

# **BMID Drinking Water Source Protection Strategy**

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## **Overview of Potential Impacts/Risks to Water Quality/System Integrity**

### **1.0 Natural Events**

- Spring freshet (poor quality water)
- Low snowpack
- High rainfall (spring through fall rains)
- Landslides (sediment input)
- Pathogens from wild animals
- Forest fires
- Low flows
- Forest health
- Beaver Dams (low gradient hardwood areas, Increased temp, algal growth)
- Lightning Strikes (damage to system, chlorination system etc..)
- Earthquakes (damage to system, landslides etc..)
- Dead Animals (bacterial input, foul smell/taste to water)

### **2.0 Industrial Impacts**

- Forestry road building/maintenance (sediment delivery potential, fuel or lubricant spills)
- Timber harvesting (slash in creeks, stream bank disturbance, fuel or lubricant spills...)
- Log hauling (sediment delivery, fuel or lubricant spills)
- Utilities (electrical right of ways, gas pipelines, transportation routes)
- Post harvest practices (planting crews, fertilizer application...)
- Mining and mineral exploration (poss sediment input, chemical input)
- Trappers (similar to recreational risks to water quality)
- Human caused landslides/earth movements (Same as in 1.0)
- Possible excavation of pipes (Road cuts poss. Damage infrastructure)
- Human waste (possible pathogens entering water system)
- Aerial spraying (pesticides, herbicides)

### **3.0 Agricultural Impacts**

- Open Cattle Grazing (bank shearing, fecal material in stream, )
- Riparian clearing (sediment delivery, livestock feces, herb/pesticides, fertilizers)

### **4.0 Recreational Impacts**

- Camping (recreational properties, day use sites etc...)
- Motor Vehicle (bikes, atv's, 4 x 4's – sediment into creeks)
- Fishing (streams, lakes)
- Boats (fuel contamination to streams possible)
- Hunting (carcass cleaning in streams, lead shot into watercourses...)
- Winter Sports (xcountry skiing, snowshoeing, snowmobiling...)
- Foot traffic (hiking, cycling)

## **5.0 Vandalism/Sabotage**

- Damage to equipment (chlorinators, gates, valves)
- Introduced substances (pathogenic or poisons into system)
- Graffiti

## **6.0 Other**

- Hydrocarbon and or dangerous cargo contamination from MVA's
- Illegal dumping
- Illegal land use (cabins, grow operations)

| 1.0 Natural Events                                                                              | Potential Impact                                                                                        | Time of Year                                                  | *Risk<br>H x C =<br>Risk | Action to be Taken                                                                                                              | Frequency of Action                                                                                            | Responsibility and Time Required            |
|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Risk is a function of Hazard (H) and Consequence (C) See risk matrix at the end of this section |                                                                                                         |                                                               |                          |                                                                                                                                 |                                                                                                                |                                             |
| Spring Freshet (poor quality water)                                                             | Turbidity and sediment, CI demand                                                                       | Late April through early June                                 | H x H = H                | Review snow pillow/course data and regional forecast to help anticipate when peak flow may occur.                               | Monitor data weekly from mid April to mid May and possibly daily through late May.                             | BMID/Watershed Inspector<br>(5 days/year)   |
| Low Snowpack Conditions                                                                         | Potential Reduced Water Supply                                                                          | Winter                                                        | H x H = H                | Measure snowpack to determine if early season water restrictions are required                                                   | March and April                                                                                                | BMID/Watershed Inspector<br>(2-3 days/year) |
| High Rainfall Events                                                                            | Sediment delivery to streams, affecting disinfection, potential hydrocarbons from paved highway runoff. | Spring through fall                                           | H x H = H                | Check local weather sources.                                                                                                    | Inspect Sed. Sources (roads/landslide tracks) after any period of sustained rainfall (3 days consecutive rain) | BMID/Watershed Inspector<br>(3 days/year)   |
| Landslides                                                                                      | Sediment input, potential blockage of flow.                                                             | Early spring through fall, most likely, but possible anytime. | H x H = H                | Annual fix-wing overview, check for any new sediment sources. Possible remediation measures to reduce sediment on active sites. | Annual overview inspection.<br>Additional onsite inspections if new slides impact source streams.              | BMID/Watershed Inspector<br>(1-2 days/year) |

