

Narrator: It's clear to see why Lake Mead is such a favorite. Clear, deep blue waters offer a refreshing dip in desert's heat and healthy habitat. The reflection of surrounding mountains and canyons creates a landscape so beautiful it was named the country's first National Recreation Area.

Sixty-five miles long and more than 700 miles of shoreline make up an ambitious amount of water for scientists to monitor. Yet dozens of scientists over dozens of years have done just that.

As a result, today the water quality in Lake Mead is high. Compared to water at other reservoirs across the nation. Lake Mead ranks in the category of "highest" for recreation and aquatic health.

Keeping clean the water of Lake Mead is not a simple task, by any measure. On the one hand, the greatest volume of water entering the lake is nearly pristine snowmelt flowing from high in the western Rocky Mountains into the Colorado River.

But on the other hand, parts of Lake Mead are the repository for 190 million gallons a day of highly treated wastewater from nearly 2 million people and population continues to increase.

Former chemical manufacturing sites have left a legacy of pollution of banned substances like DDT and PCBs.

A clean Lake Mead is crucial-- for the irrigation of two million acres of crops.-- for swimming, and other water-based recreation-- and drinking water for 25 million people. Water quality here is so important Lake Mead has become one of the most studied bodies of water in the U.S.

Scientists from a broad mix of agencies are focused on researching its water.

Michael Rosen: There are scientists from all over the US who are working on this project. Biologists, hydrologists, eco-toxicologists, chemists all contributing their data to this interpretive work.

Todd Tietjen: The benefit of collaboration between the various state, local, federal agencies and SNWA has facilitated the analysis of data for all of us.

Kent Turner: There's been a tremendous amount of monitoring and research conducted by various agencies that provided an opportunity to develop a partnership and coordinate some of that research to identify where those gaps were and what might be a holistic picture for the current status and condition ecologically of Lake's Mead and Mohave.

Michael Rosen: It's really important that we all collaborate together and I think everybody realizes that.

Narrator: A new report dubbed " The Lake Mead Circular" brings the science together into one document for the public, managers and scientists.

Michael Rosen: The goal of the circular was to combine all of this in one place for the general public, for managers and for scientists, to be able to show how the ecosystem is functioning and where we can go in the future.

Kent Turner: We kind of think of it as Lake Mead and Lake Mohave 101 for understanding. It gives them an appreciation for the lake and appreciation for those resources and a better understanding of the threats and what's needed to protect them.

Michael Rosen: I mean I'm really excited about the circular it has sections that are easily interpretable by the general public so that the public can get a better understanding of Lakes Mead and Mohave.

Narrator: The Circular explains significant research –both completed and ongoing. One example is the wastewater treatment story:

Kent Turner: It was obvious that there was need for enhanced research on the lake related to contaminants from some of the urban inputs and some of the needs of the wastewater treatment facilities to modify some of their discharge inputs into the lake.

Todd Tietjen: In 2001 there was a massive algal bloom. Pictures show the lake turning green.

Narrator. Fertilizers used on lawns, landscaping and agriculture contain the mineral phosphorous which often feeds algal blooms in lakes.

Todd Tietjen: A combination of the loading of phosphorous and weather events really fed the algal bloom that year it kept the phosphorous available to the algae for an extended period of time and as a result it turned the lake green. And from that it led to we need to solve this problem because people don't like a green Lake Mead.

Narrator. A strong coordinated response from the cities, county, state and federal agencies followed the algal bloom. Wastewater treatment, urban runoff and water quality were all addressed.

Narrator. Incoming data from all of the agencies led to significant improvements like developing additional wetlands in the Las Vegas Wash to naturally filter out phosphorous from urban runoff and wastewater.

Narrator: And as managers learned from scientific results, improvements were made in wastewater treatment in the Las Vegas Valley.

Todd Tietjen: Over the past 10 years the 3 waste-water treatment plants, originally, and now 4 waste-water treatment plants have combined treatment processes using either chemical flocculation where they precipitate the phosphorous out of the water or biological treatment where they raise bacteria in the treatment plant that consume the phosphorous and over that ten year period they've been able to reduce their phosphorous loading by literally 100's of pounds per day.

Michael Rosen: But the added bonus that was that this phosphorous removal process also removed other contaminants from the lake so of clarity because of the removal of phosphorous but also removed organic contaminants but also other potential harmful chemicals from the lake as well.

Narrator: Between 2004 and 2009 the U.S. Geological Survey used automated research platforms in the lake to collect round-the-clock water quality data crucial for understanding lake processes.

