning water hauling equipment to prevent the spread of invasive species. This protocol would also be appropriate for disinfecting other vectors identified by the groups. The Red Fleet Rapid Response group will monitor our partners were applicable, to ensure that this protocol is implemented when applicable.

The natural flow of water from Red Fleet into Brush Creek may eventually lead to the infestation of the Green River. However, at this time it is unknown if veligers will survive the journey to the Green River or survive in the turbid environment that the Green River produces. Increased monitoring this summer (2009) will help answer that question. The Value of Red Fleet as a drinking water source, irrigation source and as a popular State Park makes this resercior a prime location for mussels to cause large scale economic damage. Steinaker State Park is located close to Red Fleet and is a concern to the farmers, ranchers and water users in the Vernal area. Steinaker did not show any signs of veligers when tested in 2008.

Efforts are currently being made to increase the staffing and coverage of Steinaker State park, Pelican Lake, Starvation and other lakes in the Northeastern Region of Utah.

Task 2: Restrict dispersal vectors and pathways, where feasible, including the following or similar measures that are suitable for individual species:
• Under authority of Rule R657-60-8, consider closure of infested water bodies, facilities, or water supplies, as needed, to prevent spread of *Dreissenid* mussels by human activity, construction, water-haul and recreational equipment, movement by fish and wildlife, movement via water flow, and other physical processes;

Note [1]: Further discussions about the closure or limited use of Red Fleet has been discussed. Rule R657-60-8 makes it mandatory for boaters departing Red Fleet to either self decontaminate or have a professional decontamination. Some have suggested that closing the water would be the sure way to minimize the threat of spread to other water bodies. One alternative to completely closing the lake to boating is to use a controlled access system. Boating on the lake could take place during set hours when a technician and a decontamination unit would be available to clean departing boats. If a controlled access strategy is chosen the UDWR would need partners to help fund technicians. As talked about in Feb 17th meeting restrictions and changes in park hours would have to be approved by all parties involved and a funding source would need to be identified.

• Assess the likely movement patterns of boats that recently used the infested water body to identify risk and inspection needs at other water bodies;
• Establish inspection requirements and decontamination protocols for boats and equipment, and provide decontamination opportunity;
• Ensure that AIS "alert" signs are adequately deployed;
• Develop and implement Hazard Analysis and Critical Control Point plans to ensure that private and local, state, tribal or federal government response personnel do not further spread the original infestation;
• If possible, stop or slow water releases to potentially non-infested sites;
Note: Consider making water draws from below the thermocline; and
• Install physical barriers, if possible, to affect AIS movement (e.g. migration barriers to fish populations that harbor whirling disease, keeping them out of non-infested areas)

Note [1]: Uintah Water Conservancy district will work with CUWCD to limit pumping of water through out the system to Flushing in the spring and Draining in the fall. The idea is to limit the spread of veligers down the system and prevent the introduction of veligers via pipeline into Steinaker State Park.

Rapid Response Objective 8: Apply available, relevant and legally defendable eradication, control and/or containment actions and implement mitigation.

Strategy: The Incident Commander and the response team must evaluate management options for eradication, control and/or containment of the AIS, and then proceed, including implementation of suitable mitigation.

Task 1: Decide whether eradication, control and/or containment is possible based on rapid analysis of population dynamics, extent of distribution and analysis of vectors and pathways for AIS spread and available management options. Consider the following:
• Anticipated cost of eradication effort and follow-up monitoring relative to available funding;

Note [1]: The cost of treating water bodies with KCL has been estimated using information from small scale Kcl treatments and the current price of the product.
Note [2]: Chemical treatments have not been proven to be 100% effective in mussel removal. Kill rates will very

****Note [3]:** Red Fleet is a drinking water source for the Vernal area. All treatments will follow drinking water and source water standards.

Note 4: Reflected below is cost for chemicals only. The larger cost of a treatment like this is the loss of stored water for the system and all of its components. This cost has not yet been figured, it

Red Fleet Example
UWCD indicated that they could bring Red Fleet Reservoir to a conservation pool level of 4,000 AF. Dead pool level is 300 AF

Calculations using a rate of 100mg/liter of water and a cost of .44/pound (KCL):
Conservation pool costs below
1 Acre Feet = 1,233,000 liters
1,233,000 liters * 100 mg = 123,300,000 mg/ Acre feet
123,300,000 mg = 271.829 pounds
271.829 pounds * 4,000 = 1,083,316 pounds
1,083,316 * .44 = **$478,419**

Dead pool costs
1 Acre Feet = 1,233,000 liters
1,233,000 liters * 100 mg = 123,300,000 mg/ Acre feet
123,300,000 mg = 271.829 pounds
271.829 pounds * 300= 81548.7 pounds
81548.7 pounds * .44 = **$35,881.43**

Or $119.6 per Acre Foot

Above estimates are for the price for the KCL alone and does not include the large effort that would be needed to get the salt into the water and monitor its effects.

