Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other *Dreissenid* Species

Columbia River Basin Team, 100th Meridian Initiative
September 19, 2011

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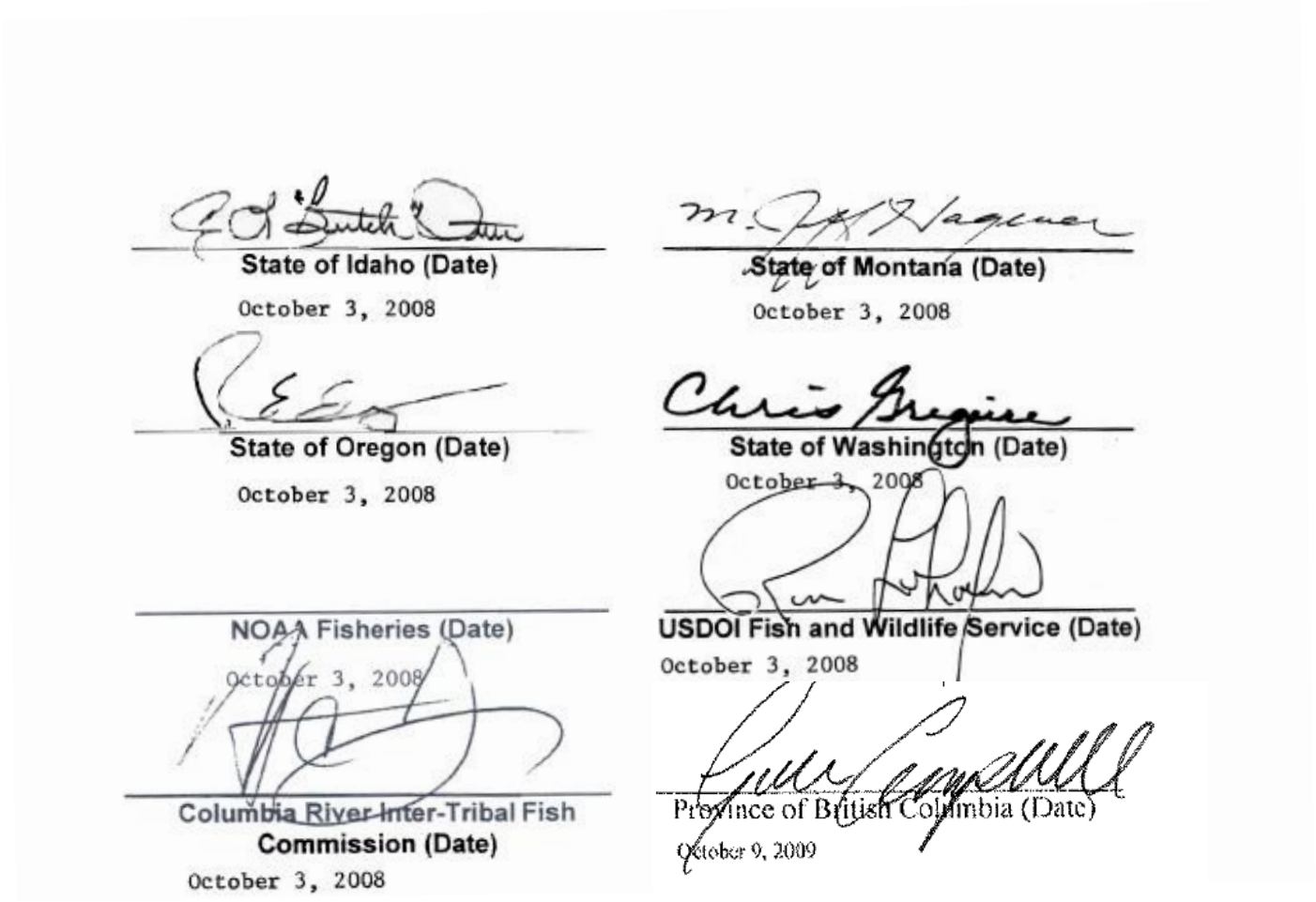
An electronic version of this Plan and information about the100th Meridian Initiative Columbia Basin Team is available at http://100thmeridian.org/ColumbiaRT.asp.

Signature Page



State of Idaho (Date)
October 3, 2008

State of Montana (Date)
October 3, 2008

State of Oregon (Date)
October 3, 2008

State of Washington (Date)
October 3, 2008

NOAA Fisheries (Date)
October 3, 2008

USDOI Fish and Wildlife Service (Date)
October 3, 2008

Columbia River Inter-Tribal Fish Commission (Date)
October 3, 2008

Province of British Columbia (Date)
October 9, 2009

As signatories, the above parties agree to implement this plan as appropriate consistent with each signatory's laws, policies, and authorities in the event that zebra mussels or other dreissenid species are detected in Columbia River Basin waters.

Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other *Dreissenid* Species

PLAN AMENDMENT RECORD

Amendment #	New Amended Date of Plan	Amendment Description	Approval Date
1	September 19, 2011	Updates of Figures 1 and 2, Modification of Rapid Response Objective 10, update of ESA provisions in Appendix E, update of Appendix C contacts	August 25, 2011

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Introduction

The 100th Meridian Initiative is a cooperative effort between state, provincial, and federal agencies to: 1) prevent the spread of zebra mussels and other aquatic nuisance species (ANS) into the western United States and 2) monitor and control zebra mussels and other ANS if detected in these areas (USFWS 2001). Most of the Initiative's activities are centered on monitoring and education. The 100th Meridian Initiative has proven highly effective in enhancing early detection capacities and reducing the risk of introductions. However, if prevention efforts fail, agencies must be prepared to respond rapidly and effectively to reduce impacts. As demonstrated time and again for oil spills, forest fires, and other environmental emergencies, effective interagency response depends on effective contingency planning.

The Columbia River Basin (CRB) Team has been established as part of the 100th Meridian Initiative to address the special needs of the Columbia River Basin. The CRB Team includes state, federal, Tribal, and university ANS managers and researchers. This dreissenid mussel Interagency Response Plan for the Columbia River Basin reflects strategies, models, and activities gleaned from a variety of other contingency plans. In particular, it draws from the *Model Interagency Response Plan* created in 2003 by the Western Regional Panel (WRP) of the ANS Task Force.

It should be noted that while this Interagency Response Plan is dreissenid-specific, the response framework could be applied to other invasive species that pose a threat to the region.

I. Hazard Analysis

The family *Dreissena* consists of three genera of mussels: *Congarea*, *Mytilopsis* and *Dreissena*. Collectively, these are known as dreissenids. *Mytilopsis leucophaeta (*Conrad's false mussel, aka false dark mussel) occasionally shows up on boats entering the Pacific Northwest and represents a threat to brackish waters. However, this Plan is concerned with two members of the genus *Dreissena*; the zebra mussel (*Dreissena polymorpha*) and the quagga mussel (*Dreissena rostriformis bugensis*). Although there are differences in the biology of these two species, they share many similar life history traits and cause similar adverse impacts. Both species have European origins and were introduced to the United States in the 1980's as the result of ballast water discharge. Both zebra and quagga mussels attach to a broad range of surfaces, including pilings, pipes, rock, cement, steel, rope, crayfish, other bivalves, aquatic plants, and each other, forming dense colonies. Zebra and quagga mussels appear to have divergent spatial distributions; zebras being primarily warm, eutrophic, shallow water inhabitants, and quaggas being shallow, warm water to deep, oligotrophic, cold-water inhabitants (MacIsaac 1994). While this Plan includes some references specific to zebra mussels (reflecting a larger national focus on the spread of this species), its objectives and tactics also apply to quagga mussels and other dreissenid species.

A. Zebra Mussels

The zebra mussel is a small bivalve mollusk with two matching half shells. Its name is derived from the striped pattern on its shell. Since its introduction, the zebra mussel has spread to 24 states and two Canadian provinces. It rapidly dispersed throughout the Great Lakes and much of the Mississippi River due to its tremendous reproductive capability, the fact that larvae may establish colonies downstream of spawning locations, and the ability to attach itself to boats navigating from infested waters. Drake and Bossenbroek (2004) identify the Columbia River as being at high risk for a zebra mussel invasion. However, Whittier et al. (2008) classify western portions of the Pacific Northwest as being at "very low risk" or "low risk", for *Dreissena* species invasion. Zebra mussels have been found on recreational water craft entering the Columbia River Basin (CRB), such as a zebra mussel-infested boat intercepted after traveling through Oregon en route to British Columbia in 2007. In fact, there were over 100 interceptions of watercraft with attached zebra mussels in western states during 2004-2006. In 2008, zebra mussel populations were confirmed in several water bodies west of the 100th Meridian; including Lake Pueblo in Colorado and San Justo Reservoir in California (Figure 1).

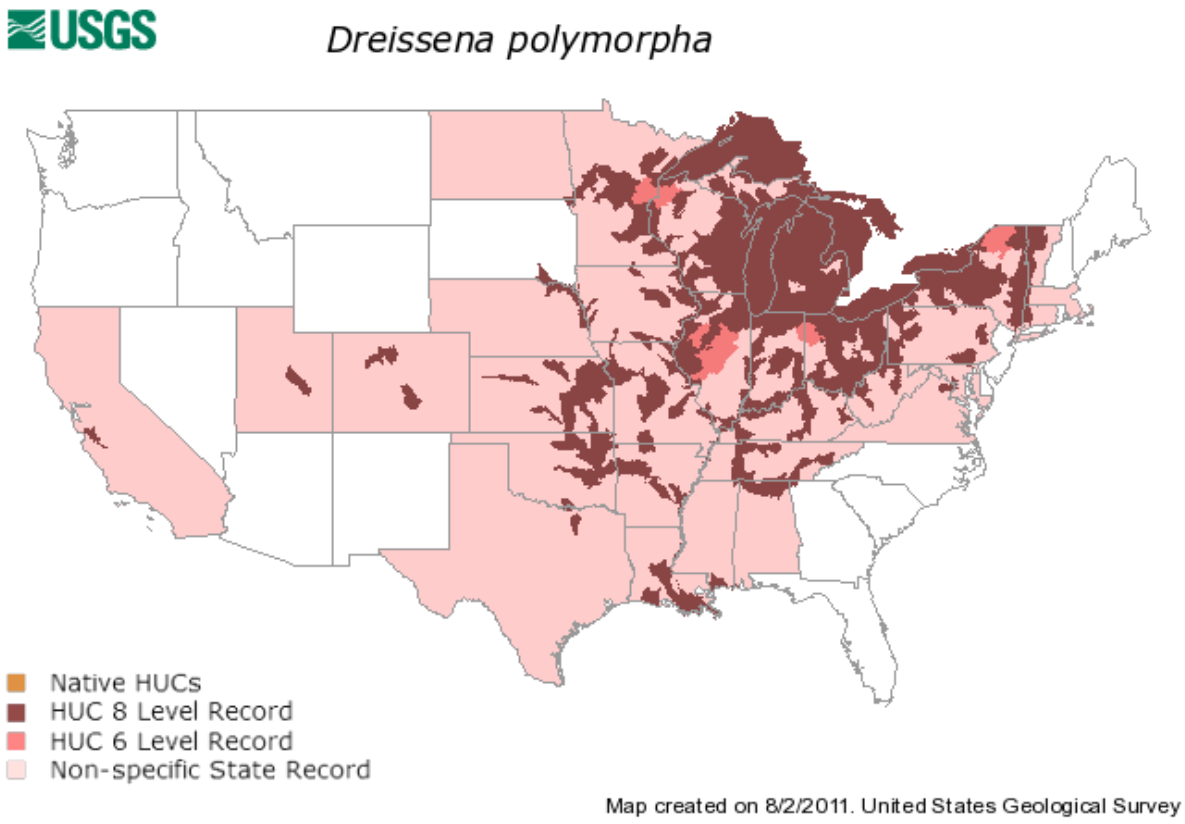


Figure 1: Distribution of zebra mussels (Dreissena polymorpha) in the United States and Canada on August 2, 2011. Source: U.S. Geological Survey (http://nas.er.usgs.gov/queries/speciesmap.aspx?SpeciesID=5).

B. Quagga Mussels

The quagga mussel (*Dreissena rostriformis bugensis*) resembles the zebra mussel, but is rounder, with shells that appear asymmetrical when viewed from the front or ventral side. Until recently, quagga mussels in the United States were limited to the Great Lakes region. However, in January 2007, live quagga mussels were found living in Lake Mead. Since then, quagga mussels have been found in other waters of the Colorado River Basin, including Lake Mojave and Lake Havasu and water bodies associated with the Colorado River Aqueduct and Central Arizona Project (Figure 2). This new invasion represents a tremendous jump across the country, and presents a more imminent threat that a *Dreissena* species will be introduced into Columbia Basin waters. In fact, in February 2008 a boat was intercepted in Oregon with dreissenid mussels (presumably quagga mussels) en route from Lake Mead to British Columbia.

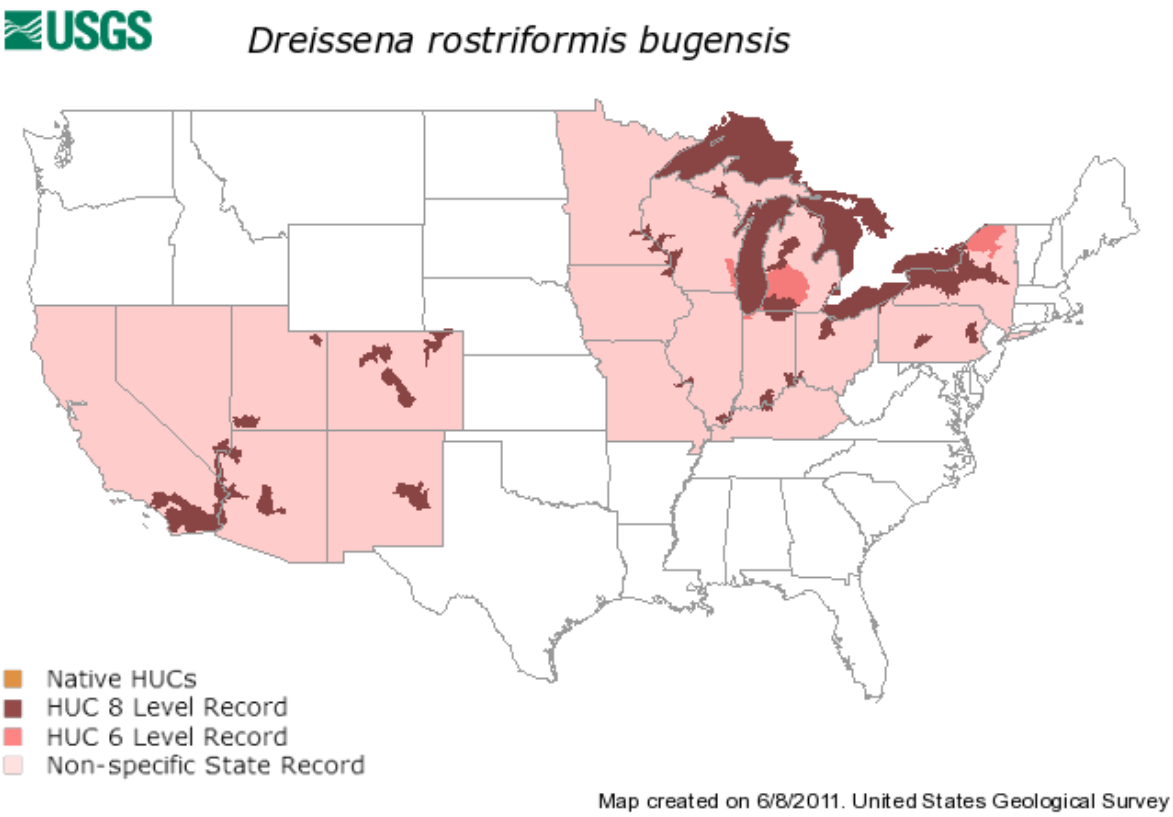


Figure 2: Distribution of quagga mussels (*Dreissena rostriformis bugensis)* in the United States on June 8, 2011. Source: U.S. Geological Survey (http://nas.er.usgs.gov/queries/speciesmap.aspx?SpeciesID=95).

Additional information about dreissenids can be found in Appendix A, Biology of Dreissenids.

C. Environmental and Economic Implications

The environmental impact of zebra and quagga mussels upon lakes and rivers is profound. Both compete effectively with many native species and may completely replace native mussels, causing a collapse of the native food chain. The introduction of zebra and quagga mussels into the CRB, which drains 258,500 square miles in seven Western states and Canada, could not only threaten native species, (particularly salmon and trout), but also industrial, agricultural, recreational, navigation, and subsistence use of the infested waters.

The economic costs associated with these invaders are also significant. A variety of studies have reported economic impacts of zebra mussels in the eastern United States, including a recent survey that estimates $268 million in zebra mussel-related impacts just to drinking water and power plant facilities from 1989 to 2004 (Connelly et. al, 2006).

The economic impact of zebra and quagga mussels to the hydropower system on the Columbia and Snake Rivers is of particular concern. If introduced into the CRB, the mussels could affect all submerged components and conduits of this system, including fish passage facilities, navigation locks, raw water distribution systems for turbine cooling, fire suppression and irrigation, trash racks, diffuser gratings, and drains (see Appendix F).

In 2005, the Bonneville Power Administration commissioned a study of the costs associated with zebra mussel control on hydro-power facilities in the Columbia River. The study found that the one-time cost for installing zebra mussel control systems at hydroelectric projects could range from the hundreds of thousands of dollars to over a million dollars per facility (Phillips et al. 2005). When additional study estimated maintenance costs are considered over five years, the cost estimate for 13 hydroelectric projects grows to $52,704,301 (Pacific States Marine Fisheries Commission, unpublished data). The costs of zebra mussel control cited in this study will increase significantly, potentially 2-3 fold or more, when mitigation costs for juvenile and adult fish passage facilities, and maintenance and cleaning down time for systems and equipment including (but not limited to) generators, fire suppression/deluge, heating, ventilation, and air conditioning equipment, drain galleries, sumps, oil water separator and forebay/tailwater sensors are factored in.

II. Scope and Purpose

The purpose of the Plan is to coordinate a rapid, effective, and efficient interagency response in order to delineate, contain, and when feasible, eradicate zebra, quagga, and other dreissenid mussel populations if they are introduced in CRB waters. Recognizing that dreissenid mussels typically establish firmly in a watershed prior to detection, this plan assumes that a detected population has not dispersed widely or reproduced (i.e., eradication is still reasonable to consider) until further analysis reveals otherwise.

A. Planning Assumptions:

Prevention is the first priority for addressing the risk of zebra and quagga mussels in the CRB. This includes preventing contaminated watercraft from entering uncontaminated water bodies. This Plan is not intended to guide interception of contaminated watercraft prior to launching.

The provisions of this Plan are intended to enhance interagency coordination beginning with the discovery of an infestation through containment and initial control efforts. Long-term monitoring and control of a permanent infestation will require a separate management plan developed and implemented by the individuals or organizations with authority and responsibility for managing the infested site(s).

Finally, this Plan focuses on actions that would **follow** a reported dreissenid introduction. It does not address strategic actions needed to enhance preparedness prior to an infestation. Those actions are covered in the document entitled "*Strategy to Enhance Columbia River Basin Interagency Response to Zebra Mussels and Other Dreissenid Species" (go to http://www.100thmeridian.org/ColumbiaRT.asp).*

B. Responsibilities

The specific agencies and entities required to respond to the discovery of dreissenid species depends on where the infestation is discovered. However, regardless of location, implementation of this Plan depends upon the cooperation of a broad variety of public and private sector organizations, including, but not limited to the agencies that are signatories to this Plan, and those included in Table 1.

Table 1: Agencies and Organizations with Invasive Species Management/Coordination Responsibilities in the CRB

• Idaho Department of Agriculture • Idaho Department of Environmental Quality • Idaho Department of Fish and Game • Montana Department of Fish, Wildlife, and Parks • Oregon Department of Environmental Quality • Oregon Department of Fish and Wildlife • Oregon State Police • Oregon State Marine Board • Washington Department of Ecology • Washington Department of Fish and Wildlife • State and Local Emergency Management Offices • State aquatic/general invasive species committees and councils • Department of Fisheries and Oceans, Canada • Provinces of British Columbia and Alberta • Portland State University, Center for Lakes and Reservoirs	• Bureau of Land Management • NOAA Fisheries • U.S. Army Corps of Engineers • U.S. Bureau of Reclamation • U.S. Department of Agriculture • U.S. Environmental Protection Agency • U.S. Fish and Wildlife Service • U.S. Forest Service • U.S. Geological Survey • U.S. National Park Service • Columbia River Intertribal Fish Commission • Individual Columbia River non-treaty tribes • 100th Meridian Initiative Columbia River Basin Team • Bonneville Power Administration • City and County Governments • Mid-Columbia River Public Utility Districts • Pacific States Marine Fisheries Commission • Port authorities • Western Regional Panel on Aquatic Nuisance Species • Mid-Columbia River Public Utility Districts • Western Regional Panel on Aquatic Nuisance Species

The 100th Meridian Initiative's Columbia River Basin Team is responsible for:

- The development, review, and maintenance of this Plan. Review of the Plan shall take place annually.
- Posting the current Plan on the 100th Meridian Initiative CRB Team website. (http://100thmeridian.org/ColumbiaRT.asp).
- Facilitating training, conferences, meetings, and exercises as necessary to ensure all participants are aware of roles, procedures, and changes to the Plan.

- Encouraging member organizations to maintain appropriate staffing levels for the organizational elements identified in this Plan.

Each member organization is responsible for:

- Participating in such meetings, conferences, and working groups necessary to develop, test, and maintain the Plan;
- Participating in the development and review of this Plan and associated documents and procedures;
- Identifying staff to participate in the organizational elements of this Plan;
- Ensuring that relevant individuals have access to the Plan.
- Establishing and maintaining inventories of resources that may be available in the event this Plan is activated;
- Ensuring that its employees are familiar with the Plan and trained in their duties and responsibilities;
- Implementing the Plan according to its internal authorities and guidelines, and the provisions of this plan; and for
- Participating in evaluations of exercises and activations of the Plan.

This Plan does not stand alone; it relates to a set of Interagency Response documents that in some cases are more general (e.g., State and local Emergency Operations Plans, ANS early detection/interagency response plan developed by the State of Washington, etc.) and in other cases are more specific (e.g., individual agency ANS response plans, the Bonneville Hydroelectric Project addressed in Appendix F).

III. Concept of Operations

The 100th Meridian Initiative's Columbia River Basin Team is responsible for activating and implementing the management structures necessary to respond to and support efforts to contain and control an infestation. Because CRB member agencies do not share a standard organizational structure on a day-to-day basis, the Team has adopted the organizational structure described in this Plan as its emergency response structure. The organizational elements are divided into two groups: coordination (policy and communication) and incident management (tactical). The structure is designed to be flexible. Only those elements needed to respond to and support a given infestation will be activated. Note that personnel of 100th Meridian Initiative Columbia River Basin Team member agencies may be assigned to any or all of the described organizational elements, depending on their organizational role, expertise, and management requirements of the specific infestation.

Activation of the organizational structure typically is made through State invasive species coordinators to the national US Fish and Wildlife STOP-ANS reporting system and to the CRB Notification Coordinator (Figure 3), which is staffed by the USFWS (Pacific Regional Office). The Notification Coordinator has the authority and responsibility to convene the rest of the MAC Coordination and Support Staff, the MAC Group Chair, and the standing members of the CRB MAC Group, and to ensure all organizations on the Priority 1 and 2 notification lists (see Appendix C) have been notified.

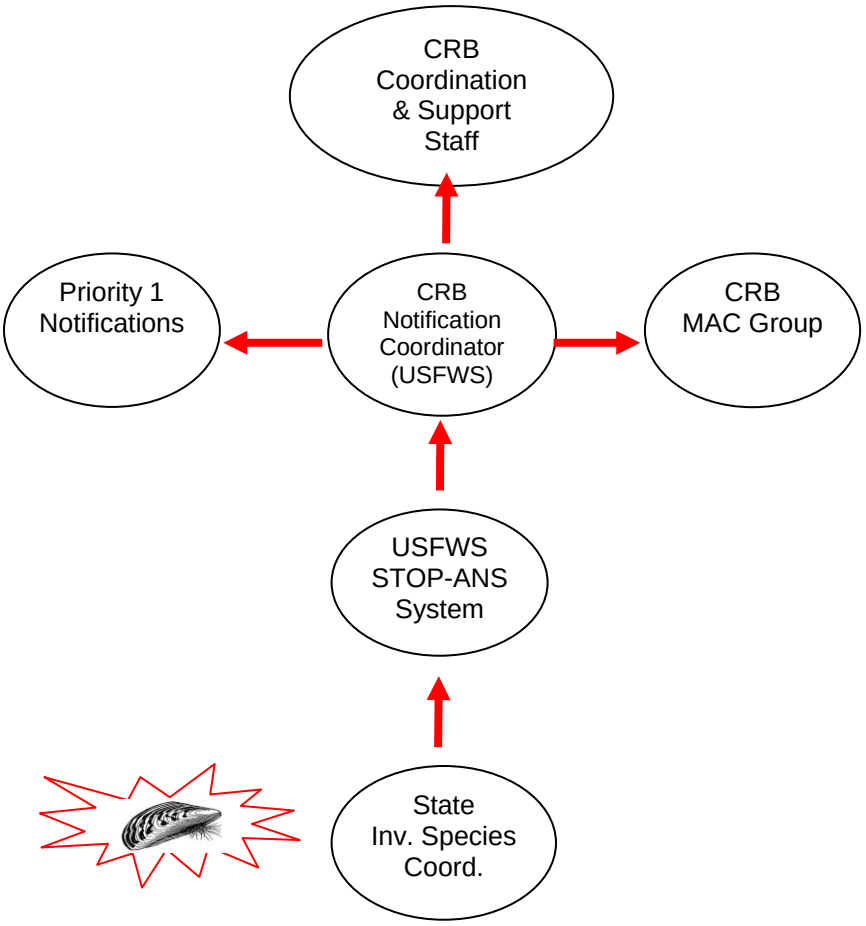


Figure 3: Diagram showing dissemination of a dreissenid report from initial call into state agency to CRB Notification coordinator to CRB MAC Group, Priority 1 contacts and support staff.

A. Coordination Structure

The coordination structure described in this Plan is designed to comply with the requirements of the National Incident Management System (NIMS). This structure focuses on interagency decision-making and communication, rather than on the ground tactics.

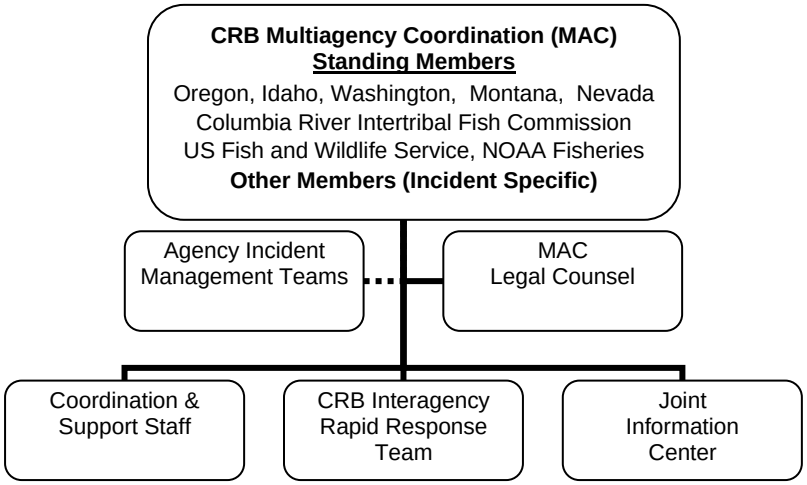


Figure 4: Multiagency Coordination (MAC) structure and organizational elements.

The coordination structure includes four organizational elements (see Figure 4) with the following general responsibilities (also see Appendix B for checklists):

- **Columbia River Basin (CRB) Multiagency Coordination (MAC) Group**: Policy decisions, including approval of management plans, assignment of resources, and interagency media coordination.

  The MAC Group includes "standing" or permanent members, who are representatives of those CRB Team member agencies that can be expected always to participate in the activation of this Plan. Standing members are included because they have authorities and responsibilities that are not limited by geography within the Columbia River Basin. Standing members of the CRB MAC Group include the US Fish and Wildlife Service, NOAA Fisheries, the Columbia River Intertribal Fish Commission, and the states within the Columbia River Basin. The second tier of MAC Group Members includes agencies or organizations who may participate depending upon their

responsibilities where the infestation is found such as U.S. Forest Service, specific tribes or local government.

It is the responsibility of the standing members of the CRB MAC Group to identify, notify, and include representatives of other organizations who should join the MAC Group depending on the location of the infestation.

The CRB MAC Group may be supported by Legal Counsel. The CRB MAC Group will annually select one of its members to serve as the CRB MAC Group Chair.

- **Columbia River Basin (CRB) Coordination and Support Staff**: This group provides technical, scientific, and logistical support to the CRB MAC Group, the Interagency Rapid Response Team (IRRT), and local affected agencies/entities, including positive confirmation of extent and scope of the infestation. They assist in identifying appropriate containment, control, and eradication efforts. The CRB Coordination and Support Staff is made up of subject matter experts activated in response to the specific needs of the reported infestation. Subject matter experts may be employees of any or all entities participating in this Plan, or from organizations outside the Columbia River Basin Team.

- **CRB Joint Information Center (JIC)**: As part of its external communications system, the CRB MAC Group may activate a Joint Information Center (JIC) to support its efforts to develop and implement effective interagency development and dissemination of information to the public and other interest groups.

- **CRB Interagency Rapid Response Team (IRRT)**: This team includes interagency personnel that may be assigned to provide on-scene technical support or incident management support at the request of the impacted jurisdiction/entity and the approval of the CRB MAC Group. They also assist in confirming the presence and determining the scope of the infestation, as well as identifying and implementing appropriate containment, control, and eradication efforts. Team members will be selected based on the technical and management needs of the specific infestation.

B. Management Structure

The management structure described in this Plan is designed to comply with the requirements of the National Incident Management System (NIMS). This structure focuses on tactical implementation.

- **Agency Incident Management Teams**: ICS-based organizations responsible for the on-scene implementation of agency and CRB MAC Group management decisions. The Incident Management Team reports to the Agency Administrator(s) of the responsible entity or entities. Note: The CRB IRRT may be deployed as an Incident Management Team. In such assignments, the IRRT will operate in the place of the Agency Incident Management Team, under a written delegation of authority from the Agency Administrator.

IV. Interagency Response Procedures

A. Response Objectives

Ten response objectives support the Plan's goal to delineate and control zebra, quagga, and other dreissenid mussel populations if they are detected in CRB waters. **Note that tasks associated with these objectives are not necessarily sequential; many may be implemented simultaneously**.

Table 2 below lists the ten objectives, and indicates which part of the Plan addresses the objective. Table 2 also indicates which element of the CRB Coordination organization is responsible.

Table 2: Response objectives that support the Plan's goal to delineate and control zebra, quagga, and other dreissenid mussel populations if they are detected in CRB waters

Rapid Response Objective	Plan Location	Responsible Coordination Element
1. Make Initial Notifications	Section IV-A Pages 13-14; Appendix C	State invasive species coordinators; 877-STOP-ANS System
2. Activate appropriate organizational elements of the CRB Interagency Response Plan	Section IV-A pages 14-15	CRB Notification Coordinator; MAC Group Chair
3. Verify Reported Introduction	Section IV-A, page 15	Responsible Agency/State ANS Coordinator
4. Define Extent of Colonization	Section IV-A page 15 Appendix B Field Operations Page B-52	Responsible Agency or CRB Coordination and Support Staff and IRRT/IMT
5. Establish External Communications System	Section III, page 10; Section IV,-A page 16 Appendix B- Joint Information Center. Page B-41	CRB MAC Group
6. Obtain and Organize Resources	Section IV-A, page 16	CRB MAC Group & CRB Coordination & Support Staff
7. Prevent Further Spread Via Quarantine and Pathway Management	Section IV-A, page 16 Appendix B Field Operations page B-53	Responsible Agency or CRB IRRT/IMT
8. Initiate Available/Relevant Control Actions	Section IV-A, page 16 Appendix B Field Operations Page B-54 Appendix D-Control Options	Responsible Agency or CRB IRRT/IMT
9. Institute Long-Term Monitoring	Section IV-A, page 16 Appendix B Field Operations Page B-56	Responsible Agency
10. Stand Down Incident, and Evaluate the Response and the Plan	Section IV-A, page 17	CRB MAC Group CRB Team/all responding elements.

Objective 1: Make Initial Notifications

Purpose: Ensure that all parties that have jurisdiction in response decisions or can provide technical support are quickly engaged, and also rapidly inform all other interested parties.

Lead entity: The agency that initially receives confirmation of zebra/quagga mussel identification, State ANS coordination contacts and US Fish and Wildlife 1-877-STOPANS hotline staff.

Notification of a possible infestation of dreissenid species may come from any number of sources. All states within the Columbia River Basin have established reporting contact points for invasive species. These numbers have been widely disseminated and are supported with internal notification and confirmation procedures. This Plan assumes that reports of *Dreissena* will follow those established processes.

1. The first participating agency to discover or receive a report of a potential infestation will notify the appropriate State Invasive Species contact point (see Appendix C). The initial recipient should collect as much of the following information as possible:
   - Date and time of the report.
   - Date and time of the sighting(s).
   - Name, agency and contact information for the person making the report.
   - Name, agency/entity and contact information of identifying biologist (if positive identification has been made).
   - Details of the location of the infestation, such as name of the affected water body, landmarks, highway mile, and other (GPS if possible) where the suspect mussels were found or introduced.
   - An estimate of the number, density, and extent of the mussel colonies found or introduced.
   - A digital or other photograph (with scale indicator), if possible.
   - A sample of the mussels if possible (in compliance with relevant state/federal regulations regarding movement of live prohibited species).
   - Other relevant conditions (access limitations, etc.)
2. After confirming that the report appears to be credible, the State Invasive Species coordinators will notify the US Fish and Wildlife Service's national 877-STOPANS system. The State Invasive Species coordinators will also notify all impacted local agencies and organizations.
3. The US Fish and Wildlife Service 877-STOPANS staff will notify the CRB Notification Coordinator.
4. The following statement can be used as a template for disseminating

initial alerts (see text box below) while verification is in progress:

"A preliminary report suggests that dreissenid mussels have been found in [*insert name of water body or other location*]. We are still investigating the veracity of this report, and will communicate updates via [*insert name of listserv, website, etc*.]. Until then, we encourage other jurisdictions to treat this location as an elevated risk. In order to expedite the local response, we also request that you keep this information internal and wait for us to release further information to interested parties."

SHARING PRELIMINARY REPORTS

Given the potential for regional spread, agencies handling preliminary reports of dreissenid introductions need to consider the importance of alerting all vulnerable jurisdictions – including those outside of the Columbia River Basin (e.g., other Western states). At the same time, disseminating inaccurate information rapidly and broadly can compromise response effectiveness. Unless unique law enforcement or other conditions warrant extreme caution, this plan recommends that the above initial alert message be communicated via email (and phone if possible) as soon as possible to all state invasive species coordinators in the West, even if positive identification is still pending.

Objective 2: Activate Appropriate Organizational Elements of the Interagency Response Plan

Purpose: Activate a response management system that expedites interagency decision-making, promotes information sharing, ensures efficient resource management, and supports on-scene management of the infestation.

Lead entity: CRB Notification Coordinator and CRB MAC Group.

Activation of the coordination structure described in this Plan begins with the notification of the CRB Notification Coordinator. The Coordinator will discuss the appropriate level of response with the MAC Group Coordinator during the Priority 1 notification. The level of activation is flexible, depending on the size, location, and life-cycle of the infestation, and the support requirements of the responsible agency.

The CRB Notification Coordinator will notify the members of the Columbia River MAC Group identified in the Priority 1 table of Appendix C. The MAC Group Chair may elect to request a preliminary meeting of the CRB MAC Group in person or via conference call in advance of positive identification

(see Objective 3 below), or wait until positive identification has been confirmed, depending on the nature and credibility of the report.

The CRB Notification Coordinator will notify the members of the Columbia River Coordination and Support Staff identified in the Priority 1 table of Appendix C. The members will report at the time and location indicated by the Notification Coordinator.

Following notification of Priority 1 contacts the CRB Notification Coordinator, with assistance from the Coordination and Support Staff, will notify Priority 2 contacts. All primary contacts listed in Appendix C will be responsible for further notifications internal to their agency/entity or jurisdiction. Additional contacts may be required depending on the location of the infestation and the affected jurisdictions.

Objective 3: Verify Reported Introduction

Purpose: Confirm positive identification of the mussels as a species within the family Dreissenidae. Confirmation may include one or both of the following methods:

- Visual identification at the infested site by one or more qualified subject matter experts (Appendix C).
- Visual and genetic identification of a sample sent to a qualified subject matter expert (and handled based on directions given by that qualified subject matter expert in compliance with relevant state/federal regulations regarding movement of live prohibited species).

Until further analysis reveals otherwise, the CRB response organization will assume that the reported mussels might be either zebra or quagga mussels and that the detected population has not dispersed widely or reproduced (i.e., eradication is still reasonable to consider).

Lead entity: The agency that receives and accepts responsibility for handling the initial report in coordination with subject matter experts.

Objective 4: Define Extent of Colonization

Purpose: Establish physical range of infestation, and identify life-cycle phase of mussels in order to inform policy and tactical response to the infestation.

Lead entity: The responsible agency where the initial sighting(s) of mussels occurs in partnership with other CRB agencies and organizations.

Additional procedures are described in Appendix B, Field Operations

Objective 5: Establish External Communications System

Purpose: Activate and staff the CRB Joint Information Center to ensure consistent and effective communication to interested external stakeholders, including the media and public.

Lead Entity: CRB MAC Group.

Additional procedures are described in Appendix B - Joint Information Center

Objective 6: Obtain and Organize Resources

Purpose: Provide sufficient resources to implement response objectives.

Lead Entity: CRB MAC Group and Coordination and Support Staff with resource support from CRB agencies and organizations.

Additional procedures are described in Appendix B

Objective 7: Prevent Further Spread Via Quarantine and Pathway Management

Purpose: Minimize all vectors that might further spread the original infestation.

Lead Entity: Agency with jurisdiction with technical assistance from CRB agencies and organizations.

Additional procedures are described in Appendix B - Field Operations

Objective 8: Initiate Available/Relevant Control Measures

Purpose: Evaluate management options, and then proceed with either eradication efforts or containment/mitigation activities.

Lead Entity: Agency with jurisdiction with technical assistance from CRB agencies and organizations.

Additional procedures are described in Appendix B - Field Operations

Rapid Response Objective 9: Institute Long-Term Monitoring

Purpose: Provide for data for adaptive management and long-term evaluation efforts.

Lead Entity: Agency with jurisdiction.

Additional procedures are described in Appendix B - Field Operations

Rapid Response Objective 10: Stand Down Incident, and Evaluate the Response and the Plan

Purpose: Close down active groups and operations, and demobilize associated personnel and equipment. Capture and implement lessons

learned during exercises and activations of the Interagency Response Plan in order to enhance preparedness and response.

Lead Entity: CRB MAC Group; 100th Meridian Initiative Columbia Basin Team.

Additional procedures are described in Appendix B.

References

Aldridge, C., P. Elliot, and G. Moggridge. 2006. Microencapsulated BioBullets for the Control of Biofouling Zebra Mussels. Environ. Sci Technol.Vol 40 (3). 975-979.

Athearn, Jim. 1999. Risk Assessment for Adult and Juvenile Fish Facilities on the Mainstem Lower Snake and Lower Columbia Rivers Relative to a Potential Zebra Mussel Infestation. US Army Corps of Engineers, Northwest Division. Portland, Oregon.

Benson, A. J. and D. Raikow. 2007. *Dreissena polymorpha*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=5> Revision Date: 1/10/2007

Caraco, N. F., J. J. Cole, P. A. Raymond, D. L. Strayer, M. L. Pace, S. E. G. Findlay, and D. T. Fischer. 1997. Zebra mussel invasion in a large, turbid river: phytoplankton response to increased grazing. Ecology 78:588-602.

Claudi, R. and G. L. Mackie. 1994. Practical Manual for Zebra Mussel Monitoring and Control. Chapter 1. Biology of the Zebra Mussel. Lewis Publishers, CRC Press, Boca Raton, FL. 227 pp.

Claxton, W. T. and G. L. Mackie. 1998. Seasonal and depth variations in gametogenesis and spawning of *Dreissena polymorpha* and *Dreissena bugensis* in eastern Lake Erie. Can. J. Zool. 76:2010-2019.

Cohen, A.N., Weinstein, A. 2001. Zebra Mussel's Calcium Threshold and Implications for its Potential Distribution in North America. San Francisco Estuary Institute.

Connelly, N.A., B.A. Knuth, T.L. Brown, and C.R. O'Neill. 2006. Estimating the economic impact of zebra mussels within their North American range, 1989-2004. Fourteenth International Conference on Aquatic Invasive Species. Biscayne, Florida.

Culver, C.S. and A.M. Kuris. 2000. The apparent eradication of a locally established introduced marine pest. Biological Invasions 2(3): 245-253.

Drake, J. and J. Bossenbroek. 2004. The Potential Distribution of Zebra Mussels in the United States. BioScience Vol. 54: 931-941.

Green, R.F. 1995. Strategies for application of non-oxidizing biocides. Proceedings of the Fifth International Zebra Mussel and Other Aquatic Nuisance Organisms Conference, Toronto, CA, February 1995: 175-181.

Kovalak, W, Longton G. and R. Smithee. 1993. Dispersal Mechanisms of the Zebra Mussel (*Dreissena polymorpha*), in *Zebra Mussels: Biology, Impacts, and Control*. Nalepa, T.F., and Schloesser, D.W., eds., Lewis Publishers, Boca Raton, FL, pgs 359-380.

Kraft, C. 1995. Zebra Mussel Update #24**.** University of Wisconsin-Madison, Wisconsin Sea Grant Institute.

Mackie, G.L., P. Lowery, and C. Cooper. 2000. Plasma pulse technology to control zebra mussel biofouling. U.S. Army Engineer Research and Development Center. Vicksburg, MS.

MacIsaac, H. G. 1994. Comparative growth and survival of *Dreissena polymorpha* and *Dreissena bugensis*, exotic mollusks introduced to the Great Lakes. J. Great Lakes Res. 20(4):783-790.

Malloy, D. 2008. Personal Communication, January 4, 2008. Division of Research & Collection. New York State Museum. Cambridge, New York.

McMahon, R.F., T.A. Ussery, A. C. Miller, 1993. Thermal tolerance in zebra mussels (Dreissena polymorpha) relative to rate of temperature increase and acclimation temperature. Proceedings of the Third International Zebra Mussel Conference. EPRI TR -0102077: 4-97 – 4-118,22 pages.

Messer, C. and T. Veldhuizen. 2005. Zebra Mussel Early Detection and Public Outreach Program Final Report. Report for California Bay-Delta Authority and US Dept of the Interior, Fish and Wildlife Service. CBDA Project No.99-F07, Zebra Mussel Detection and Outreach Program. 278 pp.

Minnesota Dept of Natural Resources. 2005. Feasibility Study to Limit the Spread of Zebra Mussels From Ossawinnamakee Lake. Prepared by FISHPRO Consulting Engineers and Scientists. Springfield, IL.

Nalepa, T.F., and D.W. Schloesser. 1993. Zebra Mussels Biology, Impacts, and Control. Lewis Publishers, Boca Raton, Fl.

Neumann, Dietrich, Borcherding, Jost and Brigette Jantz. 1993. Growth and Seasonal Reproduction of *Dreissena polymorpha* in the Rhine River and Adjacent waters. in *Zebra Mussels: Biology, Impacts, and Control*. Nalepa, T.F., and Schloesser, D.W., eds., Lewis Publishers, Boca Raton, FL, pgs 95 - 109.

Nierzwicki-Bauer, Sandra. Personal communication with Paul Heimowitz. January 16, 2008.

Ohio Sea Grant, 1997. Zebra Mussels in North America: The invasion and its implications. Fact Sheet 045. Columbus, Ohio.

Payne, B.S. 1992. Freeze survival of aerially exposed zebra mussels. US Army Corps of Engineers Waterways Experiment Station Technical Note ZMR-2-09.

Phillips, S., T. Darland, M. Sytsma. 2005. Potential Economic Impacts of Zebra Mussels on the Hydropower Facilities in the Columbia River Basin. Prepared for the Bonneville Power Administration. Pacific States Marine Fisheries Commission, Portland, OR.

Roe, S.L., and MacIsaac, H.J. 1997. Deepwater population structure and reproductive state of quagga mussels (*Dreissena bugensis*) in Lake Erie. Can. J. Fish. Aquat. Sci. 54: 2428–2433.

Smythe, A.G. and Miller. 2003). Power-Pulse; A possible alternative to chemicals for zebra mussel control: Summary of 2000 field studies. U.S. Army Engineers Research and Development Center, Vicksburg, MS.

Sonalysts, and Aquatic Sciences. 1991. Zebra Mussel Deterrence Using Acoustic Energy. Research Report 90-38 Empire State Electric Energy Research Corporation.

U.S. Fish and Wildlife Service. 2001. The 100th Meridian Initiative: A Strategic Approach to Prevent the Westward Spread of Zebra Mussels and Other Aquatic Nuisance Species. 20 pp.

Western Regional Panel on Aquatic Nuisance Species. 2003. Model Interagency Response Plan for Aquatic Nuisance Species. Denver, CO 82 pp.

Whittier, T., P. Ringold, A. Herlihy, and S. Pierson. 2008. A calcium-based invasion risk assessment for zebra and quagga mussels (*Dreissena* spp). Front Ecol Environ 2008; 6, doi:10.1890/070073.

Wright, D., Magee J., Setzler-Hamilton, E., Chalker-Scott, L. and G. Morgan. 1995. Use of High Energy Monochromatic UV Light to Kill Dreissenid Larvae. University of Maryland System, SUNY college at Buffalo, Triton Thalassic Technologies.

APPENDIX A- DREISSENID BIOLOGY

Appendix A: Dreissenid Biology

Density and Food Availability

Zebra mussel densities within the CRB could vary widely depending on water chemistry, food availability, and breeding population. After their initial introduction, zebra mussel populations can rapidly increase by orders of magnitude, and then similarly decrease. Eurasian zebra mussel population densities range up to 40,000 mussels per square meter (Neumann et al. 1993). Under ideal conditions in the Laurentian Great Lakes, zebra mussel densities reach 700,000 – 800,000 per square meter (Kovalak et al. 1993). In the lower Mississippi River, where the zebra mussel has been introduced, densities of 400,000 per square meter have been reported (Kraft 1995). The Mississippi has an ideal environment for zebra mussels, in part because food resources are abundant (Kraft 1995). The Columbia River's lower plankton densities in comparison to the Mississippi or Great Lakes, may limit zebra mussel population densities, though this has yet to be quantified.

Water Temperatures

Dreissenids can tolerate a wide range of water temperatures from roughly 32^0 to 86^0F ($0\ ^0$F to 30^0 C) (Ohio Sea Grant 1997). North American zebra mussel spawning (release of gametes into the water column) will not generally occur at temperatures below about 12 °C (Claudi and Mackie 1994). There is evidence, however, that quagga mussels in deep waters of the Great Lakes are capable of spawning at temperatures near 5 °C (Roe and MacIsaac 1997) and 9 °C (Claxton and Mackie 1998).

Based on these parameters, a water temperature profile created from data recorded at the smolt monitoring facilities at Bonneville and John Day Dams shows the potential for quagga mussel egg release for approximately 7 months of the year (late March to late-November). However, peak spawning temperatures of 68 F (20^0 C) and above occur for 2 months during mid-July to mid-September (see Figure 1).

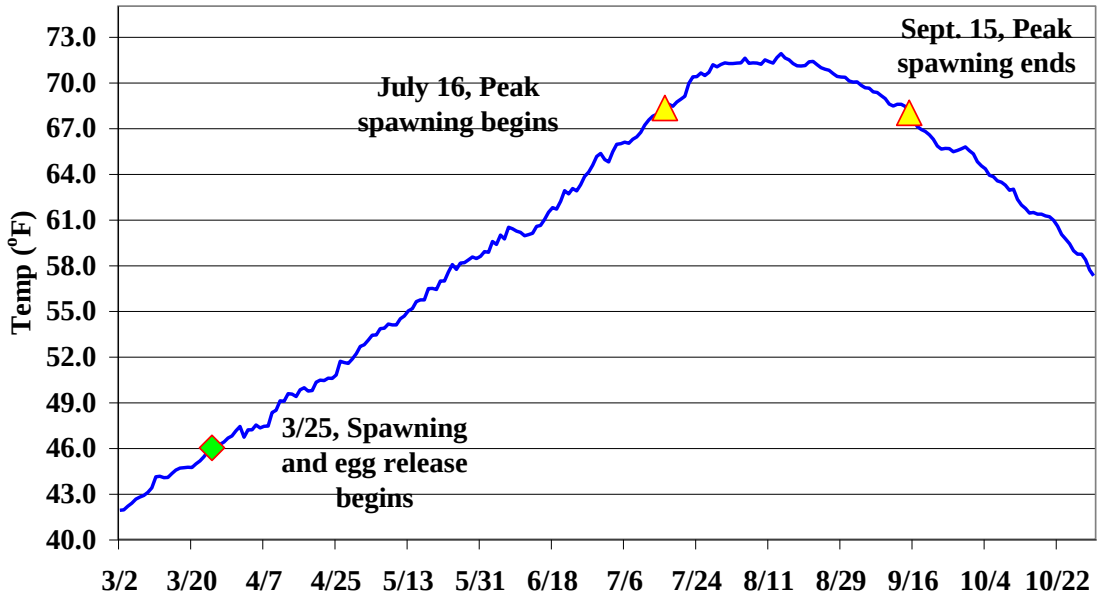


Figure 1. Daily average water temperatures at Bonneville Dam and John Day Dam Smolt Monitoring Facilities, 2000-2006 (Kovalchuk 2007).

