

# TESTING THE WATERS

## A BEEF AND DAIRY PRODUCERS' GUIDE TO CHECK WATER QUALITY BELOW OPEN LOTS

ENVIRONMENTAL SERVICES DIVISION | WWW.IOWADNR.GOV



*Beef cattle on central Iowa open lot.*

Managing runoff from a cow yard or open lot can be challenging, but it's possible. Testing the waters is a first step. If there is a problem, partners in the Small Open Lot Plan can provide information and help find solutions that work.

Only the producer can get a complete picture of water quality below an open lot, because it takes constant monitoring to know if there is a problem. Some lots have issues only during snowmelt or when the ground is frozen. For others, rainfall can cause runoff over land or a discharge through tile lines. In a few lots, located on very flat ground far from a stream, the discharge might soak into a field and never reach the stream.

There are two basic ways to check on water quality below a lot:

- Visual inspection
- Tests for chemical, physical and biological properties such as ammonia, phosphorus, oxygen, temperature, pH and bacteria.

### Visual Inspection

To conduct a visual inspection, follow the runoff path(s) from the lot. Check the pathway during or after it rains, and after the snow melts or the ground thaws. If brown, discolored water is reaching the stream directly, you probably have a water quality issue. If you find any of the following where runoff reaches the stream, there is a problem:

- a large amount of foaming
- a strong odor of manure
- discolored water
- evidence of manure solids such as corn hulls in the pathway to the stream or on the stream bank after a rainfall or snowmelt.

### The Role of Nitrogen

Sources of nitrogen in a stream include fertilizer, human and animal waste, legume fixation and direct deposition from rain. Nitrogen in a stream may occur in many forms including ammonia, organic nitrogen and nitrate, although nitrate is the most common form found in Iowa's water. High levels of nitrate in drinking water have been linked to human health issues such as cancer and blue-baby syndrome.

Nitrogen in lot runoff is likely to occur as ammonia and ammonium with the ammonia portion highly toxic to fish. The balance between the two, ammonia and ammonium, depends on the pH and temperature in the stream. Ammonia is normally short-lived in the environment and quickly converts to other forms of nitrogen such as nitrate. Thus, the impacts from ammonia tend to be localized in small streams.

If manure discharges to a tile, look at the tile outlet or discharge. Any discharge could be a problem.

### Ammonia Tests

Even if there is no visible sign of a problem, producers can use the low range ammonia nitrogen test kit to determine if there is ammonia in the water. The ammonia test is convenient and easy to use, but it doesn't rule out other pollutants, such as bacteria, that may be high.





Take the sample in the stream. Pick a location below the pathway(s) where runoff from the lot enters the stream.

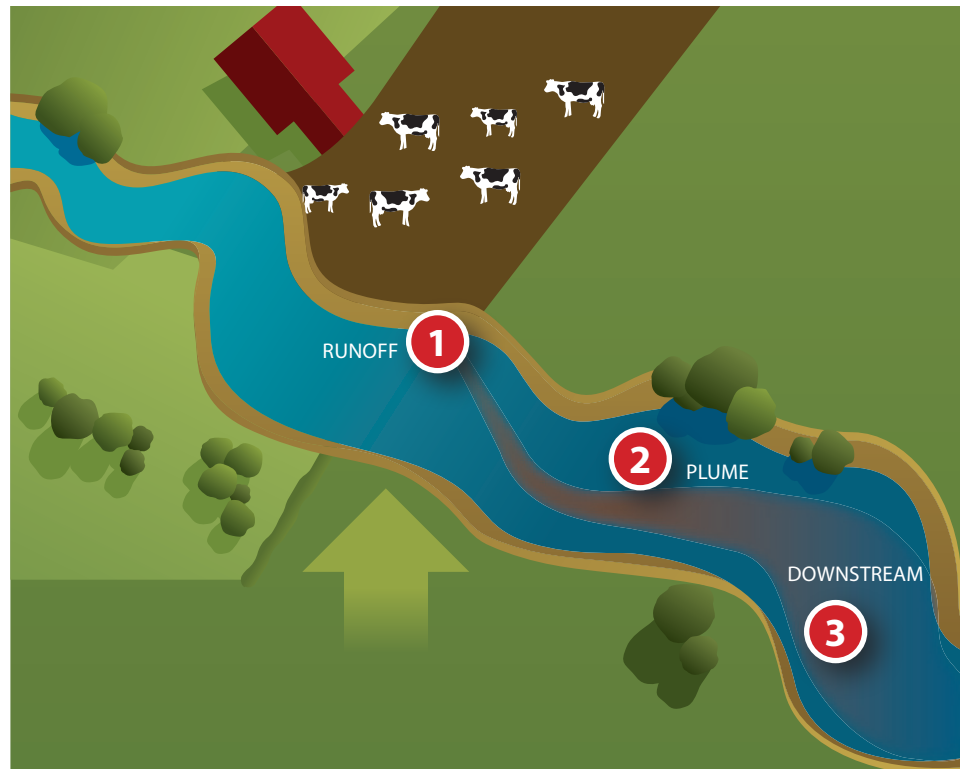
## Testing for Ammonia

### Pick Up Kit

Low range ammonia-N test kits are available at about 20 Iowa State University (ISU Extension and Outreach offices. Check with your local office to find the nearest kit location or go online to: <https://www.extension.iastate.edu/immag/>. Each office may have slightly different policies on check out and return of test kits, so please call ahead to confirm that a kit is available and to find out how long you can keep it.

