Canadian Hydrokinetic Turbine Test Centre
Safety Rules and Regulations

CHTTC
Canadian Hydrokinetic Turbine Test Centre

Last Revised: May 2017

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1. Contact information

1.1. Emergency contact information

In case of any emergency situation, the following emergency contacts are available:

Police, fire, medical and poison emergencies --- 911
Beausejour District Hospital --- (204)–268–1076 --- 151 First St. S
Lac Du Bonnet Pinawa Hospital --- (204)–753–2334 --- 30 Vanier Dr. Pinawa

Fire emergencies at the CHTTC site should also be reported to the Manitoba Hydro Great Falls Generating Station Control Room. The contact is:

Great Falls Generating Station Control Room --- (204)-345-7121

1.2. Contact information for Manitoba Hydro

During normal business hours should any need arise to contact a Manitoba Hydro Station Authority contact either Rob Duke or Scott Richards.

Rob Duke --- (204)-367-5133 --- rduke@hydro.mb.ca
Scott Richards --- (204)-367-5123 --- srichards@hydro.mb.ca

Should any need arise to contact a Manitoba Hydro Station Authority outside of normal business hours contact the Great Falls Generating Station Control Room to get the appropriate contact number or to be transferred to the appropriate contact. The contact is:

Great Falls Generating Station Control Room --- (204)-345-7121

1.3. Contact information for the University of Manitoba

Should any need arise to contact the University of Manitoba the following contact numbers are available:

Dr. Eric Bibeau --- (204) – 470–8901 --- eric_bibeau@umanitoba.ca
Dr. Jonathan Beddoes --- (204)-474-9806 --- dean_engineering@umanitoba.ca
Environmental Health and Safety Office --- (204)-474-6633 --- ehso@umanitoba.ca
Fort Garry Campus Security --- (204)-474-9312 --- emergency_response@umanitoba.ca

1.4. Contact information for the Canadian Hydrokinetic Turbine Test Centre

Should any need arise to contact the Canadian Hydrokinetic Turbine Test Centre (CHTTC) the following contact information is available:

Dr. Eric Bibeau --- CHTTC Director --- eric_bibeau@umanitoba.ca
Kirk Dyson --- Watercraft Safety Officer --- kirk.dyson@umanitoba.ca
Samuel d'Auteuil --- CHTTC Site Manager --- umdautes@myumanitoba.ca
Jody Soviak --- CHTTC Technical Manager --- umsoviaj@myumanitoba.ca
Zeev Kapitanker --- Technical Specialist --- zeev.kapitanker@umanitoba.ca

2. Responsibilities

2.1. CHTTC employee responsibilities

CHTTC Director

- Provide approval of all operations that occur at the CHTTC site.
- Ensure that all operations at the site are conducted in a safe manner as per *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures*.

CHTTC Site Manager

- Schedule all work that occurs at the CHTTC site.
- Hire independent contractors as required.
- Publish a weekly work schedule detailing the events that occurred during the previous week, all planned events for the current week and all long-term or future activities. The work schedule is to be distributed to University of Manitoba personnel, Manitoba Hydro personnel, CHTTC personnel, members of funding organizations and industry partners.
- Ensure that CHTTC equipment and instrumentation is available and in good working order for research and testing campaigns.
- Ensure that all operations at the site are conducted in a safe manner as per *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures*.

CHTTC Technical Manager

- Maintain all CHTTC safety documentation including *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations, The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures,* attendance records and incident reports.
- Sort, store and organize all CHTTC collected data and media pertaining to research and testing campaigns.
- Ensure that CHTTC instrumentation and software is available and in good working order for research and testing campaigns.
- Ensure that all operations at the site are conducted in a safe manner as per *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures*.

CHTTC Watercraft Safety Officer

- Ensure that all CHTTC watercraft are maintained, are available and are in good working order for all CHTTC operations.
- Approve all operations involving CHTTC watercraft and approve all rules, regulations and procedures involving CHTTC watercraft.
- Contact Manitoba Hydro prior to the beginning of spring operations to assess the hazards associated with debris build-up and determine when it is safe to launch any watercrafts for the new season.
- Ensure that all operations at the site are conducted in a safe manner as per *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures*.

Technical Specialists

- Provides authority on technical matters
- Provides support and assistance to researchers on technical matters.
- Ensure that all operations at the site are conducted in a safe manner as per *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures*.

2.2. Researchers and guests

Upon arrival at the CHTTC all researchers and guests must ensure that the CHTTC Site Manager knows of their presence. All researchers and guests are required to record their attendance and presence, as well as ensure that they have signed the safety waiver. Furthermore, all researchers and guests are required to comply with *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures* and comply with the instructions of the CHTTC Site Manager.

2.3. Contractors and self-employed workers

All contractors and self-employed workers hired for work at the CHTTC will be journeymen or otherwise certified or approved in the trade or service they are hired to deliver and will be referred by other reputable organizations in the region.

Upon arrival at the CHTTC site all contractors and self-employed workers will be provided orientation, record their attendance and presence, report to the CHTTC Site Manager and follow *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures*.

2.4. Working alone

Working alone at the CHTTC site is prohibited with the following exceptions:

- Pick-up and delivery of goods to and from the CHTTC site
- Performing visual inspections of the CHTTC site and surrounding areas from the shore
- Monitoring of instrumentation or data analysis from within the sea-cans

Furthermore, anyone who intends to work alone at the CHTTC is required to obtain permission from the CHTTC Director prior to performing work alone and anyone working alone at the CHTTC site is required to follow the University of Manitoba's working alone policy. The working alone policy can be found at:

www.umanitoba.ca/admin/vp_admin/risk_management/ehso/WorkingAlone.html

2.5. Reporting and investigating incidents

An incident is defined as an unplanned and undesired event that causes injury, property damage or delays to the completion of a task or could cause significant injury, property damage or delays to the completion of a task given a different set of

circumstances. All incidents are to be reported immediately to either the CHTTC Director, CHTTC Site Manager, CHTTC Technical Manager, CHTTC Watercraft Safety Officer or Campaign Manager and logged in an incident report.

The CHTTC management will investigate all incidents in an attempt to mitigate the occurrence of the incidents. All incidents that caused or could have caused serious injury to workers will be investigated with the assistance of the University of Manitoba Environmental Health and Safety Office.

2.6. Worker involvement

All workers at the CHTTC site are provided copies of *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures* and they must certify that the documents have been read and understood.

All workers at the CHTTC site are encouraged to participate in the development of procedures and safety regulations for the continued safety and improvement of CHTTC operations and to help further the marine industry.

2.7. The right to refuse dangerous work

All workers at the CHTTC site have the right to refuse any work they feel is unsafe or uncomfortable performing. Any person that detects an unsafe operation being performed at the CHTTC site should contact the Campaign Manager, CHTTC Director, CHTTC Site Manager, CHTTC Technical Manager or CHTTC Watercraft Safety Officer to have the operation or procedure modified or terminated immediately.

