EMERGENCY ACTION PLAN

FAWN LAKE DAM
SPOTSYLVANIA COUNTY, VIRGINIA

Inventory Number: 17709

Fawn Lake
HISTORIC FREDERICKSBURG, VIRGINIA

April 2017

DISTRIBUTION

Fawn Lake Community Association (3)
Virginia Department of Conservation and Recreation, Division of Dam Safety (2)
Virginia State Emergency Operations Center (1)
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REVISIONS

Revision Number	Description	Revision Pages	Added by
1	Responses to DCR review comments.	Pages 1-38 and Inundation Maps. Retain all other appendix figures.	P. O'Hara
2	Updates generated from EAP Drill held on 4/15/11	Cover, Pages 1,3,16,19, 20, 22	P. O'Hara
3	Change of ownership	Cover, Pages 1,3,11, 13, 28, 29	P. O'Hara
4	Updates from EAP Table Top Exercise held on 12/18/12	Remove pages 1-38 and replace with new pages 1-34. Retain all maps and appendix figures.	P. O'Hara
5	Updates from EAP Table Top Exercise held on 10/20/14, EAP Drill held on 12/9/15 and replacement of low-level outlet gate.	Cover, Remove pages 1 – 34 and replace with new pages 1 – 32. Retain all maps and appendix figures.	P. O'Hara
6	Updates from EAP Table Top Exercise held on October 15, 2016	Cover, Remove pages 1 – 32 and replace with new pages 1 – 32. Retain all maps and appendix figures.	P.O'Hara
7	Revise contact information for Region 2 Dam Safety Engineer	Cover, Remove pages 1 – 32 and replace with new pages 1 – 32. Retain all maps and appendix figures.	P.O'Hara

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EXECUTIVE SUMMARY

The Emergency Action Plan is formatted to be used as a planning tool as well as a working document. In case of emergency, the sections with the red colored tabs at the top of the pages will be of the most immediate use to someone who has never read this plan.

Inundation maps are contained within the Appendix of this Emergency Action Plan. The maps show the area downstream of the Fawn Lake Dam that will be flooded in the event of a dam breach. The inundation zone extends from the Fawn Lake Dam to a point approximately 1.6 miles downstream of Interstate 95 and approximately 1.6 miles upstream of the confluence of the Po and Ni River. The flood travel time in the event of a dam break is shown on the maps for various points along Greenfield Creek and the Po River. In the event of a dam breach during a full probable maximum flood event, the total flood travel time to reach Interstate 95 is approximately 6 hours.

There are 8 occupied structures within the sunny day breach inundation zone. The flood wave travel time to the first structure located at 7300 Snow Hill Drive is approximately 9.4 hours.

There are 69 occupied structures within the PMF breach inundation zone. The flood wave travel time to the first structure located at 8521 Heron Pointe Way is approximately 2.7 hours

A list of structures that will be inundated due to a dam breach is contained in the Appendix of this plan. Phone numbers that were available for those structures for are shown on the list.

Upon detection of an existing or potential emergency, it is preferable that the dam operator and Fawn Lake Community Association be notified immediately. Regardless of the initial assessment of severity, notification should be made to the Spotsylvania County Emergency Dispatch Center so as to alert them of a potential emergency. It is best to err on the side of caution and notify emergency services early. **Phone numbers for all participants are located in Appendix D**. **A notification flow chart is located on page 3** of this document.

Because of method, procedures, and assumptions used to develop the flooded areas, the limits of flooding shown and flood waver travel times are approximate and should be used only as a guideline for establishing evacuation zones. Actual areas inundated will depend on actual failure or flooding conditions and may differ from areas shown on maps.

I. CERTIFICATIONS

Certification by Dam Owner/Operator

I certify that procedures for implementation of this Emergency Action Plan have been coordinated with and a copy given to each local Emergency Services Coordinator serving the areas potentially impacted by the dam. Also, that a copy of this Emergency Action Plan has been filed with the Virginia Department of Emergency Management in Richmond and a copy of the Dam Break Inundation Map has been provided to the local government office with plat and plan approval authority or zoning responsibilities as designated by the locality for each locality in which the dam break inundation zone resides; that this plan shall be adhered to during the life of the project; and that the information contained herein is current and correct to the best of my knowledge.

Richard W. Berry

(Signature of Dam Owner/Operator)

This 11th day of April, 2017

Printed Name: Richard H. Berry for the Fawn Lake Community Association

Certification by Preparer

I certify that the information provided in this report has been examined by me and found to be true and correct in my professional judgment.

Peter O'Hara

(Signature of Preparer)

This 12th day of April, 2017

Printed Name: Peter W. O'Hara Title: Principal Engineer

Address: 915 Maple Grove Drive, Suite 100, Fredericksburg, Virginia 22407

Phone: (540) 785-6100

I. CERTIFICATIONS

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_____

(Signature of Dam Owner/Operator)

This _____ day of _____, 20____

Printed Name: Richard H. Berry for the Fawn Lake Community Association

Certification by Preparer

I certify that the information provided in this report has been examined by me and found to be true and correct in my professional judgment.

