NORTHWEST TERRITORIES POWER CORPORATION

Box 2250, Yellowknife NT X1A 2P7 Phone (867) 669-3327 Fax (867) 669-3316



Date: February 13, 2007

Sarah Baines
Regulatory Officer
Wek'eezhii Land and Water Board
7th Floor – 4910 50th Avenue
P.O. Box 2130
Yellowknife, NT X1A 2P6

Dear Ms. Baines

Re: Response to comments from Water Resources Division, INAC for Water Licences **N1L4-0150** and **MV2003L4-0014** Snare Hydro / Snare Cascades, **Snare Hydro Emergency Preparedness Plan**

The following changes have been incorporated into the **Snare Hydro Emergency Preparedness Plan**

Emergency Preparedness Plan

- There is an operator at Snare twenty four hours a day three hundred and sixty five days a year. All Operators are trained to identify any problems with the dams; crest, upstream face, down stream face, toe and abutments. The operators are also able to estimate flow, how ever if they can estimate the width and depth of a breach the formula;
  1.86 x width x (lake elevation – depth)^1.5 x 2 will give the flow.
- All persons on the Emergency Notification list will be called and if required an emergency response team would be set up.
- There is no down stream monitoring of Strutt Lake, Slemon Lake, Russell Lake or Marian Lake. The first down stream lake with a Water Survey site is Great Slave Lake. We use the analyses of the inundation flood study done for the 2000 Dam Safety Review under taken by AGRA Monenco, to forecast down stream effects, which has been included in the plan.
- Comments from the 2006 Dam Safety Review have also been incorporated.

If you have any questions or concerns please contact me at 669-3327

Yours truly,

Ken Dies
Manager, Systems Control & Hydro Planning

NORTHWEST TERRITORIES
POWER
CORPORATION



# Snare Hydro

## Emergency Preparedness Plan

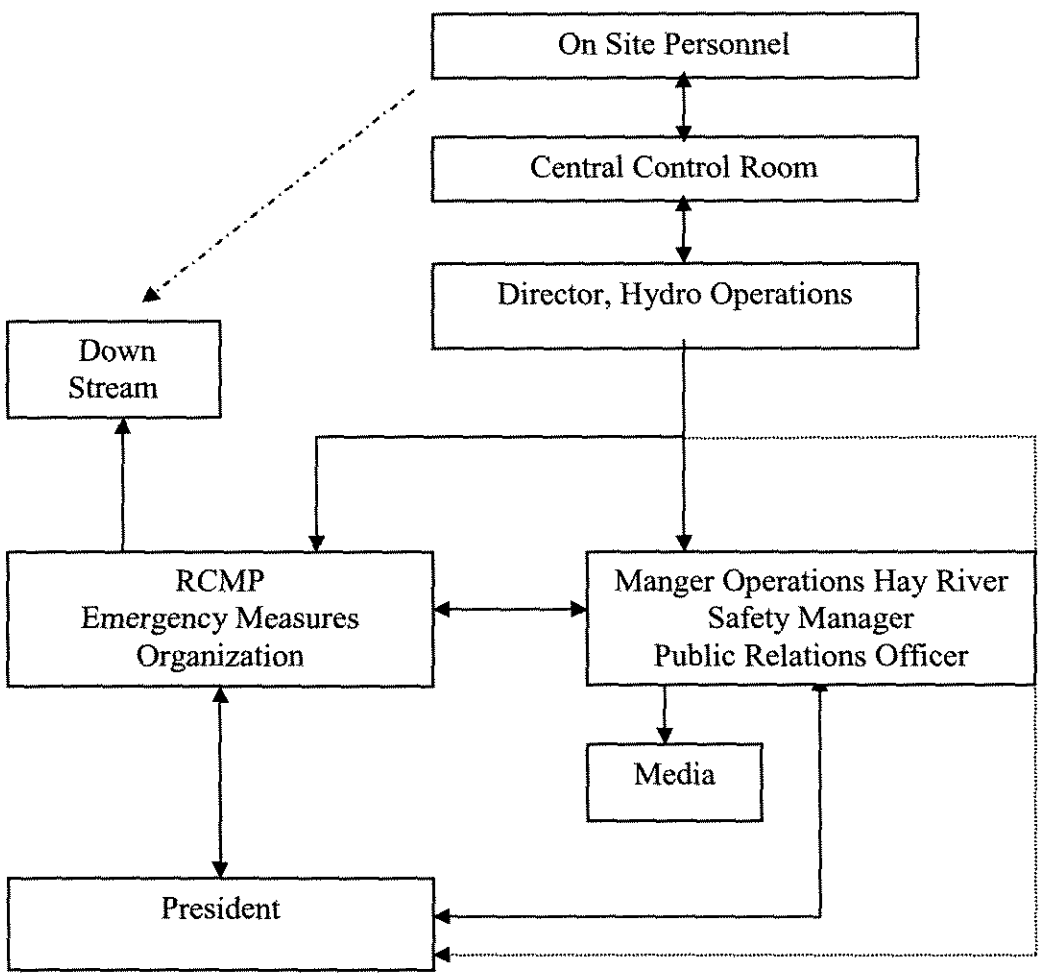
2007

## Contents

# *Snare Emergency Preparedness Plan*

## 1.0 Emergency Notification

### *1.1 Emergency Notification Flowchart Organizational Communication Plan*




If any individual cannot contact the next person on the list that position should be skipped and immediately go to the next position.

## *1.2 Emergency Notification Information*

**Calls that must be made:**

1. **On Site Personnel / Control Center Operator shall report to:**

| | |
|---|---|
| Manager, System Control & Hydro Planning – Ken Dies | 867-669-3327 (O)<br>867-873-8034 (H)<br>867-445-6515 (cell) |
| Plant Manager – Norm McBride | 867-669-3326 (O)<br>867-920-2885 (H)<br>867-445-6521 (cell) |
| Hydro Maintenance Manager – Randy Waddell | 867-669-3306 (O)<br>867-873-4322 (H)<br>867-445-6514 (cell) |
| Director, Hydro Operations – Randy Patrick | 867-669-3301 (O)<br>867-766 2392 (H)<br>867-445-6525 (cell) |

2. **Regional Director shall report to the following:**

| | |
|---|---|
| President & CEO – Leon Courneya | 867-874-5245 (O)<br>867-874-2417 (H)<br>780-719-0612 (cell) |
| Manager Safety & Envir – Robert Schmidt | 867-669-3313 (O)<br>867-669-0858 (H)<br>867-444-1207 (cell) |

3. **Local Agencies (Yellowknife):**

| | |
|---|---|
| Fire Department/Ambulance | 867-873-2222 |
| Hospital | 867-669-4111 |
| RCMP | 867-669-1111 |
| City Hall | 867-920-5600 |
| Public Works | 867-920-5670 |
| Public Works (After Hours Emergency) | 867-920-5699 |

4. **Downstream Water Users:**

| | |
|---|---|
| RCMP – Rae / Edzo | 867-392-6181 |
| Hamlet of Rae Senior Administrative Officer | 867-392-6500 |
| Dogrib Rae Band | 867-392-6581 |

**Other important phone numbers:**

| | |
|---|---|
| GNWT Emergency Measure Organization | 867-873-7554 |

# 2.0 Statement of Purpose

## *2.1 Purpose*

This Emergency Preparedness Plan (EPP) has been prepared to assist NTPC personnel, the Territorial Emergency Coordinating Committee, the RCMP, and other responsible local and regional officials in responding swiftly and effectively to emergencies at the four Snare River Dams. It facilitates efficient mobilization of NTPC manpower and equipment to deal with any developing emergency condition. It allows the non-NTPC emergency officials to establish timely warning procedures for the protection and security of property downstream.

This document is the Emergency Preparedness Plan for all of the NTPC hydro facilities - Snare Rapids, Snare Falls, and Snare Forks. Snare Cascades, although under a separate water license held by the Dogrib Power Corporation, is included due to location and for completeness. Rather than producing nearly identical EPPs for each dam, the differences in EPP for each dam are clearly noted where necessary in sections 3.1 (Dam Locations) and 7.0 (Inundation mapping).

**Inclusion in the EPP of procedures dealing with the safety of the dam itself does not in any way reflect upon the integrity of the dam.**

## *2.2 Scope*

The EPP sets out initial instructions for the Hydro Operations Director (HOD) and his staff to follow during emergencies at the dam. It describes:

5. Initial actions and observations to be taken;
6. Organizations and persons to be notified;
7. Remedial or deviating actions to be initiated; and
8. Resources available.

The procedures are designed to prevent or minimize loss of life and/or damage of property resulting from an emergency at a dam. In case of an emergency affecting the safety of the dam, procedures for initiating warning of downstream users are specified, consisting essentially of notification of local emergency agencies. Detailed public warning procedures are the responsibility of the RCMP and local and territorial emergency programs, agencies, and authorities.

Emergencies not specifically identified in the EPP shall be handled by the 0S and his staff using procedures appropriate to the degree of threat to life and property posed by the emergency, based on the procedures outlined in the Plan for emergencies of similar severity.

### *2.3 Abbreviations*

The following abbreviations are used throughout this document:

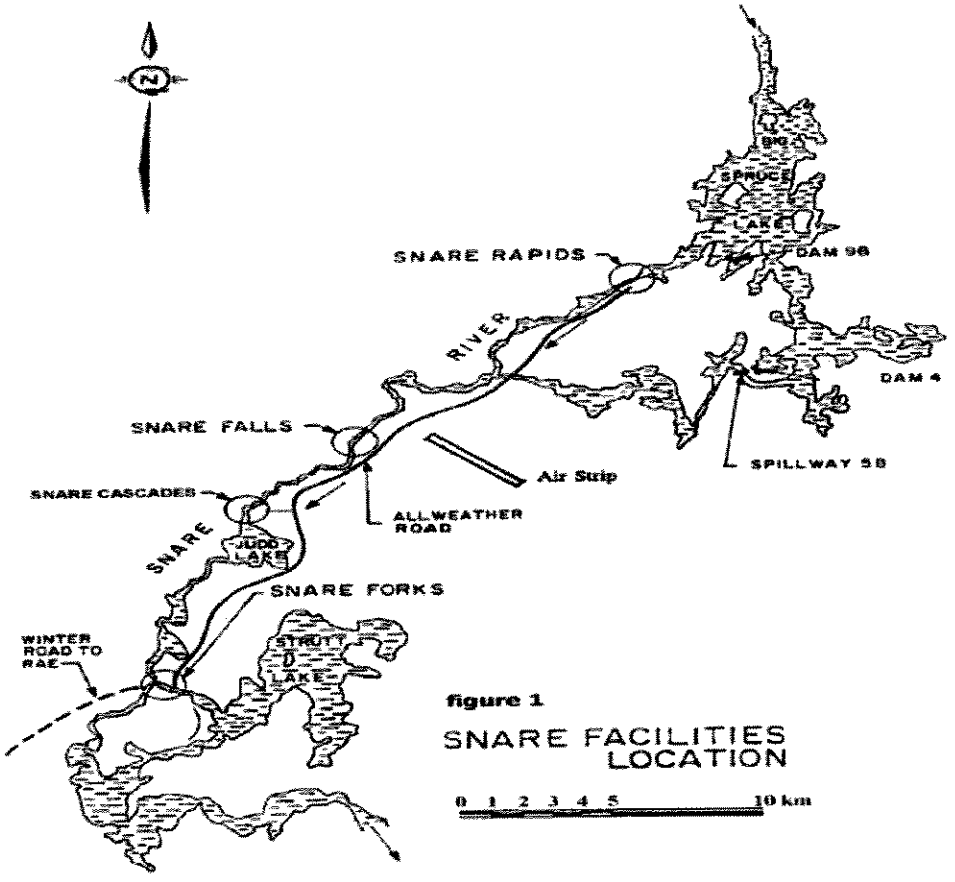
HOD Hydro Operations Director
EPP Emergency Preparedness plan
CC System Control Centre (at Yellowknife)

# 3.0 Project Description

## *3.1 Location of Dams and Downstream Areas*

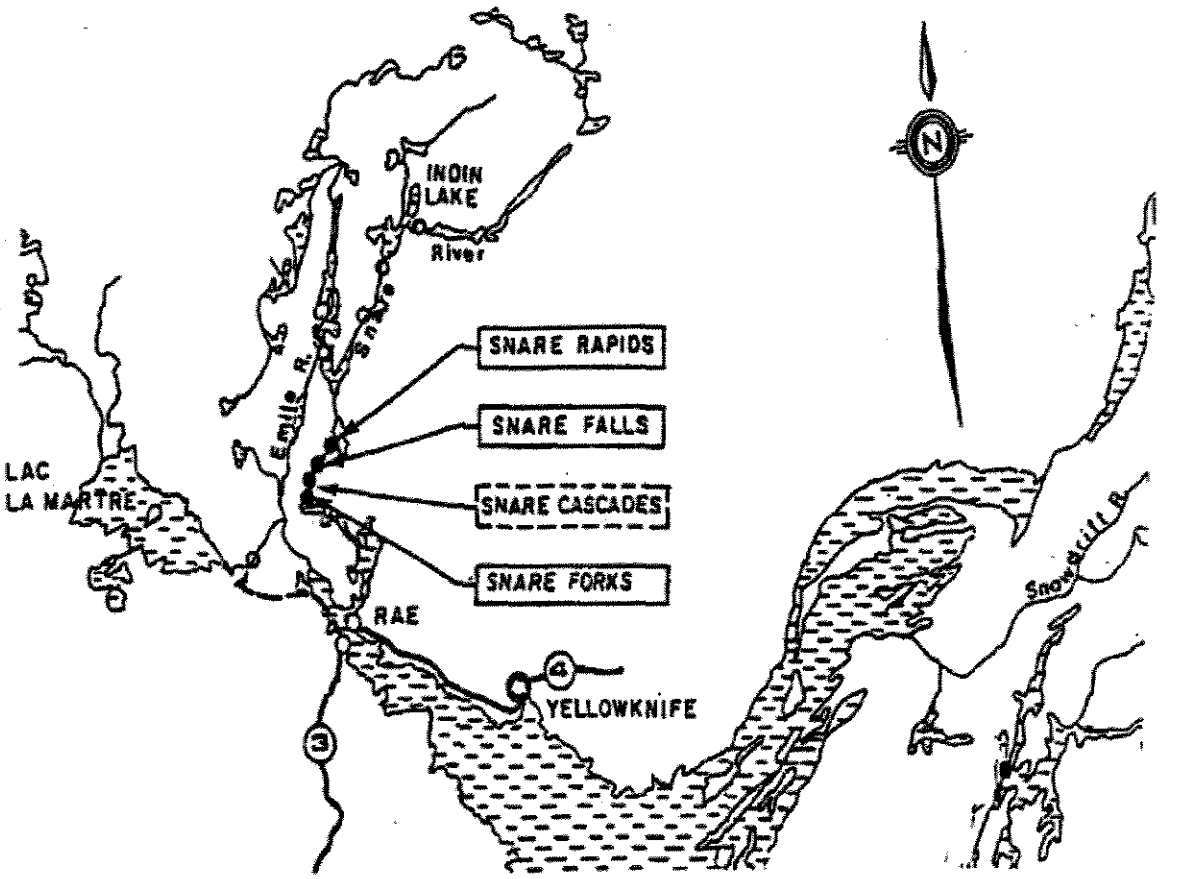
The location of the four Snare River Hydro Facilities is shown on figure 1. The main Snare Rapids dam with power plant and the 5B spillway are the furthest upstream on the Snare River. These components control outflow from the major storage reservoir, a combination of Big Spruce and Kwejinne Lakes called Big Spruce Reservoir. Next in line downstream is the Snare Falls dam with associated power plant and spillway. The Snare Falls forebay, although very small in storage capacity, backs up water to the toe of the Snare Rapids plant. Closely downstream to Snare Falls is the Snare Cascades plant and spillway. Furthest downstream is the Snare Forks dam with associated spillway, power plant, and small forebay.

