Behind the Mystery of the Disappearing Mountain Lake

The stony Mountain Lake Lodge in Pembroke, VA (formerly the Mountain Lake Hotel) is a stunning site on a sunny summer’s day. Sunlight plays off the lush green lawns and brilliant red metal roof, illuminating the forestry surrounding the complex. The lodge is roughly 60% full – normal for this time of year – its inhabitants are enjoying the pool and tennis court, the nearby Treetop aerial adventure park, and 22 miles of hiking trails.

But as recently as 10 years ago, these weren’t the attractions that brought vacationers to Mountain Lake. What kept travelers from all over Virginia, and the entire country, returning to Mountain Lake was the lake itself. Barely a shadow of its former self, Mountain Lake is now less than a quarter of its previous size. The once half-mile-long, 110 ft.-deep, naturally-formed lake began draining in 2006 and, by the summer of 2008, had dried completely, leaving behind acres of silt, dead fish, and a Hollywood legacy.
Mountain Lake has been a scenic stop for travelers since the early 19th century, when the lodge was used to temporarily house those traveling by public stagecoach. By the early 1900’s, when only the single small hotel was located on site, many vacationers built their own cabins, establishing permanent summer homes. In 1930, William Lewis Moody Jr of Galveston Texas, a banker, businessman, ranch- and hotel-owner, and philanthropist, purchased the hotel and surrounding property, claiming that it had been his family’s summer home since 1918. On his death, his daughter Mary Moody Northern, purchased Mountain Lake, the site of many of her early childhood memories.  

**Mountain Lake has a past as troubled as its present.**

A look into the past reveals that Mountain Lake’s current drainage problem is not its first. The lake is estimated to be between 4,000 and 7,000 years old, with written accounts of the lake first appearing as early as 1751. In this first account, Christopher Gist of the Ohio Company describes the lake as “relatively small…surrounded by an extensive wide meadow,” going to show that the lake was not always as large as it was known to be from the 1960’s on. In fact, the lake is estimated to have naturally drained six times since it first formed, a conclusion based on the ring analysis of trees found growing in the lake. These trees, some dating back to
the mid-1600’s, once grew along the sides of a much smaller mountain lake for as short a period of time as 30 years.¹

More recently, the lake experienced fluctuations in size in the mid 1950’s, draining to nearly half of its previous capacity and exposing the submerged springs that feed it. That is, until April of 1959, when an earthquake, with enough force to crack the stone mantel of the lodge’s central fireplace and dislocate its doorframes, caused a shift in the stone basin of the lake resulting in the complete re-filling of the lake by the end of the year.¹

The level of Mountain Lake then stayed consistent until 1997, when the water level fell 3 m. in the course of two years as a result of drought and no surface outflow.¹ From 1998 to 2002, the water level continued to fall until it reached half of its normal depth, yet rose again to its
original level in 2003. Unfortunately, the cycle didn’t stop there. The water level stayed constant form 2003 until 2006, when it rapidly began diminishing until 2008, when the lake finally dried up completely for 3 days, from then on remaining nearly empty until 2012.²

So what’s happening to all of the water?

Mountain Lake’s drainage problem is the result of its geological sub-base. The bedrock that makes of the lake floor is full holes. Known in the hydrologic and geotechnical fields as “piping holes,” these cracks in the bedrock act as drains that, when not properly plugged with silty clay and rock, allow the lake water to flow into the ground and away from the basin, often at a rate which greatly exceeds the inflow rate of rainwater and surface runoff.²

Mountain Lake has five exceedingly large piping holes, with an estimated 15 smaller ones pulling water out of the lake. In January of 2012, 4 lbs. of fluorescent dye were placed in the lake – that’s one pound per each of the four large holes (the fifth large hole had yet to be discovered) – in an attempt to determine where the drainage from the lakes was going. Despite the effort of cutting through the January ice to accomplish this task, by April of 2013, no substantial conclusion could be reached as to the whereabouts of the seepage, though faint traces were noticed in the nearby Pond Drain stream.² ³
Mountain Lake needs rehabilitation.

