

Emergency Action Plan

DEER PARK, WASHINGTON WASTEWATER STORAGE LAGOONS



Project Name: **DEER PARK WASTEWATER STORAGE LAGOONS**

Dam Safety Office File Number: **SP55-1468 (Cell 1 & 2); SP 55-0655 (Cell 3)**

Location: **CITY OF DEER PARK, SPOKANE COUNTY (not located along stream, 1 mile east of Dagoon Creek)**

Owner: **CITY OF DEER PARK, 316 EAST CRAWFORD ROAD
(509) 276-8801 PHONE
(509) 276-5764 FAX
(509) 276-2822 MAINTENANCE SHOP**

Issue Date: **JANUARY 2008 (Original EAP)**

Revised Date: **MARCH 2018**

Introduction

This is the Emergency Action Plan (EAP) for the City of Deer Park Wastewater Storage Lagoons. This EAP will help City leaders to act quickly and strategically, thereby reducing the risk of injury or loss of life and minimizing property damage. The EAP defines responsibilities and provides procedures designed to:

- Identify conditions that may endanger the dam.
- Begin remedial actions to prevent or minimize the downstream impacts of a dam failure.
- Notify local emergency personnel and effectively communicate conditions.
- Warn downstream residents of impending or actual failure of the dam.
- Conclude the response to the unusual or emergency event.

Read through the whole plan before it's needed to know what is included and understand the general emergency process. For example, it is important to become familiar with the three different emergency levels and situations before an event occurs. After an unusual or emergency event is detected or reported, the City of Deer Park or representative is responsible for classifying the event into one of the three emergency levels.

Ecology's Dam Safety Office (DSO) is always available to help and assist in dam safety and maintenance procedures. The City of Deer Park and Staff are ultimately responsible for the maintenance and safety of the Storage Lagoons.

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Dam Basics: Impacted Area and Dam Description

Potentially Impacted Downstream Area:

Please describe the property(s) downstream of the dam (agricultural, residential, industrial, critical wildlife habitat, etc.):

Single Family Dwellings, Small Commercial Occupancies, Public School Facility, City Infrastructure

Additional information on impacted areas, if available:

Residential homes would be impacted first before the commercial and public facilities. If the worst case failure scenario were to occur, conditions would be most probable for the occurrence in the spring (March or April), when the Storage Lagoons are usually full from winter storage and before irrigation begins. The risk of a dam break is minimized when the storage lagoon volumes are low (majority of the year).

Location: The Deer Park Wastewater Storage Lagoon facility is located on the north side of the city limits of the City of Deer Park, Washington, on a site situated approximately 1,400 feet east of Colville Road, and just north of 6th Street.

Downstream flood path: The Storage Lagoons are not located along a tributary of a creek or river. The nearest river body is Dragoon and Spring Creek (tributaries to the Spokane River), located one mile west of the Storage Lagoons.

Description of the dam

Official dam name: Deer Park Storage Lagoons (Cells 1, 2 & 3)

State I.D. number: SP55-1468 (Cells 1 & 2); SP55-0655 (Cell 3)

Dam owner and/or operator: City of Deer Park (owner); Roger Krieger, Mark Lewis, Clint Drury, and Jarred Roberg (City Water/Wastewater Operators)

Owner and/or operator contact numbers: (509) 276-8802 (office); (509) 220-0285 (Roger cell); (509) 220-0288 (Mark cell); (509) 951-0299 (Clint cell); (509) 939-1370 (Jarred cell)

E-mail address: rkrieger@ci.deerpark.wa.us (Roger email); mlewis@ci.deerpark.wa.us (Mark email); cdrury@ci.deerpark.wa.us (Clint email); jroberg@ci.deerpark.wa.us (Jarred email)

Section 35 Township 29N Range 42E (or) Latitude: 47°57'41"N Longitude: 117°27'40"W
County: Spokane

Type of dam (ex: earthfill, concrete, rockfill): Three lagoon cells; Earthen lagoon embankment with double HDPE liner, sand and riprap covering over liner.

Dam height: 20 feet Crest length: 4,400 feet Crest width: 12 feet

Maximum storage: 379.00 acre-feet (123.5 MG) Combined with three lagoon cells

Normal storage: Ranging between 9.21 acre-feet (3 MG) and 376.86 acre feet (122.8 MG)
Ponds near empty at end of irrigation season (October)
Pond can be near full before start of irrigation (March or April)