_____

(Signature of Preparer)

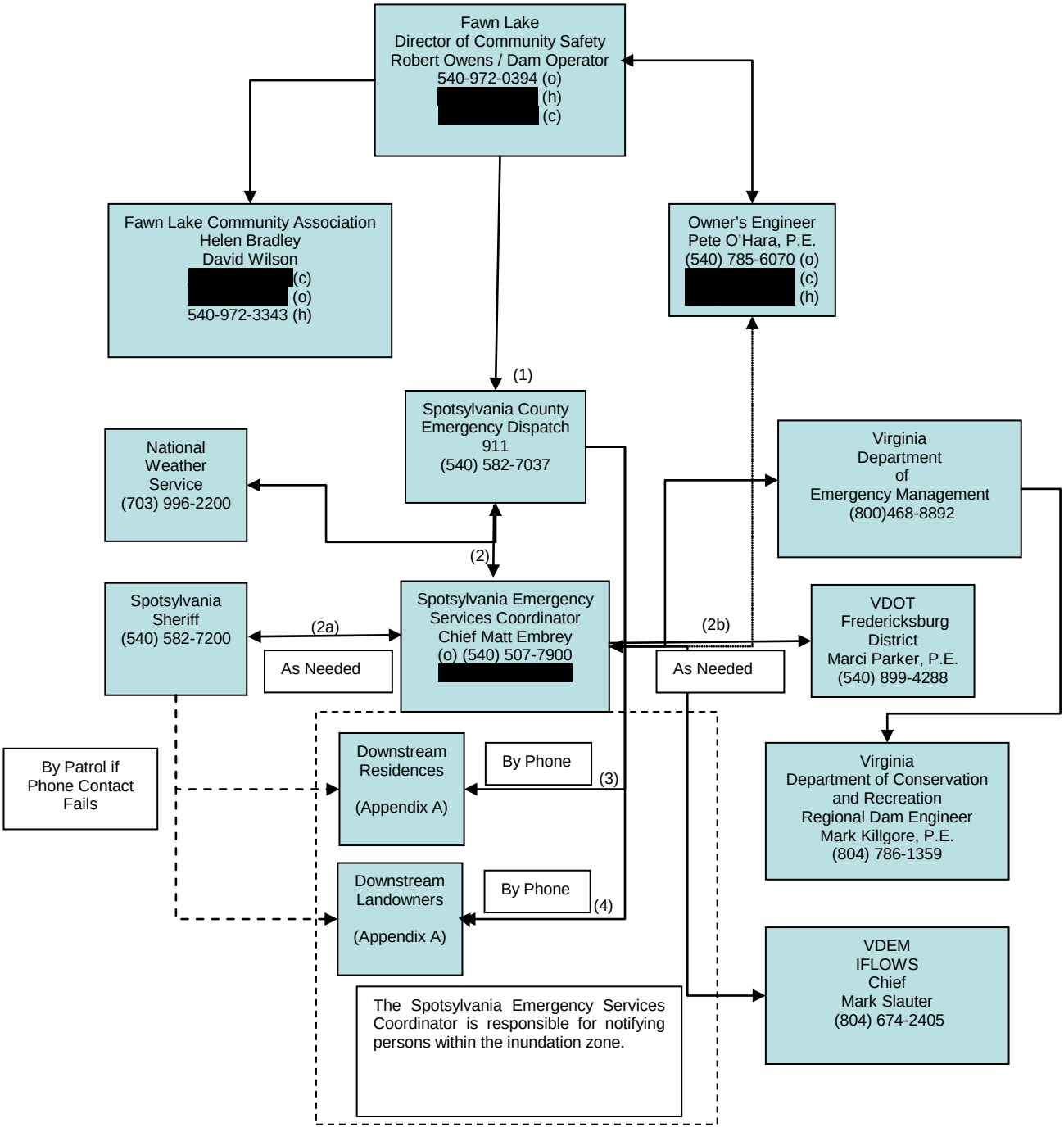
This _____day of _____, 20____

Printed Name: Peter W. O'Hara Title: Principal Engineer

Address: 915 Maple Grove Drive, Suite 100, Fredericksburg, Virginia 22407

Phone: (540) 785-6100

II. NOTIFICATION FLOW CHART



Note: (#) – Indicates order of notification

III. STATEMENT OF PURPOSE

The purpose of this Emergency Action Plan (EAP) is primarily to safeguard lives and secondarily to reduce property damage to the citizens of Spotsylvania County who live downstream of Fawn Lake Dam in the event of flooding caused by high flows from or failure of Fawn Lake Dam. This EAP provides the following:

1. Information about Fawn Lake Dam.
2. A basis for pre-planning the necessary response by the dam owner/operator and the responsible local, state, and federal emergency organizations.
3. Contact information for persons residing within the inundation zone of the dam in order to provide timely warning of a dam emergency, and
4. A listing of conditions which could lead to the failure of the dam and typical responses.

It is not the intent of this plan to be used for "cookbook" solutions for all situations. Rather it should be used in conjunction with the sound judgment of engineering and emergency services professionals.

IV. PROJECT DESCRIPTION

Description of Dam

Fawn Lake Dam is located on Greenfield Creek in Spotsylvania County, Virginia. The dam is owned by Fawn Lake Community Association. The dam creates a 45.5 acre lake used for recreational purposes. The lake's drainage area is 4.14 square miles. The reservoir flood storage capacity is 6,875 acre-feet at the emergency spillway crest. Downstream of the dam, Greenfield Creek runs through Beal's farm, passes under Catharpin Road between Solon Drive and Robert E. Lee Drive and then enters the Po River. Original Design Plans (with some sheets missing) are contained in the Appendix. All elevations are referenced to MSL.

The main components of the dam are:

1. A homogenous earth embankment, approximately 2,230 feet long with a crest elevation of 343 feet and an approximate structure height of 61 feet.
2. A 2.5H:1V to 3.0H:1V upstream embankment slope with a 10 feet wide berm at elevation 336.46 feet, a 17 feet wide crest, and a 2.5H:1V downstream slope.
3. A concrete rectangular drop inlet principal spillway, with interior dimensions of 3 feet by 9 feet. It has two inlets at elevation 335.5 feet.
4. A low-level drain with a 30-inch diameter knife gate valve located at elevation 284 approximately 112 feet upstream of the drop inlet. It is operated hydraulically from the control panel on the upstream berm near the riser. The hydraulic pump can be operated with the 12V marine battery in the panel which is charged by a solar panel, jumper cables attached to another vehicle or by hand pump. The control panel is located on the upstream berm adjacent to the drop inlet. This valve is used as an emergency drain. It can initially lower the lake ~12 inches on the first day, with that rate decreasing as the pool elevation decreases.
5. A high-level drain with a 10-inch diameter knife gate valve with an invert at elevation 325.5. This valve is controlled with the same control panel at the 30-inch diameter knife gate valve. This valve is primarily used to supply a downstream cattle farm with water when water is not flowing through the drop inlet.
6. A pre-stressed cylinder concrete principal spillway conduit and outlet, 36 inches in diameter with an outlet invert elevation of 281.0 feet. A series of anti-seep collars provide seepage control at the downstream end of the conduit.
7. A riprap lined stilling pool.
8. A vegetated earth channel emergency spillway, 200 feet wide at the bottom with a control elevation of 338 feet located at the left abutment.

