The South Jersey Water Savers is a collaboration of non-profits working throughout South Jersey to protect, conserve, and restore clean water. Learn more by visiting sjwatersavers.org

The South Jersey Water Savers would like to thank Nick Procopio for his technical support and data analysis that made this brochure possible. A detailed water quality and withdrawal summary report can be found under the following citation: Procopio, N.A. 2017. Regional water-quality and water-withdrawal summaries. Prepared for the Pinelands Preservation Alliance, On Behalf of The Kirkwood-Cohansey Cluster, Delaware River Watershed Initiative. February 18, 2018.

Funding for this guide was generously provided by the William Penn Foundation.
The Kirkwood-Cohansey Aquifer system is displayed in light blue and the Pinelands boundary is shown in bright green. In 2017, a summary report was completed that summarized data trends for the streams and rivers that flow through the Kirkwood-Cohansey aquifer and surrounding rivers (outlined in red). These data were analyzed to determine how healthy the aquifer and surrounding streams are. Read on to learn more!

### Study Area
- Streams
- Pinelands Area
- Kirkwood-Cohansey Aquifer

**Source for aquifer illustration:** Pinelands Preservation Alliance
**Source for map:** Procopio, 2017
**Photo by Joann Kingsley**

### Did you know?
An aquifer is an underground sediment layer that can store and move water through the ground. Often this groundwater is what wells tap into for our drinking water!

### Your Community
- **Drinking Water:** The aquifer provides drinking water for about 1 million people in South Jersey. Chances are when you turn on the tap, the coffee pot, the shower, or the garden hose, that’s Kirkwood-Cohansey Aquifer water.
- **Economic Value:** The aquifer is also the source of water for farmers, who use it to irrigate hundreds of thousands of acres of cropland every year. It’s not just Jersey-fresh produce that relies on the aquifer — businesses all across South Jersey, from breweries to hospitals and food processors and manufacturing businesses need an abundant and clean water supply to thrive.
- **Recreation:** Don’t forget about fun! The aquifer feeds rivers and streams that are ideal for fishing and canoeing. Wetlands, where the aquifer touches the surface, are prime spots for birders. And the forests and fields above this critical resource are home to trails and natural areas visited by thousands of nature enthusiasts every year. Across the 8 counties that intersect the underground aquifer, recreation alone generated $2.1 billion in 2016.

*2016 Tourism Economic Impact Study completed by Tourism Economics, Philadelphia, PA.

### Your Environment
- **Nature:** In addition to the 1 million people who rely on the aquifer daily, the plants and animals that call South Jersey home rely on groundwater and its connection to surface water. The lands above the aquifer are home to thousands of species of flora and fauna, including some that are rare and endangered, like the swamp pink, pink lady slipper, purple martin, bald eagle, and Pine Barrens tree frog. Whether fish and wildlife live in the water, make their home on its banks, or fly through the air above, clean water from the aquifer provides habitats that sustain the food web and protect fish and wildlife.
How do groundwater withdrawals affect the aquifer?

- There’s a good chance that if you turn on your tap in South Jersey, the water that flows from your faucet is coming from groundwater wells that draw on the Kirkwood-Cohansey Aquifer. And it’s not just faucets; the hose in your garden, the irrigation systems on farms, and the cleaning systems in local industries all rely on a steady supply of groundwater to function.

- Over time, rainwater seeps through the ground to replenish the groundwater system, which can help balance out what humans remove for our daily water needs. Using groundwater is a natural part of life, but using too much too quickly can be a problem, particularly if we pump water out faster than rainwater can filter back in.

Impact on humans and environment

- A plentiful Kirkwood-Cohansey Aquifer is critical for people, plants, and animals all across South Jersey. When too much water is pumped out of the ground, it can dry up local streams, wetlands, and even neighboring wells. This can destroy the delicate habitats that sustain life for countless species, and make it challenging for families and businesses.