Since the drought of 1999, the owners of Mountain Lake have explored numerous methods of rehabilitation, the first of which was implemented in 2002, when they attempted to refill the lake by pumping-in ground water from a nearby well. But the holes in the lake bottom were releasing more water than could be replaced by the well, with the largest losing water at a rate of 3 million gallons per day.\(^3\) In July of 2008, with sparing water left, plans were made to plug the holes in the lake with sandbags, but the venture was scrapped because the water 15 ft. below the surface offered zero visibility to divers.\(^2\)

By November of 2012, the owners of the Mountain Lake Hotel and the 2,600 acres of surrounding land could take no more, and the facility was closed for the winter season for renovations. It was during this time that the Mary Moody Northern Endowment, owner of Mountain Lake, sought the help of the Urban Land Institute and Radford University engineering geologist Skip Watts.\(^4\) Watts planned to seal the piping holes with the natural material from the colluvium on the lake edges, first adding large rocks, then stepping down gradually in size to a fine clay. This idea was chosen over that of paving the bottom of the lake with asphalt and concrete, as this would have damaged the lake’s reputation of being natural.\(^2\)
Mountain Lake is new and improved, but not yet fixed.

The hotel re-opened as the Mountain Lake Lodge, introducing new hiking trails and the Treetops aerial adventure ropes course, as well as a revitalized dining scene.³ The Lake is the site of the 1987 hit movie ‘Dirty Dancing’ and, capitalizing on this, the Lodge opened an exhibit to highlight the time spent there by the cast and crew, and every year host Dirt Dancing-inspired festivities.² The Lodge, which had experienced roughly a 50% decline in business when the lake completely dried up in 2008, soon saw the return of normal guest rates which, since then, have continued to improved, with busy seasons seeing an average of 2,000 residents in a season – far better than the 2,000 residents recorded for a single year after the draining of the lake and before the opening of the renovations.⁴

To maintain the oligotrophic nature of the lake – that is, its nutrient-poor soil and well-oxygenated water – an artificial wetland was constructed between the lodge and lake, as a means of intercepting the surface runoff of pesticides and fertilizer used to treat the grounds. The plants in the wetland absorb excess nutrients, leaving clean water to filter into the lake.² Fewer nutrients in the lake prevents the growth of algae and other freshwater flora, providing a healthy habitat for fish species like cold-water lake trout, which require water with a greater oxygen, as made

Since the implementation of this technique in February of 2013, the level of the Mountain Lake has doubled, reaching a depth of 53 m.

Treetops adventure park, one of the many newly-developed attractions near Mountain Lake Lodge (MLL).
possible by the lack of aquatic flora pulling oxygen out of the water. Fewer excess nutrients mean less biomass is contained within the lake, making for clearer, more-appealing water and better fishing, in the case of the lake trout, both of which are essential to Mountain Lake’s image.\(^6\)

Watt and his team were hopeful that, in two years’ time, the lake would have returned to full capacity. Now in 2015, the lake is not even close to that level, though it does still contain about 53 m.-worth of water. To further investigate the mysterious lake, Skip Watt has teamed up with Jon Cawley, a professor of Environmental Studies at Roanoke College, to observe how watershed changes and storm water management may be affecting the lake.\(^3\) But the holes that Watt patched have held, and water over these areas is no longer leaking at an above-normal rate. The existing problem at Mountain Lake is the weak, porous layer of sandstone that makes up the lakebed. This type of bedrock has a propensity to crack, producing holes large-enough to pull water from the lake on the order of millions of gallons per day. As recently as August 2014, a
new hole was found in Mountain Lake, estimated to drain 1 million gallons per day. Because of this newly-found hole, the lake is unable to rise any higher. Watt claims that patching this hole would be just as easy as patching the others, but Mountain Lake is owned by a non-profit endowment, and funds are limited. Bar another miracle earthquake, the lake will remain at its current level until the newest hole can be filled. Until then, Mountain Lake will remain a fragment of its former self and a testament to the variability and unpredictability of nature.

Mountain Lake, partially-full, in August, 2014 (virginiaplaces.org).
Reference Links

1. New Observations of the Geomorphology and Origins of Mountain Lake, VA

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4. The Roanoke Times: Mountain Lake, Lodge Both Refilling After Repairs:

5. Mountain Lake Lodge:
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6. Marietta College: Lake Habitat Tour:
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