State of the Dams:

Investment in the protection of South Carolina's people, natural resources, and infrastructure through dam safety

Cary's Lake Dam—Richland County. Cary's Lake Dam breached as a result of October 2015's historic rainfall. The repaired dam is now back in service and soon a new bridge will be constructed to allow reopening of Arcadia Lakes Drive.

dhec
S.C. Department of Health and Environmental Control

Dam Safety Program

Bureau of Water

20 August 2020

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Table of Contents

Executive Summary

This Summary is intended to be a quick look at the status of dam safety in South Carolina and is provided as a courtesy to the reader. The reader is encouraged to review the entire report for the complete analysis presented and to gain a thorough understanding of the Dam Safety Program (the Program).

Since the historic rainfall and widespread dam failures of October 2015, a renewed awareness of the presence and risks associated with dams led the SC General Assembly to increase funding to DHEC to enhance the staffing and capabilities of the Program. Improvements can be seen in virtually every aspect of the Program's execution of its mission to ensure that state-regulated dams are constructed, operated, and maintained properly so as not to jeopardize public health, safety, and welfare.

South Carolina has, on average 2,300 dams subject to regulation under the South Carolina Dams and Reservoirs Safety Act and Regulations. A breakdown and analysis of the inventory by various categories is provided on Pages 7-18. As a simple snapshot, as of June 1, 2020, the inventory is comprised of the following dams by Hazard Potential Classification (see Page 4 for definitions of the different Hazard Potential Classifications):

- 23.7% are High Hazard Potential
- 12.6% are Significant Hazard Potential
- 63.7% are Low Hazard Potential

Ownership of these approximately 2,300 state-regulated dams is predominantly private, with a much smaller percentage made up of state and local government ownership. A statistical breakdown of ownership is as follows:

- 87.7% are owned by a Private Entity (individuals, estates, corporations, etc.)
- 3.3% are owned by a State Agency
- 3.9% are owned by a Local Government (counties, municipalities, special purpose districts, etc.)
- 0.9% are owned by a Private Utility
- 4.0% are jointly owned by a Local Government and Private Entity
- 0.2% are jointly owned by State and Local Government

Due to exemptions specified in the Dams and Reservoirs Safety Act (see Page 6 for more information), the majority of dams in the state (roughly estimated to be over 20,000) are not regulated. Most exempt dams are too small to meet the thresholds required for regulation. The largest dams in the state are exempt for a different reason - because they are either regulated or owned by the federal government. For example, dams such as Saluda Dam (dam that created Lake Murray) that impound water used for the production of hydroelectricity are regulated by the Federal Energy Regulatory Commission, and, thus, qualify for an exemption from state regulation.

Following the historic October 2015 rainfall event, DHEC funds were reallocated and new funds appropriated to rapidly rebuild and grow the Program. In all, $12,225,121 in additional funding has been directed to the Program. This value includes both one-time and recurring funds. This report provides an accounting of the uses of these funds and of the investments and returns on investment in the form of improvements to dam safety.

Since October 2015, the largest expenditures in dam safety have been:

- $3,115,000 for engineering and technical support services from engineering contractors. See Page 26.
- $3,000,000 for the inspection of 2,000 dams. See Page 24.
- $2,320,000 for state-led action on making dams safe. See Page 21.
- $750,000 for dam breach inundation mapping. See Pages 34-38.
- $595,000 / year starting in Fiscal Year 2017 in recurring funds to establish six dedicated dam safety positions in DHEC's regional offices. See Pages 28-29.

The Program has made investments in technological innovation, training and development of staff, and outreach and education for dam owners:

- Developed a Dam Safety GIS-based Web Application. See Page 30.
- Utilized CodeRed™ service to send alerts and messages to dam owners. See Page 31.
- Developed a new Emergency Action Plan (EAP) template and assisted over 600 dam owners transition their EAPs to the new format. See Page 29.
- Conducted dam breach modeling and inundation map creation for nearly every dam in the inventory, with maps made available via the GIS-based web application and incorporated into the new EAP documents. See Pages 34-38.
- Utilized drones and bathymetric surveying equipment. See Page 32.
- Developed Screening Level Risk Analysis methodology for dams. See Pages 22-23.
- Provided training and education opportunities for dam owners, including webinars, online courses, newsletters, and a wealth of resources made available via DHEC's website. See Pages 39-41.

Challenges remain, however, that DHEC and the State of South Carolina must address. The challenges most consequential to the Program's mission of ensuring that state-regulated dams do not jeopardize public health, safety, and welfare warrant mentioning here. They include:

- Maintaining an accurate database of dam ownership. See Page 42.
- The aging of dams. See Pages 17-18.
- Extreme costs faced by dam owners, even to remove a dam, with minimal options for financial assistance. See Page 42.
- No source of recurring funds to ensure the Dam Safety Program can take action on unsafe dams where owners are unable or unwilling to do so. See Page 43.
- Complexities regarding ownership or maintenance of dams which support public roads. These situations result in a near state of paralysis, leading to significant delays in returning roads on dams to service. See Page 43.

The Program takes pride in its stewardship of the resources it has been entrusted with, and how those resources have been invested to improve dam safety in South Carolina. Just this July, the Association of State Dam Safety Officials recognized DHEC's Dam Safety Program with its 2020 Association of State Dam Safety Officials (ASDSO) Southeast Regional Award of Merit. The Association gives this award annually to individuals or organizations working in the dam safety field that have made outstanding contributions to dam safety on a regional level. South Carolinians can take comfort knowing a talented, trained, and committed team of dam safety professionals is on the job in their state.

Introduction

Dams often go unnoticed in everyday life in South Carolina, yet they play a number of important roles in sustaining our infrastructure, economy, and way of life. These roles include protecting our citizens from the impacts of flooding, providing a source of water for crops and livestock, creating opportunities for recreation and outdoor sports for residents and visitors, serving industries that rely on various basins and lagoons in their operations, providing water sources for drinking water production and fire protection, and more. However, for all their benefits, October 2015's historic rainfall followed by Hurricane Matthew in 2016, which combined resulted in 70 regulated dams failing statewide, showed that living with dams has a downside.

Program staff conferring with a consulting engineer at a regulated dam

The mission of the Dam Safety Program (the Program) within the Department of Health and Environmental Control's (DHEC/the Department) Bureau of Water is to ensure:

- State-regulated dams are inspected regularly and maintained in a safe condition;
- That repairs and alterations to these dams are in accordance with regulatory standards and represent good engineering practices;
- That these dams are accurately classified for the hazards they pose to downstream areas;
- That these classifications are regularly reviewed and dams reclassified as necessary; and,
- That owners of state-regulated dams are trained and prepared to perform proper maintenance, conduct safe operations, and respond prudently to emergency events at their dams.

Through investment in the Program, the General Assembly has provided DHEC with staffing and operational resources to fulfill this mission. The return on this investment includes the following:

- Increased capabilities and expertise of staff
- Rapid response to incidents at dams
- Better preparation and experience in dealing with events such as hurricanes and floods
- Improved relationships with dam owners
- Improved relationships with the emergency management community, both at the state and local levels
- Increased knowledge of the condition of state-regulated dams
- Technological tools that allow Program staff to make well-informed, science and engineering-based decisions

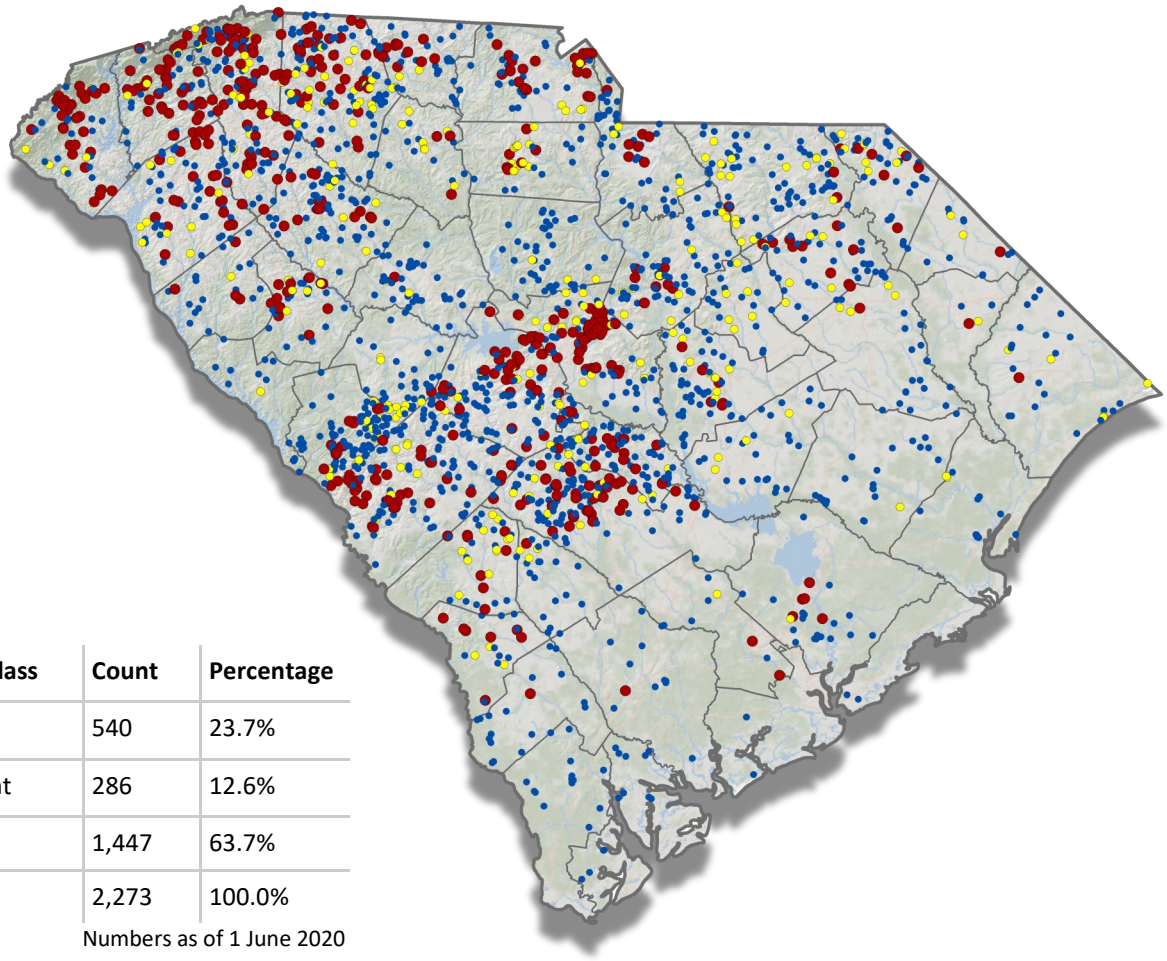
The Program has utilized these investments to work cooperatively with dam owners to increase its efforts to protect the lives and property of the citizens of South Carolina.

Hazard Potential Classification of Dams

A dam subject to regulation under South Carolina's Dams and Reservoir Safety Act (the Act) is classified based on its potential for causing loss of life or damage to improved property in the event of the dam's failure or improper operation. Consequences from dam failure that the Program considers and evaluates in assigning a Hazard Potential Classification include potential impacts to homes, businesses, roads, railroads, industrial facilities, and critical utilities (water, sewer, electric, gas).

Class I	Class 2	Class 3
High Hazard	Significant Hazard	Low Hazard
Dam failure will likely cause loss of life or serious damage to home(s), industrial and commercial facilities, important public utilities, main highway(s) or railroads.	Dam failure will not likely cause loss of life but may damage home(s), industrial and commercial facilities, secondary highway(s) or railroad(s), or interrupt the service of relatively important public utilities.	Dam failure may cause minimal property damage to others. Loss of life is not expected.

Regulation 72-2.C. Hazard Potential Classification



	Hazard Class	Count	Percentage
	High	540	23.7%
	Significant	286	12.6%
	Low	1,447	63.7%
	TOTAL	2,273	100.0%

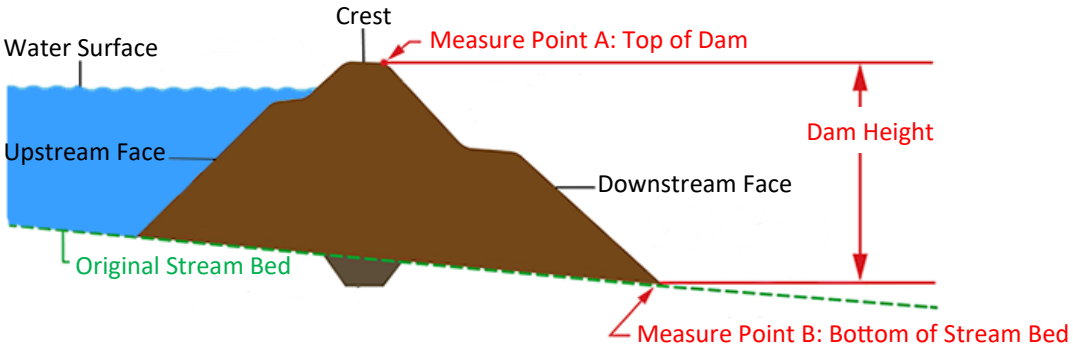
Numbers as of 1 June 2020

The Basics of Dam Safety in South Carolina

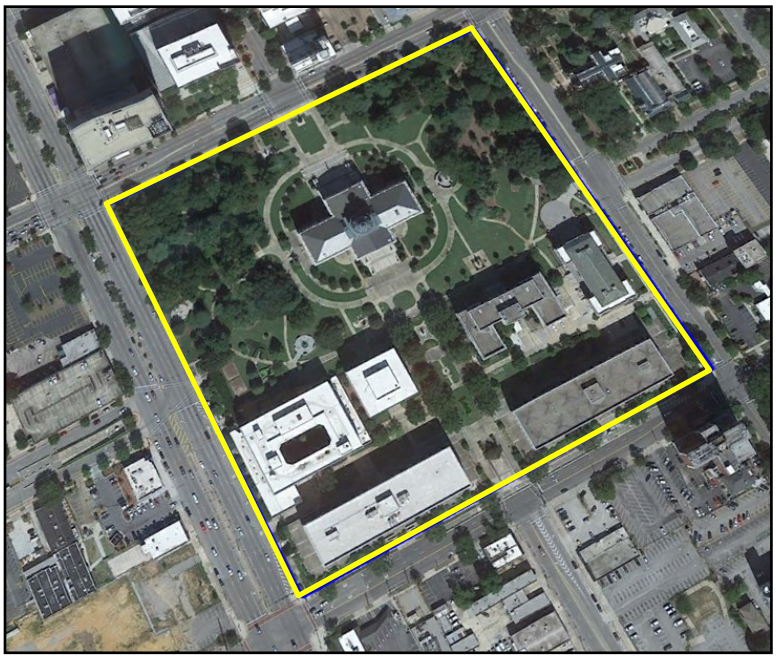
From the Act § 49-11-120, a ***dam*** is any artificial barrier, together with its appurtenant works, including but not limited to dams, levees, dikes or floodwalls for the impoundment or diversion of water or other fluids where failure may cause danger to life or property. Furthermore, a ***dam*** is subject to the authority of the South Carolina Dams and Reservoir Safety Act and Regulations when it meets at least one of the following:

- Measures 25 feet or more in height from the invert of the receiving stream or natural ground
- Impounds 50 acre-feet or more of water
- Failure of the dam may result in loss of human life, regardless of size

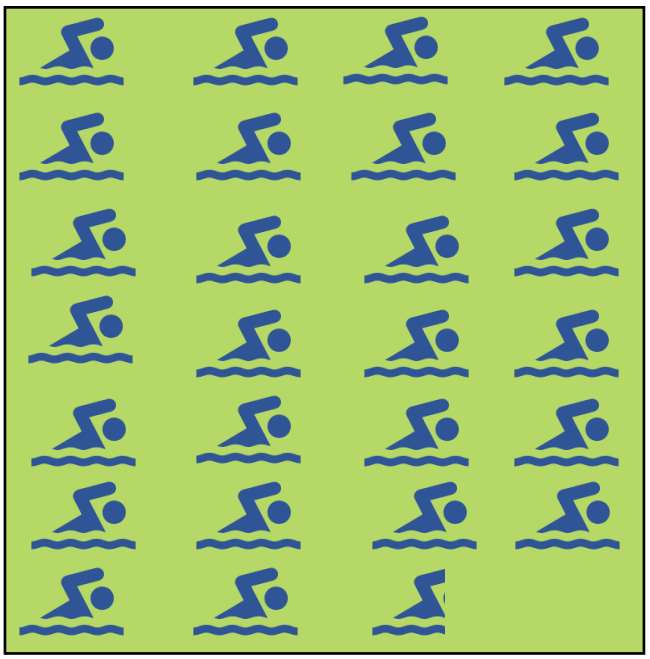
Measuring the height of a dam…



Exactly what is an "acre–foot"? It's a unit of volume. One acre covered in one foot of water = 325,851 gallons. So how much water is 50 acre-feet?



50 acre-feet = 2 feet, 3 inches of water covering the State House grounds



50 acre-feet = 26.6 Olympic-sized swimming pools

Dams that the State Does Not Regulate

Due to exemptions found in the Act and Regulations, the vast majority of dams in the state are exempt from regulation. These exemptions, found in Section 49-11-120 of the Act and Section 72-2.D. of the Regulations, are as follows:

1. Any dam that meets the following: a) is less than 25-feet in height, b) has less than 50-acre-feet of impounding capacity, and c) failure or improper reservoir operation would not cause loss of life. (S.C. Code Ann. § 49-11-120(4)(a))
2. Any dam owned or operated by a department or agency of the federal government. (S.C. Code Ann. § 49-11-120(4)(b))
3. Any dam owned or licensed by the Federal Energy Regulatory Commission (FERC), the South Carolina Public Service Authority (Santee-Cooper), the Nuclear Regulatory Commission (NRC), the United States Army Corps of Engineers (USACE), or any other responsible federal licensing agencies considered appropriate by the department. (S.C. Code Ann. § 49-11-120(4)(c))
4. Any dam upon which the Department of Transportation (SCDOT) or county or municipal governments have accepted maintenance responsibility for a road or highway where that road or highway is the only danger to life or property with respect to failure of the dam. (S.C. Code Ann. § 49-11-120(4)(d))
5. Any dam, which in the judgment of the department, because of its size and location could pose no significant threat of danger to downstream life or property. (R.72-2.D.5).

Most exempt dams (an accurate estimate is unavailable, but roughly estimated to be over 20,000) are not subject to regulation as a result of Exemption #1. As of the 2018 National Inventory of Dams, 76 dams are exempted from regulation as a result of Exemptions #2 and #3. This includes many of the largest dams in the state which are used for the production of hydroelectricity and are regulated by the Federal Energy Regulatory Commission. Please see the map and table in Appendix A, Page A-13 and Page A-14, for the dams that are exempt from state regulation due to ownership or regulation by a federal government agency.

Exemption #4 has proven to be problematic in recent years following the widespread dam failures of 2015, 2016, and 2018. The Act was likely created based on an incorrect assumption that the SCDOT or a county or municipality would be willing to accept complete maintenance responsibility for not only the roadway but also the supporting embankment (i.e., the dam). Generally, the SCDOT, county, or municipality only has a right-of-way, not fee simple ownership of the roadway, and thus if repairs beyond what is considered the roadway are required, it has resulted in significant delays where the landowners have no desire to repair a roadway and the SCDOT, county, or municipality have no desire to perform work on a dam.

Exemption #5 is a useful tool for the Program, and has been used in a limited number of cases where common sense indicates there is no benefit to public safety from a dam being subject to regulation. For example, a dam built close to or next to the ocean, or a large lake or river, where the failure would cause a negligible rise in the receiving water body, would potentially qualify for this exemption.

State-Regulated Dams by the Numbers

Ownership

Most regulated dams in South Carolina are privately owned by individuals, homeowners associations and corporations. Additionally, multiple ownership situations—predominantly dams owned by multiple private entities, but also some where ownership is a combination of local government, state government, and/or a private entity—are extremely common.

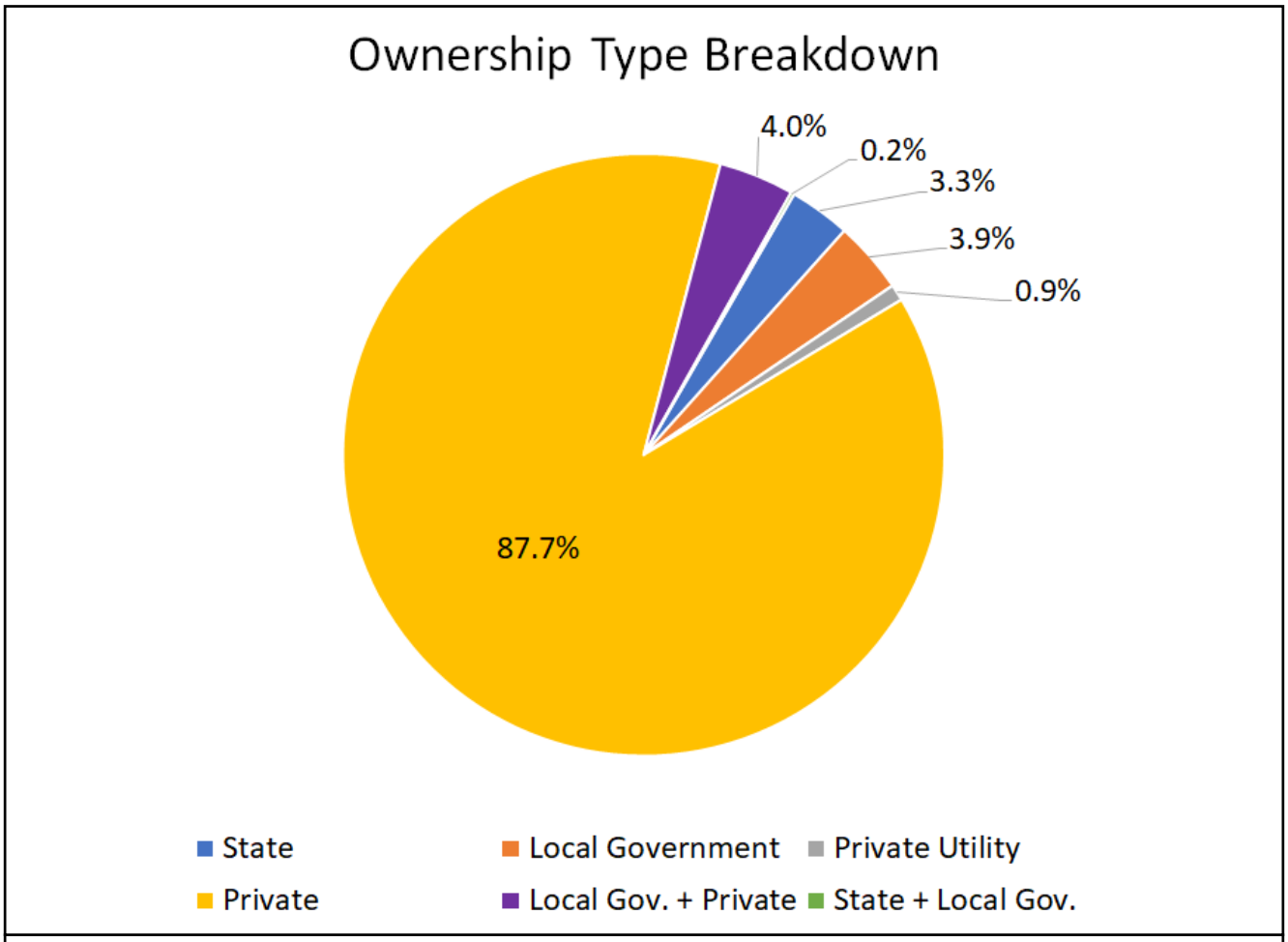
Ownership Type	Count	Percentage
State	75	3.3%
Local Government	88	3.9%
Private Utility	20	0.9%
Private	1,994	87.7%
Joint (Local Gov. + Private)	92	4.0%
Joint (State + Local Gov.)	4	0.2%
TOTAL	2,273	100.0%

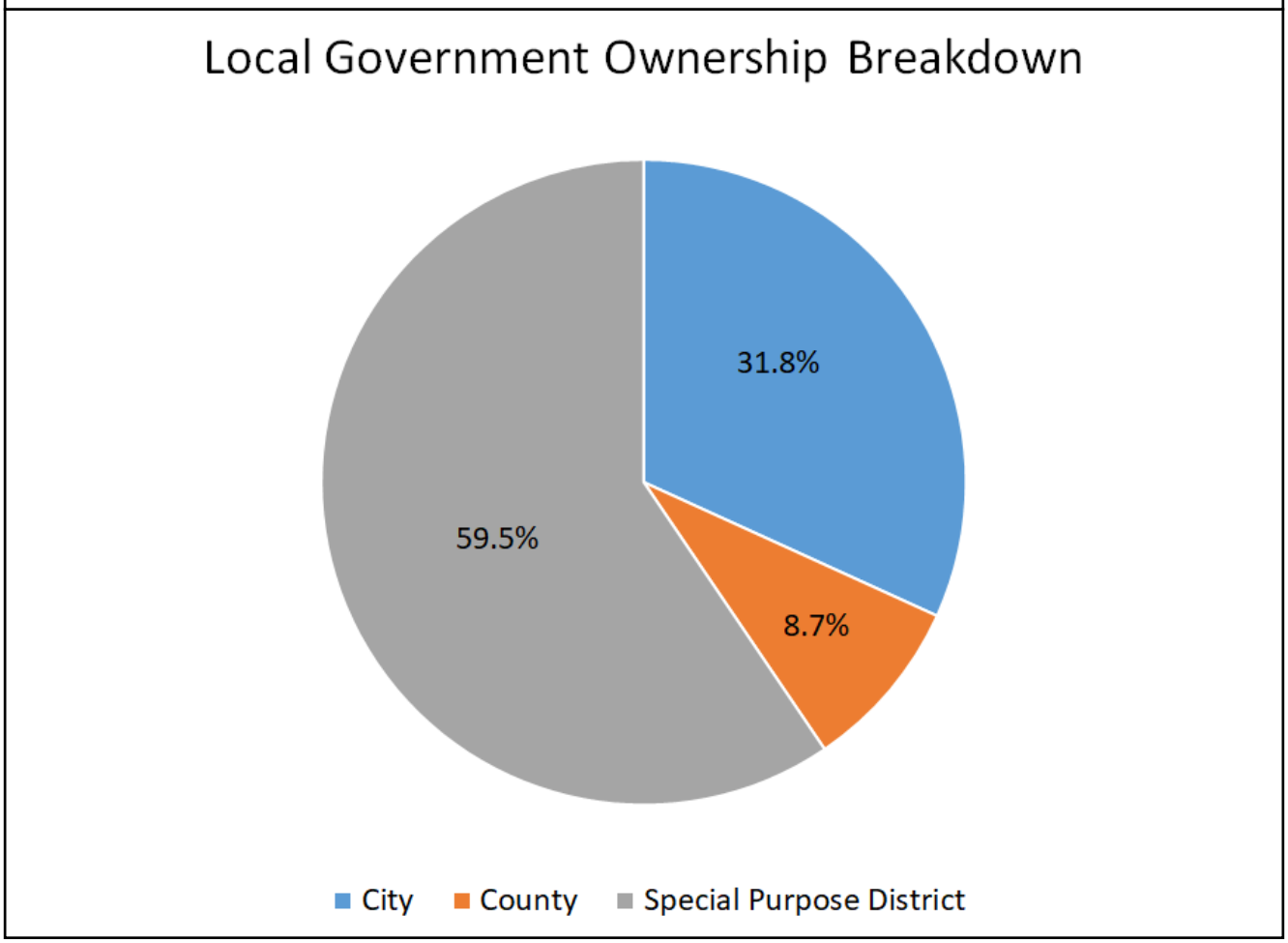
Local-Government Ownership

Municipalities, Counties and Special Purpose Districts own a significant number of regulated dams. Many are used for water supply or as wastewater lagoons, some are found at City or County parks, and a particularly large subset are dams operated by Watershed Conservation Districts that were built by the NRCS under Public Law 566. The category "Municipalities" includes Commissions of Public Works. The category "Special Purpose Districts" includes Water and Sewer Districts, Watershed Conservation Districts, and Soil and Water Conservation Districts.