3. Canadian Hydrokinetic Turbine Test Centre site

3.1. Introduction

The objective of the Canadian Hydrokinetic Turbine Test Centre (CHTTC) is to create a national hydrokinetic turbine testing location that allows companies to test hydrokinetic turbine systems. The centre is located on the Winnipeg River in the rural community of Seven Sister Falls, Manitoba. The CHTTC assists in accelerating the development of hydrokinetic turbine technologies.

The CHTTC provides an opportunity to better understand the operational effects of hydrokinetic devices on the environment and provides information to help inform regulatory decisions for future projects. The center provides significant cost savings to stakeholders by reducing the time and cost to market for developers.

3.2. General site description

The Canadian Hydrokinetic Turbine Test Centre is located in the tailrace channel of the Manitoba Hydro Seven Sisters Power Generating Station at Seven Sister Falls Manitoba. The channel runs approximately northwest, towards Lac Du Bonnet and southeast toward the generating station. The CHTTC shore site consists of a fenced compound, office sea-can, storage sea-can and watercraft dockage located on a rocky ledge approximately 700 meters (2300 feet) downstream of the generating station on the northeast side of the channel.

The channel is approximately 60 meters (195 feet) wide from shoreline to shoreline, though the width of the river varies at different locations. The water is approximately 11 meters (36 feet) deep in the main channel rising sharply to less than 2 meters (6.5 feet) along its edge. The current typically ranges from 1.2 to 3 meters per second (4 to 10 feet per second).

The shoreline of the channel consists of sharp, steep boulders and blasting rubble from the construction of the channel. It is slippery when wet or covered in snow or ice.

Figure 1.1 – Upstream view of the CHTTC towards the Seven Sister Falls Generating Station

Standard shore and water operations at the CHTTC may commence as early as April, provided the shore ice has melted and go as late as November dependant on

the weather. The preference is to avoid shore ice and winter operations. Special regulations for winter operations are described in Section 7.

3.3. Directions and site access

The CHTTC is located 90 kilometers (55 miles) northeast of Winnipeg and approximately 700 meters (2300 feet) downstream of the generating station on the northeast side of the channel. Access to the CHTTC site is limited to two methods. The first method to access the site is by traversing across the Seven Sisters Generating Station dam. Access to the dam can be achieved by the following route:

Highway 307 ---> Townsite Road ---> Hydro Drive

After passing over the dam, take the first left twice to arrive at the CHTTC compound. The second method to access the site is through a Manitoba Hydro gravel service road located off of Highway 211. A large road gate, located 45 meters (150 feet) from the highway, identifies the service road.

All Manitoba Hydro road gates leading to the site are to be left in the same positions as when they are encountered unless otherwise requested by authorized Manitoba Hydro personnel; a locked gate is to remain locked and an open gate is to remain open.

3.4. Safety equipment and locations

The CHTTC site safety equipment includes:

- Ring buoy and safety throwing line attached to the outside of the north side fence
- Ring buoy and safety throwing line attached to the outside of the west side fence
- ABC Fire extinguishers located on the wall inside the door of the office sea-can and attached to the outside wall at the east end of the storage sea-can.
- First aid kits located on the wall inside the door of the office sea-can

Personal protective equipment at the CHTTC site is for CHTTC personnel. All users of the CHTTC site are personally responsible for wearing the appropriate personal protective equipment and ensuring the availability of the required equipment. The CHTTC site has a limited number of the following personal protective equipment:

- Hard hats
- Reflective vests
- Work gloves
- Personal floatation devices
- Full floatation survival suits
- Safety glasses
- Hearing protection
- Safety harnesses

All CHTTC personnel and users are responsible for providing the following additional personal protective equipment including but not limited to:

- Safety footwear meeting the requirements of CSA Standard Z195-02
- Sunscreen, SPF 30 or higher recommended
- Hat and sunglasses
- Kneepads

3.5. General site hazards

The hazards of the CHTTC site consist of but are not limited to:

- Falling in to the water from the shoreline or watercrafts
- Slipping and falling on wet or icy surfaces
- Fauna and flora including:
    - Bears, foxes and snapping turtles
    - Poison ivy, oak or sumac
    - Insects including but not limited to ticks, mosquitos, horse flies and hornets
- Head, foot, back or knee injuries
- Cuts, bruises, scrapes, sprains or strains
- Hypothermia and hyperthermia

3.6. Ticks and Lyme disease

As most work at the CHTTC site is conducted in an outdoor environment during the summer months, ticks are an ever-present risk to anyone working at the CHTTC. Ticks survive best in humid habitats; wooded or forested areas are very suitable as the trees provide shade and leaf litter for ground cover. Ticks become active in the spring, late April to early May, and they remain active until the air temperature remains consistently below 4°C.

Lyme disease is a bacterial infection that can be transmitted to people through the bite of an infected tick. In Manitoba, blacklegged ticks may carry the Lyme disease bacteria. Many people, 60-80% will develop a red expanding skin rash 3 to 30 days after a bite from an infected tick. Other symptoms of Lyme disease may include headache, flu like symptoms or swollen lymph nodes. Blacklegged ticks can also transmit numerous other infections.

After spending time outdoors, perform inspections for ticks and remove any ticks found as soon as possible. Ticks infected with Lyme disease must be attached for 24 hours or more before the bacteria is transmitted.

To remove any ticks that have attached to the skin, use a pair of tweezers to grasp the tick close to the skin and slowly pull upwards with a steady pressure to avoid twisting or crushing the tick. Cleanse the skin around the tick bit with soap and

water. It is important to note the date and location of the tick bite as ticks can carry many different diseases. If a rash should develop seek medical attention.

To minimize the probability of tick attaching to the skin:

- Use trails, whenever possible and remain in the centre of the trail
- Wear light coloured clothes to make ticks more identifiable
- Apply an appropriate tick repellent on clothing
- Minimize exposure to tick prone environments including tall grassy areas and woody areas. Keep grass mowed short, remove leaf litter and trim vegetation in areas of work.
- When working in tick prone environments, wear long pants and a long-sleeved shirt and tuck your shirt into your pants and your pants into your socks.

3.7. Hypothermia and hyperthermia risks

As the bulk of the work at the CHTTC site is conducted in an outdoor environment, there is an ever present risk of hypothermia and hyperthermia.

Hypothermia can occur immediately if a person falls into the water when the water temperature is less than 10°C. Hypothermia may also occur if the person is in the water for a sustained period even during the summer months. When a person is retrieved from the water:

- Immediately get the person into a heated space
- Remove the wet clothes
- Wrap the person in blankets or coats until the shivering ceases
- Change into dry clothes

If the person is non-responsive or convulsing, or if there is any cause for concern regarding his or her condition immediately call emergency services at 911.