**Figure 1: Snare River Hydro Facilities**




Outflows from the Forks forebay immediately enter a small lake (Strutt Lake) and then pass into Slemon Lake. Outflows from here enter Russell Lake (which is essentially part of Marian Lake) within 5 km. The closest permanently inhabited communities of Rae and Edzo are located on the south-east comer of Marian Lake. Marian Lake, joined to the North Arm of Great Slave Lake by the Frank Channel, can be considered part of this huge body of water.

**Figure 2: Downstream Communities**



**A) Snare Rapids**

| | | | |
|---|---|---|---|
| **Hazard Classification:** | High | | |
| **Location and Access:** | 150 km by air northeast of Yellowknife, NT<br>115 km by water north of Rae/Edzo, NT | | |
| **Latitude:** | 63031'N | **Longitude:** | 1160 00' W |
| **River/Stream:** | Snare River | **Nearest City/Town:** | Rae/Edzo, NT |
| **Height:** | 22 m | **Normal Surface:** | 130,203,559 m2 |
| **Length:** | 233 m | **Normal Capacity:** | 546,177,502 m3 |
| **Dam Type:** | rock-fill with impermeable core | **Max Capacity:** | 1,944,624,000 m3 |
| **Spillway:** | 8 controlled stoplog weirs | **Spillway Capacity:** | 528 m3 |
| **Dikes:** | (3) #4, #5B, #9B | **Drainage Area:** | 14,020 km2 |
| **Outlet other than spillway**: | Powerhouse Unit # 1, Unit #2, draw #8 at high levels | | |
| **Purpose/Operation of Dam:** | Hydroelectric **Instrumentation**: core temperature | | |
| **Significant upstream dams:** | None | | |
| **Significant downstream dams:** | Snare Falls, Snare Cascades, Snare Forks | | |
| **Overview of Inundation Area:** | Snare River downstream to Marion Lake | | |
| **Method of emergency drawdown:** | breech freeboard dyke #9 | | |

**B) Snare Falls**

| | | | |
|---|---|---|---|
| **Hazard Classification:** | Low | | |
| **Location and Access:** | 145 km by air northeast of Yellowknife, NT<br>103 km by water north of Rae/Edzo, NT | | |
| **Latitude:** | 63026'N | **Longitude:** | 1160 11' W |
| **River/Stream:** | Snare River | **Nearest City/Town:** | Rae/Edzo, NT |
| **Height:** | 23 m | **Normal Surface:** | 5,640,147 m2 |
| **Length:** | 152 m | **Normal Capacity:** | 3,384,013 m3 |
| **Dam Type:** | Rock-fill with impermeable core | **Max Capacity:** | 87,306,912 m3 |
| **Spillway:** | 2 controlled underflow gates | **Spillway Capacity:** | 442 m3 |
| **Dikes:** | (2) North, South | **Drainage Area:** | 153 km2 |
| **Outlet other than spillway:** | Powerhouse Unit # 1, uncontrolled weir | | |
| **Purpose/Operation of Dam:** | Hydroelectric **Instrumentation**: none | | |
| **Significant upstream dams:** | Snare Rapids | | |
| **Significant downstream dams:** | Snare Cascades, Snare Forks | | |
| **Overview of Inundation Area:** | Judd Lake, Strutt Lake | | |
| **Method of emergency drawdown**: | breech north saddle dam | | |

### C) Snare Cascade

**Hazard Classification:** Low
**Location and Access:** 150 km by air north-east of Yellowknife, NT
100 km by water north of Rae/Edzo, NT
**Latitude:** 63o 25.3' N **Longitude:** 116o 13.2' W
**River/Stream:** Snare River **Nearest City/Town:** Rae/Edzo, NT
**Height:** 7 m **Normal Surface:** 220,000 m2
**Length:** 162 m **Normal Capacity:** 220,000 m3
**Dam Type:** rock-fill with impermeable core **Maximum Capacity:** 1,261,834 m3
**Spillway:** uncontrolled labyrinth weir **Spillway Capacity:** 434 m3
**Dikes:** none **Drainage Area:** 28 km2
**Outlet other than spillway:** Powerhouse Unit #1
**Purpose/Operation of Dam:** Hydroelectric **Instrumentation**: none
**Significant upstream dams:** Snare Rapids, Snare Falls
**Significant downstream dams:** Snare Forks
**Overview of Inundation Area:** Judd Lake
**Method of emergency drawdown:** breech right abutment

### D) Strutt Lake & Snare Forks

**Hazard Classification:** Low
**Location and Access:** 140 km by air north-east of Yellowknife, NT
90 km by water north of Rae/Edzo, NT
**Latitude:** 63o 20' N **Longitude:** 116 o 20' W
**River/Stream:** Snare River **Nearest City/Town:** Rae/Edzo, NT
**Height:** 18 m, 10 m **Normal Surface:** 10,900,205 m2
**Length:** 160 m, 105 m **Normal Capacity:** 6,540,018 m3
**Dam Type**: rock-fill with impermeable core **Max Capacity:** 77,449,680 m3
**Spillway:** uncontrolled weir **Spillway Capacity:** 364 m3
**Dike:** (3) #1, #2, #3 **Drainage Area:** 73 km2
**Outlet other than spillway:** Powerhouse Unit #1, Unit #2
**Purpose/Operation of Dam:** Hydroelectric **Instrumentation:** none
**Significant upstream dams:** Snare Rapids, Snare Falls, Snare Cascades
**Significant downstream dams:** None
**Overview of Inundation Area:** Strutt Lake
**Method of emergency drawdown:** breech freeboard dyke #1

# 4.0 Emergency Detection, Evaluation and Classification

## *4.1 Potential Dam Breach*

### *4.1.1 Definitions*

There are two classifications of Potential Dam Breach:

**i. Dam Advisory Condition**

A Dam Advisory Condition is a situation where an unusual problem or situation has occurred, but a failure of the dam is not imminent. Examples of a Dam Advisory Condition are:

- Instrumentation readings reach pre-determined numerical limits;
- Any undocumented or unusual spring;
- Any sign of piping;
- Any sign of slumping;
- Any sinkhole;
- Any unusual crack;
- Any unusual wet spot or boggy area;
- Any seismic event regardless of how slight;
- Any obstruction in the spillway;
- Evidence of damage due to vandalism at any structure(s);
- Bomb threat;
- A civil disorder near the reservoir structure(s); and
- Any aircraft accident near the reservoir structure.

**ii. Dam Warning Condition**

A Dam Warning Condition is any developing or occurring event or circumstance which is or may adversely affect the integrity of the dam but is considered controllable. The Dam Warning Condition has the potential of evolving into a Dam Emergency or Dam Breach condition. Examples of a Dam Warning Condition are:

- Water level of the reservoir is at an unsafe level and is rising threatening to overtop the dam; and
- Any developing erosion, settlement or upheaval occurring on the downstream slope or at the toe of the dam and is considered to be controllable.

### *4.1.2 Hazard*

A potential dam breach may require the controlled release of unusually large flows causing downstream flooding and/or requiring action at downstream dams and reservoirs.

### *4.1.3 Response*

Any observer who learns or suspects for good reason that potential breach condition exists in the dam shall immediately **report the situation to the System Control & Hydro Planning Manager**. Phone numbers are given in Section "Communications Directory."

(See also Section 3.0 for telephone locations, radio, and back-up systems.)

The System Control & Hydro Planning Manager shall:

1. Ascertain and verify details of failure threat;
   - **a.** Description of sloughs, subsidence, movement, cracking, seepage, drainage disturbances, etc.
   - **b.** Location and extent
   - **c.** Likelihood of deterioration
   - **d.** Effects on adjoining structures
   - **e.** Reservoir and tail water elevations (if available)
   - **f.** Prevailing weather conditions
   - **g.** Other facts believed to be pertinent

2. Initiate notifications procedures shown on Fig. 2-1. Make certain all officials understand the nature of a potential breach condition and the possibility of eventual dam breach;

3. Evaluate threat;

4. Determine and implement the immediate actions which must be taken to reduce or eliminate risk of a breach;

5. Take action to minimize potential for downstream flooding; and

6. If the situation deteriorates markedly and a breach occurs or becomes imminent, implement "Dam Breach" procedures set out in Section 4.2.

### *4.1.4 Notifications*

1. Immediate notifications shall be made as shown in Section 1-1. The HOD plays a larger role in initial notifications in the case of potential breach compared with an actual breach because he is the key coordinator in the evaluation of breach potential, possible remedial measures, impact reduction, etc.

2. If any individual or agency responsible for making further notifications cannot be reached, it shall be the responsibility of the initiating caller to make the next stage of notifications himself.

3. The HOD may specify additional people or agencies that should be notified and initiate actions which may reduce the downstream flooding hazard. Refer to Communications Directory in Section 6.0 for a full list of phone numbers.

4. Yellowknife System Control Centre shall be kept fully informed of any change affecting reported condition of the emergency.

### *4.1.5 Media Contacts*

Formal media contacts with NTPC related specifically to a potential dam breach shall be handled in conjunction with NTPC's Public Relations Officer.

## *4.2 Dam Breach*

### *4.2.1 Definition*

There are two kinds of Dam Breach situations:

i. **Dam Emergency Condition**
A Dam Emergency Condition is defined as one or more of the following situations:
- Water has overtopped or will overtop any dam or dike.
- Any uncontrollable erosion, settlement, or upheaval occurring on the downstream slope or at the toe of the dam.
- Any uncontrollable leakage through any dam structure.

ii. **Dam Breach Condition**
A Dam Breach Condition is defined as:
- A dislocation or failure of any structure which allows for an expanding, uncontrollable discharge of water through the spillway, dam or dykes indicating a breach is occurring.

### *4.2.2 Downstream Hazard*

Any building, road, bridge, powerhouse, dam, or settlement which could possibly be reached by flooding.

### *4.2.3 Response Checklist*

1. Observe and report breach (see below)
2. Verify breach report
3. Notify people shown Section 1.1 to start warnings
4. Take action to stem or alleviate flooding downstream

### *4.2.4 Observations*

Any observer who learns or suspects for good reason that a breach has formed in one of the dams shall immediately **report the situation to the System Control & Hydro Planning Manager.** If the System Control & Hydro Planning Manager is not available, the observer shall contact the alternate person. Phone numbers are given in Section 1-2 and in Section 6.0 "Communications Directory." (See also Section 3.0 for telephone locations and radio information.) In clear concise language the observer shall relate:

1. Name and position
2. Identification of the breached dam
3. Location of breach
4. Magnitude (size of cracks, gaps, erosion rate)
5. Rate of enlargement
6. Rate of uncontrolled flow
7. Rate of increase in flow
8. Time of commencement of breach

The observer must estimate the above to the best of his ability as measures taken by others will depend on the information supplied.

### *4.2.5 Verification*

Before notifying others, the System Control & Hydro Planning Manager shall be satisfied that the failure report is genuine. Verification may include:

1. Recognition of caller;

2. Caller's demonstrated knowledge of NTPC procedures, personnel, systems, etc;

3. Corroborative evidence from instrumentation, current environmental conditions (e.g., weather, earthquake); and/or

4. Contacting another member of staff at or near the dam site for confirmation (but only if there is serious doubt about the veracity of the report. Remember, time may be of the essence).

### *4.2.6 Notification*

1. Immediate notifications shall be made as shown on the chart in Section 1.1. The notifications are arranged to maximize the time available to allow site personnel to devote their time to remedial operations and actions to lessen flooding.

2. If any individual or agency responsible for making further notifications cannot be reached, it shall be the responsibility of the initiating caller to make the next stage of notifications himself.

3. Yellowknife System Control Centre shall be kept fully informed of any change affecting the reported condition of the emergency.

4. Staff residing at the Snare Rapids staff house may be aware of temporary hunting or fishing camps in the area. If an evacuation is planned and the camps are accessible by vehicle or boat, notification will be made. The Snare Falls spillway is equipped with a klaxon horn, which is sounded when the spill gates are opened. If camps are not easily accessible, the RCMP will be notified.

### *4.2.7 Media Contacts*

In general, emergency announcements through the local media will be the responsibility of RCMP and/or local officials. The HOD may contact the local communications media as necessary to assist with any emergency announcements or to obtain information. However, formal contact by NTPC staff with the media should be handled in conjunction with the Public Relations Officer. Prior consultation between Territorial and NTPC Public Relations Officer is encouraged in dealing with media inquiries.

### *4.3 Earthquakes*

An earthquake alert exists if an earthquake is felt in the Snare area.

In the case of an earthquake alert the System Control & Hydro Planning Manager shall immediately arrange for a general overall inspection of the dam and surrounding slopes.

The System Control & Hydro Planning Manager shall proceed as follows:

1. **Severe Damage** - If a dam is damaged to the extent that there is a rapidly increasing or large uncontrolled flow passing downstream, implement "dam breach" procedure set out in Section 4.2.

2. **Significant Damage** - If damage has occurred which has not caused a breach but which poses an immediate threat to the safety of the dam (e.g. significant increases in drain flow, new seepage or boils, cracking or slumping of dam embankment or major cracks in concrete control structure), implement "Potential Dam Breach" set out in Section 4.1.

3. **Minor Damage** - If damage has occurred which does not present an immediate threat to the safety of the dam (e.g. small cracks or displacements, small increases in drain flow, small rock or earth slides), the following shall be implemented by the System Control & Hydro Planning Manager:

   **a.** Conduct a thorough re inspection of both faces of dams and crests for cracking, slumping, offset or seepage.

   **b.** Conduct a detailed inspection of areas in vicinity of abutments for possible landslides, displacements or seepage.

   **c.** Inspect all drainage systems and note any changes in established drainage patterns and whether drainage flow is clear or cloudy.

   **d.** Inspect powerhouse, power intakes and spillways to determine any damage.

   **e.** Observe reservoir slopes and downstream areas visible from dam crest for landslides or ground ruptures.

   **f.** Immediately upon discovery of any damage or upon completion of each detailed investigation, a report shall be made orally to the OS.

   **g.** Some damage to structures may not be readily apparent during the inspection immediately following an earthquake. Inspection and close monitoring of the facilities should be continued for at least 48 hours.

A secondary inspection shall then be made 2 weeks to a month after the initial inspection.

4. **No damage** - If no damage is evident, the OS shall notify the Vice-President of Operations who will decide whether a thorough inspection such as outlined in Item 3 above, should be made, having regard to the intensity of the earthquake.

## *4.4 Sabotage, Bomb Threat, Riot*

### *4.4.1 Sabotage*

If there are indications that an act of sabotage has been committed at the dam, local staff shall notify the HOD, who shall:

1. Ensure safety of members of public and NTPC employees at or near dam. This may include evacuation of the dam site.
2. Determine (if possible) whether saboteur is still at the dam site and assess sabotage potential and situation.
3. Notify:
   **a.** RCMP
   **b.** Vice-President of Operations and Engineering
   **c.** Director of Security and Safety
4. If the saboteur has left, check the area for evidence that might aid in apprehending him/her.

### *4.4.2 Bomb Threat*

If a telephone bomb threat is received, the person receiving the call should:

1. Keep the caller on line as long as possible. Ask caller to repeat message. Try to record every word spoken by caller.
2. If caller does not indicate the location of bomb or time of detonation, ask caller for this information.
3. Listen closely to voice: sex, voice quality, accent, or speech impediment.
4. Pay particular attention to background noises such as motors running or music that could give a clue to location from which the call is made.
5. Notify the HOD, who shall then notify:
   **a.** RCMP
   **b.** Vice-President of Operations
   **c.** Safety Manger, West
6. Evacuate dam site under supervision of the HOD.