Ownership Type	Count	Percentage
Municipality	62	31.8%
County	17	8.7%
Special Purpose District	116	59.5%
TOTAL	195	100.0%

Ownership data is as-submitted to the US Army Corps of Engineers for the National Inventory of Dams (NID) in 2018. See Page 25 for a description and background on the NID.


Ownership Type Breakdown
4.0%
0.2%
3.3%
3.9%
0.9%
87.7%
State
Local Government
Private Utility
Private
Local Gov. + Private
State + Local Gov.


Local Government Ownership Breakdown
31.8%
59.5%
8.7%
City
County
Special Purpose District

State Regulated Dams by the Numbers

All Dams Condition Rating

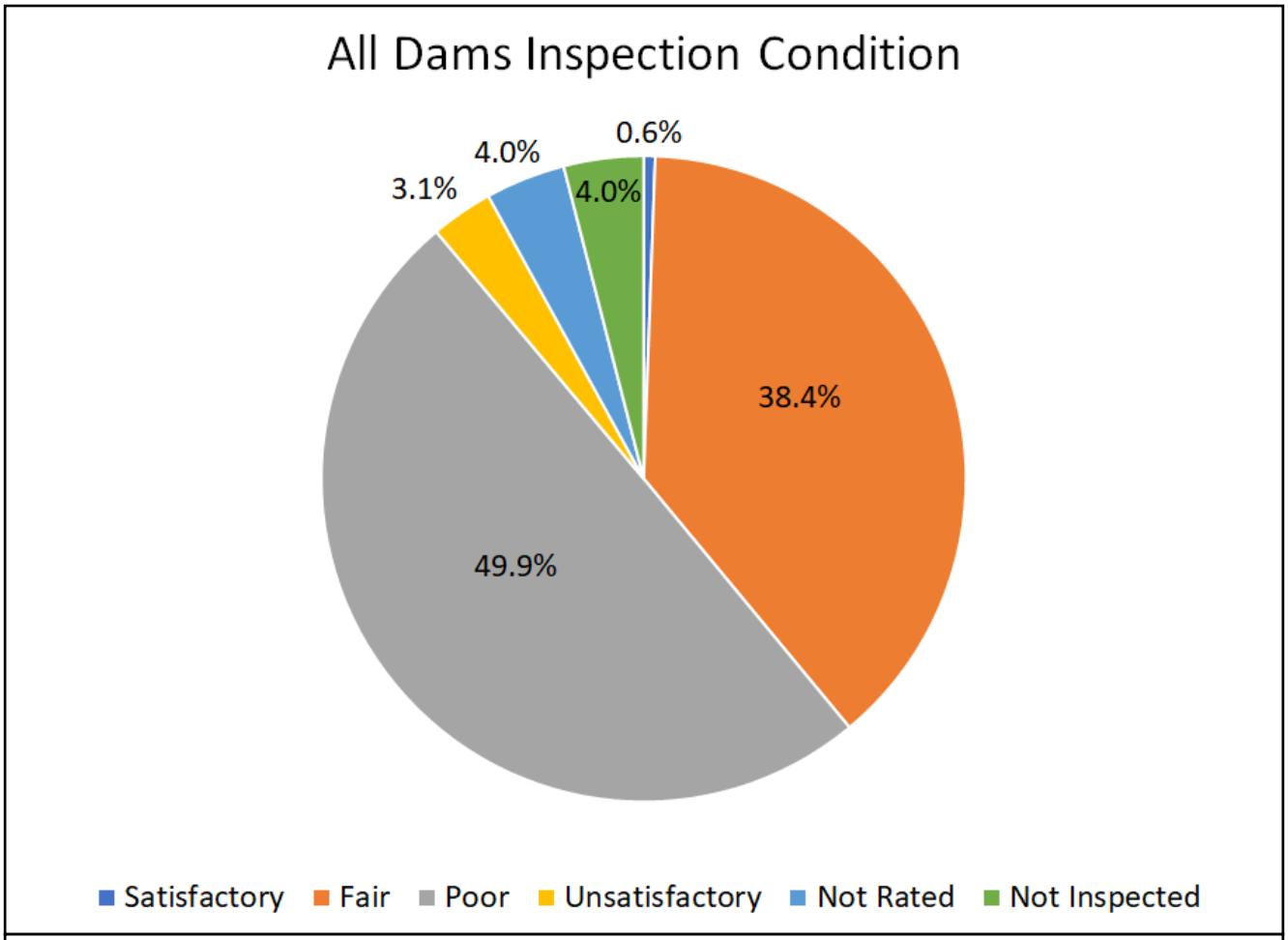
When Program staff perform a Preliminary Inspection of a regulated dam, the overall condition of the dam is assigned a condition rating that complies with requirements established by the National Dam Safety Review Board and the US Army Corps of Engineers for the National Inventory of Dams (NID). The allowable condition ratings are "Satisfactory," "Fair," "Poor," "Unsatisfactory," or "Not Rated." For context, a condition rating of "Satisfactory" is difficult to obtain because such a rating implies the dam has been studied for its stability under "all loading conditions" (e.g., an earthquake, a major flood, etc.) and shown to have a suitable factor of safety against failure. A "Not Rated" condition rating is usually given when staff encounter difficulties accessing/observing all parts of the dam, safety concerns prevent a full inspection, or when a dam is breached. Please see Page 25 for descriptions of all of the condition ratings.

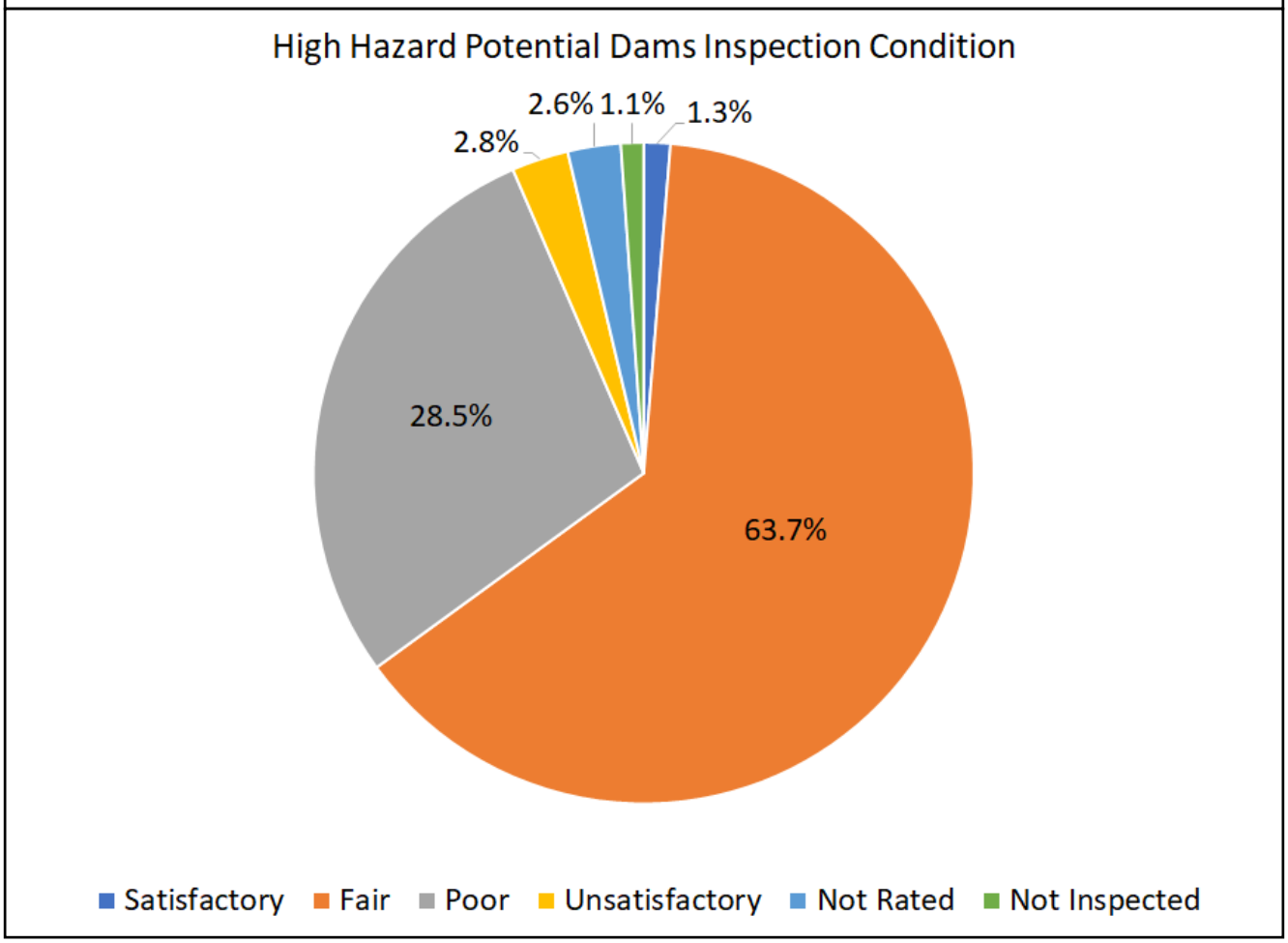
All Dams Inspection Condition	Count	Percentage
Satisfactory	13	0.6%
Fair	873	38.4%
Poor	1,134	49.9%
Unsatisfactory	71	3.1%
Not Rated	91	4.0%
Not Inspected	91	4.0%
TOTAL	2,273	100.0%

High Hazard Potential Dams Condition Ratings

Looking specifically at high hazard potential dams shows a significant percentage of dams (65%) that are either in "Satisfactory" or "Fair" condition and a much smaller percentage (31.3%) as "Poor" or "Unsatisfactory". Of the six dams in the "Not Inspected" category, one is new construction which has undergone a certification inspection but not a scheduled Preliminary Inspection where the Department assigns a condition rating, four are scheduled to be inspected this year, and one is currently breached.

High Hazard Potential Dams Inspection Condition	Count	Percentage
Satisfactory	7	1.3%
Fair	344	63.7%
Poor	154	28.5%
Unsatisfactory	15	2.8%
Not Rated	14	2.6%
Not Inspected	6	1.1%
TOTAL	540	100.0%


All Dams Inspection Condition
0.6%
4.0%
3.1%
4.0%
38.4%
49.9%
Satisfactory
Fair
Poor
Unsatisfactory
Not Rated
Not Inspected


High Hazard Potential Dams Inspection Condition
2.6%
1.1%
1.3%
2.8%
28.5%
63.7%
Satisfactory
Fair
Poor
Unsatisfactory
Not Rated
Not Inspected

State Regulated Dams by the Numbers

Significant Hazard Potential Dams Condition Ratings

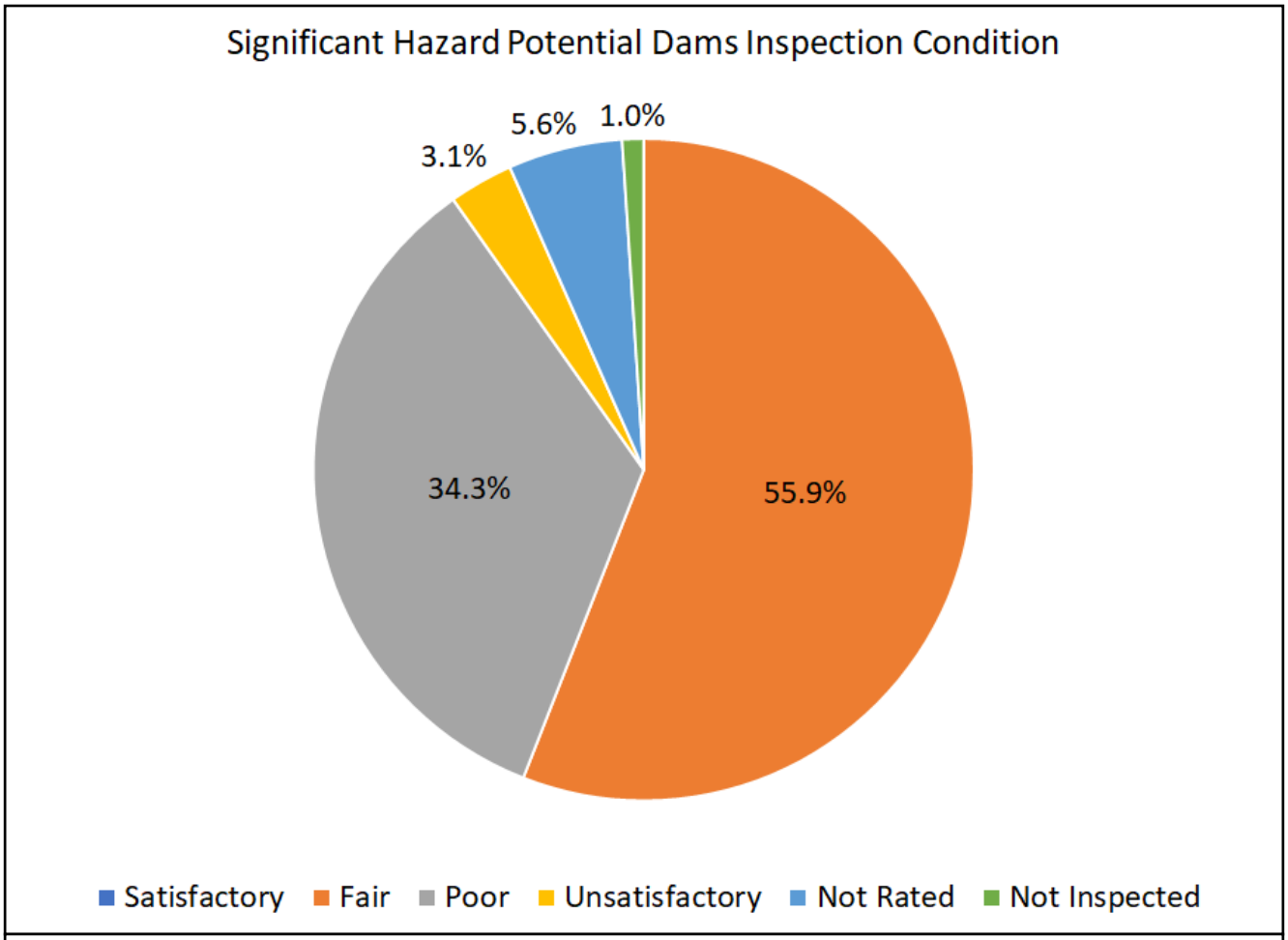
Significant hazard potential dams are in slightly worse condition, overall, than high hazard potential dams, with 37.4% either in "Poor" or "Unsatisfactory" condition. Also, the total number of Significant Hazard dams has decreased significantly in the past 5 years. Reasons for this include improved dam breach modeling capabilities (see Pages 34-38) and the Joint Resolution that prevents the Program from reclassifying low hazard potential dams to significant hazard potential (see Page 44).

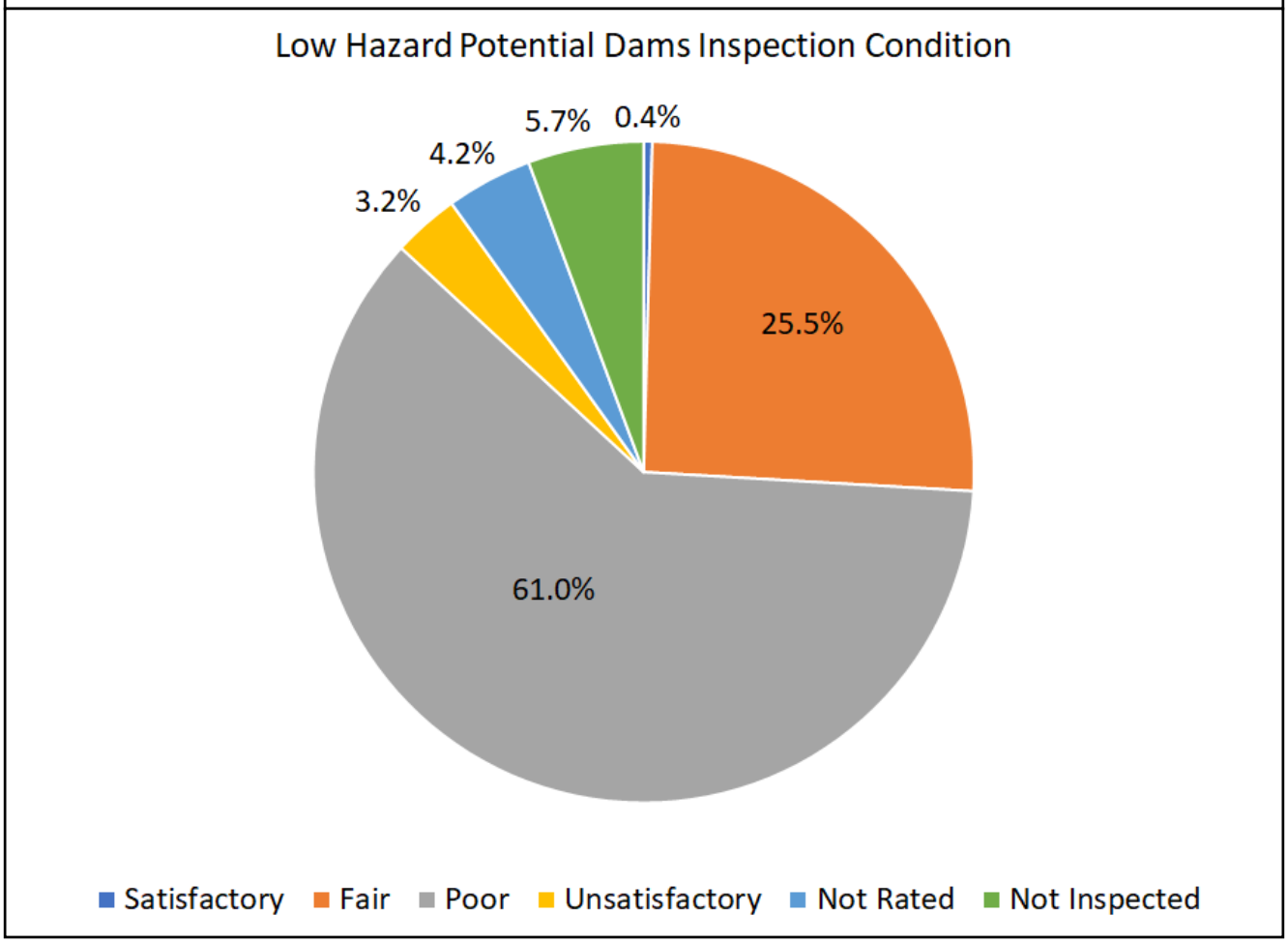
Significant Hazard Potential Dams Inspection Condition	Count	Percentage
Satisfactory	0	0.0%
Fair	160	55.9%
Poor	98	34.3%
Unsatisfactory	9	3.1%
Not Rated	16	5.6%
Not Inspected	3	1.0%
TOTAL	286	100.0%

Low Hazard Potential Dams Condition Ratings

Not surprisingly, a large percentage of low hazard potential dams fall into the "Poor" condition category. This is likely due to the fact that the Department does not routinely inspect low hazard dams, and instead only performs a routine "Classification Inspection" to determine if any changes in the inundation area necessitate a reclassification of the dam to a higher hazard classification. The Department's 2017-2018 inspection effort of 2,000 dams, many of which were low hazard potential, was a one-time event, not likely to be repeated due to the resources required to accomplish such a large undertaking (see Page 24). Also, it is worth noting that the vast majority of "Not Inspected" dams are low hazard potential.

Low Hazard Potential Dams Inspection Condition	Count	Percentage
Satisfactory	6	0.4%
Fair	369	25.5%
Poor	882	61.0%
Unsatisfactory	47	3.2%
Not Rated	61	4.2%
Not Inspected	81	5.7%
TOTAL	1,447	100.0%


Significant Hazard Potential Dams Inspection Condition
5.6%
1.0%
3.1%
34.3%
55.9%
Satisfactory
Fair
Poor
Unsatisfactory
Not Rated
Not Inspected


Low Hazard Potential Dams Inspection Condition
5.7%
0.4%
4.2%
3.2%
25.5%
61.0%
Satisfactory
Fair
Poor
Unsatisfactory
Not Rated
Not Inspected

State Regulated Dams by the Numbers

State-Owned Dams Condition Ratings

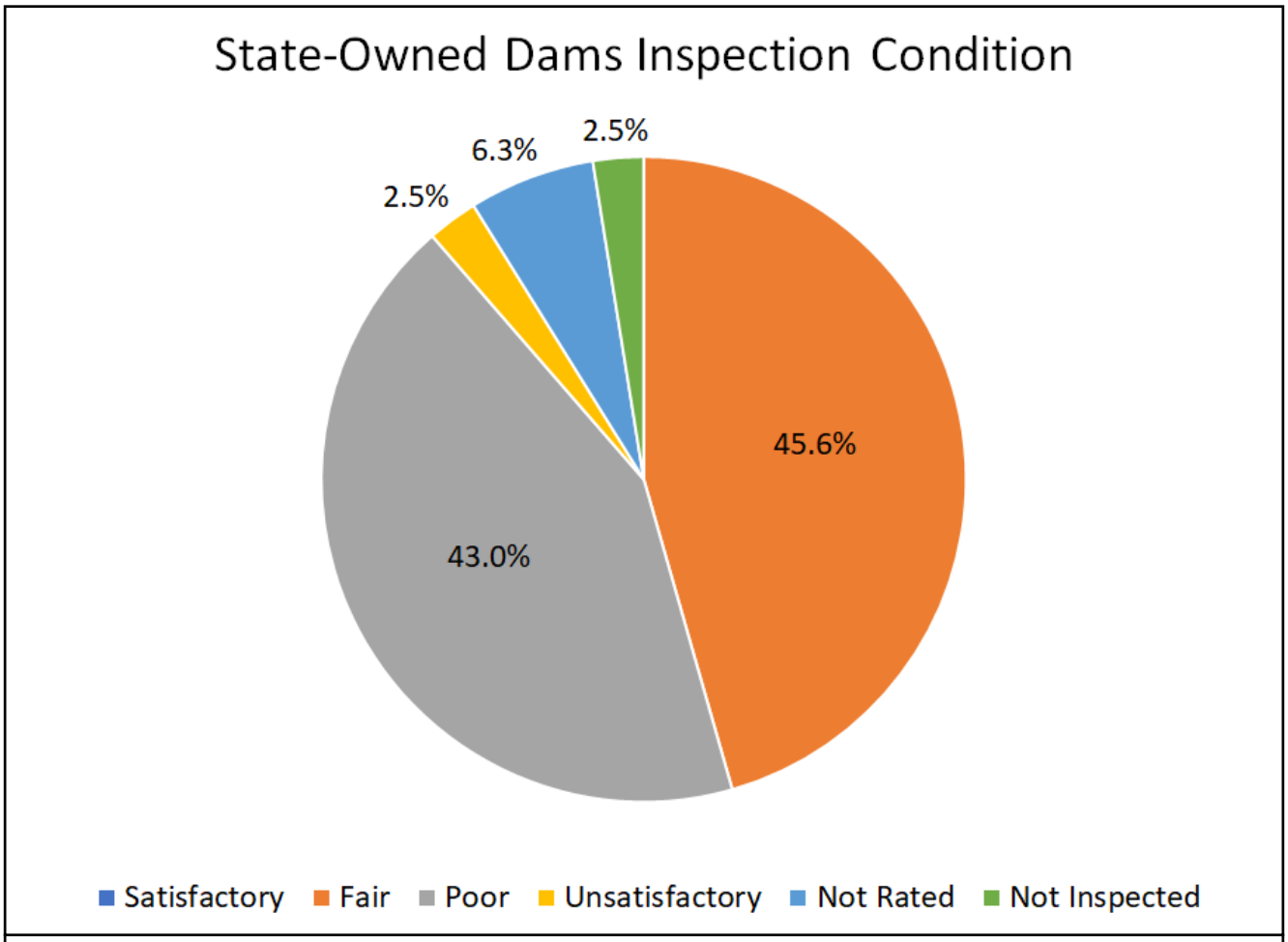
Multiple state agencies own, operate, and maintain dams located on state property. These agencies are responsible for the condition of the dams on the state lands they control. The state agencies that own more than one dam (with # owned) are as follows: State Forestry Commission (21), Department of Parks, Recreation, and Tourism (20), Department of Natural Resources (15), Clemson University (9), Department of Corrections (3), Department of Disabilities and Special Needs (2).