Downstream hazard classification: High, Class 1B

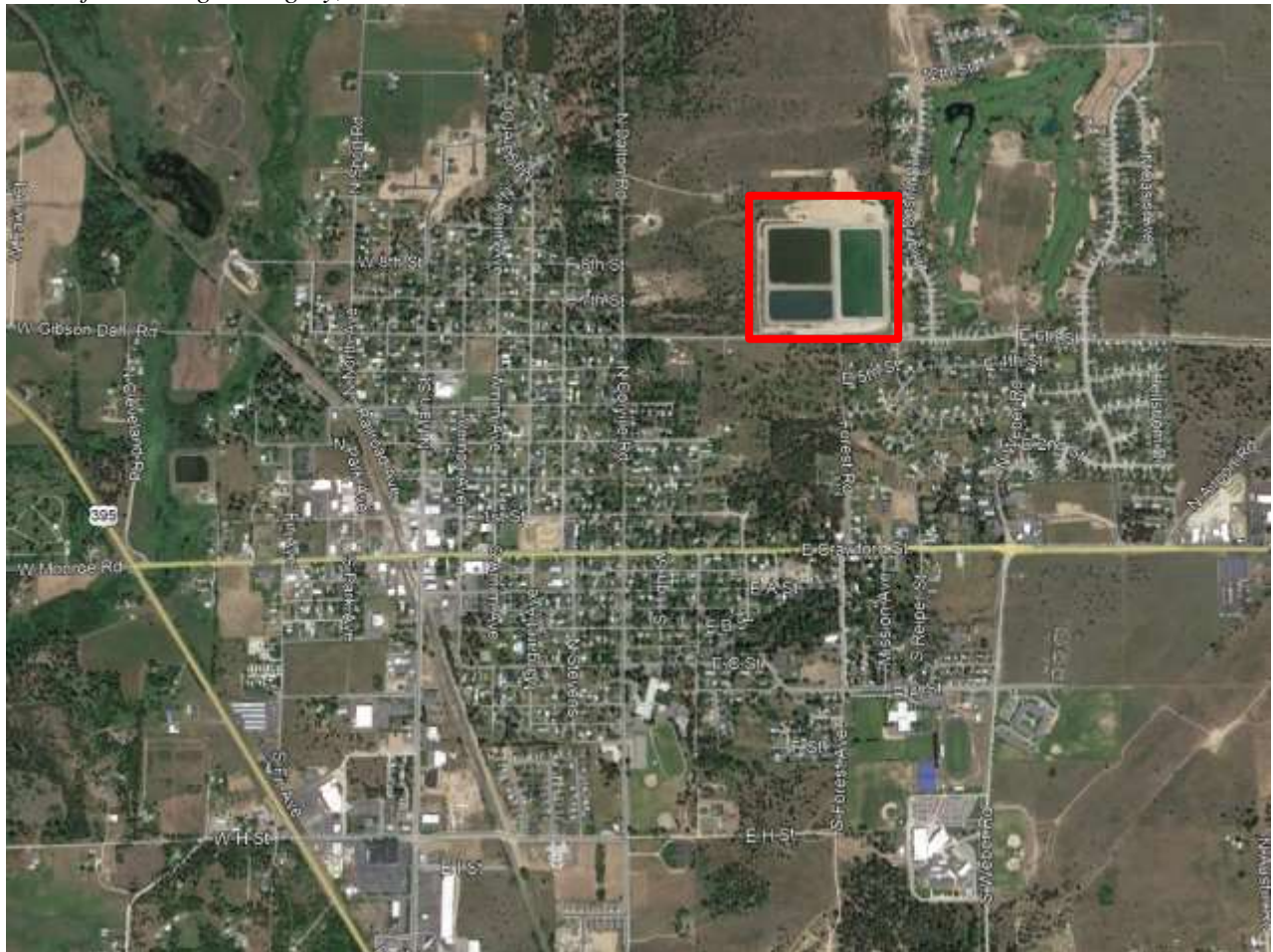
Number of homes in the dam break floodplain (the number of homes that would be in the path of flood water if the dam should fail):

If there was a breach along the westerly edge of cell 1 and cell 2, approximately 100 structures (99 homes, 1 church) would be in the expected floodpath. This risk is highest when these cells are full before irrigation (March or April).

A 2007 flood inundation study expected that 439 residents would be in the flood path if the Storage Lagoons failed. However, it is unlikely that all cells will be full simultaneously and that a breach in one of the cells would cause the other two to empty, due to the dike and embankment separating the lagoon cells. The risk of dam failure is highest prior to the irrigation season. Real flooding and dam breach risks are minimized for a majority of the year while the cells are not full.

LOCATION MAP:

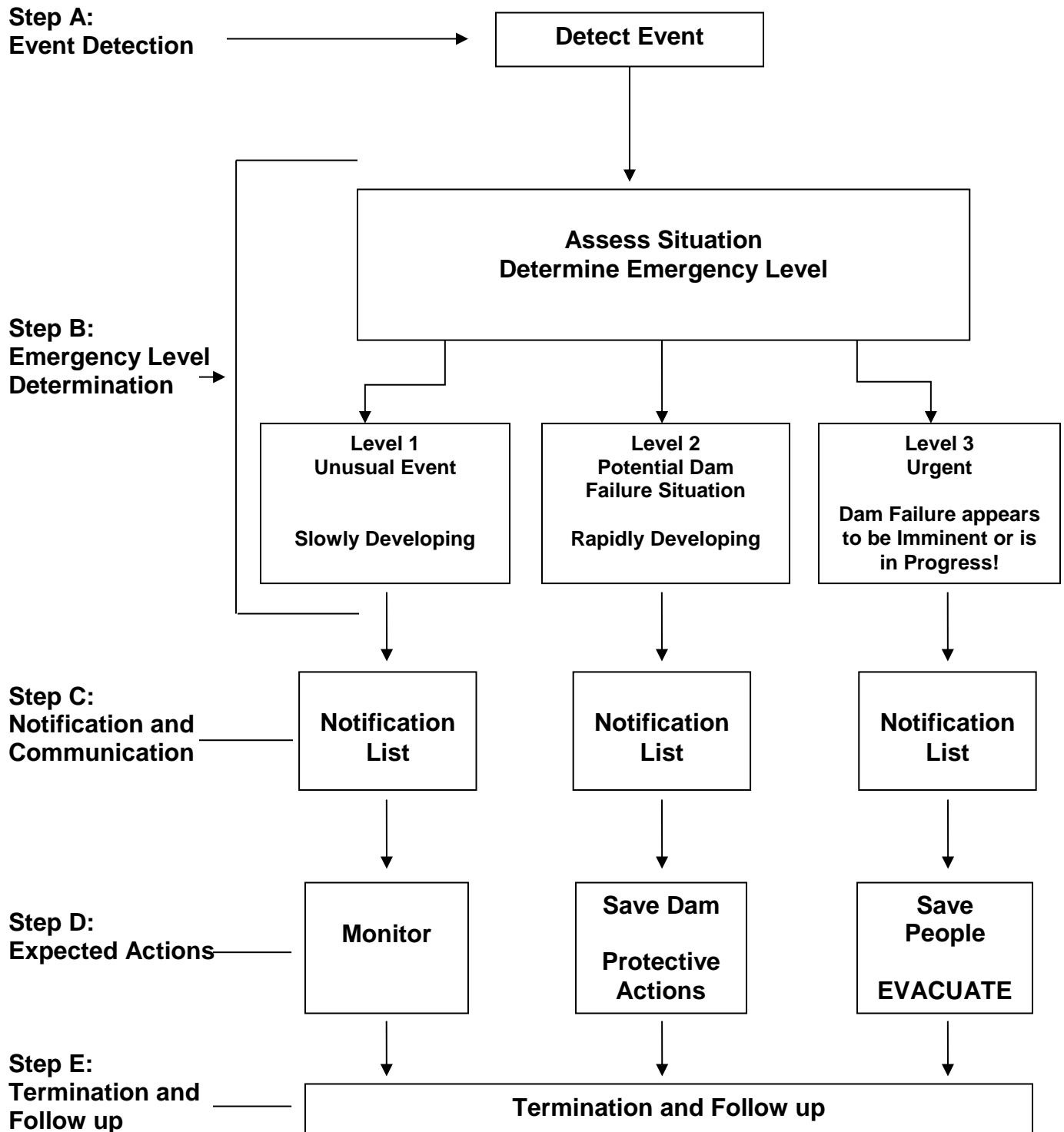
Taken from Google Imagery, 2018.



