

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Invasive Species Management Protocols

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WDFW Invasive Species Management Committee:

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INTRODUCTION

A. Policy Background

Policy 5310, Managing Invasive Species, commits the Department to “adopt and actively maintain science-based protocols for minimizing the risk that field and property management activities will contribute to the spread of invasive species.” The accompanying Procedure established the Invasive Species Management Committee (ISMC), with responsibility for developing and updating these protocols, monitoring their implementation, and ensuring that training needs are met.

B. Adaptive Management

The ISMC relies upon best available science in developing these decontamination protocols. However, the science regarding effectiveness of decontamination protocols (either chemicals or procedures) on the entire suite of undesirable or invasive aquatic organisms remains incomplete. In particular, protocols known to be effective on selected undesirable organisms remain untested or poorly understood on others. Ultimately, science can adaptively fill these gaps. However, where effectiveness of a protocol on a specific undesirable organism is unknown and alternatives for control are lacking, protocol application must be viewed as exploratory and experimental, and control is not guaranteed. The ISMC will keep abreast of scientific developments, as well as monitoring implementation issues, and will adaptively modify these protocols as necessary to ensure they remain science-based, effective and safe.

C. Phase In and Funding Constraints

Policy 5310 stipulated that “Fiscal impacts may be phased in based on available revenue.” Full implementation of these protocols, in terms of purchase of materials and establishing proper decontamination stations, may take several years. However, all staff are expected to comply with these protocols to the extent feasible, within existing budget and staff constraints. Basic techniques of Clean, Drain and Dry can be followed at little or no additional cost to the agency and should be implemented immediately. Much of this is already required by existing statutes prohibiting transport of aquatic plants, noxious weeds or prohibited aquatic animal species.

PART I.

PROTOCOLS FOR FIELD WORK IN TERRESTRIAL AREAS

A. Internal Consultation/Approval

1. When any acquisition, habitat enhancement/restoration, or construction projects are proposed, the Regional Director will be notified to disseminate the information to ensure that staff can review for invasive species management issues.
2. Before conducting field work, determine whether those activities will occur in an area with invasives, and ensure that work plan allows for suitable decontamination and that appropriate decontamination equipment is available.
3. On Department lands, follow the requirements of the local Weed Management Plan located in the Wildlife Area Management Plan specific to that site. Consult with the Wildlife Area Manager or Access Site Manager prior to conducting of field work.
4. On other public lands, determine whether any local requirements exist and comply with those rules.
5. Employ basic weed-free precautions prior to entering the field by ensuring equipment, vehicles and clothing are free of invasives. Regularly check clothing and boots for attached weed seeds, remove them immediately to avoid distributing to new areas. Before exiting the field, visually inspect clothing and vehicles for plant hitchhikers and remove. Carry zip lock bags for this purpose, and dispose of them where they will not get reintroduced into the environment. Thoroughly wash vehicles in a contained area before moving to a new site, paying special attention to the flooring, undercarriage, grill and wheel wells.
6. Ensure that any wildlife translocation or relocation efforts comply with pathogen/disease screening criteria¹.
7. Observe special precautions for field work at bat roosts/caves (for example, where white-nose syndrome may be present) and other special circumstances².

B. Protocols for Purchasing Hay

Hay purchased for wildlife feeding must meet certain nutritional requirements and be available in bale sizes that are compatible with agency feeding equipment. To reduce the risk of introducing weeds through hay, the following procedure should be followed:

1. Feed certified weed-free hay when available with a target of using 50% weed-free hay for wildlife feeding operations by 2017. In addition, *weed-free* hay should be free of other weeds that are not currently listed as “noxious weeds” but pose a threat to agency lands (e.g. *Ventenata dubia*, cheatgrass, etc.).
2. Hay that is not certified weed-free must include bid and contract language addressing noxious weeds/unwanted plants. Bales, or hay fields that do not

¹ Contact Kristin Mansfield (WDFW Veterinarian) 509-892-1001 Ext 326, Kristin.Mansfield@dfw.wa.gov.

² Decontamination protocols for white nose syndrome available at: <http://www.fws.gov/WhiteNoseSyndrome/Research.html>

meet the standards will be cause for terminating the contract and rejecting the hay.

3. Feeding of wildlife will occur in established feed sites to reduce the potential spread of weeds to wild lands. These feed sites will be surveyed and treated annually for new weeds.