Hypothermia can also occur if a person is exposed to the cold for a significant period of time. During cold and/or windy conditions restrict the length of outdoor activities and retire to warm up areas between sessions. As the risk of hypothermia increases reduce the length of the work sessions and increase the length of the warm-up periods.

Hyperthermia can occur from significant physical exertion in hot conditions or during period of extreme heat. The most common symptoms of hyperthermia include heavy sweating, nausea, headaches and dizziness. If a person becomes non-responsive, or if there is any cause for concern regarding his or her condition immediately call emergency services at 911.

Most cases of hyperthermia can be treated with simple self-care measures such as increasing water consumption resting in a cool place and placing a wet cloth on the neck or head.

3.8. Electrocution risks

As operations at the CHTTC may involve the use of generators, extension cords and power tools, there is an electrocution risk when working on site. In the case that an individual becomes in contact with an electrical source, break the contact between the person and the electrical source by turning off the source. Never touch a person in contact with an electrical source.

If it is not possible to disconnect the source, break the contact between the person and the source using non-conductive materials such as a wooden pole. Once the contact between the person and the electrical source is broken, preform a primary survey of the situation. For serious incidents, seek medical help immediately.

3.9. Hazardous chemicals on site

Hazardous chemicals expected to be present at the CHTTC site consist of but are not limited to:

- Gasoline
    - Gasoline will be stored in red Canadian Standards Association (CSA) approved polyethylene fuel cans, standard B376, for use in marine engines and electrical generators. All fuel cans will be stored in the sea-cans.
- Lubricants
    - Four stroke engine oil will be stored in their original containers in the storage sea-can. Empty contains will be disposed of through authorized oil recycling outlets.
    - Grease
    - WD-40
- Battery acid
    - All batteries must be stored in tubs to contain any battery acid leakage.
    - Leakage can occur when carrying batteries by hand. This can cause corrosion of clothing and irritations of the skin. When possible, transport batteries in a container, wheelbarrow or storage tub.
- Propane
    - Propane will be stored in propane tanks outside of the sea-cans in the fenced compound.

4. General operation regulations

4.1. Daily contact with Manitoba Hydro

As per regulations with Manitoba Hydro, upon arrival at the CHTTC site, Manitoba Hydro must be informed that there are activities occurring at the CHTTC site. Manitoba Hydro must also be informed as to the duration of the activity and the number of people that will be on site. The contact is:

Great Falls Generating Station Control Room --- (204)-345-7121

If there is no response to the initial call, leave a voicemail.

4.2. Attendance records

Upon arrival at the CHTTC site, all people whether CHTTC employees, researchers or guests must document their presence on an attendance sheet that is maintained in the CHTTC office sea-can. Upon arrival, record your name, the time of arrival and the purpose of the trip. Prior to departure, record the departure time and any relevant comments or observations that may be of interest to the CHTTC.

4.3. General site safety inspections

Everyday, prior to beginning any activities at the CHTTC designate one person to perform a general safety inspection. The person must check the following:

- Manitoba Hydro has been notified of activates occurring at the CHTTC site as per Section 4.1.
- Everyone on site has recorded his or her attendance as per Section 4.2.
- A ring buoy and safety throwing line is attached to the outside of the north site fence.
- A ring buoy and safety throwing line is attached to the outside of the west site fence.
- ABC Fire extinguishers are located on the wall inside the door of the office sea-can and attached to the outside wall at the east end of the storage sea-can.
- First aid kits are located on the wall inside the door of the office sea-can.
- The compound and surrounding areas are free of trash and anything that might create a safety or fire hazard.
- All required watercraft, vehicles, tools and equipment is available for that day's activities.
- Everyone on site is wearing the required personal protective equipment for the activities that they will be performing.

4.4. General safety regulations

Any person who fails to comply with *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations, The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures* or Workplace Safety and Health regulations will be suspended from the CHTTC site.

Any prohibited items or actions will result in the individuals involved being suspended from the site. Prohibited actions include but are not limited to:

- Fighting
- Horse play
- Alcohol
- Non-prescription drugs including narcotics and marihuana
- Firearms
- Health and safety violations

Anyone performing general activities at the CHTTC site is required at a minimum to wear closed toe footwear. Slip-resistant footwear is also recommend.

Any person, as determined by the CHTTC Site Director, the CHTTC Site Manager, the CHTTC Technical Manager, the CHTTC Watercraft Safety Officer or the Campaign Manager to be unfit for his or her duties due to intoxication, sickness, fatigue, injury or any other reason will be not allowed to perform any operations at the CHTTC and may be asked to leave the premises.

Research and testing campaigns will be broken into individual activities. Before undertaking the work plan for a specific activity, the work plan will be discussed with everyone involved prior to its execution to ensure:

- The team is aware of the objective of the activity
- The work plan can be safely executed with the available personnel
- Each person participating understands and is capable of undertaking the tasks they are assigned
- All equipment, tools, supplies etc. required to undertake the tasks are available and are in good working order

Guardrails such as those on working platforms are not to be removed unless:

- The guardrails create a significant hazard as deemed by the Campaign Manager
- The guardrails prevent the completion of a task
- *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures* specifies the removal of the guardrails for a task

If a particular task requires the removal of any guardrails, notify the Campaign Manager and that everyone working in the area is aware that the guardrails have been removed. Ensure that the guardrails are replaced upon the completion of the task.

All equipment to be used on site shall be:

- In good mechanical and operational working order
- Dry, clean and free from all aquatic organisms

Waste will not be allowed to accumulate. It will be placed in appropriate receptacles within the fenced compound out of reach of wildlife and removed regularly.

4.5. Falling into the water

A person who has fallen into the water from the shoreline can be retrieved by throwing them a ring buoy attached to a 15 meter (50 feet) lifeline and dragging them to safely to the shore or a watercraft. Ring buoys are located:

- On the north and west sides of the compound
- On all watercraft and work platforms

If the person is out of reach of the ring buoy and safety lines they can be rescued by using the rescue boat. They can be rescued by either moving the rescue boat close enough to reach them using the ring buoy and safety line and dragging them to safely to the watercraft or by bring the rescue boat up to the overboard person and pulling them into the boat.

When a boat is moving to retrieve a person, or any other item, from the water it must always come up to the person from downstream. Since the person being retrieved will be in the blind spot of the helmsperson the support person will have to provide steering directions.

Any person who falls into the water when the water temperature is less than 10°C must be treated for hypothermia.

4.6. Scheduling research and testing campaigns

Prior to being approved and scheduled to use the CHTTC site, a researcher must discuss or submit a work plan to the CHTTC Site Manager. The work plan must outline all activities to be performed at the CHTTC, list the support and equipment required for the activity and specify all procedures required to safely perform the activity by referencing *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures.*

For activities requiring procedures not provided within *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures,* a safe work procedure must be submitted to the CHTTC Technical Manager prior to being approved and scheduled to use the CHTTC site.