Directions to the dam (note any locked gates or other access issues): From Highway 395, head to intersection of Colville and 6th Street. From there, head east along 6th Street. Gated entrance located on southwest corner of property with City key and lock.

Emergency Action Plan Overview: Steps A - E

This flowchart presents the basic steps to take in an unusual event or emergency. Details on each step follow.



STEP A: Detect/Recognize the Event

Unusual or emergency events can be detected by:

- Observations made at or near the dam.
- Earthquakes felt or reported at or near the dam.
- Other conditions that can cause an unusual or emergency event at the dam. For example, forecasts of a severe weather event.

STEP B: Determine the Emergency Level (1-3)

You need to evaluate the potential extent of the emergency *before* you notify the appropriate people/agencies. The Emergency Level determines your next steps. Responding to a slowly developing event clearly requires a different response than an imminent dam failure, for example.

The Guidance table on the next page is a quick reference guide to events, situations and levels. For more detailed examples, see Appendix.

Emergency Level 1 - Unusual event, slowly developing

This event is not normal but has not yet threatened the operation or structural integrity of the dam. This event could affect the structural integrity of the dam if left unchecked.

Emergency Level 2 - Potential dam failure, rapidly developing

This event may eventually lead to dam failure and potential flooding downstream, but there is not an immediate threat of dam failure. This emergency level also applies when uncontrolled flow through the dam's spillway has or is likely to result in flooding of downstream areas, but is not yet affecting buildings or roads, or posing a significant risk to health, safety, or welfare.

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

This is an urgent event, where a dam failure is occurring or is clearly about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. The amount of flooding and resulting damage will be dependent upon several factors, such as the lagoon cell impacted, the time of year, and location of the breach.

- If the breach occurs during the dry season when the water level in the reservoir level is low, the escaped water will flood a significantly smaller area than when the breach occurs at the time the dam's reservoir is full.
- If a breach occurs when the dam's reservoir is full, the entire area shown on the Inundation Map (last page of this document) will be flooded.

This event level is also applicable when flow through the dam's spillway is flooding buildings or roads. The dam owner **will contact 911** and the **responsible Emergency Services** to evacuate people at risk and close roads in the flood path if necessary.

Guidance for Determining the Emergency Level

(more detailed examples in Appendix; also graphics of typical dam and possible dam failures)

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

Emergency Level 2: Potential dam failure situation, rapidly developing.

Emergency Level 3: Urgent; dam failure appears to be imminent or is in progress.

Event	Situation	Emergency Level
Earthquake	Measurable earthquake felt or reported within (50) miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Embankment cracking	New cracks in the embankment greater than 1/2-inch wide and greater than 2-feet deep, without seepage	1
	Cracks in the embankment with seepage emerging	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly proceeding slides of the embankment slopes	2
Flooding	National Weather Service issues a flood warning for the area	1
	The reservoir elevation reaches the predetermined notification trigger elevation of 12 inches below dam crest	2
	The reservoir elevation reaches the predetermined notification trigger elevation of 6 inches below dam crest	3
Instruments	Instrumentation readings beyond predetermined values	1
Sabotage/Vandalism	Damage to the dam or appurtenances with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to the dam or appurtenances that has resulted in seepage flow	2
	Damage to the dam or appurtenances that has resulted in uncontrolled water release	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Seepage	New seepage areas in or near the dam	1
	Boils observed downstream of dam	1
	Boils observed downstream of dam with cloudy discharge	2
	New seepage areas with cloudy discharge or increasing flow rate	2
	Cloudy flow and one or more of the following (with constant reservoir level): accelerating rate of flow, expanding flow at exit point, or buildup of soils	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	2
	Rapidly enlarging sinkhole	3
Spillways	Principal spillway severely blocked with debris or structurally damaged	1
	Principal spillway leaking with muddy flows	1
	Principal spillway blocked with debris and pool is rapidly rising	2

Step C: Notification and Communication

Once you have determined the Emergency Level (in Step B), follow the appropriate notification steps below. How you proceed will depend on the identified Emergency Level. Your prepared list of “Owner/operator contact numbers” and individual responsibilities follows.

Emergency Level 1: Slowly developing failure or unusual situation

If there is a **slowly developing failure** or **unusual situation**, where dam failure is not imminent but could occur if no action is taken, dam-tending personnel should:

1. Contact the appropriate persons associated with your dam (see “Owner/Operator Contact Number and Emergency Contacts”).
2. Notify Local Emergency Services (Spokane County Crime Check) (509) 456-2233 of the potential problem and keep them advised of the situation. 911 after hours.
 - Be sure to ask if there are any immediate actions you can take to reduce the risk of failure.
3. If the event is *during office hours*, call the Ecology Dam Safety Office, (360) 407-6872 for an evaluation of the dam.
 - Be sure to ask if there are any immediate actions you can take to reduce the risk of failure.
4. If necessary, implement the preventative actions described under **Step D** of this plan, under the direction of a professional engineer.
5. **If the situation deteriorates**, be prepared to notify downstream residents (see “Public Notification Procedures”).

Emergency Level 2: Potential dam failure, rapidly developing

If there is a potential dam failure, contact the appropriate authorities immediately *in the order listed below*.

1. Call 9-1-1 or (509) 456-2288 Crime Check.
2. Contact the appropriate persons associated with your dam (see “Owner/Operator Contact Number and Emergency Contacts”).
3. Call County/City Emergency Services Personnel or Sheriff (see “Owner/Operator Contact Number and Emergency Contacts”).
4. Call the State Division of Emergency Management
 - a. Call the Duty Officer (available 24 hours/day) at **1-800-258-5990**
 - b. Clearly state that this is a “**dam safety emergency**”
5. If the event is *during office hours*, call the Ecology Dam Safety Office, (360) 407-6872.
6. **If the situation deteriorates**, be prepared to notify downstream residents (see “Public Notification Procedures”).