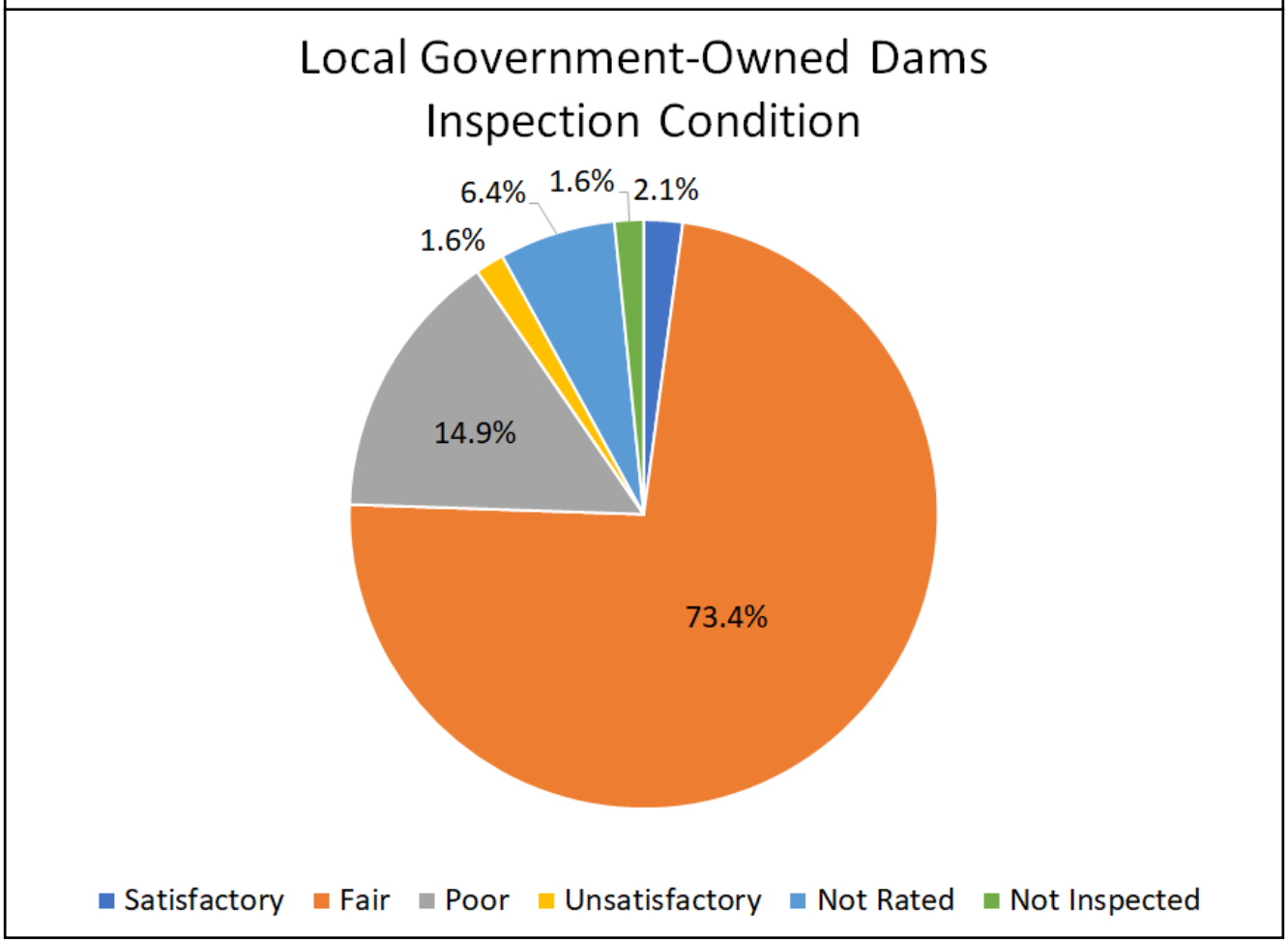
State-Owned Dams Inspection Condition	Count	Percentage
Satisfactory	0	0.0%
Fair	36	45.6%
Poor	34	43.0%
Unsatisfactory	2	2.5%
Not Rated	5	6.3%
Not Inspected	2	2.5%
TOTAL	79	100.0%

Local Government-Owned Dams Condition Ratings

Local Governments includes municipalities, counties, and special purpose districts.

Local Government-Owned Dams Inspection Condition	Count	Percentage
Satisfactory	4	2.1%
Fair	138	73.4%
Poor	28	14.9%
Unsatisfactory	3	1.6%
Not Rated	12	6.4%
Not Inspected	3	1.6%
TOTAL	188	100.0%


State-Owned Dams Inspection Condition
2.5%
6.3%
2.5%
45.6%
43.0%
Satisfactory
Fair
Poor
Unsatisfactory
Not Rated
Not Inspected

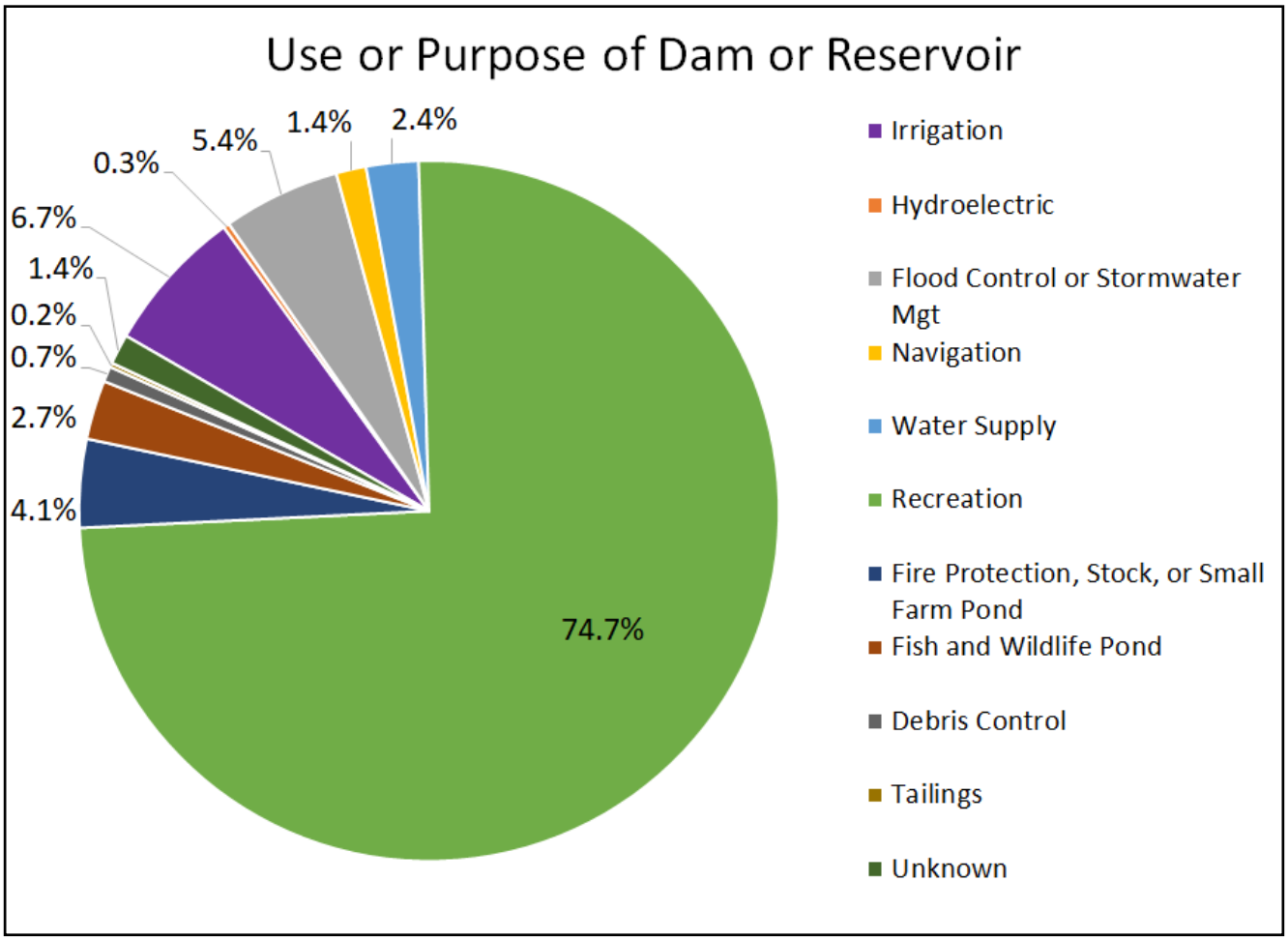

Local Government-Owned Dams Inspection Condition
6.4%
1.6%
2.1%
1.6%
14.9%
73.4%
Satisfactory
Fair
Poor
Unsatisfactory
Not Rated
Not Inspected

State Regulated Dams by the Numbers

Use or Purpose of Dams

Dams are constructed to create impoundments that serve various functions. A dam may serve a single or multiple functions, and these functions can change seasonally throughout the year as well as over a dam's lifespan as ownership or other conditions change. Dams are not only used for impounding water, but serve a critical role in industries ranging from manufacturing to mining for providing a storage solution for process needs or by-product waste management. Again, since a single dam may serve multiple uses, the number of purposes in the below table exceed the number of dams in the previous tables.

Purpose	Count	Percentage
Irrigation	169	6.7%
Hydroelectric	7	0.3%
Flood Control or Stormwater Mgt	137	5.4%
Navigation	35	1.4%
Water Supply	61	2.4%
Recreation	1,887	74.7%
Fire Protection, Stock, or Small Farm Pond	103	4.1%
Fish and Wildlife Pond	69	2.7%
Debris Control	18	0.7%
Tailings	5	0.2%
Unknown	35	1.4%
TOTAL	2,526	100.0%

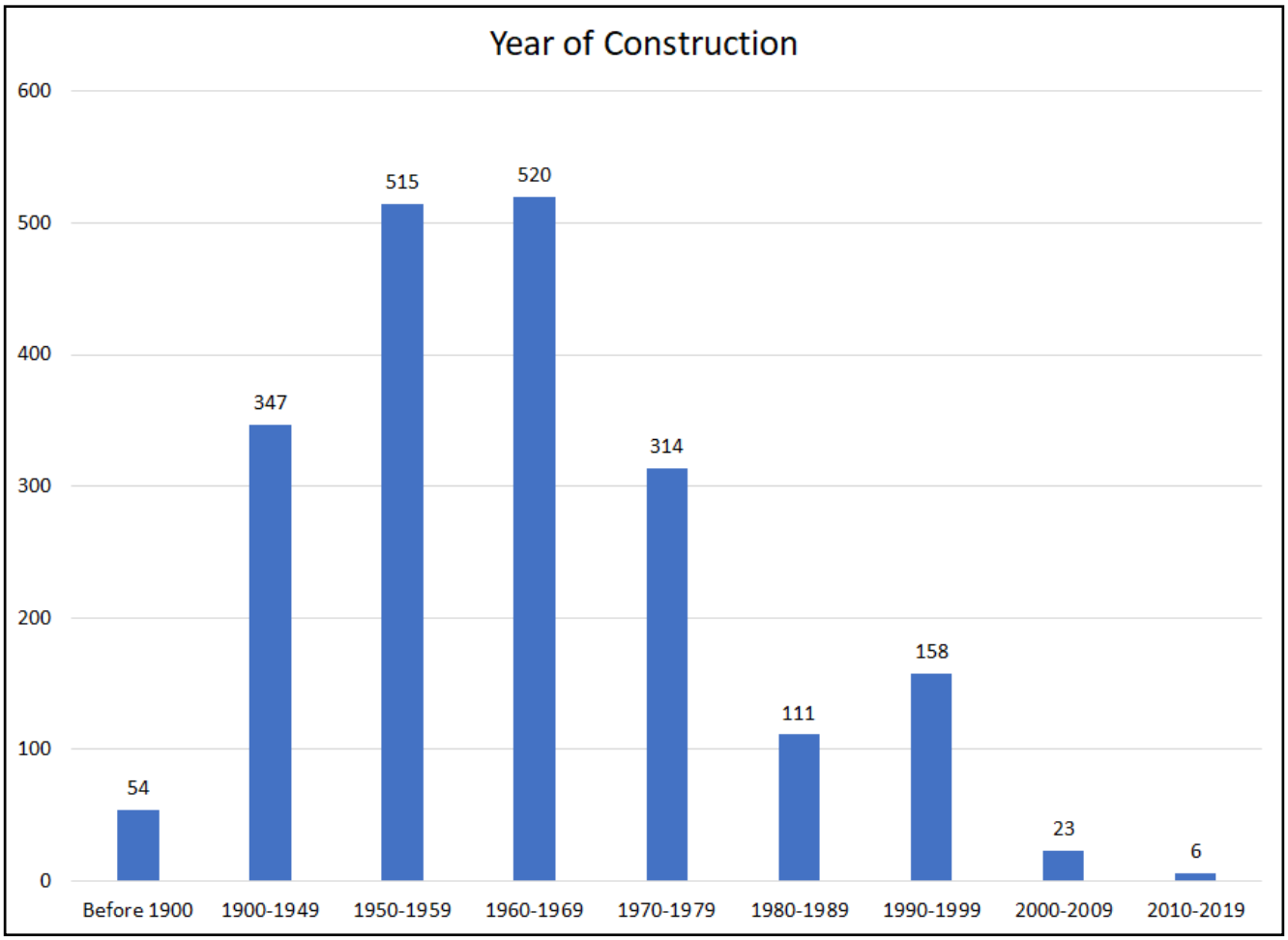

Use or Purpose of Dam or Reservoir
2.4%
1.4%
5.4%
0.3%
6.7%
1.4%
0.2%
0.7%
2.7%
4.1%
74.7%
Irrigation
Hydroelectric
Flood Control or Stormwater Mgt
Navigation
Water Supply
Recreation
Fire Protection, Stock, or Small Farm Pond
Fish and Wildlife Pond
Debris Control
Tailings
Unknown

State Regulated Dams by the Numbers

Age of Dams

Many of the actual construction dates of state-regulated dams are unknown due to the fact that the Act was passed recently (in 1978) relative to the age of many dams. A large percentage (~77%) of the existing inventory of dams were already constructed by the time the General Assembly established a regulatory framework for dam safety in the state. Thus, as no oversight agency or body existed, virtually no records exist to document with certainty the exact year of construction of many of the state-regulated dams. However, even if not accurate to the exact year, the numbers below have an important takeaway—that many of the dams in this state have exceeded the useful lifetimes for the construction methods and materials of their day. This is a national problem, as the 1950's and 1960's were a heyday for dam construction in this country. Even today, it is rare that a dam is constructed with a design lifespan that exceeds 50 years.

Year of Construction	Count	Percentage
Before 1900	54	2.4%
1900-1949	347	15.3%
1950-1959	515	22.7%
1960-1969	520	22.9%
1970-1979	314	13.8%
1980-1989	111	4.9%
1990-1999	158	7.0%
2000-2009	23	1.0%
2010-2019	6	0.3%
Unknown	225	9.9%
TOTAL	2,273	100.0%


Year of Construction
600
500
400
300
200
100
0
54
347
515
520
314
111
158
23
6
Before 1900
1900-1949
1950-1959
1960-1969
1970-1979
1980-1989
1990-1999
2000-2009
2010-2019

Investment in Safety

One of the critical components of a dam safety program is the ability to respond quickly to a dam safety incident, be it a dam failure or potential failure, with adequate resources to protect lives and properties. The infusion of funding by the General Assembly into the Program has better positioned the Program for this task with additional staff, tools, and access to supplementary resources. The Program continues to plan and prepare its response to severe weather through training and coordination with our partners at the local, state, and federal level.

In 2015 and 2016, South Carolina was struck by a pair of historic rainfall events.

October 2015's historic rainfall event followed by Hurricane Matthew in 2016 charted a new, challenging course for the Program. These events resulted in the failure of 70 dams regulated under the Act. Following each of these events, DHEC partnered with the US Army Corps of Engineers to assess the condition of dams throughout the state. A total of 652 dams were assessed after the 2015 flood and 469 were assessed following the landfall of Hurricane Matthew the next year.

Recovery from these events is an ongoing endeavor. While some dam owners were eager to engage an engineer and submit a plan to repair their dams, others continue to evaluate whether to repair or remove the dam. In order to set owners on a good path, the Department has utilized consent agreements to establish a timeline for decision-making. Sixty percent of the dams breached as a result of October 2015's historic rainfall have been repaired, removed, or exempted from regulation and another twenty percent are either under repair, have a repair permit in-hand, or have submitted a permit application. Of the Hurricane Matthew breached dams, fifty percent have been repaired, removed, or exempted and fifteen percent either have a repair permit in-hand or have an engineer actively developing repair plans. The additional staffing resources provided to the Program have allowed staff to spend more time assisting individual dam owners in their decision-making processes.

Spring Lake Dam in Richland County was damaged as a result of the 2015 storm. The dam was overtopped by several feet of water resulting in the loss of soil from the back slope (top photo), as well as damage to the concrete spillway. The dam owners quickly engaged an engineer and repaired the dam. Suitable material was brought in and the slope was reconstructed at a milder grade and armored to withstand overtopping in future events (bottom photo).

Investment in Safety

Increased Response Capabilities

DHEC closely follows weather forecasts and, if necessary, contacts dam owners to recommend preemptive safety actions. Dam Safety Program staff can contact individual dam owners directly if feasible, but if large areas are potentially impacted, staff also have the ability to send mass communications via telephone, text message, and e-mail using the CodeRED™ service. Just prior to and during a storm event, Program staff activate an emergency operations center to help coordinate DHEC field assessment teams and to communicate with and provide information to colleagues in the emergency management community. After a storm event has passed, staff again perform assessments of dams in the hardest hit areas.

Outside of hurricanes and tropical storms, Program staff are frequently called upon to respond to incidents at dams due to localized storms and non-weather-related "sunny-day" events. Examples of "sunny-day" events include excessive seepage or a malfunctioning or blocked spillway. Program staff rotate weeklong shifts manning the 24-hour-a-day Dam Safety Technical Assistance phone line. The Program's engineers are always standing by to assist dam owners whenever trouble arises and the dam owner needs help identifying the severity of a situation and whether local emergency response officials should be notified. This has resulted in Program staff responding to after-hours dam failure emergencies on multiple occasions. When a member of the Dam Safety staff is on-call they carry an equipment "go bag," their DHEC-issued cell phone, and DHEC-issued laptop to be able to respond to a report of a dam failure at any time of the day or night.

Sinkhole that appeared, and then quickly grew in size, in a public road on a dam in Richland County

Investment in Safety

Use of Construction Firms

The Act charges DHEC with the responsibility to take emergency action to make dams safe in situations where the dam owners either cannot or will not do so. To fulfill this responsibility, the Program must have a construction contractor ready on a moment's notice with the necessary expertise and equipment to dewater a reservoir and/or remove a dam's ability to impound water.

The state's procurement requirements for state agencies mandate that any such contracting opportunities be advertised publicly for a minimum of 30 days, be subject to competitive sealed bids, be awarded on the basis of lowest bid, and receive approval of the Office of State Engineer before entering. This process does not lend itself to the needs of the Program, mainly because the specific circumstances of an emergency situation cannot be foreseen (i.e., the scope of work and the duration of the contract cannot be known in advance) nor can the time to procure a contractor by this method be afforded. Additionally, while procurement of a contractor under emergency procurement procedures can be immediate and open-ended, it is not desirable from a perspective of best price or duration of contract (i.e., contract generally ends when emergency situation no longer exists).

To solve this dilemma, DHEC desired to procure a construction contractor with a schedule of services that can be billed on a time-and-materials basis, similar to the procurement of goods and services, but only after pre-qualifying potential contractors based on expertise and experience working on dams. This required DHEC to obtain an exemption from portions of the State Procurement Code. On May 2, 2017, the State Fiscal Accountability Authority granted the Department a five-year exemption to allow procurement of a construction contractor for use by the Program. The Department currently has contracts with two heavy civil construction firms, Phillips and Jordan, Inc., and Crowder Construction, Inc., that expire in 2022.

DHEC's contractor breaching an unsafe dam to eliminate risk to downstream areas

Investment in Safety

Risk Assessments and High Hazard Potential Dam Rehabilitation

As in many fields of engineering where failures of an engineered structure can have disastrous impacts on people's lives and property, it becomes necessary to look beyond simple consequence-based decision making (i.e., "What's downstream?") and adopt a more holistic, risk-informed approach to addressing the problem. With the assistance of its engineering contractor, CDM Smith, the Dam Safety Program has undertaken an initiative that focuses on High Hazard Potential Dams (HHPD), i.e., dams whose failure would likely lead to loss of life or serious damage to important infrastructure and utilities, and analyzes those dams not just on the current condition of the dam but on the risks posed by those dams. Risk, by definition, considers not just consequences but also the probability of an event occurring. By considering factors such as likelihood of different threats/loadings occurring to the dam, the dams' ability to resist failure under the stress of these loadings, and a quantification of the consequences of failure of the dams, an overall risk metric can be calculated. The Department and CDM Smith have developed a methodology for analyzing HHPDs for overall risk, based on established practices in the industry, and assigning a Total Risk Factor (TRF) score to every HHPD in the state's inventory. Completion of this initiative will allow for the Program's limited resources to be directed to the dams that pose the greatest risk to people's lives and property.

Before the process even starts, trained and experienced Dam Safety engineers assemble all pertinent information about each dam's design, construction, current condition, and consequences of failure. If there are data gaps, these must be filled before the process can begin. The methodology first requires evaluation of the likelihood of a threat to the dam occurring (i.e., a flooding event or a seismic event). Second, the methodology requires evaluation of the current condition of the dam and the presence of any defensive design features that would reduce the likelihood of the dam's failure. Lastly, the methodology requires an assessment and quantification of the downstream consequences of dam failure, and assigns risk factors based on, for example, the population at-risk in the dam's inundation area. The overall Total Risk Factor (TRF) for the dam is determined by combining all the risk factors and risk reduction factors through an equation and then arriving at a value that represents the overall risk (ranging from 0, lowest risk, to 500, highest risk). A simplified version of the formula for TRF is as follows, where the values a, b, and c represent numbers that serve to "weigh" each risk factor equally into the calculation:

$$\text{Total Risk Factor (TRF)} = (\text{Threat Risk Factor})^{a} \times (\text{Resistance Risk Reduction Factor})^{b} \times (\text{Consequences Risk Factor})^{c}$$

Investment in Safety

Risk Assessments and High Hazard Potential Dam Rehabilitation, Continued

FEMA's High Hazard Potential Dams (HHPD) Rehabilitation Grant Program requires the previously-discussed risk assessment and ranking process be completed for a dam to be approved for a rehabilitation grant. Rehabilitation grants are competitive in the sense that projects selected for awards must represent the greatest risk reduction for a given investment of federal funds. More information on FEMA's HHPD Rehabilitation Grant can be found at the following website:

https://www.fema.gov/rehabilitation-high-hazard-potential-dam-grant-program

Another requirement of this grant program is that the state and local governments incorporate this risk-informed decision making into their hazard mitigation plans. The current State Hazard Mitigation Plan (October 2018) acknowledges but does not directly address the hazards dam failures pose, instead grouping dams into the broader category of "Floods" as a natural hazard. This is not ideal, as dam failures and the flooding that can result are often unpredictable, can be the result of human error as much as natural causes, and can occur with no warning on a sunny day. DHEC and the South Carolina Emergency Management Division (SCEMD) are working together to create a "Dams Annex" to the State Hazard Mitigation Plan that incorporates DHEC's risk rankings. The Dams Annex will help ensure that the highest risk dams are identified and that this information is available to those whose decisions serve to mitigate the hazard. These decision makers (at SC EMD and at the County level) are responsible for the establishment of mitigation goals, enacting policies to achieve these goals, and finally selecting and funding mitigation projects that are in accordance with these policies. The plan states that "Mitigation is the most sustainable and cost-efficient method to prevent future losses." Adopting a collaborative approach to risk-informed decision making, where risk information is regularly updated by the dam safety engineers at DHEC and shared with SCEMD and the County Emergency Managers, will serve to better protect the lives and property of the citizens of South Carolina in a cost-effective and sustainable manner. The South Carolina Hazard Mitigation Plan can be found at the following website:

https://www.scemd.org/em-professionals/plans/hazard-mitigation-plan/

Lastly, the Dam Safety Program plans to use the completed risk rankings to inform its processes and decision-making on a daily basis, including determining a dam's inspection frequency, whether a dam owner should be issued a Maintenance Order or an Inspection and Repair Order, or where enforcement or legal action against a dam owner is necessary. The risk-informed decision-making that this initiative will make possible can revolutionize the functioning of the Program and serve to direct limited state resources to the dams that represent the highest risk to the citizens of the state.

Investment in Knowledge

In 2016, DHEC tasked its engineering contractor with inspecting 2,000 dams, many of which had not previously been inspected on a routine cycle. Between February and December 2017, 1,989 inspections of regulated dams were conducted, with the remaining 11 being completed by September 2018. Using four two-person teams, the inspectors were able to observe, photograph, characterize, and document conditions at over 50 low, significant, and high hazard dams each week. These teams worked closely with the DHEC Regional Dam Safety Engineers, especially when encountering "Unsatisfactory" dams that pose a potential threat to the public. The effort included the Department's first widespread use of nSpect, DHEC's field data collection software. nSpect delivered inspection data directly to ePermitting, DHEC's new environmental facilities database, where documentation of the inspections was finalized in an automated report format.

A DHEC dam inspection in progress

Through the inspection effort, DHEC identified over one-third of the low hazard dams that should be reclassified from low hazard to high or significant hazard potential.

The one-time funds provided by the Legislature allowed DHEC, for the first time since South Carolina's Dam Safety Program began as part of the South Carolina Land Resources Conservation Commission in the early 1980s, to perform this baselining of the condition of nearly every dam in the Program's inventory. Approximately 400 additional dams were not included in the Department's inspection effort because those dams had been severely impacted by the Historic Flooding of October 2015 or Hurricane Matthew in 2016 and the Department had adequately documented the conditions of those dams. The knowledge gained from these inspections has aided Program staff in evaluating hazard classifications and prioritizing the use of its resources on dams with the most serious safety concerns. The results of the inspections have helped staff tailor education and outreach initiatives to the most common deficiencies identified. This has included workshops for dam owners, a newsletter that highlights issues such as animal impacts on dams, videos on siphon use and installation, and a webinar on development and use of Emergency Action Plans, just to name a few.

Investment in Knowledge

National Inventory of Dams Condition Ratings

Every dam safety program in the nation reports the condition of state-regulated dams to the U.S. Army Corps of Engineers' (USACE) National Inventory of Dams (NID) on a recurring basis. The last comprehensive report to the NID was in 2018. The next report is expected by the end of 2020. As part of their inspection programs, every dam safety program in the nation is required to assign condition ratings that comply with the USACE's standard condition ratings, which are:

Outlet conduit and plunge pool of a regulated dam

SATISFACTORY - No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions in accordance with state engineer's rules and regulations for dams or tolerable risk guidelines.

FAIR - No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.

POOR - A dam safety deficiency is recognized for loading conditions, which may realistically occur. Remedial action is necessary. A POOR condition is used when uncertainties exist as to critical analysis parameters, which identify a potential dam safety deficiency. Further investigations and studies are necessary.

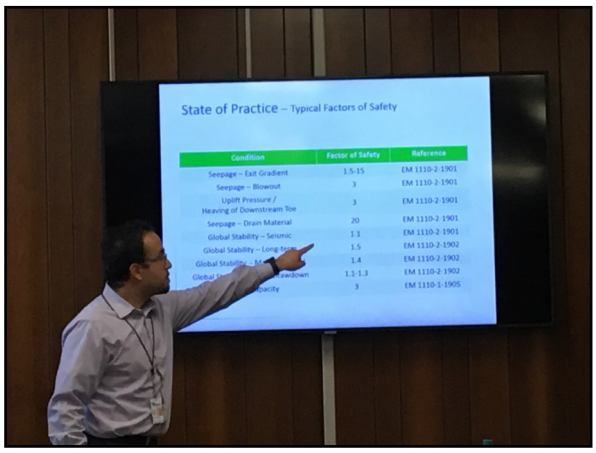
UNSATISFACTORY - A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.

NOT RATED - This should only be used if it is not possible to assess to dam's condition due to site constraints on visibility on the day of inspection. If vegetation is a problem the owner should be ordered to perform maintenance to remove it before the next visit.

Dam Safety Program staff members performing inspections in the field

Investment in Knowledge

One consequence of the increase in staffing for the Dam Safety Program is that the many new hires since 2015 require an investment of time and resources for training, education, and development. Having an engineering firm under contract has proved invaluable for staff training and development. Starting with HDR Engineering in October 2015 and transitioning to CDM Smith in August of 2016, these engineering firms have provided technical assistance on complex permit application reviews, provided trainings on a wide array of dam safety-related concepts and developments, best practices in the field, and helped the Program develop a series of guidance documents and standard operating procedures. Through this assistance and these trainings and tools, staff are better prepared and capable of consistent decision-making and application of the Regulations Program-wide.