Treatment with traditional fisheries chemicals.

RotenoneTM (15 mg/L for 24 hours) or chelated copper (2 mg/L for 48 hours) have been shown to kill zebra mussels when applied for other control purposes in infested ponds. These compounds are not, however, labeled specifically for zebra mussel control in aquaculture settings.

Red Fleet Example (Rotenone treatment cost estimate, 15 mg/liter, $2.17/pound) @ conservation pool
1 Acre Feet = 1,233,000 liters
1,233,000 liters * 15 mg = 18,495,000 mg/ Acre feet
18,495,000 mg = 40.77 pounds
40.77 pounds * 4000 = 163,080 pounds
163,080 pounds * $2.17 = **$353,883.60**

@ Dead Pool
1 Acre Feet = 1,233,000 liters
1,233,000 liters * 15 mg = 18,495,000 mg/ Acre feet
18,495,000 mg = 40.77 pounds
40.77 pounds * 300 = 12,231 pounds
12,231 * $2.17 = $**26,541.27**

$88.4 per Acre Foot

This method kills everything in the water as opposed to KCL which only kills mussels.

Chemical treatment options

There are four chemicals that have been identified as 100% effective in killing zebra and quagga mussels. Drawing down the water to dead storage will decrease that amount of chemical needed to treat the water. Also, drawing down the water in the late fall when night time temperatures approach freezing will effectively kill any mussels around the lake that do not make their way back into water.

Chemical	Application	Effect
Potassium Phosphate (KH2PO4)	160-640ppm (continuous)	100% kill
Potassium Hydroxide (KOH)	>10ppm	100% veliger kill
Potassium Chloride (KCL)	50ppm (48 hours)	100% kill
Copper ions	5ppm (24 hours)	100% kill

Formula

Volume of water to be treated * PPM * Correction factor / strength of the chemical = weight of the chemical

Correction factor if using grams / gallon is 0.00378

Potassium Chloride is preferred to other treatments because the other available chemicals can harm fish. Potassium Chloride has been used in a zebra mussel eradication in the Millbrook Quarry, Virginia. 100 ppm Potassium Chloride was maintained for 48 hours this concentration and duration killed 100% of the mussels in the quarry but did not harm the bass and bluegill which are present in the quarry.

Task 2: Obtain relevant permits and regulatory agency support or concurrence for planned actions facilitating AIS eradication, control and/or containment methods, including agreed upon mitigation.

• Identify the lead contact within each regulatory agency who will facilitate permit approval, staying in touch until the permit or letter of authorization is issued.

Task 3: Implement appropriate eradication, control and/or containment methods using adaptive management approaches as appropriate.

Task 4: Consider funding research and development efforts to find new eradication, control and/or containment methods.

Task 5: Implement agreed upon mitigation.

Rapid Response Objective 9: Institute Long-Term Monitoring.

Strategy: The Incident Commander and the Red Fleet response team must collect and document data from long-term monitoring of the AIS infestation, including the post treatment period.

Task 1: Design and conduct a project-specific and long-term monitoring program to evaluate the status of the AIS infestation. Include the post treatment period as it relates to effectiveness of treatment or non-treatment.

Note: Every monitoring project will be uniquely different in terms of AIS, location and sampling periodicity, although methodologies for biological monitoring of aquatic populations and aquatic habitats are relatively standardized.

• Monitoring of the AIS infestation can be carried out in coordination with other field operations, such as monitoring to meet permit or other regulatory compliance resulting from eradication, control and/or containment actions or monitoring for mitigation effectiveness.

Task 2: Disseminate findings through an easily accessible, consolidated, coordinated real-time database and list serve (e.g. 100th Meridian Initiative's website).

Rapid Response Objective 10: Evaluate response effectiveness, modify the Rapid Response Strategy as needed, and pursue long-term funding for AIS management.

Strategy: The Incident Commander and the response team, in order to allow for adaptive management by assuring feedback on the efficacy of response actions and

the effectiveness of the Red Fleet/ Steinaker Response Strategy, can enhance long-term preparedness for responses to other AIS introductions.

Task 1: Conduct a follow-up evaluation by response team organizations and other interest groups to identify opportunities for improving the Rapid Response Strategy. Disseminate "lessons learned" to other interested organizations (e.g. states, national Aquatic Nuisance Species Task Force, 100th Meridian Initiative, Regional Panels and River Basin teams).

