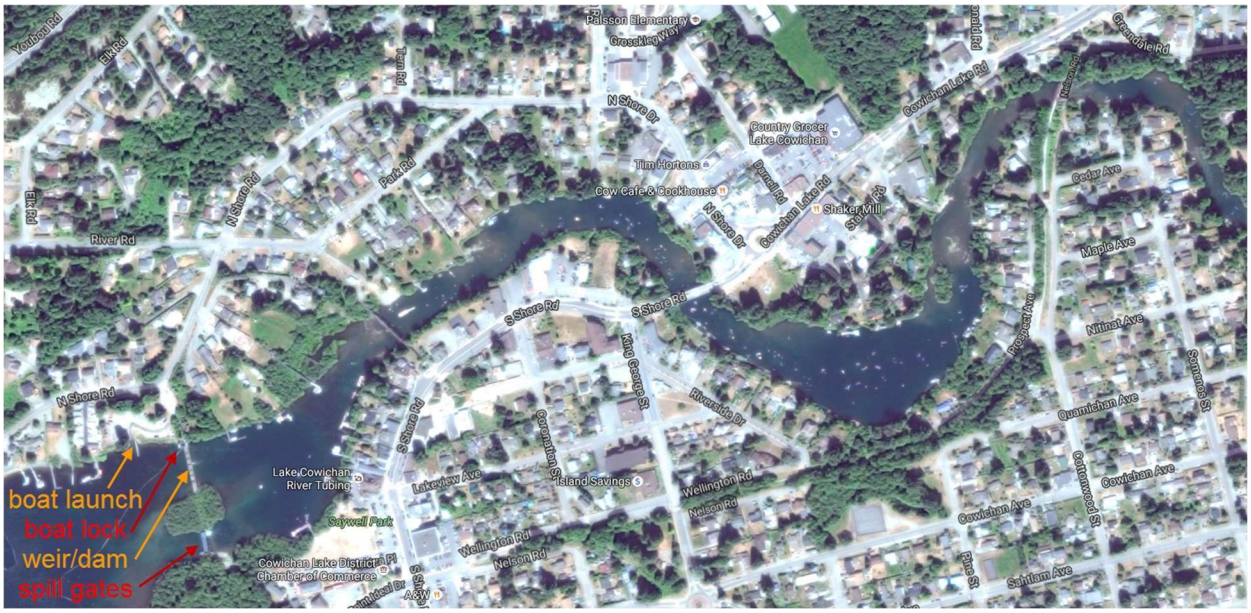
Dam Emergency Plan (DEP)

Lake Cowichan Weir (Dam)

Cowichan River

Provincial Dam Number 730195

Lake Cowichan, BC



Dam Owner: Catalyst Paper Crofton Division

A Paper Excellence Company

Prepared By: Brian Houle

Revision: February 8, 2021

Reviewed and Updated: February 8, 2021- first issue of plan

9 controlled copies are maintained – see page 18 for list of owners of controlled copies

Contents

DEP Overview

The purpose of this Dam Emergency Plan (DEP) is to reduce the risk of human life loss and injury and minimize property damage during an unusual or emergency event at Cowichan Lake Dam. This DEP has been prepared with the intent of meeting the requirements of the Water Sustainability Act, Dam Safety Regulation (Regulation). The dam owner, Catalyst Crofton, and local, regional and provincial response agencies all play a role in responding to an emergency under the Emergency Program Act.

Notifications regarding an unusual or emergency event at the dam are based on the three emergency levels which are determined by the dam owner, Catalyst Crofton. The notification charts for each of the three emergency levels, located in Appendix B-1, must be reviewed, and if necessary, revised annually.

Basic DEP Data

Dam Name	Cowichan Lake Weir
Stream Name	Cowichan River
Consequence Classification	Significant
Dame Type	Rock filled
Provincial Dam Number	730195
Height	0.97 m
Storage Volume	61,000,000 m3
Drainage Area	930 km2
Spillway Type	Gated
Low Level Outlet	Other
Coordinates (i.e. long/lat or UTM)	Lat +49 49’ 29” & Long -14 3’ 42”
Other description	Rock filled timber crib structure with a continuous sheet pile wall along the length of upstream face of dam

2.1 Dam Description

See Plan View of Dam, Appendix C.

2.2 Directions to Lake Cowichan Weir

The Cowichan Lake Weir is located at the outlet (East end) of Cowichan Lake in the Town of Lake Cowichan.

From Highway 1 (Trans Canada Highway) on Vancouver Island, turn west onto Highway 18 and continue for approximately 26 km. When approaching the town of Lake Cowichan, stay left on Highway 18 as it turns onto Cowichan Lake Road. Turn right on North Shore Road (the new traffic circle) and the Weir is located about 500 m past River Road and is on your left. The public access boat launch is located on this same property. Alternatively, access to the spill way is to return to the new traffic circle and take the first right hand exit heading west and into the Town of Lake Cowichan. Turn right after passing Saywell Park, drive beyond the museum (on your left) to the gated Spillway property used to control the release rate of water from lake to river during control season.

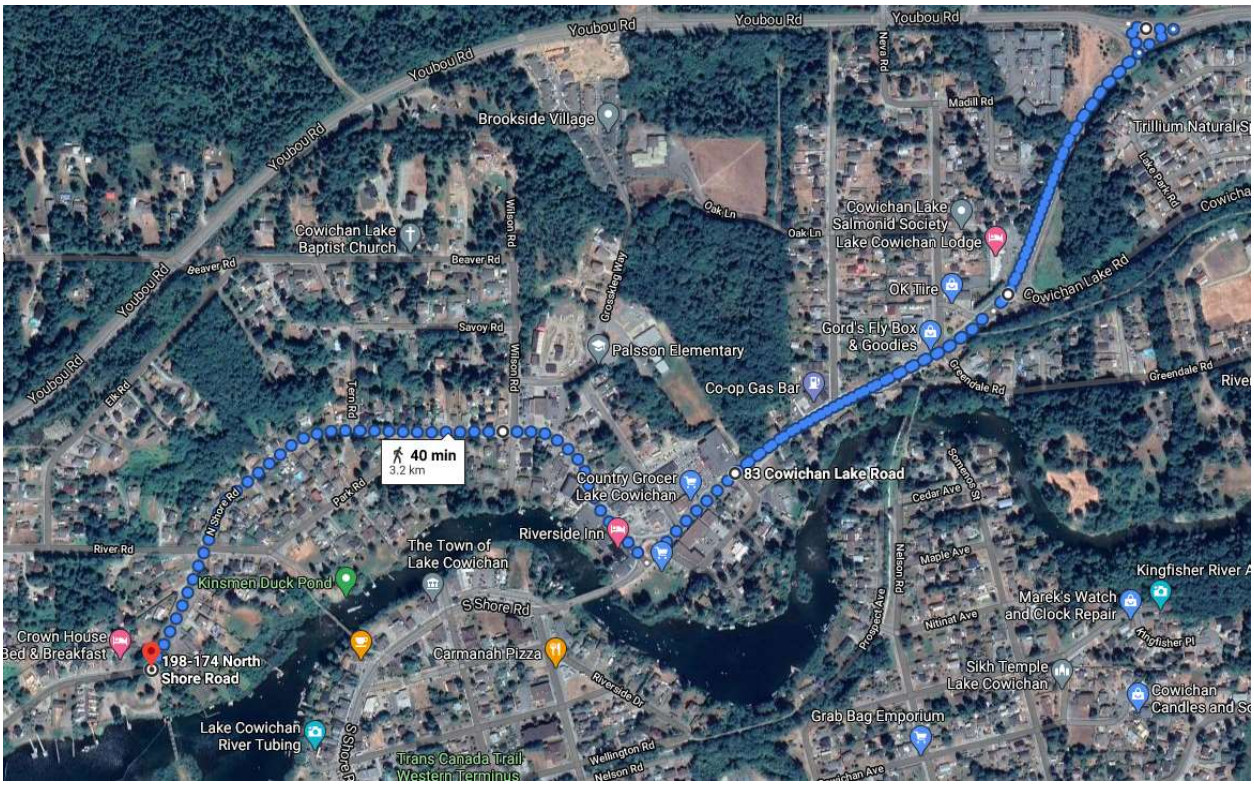
Access to the weir spill way structure and boat lock are restricted by locked gates. Keys are held by the Weir Operator (during control season typically April 1 through Oct 31) and at the Catalyst Paper Crofton Gatehouse (24/7 and year-round). To support local emergency response

activities the access gate at South access to weir has an emergency lock managed by Lake Cowichan Fire Department. The large red emergency lock is owned and maintained by Lake Cowichan Fire Hall.