Known Conditions

None.

Inundation Zone

An update breach analysis of the Fawn Lake Dam and a mapping of the downstream inundation zone were completed by Dewberry & Davis in March of 2010. A breach analysis is the modeling of how a breach of the embankment would affect the downstream floodplain. It takes into account the volume in the reservoir, the physical dimensions of the embankment, and the topography of the downstream floodplain. This model is used to determine the area which would be inundated if the embankment were to breach under a number of scenarios ranging from a "sunny day" failure where the embankment fails due to internal erosion to an overtopping of the embankment during a "probable maximum flood" (PMF). It should be noted that actual storms will vary from this design standard in duration and intensity. The area that is flooded (or inundated) due to these scenarios is mapped and presented as an inundation zone map.

The analysis extended from the Fawn Lake Dam to a point just approximately 1.6 miles downstream of Interstate 95 and approximately 1.6 miles upstream of the confluence of the Po and Ni Rivers. The inundation zone ends approximately 14 miles downstream of the dam at the confluence of the Po and Ni Rivers. Inundation maps showing the area that would be inundated by a sunny day breach and a PMF breach as well as failure flood profiles for the floodplain are included in Appendix I and J.

Residences Affected by a Breach or Major Flooding

Based on our analysis, there are 8 residences that may be affected by floodwater during a sunny day breach and 69 residences that may be affected by a PMF breach. A listing of structures affected by a **sunny day breach** is included in **Appendix I** and a listing of structures affected by a **PMF** is included in **Appendix J**.

Public Roadways Affected

Roadways that are expected to be submerged or partially submerged during an PMF Breach are as follows:

1. West Catharpin Road (Rte. 608) – From 11236 West Catharpin Road to 11670 West Catharpin Road. A length of approximately 3,000 ft.

2. Catharpin Road (Rte. 612) – 9768 Catharpin Road to intersection of Catharpin Road and Corbin Lane.

3. Corbin Lane - From intersection of Catharpin Road (Rte. 612) to 4,250 ft. west of intersection.

4. Mill Pond Road - from intersection with Beaver Lane to 2,000 ft. south of intersection.

5. Private Drive – Located on east side of Mill Pond Road between Fox Hunt Trail and Vanreenen Way. Beginning 530 ft. from intersection with Mill Pond Road and continuing past that point approximately 300ft.

6. Vanreenen Way – Beginning approximately 1,000 ft. east from intersection with Mill Pond Road and continuing past that point approximately 225 ft.

7. Mystic Lane – Beginning approximately 2,000 ft. north of the Intersection with Robert E. Lee Drive and Mystic Lane, and continuing past that point approximately 800 ft.

8. JR Montgomery Lane – Beginning approximately 900 ft. north of intersection with Robert E. Lee Drive and continuing north approximately 300 ft.

9. Robert E. Lee Drive (Rte. 608) – From 8974 Robert E. Lee Drive to 8528 Robert E. Lee Drive. A length of approximately 3,700 ft.

10. River Valley Lane – Beginning at the intersection with Robert E. Lee Drive (Rte. 608) and extending

north on River Valley Lane approximately 1,100 ft.

11. Singing Wood Lane – Two areas along this road: (a) From approximately 8305 Singing Wood Lane to Singing Wood Lane 8100, (b) From approximately 8028 Singing Wood Lane to 8305 Singing Wood Lane.

12. Millwood Drive – Three areas along this road: (a) From approximately 8700 Millwood Dr. to 8802 Millwood Dr, (b) From approximately 8805 Millwood Dr to 8809 Millwood Dr, (c) From approximately 8909 Millwood Dr to 8911 Millwood Dr.

13. Millwood Court – West of 9009 Millwood Ct.

14. North Lake Drive – Two areas along this road: (a) Beginning at the Intersection of Jennings Lane and Northlake Drive, (Two isolated areas), go approximately 528 ft. west on Northlake Drive to the beginning of the inundated area for the length of approximately 158 ft, (b) proceed approximately another 1,000 ft. to the beginning of the inundated area for the length of approximately 264 ft.

15. Southlake Drive – Two areas along this road: (a) Beginning at the intersection of Jennings Lane and Southlake Drive, go approximately 580 ft. south to the beginning of the inundated area for a length of approximately 425 ft. (b) proceed approximately another 850 feet to the beginning of the inundated area for the length of approximately 700 feet.

16. Millwood Drive – Two areas along this road: (a) Intersection of Millwood Drive, east to end of Millwood Drive at cul-de-sac, (b) from approximately 8810 Millwood Drive to 8812 Millwood Drive.

17. Old Mill Lane – From approximately 8312 Old Mill Lane to 8314 Old Mill Lane.

18. Block House Road (Rte. 648) From approximately 7893 Blockhouse Road to 7812 Blockhouse Road over the Poe River.

19. Courthouse Road (Rte. 208) - 8150 Courthouse Road to 8044 Courthouse Road, a length of approximately 1,400 feet.

20. Snow Hill Drive – From approximately 7142 Snow Hill Drive to 7240 Snow Hill Drive.

21. Garner Farm Road – Beginning approximately 1,250 ft east of intersection with Courthouse Road and extending 1,000 feet beyond that point.