Task 2: Revise the Rapid Response Strategy and associated documents/guidelines based on evaluation and long-term monitoring results.

Task 3: As resources allow, develop and implement an assessment that evaluates the associated ecological and economic impacts of the AIS invasion, the effectiveness of management interventions, and negative consequences of management interventions beyond that required by permits.

Task 4: Determine the need for long-term funding for the current AIS management effort, and seek this funding as warranted by meeting with state and federal legislators.

Appendix A.

Located on the website www.utah.wildlife.gov/mussels

Results of Dreissenid mussels sampling in the State of Utah (2008)			
Water	Status	Mussels found	Region
Bear Lake	not detected	none	Northern
Big Sandwash Reservoir	not detected	none	Northeastern
Bottle Hollow Reservoir (Ute Tribe)	not detected	none	Northeastern
Calder Reservoir	not tested	unknown	Northeastern
Colorado River (Moab)	not detected	none	Southeastern
Crouse Reservoir	not tested	unknown	Northeastern
Cutler Reservoir	not tested	unknown	Northern
Deer Creek	not detected	none	Central
East Canyon Reservoir	not tested	unknown	Northern
Echo Reservoir	not tested	unknown	Northern
Electric Lake	infested	Zebra	Southeastern
Fish Lake	not detected	none	Southern
Flaming Gorge	not detected	none	Northeastern
Green River (Ouray bridge)	not detected	none	Northeastern
Gunlock Reservoir	not tested	unknown	Southern
Huntington North Reservoir	inconclusive	more testing required	Southeastern
Hyrum Reservoir	not tested	unknown	Northern
Joes's Valley Reservoir	inconclusive	more testing required	Southeastern
Jordanelle Reservoir	not detected	none	Central
Koosherm	not detected	none	Southern
Lake Powell	inconclusive	more testing required	Southern
Mammoth Reservoir	not detected	none	Southeastern
Mantua Reservoir	not tested	unknown	Northern
Matt Warner Reservoir	not detected	none	Northeastern
Midview Reservoir (Ute Tribe)	inconclusive	more testing required	Northeastern
Millsite Reservoir	not detected	none	Southeastern
Minersville Reservoir	not tested	unknown	Southern
Newton Reservoir	not tested	unknown	Northern
Otter Creek Reservoir	not detected	none	Southern
Panguitch Lake	not detected	none	Southern
Pelican Lake	inconclusive	more testing required	Northeastern
Piute Reservoir	not detected	none	Southern
Pineview Reservoir	not detected	none	Northern
Quail Creek Reservoir	not detected	none	Southern
Recapture Reservoir	not tested	unknown	Southeastern
Red Fleet Reservoir Substrate	infested	Quagga	Northeastern
Rockport Reservoir	not tested	unknown	Northern
Sand Hollow Reservoir	not detected	none	Southern
Scofield Reservoir	not detected	none	Southeastern
Starvation Reservoir	not detected	none	Northeastern
Steinaker Reservoir	not detected	none	Northeastern
Strawberry Reservoir	not detected	none	Central
Utah Lake	not detected	none	Central
Willard Bay	not detected	none	Northern
Yuba Reservoir	not detected	none	Central

Appendix B. Participants Invited to attend Feb. 9th Meeting

Utah Division of Wildlife Resources:
Roger Schneidervin
Garn Birchell
Clay Perschon
Natalie Muth
Torrey Christophersen

Blue Ribbon Fisheries Rep
Jeff Taniguchi

Utah Division of Water Resources:
Bob Leak
Andrew Dutson

Utah State Parks & Recreation:
Mike Murray

U.S. Fish & Wildlife Service:
Mark Fuller

Central Utah Water Conservancy District:
Reed Orbendorpher
Brad Grammer
Monica Reed
Gerard Yates

Uintah Water Conservancy District
Scott Ruppe
John Hinting
Devin Mckee

Bureau of Reclamation:
Russ Findlay

Bonanza Power Plant:
Stan Gordon
Brian Ohler

Ashley Creek water commissioner:
Larris Hunting

Ashley Valley Water
Boyde Workman
Dusty McCormick

NRCS:
Wayne Greenhalgh
Bill Rasmussen

Uintah County Commissioner
Mikael McKee
Boyde Kitchen

NACD:
William Merkley

Other:
Harlan Wilkins

Appendix C. Contact list for Red Fleet

Red Fleet Rapid Response Team Meeting # 1

List of attendants

Representatives for the Red Fleet Steinaker Complex

• Scott Ruppe	435-828-1402	uwcd5@easilink.com
• Mike Murray	435-789-4432	mikemurray@utah.gov
• Larris Hunting	435-781-1650	
• Brad Grammer	435-789-0421	avwtp@easilingk.com
• W. Russ Findlay	801 379-1084	rfindlay@uc.usbr.gov
• Natalie Muth	435-790-8938	nataliemuth@utah.gov
• Reed Oberndorfer	801-226-7160	reed@cuwcd.com
• Mark Fuller	435-789-0366	mark_h_fuller@fws.gov
• Monica Hoyt		
• John Hunting		uwcd3@easilink.com
• Devin Mckee		