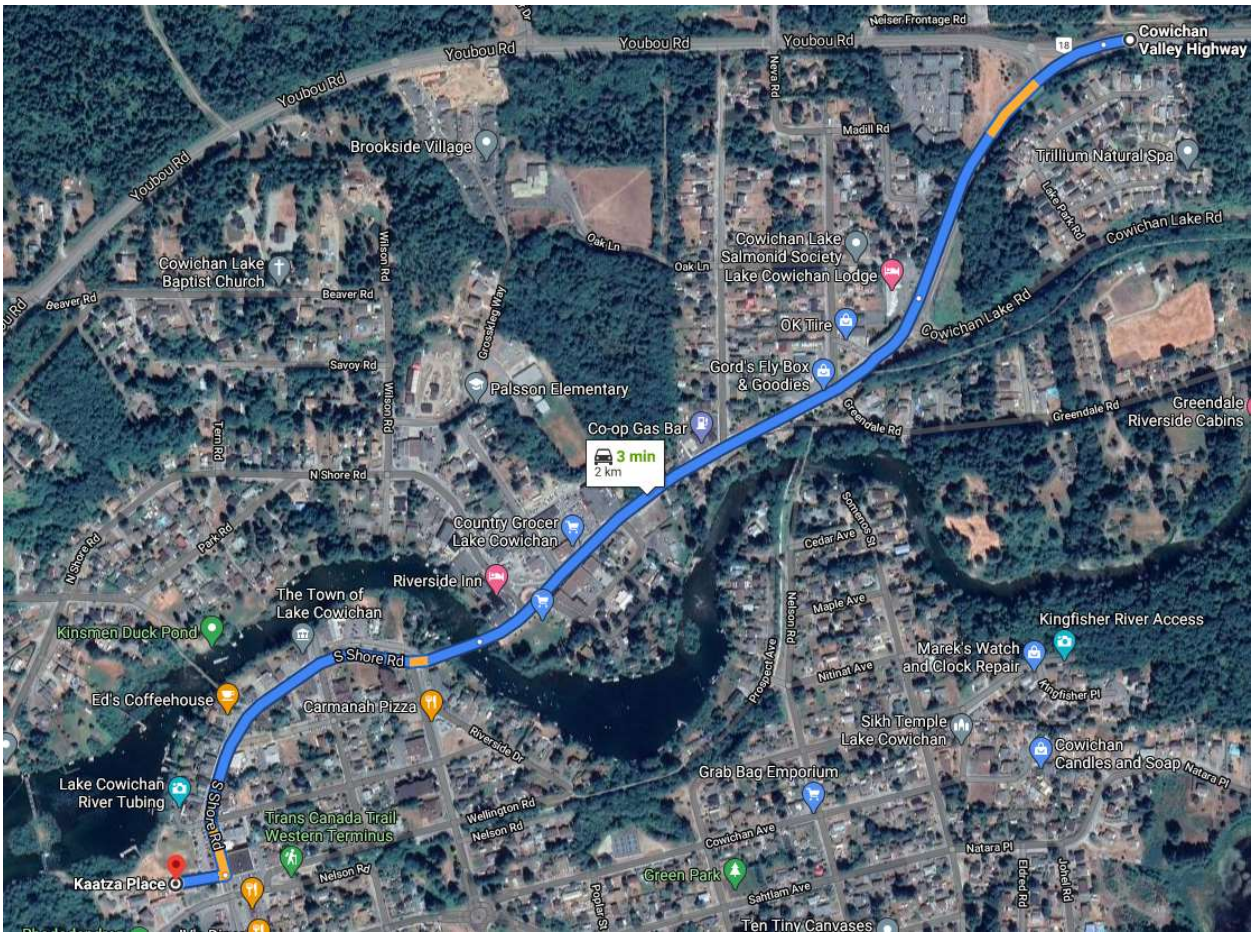
The local detachment of the RCMP have also been provided a key to the Weir gate lock to ensure access is possible for responding to emergencies.

2.3 Access Map to Lake Cowichan Weir

Travel to Boat Lock/Operator workstation on north side of weir is shown below:



Travel to flood gate / control gate structure on south side of weir and emergency access to river side boat launch area is shown below:



3. Roles and Responsibilities

3.1 Dam Owner

- As soon as an emergency event is observed or reported, immediately determine the emergency level (see Guidance for Determining the Emergency Level*, Appendix D*).
  - Level 1: unusual event, slowly developing
  - Level 2: potential dam failure situation, rapidly developing
  - Level 3: dam failure appears imminent or is in progress
- Immediately notify the personnel in the order shown on the Notification Chart (Appendix B-1) for the appropriate emergency level.
- Provide updates of the situation to the local emergency authority to assist them in making timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the DEP is reviewed and updated annually and copies of the revised DEP are distributed to all who received copies of the original DEP including the records for the local emergency authorities.

3.2 Local Emergency Authorities

- Serve as the primary contact responsible for coordination of all emergency actions for potentially affected communities.
- When a Level 2 situation occurs:
  - Prepare emergency response personnel for possible evacuations that may be needed if a Level 3 situation occurs.
  - Consider drafting a State of Local Emergency in preparation for Level 3.
- When a Level 3 situation occurs:
  - Initiate warnings and order evacuation of people at risk downstream of the dam.
  - Declare a State of Local Emergency if required.
  - Direct local emergency response services (may include local law enforcement) to carry out the evacuation of people and close roads within the evacuation area (see Evacuation Area Map, Appendix A-2).
- Decide when to terminate the emergency.
- Participate in review, updates and exercises of the DEP.

3.3 Emergency Management BC (EMBC)

- When a Level 2 situation occurs:
  - Assist local emergency authority, when requested, in preparing emergency response personnel for possible evacuations that may be needed if a Level 3 situation occurs.
  - Alert the public as appropriate.
- When a Level 3 situation occurs:
  - Declare a Provincial State of Emergency if required.
  - Alert the public.
  - Immediately close roads and evacuate people within the evacuation area (see Evacuation Map tab).
- Maintain communication with media.
- Participate in review, updates and exercises of the DEP.

3.4 Dam Owner's Technical Representatives

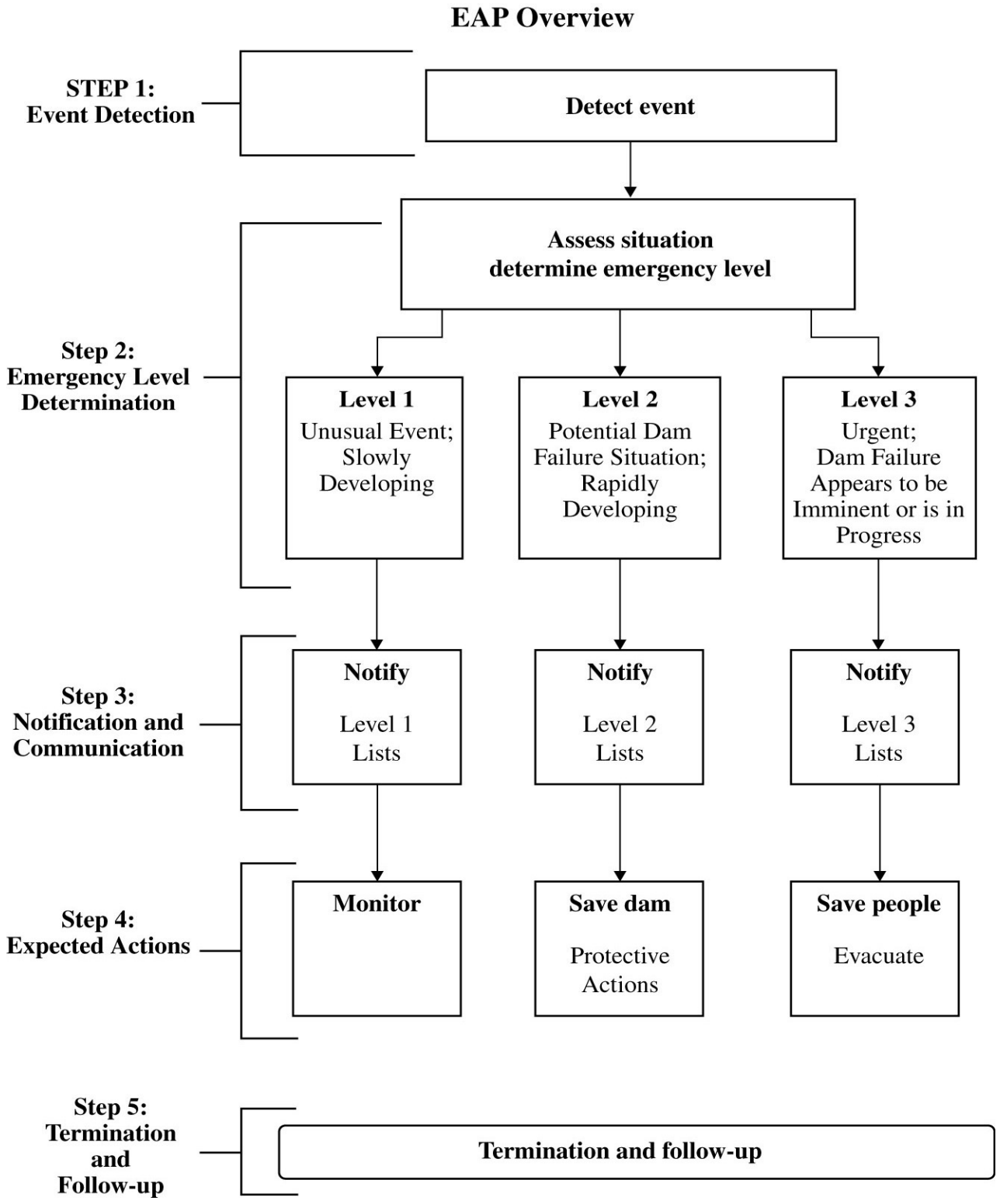
- Undertake an engineering assessment of the safety hazard at the dam.
- Assist the dam owner to determine the emergency level, if time permits.
- Advise the dam owner of remedial actions to take if Level 2 event occurs, if time permits.

3.5 Ministry of Forests, Lands and Natural Resource Operations

- Advise the dam owner of the emergency level determination, if time permits.
- Advise the dam owner of remedial actions to take if Level 2 event occurs, if time permits.
- Support EMBC, local emergency authorities, and other agencies; the Dam Safety Officer may be called on to be the Subject Matter Expert at an emergency response center.

4. Five-Step DEP Process

4.1 DEP Overview



4.2 Five Steps

Step 1 - Event Detection

This step describes the detection of an unusual or emergency event and provides information to assist the dam owner in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations at or near the dam by dam owner, government personnel (local, Provincial, or Federal), landowners, visitors to the dam, or the public
- Dam safety review, formal inspection or site surveillance
- Evaluation of instrumentation data
- Earthquakes felt or reported in the vicinity of the dam
- Forewarning of conditions that may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

Step 2 - Emergency Level Determination

After an unusual or emergency event is detected or reported, the dam owner or his alternate is responsible for classifying the event into one of the following three emergency levels *(See table* Guidance for Determining the Emergency Level *(Appendix D) for guidance in evaluating specific events to determine if they are unusual or emergency situations)*:

Emergency Level 1 - ***Non-emergency, unusual event, slowly developing*:**

This situation is not normal and has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop (corresponds to Section 15 - *Potential safety hazard* of the Dam Safety Regulation, *Water Sustainability Act*). A dam safety engineer or technical expert should be contacted to investigate the situation and recommend actions to take. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Local Emergency Authority should be informed if it is determined that the issue may possibly develop into a worse condition that may require emergency actions.

