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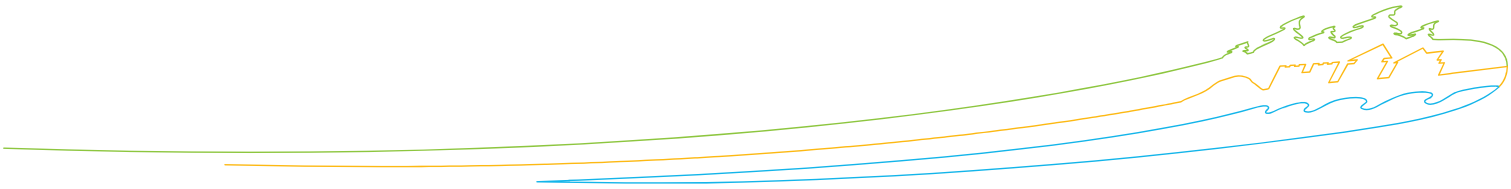

Standard Operating Procedure (SOP)

Direction for Permitted Users conducting water related activities in MRGNP

Mount Revelstoke and Glacier National Parks
March 2020

Canada

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1.0 Scope and Application

The following document is intended to provide a consistent decontamination protocol and direction, in the form of a standard operating procedure, for anyone who is conducting work in or near water bodies, ephemeral or otherwise, or involved in the use or transportation of surface waters in Mount Revelstoke and Glacier National Parks. This decontamination protocol has been developed to prevent the spread of aquatic invasive species (AIS), with special consideration to Myxobolus cerebralis, the causative agent for whirling disease, however this protocol can be applied to mitigate risk against chytrid, didymo and many other types of AIS.

This information and associated conditions are to be added to Restricted Activity Permits, Development Permits or other tools used to permit researchers, contractors, partners, stakeholders, etc. who are working in muddy or aquatic environments in MRGNP but not handling fish. If handling fish, there is a more rigorous protocol to be followed.

Users must also ensure they are meeting all applicable standards and regulations as it pertains to in-stream works, especially the fish and fish habitat protection provisions of the Fisheries Act and the Department of Fisheries and Ocean's measure to protect fish and fish habitat.

2.0 Background

The first documented case of Whirling Disease (WD) anywhere in Canada was in Banff National Park, in August 2016. Whirling Disease has not been detected in MRGNP. While there are no human health concerns, effects on native fish populations can be very significant with 90% mortality being reported in other jurisdictions. The parasite attacks juvenile fish and causes spinal deformity (whirling swimming pattern) and discoloration (blackened tails). Some species of fish, or individual fish, can be infected but show no visible symptoms at all. Whirling Disease is a parasitic freshwater disease that affects most salmonids, including bull trout. The disease is spread by a small parasite that goes through both spore and planktonic life stages, which infect both fish and aquatic tubifex worms.

The invasive freshwater algae Didymosphenia geminata, commonly referred to as Didymo (and sometimes referred to as 'rock snot') is a microscopic freshwater algae that can form large mats in rivers and streams. It is a species of diatom that produces nuisance growths in freshwater rivers and streams with consistently cold temperatures and low nutrient levels and can adversely impact stream habitats and sources of food in aquatic environments.

Chytrid Disease is caused by the fungus Batrachochytrium dendrobatidis. This disease has driven the decline or complete extinction of over 200 species, mainly frogs, worldwide. The fungus has been detected throughout much of Canada, although disease outbreaks are not known to be common.

2.1 HOW IS WHIRLING DISEASE SPREAD?

The disease is most often spread by (in descending order):

1. **Movement of fish** (fish stocking) or parts of fish (use of live or dead baitfish). All of these activities are illegal in Mount Revelstoke National Park.
2. **Movement of mud** that is laden with the resistant spore stage or infected tubifex worms. Likely vectors include dirty waders, boats, and construction equipment *(spores are small & hard to destroy*).
3. **Movement of water** that is transporting the planktonic life stage called a TAM (*triactinomyxon (TAM) platonic lifestage*).

The only effective means of killing the WD spores include hot water (>90°C) or 10 minutes soaking in effective detergents (preferably bleach although stronger alternatives such as quaternary ammonium-based cleaners can be used if required); pro-longed freezing (7 days at -20°C) or complete desiccation (drying) for at least 24 hours (less if exposed to direct sunlight). Therefore, preventing the movement/transport of mud from infected water ways (where spores are most often found) is of critical importance. Although the TAM stage is more vulnerable to hot water, effective detergents, freezing or desiccation, the TAM stage is still a concern because it is often more mobile as it floats in the water column. For this reason, movement of water also needs to be prevented (e.g. water withdrawal permits for hydro-seeding, paving crews, etc.).