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

If a dam failure is imminent or in process, immediately contact the appropriate authorities *in the order listed below*.

1. Call 9-1-1
2. Contact the appropriate persons associated with your dam (see “Owner/Operator Contact Number and Emergency Contacts”).
3. Notify persons immediately downstream from the dam of the failure (see “Public Notification Procedures”). Refer to the Inundation Map.
4. Call County/City Emergency Services Personnel or Sheriff (see “Owner/Operator Contact Number and Emergency Contacts”)
5. Call State Division of Emergency Management
 - a. Call the Duty Officer (available 24 hours/day) at **1-800-258-5990**
 - b. Clearly state that this is a “**dam safety emergency**”
6. If it is during *regular office hours*, contact the Ecology Dam Safety Office, (360) 407-6872.
7. Begin any recommended procedures; take preventative actions as described in ***Step D*** of this plan under the direction of a professional engineer.

Owner/Operator Contact Number and Emergency Contacts

It is important that no one person becomes overwhelmed during an unusual event or an emergency. The following list indicates who is responsible for each predetermined duty and other relevant emergency contact numbers.

Name	Telephone/Email	Responsibility
Tim Verzal Mayor, City of Deer Park	(509) 276-8802 office (509)991-7560 cell	Owner Representative
Roger Krieger Community Services Director	(509) 276-8230 home (509) 220-0285 cell rkrieger@ci.deerpark.wa.us	On site management Supervision
Brian Ramsden Maintenance Supervisor	(509) 276-8927 home (509) 220-0286 cell bramsden@ci.deerpark.wa.us	Locate supplies and equipment
Mark Lewis Wastewater Operator	(509) 276-9265 home (509) 220-0288 cell mlewis@ci.deerpark.wa.us	Notify downstream residents
Clint Drury Wastewater Operator	(509) 998-3963 home (509) 951-0299 cell cdrury@ci.deerpark.wa.us	Notify downstream residents
Jarred Roberg Wastewater Operator	(509) 939-1370 cell jroberg@ci.deerpark.wa.us	Notify downstream residents
Spokane County Fire District #4 Duty Officer	911 (509) 467-4500 District Office	Assist in notification of downstream residents through AlertSpokane.com
Spokane City/County Department of Emergency Management	(509) 456-2288 Crime Check 911 (509) 477-2240 Sheriff’s Office	Assist in notification of downstream residents and respond to related emergencies.

Public Notification Procedures

The City of Deer Park has collaborated with AlertSpokane.com (powered by Code Red) to identify areas which would be impacted by a flood event at the Storage Lagoons. Geographic areas can be identified on the map for notices to be sent out in the unlikely event of a dam breach flood.

Example message for notification of flood incident:

Attention: Dam breach at storage lagoons imminent. Expect up to [value] feet of flood water in your area. Please keep children and animals out of the flood water and be alert of your surroundings.

Areas that are a priority alert area are listed in the following table for a breach along the westerly edge of pond 1 and 2. Risk is greatest prior to irrigation season (March and April) and as the lagoon cells are emptied.

Neighborhood (street boundaries)	Number of Structures Impacted	Approximate time flood may arrive	Approximate depth of flood water (peak breach)
9 th Street – 6 th Street Colville Road – West of Lagoons	3 homes, Colville Road, 6 th Street.	Less than 1 minute	2.5 feet
6 th Street – 3 rd Street Colville Road – Arcadia Avenue	19 homes, 1 church, Colville Road, 4 th Street, 3 rd Street	4.5 minutes	Less than 1 foot
9 th Street – 6 th Street Stevens Road – Colville Road	21 homes, 8 th Street, 7 th Street, 6 th Street, Stevens Road	4.5 minutes	Less than 1 foot
9 th Street – 6 th Street Arnim Avenue – Stevens Road	30 homes, Margaret Avenue, Arnim Avenue, 8 th Street, 7 th Street, 6 th Street	7.5 minutes	Less than 1 foot
6 th Street – 3 rd Street Stevens Road – Colville Road	26 homes, 5 th Street, 4 th Street, 3 rd Street, Stevens Road	5.0 minutes	Less than 1 foot

Step D: Expected Actions: Take Preventative Actions

The following actions may help to prevent or delay a dam failure after an emergency is first discovered. **These actions should only be performed under the direction of the Dam Safety Office, or other qualified professional engineers.** This list includes some of the more likely issues; it is not intended as a comprehensive list. (See Appendix for graphics of typical dam and possible failures.)

1. Erosional seepage or leakage (piping) through the embankment, foundation, or abutments

- Plug the flow with whatever material is available (hay bales, bentonite, or plastic sheeting if the entrance to the leak is in the reservoir).
- Lower the water level until the flow decreases to a non-erosive velocity or until it stops.
- Place a blanket filter (a protective sand and gravel filter) over the exit area to hold materials in place.
- Continue lowering the water level until the reservoir reaches a safe elevation.
- Continue operating at a reduced level until repairs are complete.

2. Excessive seepage and high level saturation of the embankment

- Lower the water to a safe level.
- Continue frequent monitoring for signs of slides, cracking, or concentrated seepage.
- Continue operations at a reduced level until repairs are complete.

3. Excessive settlement of the embankment

- Lower the water level by releasing it through the outlet, or by pumping or siphoning.
- If necessary, restore freeboard, preferably by placing sandbags.
- Lower water to a safe level.
- Continue operating at a reduced level until repairs can be made.

4. Failure of an appurtenant structure such as an outlet or spillway

- Implement temporary measures to protect the damaged structure, such as closing an outlet or providing temporary protection for a damaged spillway.
- Employ experienced, professional divers, if necessary, to assess the problem and possibly implement repair.
- Lower the water level to a safe elevation. If the outlet is inoperable, pumping, siphoning, or a controlled breach may be required.

5. Mass movement of the dam on its foundation (spreading or mass sliding failure)

- Immediately lower the water level until excessive movement stops.
- Continue lowering the water level until a safe level is reached.
- Continue operation at a reduced level until repairs are complete.