Emergency Level 2 - ***Potential dam failure situation, rapidly developing*:**

This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure (corresponds to Section 14 – *Hazardous conditions* of the Dam Safety Regulation, *Water Sustainability Act*). A dam safety engineer or technical expert should be contacted to investigate the situation, if time permits, and recommend actions to take. The dam owner should closely monitor the condition of the dam, modify the operation of the dam if needed, and undertake other appropriate hazard

response activities. The dam owner should periodically update the status of the situation to appropriate emergency response authorities. If the dam condition worsens and failure becomes imminent, evacuation procedures must be implemented under Level 3.

Emergency Level 2 is also applicable when flow through the spillway has caused or is expected to cause flooding of downstream areas and people near the stream channel could be endangered. The dam owner may need to refer to flood release operations as outlined in the Operation, Maintenance and Surveillance manual.

Persons in the immediate vicinity of the dam, local emergency authorities and EMBC should be on alert to initiate evacuations or road closures if the flooding increases or the level 2 emergency escalates.

Emergency Level 3 - *Urgent; dam failure appears imminent or is in progress*:

This is an extremely urgent situation where a dam failure is occurring or obviously is about to occur and cannot be prevented. This situation is also applicable when flow through the spillway is causing downstream flooding and creates a hazardous condition that places persons in danger. The following persons must be contacted immediately so persons in imminent danger can be evacuated from the endangered area, roads can be closed as needed and other emergency response activities can be undertaken (see Evacuation Area Map, *Appendix A-2*); the persons in the immediate vicinity of the dam, Emergency Management BC, Local Emergency Authority and the Dam Safety Officer (Regulation, Section 14, *Hazardous conditions*).

See Examples of Emergency Situations (*Appendix F).*

Step 3 - Notification and Communication

Notification

After the emergency level has been determined, the people on the Notification Chart (*Appendix B-1*) for the appropriate emergency level shall be notified immediately.

Communication

The Dam Emergency Situation Report (*Appendix F*) may be used as a guide for the information that should be communicated with the various emergency personnel.

Emergency Level 1 - *Non-emergency, unusual event, slowly developing*:

The dam owner should contact their Technical Expert and must notify the Dam Safety Officer to describe the situation, and request technical assistance on next steps to take.

Emergency Level 2 - *Potential dam failure situation, rapidly developing*:

The dam owner should contact their Technical Expert if time permits but must notify the following of this emergency situation (see Regulation, Section 14, *Hazardous conditions*); Emergency Management BC, Local Emergency Authority, Persons in the Immediate Vicinity of the Dam (*Appendix A-3*) and the Dam Safety Officer.

The following message may be used to help describe the emergency situation to the Local Emergency Authority:

This is ……. (identify yourself, name and position).

We have an emergency condition at the Cowichan Lake Weir, located in the Town of Lake Cowichan.

We have activated the Dam Emergency Plan for this dam and are currently at an emergency level 2.

We are implementing predetermined actions to respond to a rapidly developing situation that could result in dam failure.

Please be prepared to evacuate the area along low lying portions of the Cowichan River.

Reference the evacuation map in your copy of the Dam Emergency Plan.

Catalyst Paper will advise you when the situation is resolved or if the situation gets worse.

Catalyst Paper can be contacted at 250-246-6100 and the telephone is manned 24/7. Depending on the nature of the emergency, the telephone line could be busy, please be patient and redial if needed.

<u>Emergency Level 3</u> - *Urgent; dam failure appears imminent or is in progress*:

The following actions should be taken:

1. Contact all Persons in the Immediate Vicinity of the Dam (*Appendix A-3*) to advise them to vacate the endangered area and call the Local Emergency Authorities. Be sure to say, "This is an emergency." The Local Emergency Authority will implement their mandated emergency plan and begin the evacuation.
   The following message may be used to help describe the emergency situation:

This is an emergency. This is …… (identify yourself, name & position). The Cowichan Lake Weir located in the town of Lake Cowichan is failing. The downstream area must be evacuated immediately. Repeat, the Lake Cowichan Weir is failing; evacuate the area along low lying portions of the Cowichan River. We have activated the Dam Emergency Plan for this dam and are currently under level 3. Reference the evacuation map in your copy of the Dam Emergency Plan. I can be contacted at the following emergency contact phone number……. If you cannot reach me, please call the following alternative phone number …….

2. Notify Emergency Management BC and the Dam Safety Officer of this emergency situation (see Regulation, Section 14, *Hazardous conditions*).
3. Do whatever is necessary to bring people in imminent danger (anyone on the dam, downstream from the dam, boating on the reservoir, or evacuees) to safety.
4. Keep in frequent contact with the Local Emergency Authorities and to keep them up-to-date on the condition of the dam. They can help handle the emergency.
5. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to re-establish communications. If these means fail, handle the immediate problems as best as you can, and periodically try to re-establish contact with Local Emergency Authorities.

The following message may be used as a guide for the Local Emergency Authorities to communicate the status of the emergency with the public:

> Attention; This is an emergency message from the local emergency authority. Listen carefully. Your life could depend on immediate action.
>
> The Cowichan Lake Weir, located in the town of Lake Cowichan, is failing. Repeat, The Cowichan Lake Weir in the town of Lake Cowichan is failing.
>
> If you are in or alongside the Cowichan River, proceed immediately to high ground and away from the river. A level 3 emergency does not include evacuation of or no longer use of bridges, roads or river side home due to the lower volume of water involved in wort case scenario loss of dam. If you are in the river or alongside, you cannot outrun or outswim the flood of water. Proceed immediately to high ground and away from the river.
>
> Repeat message

Step 4 - Expected Actions

If the dam owner becomes aware of an unusual or emergency event at their dam, they should immediately determine the emergency level and the following actions should be taken. If time permits, the dam owner's Technical Expert should be contacted for technical consultation.

Emergency Level 1 - *Non-emergency, Unusual event, slowly developing*:

A. The dam owner should inspect the dam; at a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to their Technical Expert; refer to the table Guidance for Determining the Emergency Level (*Appendix D*) for guidance in determining the appropriate event level for the new condition and recommended actions.**
B. The dam owner must notify the Dam Safety Officer and prepare a plan, through their Technical Expert, that sets out any actions required to rectify this potential safety hazard (see Dam Safety Regulation, Section 15, *Potential Safety hazard*).
C. Record all contacts that were made on the Notification Chart (*Appendix B-1*). Record all information, observations, and actions taken. Note the time of changing conditions. Document the situation with photographs and video, if possible.

Emergency Level 2 - *Potential dam failure situation, rapidly developing*:

A. The dam owner should contact their Technical Expert, if time permits, to report the situation and request technical staff to investigate the situation and recommend corrective actions.
B. The dam owner must contact EMBC, the Local Emergency Authorities and Persons in the Immediate Vicinity of the Dam to inform them that the DEP has been activated and if current conditions get worse an emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.
C. Provide updates to the Persons in the Immediate Vicinity of the Dam and Local Emergency Authorities to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.
D. If time permits, the dam owner should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the Technical Expert; refer to the table Guidance for Determining the Emergency Level (*Appendix D*) for guidance in determining the appropriate event level for the new condition and recommended actions.**
E. Record all contacts that were made on the Notification Chart (*Appendix B-1*). Record all information, observations, and actions taken. Note the time of changing conditions. Document the situation with photographs and video, if possible.
F. If time permits, follow the Emergency Remedial Actions for Level 2 Conditions (*Appendix E*) as appropriate.

Emergency Level 3 - *Urgent; dam failure appears imminent or is in progress*:

A. The dam owner shall immediately advise the Local Emergency Authorities of the urgent condition of the dam and request that they lead the efforts to evacuate persons in the endangered area, carry out warnings and close roads (see Evacuation Area Map, *Appendix A-2*) to safeguard persons in imminent danger. The dam owner shall also immediately advise Persons in the Immediate Vicinity of the Dam (*Appendix A-3*) to vacate the endangered area.
B. The dam owner shall immediately contact others shown on the Notification Chart (*Appendix B-1*).
C. The dam owner shall maintain continuous communication and provide the Local Emergency Authorities with updates of the situation to assist them in making timely decisions concerning warnings and evacuations.
D. The dam owner should record all contacts that were made to Persons in the Immediate Vicinity of the Dam and record all information, observations, and actions and note the time of changing conditions. Document the situation with photographs and video, if possible.
E. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

Step 5 - Termination

Whenever the DEP has been activated, an emergency level has been declared, all DEP actions have been completed, and the emergency is over, the DEP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Local Emergency Authority is responsible for terminating DEP operations and relaying this decision to the dam owner. It is then the responsibility of each person to notify the same group of contacts that were notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Level 3 event that has not resulted in an actual dam failure, the dam owner's Technical Expert or the Dam Safety Officer will inspect the dam or require the inspection of the dam to determine whether any damage has occurred that could potentially result in loss of life, injury, or property damage. If it is determined those conditions do not pose a threat to people or property, the Local Emergency Authority will be advised to terminate DEP operations as described above.

The dam owner shall ensure that a final Dam Emergency Situation Report (*Appendix F*) is completed, and document the emergency event and all actions that were taken. The dam owner shall distribute copies of the completed report to the Dam Safety Officer.

5. DEP Maintenance

5.1 Annual Review of DEP

Update the emergency contact information in the DEP at least once a year as per the Regulation, Schedule 2. The DEP should be revised if any of the contacts have changed. The DEP annual review will include the following:

- Verifying that all of the contact information in Emergency Contact for the Dam (*Appendix A-1*), Evacuation Area Map (*Appendix A-2*) and Persons in the Immediate Vicinity of the Dam to be Evacuated (*Appendix A-3*) is current.
- Verifying that all contact information in Notification Chart (*Appendix B-1*), Emergency Services Contacts and Other Agencies (*Appendix B-2*) and Emergency Response Resources (*Appendix B-3*), is current.

5.2 Revisions

Update the DEP document at least every 10 years for significant and high failure consequence classification dams and every 7 years for very high and extreme failure consequence classification dams as per Schedule 2 of the Regulation. The DEP document held by the dam owner is the master document. When revisions occur, the dam owner will provide the revised pages and an updated revision summary page to all the DEP document holders. The document holders are responsible for revising any outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately destroyed to avoid any confusion with the revisions.