Attendance list for Feb 9th 2009 Meeting

• Bill Rasmussen	435-789-1383	uacdbill.rassussem.2@ut.nacdnet.net
• Boyd Workman	435-789-9400	avboyd@easilink.com
• Wayne McAllister	435-789-2100 ext 135	wayne.mcallister@utah.usda.gov
• John B. Hunting	435-790-4696	uwcd3@easilink.com
• William Merkley	435-247-2150	william.merkley@ut.nacdnet.net
• Roger Schneidervin	435-781-5413	rogerschneidervin@utah.gov
• Torrey Christophersen		torreychristophersen@utah.gov
• Andrew Dutson	435-781-5331	andrewdutson@utah.gov
• Garn Birchell	435-781-6718	garnbirchell@utah.gov
• Michael McKee	435-781-5382	mmckee@co.uintah.ut.us
• Boyd Kitchen (Mike McKee's Represenative)		
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• Harlan Wilkins	435-789-7780	bigred@ubtanet.com
• Dusty McCormick	435-790-2745	dusty@sbtnet.com
• Stan Gordon	435-781-5701	sgordon@deseretpower.com
• Brian Ohler	435-781-5748	bohler@desererpower.com
• Clay Perschon	801-538-4809	clayperschon@utah.gov
• Gerard Yates	801-226-7100	gerard@cuwcd

Appendix D. Red Fleet and Surrounding Area Maps

Appendix E.

FINAL
PREVENTING SPREAD OF AQUATIC INVASIVE ORGANISMS COMMON TO THE INTERMOUNTAIN REGION

INTERIM GUIDANCE FOR 2007 FIRE OPERATIONS

The following interim guidelines were developed for fire personnel to help them avoid the spread of aquatic invasive species. The aquatic invasive species considered here were selected based on their current significance in the intermountain area and do not include fish. Because of the large expanses which fire crews travel, the potential to serve as vectors for invasive species is significant. These guidelines are intended for use during the 2007 fire season and will be refined and revised over time.

The table (Aquatic Invasive Species of Concern in the Intermountain Region and Methods of Control) outlines specific disinfection treatments for each species and the sources of information. The table serves as a reference. Included are specific recommendations for fire operations broken down by organism. For additional information, the Appendix provides background and technical information for the recommended chemicals, including supply sources for chemicals and use of swimming pool products. The attached Excel spreadsheet, Technical Chemical Information for Disinfecting Aquatic Invasive Species, gives details and calculates dilutions and relative costs of various products. See the MSDS_all attachment for chemical safety and disposal precautions.

Below are seven guidelines that distill the information in the table and generalize the recommendations to all species:

OPERATIONS GUIDELINES

(1) Obtain maps of where aquatic invasive organisms occur in watersheds where the operation will take place. GIS coverages of individual species for most areas are accessible to biologists, resource advisors, and fire personnel. These GIS coverages are contained in a personal geodatabase ("Invasives Database"—7.2 mb) available for download at http://www.fs.fed.us/r4/workshop/. You can never be certain that invasives are NOT present, but at least you will know ahead of time where they ARE present.

(2) Avoid entering waterbodies or contacting mud and aquatic plants. Avoid transferring water between drainages or between unconnected waters within the same drainage.

(3) Avoid sucking organic and bottom material into water intakes when drafting from streams or ponds.

(4) External equipment surfaces:

(a) Prior to leaving the project site (or, if equipment has been obtained from a source where sanitizing history is unknown), power wash all accessible surfaces with clean water (and ideally, soap, as in a car wash), and completely remove all mud and organics. Weed washers are effective, and can be used to do double duty. This will greatly reduce the likelihood that any target aquatic invasives are present and chemical treatment of external surfaces is not recommended. However, New Zealand mudsnails may insert themselves in small crevices and resist flushing. Unless vehicles are driving through streams or helicopter buckets scrape up bottom sediments, snails are unlikely to get on external surfaces.