Calcium Requirements

North American zebra mussel populations require 10 mg Ca^{2+}/l to initiate shell growth and 25 mg Ca^{2+}/l to maintain shell growth. Larval development is inhibited at pH of 7.4. Higher rates of adult survival occur at a pH of 7.0-7.5, but populations have been found in the hypolimnetic zone of lakes with a pH of 6.6-8.0, and in the epilimnetic zone with a pH of 7.7-8.5. Optimal larval survival occurs at a pH of 8.4, and optimal adult growth occurs at pH 7.4-8.0. (Benson and Raikow 2007).

Calcium concentrations could be a factor limiting dreissenid densities in the Columbia River Basin. Large populations of zebra mussels are not expected where calcium levels are less than 25 mg/l (Hincks and Mackie). Cohen and Weinstein (2001) found little evidence that zebra mussels can become established at ambient calcium concentrations below about 20mg/l. Calcium thresholds in the Columbia River West of the Cascades and in particular the Willamette River may be suboptimal for establishment of dreissenid populations (Whittier et al. 2008).

It should be noted that calcium may be elevated near concrete structures (Cohen and Weinstein 2001). This needs to be studied further in relation to the Columbia River Basin with its numerous hydroelectric projects made of concrete, including concrete fish passage facilities such as fish ladders. There are also cases where dreissenid populations have become established in calcium-limited water bodies at locations that have input from other water sources with higher calcium levels (Cohen and Weinstein 2001).

History of Control Efforts

Although an attempt to eradicate a new dreissenid mussel infestation presents significant challenges, there is at least one documented success story. In 2002, the first introduction of zebra mussels in Virginia was confirmed in Millbrook Quarry. The 12-acre quarry is located on property under private ownership. The Virginia Department of Game and Inland Fisheries led an effort to eradicate this population. Over a three-week period in early 2006, the water body was treated with 174,000 gallons of potassium chloride solution over a 3-week period from January 31 to February 17, 2006. Potassium concentrations were measured weekly throughout the quarry and in adjacent surface waters to ensure a target concentration of 100 milligrams of potassium per liter of water (below the level that would have human health or significant ecological impacts, but over twice the minimum concentration needed to kill zebra mussels). No potassium leakage from the quarry into adjacent waters was detected.

Monitoring results demonstrated that lethal potassium concentrations were achieved at various depths. Several weeks after treatment ended, four independent methods were also used to confirm zebra mussel eradication. First, more than 1,000 mussels were sampled from rocks at numerous sites around the quarry; none were alive. Divers also visually inspected the quarry and could not find live zebra mussels. Next, an extensive video survey also was conducted using a robotic camera system, documenting dead zebra mussels. Finally, 80 sets of live zebra mussels (100 per set) were placed at various locations and depths within the quarry. After one month of exposure to the treated quarry water, mortality of these test mussels was 100% (as opposed to zero mortality of a control set placed in untreated water). Other aquatic life in the quarry (including turtles, fish, and aquatic insects) appear to be thriving after the treatment. As of the date of this Plan, no additional zebra mussels have been found in the quarry. It is important to note that this case involved infestation in a small, contained water body. A similar example of an eradication effort in an isolated water body began In September 2008 on Offutt Air Force Base in Bellevue, Nebraska using copper sulfate. However, attempting to eradicate zebra or quagga mussels in a large river system presents a very different set of challenges.

References

References for Appendix A are incorporated in the main document.

APPENDIX B

RAPID RESPONSE CHECKLISTS

APPENDIX B-Rapid Response Checklists

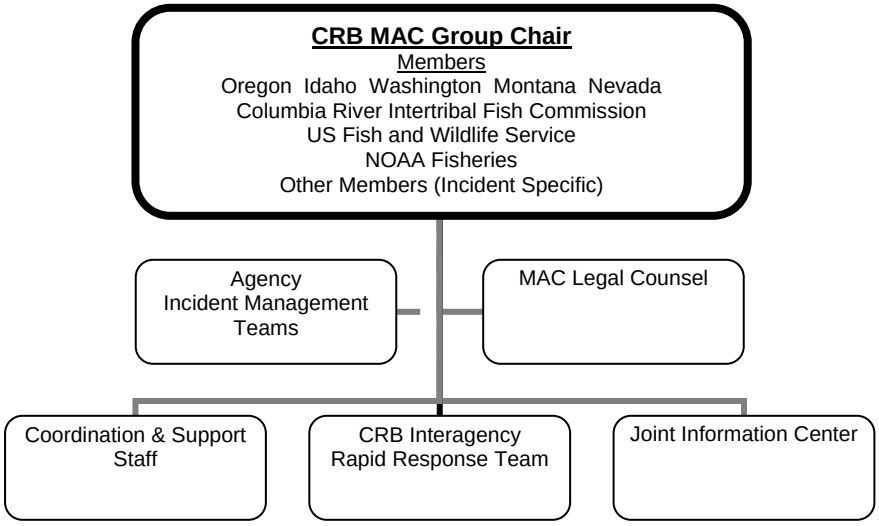
Appendix B: Rapid Response Checklists

This appendix includes a review of rapid response objectives, and the CRB Plan organizational structure. These discussions are followed by detailed position descriptions and rapid response checklists for coordination and field operations.

Note: The nature and scope of the invasive species threat in the Columbia River Basin as well as the deliberate flexibility of the NIMS organizational structure make it impossible to develop definitive position descriptions and checklists. Some incidents will not require activation of all elements, or completion of all tasks. Others may require that all elements of the organization be activated, and that additional tasks developed on a case-by-case basis. The organizational structure and information in this annex should be used as a guide to establish the response framework appropriate to the specific infestation.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: MAC Group Chair	**Reporting Relationships**: Reports to: Elected Officials Reports to this Position: ▪ CRB Coordination and Support Staff Manager ▪ CRB MAC Group Legal Counsel ▪ Interagency Rapid Response Team (IRRT) Leader ▪ CRB Joint Information Center Manager

Location in Organization:



General Responsibilities:

The MAC Group Chair is selected by the standing members for a term of one year, and has responsibilities in all phases of the CRB Invasive Species Planning Process.

- Mitigation: The Chair of the MAC Group will ensure that the signatories to the Plan pursue a coordinated and consistent approach to invasive species mitigation.
- Preparedness: The Chair of the MAC Group will ensure that the CRB Rapid Response Plan is reviewed, exercised and revised to ensure currency.
- Response: The Chair of the MAC Group will serve as the facilitator for the MAC Group, and the liaison to the Coordination and Support Staff, MAC Legal Counsel, Joint Information Center and IRRT.
- Recovery: The CRB MAC Chair will ensure that response activities are evaluated for lessons learned, and that these are incorporated into the CRB Plan as appropriate.

CRB MAC Chair Response Checklist (page 1 of 3)

The following checklist is a guideline for the Chair of the CRB MAC Group. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Activate appropriate members of the CRB MAC Group.

____ Obtain initial briefing from CRB Notification Coordinator.

____ Assess infestation situation.

- Review the current situation status. Ensure that all County, State and Federal agencies impacted by the infestation are notified.
- Determine probable scope and impact of infestation.
- Determine the need for/status of disaster declarations.
- Determine impact on commercial and recreational activities.
- Determine current priorities

____ Review current status of CRB Coordination and Support Staff. Ensure appropriate staffing pattern has been established.

____ Brief CRB MAC Group and Coordination and Support Staff

- Identify priorities, strategic considerations, and fiscal and policy directives for the management of the infestation.
- Determine the time and location of first CRB MAC Group meeting.
- Define what agency contacts will be delegated to the CRB Coordination and Support Staff and which will be retained by the CRB MAC Group (for example, routine updates may be assigned to the Coordination and Support Staff, but policy-level communication may be retained by the MAC Group).

____ Establish External Communications System:

- Notify impacted County Commissioners and other elected officials of infestation, and keep them informed as to incident status and activities. Include in MAC Group meetings as appropriate.
- Authorize release of information to the media. Activate Joint Information Center as required.

____ Direct the call back of off-duty personnel as needed (keep in mind the possible need to staff additional shifts). Assess staffing needs for:

- IRRT
- CRB Joint Information Center
- Establish what resources will be procured, managed and allocated through the CRB MAC Group.

____ Determine information needs and inform staff of requirements.

CRB MAC Chair Response Checklist (page 2 of 3)

____ Prioritize incidents daily, when new incidents occur, or if there is a major change in existing incidents. The following rankings may be used to prioritize incidents:

- 1st Priority-Infestations which can be contained and eradicated.
- 2nd Priority-Infestations which present a threat to essential infrastructure.
- 3rd Priority-Infestations which present a threat to commercial or subsistence activity.
- 4th Priority-Infestations which present a threat to recreational activity.
- 5th Priority-Infestations that present a threat to imperiled species or another significant ecological value.

____ Obtain and organize resources.

- Allocate scarce/limited resource to incidents based on priorities.
- Establish parameters for resource requests and releases.
  - Review requests for critical resources.
  - Approve assignment of IRRT upon request from impacted jurisdiction.
  - Confirm who has ordering authority within the organization and in impacted jurisdictions.
  - Define those orders which require CRB MAC Group authorization.

____ Establish level of planning to be accomplished.

- Contingency Planning
- Formal CRB MAC Group Meetings

____ Establish parameters for tactical response.

- Define those management plans which require CRB MAC Group authorization. Coordinate authorization with responsible agency administrator and on-scene IMT(s).
- Review and approve proposed management plan(s).
- Authorize implementation of approved management plan(s).

____ Ensure CRB MAC Group and CRB Coordination and Support Staff coordination.

- Periodically check progress on assigned tasks of MAC and Coordination and Support Staff personnel.
- Approve necessary changes to strategic goals and action plans.

____ Ensure Inter-jurisdictional coordination.

- Ensure that all press releases are coordinated with other impacted jurisdictions and agencies.

CRB MAC Chair Response Checklist (page 3 of 3)

- Ensure that agency Incident Management Teams are sharing information and coordinating activities as appropriate.
- Ensure that situation status is being shared with cooperating and assisting agencies.
- Ensure that logistical support requests are being handled efficiently.

____ Request emergency declaration as necessary. Ensure declaration is forwarded to impacted County Emergency Manager(s) (Counties must process request for disaster declaration from the Governor of the impacted State). Provide courtesy call to Governor's Office and Office of Emergency Management in affected State(s).

____ Review and approve disaster assessment statements from CRB Coordination and Support Staff prior to forwarding to County(ies) and State(s).

____ Facilitate meetings. Ensure documentation of decisions and actions taken.

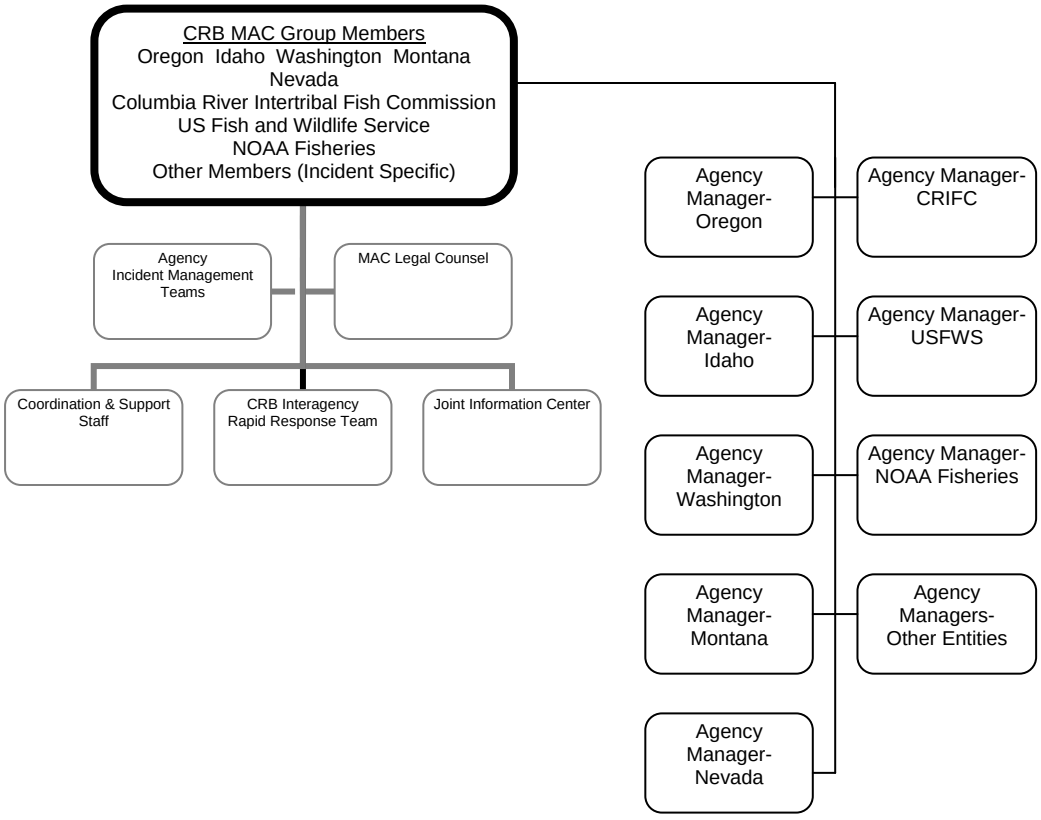
____ Ensure post action review is conducted, and lessons learned are captured and incorporated into training and Plan revisions and updates.

- Conduct a follow-up evaluation of response organizations and other interest groups to identify opportunities for improving rapid response capacity. Disseminate "lessons learned" to other interested organizations (e.g., regional ANS panels).
- Revise the Rapid Response Plan and associated documents/guidelines based on evaluation and long-term monitoring results.
- As resources allow, develop and implement a research plan that evaluates the associated ecological and economic impacts of the invasion, the effectiveness of management interventions, and negative consequences of management interventions (beyond that required by permits).
- Determine the need for long-term funding for the current management effort and seek this funding as warranted.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: MAC Group Member	**Reporting Relationships**: Reports to: Elected Officials Reports to this Position: Agency/Entity Managers

Location in Organization:



General Responsibilities:

CRB MAC Group members are responsible for assisting the CRB MAC Chair in prioritizing infestations, allocating scarce resources, and establishing policy for management of the incident. **CRB MAC Group members must have the authority to commit their agencies/entities to the decisions developed by the CRB MAC Group.** CRB MAC Group members are responsible for:

- assessing the impact of the infestation on their agencies or entities
- adjusting personnel, financial, and other resources to meet the needs of the incident and to continue service delivery.
- approving appropriate control options and incident priorities.
- ensuring that the priorities and policies formulated by the CRB MAC Group are implemented by their agencies/entities.

CRB MAC Group Members Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Confirm identification and appointment of MAC Chair (this may be done annually).

____ Obtain initial briefing from CRB MAC Chair, CRB Coordination and Support Staff Manager and impacted jurisdictions.

- Identify priorities, strategic considerations, and fiscal and policy directives for the management of the emergency.
- Determine the time and location of first CRB MAC Group meeting.
- Determine which agency contacts will be yours to establish and maintain.

____ Assess infestation.

- Determine probable scope and impact of infestation.
- Determine the need for/status of disaster declarations.
- Determine impact on services
- Project impact on budget allocations
- Determine current resource priorities
- Assess adequacy of current resources
- Identify available resources
- Identify needed resources
- Assign resources as requested

____ Assist the CRB MAC Chair in identifying additional agencies/entities that should be included in the CRB MAC Group.

____ Inform CRB MAC Chair if emergency will impact the agency's ability to meet current work assignments, or will exceed budget allocations.

____ Review current policies, procedures and agreements for resource sharing. Determine status of implementation. Implement or suspend as appropriate.

____ Anticipate future resource needs.

____ Direct the call back of off duty personnel as needed (keep in mind the possible need to staff additional shifts). Assess staffing needs for:

- CRB Coordination and Support Staff
- CRB Joint Information Center
- IRRT

____ Approve the assignment of the IRRT as requested by the responsible jurisdiction.

____ Determine information needs and inform staff of requirements.

CRB MAC Group Members Response Checklist (page 2 of 2)

____ Ensure that agency personnel observe protocols for resource requests and releases.

____ Participate in CRB MAC Group Meetings as scheduled by the CRB MAC Chair:

____ With assistance from on-scene representative(s), identify impact of the infestation on your agency/entity. Assist CRB MAC Group Chair in establishing incident priorities.

____ With assistance from on-scene representative, identity resource shortages. Assist CRB MAC Group Chair in allocating scarce resources according to incident priorities.

____ Identify policies and procedures to facilitate management of the infestation. Assist the CRB MAC Chair and CRB MAC Legal Counsel in determining appropriate changes.

____ Ensure interagency/inter-jurisdictional coordination.

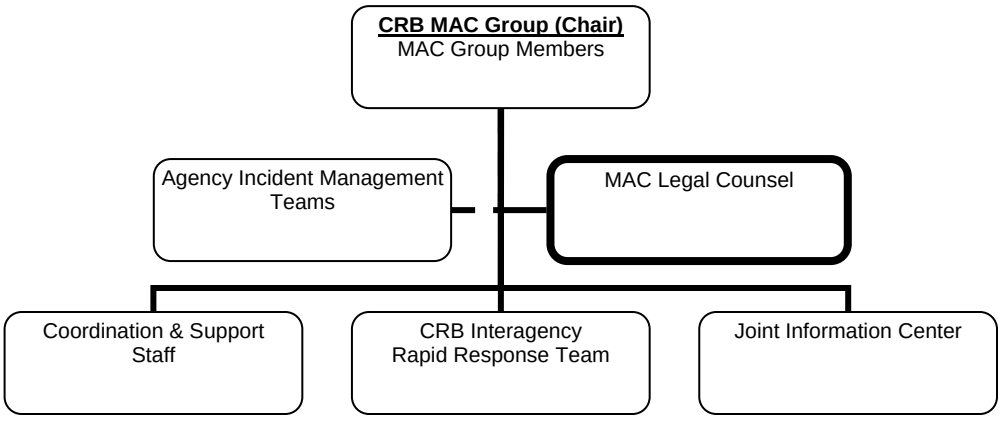
- Make periodic contact with assigned agencies and jurisdictions.
- Ensure that all agency/entity press releases are coordinated with the CRB MAC Public Information Officer and/or the Joint Information Center.
- Ensure that situation status is being shared with cooperating and assisting agencies.
- Ensure that logistical support requests are being handled efficiently.

____ Direct agency/entity managers to implement decisions of the CRB MAC Group. Monitor outcomes.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: MAC Group Legal Counsel	**Reporting Relationships**: Reports to: MAC Group Chair

Location in Organization:



General Responsibilities:

The CRB MAC Group Legal Counsel serves as the CRB MAC Legal Counsel, a member of the CRB MAC Group Support staff, and is responsible for:

- advising the CRB MAC Group in matters of legal authority and responsibility,
- assisting in the drafting of interagency and private-sector agreements necessary to manage the infestation
- advising the CRB MAC Group on issues of regulatory compliance,
- coordinating legal issues with outside legal counsel, and
- assisting in the formulation of policies and procedures to manage the infestation.

CRB MAC Group Legal Counsel Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Obtain briefing from CRB MAC Chair. Determine:
- What emergency codes, authorities, or provisions have been implemented or anticipated.
- Regulatory and environmental compliance issues.
- Status of disaster declarations.
- What interagency agreements have been implemented.
- What interagency or private-sector agreements are needed.
- Any known or anticipated legal ramifications of the infestation or proposed management activities.

____ Confirm the assignment of the Coordination and Support Staff Compliance Technical Specialist. Assist as necessary with processing required regulatory compliance applications.

____ Research legal issues associated with management of the infestation. Prepare and present legal opinions to CRB MAC Group.

____ Assist in the formulation of policies and procedures as appropriate.

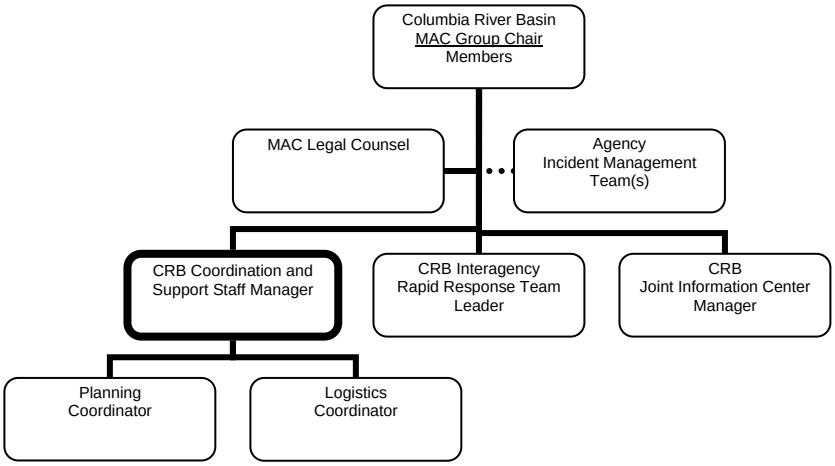
____ Coordinate with legal counsels from cooperating and assisting agencies, and other impacted agencies and jurisdictions as necessary to develop a consistent legal approach to management of the infestation.

____ Attend CRB MAC Group Planning Meetings.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Coordination and Support Staff Manager	**Reporting Relationships**: Reports to: MAC Group Chair Reports to this Position: ▪ Planning Coordinator ▪ Logistics Coordinator

Location in Organization:



General Responsibilities:

The CRB Coordination and Support Staff Manager ensures that accurate and timely situation and resource status is provided to the CRB MAC Group so that policy can be made, incidents prioritized, and resources allocated. The Manager also assists in ensuring that the organization has the resources it needs to respond to the infestation.

This responsibility has been divided into two general areas, Planning and Logistics:

- Planning requires the activation and management of subject matter experts whose skills and knowledge are vital to confirming the presence of dreissenids, the extent of the infestation, and the most appropriate control actions.
- Logistics requires providing the communications, facilities, and other support required by the MAC Group itself, as well as assisting in the identification, procurement, and delivery of resources that may be required to manage the infestation itself.

The Coordination and Support Staff Manager is responsible for activating and supervising staff assigned to Planning and Logistics.

The individual filling the position of CRB MAC Group Chair may also fill the CRB Coordination and Support Staff Manager position. In long term or very complex infestation management efforts, it may be necessary to fill both positions.

CRB Coordination and Support Staff Manager Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Obtain briefing from CRB Notification Coordinator, Incident Commanders, and/or MAC Group Chair.

____ Staff Planning and Logistics Coordinators as appropriate.

____ Confirm that Priority 1 notifications have been completed.

____ Confirm that positive identification of dreissenid species has occurred.

____ Complete or obtain completed ICS form 201 Incident Briefing, ICS Form 232 Resources at Risk and ICS Form 209 Incident Status Summary (see Appendix H for blank forms).

____ Ensure that CRB MAC Group room is set up, including resource and situation status displays.

____ Notify and convene appropriate subject matter experts to assist in confirming the presence of dreissenids, the extent of the infestation, and control and management options. Ensure that resource and situation status information is accurate, current, and complete.

____ Develop situation and resource status reports.

____ Brief CRB MAC Group.

____ Advise the CRB MAC Group on general emergency management issues and procedures.

____ Assist in obtaining and organizing resources.

- Identify scarce resources;
- Research location and availability of additional resources
- With approval of the CRB MAC Group, procure and assign additional resources.

____ Determine CRB MAC Group Schedule. Ensure CRB Coordination and Support Staff provide required information to meet time lines.

____ Document actions taken by the CRB Coordination and Support Staff. Provide copies to Planning Coordinator.

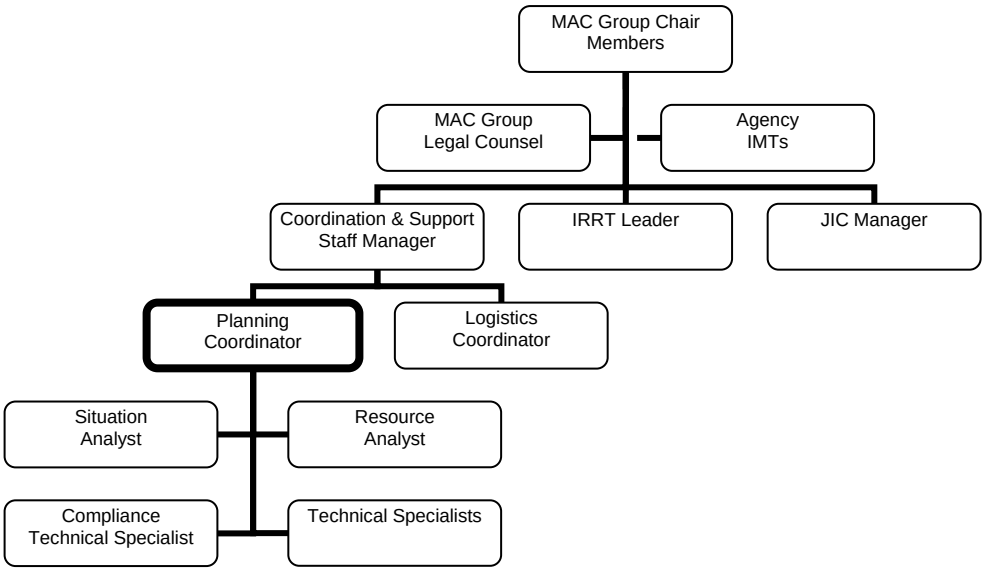
____ Brief CRB Coordination and Support Staff on decisions made by the CRB MAC Group. Ensure decisions are implemented.

____ Attend CRB MAC Group Planning Meetings.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Coordination and Support Staff Planning Coordinator	**Reporting Relationships**: Reports to: Coordination and Support Staff Manager Reports to this Position: ▪ Situation, Resource Analysts, ▪ Compliance Technical Specialist ▪ Technical Specialists

Location in Organization:



General Responsibilities:

The Planning Coordinator is responsible for the collection, evaluation, dissemination, and use of information about the development of the infestation and status of resources. Information is needed to: 1) understand the scope and implications of the infestation, 2) predict probable course of the infestation, and 3) prepare alternative strategies and control operations for the infestation.

The Planning Coordinator activates, assigns, and supervises Analysts and Technical Specialists who are subject matter experts in their areas of expertise. The Technical Specialists required will vary depending on the nature and location of the infestation, but may include:

- Biologists
- Experts in environmental compliance
- Hydrologists

- Meteorologists.

The Planning Coordinator is responsible for completing a variety of situation status forms to document analysis, management plans, and resource status. These include, but are not limited to the ICS form 201 Incident Briefing, ICS Form 232 Resources at Risk and ICS Form 209 Incident Status Summary (see Appendix H for blank forms).

The Planning Coordinator is also responsible for developing and/or procuring maps, situation and resource status displays, etc. for the use of the Coordination and Support Staff and the MAC Group.

Planning Coordinator Response Checklist (page 1 of 3)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the infestation.

____ Obtain briefing from the CRB Coordination and Support Staff Coordinator.
- Determine current resource status
- Determine current situation status
- Determine current strategic goals and tactical objectives
- Determine time and location of first CRB MAC Group Planning Meeting.
- Determine desired contingency plans.

____ Activate Situation and Resource Analysts and Technical Specialists as necessary.

____ Assist in obtaining and organizing resources:

- Establish and maintain resource tracking system.
- Identify scarce resources. Identify need for specialized resources; discuss need with CRB Coordination and Support Staff Manager; assist in identifying sources and availability of additional resources. Facilitate resource requests with Logistics.
- Form, deploy, and supervise technical specialist teams.

____ Develop situation and resource reports for the CRB MAC Group according to the schedule set by the CRB MAC Group Chair and the CRB Coordination and Support Staff Manager.

____ Advise CRB Coordination and Support Staff Manager of any significant changes in incident status.

____ Compile and display infestation status summary information.
- Forward infestation status summary reports to Priority 1 agencies/entities according to schedule established by the CRB Coordination and Support Staff Manager.
- Provide copy to JIC and local entity Public Information Officer(s).

____ Obtain/develop infestation maps.

____ Establish information requirements and reporting schedules for CRB Coordination and Support Staff and impacted entity/agencies.

____ Ensure sampling and monitoring plan has been developed and implemented (long-term monitoring is the responsibility of the responsible agency/lead entity).

____ Prepare contingency plans and containment/control recommendations.
- Review current and projected infestation and resource status.
- Develop alternative strategies.

Planning Coordinator Response Checklist (page 2 of 3)

- Identify resources required to implement contingency plan.
- Document alternatives for presentation to CRB MAC Group.

____ Identify and establish communications points with agencies responsible for compliance issues.

____ Notify Planning Coordinator of Compliance staff activated, including names and location of assigned personnel.

____ Prior to CRB MAC Group meetings, meet with CRB Coordination and Support Staff Manager and CRB MAC Group Chair to discuss proposed strategy and tactics and diagram infestation organization and resource locations.

____ Attend CRB MAC Group Meeting.

____ Participate in preparation of MAC Group Management Plan.

- Provide input on regulatory and environmental compliance issues, including approval status, estimated timelines, etc.
- Prepare the compliance assignments for the next operational period based on the contingency plans approved at the CRB MAC Group meeting.
- Identify future operational strategies, so as to anticipate compliance requirements

____ Prepare and submit compliance documents in a timely fashion. Coordinate review with CRB MAC Legal Counsel as needed.

____ Supervise preparation and distribution of the written MAC Group Management Plan, if indicated. Minimum distribution is to all CRB MAC Group Members, the IRRT, and local IMTs.

- Establish information requirements and reporting schedules for use in preparing the IAP.
- Ensure that detailed contingency plan information is available for consideration by the IRRT and local IMTs.
- Verify that all support and resource needs are coordinated with Logistics Section prior to release of plan.
- Coordinate changes with CRB Coordination and Support Staff, IRRT, and local IMTs. Obtain approval from CRB MAC Group Chair. Distribute written changes as appropriate

____ Coordinate preparation of the MAC Communications Plan with CRB Logistics Coordinator.

____ Provide periodic predictions on infestation potential.

____ Establish a weather data collection system when necessary.

____ Ensure Section has adequate coverage and relief.

Planning Coordinator Response Checklist (page 3 of 3)

____ Hold Section meetings as necessary to ensure communication and coordination among Planning staff.

____ Ensure preparation of demobilization plan (if appropriate).

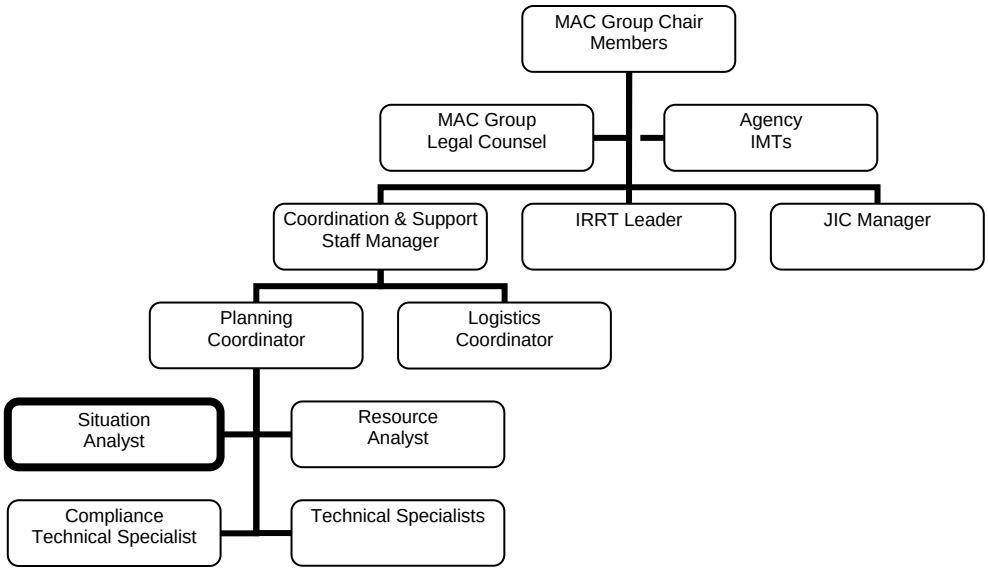
____ Ensure preparation of final incident package. Route to US Fish and Wildlife Service for archiving or follow-up.

____ Provide briefing to relief on current and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Situation Analyst	**Reporting Relationships**: Reports to: Planning Coordinator Reports to this Position: Technical Specialists

Location in Organization:



General Responsibilities:

The Situation Analyst is responsible for the collection and evaluation of information about the infestation. The Situation Analyst assigns and supervises Technical Specialists who are subject matter experts in their areas of expertise. Responsibilities will vary depending on the nature and location of the infestation, but may include:

- Determining the scope of the infestation.
- Confirming the presence and positively identifying the invasive species.
- Identifying the source of the infestation.
- Identifying and quantifying resources at risk.
- Researching likelihood of success and possible effects of proposed control options.
- Developing and recommending most appropriate control plan.

The Situation Analyst is responsible for completing a variety of situation status forms to document analysis and management plans. These include, but are not limited to the ICS form 201 Incident Briefing, ICS Form 232 Resources at Risk and ICS Form 209 Incident Status Summary (see Appendix H for blank forms).

The Situation Analyst is also responsible for developing and/or procuring maps, and situation status displays, etc. for the use of the Coordination and Support Staff and the MAC Group.

Situation Analyst Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Planning Coordinator.
- Review current incident status
- Determine current strategy, assess effectiveness
- Determine necessary reports and plans
- Identify reporting requirements and schedules-both internal and external to the incident.

____ Organize and staff unit as appropriate.
- Form, assign, and supervise Technical Specialists groups as necessary.
- Establish reporting requirements, including schedule and format.
- Request additional Technical Specialists as needed.

____ Supervise Technical Specialists as assigned.
- Brief Technical Specialists on current incident status.
- Assign analysis tasks.
- Notify staff of time lines and format requirements
- Monitor progress

(On very complex incidents, it may be necessary to assign a supervisor to oversee Technical Specialists).

____ Compile, maintain and display incident status information for MAC Group and Coordination and Support Staff.
- Sort data into required categories of information (i.e. geographic area, environmental values at risk, location of operations, etc.)
- Determine appropriate map displays
- Review all data for completeness, accuracy, and relevancy prior to posting.
- Plot infestation boundaries, location of perimeters, facilities, access routes, etc. on display maps.
- Develop additional displays (weather reports, incident status summaries, etc.) as necessary.
- Ensure displays and maps are kept up to date.

____ Provide photographic services and maps.
- Provide timely photo processing.
- Develop specialized maps.

Situation Analyst Response Checklist (page 2 of 2)

____ Provide situation evaluation, prediction and analysis for the MAC Group prepare information on alternative strategies.

- Review current and projected infestation and resource status.
- Develop alternative strategies.
- Identify resources required to implement management plan.
- Document alternatives for presentation to MAC Group.

____ Interview operations personnel to determine effectiveness of strategy and tactics, work accomplished and left to be accomplished.

____ Request weather forecasts as necessary. Spot weather forecasts may be requested directly from the National Weather Service.

____ Prepare incident status summary form (ICS209L) and other status reports as assigned prior to each MAC Group Planning Meeting. Provide copies to Coordination and Support Staff and MAC Group. Forward to other entities as directed.

____ Participate in MAC Group planning meetings as required.

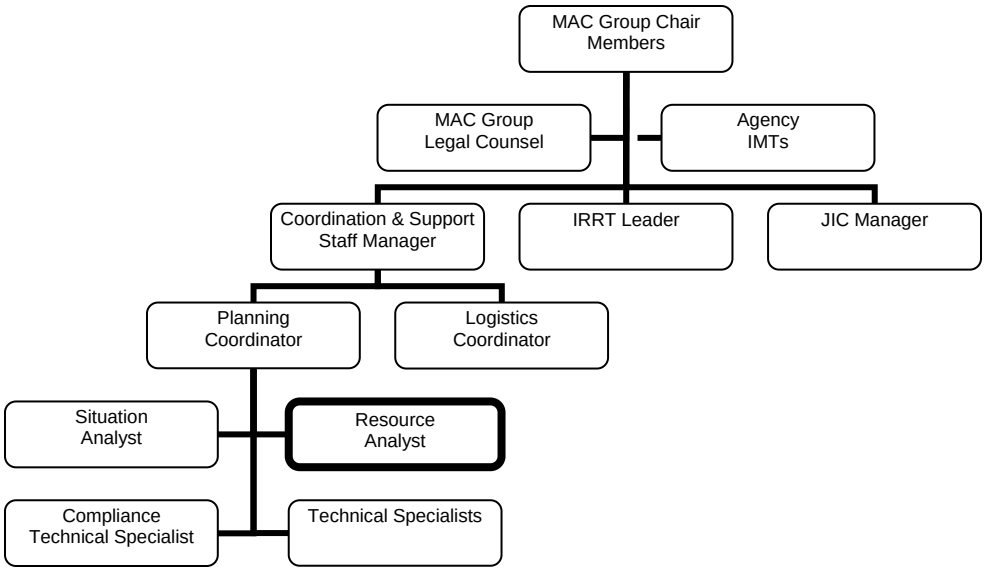
____ Prepare predictions at periodic intervals, or upon request of the Planning Coordinator. Notify Planning Coordinator if unforeseen changes occur.

____ Provide briefing to relief on current and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Resource Analyst	**Reporting Relationships**: Reports to: Planning Coordinator Reports to this Position: Technical Specialists

Location in Organization:



General Responsibilities:

The Resource Analyst is responsible for the collection and display of critical/scarce resource status, and for assisting in researching and locating additional resources required to manage the infestation.

Resource Analyst Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from the Planning Coordinator. Determine what resources are considered scarce/critical.

____ Organize, staff, and supervise unit as appropriate. Provide for adequate relief.

____ Establish contact with incident information sources to determine what scarce/critical resources have been assigned to the incident, their status, and location.

____ Compile, maintain and display scarce/critical resource status information.

____ Participate in MAC Group planning meetings as assigned.

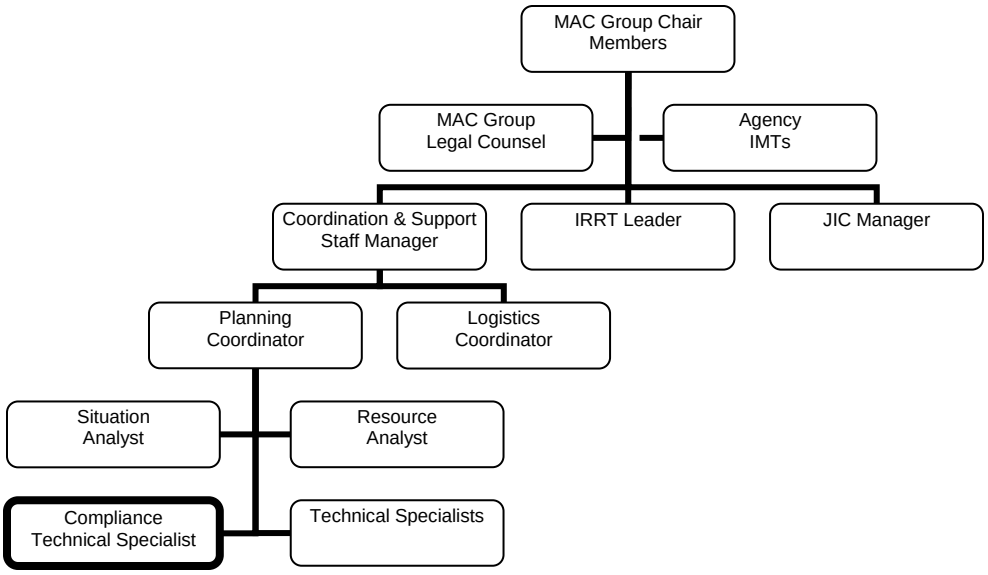
____ Brief relief on current and unusual situations.

____ Assist in identification of additional and special resources
- Other disciplines
- Technical specialists
- Resources needed to implement proposed management plans

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Compliance Technical Specialist	**Reporting Relationships**: Reports to: Planning Coordinator

Location in Organization:



General Responsibilities:

The Compliance Technical Specialist assists in identification and compliance with applicable regulatory issues, applications, and other authorizations. Tasks may include:

- Analyzing proposed management plans for regulatory implications.
- Preparing necessary applications, justification for waivers, etc. that may be necessary before the proposed management plan can be implemented.
- Coordinating applications, justifications, etc. with the MAC Group Legal Counsel as necessary.
- Advising the Planning Coordinator and the MAC Group on regulatory and compliance issues.

Compliance Technical Specialist Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Planning Coordinator.

____ Obtain copies of proposed management plans.

____ Identify regulatory issues related to the proposed management plan(s).

____ Complete applications, requests for waivers, etc. according to required format and timelines.

____ Advise Planning Coordinator of timelines for review and approval. Timelines may affect choice of management plan.

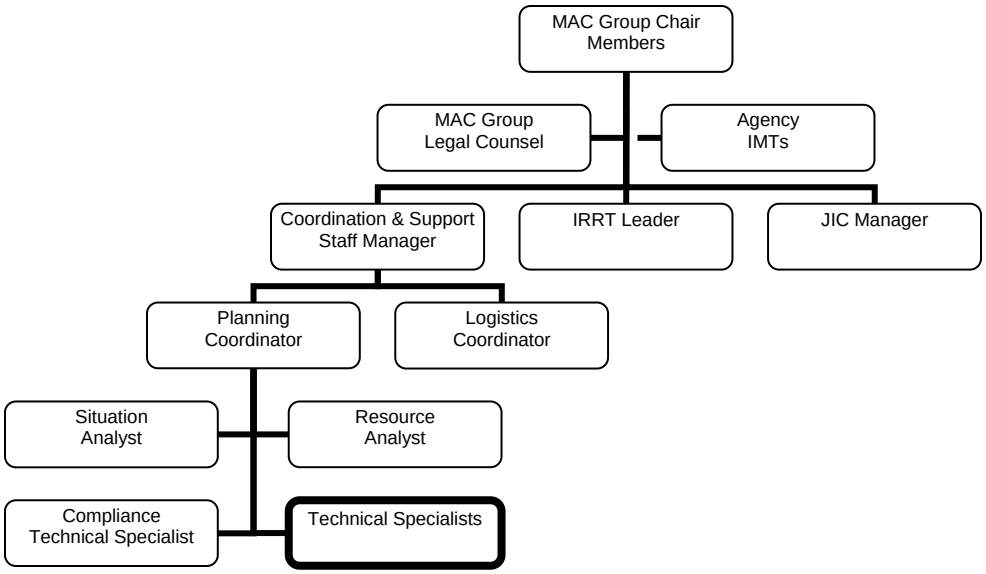
____ Participate in MAC Group planning meetings as requested.

____ Provide technical expertise to supervisor in organization according to established format, timelines, etc.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Technical Specialist	**Reporting Relationships**: Reports to: Planning Coordinator, Situation Analyst or other positions as assigned.

Location in Organization:



General Responsibilities:

Technical Specialists are advisors with special skills needed to support incident operations. Technical Specialists may report to the Planning Coordinator or Situation Analyst, or to other parts of the organization such as the on scene Incident Management Team, or to the IRRT.

Technical Specialist Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Planning Coordinator.
- Identify supervisor in organization.
- Determine nature and scope of assignment.
- Identify work location, resources available, expectations of Incident organization concerning time-lines, report format, participation in planning meetings, etc.

____ Obtain copies of management plans or Incident Action Plan (if available).

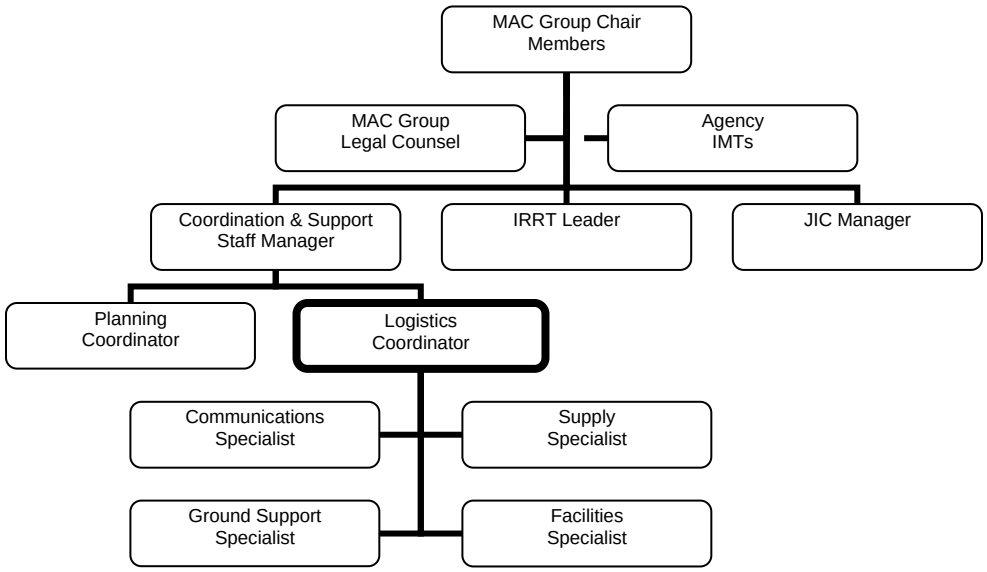
____ Participate in planning meetings as requested.

____ Provide technical expertise to supervisor in organization according to established format, timelines, etc.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Coordination and Support Staff Logistics Coordinator	**Reporting Relationships**: Reports to: Coordination and Support Staff Manager Reports to this Position: ▪ Supply Specialist, ▪ Facilities Specialist, ▪ Ground Support Specialist • Communications Specialist

Location in Organization:



General Responsibilities: The Logistics Coordinator, a member of the CRB Coordination and Support Staff, is responsible for providing facilities, services, and materials (except tactical aircraft) in support of the MAC Group and the on-scene operations managing response to the infestation. Tasks associated with these responsibilities may include, but are not limited to:

- Identifying and procuring facilities for the MAC Group, Coordination and Support Staff, and on-scene incident management team.
- Arranging for hotel rooms and food for the MAC Group, Coordination and Support Staff, and on-scene incident management team.
- Designing, procuring, and implementing communications systems and equipment in support of the MAC Group, Coordination and Support Staff, and on-scene incident management team.
- Assisting in the identification and procurement of resources needed to manage the infestation.

Providing transportation for personnel and materials to the scene of the infestation

Coordination and Support Staff Logistics Coordinator Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the infestation.

____ Obtain briefing from the CRB Coordination and Support Staff Manager.
- Review Situation and Resource status for number of personnel assigned to incident.
- Review current MAC Group organization

____ With approval from the CRB Coordination and Support Staff Manager, determine system for request and release of additional resources.

____ Assess adequacy of current MAC communications plan.

____ Organize and staff Logistics staff as appropriate. Consider the need for facility security, Communications, and Supply Specialists.

____ Assemble, brief, and assign work locations and preliminary work tasks to Logistics personnel.
- Provide summary of infestation situation
- Provide summary of the kind and extent of support the CRB Coordination and Support Staff Logistics organization may be asked to provide.

____ Notify Planning Coordinator of Logistics staff activated, including names and location of assigned personnel.

____ Attend CRB MAC Group Meeting.

____ Participate in preparation of MAC Group Management Plan.
- Provide input on resource availability, support needs, identified shortages, and response time-lines for key resources.
- Prepare the Logistics assignments for the next operational period based on the operational objectives generated at the CRB MAC Group planning meeting.
- Identify future operational needs (both current and contingency), so as to anticipate logistical requirements
- Ensure MAC Communications Plan is prepared.

____ Establish contact with adjoining and mutual aid cooperators.

____ Review Incident Action Plan and estimate section needs for next operational period; order relief personnel if necessary.

____ Assist in obtaining and organizing resources.
- Research availability of additional resources.
- Process requests for scarce resources.

Coordination and Support Staff Logistics Coordinator Response Checklist (page 2 of 2)

- Provide resource identification information and arrival times with on-scene Logistics Section Chief.

____ Hold Logistics staff meetings as necessary to ensure communication and coordination among Logistics staff.

____ Ensure coordination between Logistics and CRB staff.

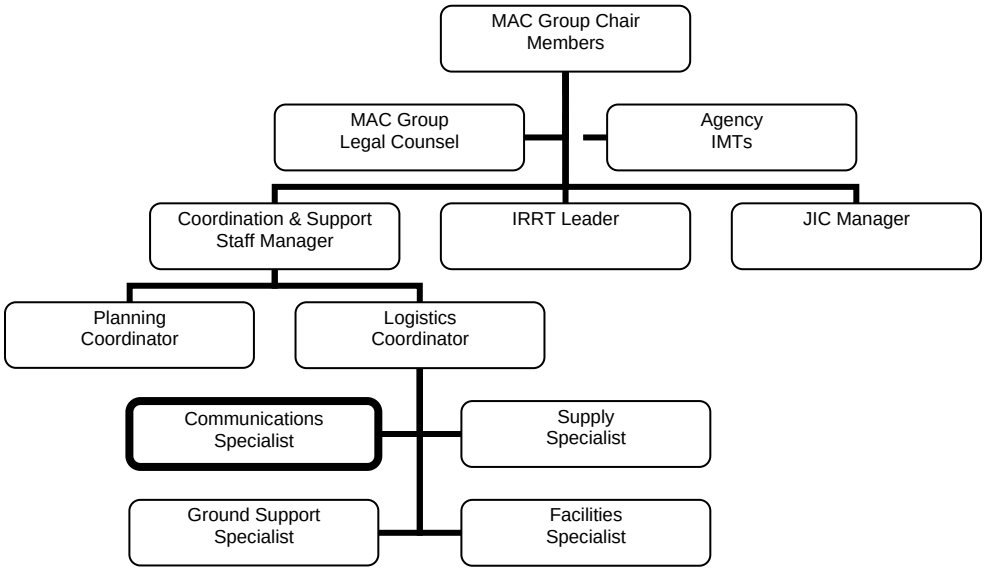
____ Ensure general welfare and safety of section personnel.