5.3 Exercises

The province along with the Canadian Dam Association recommends DEP training for all dam personnel and testing the DEP through internal exercises and periodic review and/or exercise of the DEP. Periodic exercise may consist of a simple review by the dam owner(s) and key dam owner personnel (i.e. emergency, principle, alternate contacts the dam owner's technical experts) or a more thorough exercise that could include external organizations such as the local emergency authorities (who may want to include emergency responders), persons in the immediate vicinity of the dam, the Dam Safety Officer, EMBC and others with responsibilities listed in the DEP. Other organizations that may be involved with an unusual or emergency event at the dam may also be encouraged to participate. It is recommended that before the tabletop exercise begins, meeting participants visit the dam to familiarize themselves with the dam site.

A tabletop exercise usually involves a facilitator presenting a scenario of an unusual or emergency event at the dam. The scenario should be developed prior to the exercise. Once the scenario has been presented, the participants will discuss the responses and actions that they would take to address and resolve the scenario. The facilitator controls the discussion, ensuring realistic responses and developing the scenario throughout the exercise.

After the tabletop exercise, the five-step DEP response process should be reviewed and discussed. Any recommendations for improvements should be documented.

6. Record of Holders of Control Copies of this DEP

Copies of the DEP should be provided to appropriate Dam Owner personnel and outside agencies and updates provided as the original is updated.

Copy number	Copy provided to	Person receiving copy	Whole plan or part?
1	Catalyst Paper Crofton Division	Jason Lennox (Gatehouse copy)	Whole
2	Catalyst Paper Crofton Division	Brian Houle	Whole
3	Town of Lake Cowichan	Joe Fernandez	Whole
4	Cowichan Valley Regional District	April Diver	Whole
5	Dam Safety Officer	David Skarbo	Whole
6	Lake Cowichan Fire Hall	Steve Vatcher	Whole
7	North Cowichan Municipality	Don Stewart	Whole
8	Catalyst Paper Crofton Division	Weir Operator (at Weir)	Whole
9	RCMP Lake Cowichan Office	Office copy	Whole

7. Record of Revisions and Updates Made to DEP

Revision #	Date	Revision details	By whom	Provided to holders of controlled copies?
1	Feb 8, 2021	First issue of DEP	Brian Houle	Yes (Feb 9/21)

Appendix A

(Appendix A to be forwarded to local emeregcy authorities)

1. Appendix A-1 – Emergency Contacts for Dam
2. Appendix A-2 – Evacuation Area Map
3. Appendix A-3 – Persons in the Immediate Vicinity of the Dam to be Evacuated

Appendix A-1 Emergency Contacts for Error! Reference source not found.

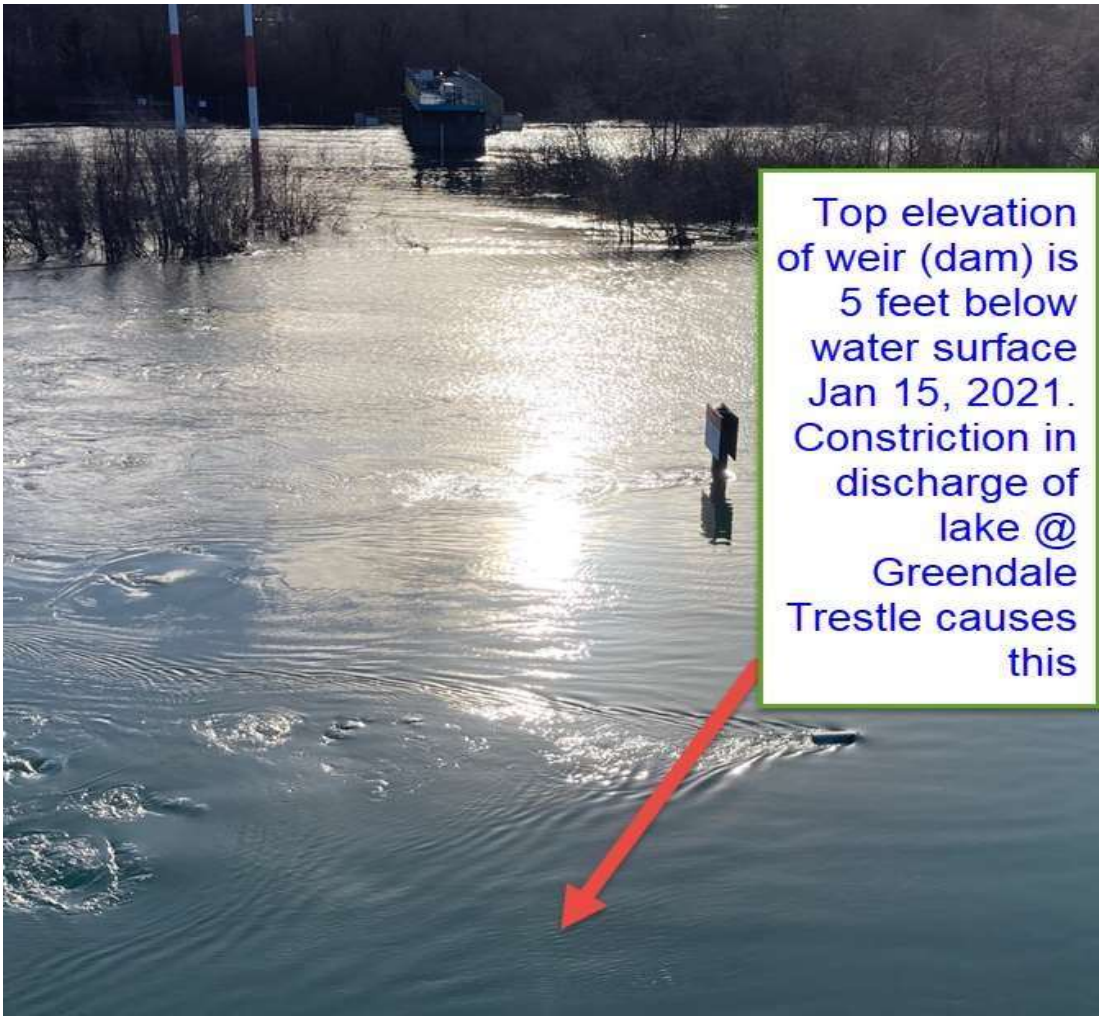
Dam Owner:	**Catalyst Paper Crofton Division**
Emergency Dam Contact:	**Plant Protection Officer**
Business Name:	Catalyst Paper Crofton Division
Address	8541 Hay Road, Crofton, BC
Business Phone	250-246-6100
Cell Phone:	No cell, business phone manned 24/7
Fax:	Contact via telephone
Email:	Contact via telephone
Other:	
Principal Dam Contact:	**Shift Engineer**
Business Phone:	250-246-6100 (dial 3 – environmental contact number)
Cell Phone:	250-510-1747 (cell phone reception can be a problem in mill)
Email:	Not used for emergency contact – use telephone
Other:	
Alternate Dam Contact:	**Brian Houle**
Business Phone:	250-246-6236
Cell Phone:	250-715-8718
Email:	Brian.houle@catalystpaper.com
Other:	250-591-7927 (home telephone)

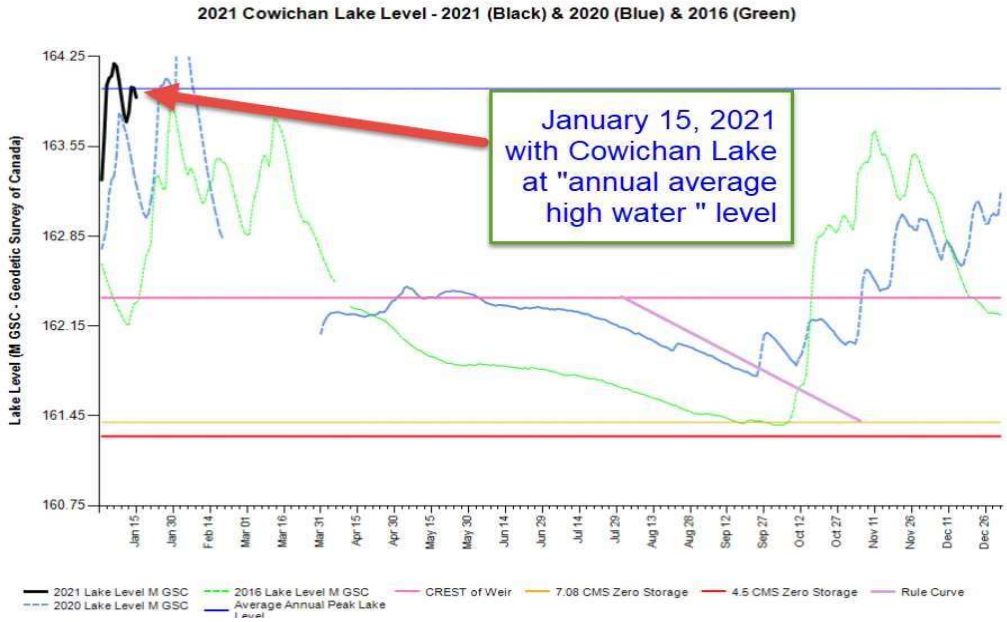
Appendix A-2 Evacuation Area Map

An evacuation map is not required for emergency events related to the Cowichan Lake Weir. An emergency event related to the weir at the lake will only occur when the weir is actively holding water back from the river, normally from April 1 through Nov 1. The river is capable of handling over 250 cubic meters per second (cms) near Lake Cowichan and closer to 500 m3/sec closer to Duncan as these flows are experienced every year on this river – during the wet season.

An evacuation map is also not required during the dry season due to the way the dam is operated. On or about April 1 Catalyst Paper is authorized by the Water Manager of BC to begin to operate the dam at Cowichan Lake. The condition of bringing the dam into actively holding water in lake can only be initiated by the mill if the lake level has declined down to the crest of the dam. When the lake level is equal to the dam level with all 4 control gates open and the boat lock gates also open, the river flow from Cowichan Lake to Cowichan River is predictably less than 60 cubic meters per second. The total loss of the dam during control season will bring maximum 60 cms flow to a river that can handle 250 cms flowing within the banks of the river. The reason an evacuation map is not required for the various emergency events that could occur at the Lake Cowichan Dam is due to these reduced flows.