| <b>1.0 Natural Events cont'd</b> | <b>Potential Impact</b>                                                                                            | <b>Time of Year</b>      | <b>*Risk<br/>H x C =<br/>Risk</b> | <b>Action to be Taken</b>                                                                                                                                                                              | <b>Frequency of Action</b>                                                                                                                                                              | <b>Responsibility and Time Required</b>                             |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Pathogens from Wild Animals      | Possible sickness to customers, high CI demand.                                                                    | Snow free times.         | M x H = H                         | Scare wildlife away from intakes and reservoirs.                                                                                                                                                       | Establish and maintain scare/control devices.                                                                                                                                           | BMID/Watershed Inspector<br>(2-3 days/year)                         |
| Forest Fires                     | Water temp, ash/turbidity, damage to structures. Fire suppression chemicals possibly input to stream.              | Summer months typically. | M x H = H                         | Fuel management around structures and facilities. Set up fire suppression crew on site during active fires to protect buildings. Water quality monitoring for chemicals from fire suppression efforts. | Manage fuel prior to each fire season (early summer) weeds shrubs, small tree removal. Suppression crews dependant upon occurrence. Water quality monitoring dependant upon occurrence. | BMID/Watershed Inspector, Fire Suppression Crews<br>(0-5 days/year) |
| Low Flows                        | Increased temperatures, algal growth, CI demand, increased cattle/wild animal use of main channels and reservoirs. | Summer low flows         | M x M = M                         | Inspect possible creek-side cattle watering areas during very dry summer months. Keep birds away from settling ponds to reduce potential fecal material deposition.                                    | Weekly inspection of sites during very dry spells (routine weekly site visits July through sept.)                                                                                       | BMID/Watershed Inspector<br>(12 days/year)                          |
| Forest Health                    | Potential increased harvest (infestations), potential increased risk of fire.                                      | Throughout               | M x M = M                         | Routine visits to BMID private lands. Notify and advise how to deal with forest health issues.                                                                                                         | Routine visits during other watershed activities.                                                                                                                                       | Watershed Inspector<br>(8 days/year)                                |

| <b>1.0 Natural Events cont'd</b>                          | <b>Potential Impact</b>                                                | <b>Time of Year</b>                            | <b>*Risk<br/>H x C =<br/>Risk</b> | <b>Action to be Taken</b>                                                                                 | <b>Frequency of Action</b>                                     | <b>Responsibility and Time Required</b>            |
|-----------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------|
| Beaver Dams (low gradient hardwood areas)                 | Increased temp, algal growth, possible release of water and sediment.  | Snow free times                                | L x H = M                         | Assess status of known areas with dams. Trap out animals.                                                 | Check areas on a schedule related to potential risk (monthly). | BMID/Watershed Inspector (done with other work)    |
| Lightning Strikes                                         | Damage to system works.                                                | Early spring through late fall                 | L x H = M                         | Check electrical equipment earth grounds after events.                                                    | Dependant upon occurrence.                                     | BMID/Watershed Inspector (done with other work)    |
| Earthquakes                                               | Damage to system works, landslide initiation, etc.                     | Year round                                     | L x H = M                         | Site inspections, inspect dams, and equipment (gates, chlorination facilities etc). Possibly contact PEP. | Dependant upon occurrence                                      | BMID/Watershed Inspector (dependant on occurrence) |
| Dead Animals (bacterial input, foul smell/taste to water) | Possible pathogens in water, rotting organic material, high Cl demand. | Year round, but likely highest risk in spring. | L x M = L                         | Inspect in spring, remove carcasses if necessary.                                                         | Dependant upon occurrence                                      | BMID/Watershed Inspector (done with other work)    |