If a search is conducted for a bomb, use of radios during the search should be avoided; radio signals could cause premature detonation of a blasting cap. If

during the search a suspicious package or object is found, **DO NOT TOUCH**. It should be left for trained personnel to remove or disarm.

### *4.4.3 Riot*

If there is a riot or demonstration at the dam, the HOD shall:

1. Ensure safety of members of public and NTPC employees at or near dam. This may include evacuation of the dam site.
2. Lock all gates and doors.
3. Notify:
   - **a.** RCMP
   - **b.** Vice-President of Operations
   - **c.** Director of Security and Safety

## 4.5 Floods

### *4.5.1 Early Warning*

The area draining into Big Spruce reservoir contains a very high proportion of lakes. These act to hold back and slow down snowmelt and rainfall runoff before it reaches the Snare River and its main tributaries. Once reaching a major channel, numerous lakes hold runoff back still further. These include Winter Lake, Round Rock Lake, Snare Lake, and Indin Lake on the mainstem, and Ghost Lake on the Ghost River.

Consequently, it takes close to two months after a major storm event or after the start of snowmelt before the ensuing reservoir inflows reach a peak. If the forecasted peak inflow is very high, then a two month early warning period is available to organize a wide range of mitigative measures. Initially this would involve planning and organizing.

An even more accurate inflow forecast can be made about 4 weeks before the peak when complete flow information from the indicator basin on the Indin River is available from satellite. If, at this point, the forecast remains extremely high, the previously organized mitigative measures would be implemented. These would include, for example, early draw down of Big Spruce reservoir and the Falls and Forks forebays, heightening of major dams, removal of small very low head side dams, etc. as described subsequently.

### *4.5.2 Mitigative Measures*

1. **Big Spruce Reservoir** - Large amounts of water are stored in Big Spruce reservoir. The normal range of licensed water levels varies from 217.93 m (715.0 ft.) to 222.29 m (729.3 ft.). The impermeable core of the dam was constructed at elevation 222.50 m (730.0 ft.) and in 2002 the core was raised to an elevation of 223.0 m (731.66). Consequently, the maximum licensed operating level of the Snare Rapids dam, (valid only during periods of high flow) which is 222.50 m (730.0 ft.) is now 1.66 m below the top of the core.

   Material above the core, a compacted mixture of large gravel, silt and clay is also fairly impermeable.

   The Snare Rapids dam and powerhouse would be severely damaged and a gap would develop if reservoir levels exceeded the top of the dam at 224.03 m (735.0 ft.).

   To prevent this from happening during flood periods, water is spilled from Big Spruce Reservoir through the 5B spillway, located about five kilometres away from the Snare Rapids dam. This two-man operation is accomplished

by selectively withdrawing stop logs (12", 18" and 24" high), with a traveling, powered crane, from each of the eight 6.1 m (20 ft.) wide bays. Stop logs can be removed to elevation 216.41 m (710 ft.) in bays #3, and #4, and to elevation 219.76 m (721 ft.) in the other six bays. Stop log removal time is dependent upon several factors. Complete removal of all stop logs requires about 5 hours of time. To minimize the sudden rise in downstream water levels, spillage would begin well before the peak is reached.

If inflows were to exceed the spill capacity with the Rapids generator also passing maximum amounts of water, then a nearby borrow pit of till and heavy equipment on site could be used to raise the top of the dam by 0.3 to 0.6 meters and to repair small weaknesses that may develop. Gaps could also be dug by 4 men crews into several small side dams (i.e. #9B). Subsequently washouts would safely expand these gaps and thus the spill rate but would not deepen more than approximately 2 to 3 meters.

2. **Snare Falls Forebay** - Only small amounts of water are stored in the Falls forebay. Water levels are normally maintained between 202.08 m (663.0 ft.) and 202.39 m (664.0 ft.).

   The Snare Falls dam and powerhouse would be severely damaged if forebay water levels exceed the top of the dam at elevation 20.574 m (675.0 ft.). The impervious core of the dam rises to elevation 204.83 m (672.0 ft.). To prevent a dam break from happening, water is spilled through two 5.79 m (19 ft.) wide motorized undershot gates that open from 195.38 m (641.0 ft.) to 202.39 m (664.0 ft.).

   Small amounts of water also spill uncontrollably over a small 12.2 m (40 ft.) wide weir whenever water levels exceed 202.39 m (664.0 ft.). With both gates fully open, and with the forebay topped up, maximum Falls outflows would match maximum spill capacity from Big Spruce reservoir. If it were necessary to spill through gaps in the Big Spruce side dams, then (time permitting) gaps should be placed in the two right bank side dams near the Falls dam to increase spillage at the Falls too. This could easily be accomplished with heavy equipment. However, first priority would be directed towards saving the Rapids dam with its attendant large volume of stored water.

3. **Snare Forks Forebay** - Only small amounts of water are backed up behind the Forks dam. Water levels normally range between 173.43 m (569 ft.) and 173.74 m (570 ft.).

   NTPC drawings show the top of the core of the dam at elevation 175.56 m (576 ft.). This is the maximum water level allowed by licence. The top of the dam is at elevation 176.78 m (580 ft.). The top of the right side dam is slightly lower at about elevation 175.3 m (575 ft.).

The Snare Forks plant would be severely damaged if the adjacent dam were breached. This is normally prevented by uncontrolled spillage over the concrete weir at elevation 173.74 m (570 ft.). However, if the forebay inflows were to become higher than combined spillway plus plant flows, water levels would rise until the low side dam failed. At that point outflow rates would increase substantially. This additional spill would be located far enough away from the power plant that it would not be damaged.

Even greater additional spill protection would, in fact, be provided because heavy equipment would be used to initiate wider areas of washout. This measure would have a lower priority, however, than mitigative measures to ensure the integrity of the Snare Rapids dam and the Snare Falls dam.

### *4.5.3 Downstream Flooding Hazards*

1. **Historical Peak Flows**

No serious downstream flood damage has been reported in the over fifty year history of Snare hydroelectric development.

2. **Spillway Design Discharge**

In 1998 Dillon Consulting Limited determined that the 1:1000 AEP flood equal to 458 m3/s at Big Spruce Reservoir was attenuated to a maximum daily outflow of 424 m3/s. A confirming estimate of 434 m3/s for the 1:1000 AEP flood was determined by KGS Group in 1999. According to KGS Group at the normal operating level of elevation 222.29 m (729.3 ft), the total spillway capacity is approximately 475 m3/s, which is greater than the 1:1000 year flood. This capacity includes a head loss of approximately one-foot in the approach channel between the main body of the lake and the spillway control structure. In the 2000 Dam Safety Review carried out be AGRA Monenco the maximum daily outflow was calculated at 457 m3/s, 20% larger than estimated by earlier investigators, but is still within the original dam design parameters, as the maximum flood level 222.41 (729.72) is lower than the design core elevation 223.0 (731.66).

3. **Dam Breach due to Earthquake**

All three Snare hydroelectric dams are gravity dams of moderate head (maximum 21 m). Consequently, they are very resistant to earthquake damage. If either the Snare Falls or Snare Forks dams were to be breached, very little downstream damage would occur because the small volumes of water that would be released would be dissipated quickly by the first two lakes encountered downstream - Strutt Lake and Slemon Lake. In the

extremely unlikely event that the Snare Rapids dam was to be breached by a very strong earthquake, then both downstream dams would be taken out too, either by the flood of water from the upstream breach, or by the earthquake itself.

The force of the earthquake would forewarn NTPC personnel at or in the vicinity of the Snare Rapids staff house. They would have time to move immediately to adjacent high ground while the breach develops and widens, and then to notify the control centre operator by radio. The highest rise in water levels would occur just below each dam. The flood wave would have virtually no major affect upon Russell Lake or Marian Lake because they are essentially part of Great Slave Lake.

### *4.6 Failure of Spillway Operating Equipment During an Emergency*

If a spillway gate at the Falls, or the stop log hoist at the 5B spillway fails to operate, the field crew shall:

1. determine the possible cause of failure and effects on reservoir operations.

2. and, if gate failure could endanger one of the dams, determine what immediate assistance is required to remedy the problem including:
   **a.** replacement parts;
   **b.** manpower, and
   **c.** repair equipment

3. determine temporary replacement or operating procedures.

4. contact the System Control & Hydro Planning Manager report conditions, in the event of conditions not predicted or not covered by operating instructions, request directions on how to proceed.

5. if dam security is threatened, notify the HOD and the System Control & Hydro Planning Manager.

### *4.7 Response During Periods of Darkness and Adverse Weather*

The normal period of high flows and potential high precipitation events occurs in the summer months when the Snare structures are subject to a predominance of daylight. If, however, a response was needed during a period when darkness was a hindrance, artificial illumination equipment is available at the Emergency Response Facility. This building is located near the Snare Rapids helipad and contains a portable generator, halogen lights, flashlights and propane lanterns.

Also contained in the Emergency Response Facility are torches, heaters, tarps and rope to aid in response during adverse weather.

## 4.8 Spring, Seepage or Increased Drainage

Periodic measurement of seepage is taken by operating staff at:

1. Left abutment drainage sump at Snare Rapids;
2. 5B Spillway Side Dam; and
3. Downstream of the powerhouse at Snare Forks.

If new springs or seepage are observed or existing ones increase abnormally, the observer shall report the following to the System Control & Hydro Planning Manager:

1. Location of springs or seeps, including identification of structure or embankment and a description of affected area;
2. Size;
3. Estimated discharge or change of discharge;
4. Nature of flow - clear or cloudy;
5. Type of flow - wet spot, slow seepage, boil, or piping; and
6. Reservoir and tailwater elevations.

The HOD shall decide what immediate emergency measures are necessary.

## 4.9 Droughts

### *4.9.1 Aquatic Habitat and Downstream Licensed Minimum Water Release Requirements*

There are no minimum flow requirements from Big Spruce reservoir because water will always be backed up to the base of the Rapids dam by the Snare Falls dam as long as the Falls forebay is kept within licensed limits.

The minimum flow release requirement below the Falls forebay is 5.66 m3/s (200 cfs). This is required to maintain flows and water depth in the short section of river channel between the Falls dam and the upstream end of the Forks forebay. Because of the series of small rapids in this section of river channel, a series of pools would maintain fish in the event of a short duration cessation of inflows.

The minimum flow release requirement from the Forks forebay is a 0.0 m3/s (0.0 cfs). The constriction at the outlet of Strutt Lake backs up water to the Forks dam so that even a complete cessation of flow for extended periods would not eliminate fish habitat between the Forks dam and the outlet of Strutt Lake. Also, outflow from water stored in Strutt Lake would continue for many days should a complete halt to Forks dam outflows ever occur. At any rate, only a short 1 kilometre section of channel between Strutt and Slemon Lake would be affected. Slemon Lake is so large that it would buffer any downstream effects for a month or more.

4.9.2 Licensed Minimum Water Level Requirements

The level of Big Spruce reservoir must be kept above 217.8 meters (715.0 ft.) according to its water licence unless a written request is filed with the Water Board and a letter of approval received. The Falls forebay must be kept above 201.8 meters (662.0 ft.) according to its water licence unless a written request is filed with the Water Board and a letter of approval received. The Forks forebay must be kept above 173.1 meters (568.0 ft.) according to its water licence unless a written request is filed with the Water Board and a letter of approval received.

### *4.9.3 Special Water Licence Exemptions for Scheduled Maintenance*

For short periods of time each year, it is necessary to apply to the Water Board for special exemptions to draw down the Falls forebay to about 201.2 meters (660.0 ft.) so that the tailrace of Rapids plant can be dewatered for scheduled inspections and repairs.

After periods of high spillage from the Falls dam, rock debris accumulates in the tailrace channel below the spillway. This raises tailrace levels and consequently reduces the output of the Falls generator. It is therefore necessary approximately every five years on average to apply to the Water Board for special exemption to cease Falls dam releases completely for one eight hour period while debris is cleared from the tailrace with heavy equipment.

### *4.9.4 Operational Strategies for Drought Conditions*

**a. Maintaining High Generation Efficiencies with Low Average Plant Flows**

During the worst historical drought conditions, Big Spruce reservoir net inflows averaged 26.0 m3/s (in 1980/81) and only 24.6 m3/s the following year. If such a drought were to recur, then there would be a very large shortfall in hydroelectric generation. As happened during the last drought, this would be foreseen in the springtime because of snow survey information and satellite information on early Indin River snowmelt runoff. Consequently, heavy base-load diesel generation would start in June. If this action were not taken, it might not be possible to make up the hydro-generation shortfall for the following 12 months with the existing diesel generation capacity.

In conjunction with the lighter summer loads, the heavy base load diesel generation would result in small amounts of summertime hydro generation. To maintain reasonably high generation efficiencies, with such low amounts of water usage (15 to 16 m3/s) in the summer, it would be necessary, as in the early 1980's, to shut individual hydro

units off for periods of up to half the day each day. Then, whenever each unit was on, it could be operated much closer to optimal. Such reduced summertime outflows would also raise the average annual elevation of Big Spruce Lake and hence the total amount of generation from the Rapids plants. In addition, it would store more water for wintertime use. This would allow higher generation rates and hence higher generation efficiencies in the wintertime. And secondly, it would provide more water so that the hydro units could be on at all times or at least 22 hours per day. Hence no intakes would freeze.

Because of its unique design, the Falls unit would be kept on 24 hours a day both summer and winter. Its generation efficiency can be maintained even with low plant flows.

The above mode of operation requires one licence exemption. The 5.66 m3/s minimum outflow requirement from the Forks plant would have to be changed to zero for half of each day in the summer, and for about two hours per day in the wintertime. As previously indicated, this will not unduly stress the aquatic environment.

**b. Extra Big Spruce Reservoir Drawdown**

During the worst historical drought, NTPC asked for special exemption, as provided for in the licence, and received it to draw down Big Spruce reservoir below the licensed minimum level of 217.9 meters (715.0 ft.). As 0.30 meter of stored water saves about 4.3 GWH of diesel generation worth a substantial amount in savings to NTPC customers, NTPC would again request an extended late winter/early spring drawdown at the end of a drought if snow survey data collected at the time indicated that the probability of subsequent full reservoir recharge was high.

### *4.9.5 Failure of Outflow Components and the Maintenance of Licensed Flows/Elevations*

If the Rapids generator were to fail, then about 2.8 m3/s (100 cfs) of Big Spruce reservoir outflow could be released through the station service generator at Snare Rapids. Within 24 hours, the 5B spillway gates would be opened to provide more water downstream. Hence the licensed minimum outflow from the Falls forebay could be sustained. During the few days it would take the 5B spillage to work its way through the several small lakes between the 5B spillway and the Falls forebay, minimum licensed outflows from the Falls forebay could be sustained by withdrawing water from storage. This would only draw down the Falls forebay about 0.1 meter. As the forebay would initially be the usual 0.5 to 0.6 meter above the licensed minimum level, it would not be drawn down too low

The above procedure would be satisfactory as long as Big Spruce reservoir is above the minimum licensed level of 217.9 m (715.0 ft.).

In the very unlikely event that Big Spruce reservoir was below this level at the time that the Rapids generator failed, then the constriction in the 5B channel would not allow sufficient spillage from Big Spruce reservoir to satisfy downstream licensed minimum flow releases for more than a few weeks. If this were to happen, then NTPC would immediately remove some of the restrictions. A wintertime operation would involve a drag line. A summertime operation would require blasting and some hand labour.

If the Falls plant generator were to fail, licensed minimum forebay flow releases would be maintained by opening the spillway gates.

If one of the Forks generators were to fail, licensed minimum Forks forebay outflows would be sustained by the second generator. If both were to fail simultaneously, the Forks forebay level would rise 0.1 to 0.2 meter above its usual operating level within one half of a day. At that point, there would be sufficient outflow over the uncontrolled Forks spillway to meet the licensed minimum release requirement.

