APPENDIX D

Aquatic Invasive Species Protocols

AQUATIC INVASIVE SPECIES PREVENTION PROTOCOLS

These protocols for preventing the spread of aquatic invasive species (AIS) are designed to guide the operations of new and existing decant facilities. ROADMAP (the NPDES Regional Operations and Maintenance Program group) developed them with a grant from the Washington State Department of Ecology (Ecology). Many of the protocols apply to all decant facilities while some are intended primarily for facilities that accept stormwater liquids/solids from other municipalities or private haulers. These protocols supplement the set of protocols developed to guide the operations of decant facilities.

These protocols are guidance for both owners and users of decant facilities and are not intended as prescriptive operating requirements.

This document is organized as follows:

First we present background information on aquatic invasive species, identify the priority AIS for decant facilities, and note how AIS recently changed plans to build a regional decant facility in the City of Kirkland. Then we present the protocols in a checklist format using the following elements:

- Basic hauler procedures
- Basic facility procedures
- Considerations for opening use to external entities
- Facility design considerations
- Permit compliance considerations
- Proposed future actions

These decant facility protocols are based on the following sources of information:

- Washington Invasive Species Council website (WISC 2013)
- Washington State Aquatic Nuisance Species Watch List (WSANSC 2008)
- Washington State Noxious Weed Control Board website (NWCB 2013)
- Washington Department of Fish and Wildlife Aquatic Invasive Species website (WDFW 2013) and management protocols (WDFW 2012)
- Washington Department of Ecology Aquatic Plant Monitoring website (Ecology 2013)
- University of Washington Olden Research Group Freshwater Ecology and Conservation Lab website (Olden 2013)
- United States Geological Survey Nonindigenous Aquatic Species website (USGS 2013)

- Telephone interviews with stormwater managers and AIS managers, including Allen Pleus of the Washington Department of Fish and Wildlife

Background

Invasive species are defined by Washington State law as non-native (non-indigenous) organisms that cause economic or environmental harm and are capable of spreading to new areas of the state (RCW 79A.25.310). Invasive species do not include domestic livestock, intentionally planted agronomic crops, or non-harmful (introduced) exotic organisms. Terrestrial and aquatic plants, animals, and microbes may be invasive species. They are not native to Washington, but were brought here by someone or something. Because they are new to this state, there are often no natural predators or pathogens to control their numbers, which can allow them to spread at alarming rates.

Freshwater AIS are of particular concern to stormwater managers because AIS may be present in stormwater systems and spread through improper maintenance activities. Various Washington State agencies are developing AIS prevention protocols for work in surface waters, but have not specifically addressed work in stormwater facilities and conveyance systems. Recent observations of one AIS, the New Zealand mud snail (NZMS) (*Potamopyrgus antipodarum*), prompted the City of Seattle (2012) and other municipalities to develop procedures for controlling the spread of AIS by stormwater management activities.

Aquatic Invasive Species of Concern for Decant Facilities

AIS include a variety of plants, animals, and diseases that pose a serious threat to the biological diversity of surface waters in Washington and the world over. Humans have carried aquatic invasive plants, animals, and diseases with them since they first began to travel. Improvements in shipping and travel technology have dramatically increased the rate of AIS introductions. In the U.S, invasive species cause hundreds of billions of dollars of damage and affect nearly half of the plants and animals listed as threatened or endangered under the Endangered Species Act.

Once AIS become established in a new environment without the natural enemies, pests, or diseases that kept them in check in their native environment, they may spread rapidly and cause unanticipated negative biological and economic impacts. There are numerous examples of the impacts of AIS in both marine and freshwater environments. One of the most well-known species is the zebra mussel (*Dreissena polymorpha*). The zebra mussel has caused extensive economic and ecological damage since arriving in the Great Lakes, and is rapidly spreading throughout North America. The quagga mussel (*Dreissena bugensis*), a sister species, is now present in Lake Mead (NV, AZ) and Lake Havasu (CA), which greatly increases the risk of introduction into Washington State (WDFW 2013).

Freshwater AIS of concern in Washington include 37 plants (Table 1) and 53 animals (Table 2) (WSANSC 2008). Most of the aquatic plants are present in Washington while most of the aquatic animals have not been observed in Washington. It is prohibited by law to possess or transport many of these species including all aquatic plants on the quarantine list (see classification *NWQ* in Table 1) and all aquatic animals on the prohibited list (see status *P* in Table 2).