6. Overtopping by flood waters

- Open outlet to its maximum safe capacity.
- Place sandbags along the dam crest to increase freeboard and force more water through the spillway and outlet.
- Provide erosion-resistant protection to the downstream slope by placing plastic sheets or other materials over eroding areas.
- Divert flood waters around the reservoir basin if possible.

7. Reduction in freeboard and/or loss of dam crest width

- Place additional rip rap or sandbags in damaged areas to prevent further embankment erosion.
- Lower the water level to an elevation below the damaged area.
- Restore freeboard with sandbags or earth and rock fill.
- Continue close inspection of the damaged area until the storm is over.

8. Slide on the upstream or downstream slope of the embankment

- Lower the water level at a rate, and to an elevation, that is considered safe given the slide condition. If the outlet is damaged or blocked, pumping, siphoning, or a controlled breach may be required.
- Restore lost freeboard by placing sandbags or fill in the top of the slide.
- Stabilize slides on the downstream slope by weighting the toe area with additional soil, rock, or gravel.

9. Spillway back cutting threatening reservoir evacuation

- Reduce the flow over the spillway by fully opening the main outlet.
- Provide temporary protection at the point of erosion by placing sandbags, rip rap materials, or plastic sheets weighted with sandbags.
- When inflow subsides, lower the reservoir to a safe level.
- Continue operating at a lower water level to minimize spillway flow.

Supplies and Resources

In an emergency situation, equipment and supplies (such as sandbags, fill materials, equipment and laborers) may be needed on short notice. The table below lists supplies and how to access them.

Item	Contact	Location
Earthwork equipment or sand, gravel or rock	County Engineer (509) 477-3600	Spokane County Public Works
Sand and Gravel	Toner Sand & Gravel (509) 292-2360	4321 E. Eloika Road Chattaroy, WA 99003
Sand Bags	Justus Bag Company (509) 924-8353	11205 E. Trent Spokane, WA 99206
Pumps	GPM (509) 495-8658	125 N. Park Ave. Deer Park, WA 99206
Pipe	HD Fowler (509) 568-8400	6625 E. Sharp Ave. Spokane, WA 99212
Laborers	City volunteers	Deer Park, WA
Concrete	Toner Sand & Gravel (509) 292-2360	4321 E. Eloika Road Chattaroy, WA 99003
Heavy Equipment	Rowand Machinery Co. (509) 838-5252	6210 W. Rowan Road Spokane, WA 99224
Heavy Equipment	United Rentals (509) 532-1235	204 S. Fancher Spokane, WA 99212
Other:		

Step E: Termination and follow-up

Your responsibilities do not end once the immediate crisis is over; you must still do a formal termination and follow-up.

Termination responsibilities for Level 1 unusual event

If you have activated the EAP, you must take actions to conclude the EAP once the event is over and you have followed all the needed procedures.

- Contact Ecology's Dam Safety office and your dam engineer to further investigate the situation and recommend corrective actions if necessary.
- Document the situation with photographs and/or video, note times and conditions.
- Inspect the full length of the upstream slope, crest, downstream slope, and downstream toe of the dam. Check the reservoir area, abutments, and downstream channel of the dam.

Termination responsibilities for Level 2 or 3 emergencies

Your Local Emergency Manager is responsible for terminating the EAP operations for a Level 2 or Level 3 emergency, and relaying this decision to the dam owner.

- The Washington State Dam Safety Engineer must assure the dam is inspected to determine if any hazardous conditions exist.
- If it is determined that hazardous conditions no longer exist, the Washington State Dam Safety Supervisor will advise the Local Emergency Manager to terminate EAP operations.
- The person who made the original calls must inform each person contacted that the emergency has ended.

For additional inquiries, you may always contact Joe Witczak P.E. Dam Safety Supervisor at jwit461@ecy.wa.gov or by calling (360) 407-6603 office, or (360) 972-4426 cell

or:

Gustavo Ordonez P.E., Geotechnical Engineer at gord461@ecy.wa.gov or (360) 407-6619 office or (360) 742-7925 cell

Department of Ecology
Dam Safety Office
PO Box 47600
Olympia WA 98504

APPENDIX

- I. Examples of emergency situations – to help determine Emergency Level (1-3)
- II. Dam diagram and possible dam failures (graphics)
- III. Glossary and Water Equivalents Table
- IV. Final Plan Approval and Signatures
- V. More Information
- VI. Inundation Map

I. Examples of Emergency Situations

To help you determine the Emergency Level (1-3)

Assessing the Emergency Level is essential for proceeding in a strategic and effective way in a potential emergency. Use conservative judgment in determining whether a condition at the dam constitutes an emergency. Refer to graphics of typical dam and possible dam failures.

Some of the conditions that usually constitute an emergency situation include:

- Dam failure due to aging, or design and construction oversights.
- Significant flow through the emergency spillway or overtopping of the embankment due to extreme weather events (weather conditions that may exceed design expectations).
- Accidental or intentional damage to the dam.

The examples below identify some of the more likely emergency level conditions, but may only be present in unusual circumstances:

1. Embankment movement and cracking
2. Embankment overtopping
3. Emergency spillway flows
4. Seepage and sinkholes
5. Wildfire impacts
6. Other problems

1. Embankment Movement and Cracking

Emergency Level 2 - Potential dam failure; rapidly developing:

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

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

- Sudden or rapid progression of slides, settlement, or cracking of the embankment crests, slopes, abutments, and/or foundation, where breaching of the dam appears imminent or is in progress.

2. Emergency Spillway Flows

Emergency Level 2 - Potential dam failure; rapidly developing:

- Significant erosion or head cutting of the spillway is occurring, but a breach of the spillway crest (that would result in an uncontrolled release from the reservoir) does *not* seem imminent.
- Flow through the emergency spillway *is likely to* cause flooding that threatens harm to any person, home, or road downstream from the dam.

Emergency Level 3 – Urgent; dam failure is imminent or in progress:

- Significant erosion or head cutting of the spillway is occurring at a rapid rate and a breach of the control section appears imminent.
- Flow through the emergency spillway is causing flooding that threatens harm to any person, home, or road downstream from the dam.