**Use and Care of Test Kit** Follow manufacturer's instructions for handling test kits. Also, avoid getting Nessler's reagent on hands or in eyes. Keep away from children.

Do not allow test kit to freeze or leave it in a hot car. Keep kits, especially the color wheel, out of direct sunlight. Please report any problems with the test kit to the Extension and Outreach office, so the Iowa Department of Natural Resources (DNR) can repair or refill the kits.



## TAKING THE SAMPLE & RUNNING THE AMMONIA TEST

**1.** Follow runoff path(s) from the lot to determine where runoff enters the nearest stream. Trace over-land pathway(s) during or after it rains, snow melts or the ground thaws when it's easy to see the flow path. Check for flows into tile inlets. If runoff flows into a tile, trace where the tile line flows into a stream. Drainage district or county tile line records may be helpful.

Sample water as close to a rainfall or snowmelt event as you can, because that's when ammonia is transported to the stream. Sample while runoff is flowing into the stream, because once the flow stops pollutants are quickly carried downstream. Sample in the stream directly downstream of the feedlot or cow yard, even if the stream is a drainage ditch. Sample regardless of stream size and stream flow, although pollutants are most concentrated when flows are low. (While you may be interested in ammonia levels in the runoff coming off the feedlot, you will need to sample water in the receiving stream to determine if the runoff is likely to violate state water quality standards or cause a fish kill.)

**2.** If a plume of brown or discolored runoff is flowing into the stream, you may want to include the brown water in the sample. This is where the pollutants are likely to be most concentrated.

**3.** If you move downstream and take another sample where more mixing of the runoff and stream water has occurred, that sample may further indicate downstream impact.

**4.** Use a bucket or gallon jug to collect the sample. Rinse it three times with the stream water, then collect enough to fill several test tubes.

**5.** Remove two test tubes from the ammonia test kit. Rinse them three times with the water sample.

**6.** Fill one test tube with the water sample and place it in the left side of the color comparator wheel. This is the control test tube.

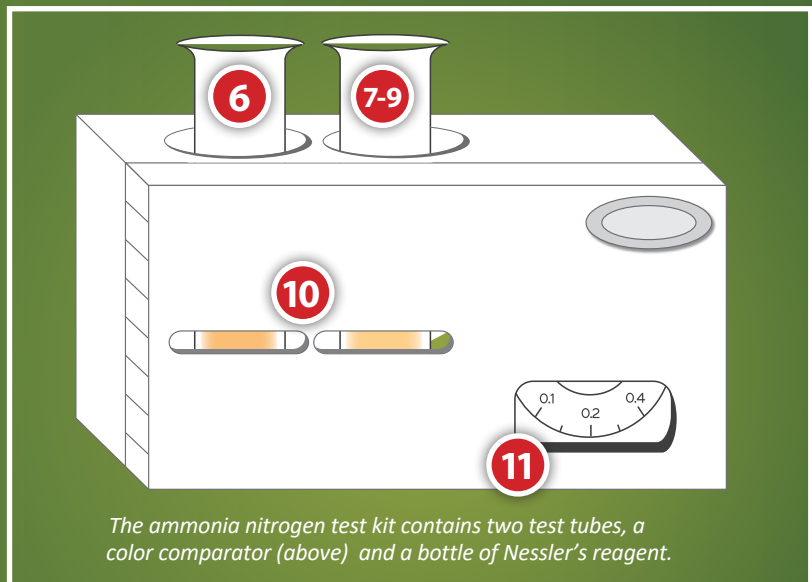
**7.** Fill the second test tube with the water sample to the 5-milliliter mark. Flicking the bottom of the test tube is the easiest way to get the right size sample.

**8.** Add three drops of Nessler's reagent to this test tube and gently shake it to mix the sample. Wait one minute, but no more than five minutes for the sample to change color. If ammonia nitrogen is present, the water will turn a shade of yellow-orange. The darkness of the color change indicates how much ammonia is present.

**9.** Place this test tube on the right side of the color comparator.

**10.** Hold the comparator up to a light source such as the sky or reflections off a white building. Turn the wheel on the color comparator until the colors in both test tubes match.

**11.** Read ammonia nitrogen concentration as milligrams per liter (mg/L) which is equivalent to parts per million (ppm).



## Confidentiality

Test results are available only to you, the cattle or dairy producer, unless you want to share them.