22. Blackfish Lane – Two location on this road: (a) Between Iowa Lane and Ponca Lane, (b) Between Kusan Lane and Cornstalk.

23. Laughing Water Lane – From intersection with Fawnskin Lane, east to end of Laughing Water Lane.

24. Fawnskin Lane – From Laughing Water Lane to Canonchet Lane.

25. Naomi Lane – From Laughing Water Lane to Snow Bird Lane.

26. Blackfoot Lane – For its entire length.

27. Algonquin Drive – From Blackfoot Lane to Seneca Drive.

28. Maya Lane – From Cliff Dweller Lane to Kickapoo Lane

29. Jefferson Davis Highway (Rte. 1) - 6828 Jefferson Davis Highway South to 6636 Jefferson Davis

Highway, length of approximately 1,200 ft over the Po River.

30. North Roxbury Mill Road (Rte. 632) – From 6906 North Roxbury Mill Road to 6973 North Roxbury Mill Road over the Po River

31. Interstate 95 - I-95 over the Po River at approximately mile marker 119.

Bridges and culverts that would be affected include:

1. Catharpin Road (Rte. 612) over the Po River
2. Mill Pond Road over Wright's Pond
3. Robert E. Lee Drive over the Poe River between 8700 and 8517
4. Block House Road (Rte. 648) over Po River
5. Courthouse Road (Rte. 208) over the Po River
6. Jefferson Davis Highway (Rte.1) over the Po River
7. North Roxbury Mill Road (Rte. 632) over the Po River
8. Interstate 95 over the Po River

Impoundments

Wright's Pond is the only impoundment within the inundation zone which has Fawn Lake Dam in its watershed. The dam at Wrights Pond will be overtopped during a during a dam breach. This dam should be inspected when the water recedes and prior to opening Mill Pond Road to traffic.

Jennings Pond and Lake Pocahontas may be inundated by the backwater during a dam breach. These dams should also be inspected after any upstream breach event.

Critical Facilities

No known critical facilities, such as hospitals, rescue and relief facilities, water supply facilities, or hazardous waste facilities are located in the hazard area.

Time Line

The estimated travel times of the flood wave from the time of a PMF breach to the bridges along the main channel are as follows:

	Initial Impact	Flood Peak
Corbin Lane/Catharpin Road	15 min	54 min
Mill Pond Road	40 min	1hr 56min
Robert E. Lee Drive	1hr 30min	3hr 13min
XSEC 58352	2hr 40min	5hr 13min
Courthouse Road	2hr 55min	5hr 46min
Indian Acres	3hr 15min	6hr 28min
N. Roxbury Mill Road	3hr 40min	6hr 45min

Because of method, procedures, and assumptions used to develop the flooded areas, the limits of flooding shown and flood waver travel times are approximate and should be used only as a guideline for establishing evacuation zones. Actual areas inundated will depend on actual failure or flooding conditions and may differ from areas shown on maps.

V. EMERGENCY DETECTION, EVALUATION, AND CLASSIFICATION

This section describes the events or conditions that indicate an emergency, defines the stages of emergency, and describes how EAP participants and the public should be notified in the event of emergency.

Detection

Existing or potential emergencies can be detected in various ways:

1. "Flash Flood Warnings" are issued by the National Weather Service when flash flooding is actually occurring or imminent in the warning area. It can be issued as a result of torrential rains, a dam failure, or ice jam.
2. Visual inspections of embankment or reservoir levels during Community Safety patrols, maintenance of the embankment, or engineering inspections.
3. Earthquakes

Instrumentation on the dam includes staff gauges on the riser and adjacent to the emergency spillway, piezometers on the embankment and a V-notch weir at the outlet of the left toe drain. These can be used to detect significant changes in the dam that may lead to eventual failure.

Evaluation

Existing and potential emergencies can be the result of normal operating conditions or extreme loading conditions. Each of these conditions has the potential to create conditions that could lead to an emergency. While not exhaustive, the following is a discussion of some possible conditions.

Normal Operating Conditions

During normal operating conditions, seepage can develop within the embankment (through internal erosion), inside the pipes that penetrate the embankment through infiltration or exfiltration, or along the downstream toe. The danger of such seepage would be that it eventually leads to piping, (transport of soil from within the embankment) resulting in a cavity or "pipe" to be established from the point of beginning back to the reservoir. Seepage along the toe of the embankment can also weaken the slope causing a failure of the downstream slope. These situations can lead to the uncontrolled release of the reservoir.

Seepage should be evaluated periodically based on quantity of flow as well as turbidity. Seepage that is essentially stagnant and clear in color is generally not an urgent condition. However, when the flow increases and becomes turbid, an emergency should be declared. It is important to note that seeps can change in character very quickly; hence they should be taken seriously!

Extreme Loading Conditions

Flood Related Failure is primarily the result of overtopping of the embankment particularly where there is a concentrated flow leading to erosion of the embankment. This erosion will eventually lead to a full or partial breach of the embankment. The potential for overtopping should be evaluated based on whether the reservoir level is rising, falling, or remaining steady as well as the current and forecast weather. Also, as the water level in the reservoir rises existing seeps may flow at a faster rate and begin to transport soil due to the increased head pressure. As stated above in the section regarding normal operating conditions, seeps should be taken seriously and monitored periodically for changes.

Flood or high water events are to be tracked using a system of "stages" which are defined as follows:

Stage I Condition	**0.5 feet below emergency spillway control section**
Stage II Condition	**1.0 feet of flow in emergency spillway**
Stage III Condition	**2.0 feet of flow in emergency spillway**

The emergency spillway can convey up to 4 feet of water prior to overtopping the embankment. The

Surveillance section of this plan discusses the requirements for periodic monitoring of the water level.

