Clean Water Program Task Force

# Technical Memorandum No. 5

## – Water Quality Standards –

## What is Water Quality?

Water Quality refers to the chemical, physical, and biological condition of water. Often it is used to describe the suitability of water for swimming, fishing, drinking, agriculture, etc. It has a range of meanings depending on the intended use of the water. For example, the water quality in irrigation might be good for farming but may not be suitable for swimming and maybe dangerous to drink.

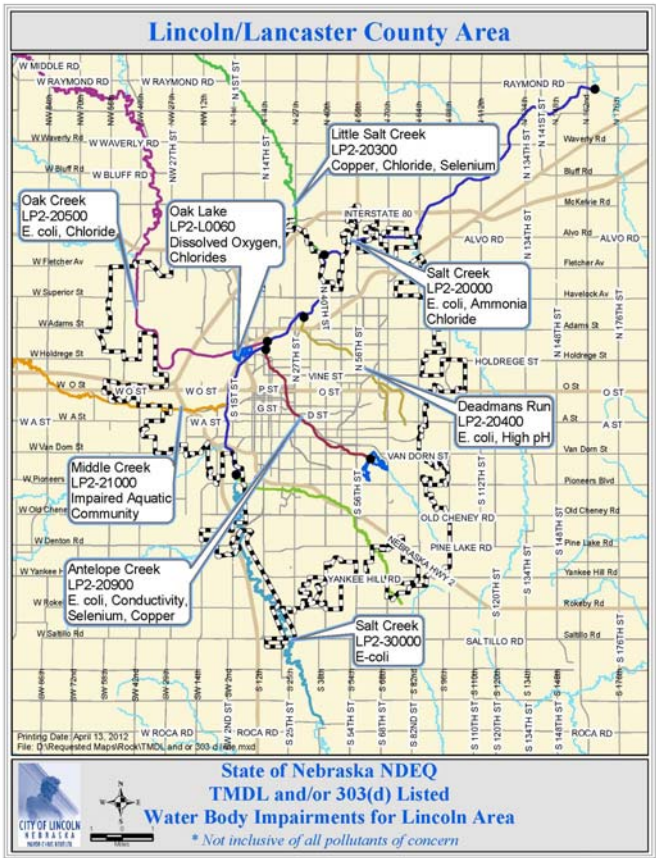
## History of Water Quality Standards

As far back as 1850 there has been a national interest in flood control. However, it wasn't until the 1970's that the United States started evaluating and understanding the impacts of poor water quality. The Nationwide Urban Runoff Program (NURP), for example, which ran from 1973-1983 was one of the first major evaluations of pollution and water quality in urban watersheds. The Federal Water Pollution Control Act of 1956 and the Water Quality Act of 1965 were early efforts in the U.S. to establish water quality standards. As States began to establish standards and face complexities of enforcement, congress passed the Clean Water Act of 1972 to promote a more effective program. The focus of the programs is to restore and maintain the health of U.S. waters for both aquatic life and human recreation by eliminating or reducing discharge of pollutants. In order to implement the requirements of the Clean Water Act, the Environmental Protection Agency (EPA), a federal regulatory agency, developed Water Quality Standards. These Federal Water Quality Standards regulations can be found in 40 CFR Part 131 and are the foundation behind the water quality-based approach to mandate control of the urban stormwater pollution.

## EPA's List of Impaired Water Bodies

As part of the Clean Water Act - Section 303, the EPA and subsequently the Nebraska Department of Environmental Quality (NDEQ) is charged with reporting on the quality of water in its jurisdiction. The reports, known as 303(d) reports, are developed by the NDEQ and are submitted to EPA for approval biannually. The NDEQ summarizes the water quality information for the streams, rivers and lakes within the State. For each water body, the water is sampled and compared against corresponding water quality standards based on the intended use. The Clean Water Act requires that a stream, river, or lake be placed on the 303(d) impaired waters list if it fails to meet the water quality criteria. Furthermore, the law requires that the EPA develop a Total Maximum Daily Load (TMDL) for these impaired waters. A TMDL Management Plan must then be developed with a strategy to reduce the pollutants in the water body below the TMDL limit. In Lincoln, most of the major urbanized streams and channels have been declared impaired, meaning the water does not meet the thresholds established for their intended use (e.g., recreation or aquatic life).

***Total Maximum Daily Load (TMDL)*** *is the calculated maximum amount of a pollutant that a water body segment can receive and still safely meet water quality standards. In Nebraska, NDEQ calculates TMDL's for impaired water body segments.*




## Antelope Creek - Basin Management Plan

Antelope Creek from Holmes Lake to its confluence at Salt Creek, near Bob Devaney Sports Center, is one of the 303(d) impaired waters listed in Lincoln mainly due to the high levels of Escherichia coli (E. coli) measured in the creek. In 2007, NDEQ calculated the TMDL of E. coli and set a reduction goal as 113 colony forming units per 100 milliliters (cfu/100mL). As a result, in 2010 the City of Lincoln and Lower Platte South NRD hired EA Engineering, Science, and Technology, Inc. to develop the *Antelope Creek Watershed Basin Management Plan*. The purpose of the Basin Plan was to identify sources of the pollutants, provide alternatives to reduce pollutant loads, and to develop a strategy to remove the Antelope Creek waterway from the list of Impaired Waters. The sampling and research completed for the Plan in 2010-2011 indicated the concentration of E. coli at the confluence with Salt Creek was 1,511 cfu/100mL, therefore a 93% reduction in the E. coli pollutant load is needed to meet the level set by NDEQ.