____ Provide briefing to relief on current activities and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Communications Specialist	**Reporting Relationships**: Reports to: Logistics Coordinator Reports to this Position: ▪ Communications Technicians ▪ Communications providers

Location in Organization:



General Responsibilities:

The Communications Specialist is responsible for designing and implementing communications plans to support the CRB MAC Group and the on-scene operations. Tasks may include:

- Identifying communications modes already in use.
- Determining additional communications support that may be required.
- Identifying and activating sources of communication support.
- Developing a communications plan to ensure effective communication between the MAC Group, its constituent agencies/entities, and the on-scene Incident Management Team.

Communications Specialist Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from the Logistics Coordinator.

____ Organize and staff unit as appropriate.
- Ensure adequate staff is assigned to answer phones and email and attend fax machines.

____ Assess communications systems in use; determine communications capabilities/limitations.

____ Develop and implement effective communications procedures (flow) internal and external to the Coordination and Support Staff.

____ Assess phone load. Activate additional lines as needed.

____ Prepare and implement MAC Communications Plan.
- Obtain current organizational chart
- Identify email addresses, cellular and land-line telephone numbers, or radio links for the following:
  - MAC Group Chair
  - Coordination and Support Staff (including Technical Specialists assigned to the field).
  - MAC Group Members
  - Constituent agencies/entities
  - JIC
  - Local/national press
  - Incident Management Team
  - MAC Group Legal Counsel
  - IRRT Leader

____ Determine need and research availability of additional nets and systems. Order through Supply Specialist after approval by Logistics Coordinator.

____ Document malfunctioning communications equipment, facilitate repair.

____ Establish and maintain communications equipment accountability system.

____ Provide technical information, as required, on:
- Adequacy of communications system currently in use.
- Geographic limitation on communications equipment.
- Equipment capabilities.

Communications Specialist Response Checklist (page 2 of 2)

- Amount and types of equipment available.
- Anticipated problems in the use of communications equipment.

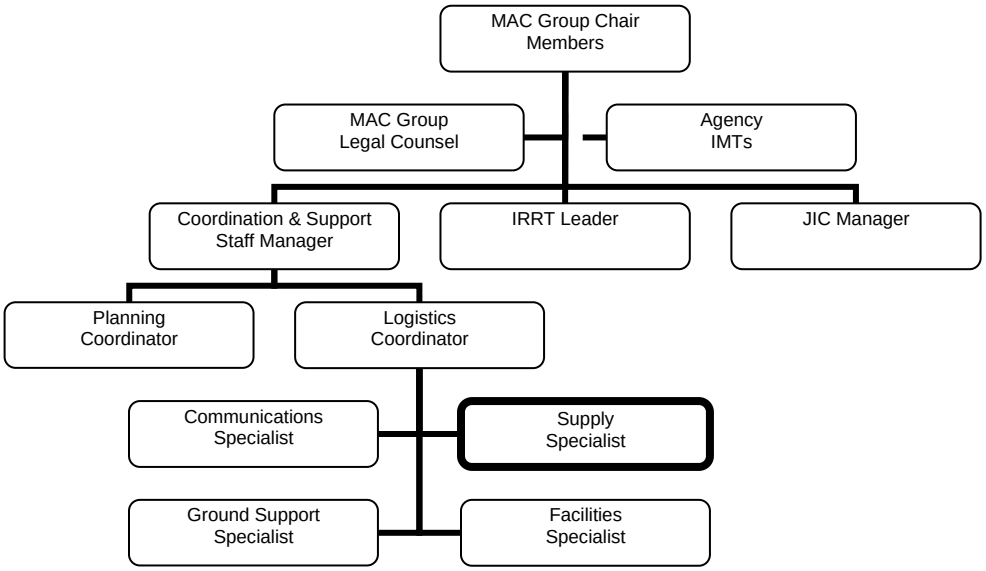
____ Estimate unit needs for expected operations; order relief personnel.

____ Provide briefing to relief on current activities and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Supply Specialist	**Reporting Relationships**: Reports to: Logistics Coordinator Reports to this Position: ▪ Ordering staff ▪ Technical Specialists-Resources

Location in Organization:



General Responsibilities:

The Supply Specialist is responsible for ordering, receiving, and storing all resources needed to support MAC Group Operations. Tasks may include:

- Identifying and purchasing general office supplies and other resources.
- Activating additional staff upon request from other MAC Group staff.
- Maintaining accountability for resources purchased.
- Identifying and ordering scarce/critical resources.

Supply Specialist Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Logistics Coordinator
- Determine charge code or purchasing process for incident.
- Confirm ordering process
- Determine scope of supply process (on scene and MAC Group)

____ Organize and staff unit as appropriate.
- Consider need for "lead agency" representation in ordering process
- Consider dividing ordering responsibilities either by discipline or by type (equipment, personnel, supplies)

____ Determine ordering parameters, authorities and restrictions. Ensure that ordering staff observe ordering system and chain of command for ordering.

____ Contact Resource Analyst to determine what resources are scarce/critical.

____ Receive resource orders from authorized staff. Document:
- Qualifying specifications (size, extra equipment, personnel protective equipment, qualifications, etc.),
- Desired delivery time and location, person ordering, and person to whom the resource should report or be delivered.
- Obtain estimated price for resources which expect reimbursement.
- Ensure rented equipment is inspected before use.

____ Order, receive, distribute, and store supplies and equipment.
- Obtain resource name, number, identifiers, etc., along with ETA's.
- Relay this information to appropriate staff.

____ Advise affected personnel of changes in arrival times of requested resources. Advise immediately if order cannot be filled.

____ Alert Logistics Coordinator to changes in resource availability which may affect incident operations.

____ Maintain inventory of supplies and equipment.

____ Keep and submit copies of all orders and related documentation to the Planning Coordinator.

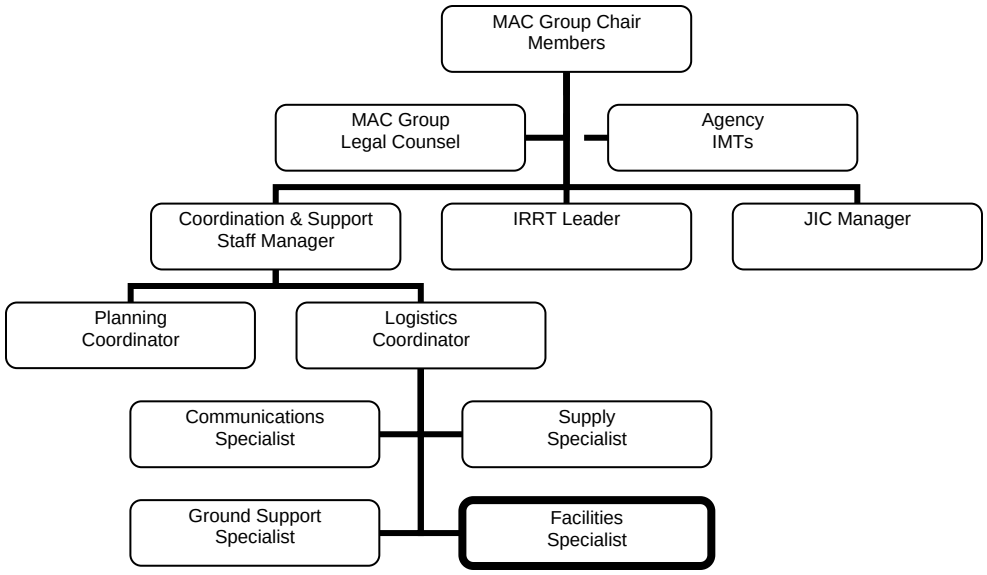
Supply Specialist Response Checklist (page 2 of 2)

____ Brief relief on status of outstanding orders, current activities, and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Facilities Specialist	**Reporting Relationships**: Reports to: Logistics Coordinator

Location in Organization:



General Responsibilities:

The Facilities Specialist is responsible for the layout and activation of facilities required to support the MAC Group, including office space, meeting rooms, and the JIC. The Facilities Specialist also ensures that staff have sleeping accommodations, and identifies and arranges for food to be delivered to staff who are unable to leave their work assignments to eat. Tasks may include:

- Identifying appropriate office/workspace for the MAC Group and its support elements.
- Negotiating use agreements for workspace.
- Making reservations for hotel/motel rooms.
- Identifying easily accessible restaurants.
- Arranging for food and coffee service as necessary.

Facilities Specialist Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from the Logistics Coordinator.
- Expected duration and scope of the incident.
- Anticipated facility needs.

____ Assess need for additional workspace.

____ Determine requirements for each facility to be established.
- Workspace
- Meeting rooms
- Sanitation
- Supply area
- Communications needs (including computers)
- Security needs
- Break areas
- Parking

____ Plan facility layouts in accordance with above requirements.

____ Coordinate negotiation for rental office or storage space:

____ Video or photograph rental office or storage space prior to taking occupancy.

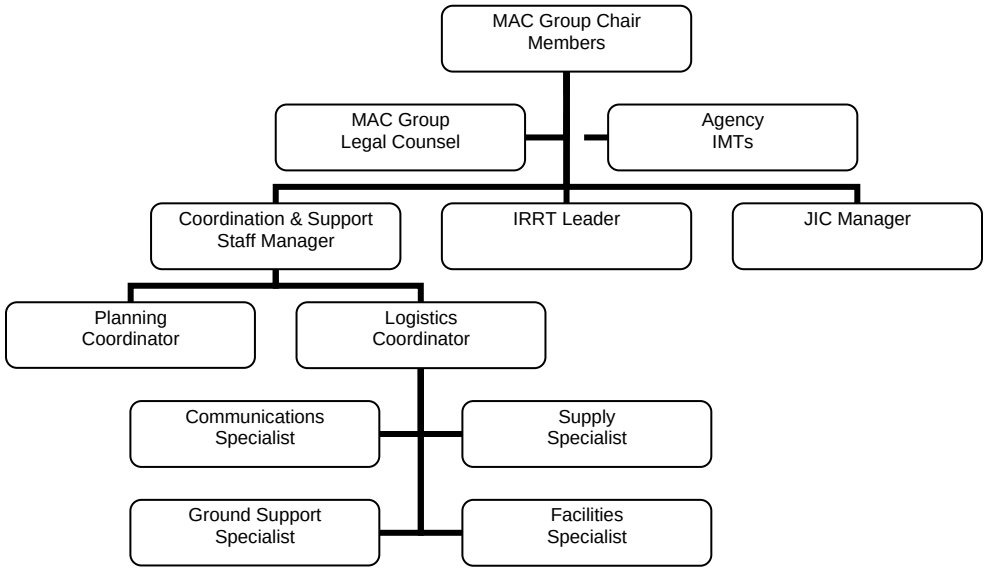
____ Make hotel reservations for staff as necessary.

____ Order food and coffee service as necessary.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Ground Support Specialist	**Reporting Relationships**: Reports to: Logistics Coordinator Reports to this Position: ▪ Drivers ▪ Transportation providers

Location in Organization:



General Responsibilities:

The Ground Support Specialist is responsible for transportation of personnel, supplies, food, and equipment to and from the MAC Group and support staff, and to the scene of the infestation. Depending on the complexity of the operation, and funding agreements, tasks could include:

- Requesting, assigning and tracking agency or rental vehicles.
- Negotiating delivery of resources to the MAC Group or to the scene of the infestation.
- Arranging commercial transportation for personnel responding to or returning home from assignment to the MAC Group or scene of the infestation.
- Ensuring that rental vehicles and other equipment are inspected before use.

Ground Support Specialist Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Logistics Coordinator.
- Transportation needed for MAC Group and on-scene Staff.
- Location of Supply Specialist receiving and distribution point(s)

____ Staff Unit as indicated by the above considerations.

____ Consider the need to use agency/entity pool vehicles or rental vehicles to augment transportation resources.

____ Maintain inventory of support and transportation vehicles.

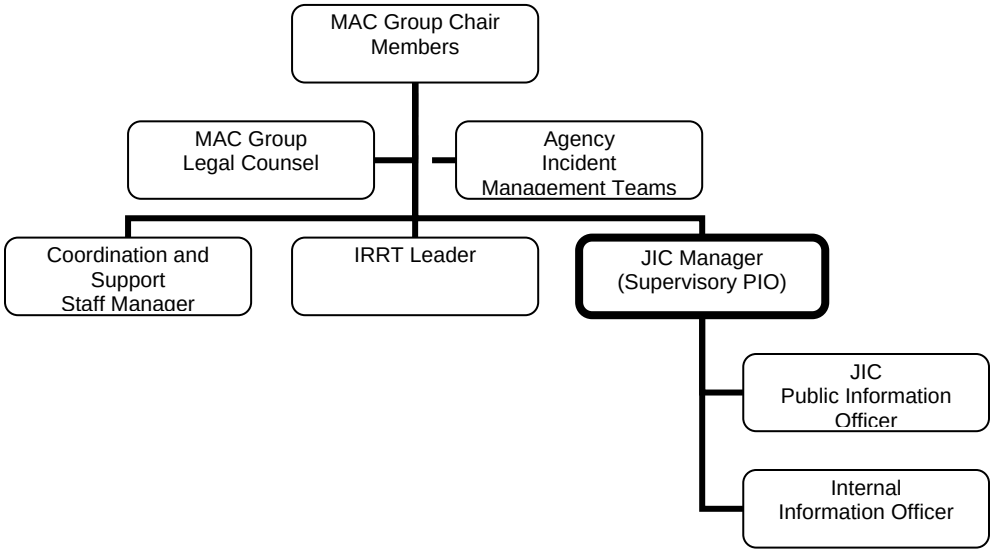
____ Provide transportation services.
- Review management plans for transportation requirements.
- Review inventory for needed resources.
- Request additional resources through Supply Unit. Give type, time needed, and reporting location.
- Schedule use of support vehicles.
- Document mileage, fuel consumption, and other costs.

____ Ensure that the condition of rental equipment is documented prior to use.

____ Maintain Unit Log (ICS 214). Provide all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: Joint Information Center Manager/Supervisory PIO	**Reporting Relationships**: Reports to: MAC Group Chair Reports to this Position: ▪ Public Information Officers ▪ Internal Information Officer

Location in Organization:



General Responsibilities:

The CRB Joint Information Center (JIC) Manager/Supervisory PIO is responsible for the coordinated formulation and release of information about the infestation to the news media, the public, agency/entity employees, and other agencies and organizations. Tasks may include:

- Developing press releases
- Conducting press conferences
- Developing talking points and other public information documents
- Responding to rumors and incorrect information
- Supervising JIC staff
- Advising the MAC Group in matters pertaining to public information and media relations.

JIC Manager Response Checklist (page 1 of 2)

The following checklist is a guideline for the use of the CRB JIC Manager/Supervisory PIO. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Obtain briefing from the CRB MAC Chair.
- Determine current status of infestation
- Identify current organization
- Determine point of contact for media (scene or JIC)
- Determine current media presence and interest

____ Contact Public Information Officers from impacted agencies and jurisdictions. Determine:
- Status of press contacts.
- Method for coordinating press releases and briefings.
- Need for a CRB Joint Information Center (it may be possible to issue a joint press release or hold a joint press conference rather than set up a formal JIC).
- Ensure that information provided to the public is consistent across jurisdictional boundaries when appropriate.

____ Assess need for special alert and warning efforts, including industries especially at risk, or which may need advance notice in order to shut down processes.

____ **The initial release of information about the infestation is the responsibility of the affected jurisdiction.** Prepare initial information summary as soon as possible after activation. If no other information is available, consider the use of the following general statement:

> *We are currently investigating reports of (name of invasive species) in the vicinity of (general location). Experts from the Columbia River Basin Interagency Response Team and local agencies are responding, and we will have additional information available as we are able to confirm it. We will hold a briefing at (location), and will notify the press at least ½ hour prior to the briefing. At this time, this briefing is the only place where officials authorized to speak about the incident and confirmed information will be available. Thank you for your assistance.*

____ Ensure adequate work space, materials, telephones, and staff. Consider activating:
- JIC Public Information Officers
- Internal Information Officers

JIC Manager Response Checklist (page 2 of 2)

____ Establish contact with Field (IMT) Public Information Officers. Assist in the development of a coordinated, interagency approach to public information.

____ Establish contact with local and national media representatives as appropriate.

____ Establish location of Information Center for media and public, away from MAC Group and Coordination Group work areas.

____ Establish schedule for news briefings.

____ Coordinate with Logistics the activation and staffing of message center "rumor control" lines to receive requests and answer questions from the public and impacted entities. Provide statement to operators.

____ Obtain current incident status reports from Planning Section; coordinate a schedule for updates.

____ Observe constraints on the release of information imposed by the CRB MAC Group and impacted jurisdiction Incident Commanders.

____ Obtain approval for information release from CRB MAC Chair.

- Confirm details to ensure no conflicting information is released.
- Identify site and time for press briefings, and confirm participation by other CRB MAC Group members, and representatives from impacted jurisdictions.
- Confirm who can authorize information releases in the absence of the CRB MAC Chair.

____ Release news to media, and post information in Coordination and MAC Group work areas and other appropriate locations.

____ Record all interviews and copy all news releases. Contact media to correct erroneous or misleading information being provided to the public via the media. Coordinate this activity with PIOs from impacted jurisdictions.

____ Update affected agencies/entities on a regular basis. Electronic mail may be used for updates. Provide standard statement which can be given to general requests for information.

____ Attend CRB MAC Group planning meetings.

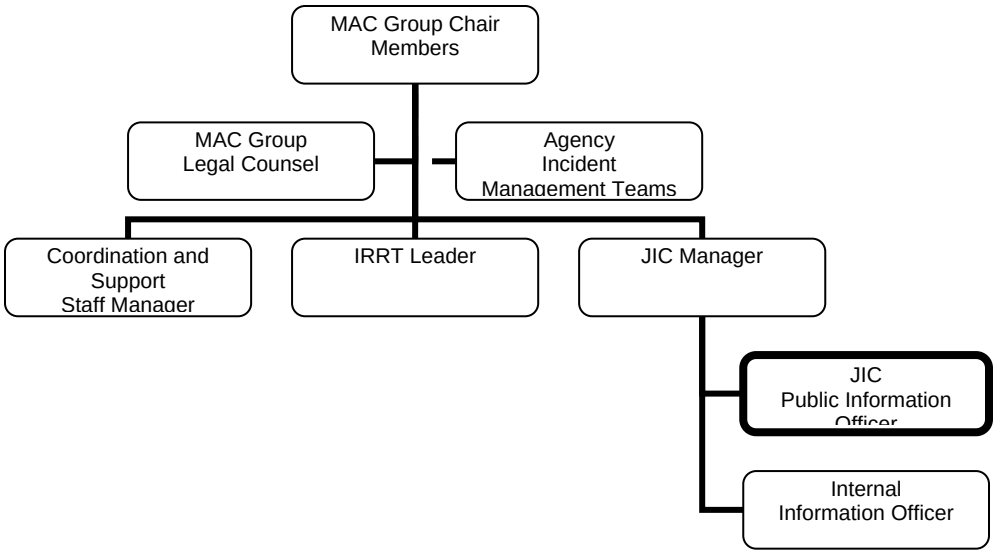
____ Respond to special requests for information.

____ Provide all news releases, bulletins, and summaries to Coordination Group Planning Coordinator to be included in the final incident package.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: JIC Public Information Officer	**Reporting Relationships**: Reports to: JIC Manager/Supervisory PIO

Location in Organization:



General Responsibilities:

Public Information Officers assigned to the JIC are responsible for developing a coordinated approach to public information related to the infestation. Tasks may include

- Developing press releases, talking points, and information summaries for dissemination to the press, agency employees, and outside agencies/entities.
- Coordinating document development with agency and Field Public Information Officers.
- Conducting briefings for the press and other interested groups.
- Identifying trends in press and public opinion and bringing these to the attention of the JIC Manager

JIC Public Information Officer Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Receive briefing from Supervisory Public Information Officer.

____ Determine location and participants in Joint Information Center (JIC).

____ Assist in the development of public information documents such as press releases, internal employee briefings, etc.

____ Determine constraints on information to be provided by the JIC.

____ Observe constraints established on information release. Provide copies of JIC releases to home unit and Field Public Information Officers. Request that errors or misleading/confusing information be identified.

____ Be proactive in requesting updates on information from home unit.

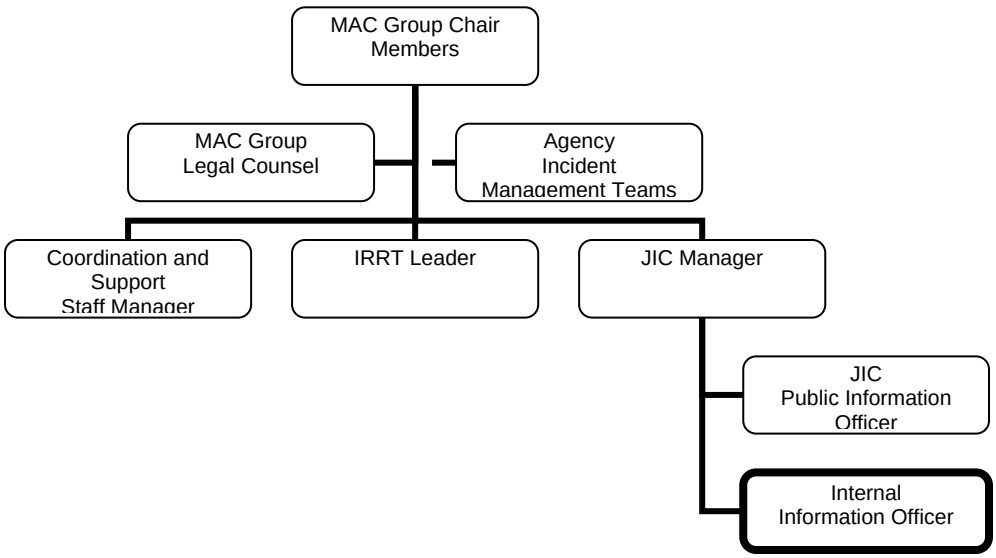
____ Keep home unit Public Information Officer apprised of activities of JIC.

____ Maintain copies of releases; provide to Supervisory Public Information Officer for inclusion in Final Incident Package.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: JIC Internal Information Officer	**Reporting Relationships**: Reports to: JIC Manager/Supervisory PIO

Location in Organization:



General Responsibilities:

The Internal Information Officer assigned to the JIC is responsible for ensuring that employees of agencies and entities responding to the infestation are kept informed on response activities. Tasks may include

- Developing summaries for dissemination to agency employees and communications points.
- Coordinating document development with agency/entity Public Information Officers.
- Conducting briefings for agency/entity employees.
- Identifying and addressing rumors, discrepancies in information, etc.

Internal Information Officer (page 1 of 1)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Obtain briefing from JIC Manager/Supervisory Public Information Officer.

____ Develop standard statement to be provided to communications points.
- Department secretaries and switchboard operators
- 911 Centers (if necessary)
- Other communications points which may receive calls about the infestation

____ Obtain approval for statements from JIC Manager/Supervisory Public Information Officer.

____ Determine communications methods available. e-mail may be used to update affected entities simultaneously.

____ Determine what phone line has been established for internal updates, make sure affected entities are appraised of the number.

____ Provide copies of statements to Logistics Coordinator for use by rumor control operators.

____ Be proactive in requesting information updates from JIC Manager/Supervisory Public Information Officer and other JIC staff.
- Planning Coordinator for Incident updates
- Logistics Section for information on resource use.

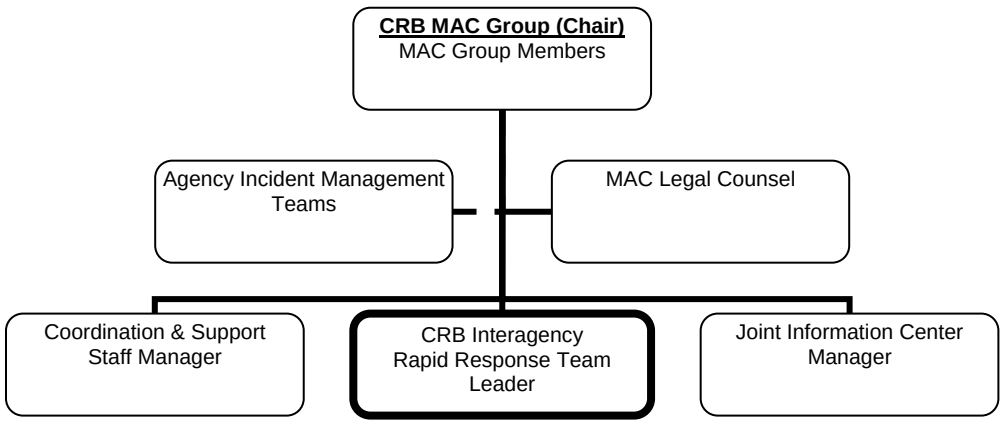
____ Update communications points on a regular schedule.

____ Maintain copies of statements given; provide to JIC Manager/Supervisory Public Information Officer for inclusion in Final Incident Package.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

CRB Multi-Agency Coordination Structure	***Position Description***
Position: IRRT Leader	**Reporting Relationships**: Reports to: MAC Group Chair, Agency Administrators (when responding as an Incident Management Team) Reports to this Position: Individual Team Members, Subject Matter Experts

Location in Organization:



General Responsibilities:

The Interagency Rapid Response Team consists of ICS-trained subject matter experts that can be deployed to the scene in three ways:

- as a Unified Command incident management team providing on-scene response, management, and control of the infestation,
- as individual ICS Command/General Staff Filling vacancies within the local Incident Management Team's Command and General Staff or
- as Technical Specialists providing technical expertise to the local Incident Management Team, or serving as Field Observers or Technical Specialists to the MAC Coordination and Support Staff's Planning function.
- depending upon the management needs of the agency suffering from the infestation.

IRR Team Leader Response Checklist (page 1 of 3)

The following checklist is a guideline designed for use by the IRRT Leader/IC. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Receive assignment from CRB MAC Group. Determine:
- Configuration (IMT or Technical Specialists).
- Status of Delegation of Authority (IMT)
- Team members assigned and en route

____ Name and location of local Incident Commander (Technical Specialist assignment)

____ Conduct assignments according to established agency SOPs.

The remaining elements of the checklist are for use by the IRRT Leader when responding as Incident Commander. Checklists for Command and General Staff can be found in the NIMS Field Operations Guide. Checklists for Rapid Response Objectives assigned to the field operations elements of the responsible agency or to the IRRT Incident Management Team can be found in *Field Operations* beginning on page B-27.

The Incident Commander is responsible for the overall management of the infestation, the development and implementation of strategic goals and objectives (in coordination with the CRB MAC Group), and for approving the ordering and release of resources. IRRT Command will be Unified, with Command personnel from USFWS, the impacted state Fish and Wildlife Agency, and tribal or other agencies or jurisdictions who share authority for the incident. **Any functions not assigned by the Incident Commander remain the responsibility of the Incident Commander.**

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the incident.

____ Supervise Command and General Staff; ensure welfare and safety of incident personnel.

____ Obtain initial briefing.

____ Assess infestation situation.
- Review the current situation status and initial strategic objectives. Ensure that all County, State and Federal agencies impacted by the incident are notified.

IRRT Leader Response Checklist (page 2 of 3)

____ Conduct Unified Command Meeting. The Command Meeting is usually attended only by the Incident Commanders, and the following topics should be discussed as appropriate:

- Jurisdiction or agency priorities
- Jurisdiction or agency limitations, concerns, restrictions
- Develop a collective set of incident objectives (coordinate with CRB MAC Group)
- Establish and agree on acceptable priorities
- Adopt an overall strategy or strategies to achieve objectives
- Agree on basic organizational structure.
- Designate the best qualified and acceptable Operations Section Chief.
- Agree on General Staff personnel designations and planning, logistical, and financial arrangements and procedures.
- Confirm the resource ordering process to be followed (with CRB Coordination and Support Staff).
- Agree on cost-sharing procedures.
- Agree on informational matters (with CRB JIC if activated).
- Designate one IC to act as the Unified Command spokesperson.

____ Activate appropriate Command and General Staff positions.

- Confirm dispatch and arrival times of activated resources.
- Confirm work assignments.

____ Determine what management plans and activities require MAC Group approval.

____ Brief staff

- Identify strategic goals and any policy directives for the management of the infestation.
- Provide a summary of current organization.
- Provide a review of current activities.
- Determine the time and location of first planning meeting.

____ Determine information needs and inform staff of requirements.

____ Ensure interagency coordination.

- Ensure that affected elected officials have been informed of infestation, and keep them informed as to status and activities. Include elected officials in planning meetings as appropriate.
- Determine status of Disaster Declarations and Delegation of Authority.
- Ensure that the Liaison Officer is making systematic contact with elected officials and cooperating and assisting agency/entity managers.

IRR Team Leader Response Checklist (page 3 of 3)

____ Establish parameters for resource requests and releases.
- Review requests for critical resources.
- Confirm who has ordering authority within the organization.
- Confirm those orders which require Command authorization.
- Establish contact and coordination procedures with CRB Coordination and Support Staff Logistics Coordinator.

____ Authorize release of information to the media.
- If operating within a Unified Command, ensure all ICs approve release.
- Coordinate release of information with CRB JIC (if activated)

____ Establish level of planning to be accomplished.
- Written Incident Action Plan (in coordination with the CRB MAC Group)
- Contingency Planning
- Formal planning meeting

____ Ensure planning meetings are conducted according to schedule.

____ Approve and authorize implementation of the Incident Action Plan.
- Review IAP for completeness and accuracy
- Verify that objectives are incorporated and prioritized.
- Sign ICS202

____ Ensure Command and General Staff coordination.
- Periodically check progress on assigned tasks of Command and General Staff personnel.
- Approve necessary changes to strategic goals and action plan.
- Ensure that Liaison Officer is making periodic contact with participating agencies.

____ Request emergency declaration as necessary (in coordination with CRB MAC Group). Ensure declaration is forwarded to affected local or tribal agency Office of Emergency Management, and to the affected State Office of Emergency Management.

____ Review and approve disaster assessment statements from Planning staff prior to forwarding to State.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

IV. Field Operations Response Checklists

The following checklists provide additional guidance for field operations. Field operations may be conducted by the responsible agency or by the IRRT Incident Management Team**.**

Rapid Response Objective 4- Define Extent of Colonization

Site Surveys

Purpose: Establish physical range of infestation, and identify life-cycle phase of mussels in order to inform policy and tactical response to the infestation. Determine geographic extent and demography of infestation, (including upstream and downstream areas and connected water bodies) in order to guide subsequent management decisions, including survey design. Since veligers may only be in the water for a short period of time, plankton sampling and identification must have a quick turnaround time (no more than a week) so that further sampling can occur swiftly and in a coordinated fashion that ensures proper geographic coverage.

Lead entity: The agency where the initial sighting(s) of mussels occurs. In the event the agency does not have the incident management capability or the technical expertise to conduct the site survey, it may formally delegate that responsibility to the CRB IRRT.

Tasks:

1. Survey nearby water bodies with vulnerability to the same vectors (using information from boater surveys where available to determine high traffic areas). Potential methodologies include:
    - sampling fixed and temporary hard substrates,
    - shoreline surveys,
    - SCUBA and snorkel surveys, and
    - plankton sampling. Plankton sampling may be analyzed microscopically or via Polymerase Chain Reaction (PCR) genetic analysis (see Appendix C for associated analytical resources). Plankton samples should involve sufficient water volume to detect low veliger concentrations via either of those methods. These efforts should follow existing regional or national protocols.
2. Assess maturity and spawning condition of mussels at the infestation site(s).
3. Determine likely water flow dispersal of mussel veligers. Potential methodologies include:
    - dye studies
    - other hydrographic research techniques
    - interviewing field personnel

4. Identify facilities (e.g., hydropower, fish hatcheries, irrigation systems, etc.) that could be affected. See Appendix F-Contingency Plans.
5. Ensure that surveys are completed and that results are reported to the CRB Coordination Group via the 100th Meridian Initiative website (http://100thmeridian.org).

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

Purpose: Minimize all vectors that might further spread the original infestation.

Lead entity: The agency where the infestation of mussels is found. In the event the agency does not have the incident management capability or the technical expertise to conduct quarantine and pathway management tasks, it may formally delegate that responsibility to the CRB IRRT.

Tasks:

1. Identify dispersal vectors (including movement by humans, fish and wildlife, water traffic, water flow, and other processes). Assume measures are needed to prevent release of veligers as well as movement of adult mussels.
   - Assess the likely movement of boats that recently used the infested water body to identify inspection needs in other water bodies.
2. Establish public outreach efforts, including:
   - Ensure that zebra/quagga mussel “alert” signs are adequately deployed.
   - Alert prior users of these waters of the risks their boats and equipment create for other water bodies.
   - Design and implement educational outreach programs using print, electronic media and other avenues, with an emphasis on raw water users.
3. Restrict dispersal pathways, where feasible, including:
   - If feasible, identify and eliminate the likely source of mussel inoculation (e.g., infested boat).
   - Quarantine any hatcheries or aquaculture operations that are likely to spread mussels or their larvae via transfers outside the affected watershed(s).
   - Quarantine infested water bodies as needed to prevent spread by watercraft.
   - Consider and implement any needed prevention of overland veliger or adult mussel transport to other water bodies.

- — Develop and implement Hazard Analysis and Critical Control Point (HACCP) plans to ensure that response personnel do not further spread the original infestation.
- — Stop or slow water release to potentially uninfested sites.
- — Draw water from below thermocline.
- — Install physical barriers.
- — Consider special management measures for operations of locks and commercial vessel traffic

4. Establish wash and inspection requirements on boats and equipment, and provide for associated logistical support (e.g., disinfection kits).
   - — Begin a post haul-out inspection of boats and equipment in the areas where mussels were found.
   - — Begin a pre-launch inspection program for all boats and equipment in places where boats and equipment from a contaminated area are likely to be launched next.

Rapid Response Objective 8: Initiate Available/Relevant Control Measures

Purpose: Evaluate management options, and then proceed with either eradication efforts or containment/mitigation activities.

Lead entity: The responsible agency where the infestation of mussels is found. In the event the agency does not have the incident management capability or the technical expertise to conduct control measures, it may formally delegate that responsibility to the CRB IRRT.

Tasks:

1. Decide if eradication is possible based on rapid analysis of population dynamics and pathways of spread. Consider the following:
   - — Cost vs. benefit of treatment options.
   - — Type of water body – contained lake, mainstem reservoir, tributary reservoir, small stream, large river, estuary, or water diversion facility.
   - — Type of substrate – e.g., rocks that allow mussel attachment on their undersides where chemicals may not reach them.
   - — Extent of population distribution – isolated vs. widespread coupled with *a priori* assumptions about the spread of mussels before detection.
   - — Life stage(s) present (default assumption is both veligers and adults).

— Time of year in relation to spawning season.

— Is spawning occurring now or at least possible based on current water temperature (e.g., 12 °C or greater)?

— When is the likely spawning season based on predicted temperature conditions?

— How do mean monthly temperature patterns for the water body relate to mussel spawning requirements?

— Amount of water in reservoir or waterway.

— Does the reservoir need to be drawn down before treatment?

— How far can the reservoir be drawn down?

— Is river flow low enough for effective treatment?

— Circulation patterns in water body.

— Spreading pattern of population within the water body.

— Inflow rates and sources.

— If drawdown needs to occur, what is the feasibility given input source(s)?

— Rate of outflow and distance of veliger dispersal.

— Do flow patterns help or hinder eradication options?

— Presence of state or federally listed threatened or endangered species.

— Special status of water body, including:

- Water use designation (e.g., drinking water).
- ‘Wild and scenic’ designation.
- Wilderness area.
- Potential impact to cultural resources.
- Department of Defense or other restricted access areas
- Tribal lands
- Endangered Species Act critical habitat
- Presence of marine mammals covered by Marine Mammal Protection Act
- Clean Water Act 303(d) listing
- Beneficial Uses of water bodies

2. If eradication is attempted, select appropriate method(s) - see D-2.
3. If eradication is not possible, develop control objectives and select/design appropriate control measures - see D-2.
4. Obtain relevant permits and regulatory agency concurrence (see Appendix E-Regulatory Requirements).
5. Implement eradication or control strategies

Rapid Response Objective 9: Institute Long-Term Monitoring

Purpose: Provide for data for adaptive management and long-term evaluation efforts.

Lead entity: The responsible agency where the infestation of mussels is found.

Tasks:

1. Design a monitoring program to evaluate the status of the zebra/quagga mussel populations, emphasizing veliger sampling. Monitoring activities should be carried out in coordination with other field operations, such as environmental monitoring to meet permit and other regulatory compliance requirements (e.g. National Pollutant Elimination Discharge System [NPDES]).
2. Disseminate findings through an easily-accessible, consolidated, coordinated real-time database and list serve (e.g., via 100th Meridian Initiative website)

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APPENDIX C-Notification Lists and Procedures

Appendix C: Notification List and Procedures

Rapid Response Notification List

Note: Priority 1 contacts will be notified when a report is received of live dreissenids within the Columbia River Basin. These contacts represent standing members of the CRB MAC Group and the Coordination and Support Staff. The listed contacts for each agency are responsible for internal notification within their agency.

Priority 1 Notification List								
Organization	**Name/position**	**Office Phone**	**Cell phone**	**Fax**	**Email**	**Notes**	**Assignment MAC**	**C&S Staff**
Oregon Department of Fish and Wildlife	Curt Melcher	503- 947-6044			curt.melcher@state.or.us		**x**	
Oregon Department of Fish and Wildlife	Rick Boatner, AIS Coordinator	503 947-6308	xxxxxxxxxx		rick.j.boatner@state.or.us	Will coordinate with PSU for Oregon notification		**x**
Washington Department of Fish and Wildlife	Bill Tweit	360-902-2723			william.tweit@dfw.wa.gov		**x**	
Washington Department of Fish and Wildlife	Allen Pleus, AIS Coordinator	360-902-2724	xxxxxxxxxx		pleusaep@dfw.wa.gov			**x**
Idaho Department of Agriculture	Lloyd Knight	208-332-8664	xxxxxxxxxx		lloyd.knight@agri.idaho.gov		**x**	
Idaho Department of Agriculture	Amy Ferriter, Invasive Species Coordinator	208-332-8686	xxxxxxxxxx		aferriter@agri.idaho.gov			**x**
Idaho Department of Fish and Game	Phil Mamer	208-454-7638	xxxxxxxxxx		pmamer@idfg.idaho.gov			**x**
Idaho Department of Fish and Game	Dave Parrish	208-287-2773	xxxxxxxxxx		david.parrish@idfg.idaho.gov			**x**
Montana Fish, Wildlife, and Parks	Eileen Ryce, AIS Coordinator	406-444-2448	xxxxxxxxxx		eryce@mt.gov		**x**	
Montana Fish, Wildlife, and Parks	Stacy Schmidt	406-444-5228	xxxxxxxxxx		sschmidt@mt.gov			**X**

Nevada Division of Wildlife	Karen Vargas, AIS Coordinator	775-688-1532			kvargas@ndow.org			**x**
U.S. Fish and Wildlife Service	Mike Carrier, Assistant Regional Director – Fisheries	503-872-2763			michael_carrier @fws.gov		**x**	
U.S. Fish and Wildlife Service	Paul Heimowitz, Region 1 AIS Coordinator	503-872-2763	xxxxxxxxxx	503-231-2062	paul_heimowitz@fws.gov			**X**
U.S. Fish and Wildlife Service	Kevin Aitkin, AIS Coordinator, Western Washing-ton F&W Office	360-753-9508	xxxxxxxxxx	360-753-9407	kevin_aitkin@fws.gov			**X**
U.S. Fish and Wildlife Service	Bob Kibler, AIS Coordinator, Idaho F&W Office	208-378-5255	xxxxxxxxxx	208-378-5264	bob_kibler@fws.gov			**X**
U.S. Fish and Wildlife Service	Joanne Grady, Region 6 AIS Coordinator	303-236-4519	xxxxxxxxxx	303-236-8163	joanne_grady@fws.gov			**X**
National Oceanic and Atmospheric Administration	Ritchie Graves	503-231-6891			ritchie.graves@noaa.gov		**X**	
National Oceanic and Atmospheric Administration	Scott Rumsey	503- 872-2791			scott.rumsey@noaa.gov	will notify Columbia Riv. Reg. Forum Team Mems (IT, TMT WQT, SCT)		**x**
Columbia River Intertribal Fish Commission	Paul Lumley, Executive Director	503-238-0667		503-235-4228	plumley@critfc.org		**x**	
Columbia River Intertribal Fish Commission	Blaine Parker, AIS Coordinator	503-731-1268	xxxxxxxxxx	503-235-4228	parb@critfc.org	Will notify CRITFC member tribes		**X**
Columbia River Intertribal Fish Commission	Mike Matylewich	503-238-0667	xxxxxxxxxx	503-235-4228	matm@critfc.org			**X**

Note: Priority 2 contacts will be notified when a report is received of live dreissenids within the Columbia River Basin. These contacts may be incorporated into the CRB MAC Group and the Coordination and Support Staff depending on the nature of the incident. The listed contacts for each agency are responsible for internal notification within their agency.

Priority 2 Notification List

Organization	Name/position	Office Phone	Cell Phone	Fax	Email	Notes
U.S. Forest Service and BLM	Linda Ulmer, USFS CRB Coordinator	503-808-2929	xxxxxxxxxx		lulmer@fs.fed.us	Responsible for internal coordination
U.S. Forest Service	Jim Capurso, Regional Fisheries Biologist	503-808-2847	xxxxxxxxxx		jcapurso@fs.fed.us	Oregon and Washington
U.S. Forest Service and BLM	Cynthia Tait, Regional Aquatic Ecologist	801-625-5358	xxxxxxxxxx		ctait@fs.fed.us	Idaho
U.S. Bureau of Reclamation	Scott Lund (Primary)	208-378-5037	xxxxxxxxxx		slund@pn.usbr.gov	Will notify all other USBR contacts
U.S. Bureau of Reclamation	Joe DiVittorio, Invasive Species/ IPM Manager, (Alternate)	303-445-3639	xxxxxxxxxx	702-544-0663	jdivittorio@do.usbr.gov	
U.S. Environmental Protection Agency	Scott Downey Region 10	206-553-0682	xxxxxxxxxx		Downey.Scott@epamail.epa.gov	
U.S. Army Corps of Engineers	Rebecca Weiss, ANS Lead, NW Division Office	503-808-3723	xxxxxxxxxx	503-808-3725	Rebecca.J.Weiss@usace.army.mil	Will notify all other Corps contacts
U.S. Army Corps of Engineers	Lonnie Mettler Walla Walla District	509-527-7131	xxxxxxxxxx	509-527-7820	Lonnie.e.mettler@usace.army.mil	
U.S. Army Corps of Engineers	Madelyn Martinez	206-764-6940	xxxxxxxxxx		Madelyn.T.Martinez@usace.army.mil	

Shoshone-Paiute Tribes	Edmond Murrell, Director of Fish, Wildlife, and Parks Dept.	208-759-3246	xxxxxxxxxx		murrell.edmond@shopai.org	
Portland State University, Center for Lakes and Reservoirs	Mark Sytsma, Director/AIS Coordinator (Primary)	503-725-3833	xxxxxxxxxx	503-725-3834	sytsmam@pdx.edu	Will notify all other State of Oregon contacts in coordination with ODFW
Portland State University, Center for Lakes and Reservoirs	Robyn Draheim, Assistant AIS Coordinator	503-725-4994	xxxxxxxxxx	503-725-3834	draheim@pdx.edu	
Bonneville Power Administration	Jim Irish, AIS Lead, Generation Supply Dept.	503-230-5914	xxxxxxxxxx		jtirish@bpa.gov	Will notify all other BPA contacts
Pacific States Marine Fisheries Commission	Stephen Phillips, AIS Coordinator	503-595-3100	xxxxxxxxxx	503-595-3232	stephen_phillips@psmfc.org	Will notify all other PSMFC contacts
Pacific States Marine Fisheries Commission	Carol Barstow, AIS Admin. Asst.	503-595-3100	xxxxxxxxxx	503-595-3232	cbarstow@psmfc.org	
U.S. Geological Survey	Scott Smith, Invasive Species Section Leader, Western Fisheries Research Center	206-526-6282 X 331	xxxxxxxxxx		sssmith@usgs.gov	Will notify all other USGS contacts
U.S. Geological Survey	Tim Counihan, Western Fisheries Research Center	509-538-2299	xxxxxxxxxx	509-538-2843	tim_counihan@usgs.gov	
National Park Service	John Wullschleger, Fish Program Lead	970-225-3572			john_wullschleger@nps.gov	
Fisheries and Oceans, Canada	Thomas Therriault	250-756-7394			thomas.therriault@dfo-mpo.gc.ca	
Province of British Columbia , Ministry of the Environment	Matthias Herborg	(250) 356-7683			Matthias.Herborg@gov.bc.ca	

Appendix C: Recognized Experts For Confirming Zebra Mussel Identification.

Name and/or Position	Affiliation	Expertise	Phone	Email	Overnight mail shipping address	Notes
AIS Coordinator	**Portland State University, Center for Lakes and Reservoirs**	**Veligers, Adults**	**See Prior Notification List**	**See Prior Notification List**		
AIS Coordinator	**Washington Department of Fish and Wildlife**	**Adults**	**See Prior Notification List**	**See Prior Notification List**		
AIS Coordinator	**Idaho Department of Fish and Game**	**Adults**	**See Prior Notification List**	**See Prior Notification List**		
AIS Coordinator	**Montana Fish, Wildlife, and Parks**	**Veligers, Adults**	**See Prior Notification List**	**See Prior Notification List**		
AIS Coordinator	**U.S. Fish and Wildlife Service, Pacific Region**	**Adults**	**See Prior Notification List**	**See Prior Notification List**		
AIS Coordinator	**U.S. Fish and Wildlife Service, Western Washington Field Office**	**Adults**	**See Prior Notification List**	**See Prior Notification List**		
AIS Coordinator	**U.S. Fish and Wildlife Service, Mountain-Prairie Region**	**Adults**	**See Prior Notification List**	**See Prior Notification List**		
David Britton, AIS Coordinator	**U.S. Fish and Wildlife Service, Southwest Region**	**Adults**	**817-272-3714**	**david_britton@fws.gov**		
Mike Hoff, AIS Coordinator	**U.S. Fish and Wildlife Service, Great Lakes Region**	**Adults**	**612-713-5114**	**michael_hoff@fws.gov**		

Appendix C (continued): Recognized Experts For Confirming Zebra Mussel Identification.

Name and/or Position	Affiliation	Expertise	Phone/Fax	Email	Overnight mail shipping address	Notes
AIS Coordinator	**U.S. Geological Survey, Western Fisheries Research Center**	**Adults**	**See Prior Notification List**	**See Prior Notification List**		
Zebra Mussel Information System Coordinator	**U.S. Army Corps of Engineers, Engineer Research and Development Center**	**Veligers, Adults**				
Blaine Parker, AIS Coordinator	**Columbia River Intertribal Fish Commission**	**Adults**	**See Prior Notification List**	**See Prior Notification List**		
Stephen Phillips, AIS Coordinator	**Pacific States Marine Fisheries Commission**	**Adults**	**See Prior Notification List**	**See Prior Notification List**		
Sam Chan, AIS Educator	**Oregon Sea Grant**	**Adults**	**503-679-4828**	**samuel.chan@oregonstate.edu**		
Robert McMahon, Director	**Center for Biological Macrofouling Research, University of Texas-Arlington**	**Veligers, Adults, Histology**	**(817) 272-2412**	**r.mcmahon@uta.edu**		

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APPENDIX D

CONTAINMENT, CONTROL AND ERADICATION

D-1: Control Options

D-2: Response Scenarios

D-3: Scenario-Based Eradication and Control Option Matrix

D-4: Methods for In-Situ Evaluation of Chemical Control Effectiveness

D-1 Control Options

(Note: Portions of the material in this section were taken from California's Zebra Mussel Early Detection and Public Outreach Program Final Report (Messer, C. and T. Veldhuizen, 2005). Additional information including the data in Tables 2, 3, and 4 was compiled by Bruce Sutherland, consultant to the Pacific States Marine Fisheries Commission.)

Thermal Shock

Hot water treatment can kill zebra mussels. Temperatures of 37°C and above are lethal to zebra mussels. Depending upon acclimation temperature, zebra mussels will die in about 1 hour. At winter acclimation temperatures (5 to 10°C), temperatures of 33°C and above will kill zebra mussels within 13 hours. For further information, see Table 1 below (McMahon et al, 1993).

Freezing

Adult zebra mussels die when aerially exposed to freezing temperatures. In winter, populations can be controlled by dewatering and exposing zebra mussels to freezing air temperatures. Zebra mussels die in 2 days at 0°C and at minus 1.5°C, in 5 to 7 hours at minus 3°C, and in under 2 hours at minus 10°C. Duration to mortality is less for single mussels than for clustered mussels. (Payne 1992).

Oxygen Starvation

Oxygen starvation can be achieved by cycling ambient water through oxygen-starving pumps. The developer of the technology, Wilson J. Browning of Amark Corp, Norfolk County, VA, claims the equipment can cycle 200 million gallons of water. Another method of removing oxygen is to add oxygen scavenging chemicals, such as sodium-meta-bisulfite and hydrogen sulfide gas (USACE-ZMIS at http://www.wes.army.mil/el/zebra/zmis/idxlist.htm.). It should be noted, however, that zebra mussels are able to tolerate oxygen deprivation for up to 2 weeks, provided ambient temperatures are low enough (USACE-ZMIS).

Desiccation

Desiccation is a viable option for eradicating zebra mussels from areas that can be dewatered for several days. Alternatively, desiccation can also act as a population control method in areas that can not be completely dewatered. For example, reservoir levels can be lowered to expose zebra mussels inhabiting shallow water. The majority of the zebra mussel population inhabits shallow water within 2 to 7 m below the surface, with moderate to low densities up to 50m. Colonization is dependent upon water temperature, oxygen content, and food availability. They tend to colonize above the thermocline.