The Noxious Weed Control Board and Washington Department of Agriculture regulate aquatic plants on the noxious weed list for Washington State (NWCB 2013). The Washington Department of Fish and Wildlife regulates aquatic animals on the aquatic invasive species list for Washington State (WDFW 2013). Invasive species transport permits are issued by each of these agencies.

The Washington Invasive Species Council identified 50 priority invasive species in Washington for immediate action because they pose the greatest threat to the state's environment, economy, and human health (WISC 2013). This list includes 8 aquatic plants and 11 aquatic animals (shown in bold in Tables 1 and 2, respectively).

New Zealand mud snails are of highest priority among the priority AIS for decant facility operations for the following reasons (WDFW 2013) (NZMWG 2007):

- Contamination of equipment containing these snails is easily overlooked because of their small size (less than ¼ inch).
- They reproduce rapidly by cloning (rate of approximately 230/year), and can become very dense (over 100,000/m^2).
- They tolerate a broad range of temperature, salinity, and water quality.
- They can live for 24 hours without water and can survive for up to 50 days on a damp surface by closing their operculum. This facilitates their transfer between water bodies.
- They have no known natural parasites or predators in the United States.
- They are a very poor food source for fish because approximately 80 percent of them pass through a fish gut unharmed. Fish eating these animals lose weight because they are not obtaining nourishment.
- NZMS are currently present at a limited number of locations in the decant study area and other parts of western Washington:
    - Lower Columbia River and tributaries downstream of Kalama (first observed in 2002)
    - Capitol Lake in Olympia (first observed in 2009), which is fed by the Deschutes River and Percival Creek
    - Thornton Creek in Seattle (first observed in 2011)
    - Lake Washington near the mouth of Thornton Creek (first observed in 2011)
    - Kelsey Creek in Bellevue (first observed in 2012)
- They have yet to spread throughout the state.
- They migrate upstream, potentially inhabiting stormwater conveyance systems draining to infested water bodies.

Table 1. Freshwater Aquatic Invasive Plant Species of Concern in Washington			
Common Name	**Scientific Name**	**WA Status[a]**	**Classification [b]**
Priority Species of Concern			
African waterweed	*Lagarosiphon major*	X	NWQ
Brazilian elodea	*Egeria densa*	P/M	NWQ, NWB
Eurasian watermilfoil	*Myriophyllum spicatum*	P/M	NWQ, NWB
European water chestnut	*Trapa natans*	X	NWQ
Golden algae (microscopic)	*Prymnesium parvum*	X	-
Hairy willow herb	*Epilobium hirsutum*	P	NWQ, NWB
Hydrilla	*Hydrilla verticillata*	P/M	NWQ, NWA
Knotweed, Japanese*	*Polygonum cuspidatum*	P/M	NWQ, NWB
Knotweed, Bohemian*	*Polygonum bohemicum*	P/M	NWQ, NWB
Knotweed, giant *	*Polygonum sachalinense*	P/M	NWQ, NWB
Knotweed, Himalayan *	*Polygonum polystachyum*	P/M?	NWQ, NWB
Parrot feather	*Myriophyllum aquaticum*	P/M	NWQ ,NWB
Secondary Species of Concern			
Arrowhead, grass leaved	*Sagittaria graminea*	P/ M	NWQ, NWB
Arrowhead, delta	*Sagittaria platyphylla*	P	NWQ
Bladderwort, swollen	*Utricularia inflata*	P	NWQ
Curly leaf pondweed	*Pomtamogeton crispus*	P	NWC
Didymo “rock snot” algae	*Didymosphenia geminata*	P	-
Eelgrass, freshwater	*Vallisneria gigantea*	P	-
European frogbit	*Hydrocharis morsus-ranae*	P	NWQ
Fanwort	*Cabomba carolinana*	P	NWQ, NWB
Hyacinth, water	*Eichornia crassipes*	X	-
Iris, yellow flag	*Iris pseudacorus*	P/M	NWC
Loosestrife, garden	*Lysimachia vulgaris*	P/M	NWQ, NWB
Loosestrife, purple	*Lythrum salicaria*	P/M	NWQ, NWB
Lovegrass sedge	*Cyperus eragrostis*	P	-
Reed, common	*Phragmites australis* (genotype)	P	NWB
Reed, giant	*Arundo donax*	X	-
Reed, sweetgrass	*Glyceria maxima*	P/M	NWQ, NWA
Ricefield bulrush	*Schoenoplectus mucronatus*	P	NWQ, NWA
Salt cedar	*Tamarix ramosissima*	P/M	NWQ, NWB
Salvinia, giant	*Salvinia molesta*	X	-
Senegal tea	*Gymnocoronis spilanthoides*	X	-
Toxic cyanobacteria (blue-greens)	*Cylindrospermopsis raciborskii*	X	-