(b) Thoroughly drying equipment is an easy and effective sanitizing method for all the organisms. However, required drying times vary considerably with the species (see Table) and may not be practical for a quick turnaround. Drying may be practical, however, after the incident.

(5) Water tenders, engines, and other equipment with internal tanks:

Intake hoses, pumps, and tanks can be contaminated with infected water or through sucking the organisms (in particular, NZ mudsnails) up from the stream/pond bottom. Disinfect tanks after the incident, and also disinfect tanks before use if equipment has an unknown sanitizing history. First, flush tanks and hoses with clean water and drain to an upland location. Flushing will reduce the concentration of organisms and lower the risk of infection. A rinse with 5% solution of Quat128® (6.4 oz per gal) or its equivalent (see Table and Appendix) will destroy most if not all target invasive organisms. The solution must be in contact with the surface being sanitized for at least 10 minutes.
Two types of chemicals are shown in the Table. Both can be effective. Liquid bleach (such as Clorox) is readily available in supermarkets but evaporates quickly and damages gaskets and canvas gear. Quaternary ammonium compounds (brand names Quat 128® [or 'Waxie'] and Sparquat 256®) need to be ordered from a supplier (see Appendix) but solutions are safe for gear and remain effective for at least a day if not overly diluted or muddied. In addition, both bleach and quaternary ammonium compounds are available in bulk as swimming pool chemicals at reduced cost. See Appendix for details.

(6) Cleaning and sanitizing equipment as described above will be necessary before use as well as after use if equipment has been obtained from a source where sanitizing history is unknown. While operational quality control is beyond the scope of this interim guidance, some sort of equipment check-in system where sanitizing could be documented and guaranteed with certification or tagging would be extremely valuable.

(7) Do not dump treated water into any stream or lake, or on areas where it can migrate into any water body. It would be best to offload treated water to sanitary sewers if possible. All of these chemicals can cause permanent eye damage and skin burns. Check the MSDS's for precautions.

AQUATIC INVASIVE SPECIES OF CONCERN IN INTERMOUNTAIN REGION AND METHODS OF CONTROL

	Whirling Disease	New Zealand Mudsnails	Chytrid Fungus	Zebra/Quagga Mussels	Didymo	Eurasian Watermilfoil
Quaternary ammonium compounds (e.g. alkyl dimethyl benzylammonium chloride [ADBAC]; diecyl dimethyl ammonium chloride [DDAC])	For 10-15 minutes: (1500ppm quat compounds) *Quat128*® solution (7.7% quat compounds) **Low Risk** 4.4% *Quat128* •Liquid oz Quat128 per gallon water = 6.1 •Gallons Quat 128 per 100 gallons water = 4.8 **Unknown Level of Risk** 2%*Quat128* •Liquid oz Quat128 per gallon water = 2.4 •Gallons Quat 128 per 100 gallons water = 1.9 OR *Sparquat 256*® solution (12.5% quat compounds) **Low Risk** 3% *Sparquat* •Liquid oz Sparquat256 per gallon water =4.1oz/gal •Gallons Sparquat256 per 100 gallons water = 3.2 **Unknown Level of Risk** 1.2% *Sparquat* •Liquid oz Sparquat256 per gallon water =1.7oz/gal •Gallons Sparquat256 per 100 gallons water = 1.3	For 10 min: 4.6% *Quat128*® solution •Liquid oz Quat128 per gallon water = 6.4 •Gallons Quat 128 per 100 gallons water = 5 OR 3.1 % *Sparquat256* ® solution •Liquid oz Sparquat256 per gallon water = 4.3 •Gallons Sparquat256 per 100 gallons water = 3.4	For 30 sec: .015% *Quat128*® solution •Liquid oz Quat128 per gallon water =0.02 •ml Quat128 per gallon water= 0.6 •tsp Quat128 per gallon water= 1/8 •Cups Quat 128 per 100 gallons water = ⅛ •Tbsp Quat128 per 100 gallons water = 4	No data, but likely effective	No data, but likely effective	NA

