

April Amblings: The Lake System

Explore the manmade lake system and all it has to offer.



An aerial view of the lake system at Duke Farms.

Duke Farms is a surprisingly vast nature preserve tucked between the hustle and bustle of central New Jersey. Like many other locations in the state, Duke Farms has a fascinating history. One of the biggest transformations that took place here was the installation of the manmade lake system. The addition of these waterbodies creates habitat for a wide variety of species and gives humans the opportunity to observe the animals that utilize the lakes. The lake system itself takes up much of the northwest side of the park and is home to species like osprey, wood ducks, great blue herons, painted turtles, and various species of fish.

A Little Bit of History

The 2,700 acres that are now used for education and enjoyment, ecological and climate research, native plant propagation, habitat restoration, and agroecology, was once split up into about 40 individually owned farms. This was until 1893 when James Buchanan “JB” Duke started purchasing bits and pieces of what Duke Farms is today. His goal was to turn Duke Farms into a park that was not only comparable, but more superior than Central Park in New York City. If you’ve been to the property before you may have noticed the rolling hills, incredible stonework, and nine manmade lakes. The question must be asked - how did he accomplish all of this on a *huge* plot of land that was all originally flat farmland and sporadic woodlots? And not to mention that this was all completed about 100 years ago! Of course, he couldn’t achieve this transformation alone. JB Duke had selected landscape architects, a team of stonemasons, excavators, and even mule teams to help build Duke Farms into what it is today.



JB Duke, the original owner of Duke Farms, posing with his only child and eventual heir to the property, Doris Duke. Circa 1916.

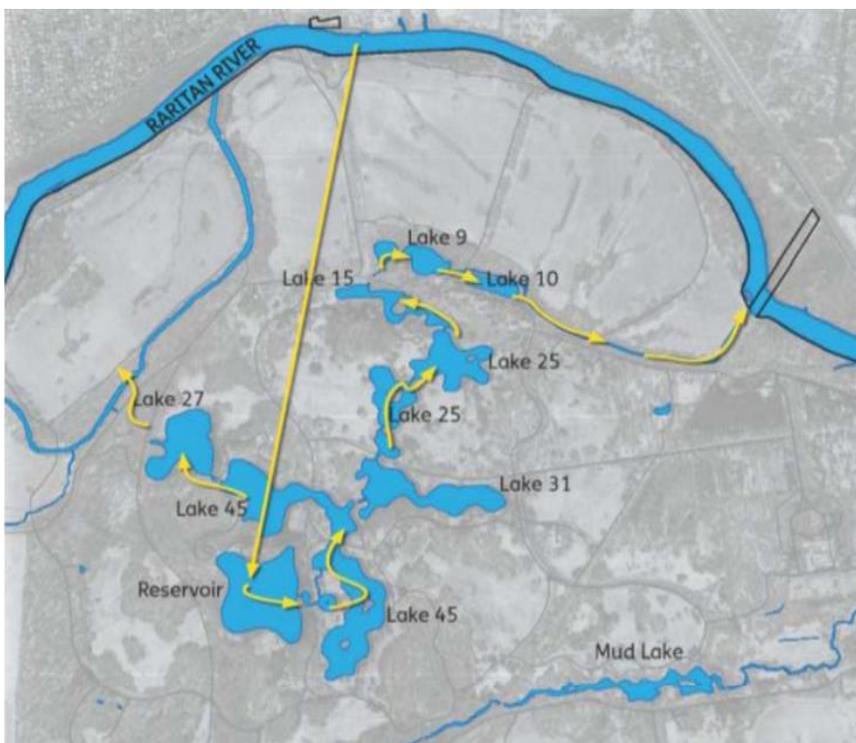
Construction of the Lake System & How it Works

The lakes cover approximately 75 acres of land and were dug out one by one with help from large crews and various mule teams. Because they were excavating the lake beds, they were able to create elevation with that same material they were digging out. Fox Hollow Lane is the steepest trail on the property and will lead you to the highest point of water, Duke Reservoir. By the time JB Duke was

finished creating the manmade system of elevated lakes it consisted of 9 lakes and 10 waterfalls. The system was completed by 1909.