Temperature is positively related and humidity is negatively related to adult zebra mussel mortality. As humidity increases and temperature decreases, survival increases (Table 1). Aerial exposure of zebra mussels to temperatures exceeding 25°C, will result

in 100% mortality in 2.1 days. Temperatures over 32°C are lethal within 5 hours. Instantaneous mortality occurs at 36°C. At temperatures below 30°C, time to mortality is dependent upon relative humidity.

Table 1. Number of days to 100% mortality of adult zebra mussels aerially exposed to different levels of relative humidity and air temperature (McMahon et al, 1993).

	Days to 100 % Mortality at Air Temperature, °C		
Relative Humidity, %	**5**	**15**	**25**
95	26.6	11.7	5.2
50	16.9	7.5	3.3
5	10.8	4.8	2.1

Benthic Mats

Researchers from the Rensselaer Polytechnic Institute in New York are investigating the use of benthic mats that would cover the sediment and zebra mussels, and smother the mussels. Preliminary laboratory bioassays carried out in aquaria demonstrated that benthic mat covering of zebra mussels for 2 weeks resulted in mortality rates of 14.9-100%, while mortality rates were 2.2% or lower for control aquaria without mats. In laboratory studies in which mussels were covered for 4 weeks, mortality rates of 20-100% occurred, and did not vary significantly with duration of covering or size class. Measurements of several water chemistry parameters beneath mats, including dissolved oxygen, ammonia, calcium and magnesium and pH, indicated that dissolved oxygen concentration was the only parameter to exhibit both significant change and a consistent trend over the course of the study, declining from nearly 100% saturation to a mean of 16.5% saturation, and remaining at this level for the duration of the experiment (Sandra Nierzwicki-Bauer, personal communication, 2008).

In field studies carried out in New York's Saratoga Lake, divers created treatment and control zebra mussel colonies at 2m depths on a rocky substrate by placing rocks with attached mussels on fiberglass screens placed on prepared gravel beds. During a field trial where two treatment colonies, composed of approximately30,000 mussels each, were covered with $4m^2$ mats, mortality rates exceeded 99% after nine weeks of covering. As observed in the laboratory tests, dissolved oxygen concentrations declined significantly under the mats, correlating strongly with increased mortality ((Sandra Nierzwicki-Bauer, personal communication. 2008).

Manual Removal

When found in relatively small numbers, manual removal may be an effective way to reduce dreissenid populations and potentially even eradicate them if reproduction has not yet occurred. Manual removal can take place via hand extraction or via mechanical scraping and suction, typically using divers. In Lake George, New York an effort involving hand harvesting by divers appears to have significantly reduced an introduced population. Divers removed 267 mussels in 1999, followed by a peak of nearly 20,000 in 2000. Since then, ongoing removal efforts have yielded fewer than 2,000 mussels per year (Sandra Nierzwicki-Bauer, personal communication, 2008). The apparent eradication of the nonnative sabellid polychaete worm *Terebrasabella heterouncinata* in California provides analogous evidence to the role of hand removal as a control technique. After this marine pest was found at an intertidal site outside of an infected abalone culture facility, over 1.6 million native black turban snails (*Tegula funebralis*) - the preferred native host - were extracted by hand, along with other infested material. This effort reduced the transmission of the pest species to the point that it no longer was detectable in follow-up surveys (Culver and Kuris, 2000).

Predation

The relatively soft shells of zebra mussels and their exposure (on substrates as opposed to buried in sediment) make them vulnerable to predation. Possible predators of adult mussels are some species of carp, catfish, bullhead, sucker, sunfish, sturgeon, crayfish, and muskrats. A possible predator of veligers is the American shad. However, there is no evidence of predation control in the Great Lakes, Ohio River, and Poland. There is some evidence of population reduction in the Hudson River. Despite the lack of clear evidence of population control through predation, it is recommended that harvest of predatory species in infested waterbodies be stopped.

Acoustic Deterrents

It should be noted that the impacts and effectiveness of the following acoustic deterrents are not fully proven, especially in high-flow areas. However, they are relatively low maintenance technologies that have a low likelihood of harming non-targeted organisms, are environmentally friendly, and have few related safety issues. Acoustic methods are only suitable for certain kinds of structures and are limited to areas where power is available.

- Cavitation is a form of acoustic energy that initiates the formation and collapse of microbubbles. At frequencies between 10 and 380 kHz, this type of energy has demonstrated mortalities of veliger, juvenile, and adult zebra mussels. Exposure times are ranges of seconds for veligers, minutes for juveniles, and hours for adults. (Nalepa, and. Schloesser. 1993).
- Sound treatment using low frequency energy has prevented the settlement of zebra mussels and could be a valid option for reducing the spread of the organisms. Sound waves in the 20 Hz to 20 kHz range have been used to cause veligers to

detach and sink. Ultrasound waves in the 39 to 41 kHz range have fragmented veligers in a few seconds and killed adults in 19 to 24 hours. (Sonalysts, and Aquatic Sciences. 1991).

- Vibration is the use of solid-borne acoustic energy in mechanical structures. This treatment will only work on structures that can be subjected to vibration and not suffer structural deterioration. Vibrational energy is effective in killing zebra mussel veligers and juveniles at just below 200 Hz and between 10 and 100 kHz. (Nalepa and Schloesser 1993).

Electrical Deterrents

- Continuous low-voltage electrical fields can control adult zebra mussel settlement. However, veligers and juveniles seem to remain relatively unaffected. Adult settlement can be completely prevented with an eight volt A-C current. This technology has recently been successfully applied using electrodes attached to the hull of a vessel to prevent mussel attachment. (Smythe and Miller 2003).
- Plasma pulse technology (Sparktec Environmental, Inc.) has proven effective in controlling zebra mussels in intake pipes. The system works by releasing stored energy that subsequently causes an intensive shockwave, a steam bubble, and ultraviolet light. (Mackie, Lowery and Cooper 2000).
- Pulse power devices can be utilized to create an electrical field between two electrodes. When the field spans the entire width of the area to be protected, it has been effective in stunning and killing juveniles as they pass through the electrical field. Although not too effective against veligers because of their small body mass, pulse power has also been used successfully to prevent mussel settlement. (Smythe and Miller 2003)

UV Radiation

UV radiation is an effective method for controlling zebra mussels in all life stages, although veligers are more sensitive than adults. Complete veliger mortality can be obtained within four hours of exposure to UV-B radiation, and adult mortalities can also be obtained if constant radiation is applied. UV radiation can be harmful to other aquatic species and its effectiveness may be decreased by turbidity and high suspended solids loads. (Wright et al, 1995).

Chemical Treatment

There are 3 general categories of chemicals used to treat zebra mussel infestations: metallic salts, oxidizing biocides, and nonoxidizing biocides. The most susceptible life stages to chemical treatment are post-spawned mussels that are in a low energy state, and veligers and pediveligers that have undeveloped shells. Application rates and duration data for these compounds come from laboratory studies, power plants, and water treatment plants.

- Metallic salts (electrolytically dissolved metallic ions), are effective on adult mussels because of the incomplete sealing of their shells.

- Potassium salts at a concentration of 50 mg/l have successfully prevented the settlement of zebra mussels. Higher concentrations between 88 and 288 mg/l are necessary to cause mortality. Such concentrations will likely kill native mussels as well but are non-toxic to fish. In 2006, KCl was used to successfully eradicate zebra mussels from a rock quarry pond in Virginia. 100% kill was attained with minimal environmental impacts to other aquatic species and to the drainage waters downstream. This method seems promising if a lethal concentration of KCl can be maintained for a 2 to 3 week period. More information about this project can be found at: http://www.dgif.virginia.gov/zebramussels/index.asp
- The product known as "BioBullets" has been developed that uses the encapsulation of an active ingredient (KCl) in microscopic particles of edible material designed for ingestion by mussels. It is also supposed to affect Asian clams (Aldridge et al. 2006).
- Chloride salts are also effective and safe for most fish species but require high dosages. Copper ions at concentrations of 5 mg/l have resulted in 100% veliger mortality. Copper sulfate concentrations between 5 and 40 mg/l are effective for adult zebra mussel control but are also lethal to native mussels and other aquatic species. The required exposure time for most metallic ions ranges from 5 to about 48 hours.

- Oxidizing biocides such as chlorine have been used by the water treatment industry for disinfection since the late 1800s. Because these chemicals have been in use for so long, their effect on the environment is understood and documented (Claudi. and Mackie, 1994). In mussels, oxidizing chemicals work by oxidizing the gill lamellae and other parts, eventually causing death. Zebra mussels can recognize oxidizing chemicals as toxins. In response to exposure, zebra mussels expel the offending water and close their valves for several days. Periodically, they reopen their valves to "test" the water. Depending upon water temperature, respiration rate, and stored nutrient reserves, zebra mussels can remain closed and withstand exposure for many days before reopening their valves to resume respiration and feeding. Therefore, required exposure time for oxidizing biocides is usually 1 to 3 weeks.

  Chlorine, bromine, hydrogen peroxide, ozone, and potassium permanganate are examples of oxidants that facilitate zebra mussel mortality.

  - Chlorination in various forms such as hypochlorite, sodium chlorite, chlorine dioxide, and chloramines is the most common method of zebra mussel treatment. The use of chlorine and its various forms is usually limited to non-open water situations because of its high toxicity to other forms of aquatic life. Treated waters must either be dechlorinated or held until the residual chlorine has dissipated before discharge.

    An example of chlorine use that may be applicable to a small isolated population of zebra mussels is the practice of using tarps to seal off an area and then injecting chlorine into the enclosed area. The State of Washington Department of Fish and Wildlife used this method in October of 2004 to successfully eradicate a small population of non-indigenous tunicates in Puget Sound near the City of Edmonds. (Personal communication with Pam Meacham, WDFW,

February 2007). This method was also utilized in Huntington Harbor, California to eradicate a marine alga, *Caulerpa taxifolia*. Patches of Caulerpa were treated by covering them with black PVC tarp and injecting liquid chlorine under the tarp. The edges of the tarp were sealed to the bottom with sandbags. While all the organisms under the tarps were killed by the treatment, the tarping method avoided impacts to surrounding areas. More information can be obtained at www.sccat.net/eradication.php.

- Hydrogen peroxide. Although toxic to zebra mussels, hydrogen peroxide is rarely used because of the high dosage rates.
- Ozone is effective at relatively low concentrations. 0.5 mg/l has been 100% effective on veligers in 5 hours and adults in 7 to 12 days. Ozone dissipates quickly and is less harsh on the environment but expensive because of the effort needed to maintain exposure.
- Potassium permanganate is effective at reducing or eliminating zebra mussels at high dosage rates but is also very toxic to other aquatic species. (Minnesota Dept of Natural Resources. 2005)

Non-oxidizing biocides are drawn into the mussel's body and attacks the cell walls. The cells lose the ability to maintain their chemical balance, and the mussel dies. Zebra mussels do not detect most non-oxidizing chemicals and continue to filter water, exposing themselves to the chemical. Treatment with non-oxidizing chemicals can be accomplished in hours as opposed to weeks for oxidizing chemicals.

The most commonly used non-oxidizing compounds are proprietary molluscicides (e.g. Clam-Trol, Bulab, and Bayluscide). These are very effective at zebra mussel control but are also highly toxic to many fish and other aquatic species. They are applied at high concentrations, and, in most cases, the water must be detoxified after treatment. These compounds are usually deactivated by releasing slurry of bentonite clay into the water. The cationic or surfactant active ingredients bind onto the clay, becoming inactive. The clay settles out of the water column and becomes part of the bed sediments. The compound is microbially degraded into nontoxic products. These chemicals are less effective at lower water temperatures, so treatment is recommended during warmer months. The chemicals are usually administered with equipment supplied by the vendors. An example of the successful use of non-oxidizing chemicals to control the Asian clam in the southeastern US can be found in a paper entitled "Strategies for application of non-oxidizing biocides." (Green 1995)).

Additional information on most of these chemicals, such as formula, manufacturer, and application method, is available at http://www.wes.army.mil/el/zebra/zmis/idxlist.htm.

Bacterial Toxin

The naturally occurring bacterium *Pseudomonas fluorescens* strain CL145A is a candidate for the biological control of zebra and quagga mussels, and progress has been achieved at the laboratories of the New York State Museum (NYSM) in moving it toward commercialization. *Pseudomonas fluorescens* is ubiquitous in the environment, and lab studies have indicated that when zebra or quagga mussels ingest artificially

high densities of strain CL145A, a toxin within these bacterial cells destroys their digestive system. Dead bacterial cells are equally as lethal as live cells, providing evidence that the mussels die from a toxin, not from infection. Future commercial products based on this microbe will contain dead cells, thus further reducing environmental concerns.

Laboratory trials to date have been very encouraging regarding nontarget safety (Malloy 2008). At dosages which produced high zebra mussel mortality (76–100%), no bacteria-induced mortality has been recorded among any of the nontargets, including fish, ciliates, daphnids, and bivalves (Malloy 2008). Although originally developed as an environmentally safe alternative for chlorination in power plants, the nontarget safety of this bacterial control agent may allow this technology to also be used for zebra and quagga mussel control in open waters, such as lakes and rivers.

Supported by funding from the National Science Foundation and in partnership with the NYSM, the biopesticide company Marrone Organic Innovations (MOI) expects to bring this bacterial control method to commercialization in 2010. This NYSM-MOI research partnership will focus primarily on: 1) increasing bacterial toxicity so that cells can routinely achieve >90% mussel kill, and 2) conducting additional nontarget toxicology studies mandated by the USEPA for product registration.

Further information on this control method can be found at:

1. http://www.netl.doe.gov/technologies/publications/factsheets/project/Proj291.pdf
2. http://www.aquaticnuisance.org/docs/Dreissena%20Novel%20Green%20Technology%20for%20Dreissena%20Control%20(4)%20Malloy.pdf
3. http://www.marroneorganicinnovations.com/pdf/PressReleaseZebraMussel.pdf

No-Growth Materials (anti-fouling paints) – Can be effective in preventing zebra mussel attachment but the leachate can be toxic to other organisms. Anti-fouling paints are expensive to use and only feasible in certain situations.

The following three tables provide a more detailed look at these control methods including target populations, application rates, efficiency and toxicity. Table 2 details non-chemical methods. Table 3 describes chemical control methods and Table 4 identifies some of the most common commercial products.

TABLE 2: Non-chemical treatment methods for dreissenid control.

METHOD	TARGET AGE	EFFICIENCY	CONTACT TIME /CONCENTRATION	COMMENTS
Thermal shock	All	100%	13 hours @ 33 C in winter 1 hour @ 37 C summer	Lethal to most aquatic species
Freezing	Juveniles Adults	100%	2 days @ 0 C 5-7 hours @ -1.5 C under 2 hours @ -10 C	Must dewater system
Oxygen starvation	All		2 weeks + @ 0 mg/l	Must isolate population
Desiccation	Juveniles Adults	100%	Immediate @ 36 degrees C 5 hours @ 32 degrees C 2.1 days @ 25 degrees C	Must dewater system for several days
Benthic mats	Juveniles Adults	Up to 99%	9 weeks	Initial tests promising for limited infestations
Manual removal	Juveniles Adults	Variable	N/A	Ongoing efforts in Lake George, New York
Predation	All	Low	Continuous	Harvest of potential predatory species must be limited
Cavitation	All	100%	veligers in seconds @ 10-380 kHz juveniles in minutes adults in a few hours	May affect other species, reduced success in high flows, needs power source

Low frequency sound	Juveniles	Inhibits settling	4 to 12 min @ 20 Hz – 20 kHz	Not lethal, needs power source
Ultra sound	All	100%	veligers in seconds @ 39-41 kHz adults in 19-24 hrs	May impact other species, needs power source
Vibration	Veligers Juveniles	100%	intermittent @ 200 Hz & 10-100 kHz	Structural integrity may be threatened
Low voltage electricity	Adults	Prevents settling	immediate results @ 8 volt AC	Not lethal, needs power source
Plasma pulse technology	Juveniles Adults	Prevents settling	intermittent high energy pulses	Not lethal, private technology
Electric field pulse	Juveniles / adults	Lethal to juveniles Inhibits adult settling	seconds	May affect other species, needs power source
UV radiation	All	100%	juveniles -4 hrs adults – continuous	Lethal to many species, effectiveness limited by turbidity and suspended solids
Bacterial toxin *Pseudomonas fluorescens*	All	95%	6 hours	Low toxicity to other organisms, few treatments needed, not yet available in commercial quantities.

NOTES:

- Extensive information on treatment methods listed above including information sources, application methods, hazards, etc. is available on the US Army Corps of Engineers website at www.el.erdc.usace.army.mil/zebra/zmis/idxlist.htm

- Information on the bacterial toxin, *Pseudomonas fluorescens* is available on the National Energy Technology Laboratory website at http://www.netl.doe.gov/technologies/publications/factsheets/project/Proj291.pdf

TABLE 3: Chemical treatment methods for dreissenid control.

NON- OXIDIZING CHEMICALS	TARGET AGE	EFFICIENCY	CONTACT TIME/ CONCENTRATION	COMMENTS
Potassium salts (KCL)	Juveniles/ adults All	Prevent settlement 50% 95-100%	50 mg/l 48 hrs @ 150 mg/l 3 weeks @ 95 – 115 mg/l	Lethal to other mussel species, non-toxic to fish at required dose rate
Potassium ion (KH2PO4)	All	100%	continuous @ 160-640 mg/l	As above
Potassium ion (KOH)	All	100%	Less than 10 mg/l	As above
Chloride salts (Nail,)	Veligers/ juveniles	95-100%	6 hours @ 10,000-20,000 mg/	Low cost, low environmental Impacts, very high dosage rates
Copper ions	Veligers	100%	24 hours @ 5 mg/l	Lethal to other aquatic species
Copper sulfate	All	55% 40% 50%	5 hrs 300 mg/l @ 22.5 C 5 hrs 100 mg/l @ 22.5 C 48 hrs 2 – 2.5 mg/l @ 17 C	Lethal to other aquatic species
OXIDIZING CHEMICALS				
Chlorine	Veligers	100%	0.25-5mg/l in 1 to 9 days	Lethal to many aquatic

	All Adults Adults	90% 95% 75%	2.0 mg/l continuous 0.3 mg/l 14-21 days 0.5 mg/l 7 days	species
Chlorine dioxide ClO2	Veligers	100%	0.5 mg/l 24 hours	Most successful on veligers
Chloramine	Veligers	100% 95%	1.2 mg/l 24 hours 1.5 mg/l continuous	Less toxic to other aquatic life than chlorine
Hydrogen peroxide	Veligers Juveniles	100%	6 hours	High dosage rates required. Lethal to other aquatic species
Ozone	All	100%	Veligers in 5 hours @ .5 mg/l Adults in 7 days @ .5 mg/l	Lethal to other aquatic species
Potassium permanganate	All	90-100 %	2.0 mg/l for 48 hours	`Must have high continuous dosage, lethal to other species

NOTES:

- Extensive information on the chemical treatment methods listed above, including information sources, application rates, toxic effects, hazards, etc. is available on the US Army Corps of Engineers website at www.el.erdc.usace.army.mil/zebra/zmis/idxlist.htm.

TABLE 4: Non-oxidizing chemical treatment methods (commercial products) for dreissenid control.

QUATERNARY AMMONIUM COMPOUNDS	TARGET AGE	EFFICIENCY	CONTACT TIME/ CONCENTRATION	COMMENTS
Clam-Trol CT 1	All	100% 48 hours after exposure	1.95 mg/l @ 11 C for 12 hours 1.95 mg/l @ 14 C for 14 hours 1.95 mg/l @ 20 C for 6-14 hours	More toxic to veligers than adults and more toxic to mussels than to trout
Calgon H-130	All	100% after 48 hours	0.85-1.12 mg/l	1.1 mg/l toxic to salmonids, must be deactivated, corrosive, flammable
Macro-Trol 9210	All	100%	5-50 mg/l continuous	Lethal to aquatic organisms, must be detoxified
Bulab 6002	All	100%	2 mg/l 7-10 days 4 mg/l 5-8 days	Lethal to fish, especially salmonids
AROMATIC HYDROCARBONS				
Mexel 432	Deters veliger settlement		Dose at 1-4 mg/l once a day	96 hr LC 50 for rainbow trout 11mg/l, corrosive

EVAC – endothal formulation	All	100%	0.3-3 mg/l for 5 to 144 hours	Lethal to fish but rapidly degrades, does not bioaccumulate
Bulab 6009	All	100%	2 mg/l 4 to 10 days 4 mg/l 3 to 8 days	96 hr LC 50 for rainbow trout 1,1 mg/l, corrosive

NOTE: The commercial products listed above have been approved for aquatic use by EPA if applied according to label instructions by a licensed applicator. It is important to note that they may not have been approved by the individual states and must have that approval before they can be applied. The molluscicides have been primarily developed for use at water impoundment and hydropower facilities, treatment facilities, water intake structures, etc. Their use in open water is not generally recommended but might be possible under certain circumstances. For example, the herbicide Endothal, has been shown to be effective against zebra mussels and has been permitted for use in open waters in Washington State to control noxious weeds.

Extensive information on the products listed above, including manufacturer, chemical formulation, application rates, toxicity, hazards, etc. is available on the US Army Corps of Engineers website at www.el.erdc.usace.army.mil/zebra/zmis/idxlist.htm

References

References for Appendix A are incorporated in the main document.

D-2 Rapid Response Scenarios

The detection of dreissenid mussels into the Columbia Basin could occur through numerous scenarios. The following cases may be more probable based on risk factors and recent history, and should be considered both for planning purposes as well as during initial investigations of actual reports. They also relate to Appendix D-3 (table of scenario-based response options).

- Veligers found in the main-stem Columbia or Snake Rivers; no adults detected

- Settled mussels found growing on moored watercraft and/or fixed structures within the main-stem Columbia or Snake Rivers; no veligers detected (*eradication might be feasible in this scenario)*

- Veligers and/or settled mussels found in an isolated, non-draining water body within the CRB (*eradication might be feasible in this scenario)*

- Reproductive mussels and veligers found in the mainstem Columbia or Snake Rivers and/or a hydrologically connected water body (*eradication would probably not be feasible in this scenario)*

Appendix D-3

SCENARIO BASED ERADICATION AND CONTROL OPTIONS

(FROM: MESSER, C. AND T. VELDHUIZEN. 2005)

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
Pond, Isolated, non-draining	• Evaluate for natural control (e.g. Winter freeze, summer desiccation) • Chemically treat area and buffer zone • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Mandatory cleaning of departing vessels and equipment	• Chemically treat entire waterbody • Stop water diversions, if any, and chemically treat diversion infrastructure • Mandatory cleaning of all departing vessels and equipment • Quarantine and/or stop all recreational uses

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
Pond, draining	• Chemically treat released water or prevent water release • Chemically treat area and buffer zone • Monitor for spread within pond and downstream • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Mandatory cleaning of departing vessels and equipment	• Minimize or prevent water release • Chemically treat released water • Chemically treat diversion infrastructure, if any • Monitor for spread downstream • Chemically treat entire waterbody • Mandatory cleaning of all departing vessels and equipment • Quarantine and/or stop all recreational and commercial uses
Small Reservoir	• Minimize water releases • Chemically treat released water • Chemically treat area and buffer zone • Monitor for spread within reservoir and downstream • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Mandatory cleaning of departing vessels and equipment	• Evaluate need to reduce reservoir volume through water releases • Chemically treat released water • Chemically treat diversion infrastructure, if any • Monitor for spread downstream • Chemically treat entire waterbody • Mandatory cleaning of all departing vessels and equipment • Quarantine and/or stop all recreational and commercial uses
Large Reservoir	• Reduce reservoir volume • Chemically treat released water	• Chemically treat released water • Monitor for spread downstream

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
	• Chemically treat infested area and buffer zone • Monitor for spread within reservoir and downstream • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Mandatory cleaning of departing vessels and equipment	• Chemically treat diversion infrastructure, if any • Evaluate potential for a water level drawdown to reduce the population • Evaluate ability to chemically treat entire waterbody • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses • Mandatory cleaning of all departing vessels and equipment

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
River, Small Volume	• Minimize or stop inflow and increase upstream water diversions to reduce stream volume and flow rate • Install veliger settlement materials at downstream end of population • Create pool conditions at downstream end of population to facilitate veliger settlement (e.g., installation of temporary weir) • Treat with molluscicide • Detoxify downstream of infested area • Monitor for spread downstream • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory cleaning of all departing vessels and equipment	• Minimize or stop inflow and increase upstream water diversions to reduce stream volume and flow rate • Treat with molluscicide • Detoxify downstream of infested area • Monitor for spread downstream • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory cleaning of all departing vessels and equipment

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
River, Large Volume	• Minimize inflow and increase upstream water diversions to reduce stream volume and flow rate • Install veliger settlement materials at downstream end of population • Create pool conditions at downstream end of population to facilitate veliger settlement (e.g., installation of temporary weir) • Treat with molluscicide • Detoxify downstream of infested area • Monitor for spread downstream • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory cleaning of all departing vessels and equipment	• Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses • Mandatory cleaning of all departing vessels and equipment • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Closure of unattended boat ramps, especially In zebra mussel-free areas • Mandatory inspection/cleaning of all vessels entering zebra mussel-free waterbodies • Evaluate ability to chemically treat

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
Estuary	• Install veliger settlement materials at perimeter of population • Divert upstream water to reduce river volume and flow rate (e.g. Rock barrier) • Create pool conditions at downstream end of population to facilitate veliger settlement (e.g., installation of temporary weir, tidal flow/rock barrier) • Treat with molluscicide • Detoxify downstream of infested area • Monitor for spread • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory cleaning of all departing vessels and equipment	• Eradication doubtful • Implement population level control measures (e.g. Salt water intrusion during spawning season and veliger settlement) • Prevent spread to upstream waterbodies, other watersheds, pumping plants, and aqueducts/diversion canals • Mandatory cleaning of all departing vessels and equipment • Closure of unattended boat ramps, especially in zebra mussel-free areas • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory inspection/cleaning of all vessels entering zebra mussel-free waterbodies • Establish regulations for ships traveling to/from ports of the Columbia River • Evaluate treatment/spread prevention at all points of diversion

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population

Water Diversions	• If only one facility is impacted, transfer all diversions to alternate facility(ies)
	• Drain and desiccate facilities, chemically treat standing water
	- OR -
	• Isolate infested area and buffer zone with temporary barriers, chemically treat
	• Chemically treat removed water or quarantine and discharge the mussel-infected water to safe disposal area
	• Monitor for downstream spread
	• Mandatory cleaning of all vessels and equipment
	• Quarantine and/or stop all recreational and commercial uses of aqueduct
	• Retrofit facility(ies) to minimize impacts
		• If only one diversion system is impacted, transfer all diversions to other facility(ies);
		• Drain and desiccate facilities, chemically treat standing water
		• If both facilities/water transfer infrastructure are impacted:
		  ○ Chemically treat water before transferring to “downstream” uses
		  ○ Chemically treat water before entrance into the facilities)
		  ○ Mandatory cleaning of all vessels and equipment departing facility(ies)
		  ○ Quarantine and/or stop all recreational and commercial uses of contaminated facilities
		  ○ Desiccate and chemically treat one facility and aqueduct at a time; continue diversions through alternate facility(ies)
		• Retrofit facility(ies) to minimize impacts

Appendix D-4

METHODS FOR IN-SITU EVALUATION OF THE CHEMICAL CONTROL EFFECTIVENESS

(MESSER, C. AND T. VELDHUIZEN. 2005)

Mortality Monitoring

- Suspend test cages containing attached live mussels into the water to be treated.
- Use at least 10 mussels per cage and multiple cages per waterbody or use a statistically designed replication study.
- Monitor kill rate as chemical is administered.
- Conduct multiple tests for alternative chemical concentrations based on kill success of mussels in test cages.
- Follow by extensive inspections of the facility(ies) (surface and by diver) looking for live mussels.

Visual determinations of dead mussels

- Valve gaping with no response of exposed mantle tissue to external stimuli.
- For mussels with gaping shells failure of plantigrade mussel to respond to the touch of a probe.
- If shell is closed absence of ciliary beating and adductor muscle activity when inserting probe between the valves of the mussel.

Mortality verification

- Monitor test cages conducting mortality counts every 24 hours post-treatment or in accord with the chosen statistical design.
- Transfer test cages to recovery tank(s) to test for false-positive kill observations.
- Transfer in-situ-killed mussels to recovery tank(s) for false-positive kill observations.

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September 19, 2011

APPENDIX E- REGULATORY REQUIREMENTS

APPENDIX E-Regulatory Requirements

I. Introduction

The decision to use chemical agents and/or physically change the aquatic environment to treat an infestation of Dreissena in the waters of the Columbia River Basin will be costly, as well as environmentally and politically sensitive. Establishing a transparent, well documented, and effectively communicated decision-making process is essential. It is also essential that the process comply with all relevant rules and regulations governing chemical applications. Because of the importance of regulatory issues, the CRB Coordination and Support Staff has established a Compliance Technical Specialist within the Planning Function. In addition to staffing this position, the following steps will help ensure appropriate regulatory review and compliance:

- Determine the permits, regulatory reviews, and applicable emergency provisions required for chosen eradication methods.
- Identify existing permits and/or templates for required permits.
- Assign Agency Representative from each regulatory agency to facilitate permit approval in a timely manner within their respective agency.
- Determine if an environmental impact statement or environmental assessment is required and if so, ensure assignment is staffed appropriately and completed in a timely fashion.

Table 1 lists some of the primary permits and regulatory reviews that may be necessary before treatment can begin.

Table 1: Partial List of State/Federal Permits and Regulatory Reviews Likely To Apply to Eradication of Zebra Mussels in the CRB.

- Corps of Engineers Section 10 permit for discharge of dredge/fill material
- Clean Water Act Section 404 permit for work in navigable waters from Corps of Engineers
- Clean Water Act National Pollutant Discharge Elimination System (Section 402) permit (or modification of existing general permit) from Environmental Protection Agency or delegated state
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) – particularly Section 18 emergency exemption
- National Environmental Policy Act reviews, such as Environmental Impact Statements (triggered by other federal authorizations) – includes provisions for emergency consultations+
- Endangered Species Act Section 7 consultations by U.S. Fish and Wildlife Service and/or National Oceanic and Atmospheric Administration consultations (triggered by other federal authorizations)
- State aquatic land use authorization
- State water diversion/water-based construction permits and project approvals
- State archaeological excavation permit
- State hazardous chemical storage and reporting requirements

II. Regulatory Requirements for the Use of Chemicals[1]

The four tables below attempt to portray the regulatory regime from the perspective of the states that could be involved in the decision making process leading up to the emergency chemical treatment of a zebra mussel infestation in the Columbia River Basin. Of particular relevance to the application of pesticides to state waters is the recently issued final Environmental Protection Agency (EPA) rule which clarifies two specific circumstances in which a CWA permit is not required before pesticides are applied. (Federal Register Vol 71, No. 227, November 27, 2006) The two situations are when: 1) pesticides are applied directly to water to control pests, including mosquito larvae, aquatic weeds and other pests in the water; and 2) pesticides are applied to control pests that are present over or near water where a portion of the pesticide will unavoidably be deposited to the water in order to target the pests effectively

The action puts into effect a rule that confirms EPA's past operating approach that pesticides legally registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) for application to or near aquatic environments, and legally applied to control pests at those sites, are not subject to NPDES permit requirements. The rule became effective January 26, 2007. EPA has determined that pesticides applied in accordance with the requirements of FIFRA are not pollutants as defined in the CWA. Specifically they are not “chemical wastes” or “biological wastes”. The EPA ruling does not address local water quality concerns under the authority of an individual state which could chose to address these concerns with an NPDES permit.

As can be seen in tables 2-5 below, each of the four states in the Columbia River Basin have different approaches to implementing the laws that apply to pesticide application. Users of this plan need to understand those differences because it may affect the method and timing of implementing control measures. The tables are not all inclusive since depending on the circumstances, local issues and concerns may add additional steps to the approval process.

The following assumptions have been made in developing the tables:

A. The goal is to eradicate the population before it spreads to other locations.
B. The control method of choice is a pesticide. Note that any chemical used as a treatment method for controlling aquatic pests is by EPA definition, a pesticide and thus falls under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).
C. The laws and regulations described below are applicable but not necessarily limited to the following three situations if no physical alterations are made to the landscape:

1. Juvenile or adult zebra mussels found on boats or within the confines of a protected marina in a CRB waterbody connected to the mainstem; no mussels or veligers found outside marina.

[1] Most of the information contained in Appendix E was developed by Bruce Sutherland, consultant to the Pacific States Marine Fisheries Commission.

2. Juvenile or adult zebra mussels found on a shallow, low current substrate that could be isolated from main stem flows;
3 Live zebra mussels in any life stage found in an isolated (no direct hydraulic connection) water body within the CRB (e.g., Lenore Lake in Grant County, Washington.).

As noted, the tables have been developed to address a situation where a zebra mussel population could be isolated from the main river flow without altering the landscape. Under some circumstances, however, isolating a population of mussels might involve erecting a temporary barrier around a site to prevent the escape of mussels and to facilitate the application, effectiveness and control of the pesticide. In this situation, not only would pesticide rules be applicable but land use laws might also apply. In Section G 2 below which focuses on non-pesticide control options, the laws that affect the placement of structures or otherwise physically altering the landscape are described in detail.

The tables also do not consider other scenarios where the use of pesticides might be possible. Some possible situations include the discovery of zebra mussels at one of the hydropower facilities or in one of the main stem reservoirs or in the free flowing portion of main stem river or in a tributary to the Columbia. Although the same regulatory regime would apply, these situations would further complicate the decision process outlined in the tables because of the difficulty of isolating the population and thus preventing negative environmental impacts in areas downstream of the pesticide application site. If populations are confined to shallow water, low current areas, then a method such as tarping and injecting pesticides might work. **Where currents, water depth, location and extent of the population preclude the possibility of physically isolating the population and the negative downstream impacts can not be controlled or mitigated, the possibility of obtaining approval for the rapid deployment of pesticides would be remote and pesticide treatment should probably not be considered.**

With this in mind, the owners and operators of hydropower facilities and other facilities in the Columbia River Basin that contemplate the use of pesticides to protect their structures should consider initiating a formal process to obtain NPDES permits for the use of pesticides at their facilities, develop an Environmental Impact Statement or an Environmental Assessment to satisfy the mandates of NEPA and request a biological opinion on the possible impacts to endangered salmonids. The owners and operators may want to consider non-pesticide treatment methods as well as a part of this permitting process. Ultimately, a formal regulatory approach would provide some degree of certainty that a timely response could be mounted should Zebra mussels be discovered in the Columbia River Basin.

At the end of this appendix are a series or recommendations aimed at filling existing gaps in knowledge, addressing regulatory issues and improving response capabilities.

TABLE 2: Pesticide Use Matrix For An Isolated Zebra Mussel Infestation In The Columbia River Basin (Washington)

REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) administered by US EPA. Pesticide licensing and application authority delegated to Washington State Dept of Agriculture (WSDA). Implemented under the **Washington Pesticide Control Act (RCW 15.58) and the Pesticide Application Act (RCW 17.21)**	• Pesticides approved for aquatic application by the WSDA must also be covered under a general NPDES permit or a State Waste Permit issued by the Dept of Ecology. (see below) • For commercial pesticides not currently approved by WSDA, a formal Section 3 application process would be required. The requesting body would submit an application through the WSDA. • For an emergency situation, FIFRA provides for exemptions under Sections 18 and 24. See next column.	• Section 18 of FIFRA allows for an emergency use exemption for a pesticide that is not already approved. The request would go through the WSDA[i] who would evaluate the request and forward it to EPA. EPA would then have 50 days to do a risk assessment. The total process would have to be completed in 120 days if it is a new request, 80 days if is a repeat request. If approved, the approval would last for one year. • Section 18 also allows for a crisis exemption that would allow unregistered use for 15 days. The requesting entity would have to justify the crisis to WSDA who would then notify EPA, EPA would do a cursory review, confer with the state and give crisis exemption. Use beyond the 15 days requires an emergency exemption. • Section 24 (c) allows the states to register an additional use of a federally registered pesticide or a new use as long as there is a "special local need" and a current tolerance for the use approved by EPA. The request would go through the WSDA for review and approval and then be submitted to EPA for review.

Endangered Species Act (ESA). The ESA is administered jointly by the U.S. Fish and Wildlife Service (USFWS) for freshwater and terrestrial species, and NOAA Fisheries for anadromous and marine species. Washington Dept of Fish and Wildlife(WDFW) maintains **a state species of concern list (WAC 232-12-297)**	• Pesticide-related response actions undertaken in the CRB could affect species or critical habitat listed under the ESA. In those cases, an ESA Section 7 consultation would need to occur. See next column for Section 7 consultation emergency provisions.	• Federal agency requests to EPA for FIFRA Section 18 or Section 24 approval to use pesticides for emergency response actions that may affect a listed species or critical habitat would trigger the requirement for an ESA Section 7 consultation between EPA and NOAA Fisheries and/or the FWS depending on the species and critical habitat affected. • Under emergency circumstances, such consultation would be conducted informally during the emergency and formal consultation would be initiated, as appropriate, as soon as practicable after the emergency is under control. • If formal consultation is required, the FWS and/or NOAA Fisheries provide an after-the-fact biological opinion to the EPA that documents the effects of the emergency response action on listed species and/or critical habitat. • If informal consultation is appropriate, the FWS and/or NOAA Fisheries provide written concurrence to the EPA that the response action is not likely to adversely affect listed species or critical habitat. • Under non-emergency circumstances, the same response action would be the subject of a completed consultation in advance of the response action being implemented. • WDFW would have to be consulted if a

		state species of concern was at risk.
National Environmental Policy Act (NEPA) administered by US EPA. **State Environmental Policy Act (SEPA)** administered by Dept of Ecology**. (RCW 43.21)**	• Any federally initiated action or action on federal lands or action that uses federal funds must also comply with the provisions of NEPA. An environmental assessment (EA) would be required and a finding of no significant impact needed before the action could take place. For an emergency situation, see next column. • SEPA provides a statewide process for identifying and evaluating the potential adverse environmental impacts of a proposal. SEPA concerns are addressed in the Ecology permit process described in the next section below.	• NEPA provides for an emergency action through consultation with the Council on Environmental Quality. The lead federal action agency would call CEQ, write a letter of notification, and prepare an environmental action statement. CEQ would respond in 24 hours. After the action is complete, a formal EIS or EA would have to be prepared • In an extreme situation where no permits exist, see the discussion in the next section below.
Clean Water Act (CWA) administered by US EPA with authority delegated to the Washington Dept of Ecology (Ecology) for regulating pollutants in state waters. Implemented under the **Washington Water Pollution Control Law (RCW 90.48)**	• A number of pesticides approved for aquatic applications are covered by Ecology issued NPDES permits but currently there are no approved applications for mollusk eradication. • A State Waste Permit or NPDES Permit (see notes below) would be required for bodies of water that are not man made, are larger than 5 acres, and that have drainage. The process would involve the development of a permit for zebra mussel eradication that would	• Under either Section 18 or Section 24, the applicant would also have to comply with Washington state law WAC 173-201A-110 which provides for short term water quality modifications to an existing permit. The request would be made to Ecology using forms available on line 30 days prior to the anticipated use. Ecology would conduct a quick risk assessment and allow an exemption if no detrimental effects were found and the use complied with the State Environmental Policy Act. • In an extreme situation where no permits

	include using one or more pesticides such as KCl. Each approved pesticide must under go a risk assessment conducted by Ecology in coordination with the WSDA and WDFW and Wildlife. The analysis takes from 6 to 9 months for each chemical. The permit would be written simultaneously and would include addressing SEPA provisions. As much as possible local jurisdictional issues would be addressed as well. Once the permit was issued to a state agency such as WDFW, they would do a statewide SEPA process. Once complete, the permitted chemical could be used immediately. • For an emergency situation where a facility has an existing NPDES permit or State Waste Permit, Washington law allows for a short term water quality modification (see next column) • For an extreme situation where there are no existing permits, an emergency order can be issued. (see next column)	exist, an emergency order could be issued that would provide for a short term action. Turn around time for the order would be within one week of the request. Prior efforts to coordinate with local jurisdictions would likely minimize local issues. This process has been successfully used on an isolated tunicate population in Puget Sound.
Resource Conservation and Recovery Act administered by US EPA with authority	• Pesticide waste must be managed in a non leak, closed container or tank that is appropriately labeled • Properly managed containers may be stored for up to one year	• Releases must be immediately contained and transferred to appropriate container. Releases over 200 #s or 25 gallons must be reported to the National Response Center 1-800-424-8802 and to the Washington

delegated to the Washington Dept of Ecology **Dangerous Waste Regulations (WAC 173-303)**	• Containers must be transported to permitted hazardous waste facility following Washington and Federal Dept of Transportation regulations	Emergency Management Division 1-800-258-5990 and the appropriate Ecology regional office

NOTES:

1. WSDA provides guides on line for requesting Section 18 and Section 24 exemptions. Requests are made through the Special Pesticide Registration Program Coordinator in the Pesticide Management Division of WSDA in Olympia. The contact number is 1-360-902-2030 or 2078.
2. The Washington Dept of Ecology has determined that it will continue to issue permits for the application of pesticides to waters of the State of Washington. At the present time, Ecology has identified the need to develop a permit for invasive animal species such as zebra mussel eradication and has identified some potential pesticides to be assessed but has not begun the risk assessment process or set a time table for its completion.
3. The SEPA program can be contacted at (360) 407-6922

TABLE 3: Pesticide Use Matrix For An Isolated Zebra Mussel Infestation In The Columbia River Basin (Oregon).

REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) administered by US EPA. Pesticide licensing and application authority delegated to Oregon Dept of Agriculture (ODA). Implemented under the **Oregon Pesticide Control Law (OAR 603-57)**	• Pesticides approved for aquatic application by the ODA need no approval from DEQ or ODFW if they are applied according to label and license requirements. • For commercial pesticides not currently approved by ODA, a formal Section 3 application process would be required. The pesticide registrant would submit an application through the ODA. • For an emergency situation, FIFRA provides for exemptions under Sections 18 and 24. See next column.	• Section 18 of FIFRA allows for emergency use exemption for a pesticide that is not already approved. The request would go through the ODA who would evaluate the request and forward it to EPA. Requests should be submitted 100 to 120 days prior to expected use. This timeframe includes the EPA 50 day risk assessment If approved, the approval would last for one year. • Section 18 also allows for a crisis exemption that would allow unregistered use for 15 days. The state agriculture department would notify EPA, EPA would do a cursory review, confer with the state and give crisis exemption. Use beyond the 15 days would require an emergency exemption • Section 24 (c) allows the states to register an additional use of a federally registered pesticide or a new use as long as there is a “special local need” and a current tolerance for the use approved by EPA. The request would go through the ODA for review and approval and then be submitted to EPA for review.

Endangered Species Act (ESA). The ESA is administered jointly by the U.S. Fish and Wildlife Service (USFWS) for freshwater and terrestrial species, and NOAA Fisheries for anadromous and marine species.	• Pesticide-related response actions undertaken in the CRB could affect species or critical habitat listed under the ESA. In those cases, an ESA Section 7 consultation would need to occur. See next column for Section 7 consultation emergency provisions. Oregon's Endangered and Sensitive Species Rules would also need to be addressed.	• Federal agency requests to EPA for FIFRA Section 18 or Section 24 approval to use pesticides for emergency response actions that may affect a listed species or critical habitat would trigger the requirement for an ESA Section 7 consultation between EPA and NOAA Fisheries and/or the FWS depending on the species and critical habitat affected. • Under emergency circumstances, such consultation would be conducted informally during the emergency and formal consultation would be initiated, as appropriate, as soon as practicable after the emergency is under control. • If formal consultation is required, the FWS and/or NOAA Fisheries provide an after-the-fact biological opinion to the EPA that documents the effects of the emergency response action on listed species and/or critical habitat. • If informal consultation is appropriate, the FWS and/or NOAA Fisheries provide written concurrence to the EPA that the response action is not likely to adversely affect listed species or critical habitat. • Under non-emergency circumstances, the same response action would be the subject of a completed consultation in advance of the response action being implemented.
Oregon Dept of Fish and Wildlife (ODFW)		• ODFW would have to participate on an informational basis in ESA consultations if

administers the **Oregon Endangered Species Rules** and **Oregon Sensitive Species Rules** for species native to Oregon.(OAR 635-0100)		the species of concern was listed as sensitive, threatened or endangered in Oregon
.**National Environmental Policy Act (NEPA)** administered by US EPA	• Any federally initiated action or action on federal lands or action using federal funds must also comply with the provisions of NEPA. An environmental assessment (EA) would be required and a finding of no significant impact (FONSI) needed before the action could take place. For an emergency situation, see next column	• .NEPA provides for an emergency action through consultation with the Council on Environmental Quality. The lead federal action agency would call CEQ, write a letter of notification, and prepare an environmental action statement. CEQ would respond in 24 hours. After the action is complete, a formal EIS or EA would have to be prepared.
Clean Water Act (CWA) administered by US EPA with authority delegated to the Oregon Dept of Environmental Quality (DEQ) for regulating pollutants in state waters. Implemented under the **Oregon Water Quality Act (OAR Chapter 340, Division 45)**	• No NPDES or WPCF permits are required in this situation.	
Resource	• Pesticide waste must be managed in a	• Releases must be immediately contained and

Conservation and Recovery Act administered by US EPA with authority delegated to the Oregon Dept of Environmental Quality under **Oregon Hazardous Wastes Laws (OAR Chapter 340, Division 109)**	non leak, closed container or tank that is appropriately labeled • Properly managed containers may be stored for up to one year • Containers must be transported to permitted hazardous waste facility following Oregon and Federal Dept of Transportation regulations	transferred to appropriate container. Releases over 200 #s or 25 gallons must be reported to the Oregon Emergency Response System. 1-800-452-0311 and the National Response Center at 1-800-424-8802.

Notes:

Section 18 requests should go to the Section 18 coordinator at the Pesticides Division of the ODA (phone: 503-986-4656).

TABLE 4: Pesticide Use Matrix For An Isolated Zebra Mussel Infestation In The Columbia River Basin (Idaho).

REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) administered by US EPA. Pesticide licensing and application authority delegated to Idaho State Dept of Agriculture (ISDA). Implemented under **IDAPA 02 Title 22 Chap 34**	• Pesticides approved for aquatic application by ISDA need no approval from Idaho DEQ or Idaho Fish and Game if they are applied according to label and license requirements. • For commercial pesticides not currently approved by ISDA, a formal Section 3 application process would be required. The pesticide registrant would submit an application through the ISDA. • For an emergency situation, FIFRA provides for exemptions under Sections 18 and 24. See next column.	• Section 18 of FIFRA allows for emergency use exemption for a pesticide that is not already approved. The request would go through the ISDA who would evaluate the request and forward it to EPA. Requests should be submitted 100 to 120 days prior to expected use. This timeframe includes the EPA 50 day risk assessment If approved, the approval would last for one year. • Section 18 also allows for a crisis exemption that would allow unregistered use for 15 days. The state agriculture department would notify EPA, EPA would do a cursory review, confer with the state and give crisis exemption. Use beyond the 15 days would require an emergency exemption • Section 24 (c) allows the states to register an additional use of a federally registered pesticide or a new use as long as there is a “special local need” and a current tolerance approved by EPA. The request would go through the ISDA for review and approval and then be submitted to EPA for their review.

Endangered Species Act (ESA). The ESA is administered jointly by the U.S. Fish and Wildlife Service (USFWS) for freshwater and terrestrial species, and NOAA Fisheries for anadromous and marine species.	• Pesticide-related response actions undertaken in the CRB could affect species or critical habitat listed under the ESA. In those cases, an ESA Section 7 consultation would need to occur. See next column for Section 7 consultation emergency provisions. Idaho's Endangered and Sensitive Species Rules would also need to be addressed.	• Federal agency requests to EPA for FIFRA Section 18 or Section 24 approval to use pesticides for emergency response actions that may affect a listed species or critical habitat would trigger the requirement for an ESA Section 7 consultation between EPA and NOAA Fisheries and/or the FWS depending on the species and critical habitat affected. • Under emergency circumstances, such consultation would be conducted informally during the emergency and formal consultation would be initiated, as appropriate, as soon as practicable after the emergency is under control. • If formal consultation is required, the FWS and/or NOAA Fisheries provide an after-the-fact biological opinion to the EPA that documents the effects of the emergency response action on listed species and/or critical habitat. • If informal consultation is appropriate, the FWS and/or NOAA Fisheries provide written concurrence to the EPA that the response action is not likely to adversely affect listed species or critical habitat. • Under non-emergency circumstances, the same response action would be the subject of a completed consultation in advance of the response action being implemented. • Idaho Fish and Game would have to participate on an informational basis in these discussions if the species of concern was listed as sensitive, threatened or endangered in Idaho.
National	• Any federally initiated action or	• NEPA provides for an emergency action

Environmental Policy Act (NEPA) administered by US EPA	action on federal lands or action using federal funds must also comply with the provisions of NEPA. An environmental assessment (EA) would be required and a finding of no significant impact (FONSI) needed before the action could take place. For an emergency situation, see next column	through consultation with the Council on Environmental Quality. The lead federal action agency would call CEQ, write a letter of notification, and prepare an environmental action statement. CEQ would respond in 24 hours. After the action is complete, a formal EIS or EA would have to be prepared.
Clean Water Act (CWA) administered by US EPA authorizes EPA to issue NPDES permits for regulating pollutants in Idaho waters. The Idaho Dept of Environmental Quality (DEQ) issues CWA 401 certification that permitted projects meet state water quality standards under **IDAPA 58 Chap 01 Title 02**	• No NPDES or WPCF permits are required in this situation.	
Resource Conservation and Recovery Act administered by US	• Pesticide waste must be managed in a non leak, closed container or tank that is appropriately labeled • Properly managed containers may	• Releases must be immediately contained and transferred to appropriate container. Releases over 200 #s or 25 gallons must be reported to the Idaho Emergency Response System.1-800-632-

EPA with authority delegated to the Idaho Dept of Environmental Quality under **IDAPA 58 Chap 01 Title 05**	be stored for up to one year • Containers must be transported to permitted hazardous waste facility following Idaho and Federal Dept of Transportation regulations	8000 and the National Response Center at 1-800-424-8802.