Table 1 (continued). Freshwater Aquatic Invasive Plant Species of Concern in Washington			
Common Name	**Scientific Name**	**WA Status[a]**	**Classification [b]**
Flowering rush	*Butomus umbellatus*	X	NWQ, NWA
Variable-leaf milfoil	*Myriophyllum heterophyllum*	P/M	NWQ, NWA
Water primrose, creeping	*Ludwigia peploides*	P/M	NWQ, NWA
Yellow floating heart	*Nymphoides peltata*	P/M	NWQ, NWB

Sources: WSANSC 2008, WISC 2013, and NWCB 2013

Bold names are one of 50 priority invasive species in Washington State according to the Washington Invasive Species Council (WISC 2013)

*Asterisk species are more terrestrial than aquatic, but are included here because they significantly impact aquatic resources in riparian areas

[a] Washington State Status Codes:

P = Known to be present in Washington State

E = Previously established but now believed eradicated in Washington State

M = Currently managed at various state and/or local locations

X = No verified presence in Washington State

[b] Regulatory Classification Codes:

NWA = Class A noxious weed of limited distribution and eradication is required by law

NWB = Class B noxious weed of limited distribution and designated for control in various regions where not yet widespread

NWC = Class C noxious weed of widespread distribution and local control can be enforced if desired

NWQ = Noxious weed on the quarantine list that is prohibited to transport, buy, sell, offer to sell, or distribute

Table 2. Freshwater Aquatic Invasive Animal Species of Concern in Washington			
Common Name	**Scientific Name**	**WA Status[a]**	**Classification [b]**
Priority Species of Concern			
Carp, Asian bighead	*Aristhythes / Hypothalmichthys nobilis*	X	P, LA
Carp, Asian silver	*Hypothalmichthys molitrix*	X	P, LA
Carp, black	*Mylopharyngodon piceus*	X	P, LA?
Carp, grass (diploid)	*Ctenopharyngodon idella*	X	P
Carp, largescale silver	*Hypothalmichthys harmandi*	X	U, LA
Crab, mitten	*Eriocheir sinensis*	X	D, P
Crayfish, northern	*Orconectes virilis*	X	P
Crayfish, red swamp	*Procambarus clarkii*	P	P
Crayfish, rusty	*Orconectes rusticus*	X	P
Mussel, quagga	*Dreissena bugensis*	X	D, P, LA?
Mussel, zebra	*Dreissena polymorpha*	X	D, P, LA
New Zealand mud snail	*Potamopyrgus antipodarum*	P	P
Nutria	*Myocastor coypus*	P/M	P
Snakehead fish	*Channa* spp.	X	P, LA?
Secondary Species of Concern			
Bass, white	*Morone chrysops*	P	U
Bass, striped	*Morone saxatilis*	P	U
Bowfin/grinnel/mudfish	*Amia calva*	X	P
Bullfrog	*Rana catesbeiana*	P	P
Catfish	All of family Ictaluridae	X	U
Catfish, walking	*Clarias batrachus*	X	P
Clam, Asian	*Corbicula fluminea*	P	U
Crayfish, ringed	*Orconectes neglectus*	X	U
Crayfish, blue	*Procambarus alleni*	X	P?
Frog, spadefoot	*Pelobates* sp.	X	P
Frog, brown & green	*Palearctic Rana* sp.	X	P
Goby, amur	*Rhinogobius brunneus*	P	U
Goby, round	*Neogobius melanostomus*	X	P
Ide/silver orfe/golden orfe	*Leuciscus idus*	X	P
Killifish, banded	*Fundulus diphanus*	P	U
Minnow, fathead	*Pimephales promelas*	P	P
Mudpuppies, nonnative	*Necturus and Proteus* spp.	X	P
Mudsnail, eastern	*Ilyanassa obsoleta*	X	U
Mudsnail, Asian	*Batillaria attramentaria*	P	U
Mute swan	*Cygnus olor*	X	D