3. Embankment Overtopping

Emergency Level 2 - Potential dam failure; rapidly developing:

- The reservoir level has reached the top of the dam and is projected to continue to rise.
- Flow is occurring over the embankment, but it is not eroding the embankment slope, and the reservoir is expected to recede.

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

- Flow is occurring over the embankment and is causing erosion damage to the embankment slope.
- The reservoir level has exceeded the top of the dam and is expected to continue to rise.

4. Seepage and Sinkholes

Emergency Level 2 - Potential dam failure; rapidly developing:

- Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
- 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.
- Significant new or enlarging sinkhole(s) on or near the dam.
- Reservoir level is falling without apparent cause.
- The following known dam defects are or soon will be inundated by a rise in the reservoir:
 - 1) Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
 - 2) Transverse cracks extending through the dam, abutments, or foundation.

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

- Rapid increase in cloudy seepage or soil deposits at seepage exit points, to the extent that failure appears imminent or is in progress.
- Rapid increase in volume of downstream seepage, to the extent that failure appears imminent or is in progress.
- 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.
- Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
- Rapid enlargement of sinkhole(s) is forming on the dam or abutments, to the extent that failure appears imminent or is in progress.
- Rapid increase in flow through crack(s) which is eroding materials, to the extent that failure appears imminent or is in progress.

5. **Wildfire Impacts on Dams**

Wildfires may not be a principal source of problems for the Deer Park Storage Lagoons, as the lagoons are not located along a streambed where mud or debris flow would impact the structural integrity of the dam structure. However, care should be taken to protect the lagoons in all instances. Refer to ECY Publications No. 15-11-015, July 2015 for full list of wild fire impacts to dam.

Emergency Level 1 - Non-emergency, unusual event; needs response to reduce risk or likelihood of a Level 2 incident

- Incident: **Wildfire at the dam.**

Responses:

- Inspect and assess damage to dam, overflow spillways, and appurtenant facilities.
- Assess whether spillways may be vulnerable to blockage by floating debris in the reservoir.
- Assess increased hydrologic risk. Watershed assessment by a qualified engineer or engineering hydrologist. See Burned Watershed guidance from the Dam Safety Office at <http://www.ecy.wa.gov/programs/wr/dams/GuidanceDocs.html>
- Determine access routes and procedures for safe access to the dam during adverse conditions, and communications procedures to activate the EAP.

- Incident: **Forecast for rain, Flash Flood Watch (not Warning, issued by National Weather Service) or Actual rain event** in the vicinity of the dam.

Responses:

- Observe for actual rainfall, observe any runoff, be prepared to respond.

Emergency Level 2 - potential failure situation; needs timely response to reduce risk or likelihood of a dam failure.

- Incident: **Forecast for heavy rain, Flash Flood Warning (issued by National Weather Service), Actual heavy rain or thunderstorm event** in the vicinity of the dam.

Responses:

- Observe for actual rainfall, observe any runoff, be prepared to respond.

Emergency Level 3 - urgent; dam failure is imminent

- Incident: **Spillway or dam dike begins to erode**

Response:

- Follow Level 3 protocol in your EAP.

6. **Other Problems**

In case of other problems occurring that might pose a threat to the dam safety, contact the Dam Safety Office and explain the situation as well as possible.

II. Dam Diagram and Possible Dam Failures

A quick look at some dam basics: a typical dam labeled with common terms, and graphic with some of the more common types of failures shown.

Dam Diagram

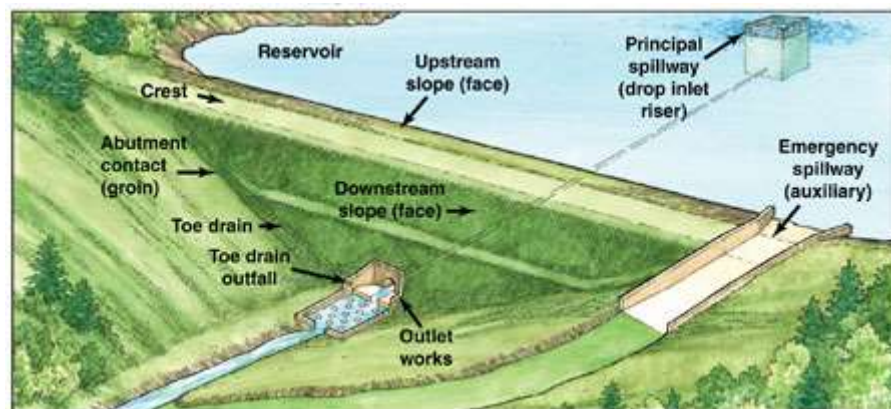


Figure 1—Typical dam diagram showing common terms.

Possible Dam Failures

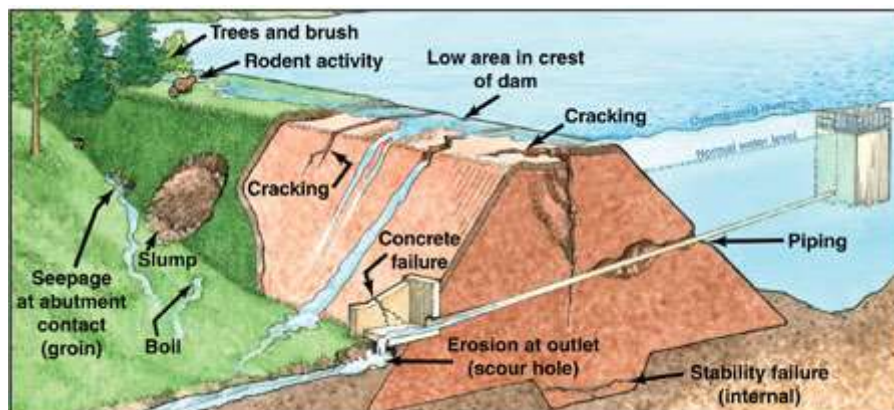


Figure 2—Some causes of dam failures.