TABLE 5: Pesticide Use Matrix For An Isolated Zebra Mussel Infestation In The Columbia River Basin (Montana)

REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) administered by US EPA. Pesticide licensing and application authority delegated to Montana Dept of Agriculture (MDA). Implemented under **Montana Pesticide Act Title 80 Chapter 8**	• Pesticides approved for aquatic application by the MDA must also be authorized by the Montana Department of Environmental Quality under the Montana Water Quality Act. (see below). • For commercial pesticides not currently approved by MDA, a formal Section 3 application process would be required. The pesticide registrant would submit an application through the MDA. • For an emergency situation, FIFRA provides for exemptions under Sections 18 and 24. See next column.	• Section 18 of FIFRA allows for emergency use exemption for a pesticide that is not already approved. The request would go through the MSDA who would evaluate the request and forward it to EPA.[ii] Requests should be submitted 100 to 120 days prior to expected use. This timeframe includes the EPA 50 day risk assessment If approved, the approval would last for one year. • Section 18 also allows for a crisis exemption that would allow unregistered use for 15 days. The state agriculture department would notify EPA, EPA would do a cursory review, confer with the state and give crisis exemption. Use beyond the 15 days would require an emergency exemption • Section 24 (c)) allows the states to register an additional use of a federally registered pesticide or a new use as long as there is a "special local need" and a current tolerance for the use approved by EPA. The request would go through the MDA for review and approval and then be submitted to EPA for their review.
Endangered Species Act (ESA). The ESA is administered jointly by the U.S. Fish and	• Pesticide-related response actions undertaken in the CRB could affect species or critical habitat listed under the ESA. In those cases, an ESA Section 7	• Federal agency requests to EPA for FIFRA Section 18 or Section 24 approval to use pesticides for emergency response actions that may affect a listed species or critical habitat would trigger the requirement for an ESA

Wildlife Service (USFWS) for freshwater and terrestrial species, and NOAA Fisheries for anadromous and marine species. Montana Fish, Wildlife and Parks (MFWP) maintains a list of threatened and endangered Montana species	consultation would need to occur. See next column for Section 7 consultation emergency provisions. Montana's Endangered and Sensitive Species Rules would also need to be addressed.	Section 7 consultation between EPA and NOAA Fisheries and/or the FWS depending on the species and critical habitat affected. • Under emergency circumstances, such consultation would be conducted informally during the emergency and formal consultation would be initiated, as appropriate, as soon as practicable after the emergency is under control. • If formal consultation is required, the FWS and/or NOAA Fisheries provide an after-the-fact biological opinion to the EPA that documents the effects of the emergency response action on listed species and/or critical habitat. • If informal consultation is appropriate, the FWS and/or NOAA Fisheries provide written concurrence to the EPA that the response action is not likely to adversely affect listed species or critical habitat. • Under non-emergency circumstances, the same response action would be the subject of a completed consultation in advance of the response action being implemented. • MFWP would have to be consulted if a state species of concern was at risk.
National Environmental Policy Act (NEPA) administered by US EPA	• Any federally initiated action or action on federal lands or action using federal funds must also comply with the provisions of NEPA. An environmental assessment (EA) would be	• NEPA provides for an emergency action through consultation with the Council on Environmental Quality. The lead federal action agency would call CEQ, write a letter of notification, and prepare an environmental action statement. CEQ would respond in 24

Montana Environmental Policy Act (MEPA) administered by the Montana DEQ under Title 75 Chapter 4 Rule 17 of the Montana Code	required and a finding of no significant impact (FONSI) needed before the action could take place. For an emergency situation, see next column. • Requires state agencies to review any action that will significantly affect the quality of the environment. A written environmental assessment (EA) must be done to determine if an EIS is needed. The EA process usually takes 2 months. For an emergency, see next column.	hours. After the action is complete, a formal EIS or EA would have to be prepared. • Under MEPA, immediate action can be taken without an EIS if a project is undertaken to prevent or mitigate immediate threats to public health, safety, welfare or the environment. The Governor and the Environmental Quality Commission must be notified in 30 days. Rule 17.4.632
Clean Water Act (CWA) administered by US EPA with authority delegated to the Montana Department of Environmental Quality to issue NPDES permits for regulating pollutants in Montana. under the Montana CWA Title 75 Chapter 5	• No NPDES or WPCF permits are required in this situation. (see notes below) (2), however, Section 308 of the Montana CWA authorizes the MDEQ to approve the application of pesticides to surface waters to control aquatic nuisance organisms. See next column.	• MDEQ may issue a short term exemption from surface water quality standards for emergency pesticide application under Section 308 of the Montana Water Quality Act if significant risk to the public is prevented and existing and designated uses are protected. Application forms are available on line at www.deq.mt.gov/wqinfo
Resource Conservation and Recovery Act administered by US EPA with authority delegated to the	• Pesticide waste must be managed in a non leak, closed container or tank that is appropriately labeled • Properly managed containers may be stored for up to one year • Containers must be transported to	• Releases must be immediately contained and transferred to appropriate container. Releases over 200 #s or 25 gallons must be reported to the Montana Disaster and Emergency Services 1-406-841-3911 and to the National Response Center 1-800-484-8802.

Montana Dept of Environmental Quality under **Title 75 Chap 10 Part 4**	permitted hazardous waste facility following Montana and Federal Dept of Transportation regulations	

III. Regulatory requirements that may apply for non-chemical control methods

Table 2 (Appendix D) provides an array of possible non-chemical control methods that might work under certain conditions. With the exception of natural predation, they all have some environmental consequences and would thus also fall under the federal/state regulatory umbrella. FIFRA would no longer play a role for non pesticide control methods but the ESA, CWA and NEPA as well as state and federal land use laws would still be a part of that regulatory regime. The procedures described in Tables 2-5 for ESA and NEPA compliance remain the same. The following paragraphs describe other Federal regulatory requirements that could apply to the use of non-pesticide zebra mussel control methods. Note that any of the federal authorizations discussed in this section may also require an ESA consultation if the authorized action "may affect" a listed species or designated critical habitat. Following the Federal requirements is a discussion of the individual state's requirements and coordination with Federal laws.

Federal Permits And Authorities

Section 10 of the Rivers and Harbors Act of 1899 gives the US Army Corps of Engineers authority to authorize the erection of structures within navigable waterways of the United States. The formal process requires filing an application with the District Engineer who then has 15 days to review the application and issue a public notice. The public notice is usually for 30 days. The District Engineer has 60 days to make a decision. During this process, the District Engineer must determine whether the project with meet the requirements of the CWA, the Endangered Species Act, the National Environmental Policy Act, and the Coastal Zone Management Act.

Two options exist for shortening the process. The first, a "Letter of Permission" provides an abbreviated process for a project where the District Engineer determines that the work is minor, has no individual or cumulative impacts on environmental values and should encounter no appreciable opposition. The District Engineer would coordinate with Federal and state fish and wildlife agencies during the determination.

The second option provides for emergency procedures. Division engineers are authorized to approve special processing procedures in emergency situations. An "emergency" is a situation which would result in an unacceptable hazard to life, a significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a permit is not undertaken within a time period less than the normal time needed to process the application under standard procedures. Reasonable efforts will be made to receive comments from interested Federal, state, and local agencies and the affected public. Also, notice of any special procedures authorized and their rationale is to be appropriately published as soon as practicable.

Section 401 of the CWA requires that any activity that may affect water quality receive certification from the EPA that water quality standards for the particular body of water

will not be violated. The EPA has delegated this authority to the state environmental agencies in Oregon, Washington and Idaho. The states have 60 days to respond to the 401 notification with a determination regarding state water quality standards. In an emergency situation, the states would be consulted but the formal process would be waived until the emergency had been resolved.

Section 404 of the CWA gives the Secretary of the Army authority to issue permits, after notice and opportunity for public hearings for the discharge of dredged or fill material into the navigable waters at specified disposal sites. The formal process which could take up to a year can be shortened under the following circumstances.

A "Letter of Permission" In those cases subject to section 404 of the CWA can be issued after:

1. The district engineer, through consultation with Federal and state fish and wildlife agencies, the Regional Administrator, Environmental Protection Agency, the state water quality certifying agency, and, if appropriate, the state Coastal Zone Management Agency, develops a list of categories of activities proposed for authorization under LOP procedures;
2. The district engineer issues a public notice advertising the proposed list and the LOP procedures, requesting comments and offering an opportunity for public hearing; and

3 A 401 certification has been issued or waived and, if appropriate, CZM consistency concurrence obtained or presumed either on a generic or individual basis.

Emergency Procedures: (same as for a Section 10 Permit see above)

Coastal Zone Management Act strives to balance the protection of coastal resources with coastal development, including energy development. The district engineer must ensure that the proposed activity is consistent with the approved state CZM Program.(see sections below for individual state programs)

Washington State Permits And Authorities

CZMA Consistency: The coastal zone extends from the coast to the downstream end of Puget Island on the Columbia River. Under Washington's Program, activities undertaken by a federal agency, that use federal funding or require federal approval that affect any land use, water use or natural resource of the coastal zone must comply with the enforceable policies within the six state laws. They are**:**

- the Shoreline Management Act (including local government shoreline master programs)

- the State Environmental Policy Act (SEPA)
- the Clean Water Act
- the Clean Air Act
- the Energy Facility Site Evaluation Council (EFSEC)
- the Ocean Resource Management Act (ORMA)

The federal consistency process allows the public, local governments, Tribes, and state agencies an opportunity to review Federal actions likely to affect Washington's coastal resources or uses. The federal consistency coordinator can be reached at the Department of Ecology (360) 407-6068.

State Environmental Policy Act ("SEPA", Chapter 43.21C RCW) was adopted in 1971 to ensure that environmental values were considered during decision-making by state and local agencies. The environmental review process in SEPA is designed to work with other regulations to provide a comprehensive review of a proposal. All state and local agencies that have a role to play in a particular proposal are included as part of the SEPA process. See the following website for the state and local agencies that participate: http://www.ecy.wa.gov/programs/sea/sepa/sepacont.html. Applications for permits to conduct activities in or near the waters of the state automatically entail a SEPA review as part of the application process. The SEPA program can be contacted at (360) 407-6922.

Joint Aquatic Resources Permit Application: Washington State has developed a simplified permitting procedure called the Joint Aquatic Resources Permit Application (JARPA). The following permits can be obtained through one application.

1. U.S. Army Corps of Engineers(Corps): Section 10 and 404 permits
2. Washington Department Ecology: 401 Water Quality Certifications. 401 certifications are issued by the appropriate Ecology Regional Office. The SW Region Office in Olympia (360-407-6300), the Central Region Office in Yakima (509-575-2490) and the Eastern Region Office in Spokane (509-329-3400).
3. Washington Department of Fish and Wildlife: Hydraulic Project Approvals (see below)
4. Washington Department of Natural Resources: Use Authorizations for State-Owned Aquatic Lands (see below)

JARPA information, contact numbers, and forms can be accessed through the following website:
http://epermitting.org/site/alias_resourcecenter/jarpa_introduction/10042/introduction.aspx

The following permits are specific to the State of Washington and might be required for zebra mussel control activities in the Washington State portion of the Columbia River Basin.

Hydraulic Use Approval: Any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state, requires a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife (WDFW). Permit processing can take up to 45 days following receipt of a complete application package
RCW 77.55.021 (8) provides for emergency situations when there exists an immediate threat to property or life. In such cases, immediate verbal approval can be obtained for work necessary to alleviate the emergency. A "hotline" telephone number is available for emergency calls during non-working hours. That number is (360) 902-2537. During normal hours, contact the nearest WDFW office. **Aquatic Use Permit:** In order to protect and manage the use of state owned aquatic lands, consistent with Chapter 79.105 RCW, any activity that takes place on state-owned aquatic lands will require this permit. The application which is called 'Application for Authorization to use State-Owned Aquatic Lands', is online and can be downloaded at
http://www.dnr.wa.gov/htdocs/aqr/indexform.html. The process usually takes 6 months but in an emergency the following DNR regional offices should be contacted to determine if the proposed action is on state owned lands and to request an emergency authorization.

Pacific Cascade Region
601 Bond Rd.
PO Box 280
Castle Rock, WA 98611-0280
(360) 577-2025
pacific-cascade-region@dnr.wa.gov

Southeast Region
713 Bowers Rd.
Ellensburg, WA 98926-9301
(509) 925-8510
southeast.region@dnr.wa.gov

Shoreline Conditional Use Permit: Before undertaking any action that will affect the shoreline, local jurisdictions should be contacted. A Shoreline Conditional Use Permit may be required. Information can be obtained through the JARPA website.

Oregon State Permits And Authorities

Section 401 Certification

Section 401 of the federal CWA provides that an applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the State must provide the permitting agency with a water quality certification issued by the State from which the discharge originates. In the State of Oregon, the Department of Environmental Quality is the designated agency for issuing certifications. For Section 10, 404 and Fill and Removal certification, contact DEQ at (503) 229-6030

CZMA Consistency: The coastal zone extends from the coast to the downstream edge of Puget Island on the Columbia River. In Oregon the Department of Land Conservation and Development is the state's designated coastal management agency and is responsible for reviewing projects for consistency with the Oregon Coastal Management Plan and issuing coastal management decisions. DLCD's reviews involve consultation with local governments, state agencies, federal agencies, and other interested parties in determining project consistency with the OCMP. The state federal consistency coordinator can be contacted at 503-373-0050 Ext. 260,

Oregon Permits: A guide to State of Oregon water use permits is available at the following website: http://www.oregon.gov/DSL/PERMITS/swrp_userguide12_06.shtml

The following permits and authorities would likely be applicable to zebra mussel control activities in the Oregon portion of the Columbia River Basin.

Removal Fill Permit; Oregon Division of State Lands(DSL) under ORS 198-600 and OAR 141-085-0005 requires a permit for the following activities:

- Projects requiring the removal or fill of 50 cubic yards or more of material in waters of the state.
- The removal or fill of **any material** regardless of the number of cubic yards affected in a stream designated as essential salmon habitat. Click on "Essential salmonid habitat areas" at left for maps.
- The removal or fill of **any material** from the bed and banks of scenic waterways regardless of the number of cubic yards affected.

The form: the application form is a joint form with Corps of Engineers Section 10 and Section 404 permitting process. The form is available on line at the following address: http://www.oregon.gov/DSL/forms.shtml

The process: State law requires DSL to determine whether an application for a joint removal-fill permit is complete within 30 days of receipt and to issue a decision within 90 days of the completeness determination. The applicant may request a deadline extension.

In an emergency, DSL can authorize work in advance verbally as soon as all the necessary information about the project is available. The emergency authorizations are

available only for very limited, unforeseen circumstances. The DSL can be contacted at the following number: 503-378-3805

Temporary Use Permit: A Temporary Use Permit is an authorization issued by the DSL allowing short-term use, usually less than one (1) year, of a specific area of publicly-owned submerged and/or submersible land for a specific use under specific terms and conditions. The DSL should be contacted to determine if a Temporary Use Permit is needed. 503-378-3805.

Other Oregon Agencies

Other Oregon agencies that could be involved in this process and may need to be notified include:

1. The Oregon State Marine Board which has responsibility for boating regulations and some authority over marinas. (503-378-8587)
2. The Water Resources Department which has authority over water withdrawals. (503-986-0900)
3. The Oregon Parks and Recreation Department for state parks and cultural and historic preservation sites. The OPRD houses the State Historic Preservation Office which reviews projects to reflect the interests of the State and its citizens in the preservation of Oregon's cultural and historic heritage (503-986-0674)

Idaho State Permits and Authorities

Section 401 Certification

Section 401 of the federal CWA provides that an applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the State must provide the permitting agency with a water quality certification issued by the State from which the discharge originates. In the State of Idaho, the Department of Environmental Quality is the designated agency for issuing certifications. For NPDES, Section 10 and 404 permits water quality certification, contact DEQ at (208-373-0502)

Joint Application for Stream Channel Alteration Permit

The Idaho Department of Water Resources under Title 58 Section Chapter 142 of the Idaho Code permits instream construction activity through a joint permit in coordination with the Corps of Engineers Section 404 permit. The permit form is available on line at http://www.idwr.idaho.gov/. In an emergency, an emergency permit may be obtained at the same website. Contact the Department of Water Resources at 208-287-4800.

Request for Assignment of Encroachment Permit

The Idaho Department of Lands requires a permit for activities that may encroach on a navigable waterway under Title 58 Chapter 13 of the Idaho Code. That permit is available on line at www.idl.idaho.gov. Contact the Idaho Department of Lands at 208-334-0200.

Other Idaho Agencies

1. Office of Species Protection: Coordinates Idaho's actions related to the Endangered Species Act. Contact the Office of Species Protection at 208-334-2189
2. Department of Parks and Recreation: Manages Idaho's state parks. Contact number 208-334-4199.
3. State Historic Preservation Office: The National Historic Preservation Act requires federal agencies to consult with the SHPO during the planning of any federal action that may endanger cultural resources. The role of the SHPO in federal project review is to reflect the interests of the State and its citizens in the preservation of Idaho's cultural heritage. Contact number 208-334-3861.

Montana State Permits and Authorities

Section 401 Certification

Section 401 of the federal CWA provides that an applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the State must provide the permitting agency with a water quality certification issued by the State from which the discharge originates. In the State of Montana, the Department of Environmental Quality is the designated agency for issuing certifications. For Section 10 and 404 permits water quality certification, contact DEQ at 406-444-4626.

Montana Environmental Policy Act

Administered by Montana DEQ, Title 75 Chapter 4 Rule 17.4 requires state agencies to integrate and review any action of state government that will significantly affect the quality of the environment. It requires a written environmental assessment (EA) to determine if an Environmental Impact Statement (EIS) is needed. All state agencies that have a role to play in a particular proposal are included as part of the MEPA process. Contact the MEPA program at 406-444-2544.

Joint Application for Proposed Work in Montana's Streams, Wetlands, Floodplains and Other Water Bodies

Montana DEQ under Title 75 Chapter 5 permits instream construction activity through a joint permit in coordination with the Corps of Engineers Section 10 and 404 permitting

process. The permit form is available on line at http://www.deq.mt.gov/permits. In an emergency, contact the DEQ at 404-444-0371.

Stream Protection Act 124 Permit:

The Fisheries, Wildlife and Parks Department issues SPA 124 permits for instream work. Contact the MFWP at 406-444-2535.

Other Montana Agencies

1. The State Historic Preservation Office located in the Montana Historical Society reviews federal and state projects to ensure the protection of Montana's cultural and historic heritage. Contact number: 406) 444-0388.
2. The Department of Natural Resources and Conservation manages water rights and water resources. Contact number 406-444-2074.

Summary of Control Methods and Applicable Regulations

The following table attempts to provide an overview of how the federal and state regulations described in the tables and sections above might apply to the various control methods. It does not cover all situations and should be used as reference only.

	PESTICIDES	BACTERIAL TOXINS	FREEZING & DESSICATION DEWATERING	THERMAL SHOCK & OXYGEN STARVATION	SOUND	VIBRATION	ELECTRICAL	UV RADIATION
FIFRA LICENCING	YES	??	NO	NO	NO	NO	NO	NO
CWA / NPDES PERMIT	NO but recommended for facilities	NO	NO	NO	NO	NO	NO	??
ESA SECTION 7	YES	YES	YES	YES	YES	YES	YES	YES
NEPA	YES	YES	YES	YES	YES	YES	YES	YES
RHA SEC 10 CWA SEC 404	NO unless isolation structure used	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
CWA SEC 401	NO unless toxins released	NO unless toxins released	YES unless WQ standards not affected	YES unless WQ standards not affected	NO	NO	YES unless WQ standards not affected	YES unless WQ standards not affected
CZMA CONSISTENCY	NO unless isolation structure needed	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
RCRA STORAGE & DISPOSAL	YES	MAYBE	NO	NO	NO	NO	NO	NO
WASHINGTON SEPA	YES	YES	YES	YES	YES	YES	YES	YES
WASHINGTON NPDES PERMIT	YES	??	NO	NO	NO	NO	NO	??
WASHINGTON HYDRAULIC	NO unless isolation	NO unless isolation	YES	NO unless structure	NO unless	NO unless structure	NO unless structure	NO unless structure

PROJECT APPROVAL	structure used	structure used		needed	structure needed	needed	needed	needed
WASHINGTON AQUATIC USE PERMIT	NO unless isolation structure used	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
OREGON REMOVAL FILL PERMIT	NO unless isolation structure used	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
OREGON CONDITIONAL USE PERMIT	NO unless isolation structure used	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
IDAHO STREAM CHANNEL ALTERATION PERMIT	NO unless isolation structure used	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
IDAHO ENCROACH-MENT PERMIT	NO unless isolation structure used	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
MONTANA SECTION 308 EXEMPTION	YES	??	NO	NO	NO	NO	NO	??
MONTANA MEPA	YES	YES	YES	YES	YES	YES	YES	YES
MONTANA FILL REMOVAL PERMIT	NO unless isolation structure used	NO unless isolation structure used	YES	NO unless isolation structure used	NO unless isolation structure used	NO unless isolation structure used	NO unless isolation structure used	NO unless isolation structure used
MONTANA SPA 124 PERMIT	NO unless isolation structure use	NO unless isolation structure used	YES	NO unless isolation structure used	NO unless isolation structure used	NO unless isolation structure used	NO unless isolation structure used	NO unless isolation structure used

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September 19, 2011

APPENDIX F-CONTINGENCY PLANS

APPENDIX F-1

Bonneville Hydroelectric Project Response Plan for Zebra Mussels (*Dreissena polymorpha*)

By

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and

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May 2007

A. Introduction - The purpose of this Plan is to provide the Bonneville Lock and Dam Project with information that will be needed to rapidly respond to a reported introduction of zebra mussels in order protect project infrastructure. While this Plan is specific to Bonneville Lock and Dam, it should provide sufficient general information that other

Columbia River basin projects could modify to cover their projects with minimal additional effort. It is most likely that projects upstream of Bonneville would be infested first.

Since zebra mussels were introduced into the United States from eastern Europe in the late 1980s, they have rapidly dispersed throughout the Great Lakes and major river systems including the Hudson, Ohio, Mississippi, lower Missouri and other rivers to the south and east including 22 states and two Canadian provinces. This rapid dispersal is due primarily to their tremendous reproductive capability and the fact that larval zebra mussels are able to remain free-floating for several weeks before setting. This ability allows them to be dispersed by downstream water currents, which has been the major vector for their rapid expansion in North America. They are also dispersed by attaching to various types of watercraft moving within or from infested waters.

If zebra mussels colonized anywhere in the Columbia River Basin (CRB) they would be expected to spread to all downstream projects and most likely to mainstem projects upstream. They could affect all submerged components and conduits of the Federal Columbia River Power System (FCRPS) such as trash racks, raw water distribution systems for turbine cooling, fire suppression and irrigation, diffuser gratings, drains, navigation locks, and fish passage facilities. Zebra mussel larvae prefer attaching to substrates in slow moving water although, in higher velocities (> 2 m/sec; > 6 ft/sec), they can find irregularities such as cracks and crevices and scaling in older pipes and flanges that provide lower velocity refugia for settlement. As the attached mussels grow, they then produce additional low flow refuges that allow colonization to progress in otherwise inhospitable flow environments. Settlement can also occur when water flow is reduced during generation outages or other facility down-time when conditions may become more conducive to attachment.

If zebra mussels are introduced and become established within the CRB, it is uncertain how densely they will colonize. They can probably be expected to thrive at least as well as the invasive Asian clam (*Corbicula fluminea*) that is already widely distributed in the CRB. Zebra mussel densities ranging up to hundreds of thousands per square meter have been observed in some areas of the eastern United States – enough to completely cover surfaces several layers deep. The severity of impacts on hydropower, navigation, and fish passage facilities and extent and frequency of mitigation actions will depend on mussel production levels. For the Plan presented here, a moderate productivity level was assumed. Maintenance costs will also be affected by the difficulty in accessing certain fouled areas, the methods available for removal and control, and the amount of time available for maintenance activities. A more detailed description of the risks and potential effects on project facilities can be provided by the Project or District Aquatic Nuisance Species (ANS) Coordinator.

B. List of Actions – Information in this Plan should assist the project in determining what immediate actions are necessary to protect project facilities and in quickly determining long-term needs in order to get funding requirements into the budget cycle. Much of what is suggested below would be too costly to fund from the normal annual O&M allocations without additional funds being included in the project budget.

Hopefully this information will assist the project in prioritizing critical actions and justifying additional funding needs.

The potential severity and consequences of a zebra mussel introduction into the Pacific Northwest, particularly the CRB, will elicit immediate and concerned reactions from resource agencies, affected facility operators, and other entities that have an interest in utilizing water from the basin and/or invasive species. This is expected because those that have been involved in ANS activities are aware of the damage zebra mussels cause and that past control successes for other invasive species were primarily achieved when a region acted quickly and cooperatively. Because we have had a very cooperative relationship both within the region and nationally, we expect that to continue if/when we face a serious ANS problem such as zebra mussels. Regional efforts will initially focus on containment, control and impact mitigation to minimize dispersal to new areas.

1. **Verify Sighting and Proximity to the Project** – Depending on where the initial sighting is made, the project will first need to determine if facilities are located within or downstream of the infested area. If zebra mussels are in another drainage, then determine the likelihood of them being spread to the lower Columbia River. In a river system, it is logical to expect that mussels will disperse to facilities located downstream. Because settlement doesn't occur until 4 to 5 weeks after spawning, larval zebra mussels can disperse a considerable distance downstream. Depending on distance, productivity, and spawning conditions (water temperatures greater than 12^{o} C, 54^{o} F) it can take a few years for populations to reach a "nuisance" level. If the initial discovery is of the larval life stage, that suggests spawning adults are present and it may take a year or two before facilities are affected to the point that remedial measures must be taken. If zebra mussels are found in another drainage or isolated lake, then dispersal to the Columbia River basin in a worst-case scenario could be expected within a year or two and severe infestation within another year or two after that. Thus, early detection may provide a couple years cushion before mitigative actions need to be implemented. This can be important for developing and managing a program within budget cycles.

2. **Survey Project Facilities** – If zebra mussels have been identified at the project or in the Columbia River drainage, then project facilities should be surveyed to confirm their presence and the extent of infestation. This information will be used to determine the appropriate "rapid response". Sites to check initially include the artificial substrates that are part of the existing monitoring program, raw water system strainers, particularly those for the turbine unit air coolers and fire suppression, and surfaces of all unwatered facilities. In unwatered facilities, attention should be directed to darker areas (out of direct light) with low ($\leq$ 2 m/sec; $\leq$ 6 fps) water velocities or in higher water velocity areas where there are irregular surfaces that could provide settling sites. Unusual changes in fish condition, such as increased descaling and lacerations, could also indicate mussels are in fish passage conduits. Their shells have sharp edges that could easily descale or more severely injure fish that rub against them.

3. **Management Briefing** – If zebra mussels are confirmed on project facilities or in

close proximity, immediate actions as described herein will be necessary. An early management briefing will provide information to facilitate approval of and guidance on an acceptable course of action, including identification of an action team and confirmation of their roles and responsibilities (see paragraph 5 for more details on the team). To assist with briefings, see the attached Draft Information Paper and Draft Talking Points. These documents should be updated periodically (about every five years) to include new information and technology.

4. Public Information – The potential for serious environmental and economic impacts to the region from zebra mussels, as have occurred in the eastern states, will undoubtedly create a high level of public interest. Some organizations have been providing general public information and outreach for several years but the reality of an invasive species introduction "close to home" will provoke an immediate, greater interest. The attached Draft Information Paper and Draft Talking Points can be used by Public Affairs for initial responses to media inquiries. See also the attached Draft Press Release. This should also be updated periodically.

5. Establish Corps Team – The Corps has been involved in limited aquatic nuisance species (ANS) activities since the early 1990s, including monitoring for zebra mussels at mainstem Columbia and Snake river projects (since 1994) and active participation on regional and national committees. Some points of contact (POCs) have already been designated and additional team members will be needed to facilitate timely, coordinated response actions. See Table 1 for a list of recommended POCs and responsibilities. Those positions that have not been established or do not have a current representative can be identified at the time a response action is needed.

6. Identify External Partners/Interested Parties – The District or Division POCs will likely lead coordination efforts with external agencies. This will include both immediate response actions and coordination of various environmental requirements (see paragraph C). See Table 2 for a list of key agencies and POCs.

7. Organize Resources – If zebra mussels are present in project facilities, certain immediate actions will be necessary that will require funding, including coordination efforts. There is no current budget line item for ANS actions so funds will have to be allocated from other programs (see paragraph 8) or obtained from outside sources. Long-term funding will also be needed for detailed monitoring and control actions. Rough estimates are provided below for specific actions and, for planning longer term. Approximately $20,000 to 40,000 would be needed for initial coordination and another $100,000 to 200,000 for rapid response actions. Long term costs could be $1,000,000 to 2,000,000 for control measures and $100,000 to 200,000 per year for operations at each mainstem project. This does not include additional manpower that would be needed for physical removal of zebra mussels from project structures. This information will have to be developed once the extent of infestation is better understood but it is safe to say that it could easily be in the $ millions annually based on what has happened in the eastern U.S. and Canada.

8. Develop Project-Specific Plan - Project staff can use the information provided in this document to develop an action plan to prioritize necessary actions and establish a work schedule. While other projects in the CRB are different, their facilities are similar enough to use this information to help quickly develop response plans specific for their projects. Ideally these would be completed in advance, like the Bonneville Project Plan, if the resources/manpower is available to do so.

C. Project Facilities - The project components described below are all vulnerable to some extent to zebra mussel infestations. See also Table 3 for a general list of at risk project facilities and some suggested preventative actions to reduce the impacts of a zebra mussel infestation. Potential effects are described, including ways to monitor for problems, suggestions for mitigative actions, if there are any, and potential costs. The focus will be according to water source with those facility features that rely on raw water as the primary source considered as needing initial attention. Those facilities that have domestic water sources will be noted but only addressed if they have raw water back-up systems that could be compromised. Priority facilities are identified because of their importance and vulnerability to potential zebra mussel infestations. These include turbine cooling systems, fire suppression systems, fish passage facilities, drains and sumps, and certain monitoring facilities (forebay/tailwater sensors, oil/water separators, and dissolved gas monitors). There is also detailed cost estimate information in the paper by Phillips and Darland.[2]

1. Powerhouse 1 – This powerhouse is more vulnerable than Powerhouse 2 because access is more limited, generators are on standby more often, and more areas are available for larval zebra mussel settlement (e.g., lower water velocities, more irregular surfaces, particularly from corrosion and surface deterioration). Rather than try to predict which facility components may be excluded from concern based on water velocity, this Plan will consider that as a minimum if Asian clams have been observed then zebra mussels would also be expected.

a. Generator air coolers – For each generator unit there are 12 coolers that use 900 to 1100 gpm supplied from the main raw water header, or equalizing header, which draws from the scroll case at elevation +23 (feet above mean sea level). The 24" supply line feeds two 12" lines that run through an automatic and a manual strainer (to keep debris out of the cooling coils) with porosities of 1/8" and 3/16," respectively. Each strainer services two generator units. The automatic strainers are located on odd units (3, 5, 7, and 9) and the manual strainers are located on even generator units (4, 6, 8, and 10). Generator units 1 and 2 differ from the other units in that they each have a strainer supplied from each scroll case and have the capability of using a raw water backup from the unit 0 penstock or a pier nose intake located at +68 elevation which runs through a duplex strainer at -10 level. The automatic strainers are primarily used with the manual strainer as a backup. Automatic strainers have pressure gauges to measure the differential across the screen and will alarm in the Control Room if a problem arises. After the strainer, raw water exits to a 10" line that further necks down

[2] Potential Economic Impacts of Zebra Mussels on the Hydropower Facilities in the Columbia River Basin. 2005. Phillips, Stephen and Tim Darland. Pacific States Marine Fisheries Commission. 22 p.

to 8", then 6", and 4" before entering the 5/8" cooling tubes. The heated discharge water is diverted to sumps, through an oil/water separator, and, ultimately, to the tailrace. The generator unit cannot operate if the cooling water system doesn't function properly. No domestic water supply exists as a backup for the air coolers. The discharged water is not warm enough to cause any adverse growing conditions for zebra mussels.

Impacts: Air cooler failures could result from reduced flow in the supply pipes, strainer blockages, or flow gauge malfunctions. Zebra mussels could settle on the intake gratings, in the pipes, on the strainers, or in the flow gauges. This could result in reduced flow due to friction loss or blockages from growing mussels and dislodged shells. Zebra mussels grow to an inch or two which would be sufficient to plug the cooling tubes. Because the system goes from large diameter pipes to progressively smaller diameter pipes, it will be more difficult to difficult to remove severe mussel accumulations.

Actions: It should be noted that Asian clams are cleaned from cooling tubes during main unit overhauls (every 5 years) and they are typically larger than the strainer openings, suggesting that they grew in the supply lines between the strainers and the cooling tubes. If zebra mussels may be present, then some end bells should be removed to spot check for potential plugging. If mussels are discovered in densities that would suggest potential cooling water supply loss, then the system should be immediately checked and cleaned, beginning with the cooling tubes and working towards the intake. Because the manual strainers are checked monthly, mussels will hopefully be detected before their density reaches a critical level or they grow to a large enough size to block cooling tubes.

b. Thrust bearing coolers - For each generator unit there is one cooler that uses a total of 100 gpm supplied from the equalizing header which draws raw water from the scroll case at elevation +23. The 24" supply line feeds a 12" line that runs through an automatic strainer (1/8" porosity) to a 10" line that further necks down to 8", then 6", and 4" before entering the "plate and frame cooler". There is a gauge to measure differential across the strainer and an alarm will sound in the control room if the pressure is excessive. The heated water is diverted to sumps, through an oil/water separator, and, ultimately, to the tailrace. If the thrust bearing coolers don't operate properly, then generator units will be shut down. The discharged water is not warm enough to cause any adverse growing conditions for zebra mussels.

Impacts: Thrust bearing cooling water system failures could result from reduced flow in the supply pipes and blockage of the automatic strainer. Zebra mussels could settle on the intake gratings, in the pipes, and the strainer. This could result in reduced flow due to friction loss or blockages from growing mussels and dislodged shells.

Actions: Because the automatic strainers have pressure differential gauges and are monitored by operators, mussels will hopefully be detected before their density reaches a critical level or they grow to a large enough size. A domestic water supply as a back-

up does not currently exist. Asian clams have never been found in the plate and frame cooler sections.

c. Fire suppression/deluge and deck wash pumps – Raw water is gravity fed from the forebay from either Unit 0 penstock or a pier nose intake located at +68 elevation which runs through a duplex strainer at -10 level. Since the intake to the pumps is gravity fed, the lines remain charged down to the duplex strainer. The strainer has 1/8" to 1/4" porosity plate and splits to the deck wash pump and fire pumps. The deluge system for the transformers is supplied from fire pump No. 1. There are 15 transformers separated into 5 banks located on the +90 deck. The fire suppression system relies solely on raw water. Because of inadequate domestic water supply from the wells on project, a domestic water backup system is not feasible. Malfunction of the fire suppression system would result in additional damage and likely cost more to repair or replace equipment.

Impacts: If zebra mussel larvae settle in the pipes from Unit 0 or from the +68 intake, plugging from mussel shells may occur in the strainer thus causing inadequate water supply to suppress a fire. Water leakage through the valves may provide enough dissolved oxygen (DO) to sustain zebra mussel growth.

Actions: The duplex strainer is checked semi-annually. If zebra mussels are present in the Columbia River, more frequent checks will be recommended (such as monthly or quarterly). The fire deluge systems for the transformers are tested every five years. In addition to checking the strainer, the project should test the deluge system more often than the five year cycle. If leaky valves exist, the project should consider replacing them to prevent DO-laden water from entering and sustaining potential zebra mussel growth.

d. Heating, Ventilation, and Air Conditioning (HVAC) - Raw water is supplied to the HVAC system from the 24" equalizing header which draws from the scroll case at elevation +23. The 24" supply line feeds a 10" line that runs through an automatic strainer (3/16" porosity) to the coils in the chiller located between generator units 8 and 9. If there is a problem with zebra mussel fouling, it should be evident by improper heating or cooling. The powerhouse air supply and exhaust fans operate continuously. Although there will be some air circulation if the HVAC system fails, air temperatures will probably reach unacceptable levels. The HVAC system that controls temperature in the Control Room and +95 level office space uses domestic water.

Impacts: HVAC failures could result from reduced flow in the supply pipes, strainer blockages, or flow gauge malfunctions. Zebra mussels could settle on the intake gratings and in the pipes and strainers. This could result in reduced cooling water flow due to friction loss or blockages from growing mussels and dislodged shells. If the HVAC system malfunctions, the powerhouse may become an unacceptable working environment due to improper air circulation and elevated air temperatures.

Actions: The automatic strainer is checked quarterly. Asian clams have not been

found in the strainer or exchanger tubes. If zebra mussels are present in the Columbia River more frequent checks will be recommended (such as monthly) along with the addition of a domestic water backup system.

d. Drain galleries - Drains and sumps exist to handle leakage and discharge water from various cooling systems and expansion joints. They collect mainly raw water from a variety of sources. Although some domestic drain water mixes in, the discharge should be considered raw water. There are no pumps or water level sensors associated with the drain galleries. Asian clams have been found on level +23 from a leak between generator units 7 and 8 therefore it is likely that zebra mussels could also settle in the area. Operators regularly inspect drain galleries to monitor for plugged drains.

Impacts: Zebra mussels could plug drains causing water to back up and flood certain areas. Zebra mussels could settle in pipes under the drain gratings, therefore reducing effective water passage.

Actions: Continue to inspect drains for the presence of zebra mussels. If water is backing up through a drain and no visible debris is present on the drain grating, the project should suspect for zebra mussel fouling and clean the pipes or divert the drain water through an alternate route.

f. Sumps – There are two sumps that receive raw drain water. One is located on the south and one on the north side of Powerhouse 1. The south sump is normally used first with the north sump as a backup. In addition, the north sump is primarily used to dewater generator units (e.g., scroll case and draft tube). Failure to operate properly could result in flooding and additional equipment malfunction on the -53 level. Project operators inspect the sumps daily.

Impacts: Zebra mussel larvae could settle in the sump chambers or piping thus causing reduced flow or plugged lines to the oil/water separator. In turn, this would cause more wear on pumps and, possibly, water level sensor malfunctions.

Actions: Continue to monitor sumps for the presence of zebra mussels. If detected, closer monitoring of sump pumps and motor amperage readings should indicate if flow is being reduced. In addition, more frequent cleaning of the chambers and sump piping will be recommended.

g. Oil/water separator – Drain water (raw) from the south sump is pumped to an oil/water separator. Raw water in the north sump is pumped directly to the tailrace. The oil/water separator contains an oil absorbing filter that is cleaned bi-weekly. Once residual oil is removed, the water is gravity fed to an oil monitoring building before it is discharged to the tailrace. If the oil/water sensor system fails, then unacceptable amounts of oil could be discharged to the river and potentially violate state water quality standards.

Impacts: Zebra mussel shells could plug sensitive oil monitoring equipment and cause erroneous readings leading to oil discharge into the river. Since the raw water is gravity fed once it reaches the oil/water separator and at a lower velocity, zebra mussels could more easily settle in the discharge line to the oil monitoring building causing water to back up in the separator. If this occurs, contaminated water may be inadvertently discharged to the river in the old navigation lock channel.

Actions: If zebra mussels are present in the Columbia River, more frequent checks should be conducted in the separator chambers and oil monitoring building. The system may require frequent cleaning.

h. Air Compressors - There are two separate air compressor systems that are vital for generator operation. The 300 lb air compressor supplies the governor oil tanks and the 100 lb air compressor supplies the generator head cover pumps and provides service air to the entire powerhouse. Since this is such a vital system, domestic water is used to cool the air compressors with raw water as a backup. The project would be forced to shut down generator units if the compressors malfunction.

Impacts: Little impact is expected since domestic water is primarily used to cool air compressor coils. If raw water were needed for a brief period, subsequent return to domestic water would provide little or no food for zebra mussels to filter and grow in the system. During raw water use, some shells may be dislodged and need to be removed from the compressor cooling coils.

Actions: Continue to maintain equipment to minimize raw water use. Record the dates of raw water use during the year. Depending on the time of year, larval zebra mussels could be present in the system (summer months).

i. Forebay/Tailwater Sensors – These sensors are located throughout the project and are in direct contact with raw water. They provide water level information, mainly to fish passage facility components, that is used to adjust valves controlling water level differentials at fishway entrances and the smolt monitoring facility (SMF) outfall pipes. In addition to fish passage components, sensors inform the control room about forebay and tailwater levels to avoid operating outside design criteria.

Impacts: Mussel growth in the sensor wells could cause false readings to be used for valve operation to control fish passage facilities. Erroneous information would cause fishways to operate out of criteria and impact fish passage and survival past the project. Improper forebay and tailwater levels could cause other problems both at the project and farther upstream/downstream - e.g., structural integrity, navigation, irrigation, and recreation facilities.

Actions: Verify whether mussels have settled in the sensor wells and, if so, remove them. Set up more frequent maintenance schedules. If the sensor still wells fail, the project can rely on above water sensors that are designed to send water level information to the generator 3-D cams for unit efficiency.

j. Juvenile Fish Bypass and Monitoring – Juvenile bypass facilities consist of screened diversions, powerhouse collection channel, auxiliary water supply system, and monitoring facilities. They are operated from 1 March through 14 September for juvenile bypass and from 15 September through 15 December for adult fish fallback. Loss of the juvenile bypass system capability could force the project to provide more spill as an alternative means of bypass.

Impacts: All submerged surfaces in low velocity areas could become colonized by zebra mussels and, if they are in areas where fish are present, could cause increased descaling and more severe injuries if the fish come in contact with the sharp shell edges. Water velocities commonly associated with most fish screen systems are ideal (< 1 m/sec; < 3 ft/sec) for zebra mussel colonization. Zebra mussels attached to dewatering screens and porosity plates, would affect the open area and reduce the water volume passing through and increase the water velocity at the screen resulting in an increased rate of impingement. These systems are specifically designed to provide particular flow characteristics. Fish guidance efficiency (FGE) could be reduced if less flow passed through submersible fish bypass screens and was instead diverted around the lower end. More flow would be directed up into the gatewell slots by plugged or partially plugged screens. This would create adverse hydraulic conditions for juvenile fish. This could be further aggravated if the vertical barrier screens (VBS) and porosity plates were also partially blocked. Major colonization by zebra mussels on trash racks and other screens would hinder flow and increase the weight of these structures.

If some components of the fish bypass systems are not functional, such as the STSs and VBSs, then generally fish passage criteria do not allow turbine operation in affected units. Problems resulting from zebra mussel colonization could cause this to occur. Even more of a concern might be that severe zebra mussel fouling could require extensive maintenance and removal from within the turbine intake, scroll case, and draft tube. The schedule for this could impact normal fish operations if it exceeded the 2-3 month winter maintenance period currently allowed. Even if it could be done quickly, it would add to other fish facility maintenance activities occurring at the same time.

Some of the emergency bypass lines and drain lines would be at risk as described previously. Dewatering screens with fine mesh could be at risk even though they would be unwatered for part of the year. There could be sufficient time for zebra mussels to establish and grow large enough to affect flow through the screens. Even if they didn't cause enough blockage to seriously hinder the operation, their presence might cause the screens to have a rougher surface that could be more susceptible to debris buildup. The cleaning brushes should keep this risk low on those surfaces that are brushed regularly.

Actions: It will be important to assure that the facilities are entirely unwatered as zebra mussels could persist through the winter in pools (areas that receive leakage) as long as they didn't freeze. Although the STSs are pulled and dogged off at deck level during the winter, a portion of the screen remains submerged and at risk.

k. Adult Fish Passage – Adult fish passage facilities include entrance and collection facilities, ladders, auxiliary water supply system, and counting stations. They are operated exclusively with raw water. Depending on the circumstances, forced outage of adult fish facilities could result in delayed fish passage and may require modified or curtailed powerhouse operations. This occurred in 2000 when Powerhouse 2 ladder diffuser gratings were dislodged after they became plugged with debris and both the ladder and powerhouse were taken out of service until repairs could be made.

Impacts: The presence of zebra mussels could diminish the water carrying efficiency of the auxiliary water supply system. If valves are not operated on a regular basis, the valve plates, seals, and guide channels could become colonized and not function properly. Diffuser gratings would be particularly susceptible to fouling that could further aggravate the current problems with fine woody debris and other materials that clog the gratings. Even if zebra mussels did not colonize the diffuser gratings sufficiently to plug them (such as if the gratings were removed and cleaned periodically), they could still be clogged by druses (clumps of zebra mussels 2-3" in diameter) that break off from colonies inside the water supply conduits. Water level and velocity monitoring equipment could be affected by zebra mussel colonies and give erroneous information to the automatic control systems. All concrete surfaces in the ladders and collection systems could become colonized and, where fish are present, cause descaling.

Actions: If the zebra mussels cannot be controlled, they would have to be physically removed. Depending on the growth rate, this would be necessary at least annually and would require unwatering the facilities. Access to much of the auxiliary water supply systems is limited and it requires the entire ladder system be unwatered. Physical removal would be time consuming and limited by in-water work windows and by regulations regarding work in confined spaces. Picketed lead fouling would be similar to that described above for diffuser gratings. Counting station crowders should be operated on a regular basis to prevent any buildup of zebra mussels that could cause them to malfunction.

If the Powerhouse 1 adult passage system had to be shut down for additional maintenance associated with zebra mussel accumulations, all passage would be diverted through Powerhouse 2 facilities. During this time, Powerhouse 1 would also need to be taken out of service to prevent adult fish from being attracted into the tailrace.

l. Gland water for cooling/lubrication – The main turbine shaft packing glands keep raw water from entering the packing because the river water contains sediments that would damage the packing and shaft. Gland water is fed from a domestic line with raw water backup and flows at a rate of 10 gal/min. Gland water continues to flow regardless of whether the unit is in service. If the domestic system malfunctioned, raw water would automatically begin since the decrease in pressure would allow the back flow valve to open. The gland water system is monitored/maintained quarterly to detect any deficiencies that may be occurring.

Impacts: Little to no impact is to be expected with using domestic water above the Teflon packing. If raw water were to be used frequently, the generator unit could become inoperable due to zebra mussels clogging the gland water lines and additional sediments wearing on the shaft and packing material.

Actions: Continue to maintain equipment to minimize raw water use. Record the dates of raw water use during the year. Depending on the time of year, zebra mussel larvae could be present in the system (summer months). Additional inspections would be recommended.

2. Powerhouse 2 – Many of the systems are similar to those for Powerhouse 1, described above, therefore mainly the features that are different or that should be treated differently will be discussed here in more detail.

a. Generator air coolers – See information discussed for Powerhouse 1 above (paragraph C.1.a.). These coolers are similar to those for Powerhouse 1 units except that there are only 8 coolers per unit in Powerhouse 2. In addition, Powerhouse 2 units are on a 4 year overhaul schedule. Flow ranges from 650 to 750 gal/min to each unit.

Impacts: Impacts would be similar to those described above for Powerhouse 1.

Actions: Actions would be similar to those described above for Powerhouse 1.

b. Thrust bearing coolers – For each generator unit there are several 5/8" cooling tubes that are located within the bearing oil tub. Raw water is supplied from the scroll case and passes through automatic strainers located on the +5 level.

Impacts: See information for Powerhouse 1 above (paragraph C.1.b.). Any service needed on these cooling tubes will require an extensive unit outage.

Actions: See information for Powerhouse 1 above.

c. Fire suppression and deck wash pumps – See information discussed for Powerhouse 1 above (paragraph C.1.c.). The project has modified the deck wash system that services the +90 deck to use raw water instead of domestic water. The deck wash water is used to clean VBSs and, due to the cleaning frequency of the new VBSs, regional biologists wanted to minimize the amount of chlorinated domestic water entering the river.

Impacts: See information for Powerhouse 1 above.

Actions: See information for Powerhouse 1 above. The project should consider leaving the existing valving from the domestic water line intact. This would allow a simple modification to reconnect the domestic line back into the deck wash piping as a backup to raw water. The project should test the deluge system more frequently than

the current four year cycle if zebra mussels are discovered in the Columbia River.

d. HVAC The HVAC system is currently being reconfigured to a closed loop system. This system will use a refrigerant with raw water as the primary source of exchange. Domestic water will be available as a backup to the raw water cycling through the exchanger.

Impacts: See information for Powerhouse 1 above (paragraph C.1.d.).

Actions: See information for Powerhouse 1 above.

e. Drain galleries The draft tube gallery has live Asian clams living in the drain ditch. The clams were also found in the drain gallery located under the turbine intakes. Shells were not far from the leak and all appeared dead (some were checked by a project biologist).

Impacts: See information for Powerhouse 1 above (paragraph C.1.e.).

Actions: See information for Powerhouse 1 above.

f. Sumps See information discussed for Powerhouse 1 above (paragraph C.1.f.). There are two separate sumps located at Powerhouse 2. One sump receives water from the draft tube and is pumped out to the corner collector channel. This sump contains an oil monitor and will stop pumping if oil quantities exceed criteria. The second sump receives raw drain water and is pumped directly to the tailrace.

Impacts: See information for Powerhouse 1 above.

Actions: See information for Powerhouse 1 above.

g. Oil/water separator - The discharged water from the head cover pumps goes directly to the oil/water separator. From there it is discharged into the tailrace.

Impacts: See information for Powerhouse 1 above (paragraph C.1.g.).

Actions: See information for Powerhouse 1 above.

h. Air Compressors - See information discussed for Powerhouse 1 above (paragraph C.1.h.). The main difference between first and second powerhouse air compressors is that the governor oil tank is 1000 lbs and the service air and head cover supply is 125 lbs.