The researcher must designate a Campaign Manager to execute and manage the researcher's project plan. The Campaign Manager must be familiar with *The*

Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures* and be available on site throughout the activity. The campaign manager will obtain the approval of the CHTTC Site Manager prior to the execution of the researcher's work plan.

5. Standard shore operations

5.1. Introduction and definitions

Shoreline is defined as anywhere within 2 meters (6.5 feet) from the edge of the channel with the following exception:

- The sloped banks located on the east and west sides of the channel are considered to be shoreline regardless of the distance to the water due to the steep slope and unstable footing.

5.2. Personal protective equipment

Personal protective equipment required for shore-based operations are dependent on the operation. *The Canadian Hydrokinetic Turbine Test Centre Safety Procedures* should be consulted to determine the appropriate safety equipment for the operations. Visitors, guests and personnel must be kept clear of all locations where protective gear is required unless otherwise equipped or they will be required to leave the area.

5.3. Shoreline operations

A CSA approved personal floatation device is required when on the shoreline with the following exceptions:

- When accessing a pontoon work platform in which all of the following conditions are met:
    - The platform is moored to the shore
    - All side rails are in place except for one section allowing boarding of the watercraft
    - The platform is accessible from the shore via a walkway or dock
- When the air temperature is below 10°C and the water temperature is below 10°C floatation survival suits must be worn instead.

For all shoreline operations, at least two people on site must be certified in standard first aid and CPR C. Additionally, a powered watercraft must be on the water and available to serve as a rescue boat in case of an emergency.

5.4. Heavy equipment operation

Heavy equipment and machinery including but not limited to excavators, boom trucks and cranes may be operated on site during research and testing campaigns. During such operations, the dangers of the site are typical of any construction site.

All heavy equipment and machinery operated at the site must be inspected and approved by the appropriate certification agencies. Only licensed and certified individuals will operate heavy equipment or machinery. A spotter will be designated for the duration of the heavy machinery operation.

CHTTC personnel or contractors will not operate machinery or permit machinery that is greater than 4.25 meters (14 feet) in height to be operated at the CHTTC site without the prior approval of Manitoba Hydro.

A CSA approved pair of protective footwear (Z195-02), hardhat (Z94.1-05) and reflective vest (Z96-09) are required when operating within 25 meters (80 feet) of heavy equipment that includes but is not limited to excavators, loaders and cranes with the following exception:

- Personnel located within the office or storage sea-cans are exempt from the above regulation provided they remain within the sea-can for the duration of the activity

6. Standard water safety regulations

6.1. Introduction and definitions

A mission is defined as any operation undertaken with a watercraft from the time it leaves the dock, shore, mooring or launch until it returns to the dock, shore, mooring or launch at the end of the operation. A support mission is defined as any mission conducted under the authority and control of entities other than the CHTTC.

An autonomous boat operation is defined as a mission in where an operated watercraft does not make physical contact with the shore, any other watercraft, turbines, buoys or structures with the following exception:

- Physical contact with the shore, other watercraft, turbines, buoys and structures are permitted for the transport of tools, equipment and personnel only.

A launch operation is defined as a mission that involves the placement or repositioning of watercraft, turbines or structures on or in the water. An extraction operation is defined as a mission that involves the removal of watercraft, turbines or structures from the water.

The operations area is defined as the area of the Seven Sisters channel from the downstream mouth upstream to the point where the channel curves easterly towards the Seven Sisters Generation Station.

6.2. CHTTC watercraft

The watercraft operated by CHTTC personnel may include:

- 6.5 meter (21 foot) Zodiac boats with up to 150 horsepower engines
- 7.3 meter (24 foot) custom measurement known as the blue pontoon
- Pontoon work platforms which may or may not be powered
- Rented watercrafts

All people aboard any CHTTC operated watercraft for any reason must wear an approved personal floatation device with the following exceptions:

- People on pontoon working platforms must wear an approved personal floatation device unless all of the following conditions are met:
    - The platform is moored to the shore
    - All side rails are in place
    - The platform is accessible from the shore via a walkway or dock
- When the air temperature is below 10°C or the water temperature is below 0°C floatation survival suits must be worn instead.

6.3. CHTTC watercraft safety equipment

All watercraft operated at the CHTTC must be equipped with the following items:

- Painter, line attached to the front of a watercraft for securing the watercraft to a dock, of sufficient length to secure the watercraft but not long enough to reach the engine
- Ring buoy with an outside diameter of 610 millimeters (24 inches) free and ready to be thrown with at least 15 meters (50 feet) of floating safety line neatly coiled and firmly secured to the watercraft
- Anchor with a neatly coiled anchor rope of at least 15 meters (50 feet)
- Two paddles and retrieving pole with the following exception:
    - Paddles are not required on pontoon work platforms
- Portable two way radio with charged battery tuned into the CHTTC radio channel
- Safety bag containing the following equipment:
    - Complete Canadian Coast Guard approved safety equipment canister containing one bailer, one rescue throw rope and one pearless whistle
    - Complete first aid kit
    - Six Canadian approved flares of Type A, B or C
    - Class 5BC fire extinguisher
    - All weather emergency blanket
    - Watertight flashlight
    - Air horn
    - Roll of water resistant duct tape and electrical tape
    - One multi-tool, knife, crescent wrench and packet of large zip ties
- Sonar, GPS and blue water charts (e.g. Humminbird 898c HD SI) with mount and associated Allen keys with the following exception:
    - Sonar, GPS and blue water charts are not required for any mission where the operated watercraft remains in the centre of the channel does not make physical contact with the shore except for launching and docking at a CHTTC dock or launch point.

All powered watercraft operated at the CHTTC must be equipped with the following additional equipment:

- One spare propeller

All watercraft with inflatable pontoons must be equipped with the following additional equipment:

- One air pump
- One patch repair kit with Tear-Aid Type A and B

6.4. CHTTC watercraft inspections

Prior to the beginning of a new season in May, all CHTTC watercraft are to be thoroughly inspected for damage to the hulls, pontoons, propellers and engines. All watercraft engines are to have the oil reservoir topped up.

Prior to deploying a watercraft all watercraft operators must inspect the watercraft from the shoreline to ensure that:

- The watercraft contains all equipment listed in Section 6.3
- The watercraft contains no significant damage to the hull, pontoons, propeller or engine. Ensure that all pontoons are properly inflated.
- The drain plug is properly inserted into the watercraft.

Prior to using a watercraft during a mission, the watercraft operator must inspect the watercraft from the shoreline to ensure that:

- The watercraft contains all equipment listed in Section 6.3
- The fuel tank is at least ½ full
- The engine coolant is circulating and functional
- The portable two-way radio is charged, turned on and tuned into the CHTTC radio channel.
- The watercraft contains no significant damage to the hull, pontoons, propeller or engine.
- For Zodiac boats ensure that all pontoons are properly inflated.