### *4.10 Severe Storms*

Heavy rainfall or snowfall, high winds and/or heavy icing conditions can result in building and equipment damage, major transmission line outages, communications failure and road washouts.

If severe weather conditions are forecast or experienced, local staff shall:

1. Keep abreast of forecasts and storm developments;
2. Maintain close surveillance of all dam facilities; and
   Immediately report any storm damage or personal injury to the System Control & Hydro Planning Manager

The System Control & Hydro Planning Manager shall:

1. Notify the HOD and the Operations Director of any damage;
2. Take action to restore services and repair damages; and
3. Ensure safety of any members of the public in area.

If the OS is informed of an accident already reported to the RCMP, he shall report the event to the Vice-President of Operations.

# 5.0 General Responsibilities Under the EPP

## *5.1 Dam Owner/ Operator Responsibilities*

During an emergency condition:

1. Identification of the emergency condition;
2. Notification of the RCMP;

**Person responsible for the notification: HOD**

3. Implementation and direction of emergency repairs;
4. Update emergency status to the RCMP;

**Person responsible for the notification: HOD**

5. Provisions for security measures at the dam; and
6. Reporting termination of emergency situation on-site at the dam.

In non-emergency conditions, owner operator must also provide for:

1. Routine maintenance and operations of the dam;
2. Routine surveillance of the dam; and
3. Annual review, updating and distributing of the EPP.

## *5.2 Operations Superintendent Responsibilities*

Responsibility for the day-to-day operation of the Snare Dams rests with the System Control & Hydro Planning Manager whose headquarters are the Yellowknife Area Office and can normally be contacted there. Local staff attends the dams each day. Normal working hours are 0800 to 1700 hours, Monday to Friday at Yellowknife and seven days a week at Snare Hydro.

During an emergency, decisions regarding operations at the Snare Dams shall be made by the HOD. Where advice or special expertise is required, it is the responsibility of the HOD to obtain guidance from NTPC Engineering, and others such as government agencies or outside consultants.

An organization chart showing the relationships between key NTPC personnel identified in the EPP is shown in Section 1-1.

# 6.0 Preparedness

## *6.1 Emergency Notification Directory*

The Communications Directory contains specific contacts which may be necessary in handling an emergency. Contacts are grouped as follows:

6.1.1 NTPC
6.1.2 RCMP
6.1.3 NWT Emergency Coordinating Committee
6.1.4 Local Municipalities

For **order of notification** required in particular emergencies, refer to Section 1.1.

**Long Distance Telephone Calls**

1. To dial direct from within NWT (area code 867), but not within municipality, to NWT (area code 867); dial 1 + 867 + number.

2. To dial direct from outside NWT (area code 867) to within NWT (area code 867); dial 1 + 867 + number.

3. To dial direct from NWT (area code 867) to outside of NWT (area code 867); dial 1 + area code + number.

### *6.1.1 NTPC*

| | Office Telephone | Home Telephone |
|---|---|---|
| **Yellowknife** | | |
| **Area Office** | | |
| Manger, System Control & Hydro Planning<br>Ken Dies | 669-3327 | 873 8034 |
| Plant Manager<br>Norm McBride | 669-3326 | 920-2885 |
| Hydro Maintenance Manager<br>Randy Waddell | 669-3306 | 873-4322 |
| Director, Hydro Operations<br>Randy Patrick | 669-3301 | 766 2392 |
| Yellowknife Control Centre | 669-3340 | |
| Snare Staff House | 669-4863 | |
| Snare Rapids Powerhouse | 669-4860 | |
| Snare Falls Powerhouse | 669-4850 | |
| Snare Cascades Powerhouse | 669-4880 | |
| Snare Forks Powerhouse | 669-4870 | |
| **Head Office – Hay River** | | |
| President & CEO<br>Leon Courneya | 874-5245 | 874-2417 |
| Director of Engineering<br>Steven Kerr | 874-5276 | |

### *6.1.2 RCMP*

| | |
|---|---|
| Rae/Edzo | 392-6181 |

### *6.1.3 GNWT Emergency Measure Organization*

| | |
|---|---|
| Yellowknife | 873-7554 (24 hours) |
| FAX | 873-8193 |

### *6.1.4 Local Municipalities*

**Rae/Edzo**

| | |
|---|---|
| Hamlet Offices | |
| Rae | 392-6500 |
| Rae/Edzo | 392-6561 |
| Garage | 392-6111 |
| Medical emergency | 392-6075 |
| Fire | 392-2222, 371-2222 |
| RCMP | 392-6181 |

**Yellowknife**

| | |
|---|---|
| City Hall | 920-5600 |
| RCMP | 669-1111 |
| Ambulance | 873-2222 |
| Fire | 873-2222 |
| Stanton Hospital | 669-4111 |

## 6.2 Telecommunication Information

### Telephone and Radio

This Section briefly describes the telephone and radio facilities available at Snare.

Communications to Snare River facilities are via a microwave and radio link. Access can be obtained by calling directly the numbers shown in Section 6.1.1 or by phoning the control centre operator in Yellowknife at 669-3340. Each powerhouse, staff house, and vehicle is equipped with phone access through the microwave system and with repeaters at Snare Rapids Snare Falls and Snare Forks. In addition, the staff house at Snare Rapids and the operator's truck at Snare are equipped with radio telephones to access the Northwest Tel system through their Snare repeater and Rae Edzo repeater. These phones are generally used only if the microwave system is out of service. In addition there is a powerline carrier that can be used as a backup communications system.

## 6.3 Road Communications

The only year round roads in the Snare Area are gravel roads between Snare Rapids, Snare Falls and Snare Forks. The Snare Rapids to Snare Falls road is 16 km in length. The road from Snare Falls to Snare Forks is 20 km. In the event of a major dam breach at the Snare Rapids, these roads would be flooded at several locations.

During the winter from approximately February 15 to March 15, a winter road is constructed from Rae-Edzo to connect to the local road system at Snare Forks, a distance of 60 km. This section of winter road would not be subject to flooding from a dam breach.

## *6.4 Air Communications*

1. **Fixed Wing Aircraft**

   A 3000 ft gravel airstrip, designated C-EV9 "Snare River", capable of handling DC3 and Twin Otter aircraft is located adjacent to Snare Falls powerhouse at latitude 63° 26' longitude 116° 11'. It is suitable for landing aircraft on wheels all year round, during daylight hours. V.F.R. flight rules apply. Navigational aids were installed in the summer of 2000. Landing of float-equipped planes on all the reservoirs is feasible only during daylight hours and in suitable weather conditions. The airstrip could not be affected by a major dam breach.

   Landing of ski-equipped planes on all the reservoirs is normally feasible during winter months and during daylight hours and in suitable weather conditions. During the shortest days of the year, there is sufficient daylight for only a few hours of flying each day. It is impossible to land on the reservoirs for a period of one month in the spring and for a similar period in the early winter because of poor ice conditions.

2. **Helicopters**

   There are numerous possible helicopter landing areas at each dam.

## 6.5 Power Sources

### *6.5.1 Water Discharge Control Facilities Power Sources*

Normal power for all station operations, including all power intake gates and spillway gates, is supplied by station service from the local powerhouse. In the event of a complete station outage, Snare Rapids has an emergency 120 kW hydro generator and Snare Forks has an emergency 150 kW diesel generator to supply station service. The Snare Forks diesel starts out automatically on loss of station service. Each plant can be fed power from the main 115 KV line. At Snare Falls there are emergency gasoline engines to operate the spillway gates. There is also an emergency gasoline engine on the 5B spillway to operate the stop log hoist.

### *6.5.2 Communication System Power Sources*

All communication system power sources are battery operated, charged by station service. Batteries would last for several hours without recharging.

### *6.5.3 Backup Power Sources*

All Snare River hydro facilities are equipped with backup power supplies in the form of batteries and backup diesel engines. There is also a portable gas generator located in the Emergency Response facility located near Snare Rapids helipad.

## 6.6 Available On-site Equipment and Repair Material

There are various borrow areas with 1/2 km of each dam where materials could be obtained to repair a breach.

The following heavy equipment is located at Snare:

2 - Tandem Ford LTS 8000 dump trucks
1 - Cat D-6 Bulldozer c/w hydraulic angle blade
1 - Cat ITC38 Front end loader c/w bucket, forks, boom, and backhoe
1 - John Deer tracked Hi Hoe – back hoe
1 - Champion D-760 Grader c/w V-plow, wing-plow
1 - Pelomix 1 yd batch cement mixer
2 - 16 foot aluminum boats with 25 hp outboard motors
2 - 14 foot aluminum boats with 15 hp outboard motors

### *6.7 Off-site Equipment and List of Contractors*

During the period of time when the winter road is available for travel, there is additional construction equipment available in Rae-Edzo and in Yellowknife.

| | **Office Telephone Numbers** |
|---|---|
| **Hamlet of Rae-Edzo** | 371-3886 |
| Garage | 392-6111 |
| **City of Yellowknife** | 920-5600 |
| Works Garage & City Stores | 873-2671 |
| | |
| RTL Robinson Trucking Ltd. | 873-6271 |
| Two Way Enterprises | 873-5322 |
| First Air | 669-6600 |
| Air Tindi | 669-8200 |
| Great Slave Helicopters | 873-2081 |
| Arctic Sunwest | 873-4464 |

## 7.0 Inundation Maps

In the event of a complete dam breach, the areas of inundation have been determined for each dam site. This area was determined by finding the area covered if all of the water in the reservoir of the dam was immediately displaced into the inundation area. This method neglects the time taken for the water to reach the inundation area and neglects the outflow from the inundation area. Using this method, the inundation areas calculated were slightly larger than the worst case scenario possible. This is considered to be a high factor of safety for this study.

The inundation studies were concentrated in the bodies of water at the outlet of Snare Forks Dam, as this is the only area that would be affected immediately following a dam breach. This area includes Strutt Lake and the section of the Snare River from Snare Forks to Slemon Rapids. Slemon Rapids has been modeled as a constriction point and outflow has been neglected.

1. **Snare Rapids**

   The Snare Rapids dam has the largest reservoir of the dams on the Snare River. A total breach of the Snare Rapids Dam would cause a breach of all the subsequent dams on the Snare River: the Falls, the Cascades, and the Forks. The area of inundation in the event of a complete breach is shown on figure 1 as Snare Rapids Failure. The water in this area would reach an elevation of approximately 176 m (580 ft) within 40 hours after the breech of Snare Rapids dam as shown in figure 1.

2. **Snare Falls**

   A complete failure of the Snare Falls dam would cause subsequent failure of the Snare Cascades and Snare Forks dam. The area of inundation in the event of a breach is shown as Snare Falls Failure on figure 1.

3. **Snare Cascades**

   A failure of Snare Cascades would not cause a subsequent failure of the Snare Forks dam. The water from the Snare Cascades reservoir would be contained in the Snare Forks forebay (Judd Lake) and would not cause a significant change in the surface area of the Forks forebay. Judd Lake would remain as shown on figure 1.

4. **Snare Forks**

   A complete failure of Snare Forks would cause an insignificant change to the area of Strutt Lake and the Snare River. It would remain the original size shown on figure 1 .

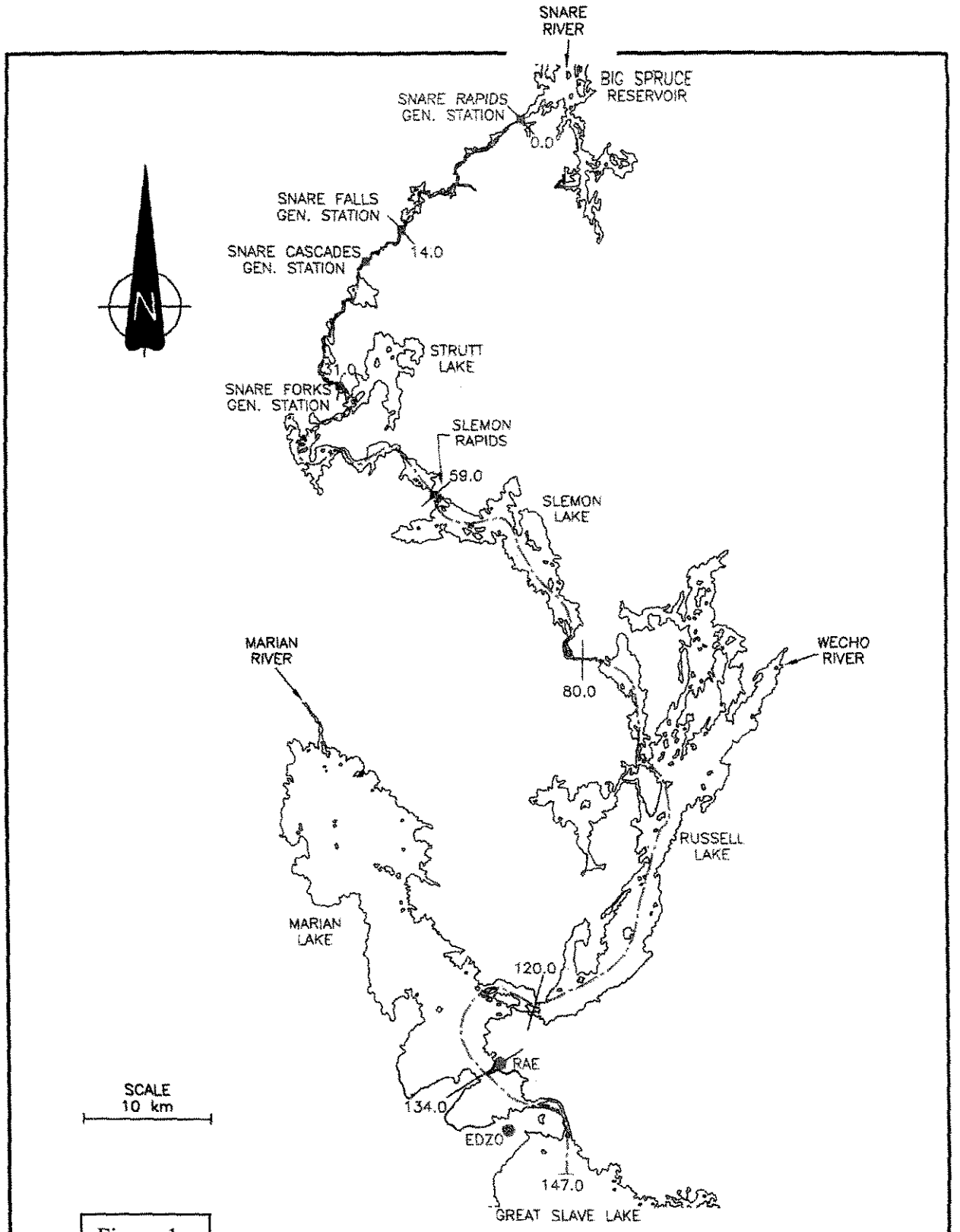
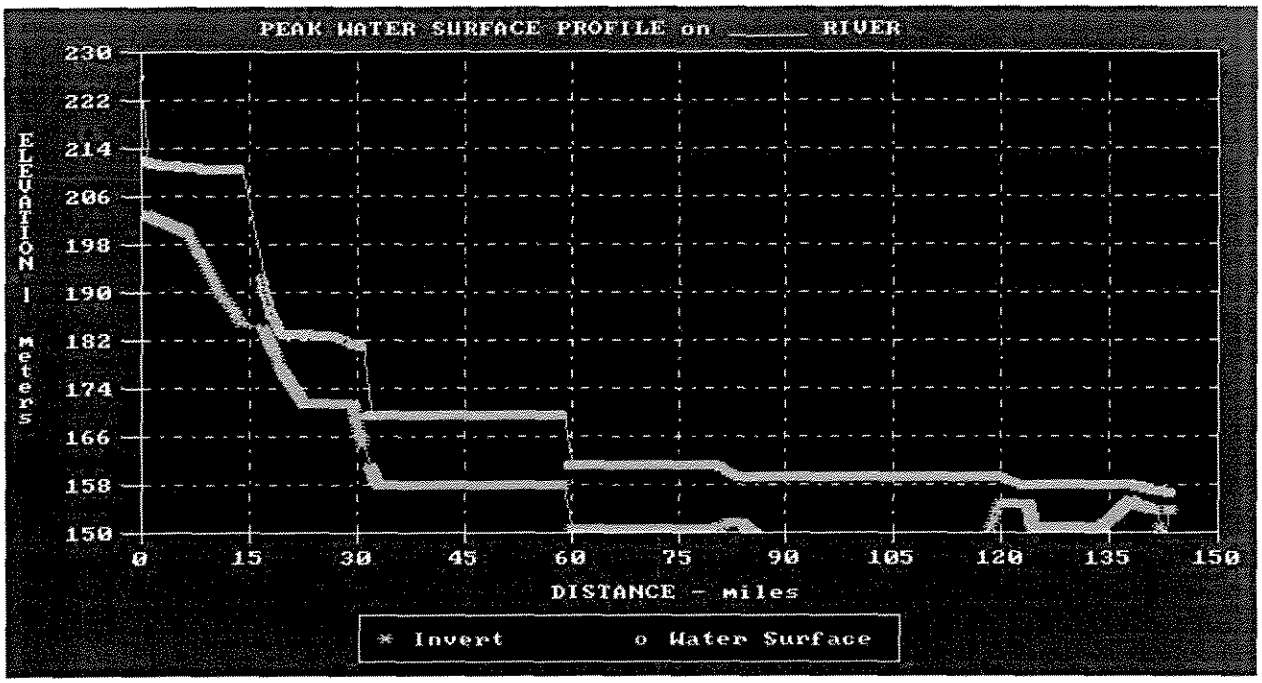



Figure 1 Features of Snare Hydro Complex and Downstream Waterways.