RECOMMENDATIONS

Whirling disease	NZ Mudsnails	Chytrid Fungus	Zebra/Quagga Mussels	Didymo	Eurasian Watermilfoil
The principle vector for spread of whirling disease is contaminated fish parts and not typically through fire activities. Avoiding and removal of organics (the spores reside in mud), power washing, and flushing will greatly reduce or eliminate spores on external gear surfaces. However, wet internal tanks and hoses should be decontaminated with a quaternary ammonium compound, such as *Quat128*. 'Low risk' concentrations of quat compounds are backed by research. 'Unknown level of risk' dilutions are likely effective, but not yet proven. While 6.1 oz per gal (low risk) is required for whirling disease, a slightly higher concentration (6.4oz/gal) would also knock out NZ mudsnails.	NZ mudsnails are resistant to treatment, and may insert themselves in small crevices and resist flushing. However, unless vehicles are driving through streams, or buckets scrape bottom sediments, they are unlikely to get snails on external surfaces. Avoiding organics, power washing, flushing, and drying gear in the sun for 48 hours (if possible) will reduce risk. Wet internal tanks and hoses should be decontaminated with a quaternary ammonium compound, such as *Quat128* at a concentration of 6.4oz/gal. This concentration will also kill whirling disease spores and chytrid fungus.	Avoiding organics, power washing, flushing, and letting equipment dry in the sun for 3 hours (if possible) will reduce risk of transfer on external surfaces. However, wet internal tanks and hoses should be decontaminated with a quaternary ammonium compound, such as *Quat128*. While only 1/8 tsp per gal is required for chytrid, a higher concentration (6.4oz/gal) would also knock out whirling disease and /or NZ mudsnails.	Fire activities are unlikely to come into contact with adult mussels. However, it is possible that water used for activities or surfaces of gear may be contaminated with the microscopic veliger stage. Pressure washing and strong flushing of tanks and hoses should be sufficient to injure and remove these organisms.	Didymo is a native diatom that erupts into high densities in special habitats, such as tailwaters below dams. Avoiding contaminated water sources and organics, power washing, and flushing would likely reduce risk of transfer on fire equipment to acceptable levels. For waders, routine protocols for chytrid or whirling disease may apply for this species.	Watermilfoil propagates from broken stems. Avoiding organics, power washing, and flushing to ensure the removal of all plant parts will prevent transport on external and internal gear.

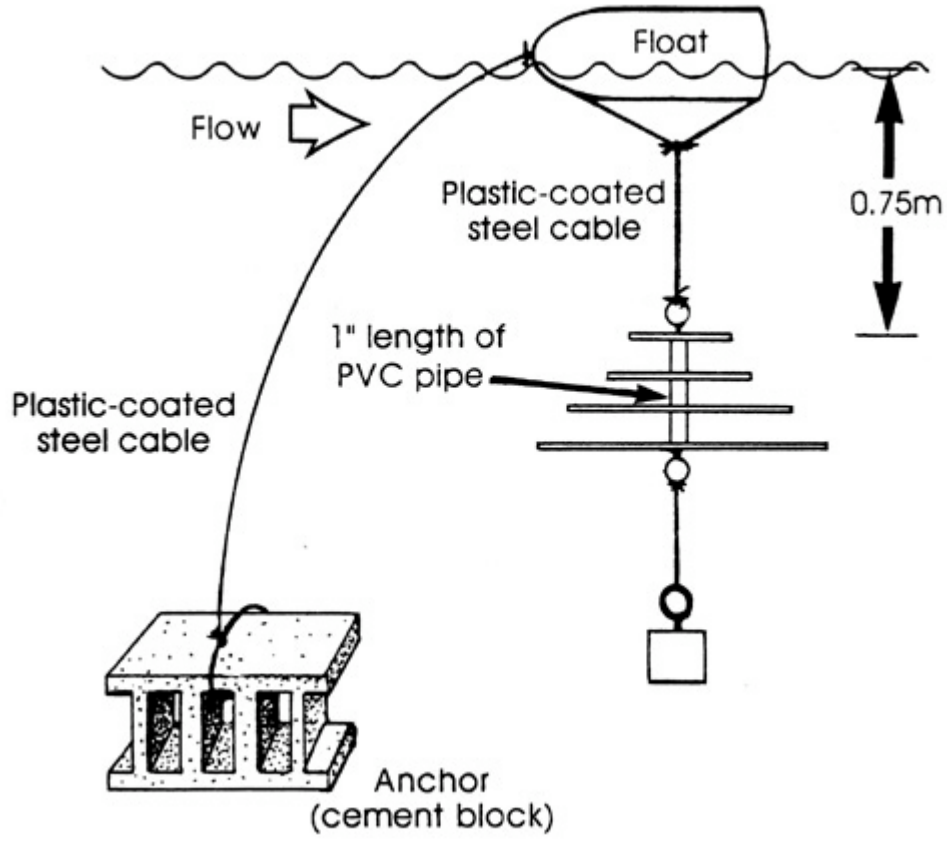

Figure 1. Example of a zebra mussel substrate sampler.

Appendix F: Glossary of Terms

GLOSSARY OF TERMS

Aquatic: Relating to water, including wetlands.