Initially the lakes were run by pumping water through a large underground pipe that was connected to the canal at the Raritan River, the northern boundary of the property. That water was then pumped to the highest point of the lake system at Duke Reservoir. This was done via the pump house, which is not open to the public, but is still standing and can be viewed from the far side of the river. From the reservoir, it was controlled and released by gravity to flow through the connected lake system and back to the Raritan River. Because this was a gravity fed system, each lake had to be tiered so that the water would flow down from one lake to the next. Eventually, the water would reach the end of the lake system, and that same water that came from the Raritan River would feed back into the river. This created a continuous cycle of waterflow from the from the Raritan to Duke Reservoir, down each lake, and then back to the Raritan. This system pumped approximately one million gallons of water a day!

Here is a historical map of Duke Farms. Traditionally, each lake was number with relationship to the Raritan river at the north end of the map, with a long, yellow arrow pointing to the reservoir, which indicates the 2-mile journey that the water would make to get to the core of Duke Farms. From there the water would flow into lake 45, and then into either lake 27 (left) and then back into the river or lake 31 (right), which would continue flowing down the lake system to lake 25, lake 15, lake 9, lake 10, and then eventually back into the river again. Mud Lake, which was part of Duke's Brook is not connected to the system.



Historical map of the lake system at Duke Farms.

In addition to the pumphouse, at the turn of the century, Duke also built a dam to generate power for the hydroelectric plant at the Nevius Street Bridge. That dam was removed in 2013 by the NJDEP. The deconstruction of the dam was done to restore the river to its natural state, which supports native fish migration patterns and other species that depend on the natural flow of the river. Watch [video one](#) and [video two](#) from the NJDEP dam removal.

Regarding the lake system now, water is pulled from wells that have been installed on the land, rather than pumping from the river. This creates a closed loop system that brings cleaner water into the lakes.



Exploring the Lake System



The Great Falls during the autumn

There is so much to be discovered around these waterways. A few spots you'll need to make sure not to miss are the Great Falls, the view of Otter Lake and Great Falls Lake from Fox Hollow Lane, Wood Duck Lake, and Turtle Lake.

The Great Falls is the largest waterfall on the property and is set to release water on a timer to save energy. You can check the run times for the falls on the [Duke Farms app](#) during the on-season. Look out for the osprey that have been spotted in this area! You may see them utilizing tree branches as they keep watch for their next meal.

The view of Otter Lake and Great Falls lake is magical from Fox Hollow Lane. This less-traveled forested trail leads you on a gravel path under bridges and over the falls, with many spots to stop and observe. Don't take this quiet trail for granted! Keep an eye out for wood ducks, mallards, and common mergansers.

Wood Duck Lake and Turtle Lake are both tucked away off the beaten path. You should be ready to venture from paved pathways and on to grassy trails. You may spot a majestic great blue heron calmly walking through the water.



Female (left) and male (right) common mergansers that can be found Duke Farms.



A handful of our lakes are now named after native animals, but each lake is not specific to only those animals. For example, you may see some turtles at Turtle Lake and also at Heron Lake. They are named after animals that you can commonly find on the property so pack up your binoculars and field notebook and come explore! Remember that you can use free resources like the [Seek app from iNaturalist](#) and the [Merlin Bird app from the Cornell Lab of Ornithology](#).

For Further Investigation

Water Flow for Young Learners

How does elevation impact [water flow](#)?

This lesson from the Virginia Department of Education has some ideas for younger learners including vocabulary: water, flow, direction, downhill, absorb, stream, path, dam

Strand Matter/ Topic Investigating natural flow of water / The student will investigate and understand that water flows and has properties that can be observed and tested. Key concepts include - water flows downhill.

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations

New Jersey Student Learning Standards

Science and Engineering Practices – Developing and Using Models

A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs.

PROJECT WET

For an enormous assortment of resources designed for formal and informal educators, check out [PROJECT WET](#). Their mission is: Advancing water education to understand global challenges and inspire local solutions.

Project WET's educator guides feature field-tested activities for formal and non-formal educators of children from pre-K through high school. The Curriculum and Activity Guide 2.0 can also be used in a college setting, training future educators on how to teach about water.

Project WET's series of student activity booklets includes more than sixty titles. Written and illustrated for children ages eight to twelve, the colorful booklets engage students in hands-on learning about water science through creative investigations, demonstrations, experiments, educational games and stories. The series also includes Water, Sanitation and Hygiene (WASH) materials customized for many countries and regions worldwide.

For more information about how to incorporate these and other resources into your own lessons including those involving Climate Change, contact Kate Reilly, Manager of Education at Duke Farms at kreilly@dukefarms.org.