**Figure 2**

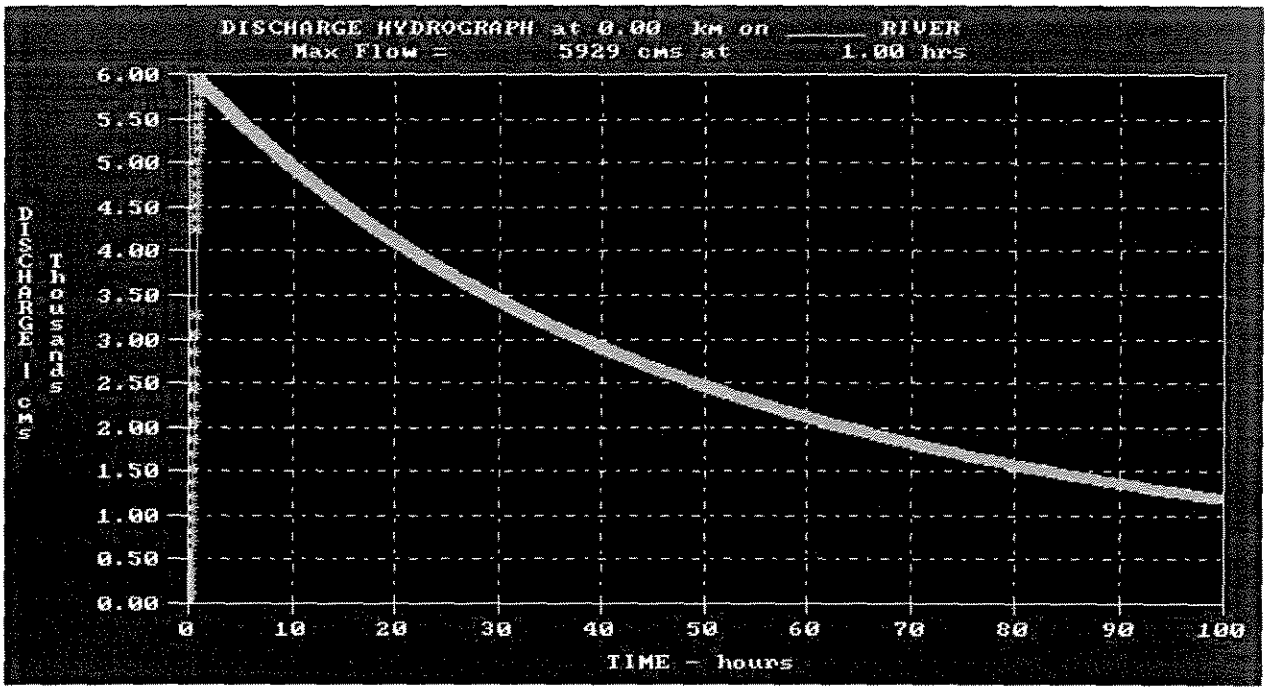



**Sunny Day Dam Failure, Peak W.L. Profile – Snare Rapids to Great Slave Lake**

Locations:

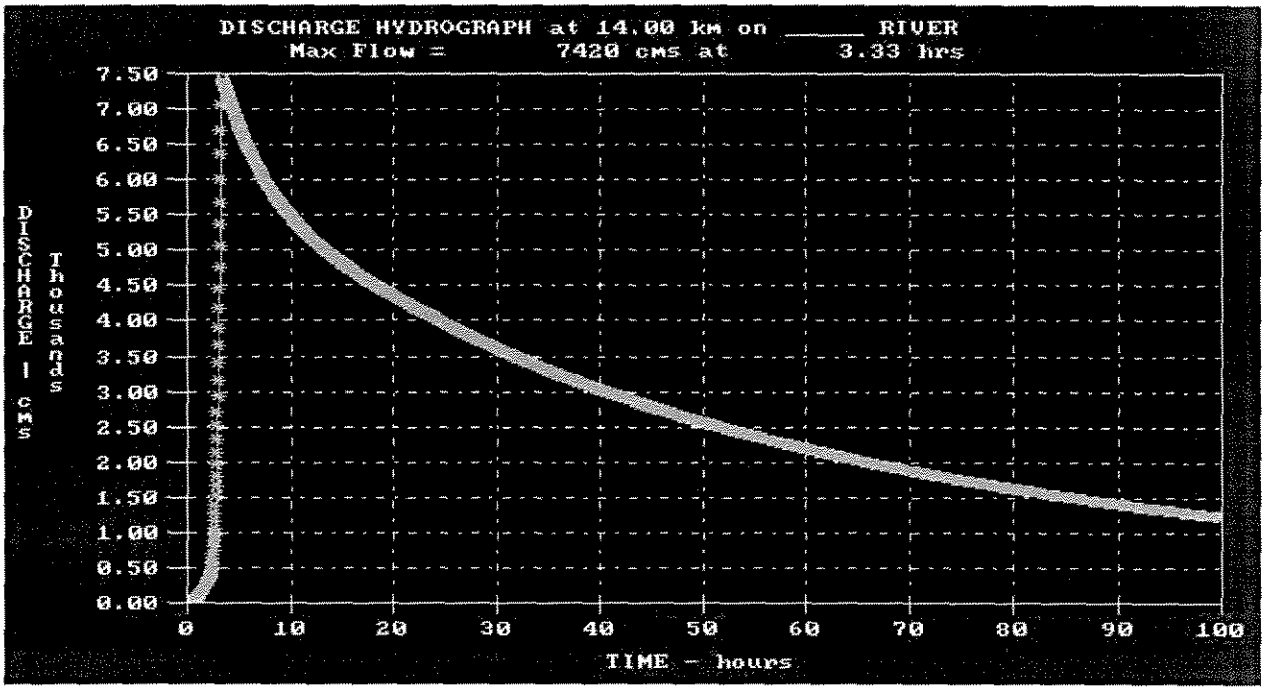
| | |
|---|---|
| km 0.0 | Snare Rapids G.S |
| km 14.0 | Snare Falls G.S. |
| km 31.0 | Snare Forks G.S. |
| km 59.0 | Slemon Rapids (outlet Strutt Lake) |
| km 80.0 | Outlet – Slemon Lake |
| km 120.0 | Outlet – Russell Lake |
| km 134.0 | Rae |
| km 136.0 | Edzo |
| km 142.5 | Highway Bridge |
| km 144.0 | Great Slave Lake |