Source: USDA Forest Service; <http://www.fs.fed.us/t-d/pubs/htmlpubs/html12732805/page02.htm>

III. Glossary

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 in the <i>downstream</i> direction from the dam.
Acre-foot	The volume of one acre of surface area to a depth of one foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons. It is enough water to cover an acre of land, about the size of a football field, one foot deep.
Appurtenances	Structures associated with, but secondary to, a dam. Examples include outlets, spillways, tunnels, etc.
Berm	A nearly horizontal step in the sloping profile of an embankment dam. Also a step in a rock or earth cut.
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 a dam that allows the uncontrolled draining of a reservoir. A controlled breach is a constructed opening. An uncontrolled breach is an unintentional opening caused by discharge from the reservoir. A breach is generally associated with the partial or total failure of the dam.
Conduit	A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.
Crest of dam:	See “Top of dam”
Dam	A man-made barrier, together with appurtenant structures, constructed above the natural surface of the ground for the purpose of impounding (holding) water. Water may contain any substance in combination with sufficient water to exist in a liquid or slurry state.
Dam failure	The uncontrolled release of a dam’s impounded water.
Dam owner	Any person, private or non-profit company, special district, federal, state, or local government agency, or any other entity in direct routine control of a dam and reservoir, and/or directly involved in the physical operation and maintenance of a dam.
Downstream	Situated or moving in the direction in which a stream or river flows.
Drawdown	The difference between a water level and a lower water level in a reservoir within a particular 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.
Emergency Action Plan	A written document prepared by the dam owner, describing a detailed plan of actions for response to emergency or unusual events, including alerting and warning emergency officials in the event of a potential or imminent dam failure or other emergency related to the safety of the dam and public.
Emergency Level	Levels 1-3 (low to high); used to assess the potential extent of the emergency. Once assessed, the Level determines your next steps.
Embankment	A wall or bank of earth built to prevent a river flooding an area.
Engineer	A Professional Engineer registered and licensed in the State of Washington. The engineer must be sufficiently qualified and experienced in the design, construction, and safety evaluation of the type of dam under consideration.
Filter	One or more layers of granular material graded (either naturally or by selection) which allow seepage through or within the layers while preventing the migration of material from adjacent zones.
Floodplain	An area adjoining a body of water or natural stream that may be covered by floodwater. Also, the downstream area that would be inundated or otherwise affected by the failure of a dam or by large flood flows.
Freeboard	The vertical dimension between the crest (or invert) of the emergency spillway and the crest of the dam.
Hazard Classification	The placement of a dam into one of three categories (High, Significant & Low) based on the hazard potential derived from an evaluation of the probable adverse consequences due to failure or improper operation of the dam.
Impoundment	A body of water confined within an enclosure, such as a reservoir; impound (v.) to confine within an enclosure or within limits.
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 Map	A map depicting the area downstream from a dam that would reasonably be expected to be flooded in the event of a failure of the dam.
Local Emergency Manager	Person(s) responsible for developing, organizing, and exercising a community's emergency operations plan. Typically, City Police or Fire Department, or County Sheriff's Department personnel act as the Local Emergency Manager.

Overtopping	When water rises over the sides of the dam.
Outlet	A conduit (usually regulated by gates or valves) used for controlled or regulated releases of water from the reservoir.
Piping	The progressive development of internal erosion by seepage.
Reservoir	A body of water impounded by a dam and in which water can be stored.
Rip rap	Loose stone used to form a foundation for a breakwater or other structure.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Sinkhole	A cavity in the ground caused by erosion and providing a route for surface water to disappear underground.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway	An appurtenant structure that conducts overflows from a reservoir.
Spillway (principal)	The overflow structure designed to limit or control the operating level of a reservoir, and first to be activated in runoff conditions.
Spillway (emergency)	The appurtenant structure designed to pass the Inflow Design Flood in conjunction with the routing capacity of the reservoir and any principal or service spillway(s).
Spillway crest	The lowest level at which water can flow over or through the spillway.
State Dam Safety Engineer	For purposes of this EAP, the Washington State Department of Ecology Dam Safety Office engineer(s) responsible for safety inspections, plan review and determining the safe reservoir storage level of assigned dams.
Toe of dam	The junction of the downstream slope or face of a dam with the ground surface; also referred to as the downstream toe. The junction of the upstream slope with ground surface is called the upstream toe.
Top of dam (dam crest)	The elevation of the uppermost surface of a dam, usually a road or walkway, excluding any parapet wall, railings, etc.
Upstream	Moving or situated in the opposite direction from that in which a stream or river flows; nearer the source.

Water Equivalents Table

Water is measured under two conditions: at rest and in motion. Water at rest is measured by volume. Water in motion uses units of flow – a unit of volume for a specified period of time.

acre-foot: covers one acre of land, to a depth of one foot

cfs: cubic feet per second

gpd: gallons per day

gpm: gallons per minute

Volume units

1 cubic foot.....	7.48 gallons.....	62.5 lbs of water
1 acre foot.....	43,560 cubic feet.....	325,851 gallons

Flow units

1 cfs.....	7.48 (gps)	
1 cfs.....	448.8 gpm	646,272 gpd
1,000 gpm.....	2.23 cfs.....	4.42 acre-ft./day
1 million gpd.....	694 gpm.....	1.55 cfs

IV. Final Plan Approval and Signatures

The undersigned persons have reviewed this Emergency Action Plan and concur with the proposed notification procedures:

Dam Owner: _____

Dam Operator: _____

Local Emergency Services: _____

Ecology Dam Safety Office: _____

Other: _____

V. More Information

This form is a simplified emergency action plan template provided by the Washington State Department of Ecology (Form #ECY 070-37; originally published January 2003; last revised: June 2016).

Also available is the comprehensive *Emergency Action Plan* template and the accompanying *Guidelines for Developing Dam Emergency Action Plans*.

You can request a copy of these, or any other Ecology publication, by calling 360-407-6872, or by emailing ecypub@ecy.wa.gov.

Websites

Association of State Dam Safety Officials (ASDSO): <http://www.damsafety.org/>

Ecology dam safety emergency response:
<http://www.ecy.wa.gov/programs/wr/dams/Emergency.html>

Ecology general dam safety information: <http://www.ecy.wa.gov/programs/wr/dams/dss.html>

Federal Emergency Management Agency (FEMA) Dam Safety: <http://www.fema.gov/dam-safety>

Other Resources

State Division of Emergency Management
(800) 562-6108
<https://www.mil.wa.gov/emergency-management-division/>

Local Emergency Planning Committees within Washington State (LEPC)
<https://ecology.wa.gov/Regulations-Permits/Reporting-requirements/Emergency-Planning-Community-Right-to-Know-Act/Local-Emergency-Planning-Committees>

VI. Inundation Map

If there was a breach along the westerly edge of cell 1 and cell 2, approximately 100 structures (99 homes, 1 church) would be in the expected flood path within 1 minute after the dam failure. This risk is highest when these cells are full before irrigation (March or April).