3.0 Standard Operating Procedure

If you have been issued a permit to,

a) conduct in-stream works;
b) work in wet or muddy riparian areas, or soils that are seasonally wetted (ephemeral); or
c) conduct the pumping or moving of surface water;

then, you are required to follow these decontamination protocols.

1. **PREVENTION**: Do not allow equipment to enter a watercourse or wet riparian area, or to pump or transport water, unless the equipment has been properly decontaminated **before AND after** use in different waterbodies. The current extent of Whirling Disease in Alberta and/or British Columbia is not known, so your equipment may already be contaminated or may become contaminated during use. Never move equipment between water bodies without applying the following decontamination protocols.
2. **PRE-CLEAN**: When you leave a work area **remove all mud**. The most resistant life stage is the myxospore and these spores settle into the mud. By washing off all mud (in an area where the rinse water will not re-enter the watercourse, a storm water system, or sanitary sewer system) you can reduce the chances of spreading this disease.

3. **HOT WASH or DISSINFECT**: At an appropriate facility, where wastewater will not re-enter a watercourse (either through storm water or sanitary water treatment), wash or disinfect your equipment as follows:
    a. **HOT WASH** – use a low pressure hot water wash system (e.g. Hotsy) to apply very hot water (>90oC) across all equipment surfaces for at least 10 minutes. Appropriate PPE is required to prevent injury when using water at these temperatures. For smaller items or in remote locations – boiling in water for 10 minutes will destroy the spores.

OR

    b. **DISSINFECT** – For equipment that cannot withstand these temperatures, (e.g. glued fabrics such as inflatable watercraft, aqua-dams, Gore-Tex, etc.) use regular water to remove any residual mud and destroy the TAM stage. Extra diligence must be taken in disinfecting this equipment in order to destroy the spore stage. All equipment must be soaked, for at least 10 minutes, in an appropriate concentration of disinfectant (see Appendix A and B)*. Disposal of rinse water containing disinfectant may go into sanitary sewers (spores should be chemically destroyed) provided quantities are diluted enough not to impact your local wastewater treatment plant by killing bacteria. Contact your Wastewater Treatment Plant for approval if disposing of more than 45 gallons in any given day.
4. **DRY**: Allow all equipment to dry thoroughly (fully dry + an additional 24 hours) before being used in each new waterbody. Drying is ONLY effective if every surface is completely dry. Again, this is why removal of **ALL** mud is so important, as it aids effective drying. **Note** - Freezing (<-20oC) for 7 or more days will also kill spores and TAMs provided temperatures remain below -20oC .

**Follow all manufactures MSDS and instructions for use of Personal Protective Equipment.*

APPENDIX A: Sample Calculation/Method to Mix a 2% Bleach Solution

EXAMPLE:

Regular strength bleach has a concentration of about 5.25% sodium hypochlorite (check your bottle to make sure) and "concentrated" bleach has a concentration of about 8.25% sodium hypochlorite.

The "Dilution Equation" states that the initial concentration of a solution multiplied by the initial volume of that solution is equal to the final concentration multiplied by the final volume:

$$\mathbf{C1 \times V1 = C2 \times V2}$$

In this example:

C1= initial concentration of regular strength bleach = 5.25%
V1= initial volume of regular strength bleach = Unknown (what we want to solve for)
C2= final concentration of solution = 2%
V2= final volume of solution = 1L = 1,000 mL

Solving the above equation for V1:

$$\mathbf{V1} = \frac{\mathbf{C2 \times V2}}{\boldsymbol{C1}} = \frac{\mathbf{2\% \, \boldsymbol{x} \, 1{,}000 \, \boldsymbol{mL}}}{\mathbf{5.25\%}} = \mathbf{380.95 \, \boldsymbol{mL} \approx 400 \, \boldsymbol{mL}}$$

Therefore, mix 400 mL (conservatively rounded up for simplicity of mixing) of regular strength bleach (5.25%) into 600 mL of water for a final volume of 1,000 mL of 2% bleach/sodium hypochlorite solution.

For a 20L, 2% solution, simply multiply both numbers above by 20.

Therefore, mix 8L of regular strength bleach (5.25%) into 12L of water for a final volume of 20 L and a 2% bleach/sodium hypochlorite solution.

APPENDIX B: Bleach Alternatives (i.e. QACs)

Higher strength (bleach alternative) solutions exist and can be used should there be an elevated risk of exposure to AIS's due to local conditions, origin of equipment/gear or other factors. However, with higher strength solutions comes the requirement to neutralize the solution post decontamination as well as the fact that these solutions/products are inherently more harmful to the natural environments as well as the equipment/gear they are decontaminating. As such, within MRG, use of these alternatives should be minimized whenever possible.