A CDM Smith engineer conducts a training for DHEC staff on seismic hazards

Furthermore, staff have taken advantage of the offerings and opportunities made available by FEMA and professional organizations such as the Association of State Dam Safety Officials (ASDSO) for courses, webinars, and conferences held nationwide. Because of its invaluable experiences over the last 5 years and its efforts in rebuilding the Program, staff are frequent invitees to make presentations at conferences around the country.

A Dam Safety Program staff member presents at the National Dam Safety Technical Seminar in Emmitsburg, Maryland, on February 18, 2020

Investment in People

It takes a dedicated team of engineers and support staff to carry out the duties of the Program. These individuals are committed to working with dam owners and their engineers to make the dams that DHEC regulates safe. Interactions with dam owners come in the form of routine inspections, telephone calls, meetings to discuss repair plans and strategies, and presentations to homeowners associations and other groups. It is in these venues that DHEC staff have the opportunity to serve as a resource to dam owners.

The past decade has seen a revitalization in the Program, bringing it to a point where adequate resources are in place to meet the inspection and permitting needs brought about by the renewed focus on the critical role dams play in the state. The current Program staffing model includes a full-time manager to oversee the day-to-day operations of the Program. That role is supported by a team of engineers and support staff housed within the Bureau of Water in Columbia who focus on permitting for the repair of regulated dams, development of emergency action plans, and inspection of dams.

Permits Issued by Calendar Year	Count
2016	65
2017	89
2018	64
2019	85
TOTAL	303

DHEC's Dam Safety Program visits the recently rebuilt Cary's Lake Dam in Richland County

Investment in People

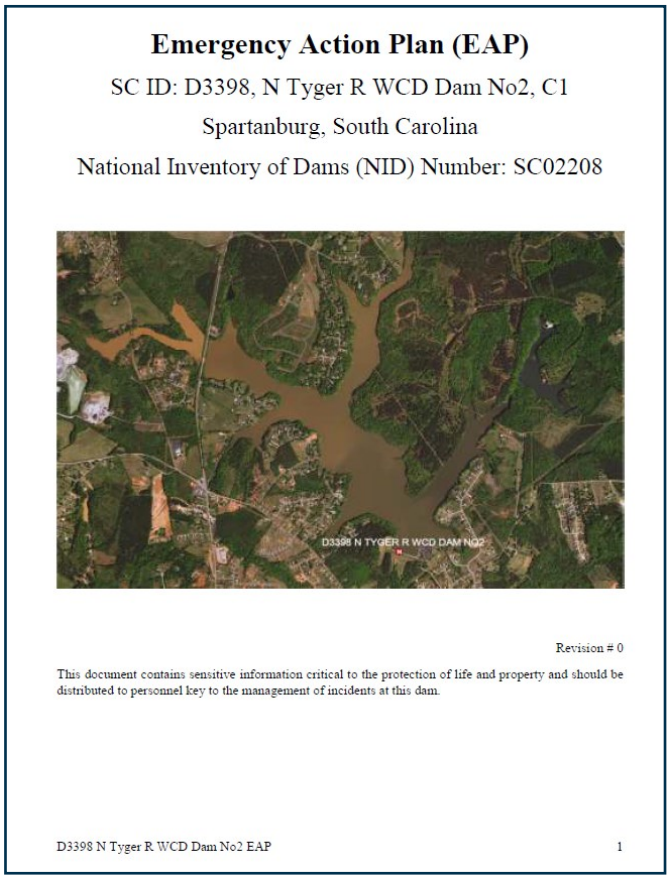
The other vital half of the Program are the six regional engineers housed in DHEC's Bureau of Environmental Health Services' offices throughout the state. The focus of the regional dam safety engineers (RDE) is the routine inspection of the roughly 2,300 state-regulated dams. Dam owners have come to rely on the regional engineers as a resource when they have questions regarding the safety or upkeep of their dam. Though the RDEs focus on inspections, they receive the same training in permit application reviews as the engineers housed within the Bureau of Water.

DHEC Regional Staff Listing

Area	Regional Office	Dam Safety Staff	Office Phone	Mobile Phone
1	Anderson	Hannah Vinson vinsonhm@dhec.sc.gov	864-260-5585	864-276-1907
2	Greenville	Chuck Owens owensc2@dhec.sc.gov	864-372-3273	864-561-1395
3	Columbia	Ryan Sullivan sullivrd@dhec.sc.gov	803-896-9548	843-992-0238
4	Florence	Jared Woodard woodarjc@dhec.sc.gov	843-673-6684	843-687-5991
5	Orangeburg	Dani Felkel felkeldh@dhec.sc.gov	803-533-5490	803-614-5222
6	Aiken	Brian Young youngbc@dhec.sc.gov	803-642-1637	803-995-0030

Investment in Services

Among the core values of the Dam Safety Program is embracing service to the citizens of South Carolina. Program staff interact on a daily basis with dam owners, individuals who live near dams, professionals in the Emergency Management field, and the consulting engineers who serve dam owners — all of whom rely on the knowledge and resources that only our staff can provide. The relationship between dam owners and their regional dam safety engineer (RDE), who performs the routine inspections of the dams and provides their advice and recommendations for maintenance and repair needs, is probably the most important service DHEC provides, as these face-to-face interactions serve to educate dam owners on how a dam functions as well as their responsibilities under the Act and the Regulations. The General Assembly's appropriations to increase the Program's recurring budget has provided for six of these positions in DHEC's regional offices around the state. The Department putting staff engineers dedicated solely to dam safety in the regional offices closest to the dams they regulate has resulted in relationships that are on a first-name basis. It is not uncommon for the RDEs to exchange text messages with the dam owners in their area, for example, when a storm is forecast or when a dam owner needs advice.



Emergency Action Plan (EAP)

SC ID: D3398, N Tyger R WCD Dam No2, C1

Spartanburg, South Carolina

National Inventory of Dams (NID) Number: SC02208

Revision # 0

This document contains sensitive information critical to the protection of life and property and should be distributed to personnel key to the management of incidents at this dam.

D3398 N Tyger R WCD Dam No2 EAP 1

Example of the cover page of an EAP

Emergency Action Plans (EAPs) guide dam owners and operators through who to call and what actions to take when a potential failure is occurring at their dam. Each high and significant hazard dam is required to have a current EAP. A staff review in the spring of 2017 highlighted the fact that many EAPs were out-of-date or insufficient to guide an owner through an incident. To help remedy this situation, the Program used college interns, most of whom are aspiring engineers, to review inundation mapping and populate lists of potentially inundated properties to aid in developing new EAPs for approximately 600 high and significant hazard dams. This effort resulted in pre-populated EAPs — where the vast majority of the EAP had been filled out — that were sent to dam owners with a request to review the document for accuracy and, if necessary, add telephone numbers or other notification methods for the downstream potentially inundated properties. These approximately 600 dam owners have been provided with a robust EAP that also serves as a guidebook to help them identify potentially hazardous conditions that could lead to failure of their dam. Going forward, the Program has plans to build an internet-based EAP application/website for dam owners to create and manage their EAPs and to also serve as a repository for EAPs for sharing with emergency management professionals.

Investment in Technology

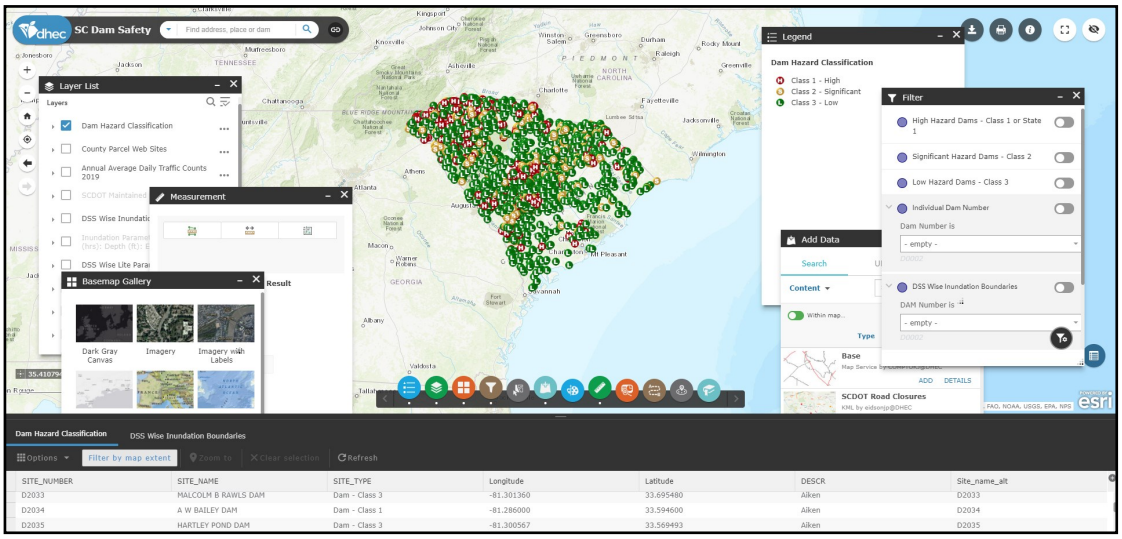
GIS and Web Applications

The Dam Safety Program's reliance on Geographical Information Systems (GIS) cannot be overstated, as this powerful software allows staff to see, manipulate, and understand any data that is geographically referenced to the Earth. DHEC has a dedicated GIS section staffed by professionals that are constantly innovating ways to utilize the copious amounts of spatial data available both internally and externally to the Department to improve the decision-making processes. The accessibility of statewide LiDAR (Light Distance and Ranging) provides staff an accurate baseline to measure elevations, slopes, heights, areas, and volumes at almost any location, and to create detailed contour maps of dams, impoundments, and areas subject to flooding in the event of dam failure. GIS also allows staff to create detailed, descriptive maps of dam break inundation areas for the use of dam owners and emergency management officials.

As more and more information is available online, development of GIS web applications has exploded. The Dam Safety Program has developed a GIS web application that is an indispensable tool for disseminating information on state-regulated dams to staff, dam owners, emergency management professionals, and the general public. Information available through the application includes:

- Location, name, ID number, and hazard potential classification of regulated dams
- The dam failure inundation area extent, depth of inundation, arrival time of maximum flood depth, and ground elevation for every High and Significant (and many Low) Hazard Potential dams regulated by DHEC
- Parameters for each dam that have been extracted, or "mined," from statewide LiDAR, including dam crest elevation, dam bottom elevation, dam height, normal pool surface area, maximum pool surface area, normal volume, and maximum volume
- Via its "Add Data" capability, the National Weather Service's vast array of weather data can be viewed geographically in relation to the location of dams in the state. This includes rain and wind forecasts as well as accumulated rainfall and observed winds.

Please visit the Dam Safety Program's GIS web application at: https://gis.dhec.sc.gov/scdams



Investment in Technology

ArcGIS Collector

Beginning with the Program's response to October 2015's historic floods, the Department has utilized a mobile app called ArcGIS Collector by ESRI for every major storm event. ArcGIS collector allows field staff to input dam data on-site and central office staff to view that data in real time. In addition to capturing the inspectors' observations, pictures and videos are also submitted. Central office staff view the "big picture" through the ArcGIS Online website, which shows the progress of field teams towards established goals via a summary "Dashboard" page. Furthermore, the ability to install the app on iPhone or Android, whether on DHEC or personal devices, allowed a large field team to be assembled and deployed to perform rapid assessments in the Flood of 2015, Hurricane Matthew, Hurricane Irma, Hurricane Florence, and Hurricane Dorian. The application itself is free to download but one must have necessary software licenses and assigned user accounts to collect data.

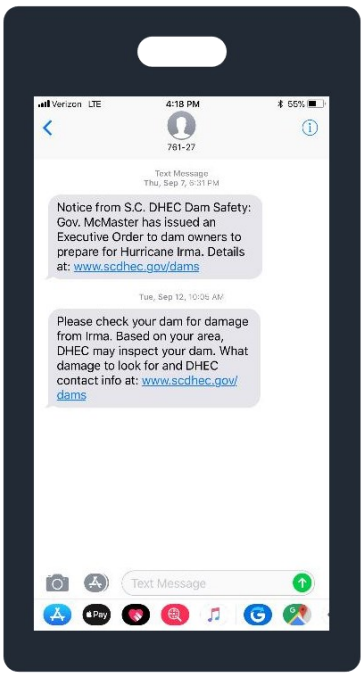
A DHEC post-storm assessment utilizing ArcGIS Collector

Inspections Performed

- October 2015 Flood: 660 over 17 days (Post)
- Hurricane Matthew: 474 over 5 days (Post)
- Hurricane Irma: 91 over 4 days (Pre) & 53 over 2 days (Post)
- Hurricane Florence: 263 over 5 days (Pre) & 287 over 3 days (Post)
- Hurricane Dorian: 31 over 2 days (Pre) & 32 over 1 day (Post)

CodeRED™

Following October 2015's historic rainfall, DHEC's Dam Safety Program realized that it was critical to have a mechanism to quickly and efficiently reach dam owners and operators when inclement weather is forecast. DHEC has contracted with OnSolve, Inc., to utilize its CodeRED™ emergency notification system. CodeRED™ allows DHEC to send automated voice calls, text messages and emails to owners and operators of regulated dams to alert them when the time arrives to begin preparing their dams for large volumes of inflow and for high winds. Thousands of messages can be sent in only minutes with this tool, which frees up staff for other necessary tasks during the critical days and hours prior to impacts arriving in the state.

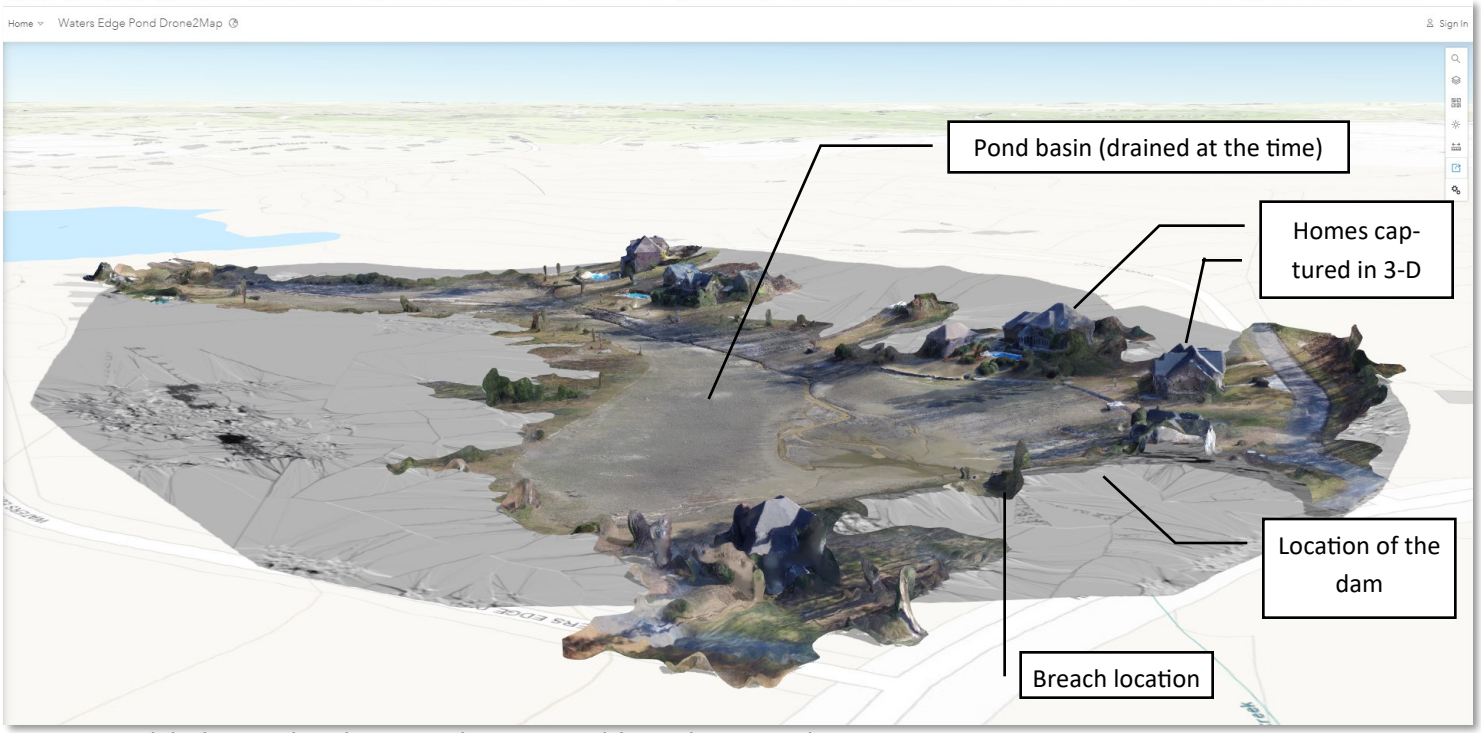


Investment in Technology

Drones and Bathymetry

The Program has at its disposal an unmanned aerial vehicle (UAV), or drone, for performing inspections of dams. The drone allows Program staff to access areas previously deemed unsafe or extremely difficult to enter. Drones can collect high-resolution pictures and video, and have the capability to produce topographic maps and 3-D models of ponds, dams and surrounding areas.

Program staff launch a drone to collect aerial imagery of a dam



A 3-D model of a pond and surroundings created from drones and GPS survey

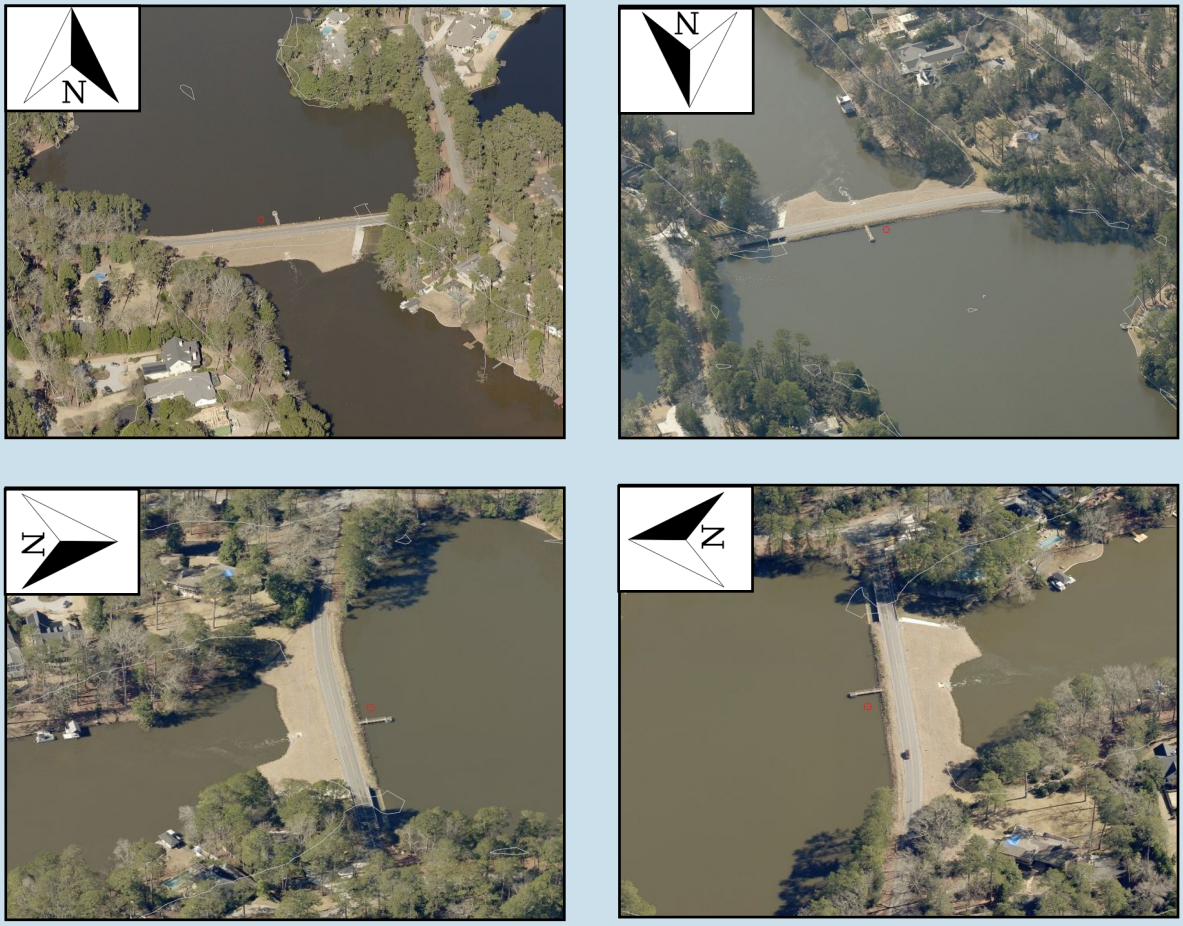
Bathymetry is the technique of mapping the bottoms of ponds, lakes, rivers, and the ocean. The Program uses bathymetry equipment to create detailed 3-D models of the impoundment created by a dam. These 3-D models allow staff to create elevation-storage relationships for impoundments, including the maximum impoundment volume, which is a critical input for dam breach computer modeling. This capability allows staff to determine with accuracy if a dam has the ability to impound 50 acre-feet or more of water. Previously regulated dams have been exempted as a result of this new capability.

The canoe setup used for performing bathymetric surveys

Investment in Technology

Pictometry

Imagery from services such as Google Earth, Google Street View, the National Agricultural Imagery Program, ESRI, Microsoft Bing, etc., is critical to the Program's mission as it allows surveillance, monitoring and measurement of features on the ground over time. Another imagery service, Pictometry from EagleView Technologies, provides additional sets of aerial imagery taken on different dates, at higher resolutions, and at oblique angles to the ground (Google and the other services provide orthogonal images taken at 90° to earth's surface). Pictometry's oblique imagery allows provides viewpoints from four directions (north, south, east and west), and thus is another useful tool in the Program's toolbox.



Images showing Spring Lake Dam in Richland County from 4 different perspectives available via EagleView Technologies' Pictometry service.

Investment in Technology

Dam Breach Modeling and Inundation Mapping

The Act and Regulations require the Department to make Hazard Potential Classification determinations for the dams it regulates. Furthermore, owners of High and Significant Hazard Potential dams are required by the Regulations to create and maintain EAPs that identify the at-risk properties downstream of a dam and have an emergency alert notification plan for informing those at risk if the dam is at or near failure. (For more on EAPs, see Page 29.) Hazard Potential Classification determinations require identifying at-risk properties, which cannot be done without first performing dam breach modeling and creating corresponding inundation maps. The Regulations place the responsibility of performing this modeling on the dam owners, and requires them to provide a description of properties located in the floodplain below the dam (to include number of homes, buildings, roads, utilities, and other property) that would be endangered should failure of the dam occur. By Regulation, the area in which properties are considered endangered is all locations where the water surface elevations increase a minimum of one foot as a result of the dam failure. Without dam breach inundation modeling, accurate delineation of this area of endangerment is simply not possible. Furthermore, dam breach inundation modeling is a highly technical undertaking that requires the expertise of a licensed Professional Engineer with specific training in the fields of hydrology and hydraulics and a knowledge of the failure mechanisms of earthen dams. The cost of dam breach inundation modeling can exceed $10,000 for a fully developed dam breach model and the corresponding report and mapping products, which can be prohibitive for a dam owner.

Primarily because of the cost and complexities described above, most dams do not have sufficient owner-provided inundation modeling and mapping. Prior to 2017, this made it virtually impossible to assign accurate and appropriate Hazard Potential Classifications to every state-regulated dam. Most of the Hazard Potential Classifications at the time were based on a simple visual check of properties immediately downstream of the dam without any real understanding of the downstream extent and depths of potential flooding. A Simplified Inundation Maps (SIMS) technique (a method not based on any physical computer-based model) did exist as a means to predict the downstream impact in the event of a dam failure, but this method is specifically caveated as not appropriate for hazard potential classification determinations but to be used solely in cases where no other inundation mapping existed for informing emergency management decisions (i.e., evacuations). This also meant that many High and Significant Hazard Potential dams did not fully comply with the requirements for EAPs as the identification of at-risk properties and an actionable emergency alert notification plan was either missing or could not be relied on.

Investment in Technology

Dam Breach Modeling and Inundation Mapping, Continued

The lack of available and reliable EAPs made response to the dam failures in October 2015 a challenge. Furthermore, the lack of comprehensive dam breach inundation modeling meant that for nearly the entire inventory, the Hazard Potential Classifications were suspect and unreliable. Exceptions generally included large utilities, industries, corporations, etc., where the requisite modeling had been performed.

Since 2017, DHEC and its engineering contractor have inspected and performed inundation modeling and mapping of 2,200+ dams to capture and correct those misclassified dams. With a team of engineers and interns, SCDHEC has utilized the dam breach modeling program DSS-WISE™ Lite to perform inundation modeling for nearly all of the dams in the SCDHEC inventory. (More information on DSS-WISE™ Lite can be found on Page 37.) In addition to performing dam breach modeling for purposes of Hazard Potential Classification determinations and for EAP preparation, DSS-WISE™ Lite has proven to be extremely useful during hurricane events to help emergency managers plan and prepare for impacts to dams in the hurricane's path. As of July 16, 2020, only about 5% of the total inventory (all currently classified Low Hazard Potential) remain to have inundation modeling and mapping completed (see figure on next page). South Carolina is the one of the only states in the nation to have such complete inundation mapping for the dams under state regulation.

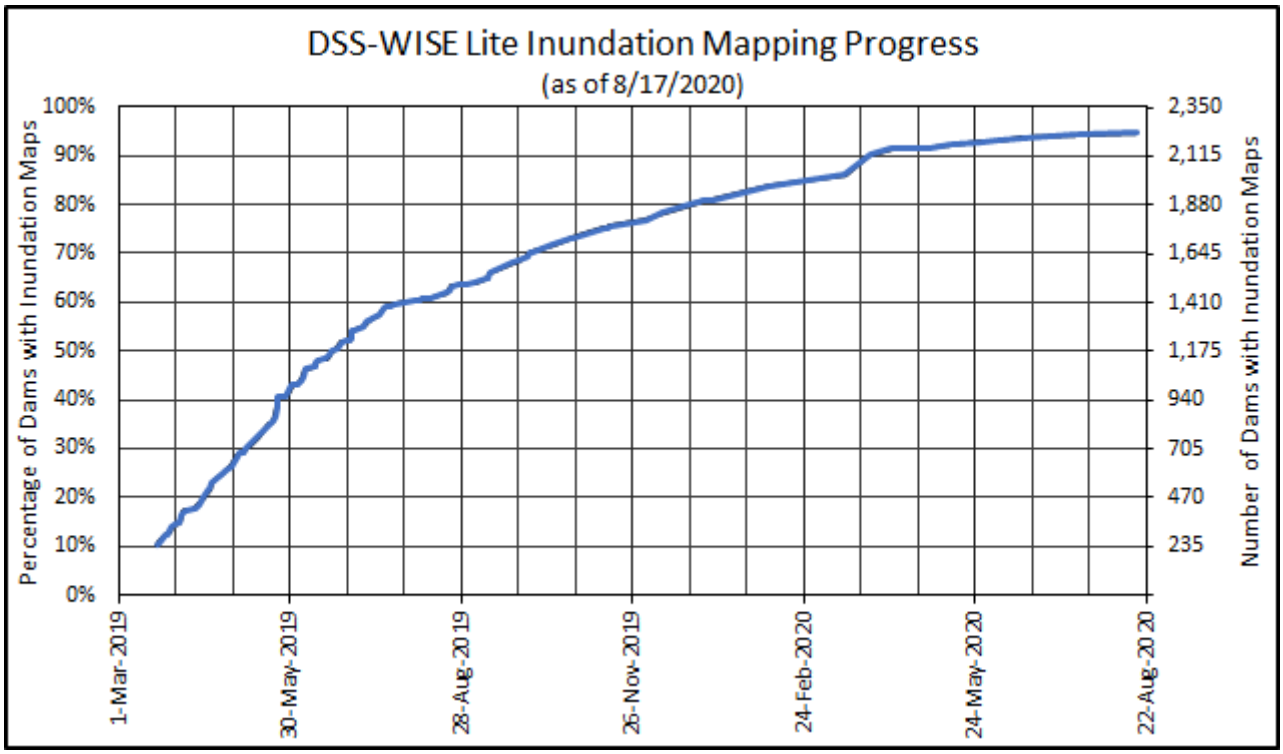
During this process, the Department has also identified dams which pose additional dangers and has a much better grasp of the inventory. As a consequence of this modeling and mapping initiative, the number of dams that have been identified as posing some hazard to life and/or property has increased sharply, highlighting the importance of the Program's role in public safety. The table below shows the change in hazard potential classifications from 2015 to 2020, primarily attributable to the Program's improved modeling capabilities.