## Interpreting test results

The DNR's field testing shows many of Iowa's smaller streams in cattle country typically have ammonia nitrogen levels at 0.1 to 0.2 parts per million (ppm). The DNR's long-term monitoring program has found an average of less than 0.1 ppm in mid- to large-size Iowa streams. Readings above 0.5 ppm indicate that the stream has a problem with pollution from ammonia nitrogen.

This test kit measures relatively low levels of ammonia nitrogen, with a maximum reading of 3.0 ppm. If your sample tests at 3.0 ppm, then the actual level could be a little higher (like 5.0 ppm) or a lot higher (like 100 ppm). Producers interested in more accurate test results can purchase a mid-range or

high-range ammonia-N test kit from several companies, including Hach Chemical. Or, check with a private laboratory for testing services.

Conditions in streams are constantly changing and there are many factors that can cause problems. Fish kills can be caused by relatively low concentrations of ammonia nitrogen (less than 3.0 ppm) depending upon other conditions in the stream.

The DNR's inspections following fish kills often find low levels of dissolved oxygen, combined with manure solids and elevated levels of ammonia nitrogen. The ammonia nitrogen test is just one way to measure possible pollution problems. It's an indicator, but not the only way.

## Next steps

If you find ammonia nitrogen levels at 0.5 ppm or greater, it would be wise to take another sample upstream to make sure the pollution is coming from the lot or cow yard runoff, not some other source. Walk far enough upstream to take the sample above all discharges from the lot and below other potential sources of pollution (such as a tile line). Compare the upstream sample with the sample where runoff enters the stream to decide how much is coming from the lot or yard.

If you know the high reading is coming from the lot, you probably have bacteria and manure reaching the stream too. You may need expert help to solve the problem. There are many different solutions, but the right solution depends upon the specifics of each lot or cow yard. Sometimes it's as simple as building a water diversion above the lot or improving routine maintenance. Other times, more engineering and some construction might be needed to solve the problem.



tests show nutrients ending up in nearby waters, the impact is negative for both the producer and the stream.

Many groups and agencies are working together to provide information for farmers with small operations. Farmers can rely on the same partners for more information, resources and technical assistance. Partners can help farmers evaluate the source of the problem and select the best solution for their lot and management style.

Working together, partners and producers can keep nutrients for crops and pastures — a win-win solution for cattle and dairy farmers and Iowa waters.

Dairy cattle on open lot. Photo courtesy of ISU Extension and Outreach.

**Summary**

By testing waters below their lots, beef and dairy farmers will learn more about what’s running off their

feedlots and cow yards. Capturing manure nutrients from the lot benefits farmers by providing fertilizer for crop production. If the visual inspection or

Important Links	Iowa DNR Field Offices
<p>Iowa State University Iowa Manure Management Action Group  <a href="https://www.extension.iastate.edu/immag/">https://www.extension.iastate.edu/immag/</a></p> <p>State Revolving Fund  <a href="https://www.iowasrf.com/">https://www.iowasrf.com/</a></p>	<p><b>Northeast</b> • 563-927-2640</p> <p><b>North central</b> • 641-424-4073</p> <p><b>Northwest</b> • 712-262-4177</p> <p><b>Southwest</b> • 712-243-1934</p> <p><b>South central</b> • 515-725-0268</p> <p><b>Southeast</b> • 319-653-2135</p>
<p>Report spills to DNR field offices during office hours. Call the 24-hour spill line   <b>515-725-8694</b>   after hours, weekends or holidays.</p>	

**Technical Assistance**

You may want to contact your local ISU Extension and Outreach, USDA-Natural Resources Conservation Service, or Soil and Water Conservation District for technical assistance. Private engineers can also help.

The DNR can offer advice on what needs to be done to comply with state and federal regulations. ISU Extension and Outreach offers workshops and has educational materials available to assist mid-sized dairy and cattle producers. Check with your local Extension office or the Iowa Manure Management Action Group’s website.

**Financial Assistance** - Financial assistance is available for water quality improvements through state and federal cost-share and state revolving fund low interest loans [www.iowasrf.com/](http://www.iowasrf.com/).

**Partners in the Small Open Lot Plan**

- Iowa Beef Center  
[www.iowabeefcenter.org/](http://www.iowabeefcenter.org/)
- Iowa Cattlemen’s Association  
[iacattlemen.org/](http://iacattlemen.org/)
- Iowa Department of Agriculture and Land Stewardship  
<https://iowaagriculture.gov/>
- Iowa Department of Natural Resources  
[www.iowadnr.gov/](http://www.iowadnr.gov/) • [www.iowadnr.gov/afo/](http://www.iowadnr.gov/afo/)
- Iowa State Dairy Association  
[www.iowadairy.org/](http://www.iowadairy.org/)
- Iowa State University Extension and Outreach  
[www.extension.iastate.edu/immag/](http://www.extension.iastate.edu/immag/)
- USDA – Natural Resources Conservation Service  
[www.ia.nrcs.usda.gov/](http://www.ia.nrcs.usda.gov/)