| <b>2.0 Industrial Impacts</b>          | <b>Potential Impact</b>                                                                                                                            | <b>Time of Year</b> | <b>Risk</b> | <b>Action to be Taken</b>                                                                                                                                                                           | <b>Frequency of Action</b>                                                                 | <b>Responsibility and Time Required</b>                                             |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Forestry Road Building and Maintenance | Sediment delivery potential, fuel or lubricant spills.                                                                                             | Throughout          | H x H = H   | Operators to use spill kits. Inspect roads and drainage structures with high sediment delivery potential. Incorporate a deactivation plan for non status roads.                                     | During and or post construction and deactivation. During spring freshet and rainy periods. | Licensees, Government, BMID/Watershed Inspector<br>(3-5 days/year)                  |
| Timber Harvesting                      | Slash in creeks, stream bank disturbance, fuel or lubricant spills, etc. Increased access to stream/riparian areas by wildlife, cattle and people. | Throughout          | H x H = H   | Inspect harvest plans and assess function of riparian management zones. Ensure FPC adhered to. Assess areas that may indirectly affect water quality (openings allowing wildlife/cattle corridors). | Post harvest inspections throughout year.                                                  | Licensees, Government, BMID/Watershed Inspector<br>(done during the above 3-5 days) |
| Log Hauling                            | Sediment delivery, fuel or lubricant spills.                                                                                                       | Throughout          | H x H = H   | Assess road bed conditions, recommend surfacing options, and possibly shut downs during wet/muddy periods and even dusty periods.                                                                   | Inspect during active harvest periods.                                                     | Licensees, Government, BMID/Watershed Inspector<br>(3-5 days per year)              |

| <b>2.0 Industrial Impacts cont'd</b>                                          | <b>Potential Impact</b>                                                                      | <b>Time of Year</b>                                           | <b>Risk</b> | <b>Action to be Taken</b>                                                                                                                                                                    | <b>Frequency of Action</b>                                                                     | <b>Responsibility and Time Required</b>                           |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Utilities (electrical ROW's, gas pipelines, transportation routes...)         | Possible road building/land clearing impacts as discussed above.                             | Throughout                                                    | H x H = H   | Liaise with the contractors, inform them of where system may be at risk.                                                                                                                     | As required.                                                                                   | BMID/Watershed Inspector<br>(1-3 days/year)                       |
| Post Harvest Practices (site prep, planting crews, fertilizer application...) | Sediment delivery, fuel or lubricant spills, fertilizer/pesticides input to stream channels. | Throughout                                                    | M x H = H   | Inspect planting crew facilities, waste disposal follows BMP's. Assess water quality if any fertilizer applications are carried out. Check for pesticides if necessary (from nursery trees). | Inspect during active periods.                                                                 | Licenses, Government, BMID/Watershed Inspector<br>(3-5 days/year) |
| Mining/Mineral Exploration                                                    | Possible sediment input, garbage, human waste, chemical inputs.                              | Throughout                                                    | M x H = H   | Inspect claim sites that are connected to supply streams.                                                                                                                                    | Annual may be sufficient. More frequent depending on size of operation.                        | Government, BMID/Watershed Inspector<br>(1-3 days/year)           |
| Human Caused Landslides/earth movements                                       | Sediment input, potential blockage of flow.                                                  | Early spring through fall, most likely, but possible anytime. | L x H = M   | Annual fix-wing overview, check for any new sediment sources. Possible remediation measures to reduce sediment on active sites.                                                              | Annual overview inspection. Additional onsite inspections if new slides impact source streams. | BMID/Watershed Inspector<br>(1-2 days/year)                       |
| Human Waste                                                                   | Possible pathogens entering water system.                                                    | Throughout                                                    | L x H = M   | Educate industrial users, install CWS signage.                                                                                                                                               | Maintain signs, possibly visit sites with high usage to talk to people.                        | BMID/Watershed Inspector<br>(done with other work)                |

| <b>2.0 Industrial Impacts cont'd</b>                                             | <b>Potential Impact</b>                                   | <b>Time of Year</b> | <b>Risk</b>      | <b>Action to be Taken</b>                                                                                              | <b>Frequency of Action</b> | <b>Responsibility and Time Required</b>                            |
|----------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------|------------------|------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------------|
| Aerial Spraying (mosquitoes for west Nile, or for freshly planted forest sites). | Possible pesticides/herbicide introduced to water system. | Snow free periods.  | $L \times H = M$ | Monitor water quality for presence of applied substance.<br>Communicate with officials regarding application schedule. | As required.               | Licensees, Government, BMID/Watershed Inspector<br>(0-5 days/year) |