Hazard Class	2015 Count	2015 Percentage	2020 Count	2020 Percentage
High	160	6.8%	540	23.7%
Significant	471	19.9%	286	12.6%
Low	1,732	73.3%	1,447	63.7%
TOTAL	2,363	100.0%	2,273	100.0%

Hazard Classifications for 2015 are as-submitted to the US Army Corps of Engineers for the National Inventory of Dams (NID) in 2015. Hazard Classifications for 2020 are as of 1 June 2020.

Investment in Technology

Dam Breach Modeling and Inundation Mapping, Continued

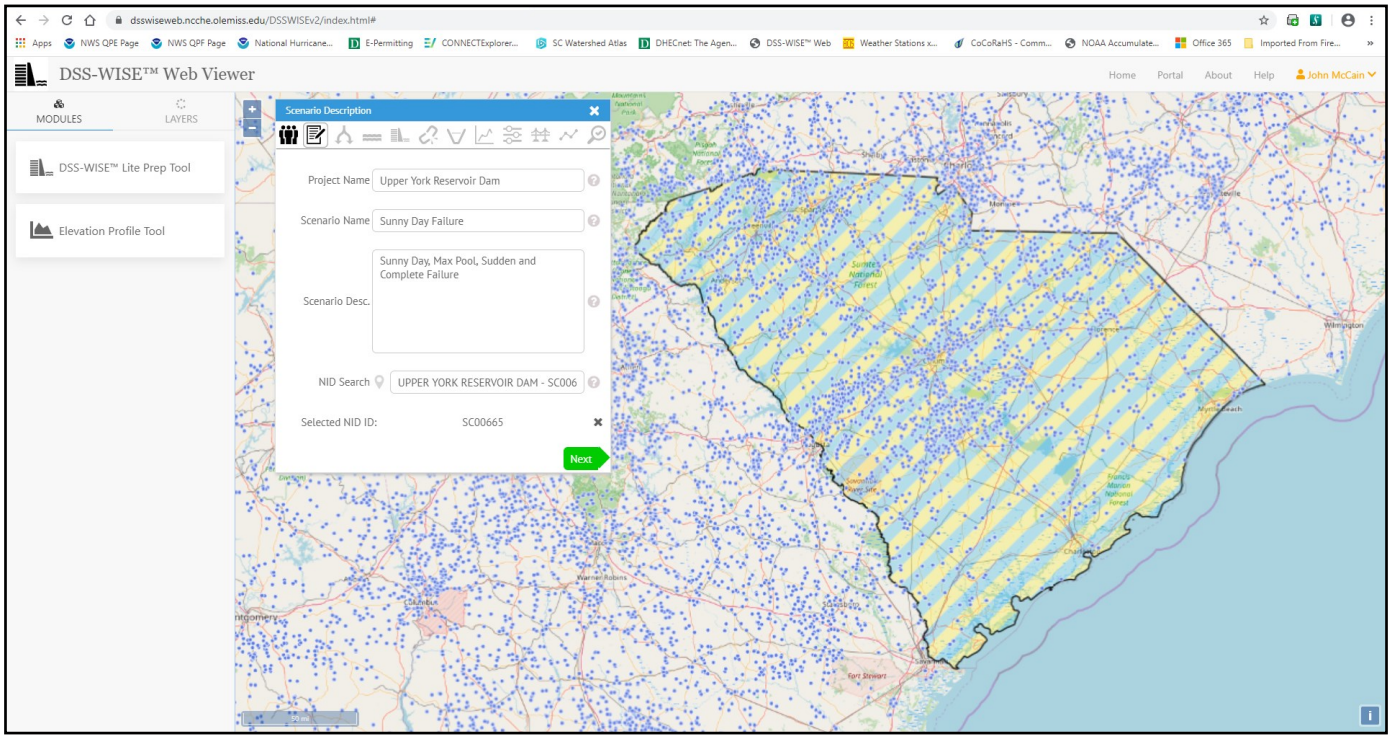


Investment in Technology

DSS-WISE™ Lite

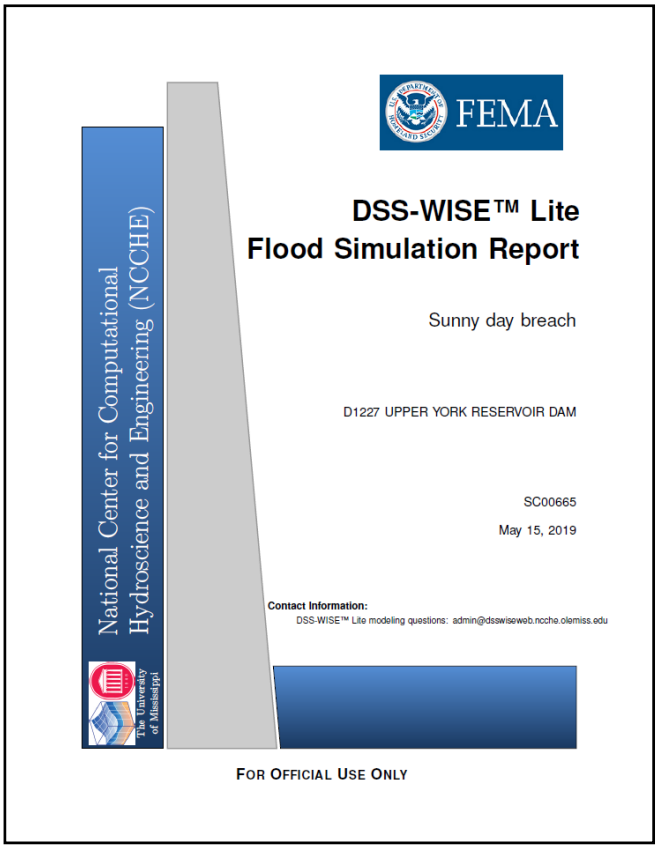
The Decision Support System for Water Infrastructural Security (DSS-WISE™) Lite, developed by the National Center for Computational Hydroscience and Engineering at the University of Mississippi and funded by FEMA, is a sophisticated yet easy-to-use inundation modeling software that allows the Dam Safety Program to perform simulations of dam failures to make better predictions of the impacts on downstream areas (i.e., depth of flooding, water velocity, flood wave arrival time, etc.).

FEMA makes DSS-WISE™ Lite available to state and federal dam safety agencies for free, and new capabilities and enhancements are regularly being brought online to enhance the accuracy of the model. When it was first released to State Dam Safety Programs in late 2016, DSS-WISE™ Lite relied on a very coarse terrain model that severely limited its accuracy and thus its usefulness. Improvements made in 2018 allowed South Carolina's own Light Distance and Ranging (LiDAR) data to be utilized as the terrain model, however at a 30-foot resolution. Additional updates in 2019 resulted in a 10-foot resolution for the state's LiDAR as the terrain model and made it possible to run a simulation with as small as a 10-foot simulation cell size. At this time, DSS-WISE™ Lite represents one of the most powerful tools that the Program has in its toolbox for accomplishing its mission of protecting the public from unsafe dams.

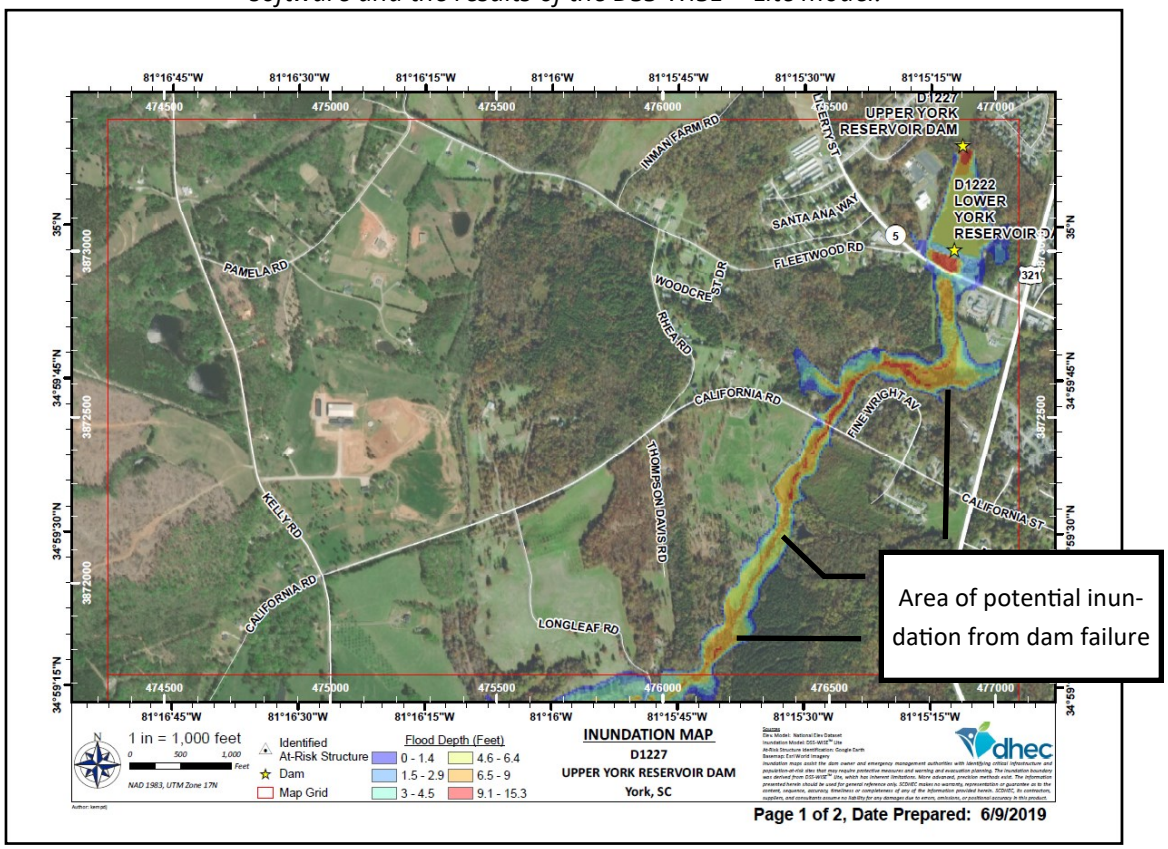


Screenshot of the DSS-WISE Lite setup screen in a web browser. No special software is needed. Graphical interface makes setting up and launching a simulation very user-friendly.

Investment in Technology



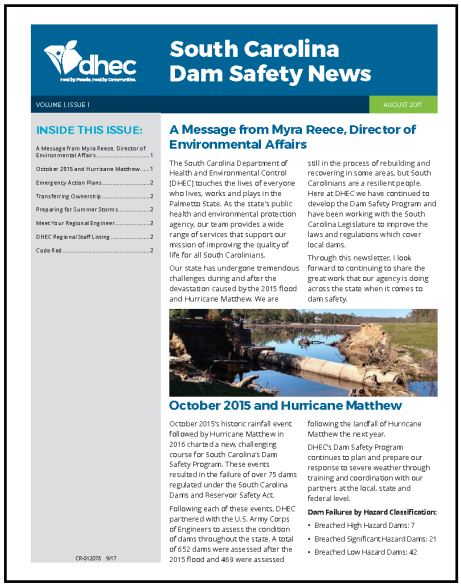
Products of inundation modeling with DSS-WISE™ Lite. Above, the report that is generated by the DSS-WISE™ Lite system that documents the inputs and outputs of the simulation. Below, an inundation map generated by DHEC staff using GIS software and the results of the DSS-WISE™ Lite model.



Investment in Outreach

DHEC has increased its efforts to provide education and training for dam owners in the form of multiple outreach initiatives.

The Program's main outreach initiative is the annual newsletter distributed to all owners of state-regulated dams. The inaugural issue of this newsletter was in August 2017 and has been followed up by a new issue every year. Complementing the newsletter, a Technical Information Bulletin is being sent to all dam owners providing information and instructions for maintaining and operating a dam. The inaugural Technical Information Bulletin of June 2020 instructed dam owners on how to install a temporary siphon system when it is necessary to lower the water level of a pond or reservoir where no other means exist. In subsequent years, the newsletter and Technical Information Bulletins will be sent 6 months apart.



South Carolina Dam Safety News

VOLUME 1 ISSUE 1 AUGUST 2017

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A Message from Myra Reece, Director of Environmental Affairs

The South Carolina Department of Health and Environmental Control (DHEC) touches the lives of everyone who lives, works and plays in the Palmetto State. As the state's public health and environmental protection agency, our team provides a wide range of services that support our mission of improving the quality of life for all South Carolinians.

Our state has undergone tremendous challenges during and after the devastation caused by the 2015 flood and Hurricane Matthew. We are still in the process of rebuilding and recovering in some areas, but South Carolinians are a resilient people. Here at DHEC we have continued to develop the Dam Safety Program and have been working with the South Carolina Legislature to improve the laws and regulations which cover local dams.

Through this newsletter, I look forward to continuing to share the great work that our agency is doing across the state when it comes to dam safety.

October 2015 and Hurricane Matthew

October 2015's historic rainfall event followed by Hurricane Matthew in 2016 charted a new, challenging course for South Carolina's Dam Safety Program. These events resulted in the failure of over 75 dams regulated under the South Carolina Dams and Reservoir Safety Act.

Following each of these events, DHEC partnered with the U.S. Army Corps of Engineers to assess the condition of dams throughout the state. A total of 652 dams were assessed after the 2015 flood and 469 were assessed following the landfall of Hurricane Matthew the next year.

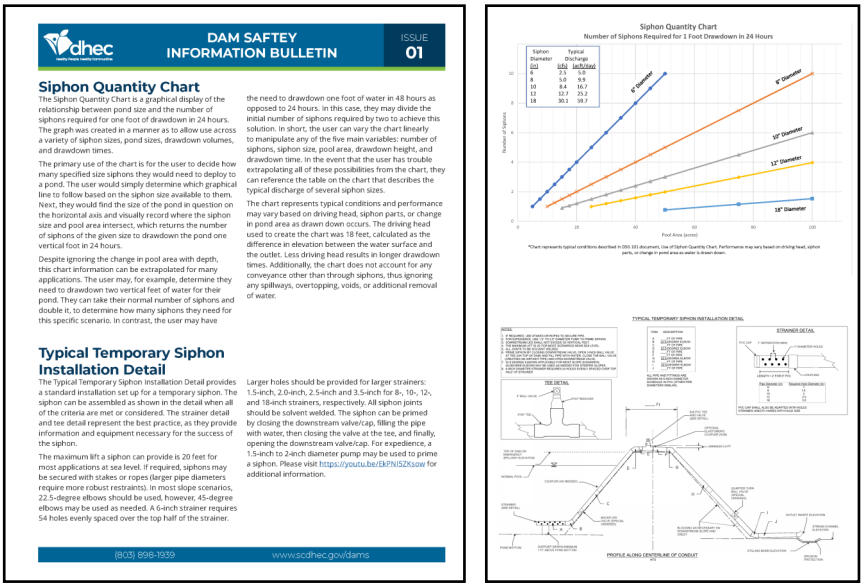
DHEC's Dam Safety Program continues to plan and prepare our response to severe weather through training and coordination with our partners at the local, state and federal level.

Dam Failures by Hazard Classification:

- Breached High Hazard Dams: 7
- Breached Significant-Hazard Dams: 21
- Breached Low Hazard Dams: 42

CR-012078 9/17

Volume 1, Issue 1 of the Dam Safety Newsletter (August 2017)



DAM SAFTEY INFORMATION BULLETIN

ISSUE 01

Siphon Quantity Chart

The Siphon Quantity Chart is a graphical display of the relationship between pond size and the number of siphons required for one foot of drawdown in 24 hours. The graph was created in a manner as to allow use across a variety of siphon sizes, pond sizes, drawdown volumes, and drawdown times.

The primary use of the chart is for the user to decide how many specified size siphons they would need to deploy to a pond. The user would simply determine which graphical line to follow based on the siphon size available to them. Next, they would find the size of the pond in question on the horizontal axis and visually record where the siphon size and pool area intersect, which returns the number of siphons of the given size to drawdown the pond one vertical foot in 24 hours.

Despite ignoring the change in pool area with depth, this chart information can be extrapolated for many applications. The user may, for example, determine they need to drawdown two vertical feet of water for their pond. They can take their normal number of siphons and double it, to determine how many siphons they need for this specific scenario. In contrast, the user may have the need to drawdown one foot of water in 48 hours as opposed to 24 hours. In this case, they may divide the initial number of siphons required by two to achieve this solution. In short, the user can vary the chart linearly to manipulate any of the five main variables: number of siphons, siphon size, pool area, drawdown height, and drawdown time. In the event that the user has trouble extrapolating all of these possibilities from the chart, they can reference the table on the chart that describes the typical discharge of several siphon sizes.

The chart represents typical conditions and performance may vary based on driving head, siphon parts, or change in pond area as drawn down occurs. The driving head used to create the chart was 18 feet, calculated as the difference in elevation between the water surface and the outlet. Less driving head results in longer drawdown times. Additionally, the chart does not account for any conveyance other than through siphons, thus ignoring any spillways, overtopping, voids, or additional removal of water.

Typical Temporary Siphon Installation Detail

The Typical Temporary Siphon Installation Detail provides a standard installation set up for a temporary siphon. The siphon can be assembled as shown in the detail when all of the criteria are met or considered. The strainer detail and tee detail represent the best practice, as they provide information and equipment necessary for the success of the siphon.

The maximum lift a siphon can provide is 20 feet for most applications at sea level. If required, siphons may be secured with stakes or ropes (larger pipe diameters require more robust restraints). In most slope scenarios, 22.5-degree elbows should be used, however, 45-degree elbows may be used as needed. A 6-inch strainer requires 54 holes evenly spaced over the top half of the strainer. Larger holes should be provided for larger strainers: 1.5-inch, 2.0-inch, 2.5-inch and 3.5-inch for 8-, 10-, 12-, and 18-inch strainers, respectively. All siphon joints should be solvent welded. The siphon can be primed by closing the downstream valve/cap, filling the pipe with water, then closing the valve at the tee, and finally, opening the downstream valve/cap. For expediency, a 1.5-inch to 2-inch diameter pump may be used to prime a siphon. Please visit https://youtu.be/EkPNI5ZKsow for additional information.

(803) 898-1939 www.scdhec.gov/dams

Volume 1, Issue 1 of the Dam Safety Technical Information Bulletin (June 2020)

Another initiative has been to provide workshops and courses, both in-person, and (in the age of COVID-19) via the internet. For these workshops and courses, DHEC has leveraged its partnerships with other agencies and organizations (see Pages 40-41) to provide multiple training and education opportunities. The Program utilizes DHEC's YouTube channel as a distribution method for videos and recordings of these workshops, courses, and webinars. Links to the videos are available at the Program's website at www.scdhec.gov/dams.

The Program's internet presence, via the website above and the GIS-based web application at https://gis.dhec.sc.gov/scdams, provides dam owners with a wealth of resources for training, education, planning, and preparedness, so that dam owners have the tools and knowledge they need to be effective partners in achieving our joint mission of protecting public safety and welfare.

Investment in Partnerships

The Dam Safety Program is not alone in ensuring that dams are constructed properly, operated safely, and maintained adequately, and that emergency situations are properly managed to minimize impacts to human life and property. Other agencies and organizations—described below—are effective partners. The funds allocated to the Program have helped foster relationships with our partners which has enhanced the Program's impact.

Clemson University Cooperative Extension Service

The Dam Safety Program provides dam safety regulatory guidance to Clemson Extension, which uses the information to educate dam owners and managers. Program staff are regularly invited to provide instruction on dam safety as part of Clemson's Master Pond Manager classes.

South Carolina Department of Transportation (SCDOT)

The Program coordinates with the SCDOT in matters concerning roads located on or near dams. This includes emergency closures when a road's integrity may be threatened by a distressed dam, coordinating repair efforts with dam owners, and keeping the public advised of dam repair activities as they affect the transportation network.

National Weather Service (NWS)

The NWS provides a vast array of forecasts and weather data relevant to the field of dam safety, and is a trusted source of information for Program decision making before and after rainfall events. For example, the Program relies on the NWS' rainfall forecasts to know the appropriate times and locations to send pre-storm alerts of potential adverse weather conditions to regulated dam owners.

South Carolina Emergency Management Division (SCEMD)

Dam Safety Program staff participate in exercises and incident responses to ensure that SCEMD decision makers have access to the best available information concerning dam safety issues. Dam Safety Program staff also routinely participate in SCEMD's meetings with County Emergency Managers.

US Army Corps of Engineers

The US Army Corps of Engineers (USACE) is one of the nation's leading proponents of dam safety. At a national level, the USACE provides vast tools and resources that benefit all dam regulators and dam owners. At a local level, it provides staff augmentation for emergency assessment and recovery efforts. Program staff and the USACE coordinate activities when a landowner is planning dam construction or modification in areas under USACE jurisdiction, which includes navigable waters and Waters of the United States. Program staff participate in Corps of Engineers dam inspections for dams that the USACE regulates.

Investment in Partnerships

Federal Emergency Management Agency

The Department of Homeland Security and the Federal Emergency Management Agency provide valuable resources and training to help support state dam safety programs. They also provide staff to assist in evaluation and recovery efforts following major weather events. FEMA provides funding for Dam Safety staff members to participate in monthly Association of State Dam Safety Officials training events. FEMA also provides grants to DHEC to fund dam safety efforts. FEMA also supports states' free access to the DSS-WISE™ Lite software. In 2020, FEMA and DHEC partnered on a series of webinars targeted to community associations (such as homeowners associations) that own dams and must deal with a very unique set of challenges not experienced by other dam owners. These challenges include a rotating cast of board members or officers, potentially outdated covenants and by-laws, potential difficulty raising funds quickly for unexpected maintenance or repair costs -- either due to inability to reach consensus among members or unavailability of bank loans -- and more. These webinars were recorded and have been posted on the Program's website.

Association of State Dam Safety Officials (ASDSO)

The ASDSO provides an array of services to state dam safety officials and to dam owners. ASDSO offers many training opportunities including monthly webinars related to dam safety topics. DHEC routinely sends staff members to multi-day training courses offered by ASDSO so staff stay current on trends and developments in the field of dam safety. In November 2018, DHEC hosted an ASDSO Dam Owners Workshop at DHEC's headquarters. A recording of the workshop is available on the Program's website.

Dam Owners Workshop conducted by ASDSO at DHEC's 2600 Bull Street headquarters in Columbia on November 9, 2018. Recordings from the workshop are available via the Dam Safety Program's website at www.scdhec.gov/dams

Challenges for Dam Safety

Program staff look forward to working with dam owners, our technical and community partners, and other groups to face continuing and emerging challenges.

- ***Dam Ownership***

  One of the most challenging tasks faced by the Dam Safety Program is determining who owns and is responsible for the upkeep of a dam. Over time, as property is sold (and resold), parcel lines are drawn through the middle of dams, along the crest line, around outlet structures, etc. Furthermore, titles, plats, deeds and other records have to be researched and traced back over several ownership changes, which usually means many decades back. Easements and rights-of-way for roads and utilities located in/on dams only further complicates these situations. Very frequently, the Program is unable to make a definitive determination of ownership, and it is only through the court system that the responsible parties can be identified.

- ***Age of dams***

  Dams, like roads, buildings, and bridges, are man-made structures which have a finite lifespan. If regular maintenance is deferred (or ignored) during the dam's lifetime, the useful life of the structure is reduced. The average age of regulated dams in South Carolina is just over 60 years, with at least 50 dams constructed prior to 1900 still in service. See Pages 17-18. As dams age, the need for repair and rehabilitation only increases, and the scope of those repairs grows more costly, while at the same time the dams become more susceptible to failure.

- ***Cost to Dam Owners***

  As stated above, many of the dams in South Carolina are well past their service life, and as they age, the costs to repair only increase. Privately-owned dam owners only have a small state tax credit (maximum $2,500) to help offset the cost of repairs, and this tax credit is limited to dams that serve a specific purpose established in state law (see S.C. Code Ann. § 12-6-3370). Publicly-owned dams fare only slightly better, due to the availability of federal grants that can help fund dam rehabilitation for this set of dam owners. Repairs can range from several thousands of dollars for tree removal to millions of dollars to rebuild a dam that has breached. Owners bare the entire burden of these repairs. Even a dam owner that wants to remove a dam is faced with a project that can easily exceed one-hundred thousand dollars and require multiple federal, state, and local permits and approvals.

Challenges for Dam Safety

- ***Funds for State Action on Dams***

  There is currently no mechanism to replenish the funds available to the Dam Safety Program for construction and engineering contractors to take action on dams when owners are unwilling or unable to make their dams safe. The Department is only authorized under the Act to recover expenses from dam owners after an action has been taken.