During any mission involving the operation of a CHTTC watercraft, ensure that either sufficient fuel is available for the duration of the mission or that additional fuel is readily available should refuelling be required.

6.5. Watercraft operators

Only CHTTC personnel or hired watercraft operators will operate CHTTC watercrafts. Eligibility to operate CHTTC watercrafts is based upon a three-tier classification system. A special classification is devised for hired watercraft operators.

C class watercraft operator

C class watercraft operators must meet with the following criteria**:**

- Have a valid pleasure craft operators license

C class watercraft operators must comply with the following regulations:

- Will operate only under the direct supervision of an A or B class boat operator
- Will perform only autonomous boat operations

- Will operate only the Zodiac watercrafts, the blue pontoon or a rented boat less than 9 meters (30 feet) in length
- Will not operate in white water or during winter conditions, consult Section 7.1 for the definition of winter conditions

B class watercraft operator

B class watercraft operators must meet the following criteria:

- Have a valid pleasure craft operators license
- Completed a training course in boat rescue
- Have a minimum of 50 hours of boating experience with at least 5 hours of boating experience at the CHTTC site or in similar fast water conditions

B class watercraft operators must comply with the following regulations:

- Can perform only autonomous boat operations in the CHTTC operations area with the following exception:
    - Can perform the launch and retrieval of Zodiac boats and the blue pontoon.

- Will operate only the Zodiac watercrafts, the blue pontoon or a rented boat less than 9 meters (30 feet) in length
- Can operate in Canadian waterways with the Humminbird blue water chart activated under the supervision of an A class watercraft operator.
- Will operate in white water only after consultation with locals in the area and will operate under the direct supervision of an A class watercraft operator.
- Will not operate during winter conditions, consult Section 7.1 for the definition of winter conditions

A class watercraft operator

A class watercraft operators must meet the following criteria:

- Have a valid pleasure craft operators license
- Completed a training course in boat rescue
- Have a minimum of 150 hours of boating experience with at least 15 hours of boating experience at the CHTTC site or in similar fast water conditions

A class watercraft operators must comply with the following regulations:

- Can perform all watercraft operations in the CHTTC operations area with the following exception:

- Launch and extraction operations excluding launching and retrieving Zodiac boats and the blue pontoon require the prior approval of the Watercraft Safety Officer.

- Can operate all watercraft in the CHTTC operations area with the prior permission of the Watercraft Safety Officer with the following exception:

    - Prior permission from the Watercraft Safety Officer is not required to operate the Zodiac watercrafts, the blue pontoon or a rented boat less than 9 meters (30 feet) in length.

- Can operate any CHTTC watercraft worldwide with the Humminbird blue water chart activated
- Will operate in white water only after consultation with locals in the area
- May operate during winter conditions with the prior approval of the Watercraft Safety Officer, consult Section 7.1 for the definition of winter conditions

A⁺ class watercraft operator (hired watercraft operators)

The A⁺ class watercraft operator is designated solely for hired watercraft operators. All watercraft operators hired by the CHTTC are to be experienced in the operation of the watercraft that they are hired to operate and to be knowledgeable and experienced in the waterway in which they are hired to operate.

A⁺ class watercraft operators must meet the following criteria:

- Have a valid pleasure craft operators license
- Have a minimum of 150 hours of boating experience with at least 15 hours in the conditions in which they are to operate.

A⁺ class watercraft operators must comply with the following regulations:

- Will obtain the prior approval of the Watercraft Safety Officer prior to performing any operations
- Will perform only the operations they are hired to perform using only the watercrafts they are hired to operate
- Will not perform any operations in conditions that they deem unsafe

When a hired watercraft operator is performing any operations at the CHTTC site they are to be accompanied by at least one CHTTC member and comply with *The Canadian Hydrokinetic Turbine Test Centre Safety Rules and Regulations* and *The Canadian Hydrokinetic Turbine Test Centre Safe Work Procedures.*

6.6. CHTTC watercraft operations

Only qualified watercraft operators as per Section 6.5 will operate the CHTTC watercrafts. The watercraft operator is responsible for the safe operation of the watercraft and the safety of all people aboard.

For all watercraft operations, a safety boat must be on the water and available to serve as a rescue boat in case of an emergency. Anyone operating the safety boat must be qualified to accurately deploy a ring buoy and safety line and be physically capable of extracting a person from the water and into the safety boat.

For all watercraft operations, at least two people on site must be certified in standard first aid and CPR C.

During support missions the CHTTC personnel will comply with all rules and regulations of the entity with the authority. All CHTTC safety rules and regulations will continue to apply to CHTTC personnel including those rules and regulations pertaining to watercraft operation.

Any serious rules infraction related to watercraft operation by an individual as designed by the CHTTC Director, CHTTC Watercraft Safety Officer, CHTTC Site Manager or CHTTC Technical Manager can result in that individual loosing the their eligibility to operate CHTTC watercrafts indefinitely.

7. Winter water safety regulations

7.1. Introduction and definitions

A winter operation is defined as any operation in which the atmospheric temperature is less than -10°C and the water temperature is close to freezing.

7.2. General site description during winter

During winter conditions the majority of the CHTTC site remains unfrozen even during the extreme winter climate. Flow rates and water levels during the winter months tend to be lower than during the summer months, however, they are dependent upon the upstream Seven Sister Falls Generating Station output.

Additionally, during winter conditions, the shoreline becomes covered in snow and ice and a layer of solid ice forms along the shoreline. As temperatures during winter can reach -30°C, any watercrafts or structures that bridge the water air interface tend to accumulate large amounts of ice and become icebergs.

Figure 2 - View of the CHTTC site during winter conditions

7.3. Additional general safety regulations for winter operations

Anyone participating in any winter activities at the CHTTC site is expected to dress appropriately for the weather conditions. Additionally, a heated area large enough to accommodate everyone working at the CHTTC will be maintained at a constant temperature of at least 20°C. The heated area may be the office sea-can or a vehicle left running.

All people participating in winter operations must be knowledgeable on the signs, symptoms and first aid procedures for hypothermia and cardiac arrest.

Additional general safety regulations for winter operations are still currently under development and this section will be updated prior to the performance of any winter operations at the CHTTC site.

7.4. Additional safety regulations for shored based winter operations

Additional safety regulations for shore based winter operations are currently under development and will be added prior to the performance of any winter operations at the CHTTC site.

7.5. Additional risks of water based winter operations

The operation of watercrafts is unadvisable during winter conditions as watercraft components are not designed for these conditions. The additional risks of watercraft operation in winter include:

Zodiac Boats

- The pontoon fabric looses its elasticity, becomes brittle and is easier to crack and tear
- The pontoon surfaces and the fiberglass decks are extremely slippery due to ice, snow and frost present over open water and on the soles of footwear
- Launching and retrieving the boat through ice damages the hull and hull mounted equipment including transducers
- Lines such as the painter or safety line on the life buoy become frozen, stiff and slippery when they get wet and knots in a frozen line will not hold
- Knots tied in a frozen line will not hold and knots that become wet and freeze will not untie

Marine Engines

- Marine fuel tanks are vented to the atmosphere. As a result of water forms from condensation and fuel lines frequently freeze up
- The viscosity of engine oil on four stroke engines increases in winter temperatures resulting in poor fuel and oil mixtures, increased engine wear and the risk of stoppage
- Water in the engine cooling system may freeze
- The rapid freezing of water on the inlet side of the cooling system creates the risk of rupturing the cooling system.