Aquatic Invasive Species (AIS): AIS are defined as water-associated non-native plant and animal species that threaten the diversity or abundance of native species due to their uncontrollable population growth, causing ecological instability of infested waters, or economic damage to commercial, agricultural, aquacultural, or recreational activities dependent on such waters. The term AIS in many documents and laws is referenced as Aquatic Nuisance Species; for purposes of this plan both aquatic invasive species and aquatic nuisance species mean the same thing.

AIS Infested Waters: Waters with an established population of AIS (i.e., having the ability to reproduce). In the instance of *Dreissenid* mussels, infested waters must be declared through Utah Wildlife Board action resulting from a scientific protocol that includes visual observation of the animal, which may include microscopic observation, followed by a positive finding from two independent deoxyribonucleic acid (DNA) polymerase chain reaction (PCR) tests of tissue.

Biocontrol: The use of living or dead organisms, such as predators, parasites, bacteria and other pathogens (disease causing microbes or organisms) to control AIS.

Control: Any efforts by man to eradicate (eliminate), suppress or reduce populations or otherwise manage AIS.

Fouling: Clogging, entanglement or obstruction by AIS of the hulls on watercraft or their operational equipment; and clogging, entanglement or obstruction by AIS of water intake structures, pipes or other water transportation facilities.

Media: Multiple mediums of communication including, but not limited to signs, billboards, brochures, newspapers and other publications, internet, and radio or television broadcasts.

Native Species: Biota (plant or animal species) occurring naturally in a specified geographic area comprising its ecological range.

Non-native Species: Biota (plant or animal species) not natural to a specified geographic area, having been introduced either purposely or unintentionally. Only a select group of non-native species are recognized as AIS, since many others create a quality of life desired by man.

REFERENCES

For electronic copies of most of these documents, see http://www.fs.fed.us/r4/workshop/ **under 'Handouts and Documents'**

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ABOUT THE SOURCES OF INFORMATION USED IN THIS GUIDANCE

The methodologies and decontaminants recommended in this guidance derive from primary data sources, either peer-reviewed and published original studies, research studies that are in press or review, or in some cases, personal communication with researchers from established institutions who are currently working with a particular invasive species. Sources of information for each species are listed in the Methods of Control table (pg 3) and under References. Information was not borrowed or passed on from other protocols without first tracing it to its source of origin and assuring its validity.

USING CHLORINE BLEACH

Important note: Mixing any chlorine-containing compounds (including any form of household bleach or dry form of chlorine) with any ammonia-containing compounds (including fire retardant mixes or residues) can lead to extreme health and safety hazards, including the release of chlorine gas.

Liquid bleaches, such as household bleach, are a 5—8% solution of sodium hypochlorite, a stabilized form of chlorine. Bleaches can be very corrosive to fabrics, plastics, rubber, and metal, and disinfectant properties will dissipate quickly when exposed to air.

Dry bleach products

Many dry forms of chlorine are available that would offer advantages for transport and storage. Products such as DryTec or CCH are granular 68% calcium hypochlorite (Arch Chemicals, Inc., manufacturer of both products, 800-478-5727). Granular calcium hypochlorite (68%) can also be ordered from GSA (NSN No. KE0472). The sanitizing active agent in liquid chlorine bleach is the chlorine (Cl^-) produced when dry bleach is added to water. The accompanying Technical Chemical Information spreadsheet shows how much dry calcium hypochlorite to mix per gallon of water to obtain the desired concentration. The spreadsheet will automatically calculate dilutions if the dry form of chlorine you purchase has a different percentage of hypochlorite (other than 68%). Just type in the percentage hypochlorite in the yellow cell.

Lithium hypochlorite is also available in dry form but provides less than half the available chlorine per volume compared to calcium hypochlorite, and is much more expensive.

Do NOT use any pools chemicals that contain something called “trichlor”, which is very commonly used as a swimming pool chlorinator. It is trichloro-s-triazinetrione, which includes cyanuric acid to extend its photostability. Following the recent retardant-sodium ferrocyanide decisions, a great deal of caution would be advised before recommending any compounds containing any form of cyanide-containing compound, regardless of its expected safety.

Similarly, do not use chemicals containing “dichlor”, or dichloro-s-triazinetrione, another member of the chlorinated iso-cyanurate family that is very commonly used in swimming pools. Caution is advised for the same reason as trichlor.