- Over-withdrawals from the aquifer can even lead to subsidence, which is where the land sinks as groundwater is removed. If the groundwater is removed and no longer takes up space in the aquifer, the sediments will sink to fill the void.

Conditions that may lead to excess withdrawals

- Often times, people use more water than they realize. Especially in areas with high demands on groundwater supplies, like in dense residential or agricultural areas, it’s possible that more water is being pumped out of the aquifer than what is being replenished each year. Leaking pipes and fixtures, over-watering of lawns, and inefficient irrigation are some of the main culprits of excessive groundwater pumping. Even smaller water uses add up, like long showers, brushing your teeth with the faucet on, or running the dishwasher or washing machine before it’s full.

The next four sections discuss four main parameters, or defined measurements that are used to assess the health of the Kirkwood-Cohansey Aquifer. These four parameters are:

1. Groundwater Withdrawals
2. pH Levels
3. Specific Conductance
4. Nutrients, including measurements of Nitrates and Phosphates

Map of Water Withdrawals

This map shows reported water use across South Jersey in 2011. Areas displayed in tan reported using less water in 2011 than areas shown in brown. Factors that may influence the amount of water used can include population size, demand, and development pressure. Also, water use may change from year to year based on drought conditions.

Water use is reported by individual land and property owners, which may result in inaccurate values or under-reporting of water use. Because of this, it’s possible that some areas are using much more water than what is shown on the map, but further research is required.

Making water conservation part of your everyday life will help prevent excessive water withdrawals from the aquifer and help protect it for future use.

Did you know?
The average family of four uses about 400 gallons of water per day? Your household can easily save 30 gallons of water a day by turning the water off while you brush your teeth or shave!
pH is different across the many streams of South Jersey, but this is normal. By knowing what a normal pH is for a specific stream, we can take measurements over time to see if they change. If they do change, then we need to take a closer look to see what factors may be changing the stream health.

pH is an important water quality indicator, especially in Pinelands waters. According to the New Jersey Department of Environmental Protection (NJ DEP), Pinelands waters should have a pH in the range of 3.5-5.5. pH levels lower or higher than this recommended amount could disrupt the Pinelands pristine system.

What is pH?
Measurements of pH tell us how acidic or basic a water body is. The measurement is on a scale from 0 (acidic) to 14 (basic), with a neutral point of 7. Surprisingly, natural water in streams and underground isn’t always neutral, and that’s okay. In fact, it’s common for pH to vary by region and environmental conditions. For example, in the Pine Barrens, water naturally tends to be more acidic, which is good for the organisms that have adapted to live there. Meanwhile, streams on the coast naturally are not as acidic. Check out the map on the right for differences in pH across South Jersey!

Impact on community and nature
pH plays a major role in determining whether or not a stream is healthy enough to support plant and animal species, and directly impacts water chemistry, including nutrients and heavy metals. If a stream becomes more acidic or basic than it normally would be, animals that can move may be forced to seek new habitats, and those that can’t, might not survive.

Some conditions that may change pH
- Acid rain from burning fossil fuels like coal, oil, and natural gas.
- Fertilizer runoff from lawns and farm fields.

Did you know?
Items in our everyday lives have different pH levels? The pH of lemon juice is 2 whereas the pH of soapy water is 12!
What is specific conductance?

Specific conductance, or conductivity, is a measure of how well water can conduct an electrical current. Interestingly, this information can tell us about how healthy our streams and rivers are! For example, the more dissolved ions in the water, the greater the ability to conduct an electrical current, and therefore the higher the specific conductance. Although conductivity cannot tell you exactly what is happening in a stream, it is a piece of the puzzle that can provide information on changes to water quality, or the health of a stream.

Impact on community and nature

Healthy freshwater streams and rivers in this region have specific conductance ranging from 50-500 µS/cm (microsiemens per centimeter).* Once you know what the normal conductivity range is for your water, you can measure it from time to time to look for changes. If conductivity does change, then it’s likely that the water chemistry of your stream has changed, which could be hurting fish and other aquatic wildlife.