- ***Public Roads on Dams***

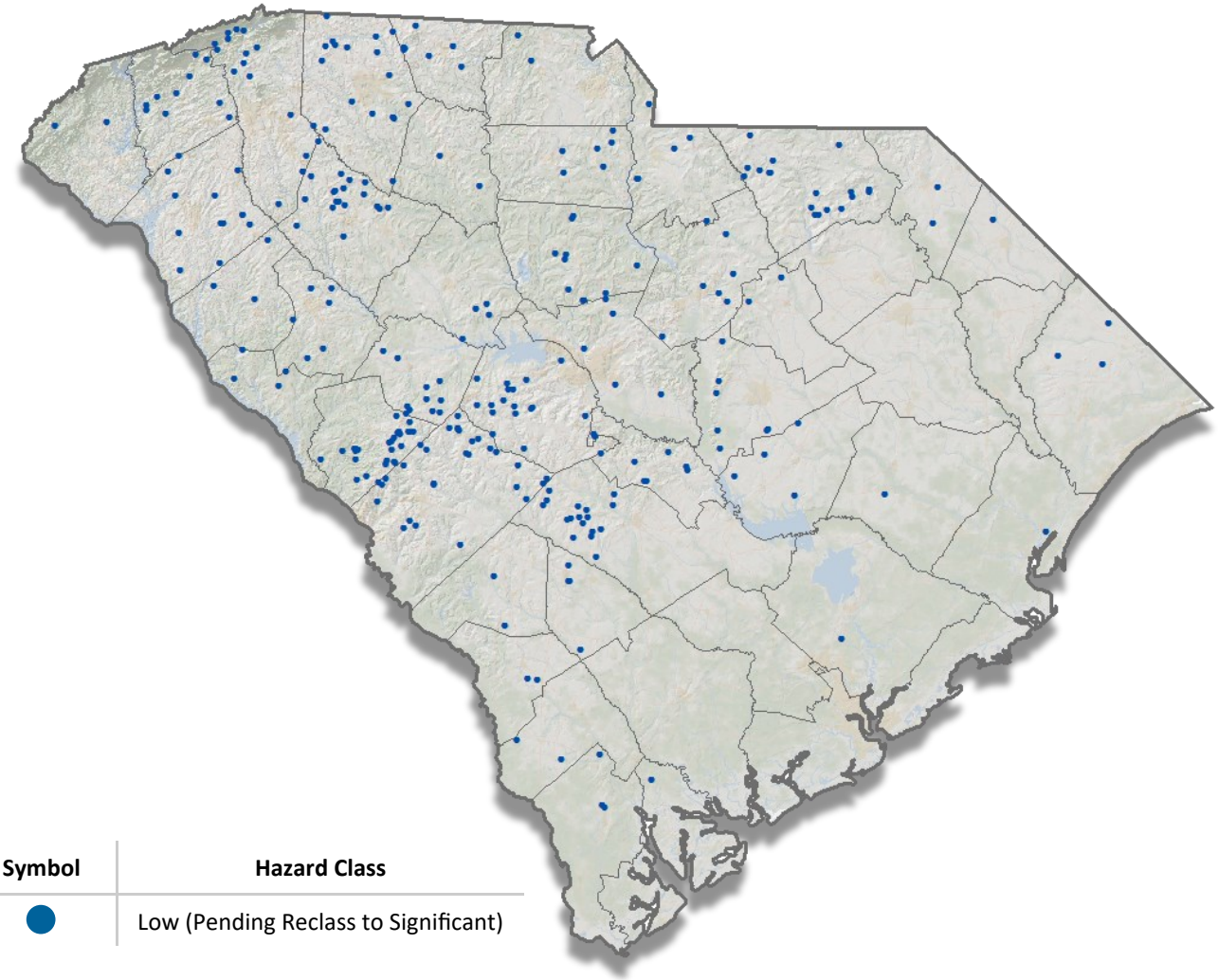
  Public roads on dams present a special challenge to the Department. In these situations, the dam not only serves as a structure that creates an impoundment, but also as the supporting structure/causeway for a public road. Just as with changing property owners and parcel lines over time, knowledge of who is responsible for maintenance of a dam below a road can be nearly impossible to determine without a court's ruling and this typically leads to an impasse, resulting in significant delays in returning roads on dams to service.

Impact of the Joint Resolution

Joint Resolution 231 (S.1190) states:

> "The General Assembly hereby directs the Department of Health and Environmental Control to focus the resources of the department's Dams and Reservoirs Safety Program on regulating the state's high and significant hazard dams only and reclassifying dams when the failure or improper operation of a dam will likely result in loss of human life."

The Dam Safety Program abides by this directive from the General Assembly, signed by the Governor on May 17, 2018, and has only reclassified dams either from Low or Significant Hazard Potential to High Hazard Potential (and in some cases, in a downward direction). The Department is aware of many dams currently classified as Low Hazard Potential that meet the regulatory description of a Significant Hazard Potential dam. Pursuant to the limitation on reclassifications in the Joint Resolution, Low Hazard Potential dams are not being formally reclassified to Significant Hazard Potential; however, Program staff will inspect these dams every three years as though they are Significant Hazard Potential and will provide the inspection results to the dam owners. As of June 1, 2020, there are 302 dams identified for reclassification from Low Hazard Potential to Significant Hazard Potential. See below for a map of these dams.



Symbol	Hazard Class
●	Low (Pending Reclass to Significant)

Financial Stewardship

Monetary Inputs to the Dam Safety Program

DHEC received $3,150,000 in the 2016-2017 Appropriations Act (Section 34.54: Home Health License Transfer) for flood response efforts. This was combined with $1,000,000 in DHEC carry-forward funds. The General Assembly also appropriated $595,000 in recurring funds, beginning in Fiscal Year 2017, to add six Engineer/Associate Engineer full-time equivalent (FTE) positions, an Environmental Health Manager FTE position, vehicle replacement, and equipment. In Legislative Session 122, with the passage of House Bill 3721, the General Assembly appropriated $4,893,750 in one-time funds becoming available in Fiscal Year 2018 for, among other things, response to Hurricane Matthew and inspection of 2,000 dams by the Dam Safety Program's contractor, CDM Smith. This was combined with $500,000 in DHEC carry-forward funds. All together, this represents a total increase in funds of $12,225,121. The cash flow into the Dam Safety Program since October 2015's Historic Flooding is as follows:

State Fiscal Year (SFY)	FEMA NDSP State Assistance Grant	FEMA HHPD Rehabilitation Grant	DHEC Carry-forward	Home Health License Transfer	Appropriations (One-Time Funds)	Appropriations (Recurring Funds)	Total
SFY 16	$207,577					$452,099	$659,676
SFY 17	$219,528		$1,000,000	$3,150,000		$1,064,000†	$5,433,528
SFY 18	$212,053		$500,000		$4,893,750	$996,278	$6,602,081
SFY 19	$204,725					$1,019,760	$1,224,485
SFY 20	$203,514	$301,821				$1,029,441	$1,534,776
Total	$1,047,397	$301,821	$1,500,000	$3,150,000	$4,893,750	$4,561,578	$15,454,546

† represents an increase of a recurring $595,000 starting in FY17

The additional recurring funds have stabilized and expanded the level of staffing for the Dam Safety Program (see Pages 27-28). The one-time funds have allowed the Department to contract with engineering firms, first HDR and currently CDM Smith, to help with virtually every aspect of fulfilling the regulatory duties and responsibilities of the Program. These engineering firms have provided technical training to improve the capabilities of Program staff and have given the Program access to experts in the various dam-safety-related engineering disciplines of geotechnical engineering, seismic analysis, structural engineering, and hydrologic and hydraulic (H&H) engineering for assistance in complex permit application reviews.

Financial Stewardship

Monetary Inputs to the Dam Safety Program, Continued

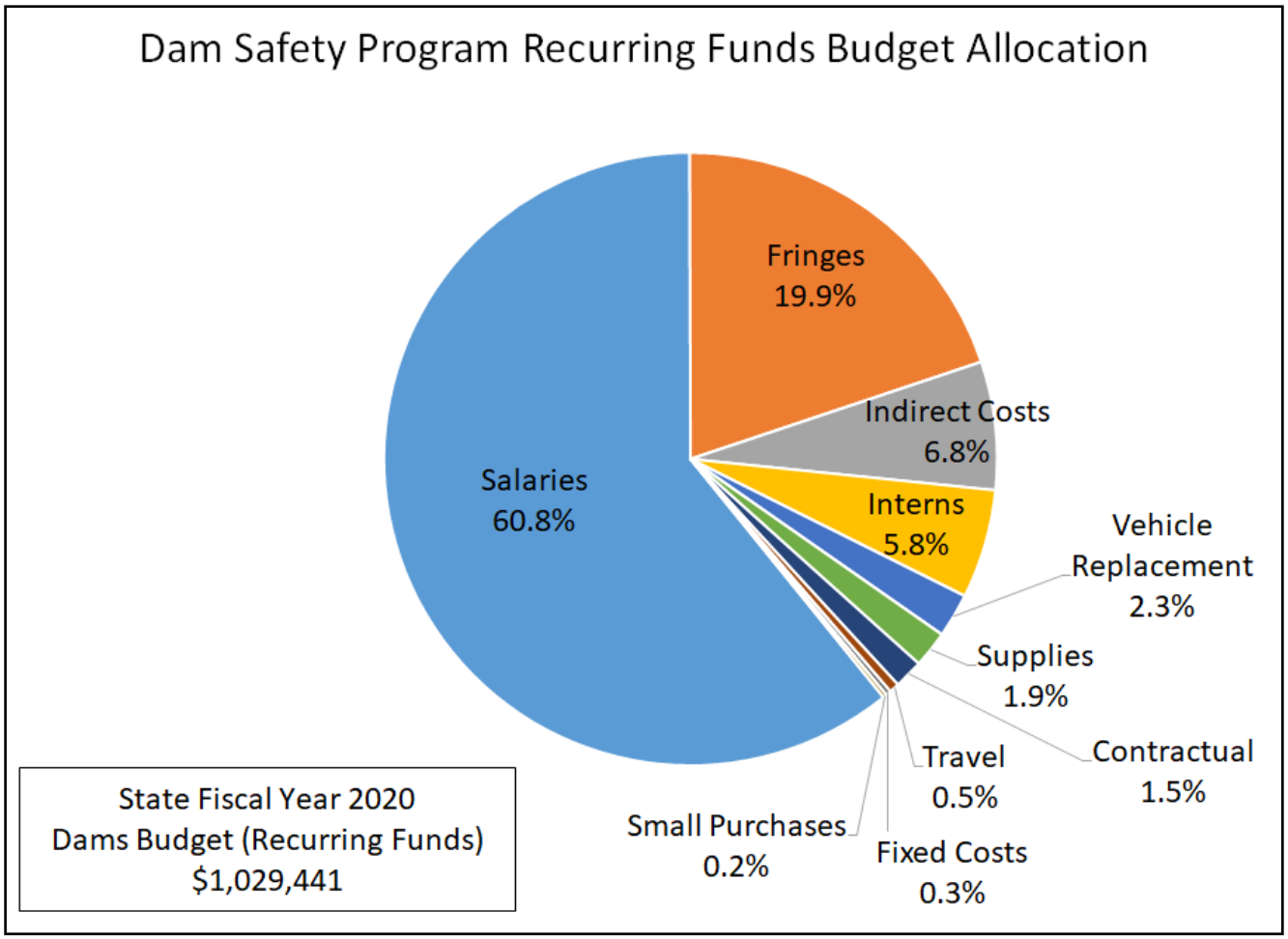
The Program continues to rely on an annual FEMA National Dam Safety Program State Assistance grant to partially fund positions in the Central and Regional offices. The grant award from FEMA fluctuates from year-to-year based on Congressional appropriations and the formula for determining individual awards to states, but averages approximately $200,000 per year.

In August 2019, DHEC was awarded a FEMA High Hazard Potential Dams (HHPD) Rehabilitation Grant in the amount of $301,821 for Federal Fiscal Year (FFY) 2019 for rehabilitation of the highest-risk High Hazard Potential Dams. This grant requires a 35% non-Federal cost share, so DHEC has contributed $162,519 in one-time funds towards this undertaking. DHEC applied for this grant for FFY 2020 and expects to receive an award, which the Program plans to use to make sub-awards to owners of eligible HHPDs. For the FFY 2020 grant, dam owners will be required to provide the 35% non-Federal cost share. To read more about the Program's initiative for risk assessments and risk ranking of HHPDs and rehabilitation of those dams representing the highest risk, please see Pages 22-23.

Financial Stewardship

Expenditures

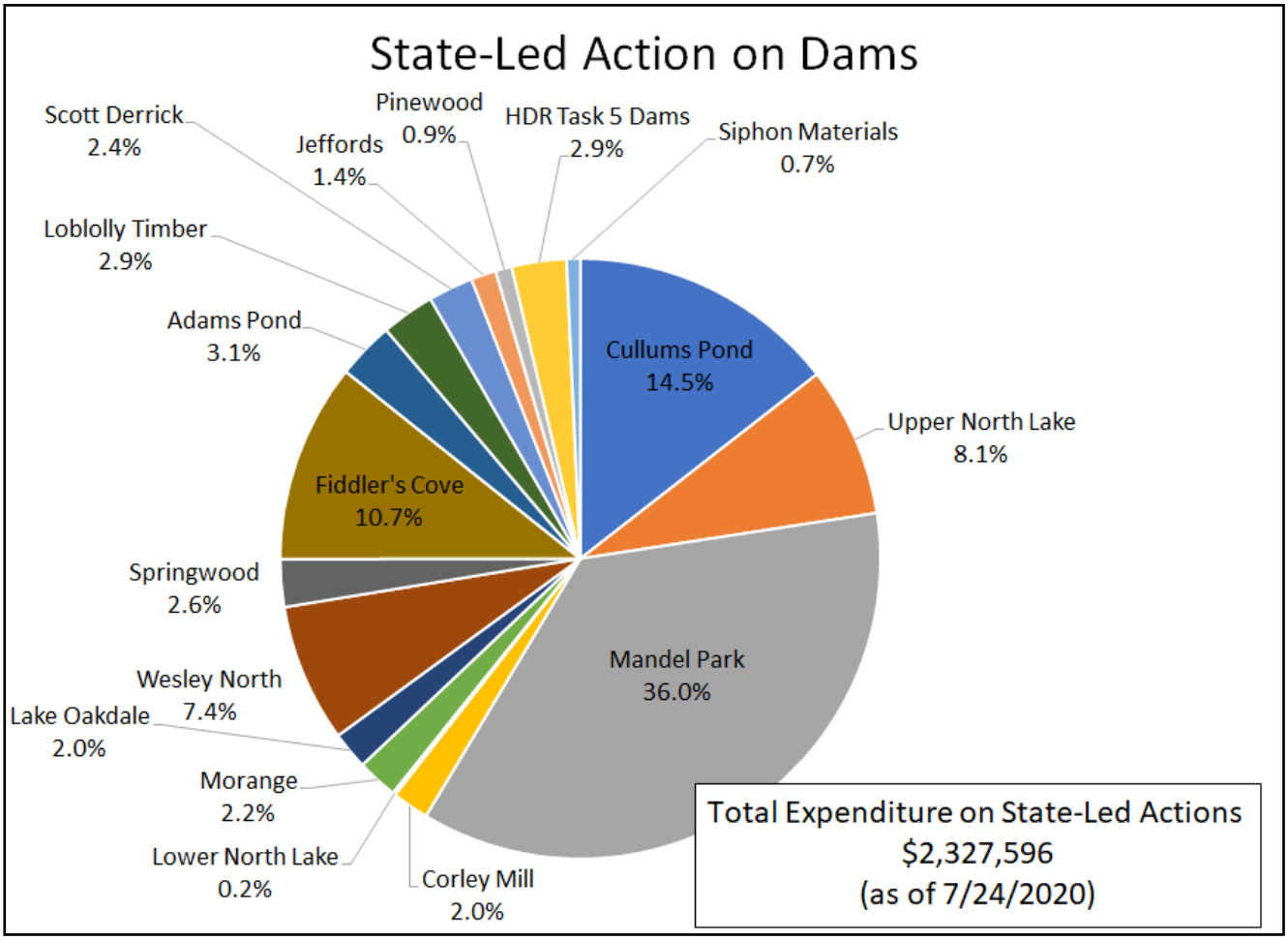
The recurring funds appropriated by the General Assembly are used primarily for staff salaries and associated fringes and indirect costs. A small percentage is used for vehicle replacement for the six regional engineers and the central office, and an even smaller percentage is used for travel, training, and equipment for Program staff. See figure of recurring funds expenditures below. The FEMA National Dam Safety Program State Assistance Grant also helps fund staff salaries and associated fringes and indirect costs.



Expenditures of non-recurring funds (e.g., state carry-forwards, Home Health Licensing proceeds, Legislative appropriations, and grants) have been primarily associated with flood and hurricane response activities (e.g., contractor costs for state-led action on dams and assistance with post-storm dam assessments) and with ongoing contractor Program support (e.g., technical assistance, inspections, staff training and development, inundation modeling and mapping, etc.).

Financial Stewardship

Expenditures, Continued



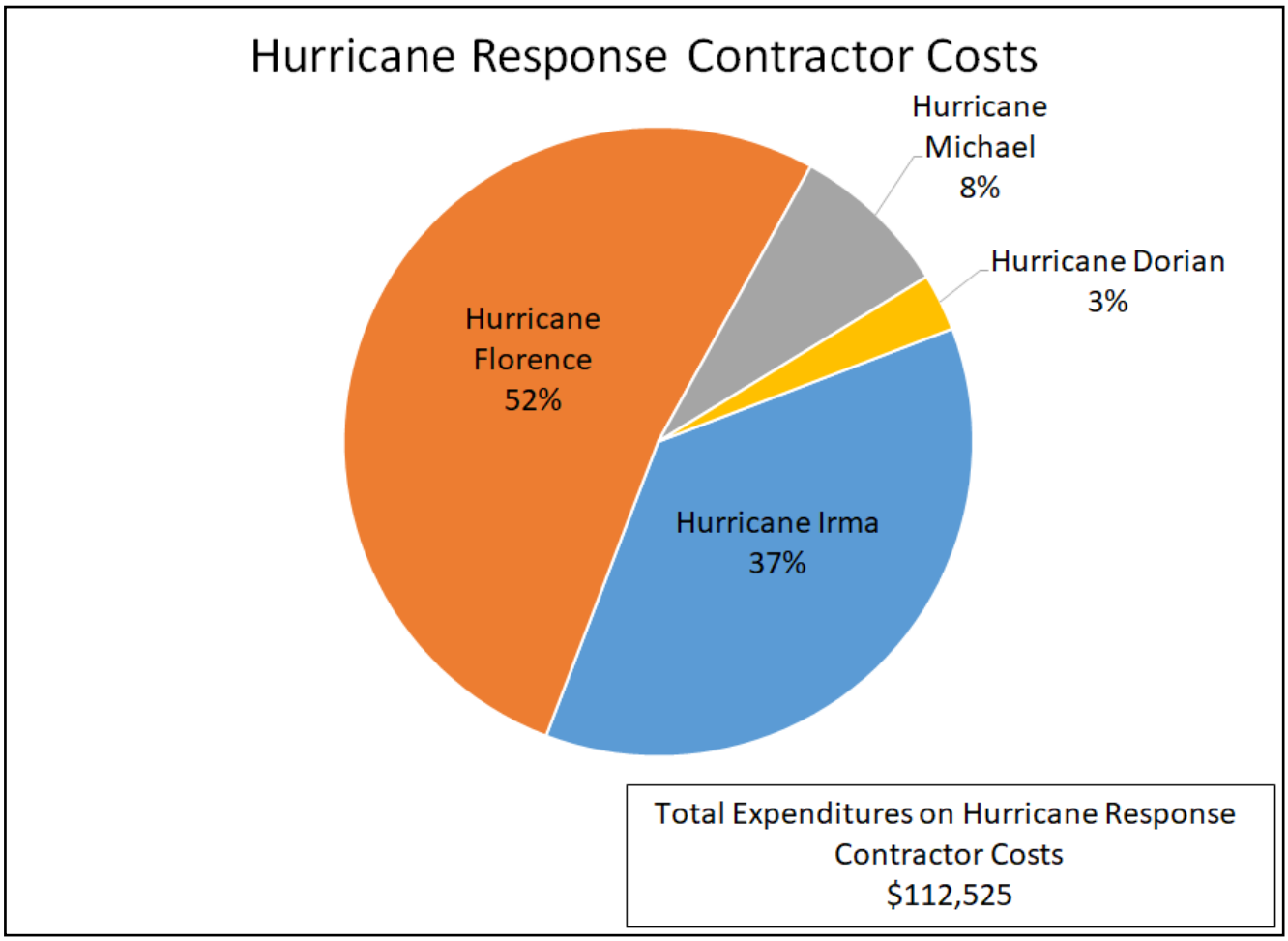
State-led actions on dams from October 2015 forward accounts for the Department's use of contractors (HDR, CDM Smith, Phillips and Jordan, Crowder Construction) to take action on dams when the owners either cannot or will not.

- Mandel Park Dam—$840,000. This dam was damaged in October 2015 and was the first dam removed by DHEC utilizing its construction and engineering contractors.
- Upper North Lake Dam—$188,000. This dam is currently under an Administrative Order requiring the owners to remove or repair the dam, but the Department has completed design work and obtained all necessary permits necessary to remove it using its construction contractor, if needed.
- Cullums Pond Dam—$336,000. This dam required deployment of the Department's construction contractor on multiple occasions to dewater the pond. The dam owner has since removed the dam under the terms of a Consent Agreement with the Department.
- Fiddler's Cove Dam—$248,000. The Department's construction contractor utilized pumps and siphons to dewater this reservoir until the dam owner (a Homeowners Association) could mobilize the resources necessary to hire an engineer and formulate necessary remediation and repair plans.
- Wesley North Dam—$174,000. Another dam removed by the DHEC using its construction contractor.

Financial Stewardship

Expenditures, Continued

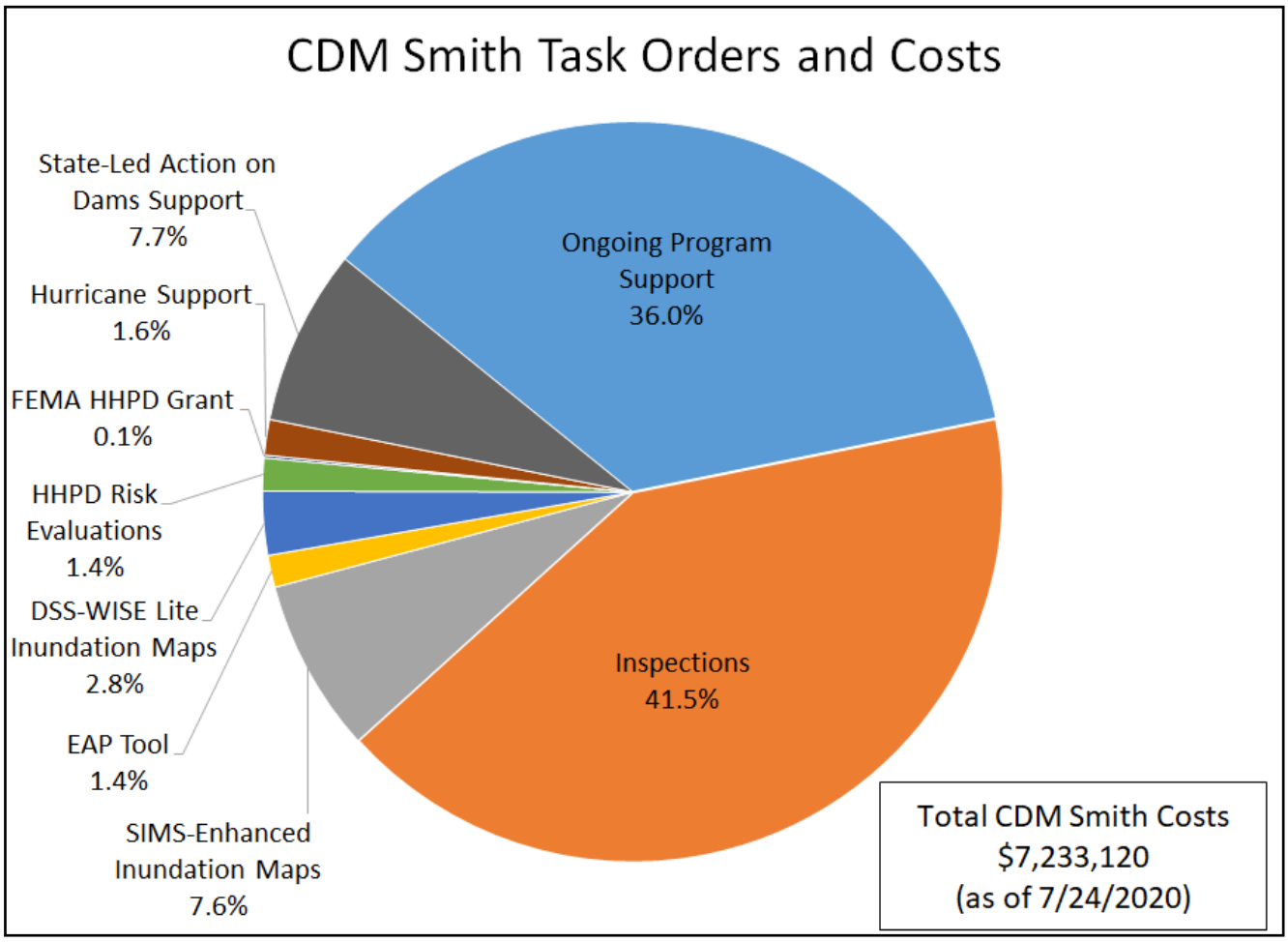
During Hurricanes Irma (2017), Florence (2018), Michael (2018), and Dorian (2019), the Program's engineering contractor, CDM Smith, was used to assist Program staff with performing rapid pre–storm assessments of dams forecast to receive the most rainfall from these storms and also rapid post-storm assessments of dams receiving the greatest rainfall amounts. Contractors were not used in this manner for Hurricanes Joaquin (2015) and Hurricane Matthew (2016) and thus are not included in the chart below.



Another expense that has been borne by the Dam Safety Program is the funding of a $185,000 study of repair and replacement options for the Lake Conestee Dam in Greenville County. The funds for this study, which was performed by Kleinschmidt Group and completed in October 2019, were originally appropriated by the General Assembly but vetoed by the Governor, resulting in the study being paid for by DHEC from funds appropriated for the Dam Safety Program.

Financial Stewardship

Expenditures, Continued



The Department has had the engineering firm CDM Smith under contract since August 2016 and has issued them multiple task orders that have benefited dam safety in the state.

- Inspections—$3,000,000 for inspection of 2,000 dams. See Page 24.
- Ongoing Program Support—$2,500,000 for assistance with complex permit application reviews, trainings, development of guidance and Standard Operating Procedures, and various other assigned tasks. See Page 26.
- SIMS-Enhanced Inundation Maps—$547,000 for inundation maps for 650 high and significant dams using the Simplified Inundation Mapping methodology with enhancements provided by CDM Smith. See Page 34.
- EAP Tool—$103,000 for the design and prototyping of an Emergency Action Plan (EAP) creation application/website for use by dam owners. See Page 29.
- DSS-WISE™ Lite Inundation Maps—$200,000 for quality assurance and quality control for production of inundation maps using the DSS-WISE™ Lite dam breach modeling software. See Pages 35-38.
- HHPD Risk Evaluations—$84,000 for development of the methodology for performing risk assessments of High Hazard Potential Dams (HHPD) and executing that methodology by performing over 300 risk assessments of HHPDs as part of the Department's transitioning to risk-informed decision making. See Pages 22-23.