With a maximum flow from lake to river defined as 60 cms in worst case scenario for dam failure, there is no risk that the sudden presence of this full flow would bring risk to properties, roads, bridges etc as the river demonstrates no issue with flows that rise in winter months to as much as 4 times higher than the maximum summer flow of 60 cms. The following images show the lake level trend indicating lake at mean annual high lake level and photograph of the weir taken on that same day. The image highlights how the dam is submerged under about 5 feet of water in this image. The Green Dale Trestle section of river which is about 2 kilometers down river is pinch point and causes this flooding condition at weir.


Top elevation of weir (dam) is 5 feet below water surface Jan 15, 2021. Constriction in discharge of lake @ Greendale Trestle causes this


2021 Cowichan Lake Level - 2021 (Black) & 2020 (Blue) & 2016 (Green)
Lake Level (M GSC - Geodetic Survey of Canada)
164.25
163.55
162.85
162.15
161.45
160.75
January 15, 2021 with Cowichan Lake at "annual average high water " level
Jan 15
Jan 30
Feb 14
Mar 01
Mar 16
Mar 31
Apr 15
Apr 30
May 15
May 30
Jun 14
Jun 29
Jul 14
Jul 29
Aug 13
Aug 28
Sep 12
Sep 27
Oct 12
Oct 27
Nov 11
Nov 26
Dec 11
Dec 26
2021 Lake Level M GSC
2020 Lake Level M GSC
2016 Lake Level M GSC
Average Annual Peak Lake Level
CREST of Weir
7.08 CMS Zero Storage
4.5 CMS Zero Storage
Rule Curve

Gate side of Lake Cowichan Weir at lower and at high water levels

When lake at mean annual high lake level, see image below, access to river is impeded by flooding of area. At normal lake levels, see image above, no issues with access to gate structure on South side of weir

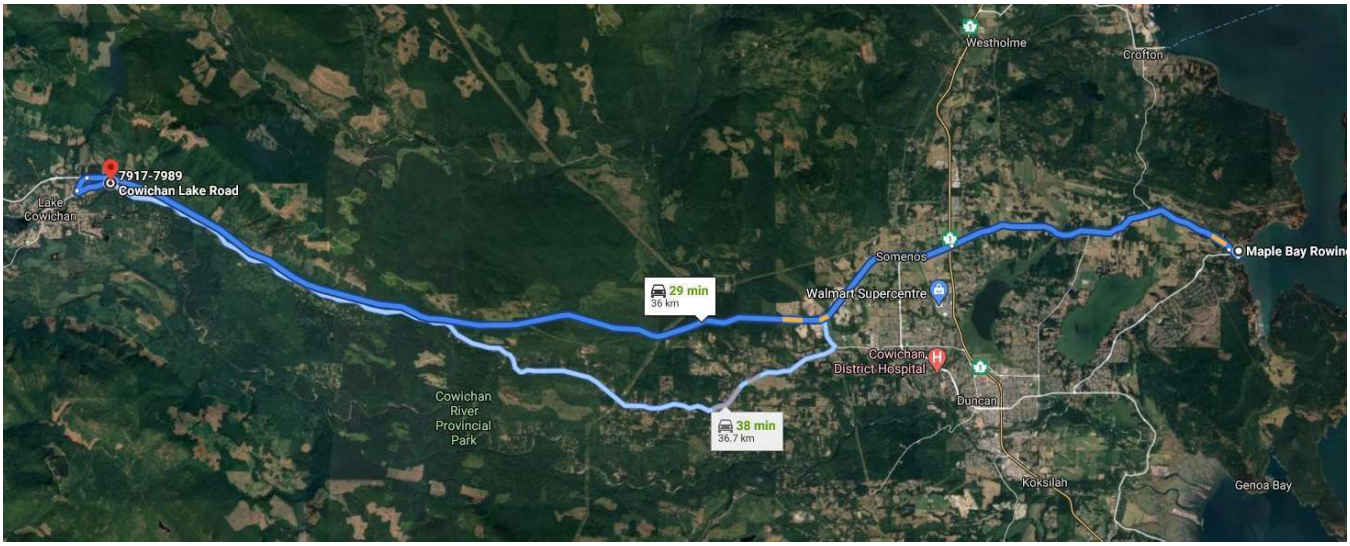
Appendix A-3 Persons in the Immediate Vicinity of the Lake Cowichan Weir to be evacuated

The nature of an emergency event related to loss of or damage to the Lake Cowichan Weir will not result in a need to evacuate citizens from dry land areas along the river downstream. As was noted previously in Appendix A-2, water levels associated with total loss of weir in dry season will result in a specific hazard to people who are in the river and not a hazard to infrastructure like bridges or riverfront residences. While the anticipated change in river flow will not be significant, recreational water users will not be prepared for the sudden rise in river flow that could arrive. The surprise of sudden rising water flows can be very dangerous to swimmers and other recreational users of the Cowichan River and all the way from the lake through to discharge in the ocean near Cowichan Bay.

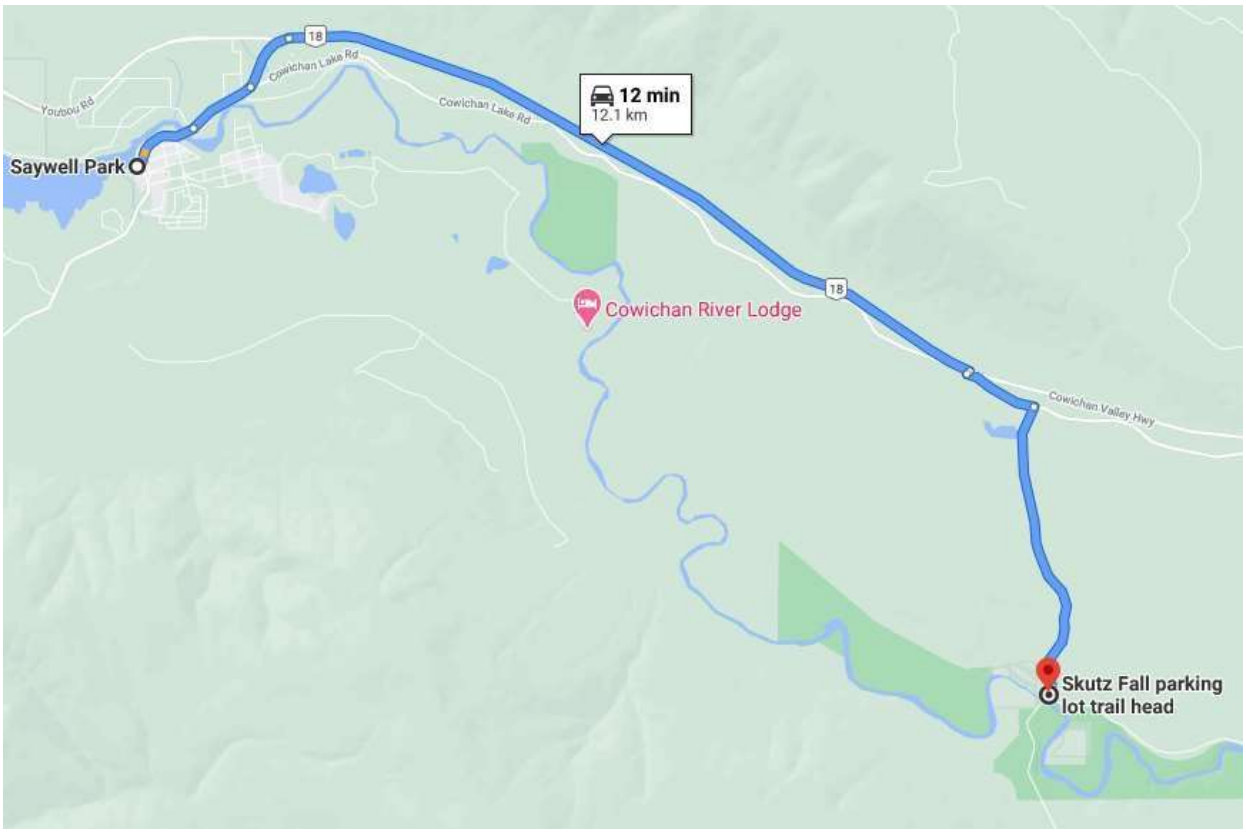
The focus of evacuation of people in the immediate vicinity of the Cowichan Lake Weir and the many recreational users of the Cowichan River will include emergency notifications to the various agencies identified in this plan. Emergency alerts to be provided to key business operators such as the Tube Shack where recreational river users congregate prior to entering the river. Also, as noted in image below, tubers using the upper Cowichan River travel a short distance down river prior to exiting the river and taking arranged bus transportation back to the Tube Shack. It may be necessary to travel to the location where tubers exit the river to ensure the message is heard regarding the dam emergency

The remaining 35 kilometers of river run to the discharge into the ocean also has risk for recreational water users and for same reason, during dry season the lower and steady flows in the Cowichan River are expected. If river flows suddenly rise, the unexpected nature of higher river flows can be surprising to people in the river and adds risk for these people. The following map shows the entire Cowichan River and highlights the two roadways that can be used to travel from the lake to the discharge in Cowichan Bay.