Earthquake related failures can result in liquefaction of the embankment, overtopping of the embankment due to deformation of the embankment or fault displacements, or the initiation of seepage related failures (e.g. damage to outlet works). A visual inspection of the entire embankment should be made as soon as possible after a seismic event and then weekly for four weeks afterward in order to detect cracks, sags, sloughs, slides, misalignments, or new seeps. A video inspection of the pipes that penetrate the embankment should also be made to check for misaligned joints, sags, or structural damage to the pipes.

Classification

The three levels of emergency condition in order of increasing urgency are:

Alert Condition

An alert condition indicates a situation when there is no danger of dam failure, but flow conditions from the dam are such that flooding is expected to occur downstream of the dam. **This condition should be declared either once the level of the lake reaches Stage I (0.5ft below emergency spillway) and rising or a condition during a *sunny day condition* is detected that could either lead to failure of the dam or produce flooding downstream,**

Warning Condition

A warning condition indicates that while dam failure **may** result, there is some amount of time available for further analyses/decisions to be made before dam failure is considered to be a foregone conclusion. During this condition, preparations should be made to notify persons downstream and close roads that would be affected by a dam failure. **This condition should be declared either once the level of the lake reaches Stage II (1 foot of flow in emergency spillway) and rising or failure of the dam or release of flooding flows during *a sunny day condition* is likely**

Failure Notice

A failure notice indicates that the dam has or is about to fail. For purposes of this plan "about to fail" should be interpreted by emergency management agencies as "has failed". It is critical that the time of failure be provided as this can be used to gauge the amount of time available in order to notify and evacuate persons downstream. **This condition should be declared once the level of the lake reaches Stage III (2 feet of flow in the emergency spillway) and rising or failure of the dam or release of flooding lows during *sunny day condition* is imminent**

Declaration of an emergency can be a very controversial decision. The issue should not be debated too long. An early decision and declaration are critical to maximize available response time. A late decision could cause additional harm and damage to those downstream and their property.

VI. GENERAL RESPONSIBILITIES

A. Impounding Structure Owner Responsibilities

Dam Operation and Maintenance

The owner, Fawn Lake Community Association maintains the dam. David Wilson is the dam operator. An emergency phone number list is located in Appendix D.

The dam operator works at Fawn Lake and observes the dam two or three times a year during inspections and routine maintenance. The operator is also on call during high water conditions.

The dam owner is responsible for enacting the EAP. The owner and the owner's engineer are responsible for coordinating the Emergency Action Plan with emergency managers.

In the case of a storm event that threatens an overtopping event, all boats at the marina shall be removed from the water or moved up stream and secured to a dock or beached so that they will not obstruct the flow of water through the emergency spillway.

B. Responsibility for Notification

The following persons or agencies are authorized to implement this plan:

1. Fawn Lake Community Association – Richard Berry (President)
2. Owner's Engineer – Peter O'Hara, PE
3. Dam Operator – David Wilson
4. Fawn Lake Community Safety Department – Robert Owens or Shift Supervisor
5. Fawn Lake Maintenance Department – David Wilson
6. Any State or Local Emergency Management Agency
7. Virginia Department of Dam Safety and Floodplain Management

Any other persons should contact the Fawn Lake Community Safety Department if they believe an unsafe condition exists at the dam.

Detection of a condition or event that is the basis for an existing or potential emergency will most likely be by Fawn Lake's Community Safety Department during routine patrols or Fawn Lake's Maintenance Department during routine maintenance. Upon detection, it is preferable that the dam operator and Fawn Lake Community Association be notified immediately. If the observed condition is such that the situation is not urgent (e.g. a small seep flowing clear), it is best if the owner's engineer can be requested to make a site visit to make a determination as to the severity and urgency of the condition. However, if these people cannot be contacted, then notification should be made to the Spotsylvania County Emergency Dispatch Center.

Upon notification, the party that first detected the condition shall proceed to the dam and establish constant monitoring until relieved. At the same time, the owner, owner's engineer, and Emergency Services Coordinator shall proceed to the dam to make an initial assessment. In order to expedite this initial assessment, Fawn Lake Security should be notified that first responders will be arriving at the gate and will need access and/or directions to the dam.

Once the initial site visit has been completed, a **command post should be established at the Fawn Lake Community Association Clubhouse located at the end of Longstreet Drive (from the Main Gate proceed straight to the end of the road)**. The location of the clubhouse is show on the area map contained in Appendix L of this report. A holding area for members of the media should also be established should the emergency condition attract media attention.

C. Responsibility for Evacuation

Warning and evacuation of persons downstream is the responsibility of the local authorities.

D. Responsibility for Duration, Security, Termination, and Follow-up

The dam operator is responsible for on-site monitoring of the situation at the dam and keeping local authorities informed of developing conditions at the dam from the time that an emergency starts until the emergency has been terminated.

Fawn Lake Community Safety shall maintain access control to the dam at both ends during the duration of the emergency.

The Emergency Services Coordinator, in consultation with the Owner's Engineer, shall be responsible for the decision to declaring that the emergency is terminated.

Any roads, utilities, and structures should be inspected prior to reentry into flooded areas. The Virginia Department of Transportation, the Building Official, and appropriate utility agencies should be on hand to conduct the inspections. Photographs and written logs should be used to document any damage. The Spotsylvania County Sheriff's department will control access into these areas until such time that these areas are declared safe.

The owner's engineer shall convene an initial emergency evaluation conference within 7 days of the termination of the emergency to be attended by representatives of all participants in the emergency event. A written report shall be prepared within 30 days of the termination of the emergency.

E. EAP Coordinator Responsibility

The owner's engineer shall be the EAP Coordinator. Responsibilities of the EAP coordinator shall include preparing revisions to the EAP, establishing training seminars, and coordinating EAP exercises. The EAP Coordinator shall be the point of contract for any questions about the plan. Bi-annual table top exercises conforming with 4VAC50-20-53 are required for this dam. Drills shall be conducted during alternate years.

VII. PREPAREDNESS

Actions can be taken that can help to mitigate the extent of damage resulting from any emergency events.