Summary findings of the Plan include:

1. E. coli bacteria are likely from a diffuse source such as urban wildlife and pets
2. There are no indications of a point source polluting Antelope Creek (e.g., illicit connections from sanitary sewers)
3. Achieving the TMDL standard for E. coli will be difficult, costly, and require a long term systematic approach
4. The most effective pollution control strategies for diffuse sources of E. coli and other pollutants are structural BMPs that achieve stormwater runoff volume reduction or infiltration and source controls (e.g. reducing pet waste)
5. The levels of pollutants found in Antelope Creek are typical of other urban streams found throughout the Unites States

The Plan formulated a range of recommendations with strong emphasis on the expansion of existing programs and activities, and creation of new activities including development of post-construction standards. Altogether, the estimated total implementation cost for the activities recommended to remove the water body from the 303(d) list exceeded $50 million for the Antelope Creek watershed given the fact that it's fully urbanized and there were no previous post-construction standards.

## Pollutants and Pollution Sources

The sources of pollution can be 'point' sources such as an industrial plant discharging into a creek, or 'non-point' sources such as pet waste, fertilizers, pesticides, etc. Pollution sources often contain, carry, or create, a variety of specific pollutants. As sources contribute pollutants to the streams and lakes, water bodies can become impaired.

The primary pollutants of concern for Lincoln are Total Suspended Solids (TSS), E. Coli (as previously mentioned), and nutrients such as phosphorous (typically from fertilizers). Other pollutants and causes for impairments include heavy metals, pesticides, oil, high pH, and temperature. The table below shows typical pollution sources and associated pollutants found in Lincoln urban water bodies.

## Summary

A long term systematic and proactive approach is needed to reduce pollutant levels to local streams and lakes. In addition to reducing pollutant levels, implementing practices that will allow the City to meet water quality standards will have many other benefits. Benefits include:

- Reduced streambank erosion
- Reduced stormwater volume
- Reduced localized flooding
- Increased base flows
- Increased biodiversity in streams and lakes
- Improved public amenities
- Lower long term maintenance costs
- Increase in aquatic riparian habitats

As there is not enough known water quality data in Lincoln, especially on the non-point sources, the best available technology for reducing pollutants is structural Best Management Practices (BMPs) such as bioswales, pervious pavement, green roofs, etc. BMPs reduce storm water volume and promote infiltration for the majority of rainfall events. They have also been shown to be effective in reducing all pollutant levels, especially sediment. which is a carrier of other pollutants. In conjunction with these structural controls, it is also important to continue to implement new controls through education and ordinances.

| **Pollution Source** | **Source Explaination** | **Pollutants** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | ***Solids*** *(Sediment, TSS)* | ***Nutrients*** *(P, N, Se)* | ***Pathogens*** *(E. coli, bacteria)* | ***Oxygen Demand*** *(BOD, COD)* | ***Metals*** *(Cu, Pb, Zn, Se, As, Hg)* | ***Oils*** | ***Synthetic Organics*** *(PCBs)* |
| Wildlife and Pet Waste | Pet waste (typically from dogs & cats) may contribute significatnly if waste is not properly disposed. Bird droppings into the streams and creeks often occur at bridges and other structures where birds nest and perch. Also, wildlife (such as raccoons, squirrels, etc.) live in most watersheds and their droppings contribute as a source. | X | X | X | X | | | |
| Fertilizers | Improper storage and disposal of fertilizers, over application, or incidental application to impervious surfaces (e.g. drivewasy & sidewalks), can lead to excess nutrients in stormwater runoff. Excess nutrients often contribute to algal blooms. | | X | X | X | | | |
| Soil Erosion and Construction Site Runoff | Sediment entering a stream through natural processes, erosion, or from construction sites can decrease the biological function of the water and be detrimental to aquatic habitat. In addition, sediment can 'pick up' nutrients such as nitrogen and phosphorus, and carry them downstream in the waterbody. This can create an incubation zone for bacteria growth. | X | X | | X | X | | |
| Pesticides | Pesticides are common in the rural and urban settings used to prevent, destroy, control, or repel pests (such as insects, weeds, microbes, etc). Subclasses of pesticides include insecticides, fungicides, herbicides, etc. | | | | X | X | X | X |
| Vehicle fluids | Pollutants from vehicles include oil, metals, grease and fuel. Streets and parking lots typically drain directly to urban storm drainage systems. | X | | X | X | X | X | |
| Household Chemicals and Industrial Processes | Industrial processes can knowingly or unintentially contribute point source pollution to waterbodies. Household chemicals, including paint and preservatives can also contribute to the degredation of water quality. In some cases heavy metals or other pollutants can come from unkown sources such as contaminated soil. | X | X | | X | X | X | X |

Adapted from: E. Shaver, R Horner, J. Skupien, C. May, G. Ridley. 2007. *Fundamentals of Urban Runoff Management: Technical and Institutional Issues, 2nd Edition,* Madison, WI: NALMS and EPA.)