USING QUATERNARY AMMONIUM COMPOUNDS

Quaternary ammonium compounds, or 'quats', are common disinfectants with an array of uses, from killing algae in swimming pools to sanitizing workout equipment at the gym. They are relatively nontoxic and do not damage fabric, metals, or gaskets. Solutions of quat compounds retain their effectiveness over days and can be reused if not excessively diluted. These compounds exist as a family with various ratios of carbon to nitrogen and chlorine. There are hundreds, but much of research for their effectiveness against aquatic invasive species has focused so far on one of the alkyl dimethyl benzylammonium chlorides, abbreviated as ADBAC, the active ingredient in Formula 409®. Formula 409® was selected to test against whirling disease and New Zealand mudsnails because it was thought to be easy to obtain for anglers, but this household product is not practical for land management use. However, ADBAC, along with other quaternary ammonium compounds, also occurs in Quat 128®, Sparquat 256®, Bioguard Algicide®, and other commercial disinfectants.

Another quaternary ammonium compound, diecyl dimethyl ammonium chloride, or DDAC, was tested against chytrid fungus and found to be effective (see below). DDAC also occurs in Quat 128®, Sparquat 256®, and Bioguard Algicide®.

Whirling disease and quaternary ammonium compounds

The effectiveness of quaternary ammonium compounds against whirling disease spores is based on research (in review) by Ronald Hedrick of University of California—Davis. He tested the active ingredient in Formula 409® (ADBAC), and found it to efficiently kill spores in 10 minutes at a concentration of 1500 ppm. The commercial quaternary ammonium products recommended in this guidance contain ADBAC as well as other quaternary compounds which may be quite good at killing spores but that have not been tested. Hedrick (pers. comm.) assumes that the other compounds would function similarly with respect to damaging the spores and thus provide an additive effect in a mixed formulation such as Quat 128®, but because his testing was limited specifically to ADBAC, there is currently no proof that the other compounds would have the same effects as ADBAC. *Consequently, two concentrations of quaternary ammonium products are given in this guidance for whirling disease.* One ("low risk") is conservative and based only on the amount of ADBAC in the product. The other concentration ("unknown level of risk"), which is less than half the concentration of the first, assumes that all the quaternary ammonium compounds in Quat 128® or Sparquat 256® are equally effective; however, this assumption has not yet been tested.

Chytrid fungus and quaternary ammonium compounds

The quaternary ammonium compound used as the active ingredient against chytrid fungus was a different one than was tested for whirling disease. For chytrid, Johnson et al. (2003) used DDAC. Both DDAC and the compound tested for whirling disease and New Zealand mudsnails, ADBAC, occur together in Quat 128® and Sparquat 256® (Sparquat has some other quat compounds as well). Consequently, the technical information and calculations for chytrid fungus are derived from DDAC and are shown separately on the spreadsheet.

Using swimming pool algicides in place of Quat 128® or Sparquat 256®

Swimming pool chemicals used to kill algae and that have the proper quaternary ammonium compounds as their active ingredients may be substituted for Quat or Sparquat at almost HALF the cost. One example of a pool chemical is BioGuard Algicide28-40®, which is 40% ADBAC, the same active ingredient found in Quat and Sparquat but at a much higher concentration. Dilution formulas for BioGuard Algicide28-40® are calculated for you on the accompanying Excel spreadsheet. If you are looking at other brands of quaternary ammonium products and want to calculate concentrations, type in the % of the active ingredient in the yellow cell under Bioguard, and the spreadsheet will automatically recalculate the dilutions and costs. Bioguard products (BioLab Inc) are available from local pool vendors and are listed at **http://www.bioguard.com/msds.cfm**.

As the concentration of ADBAC increases, so do the occupational health and safety hazards (irreversible eye damage, skin burns, respiratory irritation) and importance of adhering to personal protective equipment requirements when handling the concentrated product. Check the MSDS's.

CHEMICAL SUPPLY SOURCES

Most of the recommended chemicals are available through GSA. See the General Services Administration website, and search with the product's NSN number: https://www.gsaadvantage.gov

Liquid household bleach

Grocery stores, prices and strength vary

Calcium Hypochlorite, Technical—68%

Arch Chemical GSA (NSN No. KE0472) =$112 per 100lbs

Quat 128® (Waxie)

Waxie's Enterprises Inc.GSA (NSN No. 170304) =$36 per case (4 gal)

Sparquat 256®

Spartan Chemical Company GSA (NSN No. 102504) Sparquat 256 = $52 per case (4 gal)

BioGuard Algicide28-40®

Bioguard products (BioLab Inc) are available from local pool vendors and are listed at **http://www.bioguard.com/msds.cfm**

Price quote from Dolphin Pools, Salt Lake City (801-277-8700, Paul) = $5-6 per quart