Surveillance

The level of surveillance during an emergency event will depend on the severity and urgency of the condition.

Stage	Storm Event Pool Elevations (Relative to Emergency Spillway)	Sunny Day Incident	Surveillance Frequency	Notification Worksheet
1	0.5 ft below & rising	Unusual condition slowly developing	Every 2 Hours	Appendix F – Alert
2	1.0 ft above & rising	Potential dam failure situation rapidly developing	Every 30 minutes	Appendix G – Warning
3	2.0 ft above & rising	Dam failure appears inevitable	Continuous	Appendix H-Failure

Table 1. Definition of stages, surveillance frequency and notifications for storm events and sunny day incidents.

It may be necessarily to conduct surveillance more often when the reservoir level is rising rapidly.

Response During Periods of Darkness

During periods of darkness it will be necessary to light the affected areas of the dam with flash lights and car headlights. Light plants should be brought in if the situation is expected to occur over a long period of time.

Access to the Site

Access to the dam will normally be by car along Fawn Lake Parkway. In the case, where access to the low level outlet valve is necessary and the emergency spillway is either in operation or expected to operate, it will be necessary to access the dam from the right side using Fawn Lake Parkway. As this road become unpaved, it is only suitable for four-wheel drive vehicles. The map in Appendix L shows the primary and secondary access routes to the dam.

Response During Weekends and Holidays

Fawn Lake Community Safety is available 24 hours a day, 7 days a week. Phone numbers are available for all key participants. **Phone numbers are contained in Appendix D.**

Response During Periods of Adverse Weather

During flood watches, the dam operator will be available on property.

Alternate Systems of Communication

The primary system of communication within the Fawn Lake Property will be by cell phone and Community Association portable radios operating on Channel 2. Fawn Lake Community Safety 'Base' will monitor this channel. **Phone numbers are contained in Appendix D.** Alternate systems will be either landline from a neighboring house or the Fawn Lake Community Association office. If all phone service is unavailable, it may be necessary to request portable radios operating on assigned incident channel on the Spotsylvania Fire and Rescue Net from the Spotsylvania County Emergency Services Coordinator.

Emergency Supplies and Information

Stockpiling Materials and Equipment

The following equipment and materials are available on-site.

1. Backhoe Loader
2. 1 Ton Dump Truck

Sand and stone can be obtained at a local quarry during business hours or possibly from the Virginia Department of Transportation after hours. A light plant can be rented from a local rental company. Contact information is contained in Appendix

Potential Mitigating Actions

There are certain actions that can be taken to prevent a dam failure or mitigate damage if taken in a timely manner. However, it is important to note that these actions are not always appropriate and therefore should be carefully considered before attempting.

Open Low Level Outlet

In most cases where the low level outlet pipe and the principal spillway pipe are not affected by the emergency, the concept of reducing the amount of the water behind the dam is sound. This will have two results. First, it reduces the amount of water released during a failure by approximately 14 inches per day during for the top 4-1/2 feet which equates to approximately 400 million gallons. Second, by decreasing the pressure head on any seeps, the velocity of water will be lowered which will eventually decrease below a point where it can no longer transport soil from the embankment.

However, care should be taken to ascertain if the spillway conduit is damaged prior to opening the outlet. If the principal spillway conduit became clogged with soil or debris, allowing a high volume of water under high pressure may cause further damage the conduit to a point where piping could occur.

A secondary concern with rapid lowering of the reservoir is surficial slope failures on the upstream slope. Based on experience during the uncontrolled release in 2014, the upstream slope experienced very superficial movement of the slope with depths of only a few inches.

Finally, the potential of failure while personnel are opening the low level outlet should be considered prior to conducting such an operation. If it is decided to open the outlet, it is suggested that two people operate the hand wheel (which is geared low requiring many revolutions) and one person observe the embankment for changes. Also, an escape route should be planned prior to the operation should the need to evacuate the dam crest arise. The key for the control cabinet is kept at the Front Gatehouse.

Reduction in Freeboard and/or Loss of Dam Crest Width

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

Slide on the Embankment Slope

If a slide occurs on the embankment slope, initiate lowering the reservoir level to a level below the bottom of the failure.

Piping through the Embankment, Foundation, or Abutments

Immediately open the low level outlet in order to lower the reservoir level. Then place an inverted filter at the exit area of the pipe if the flow velocity is slow enough. Also attempt to plug the flow on the upstream end with whatever material is available (hay bales, bentonite, or plastic sheeting) if the entrance is apparent in the reservoir.

In the case of small boils or seeps whose flow is relatively slow, an "inverted filter" can be constructed by placing layers of granular materials with increasing grain size over the affected area. Ideally, the first layer should be sand, followed by VDOT #78 stone, VDOT #57 Stone, and VDOT #3 Stone. The purpose of the inverted filter is to allow water to pass, but to prevent soil from being transported out of the dam. If the flow of water is too fast, it will simply transport the filter away. At that point, eventual failure is very likely.

When flows from boils are relatively slow, sand bags can be used to create circular pools over boils effectively slowing or stopping the flow.

Failure of Outlet Works

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 an expedient repair.

If possible, lower the water level to a safe elevation. If the outlet is inoperable, pumping, siphoning, or a controlled breach may be required.

Because of uncertainties about their effectiveness, these preventive actions should be carried out simultaneously with appropriate notification of an alert condition or warning condition.