Financial Stewardship

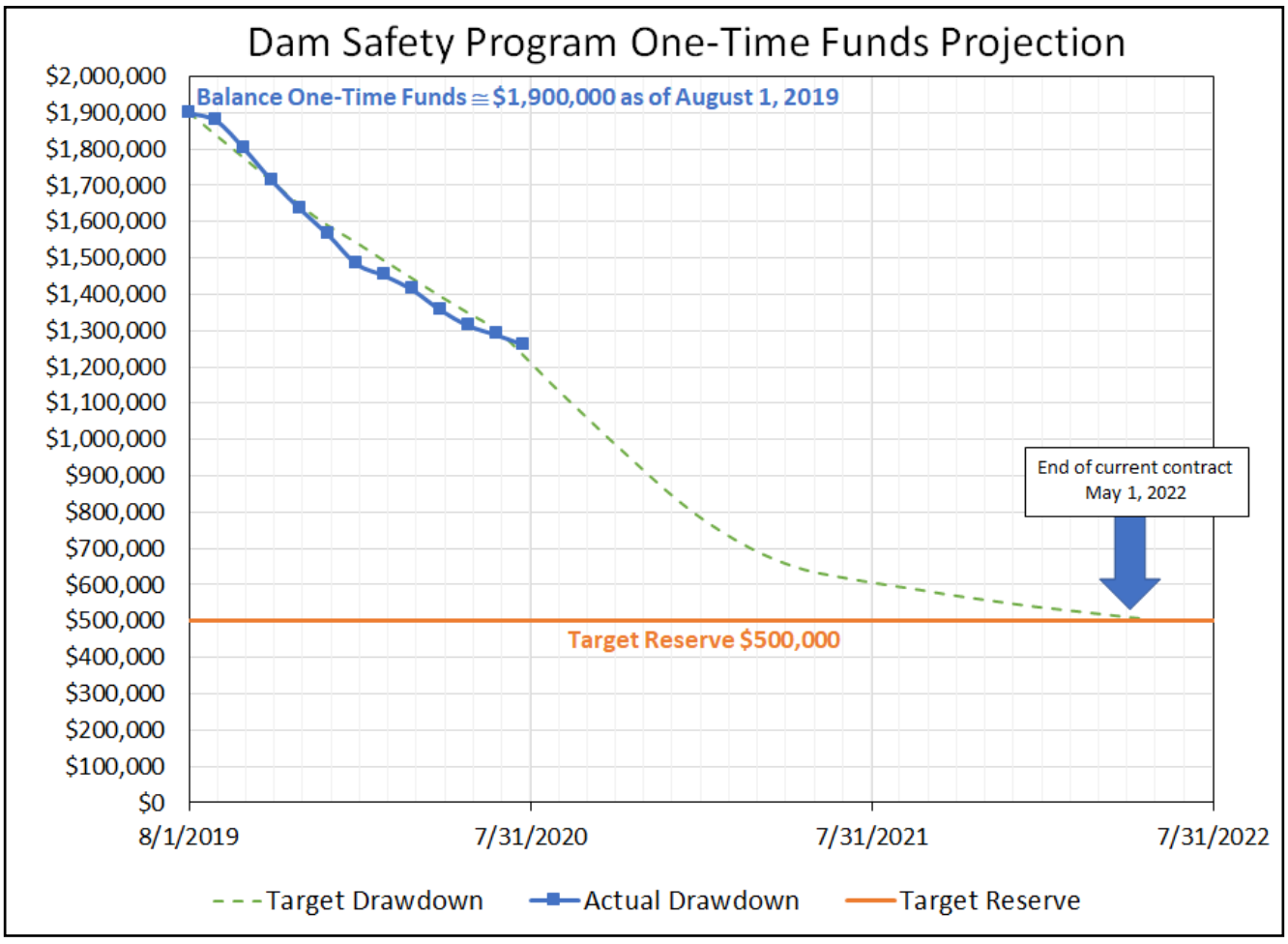
Expenditures, Continued

- FEMA HHPD Grant—$65,000 to further the HHPD Risk Evaluations where the highest risk dams are studied and quantitatively analyzed as part of a probable failure mode analysis. This work is funded 65% by a FEMA grant with a 35% state match. This effort is anticipated to continue through 2021 for a total task value of $464,340. See Page 23.

Financial Stewardship

Projected Utilization of Remaining Funds

The current contract with CDM Smith began on August 22, 2019, and expires on May 1, 2022. As good stewards of the public funds it manages, the Dam Safety Program has engaged in long-term planning with CDM Smith to ensure the remaining funds are expended prudently and that a reserve is maintained through the end of the contract to account for unforeseen expenses. As currently envisioned, the Program will reach the end of the current contract with CDM Smith with a reserve of $500,000; however, this reserve could easily be depleted by the end of the contract given the occurrence of severe hurricane or tropical system impacts to South Carolina and/or the need for the Department to take actions on dams where the owners are unable or unwilling to do so. The chart below illustrates the remaining balance of one-time funds as of August 1, 2019, at roughly the start of the current contract, and the gradual ramp down of CDM Smith assistance through the end of the contract. Going forward, it is envisioned that the role of the Program's engineering contractor will be primarily to provide technical assistance with reviews of highly complex permit applications and to provide construction engineering services and construction contractor management on state-led action on dams.



Appendix A — Maps

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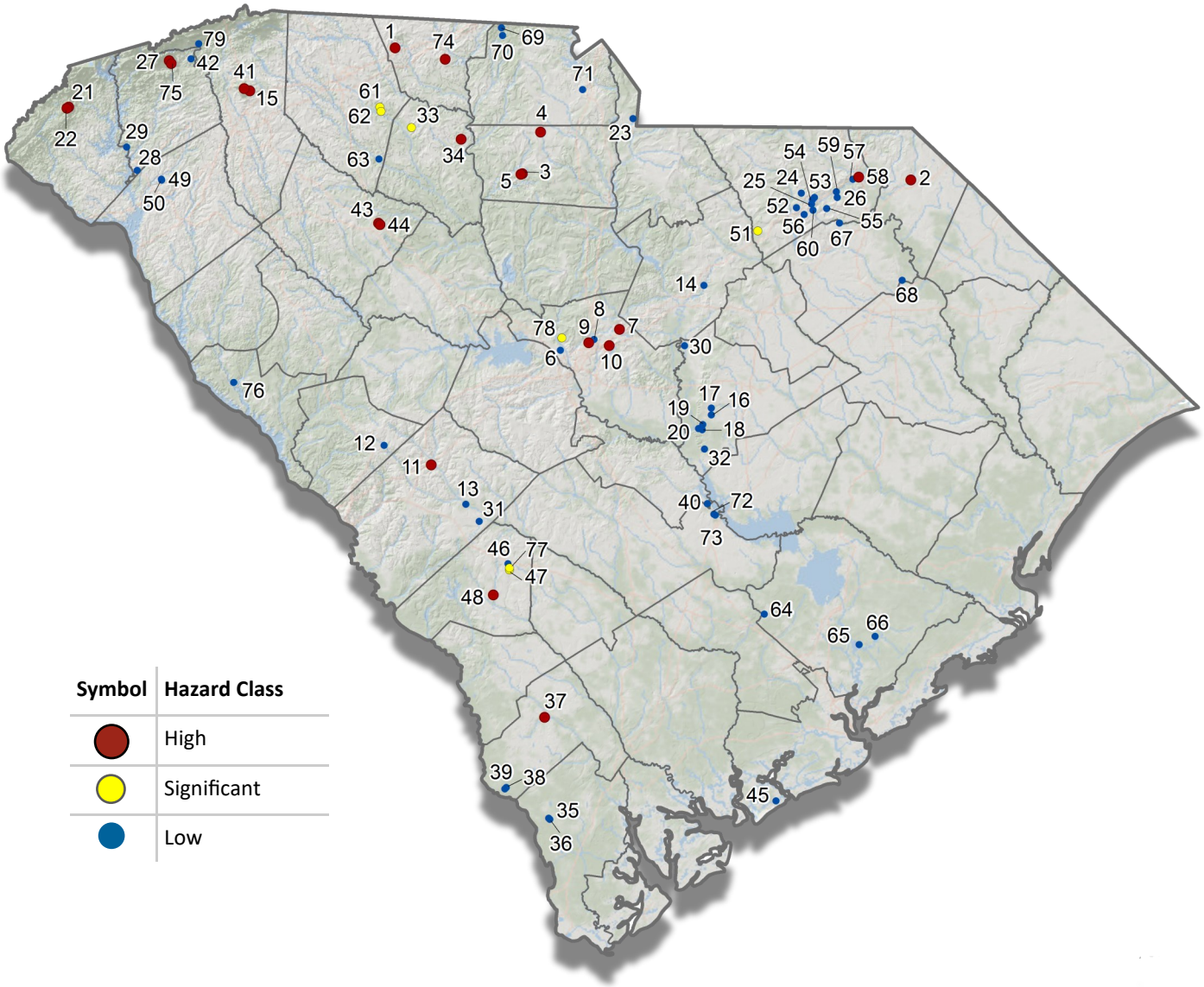
State-Owned Dams



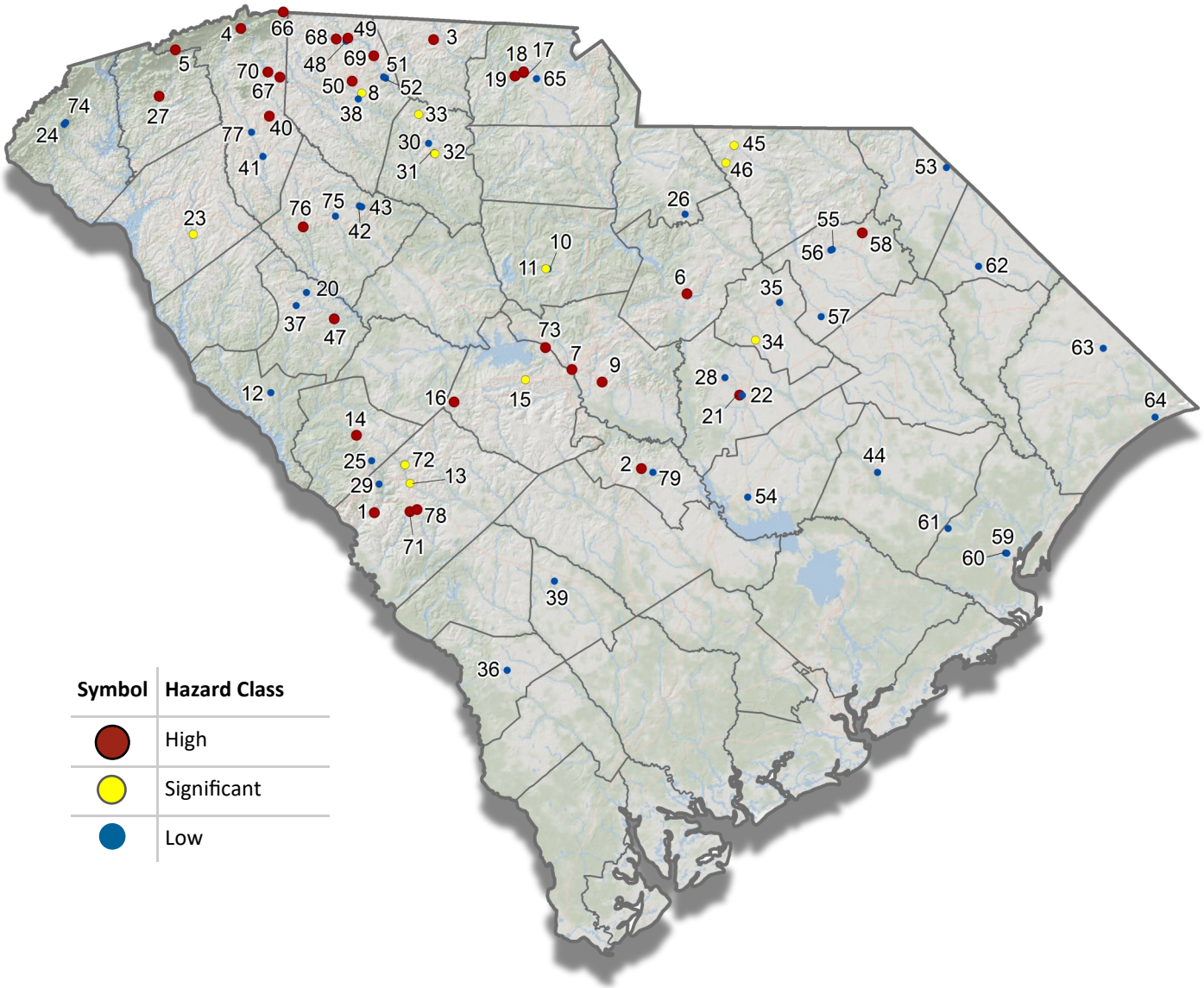
Symbol	Hazard Class
	High
	Significant
	Low

State-Owned Dams

Map Index #	Dam Name	Dam #	Hazard Class
1	THICKETTY CREEK WCD 26	D0009	High
2	LAKE WALLACE DAM	D0021	High
3	LARGE UPPER MTN LAKE	D0209	High
4	LAKE OLIPHANT DAM	D0217	High
5	SMALL UPPER MTN LAKE	D0226	High
6	DYS DAM	D0542	Low
7	SANDHILL EXP STA DAM	D0553	High
8	MOORES POND DAM	D0555	Low
9	ALCOHOL AND DRUG ABUSE LAKE	D0556	High
10	SESQUI DAM	D0569	High
11	CAMP LONG LAKE DAM	D0821	High
12	FORESTRY COMMISSION DAM	D0913	Low
13	AIKEN STATE PARK DAM	D1192	Low
14	ADAMS MILLPOND DAM	D1329	Low
15	LAKE PLACID DAM	D1399	High
16	ELLIOTT'S LAKE DAM	D1448	Low
17	BURNT GIN LAKE DAM	D1450	Low
18	CHRISTMAS MILL LAKE DAM	D1574	Low
19	CAMPBELL POND DAM	D1585	Low
20	POINSETT STATE PARK LAKE DAM	D1589	Low
21	OCONEE STATE PARK DAM 1	D1642	High
22	OCONEE STATE PARK DAM 2	D1643	High
23	ANDREW JACKSON ST PK LAKE	D1777	Low
24	MOUNT LAKE DAM	D1837	Low
25	SANDHILL STATE PARK DAM	D1842	Low
26	GRIGGS POND DAM	D1869	Low
27	PINNACLE LAKE DAM	D1946	High
28	LAMASTER POND DAM	D1966	Low
29	ISSAQUEENA LAKE DAM	D1967	Low
30	WHITE OAK SLASH LAKE DAM	D1972	Low
31	T B HALLMAN DAM	D2037	Low
32	MILL CREEK POND PARK DAM	D2066	Low
33	WHITE PINES LAKE DAM	D2149	Sig
34	LAKE JOHN D LONG	D2162	High
35	SCNONAME 27005	D2588	Low
36	HOVER PLANTATION DAM	D2592	Low
37	LAKE WARREN ST PARK DAM	D2603	High
38	WILDLIFE LAKE NO1	D2609	Low
39	WILDLIFE LAKE NO2	D2610	Low
40	CAMP DANIELS POND DAM	D2689	Low
41	MOUNTAIN LAKE DAM	D2854	Sig
42	GARREN LAKE DAM	D2916	Low
43	LAWSON LAKE	D2999	High
44	DUNCAN CREEK WCD DAM 7	D3005	High
45	MARGARET MEYER DAM	D3043	Low
46	EDISTO POND DAM	D3061	Low
47	BARNWELL ST PARK LWR DAM	D3062	Sig
48	EDGAR A BROWN LAKE DAM	D3064	High
49	CLEMSON UNIV POND DAM 1	D3113	Low
50	CLEMSON UNIV POND DAM 2	D3114	Low
51	SEXTON POND DAM	D3186	Sig
52	MIDDENDORF POND DAM	D3199	Low
53	LEE POND DAM	D3209	Low
54	HUNTER POND DAM	D3210	Low
55	BROWN SRINGS POND DAM	D3212	Low
56	SCOTT POND DAM	D3213	Low
57	CHERAW STATE PARK DAM 2	D3224	Low
58	EUREKA LAKE DAM	D3225	High
59	CAMPBELL LAKE DAM	D3226	Low
60	SANDHILL ST FOREST DAM 6	D3228	Low
61	LAKE EDWIN JOHNSON DAM	D3379	Sig
62	CROFT STATE PARK LAKE DAM	D3383	Sig
63	DUTCHMAN CORRECTIONAL DAM	D3391	Low
64	DEPT OF CORRECTIONS DAM	D3464	Low
65	WESTVACO DAM 1	D3471	Low
66	WESTVACO DAM 2	D3472	Low
67	DARLINGTON POND DAM	D3529	Low
68	DARGAN'S POND DAM	D3553	Low
69	LAKE CRAWFORD DAM	D3639	Low
70	LAKE YORK DAM	D3640	Low
71	WINTHROP UNIVERSITY DAM	D3670	Low
72	SANTEE STATE PARK DAM 1	D3744	Low
73	SANTEE STATE PARK DAM 2	D3745	Low
74	WILDLIFE DAM	D3780	High
75	OOLENOY WCD DAM 40	D4036	High
76	JOHN DE LA HOWE DAM	D4237	Low
77	BARNWELL ST PARK UPR DAM	D4374	Sig
78	SCFIRE ACADEMY DAM	D4455	Sig
79	LAKE WATTACOO	D4596	Low

Dams can also be viewed by visiting the SC DHEC Dams and Inundations Web Application at the following address: https://gis.dhec.sc.gov/scdams Application is searchable by Dam Name or Dam # (e.g., DXXXX)

City- and County-Owned Dams

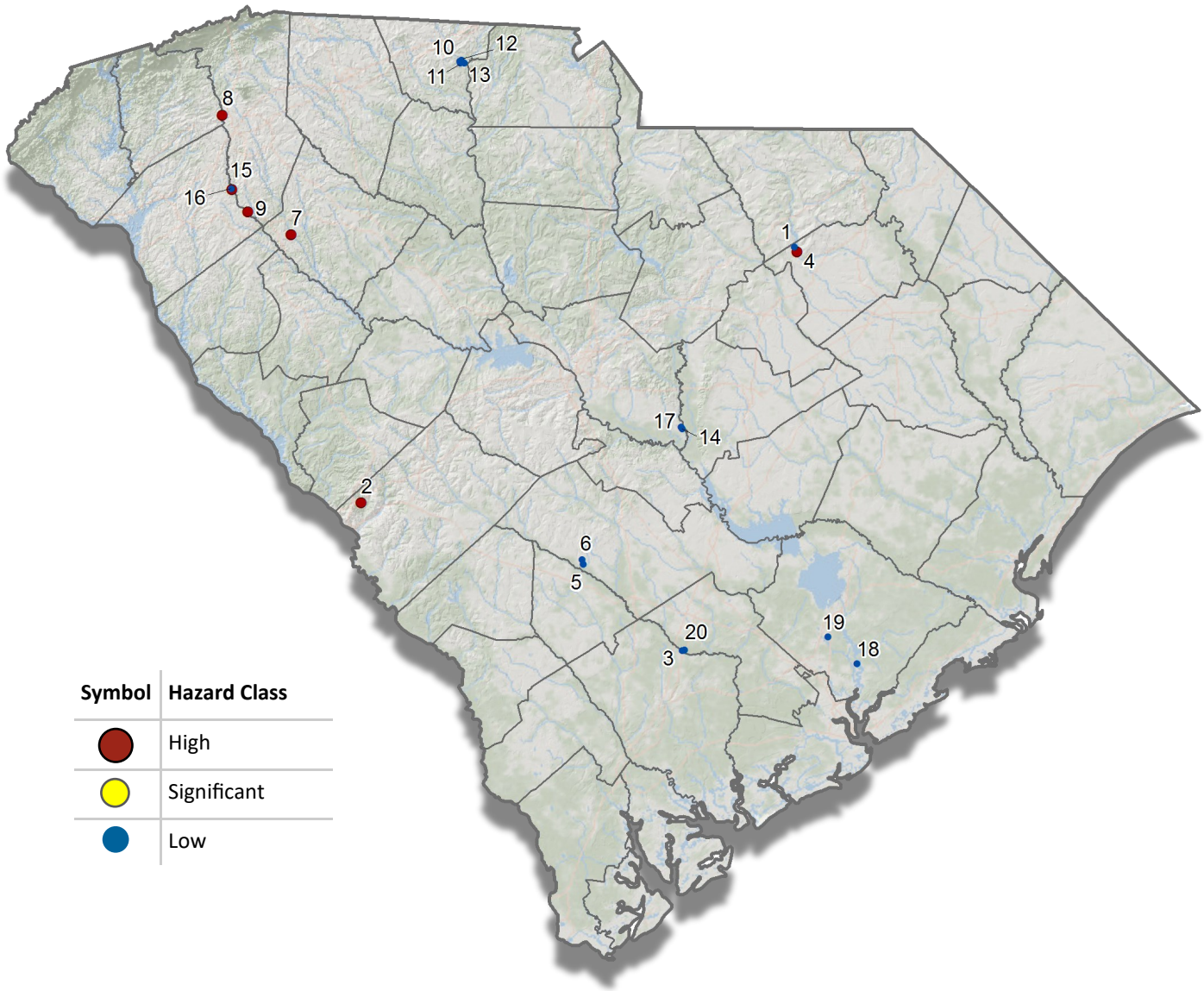


City- and County-Owned Dams

Map Index #	Dam Name	Dam #	Haz Class	Public Utility
1	LANGLEY POND DAM	D0003	High	N
2	LAKE INSPIRATION DAM	D0007	High	N
3	LAKE WHELCHEL	D0008	High	Y
4	NORTH SALUDA RESERVOIR DAM	D0015	High	Y
5	TABLE ROCK RESERVOIR DAM	D0016	High	Y
6	KENDALL LAKE DAM	D0018	High	Y
7	COLUMBIA RESERVOIR DIKE	D0023	High	Y
8	DUNCAN PARK LAKE DAM	D0032	Sig	N
9	SE COMMUNITY PARK DAM	D0090	High	N
10	WINNSBORO RESERVOIR DAM	D0522	Low	Y
11	JACKSON-MILL CK WCD DAM 7	D0523	Sig	Y
12	MCCORMICK WAT WKS DAM	D0640	Low	Y
13	REYNOLDS POND DAM	D0710	Sig	N
14	SLADE LAKE DAM	D0910	High	N
15	GIBSON'S POND DAM	D0959	Sig	N
16	BATESBURG RESERVOIR DAM	D1180	High	Y
17	LOWER YORK RESERVOIR DAM	D1222	High	Y
18	UPPER YORK RESERVOIR DAM	D1227	High	Y
19	CALDWELL LAKE DAM	D1230	High	Y
20	CITY OF GREENWOOD DAM	D1257	Low	N
21	SECOND MILLPOND DAM	D1444	High	N
22	SWAN LAKE DAM	D1447	Low	N
23	BROADWAY LAKE DAM	D1573	Sig	N
24	WALHALLA RESERVOIR DAM	D1647	Low	Y
25	YONCE POND DAM	D1693	Low	N
26	KERSHAW CITY RES DAM	D1781	Low	Y
27	PICKENS CITY RESERVOIR LAKE DAM	D1955	High	Y
28	BOOTHS POND DAM	D1985	Low	N
29	GRANITEVILLE CO DAM 1	D2128	Low	N
30	UNION COUNTY POND DAM	D2151	Low	N
31	UNION WATER WORKS DAM	D2154	Sig	Y
32	FOSTER PARK DAM	D2155	Sig	N
33	CITY OF JONESVILLE DAM	D2161	Sig	Y
34	LAKE ASHWOOD DAM	D2414	Sig	N
35	BISHOPVILLE DAM	D2421	Low	Y
36	ALLENDALE WASTE POND DAM	D2566	Low	Y
37	COMM OF PUB WORKS DAM	D2702	Low	N
38	J H PAGE LAKE DAM	D2760	Low	N
39	DENMARK WSTWTR TRT PD DAM	D2808	Low	Y
40	OAK GROVE LAKE DAM	D2893	High	N
41	TRICKLE LAKE DAM	D2896	Low	N
42	CITY OF CLINTON DAM	D2983	Low	N
43	DUNCAN CREEK WCD DAM 6B	D2984	Low	Y
44	KINGSTREE OXIDATION DAM	D3086	Low	Y
45	TOWN POND DAM	D3170	Sig	Y
46	LAKE TERRY DAM	D3172	Sig	Y
47	G & G ASSOCIATES 96 DAM	D3298	High	N
48	TR S PACOLET RIVER DAM	D3323	Low	N
49	SOUTH PACOLET RIVER RES 1	D3324	High	Y
50	CLEVELAND PARK LAKE DAM	D3352	High	N
51	CLIFTON MILLS POND 1 DAM	D3371	Low	N
52	CLIFTON MILLS POND 2 DAM	D3372	Low	N
53	MCCOLL POND DAM	D3448	Low	Y
54	SUMMERTON WATER TR DAM	D3501	Low	Y
55	CITY SEW DISP DAM	D3518	Low	Y
56	TILLOTSON POND DAM 2	D3519	Low	Y
57	CITY OXIDIZATION POND	D3527	Low	Y
58	LAKE DARPO DAM	D3530	High	N
59	GEORGETOWN SEWER DAM 1	D3588	Low	Y
60	GEORGETOWN SEWER DAM 2	D3589	Low	Y
61	ANDREWS SEWER POND DAM	D3594	Low	Y
62	LATTA LOGAN POND DAM	D3604	Low	Y
63	LORIS OXIDATION POND DAM	D3615	Low	Y
64	AIRPORT LAGOON DAM	D3636	Low	N
65	YORK COUNTY DAM	D3661	Low	N
66	LAKE LANIER DAM	D3984	High	Y
67	LAKE CUNNINGHAM DAM	D3985	High	Y
68	LAKE BOWEN DAM	D4002	High	Y
69	H TAYLOR BLALOCK RES DAM	D4006	High	Y
70	LAKE ROBINSON DAM	D4007	High	Y
71	MALLARD LAKE DAM	D4029	High	N
72	AIKEN RESERVOIR DAM	D4070	Sig	Y
73	HARBISON STRUCTURE 9	D4085	High	N
74	WALHALLA RESERVOIR 3	D4097	Low	N
75	LITTLE RIVER WATERSHED 14	D4128	Low	N
76	RABON CREEK WCD DAM 32	D4320	High	Y
77	EMERG STOR BASIN DAM	D4539	Low	Y
78	FOX HAVEN SUBDIVISION DAM	D4919	High	N
79	ST MATTHEWS WW BASIN DAM	D4935	Low	Y

Dams can also be viewed by visiting the SC DHEC Dams and Inundations Web Application at the following address: https://gis.dhec.sc.gov/scdams Application is searchable by Dam Name or Dam # (e.g., DXXXX)

Private Utility-Owned Dams



Symbol	Hazard Class
	High
	Significant
	Low

Private Utility-Owned Dams

Map Index #	Dam Name	Dam Owner	Dam #	Hazard Class
1	LAKE ROBINSON DAM	Duke	D0010	High
2	MISTY LAKE DAM	Dominion	D2042	High
3	SCE&G ASH POND DAM	Dominion	D2555	Low
4	DUKE ROBINSON ASH POND DAM	Duke	D3514	Low
5	SC ELEC & GAS DAM	Dominion	D3776	Low
6	CAROLYN W COPE DAM	Dominion	D3777	Low
7	BOYD'S MILLPOND DAM	Northbrook	D4003	High
8	SALUDA LAKE DAM	Northbrook	D4469	High
9	HOLLIDAYS BRIDGE DAM	Northbrook	D4470	High
10	LEE NUCLEAR DAM 1	Duke	D4575	Low
11	LEE NUCLEAR DAM 2	Duke	D4576	Low
12	LEE NUCLEAR DAM 3	Duke	D4577	Low
13	LEE NUCLEAR DAM 4	Duke	D4578	Low
14	WATEREE STATION COAL ASH POND TWO	Dominion	D4780	Low
15	WS LEE STEAM PLANT PRIMARY ASH BASIN DAM	Duke	D4887	High
16	WS LEE STEAM PLANT SECONDARY ASH POND	Duke	D4888	Low
17	WATEREE STATION 1 ASH POND	Dominion	D4889	Low
18	WILLIAMS SEDIMENT POND E	Dominion	D4891	Low
19	WILLIAMS HWY 52 LANDFILL RUNOFF POND	Dominion	D4892	Low
20	CANADYS STATION ASH POND 2	Dominion	D4893	Low