Impacts: See information for Powerhouse 1 above.

Actions: See information for Powerhouse 1 above.

i. Forebay/Tailwater Sensors - See information for Powerhouse 1 above (paragraph C.1.i.).

Impacts: See information for Powerhouse 1 above.

Actions: See information for Powerhouse 1 above.

j. Juvenile Fish Bypass and Monitoring - Juvenile fish bypass facilities at Powerhouse 2 are similar to those at Powerhouse 1 (paragraph C.1.j.) plus there are some unique features, including a corner collector on the south end, turbine intake extensions (TIEs) in the forebay, and a smolt monitoring facility with surface outfalls 2 miles downstream on the Washington shore. They are operated from March through October for juvenile fish bypass and from November through December 15 for adult fish fallback. Loss of juvenile bypass system capability at Powerhouse 2 could also force the project to provide more spill as an alternative means of bypass.

Impacts: Impacts would be generally similar to those described for Powerhouse 1. The corner collector bypass channel and long bypass pipes to the smolt monitoring facility may not be severely affected because they operate with high water velocities. Of most concern would be irregular surface areas and other places with small eddies where mussel larvae could settle and grow, particularly if they weren't completely unwatered during the non-bypass season. Because the bypass pipe is buried, winter temperatures probably would not be low enough to kill mussels that settled in areas that were not completely unwatered.

Actions: Just as at Powerhouse 1, it will be important to assure that the facilities are unwatered as much as possible to minimize refugia where zebra mussels could persist through the winter. Any areas where water remains should be inspected for mussel growth. The current practice of TIE removal during the non-bypass season should be sufficient to kill any zebra mussels attached to them.

k. Adult Fish Passage - Adult fish passage facilities at Powerhouse 2 include entrance and collection facilities, ladders, auxiliary water supply system, and counting stations. There is also an adult fish monitoring facility on the north shore of Powerhouse 2. They are operated exclusively with raw water.

Impacts: Impacts would be generally similar to those described for Powerhouse 1 (paragraph C.1.k.). Depending on the circumstances, forced outage of adult fish facilities could result in delayed fish passage and modified/curtailed powerhouse operations.

Actions: Impacts would be generally similar to those described for Powerhouse 1. If the Powerhouse 2 adult passage system had to be shut down for additional maintenance associated with zebra mussel accumulations, then all passage would be diverted through the Powerhouse 1 facilities. During this time, Powerhouse 2 would also need to be taken out of service to prevent adult fish from being attracted into the

tailrace.

l. Adult Fish Monitoring Facility - There is an adult monitoring facility on the north shore of Powerhouse 2. This is operated exclusively with raw water. Depending on the circumstances, forced outage could result in lost monitoring/research data. Some of this information is important for fish stock management.

Impacts: The submerged, inaccessible parts at the Bonneville adult evaluation facility would be susceptible similar to other fish passage facilities with piping, gratings, concrete and metal surfaces, and moveable structures. Forced outages of the adult fish monitoring facility would mean that important fish stock information might not be available for regional fish managers to use for making fisheries management decisions.

Actions: Similar to those for adult passage facilities.

m. Gland water for cooling/lubrication - See information discussed for Powerhouse 1 above (paragraph C.1.l.). The gland water system is monitored/maintained monthly to detect any deficiencies that may be occurring.

Impacts: See information for Powerhouse 1 above.

Actions: See information for Powerhouse 1 above.

3. Spillway - Other than fouling, spill gates and hoisting equipment are not likely to be impacted by zebra mussels to the point that they would be inoperable.

a. Sumps - See information for Powerhouse 1 sumps above (paragraph C.1.f.).

Impacts: No Asian clam shells have ever been found in the sump.

Actions: See information for Powerhouse 1 above.

4. Navigation Lock

a. Fire suppression pumps - See information for Powerhouse 1 above (paragraph C.1.c.). In addition to fire suppression, the pumps are used for irrigation around the navigation lock. The system contains a manual strainer that is checked and flushed once per week.

Impacts: See information for Powerhouse 1 above.

Actions: See information for Powerhouse 1 above.

b. Floating mooring bits – There are 8 floating mooring bits located on the navigation lock walls. They are used to secure vessels during lockages and they move up and down with the changing water level in the lock.

Impacts: Although zebra mussels could settle in the guide channels, the mooring bits are used frequently enough that they would constantly scrape off any mussels that do settle and begin growing. The weight of mussels that could accumulate on the mooring bits between normal maintenance periods should not be sufficient to affect their buoyancy.

Actions: Clean during lock maintenance to prevent buildup that could cause increased corrosion. The project might want to consider anti-fouling paint if available for this application (there may be environmental constraints).

5. Service Building – The Service Building houses maintenance, technical, and operations staff. Along with office space, there are several service bays that the structural, electrical, mechanical, and paint crews use to conduct day to day activities. This includes machine shops, paint and sandblast booths, welding stations, and equipment fabrication/repair facilities.

a. Fire suppression pumps – There are two pumps located at "Windy Welders" on the south side of the main dam (+82 deck). They draw raw water (only on demand) from the forebay through an 8" line and debris is filtered through a manual strainer. A malfunction of the fire suppression system would result in displaced project staff (approximately 50%), additional damage, and likely cost more to repair or replace equipment.

Impacts: See information for Powerhouse 1 above (paragraph C.1.c.).

Actions: See information discussed for Powerhouse 1 above. The fire suppression system is checked and operated annually which should be sufficient to monitor for zebra mussels.

6. Ice and Trash Sluiceways – The ice and trash sluiceways are located upstream of each powerhouse and they pass debris and fish. Little impact is expected due to the high water velocity through the channels. Even where there are surface irregularities that might allow zebra mussel settlement, there should never be accumulations that would prevent adequate operation. If the sides became coated with zebra mussels, the project would need to physically remove them. Since the project passes debris through the sluiceways, this may help scour out mussels.

7. Other Facilities

a. Turbine intake trashracks - There are trashracks for all of the turbine intakes to prevent debris from entering the intakes. Bar spacing varies from 1 inch on fish units to 6 inches for main generator units.

Impacts: The trashracks are located in areas with low water velocity where zebra mussels could easily colonize. This could affect fish passing through them

(descaling/injury) and, if fouling was severe enough, affect turbine efficiency.

Actions: Typically the trashracks are cleaned by raking however they would have to be removed to clean zebra mussels because they could also grow on the downstream side where the trash rake doesn't reach. During trashrack cleaning, either by removal or raking, the unit must be shut off. If this occurs during a high river flow period, it could result in increased spill.

b. Irrigation Systems - These systems are located at the navigation lock, Bradford Island, Cascades Island, and the Washington shore. They are supplied with raw water, either pumped directly from the forebay or from other large raw water distribution lines (navigation lock only). They are operated annually from March until October.

Impacts: Since these systems are shut down in the winter, zebra mussels should not survive in the distribution lines. The lines will either be unwatered or segments containing water should stagnate and become anoxic. All irrigation intakes could contain mussels that inhibit flow into the system. This would cause increased load on the pumps and possibly poor valve operation. Also, mussels (shells) could dislodge from various parts of the supply lines, travel through the distribution lines and plug sprinkler heads. No Asian clam shells have ever been found in the irrigation system.

Actions: Immediate response actions would be mainly to maintain the sprinklers to remove any shells plugging the outlets. Any valve leaks should be repaired so that mussels can not survive in the line during the non-irrigation season.

c. Total Dissolved Gas (TDG) Monitors – These monitors are located in the forebay and tailrace inside fixed pipes (6-inch diameter) that are submerged to approximately 15 feet. River water flows freely through the pipes to the sensors, creating a perfect site for zebra mussels to inhabit. Data from these monitors are used by Reservoir Control Center to adjust project spill levels to meet water quality standards and to protect ESA-listed salmon. The sensors are removed for maintenance and calibration every 3 weeks during the spill season (April 15 – August 31). Any zebra mussels that have settled on the sensor should be noticed.

Impacts: Accumulations of zebra mussels could inhibit removal and replacement of the sensors during routine maintenance and obstruct water flow to the sensors. Erroneous TDG readings could result from either incorrect placement of the sensors or poor circulation in the pipe.

Actions: Immediate actions would include verification that no mussels are obstructing the pipes. If they are found, they should be removed or the pipe replaced and a periodic maintenance plan developed.

d. Dock, Boat Ramps, and Boats – The project has one boat that is moored downstream of the navigation lock. Typically it is kept in the water all year long.

Impacts: Zebra mussels would likely attach to the hull, particularly on the underside and this would result in a loss of efficiency for boat operation. More importantly, the mussels are commonly found inside cooling water intakes because of their preference for less exposed areas. If they plug this intake, the motor could be damaged if it is operated before the intake is cleared. It may be difficult to see the mussels if they are very far up in the line.

Actions: Boat operators should verify that the boat hull and cooling water intake are clean. If the boat becomes fouled with zebra mussels then at least the intake must be thoroughly cleaned, including the bilge, before the boat is used. It the boat is taken to any other location off-project, then it should be thoroughly cleaned before being taken anywhere else to prevent potential spread of the zebra mussels. If zebra mussels are in the river, then it would be better to not leave the boat in the water except when it is being used.

e. Parks and Recreation - Little impact is expected at any of the parks or other recreation facilities with the exception of irrigation systems mentioned above.

f. Visitor Centers - Little impact is expected at either of the visitor centers. The water systems are all domestic, including fire suppression. Fish viewing windows are cleaned daily with automatically-timed brushes that should remove zebra mussels.

g. Bonneville Hatchery – This hatchery, operated by Oregon Dept of Fish and Wildlife, uses water from wells and Tanner Creek for operations. Tanner Creek is such a small tributary it is not likely to become infested with zebra mussels. Underwater fish release pipes are particularly vulnerable to zebra mussels however Bonneville Hatchery's fish release pipe is exposed. Therefore, no impact is expected at this facility from zebra mussels.

D. Environmental Constraints – Advanced planning and environmental coordination for invasive species rapid response actions will facilitate timely actions and regional coordination.

1. Endangered Species Act (ESA) – Most project activities include consideration of ESA-listed species and any response to zebra mussels would be no different. The Action Agencies' Updated Plan of Action (UPA) references this rapid response planning effort which sets the stage for future follow-up if/when it becomes necessary. At that time, coordination letters could be prepared fairly quickly to address specific actions that are deemed necessary.

2. National Environmental Protection Act (NEPA) - Consider filing a Programmatic Environmental Impact Statement (EIS) covering possible actions and treatments, including chemicals that may be used. With such a document available, having already gone through the agency and public review process, the time required to take specific actions can be greatly shortened. An emergency supplement can then be filed based on the Programmatic document that can be approved fairly quickly.

3. EPA – A similar approach can be made with the water quality variance permit, which can be obtained relatively quickly if it is based on information presented and reviewed by EPA and State water quality agencies during the Programmatic EIS process.

4**. Other** – If materials were to be placed in the water to control zebra mussels, then Corps of Engineers permits (Section 10 or Section 404) could be required, as well as state hydraulic permits. However, at this time, there is no application known that would be suitable for use at a hydropower project.

E. Control Options – There are no silver bullets to solve zebra mussel problems but there are some applications available under certain conditions that are described below. Rather than attempt to be too prescriptive, examples will be presented that project personnel familiar with various systems can consider for specific applications.

Typically zebra mussel growth increases when water temperatures reach 10^{o} C and spawning begins at about 12^{o} C. Spawning will continue until water temperatures drop below 10 – 12^{o} C. This is important to know because, if lethal control methods are to be applied, they should be scheduled for some time in early spring or in the fall after the mussels have finished spawning to minimize recruitment of new mussels into the area. The project should have time to schedule activities unless zebra mussels have already reached a critical level that is causing serious problems. This is unlikely since they should be discovered well before the population reaches problem levels. This section should be updated periodically as new information and technology becomes available.

1. Physical Control – The easiest control, if available, is to switch from raw to domestic water and eliminate the potential for mussel contamination. The volume of water needed however would be prohibitive for some activities (e.g., generator air coolers) due to structural constraints and/or supply well capacities but there may be some useful applications (e.g., fire suppression). As a minimum, domestic water systems with raw water back-up should be evaluated for leaks that could allow mussel larvae to enter the system. These should be corrected as soon as possible to minimize mussel contamination because, once they settle in an area, they will either have to be killed or physically removed. While it will be nearly impossible to stop all leaks in all of the watered systems, particularly at Powerhouse 1, priority should be placed on leaks in critical systems such as generator air coolers and fire suppression systems.

In accessible areas, mussels can be physically removed by a variety of means, including scraping, pressure washing, or pigging. Pressures of 2,000 to 3,000 psi should remove mussels but it may take 4,000 to 10,000 psi to remove their byssal fibers (the fibers that they use to attach to hard surfaces). While the byssal fibers may not have to be removed to substantially improve water flow, their presence could allow increased corrosion of metal surfaces by anaerobic bacteria. Pigging would not be practical in pipes and conduits with lots of bends or size changes.

Physical removal can be labor intensive and time consuming which may pose problems meeting in-water work windows. Once the mussels are removed, they will have to be disposed of and the potentially large volume of dead and putrefying mussels must be considered when choosing this option and disposal locations.

Zebra mussels are susceptible to exposure and desiccation and they are more sensitive to longer exposure times and either higher temperature or freezing. If this is an option, the project should plan on unwatering a facility for a minimum of 3 weeks in non-freezing temperatures. This can be reduced to about a week if air temperatures can be raised to > 25^{o} C. Freezing will kill zebra mussels within a day although exposure time will need to be increased to a few days if there are clumps of mussels to assure thorough freezing. After a facility is watered up, there will still be dead mussel bodies and shells to collect and dispose of.

In systems that cannot be unwatered, the project may elect to try and isolate the area for either treatment with hot water or through oxygen deprivation (anoxia). The water temperature should be about 33 to 35 ^{o} C to assure a kill and this should be repeated once or twice a year for longer-term applications. For oxygen deprivation to work, the system must be well sealed as the mussels will survive for long periods in low-oxygen environments. Depending on water volume and mussel density, it could take several weeks for a system to go sufficiently anoxic to assure a kill. This can be accelerated if the water is warmer (up to about 25 ^{o} C) or if certain chemicals, such as hydrogen sulfide gas or sodium metasulfite, are added to eliminate oxygen. Additives should not be used without consideration of their potential impacts in discharge water. As with desiccation, there will be mussel disposal requirements post-treatment.

Antifouling surface coatings or foul-release coatings may be longer-term options for certain facilities but are less applicable for rapid response. These are typically expensive and difficult to apply and more information can be provided if/when long-term plans are developed.

2. Chemical Control – Chemical controls fall into two general categories, those that are lethal and those that are “irritants” (generally oxidizing chemicals) that discourage settlement or inhibit respiration, growth, or metabolic function. General information will be provided to illustrate possible chemical control options but, because of their potential impacts on non-target organisms, including ESA-listed species in the CRB, prescriptive alternatives will be left for later development and coordination once mussel control is needed. This section should be periodically updated, particularly if new, effective chemical products become available.

Lethal chemicals include molluscicides, copper sulfate, and certain metal ions (e.g., potassium). These may be used with or without detoxification and some are proprietary (e.g., Clam-trol). Use of chemicals will also likely require a National Pollution Discharge Elimination System (NPDES) permit from the EPA. Copper sulfate and most metal ions are also toxic to other organisms in the Columbia River and would have to be contained.

Oxidizing chemicals approved for use in drinking water, such as chlorine, potassium permanganate, ozone, and bromine, are effective in controlling zebra mussels but they also impact non-target organisms. If they were used, they could not be discharged into the river without serious environmental impacts. Sodium hypochlorite (NaOCl) injection systems are used by Ontario Power Generation, Canada, under a permit similar to the NPDES permit in the U.S. Another product, BioBullets, has been developed that uses the encapsulation of an active ingredient (KCl) in microscopic particles of edible material designed for ingestion by mussels. It is also supposed to affect Asian clams.

**********This section of the Plan should be updated periodically as new products or technologies are developed.**********

3. Biological Control – No biological control options are available at this time. Some waterfowl (e.g., lesser scaup) and fish (e.g., freshwater drum, carp, and some sunfish) will feed on zebra mussels but not to the point of controlling populations and certainly not within project facilities. Research is ongoing to determine if any known mussel parasites or microbes could be used to control zebra mussels. Again, these organisms are unlikely to provide controls for project facilities, however this Plan should be updated if any organisms are identified that may be useful.

F. Monitoring and Evaluation – An in-progress evaluation should be conducted to provide feedback on the efficacy of rapid response actions and to provide recommendations for improvements to either process or to identify additional actions. In addition, a follow-up evaluation should be conducted to identify opportunities to improve rapid response capabilities. Plans should also be made for a long-term monitoring strategy to address continuing risks from zebra mussels as well as other potentially harmful invasive species.

G. Looking Forward – Although the purpose of this Plan is to provide information for project use in responding to a reported zebra mussel invasion, some opportunities may arise to modify project facilities during routine maintenance or facility upgrades to "less friendly" mussel habitat. If these proactive changes could be made at little or no extra cost, they could be very important compared to potential future, unscheduled project impacts. These are the types of concepts that have been applied in Europe where they have been successfully dealing with zebra mussels for hundreds of years.

1. Redundant systems – If possible and cost effective (facility cost versus maintenance and loss of facility operation costs), add redundancy to existing systems or build new systems with redundancy. This will allow one part to operate while the second is down for maintenance, isolation, or other treatment.

2. Short versus long conduits or pipes – Short conduits will have less surface area to deal with if it becomes fouled.

3. Water velocity – Less zebra mussel settling will occur in smaller diameter pipes with higher water velocities (> 2 m/sec; > 6 fps) and smooth surfaces that are

continuously running as opposed to intermittent high-velocity pipes or larger, slow-moving systems.

4. Over-design – Systems should be over-designed to be able to deliver enough water despite some level of mussel colonization that would otherwise inhibit water flow.

5. Pipe/conduit surfaces – Smooth or slippery surfaces are preferable to minimize settling opportunities (silicone or other slick surfaces). Copper and galvanized metals also provide less hospitable settling sites. These are not, however preferred in anadromous fish passage conduits. Likewise, straight pipes/conduits would be preferred over numerous bends to also minimize potential settling sites.

6. Isolate systems – Provide the capability to isolate systems so they can be sealed and treated (e.g., desiccation, thermal, or chemical).

7. Access – Improved access for people and equipment will facilitate maintenance activities for zebra mussel removal and control.

8. Spare parts – If critical components could be easily and quickly replaced with spares, then outage times could be minimized. Easy access would also simplify periodic monitoring of critical areas.

9. Steam injection – Steam injection could be used for periodic thermal control. Consideration would have to be given to discharge water temperatures to avoid downstream impacts.

Table 1. List of Corps of Engineers points of contact and roles/responsibilities.

Office	Position	Current Member	Phone	Roles/Responsibilities	Alternate Member	Phone
Northwestern Division	Division ANS Coordinator	Rock Peters	(509) 808-3723	Coordinate ANS activities with Division/Districts and with regional/national committees and programs	Lonnie Mettler	(509) 529-7131
Portland District	District ANS Coordinator	Tim Darland	(541) 374-4551	Coordinate ANS activities with District/projects and with Division and regional programs	Blaine Ebberts	(503) 808-4763
Bonneville	Project ANS Coordinator	Tim Darland	(541) 374-4551	Coordinate ANS activities on project and with District Coordinator		
The Dalles/John Day	Project ANS Coordinator	Jeff Randall	(541)-296-1181	Coordinate ANS activities on project and with District Coordinator		
Willamette Valley	Project ANS Coordinator	Greg Taylor	(541) 937-2131	Coordinate ANS activities on project and with District Coordinator		
Environmental Resources		Blaine Ebberts	(503) 808-4763	Coordinate environmental aspects of ANS activities		
Public Affairs		Matt Rabe	(503) 808-4501	Coordination with news media		
Office of Counsel		To be determined		Legal review/guidance		
Walla Walla District	District ANS Coordinator	Lonnie Mettler	(509) 529-7131	Coordinate ANS activities with District/projects and with Division and regional programs		
McNary	Project ANS Coordinator	Brad Eby	(541) 922-2263	Coordinate ANS activities on project and with District Coordinator		
Ice Harbor	Project ANS Coordinator	Mark Plummer	(509) 543-3208	Coordinate ANS activities on project and with District Coordinator		

Office	Position	Current Member	Phone	Roles/Responsibilities	Alternate Member	Phone
Lower Monumental	Project ANS Coordinator	Bill Spurgeon	(509) 282-7211	Coordinate ANS activities on project and with District Coordinator		
Little Goose	Project ANS Coordinator			Coordinate ANS activities on project and with District Coordinator		
Lower Granite	Project ANS Coordinator	Mike Halter	(509) 843-1493	Coordinate ANS activities on project and with District Coordinator		
Dworshak	Project ANS Coordinator			Coordinate ANS activities on project and with District Coordinator		
Environmental Resources		To be determined		Coordinate environmental aspects of ANS activities		
Public Affairs		To be determined		Coordination with news media		
Office of Counsel		To be determined		Legal review/guidance		
Seattle District	District ANS Coordinator	Carol Hewes		Coordinate ANS activities with District/projects and with Division and regional programs		
Chief Joseph	Project ANS Coordinator			Coordinate ANS activities on project and with District Coordinator		
Libby	Project ANS Coordinator			Coordinate ANS activities on project and with District Coordinator		
Environmental Resources		To be determined		Coordinate environmental aspects of ANS activities		
Public Affairs		To be determined		Coordination with news media		
Office of Counsel		To be determined		Legal review/guidance		

Table 2. List of agencies that have an interest in zebra mussel activities and their points of contact.

Agency	POC	Phone	Alternate POC	Phone
Federal				
US Fish and Wildlife Service	Paul Heimowitz	(503) 872-2763	Kevin Aitkin	(360) 753-9508
Bureau of Reclamation	Scott Lund		Joe DiVitorrio	
Bonneville Power Administration	Jim Irish	(503) 230-5914	Mark Jones	
National Marine Fisheries Service				
EPA	Joan Cabreza	(206) 553-7369		
USGS	Tim Counihan	(509) 538-2299	Jill Hardiman	(509) 538-2299
State				
Oregon				
Washington	Scott Smith	(360) 902-2724	Pam Meacham	(360) 902-2741
Idaho	Amy Ferriter	(208) 332-8686		
Montana	Eileen Ryce	(406) 444-2448	Nancy Podolinsky	
Others				
Portland State University	Mark Sytsma	(503) 725-3833	Robyn Draheim	(503) 725-4994
Pacific States Marine Fisheries Commission	Stephen Phillips	(503) 595-3100	Susan Anderson	(503) 595-3100
Columbia River Inter-Tribal Fish Commission	Blaine Parker	(503) 731-1268		
Forest Service	Cynthia Tait	801-625-5358	Linda Ulmer	503-808-2929
Bureau of Land Management	Joe Moreau	503-808-6418	Linda Ulmer	503-808-2929

Table 3. General list of most vulnerable project facilities and some potential preventative actions to reduce the impacts of a zebra mussel infestation. It is not intended that the project immediately begin making changes but, rather, to provide information that could be used to modify facilities during the normal course of project maintenance and replacement activities.

Facility	Level of Risk	Reason for Risk Level	Potential Preventative Actions
Turbine cooling systems	High	Use raw water with no domestic water backup	- Provide redundancy in supply lines - Provide additional water supply capacity - Repair/replace leaking valves
Fire suppression systems	High	Use raw water with no domestic water backup	- Provide redundancy in supply lines - Provide additional water supply capacity - Repair/replace leaking valves - Provide domestic water backup
Fish passage facilities	High	Use raw water with no domestic water backup	- Provide redundancy in supply lines - Provide additional water supply capacity - Repair/replace leaking valves - Provide/improve access to all components/facilities in contact with raw water - Eliminate leakage of raw water into unwatered facilities - Provide backup equipment for removable components (e.g., various screens and gratings)
Drains and sumps	High	Exposure to raw water	- Provide redundancy in drain lines - Repair/replace leaking valves - Provide backup pumps
Monitoring facilities			
- Forebay/tailwater sensors	High	Exposure to raw water	- Provide redundant sensing capability
- Oil/water separators	High	Exposure to raw water	- Provide redundancy in supply lines - Provide additional water supply capacity - Repair/replace leaking valves
- Dissolved gas monitors	High	Exposure to raw water	- Provide redundant monitoring capability
HVAC[1] systems	High	Use raw water with no domestic water backup	- Provide redundancy in supply lines - Provide additional water supply capacity - Repair/replace leaking valves - Convert to domestic water
Turbine intake trashracks	High	Exposure to raw water	- Provide backup equipment to allow replacement of racks for cleaning

Facility	Level of Risk	Reason for Risk Level	Potential Preventative Actions
Boats	High	Exposure to raw water	- Provide site for storing boat out of the water when not in use
Air compressors	Medium	Use domestic water with raw water backup	- Repair/replace leaking valves in raw water system - Provide redundancy in supply lines - Provide additional water supply capacity
Gland water for cooling/lubricating	Medium	Use domestic water with raw water backup	- Repair/replace leaking valves
Spillway	Medium	Exposure to raw water but should remain operable	- Paint with protective, antifouling coating
Navigation lock - floating mooring bits	Medium	Exposure to raw water but should remain operable	- Paint with protective, antifouling coating
Irrigation systems	Medium	Seasonal use raw water with no domestic water backup	- Repair/replace leaking valves - Provide domestic water backup - Provide capability to drain systems when not in use
Ice and trash sluiceways	Low	Exposure to raw water (at high velocity)	
Bonneville hatchery	Low	Use well water and Tanner Creek	
Visitor centers	Low	No exposure to raw water	

[1] Heating, ventilation and air conditioning

ATTACHMENT 1

Draft Information Paper: Introduction of Zebra Mussels into the Columbia River Basin

1. Background: Since zebra mussels (*Dreissena polymorpha*) were introduced into the United States in the late 1980s from eastern Europe, they have rapidly dispersed throughout the Great Lakes and major river systems including the Hudson, Ohio, Mississippi, lower Missouri, and other rivers to the south and east covering 22 states and two Canadian provinces. This rapid dispersal is due primarily to its tremendous reproductive capability and the fact that larval zebra mussels are able to remain free-floating for several weeks before settling. This ability allows them to be dispersed by downstream water currents, which has been the major vector for their rapid expansion in North America. They are also dispersed by attaching to various types of watercraft moving within or from infested waters. They are particularly troublesome because of their ability to attach to any submerged hard surface, preferring secluded areas with moving water.

If zebra mussels are introduced and become established within the CRB, it is uncertain how densely they will colonize. They can probably be expected to thrive at least as well as the invasive Asian clam (*Corbicula fluminea*) that is already widely distributed in the CRB. Densities ranging up to hundreds of thousands per square meter could be attained under favorable conditions – enough to completely cover surfaces several layers deep. The severity of impacts on hydropower, navigation, and fish passage facilities and extent and frequency of mitigation actions will depend on mussel production levels.

2. Potential Impacts: If zebra mussels colonized the Columbia River Basin (CRB) they could affect all submerged components and conduits in contact with raw water in the Federal Columbia River Power System (FCRPS) such as trash racks, raw water distribution systems, turbine cooling systems, diffuser gratings, service and fire suppression systems, drains, navigation locks, and fish passage facilities. Zebra mussel larvae attach to substrates, including in moving water where they can find irregularities such as cracks and crevices and scaling in older pipes and flanges that provide lower velocity refugia for settlement. The attached mussels then grow and produce additional low flow refuges, allowing colonization to progress in otherwise inhospitable flow environments. Settlement can also occur when water flow is reduced during generation or other facility down-time when conditions may become more conducive to attachment.

3. Risk to Corps Facilities: Critical facility components that could be affected by zebra mussels include turbine cooling systems, fire suppression systems, adult and juvenile fish passage facilities, drains and sumps, and some monitoring equipment. Heavy zebra mussel infestations could force these facilities out of service until remedial actions could be taken. Aside from the serious economic impacts of forcing the turbines out of service, or biological effects of disrupted fish passage, the river flow might have to be diverted through the spillway which could have other negative effects (e.g., high dissolved gases downstream).

4. Response Actions: Initial response is to determine if zebra mussels are present, where they have settled, and how dense the population is. If critical facilities are in imminent danger of failure, then remedial actions will be developed. If components can be removed and replaced or backup systems can be used, the response can be more rapid and effective. If facilities are accessible but not removable, then the mussels must be physically removed until prevention/control measures can be installed. Inaccessible areas will be most difficult and may need to be taken out of service until access is achieved or control measures can be installed. At this time, effective chemical or other control measures are limited due to risks to the environment.

ATTACHMENT 2

Draft Talking Points: Introduction of Zebra Mussels into the Columbia River Basin

1. Where did zebra mussels come from?
Zebra mussels originated in the Balkans, Poland, and the former Soviet Union and were introduced in the mid-1980s into the Great Lakes as a result of ballast water discharge. Since their introduction, zebra mussels have spread to 22 states and two Canadian provinces. They rapidly dispersed throughout the Great Lakes and much of the Mississippi River basin due to their tremendous reproductive capability, the planktonic nature of the larvae allowing water currents to cause downstream drift over great distances, and ability to attach to boats traveling within and from infested waters. The recently-discovered population in _____ is believed to have been from mussels attached to _____ (a recreational boat) that was brought from _____.

2. What is the problem?
If zebra mussels colonized the Columbia River Basin (CRB) they could affect all submerged components and conduits in contact with raw water in the Federal Columbia River Power System (FCRPS) and throughout the rest of the basin. These small mussels could reach densities in excess of 100,000 per square meter and no effective means of eradication exists to eliminate established populations. All other public and private facilities on or in contact with infected waters would also be affected.

3. How will they affect Corps of Engineers facilities?
Critical facility components that could be affected by zebra mussels include turbine cooling systems, fire suppression systems, adult and juvenile fish passage facilities, drains and sumps, and some monitoring equipment. Heavy zebra mussel infestations could force these facilities out of service until remedial actions could be taken. Aside from the serious economic impacts of forcing the turbines out of service, or biological effects of disrupted fish passage, the river flow might have to be diverted through the spillway which could have other negative effects (e.g., high dissolved gases

downstream).

4. What can/is being done to deal with them?
A comprehensive, coordinated regional effort, led by _____ Team, has been assembled to address the problem. First priority is to contain and control the existing population to prevent further dispersal into the region. This could include a general quarantine of the infected area with access restricted to authorized parties or _____. At the same time, discussions are underway to determine if any practical means of eliminating the zebra mussels exists. As this is unlikely, long-term management options are also being developed. These efforts are being guided by a Rapid Response Plan that was developed by the Columbia River Basin Coordinating Committee in 2006 to deal with this very problem.

5. What is the Corps doing?
The Corps of Engineers is participating with the regional coordination team to assist in development and implementation of a regional response strategy. We are also evaluating potential impacts to Corps facilities and developing remedial actions to protect the integrity of project facilities and to prevent the interruption of vital services. Our priority is to protect critical facilities, including those listed above, while at the same time not inflicting any environmental damage on non-target species.

ATTACHMENT 3

Draft Press Release Example: Introduction of Zebra Mussels into the Columbia River Basin Raises Concerns [Public Affairs Office review for style/content]

The recent discovery of zebra mussels in _____ has raised serious concerns among regional experts about their potential effects on our aquatic resources and economy. This small freshwater mussel, originally from eastern Europe, was introduced into the Great Lakes area in the late 1980s and rapidly spread throughout the eastern United States and Canada. They are believed to have been brought into our area by _____.

Some estimates of the economic impact of these small mussels to water intake and conveyance facilities in the eastern U.S. are several $1 billion. Much of the existing infrastructure had to be modified or replaced to deal with the prolific mussels that are able to attach to about every hard surface in contact with raw water supplies. Possibly even more significant, are the as of yet unquantified, monetary impacts they are expected to have on recreation and natural resource values.

It is not certain how great the impact will be in _____ (the Northwest) but an interagency coordinating group, led by _____, is extremely concerned. Once the zebra mussels become established, it is almost impossible to get rid of them. The best hope is to launch an early, coordinated program to contain the current infestation and hopefully determine a means of control.

The _____ (group) is fortunate to have a head start using a rapid response strategy that was developed earlier in anticipation of just this kind of problem. Other similar rapid response programs have been most successful when there was early detection of an invasive species and all of the agencies that had to be involved were able to quickly respond with a well-coordinated plan.

In the meantime, the _____ (agency) has _____ (restricted access) to _____ (infected location) to help prevent further dispersal of the zebra mussels. The public can help by avoiding the ____ (infected area) and following some good general guidelines. They should clean all boats, trailers, and other equipment after leaving a lake or stream and never release any live organisms into the wild.

Additional information could be added about other species already in the region and how they are being dealt with – Eurasian watermilfoil, New Zealand mudsnails, Asian clam, and kudzu (which showed up in Oregon and was successfully eradicated).

Quotes:
"We have been aware of problems zebra mussels have caused in the Great Lakes region and have been working with various agencies organizations since the early 1990s to prevent their introduction into the west."
"Although eradication is extremely difficult, our first concern is to contain the zebra mussel infestation within _____ to avoid it being spread to other vulnerable areas."
"Although the recent discovery of zebra mussels is alarming, we are fortunate to have a Rapid Response Plan available to facilitate a coordinated regional effort to deal with this new invader. "The successes we have seen in other areas were the result of the region's ability to rapidly respond with a coordinated intense effort."

APPENDIX F-2

Dreissenid Response Strategies at Lower Columbia River Basin Hydroelectric Fish Facilities

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ACRONYMS

AWS	auxiliary water supply or auxiliary water system
BiOp	Biological Opinion
Corps	Corps of Engineers
CRB	Columbia River Basin
ESA	Endangered Species Act
DO	dissolved oxygen
ESBSs	extended-length submersible bar screens
FCRPS	Federal Columbia River Power System
FDS	Fish and Debris Separator
FPOM	Fish Passage Operations and Maintenance Coordination Team
FPP	Fish Passage Plan
JBS	juvenile bypass systems
PIT	passive integrated transponder
PA	pre-anesthetizing
PDS	primary dewatering structure
ROV	remotely operated vehicle
SDS	secondary dewatering system
SMF	smolt monitoring facilities
SMP	Smolt Monitoring Program
STSs	submersible traveling screens
VBSs	vertical barrier screens

I. Introduction

The purpose of this document is to evaluate the potential impacts of a zebra mussel (*Dreissena polymorpha*) or quagga mussel (*Dreissena bugensis*) infestation on the Federal Columbia River Power System's (FCRPS) hydroelectric juvenile fish passage facilities and adult fishways and determine potential impacts and appropriate rapid responses should an infestation occur. Although this response plan is specific to the Corps of Engineer's (Corps) projects at John Day Dam and Bonneville dams on the lower Columbia River mainstem, sections may apply to the other six Corps projects, privately owned Public Utilities District, or Bureau of Reclamation hydroelectric projects which maintain similar adult and juvenile fishways in the Columbia River Basin (CRB). Many projects have unique fish passage operations and components that would require site specific knowledge and evaluation to assess risk from invasive dreissenid mussels (Four of the other Corps projects have juvenile fish transportation facilities).

II. Background

The mainstem Columbia River Basin hydroelectric projects provide power, flood control, irrigation, navigation, and recreational opportunities throughout the Pacific Northwest and are vulnerable to potential impacts from an invasive mussel infestation. An overview of Bonneville Lock and Dam Project components that may be at risk of colonization can be found in Section C, Appendix H (Athearn and Darland 2006). In addition, a review of the risks to Corps project fish facilities such as Juvenile Bypass Systems (JBS), Smolt Monitoring Facilities (SMF), and adult fishways can be found in Athearn (1999). Salmon and steelhead pass through numerous dams on the mainstem Columbia and Snake Rivers. The fish passage facilities must function properly to allow both upstream and downstream migration of salmon and steelhead, many of which are listed for protection under the Endangered Species Act (ESA). An invasive mussel infestation impact on fish passage facilities are of particular concern because hydroelectric project operations (i.e. power generation) are often determined by federal regulations regarding salmonids passage. Surface fouling created by attached dreissenid mussel on structures such as fish ladders, as well as clogging inflows, drainages, and screened areas, could create hazardous passage conditions for fish.

Even small fluctuations in flow due to debris accumulation or changes in river flow can cause weirs, valves, and screens to operate out of fish passage criteria which may cause delay or injury. At John Day Dam, approximately 90% of the spring and summer juvenile salmonid out-migrants use the bypass facility between April 1 and June 2 and the majority of the fall out-migrants (80%) pass between June 14 and August 2 (Martinson, et al, 2006). Any unnecessary facility outages due to additional cleaning or maintenance associated with a mussel infestation should be avoided during this period. Unscheduled generation unit outages can cause increased, involuntary spill which might lead to unsafe levels of atmospheric gas supersaturation for aquatic organisms, unsafe flood control conditions in reservoirs, and lost generating revenue for BPA.

A Corps document called the Fish Passage Plan (FPP) is part of the current strategy to

reduce conflicts between various river users and fish passage. The FPP is updated annually by the Corps in coordination with regional fish agencies, Indian tribes, the Bonneville Power Administration, and other participants through the Fish Passage Operations and Maintenance Coordination Team (FPOM). The plan is incorporated in the most current NOAA Fisheries and U.S. Fish and Wildlife Biological Opinions (BiOp) and contains a comprehensive list of criteria, by project, that are intended to comply with BiOp performance standards. Increased duration of maintenance periods or other emergency deviations during fish passage seasons caused by a mussel infestation would require coordination with FPOM and the Technical Management Team and consultation with NOAA Fisheries.

Invasive Bivalve Populations and Assessing the Risk for Bypass Components: The significance of any impact caused by dreissenids in the CRB will depend on their colonization potential and level(s) of infestation. Seasonal growth rates and mussel density will be determined by water quality, water quantity, and fluctuations in plankton density. Some risks at the bypass facilities associated with a mussel infestation are more easily imagined and obvious while other risks are difficult to qualify due the uncertainty surrounding how equipment and mussels will interact. Almost all risk is related to:

1. the amount of time components are submerged in raw water,
2. the level of accessibility for inspection and cleaning or replacement of key components,
3. the amount of redundancy built into the design of the system, and
4. the level of interaction between a component and fish.

In many cases submerged components are dewatered for regularly scheduled winter maintenance but good accessibility and maintenance opportunities are limited to these periods. Any built in redundancies, such as the installation of a second auxiliary water supply (AWS) pipe, would be very costly and require additional planning and funding (Phillips et al. 2005). Components such as dewatering screens, porosity plates, and separator bars have near constant interaction with fish and would need increased monitoring and more frequent maintenance and cleaning.

Asian Clam *(Corbicula fluminea.),* an Indicator Bivalve: Regional hydropower projects have been interacting with and working around an introduced bivalve, the Asian clam for decades. The Asian clam is believed to have been introduced into the Pacific Northwest in the early 1930's (Burch 1944) and has since become one of the most common bivalves in the CRB (Newell 2003). Due to the clam's prolific nature and ubiquitous distribution in the Pacific Northwest, it is found in abundance at most mainstem dams. In fact, this non-native bivalve is the predominant bivalve mollusk in many of the aquatic environments at projects and large piles of clam shells can accumulate in the collection channels, fishways, under diffuser grating, inside water lines or behind valves, and behind dewatering screens. Asian clams have been found living in some drain galleries inside the dams. They also cause direct physical injury to fish when they become lodged in dewatering screens or on separator bars. Although

Asian clams differ from dreissenids in many ways, they are similar aquatic organisms and lessons and observations regarding clams may aide in predicting the impact of dreissenids. One significant difference is the encrusting nature of dreissenids (up to several inches thick) and their ability to attach to vertical surfaces through the use of byssal threads. It is unknown how *Corbicula* might interact with introduced mussels, but clam shells do provide suitable attachment sites for juvenile mussel colonization. Larval *Corbicula* complete most of their development inside the female clam whereas dreissenids have free living, veliger larvae. It is unknown which group of bivalves would have any competitive advantage regarding reproduction or colonization, but the encrusting nature and feeding behavior of dreissenids has been shown to be a serious threat to native bivalves in other parts of North America. Of course, the site specific nature of aquatic environments, unique construction materials and flow situations at dams, and the unpredictable nature of invasive biological organisms challenge the amount of certainty in any assessment of future risk.

III. Potential Impacts and Responses - John Day Dam and Bonneville Dam Juvenile Bypass System Components

Juvenile Bypass Facilities: The juvenile facilities at John Day and Bonneville dams consist of two major components, the juvenile bypass system (JBS) (Figure 1) and the smolt monitoring facilities. At John Day Dam, both parts of the system operate together April 1 through September 15, passing fish through a passive integrated transponder (PIT) tag detector, sample gate, and the SMF. The smolt sampling season at Bonneville Dam operates March 1 through October 31. The primary risk to both parts of the bypass is that they utilize raw river water and very few components or supply lines have built in redundancies which would be beneficial should a mussel invasion occur. From September 16 through December 15, submersible traveling screens (STSs) remain in operation to prevent adult salmonids from falling back through turbine units. At this time, fish, water, and debris are routed out of the JBS, down the ogee ramp, and out to tailrace through the juvenile outfall structure. After December 16 and until the start of fish passage season in April, the STSs are stored in their respective gatewell slots and non-guided fish and debris continue to passively use the bypass system for the remainder of the year except for a short period when it is dewatered for an annual inspection. In general, the operation and shut down dates are important because they represent well established maintenance periods which usually do not conflict with juvenile or adult fish passage. Similar details and schedules specific to each Corps project can be found in the current year FPP and in Table 2.

In many cases, equipment vulnerability and associated risk may require the modification of maintenance schedules, increased inspection and maintenance, improved cleaning techniques, installation of higher capacity pipes and redundant supply lines, and purchase of spare parts or backup equipment (Table 3, Appendix F-1.).

An upstream to downstream list of components and their associated vulnerability to dreissenids follow in the text and are listed in Table 1, and a schematic showing the project layout for John Day Dam can be found in Figure 2.

1. Powerhouse and Auxiliary Water Supply Trashracks: The trashracks prevent most large woody debris from entering the turbine intake or auxiliary water supplies for the adult fish ladders and juvenile facilities. The spacing of the bars on the trashracks varies from 3/4 inch on fish turbine intakes to 6 inches for main generator units. River debris is removed by lowering a large rake to the bottom of the trashrack which then collects debris as it is pulled back up to the surface. Units must be turned off during the raking process which is performed as needed during the juvenile passage season, often coinciding with the some of the season's highest in-river flows and debris loads. The main auxiliary water supply at John Day Dam provides add-in water for the adult fishways, flushing water for the main components of the juvenile bypass system downstream of the tainter gate, and irrigation water. No duplicate water source is currently available for these locations.

Potential Impacts: These structures are permanently submerged and at high risk of colonization by mussels. Although most trashracks have relatively large openings (approx. 1 ft^2), severe fouling with mussel shells may cause more tumbleweeds and willows to accumulate which would contribute to elevated descaling and injury of fish. Any increase in the frequency of trashrack raking could pose limitations on power production by having units shut down that could be generating power. Inoperable units during high flow periods would require extra spill, amount to lost power generating revenue, and create potentially hazardous river conditions for fish. The extra weight or associated difficulty of removing debris encrusted with zebra mussels would have to be considered among the potential elevated costs of increased maintenance. The AWS and penstock area is susceptible to mussel accumulation which could cause malfunctioning adjustments to water volume or inefficient delivery to fishways or the SMF.

Response: Periodic (weekly or monthly) inspection for and hand clearing of mussel debris from sensitive guide slots or cables associated with trashrack raking may be needed. More frequent cleaning of trashracks may be necessary due to mussel shells that can catch and hold more debris than non-encrusted surfaces. Consider providing backup equipment which can be used to while trashracks are periodically removed and cleaned. Design, manufacture, test, and deploy a mussel removing brush for use with current trashrack raking structures. Duplicate auxiliary water supply pipes do not currently exist but may be required if an infestation becomes extreme and mussel growth limits the current pipe capacity.

2. Bypass Screens (STS, ESBS, and VBS): These screens are so essential to safe fish passage that units are shut down if screens are damaged or clogged with debris (USACE 2006). At least three types of bypass screens are utilized in the Columbia and Snake River mainstem dams, submersible traveling screens (STSs), extended-length submersible bar screens (ESBSs), and vertical barrier screens (VBSs). Both STSs and VBSs are made of a fine plastic screen mesh (approx. 2mm opening, or 40% minimum porosity) whereas ESBSs are made of wedge wire with a 2 mm gap width (Johnson or Hendrix wedge wire screen) backed by perforated metal plates with of various diameter

holes. These bypass screens work in tandem with the bypass channel to move out-migrating juvenile and adult salmonids from the forebay to the tailrace with minimum injury or delay. Bypass screens vastly improve turbine unit fish guidance efficiency and help determine orifice passage efficiency. John Day Dam is equipped with three STSs for each main unit in service April 1 through December 15. These screens are about 20' long and the plastic screen mesh surface rotates when deployed so that any debris caught on the upstream surface is carried to the downstream side and into the turbine intake or up into the gatewell towards the VBS and orifice. At John Day Dam, a total of three ESBSs were installed in Unit 7 for research purposes by the Corps and NOAA. These bypass screens are used successfully at other mainstem dams (e.g. McNary Dam), but were not deemed successful for use at JDA. The ESBSs are about 40' long and do not rotate for cleaning but utilize a traveling brush to remove debris. Both types of screens are deployed through bulkhead (upstream) gatewell slots, lowered down through the gatewell, and positioned into the flow of the turbine intake area. The screens direct flow, fish, and debris up through the gatewell slot towards the 14" orifices and into the bypass channel or back toward the turbine through the VBS. At most projects the upstream and downstream gatewells are separated by a VBS to confine migrating fish in the vicinity of a bypass orifice and to keep them from re-entering the turbine intake via the downstream gatewell. The VBSs are a critical component of the fish bypass system and are susceptible to debris accumulation. Too much debris disturbs the gatewell environment and creates turbulent conditions for migrating fish. Units with STS bypass screens have 3 VBS screens per gatewell and units with ESBSs are fitted with 9 VBSs per gatewell. The VBSs are currently left in place, fully submerged, during the fish passage season and during the winter. The STSs at John Day Dam are generally raised and stored in the gatewell slot between December 16 and April 1.

Potential Impacts: Both types of bypass screens and the VBS screens are at high risk and susceptible to zebra mussel attachment and fouling. The screens are submerged and in use during the most active period of the year for dreissenid reproduction, veliger dispersal, and colonization (Table 1). Although flows through and around these screens are generally fast (3-5 fps), several irregular angles and crevices would provide suitable attachment conditions for mussels, particularly on the backside of ESBS screens. The STS screen mesh could be damaged by impacts from druses that may break off the trashrack or face of the dam just upstream. Mussel encrusted river debris could become more difficult to remove by brushing or rotating mesh and lead to increased fish injury. Ongoing maintenance and repair to the drive units, seals and other components of the bypass screens may increase in frequency.

Response: Increased camera or manual inspection of bypass screens and VBSs for mussel accumulations would be likely. The STSs must currently be inspected once per month and VBS screens once every two months (Fish Passage Plan, USACE - March, 2006). Any increases to inspections would require more coordination between fisheries and reduced operations. Most inspections are possible only when a unit is out of service. If screens were found fouled with juvenile mussels, a rotating schedule of in-service and out-of-service would have to be developed. In the "off" season, STSs are

routinely stored in a gatewell slot, with the lower portion submerged in river water. The water in this environment below the screen and above the gatewell is relatively slow and conducive to zebra mussel attachment. Although veliger presence would likely be lower during colder water temperatures in the winter months, juvenile and adult mussels may detach themselves and move to more favorable conditions. Thus, a new location or improved storing technique would have to be developed to keep zebra mussels from attaching to STSs and ESBSs. If screens continue to be stored in gatewell slots, more time should be scheduled to include cleaning any mussels which may have attached during the winter months. Currently, VBS screens are left in place between the upstream and downstream gatewell slots year round, leaving them susceptible to mussel accumulation. Even minor blockage of flow through a VBS has the potential to create a turbulent gatewell environment for fish and unfavorable conditions for power generation due to excessive flow. A rotating schedule for periodic removal and cleaning of VBSs would help prevent an overabundance of mussels that could cause screen failure or poor gatewell conditions. Based on average daily air temperatures in Rufus, Oregon, approximately 79 days a year have an average below freezing and would be available if lethal temperatures for mussels are needed. Considerable time, effort, and equipment would be saved if storage or cleaning station location could be established out of the water on site.

3. Gatewells, Orifices and Juvenile Collection Channel: These three components of the JBS are interconnected and work together to move fish through the inside of the dam. The bypass screens divert water, fish, and debris from the turbine intake area, past a flow vein, and up gatewells towards the orifices and collection channel or through a VBS. The gatewell slots allow an operating gate or bulkhead gate to be lowered from the intake deck into the turbine intake for maintenance or emergency shutoff procedures. At John Day Dam, there are three bulkhead (upstream) gatewell slots and three roller gate (downstream) slots per unit and one 14 inch orifice in each upstream slot (some projects have 12 inch orifices). Orifices are fitted with pneumatic knife gates, cycled regularly to reduce the risk of debris plugs, and are fitted with an orifice light which helps attract juvenile out-migrants through the orifice into the collection channel. The collection channel flows are variable depending on the location in the channel because the overall height, width, and shape of the channel vary. Flows are generally in excess of 10 fps, but slower flow areas exist along the lower edge of the channel and near irregularities in the walls.