**Figure 3**



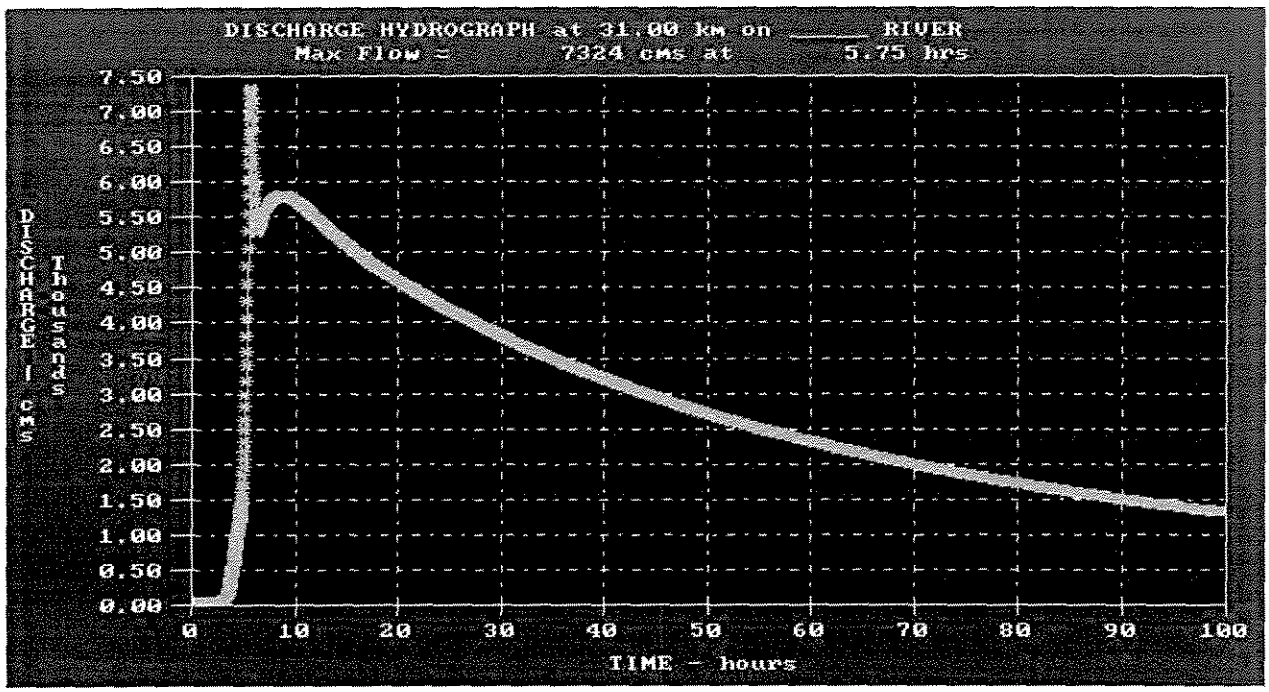

**Sunny Day Dam Failure – Outflow Hydrograph, Snare Rapids G.S.**

**Figure 4**



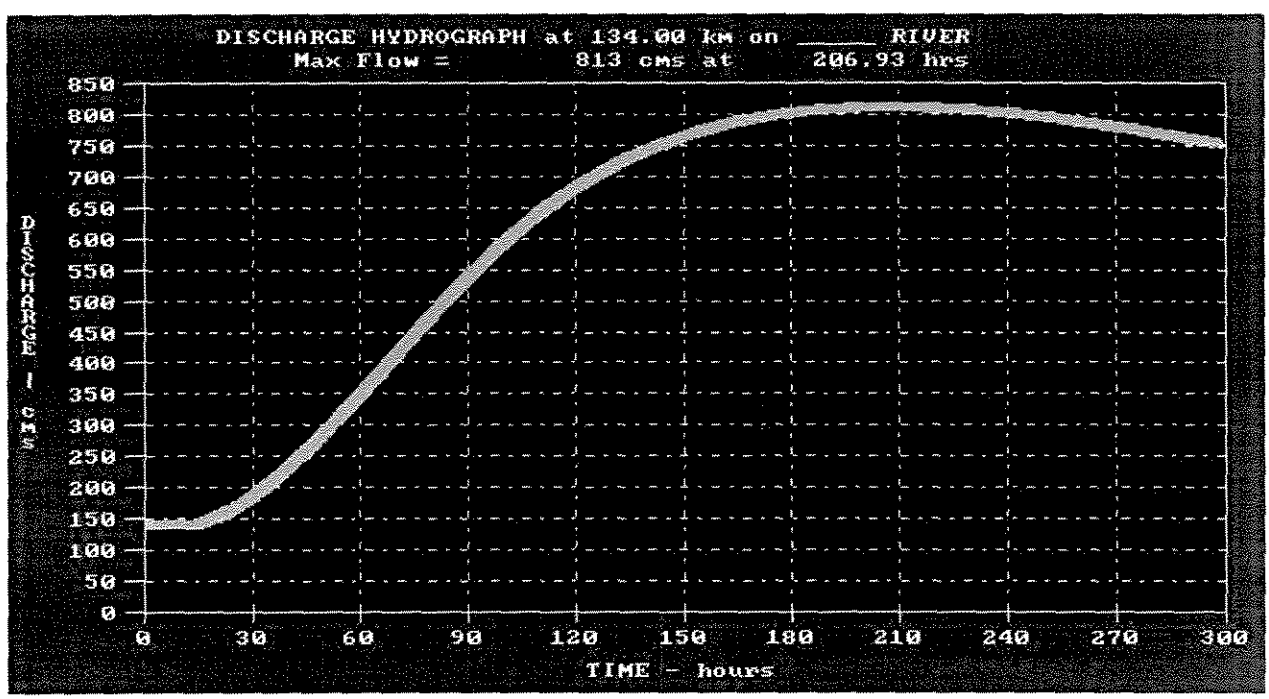

**Sunny Day Dam Failure – Outflow Hydrograph Snare Forks G.S.**

**Figure 5**



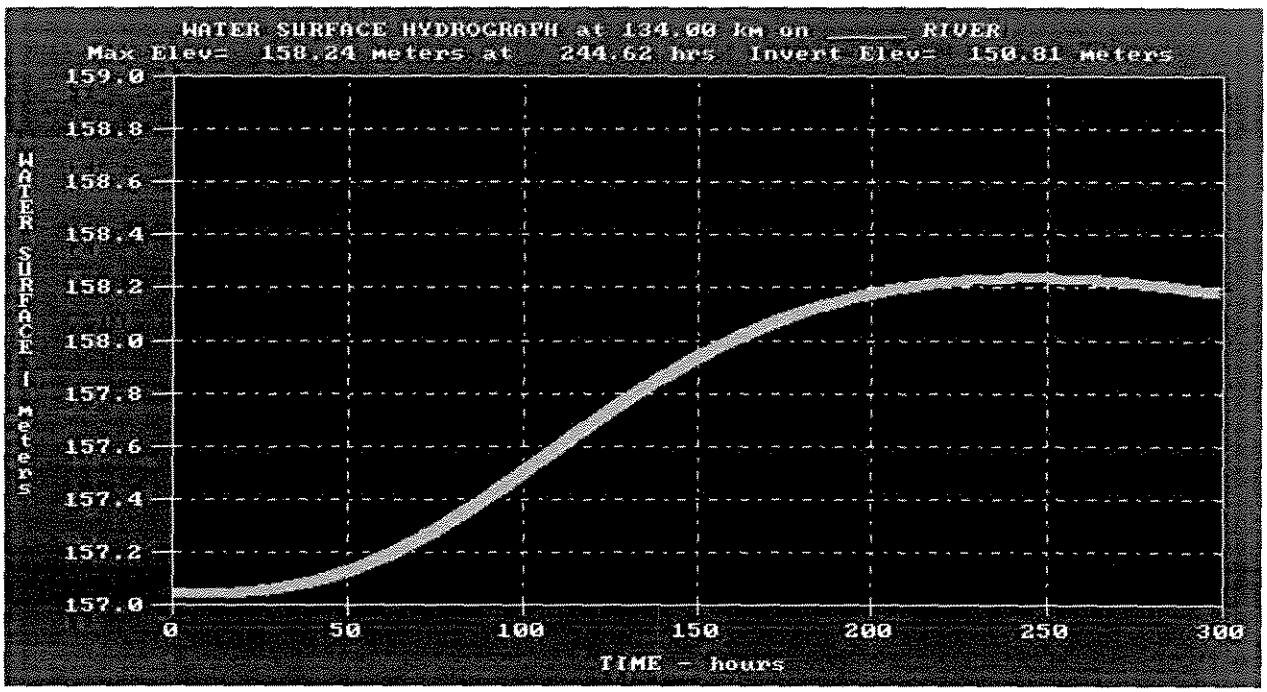

**Sunny Day Dam Failure, Outflow Hydrograph, Snare Forks G.S.**

**Figure 6**




**Sunny Day Dam Failure Flow Hydrograph at Rae**

**Figure 7**




**Sunny Day Dam Failure. W.L. Hydrograph at Rae**

**Figure 8**

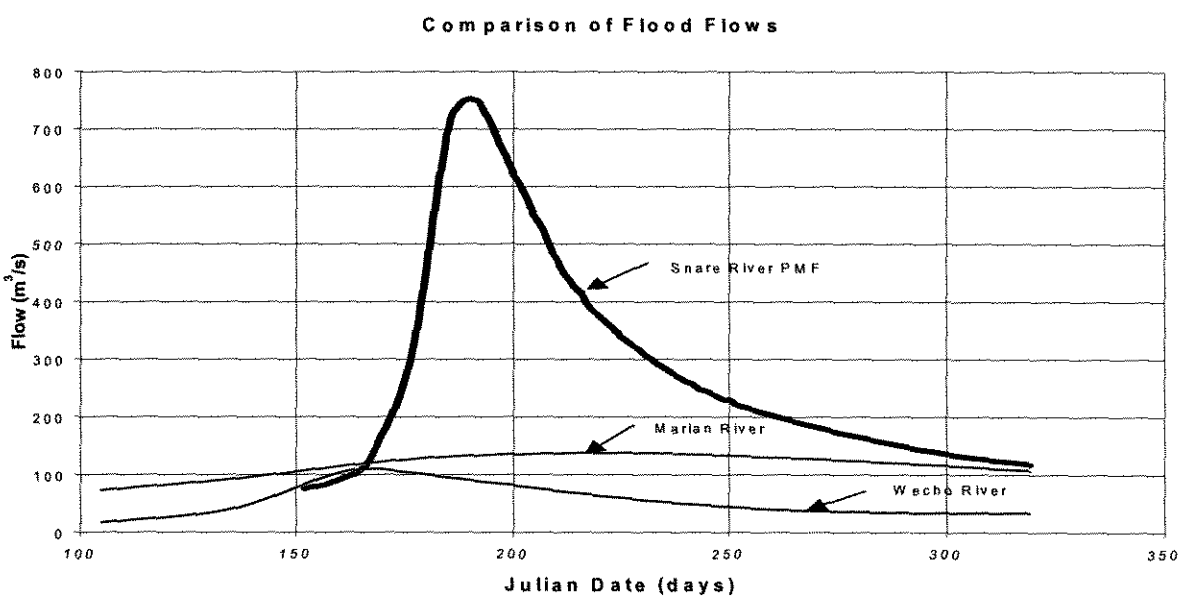
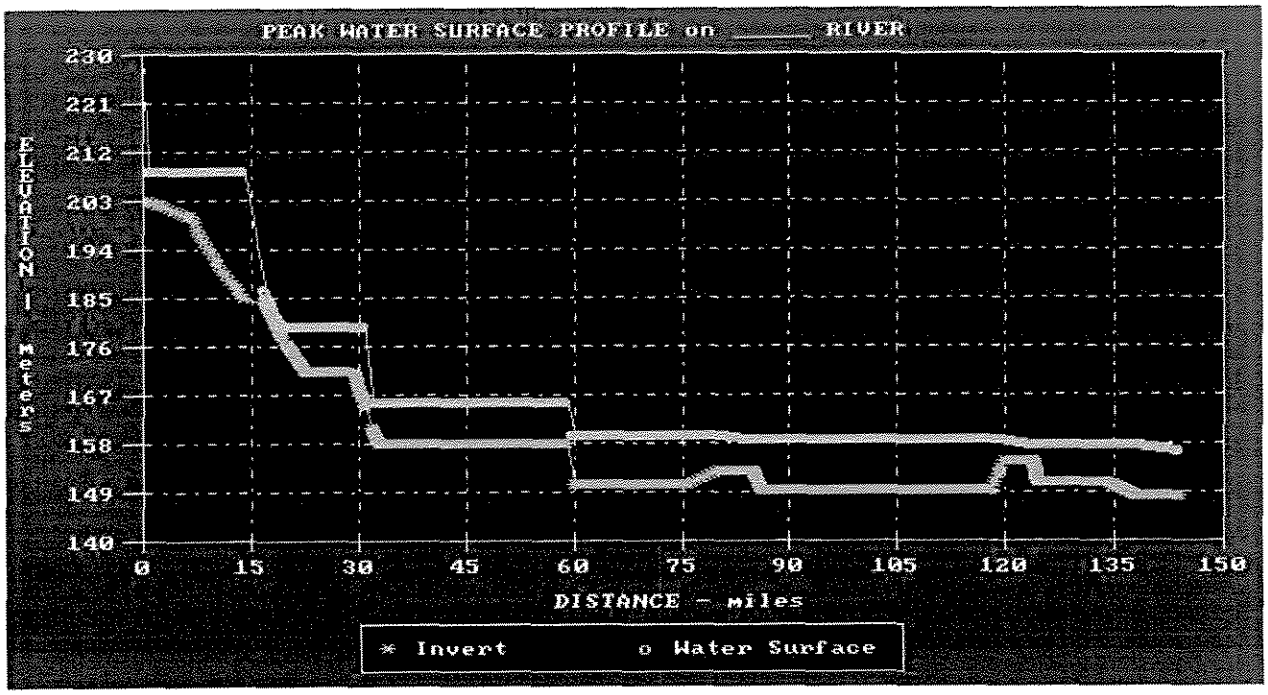