C. Protocols for Purchasing Seeds and Rootstock for Revegetation

The agency purchases seeds and rootstock to implement restoration/enhancement, plant forage crops and as an element of construction projects. Eliminating noxious weeds seeds and propagules in vegetation purchased by the agency will help reduce the potential for infestations on agency and adjacent lands. Revegetation plantings will be consistent with ecological integrity goals and objectives identified for the site. To accomplish this, the following procedure should be followed:

1. Purchase native plant seeds and rootstock adapted to the project area, when appropriate.
2. Ensure that the bid and contract language for seeds and rootstock meet quality standards for noxious weeds/unwanted plants; pathogens; or disease. Request appropriate certification documentation when applicable.
3. Restoration/enhancement and agricultural fields must be revisited and treated for weeds.
4. Refer to the *WDFW Restoration Manual* (currently in draft), *Landscaping for Wildlife in the Pacific Northwest*, and *PNW Weed Management Handbook* for information regarding planting and weed control.

PART II. PROTOCOLS FOR FIELD WORK ON ALL WATERS

A. Geographic Management Areas

Freshwater Ecosystems – Management areas are based on Watershed Resource Inventory Area (WRIA) boundaries as follows:

Level 1 Decontamination protocols are required whenever moving from one waterbody to another, regardless if in the same WRIA.

Level 2 Decontamination is required whenever:

- Moving across WRIA boundaries, or
- When leaving known infested waters, or
- Before entering protected or highly sensitive sites, or
- When moving between still-water habitats (lakes, marshes or ponds) that have no surface water connection to streams or other aquatic habitats.

Each region is responsible for reviewing the WRIA boundaries, and determining whether additional delineation to the sub-basin level is necessary: either to contain known infestations or to protect vulnerable ecosystems or native populations. Maps delineating WRIA boundaries are available on the WDFW website image gallery³ or on the SalmonScape website⁴. Sub-basin boundaries will be available on maps on the agency intranet.

Marine and Estuarine Ecosystems - Level 1 Decontamination is required whenever moving from one waterbody to another, regardless if in the same WDFW marine area. See Special Protocols section for moored boats and other typically stationary large aquatic equipment. Level 2 Decontamination is required whenever equipment or vessels are transported between:

- Major oceanographic basins (Outer coast and Strait of Juan de Fuca, Georgia/Haro Strait, Hood Canal, South Puget Sound, and North/Central Puget Sound), or
- When moving from known infested waters (eg., based on local knowledge, as available on the agency AIS website, or other sources), or
- Before entering protected or highly sensitive areas.

B. Decontamination Protocols – General Precautions

In General - All staff are encouraged to apply basic precautionary principles to control invasive species including:

³ <http://wdfw.wa.gov/gallery/index.php/Maps/album28>

⁴ <http://fortress.wa.gov/dfw/gispublic/apps/salmonscape/default.htm>

1. Prevent/Minimize - Field staff should be aware of infestations in their management areas and assess whether in-water work is necessary. If in-water work is unavoidable:
 - Arrange sampling plans to progress from the least to the most likely to be contaminated areas within a waterbody.
 - Sample from upstream to downstream in a watershed or from areas of less weed growth to dense weed growth.
 - Minimize wading and avoid running boats into sediment.
 - Consider using bank sampling poles instead of wading.
 - Consider purchase of wading gear and boots with the fewest places for organisms and debris to become attached. Best are one-piece systems with full rubber material and open cleat soles. Riskiest are the multi-piece wading systems with fabrics, detachable boots and felt soles. Mud/rock guards are recommended for all stocking-foot wades to minimize contamination on inside surfaces.
 - Reduce the amount of plants, sediment, or organisms that are removed from the water into boats or sampling gear.
 - Get in the habit of regularly inspecting and cleaning gear while working.
2. Dedicated equipment - When working in infested water bodies, field staff should maintain unique sets of dedicated equipment and clothing such as waders, nets, and other sampling tools to prevent the transfer of AIS to uncontaminated areas. Dedicated equipment does not need to be cleaned or decontaminated after each use if labeled and kept isolated from other equipment to avoid cross-contamination. Dedicated equipment must be decontaminated prior to use in another water body.

C. Level 1 Decontamination Protocol - Basic

In General - The basic steps in decontamination for all types of gear and equipment in all situations are Clean, Drain, and Rinse. Immediately upon leaving a water body, clean off any attached sediment, organisms or debris from surface areas that were in contact with the water, the bottom or the wetted perimeter. You can use local water source to help remove heavy deposits. Drain any water back into the water body from which it came. Rinse all surface areas with potable water. Equipment that comes into contact with a water body must also be decontaminated including stadia rods, measuring tapes, backpack shockers, temperature loggers, etc.