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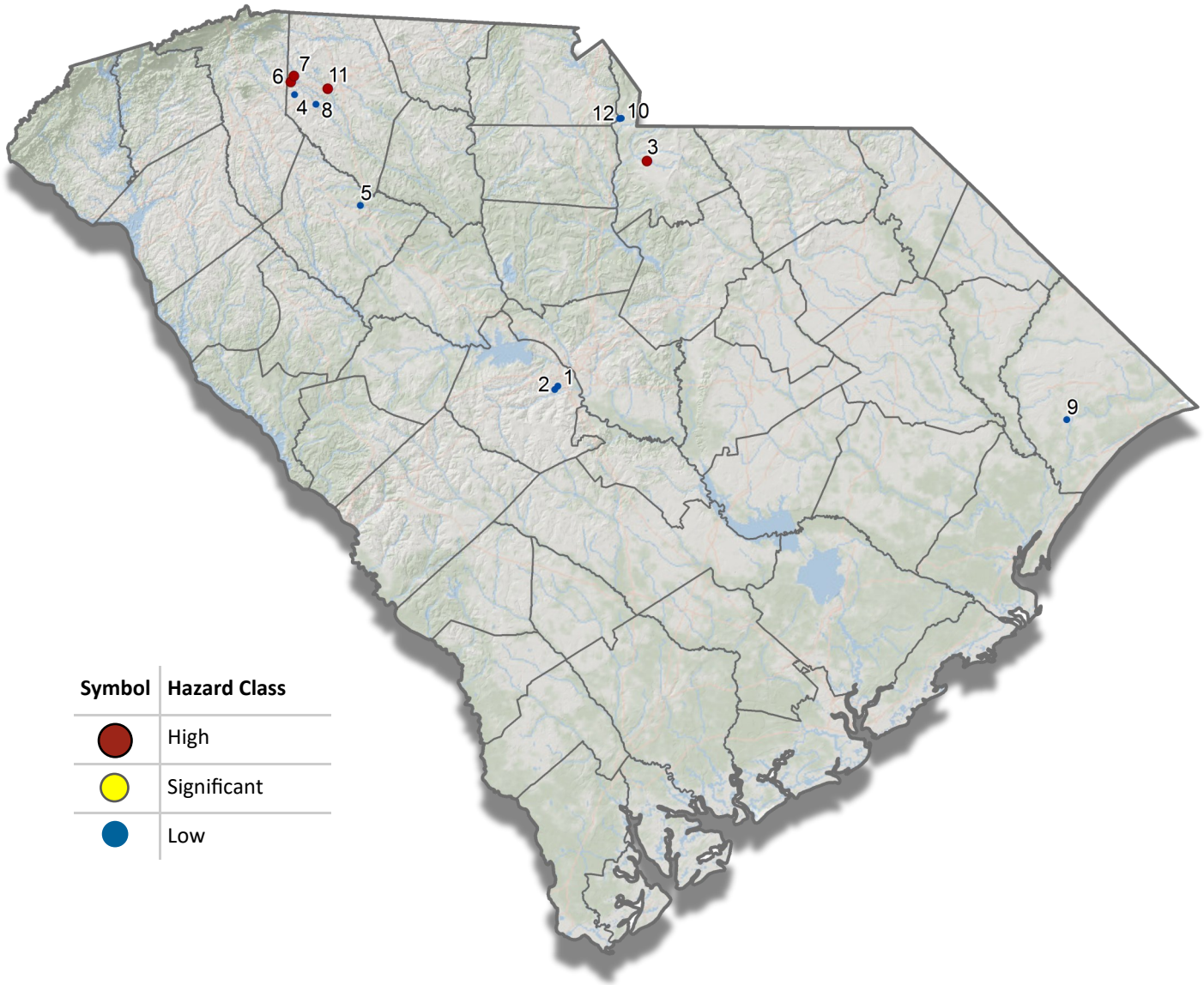
Special Purpose District-Owned Dams
(excludes Watershed Conservation Districts)

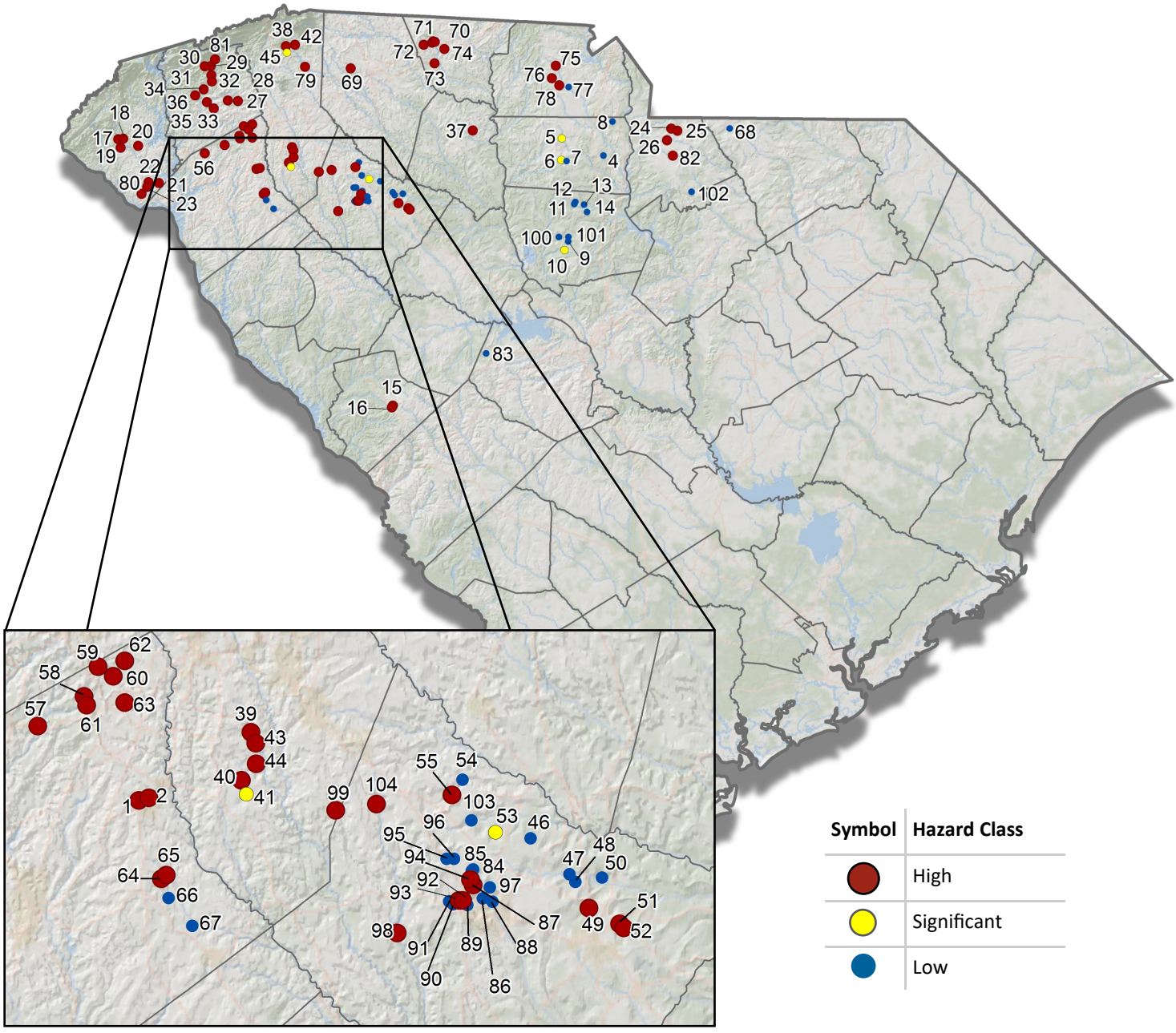


Special Purpose District-Owned Dams
(excludes Watershed Conservation Districts)

Map Index #	Dam Name	Dam #	Hazard Class	Public Utility
1	COLUMBIA AIRPORT DAM	D0985	Low	N
2	PITTS LAKE DAM	D1719	Low	N
3	LANCASTER CO WTRWRKS DAM	D1762	High	Y
4	LM DOBSON POND DAM	D2743	Low	N
5	CITY OF CLINTON DAM	D2983	Low	N
6	APALACHE MILLPOND DAM	D3338	High	Y
7	LYMAN LAKE DAM	D3340	High	Y
8	BERRY SHOALS POND DAM	D3345	Low	Y
9	CONWAY OXIDATION POND 1	D3625	Low	Y
10	UNION-LANCSTER WAT SUP DM	D4393	Low	Y
11	SJWD WATER DIST RCC DAM	D4493	High	Y
12	CATAWBA RESERVOIR NO 2	D4778	Low	Y

Dams can also be viewed by visiting the SC DHEC Dams and Inundations Web Application at the following address: https://gis.dhec.sc.gov/scdams Application is searchable by Dam Name or Dam # (e.g., DXXXX)

Watershed Conservation District-Owned Dams



With the passage of the Watershed Protection and Flood Prevention Act (Public Law 566) by the US Congress in 1954, the Soil Conservation Service (now the Natural Resources Conservation Service) was authorized to design and construct dams on private property to be maintained and operated by a local government entity via an agreement with the private landowner(s). In 1962, the SC General Assembly created Watershed Conservation Districts (WCD) as a type of Special Purpose District to, among other things, take responsibility for these dams. The 1962 law also provided taxing authority to fund their operations. There are 33 WCDs in the state that are responsible for 104 state-regulated dams built under Public Law 566.

Watershed Conservation District-Owned Dams

Map Index #	Dam Name	Dam #	Hazard Class
1	BIG CK WCD DAM-RENTZ/WILLIAMS 2	D0005	High
2	BIG CK WCD DAM-SHOREBROOK 1	D0006	High
3	THICKETTY CK WCD 26	D0009	High
4	ROCKY CK WCD DAM 1	D0212	Low
5	ROCKY CK WCD DAM 6	D0213	Sig
6	ROCKY CK WCD DAM 8	D0214	Sig
7	ROCKY CK WCD DAM 9	D0215	Low
8	TINKERS CK WCD DAM	D0216	Low
9	JACKSON-MILL CK WCD DAM 2	D0521	Low
10	JACKSON-MILL CK WCD DAM 7	D0523	Sig
11	WATEREE CK WCD DAM 1	D0536	Low
12	WATEREE CK WCD DAM 2	D0537	Low
13	WATEREE CK WCD DAM 3	D0538	Low
14	WATEREE CK WCD DAM 4	D0539	Low
15	BEAVERDAM CK WCD DAM 1	D0891	High
16	BEAVERDAM CK WCD DAM 2	D0892	High
17	CONEROSS CK WCD DAM 1A	D1652	High
18	CONEROSS CK WCD DAM 8	D1653	High
19	CONEROSS CK WCD DAM 9A	D1655	High
20	CONEROSS CK WCD DAM 21	D1656	High
21	BEAVERDAM CK WCD DAM 5	D1665	High
22	BEAVERDAM CK WCD DAM 2	D1666	High
23	BEAVERDAM CK WCD DAM 4	D1667	High
24	CANE CK WCD DAM 7	D1784	High
25	CANE CK WCD DAM 16	D1785	High
26	CANE CK WCD DAM 18A	D1786	High
27	GEORGES CK WCD DAM 1A	D1933	High
28	TWELVE MILE CR WCD DAM 12	D1940	High
29	OOLENOY RIVER WCD DAM 9	D1948	High
30	OOLENOY RIVER WCD DAM 10	D1949	High
31	TWELVE MILE CK WCD DAM 8	D1951	High
32	TWELVE MILE CK WCD DAM 22	D1952	High
32	TWELVE MILE CK WCD DAM 16	D1954	High
34	PICKENS CITY RESERVOIR LAKE DAM	D1955	High
35	TWELVE MILE CK WCD 54A	D1957	High
36	TWELVE MILE CK WCD DAM 5	D1961	High
37	BROWN'S CK WCD DAM 2	D2163	High
38	S TYGER RIVER WCD DAM 2C	D2865	High
39	HUFF CK WCD DAM 4C	D2877	High
40	HUFF CK WCD DAM 2A	D2879	High
41	HUFF CK WCD DAM 3A	D2880	Sig
42	SOUTH TYGER WCD DAM 5C	D2883	High
43	HUFF CK WCD DAM 1B	D2889	High
44	HUFF CK WCD DAM 5B	D2890	High
45	SOUTH TYGER RIVER WCD 4C MUSH CK	D2915	Sig
46	BEAVERDAM-WARRIOR CK WCD DAM 33	D2982	Low
47	DUNCAN CK WCD DAM 6B	D2984	Low
48	DUNCAN CK WCD DAM 5	D2985	Low
49	DUNCAN CK WCD DAM 2	D2986	High
50	DUNCAN CK WCD DAM 10	D2997	Low
51	DUNCAN CK WCD DAM 8	D2999	High
52	DUNCAN CK WCD DAM 7	D3005	High

Map Index #	Dam Name	Dam #	Hazard Class
53	BEAVERDAM-WARRIOR CK WCD DAM 4	D3008	Sig
54	BEAVERDAM-WARRIOR CK WCD DAM 2	D3021	Low
55	BEAVERDAM-WARRIOR CK WCD DAM 1	D3022	High
56	3 & 20 CK WCD DAM GRIFFIS 9B	D3112	High
57	3 & 20 CK WCD DAM JAMESON 5B	D3124	High
58	3 & 20 CK WCD DAM TRIPP 14	D3126	High
59	BRUSHY CK WCD DAM HOPKINS 11A	D3130	High
60	BRUSHY CK WCD DAM GANTT 17	D3131	High
61	3 & 20 CK WCD DAM ROBINSON 15	D3132	High
62	BRUSHY CK WCD DAM KRAEMER 16	D3137	High
63	BRUSHY CK WCD DAM TRIPP 18	D3139	High
64	BROADMOUTH CK WCD DAM 247-W 9	D3142	High
65	BROADMOUTH CK WCD DAM PHILLIPS 8	D3143	High
66	BROADMOUTH CK WCD DAM NEWRY-RICE 2	D3146	Low
67	BROADMOUTH CK WCD DAM MINOR 4	D3150	Low
68	HILLS CK WCD DAM	D3168	Low
69	N TYGER R WCD DAM NO2	D3398	High
70	THICKETTY CRK WCD 20	D3405	High
71	THICKETTY CRK WCD 19	D3406	High
72	THICKETTY CRK WCD 18	D3407	High
73	THICKETTY CRK WCD 25	D3408	High
74	THICKETTY CK WCD 16B	D3413	High
75	FISHING CK WCD DAM 1	D3659	High
76	FISHING CK WCD DAM 2	D3662	High
77	FISHING CK WCD DAM	D3668	Low
78	FISHING CK WCD DAM 50	D3673	High
79	LAKE ROBINSON DAM	D4007	High
80	BEAVERDAM CK WCD DAM 3A	D4026	High
81	OOLENOY WCD DAM 40	D4036	High
82	CANE CK WCD DAM 10D	D4060	High
83	HOLLOW CK WATERSHED DAM 1	D4074	Low
84	LITTLE RIVER WCD DAM 4	D4086	Low
85	LITTLE RIVER WCD DAM 8	D4087	Low
86	LITTLE RIVER WCD DAM 1	D4126	Low
87	LITTLE RIVER WCD DAM 3	D4127	High
88	LITTLE RIVER WCD DAM 14	D4128	Low
89	LITTLE RIVER WCD DAM 15	D4129	Low
90	LITTLE RIVER WCD DAM 16	D4130	Low
91	LITTLE RIVER WCD DAM 17	D4131	Low
92	LITTLE RIVER WCD DAM 23	D4132	High
93	LITTLE RIVER WCD DAM 24	D4133	High
94	LITTLE RIVER WCD DAM 2B	D4309	High
95	LITTLE RIVER WCD DAM 5A	D4310	Low
96	LITTLE RIVER WCD DAM 6	D4311	Low
97	LITTLE RIVER WCD DAM 13	D4312	Low
98	RABON CK WCD DAM 32	D4320	High
99	RABON CK WCD DAM 20	D4321	High
100	JACKSON-MILL CR WCD DAM 1	D4337	Low
101	JACKSON-MILL CR WCD DAM 8	D4338	Low
102	LITTLE LYNCHES WCD DAM 12	D4413	Low
103	BEAVERDAM-WARRIOR CK WCD DAM 5	D4464	Low
104	RABON CK WCD DAM 21	D4465	High

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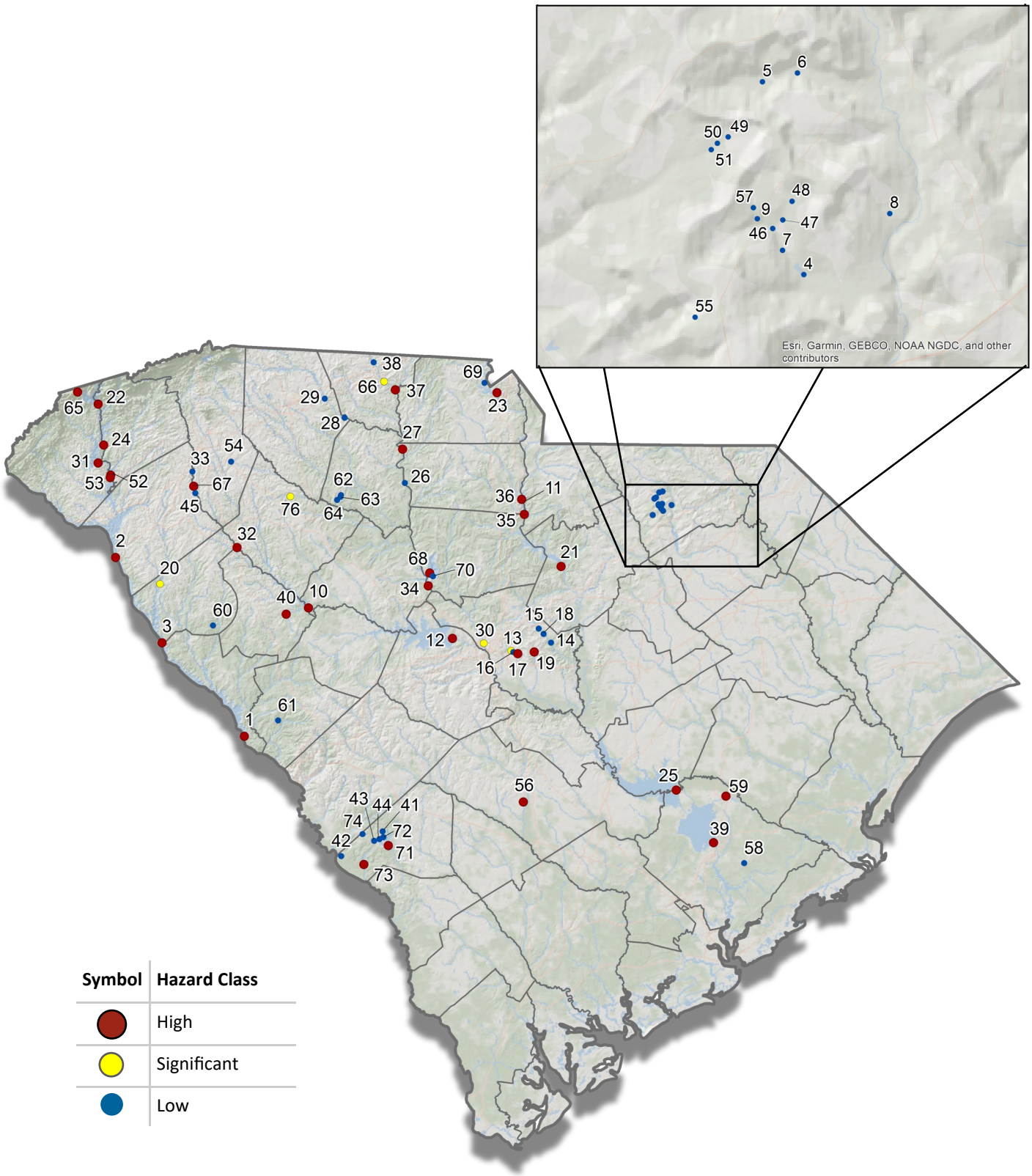
Federally-Owned and/or -Regulated Dams



Symbol	Hazard Class
	High
	Significant
	Low

Federally-Owned and/or -Regulated Dams

Map Index #	Dam Name	Dam Number	Dam Owner	Regulatory Agency	Hazard Class
1	J. Strom Thurmond Dam	GA01701	USACE	USACE	High
2	Hartwell Dam	GA01702	USACE	USACE	High
3	Richard B. Russell Dam	GA01705	USACE	USACE	High
4	Martin Dam	SC00032	USDOI-USFWS	USDOI-USFWS	Low
5	C.S. Pool K Dam	SC00034	USDOI-USFWS	USDOI-USFWS	Low
6	C.S. Pool L Dam	SC00035	USDOI-USFWS	USDOI-USFWS	Low
7	C.S. Pool D Dam	SC00036	USDOI-USFWS	USDOI-USFWS	Low
8	Mays Dam	SC00037	USDOI-USFWS	USDOI-USFWS	Low
9	Lake Bee Dam	SC00083	USDOI-USFWS	USDOI-USFWS	Low
10	Buzzards Roost Dam	SC00109	Greenwood County	FERC	High
11	Great Falls-Dearborn Dam	SC00140	Duke	FERC	Significant
12	Saluda Dam	SC00224	Dominion	FERC	High
13	Semmes Lake Dam	SC00225	US Army	US Army	Significant
14	Upper Davis Pond Dam	SC00227	US Army	US Army	Low
15	Dupre Pond Dam	SC00228	US Army	US Army	Low
16	Upper Legion Lake Dam	SC00229	US Army	US Army	Low
17	Lower Twin Lake Dam	SC00231	US Army	US Army	High
18	Messers Pond Dam	SC00232	US Army	US Army	Low
19	Weston Lake Dam	SC00233	US Army	US Army	High
20	Lake Secession Dam	SC00247	City of Abbeville	FERC	Significant
21	Wateree Dam	SC00485	Duke	FERC	High
22	Jocasee Dam	SC00529	Duke	FERC	High
23	Wylie Dam	SC00685	Duke	FERC	High
24	Keowee Dam	SC00706	Duke	FERC	High
25	Santee Dam	SC00732	Santee-Cooper	FERC	High
26	Neal Shoals Dam	SC01058	Dominion	FERC	Low
27	Lockhart Dam	SC01059	Lockhart Power Company	FERC	High
28	Lower Pacolet Dam	SC01060	Pacolet Manufacturing Company	FERC	Low
29	Clifton No. 3 Dam	SC01063	Converse Energy Corporation	FERC	Low
30	Columbia Diversion Dam	SC01064	City of Columbia	FERC	Significant
31	Little River Dam	SC01065	Duke	FERC	High
32	Ware Shoals Dam	SC01067	Aquenergy Systems, LLC	FERC	High
33	Piedmont Dam	SC01068	Aquenergy Systems, LLC	FERC	Low
34	Parr Shoals Dam	SC01069	Dominion	FERC	High
35	Rocky Creek-Cedar Creek Dam	SC01071	Duke	FERC	High
36	Fishing Creek Dam	SC01072	Duke	FERC	High
37	Ninety Nine Islands Dam	SC01074	Duke	FERC	High
38	Gaston Shoals Dam	SC01075	Duke	FERC	Low
39	Pinopolis Dam	SC01076	Santee-Cooper	FERC	High
40	Star Fort Pond Dam	SC01232	USDOI-NPS	USDOI-NPS	High
41	Pond B Dam	SC01688	USDOE-SRS	US DOE	Low
42	D Area Ash Basin Dam	SC01689	USDOE-SRS	US DOE	Low
43	Pond 2 Dam	SC01691	USDOE-SRS	US DOE	Low
44	Pond 5 Dam	SC01693	USDOE-SRS	US DOE	Low
45	Lower Pelzer Dam	SC01750	ENEL Green Energy	FERC	Low
46	C.S Lake 12 Dam	SC01889	USDOI-USFWS	USDOI-USFWS	Low
47	C.S. Pool G Dam	SC01890	USDOI-USFWS	USDOI-USFWS	Low
48	C.S. Lake 16 Dam	SC01891	USDOI-USFWS	USDOI-USFWS	Low
49	Oxpen Dam	SC01892	USDOI-USFWS	USDOI-USFWS	Low
50	Honker Dam	SC01896	USDOI-USFWS	USDOI-USFWS	Low
51	C.S. Pool J Dam	SC01897	USDOI-USFWS	USDOI-USFWS	Low
52	Clemson Upper Diversion Dam	SC02753	USACE	USACE	High
53	Clemson Lower Diversion Dam	SC02754	USACE	USACE	High
54	Ewing Dam	SC02825	USDA-USFS	USDA-USFS	Low
55	C.S. Lake 17 Dam	SC10004	USDOI-USFWS	USDOI-USFWS	Low
56	Orangeburg Substation Dam	SC10010	USDOI-USFWS	USDOI-USFWS	High
57	C.S. Pool H Dam	SC10015	USDOI-USFWS	USDOI-USFWS	Low
58	Little Hell Hole Dam	SC82060	USDA-USFS	USDA-USFS	Low
59	St. Stephen Powerhouse	SC82201	USACE	USACE	High
60	Parsons Mountain Dam	SC82404	USDOI-USFWS	USDOI-USFWS	Low
61	Lick Fork Lake Dam	SC01105	USDA-USFS	USDA-USFS	Low
62	John's Creek Dam	SC82416	USDA-USFS	USDA-USFS	Low
63	Sedalia Dam	SC82417	USDA-USFS	USDA-USFS	Low
64	Macedonia Dam	SC82419	USDA-USFS	USDA-USFS	Low
65	Bad Creek Dam	SC83011	Duke	FERC	High
66	Cherokee Falls Dam	SC83014	Cherokee Falls Hydroelectric Project, LLC	FERC	Significant
67	Upper Pelzer Dam	SC83018	ENEL Green Energy	FERC	High
68	Fairfield Dam	SC83025	Dominion	FERC	High
69	Catawba Standby Nuclear Service Water Dam	SC83101	Duke	US NRC	Low
70	V.C. Summer Emergency Cooling Water Dam	SC83102	Dominion	US NRC	Low
71	Par Pond Lower Dam	SC83401	USDOE-SRS	US DOE	High
72	Pond C Dam	SC83402	USDOE-SRS	US DOE	Low
73	Steel Creek Dam	SC83403	USDOE-SRS	US DOE	High
74	H Area Ash Basin Dam	SC83404	USDOE-SRS	US DOE	Low
75	Blakely Dam	SC83462	Vermiculite Specialty, Inc	USDOL-MSHA	Significant
76	Nabors Dam	SC83463	Vermiculite Specialty, Inc	USDOL-MSHA	Significant

Lake Conestee Dam—Greenville County
Photograph taken by DHEC Unmanned Aerial Vehicle (UAV) on April 4, 2019

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S.C. Department of Health and Environmental Control