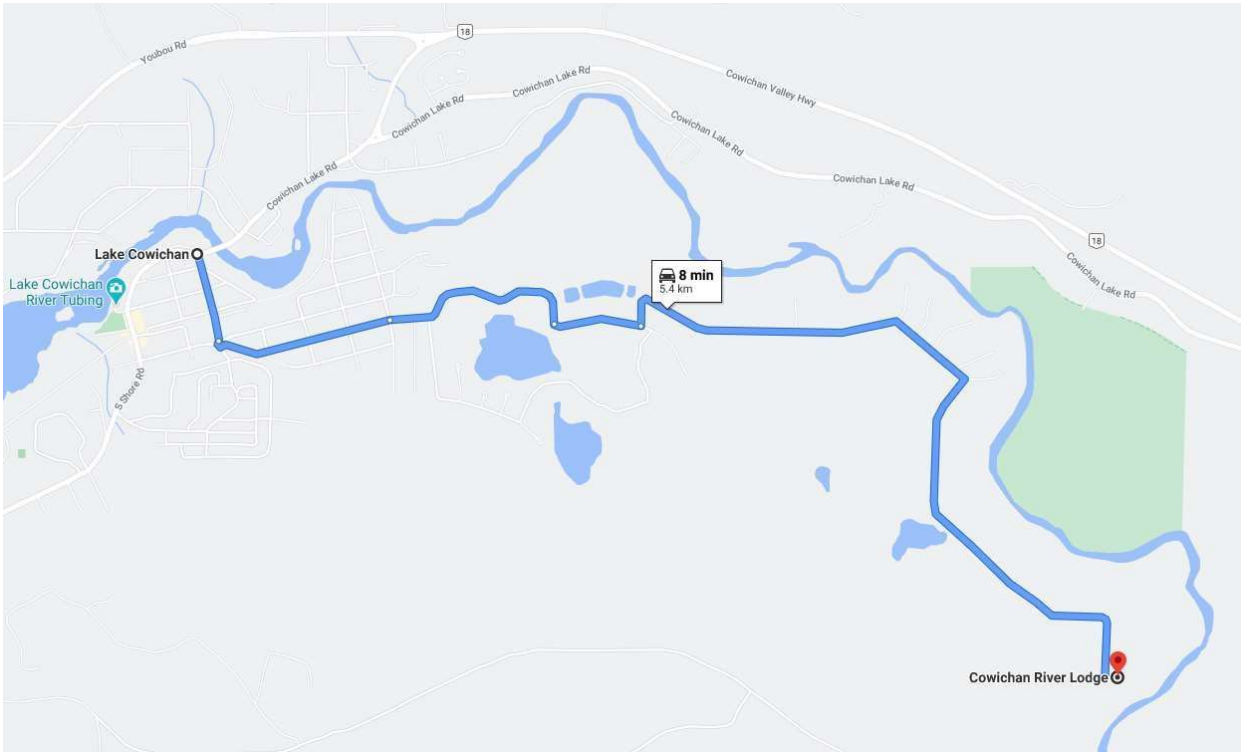
Depending on the nature of the emergency event, it may be important to evacuate the entire river and for that, local media, RCMP and other local agencies will be called on for assistance. The Cowichan River has many places where people congregate, and it is these areas that communication of emergency conditions will be most effective. Following the map of entire river length are specific routes to travel to attend the more popular river locations along with contact information if possible.



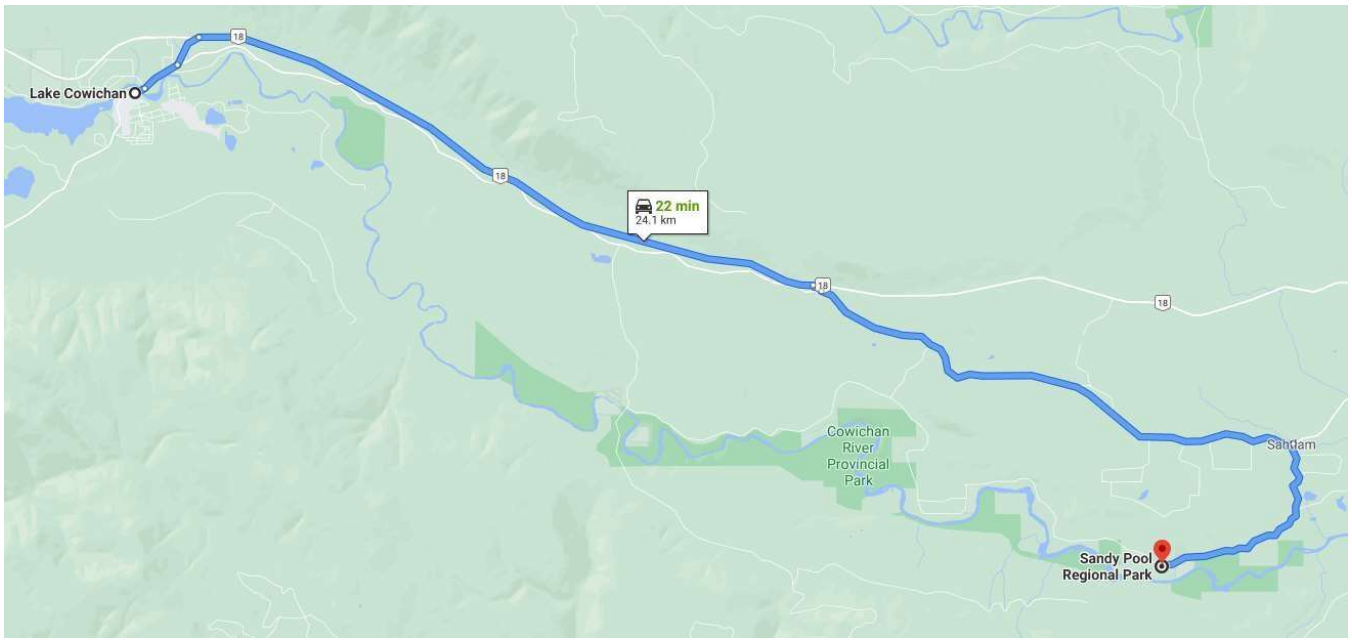
Skutz Falls is a popular location for public access to Cowichan River. Skutz Falls area does not have telephone contact options.
In order to alert people in and along side the Cowichan River at Skutz Falls, travel to this area will be required and map provided below to help.



Cowichan River Lodge is located on South side of Cowichan River and in an area that is popular for river use. Direct contact with Cowichan River Lodge will help ensure the message of danger in and around the Cowichan River is responded to.



Sandy Pool is another popular location for congregation of people in and on banks of river. There is no telephone available at Sandy Pool Regional Park and direct contact will be needed. See map below for route of travel to Sandy Pool Regional Park.



Due to the unknown nature of the risks associated with sudden changes in river flow, a special alert to Cowichan Tribes should be provided. Of note is the 12 hours it takes water to travel from Lake Cowichan Weir to the lower river and to Cowichan Tribes facilities on Allenby Road. Contact can be made through telephone at: 250-748-3196

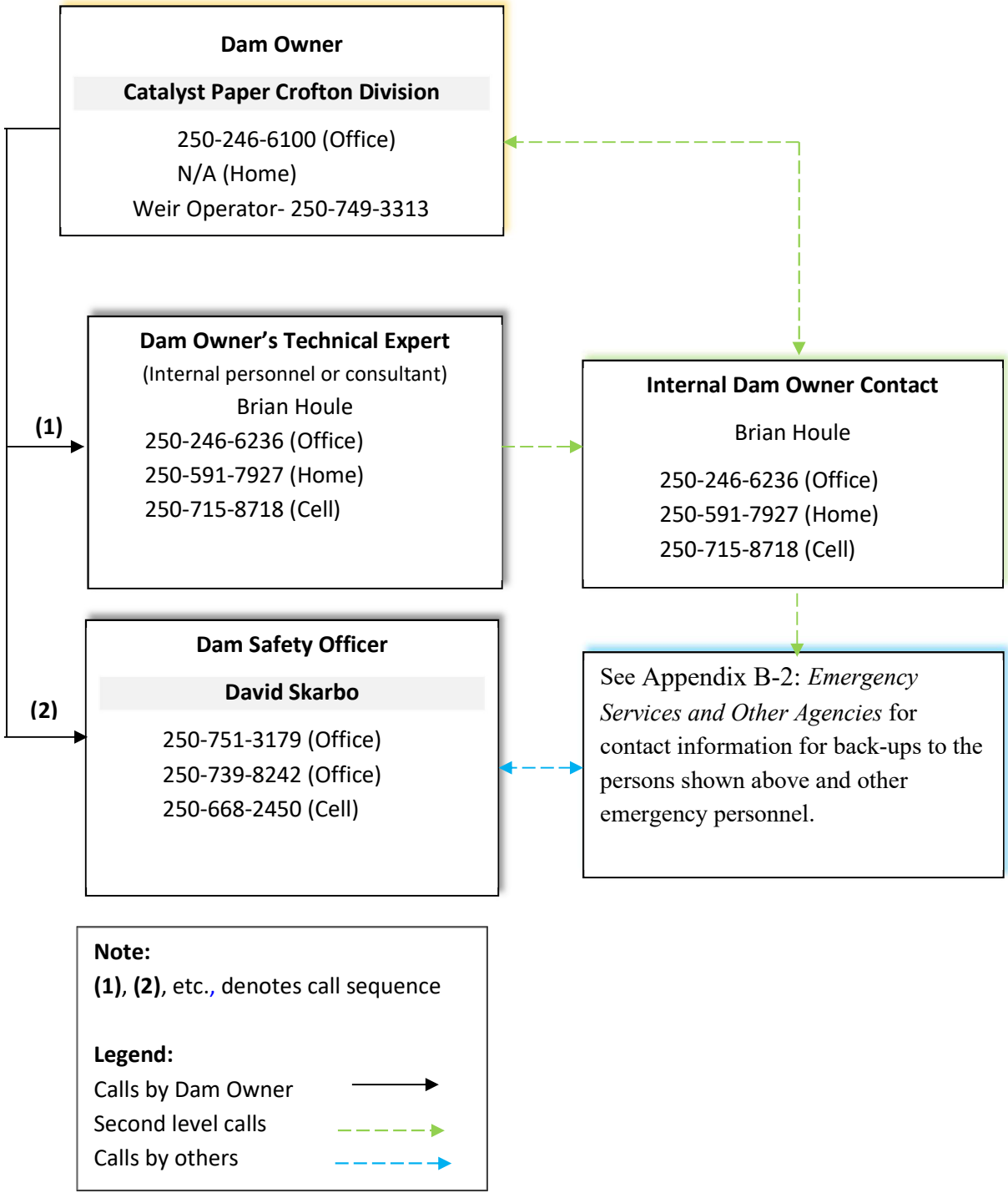
Appendix B

1. **Appendix B-1 – Notification Charts**
2. **Appendix B-2 – Emergency Services Contacts and other Agencies**
3. **Appendix B-3 – Emergency Response Resources**