Level 1 Decontamination Equipment - The basic Level 1 Decontamination cleaning equipment is a sturdy bristle brush, a boot pick, and potable rinse water. After exiting the water, remove debris from waders/boots and raingear. Clean thoroughly, especially the often complex gripping soles that tend to gather material. When decontaminating multi-piece gear, it is critical to remove attachments and boots to allow for full cleaning coverage. Once all debris has been removed, rinse off equipment with potable rinse water. Rinse water can be kept in a 3-5 gallon (10.5-17.5 L) water tank in your field vehicle (e.g., water cooler, pressurized tank sprayer; solar shower).

Level 1 Decontamination that is conducted immediately after leaving the water does not require any further containment of rinse liquids or removed debris. If the Level 1 procedures cannot be done in the field, gear must be placed in a plastic bag or tote for transportation to a proper decontamination station.

Note on Scrub Brush: Once you have completed a Level 1 Decontamination on field gear, clean and rinse the brush as well. If conducting a Level 2 Decontamination, make sure you include the brush at the end.

D. Level 2 Decontamination Protocol - High Risk Situations

In General - Level 2 Decontamination treatments are designed to kill/eradicate invasive species. Level 1 Decontamination protocols must be conducted prior to starting Level 2 protocols to ensure the effectiveness of the Level 2 treatments. The use of physical and chemical treatments for Level 2 Decontamination is based on best available science and best professional judgment. Criteria for each treatment are applicable to gear or equipment types as noted. Protocols for each treatment are footnoted to identify the scientific literature the method follows and the species of organisms for which it was tested.

Field gear must be decontaminated every day (excluding gear used solely in one water body or sub-basin, which is a recommended approach for minimizing risk of transmission). When decontaminating multi-piece gear, it is critical to remove attachments and boots to allow for full exposure to all potentially contaminated surfaces. Chemical agents or physical treatments must maintain contact with the entire surface for the duration of the treatment to be effective. Exposure times start when equipment is fully saturated or reaches appropriate temperatures. Safety glasses and waterproof gloves are required for all treatments except freezing.

Virkon[®] Aquatic Solution Treatment - This is the Level 2 Decontamination **Agency-Preferred Method** for most gear and species:

- Decontamination for bacteria and viruses (micro-organisms) requires soaking gear thoroughly with 1% solution so that it is completely saturated for a minimum of 10 minutes⁵.
- Decontamination for larger aquatic organisms such as New Zealand Mudsnails and zebra/quagga mussels requires soaking gear thoroughly with 2% solution so that it is completely saturated for a minimum of 20 minutes⁶.
- Rinse thoroughly in a contained area and dispose of rinse water down a sewage drain, not a storm drain.

⁵ Criteria based on Johnson et al. 2003 (Chytrid fungus), VESO 1991, Frerichs 1990, Hellstrom and Johansson 1990, Bennett 1997, and Rainnie 2002 on multiple fish bacteria and viruses – NOT tested on whirling disease.

⁶ Stockton 2011 for eradicating New Zealand mudsnails and quagga mussels in fish hatcheries.

Note on Mixing and Use of Virkon® Aquatic - Must be mixed in a well-ventilated area, preferably outdoors. A splash apron, gloves and safety goggles must be used. The powder should be mixed with clean water according to the dilution instructions for a 1% or 2% solution. Do not apply the powder directly on the surface you are trying to disinfect. Mix the solution in a clean container of known volume. Measure the correct amount according to the dilution table (1 quart, 1 gallon, 10 gallons or 50 gallons). Refer to the Virkon® Aquatic instructions and MSDS sheets for further information.

Information can also be obtained by going to:

<http://www.wchemical.com/VIRKON-AQUATIC-P44C11.aspx>

Virkon® Aquatic solutions can last up to seven days or more and will need to be checked regularly. Test strips can be purchased to test your solution. Not known to damage gear or equipment materials. Wear protective gear, eye protection and gloves, when using.

Hot Water Treatment⁷ – Hot water treatment can be by soaking or applying with a hot water pressure washer. A hot water pressure washer capable of 140°F (60°C) is currently available at every regional office. Note: 140°F (60°C) and higher temperatures cannot be achieved using most hot water heaters that are installed for domestic uses, which should be kept at 120°F to avoid burns.

- Hard non-porous surfaces require constant exposure for a minimum of 140°F (60°C) at a minimum of fifteen (15) seconds.
- Porous materials and gear with multiple folds/cavities require constant exposure at a minimum of 140°F (60°C) for a minimum five minutes or at 120°F (49°C) for a minimum of 30 minutes.
- If whirling disease is a possibility, you must use at a minimum of 167°F (75°C) for a minimum of five minutes.