Erin Orozco: Got it

Ron Veley: We're at one of the USGS near continuous monitoring stations that's stationed on Lake Mead. At various times over the years we've had five of these located strategically throughout the lake so that we could get pictures basically of the water chemistry coming into the lake.

Ron Veley: How are the numbers looking?

Erin Orozco: They're looking pretty good.

Ron Veley: What's the PH?

Erin Orozco: PH is about 8 point one zero.

Ron Veley: Ok. What about turbidity?

Erin Orozco: Uh, turbidity is two point five right now. A little high but we'll clean it.

Ron Veley (INT): And that data is collected here and then it's transmitted by modems electronically over to our base stations at our office and then we process the data insuring that it's of good quality.

Narrator: The scientists analyzed results that included measurements of dissolved oxygen, phosphorous, chlorophyll, organic compounds and metals in the water. This data has helped in the creation of a 3D experimental model of Lake Mead.

Todd Tietjen: Probably the biggest culmination of the collaborative efforts is the numerical modeling of Lake Mead. As of now we've developed a 3 dimensional numerical model of Lake Mead so that we can simulate changes without them actually happening. We've attempted to model climate change, we've modeled phosphorous loading changes we've modeled changes in dam operation. There's hundreds of thousands of data points that went into building that model.

Narrator. Modeling and on-going monitoring are critical to maintaining and improving water quality here in the future.

Reynaldo Patino: That's one of the funniest testes I've ever seen.

Erik Orsak: OOOHHHHHHH you didn't, you didn't cut that up or anything?

Reynaldo Patino: Nope that's the way it was.

Erik Orsak: That's the worst one I've seen yet.

Narrator: Over the past 15 years the scientists have been studying the effects of trace levels of pharmaceuticals and personal care products. These chemicals may be impacting the reproductive health

of fish. But, they're extremely hard to detect because the concentration is like a drop of water in an Olympic sized swimming pool.

Michael Rosen: We're looking at all the chemicals that we can find in these passive samplers and to see whether the chemicals that we're seeing are the ones that cause intersex or cause tumors in fish.

Narrator: The fish health studies have taken place at key locations in Lake Mead, in the Las Vegas Wash and just below Hoover Dam at Willow Beach.

Michael Rosen: With improvements at the waste-water treatment plants and other factors that have gone into changes in the water quality in the lake we actually have seen an improvement in fish health over the last 4 or 5 years and because we can do this repetitive monitoring we can actually get a sense of how things are going over time.

Narrator: A key objective for Lake Mead is to maintain safe water to support healthy populations of fish and wildlife. Scientists have documented 92 species of water- dependent birds including significant populations of peregrine falcons.

Narrator: Lake Mead is home to at least fifteen species of fish with critical habitat for federally listed endangered species and large populations of non- native sport fish.

Narrator: A destructive species known as quagga mussels has invaded Lake Mead. They befoul hard surfaces like drinking water intakes and boat engines. A female can produce a million eggs per year. Quaggas change the lakes ecosystem by altering the food web by absorbing plankton, thus depriving larval fish of a major food source.

Michael Rosen: They have been studied heavily over the last five years and they are prolific they are all over the bottom or almost everywhere within the lake. So it's very important to be able to understand how they're reproducing, where they're reproducing. Whether there's any controls that can be applied to help the ecosystem maintain its balance that it had before quaggas were introduced.

Narrator: The lake features four large deep basins. Each has a different water source making them all ecologically different and giving the lake a unique diversity of habitats.

Kent Turner: You're surrounded in a really wilderness setting of beautiful desert topography, geology and color where you're likely to see wildlife including lots of water fowl and birds possibly bighorn sheep, maybe a coyote on the shoreline.

Narrator: Without the scrutiny of scientists Lake Mead would not have such high quality water.

Todd Tietjen: The sad fact is there will be a water quality problem at some point in the future. It may be human derived, it may be naturally derived, it may be just simply the maturation of the Colorado River system that causes changes that we need to address in the future. Without the collective sampling of the lake and the synthesis of that data we'd be shooting blind basically at it.

Kent Turner: One thing that we were pleased within the circular is that we also wanted to show that while there has been a lot of research here into contaminants and water quality we wanted to document that the lake has outstanding water quality for outdoor water based recreation.

Michael Rosen: Into the future we are hoping that we can improve things even further so that water quality hopefully will get even better over the next 50 to 100 years.

Narrator: Lake Mead is a place where maintaining and enhancing high water quality is critical and the scrutiny of scientists is essential.

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