VIII. Inundation Maps

IX. Appendices

A. Appendix A - Investigation and Analysis of Impounding Structure Failure Floods

A dam breach analysis was performed for Fawn Lake Dam in accordance with the following procedures. Inflow and outflow hydrographs for Fawn Lake Dam and runoff hydrographs from downstream sub-basins were determined using the Corps of Engineers HEC-1 computer program. PMP rainfall amounts were taken from the National Weather Service (NWS) publication HMR-51 and distributed temporally in accordance with the Natural Resources Conservation Service (NRCS) publication TR-60 and spatially in accordance with NWS HMR-52. The resulting rainfall hyetographs were converted to runoff hydrographs using NRCS procedures for determination of runoff curve number, lag time, and unit hydrographs. The NRCS 24-hour, 5-point temporal rainfall distribution was determined to be the most conservative of all the NRCS temporal storm distributions and was selected for PMF development and subsequent dam break analysis. Dam breach simulation and determination of dam breach hydrographs was performed within HEC-1. The dam breach and no-breach hydrographs from HEC-1 were input into the Corps of Engineers HEC-RAS computer program (unsteady model simulation) to simulate passage of the flood waves through the stream valley downstream of the dam. Cross sections for the unsteady HEC-RAS model were developed based on USGS DRG topographic mapping. Peak water surface elevations from the unsteady HEC-RAS model for the dam breach and no-breach simulations were plotted on the USGS DRG topography in order to map the inundation zones. Spotsylvania GIS data was used to identify structures within the inundation zones.

B. Appendix B - Plans for Training, Exercising, Updating and Posting the EAP

Training
Training Sessions should be conducted annually for participants located on the property. The content for these sessions should orientation to the EAP and detection and evaluation of emergency events and conditions.

Exercising
In conjunction with the training sessions, either a drill or a table top exercise will be conducted as required by 4VAC50-20-175.

Updating
This plan shall be reviewed annually and changes distributed to all plan holders. Potential changes might include:

1. Changes in personnel.
2. Changes in telephone numbers.
3. Additions or deletions of structures and critical facilities within the danger reach.
4. New conditions that would affect flood flows or the extent of damage due to a dam failure.
5. Update 911 mapping overlay on inundation map.

C. Appendix C - Site-Specific Concerns

There is a weir box located to the left the principal spillway that measures the quantity of flow from the left toe drain and lake pool elevations. Flows outside these ranges are a potential indicated of a developing problem and should be addressed in a timely manner.

Flow Rates for a 90 degree V-Notch Weir where H is the depth of water measured at the upstream side of the weir box

H (in)	Q (cfs)	Q (gpm)	H (in)	Q (cfs)	Q (gpm)
4.25	0.0000	0.00	7.00	0.0629	28.21
4.50	0.0002	0.07	7.25	0.0781	35.07
4.75	0.0009	0.40	7.50	0.0954	42.83
5.00	0.0024	1.10	7.75	0.1149	51.55
5.25	0.0050	2.25	8.00	0.1365	61.26
5.50	0.0088	3.93	8.25	0.1604	71.98
5.75	0.0138	6.20	8.50	0.1866	83.76
6.00	0.0203	9.11	8.75	0.2153	96.63
6.25	0.0284	12.72	9.00	0.2464	110.61
6.50	0.0381	17.08	9.25	0.2802	125.75
6.75	0.0495	22.23	9.50	0.3165	142.06

D. Appendix D - Participants

Participant	Point of Contact	Contact Information
Owner Fawn Lake Community Association 11300 Longstreet Drive Spotsylvania, VA 22551	Richard H. Berry (President)	540-972-0400 - Office [redacted] rberry@ntsdevco.com
	Helen Bradley (Community Manager)	540-972-1000 - Office [redacted] hbradley@ntsdevcom.com
	Robert Owens (Director of Community Safety)	540-972-6766 - Office [redacted] rowens@ntsdevco.com
	Main Gate	540-972-0394 - Office
Owner's Engineer ECS Mid-Atlantic, LLC 915 Maple Grove Dr Ste 100 Fredericksburg, VA 22407	Peter O'Hara, P.E.	540-785-6100 - Office [redacted] pohara@ecslimited.com
Dam Operator Fawn Lake Community Association 11300 Longstreet Drive Spotsylvania, VA 22553	David Wilson	540-891-9686 - Office [redacted] dwilson@ntsdevco.com
Dam Gauge Observer Fawn Lake Community Safety	Fawn Lake Community Safety	540-972-0394 - Phone
County Emergency Services Spotsylvania County Emergency Communications 9119 Dean Ridings Lane PO Box 818 Spotsylvania, VA 22553	Chief Matt Embrey Emergency Services Coordinator	Non Emergency 540-507-7900 – Office [redacted] Emergency – 911 membrey@spotslyvania.va.us
Virginia Department of Transportation Virginia Department of Transportation Fredericksburg Residency 87 Deacon Road Fredericksburg, VA 22405	Sean Nelson – Resident Engineer Randy Newton – TOM III	540-899-4447 - Office sean.nelson@vdot.va.gov randy.newton@vdot.va.gov
Division of Dam Safety Virginia Dept of Conservation & Rec. Division of Dam Safety 600 East Main Street, 24th Floor Richmond, VA 23139	Mark Killgore, P.E. Dam Safety Engineer	804-786-1359 – Office [redacted] mark.killgore@dcr.virginia.gov

State Emergency Operations Center	Mark Slauter	800-468-8892 - Phone
Virginia Dept of Emergency Mgmt	IFLOWS Chief	804-674-2405
7700 Midlothian Turnpike	(804) 674-2405	mark.slauter@vdem.virginia.gov
Richmond, VA 23235	Mike Gray	mike.gray@vdem.virginia.gov

E. Appendix E – Emergency Supplies
(Companies that can provide assistance in the event of an emergency)

CONTRACTORS		
Bander-Smith (Dam Repair/Diving) 22 S Davis Ave, Richmond, VA 23220	Mr. Cameron Smith Mr. Austen Bander, P.E.	(804) 212-2898
W.C. Spratt Inc. 491 Central Road Fredericksburg, VA 22401	Mr. Doug Tait	540-373-2002
Chemung Contracting Corp. 7201 Rail Line Court Gainesville, VA 20155	Mr. Ed Dalrymple	540-829-7203
EQUIPMENT RENTAL (Lights and Pumps)		
Sunbelt Rentals 1200 Belman Road Fredericksburg, VA 22401		540-710-1300 800-667-9328
United Rentals 10 Le Way Drive Fredericksburg, VA 22406		540-599-0053 800-877-3687
RSC Rentals 4616 Lassen Lane Fredericksburg, VA 22408		540-710-2300 800-222-7777
MATERIALS - SAND		
Ennstone Inc 1170 Kings Highway, Fredericksburg, VA 22405-3814		540-361-1653
MATERIALS – CRUSHED STONE		
9100 Luck Stone Ln Fredericksburg, VA 22407-5302		540-898-6060
MATERIALS – MISC		
Home Depot 5771 Plank Road Fredericksburg, Virginia 22407		540-785-8871

The residents of Fawn Lake are also potential sources of materials and equipment (e.g. pontoon boats), etc.