| <b>3.0 Agricultural Impacts</b>    | <b>Potential Impact</b>                                                                                                                         | <b>Time of Year</b>                                                | <b>Risk</b> | <b>Action to be Taken</b>                                                                                                                                                                               | <b>Frequency of Action</b>                                                                                                             | <b>Responsibility and Time Required</b>                             |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Open Cattle Grazing.               | Bank shearing, fecal contamination of source streams. Possible pathogen introduced to stream.                                                   | Late spring through late fall. (especially during very dry spells) | H x H = H   | Monitor cattle watering sites, Identify locations with ranchers. Possibly analyze random feces samples for ecoli 0157. Possibly fence off areas, alternate water sources, not connected to the channel. | Weekly during summer and fall. Possibly more frequent during very dry periods when cattle most likely to be at or near supply streams. | Range officer, Ranchers, BMID/Watershed Inspector<br>(23 days/year) |
| Riparian Clearing for crop/grazing | Bank instability, sediment delivery, excess run-off (animal feces transported to creek). Pesticides and herbicides and fertilizer into streams. | Ice free periods, during the growing season.                       | M x H = H   | Maintain or re-establish riparian vegetation and stabilize unstable banks. Install settling ponds to capture surface effluent and reduce delivery to streams.                                           | Annual as required.                                                                                                                    | Landowners, Government, BMID/Watershed Inspector<br>(1-2 days/year) |

| 4.0 Recreational Impacts                                                                                                                                  | Potential Impact                                                                           | Time of Year                  | Risk       | Action to be Taken                                                                                                  | Frequency of Action                                                             | Responsibility and Time Required                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------|------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------|
| <b>*If recreation is considered acceptable, and it is a high risk, there must be more intense supervision/inspection/maintenance to reduce this risk.</b> |                                                                                            |                               |            |                                                                                                                     |                                                                                 |                                                    |
| Camping (recreational properties, day use sites).                                                                                                         | Human waste/garbage introduced to sites. Pit toilets                                       | Mostly summer and fall months | *M x H = H | Educate users on proper conduct in a community watershed. Ensure pit toilets are properly installed and maintained. | Weekends or Mondays during summer and fall.                                     | BMID/Watershed Inspector<br>(5-7 days/year)        |
| Motor Vehicles (atv's, motorbikes, snowmobiles)                                                                                                           | Possible fuel spills, sediment from trail networks into creeks. Human waste.               | Throughout                    | M x M = M  | Educate users on proper conduct in a community watershed. Post signage.                                             | Annually discuss details with recreational users. Possible routine inspections. | BMID/Watershed Inspector<br>(1-2 days/year)        |
| Fishing                                                                                                                                                   | Sediment stirred up from wading. Lead sinkers, human waste, and garbage.                   | Throughout                    | M x M = M  | Educate users, possibly restrict use near intakes on streams.                                                       | Weekly during high use periods.                                                 | BMID/Watershed Inspector<br>(1-3 days/year)        |
| Boats                                                                                                                                                     | Fuel spills, human waste, garbage etc.                                                     | Snow free periods             | M x M = M  | Educate users, possibly work towards no gas engines, electric only. Post signage regarding CWS                      | Weekly (weekends)                                                               | BMID/Watershed Inspector<br>(3-5 days/year)        |
| Hunting                                                                                                                                                   | Vehicle traffic, atv's, possible carcass cleaning in streams, Lead shot into watercourses. | Spring and fall               | M x M = M  | Educate users, signage, routine inspections of high use sites.                                                      | Mondays during season.                                                          | BMID/Watershed Inspector<br>(done with other work) |

| <b>4.0 Recreational Impacts cont'd</b>                  | <b>Potential Impact</b>                                            | <b>Time of Year</b> | <b>Risk</b> | <b>Action to be Taken</b>                                               | <b>Frequency of Action</b>      | <b>Responsibility and Time Required</b>            |
|---------------------------------------------------------|--------------------------------------------------------------------|---------------------|-------------|-------------------------------------------------------------------------|---------------------------------|----------------------------------------------------|
| Non motorized use (foot traffic/mtn bikes, skiing etc.) | Human waste/garbage, possible sediment delivery from bikes, minor. | Throughout          | M x L = L   | Educate users on proper conduct in a community watershed. Post signage. | Weekly during high use periods. | BMID/Watershed Inspector<br>(done with other work) |