Table 2 (continued). Freshwater Aquatic Invasive Animal Species of Concern in Washington			
Common Name	**Scientific Name**	**WA Status[a]**	**Classification [b]**
Newts, non-native	See WAC 220-12-090 (1)(a)(xiii)	X	P
Pike, gar	*Lepisosteidae*	X	P
Pike, northern	*Esox lucius*	P	P
Piranha, caribe	*Pygocentrus, Rooseveltia & Serrasalmus* spp.	X	P
Rudd, silver or golden	*Scardinius erythropthalmus*	X	P
Ruffe, Eurasian	*Gymnocephalus cernuus*	X	U
Salamander, non-native	See WAC 220-12-090 (1)(a)(v-xi)	X	P
Snail, Chinese mystery	*Cipangopaludina chinensis*	P	U
Sunfish, red-ear	*Lepomus microlophus*	X	U
Tapeworm, Asian (fish parasite)	*Bothriocephalus acheilognathi*	X	U
Terrapin, diamond back	*Malaclemys terrapin*	P	U
Turtle, red-eared slider	*Trachemys scripta elegans*	P	U
Turtle, Asian pond	*Mauremys* spp.	X	P
Turtle, Chinese pond	*Chinemys* spp.	X	P
Turtle, European pond	*Emys orbicularis*	X	P
Turtle, snapping	*Chelydra serpentine*	X	P
Turtle, soft shell	*Apalone* sp.	X	P
Waterflea, fishhook*	*Cercopagis pengoi*	X	P
Waterflea, spiny *	*Bythotrephes cederstroemi*	X	P

Sources: WSANSC 2008, WISC 2013, and WDFW 2013

Bold names are one of 50 priority invasive species in Washington State according to the Washington Invasive Species Council (WISC 2013)

[a] Washington State Status Codes:

P = Known to be present in Washington State

E = Previously established but now believed eradicated in Washington State

M = Currently managed at various state and/or local locations

X = No verified presence in Washington State

[b] Regulatory Classification Codes:

D = Deleterious exotic wildlife considered dangerous to the environment or wildlife of the state, and may not be possessed, purchased, sold, propagated, transported, or released into state waters with transport exceptions approved by WDFW

P = Prohibited aquatic animal species of high risk that may not be possessed, purchased, sold, propagated, transported, or released into state waters with transport exceptions approved by WDFW

R = Regulated aquatic animal species of moderate risk that may not be released into state waters (WDFW 2013)

LA = Lacey Act (50 CFR 16 pr 18 U.S.C. 42) Injurious Wildlife Species

U = Unlisted aquatic animal species not on Prohibited or Regulated lists but deemed highly threatening

Other priority invasive species for decant facilities include the plant purple loosestrife, and the zebra and quagga mussels. Purple loosestrife seeds can remain viable in sediment for many years. Other priority invasive aquatic plants typically propagate vegetatively (growth of stem, leaf, or root fragments) and are unlikely to survive decant material processing. Zebra and quagga mussels are highly invasive and a major threat to Washington waters, but are currently unlikely to be present in decant materials because they have not been observed in Washington waters. Other invasive animal species are not a priority for decant facilities because they are unlikely to be present in decant materials and/or survive material processing.

Aquatic Invasive Species Prevention Measures

Invasive species management protocols have recently been updated by WDFW (2012) to prevent the spread of AIS in Washington State. These protocols include general precautions and two levels of equipment decontamination. Equipment decontamination procedures are based on effectiveness tests for specific types of organisms reported in scientific literature. Procedures included here specifically apply to NZMS and are considered effective for most if not all other AIS. Additional information about these procedures is available from WDFW (2012).