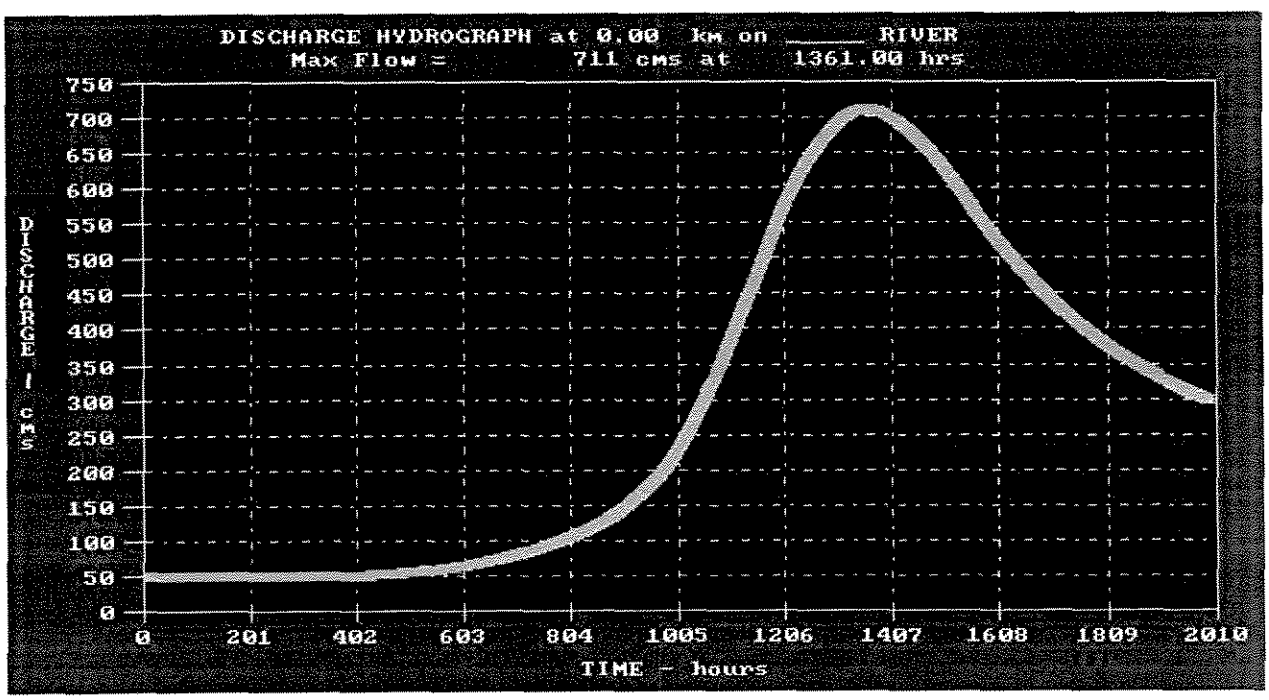
**Figure 9**




**Probable Maximum Flood – Peak W.L. Profile**

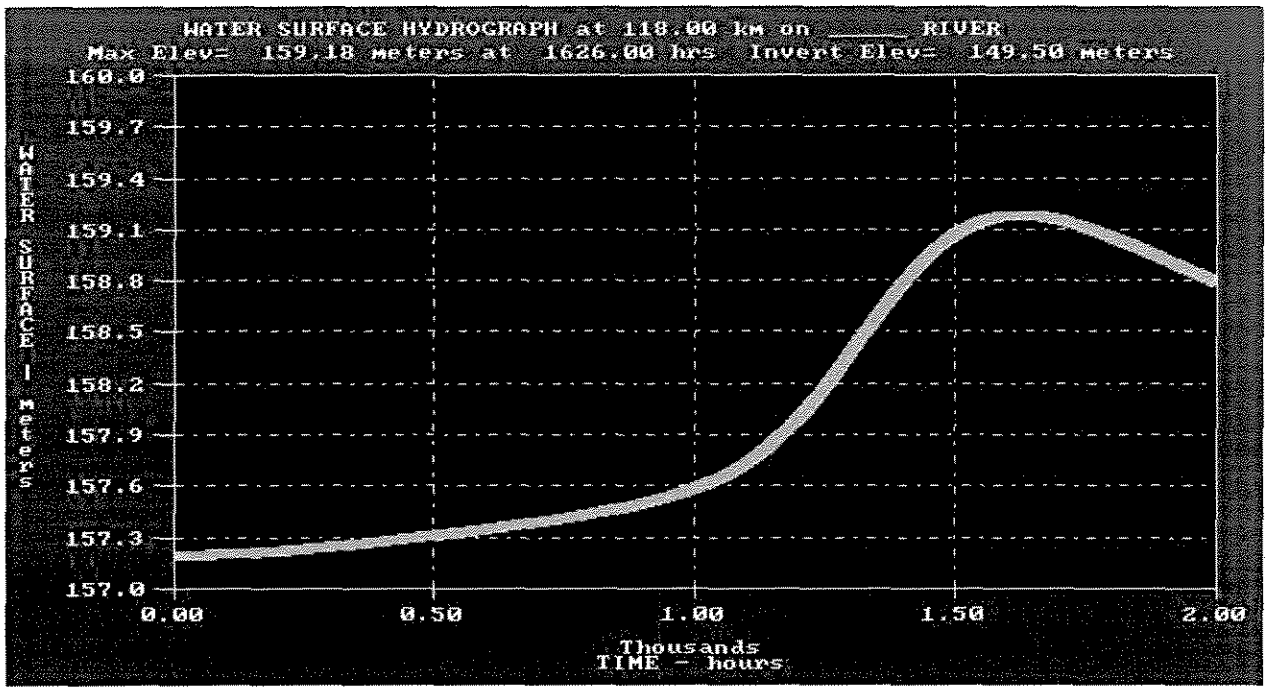
For Locations, see Figure 1

**Figure 10**



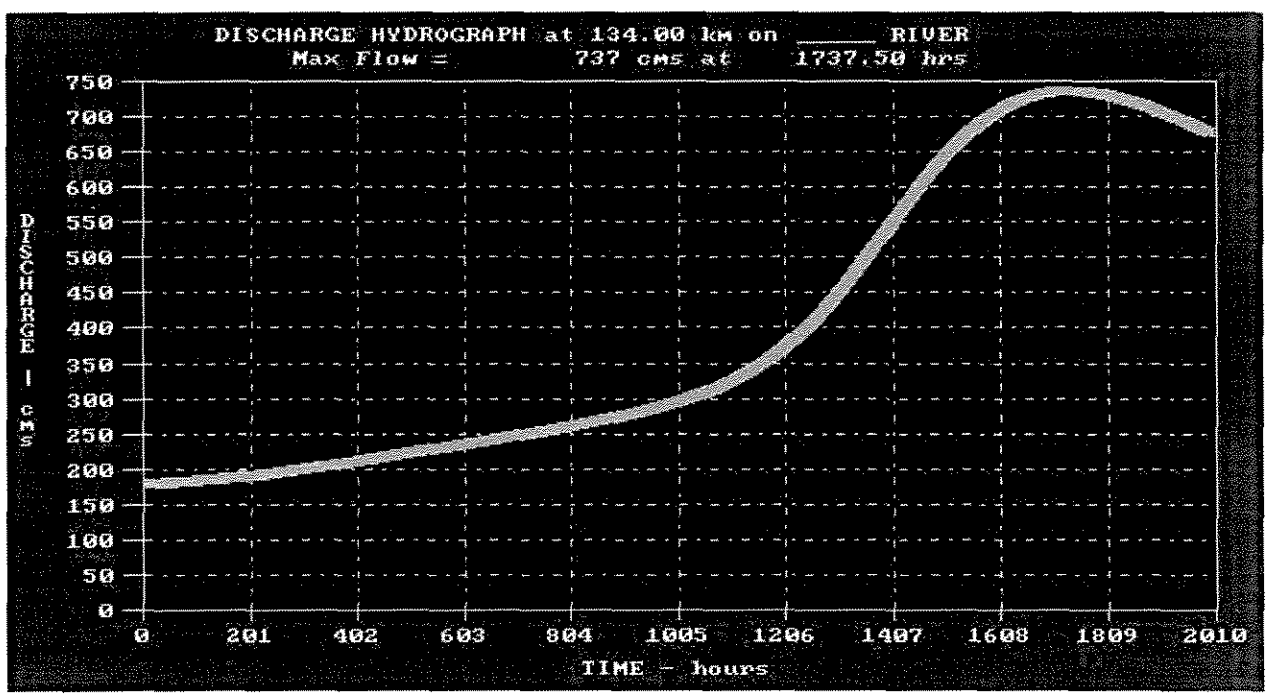

**PMF Outflow Hydrograph at Snare Rapids G.S**

**Figure 11**



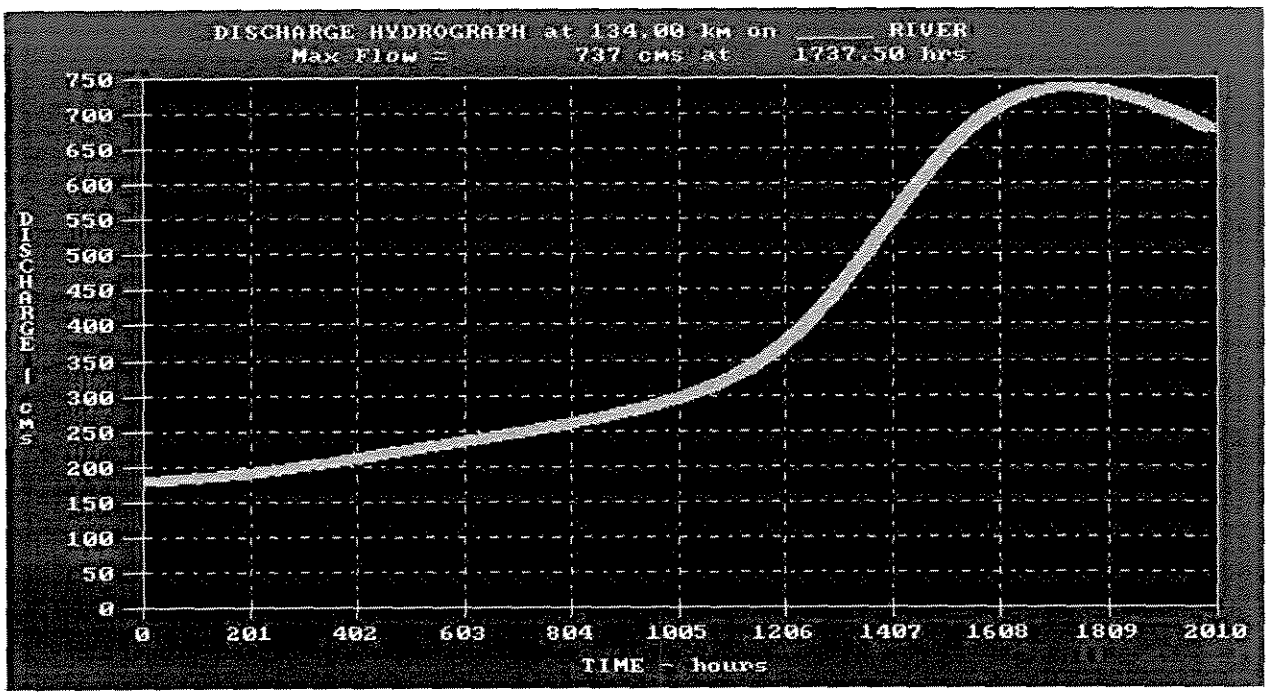

**PMF Flood Levels at Russell Lake**

**Figure 12**



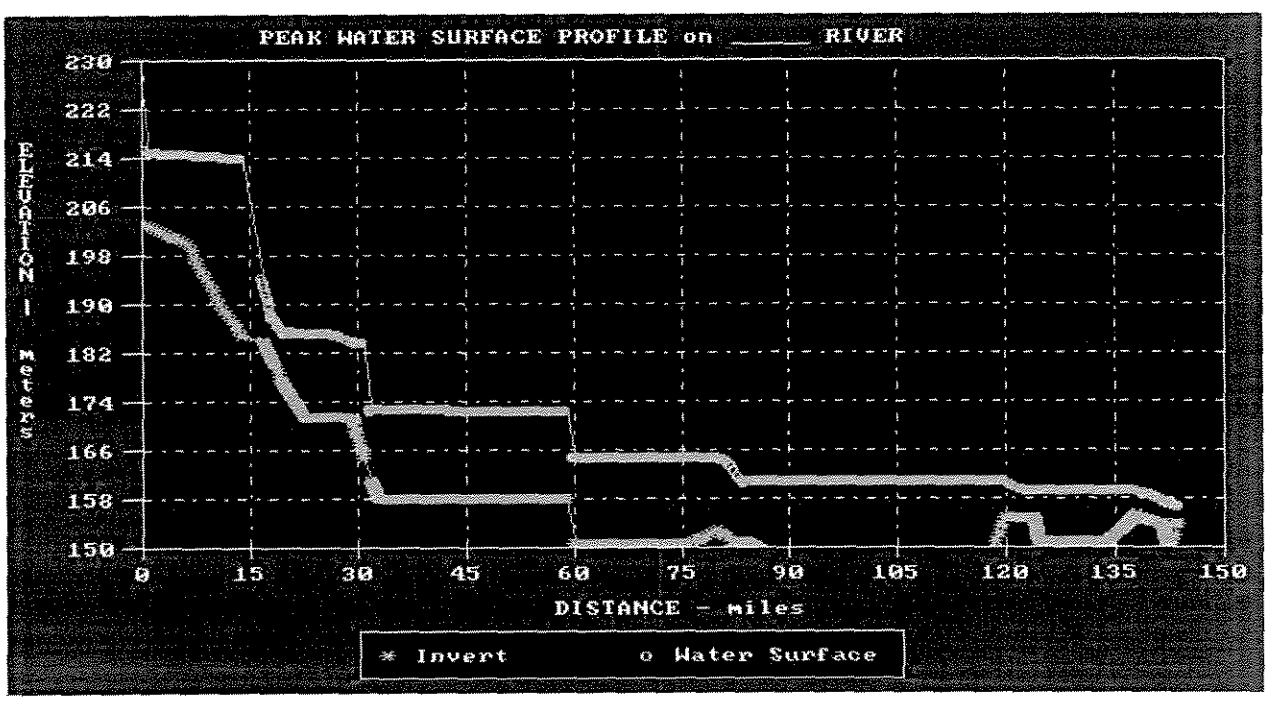

**PMF Flood Levels at Rae**

**Figure 13**




**PMF Flows at Rae**

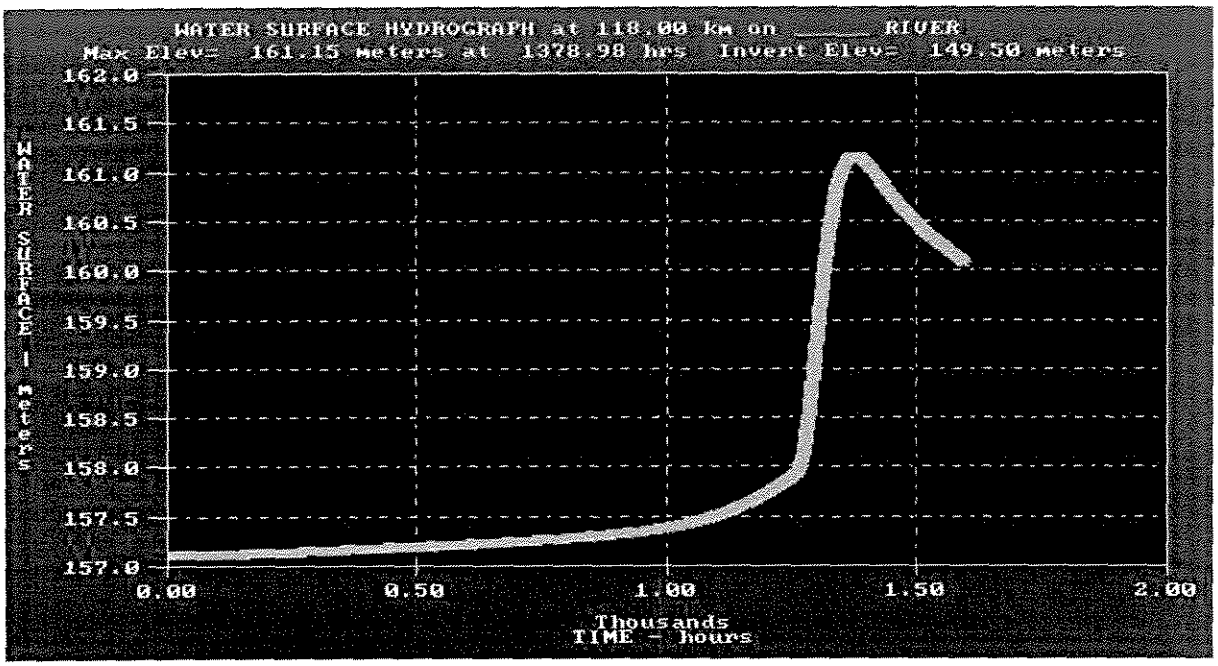
**Figure 14**




**Dam Failure with PMF. Profile of peak W.L.S.**

For Locations, see Figure 1

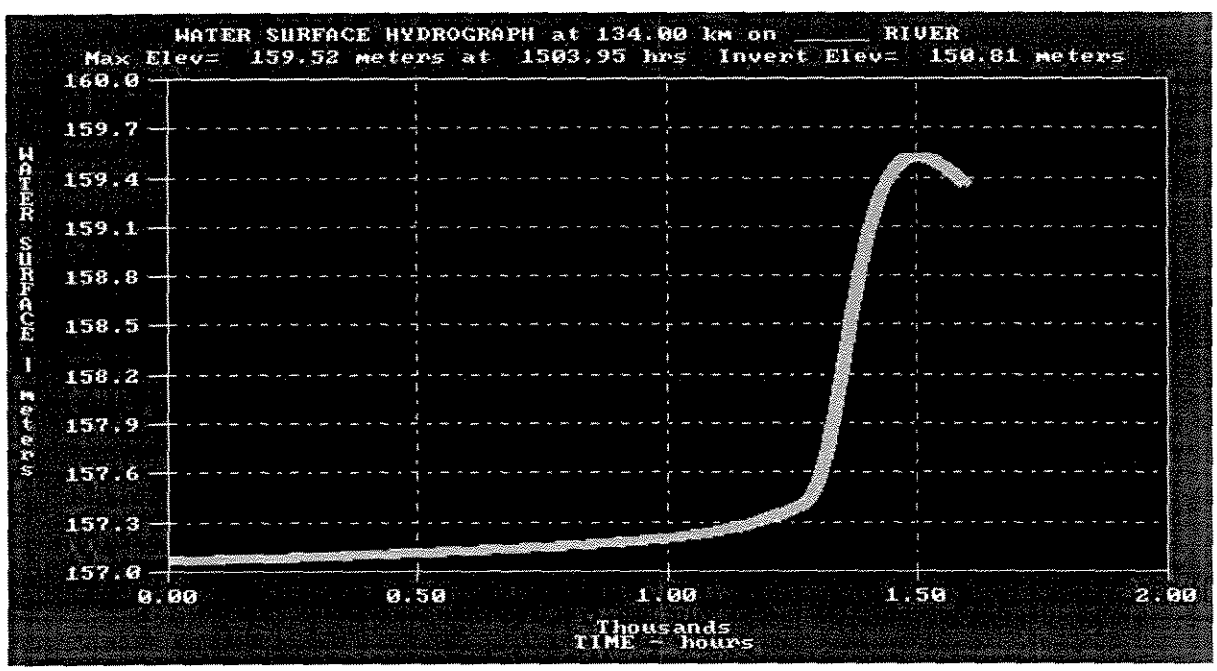
**Figure 15**




**Dam Failures with PMF Water Levels, Russell Lake**

Note: Failure of Snare Rapids Main Dam occurred at 1254 hours.

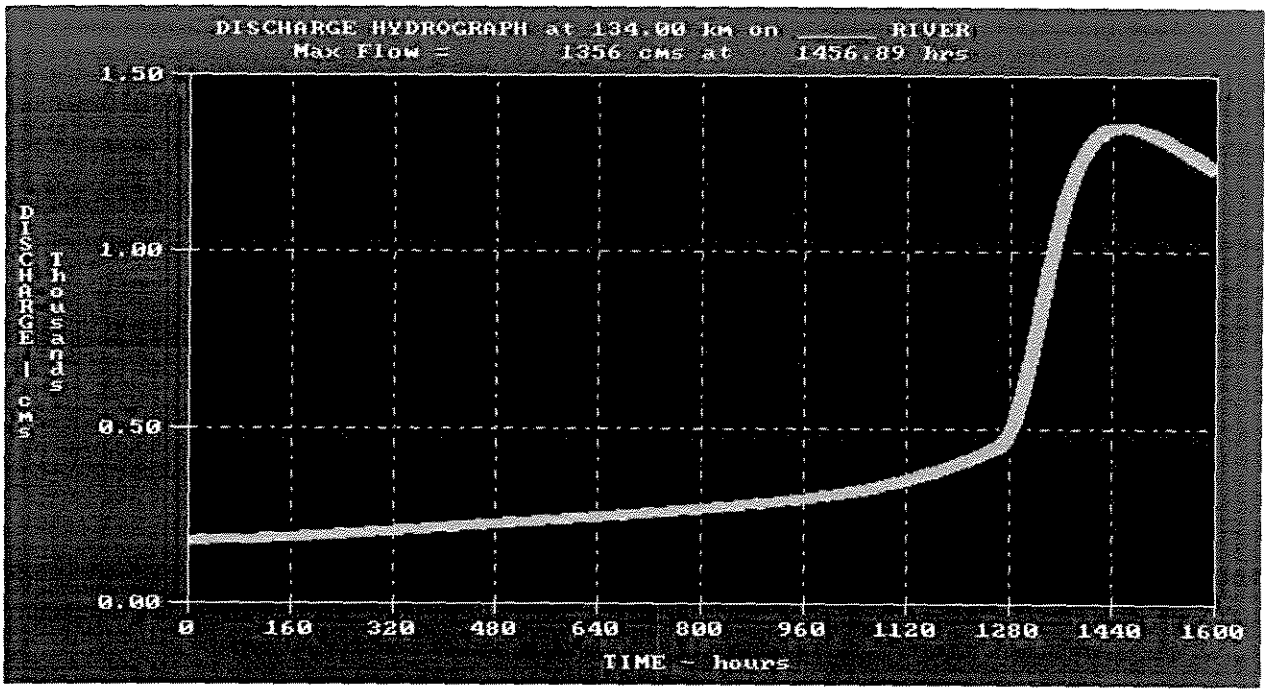
**Figure 16**




**Dam Failure with PMF Water Levels near Rae**

Note: Failure of Snare Rapids Main Dam occurred at 1254 hours.