| <b>5.0 Vandalism Sabotage</b> | <b>Potential Impact</b>                                                                     | <b>Time of Year</b> | <b>Risk</b> | <b>Action to be Taken</b>                                                                                                  | <b>Frequency of Action</b>                                                                                | <b>Responsibility and Time Required</b>            |
|-------------------------------|---------------------------------------------------------------------------------------------|---------------------|-------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Damage to equipment           | Loss of control both disinfection and flow. Threat to human health, fire flow requirements. | Throughout          | L x H = M   | Signage regarding safety (ie chlorine gas). Alarm system on buildings, with pager to notify operator. Security, locks etc. | Routine inspections of gates, valves, buildings, dams etc.                                                | BMID/Watershed Inspector<br>(done with other work) |
| Introduced substances         | Pathogenic or poisonous substances introduced to system. Threat to human health.            | Throughout          | L x H = M   | Ensure security at facilities as above. Assume worst case if broken locks could mean the water has been tampered with.     | If alarmed, upon notification. If not alarmed, routine, early in week, most vandalism occurs on weekends. | BMID/Watershed Inspector<br>(done with other work) |
| Graffiti                      | Increase potential for additional vandalism.                                                | Throughout          | L x L = L   | Remove graffiti.                                                                                                           | When noticed during routine site maintenance.                                                             | BMID/Watershed Inspector (done with other work)    |

| <b>6.0 Other</b>                                                                   | <b>Potential Impact</b>                                                                      | <b>Time of Year</b> | <b>Risk</b> | <b>Action to be Taken</b>                                                                                                                   | <b>Frequency of Action</b>                | <b>Responsibility and Time Required</b>               |
|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------|
| Hydrocarbon and or dangerous cargo contamination from MVA's (highway and aviation) | Fuel, cargo, fire                                                                            | Throughout          | L x H = M   | Ensure no impacts to water resources, advise public, shut down system if necessary to prevent any contamination in distribution network.    | Per occurrence.                           | BMID/Watershed Inspector, Government (0-3 days/year)  |
| Illegal dumping                                                                    | Household waste, both hazardous and non hazardous.                                           | Throughout          | M x M = M   | Clean up sites, possibly get volunteer groups (community service workers) Try to identify perpetrators (name and address on envelopes etc.) | When noticed on routine site inspections. | RCMP, BMID/Watershed Inspector (done with other work) |
| Illegal land use                                                                   | Water diversions, pesticides/herbicide, illegal structures, cabins, trails, grow operations. | Throughout          | L x L = L   | Notify police of any high risk sites.                                                                                                       | Monthly                                   | RCMP, BMID/Watershed Inspector (done with other work) |

## Risk Matrix

| H<br>a<br>z<br>a<br>r<br>d | Consequence |                   |                    |                    |
|----------------------------|-------------|-------------------|--------------------|--------------------|
|                            |             | Low               | Mod                | High               |
|                            | Low         | <b><i>Low</i></b> | <b><i>Low</i></b>  | <b><i>Mod</i></b>  |
|                            | Mod         | <b><i>Low</i></b> | <b><i>Mod</i></b>  | <b><i>High</i></b> |
|                            | High        | <b><i>Mod</i></b> | <b><i>High</i></b> | <b><i>High</i></b> |

Hazard is the likelihood of an occurrence

Consequence is the result of the hazard occurring

Risk is the interaction between hazard and consequence

For example, a washed out stream crossing (culvert) is a high hazard for sediment entering the stream. The consequence depends on the resources affected by the sediment deposition. In the case of a non-fish-bearing stream, not in a community watershed, there is a low consequence if sediment enters the stream. The result is a moderate risk.

## Risk Reduction

Anything that can reduce the hazard can reduce the risk. In the example above, if the washed out culvert were repaired, the hazard of sediment entering the stream would likely be moderate. The consequence would remain unchanged as low, resulting in a low risk.

## Funding Sources

Forest licencees can access Forest Investment Account (FIA) funds to address old road sections (non-status) that may pose a risk to water resources. FIA standards are also in place for recreation (Site-maintenance and establishment and trail maintenance and establishment). James Lake is a big problem with recreational use, improper waste disposal. Possibly improve signage to educate those people. Possibly supply firewood to reduce random campsite locations.

Government funding (Federal, Provincial or Municipal) may be available to assist BMID in providing adequate source protection (infrastructure grants may be available).

Cost recovery could be addressed by charging user fees (camper user fees, local property taxes and or increased utility costs to consumers).

The biggest threat to human health is biological impacts. Previous studies on fecal coliform source tracking pooled people with canine and feline. Another study suggested the coliform sources were more like 1% human and horses, 60% animals and 39% cattle. Of the animals, the vast majority was avian.

## Reporting

A full inventory of all equipment and locations (reservoirs, dams structures, recreation sites, cutblocks, stream crossings landslide scars etc) as well as any known problem sites must be developed for due diligence purposes, and legal reasons (was the inspection completed).