Potential Impacts: All of these components are at moderate risk due to the fact that they are submerged for the entire year under normal operating situations. Adult mussels would probably find the gatewell environment favorable due to the large amount of cement surfaces for attachment, moderate flows, and constant exposure to aquatic nutrients. A typical gatewell environment has gaps and crevices that may provide a starting point for veliger growth. Gatewell dip-netting or ROV inspections of STS or VBSs could be affected if mussels colonize guide rails or cables and prohibit deployment. Other methods of inspection are time consuming and costly and require dewatering of the unit. Cleaning would have to be done during any routine maintenance

or repairs, probably in the winter months during annual inspections. Currently, dewatering, fish salvage, and water up occur in the same day. Periodic cleaning would require more time out of service. Water velocity through the orifices is too high for mussel attachment, but there is some risk to the knife valve armature due to the lower flow conditions just before the orifice. The main collection channel is usually operated with flows approximately 10-15 fps, but the irregular contours, rough cement surfaces, orifice entrance recesses, and access portals (orifice light holes and drainage holes from the forebay deck) create slow flow areas that would be favorable for mussel colonization. Extremely slow flow areas exist along the floor and wall of the collection channel towards the tainter gate and would provide suitable conditions for mussel growth (personal observation, Jan. 2007). Fluctuating water levels throughout the season could create areas along the waterline or near leaks that would be susceptible to druse formation.

Response: Increased frequency of orifice cycling during the fish passage season may be required to decrease the chance of mussels collecting in valve guides or other sensitive areas associated with the orifices. Increased cycling during the winter months may also help deter colonization, but the current method of having two out of three orifices closed during the winter months to conserve water would have to be reconsidered or modified because orifices closed or open for any extended period of time may allow mussels the opportunity to attach. Orifice light recesses would have to be inspected and cleaned if mussel growth is observed so accumulations would not block attraction light. Inspection and removal of druse or individual mussel accumulations along the lower edge of channel should occur during annual dewatering.

4. Tainter gate, Elevated Chute, and Crest Gate: The tainter gate regulates the amount of water flowing out of the JBS and over the crest gate into the elevated chute. The total volume ranges between 450 to 600 cfs and depends upon forebay elevation and the number of generating turbine units. In general, flow through the chute is very fast, approximately 15-20 fps and depth varies, approximately 4-18 ft. The crest gate is made mostly of concrete and weighs several tons. When lowered, synthetic gaskets along the edges seal the gap between the gate and the wall inhibit leakage into the ogee. At the end of the smolt monitoring season, the crest gate is raised and the elevated chute is subsequently dewatered. Water flows into the elevated chute April 1 through September 15.

Potential Impacts: The tainter gate has a low risk of being affected by zebra mussels due to its associated high flows and frequent movement. Submerged sensors may be affected by mussel growth and severe accumulation would require a re-design or modifications which allow access for cleaning or replacement. If mussels were to become established in a low flow area behind the gate or in the gate guide, they would probably not have the opportunity to grow very large before being scraped off by the tainter gate motion. The crest gate is also at low risk due to very high flows and the fact that it is dogged off completely out of the water after the fish passage period and has sufficient time to dry out and freeze before the next seasons use. The majority of the surface area of the inside of the elevated chute would dry out and be exposed to

freezing air temperatures in winter. One exception could be the expansion joints, many of which have gaps and holes that could be colonized by mussels. Irregular contours in the floor trap some water after the dewatering, but it is not known if that water freezes in winter. In addition, the grated walkway on top of the structure allows precipitation to enter and accumulate.

Response: Routine inspection and cleaning of sensors for mussel accumulation would be recommended during the winter maintenance dewatering. Determine if the amount of water remaining in the elevated chute after dewatering freezes in winter or if it is enough to provide a refuge for mussels. Periodically check for and brush out any water that accumulates in the floor of the elevated chute. Check all expansion joints and crest gate seal for mussels and remove.

5. Ogee Ramp and Tailrace Outfall Flume: The ogee ramp carries all the fish, water, and debris from the juvenile collection channel to the tailrace outfall flume when the crest gate is in bypass mode. These components are dewatered during the smolt monitoring season, April 1 through September 15. The flow out of the collection channel into the ogee and outfall flume travels at approximately 10-15 fps, and usually enters the tailrace above the surface of the water except during high river flow periods, typically in the spring.

Potential Impacts: The ogee and outfall flume have a low to moderate risk of impact from mussel colonization due to normal high flow situations. Leakage from the crest gate into the ogee during the smolt monitoring season may promote mussel growth which would then pose a risk to bypassed fish when the main passage season ends. The outfall flume exit may be susceptible to mussel growth if high tailrace water levels persist for long periods.

Response: Inspect the crest gate seal for wear to prevent leakage into the ogee. If leaking persists, it may be necessary to devise a method of diverting the leaking water away from the ogee and outfall flume during the smolt monitoring season. Inspect outfall flume during the winter maintenance dewatering and remove mussels as needed.

6. Primary Dewatering Structure (PDS), Modulating Weirs, and Adult Drain: The PDS removes about 95% of the water routed down the elevated chute from the JBS. This excess water, approximately 500 cfs, flows through a series of dewatering screens and returns to the river via a 6 ft diameter underground conduit. The dewatering screens are made of stainless steel wedge wire panels with a gap width of 2 mm and are backed by perforated plates. They are lowered into guide slots on the inside walls of the bypass channel which runs the length of the structure. Dewatering screens placed vertically help minimize the velocity through the screens and reduce debris accumulation. They also help satisfy safe fish passage criteria by making it easier to maintain constant, laminar flow, to help minimize juvenile and adult fish delay. The screens are fitted with screen cleaning brushes which can be run in manually or in auto depending on debris loads. Automatic modulating weirs situated behind the dewatering screens regulate the amount of water removed from the structure. The adult drain is

situated near the floor of the structure and is activated by raising a large pneumatic knife gate. Typically, it is opened at the end of the annual dewatering process in September and allows fish that become trapped in the PDS to exit and return to river without being netted, transported, and released by hand. After the initial surge of flushing water from the PDS, a 3-inch flushing water supply valve pushes fish downstream where they dump into the corrugated transport flume. The PDS is dewatered September 16 through April 1.

Potential Impacts: These components are at low to moderate risk of colonization by zebra mussels. All the screen surfaces, perforated plates, drains, and valves associated with the PDS dry out and are exposed to freezing winter temperatures. In season accumulation of mussel shells would be hampered by periodic use of the screen cleaning brushes, although brushing may not be effective in removing all mussels. Access to the PDS channel is possible during the winter and hand cleaning with pressurized water to remove mussels after they are dried and frozen would be possible, although providing water to this remote location is difficult. Sediment, clam shells, and other debris currently collect between the wedge wire dewatering screen and the perforated plate directly behind the screens. Even heavy accumulation of shells would have a limited impact due to the nature of the modulating weir functions which is that they would just "modulate" lower to compensate for any inefficiency caused by clogging. The adult drain is located in a recess about 2' deep into the wall of the elevated chute and may provide a slow flow area where zebra mussels could attach and grow or accumulate after dying. Any leakage from this valve into the adult transport pipe during fish passage season could possibly sustain juvenile mussels which could injure fish during dewatering as they slide through the pipe.

Response: Check for areas of shell accumulation and remove as needed to prevent clogging and inefficiency of modulating weirs. Inspect screen cleaner brushes for wear and replace regularly so brushes can continue to deter mussel growth. Clear mussels from any knife valve guides or channels before winterizing procedures. There is currently no method of clearing mussels from the adult drain valve recess area before the adult drain is used during dewatering and mussels could cause serious damage to fish as they are forced to pass by this route. Modifications designed to eliminate this recess or retrofitting a type of plug or barrier to prevent mussel access to this area should be considered. In addition, the adult drain flushing water valve would also need to be purged periodically to remove any mussels.

7. Corrugated Transport Flume and Conveyance Pipe: The corrugated transport flume (JDA bypass only) and conveyance pipe (Bonneville PH2 bypass only) move water and fish from the PDS to the secondary dewatering structure (SDS) and porosity unit. Approximately 30 cfs of water flows down the transport flume at about 9 fps. A continual series of ½-inch corrugations on the floor and sides slows the water as it flows downstream and helps maintain safe passage conditions for fish. The length of the flume is approximately 1,000 feet long and is covered by sun shading grated panels, most of which can be removed to provide access for inspections or cleaning. The transport flume is dewatered September 15 through April 1.

The conveyance pipe at Bonneville contains about 33-38 cfs and flows at 4-5 fps. It is approximately 9,000 feet long and has a smooth high density polyethylene surface with minor irregularities occurring at the seams between sections of pipe. The majority of the pipe is buried underground and a series of inspection ports exist about every 1,000 feet to provide access between the powerhouse and the smolt monitoring facility. The conveyance pipe is dewatered approximately December 15 through February 28.

Potential Impacts: In general, the corrugated transport flume at John Day is at low risk of impact from zebra mussels due to the high flows experienced during the passage season (in excess of 6 fps). In addition, the flume is dewatered for most of the winter months and dries out almost completely. However, the degree to which juvenile mussels may be able to colonize the slow flow areas between the corrugations is unknown. Unfortunately, Asian clams are not a helpful surrogate bivalve in this situation because, unlike mussels, they are unable to attach to the substrate with byssal threads and cannot attach to the vertical surfaces of the flume.

The conveyance pipe at Bonneville Dam is probably a low to moderate risk area, although uncertainty exists regarding potential mussel colonization along the waterline and inside seams. Mussel growth on the smooth surface of the pipe could slow water and fish passage and seriously injury fish.

Response: These two fish passage routes should be inspected following their respective dewaterings. Seasonal cleaning may be required if mussels are able to attach and grow in the slow flow areas between corrugations, at the waterline, or inside seams. Accumulations left in place could break off during fish passage season and cause injury to fish at the separator bars, inside distribution flumes, or in sample holding tanks. Difficulty in gaining access to certain areas should be figured into any cleaning schedule. The conveyance pipe is a permit requiring confined space and presents a very difficult area to enter and clean. Should it be needed for mussel removal, providing water or electricity to these relatively remote work sites could be a major challenge. In addition, the surfaces are slippery, the environment is moist, and it is completely dark making complete removal of small mussels unlikely. Freezing air temperatures could not be relied upon to help kill mussels in the conveyance pipe because it is underground and somewhat insulated from outside temperatures.

8. Switch Gates and Flushing Valves: The switch gate is a large pivoting blade that directs the flow in the corrugated transport flume or conveyance pipe to either the bypass (back to river) or sample (to monitoring facility) flumes. A series of neoprene gaskets on the underside of the gate inhibit leakage between flumes and a perforated plate under the gate provides access for flushing water. At John Day Dam, the switch gate is dewatered and completely dry September 15 to April 1. The switch gate at Bonneville Dam continues to have water passing one side after the fish passage season until the conveyance pipe is dewatered in December.

Potential Impacts: The switch gate and associated flushing water valves have a low

risk of being affected by zebra mussels because both components are dewatered during the winter months and are exposed to freezing air temperatures. In season accumulation of mussels under the gate could abrade or cut the neoprene gasket, but the gate is moved by a pneumatic cylinder set at 80 psi or greater and mussel shells would not likely inhibit gate movement. The flushing water valves could be more sensitive to mussel shell accumulation due to their location on the floor of the flume. Clearing mussel shells from behind the perforated plates could pose a challenge if a significant numbers of juvenile mussels grow inside flushing water supply lines. Seasonal growth rates will determine whether mussels grow large enough to be trapped behind the plates or if they will remain small enough to pass through. Also, some water may remain after dewatering in the hopper under the switch gate and could provide a winter refuge for mussels. Multi-season shell accumulations could clog the inflow and render the flushing water useless, making the seasonal dewatering experience less optimal for fish.

Response: Inspection and cleaning should take place during the winter maintenance months when the switchgate is dewatered. Mussel shells should be manually cleared from any surfaces on or near the gasket under the switch gate blade. The perforated plate below the gate should be cleaned annually and a larger diameter drain valve should be installed below the switch gate flushing water hopper to insure efficient evacuation of any seasonal buildup of mussels. Increased maintenance efforts and costs would be incurred if seasonal shell accumulations pose a clogging threat and require removal, cleaning, and reinstallation of perforate plates.

9. Fish and Debris Separator (FDS) - Secondary Dewatering System (SDS), Porosity Unit, Wetted Separator Bars, Juvenile Collection Hopper, and Distribution Flumes: These four components remove most of the remaining 30 cfs of flow in the corrugated transport flume and separate juvenile and adult fish and debris. The SDS and Porosity Unit are regulated with a series of manually adjusted weirs that discharge screened water into the head tank. The wetted separator bars have a gap width of ¾" and allow juvenile fish to fall through the bars into the juvenile collection hopper and adult fish to slide over and return to the river. Smaller debris typically falls through the bars and larger debris is usually stranded on top and requires periodic manual removal. The separator bars are continually sprayed and wetted with river water to provide a slick, slippery surface for fish. The juvenile collection hopper is directly below the bars and serves to route approximately 1 cfs and all juvenile fish into the distribution flumes. The distribution flume is the final stage before fish are routed towards the PIT tag detectors and rotating sample gates. These components are dewatered September 16 through April 1.

Potential Impacts: These components exhibit a moderate risk of impact from a zebra mussel invasion due to their intimate interaction with bypassed fish and the fact that they are watered up during the most active period of zebra mussel reproduction and dispersal. All bypassed fish would be susceptible to irregular flows and subsequent poor passage conditions such as flooding of the collection hopper or drying of the porosity unit perforated plate that can be caused by mussel shell accumulation under

the screens. Fish could sustain direct physical injuries if the dewatering wedge wire or perforated plates become clogged or trap shells. In addition, the separator bars can be a very dangerous place for fish if they are forced to be separated when river debris such as chunks of wood, tumble weeds, plastic, dead fish, or druses get stranded and prevent separation. Fish forced at high velocity into debris can sustain fatal injuries to their head, gills, and body. The slick, wet surfaces of the separator bars are maintained by continual spraying and could be compromised by the accumulation of mussel shells inside the bars. The dryer, rougher surfaces that would be exposed if spray water is inhibited could contribute to elevated levels of descaling and poor fish condition. Currently, juvenile Asian clams accumulate in the separator bars and are purged several times per season by removing neoprene plugs screwed into the end of the bars. It is likely that mussels would also find these water supply lines as suitable habitat and increase the risk of plugging. Removal of the plugs can be done without any major impact to fish, but access is very difficult. The final distribution flume utilizes add-in water to help stabilize velocities and could be susceptible to mussel shell accumulation behind regulating valves.

Response: It is essential that flow conditions remain within fish passage criteria at this stage in the bypass system. Routine brushing and scraping of the FDS dewatering wedge wire and perforated plate at the porosity unit would need to be continued and potentially increased. Currently, cleaning and brushing of the FDS occurs at least every 30 minutes and more frequent monitoring prompted by mussel accumulation would limit the time used for other inspection duties. The rate of mussel shell accumulation would help determine an appropriate schedule for regular purging of the spray water system. Regular inspection and purging of add-in water valves would prevent unwanted blockage.

10. Tertiary Dewatering Units, Passive Integrated Transponder (PIT) Tag Detectors, and Rotating Sample Gates: Flow velocities through these components range about 8-10 fps. In general, the flume surfaces are smooth but small crevices between the transitional sections of pipe create some flow irregularities. The tertiary dewatering units were designed to allow flows exiting the juvenile collection hopper to be “fine tuned” in the distribution flumes. At John Day Dam, the wedge wire dewatering screens have been modified by inserting solid PVC pipes inside to prevent these units from loosing any flow. The modifications were prompted by the seasonal accumulation of sediment and Asian clams inside the dewatering baffles which was extremely difficult to remove during the winter maintenance period. The PIT tag detectors automatically record tag data when tagged fish pass an electromagnetic field created by an antenna coiled around the PVC pipe. Two antenna coils upstream of the 3-way sample gate help ensure complete code detections and data is downloaded several times a day to a database. Just downstream of the PIT tag detectors, the 3-way rotating gate is used to obtain the smolt monitoring sample and research fish (Figure 3). When rotated west, all fish and debris are diverted into the sample holding tank; when rotated east, all fish are routed to the research flume; and in the center or default position, all fish go to the tailrace outfall. Sample gate activity varies but operates at least 2 to 6 times per hour during April 1 through September 15. The gate is pneumatically operated (90 psi) and,

when activated, moves extremely fast and powerfully.

Potential Impacts: This section of the bypass system is at low to moderate risk and impact due to mussel colonization. The components become very dry when it is dewatered from September 16 through April 1 and are exposed to freezing air temperatures in winter. Several sections of the distribution flume and PIT tag detectors do not have access ports near pipe junctions so cleaning any accumulation of mussels would be difficult. Add-in water ball valves and supply lines could be vulnerable to mussel accumulations which would restrict flow and potentially effect PIT tag detection efficiency by slowing water velocities.

Response: Tertiary dewatering units would continue to be cleaned as needed. Even heavy buildup inside the baffles would not affect fish passage. New access ports near transition seams could be installed for easier cleaning or perhaps a method of scouring interior surfaces from the ends of the pipes could be devised. Periodic purging of add-in water valves during scheduled inspections would help reduce mussel accumulations during fish passage seasons.

IV. Potential Impacts and Responses - Smolt Monitoring Facility - Laboratory at John Day Dam and Bonneville Dam

1. Holding Tank, Inflow Butterfly Valves, and Crowder Panels: These components are all located inside the SMF and are routinely cleaned using water and brushes throughout the fish passage season by Smolt Monitoring Program (SMP) staff. The sample holding tank contains about 1,795 gal (6,795 L) of water and holds fish that were diverted by the sample gate throughout the day and night until they are anesthetized, sorted, and tallied by SMP personnel each morning. Fresh river water constantly flows in and out of the tank through perforated plates located in the front and the back of the tank. The total volume of water in the tank is exchanged every few minutes to remove fish waste, increase dissolved oxygen (DO) levels, and sustain suitable water temperatures for fish. This inflow water supply is delivered through a 12-inch diameter pipe on the upstream end of the tank and is regulated by a butterfly valve. The crowder panel separates groups of fish sampled at different rates or on different days. It also serves to move or crowd fish toward the pre-anesthetic (PA) chambers without causing too much stress. It is made of perforated plate and is pushed or pulled through the tank either manually or with the aide of a winch. A flexible neoprene flap is installed along the edges and bottom of the crowder panel to provide a tight seal between the crowder and tank so small fish cannot pass through or get stuck. These components are dewatered September 16 to April 1.

Potential Impacts: These components are at low risk of colonization by mussels due to the fact that they become dry during the winter months when the facility is dewatered, but in-season mussel shell accumulation in sensitive areas could injure fish. Any mussel growth associated with the perforated plate on the crowder will make it more difficult to move through the sample tank and potentially injure fish. Shells stuck to the

neoprene flap could cause increased wear or tearing and cause descaling or mortality if fish try to squeeze through. Currently the butterfly valve that regulates flow into the holding tank is periodically purged to release any clam shell accumulations and mussel shell accumulations or growth could add to the current problem involving clams.

Response: Appropriate responses to a mussel infestation may include increased maintenance and cleaning by fisheries staff, scheduled purging of inflow butterfly valves, and more frequent replacement of the neoprene seal. In-season pressure washing to periodically remove any mussel buildup on the perforated plates would be difficult because fish are always in the tank and the cleaning process would cause increased stress. A method of temporarily hoisting the crowder out of the tank and washing it on the side of the holding tank might have to be developed if mussels become too difficult to remove by hand and prohibit movement of the crowder or injure fish.

2. Pre-anesthetizing (PA) Chambers, Fish Lifts, Drainage Pipes, and Flushing Water: Fish are hand maneuvered into the PA chambers using a panel net and a metal slide gate is lowered behind the fish to separate them from the holding tank. Two chambers exist at the upstream side of the holding tank and can be used alternatively if a problem with one occurs. Water drains out of the chamber to a prescribed level dictated by the height of the valve in the side of the chamber. At John Day Dam, this drain consists of a 2-inch PVC supply line and ball valve and drains directly back to the return to river flume. At the Bonneville juvenile facility, fish lifts raise the PA chamber from the holding tank in the basement to the sample laboratory on the main floor. Fish anesthetic (Finquel, MS-222) is added to the remaining volume of water (48 liters) and fish become sufficiently anesthetized in 2-3 minutes. A pneumatic knife gate is activated and fish and water are then flushed through a 6-inch diameter PVC pipe, across a final dewatering perforated plate, and into the sorting trough for examination. Flushing water is supplied through a 2-inch supply line and regulated by a ball valve which is currently susceptible to sediment and clam buildup even though it is operated several times daily.

Potential Impacts: These components are at low risk of colonization by mussels due to the fact that they become dry when the facility is dewatered, but at moderate risk in-season because mussel shell accumulation in sensitive areas could injure fish or restrict flow. Mussels could interfere with the slide gate if they accumulate in the guide and could cause leakage into the PA chamber. The guides are made of Delrin and are particularly difficult to clean due to their position at the end of the tank and partly under water. Any irregular seal and subsequent leakage would impact the sampling effort by increasing the time it takes to anesthetize fish and process samples. Severe leaks could hamper processing and even halt sampling if anesthetizing fish becomes impossible. The drain line and ball valve are continually submerged during fish passage seasons and are susceptible to mussel growth. Blockage or constriction of flow would increase PA chamber time for fish which increases stress. The upstream side of the knife gate and bottom surface of the flushing pipe into the sorting trough is also susceptible to mussel growth.

Response: The PA chambers, slide gates, and Delrin slide gate guides may have to be cleaned more frequently than the 2-3 times per week they currently experience. Use of the existing PA chambers could be alternated every week or so which would allow the non-used chamber to be dried and or cleaned. Flushing water supply lines may need isolation and drain valves so that they could be dried out between active periods. The knife gate and 6-inch transport pipe are extremely difficult to access and may require installation of access portals or the development of a "brush on a pole" scouring method of cleaning if mussels accumulate in this area.

3. Sorting Trough, Return Pipe, and Recovery Tanks: The sorting trough receives anesthetized fish from the PA chamber and is the location for all fish identification, data collection, counting, and condition examinations. Excess water in the trough is automatically drained and flows into the anesthetic reservoir tank in the basement of the SMF. Following the data collection process, fish are released into the return pipe and transported to one of two available recovery tanks. The return pipe is supplied with raw water from a 1-inch hose and operates throughout the smolt monitoring season. Recovery tanks allow anesthetized fish to recover and become more alert before being returned to the river. Both tanks receive a constant inflow of fresh river water regulated by a 9-inch butterfly valve. A minimum of 25 minutes is required before release, so alternating between the two tanks allows sampling to continue uninterrupted. Water exits through a perforated plate and down standpipes back to the river. Fish are flushed to the exit when the perforated plate and standpipes are removed.

Potential Impacts: These components are at low risk of mussel colonization due to the fact that they become dry when the facility is dewatered. In-season risks include mussel accumulation behind the return pipe hose valve or inside the return pipe itself. Mussels may also collect behind the butterfly valves that provide fresh water to the recovery tanks.

Response: In-season cleaning of the recovery tank return pipe water is difficult but could be accomplished if it is found that mussels grow inside the pipe. Periodic shut down and temporary removal of this pipe would increase maintenance time but probably not incur much extra cost. Replacement hoses and valves should be kept on hand so serious clogs to the return pipe flushing water would not stop sampling. Inflow butterfly valves to the recovery tanks should be regularly purged to prevent excess mussel buildup. At least weekly inspections of the interior of the tanks should be performed so that any mussel growth could be brushed or scraped away before posing a threat to fish condition. Devise a scouring method for cleaning inaccessible areas.

4. Release Pipes and Exit to River Flume: The release pipes are made of PVC and convey fish from the recovery tank in the laboratory to the exit to river flume outside. Water is released through two standpipes and all fish are usually evacuated within 4-5 minutes. The exit to river flume flows at about 8-10 fps, it is constructed of concrete, and directs fish into the outfall flume which empties into the tailrace. They are both dewatered during the winter maintenance period.

Potential Impacts: These two components are at moderate risk of mussel colonization. In-season mussel growth on the inside surface of the release pipes could injure fish as they are being released to river. Upon release, fish are forced at high velocity into contact with this pipe and even small mussels could cause cuts and scrapes which could increase mortality. The injuries could be difficult to detect because monitoring for fish condition does not occur after this point on project. The exit to river flume is also vulnerable to mussel growth in-season although consistently higher flows would be less suitable for juvenile mussel attachment and the relatively wide flume would allow fish to avoid contact with the walls.

Response: The main portion of the release pipe currently provides limited access or no access for inspection purposes. Both ends of the release pipe can be accessed however, and it may be possible to clean by scouring or hot water treatment. The exit flume is more easily inspected, but a heavy grating covers the entire length of the flume and prevents in-season cleaning. In addition, the flume is exposed to precipitation during the winter and may not become completely dry or frozen.

5. Recirculation Pump, Water Chiller, and MS-222 Filters: The recirculating system at the smolt monitoring facilities allows reuse of water containing MS-222. Because these systems have the unintended potential to grow and transfer fish pathogens such as bacterial kidney disease, they are generally not used for more than one day at a time. The recirculating tank contains a water chiller that helps monitoring personnel maintain river water temperatures which reduces fish stress during handling. Water is regularly drained from the sorting trough to keep DO, temperature, and waste levels safe for fish. This water is temporarily held in a storage tank in the basement of the facility until it is pumped through a series of 55-gallon Calgon brand activated charcoal filters. The filters are replaced annually or semi-annually depending on the condition of the metal drums and filtering ability of the charcoal. The filters remove some or all of the MS-222 before it is discharged to the soil outside the facility for further breakdown.

Potential Impacts: The recirculation pump and water chiller are at low risk of impact from a mussel infestation because they are not usually used for an extended period of time and are completely dewatered September 16 to April 1. Periodic inspection and cleaning of the main line debris trap may be needed if mussels build up during the season. Drain lines leading to the filter tank in the basement are at moderate risk because they are not easily accessed or cleaned and remain wet during the most active period for dreissenids. The storage tank in the basement is at moderate risk because it remains partially full of water all year and has a small, 2-inch discharge valve that is susceptible to mussel accumulation and blockage. The filter pump, water lines between filter canisters, canister interiors, and final discharge hose are also vulnerable to clogging which could cause the storage tank to overflow.

Response: The recirculating pump and chiller can be drained thoroughly after use to avoid any mussel accumulation. Pump components should be inspected annually to check for extra wear potentially caused by mussel shells. The storage tank can be

vacuumed out or flushed clean at the end of the sampling season so debris does not accumulate and impact the pump and filters. Cleaning of the discharge lines could be accomplished using high-pressure water, compressed air, or by capping for chemical or hot water treatment. Consider installing a backup system in case of heavy shell buildup and blockage.

6. Research Activities - Temporary Holding Tanks, Degassing Columns, and Transportation Tanks: Research tagging activities focusing on juvenile salmonid behavior at the SMF often use temporary or semi-permanent components that are connected to raw water supplies. After sorting and identification, fish are held in temporary holding tanks for up to several days before being transported off-site for release to the river. The tanks are made of plastic or fiberglass and water is delivered through either 2-inch or 4-inch lines regulated with ball valves. Degassing columns made of 12-inch PVC pipes have been installed just upstream of the research holding tanks to help limit the potential risk to fish caused by supersaturated river water. Water is forced to flow through the medium inside the columns and allows any supersaturated gasses to come out of solution. If tagging occurs on-site, fish to be released at another location are held in transportation tanks designed with wheels to facilitate loading onto a vehicle. These components are dewatered during the same time frame as the smolt monitoring facilities, September 15 to April 1.

Potential Impacts: The research holding tanks are at moderate risk to impact from mussels because even small fluctuations in water flows can be lethal for fish by limiting DO or causing tanks to over flow. Their water supply lines and valves are susceptible to clogging and access for cleaning is limited. Degassing columns are at risk because they would probably provide suitable mussel attachment sites inside on the degassing medium. Too much debris accumulation in the columns could cause them to overflow and malfunction. Transportation tanks are at low risk because they are regularly cleaned and dewatered after each fish holding event to decrease the chance of transferring pathogens.

Response: These SMF components are dewatered during the winter and become completely dry. All valves are opened and drained for winter so most of the risk is associated with mussel accumulation occurring during the fish passage season by restricting flow. In-season risk can be reduced by maintaining the current routine cleaning protocol for holding and transportation tanks to reduce the chance of pathogen transfer. The tanks could be regularly inspected for mussel growth and mussels could be manually removed. Degassing columns should be taken down and cleaned as needed depending on the rate of mussel accumulation. Water supply lines that can be easily isolated and cleaned should be maintained and installation of a redundant supply system should be considered. Current transportation tank cleaning and dewatering protocols should continue.

7. Avian Hydrocannons: The avian hydro-cannons help deter avian predators such as gulls, cormorants, and terns from targeting temporarily disoriented fish at the outfall exit. The cannons are positioned at the very end of the structure and spray water in a

large arc over the tailrace surface. The hydro-cannon at John Day Dam have not been used in recent years. The cannons at Bonneville are typically used throughout the juvenile spill passage season (April 1- August 31). The water for the hydro-cannon comes from the AWS and is dewatered some time after September 1. The supply line is isolated and purged of water using compressed air during the winter maintenance period.

Potential Impacts: The hydro-cannons are at low risk of impact from mussel colonization because the water supply line is dewatered and purged annually. Accelerated wear to the nozzle may occur due to mussel shells. There is also a risk of blockage to the isolation valve from in-season mussel accumulation, which could hamper the purging process.

Response: Continue purging the hydro-cannon water supply line after seasonal use and determine if any mussel or clam accumulation can be noticed. If mussels are found to restrict flow, a redundant supply line could be installed to provide a backup. Inspect the nozzle for wear and replace as needed.

V. Potential Impacts and Responses - Adult Fishway Components - John Day Dam

1. Adult Collection Channel: The adult collection channel runs the length of the powerhouse below the tailrace deck and increases the number of locations an adult salmonid may encounter attraction water leading to a fish ladder entrance. A series of floating orifice gates can be used to provide fish access into this channel at various locations. These orifices can automatically move up and down to allow the collection channel differential and velocity to constantly adjust with changing tailrace elevations. A series of diffuser pools provide supplemental water throughout the length of the channel. Standard diffuser gratings consist of one-inch gaps with ¼-inch width galvanized metal bars. The collection channel can be dewatered in sections using cross channel bulkheads and is usually dewatered during the winter maintenance period (see FPP for project specifics).

Potential Impacts: The adult collection channel is at low to moderate risk of impact due to a dreissenid infestation. Although large amounts of surface area would be susceptible to fouling, the relatively large height and width of the channel does not force fish into contact with the channel surfaces. In addition, the floating orifices are large and heavy enough that they would probably not be affected by the presence of mussel shells. The pressure sensitive transducers used to measure the tailrace and collection channel differentials may not work correctly if mussel accumulations interfere with their measurements. Incorrect readings would lead to changes in velocities in the collection channel potentially delay upstream migrants. The gratings over the diffuser pools would be susceptible to mussel accumulation because any restriction to flow in this area can force the grating to blow out which would allow fish access into the auxiliary water supply system. In addition, fish ladders are taken out of service until diffuser gratings can be repaired and, depending on the time of year, could disrupt adult fish passage.

Response: The gratings covering the diffuser pools may have to be cleaned during the winter maintenance period to keep mussel accumulations from restricting flow during the fish passage season. In addition, in-season scheduled transducer sensor cleaning may be required if mussel accumulations cause the sensors to malfunction. If fouling is severe, in-season cleaning and maintenance may be needed and this would require installation of a removable sensor that could be cleaned without dewatering the channel.

2. South Fishway Entrance: This fishway entrance is a transitional area between the adult collection channel, the fish ladder entrance, and the fish ladder weirs. Large amounts of water are added diffuser pools with grating located on the floor of the structure. This add-in water attracts adult fish into the ladders and is regulated with a series of valves. It is possible to dewater the fish ladder entrance separately from the collection channel and it is usually dewatered during the winter maintenance period (see FPP for project specifics).

Potential Impacts: This area is relatively large and easily accessible although it is only accessible when dewatered during the winter maintenance period. Mussel growth on the walls or floor would pose a low threat to fish because they are not forced into contact with the edges of the structure. The diffuser pool grating and regulating valves are at moderate risk of impact due to mussel accumulation because any flow restriction through the 1-inch gaps could loosen the gratings and allow upstream migrants access to the diffusion chambers under the gratings where they would be trapped and, unless removed, would eventually die.

Response: Regular inspections for mussels in this area may need to occur during the annual dewaterings. If mussels accumulate on the grating surfaces, cleaning and removal may be necessary to minimize flow restrictions. Currently, many diffuser pools have large amounts of *Corbicula* shells, rocks, sand, and woody debris that accumulate under the gratings and affect the amount of flow passing through the gratings. It is likely that a mussel infestation would add to the existing problem and substantially increase the amount of time necessary for maintenance. Debris removal from this area is difficult because the grating has to be moved out of position and then the debris has to be lifted up and out of the entrance area. Furthermore, some areas under the gratings are difficult or impossible to access by hand using rakes or shovels and may require use of a debris vacuum or hose.

3. Fish Pump Intake Basin: Water from this area comes from the tailrace and is pumped back up into the lower section of the fish ladders to provide auxiliary water for fish attraction. Tailrace water entering the basin passes through a trashrack to prevent large fish and debris from entering the basin. The fish pumps then push the water into various diffuser pools through chimney style conduits.

Potential Impacts: In general, this area is at low risk of impact from dreissenids because it is very large and does not usually contain fish. A slight risk of fish injury in

the tailrace may occur if mussels accumulate on the trashrack and create high flow areas that could entrain fish as they pass by or capture debris that would then injure fish. The chimney style supply conduits are very large and their flow would probably not be affected by fouling.

Response: Inspections of the differential between the basin and the tailrace may be needed to determine the severity of mussel accumulations on the trashrack. Periodic removal and cleaning of the trashrack may be needed if mussels or debris are found to restrict flow or if dead fish are noted in the intake basin.

4. Francis Wheel Fish Turbines: The south fish ladder at John Day Dam has three Francis wheel fish turbines that are used to supplement flow in the lower section of the fish ladder. The penstock (approx. 36-inch diameter pipe) takes water from the forebay and provides each turbine with up to 100 cfs of water. The turbine wheels spin through a gear box and power impellers which are able to push up to 300 cfs of tailrace water into the south fish ladder diffuser pools.

Potential Impacts: This area is at low level of risk from dreissenids, but an accumulation of mussels between the penstock and fish turbines could impede flow and reduce turbine and impeller operating efficiency. Although flows are potentially very fast, shells from dead mussels could collect in low areas of diffuser pools. These accumulations and any extra debris trapped due to the mussels' presence could impede flow into diffuser pools. Restrictions in flow may slow or impede fish passage and increase the number of times the fish ladder is out of criteria.

Response: The fish turbines can be dewatered and potentially isolated by closing the penstock intake located in the forebay. This procedure allows access to the fish turbine intake area and would allow cleaning of turbine blades and other exposed surfaces. There is no available access for manual cleaning into the pipe between the penstock and the turbines so a method of removing any mussel accumulations would have to be developed. Water is not available for the south fish ladder diffuser pools or SMF when the penstock is closed, so any dewaterings usually occur during the winter maintenance period or for emergency repairs.

5. Fish Ladder Weirs - Submerged Orifices, Overflow Weirs, and Serpentine Weirs: Several types of weirs are utilized in CRB fish ladders. Submerged orifices are rectangular openings in the weir walls that allow fish to pass into the next weir while staying submerged. Overflow weirs allow fish an alternate route over the top of the weir wall. The water depth at the overflow weir can vary throughout the season and is periodically adjusted depending on desired fish passage criteria. During the peak of the American shad migration, overflow weir depth is kept at approximately 1 foot to facilitate shad passage and help prevent delay of salmonids. The serpentine weirs, located at the upstream end of the ladders, move water through a tall slot in the weir wall which is not directly downstream of other slots. The resulting side to side motion of the water between weirs helps reduce velocities and dissipate energy before water moves into the

overflow weir section of the ladder. Some serpentine weirs are fitted with short hydraulic adjustment weirs along the floor to help regulate flow.

Potential Impacts: Although the risk level to this area is probably low**,** the large amount of cement surface area on most weir types make them potentially susceptible to mussel fouling. Many lower flow areas in corners and on the upstream and downstream side of weir walls would create suitable areas for mussel attachment. Physical injury to fish could occur when they jump between weirs or if they contact walls or edges. Dead mussel shells or associated debris accumulation in the serpentine section of the ladder could change the flow dynamics between weirs and may cause upstream migrants to delay or fall back through the ladder.

Response: Depending on mussel accumulations, it may be necessary to inspect all weir surfaces during dewaterings and remove mussel accumulations as needed. Most vertical and horizontal surfaces inside the weirs are easily accessible during winter dewaterings although it would be difficult to provide electricity and water needed for cleaning equipment to most of these outside areas. Removal of mussel remains would also be challenging due to the elevated location of many of the fish ladder areas. Manual removal would be labor intensive, increase maintenance costs, and increase the number of days fish ladders are out of service.

6. Diffuser Pools: Diffusers pools provide access for the auxiliary water system (AWS) which supplements flow volumes in the fishways. These pools are covered by diffuser gratings and are located in the adult collection channel, at fish ladder entrances, and at several locations in the adult fish ladders. The AWS is approximately 36-inches in diameter and originates from the penstock in the forebay.

Potential Impacts: The gratings over the diffuser pools are one of the most susceptible components of the adult fishways to a dreissenid infestation. Even a small amount of fouling could restrict flow through the 1-inch grating gaps and cause them to dislodge. Even if mussel densities are low, their shells may increase the amount of debris that collects under the grating and amplify the restriction of flow. When gratings are out of position, adult migrants can be attracted to the inflow of auxiliary water and gain access to the diffuser chambers where they can become injured, trapped, or killed. Fish ladders are taken out of service until diffuser gratings can be repaired and, depending on the time of year, could disrupt adult fish passage.

Response: It will be necessary to inspect all diffuser grating surfaces during dewaterings and remove mussel accumulations as needed. Severe debris accumulations (mussel shells, rocks, woody debris, etc.) under intact gratings may have to be periodically removed to inhibit blow out potential while operating during fish passage season.

[Note: numbers 7 – 17 below are incomplete and will be finalized in the future]

7. Transition Pool, Counting Station Window, and Picketed Leads: The transition pool is located directly downstream of the adult fish counting window. This pool provides a resting and staging opportunity for fish before they move upstream through a constriction in the channel positioned in front of the counting station window. The picketed leads funnel flow and fish into the counting window area. They consist of a series of vertical metal bars spaced at about 1 inch and are designed to allow much of the flow to pass through. These components are very susceptible to debris accumulation and are usually cleaned once a day or as needed during daily inspections.

Potential Impacts:

Response:

8. Fish Ladder Exit, Trashrack, and Debris Boom: The fish ladder exit is a short area of transition from the serpentine weirs to the forebay. A trashrack with 1-foot gaps at the exit prevents most large woody debris from entering the adult fish ladder but still allows fish to exit. A floating log boom is installed upstream of the fish ladder exits to help prevent floating debris from reaching the trashrack.

Potential Impacts:

Response:

9. Upstream Migrant Channel (UMT) - Bonneville Dam:

10. Adult Fish Facility (AFF) - Bonneville Dam:

11. Sea Lion Exclusion Device (SLED):

12. Removable Spillway Weirs (RSW):

13 Temporary Spillway Weirs (TSW):

14. Juvenile Transportation Program (barges, holding raceways, loading and unloading facilities):

15. Behavioral Guidance Screens:

16. Ice and Trash Sluiceway - The Dalles Dam:

17. Spillway Guide Wall - The Dalles Dam:

Table 1. Juvenile Fish Facility Components, Potential Risk Due to a Dreissenid Infestation, Reason for Risk Level, and Response and Preventative Actions at John Day and Bonneville Dams *[Note: Information on Adult "Reason for Risk Level" and "Response and Preventative Actions" is incomplete and will be finalized in the future].*

Juvenile Fish Facility Component	Potential Risk	Reason for Risk Level	Response and Preventative Actions
Powerhouse and Auxiliary Water Supply Trashracks	High	Submerged all year, difficult to access and clean, excess debris accumulation can cause fish injury	More frequent maintenance and cleaning, design trashrack brush or backup equipment
Bypass Screens: -STS -ESBS -VBS	 High High High	Submerged during veliger season or all year (VBS), difficult access, mesh and wedge wire screens are susceptible to fouling, units must be shut down for cleaning/maintenance , storage slots in water	Increased camera or manual inspections, periodic removal of VBSs for cleaning, establish on-site cleaning station for screens
Gatewells, Orifices, and Juvenile Collection Channel	Moderate	Submerged almost all year, generally high flows, but slow flow areas may produce druses, difficult to access and clean	Increased orifice cycling, inspect and clean orifice light recesses, remove druse accumulation during annual dewatering
Tainter Gate, Elevated Chute, and Crest gate	Low	Generally high flows, dewatered after fish passage season, easy access, crest gate seal may experience excess wear, sensor fouling potential	Check and clean expansion joints and crest gate seal, remove water accumulation in winter if needed
Ogee Ramp and Tailrace Outfall Flume	Low to Moderate	Leakage from crest gate during fish passage season may promote mussel growth in ogee and flume	Inspect and maintain effective seal on crest gate, re-route leakage
Primary Dewatering Structure, Modulating Weirs, and Adult Drain	Low to Moderate	Submerged during fish passage season, slight risk of mussel growth on dewatering screens, adult drain leakage may promote mussel growth	Remove mussels during winter maintenance, inspect and clean adult drain, design plug for this area
Corrugated Transport Flume and Conveyance Pipe	Low to Moderate	Submerged during fish passage season, normal high flows, very difficult to access conveyance pipe	Seasonal inspection and cleaning after dewatering
Switch Gates and Flushing	Low	Normal high flows, leakage may allow mussel growth in bypass flumes, flushing water	Inspect and clean in winter, purge flushing water in-season, increase

Valves		blockage	drain diameter, inspect seal for wear
Fish and Debris Separator – Secondary Dewatering System, Porosity Unit, Wetted Separator Bars, Juvenile Collection Hopper, and Distribution Flumes	Moderate	Submerged during fish passage season, normal high flows, dewatering screen, perf plate, and separator bar fouling, difficult access to parts of distribution flumes	Frequent inspection and cleaning, periodically purge supply valves and separator bars, provide improved access to flumes
Tertiary Dewatering Units, PIT Tag Detectors and Rotating Sample Gates	Low to Moderate	Submerged during fish passage season, smooth surfaces, high flow areas, access possible but limited, flushing water supply valves vulnerable to fouling,	Clean units as needed, purge flushing water supply lines and valves, provide improved access to flumes, devise scouring method for cleaning inaccessible areas
SMF Laboratory: Holding Tank, Butterfly Valves, and Crowder Panels	Low	Submerged during fish passage season with periodic cleaning, discharge water perf plate fouling, inflow valve clogging potential	Increased cleaning, periodic purging of butterfly valves, inspect and replace crowder seal as needed
Pre-anesthetizing Chambers, Fish Lifts, Drainage Lines, and Flushing Water	Low to Moderate	Submerged during fish passage season, difficult to access, even small accumulations can cause problems for fish and smolt monitoring personnel	Increase cleaning, improve water supply line isolation capabilities, install access portals to drain lines, devise scouring method for cleaning inaccessible areas
Sorting Trough, Return Pipe, and Recovery Tanks	Low	Daily dewatering and cleaning, mostly easy access, water supply and valve clogging potential	Provide backup return pipe or devise scouring method for cleaning inaccessible areas
Release Pipes and Exit to River Flume	Moderate	Submerged during fish passage season, difficult to access, problems would be difficult to detect	Improve access for inspections, implement cleaning as needed
Recirculation Pump, Water Chiller, and MS-222 Filters	Low	Submerged during fish passage season, difficult to access, many small diameter supply lines, increased pump wear and charcoal filter replacement	Remove seasonal accumulation of debris from storage tank, purge or clean lines to filters, maintain pump
Research Activities - Temporary Holding Tanks, Degassing Columns, and Transportation Tanks	Low to Moderate	Submerged during fish passage season, inflow supply lines, valves, and degassing column clogging potential	Maintain tank cleaning protocols, purge supply valves daily, inspect and clean degassing columns as needed
Avian Hydro-cannons	Low	Uses raw water, supply line mostly buried and susceptible to clogging and wear, no backup	Purge water supply line after use, inspect nozzles for wear

Adult Fishway Components	**Potential Risk**		
Adult Collection Channel	Low to Moderate		
South Fishway Entrance	Low		
Fish Pump Intake Basin	Low		
Francis Wheel Fish Turbines	Low		
Fish Ladder Weirs, Submerged Orifices, Overflow Weirs, and Serpentine Weirs	Low		

Table 2. Fish Management Details for Some Hydro-electric Dams in the Columbia and Snake River Basins.

Mainstem Hydro-electric Project	**Project Managed by**	**Juvenile Fish Passage Season**	**Bypass Screen Type and Material**	**Juvenile Bypass Facility**	**Juvenile Fish Transportation**	**Operate for Adult Passage**	**Adult Fishway**
Bonneville Dam-PH1	USACE - Portland District	3/1- 10/31	No screens	Out of service	No	3/1 – 11/30	1, Bradford Island
Bonneville Dam-PH2	USACE - Portland District	3/1- 10/31	STS/VBS	Yes	No	3/1 – 11/3	2, Cascades Is., WA shore
The Dalles Dam,	USACE - Portland District	4/1 – 11/30	VBS	No	No	3/1 – 11/3	2, North and East
Public Utility District	Northern Wasco County Public Utility District	April - July	Dewatering screens only	Yes	No	NA	NA
John Day Dam	USACE - Portland District	4/1 – 9/15	STS/VBS/ESBS	Yes	No	3/1 – 11/3	2, North and South
McNary Dam	USACE - Walla Walla District	4/1 – 9/20	ESBS/VBS	Yes	Yes	3/1 – 12/31	2, North and South
Public Utility District	Northern	No sampling	Dewatering	No	No	NA	NA

	Wasco and Klickitat Co.		Screens only				
Ice Harbor Dam	USACE - Walla Walla District	4/1 – 12/15	STS/VBS	Yes	No	3/1 – 12/31	2, North and South
Lower Monumental Dam	USACE - Walla Walla District	4/1 – 9/30	STS/VBS	Yes	Yes	10/1 – 12/15	2, North and South
Little Goose Dam	USACE - Walla Walla District	4/1 – 10/31	ESBS/VBS	Yes	Yes	11/1 – 12/15	1, South
Lower Granite Dam	USACE - Walla Walla District	3/26 – 10/31	ESBS/VBS	Yes	Yes	11/1 – 12/15	1, South
Rock Island Dam	Chelan County - Public Utility District No. 1	4/1 – 8/31	VBSs, but no bypass screens	Yes	No	?	3 total

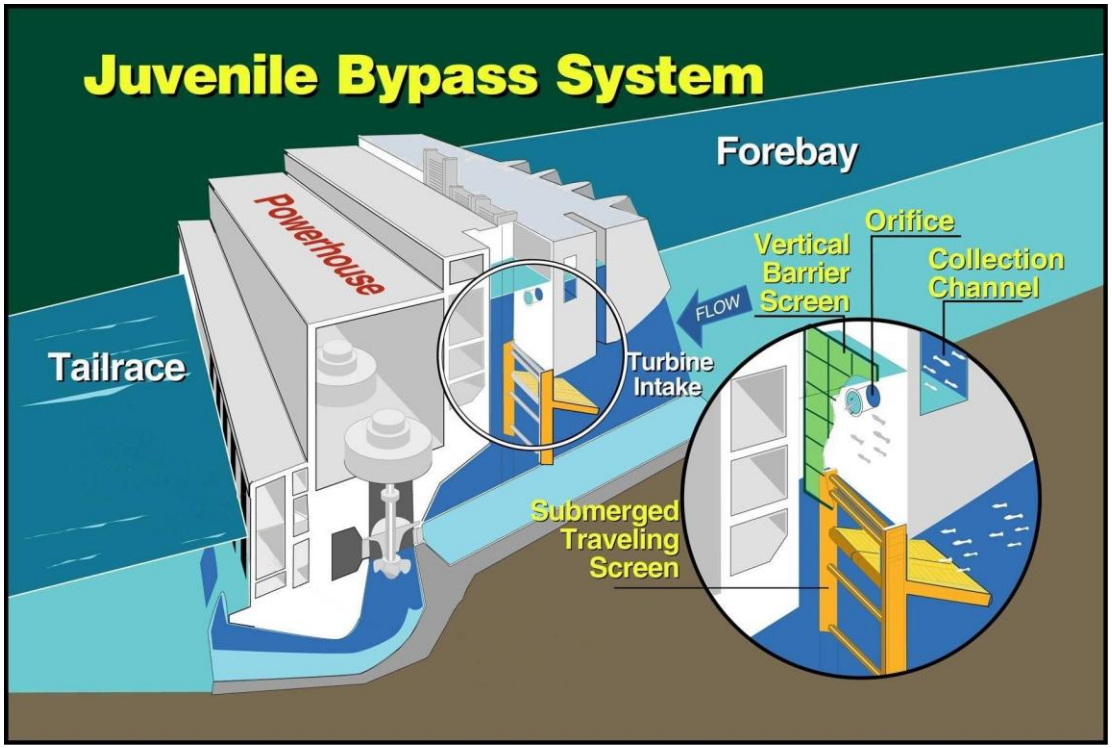

Figure 1. Generalized Juvenile Bypass System (Picture compliments USACE).