Electronics

- Sonar and GPS equipment will not operate reliably at winter temperature and if the units operate at all the readings are unreliable
- Dashboard electronic engine and battery status displays will not operate reliably if at all.

Trailers

- Wheels and their braking systems, if equipped, will freeze solid when trailers are used to launch or recover watercraft
- Trailer equipment such as lights, wiring etc., is easily damaged when watercraft are launched or recovered through shore ice
- Fabric bunks become water soaked on launch and retrieval and freeze becoming slippery allowing the watercraft to slip around or slide off

Watercraft operations

- There is a risk of the boat becoming trapped in or the prop being disabled by frazil or floating ice
- There are numerous obstructions on the bottom of the basin at the mouth of the channel. Due to low winter water levels during winter and the lack of GPS for navigation there is a risk of the prop or lower gearbox being disabled if it becomes necessary to operate in this area;
- Due to the basin being ice covered below the channel there is a risk of equipment or personnel lost overboard being dragged under the ice in conditions of rapid flow if not recovered immediately.

Falling overboard

- A person falling overboard will be temporarily immobilized by the cold water and will immediately begin to suffer hypothermia in spite of the survival suit;
- A person in the water will weigh as much as 80 pounds more than their body weight due to winter clothing and being water soaked. They will represent a dead weight of 250 to 350 pounds to be dragged up and over the side of a watercraft.

7.6. Additional safety regulations for water based winter operations

Additional safety regulations for water based winter operations are currently under development and will be added prior to the performance of any winter operations at the CHTTC site.

8. Dam or dyke breach emergency evacuation

8.1. Introduction

Flooding at the CHTTC could result from either a natural flood event or a breach of one of the Seven Sisters dam structures. Flooding resulting from a natural flood event would occur with sufficient warning to monitor flow and enable timely notification and evacuation of the site.

A breach of a Seven Sisters Generating Station structure is unlikely. Manitoba Hydro performs regular inspections of the Seven Sisters structures to ensure early detection of any unusual conditions. Such a breach would however be a catastrophic event for people at the CHTTC. It is therefore important people at the CHTTC site understand the appropriate emergency responses. Seven Sisters hydroelectric generating station structures that could breach include:

- The South Dyke above and behind the spillway
- The North Dyke above and behind the powerhouse
- The powerhouse
- The spillway

8.2. South dyke breach

The south dyke is the water retaining structure upstream of the spillway dam on the Seven Sisters Town side of the river. A breach of the south dyke would result in extensive and rapid overland flooding to the southwest of the river eliminating access to the Seven Sisters Station and the CHTTC site from that direction. The flood would proceed downstream overtopping the bridge on Provincial Road 211 in an estimated 55 minutes.

It is unlikely that the south dyke would fail rapidly without some early indication of problems that would be detected by Manitoba Hydro staff through their routine inspections.

8.3. North dyke breach

The north dyke is the water retaining structure upstream of the Seven Sisters generating station on the north side of the river. A breach of the north dyke would result in extensive and rapid overland flooding of the land to the northeast of the river including the banks of the channel.

The lead-time between dyke breach and catastrophic flooding at the CHTTC is not has not been explicitly determined, but is expected to be short. Overland flooding is expected to overtop Provincial Road 211 within 1 hour of dyke breach. The Seven Sisters Town and community will not be affected by a breach of the north dyke.

8.4. Emergency response

Upon detection of a potential or imminent dam failure, Manitoba Hydro staff will activate their dam safety emergency plan and notify the local civil authorities and emergency responders, including the CHTTC team if they are present at the CHTTC site.

Upon receiving notification from Manitoba Hydro of a potential or imminent dam failure retrieve all people in boats or on pontoon working platforms and evacuate the area immediately using any available vehicles.

- For a breach of the south dyke, evacuate by the gravel road to the northwest of the generating station along the transmission line to Provincial Road 211 and then east to the town of Pinawa.
- For a breach of the north dyke, evacuate across the generating station and spillway to either the Seven Sisters Town or community.

After evacuation, notify Manitoba Hydro and the University of Manitoba of your status and location as per the contact information in Sections 1.2 and 1.4.

8.5. North and south dyke breach inundation maps

Inundation maps of the Seven Sisters area due to breaches of the southern and northern dykes for both extreme and normal flow are provided in Figures 3 to 6 located on the following pages.