Conditions that may change specific conductance

One condition that may increase specific conductance is salt-water intrusion. Seawater has a specific conductance that is much, much higher than fresh water. This is because salt water has a higher concentration of ions than fresh water (think about all of the sodium and chloride needed to make the water “salty”). If conductivity is significantly increasing in a coastal stream, it could be due to sea level rise and increased sea water into the aquifer.

The use of road or sidewalk salt for deicing pavement during winter storms will increase the specific conductance of water when the snow or ice melts and the water runoffs into nearby streams. In addition to raising the specific conductance, this may negatively impact plants and animals that can’t tolerate salt.

Did you know?

Ions are compounds that make up the water’s chemistry. Ions are things like sodium, magnesium, sulfate, or potassium.
**What is a nutrient?**

A nutrient is something that is necessary for all life. There are different nutrients that humans, animals, and plants need in order to live, including carbohydrates, proteins, vitamins, water, and minerals. Interestingly, nitrogen and phosphorus are necessary nutrients for plants and are naturally found in the environment.

**Impact on humans and environment**

- Like many things in our daily lives, too much of a good thing can lead to negative health impacts (think sugar). The same is true in nature. Too many nutrients in our streams will lead to a condition called eutrophication, which means excessive amounts of nutrients in water. Extra nutrients running off the land will allow microscopic plants and algae in streams to grow quickly, leading to algal blooms, which can consume all of the available oxygen in a stream and cause fish to die.
  
- Not only are there too many nutrients, or eutrophication, bad for streams and wildlife, the condition can also be bad for human health.
  
- If nitrate levels are too high in drinking water, it can cause health problems like “blue baby syndrome” where too much nitrate blocks oxygen delivery in babies, causing their skin to turn blue.

**Conditions that may lead to excess nutrients in streams**

- Nitrate and phosphorus are extremely valuable to plants, but are limited in availability. For this reason, humans have introduced nitrate and phosphate into the environment with fertilizers to make lawns greener and increase crop production. But if too much fertilizer is used on lawns and farms, or if fertilizer is applied before a rain event, the nitrate and phosphate will runoff the land into nearby streams and rivers, where it may do more harm than good.
  
- Septic systems and effluent from wastewater treatment plants are other ways nutrients can sneak into streams and rivers. If a septic system hasn’t been maintained and is leaky, raw sewage which is rich in nutrients and bacteria will enter the streams and rivers.

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Phosphorus: The NJ DEP recommends that total phosphorus levels stay below 0.1 mg/L for healthy waterways. Phosphorus levels in South Jersey streams are generally below this level, however, some waterways are polluted with extra phosphorus and others are approaching an unhealthy level.

Fortunately, New Jersey has laws that require fertilizers to contain zero phosphorus. Although phosphorus can persist for a long time in the environment, these laws will help reduce excess phosphorus over time.

**Median total phosphorus as P (mg/L)**

<table>
<thead>
<tr>
<th>Key</th>
<th>Median Total Phosphorus as P (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 0.010</td>
<td>0.010 – 0.050</td>
</tr>
<tr>
<td>0.025 – 0.050</td>
<td>0.010 – 0.025</td>
</tr>
<tr>
<td>0.050 – 0.10</td>
<td>Greater than 0.10</td>
</tr>
</tbody>
</table>

**KEY TO MAP**

- Pinelands Area
- Streams

**How to conserve water to reduce water withdrawals from the aquifer:**

1. Fix leaky appliances, like faucets and toilets, as soon as you notice a problem. This can save thousands of gallons of water per year!
2. Find ways to conserve water around the house! Trim down your shower time, turn off the water when you brush your teeth, and only run the dishwasher or washing machine with a full load.
3. Consider upgrading appliances to new, water efficient models. Look for the U.S. Environmental Protection Agency’s WaterSense logo on toilets, fixtures, and other household appliances to reduce water use.
4. Minimize yard watering by planting native plants! They are uniquely adapted to thrive in local conditions, and therefore don’t need the same kind of watering that turf grass does. If you need to water your lawn, try to do so early in the morning or after dark to minimize water loss to evaporation. Be sure to pay attention to automatic sprinklers to avoid watering right after (or even during) a rainstorm.