CAUTION: These temperatures can burn exposed skin. Do not use this method for Gortex or other materials cannot hold up to high temperatures.

Freezing Treatment⁸ - Expose gear to 14°F (-10°C) or colder for a minimum of 8 hours or 15°F to 32°F (-9°C to 0°C) for 24 hours. If gear has been used in marine or estuary situations, rinse thoroughly in freshwater before freezing. Do not use for whirling disease or fish virus decontamination.

⁷ Maximum temperatures based on Johnson et al. 2003 under laboratory conditions for Chytrid fungus. Supports other decontamination studies for juvenile and adult New Zealand Mudsnaills, zebra and quagga mussels, and Didymo species by Medhurst 2003, Morse 2009, and USFS Fire Guidance 2008 respectively. Whirling disease criteria from Wagner et al. 2003.

⁸ Minimum temperatures based on Bergendorf 2004 for adult New Zealand Mudsnaills and Kilroy et al. 2006 for Didymo. Using conservative criteria as literature studies show high variability in effectiveness. Effectiveness of freezing for whirling disease questioned by Hedrick et al. 2008 as may not completely inactivate cells.

Formula 409® Solution Treatment⁹ – Must use anti-bacterial version. Expose gear thoroughly to 100% solution for a minimum of 10 minutes. Rinse thoroughly in a contained area. Rinse water must be disposed of down a sewage drain, not a storm drain.

E. Special Protocols

Felt Sole Waders/Boots - Felt soles are one of the largest risk factors for transmission of invasive species since they are extremely difficult to decontaminate fully. Consequently, WDFW policy is that all alternatives should be explored before deciding to use felt soles. The primary challenge with decontaminating felt soles is the porosity and depth of the material making it very difficult for treatments to effectively decontaminate throughout the porous matrix. For this reason, chemical decontamination treatments are inadequate for this protocol and exposure times for hot water must be sufficient to ensure that target temperatures are attained throughout the porous matrix. Some manufacturing companies are also phasing out felt-sole boots from their lines and offering rubber sole/cleat combinations in their place.

Felt sole waders/boots may only be used under the following conditions:

1. With the approval of the Program AD, based on their determination that no other suitable alternatives exist.
2. The **Agency Preferred Method** is that staff use dedicated felt sole waders/boots within an area of known infested waters not to exceed a single WRIA. A Level 1 Decontamination must still be conducted between uses.
3. If felt sole waders/boots must be used between different known infested waters within the same WRIA or between different WRIAs, a Level 2 Decontamination must be conducted using one of the following treatments¹⁰ (NOT suitable for Whirling Disease or fish viruses):
 - Hot water treatment¹¹ using standard soaking in constant 120°F (49°C) for a minimum of 30 minutes protocol; or
 - Freezing treatment using standard protocols.

Wading “Wet” - Any gear or clothing that gets wet from a water body are potential vectors for spreading invasive species. Crews that prefer not to wear regular wading

⁹ Criteria based on Schisler et al. 2008 on adult New Zealand Mudsnaills only. No data on effectiveness for other species.

¹⁰ Based on Kilroy et al 2006. Studies on the survivability of the invasive diatom *Didymosphenia geminata* under a range of environmental and chemical conditions. NIWA Client Report CHC2006-116. For Biosecurity New Zealand. 110p. Revised May 2007. <http://www.biosecurity.govt.nz/pests/didymo/cleaning>

¹¹ Unsure of effects of higher temperatures on glue used to adhere felt to boot, but if $\geq 140^\circ\text{F}$ (60°C) treatment applied, must be for a minimum of 10 minutes (best professional judgment) to allow full penetration.

gear must launder their clothing for decontamination.

Boats and Other Large Aquatic Conveyances Transported Overland - State law requires that boats and other trailered equipment used in an aquatic environment should be free of aquatic animals and plants whenever removed from a water body in order to avoid transport of invasive species to a new water body¹².