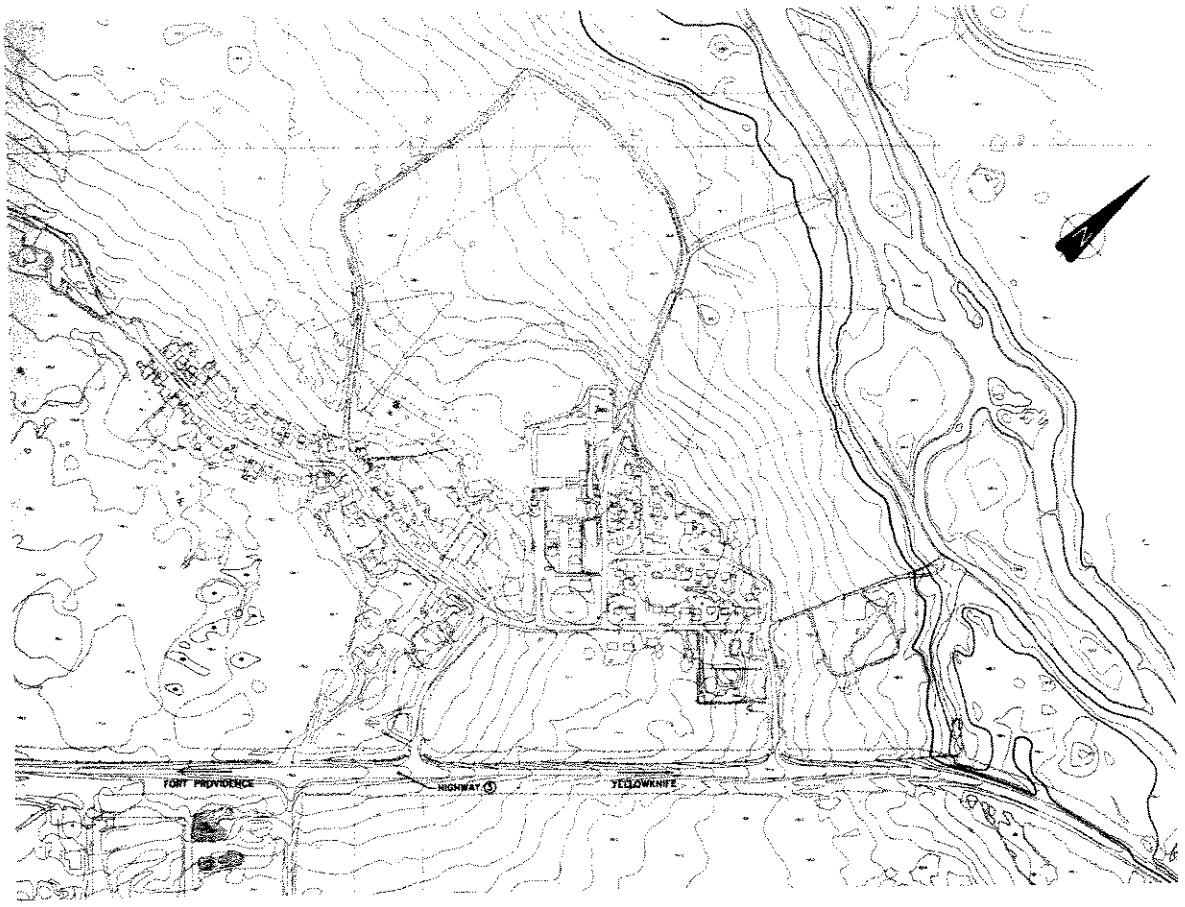
**Figure 17**




**Dam Failure with PMF Flows near Rae**

Note: Failure of Snare Rapids Main Dam occurred at 1254 hours.

Flood Contours - Rae




Flood Contours – Edzo

## 8.0 Appendices A – Maintenance and Testing of the EPP

The Safety & Environment Manager shall ensure that local staff maintains familiarity with the continually updated EPP by scheduling period reviews, briefings and operational tests as follows:

1. **Twice Per Year** - Phone numbers and responsible officials' names shall be verified, and the appropriate pages of the EPP updated and distributed. (A complete list of all updates to the plan shall be maintained at the front of the EPP.)

2. **Annually** - All affected personnel shall be given a refresher briefing on the EPP. At the option of the System Control & Hydro Planning Manager this may be done separately or as a part of a regularly scheduled safety meeting. A record of all briefing sessions shall be maintained on file by the System Control & Hydro Planning Manager, showing the dates of the sessions, the location where they were held, and the names of the individuals conducting and attending them.

3. **Annually** – All involved personnel should be given a training drill on the EPP. This may consist as a table top exercise or an actual test of timely response to spillway operation.

## 9.0 Appendices B – List of Third Party Contacts - Suppliers

### Generator Rental

| | |
|---|---|
| **Name** | **Power Plus Rentals** |
| **Contact** | Dave Lassu |
| **Address** | 7003 Girard Road<br>Edmonton, AB T6B 2C4 |
| **Phone No** | 780 485 0066 |
| **Fax No.** | 780 485 0041 |
| **Cell no** | 780 721 0971 |
| **E-mail Add.** | dlassu@telusplanet.net |
| **Max Size Unit** | 780 KW |
| **Voltage** | 600 |

| | |
|---|---|
| **Name** | **Grizzly Power** |
| **Contact** | Kevin Nelson |
| **Address** | 1400-10 Street<br>Nisku, AB T9E 8J4 |
| **Phone No** | 780 955 3305 |
| **Fax No.** | 780 955 2260 |
| **Cell no** | |
| **E-mail Add.** | generators@grizzlypower.com |
| **Max Size Unit** | |
| **Voltage** | |

| | |
|---|---|
| **Name** | **Wirtenan Electric** |
| **Contact** | |
| **Address** | 5635 Gateway Boulevard<br>Edmonton, AB T6H 2H3 |
| **Phone No** | 780 434 8421 |
| **Fax No.** | 780 437 2658 |
| **Cell no** | |
| **E-mail Add.** | wesco@wirtenan.com |
| **Max Size Unit** | Transformer, Elect. Equipment |
| **Voltage** | Temporary Power Distribution |

| | |
|---|---|
| **Name** | **Finning – Hay River** |
| **Contact** | Mitch Thompson, Cust. Serv. Mgr |
| **Address** | 23 Industrial Drive<br>Hay River, NT X0E 0R6 |
| **Phone No** | 867 874 6537 |
| **Fax No.** | 867 874 6570 |
| **Cell no** | 867 874 1104 |
| **E-mail Add.** | mathompson@finning.ca |
| **Finning 24 Hr** | ***line – 1 888 346 6464*** |

| | |
|---|---|
| **Name** | **Finning – Yellowknife** |
| **Contact** | *Patrick Kirychuk* |
| **Address** | 327-8 Old Airport Road<br>Yellowknife, NT X1A 3T3 |
| **Satellite Ph:** | 403 982 0933 |
| **Phone No** | 867 766 3578 |
| **Fax No.** | 867 873 6867 |
| **Cell no** | 867 444 3195 |
| **E-mail Add.** | |
| **General Line,** | **Parts and Service Sales** |

| | |
|---|---|
| **Name** | **Finning – Yellowknife** |
| **Contact** | Ron Drewry |
| **Address** | 327-8 Old Airport Road<br>Yellowknife, NT X1A 3T3 |
| **Phone No** | 867 920 7481 |
| **Fax No.** | |
| **Cell no** | 867 444 4500 |
| **E-mail Add.** | |
| **Manager NWT** | |

## Contractors

| | |
|---|---|
| **Name** | **Nuclear Electric** |
| **Contact** | Ron Danyluk |
| **Address** | Box 57006, 2020 Sherwood Drive<br>Sherwood Park, AB T8A 5L7 |
| **Phone No** | 780 448 1903 |
| **Fax No.** | 780 448 1905 |
| **Cell no** | |
| **E-mail Add.** | |
| | **Electrical Services** |

| | |
|---|---|
| **Name** | **Adco Power** |
| **Contact** | *Bill Slater* |
| **Address** | 8750 – 58 Ave<br>Edmonton, AB T6E 6G6 |
| **Phone No** | 780 465 3265 |
| **Fax No.** | 780 466 8086 |
| **Cell no** | 780 910 9410 |
| **E-mail Add.** | slater@adcopower.com |
| | **Electrical Mechanical Services** |

| | |
|---|---|
| **Name** | **Janus Project** |
| **Contact** | *Laurie Denys* |
| **Address** | #105 8712-48 Ave<br>Edmonton, AB T6E 5L1 |
| **Phone No** | 780 450 1818 |
| **Fax No.** | 780 465 1116 |
| **Cell no** | |
| **E-mail Add.** | ldenys@janusprojects.com |
| | **Electrical Mechanical Services** |

| | |
|---|---|
| **Name** | **South Side Porta Weld Ltd** |
| **Contact** | Danny Kernychny |
| **Address** | 8110 Davies Road<br>Edmonton, AB T6E 4N2 |
| **Phone No** | 780 465 4861 |
| **Fax No.** | 780 440 6967 |
| **Cell no** | 780 499 8469 |
| **E-mail Add.** | |
| | **Mechanical Services** |

| | |
|---|---|
| **Name** | **Odesco** |
| **Contact** | Alec |
| **Address** | 5330 89 Street<br>Edmonton, AB T6E 5G9 |
| **Phone No** | 780 414 1422 |
| **Fax No.** | 780 448 3684 |
| **Cell no** | |
| **E-mail Add.** | |
| | **Electrical Services** |

| | |
|---|---|
| **Name** | **Lapka Electric** |
| **Contact** | Joe Lapka |
| **Address** | 835 Dusseault Crt<br>Yellowknife, NT |
| **Phone No** | 867 873 5631 |
| **Fax No.** | 867 873 8446 |
| **Cell no** | 867 444 4013 |
| **E-mail Add.** | lapkael@ssimicro.com |
| | **Electrical Services** |

| | |
|---|---|
| **Name** | **Orbis** |
| **Contact** | Amin Kassam |
| **Address** | 311 3624-119 Street<br>Edmonton, AB T6J 2X6 |
| **Phone No** | 780 985 1455 |
| **Fax No.** | 780 988 0191 |
| **Cell no** | 780 913 8585 |
| **E-mail Add.** | amin@orbisengineering.net |
| | **Electrical Services** |

## Switchgear Parts and Repairs

| | |
|---|---|
| **Name** | **Laird Electric** |
| **Contact** | Kevin Pydde |
| **Address** | 4410 97 Street<br>Edmonton, AB T6E 5R9<br><br>TOLL FREE: 888 450 9636 |
| **Phone No** | 780 450 9636 |
| **Fax No.** | 780 463 3035 |
| **Cell no** | 780 914 7417 |
| **E-mail Add.** | Kevin.pydde@insulationholdings.com |
| | **Electrical Services** |

| | |
|---|---|
| **Name** | **Schneider Electric** |
| **Contact** | |
| **Address** | 12825 1144 Street<br>Bonaventure Industrial Park<br>Edmonton, AB T5L 4N7 |
| **Phone No** | 780 453 3561 |
| **Fax No.** | 780 451 5085 |
| **Cell no** | |
| **E-mail Add.** | |
| | **Electrical Services** |

## Governors

| | |
|---|---|
| **Name** | **Henery & Sons** |
| **Contact** | |
| **Address** | 87 Aurora<br>Pointe Claire, PQ |
| **Phone No** | 514 466 2063 |
| **Fax No.** | 514 466 3275 |
| **Cell no** | |
| **E-mail Add.** | |
| | **Electrical Services** |

| | |
|---|---|
| **Name** | **Woodward – Alberta Governor Service** |
| **Contact** | Jack Hauck |
| **Address** | 5977 103 A Street<br>Edmonton, AB |
| **Phone No** | 780 437 4673 |
| **Fax No.** | 780 434 2339 |
| **Cell no** | |
| **E-mail Add.** | |
| | after hours: 467 8109 or 922 4504 |
| | **Electrical Services** |

## Engine Suppliers

| | |
|---|---|
| | **MAN B&W** |
| **Engine Make** | Ruston, Paxman, Mirrlees, MAN |
| **Rating** | 500 to 6,480 kW |
| **RPM** | 1,200 to 550 RPM |
| **Name** | **MAN B&W Diesel Canada Ltd.** |
| **Contact** | John Hawkes |
| **Address** | 355 Wyecroft Road<br>Oakville, ON L6K 2H2 |
| **Phone No** | 905 845 3444 |
| **Fax No.** | 905 842 7892 |
| **Cell no** | |
| **E-mail Add.** | jhawkes@manbw.ca |

| | |
|---|---|
| **Engine Make** | |
| **Rating** | 500 to 6,480 kW |
| **RPM** | 1,200 to 550 RPM |
| **Name** | **International Energy Systems** |
| **Contact** | Doug Cullen |
| **Address** | 570 Ebury Place<br>Delta, BC V3M 6M8 |
| **Phone No** | 604 540 5080 |
| **Fax No.** | 604 540 5090 |
| **Cell no** | |
| **E-mail Add.** | ies@iesl.com |

| | |
|---|---|
| **Engine Make** | **Caterpillar** |
| **Rating** | 227 to 4,400 kW |
| **RPM** | 1,800 to 900 RPM |
| **Name** | **Finning Power System** |
| **Contact** | Gary Warneboldt |
| **Address** | 6735 11 Street NE<br>Calgary, AB T2E 7H9 |
| **Phone No** | 403 295 5740 |
| **Fax No.** | 403 295 5725 |
| **Cell no** | |
| **E-mail Add.** | gwarneboldt@finning.ca |

| | |
|---|---|
| **Engine Make** | **Caterpillar** |
| **Rating** | 227 to 4,400 kW |
| **RPM** | 1,800 to 900 RPM |
| **Name** | **Powell Arctic Ltd** |
| **Contact** | Chris Moskal |
| **Address** | 1455 Buffalo Place<br>Winnipeg, MB R3T 1L8 |
| **Phone No** | 204 453 4343 |
| **Fax No.** | 204 478 3379 |
| **Cell no** | |
| **E-mail Add.** | moskal@powell.ca |

| | |
|---|---|
| **Engine Make** | **Detroit Diesel MTU** |
| **Rating** | 270 to 4,400 kW |
| **RPM** | 1,800 to 1,200 RPM |
| **Name** | **Waterous Detroit Diesel - Allison** |
| **Contact** | Jerry Neddow, Nick Kwasnycia |
| **Address** | 10025 51 Ave<br>Edmonton, AB T6E 0A8 |
| **Phone No** | 780 437 8288, 780 437 8274 |
| **Fax No.** | 780 437 5864 |
| **Cell no** | 780 915 5762 |
| **E-mail Add.** | jneddow@wdda.com |

| | |
|---|---|
| **Engine Make** | **Detroit Diesel, EMD** |
| **Rating** | 780 to 3,600 kW |
| **RPM** | 1,200 to 900 RPM |
| **Name** | **Midwest Power Products** |
| **Contact** | David Jones |
| **Address** | 1460 Waverley Street<br>Winnipeg, MB R3T 0P6 |
| **Phone No** | 204 452 8244 |
| **Fax No.** | 204 452 2153 |
| **Cell no** | 204 228 9735 |
| **E-mail Add.** | djones@midwestdda.com |

| | |
|---|---|
| **Engine Make** | **Cummins** |
| **Rating** | 36 to 1,860 kW |
| **RPM** | 1,800 RPM only |
| | |
| **Name** | **Cummins Alberta** |
| **Contact** | Gary Potter |
| **Address** | 11731 181 Street |
| | Edmonton, AB T5S 2K5 |
| | |
| **Phone No** | 780 454 9365 Ext. 233 |
| **Fax No.** | 780 452 9887 |
| **Cell no** | 780 940 1768 |
| **E-mail Add.** | gary.a.potter@cummins.com |

| | |
|---|---|
| **Engine Make** | **Wartsila** |
| **Rating** | 690 to 11,850 kW |
| **RPM** | 1,800 to 720 RPM |
| | |
| **Name** | **Wartsila NSD Canada Inc.** |
| **Contact** | Gordon Murrin |
| **Address** | 164 Akerley Blvd. |
| | Dartmouth, NS B3B 1Z5 |
| | |
| **Phone No** | 902 468 1264, 800 468 1264 |
| **Fax No.** | 902 468 1265 |
| **Cell no** | |
| **E-mail Add.** | |

| | |
|---|---|
| **Voltage Regs** | |
| **Rating** | |
| **RPM** | |
| | |
| **Name** | **Innovelec** |
| **Contact** | W. M.. (Bill Cackett) |
| **Address** | 3 Rhatigan Road East |
| | Edmonton, AB T6R 1M9 |
| | |
| **Phone No** | 780 430 6155 |
| **Fax No.** | 780 430 6155 |
| **Cell no** | 780 905 8748 |
| **E-mail Add.** | bcackett@shaw.ca |

**Outside Agencies**
A copy of the EPP will be sent to all agencies involved in the emergency procedures as listed in Section 6.1.

NTPC will revise and update the EPP as necessary and arrange for distribution of the revisions to all outside agencies. A record of review by outside agencies shall be maintained on file by the OS.

**Surveillance**
Routine inspections shall be made once per year by NTPC personnel, usually in the fall. A Water Resource Officer from INAC generally accompanies NTPC personnel on the inspection each year. A formal geotechnical inspection of the structures is performed at 5 year intervals.

**Public Facilities**
There are no public facilities at the sites.