A 2007 flood inundation study expected that 439 residents would be in the flood path if the Storage Lagoons failed. However, it is unlikely that all cells will be full simultaneously and that a breach in one cell would cause the other two to empty also, due to the dike and embankment separating the lagoon cells.

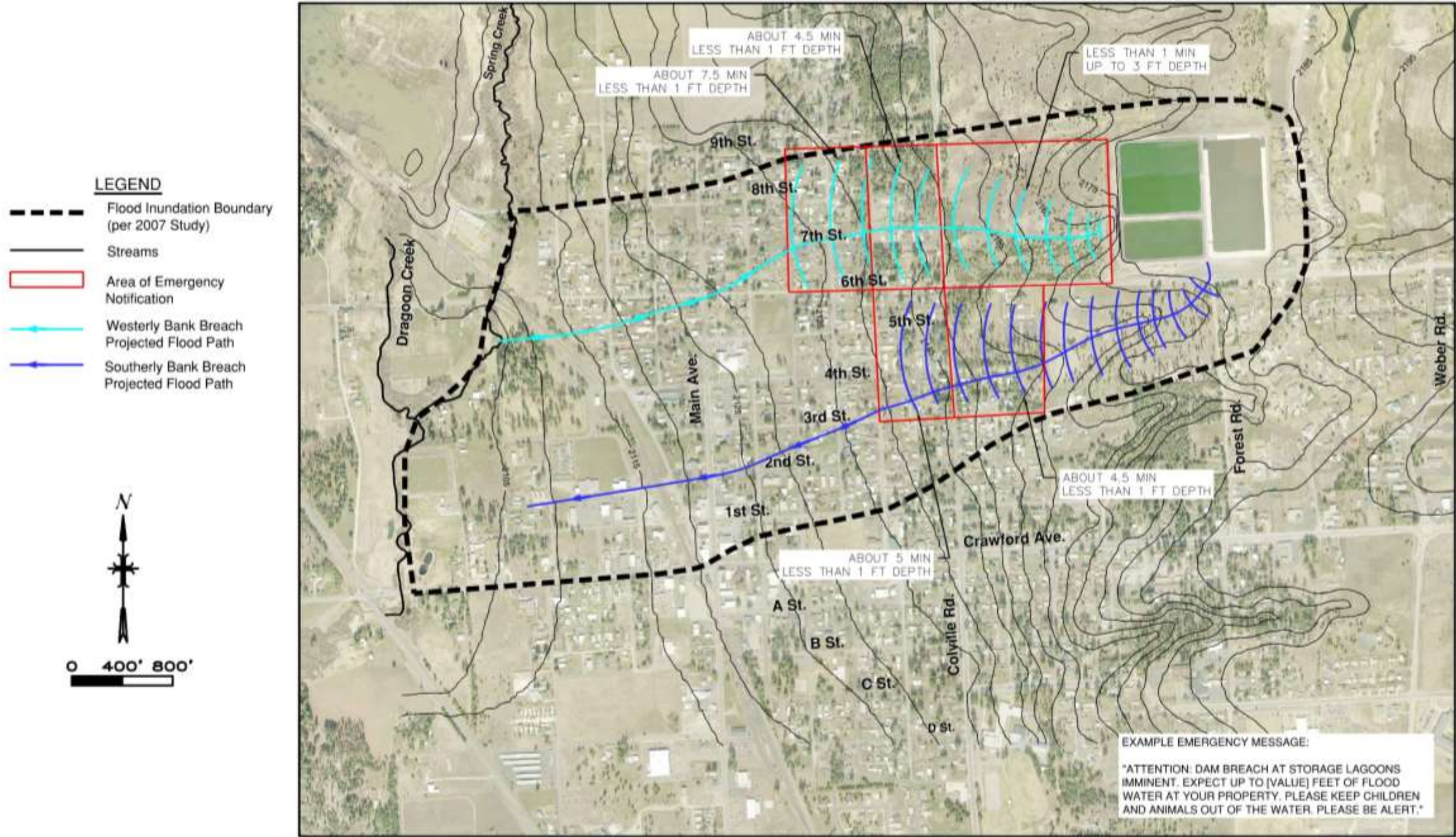
The risk of dam failure is highest prior to the irrigation season (March or April). Real flooding and dam breach risks are minimized for a majority of the year while the cells are not full during irrigation and storage operations.

Generally speaking, topographical data shows a general slope from east to west in Deer Park. Possible flooding caused by breaches at the Storage Lagoons is expected to flow “downhill” to the west. The actual flood path will be affected by existing roads, drainage structures, and topography of land. The flow path of an unlikely event of a breach is described as follows:

- A westerly breach of cell 1 and/or cell 2 is expected to flow to the west. Flood path to be affected by existing roads, drainage structures, and existing topography of land.
- A southerly breach of cell 1 and/or cell 3 is expected to flow south and turn to the west. Flood path expected to be affected by existing roads, drainage structures, and existing topography of land.
- An easterly breach of cell 3 is expected to pool along the property edge before flowing north via drainage structures. Flood path to be affected by existing roads, drainage structures, and existing topography of land.
- A northerly breach of cell 2 and/or cell 3 is expected to flow partially to the north within City land and then to the west.

The following inundation map outlines the areas that could be impacted by a dam breach flood at the Storage Lagoons. The City of Deer Park has collaborated with AlertSpokane.com (powered by Code Red) to notify those living closest to the lagoons in the unlikely event of a flood.

Flood Inundation Map - City of Deer Park, WA.



NOTE: DATA USED AND DEPICTED ON THIS MAP IS INTENDED FOR GENERAL REFERENCE ONLY. MORE EXACT INFORMATION IS AVAILABLE THROUGH VARIOUS SPOKANE COUNTY DIVISIONS.
Aerial Imagery: 2017