Appendix B-1 Notification Charts

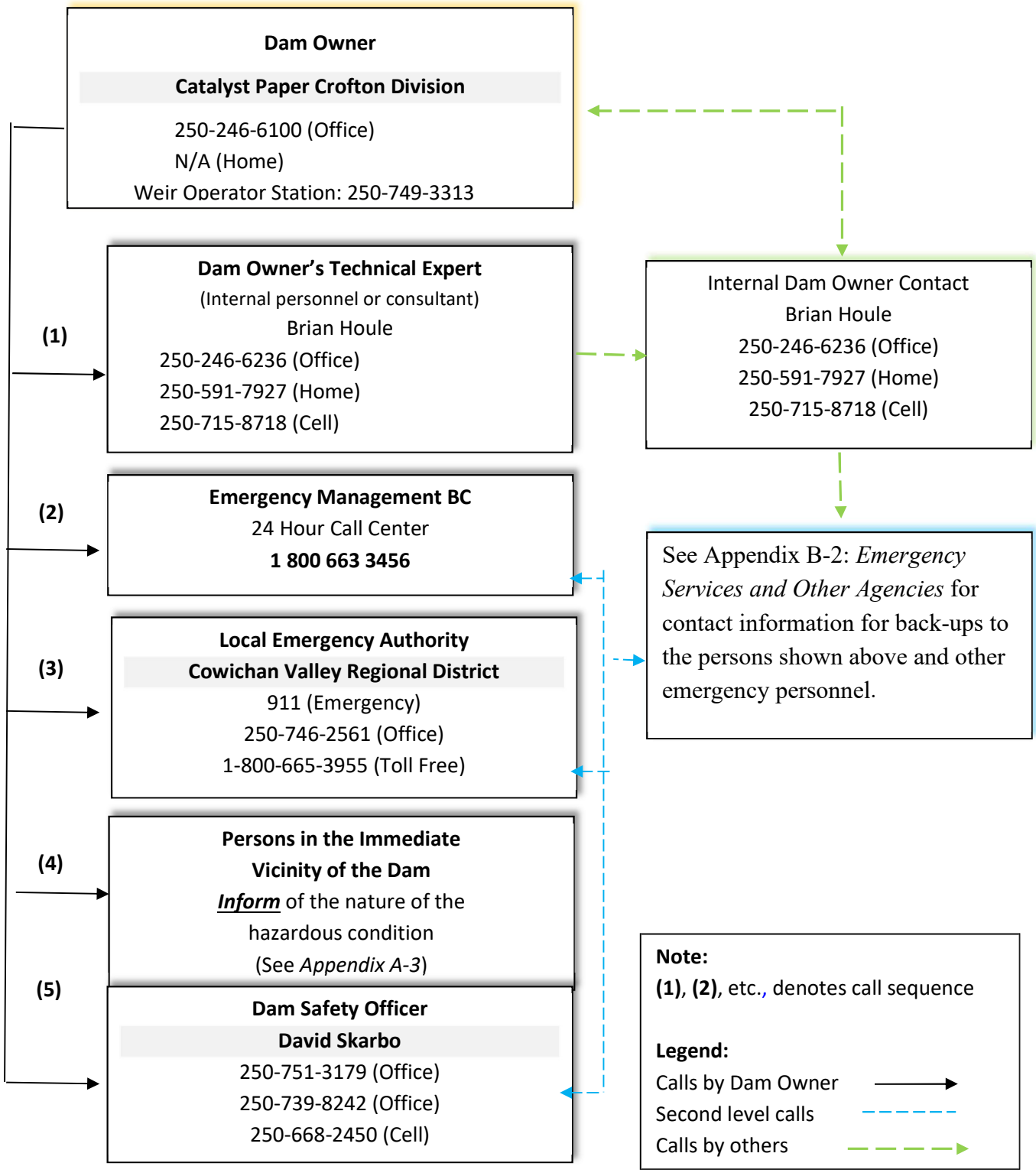
Emergency Level 1 Notifications

Non-emergency unusual event; slowly developing



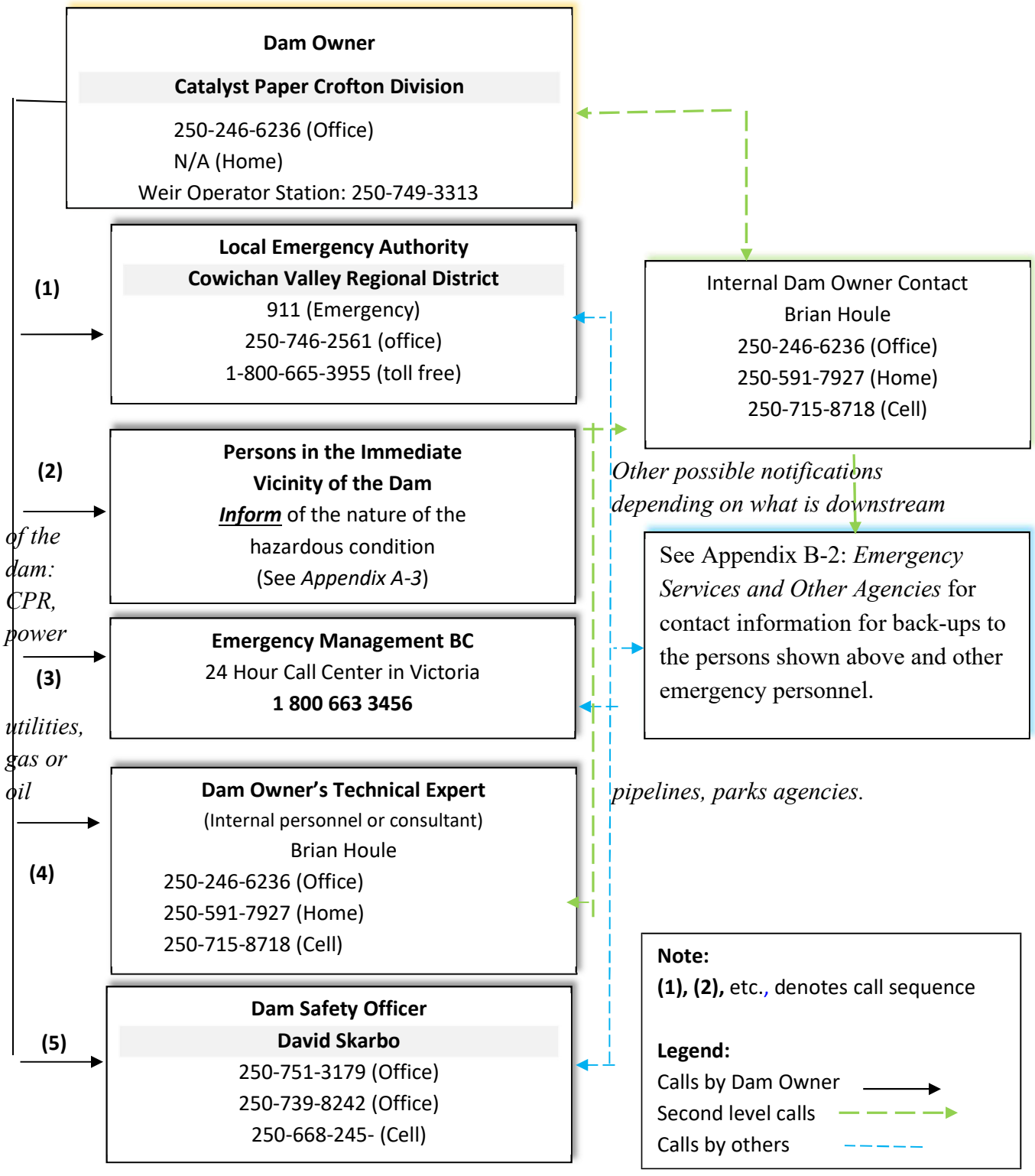
Emergency Level 2 Notifications

Emergency event, potential dam failure situation; rapidly developing



Emergency Level 3 Notifications

Urgent event, dam failure appears imminent or is in progress



Appendix B-2 Emergency Services Contacts and Oher Agencies

Agency / Organization	Principal contact	Address	Office telephone number	Alternate telephone numbers
Dam Owner's Technical Expert (alternative)	Brian Houle	8541 Hay Road, Crofton, BC	250-246-6236	250-715-8718
RCMP or Police	On duty officer	Lake Cowichan Detachment	911 or 250-749-6668	911 or 250-749-6668
Local Search and Rescue	911 for access	175 Ingram St. Duncan, BC	911	911
Ministry of Transportation and Infrastructure	Michael Pearson, District Manager	3rd Floor, 2100 Labieux Rd, Nanaimo	250-751-3287	Victoria office at 250-952-4515
EMBC Regional Manager	Saanichton office	Block A – suite 200 2261 Keating Cross Rd., Saanichton	250-952-5848	1-800-663-3456
Env. Canada Weather				
GSC Pacific Earthquakes				
River Forecast Center				
Other Agency or Organization				
Other Agency or Organization				
Other Agency or Organization				
Other Agency or Organization				

Appendix B-3 Emergency Response Resources

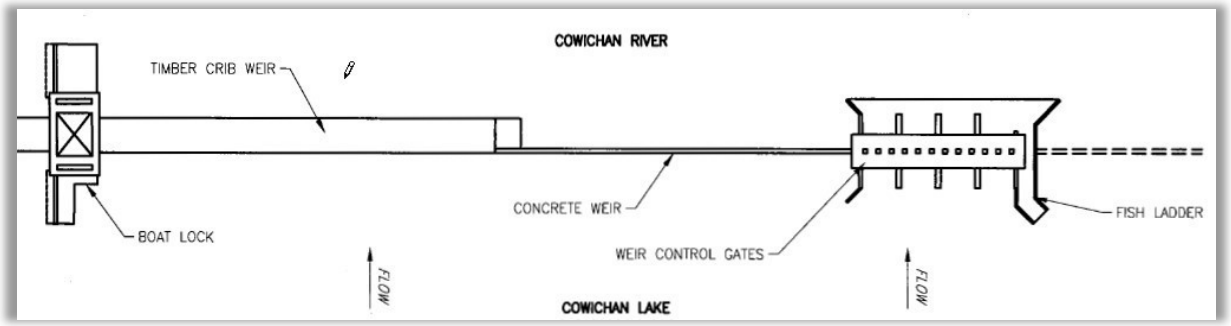
Locally available equipment, personnel and materials.