The main alternative, higher strength products are called Quaternary Ammonia Compounds or QACs. QAC's can be sourced from a variety of suppliers (see Appendix D), have special disposal requirements (see Appendix C) and may not be permitted in local wastewater treatment facilities.

Should it be determined that the use of QACs is required and appropriate, the following provides a sample calculation for mixing a 2000 ppm solution, which is the suggested concentration to be used for AIS (specifically Whirling Disease) decontamination.

EXAMPLE:

Quat Plus (for example) has a 4.8% active QAC concentration. Converting between percentage and parts per million (ppm), 1% of 1 million = 10,000. Therefore 1% = 10,000 ppm. If Quat Plus = 4.8% active concentration, then it also equals 48,000 ppm (4.8% x 10,000 ppm/%).

The "Dilution Equation" states that the initial concentration of a solution multiplied by the initial volume of that solution is equal to the final concentration multiplied by the final volume:

$$\mathbf{C1 \times V1 = C2 \times V2}$$

In this example:
C1= initial concentration of Quat Plus = 4.8% = 48,000 ppm
V1= initial volume of Quat Plus= Unknown (what we want to solve for)
C2= final concentration of solution = 2,000 ppm (0.2%)
V2= final volume of solution = 1L = 1,000 mL

Solving the above equation for V1:

$$\mathbf{V1} = \frac{\mathbf{C2 \times V2}}{\boldsymbol{C1}} = \frac{\boldsymbol{2,000\ ppm\ x\ 1,000\ mL}}{\boldsymbol{48,000\ ppm}} = \boldsymbol{42\ mL}$$

Therefore, mix 42 mL of 4.8% Quat Plus into 958mL of water for a final volume of 1,000 mL of 2,000 ppm QAC solution.

Similarly (and conservatively rounded up for simplicity of mixing), combine 1L of 4.8% Quat Plus into 19L or water for a final volume or 20L of ~2000 ppm QAC solution.

A 2,000 ppm QAC solution will remain stable for a one week period, depending on organic load. Replace the solution every week and test QAC concentrations using extra high level QAC test strips.

APPENDIX C: SUPPLIERS

QAC Suppliers

Chemical	Commercial Product / Manufacturer	SUPPLIER
QAC Concentrate	Quat Plus / Dustbane 4 L Jug	Apple Cleaning Supplies Calgary, Ab (403) 569-6969
QAC Concentrate	Quat Plus / Dustbane 4 L Jug	ARME Supply Calgary, Ab (403) 243-6662 ext. 1100
QAC Test Strips	100/pkg for 2000 ppm	Indigo Instruments Waterloo, ON (519) 746-4761
QAC Neutralizer	NeutraQuat / Hydro Solutions	Hydro Solutions Phone: 1-888-734-9376 (Elizabeth or Kennedy) Louisville, KY www.hydrosolutions.com

APPENDIX D: Disposal of Used Bleach and QAC Solutions

Disposal of Bleach Solutions - Front-country Locations

Large volumes of bleach solution need to be neutralized (as per information below) before disposal into a waste water treatment system or directly into the environment.

Small volumes — < 10 L can be diluted with additional water and disposed of directly to the waste water treatment system, i.e. flush down toilet.

Moderate Volumes — 10L – 30 L can be spread over pavement or concrete with exposure to UV light to allow evaporation of the water component, leaving the safe residue of chloride ions. Bleach solution can also be diluted in batches with additional water, i.e. in a sink with the water running.

Large Volumes — > 30 L can be neutralized with an additional chemical compound (see options below) before release into the environment or wastewater treatment system. OR diluted in 10L batches in a sink with plenty of water.

Neutralizing Hypochlorite Options

	Choose one option	
BLEACH (Sodium hypochlorite)	**Sodium thiosulfate (dry)**	**Calcium thiosulfate (solution)**
20 L 500ppm (0.05%)	20 g	50 mL
55 gallon barrel	220 g	500 mL
275 gallon tote	1.15 kg	2.5 L

Disposal of QAC Solutions - Front-country Locations

Contact the applicable wastewater treatment plant to see if it is possible to dispose of used QACs down the sink. **Do Not** pour sediment down the drain. If mud accumulates in any of the containers, it should be treated as hazardous waste. Untreated sediment cannot be dumped into the environment as it may contain viable myxospores or TAMs. Treated sediment cannot be dumped into the environment or down the drain due to the ability of QACs to bind to organic material. Water can be decanted and disposed of as per municipal wastewater treatment plant guidelines and the mud reserved for future disposal. **NEVER dispose of QACs in the environment.** In order to comply with the Fisheries Act and National Parks Act, neutralize and or dispose of QAC in accordance with federal, provincial, and municipal regulations. QAC solutions can also be "neutralized" using a NeutraQuat however, this **must** be done in consultation with the manager of wastewater treatment plant to confirm disposal is approved.