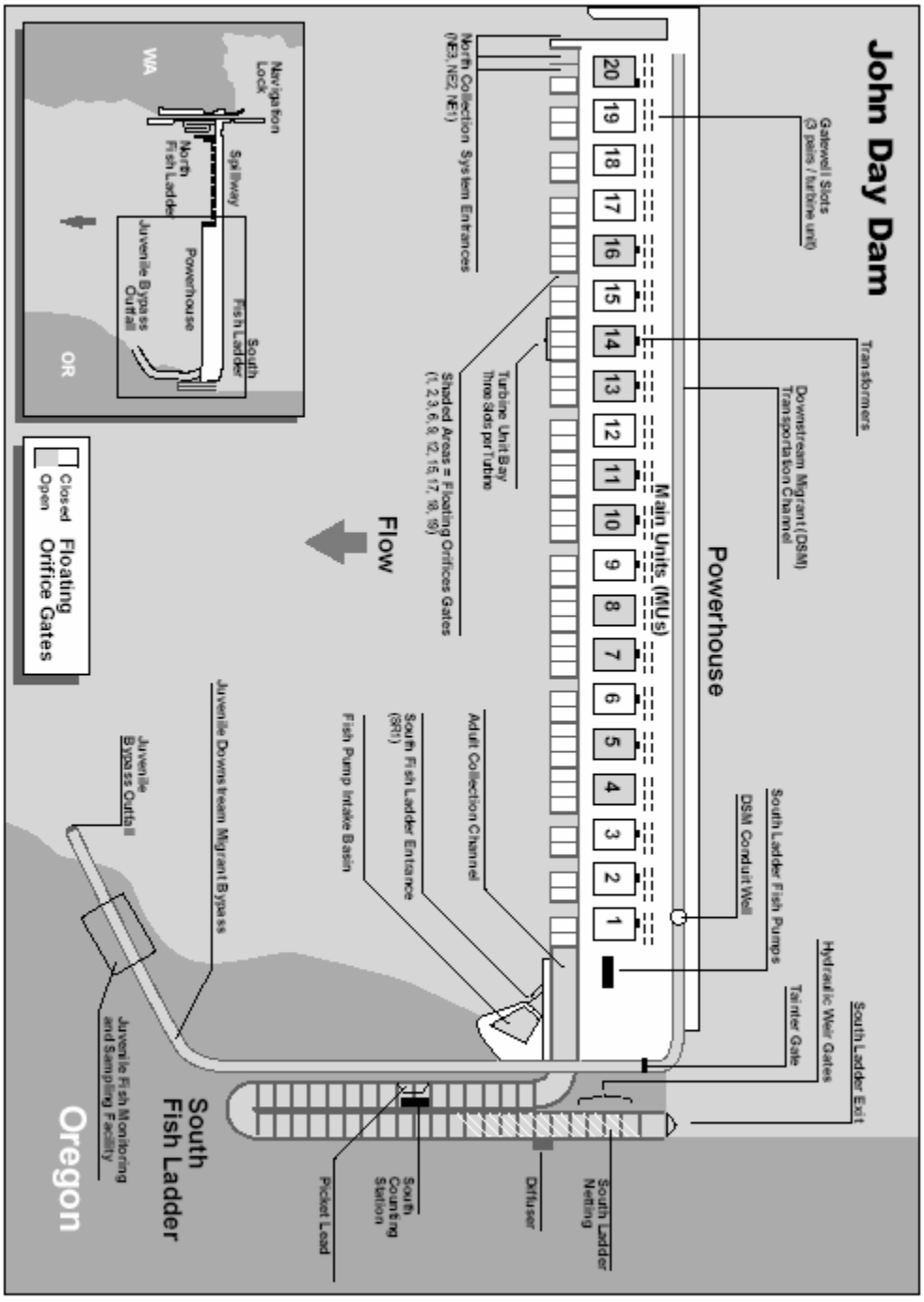

Figure JDA-1 John Day South Fish Ladder and Powerhouse Collection System.

JDA–2

Figure 2. Project Plan of John Day Dam- South Fish Ladder and Powerhouse (Diagram compliments of the U.S. Army Corps of Engineer, Fish Passage Plan, 2006).

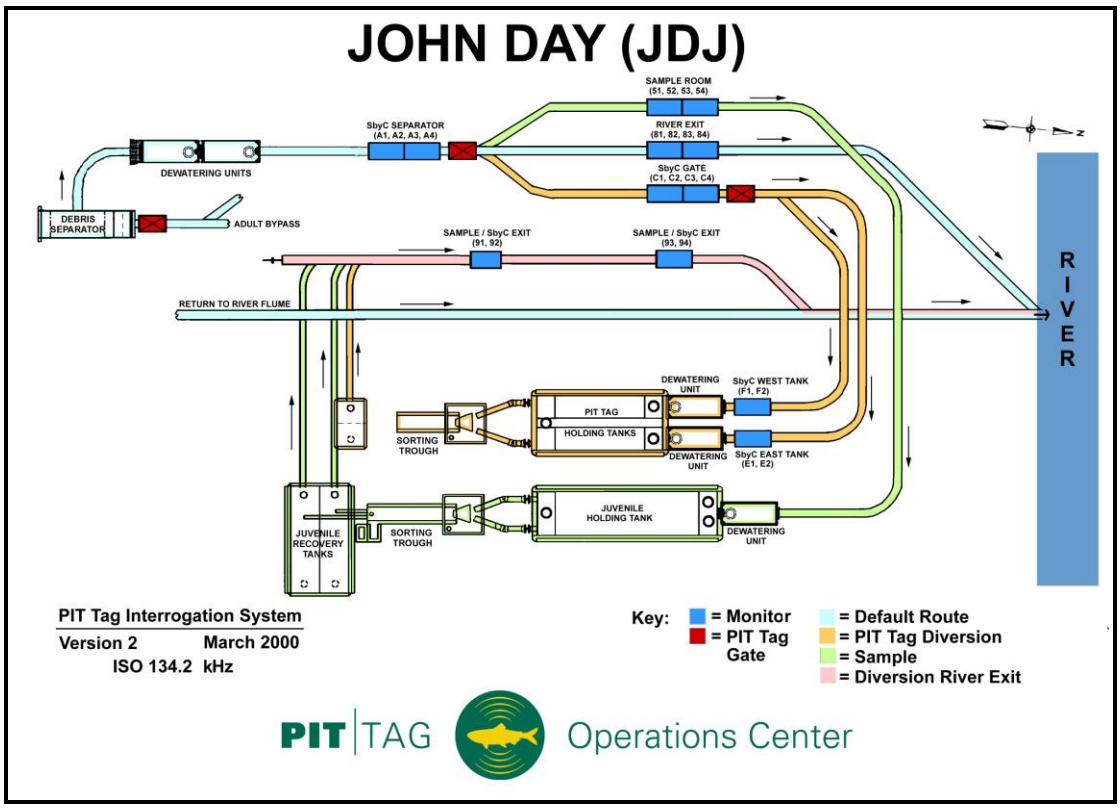

Figure 3. Passive Integrated Transponder (PIT) Tag Detection Schematic, John Day Dam Smolt Monitoring Facility (Diagram by PITAGIS, 2000).

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VII. References

1. Athearn, J. 1999. Risk Assessment for Adult and Juvenile Fish Facilities on the Mainstem Lower Snake and Lower Columbia Rivers Relative to a Potential Zebra Mussel Infestation. US Army Corps of Engineers, Northwest Division. Portland, Oregon.

2. Athearn, J and T Darland. 2006. Rapid Response Plan for Zebra Mussels in the Columbia River Basin. Appendix. H. Bonneville Hydroelectric Project Response Plan for Zebra Mussels *(Dreissena polymorpha)*.

3. Burch, J. Q. 1944. Checklist of west American mollusks. Minutes, Concological Club of southern California 38:18.

4. Martinson, R, Kovalchuk, G and D Ballinger. 2005. Monitoring of Downstream Salmon and Steelhead at federal Hydroelectric Facilities. Pacific States Marine Fisheries Commission for Bonneville Power Administration.

5. Ohio Sea Grant. 1997. Zebra Mussels in North America: The invasion and its implications. Fact Sheet 045. Columbus, Ohio.

6. Phillips, S., Darland, T. and M. Sytsma. 2005. Potential Economic Impacts of Zebra Mussels on the Hydropower Facilities in the Columbia River Basin. Pacific States Marine Fisheries Commission, US Army Corps of Engineers, Portland State University.

7. USACE (US Army Corps of Engineers). 2006. Fish Passage Plan. U.S. Army Corps of Engineers, Northwestern Division, Portland, Oregon.

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APPENDIX G

SAMPLE DOCUMENTS

G-1: Model Letter of Agreement

Date

Agency

This letter affirms that [insert agency/entity] adopts the *Columbia River Basin Interagency Response Plan for Zebra Mussels and Other Dreissena Species* (Plan) as its guiding document in the event that zebra mussels or other *Dreissena* species are introduced into Columbia River Basin waters. As such, [insert agency/entity] agrees to:

- Treat the introduction of zebra mussels or other *Dreissena* species in the Columbia River Basin as a natural resources emergency that merits immediate and significant response as long as opportunities exist to contain or eliminate the invasion.
- Appoint staff to serve on the organizational elements described in the Plan.
- Coordinate our organization's monitoring, public information, and other rapid response activities through the organizational elements described in the Plan.
- Evaluate our preparedness to respond to an invasive mussel introduction into the Columbia River Basin and take steps to enhance our capabilities as outlined in the Plan and as resources allow.

Signed this _____ day of _____

[signature block]

G-2: Sample Press Release in the Event of Discovery of Dreissenid Mussels in the Columbia River Basin

100th Meridian Initiative logo

Date

Lead agency contact information:

On [date], [agency] received a report that live zebra [and/or/quagga] mussels were present in _____. This report has been initially verified by [agency/recognized expert], and efforts are underway to [describe what's next, if anything, to confirm i.d.].

This discovery is a serious environmental and economic concern for the Pacific Northwest. Zebra mussels are small nonnative freshwater mollusks that have caused major problems in the eastern United States after their introduction in the 1980s.

[Insert quote from a lead agency administrator]

Officials have not yet determined how these mussels arrived to the Pacific Northwest. Recreational boats are known to be a major source of zebra mussel spread in the United States, and there are a number of past incidents where boats fouled by live zebra mussels have been intercepted prior to launching in Northwest waters. [If quagga mussels are found/suspected, insert information on the Colorado River invasion].

Under the national 100th Meridian Initiative campaign, regional aquatic invasive species experts have been preparing for this unfortunate incident, and recently completed a rapid response plan for zebra and quagga mussels in the Columbia River Basin. As called for by this Plan, agencies are coordinating activities such as measuring the extent of invasion, evaluating control options, and initiating measures to prevent further spread.

[Insert more details on specific next steps for surveys, etc.]

<u>Background on Zebra and Quagga Mussels</u>:

Zebra mussels are native to eastern Europe. They were introduced into the Great Lakes area in the late 1980s, likely via ballast water from commercial ships. They have since rapidly spread throughout the eastern United States and Canada.

Zebra mussels are freshwater bivalve mollusks that typically have a dark and white (zebra-like) pattern on their shells, but may be any combination of colors from off-white to dark brown. Zebra mussels are usually about an inch or less long, but may be larger. When healthy, they attach to hard substrates.

Until the mid 1980s there were no zebra mussels in North America. That changed when they were inadvertently introduced into waters near the Great Lakes region. It is suspected that zebra mussels hitched a ride in ballast water tanks of commercial ships. Zebra Mussels were first discovered in the United States in Lake St. Clair near Detroit, Michigan in 1988. Since the 1980s, zebra mussels have spread, unchecked by natural predators, throughout much of the eastern United States. They currently infest much of the Great Lakes basin, the St. Lawrence Seaway, and much of the Mississippi River drainage system. The have begun to spread up the Missouri River and Arkansas River. In 2008 zebra mussels were confirmed in California and Colorado.

Zebra mussels negatively affect the environment by reproducing quickly and in large numbers. Zebra Mussel densities have been reported to be over 700,000 individuals per square meter in some facilities in the Great Lakes area. Zebra mussels are biofoulers that obstruct pipes in municipal and industrial raw-water systems, requiring millions of dollars annually to treat. They produce microscopic larvae that float freely in the water column, and thus can pass by screens installed to exclude them. Monitoring and control of zebra mussels costs millions of dollars annually. As filter feeders, zebra mussels remove suspended material from the habitat in which they live. This includes the planktonic algae that is the primary base of the food web. Thus, zebra mussels may completely alter the ecology of water bodies in which they invade.

Some estimates of the economic impact of these small mussels to water intake and conveyance facilities in the eastern U.S. are several billion dollars. Much of the existing infrastructure had to be modified or replaced to deal with the prolific mussels that are able to attach to about every hard surface in contact with raw water supplies. Possibly even more significant, are the as of yet unquantified, monetary impacts they are expected to have on recreation and natural resource values.

It is not certain how great the impact will be in _____ (the Northwest) but an interagency coordinating group, led by _____, is extremely concerned. Once the zebra mussels become established, it is almost impossible to get rid of them. The best hope is to launch an early, coordinated program to contain the current infestation and hopefully determine a means of control.

The _____ (group) is fortunate to have a head start using a rapid response strategy that was developed earlier in anticipation of just this kind of problem. Other

similar rapid response programs have been most successful when there was early detection of an invasive species and all of the agencies that had to be involved were able to quickly respond with a well-coordinated plan.

In the meantime, the _____ (agency) has _____ (restricted access) to _____ (infected location) to help prevent further dispersal of the zebra mussels. The public can help by avoiding the ____ (infected area) and following some good general guidelines. They should clean all boats, trailers, and other equipment after leaving a lake or stream and never release any live organisms into the wild.

Additional information could be added about other species already in the region and how they are being dealt with – Eurasian watermilfoil, New Zealand mudsnails, Asian clam, and kudzu (which showed up in Oregon and was successfully eradicated).

<u>How can boaters help prevent the spread of zebra mussels</u>:
These aquatic nuisance species can hitch a ride on our clothing, boats, and items used in the water. When visitors go to another lake or stream, the nuisance species can be released. And, if the conditions are right, these introduced species can become established and create drastic results. By following a simple procedure each time boaters leave the water, they can help stop aquatic hitchhikers. Knowing which waters contain nuisance hitchhikers is not as important ---- as doing the procedure every time boaters leave any lake, stream or coastal area:

- Remove any visible mud, plants, fish or animals before transporting equipment
- Eliminate water from equipment before transporting
- Clean and dry anything that came in contact with water (Boats, trailers, equipment, clothing, dogs, etc.)
- Never release plants, fish or animals into a body of water unless they came out of that body of water.

Additional information can be found at www.100thMeridian.org.

Possible Quotes:
“We have been aware of problems zebra mussels have caused in the Great Lakes region and have been working with various agencies organizations since the early 1990s to prevent their introduction into the west.”
“Although eradication is extremely difficult, our first concern is to contain the zebra mussel infestation within _____ to avoid it being spread to other vulnerable areas.”
“Although the recent discovery of zebra mussels is alarming, we are fortunate to have a Rapid Response Plan available to facilitate a coordinated regional effort to deal with this new invader. “The successes we have seen in other areas were the result of the region’s ability to rapidly respond with a coordinated intense effort.”

G-3: SAMPLE STATE DECLARATION OF EMERGENCY

Note: the below template is provided as a resource to governmental agencies that intend to issue an emergency proclamation/order in response to an introduction of invasive mussels in the Columbia River Basin. It is not intended to obligate any government to take such action.

DREISSENID MUSSEL INVASIVE SPECIES PROCLAMATION OF EMERGENCY AND EXECUTIVE ORDER

[DATE]

WHEREAS, Dreissenid mussels are harmful, highly invasive species, not native to the United States. Dreissenid mussels, more commonly known by the species names of zebra or quagga mussels, were discovered in the Great Lakes region in and around 1988. Since this time, dreissenid mussels have spread throughout much of the eastern United States, including infesting much of the Mississippi, Missouri, and Arkansas river drainages. This infestation has caused billions of dollars in economic costs to public agencies and private industry. The environmental costs have been significant, too.

WHEREAS, Live dreissenid mussels were discovered in [INSERT WATER BODIES] on [DATE], and additional surveys may reveal the presence of dreissenid mussels within other waterbodies within the State of _____.

WHEREAS, their presence in the [INSERT WATER BODIES] greatly advances the known range of dreissenid mussels, emphasizing the fact that that dreissenid mussels can readily move from place to place, either as free-swimming larvae contained in hydrologically connected or transported water, or as adults that are attached to boat hulls, makes their presence in or near [INSERT STATE] a threat to rivers, lakes and reservoirs throughout the state.

WHEREAS, Dreissenid mussels alter the natural food web of aquatic ecosystems. They filter nutrients like planktonic algae, that are the primary base of the food chain, from the water making these nutrients unavailable for native species, resulting in decline or extirpation of native species and disruption to the ecological balance of the water body. If allowed to reach other Pacific Northwest waters, these mussels would further threaten sensitive fish species that are already in severe decline. Maintaining the ecological balance of [INSERT STATE]'s waterbodies is critical to the long-term sustainability of native species, and to [INSERT STATE}businesses, recreational sites and local communities.

WHEREAS, dreissenid mussels foul submerged pipes and other infrastructure including water diversion structures, piers and pilings, power plant intakes and cooling systems, fish screens, and boat hulls. These mussels reproduce quickly and in large numbers. They have been reported in densities of over 700,000 per square meter in some facilities in the Great Lakes.

WHEREAS, should they become established in the Pacific Northwest, the impact of dreissenid mussels on region's extensive hydropower system and irrigated agriculture is difficult to estimate but would significantly increase costs due to the mussel's capacity to clog pipes, pumps and delivery systems, and potentially cause major service disruptions.

WHEREAS, dreissenid mussels damage the hulls, props, and motors of boats and other watercraft, imposing additional costs and burdens on recreational boaters and diminishing the attraction of water-based recreation in [INSERT STATE].

WHEREAS, the [INSERT APPROPRIATE STATE AGENCY] has extensive authority over non-native species. For example, [CITE RELEVANT LAWS/REGS REGARDING POSSESSION, ETC.] However, these authorities do not provide [INSERT APPROPRIATE STATE AGENCY]with all of the tools it needs to deal with this crisis.

[REPEAT ABOVE FOR OTHER RELEVANT AGENCIES]

NOW, THEREFORE, I, [INSERT GOVERNOR NAME**],** Governor of the State of [INSERT STATE], in light of the aforementioned, find that a condition of extreme peril to the safety of persons and property exists in and around the various waterbodies of the State of [INSERT STATE] due to the infestation of dreissenid mussels. I further find that the ability of the agencies and departments of the State of [INSERT STATE] to effectively control the spread of these mussels in the State is limited. Accordingly, under the authority of the [CITE APPROPRIATE STATE EMERGENCY LAW/CODE], I hereby proclaim that a State of Emergency exists within the State of [INSERT STATE].

IT IS HEREBY ORDERED that all departments and agencies of state government utilize and employ state personnel, equipment and facilities for the performance of any and all activities consistent with the *Columbia River Basin Interagency Response Plan for Zebra Mussels and other Dreissena species* and associated incident response plans and interagency agreements. This includes assisting with the education of the public on the risks posed by the presence and spread of Dreissenid mussels within the state.

FURTHER, employees of the [INSERT APPROPRIATE AGENCIES], and their designees (hereinafter referred to as "inspectors") may stop and conduct inspections of boats and other watercraft entering into or present within [INSERT

STATE] to determine if dreissenid mussels could be present. In the event that the inspectors make this determination, the inspectors can take such actions they determine are reasonably necessary to kill the dreissenid mussels and thereby reduce the possible spread of this damaging species within the state. These actions may include, but are not limited to, temporarily stopping vehicles with boats or other watercraft, ordering that areas in the boat or other watercraft that contain water be drained and/or dried, that areas that cannot be completely drained or from which water cannot be eliminated be decontaminated, that boats or other watercraft may be impounded or quarantined for such time as is necessary to ensure that dreissenid mussels can no longer live on or within that boat or watercraft.

FURTHER, the inspectors may order that waterbodies where dreissenid mussels are found to be present on marinas, boat launch facilities, or other property be closed, quarantined, or access otherwise limited in such a manner as will not permit the spread of dreissenid mussels within the state. Any such property may be decontaminated, impounded or quarantined for such time as is necessary to ensure that dreissenid mussels can no longer live on or within that property.

I FURTHER DIRECT that as soon as hereafter possible, this proclamation be filed in the Office of the Secretary of State and that widespread publicity and notice be given of this proclamation.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of [INSERT STATE] To be affixed on this [INSERT DATE].

G-4: Sample Delegation of Authority

Everglades and Dry Tortugas National Parks

Homestead, Florida

As of 1800, May 20, 20XX, I have delegated authority to manage the Ingraham Fire number 8930 to Incident Commander XXXXXXXXX and her Incident Management Team.

The fire is burning in legislated wilderness. My considerations for management of this fire are:

1. Provide for firefighter safety.
2. I would like the fire managed under a containment strategy with suppression actions done with as little environmental damage as possible. The NPS definition of containment is attached.
3. Key cultural features requiring priority protection are: Mahogony Hammock, overlook boardwalks, park headquarters, the Pinelands campground and residential area, Royal Palm Visitor Center, hydrostations with recording equipment.
4. Key resource considerations are: protecting endangered species by providing aircraft telemetry monitoring of Florida panther, preserving as much Cape Sable Sparrow habitat as possible, and avoiding wildlife entrapment situations.
5. Restrictions for suppression actions are no tracked or wheeled vehicles in the wilderness except where roads exist and are identified for use, and no retardant will be utilized.
6. Tools approved for use are Type II/III helicopters, chainsaws, and weed whips.
7. My Agency Advisor will be the park Fire Management Officer.
8. The NE flank of the fire borders Florida Department of Forestry (DOF) protection. Chekika State Park must be protected if threatened. The District Forester will be the DOF representative.
9. Managing the fire cost-effectively for the values at risk is a significant concern.
10. Providing training opportunities for the South Florida parks personnel is requested to strengthen our organizational capabilities.
11. Minimum disruption of visitor access of the main park road consistent with public safety.

_____

Superintendent, Everglades and Dry Tortugas National Parks

Amendment to Delegation of Authority

The Delegation of Authority dated May 20, 20XX, issued to Incident Commander XXXXXXXXX for the management of the Ingraham Fire number 8930 is hereby amended as follows. This will be effective 1800 May 22, 20XX.

3. Key cultural features requiring priority protection are: Mahogony Hammock, overlook boardwalks, park headquarters, the Pinelands campground and residential area, Royal Palm Visitor Center, hydrostations with recording equipment, Shark Valley, Hammock 55, Binky Hammock Chain.

12. Use of tracked vehicles authorized to protect the Miccosukee Strip.

_____

Superintendent, Everglades and Dry Tortugas National Park

Appendix H - Forms

The attached listing of forms are commonly used during a PSMFC response with the deployment of the Rapid Response Team and Technical Specialists.

Form:	**Form Number**
ANS Initial Report Form	PSMFC 1
Incident Action Plan Cover Sheet	PSMFC 2
Incident Briefing	ICS-201
Incident Objectives	ICS-202
Organization Assignment List	ICS-203
Division Assignment List	ICS-204
Radio Communications Plan	ICS-205
Phone Communication Plan	ICS-205a
Medical Plan	ICS-206
ICS Organization Chart	ICS-207
Incident Status Summary	ICS-209
Check In List	ICS-211
General Message	ICS-213
Resource Request Message	ICS-213RR
Unit Log	ICS-214
Operational Planning Worksheet	ICS-215
Incident Meeting Schedule	ICS-230
Resources At Risk	ICS-232
Open Action Tracker	ICS-233
Work Analysis	ICS-234
Technical Specialist Report	ICS-234a
Technical Specialist Analysis	ICS-234b

1. Incident Name	**2. Prepared by:** (name) Date: Time:	INCIDENT BRIEFING ICS 201 PSMFC RRT

3. Map/Sketch (include sketch, showing the total area of operations, the incident site/area, overflight results, trajectories, impacted shorelines, or other graphics depicting situational and response status)

4. Current Situation

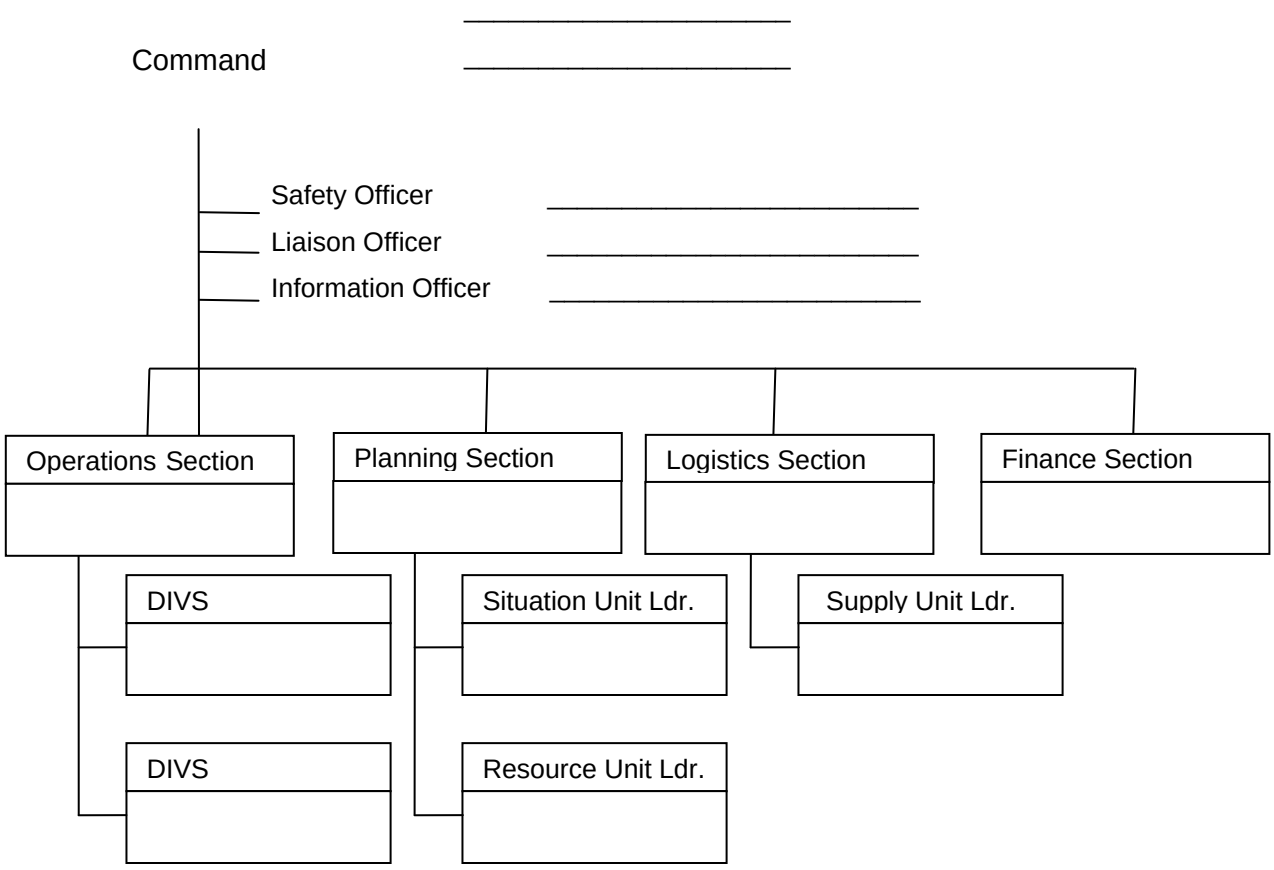
1. Incident Name	2. Prepared by: (name) Date: Time:	INCIDENT BRIEFING ICS 201 PSMFC RRT

5. Initial Response Objectives, Current Actions, Planned Actions, Potential

	Objectives:
	Priorities:
	Current Actions:
	Planned Actions:
	Potential:
	Key Decisions:

1. Incident Name	**2. Prepared by:** (name) Date: Time:	INCIDENT BRIEFING ICS 201 PSMFC RRT

6. Current Organization (fill in additional appropriate organization)



1. Incident Name	**2. Prepared by:** (name) Date: Time:	INCIDENT BRIEFING ICS 201 PSMFC RRT

7. Resources Summary

Resource	Resource Identifier	Date Time Ordered	ETA	On-Scene (X)	NOTES: (Location/Assignment/Status)

1. Incident Name	2. Operational Period to be covered by IAP (Date/Time) From: To:	IAP COVER SHEET PSMFC RRT

3. Approved by Incident Commander(s):

ORG NAME

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

INCIDENT ACTION PLAN

The items checked below are included in this Incident Action Plan:

☐ ICS 202 (Response Objectives)

_____

☐ ICS 203 (Organization List)

_____

☐ ICS 204's (Assignment Lists)
One Copy each of any ICS 204 attachments:

_____

☐ ICS 205 (Communications Plan)

_____

☐ ICS 206 (Medical Plan)

☐ ICS 208 (Site Safety Plan) or Note SSP Location _____

☐ Map/Chart

☐ Weather forecast / Tides/Currents

Other Attachments

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

4. Prepared by: **Date/Time**

1. Incident Name	**2. Operational Period (Date/Time)** From: To:	**INCIDENT OBJECTIVES** **ICS 202 PSMFC RRT**

3. Objective(s)

4. Operational Period Command Emphasis (Safety Message, Priorities, Key Decisions/Directions)

Approved Site Safety Plan Located at:

5. Prepared by: (Planning Section Chief) **Date/Time**

1. Incident Name	2. Operational Period (Date/Time) From: To:	ORGANIZATION ASSIGNMENT LIST ICS 203 PSMFC RRT

3. Incident Commander(s) and Staff

Agency	IC	Deputy

Safety Officer:	
Information Officer:	
Liaison Officer:	

4. Agency Representatives

Agency	Name

5. PLANNING/INTEL SECTION

Chief	
Deputy	
Resources Unit	
Situation Unit	
Documentation Unit	
Demobilization Unit	
Technical Specialists	

6. LOGISTICS SECTION

Chief	
Deputy	

a. Support Branch

Director	
Supply Unit	
Facilities Unit	
Ground Support Unit	

b. Service Branch

Director	
Communications Unit	
Medical Unit	
Food Unit	

7. OPERATION SECTION

Chief	
Deputy	
Deputy	
Staging Area Manager	
Staging Area Manager	
Staging Area Manager	

a. Branch – Division Groups

Branch Director		
Deputy		
Division Group		
Division Group		
Division Group		
Division/Group		
Division/Group		

b. Branch – Division/Groups

Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		

c. Branch – Division/Groups

Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		

d. Air Operations Branch

Air Operations Br. Dir	
Helicopter Coordinator	

8. FINANCE/ADMINISTRATION SECTION

Chief	
Deputy	
Time Unit	
Procurement Unit	
Compensation/Claims Unit	
Cost Unit	

9. Prepared By: (Resources Unit) **Date/Time**

1. Incident Name	2. Operational Period (Date/Time) From: To:	**Assignment List ICS 204 PSMFC RRT**
3. Branch	**4. Division/Group/Staging**	

5. Operations Personnel Name Affiliation Contact # (s)

Operations Section Chief: _____

Branch Director: _____

Division/Group Supervisor/STAM: _____

6. Resources Assigned "X" indicates 204a attachment with additional instructions

Strike Team/Task Force/Resource Identifier	Leader	Contact Info. #	# of Persons	Reporting Info/Notes/Remarks	
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐

7. Work Assignments

8. Special Instructions

9. Communications (radio and/or phone contact numbers needed for this assignment)

Name/Function	Radio: Freq./System/Channel	Phone	Cell/Pager	

Emergency Communications

Medical _____ Evacuation _____ Other _____

10. Prepared by	Date/Time	11. Reviewed by (PSC)	Date/Time	12. Reviewed by (OSC)	Date/Time

1. Incident Name	2. Operational Period (Date / Time) From: To:	INCIDENT RADIO COMMUNICATIONS PLAN ICS 205 PSMFC RRT

3. BASIC RADIO CHANNEL USE

SYSTEM / CACHE	CHANNEL	FUNCTION	FREQUENCY	ASSIGNMENT	REMARKS

4. Prepared by: (Communications Unit) **Date / Time**

INCIDENT RADIO COMMUNICATIONS PLAN ICS 205 PSMFC RRT

1. Incident Name	**2. Operational Period (Date / Time)** From: To:	**COMMUNICATIONS PHONE LIST ICS 205a PSMFC RRT**

3. Basic Local Communications Information

Assignment	Name	Method(s) of contact (radio frequency, phone, pager, cell #(s), etc.)

4. Prepared by: (Communications Unit) **Date / Time**

COMMUNICATIONS LIST ICS 205a PSMFC RRT

1. Incident Name	**2. Operational Period (Date / Time)** From: To:	**MEDICAL PLAN** **ICS 206** **PSMFC RRT**

3. Medical Aid Stations

Name	Location	Contact #	Paramedics On site (Y/N)

4. Transportation

Ambulance Service	Address	Contact #	Paramedics On board (Y/N)

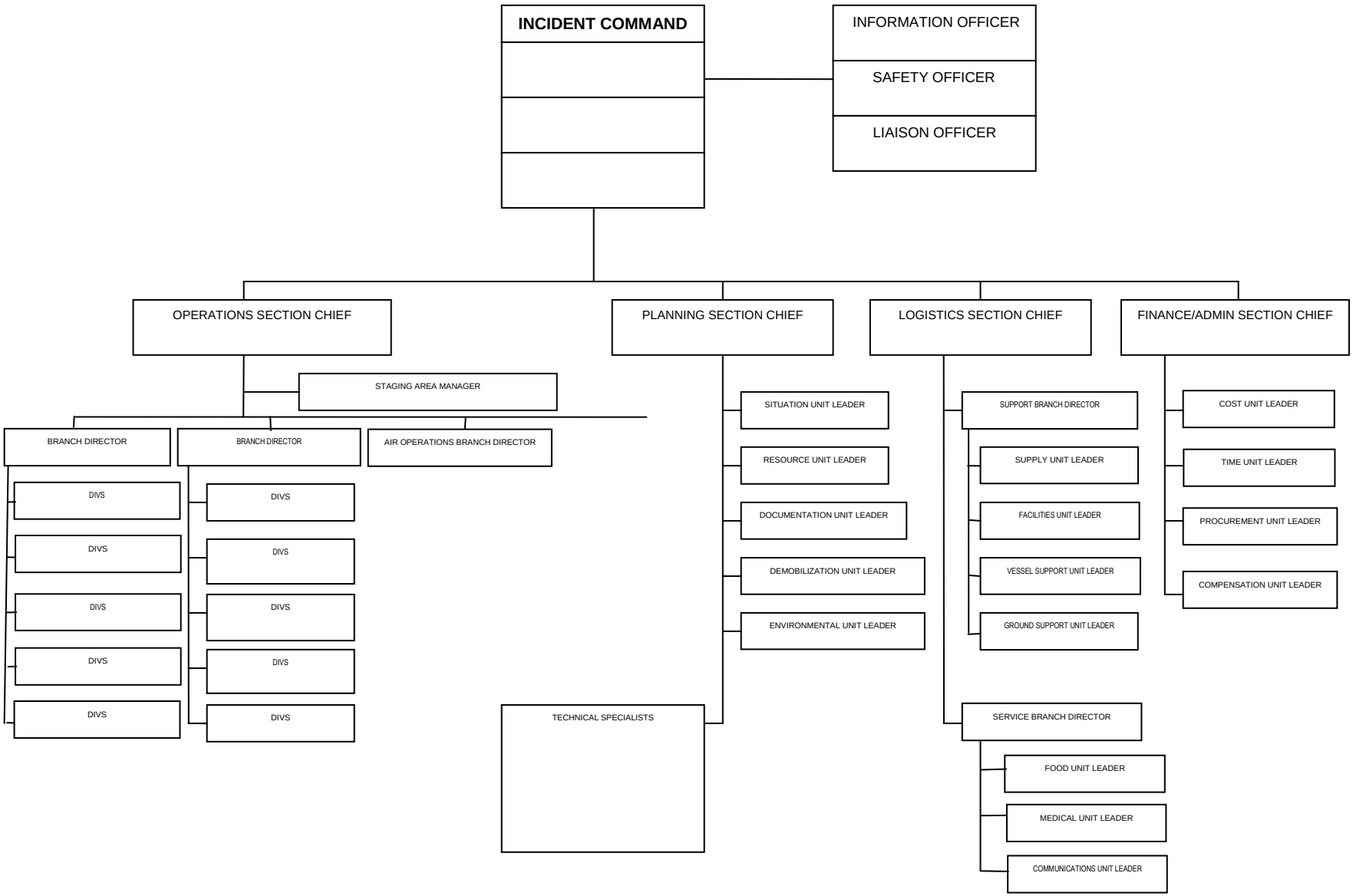
5. Hospitals

Hospital Name	Address	Contact #	Travel Time		Burn Ctr?	Heli-Pad?
			Air	Ground		

6. Special Medical Emergency Procedures

7. Prepared by: (Medical Unit Leader) **Date/Time**	**8. Reviewed by: (Safety Officer)** **Date/Time**

1. Incident Name	2. Operational Period (Date/Time) From: To:	**INCIDENT ORGANIZATION CHART ICS 207 PSMFC RRT**



INCIDENT ORGANIZATION CHART	ICS 207 PSMFC RRT

1. Incident Name	**2. Operational Period (Date / Time)** From: To: Time of Report	**INCIDENT STATUS SUMMARY ICS 209 PSMFC RRT**

3. Type of Incident

☐	Oil Spill	☐	HAZMAT	☐	
☐	Marine Disaster	☐	SI/Terrorism	☐	
☐	Civil Disturbance	☐	Natural Disaster	☐	
☐	Planned Event	x	ANS Discovery		

4. Situation Summary as of Time of Report:

5. Future Outlook/Goals/Needs/Issues:

6. Status Summary

	Since Last Report	Adjustments To Previous Op Period	Total
Mussel Finds			
Zebra Mussel Confirmation			
Vessels Involved			
Facilities Involved			
Responder Injuries			

7. Property Damage Summary

Vessel	$ Unknown
Cargo	$ Unknown
Facility	$ Unknown
Other	$ Unknown

8. Attachments with clarifying information

☐	Costs	☐		☐	
☐		☐		☐	
☐		☐		☐	

9. Equipment Resources

Kind	Notes	# Ordered	# Available	# Assigned	# Out of Service

10. Personnel Resources

Agency	**Total # of People**
WDFW	
WA-SCS	
USCG	
USFW	
PSMFC	
State	
Local	
Contractors	
Other	
Total Personnel Resources Used From all Organizations:	

11. Prepared by:	**Date/Time Prepared:**

CHECK-IN LIST	1. INCIDENT NAME	2. CHECK-IN LOCATION	3. DATE/TIME

CHECK-IN INFORMATION

4. LIST PERSONNEL (OVERHEAD) BY AGENCY NAME – OR LIST EQUIPEMENT BY THE FOLLOWING FORMAT:
S=Supplies H=Helicopter
O=Overhead VL=Vessels
E=Equipment C=Crew
A=Aircraft VH=Vehicle

AGENCY	RESOURCE IDENTIFIER	KIND	5. ORDER/ NUMBER	6. DATE/TIME CHECK-IN	7. LEADER'S NAME	8. TOTAL NO. PERSONNEL	9. INCIDENT CONTACT INFORMATION	10. INCIDENT LODGING INFO/CONTACT INFO	11. HOME UNIT	12. METHOD OF TRAVEL	13. INCIDENT ASSIGNMENT	14. SENT TO RESTAT TIME/INT.

15.

ICS 211-CG PAGE _____ of _____

16. PREPARED BY (Name and Position) USE BACK FOR REMARKS OR COMMENTS

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1. Incident Name	**2. Date and Time of Message**	**GENERAL MESSAGE ICS 213 PSMFC RRT**
3. TO:	ICS Position	
4. FROM:	ICS Position	
5. Subject:		
6. Message		
7 Reply		
8. Signature/Position (person replying)	**Date/Time of reply**	
GENERAL MESSAGE		ICS 213 PSMFC RRT

1. Incident Name	**2. Operational Period (Date/Time)** From: To:	**UNIT LOG** **ICS 214** **PSMFC RRT**
3. Unit Name/Designators	**4. Unit Leader (Name and ICS Position)**	

5. Personnel Assigned

NAME	ICS POSITION	HOME BASE

6. Activity Log (Continue on Reverse)

TIME	MAJOR EVENTS

7. Prepared by: **Date/Time**

UNIT LOG ICS 214 PSMFC RRT

1. Incident Name	2. Operational Period (Date/Time) From: To:	**UNIT LOG (CONT.)** **ICS 214** **PSMFC RRT**

6. Activity Log (Continue on Reverse)

TIME	MAJOR EVENTS

7. Prepared by: **Date/Time**

1. Incident Name	2. Operational Period (Date/Time) From: To:	DAILY MEETING SCHEDULE ICS 230 PSMFC RRT

3. Meeting Schedule (Commonly-held meetings are included)

Date/ Time	Meeting Name	Purpose	Attendees	Location
	Tactics Meeting	Develop primary and alternate Strategies to meet Incident Objectives for the next Operational Period.	PSC, OPS, LSC, EUL, RUL & SUL	
	Planning Meeting	Review status and finalize strategies and assignments to meet Incident Objectives for the next Operational Period.	Determined by the IC/UC	
	Operations Briefing	Present IAP and assignments to the Supervisors / Leaders for the next Operational Period.	IC/UC, Command Staff, General Staff, Branch Directors, Div. Sups., Task Force/Strike Team Leaders and Unit Leaders	
	Unified Command Objectives Meeting	Review/ identify objectives for the next operational period.	Unified Command members	

4. Prepared by: (Situation Unit Leader) **Date/Time**

DAILY MEETING SCHEDULE ICS 230 PSMFC RRT

1. Incident Name	2. Operational Period (Date/Time) From: To:	**RESOURCES AT RISK SUMMARY** **ICS 232 PSMFC RRT**

3. Environmentally-Sensitive Areas and Wildlife Issues

Site #	Priority	Site Name and/or Physical Location	Site Issues

Narrative

4. Archaeo-cultural and Socio-economic Issues

Site #	Priority	Site Name and/or Physical Location	Site Issues

Narrative

5. Prepared by: (Environmental Unit Leader) **Date/Time**

1. Incident Name		**OPEN ACTION TRACKING**			ICS 233 PSMFC RRT		
2. No.	3. Item	4. For	5. Status	6. Start Date	7. Briefed	8. Target Date	9. Actual Date
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32							

		WORK ANALYSIS MATRIX ICS 234-PSMFC RRT
1. Operation's Objectives DESIRED OUTCOME	2. Optional Strategies HOW	3. Tactics/Work Assignments WHO, WHAT, WHERE, WHEN

TECHNICAL SPECIALIST REPORT ICS-234a PSMFC RRT	1. Incident	2. Date/Time
3. Situation Assessment		
4. Hazard Analysis		
5. Mitigation Strategies		

6. Weather			
Page 1 of _____		Technical Specialist (Signature)	
Recommended Yes	Recommended No	Strategic/Tactical Option	Analysis

Page _____ of _____		Technical Specialist (Signature)	

	Technical Specialist Analysis ICS-234b PSMFC RRT
Tactical Options (From ICS-234)	**Analysis**
1.	**Recommended/Not Recommended**. (Explain)
2.	**Recommended/Not Recommended**. (Explain)
3.	**Recommended/Not Recommended**. (Explain)
4.	**Recommended/Not Recommended.** (Explain)
5.	**Recommended/Not Recommended.** (Explain)
	ICS-234b PSMFC RRT

1. Sighting Report	**2. Report Date / Time** Date Time of Report	**3. Reported by: (Name and Agency)**

4. Type of Sighting			
☐ Zebra Mussel	☐ Other		
☐ Quagga Mussel	☐ Other		
☐ Chinese Mussel	☐ Other		
☐ Unknown	☐ Other		

5. Site Description: (Affected water body, landmarks, mile marker, GPS)

6. Mussel Colony Description: (Number, density and extent)

7. Incident Summary

	Initial Report	Update Report	Total
Size of Find			

8. Facilities involved	
Vessels	
Docks/Piers/Moorings	
Natural Barriers	
Other	

9. Attachments with clarifying information			
☐ Photographs	☐ Lab Results		
☐ Maps/Charts	☐ Narrative		
☐ Sample	☐		

10.	**Narrative:**

11. Prepared by: **Date/Time:**

APPENDIX I:

GLOSSARY

Appendix I: Glossary

Aquatic Nuisance Species (ANS): Also called "aquatic invasive species (AIS)" are aquatic organisms that have been introduced into new ecosystems and cause harmful impacts on the natural resources in these ecosystems and the human use of these resources.

Aquatic Nuisance Species Task Force: An intergovernmental organization dedicated to preventing and controlling aquatic nuisance species, and implementing the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990. (Go to http://www.anstaskforce.gov/default.php).

Bivalve: A type of mollusk with two hinged shells (e.g., clams and mussels)

Columbia River Basin: The entire region, including watersheds in Canada, which drains into the Columbia River.

Columbia River Basin (CRB) Team of the 100th Meridian Initiative: The Columbia River Basin Team has been established as part of the 100th Meridian Initiative to address the special needs of the Columbia River Basin. The CRB Team includes state, federal, Tribal, and university ANS managers and researchers. (http://100thmeridian.org/ColumbiaRT.asp)

Coordination and Support Staff: Provide technical, scientific, and logistical support to the MAC Group, the Interagency Rapid Response Team, and local affected agencies/entities, including positive confirmation of extent and scope of the zebra mussel infestation. The Coordination and Support Staff are made up of subject matter experts activated in response to the specific needs of the reported infestation, and assist in identifying appropriate containment, control, and eradication efforts.

Multiagency Coordination (MAC) Group: A group of interagency representatives with decision making authority for their agencies that coordinates the overall management policy for a response, and may be convened at the national level, the geographic area level (e.g. Columbia River Basin), and/or at the local or zone level.

CRB Notification Coordinator: A designated staff member by the MAC that has the authority and responsibility to convene the rest of the CRB MAC Coordination and Support Staff and the standing members of the CRB MAC Group, and to ensure all organizations on the Priority One notification list (see Appendix C) have been notified of the infestation.

Joint Information Center (JIC): A centralized support system comprised of federal, state, and other external communications staff that coordinates development and dissemination of information to the media, public and other interest groups.

Interagency Rapid Response Team (IRRT): Interagency personnel that may be assigned to provide on-scene technical support to the Coordination and Support Staff, the

MAC Group, or incident management support at the request of the impacted jurisdiction/entity and the approval of the MAC Group. Assist in confirming the presence and determining the scope of the infestation, as well as identifying and implementing appropriate containment, control, and eradication efforts. Team members will be selected based on the technical and management needs of the specific infestation.

Druse: Large colonies of young mussels that settle on the older, larger zebra mussels, forming a clump.

Dreissenid: Referring to freshwater mussels in the family Dreissenidae, which includes zebra (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis bugensis*).

Epilimnetic Zone: The surface water mass in a lake above the thermocline which is well mixed and therefore of uniform temperature; the surface mixed layer.

Eutrophic: High in nutrients. Water clarity is generally lower in eutrophic water bodies due to high amounts of plant growth, including phytoplankton.

Hazard Analysis and Critical Control Point (HACCP): An internationally recognized planning tool that identifies potential introduction pathways of unwanted hazards and facilitates development of associated preventative measures.

Hypolimnetic Zone: The deepwater layer below the thermocline in a stratified lake.

Incident Command System (ICS): A systematic tool used for the command, control, and coordination of emergency response. ICS allows agencies to work together using common terminology and operating procedures to control personnel, facilities, equipment, and communications at a single incident scene. It facilitates a consistent response to any incident by employing a common organizational structure that can be expanded and contracted in a logical manner based on the level of required response.

Larvae: Juvenile form of certain organisms. For dreissenids, also called “veligers.”

Mitigation: Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards. Examples of zebra mussel mitigation measures for industrial systems include chlorination, mechanical cleaning, and dewatering.

National Incident Management System (NIMS)— A system mandated by Homeland Security Presidential Directive 5 that provides a consistent nationwide approach for governments, the private sector, and non-governmental organizations, to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity.

Oligotrophic: Low in nutrients. Oligotrophic water bodies have relatively few plants and algae, and tend to be very clear.

100th Meridian Initiative: A cooperative effort between state, provincial, and federal agencies and other partners to 1) prevent the spread of zebra mussels and other aquatic nuisance species (ANS) into the western United States and 2) monitor and control zebra mussels and other ANS if detected in these areas. (http://www.100thmeridian.org/).

Pathway: The means by which a species are transported into a geographical region or into an ecosystem. For example, recreational watercraft are one of the pathways by which zebra and quagga mussels have spread across the country.

Polymerase Chain Reaction (PCR): A method for creating millions of copies of a particular segment of DNA. If a scientist needs to detect the presence of a very small amount of a particular DNA sequence, PCR can be used to amplify the amount of that sequence until there are enough copies available to be detected. This technique has successfully been used in monitoring for zebra and quagga mussels.

Priority 1 Notifications: Agency staff indentified in this Plan (see Appendix C: Notification Lists/Procedures) that are the first to be contacted by the CRB Notification Coordinator in the event of a reported zebra mussel infestation.

Quagga Mussel (*Dreissena rostriformis bugensis*): A small freshwater bivalve mollusk that resembles the zebra mussel, but is rounder, with shells that appear asymmetrical when viewed from the front or ventral side.

Rapid Response: Immediate actions taken to contain a recently discovered invasive species before a final determination has been made that further containment or eradication is no longer feasible or warranted.

Smolt: A juvenile salmon or steelhead that has completed rearing in freshwater and migrates into the marine environment. A smolt becomes physiologically capable of balancing salt and water in the estuary and ocean waters. Smolts vary in size and age depending on the species of salmon.

Thermocline: layer within a water body (e.g., a lake) where there is an abrupt change in temperature that separates the warmer surface water from the colder deep water.

Vector: See definition for Pathway.

Veliger: A larval stage of a mollusk (e.g. zebra mussel) characterized by the presence of a velum: the locomotory and feeding organ provided with cilia.

Western Regional Panel (WRP): A regional committee of the national ANS Task Force. Formed by a provision in the National Invasive Species Act of 1996, the WRP is comprised of western region representatives from Federal, State, and local agencies and from private environmental and commercial interests. The goal of the WRP is to protect limited western aquatic resources by preventing the introduction and spread of exotic nuisance species into western marine and freshwater systems though the coordinated management and research activities of state, tribal, federal, commercial, environmental, research entities and other regional panels. (Go to: http://www.fws.gov/answest/index.htm).

Zebra mussel (*Dreissena polymorpha*) -- The zebra mussel is a small freshwater bivalve mollusk with two matching half shells. Its name is derived from the striped pattern on its shell.