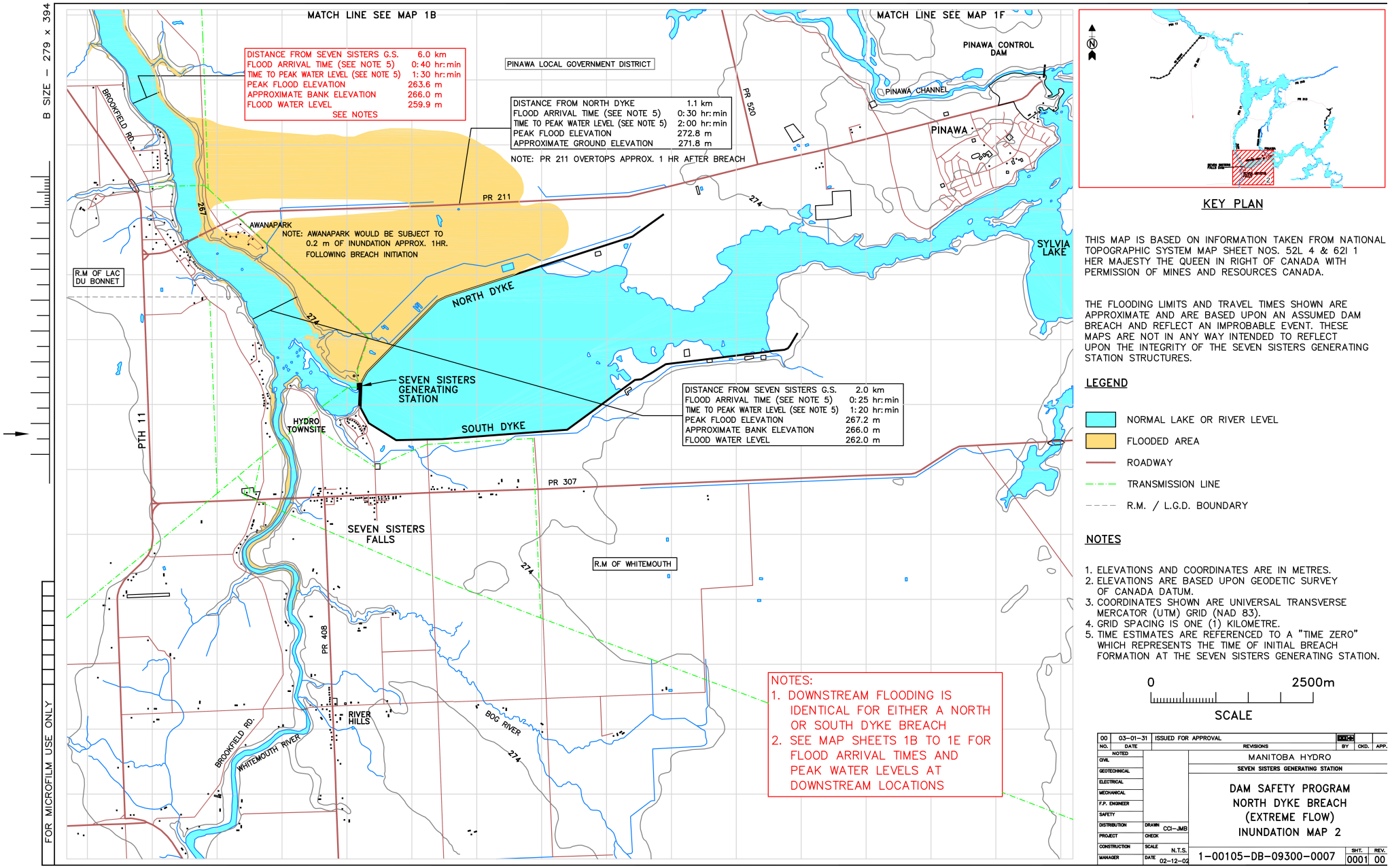

Figure 1 - North dyke breach during extreme flow conditions

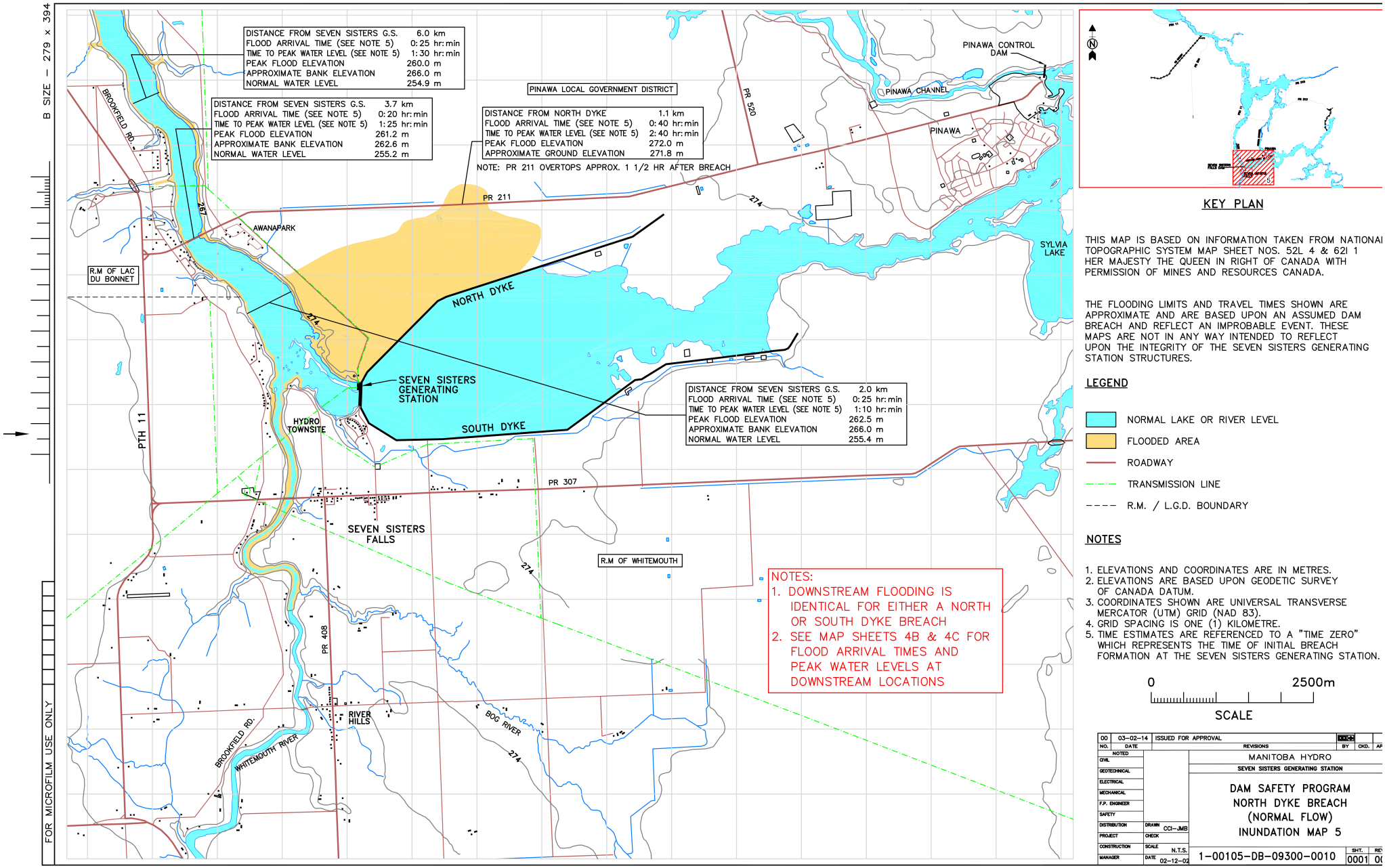

Figure 2 – North dyke breach during normal flow conditions