Catalyst Paper both operates the dam at Lake Cowichan and a large industrial pulp and paper operation in Crofton. The industrial site is manned continuously and employs emergency response trained personnel – on shift 24 hours a day. From this initial contact to the mill, the highly trained emergency response personnel have at their disposal, all manner of equipment and skilled workers to respond to all types of emergency events. The remote location of the mill from the dam in the town of Lake Cowichan (about 40 minutes' drive) may result in the need to use locally sourced equipment and personnel. To assist prompt access to locally available equipment, equipment operators and other emergency response resources, should an emergency require them, a list of local suppliers of key services is provided below. The mill maintains a large fleet of mobile equipment including dozers, loaders, pickups, cranes, dump trucks and other assorted industrial mobile equipment which could be allocated to emergency response activities at Lake Cowichan if needed.

Other locally available resources may include:

Log removal services	Diving services (Inspections)	Mechanical Trades
Ed Bonenfant 27 Savoy Lake Cowichan 250-749-3726	Randy Wright North Pacific Divers Northpacific2009@gmail.com 250-709-1651	Geo-Tech Crofton 250-246-4312
Other Services		
Catalyst Crofton Gatehouse 8541 Hay Road 250-246-6100	The Tube Shack 109 South Shore Road 250-510-7433	Town of Lake Cowichan Jas Sandhu (public works) Cell: 250-701-3858 Joe Fernandez (town Mgr.) Cell: 250-715-5049

Appendix C Plan View of Lake Cowichan Weir



Appendix D Guidance for Determining the Emergency Level

Event	Situation	Emergency level*
Earth spillway flow	Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion	1
	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	2
	Spillway flowing with an advancing head cut that is threatening the control section	3
	Spillway flow that is flooding people downstream	3
Embankment overtopping	Reservoir level is 1 foot below the top of the dam	2
	Water from the reservoir is flowing over the top of the dam	3
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2
	Seepage with discharge greater than 10 gallons per minute	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment 2	2
	Rapidly enlarging sinkhole	3
Embankment cracking	New cracks in the embankment greater than ¼-inch wide without seepage	1
	Cracks in the embankment with seepage	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly proceeding slides of the embankment slopes	3
Instruments	Instrumentation readings beyond predetermined values	1
Earthquake	Measurable earthquake felt or reported on or within 50 kilometers of the dam Earthquake resulting in uncontrolled release of water from the dam 3	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam Damage to dam or appurtenances with no impacts to the functioning of the dam 1	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Sabotage/ vandalism	Damage to dam or appurtenance with no impacts to dam function	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	3

* Level 1: Nonemergency unusual event, slowly developing
* Level 2: Potential dam failure situation, rapidly developing
* Level 3: Urgent; dam failure appears imminent or is in progress

Appendix E Emergency Remedial Actions for Level 2 Conditions

If time permits, the following emergency remedial actions should be considered for Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with the Dam Owner's Technical Expert. See Emergency Response Resources (*Appendix B-3*) for sources of equipment and materials to assist with remedial actions.

Embankment overtopping

1. If the water level in the reservoir is no longer rising, place sandbags along the low areas of the top of the dam to control wave action, reduce the likelihood of flow concentration during minor overtopping, and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection.

Seepage and sinkholes

1. Open the principal spillway gate to lower the reservoir level as rapidly as possible to a level that stops or decreases the seepage to a non-erosive velocity. If the gate is damaged or blocked, pumping or siphoning may be required.

   Continue lowering the water level until the seepage stops.
2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials such as hay bales, bentonite, soil or rockfill, or plastic sheeting.
3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the gate is damaged or blocked, pumping or siphoning may be required.
2. Repair settlement of the crest by placing sandbags or earth and rockfill materials in the damaged area to restore freeboard.
3. Stabilize slides by placing a soil or rockfill buttress against the toe of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform a field survey to determine if there has been any settlement and movement of the dam embankment, spillway, and low-level outlet works.
3. Drain the reservoir, if required.

Appendix F Dam Emergency Situation Report

To be completed by the owner at regular intervals during the emergency.

Dam name: **Cowichan Lake Dam/Weir**

Provincial Dam Number:**730195**

Dam location: **Town of Lake Cowichan** Cowichan River

Date: Time: Situation Report #:

Weather conditions: _____

General description of emergency situation:

_____

_____

Area(s) of dam affected:

_____

_____

Extent of dam damage: _____

Possible cause(s): _____

Effect on dam's operation:_____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

_____

_____

Other data and comments:

_____

Observer's name and telephone number:_____

Report prepared by: _____ Date: _____

Appendix G Examples of Emergency Situations

The following are examples of conditions that usually constitute an emergency situation that may occur at a dam. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original designed conditions can cause significant flow through the auxiliary spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency-level condition. The groupings are provided as guidance only. Not all emergency conditions may be listed, and the dam operator is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam.

Pre-existing conditions on this dam: There has been a small seepage area near the downstream toe on the north side of the release channel. This was first noticed in the 1990s, but has not changed since that time.

Earth Spillway Flows

Level 2—Potential dam failure situation; rapidly developing:

1. Significant erosion or head cutting of the spillway is occurring, but the rate does not appear to threaten an imminent breach of the spillway crest that would result in an uncontrolled release of the reservoir.
2. Flow through the earth auxiliary spillway is or is expected to cause flooding that could threaten people, homes, and/or roads downstream from the dam.

Level 3—Urgent; dam failure appears imminent or is in progress:

1. Significant erosion or head cutting of the spillway is occurring at a rapid rate, and a breach of the control section appears imminent.
2. Flow through the earth auxiliary spillway is causing flooding that is threatening people, homes, and/or roads downstream from the dam.

Embankment Overtopping

Level 2—Potential dam failure situation; rapidly developing:

1. The reservoir level is within 1 foot from the top of the dam.

Level 3—Urgent; dam failure appears imminent or is in progress:

1. The reservoir level has exceeded the top of the dam, and flow is occurring over the embankment.

Seepage and Sinkholes

Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam or settlement of the dam is observed.
4. Reservoir level is falling without apparent cause.
5. The following known dam defects are or will soon be inundated by a rise in the reservoir:
   - Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
   - Transverse cracks extending through the dam, abutments, or foundation.

Level 3—Urgent; dam failure appears imminent or is in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Embankment Movement and Cracking

Level 2—Potential dam failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam that may eventually result in breaching of the dam.

Level 3—Urgent; dam failure appears imminent or is in progress:

1. Sudden or rapidly proceeding slides, settlement, or cracking of the embankment crest, slopes, abutments, and/or foundation, and breaching of the dam appears imminent or is in progress.

Glossary of Terms

Abutment	That part of the valley side against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.
Acre-foot	A unit of volumetric measure that would cover 1 acre to a depth of 1 foot. One acre-foot is equal to 1,234 cubic meters.
Berm	A nearly horizontal step (bench) in the upstream or downstream sloping face of the dam.
Boil	A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.
Breach	An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.
Conduit	A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.
Control section	A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.
Cross section	A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. Also, a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream.
Dam	A barrier constructed for the purpose of enabling the storage or diversion of water diverted from a stream or an aquifer, or both and other works that are incidental to or necessary for the barrier.
Dam failure	An uncontrolled release of all or part of the water impounded by the dam, whether or not caused by a collapse of the dam.
Dam Owner Representative	The person(s) with responsibility for the operation and maintenance of dam.

Drain	A water collection system of sand and gravel and typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet. The drains can be located in the toe, foundation or drainage blanket.
Drainage area (watershed)	The geographic area on which rainfall flows into the dam.
Drawdown	The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.
Emergency	A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.
Dam Emergency Plan	A formal document identifying potential emergency conditions that may occur at the dam and specifying preplanned actions to minimize potential failure of the dam or minimize failure consequences including loss of life, property damage, and environmental impacts. (BC *Dam Safety Reg*., Section 9)
Evacuation map	A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.
Filter	The layers of sand and gravel in a drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.
Freeboard	Vertical distance between a stated water level in the reservoir and the top of dam.
Gate, slide or sluice	An operable, watertight valve to manage the discharge or regulation of water from the dam.
Groin	The area along the intersection of the face of a dam and the abutment.
Consequence classification	A system that categorizes dams (extreme, very high, high, significant, or low) according to the degree of their potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or mis-operation of a dam.
Height of dam	The vertical distance between the crest of the dam and the lowest point at the downstream toe, which usually occurs in the bed of the outlet channel.

Hydrograph	A graphical representation of either the flow rate or flow depth at a specific point above or below the dam over time for a specific flood occurrence. It can include inflow, outflow or a breach flow.
Incident Commander	The highest predetermined official available at the scene of an emergency situation.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation area or map	The geographic area downstream of the dam that would be flooded by a breach of the dam or other large discharge.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.
Outlet works	An appurtenant structure that provides for controlled passage of normal water flows through the dam.
Persons in the immediate vicinity of the dam:	**C**onsidered the persons located immediately downstream and adjacent to the dam where available warning time is very limited (where local emergency authorities could not be expected to respond in time).
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.
Probable Maximum Precipitation (PMP) and Prob. Max. Flood (PMF):	The theoretically greatest precipitation (PMP) or resulting flood (PMF) that is meteorologically feasible for a given duration over a specific drainage area or at a particular geographical location.
Reservoir	The body of water impounded or potentially impounded by the dam.
Riprap	A layer of large rock, precast blocks, bags of cement, or other suitable material, generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.
Risk	A measure of the likelihood and severity of an adverse consequence.

Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway (main)	The appurtenant structure that provides the controlled conveyance of excess water through, over, or around the dam.
Spillway (emergency)	An additional spillway, which usually has a crest elevation somewhat higher than the main spillway, designed to activate during extreme flood events to avoid overtopping the dam.
Spillway capacity	The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.
Spillway crest	The lowest level at which reservoir water can flow into the spillway.
Tailwater	The body of water immediately downstream of the embankment at a specific point in time.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.