When removing or before transporting boats and other large aquatic equipment:

1. Conduct a Level 1 Decontamination. This is required every time you remove the boat from a body of water. No exceptions. Thoroughly inspect both the equipment and trailer for attached or loose organisms such as weeds, algae, barnacles, mussels, snails, etc. A hand mirror and flashlight are important tools to help you see into otherwise hard to reach areas. Scrape or otherwise remove all organisms and put into a secure trash receptacle for upland disposal.
2. Pull drain plug at the boat ramp. Drain all water in bilges and live wells that could hold water from the site and rinse with tap water. Reinsert the drain plug unless you have a good system for remembering before re-launching!
3. If Level 2 Decontamination is indicated, using a self-service commercial car wash with hand operated pressure wands, pressure wash boat and trailer inside (deck or internal areas that get contaminated with aquatic debris) and out. Make sure you wash out raw water storage areas, get behind and under trim tabs, engine mounts and raw water intake ports. Use the hot water and soap setting. OR;
4. Use a department hot water pressure washer to apply constant exposure at a minimum of 140°F (60°C) for a minimum of fifteen (15) seconds on hard/non-porous surfaces; and
5. Flush engine cooling system with fresh tap water at 140°F (60°C) for a minimum of 5 minutes, or at ambient temperature for 10 minutes – no chemicals, if hot water is not available.
6. Cross-Rinsing Not Allowed. Taking a boat or equipment from a marine environment into a freshwater environment or from a freshwater to a marine environment without decontaminating does not meet decontamination requirements and is not allowed.

Moored boats and other typically stationary large aquatic equipment - Boats and other large aquatic equipment shall not be transported on the water between different WRIs on larger rivers or lakes, or major oceanographic basins (described above) until a thorough inspection ensures that no aquatic organisms are attached to the hulls, docks, nets, or other submerged equipment being moved. Boats that travel between different ecological regions frequently must have their hulls, running gear, and other niche areas (water intakes, prop shaft, trim tabs, etc.) cleaned using the protocols above on at least a quarterly basis or more often during high growth periods.

¹² RCW 77.15.253 and 77.15.290

As with boots, nets and other gear, dedicating boats to a body of water is a desirable approach. However, even boats that remain in a single body of water should be checked quarterly as described above to minimize hull fouling.

Nets - When possible use water-body specific nets and gear. If this is not possible, nets must be decontaminated before use in a new area. If possible, before leaving the sampling area, hang or stretch the net, and use a pressure washer and hand-picking to remove excess mud, debris and plant matter. If field decontamination is not possible or effective, upon return to the office, or before deploying at another sampling location in a different water body, follow the decontamination guidelines for waders/boots above and either hang the nets to allow clear access to all parts, or soak it in a large tub that allows the solution to fully penetrate the material before starting minimum exposure time.

Vehicles - Determine which vehicles will be used in bodies of water (i.e., hatchery trucks that have to back down into the water to off load fish). Also determine which vehicles will be moving in between established geographic sampling areas. Follow protocols for aquatic conveyances transported overland, including determination whether a Level 1 or 2 Decontamination is indicated.

Fish Tankers - It is vital that fish transfer tanks be disinfected when used between watersheds. Liquid chlorine bleach, which is available in several concentrations, is the preferred disinfectant for this use. Chlorine in solid form is also an effective disinfectant, but is difficult to dissolve completely and has high human health risks, and therefore not recommended. To properly disinfect tankers, use the following protocol.

1. Fill the tanker approximately half full with water at the shipping station. Add enough liquid chlorine bleach to achieve a 20-ppm active ingredient solution (30 ppm if water is noticeably dirty or discolored), Table 1.
2. Recirculate this solution for at least 10 minutes in the tanker and fish pump so that all surfaces are wetted.
3. Following recirculation add the appropriate amount of sodium thiosulfate, (Table 1.) to the tanker and circulate another 10 minutes to neutralize the chlorine and make it safe to discharge.
4. As a precaution, prior to discharge, check the water in the tanker with a test kit to make sure the chlorine is COMPLETELY neutralized.
5. Empty the tank where the discharged water will not contact fish.
6. Rinse thoroughly and refill with clean uncontaminated water for fish hauling.

Table 1. Chemical quantities required for tanker disinfection.

TANKER SIZE IN GALLONS	AMOUNT OF WATER	AMOUNT OF 12% BLEACH FOR 20 PPM	AMOUNT OF 12% BLEACH FOR 30 PPM	POUNDS OF SODIUM THIOSULFATE TO NEUTRALIZE 20 PPM¹ / 30 PPM
6000	3000 gal.	1811 ml	2717 ml	3.8 / 5.7
2500	1250 gal.	764 ml	1160 ml	1.6 / 2.4
1800	900 gal.	566 ml	849 ml	1.1 / 1.7
1000	500 gal.	311 ml	481 ml	0.6 / 0.9

¹ 5.6 grams sodium thiosulfate per 10 gallons of 20-ppm chlorine.

Heavy Equipment when used in water - To be added later.

Stream Restoration Guidelines - To be added later.

Diving Equipment - To be added later.