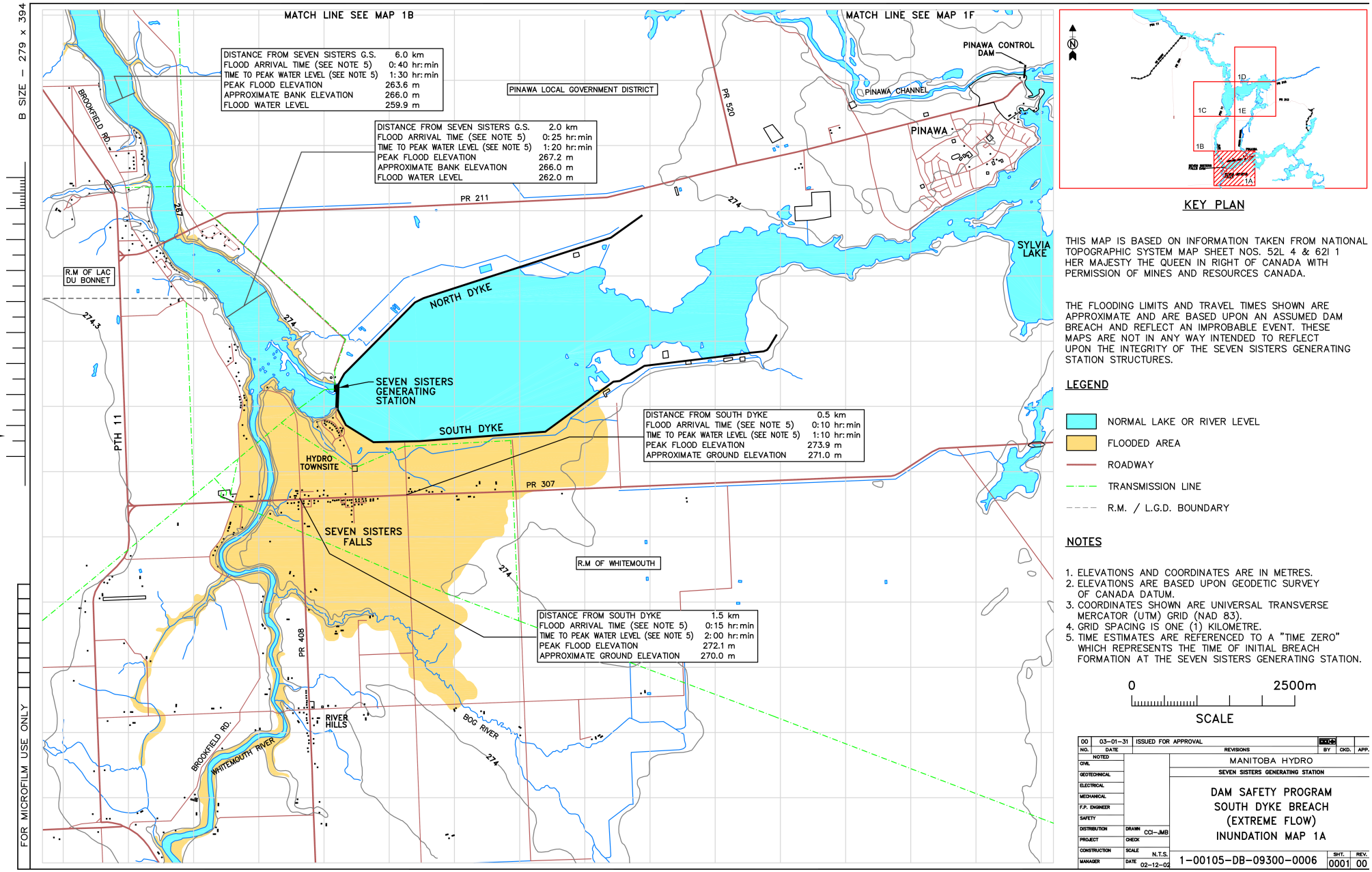

Figure 3 - South dyke breach during extreme flow conditions

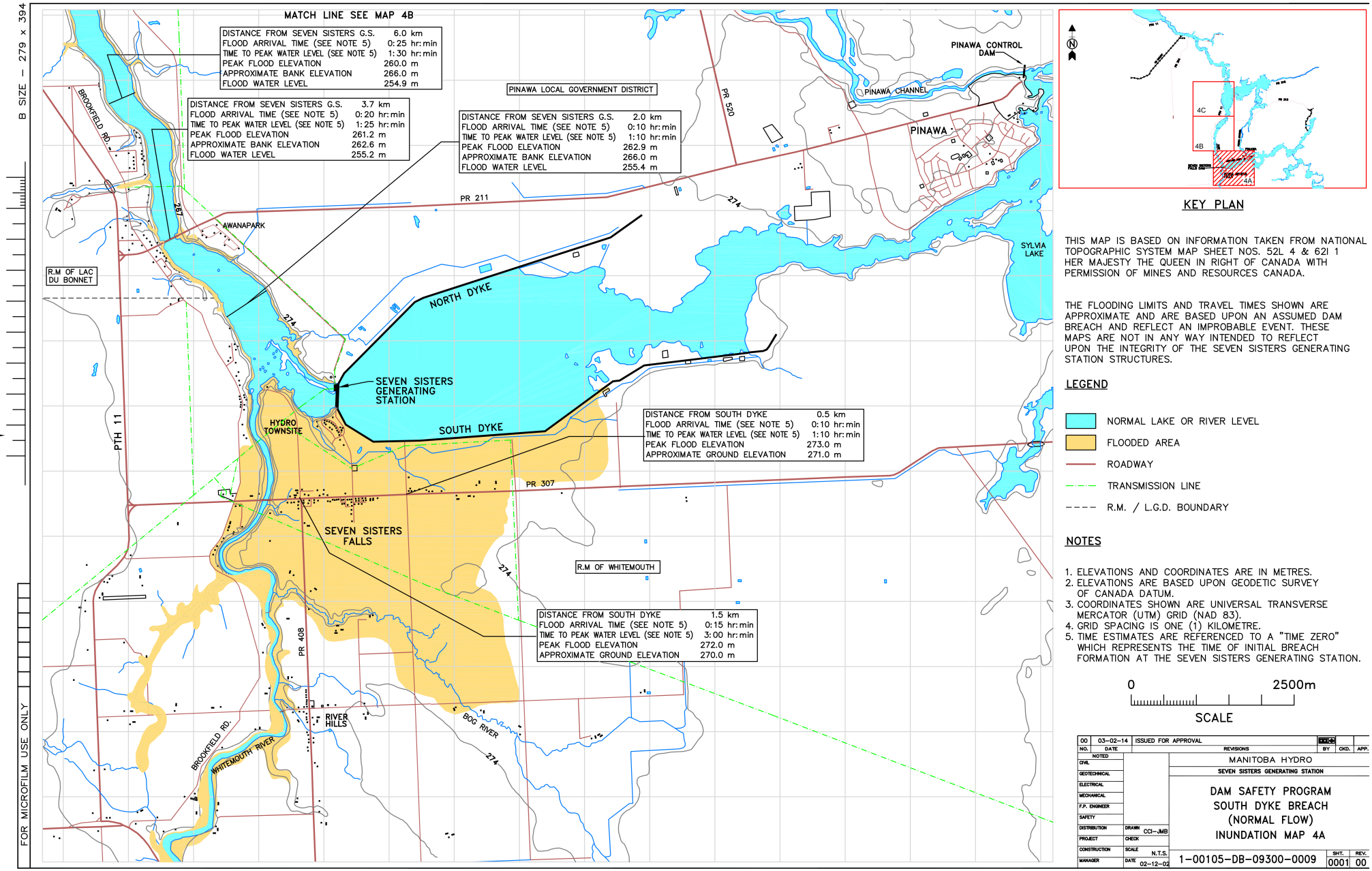

Figure 4 - South dyke breach during normal flow conditions