

Appendix A
Treatments to Remove or Render Aquatic Invasive Species Non-viable
 August 14, 2012 Draft

Species	Removal Methods	Drying Period	Wash Temp and Duration	Other Treatments
Aquatic Plants:				
Brazilian waterweed / elodea	<ul style="list-style-type: none"> • Hand pick plant fragments from equipment • Power spray specific equipment after hand removal if needed 	Unknown	Unknown	<ul style="list-style-type: none"> • Filter to 500 microns (Rendall pers. comm.)
Curly-leaf pondweed	<ul style="list-style-type: none"> • Hand pick plant fragments from equipment • Power spray specific equipment after hand removal if needed 	<ul style="list-style-type: none"> • Unknown for turions (Crowell) 	<ul style="list-style-type: none"> • Unknown for turions (Crowell) 	<ul style="list-style-type: none"> • Freeze in air for 1 week will kill turions (Crowell)
Eurasian watermilfoil	<ul style="list-style-type: none"> • Hand pick plant fragments from equipment • Power spray specific equipment after hand removal if needed 	<ul style="list-style-type: none"> • 13 hours in lab, but was only 98% effective. (Evans, Kelting, Forrest, and Steblen. <i>J. Aquat. Plant Manage.</i> 49: 2011.) 	<ul style="list-style-type: none"> • >140 F (60 C) (U of Minnesota - Blumer et al 2009) 	<ul style="list-style-type: none"> • Freeze in air for 2 days (need reference) • Filter to 500 microns (Welling, Rendall pers. comm.)
Flowering rush	<ul style="list-style-type: none"> • Hand pick plant parts from equipment • Power spray specific equipment after hand removal if needed, especially to remove mud and seeds 	Unknown	Unknown	Unknown
Purple loosestrife	<ul style="list-style-type: none"> • Hand pick plant parts from equipment • Power spray specific equipment after hand removal if needed, especially to remove mud and seeds 	None	None	None

Aquatic Animals:	Removal Methods	Drying Period	Wash Temp and Duration	Other Treatments
Faucet snail	<ul style="list-style-type: none"> Power spray or hand scrape to remove 	<ul style="list-style-type: none"> Over 2 weeks (Montz, MNDNR per Rebecca??) 	<ul style="list-style-type: none"> 122 F (50 C)/ 1 min+ (Mitchell and Cole) 	<ul style="list-style-type: none"> 24-h exposure to Hydrothol 191 at a concentration of at least 20 mg/L (Mitchell and Cole)
New Zealand mudsnail	<ul style="list-style-type: none"> Power spray to remove 	<ul style="list-style-type: none"> Dry 4 days (other treatments are preferred) (Montz) 	<ul style="list-style-type: none"> 120 F (49 C)/ 1 min (info card from MT) 	<ul style="list-style-type: none"> Freeze in air for 2-4 hours (Montz)
Spiny waterflea	<ul style="list-style-type: none"> Power spray to remove 	<ul style="list-style-type: none"> 12 hours minimum and 24 hours preferred (Branstrator, U of Minnesota - Duluth) 	<ul style="list-style-type: none"> soak for 10 minutes in hot (120-130 F degree) water (Montz pers comm. – get reference) 	<ul style="list-style-type: none"> Filter to 250 microns or less to remove resting eggs from water (Montz)
Quagga mussels	<ul style="list-style-type: none"> Power spray to remove Scraping may be necessary if objects were in the water for extended periods 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> 140 F / 5 seconds 160 F / 5 seconds (Morse, University of Texas at Arlington) 	<ul style="list-style-type: none">
Zebra mussels	<ul style="list-style-type: none"> Power spray to remove Scraping may be necessary if objects were in the water for extended periods 	<ul style="list-style-type: none"> Dry 3 days in temperatures over 65 F Drying is NOT recommended in cool wet weather (<64 F) 	<ul style="list-style-type: none"> 104 F/ 4 min (hotter temps result in better and shorter kill times) (Montz) 120 F/ 2 min ? (sources) 140 F/10 seconds 160 F / 5 seconds (Morse, University of Texas at Arlington) 	<ul style="list-style-type: none"> Freeze for 2 days Filter to 40 microns or less to remove veligers from water
Pathogens:	Removal Methods	Drying Period	Wash Temp and Duration	Other Treatments
LMBV	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> True steam cleaning (212 °F) will inactivate rhabdoviruses within seconds. This may be an option when chemical disinfection is difficult. 	<ul style="list-style-type: none">
VHS	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> VHS - 12 hours / 4 to 6 	<ul style="list-style-type: none"> True steam cleaning 	<ul style="list-style-type: none"> see disinfection table

		in the sun (Shen pers comm.?)	(212 °F) will inactivate rhabdoviruses within seconds. This may be an option when chemical disinfection is difficult. Where did the 140 F come from? MI – calls for a 15 minute exposure at this temp	below
Heterosporis	•	• Heterosporis – drying is effective (no time found)	•	•

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Fish Pathogen Disinfectants and their Properties

When mixing any of these chemicals, wear eye protection, gloves, and a dust mask if it is a powder. (Concentrations and effective times may change with additional discussion.)

Chemical	Concentration	Contact Time	Safety precautions
Chlorine	200 ppm 1000 ppm	10 min 30 sec – 1 min.	Wear eye protection, rain gear, gloves if spraying. Stay upwind of the spray. Will break down in sunlight and when in contact with organic material. Is corrosive to metal and rubber. Is toxic to fish at these concentrations so rinse well after disinfection or neutralize with sodium thiosulfate*.
Virkon Aquatic	1:100 10,000 ppm 1:200 5,000 ppm	On contact to 1 min 10 minutes	This is a new disinfectant in the peroxygen (hydrogen peroxide) family. It is a powder. It is 99.9% biodegradable and breaks down to water and oxygen. It is not corrosive at the working dilution. Wear eye protection, rain gear and gloves if spraying. Stay upwind of spray.
3.5% Free Iodine	1:20,000 or 50 ppm	30 sec. to 1 min.	Wear eye protection and rubber gloves when handling the concentrate. Wash with soap and water if concentrate gets onto skin. If concentrate gets into eyes, flush with plenty of water and call a physician. This stable, non-flammable liquid is 100% soluble in water and requires no special respiratory protection other than normal ventilation. Very safe product to use.
Quaternary Ammonia	1:833 or 1200 ppm	30 sec. to 1 min.	Wear eye protection and rubber gloves when handling the concentrate. Wash with soap and water if concentrate gets onto skin. If concentrate gets into eyes, flush with plenty of water and call a physician. This is a stable compound readily soluble in water. Vapors of ethanol can be flammable. Product residue can ignite explosively. Prior to use, eliminate ignition sources. Following use, rinse with water. Wear a respirator when normal ventilation is unsatisfactory.

* For neutralizing chlorine or iodine, spray sodium thiosulfate in an 800-ppm solution (3 grams per gallon of water) on all surfaces after the disinfection period is over. Rinse with water from the next lake to remove any remaining sodium thiosulfate.

** It is wise to have all four of these disinfectants available for use and to use them rotationally so as to minimize the chances of producing resistant bacteria, viruses and parasites.