Basic precautions include:

- After finishing work in an infested waterbody or watershed, decontaminate all equipment that contacted the water or sediment.
- Use equipment dedicated to particular water segments, waterbodies, or watersheds.
- Sequence work in waterbodies from low to high risk areas, such as from upstream to downstream.
- Minimize contact with sediment.
- Avoid using equipment with small spaces that are not easily cleaned, such as felt sole boots.

Level 1 equipment decontamination procedures are required whenever moving from one waterbody to another, even if they are in the same Watershed Resource Inventory Area (WRIA) (WDFW 2012). Level 1 equipment decontamination procedures occur before leaving a waterbody and include:

1. Clean with a brush or power washer to remove all AIS and particulate matter.
2. Drain all water from all parts of equipment to the waterbody.
3. Rinse and inspect all surfaces for the presence of AIS, draining rinse water to the waterbody.
4. If AIS are present, clean and inspect again.

Level 2 equipment decontamination procedures are required whenever moving across WRIA boundaries, when leaving known infested waters, before entering protected or highly sensitive sites, or when moving between still-water habitats (lakes, ponds, or wetlands) that have no surface water connection to streams or other aquatic habitats (WDFW 2012). Level 2 equipment decontamination procedures must be preceded by Level 1 decontamination procedures. Level 2 equipment decontamination procedures include either of three methods:

- Spray all surfaces of hard, non-porous materials with a hot water pressure washer set at a temperature of 140°F (60°C) for a minimum of 15 seconds (or 5 minutes for porous materials).
- Spray all surfaces with a 100 percent solution of Formula 409® antibacterial all-purpose cleaner, provide a minimum 10-minute contact time, rinse with tap water, and properly dispose of rinse water and excess disinfectant.
- Soak all surfaces in a 2 percent solution of Virkon Aquatic® disinfectant for a minimum of 20 minutes, rinse with tap water, and properly dispose of rinse water and excess disinfectant.

Seattle Public Utilities has established equipment inspection and decontamination procedures for work in a stream infested with NZMS or in stormwater structures located within one block of a NZMS-infested stream. These currently apply only to Thornton Creek (Seattle 2012). Stormwater maintenance equipment is inspected for the presence of NZMS and returned to the shop for decontamination if NZMS are detected. Infested equipment is decontaminated by pressure washing with Virkon Aquatic®.

Kirkland Experience

In March 2011, the City of Kirkland began working collaboratively with neighboring agencies to assess needs and options for decant facilities in the northeast region of King County (Memorandum from Pam Bissonnette, Interim Public Works Director to Kurt Triplett, City Manager, City of Kirkland, February 14, 2013). Construction of a new regional decant facility was proposed in 2012 that would use a mechanical system for recycling decant liquids for reuse for truck washing and in eductor trucks. Decant solids were to be recycled in street maintenance projects. Kirkland received a $2.25 million grant from Ecology for this purpose. In January 2013, the City received approval to purchase commercial property in the Totem Lake area for the new decant facility, and began negotiating agreements with the City of Bellevue, City of Redmond, and Washington State Department of Transportation.

In February 2013, the City of Kirkland learned that NZMS were present in Kelsey Creek located in the City of Bellevue. They recognized that the current design of the recycling decant facility would not kill the mud snails, and did not want recycled decant materials to become a pathway for spreading the mud snails to other waterbodies. They also recognized that state agencies would not allow the potential proliferation of NZMS by facility operations.

Because of NZMS, the City of Kirkland allowed the property purchase agreement to lapse (at no cost to the City), and began discussions with Ecology to extend the grant for design of a new regional decant facility. This facility would either treat NZMS in decant materials for

recycling, or dispose of the materials by current methods (liquids to sewer and solids to landfill).

The City of Kirkland explored various strategies for preventing a recycling decant facility from spreading NZMS (J. Gaus, personal communication, May 16, 2013):

- Prohibit materials from basins containing NZMS.
- Prohibit materials from streams and ponds, but accept materials from stormwater systems if those systems are shown to not contain NZMS.
- Require haulers to certify loads are free of NZMS or inspect loads for the presence of NZMS.
- Treat NZMS in every truck load with a 1 percent solution of Virkon Aquatic®.
- Treat NZMS at the facility by hot water and/or extended drying time.

The City of Kirkland has since halted plans for a regional recycling facility because of the costs, risks, and uncertainties associated with NZMS. Instead, they are planning to expand their existing facility to meet decant capacity needs (B. Wallace, personal communication, May 14, 2013).