**How to promote healthy pH levels in streams and rivers:**

1. Reduce fertilizer use on your lawn: the nutrients in fertilizers that help your lawn grow can be problematic when too much of it ends up in streams or groundwater. Do a soil test (available through Rutgers University Cooperative Extension county offices) to see if your yard needs fertilizer. If it does, focus on applying in the late summer or early fall.
2. Test your tap: acidic water can corrode your pipes and cause heavy metals like lead to leach out. Simple at-home water tests can determine whether or not your tap water has a pH issue. If it does, there are filter systems you can install to protect your pipes and your family.
3. Learn about climate change and see if you can cut back on your energy use to help reduce the burning of fossil fuels! Air pollutants can lead to acid rain, which would lower the pH of streams over time.

**How Can You Help?**

Your everyday actions and choices can make a difference in maintaining and improving the health of our streams in South Jersey!

**Consider a rain barrel for your property!**

Rain barrels help capture water that would otherwise runoff your property and stores it for later when you need to water your lawn or garden.

**Consider a rain garden!**

Rain gardens are planted with native plants and help to soak up water and reduce flooding.

**Before**

**After**

- Photo by Emma Melvin
- Photo by Norma Worley
- Photo by Bill Lynch
- Photo by Robert B. Laucks
- Illustrations by Frank McShane
- Background photos by Robert S. Leicht
In 2017, a report* was completed that summarized water quality and water quantity data by watersheds for counties that intersect the Kirkwood-Cohansey aquifer and areas where the South Jersey Water Savers are working (labeled as “study area” in the maps within this booklet). This regional assessment compiled data that is publicly available through the National Water Quality Portal** and the NJ Pinelands Commission including lakes, reservoirs, and impoundments, streams and wells. Data were analyzed by watershed and the median value was then used to represent the state of conditions in each watershed map for each parameter.

The parameters described (pH, specific conductance, etc.) can give insight into water quality conditions on a regional scale. However, because the frequency in data collection varies and there are differences among the sampling stations, this booklet serves as a broad overview of how different water quality parameters can provide information on the status of streams and rivers.

Groundwater withdrawal data are available in the New Jersey Geological Survey Digital Geodata Series publication. Data included in the report are from multiple databases that summarize information from the New Jersey Water Transfer Data Model***, which includes measured and estimated monthly withdrawal, use, and return amounts from 1990-2011. Monthly withdrawal data were summed across each of the watersheds and a percent change was reported for the 10 year period. Because the withdrawal and water use data are self-reported, they should only serve as estimates for actual changes.


**www.waterqualitydata.us


How to help keep specific conductance levels within healthy ranges for our waterways:

- Be mindful about the amount of salt you apply to your sidewalks and use around your home. Although it can be very helpful during cold winter storms, salt can wash away into nearby streams raising the amount of chloride ions in the water and damaging local wildlife. Try to only apply road or sidewalk salt in the lowest quantities and when it’s absolutely necessary.

- Consider using sand or other deicing products rather than salt on sidewalks during winter storms. These products will help keep sidewalks safe and keep salts out of streams, which raises the specific conductance.

How to reduce nutrient runoff to streams from your own backyard:

- Proper waste management by all land owners is key to avoid any waste washing into and polluting streams. Farmers should practice good manure management, pet owners should clean up dog waste, and homeowners should keep their septic systems in good working order. All of these things will reduce the amount of nutrients that can pollute streams.

- All landowners including homeowners and farmers should use fertilizer sparingly and should only do so when there is no rain in the forecast. New Jersey has laws that require fertilizers to contain zero phosphorus and have a minimum of 20% slow release nitrogen to help reduce excessive nutrients in New Jersey’s environment.

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