F. Appendix F – Alert Worksheet

Alert Condition

An alert indicates that a potentially serious condition is developing and failure could occur.

Date & Time	Contact	Phone No.
_____	Spotsylvania County Emergency Services	911
_____	Owner's Engineer	540-785-6100 Office [redacted]
_____	Division of Dam Safety	804-786-1359
_____	Virginia Department of Emergency Management	800-468-8892

Report to Emergency Services:

1. Fawn Lake Dam has condition that may cause it to fail. Please have the emergency services coordinator contact me at this number:

2. Event or condition initiating the warning – fast rising waters in lake or a condition that affects the ability to control release of water.

Log of Actions Taken

Time Action

Log of Actions Taken

Time Action

G. Appendix G – Warning Worksheet

Warning Condition

A warning condition indicates a serious condition has occurred and failure of the dam is probable.

Date & Time	Contact	Phone No.
_____	Spotsylvania County Emergency Services	911
_____	Owner's Engineer – Peter O'Hara	540-785-6100 Office [redacted]

Report to Emergency Services:

1. Fawn Lake Dam has condition that will cause it to fail. Please have the emergency services coordinator contact me at this number:

2. Event or condition initiating the warning – fast rising waters in lake or a condition that affects the ability to control release of water.

Log of Actions Taken

Time	Action

H. Appendix H – Failure Worksheet

Failure Notice

A failure notice indicates a failure within the embankment dam and the loss of ability to impound the reservoir.

Date & Time	Contact	Phone No.
_____	Spotsylvania County Emergency Services	911
_____	Owner's Engineer – Peter O'Hara	540-785-6100 Office [redacted]
_____	Virginia Department of Emergency Management	800-468-8892

Report to Emergency Services:

1. Fawn Lake Dam has failed. Please have the emergency services coordinator contact me at this number:

2. Event or condition initiating the warning – fast rising waters in lake or a condition that affects the ability to control release of water.

Log of Actions Taken

Time	Action

I. Appendix I – Structures in Sunny Day Dam Breach Inundation Zone

Structure	Address #	Street Name
1	7300	Snow Hill Drive
2	9415	Mill Pond Rd
3	9429	Mill Pond Rd
4	9428	Mill Pond Rd
5	9401	Mill Pond Rd
6	8100	Singing Wood Lane
7	8619	Robert E Lee Drive
8	7669	Courthouse Rd

J. Appendix J – Structures in the PMF Dam Breach Inundation Zone

Structure	Address #	Street Name
1	8521	Heron Pointe Way
2	7240	Snow Hill Drive
3	7300	Snow Hill Drive
4	8031	Singing Wood Lane
5	10530	Beaver Lane
6	8136	Singing Wood Lane
7	9415	Mill Pond Rd
8	9409	Mill Pond Rd
9	9429	Mill Pond Rd
10	9428	Mill Pond Rd
11	9452	Mill Pond Rd
12	9621	Paradise Ct
13	9401	Mill Pond Rd
14	9494	Vanreenan Way
15	9210	J R Montgomery Ln
16	9905	Mill Pond Rd
17	9200	J R Montgomery Ln
18	8135	Singing Wood Lane
19	8308	Singing Wood Lane
20	8217	Singing Wood Lane
21	8804	Millwood Dr
22	8802	Millwood Dr
23	9441	Southlake Dr
24	9430	Northlake Dr
25	9011	River Valley Ln
26	8323	Old Mill Ln
27	8700	Millwood Dr
28	8114	Singing Wood Lane
29	8510	Robert E Lee Dr
30	8424	Robert E Lee Dr
31	8415	Robert E Lee Dr
32	8421	Robert E Lee Dr
33	8425	Robert E Lee Dr
34	8921	River Valley Ln
35	8100	Singing Wood Lane
36	9001	River Valley Ln
37	8517	Robert E Lee Dr
38	8120	Courthouse Rd
39	8619	Robert E Lee Dr
40	8926	River Valley Ln
41	8911	River Valley Ln
42	9003	Millwood Dr

Structure	Address #	Street Name
43	8812	Millwood Dr
44	8810	Millwood Dr
45	8808	Millwood Dr
46	7669	Courthouse Rd
47	7806	Waterford Dr
48	7225	Snow Hill Drive
49	7716	Hunter Cove Dr
50	7741	Courthouse Rd
51	7640	Po River Dr
52	310	Clydesdale Ct
53	308	Clydesdale Ct
54	230	Morgan Ln
55	225	Morgan Ln
56	7630	Po River Dr
57	7708	Hunter Cove Dr
58	7700	Hunter Cove Dr
59	7315	Snow Hill Drive
60	7732	Courthouse Rd
61	7736	Courthouse Rd
62	7737	Courthouse Rd
63	7810	Courthouse Rd
64	7801	Courthouse Rd
65	6908	S Roxbury Mill Rd
66	7001	Jefferson Davis Hwy
67	6920	N Roxbury Mill Rd
68	47	Waucoma Trl
69	7235	Gardner Farm Rd

K. Appendix K – Original Dam Design Plans (Partial Set)

L. Appendix L – Fawn Lake Area Map