Aquatic Invasive Species Protocols

Basic Hauler Procedures

- ☐ Follow municipal AIS Prevention Plan.
- ☐ Determine if AIS are present in the drainage basin by contacting local authorities, or reviewing online distribution maps available from King County, USGS, and Ecology.
- ☐ Plan route to visit infested basins separately from non-infested basins.
- ☐ Inspect equipment for NZMS after use.
- ☐ If NZMS are detected:
    - o Report location to WDFW by phone at 1-888-WDFW-AIS or online at http://wdfw.wa.gov/ais/reporting/.
    - o Complete work inside drainage basin only.
    - o Deposit materials as per decant facility protocols and operations plan.
    - o Decontaminate any exterior and interior truck components and other equipment that were in contact with the infested materials, and may contact water at a future site.
- ☐ Decontaminate equipment by an acceptable method that may include either:
    - o Spray all surfaces of hard, non-porous materials with a hot water pressure washer set at a temperature of 140°F (60°C) for a minimum of 15 seconds (or 5 minutes for porous materials).
    - o Physically remove all NZMS by scrub and rinse or standard pressure washer, and then either:

- Spray all surfaces with a 100 percent solution of Formula 409® antibacterial all-purpose cleaner, provide a minimum 10-minute contact time, rinse with tap water, and properly dispose of excess disinfectant and rinse water.
- Soak all surfaces in a 2 percent solution of Virkon Aquatic® disinfectant for a minimum of 20 minutes, rinse with tap water, and properly dispose of excess disinfectant and rinse water.

☐ Obtain an AIS transport permit (at no cost) as directed by WDFW if transporting live AIS to or from a decant facility.

Basic Facility Procedures

☐ Provide driver and operator training on AIS protocols.

☐ Do not reuse liquids or solids at aquatic sites.

☐ Do not discharge treated liquids to stormwater systems or surface waters.

☐ Determine the risk of materials containing AIS based on driver observation and drainage basin location. Materials that were observed to contain AIS or were collected from known infested basins are considered high risk.

☐ Inspect loads for the presence of NZMS.

☐ Do not receive high risk liquids if they may be discharged to a stormwater system or surface waterbody.

☐ Do not receive high risk solids if they may be reused at an aquatic site.

☐ Do not overfill and minimize splashing when dumping high risk AIS loads at a facility located adjacent to a wetland or surface waterbody.

☐ Quarantine (isolate) high risk solids and treat by maintaining dry conditions for a minimum of 2 weeks.

☐ Verify treatment effectiveness by testing for the presence of live NZMS.

Considerations for Opening Use to External Users

☐ Consider an on-site, full-time or part-time operator to inspect, log, and deny or manage high risk AIS loads from external users.

☐ Prohibit loads from high risk external users or locations.

☐ Require physical inspection of materials from external users or selected locations.

☐ Require a manifest of material source locations and AIS inspection record from external users.

☐ Separately measure and record solids amounts from external users.

☐ Define revocation procedures for knowingly or inadvertently depositing AIS loads.

☐ Establish billing rates and procedures for AIS load handling and disposal.

Facility Design Considerations

- ☐ Filter liquids containing AIS if they will be discharged to a stormwater system, wetland, or surface waterbody. The effective pore size of the filter should not exceed 0.1 mm to contain juvenile NZMS and invasive mussels.
- ☐ Provide separate inspection and storage areas for high risk AIS loads deposited at the facility.
- ☐ Do not locate a facility adjacent to a wetland or surface waterbody.
- ☐ Construct an AIS transport barrier for facilities located adjacent to a wetland or surface waterbody.

Permit Considerations

- ☐ Consult with WDFW on the need for an AIS transport permit.
- ☐ Obtain an AIS transport permit (at no cost) as directed by WDFW if transporting live AIS to or from a decant facility.

Proposed Future Actions

- ☐ Expand the King County AIS location website (King County 2013) to include the other counties in the decant study area (Snohomish, Pierce, and Thurston) and update the website with all new AIS locations.
- ☐ Update AIS protocols as necessary to address NZMS and other AIS if they are observed in new drainage basins.
- ☐ Update AIS protocols if new prevention or decontamination measures become available and acceptable.

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