PRAIRIE RIVERS NETWORK

GUIDE BOOK SERIES

PRACTICING ANTIDEGRADATION IN ILLINOIS

// Protecting Existing Uses & Maintaining Quality of Waters

GUIDE BOOK SERIES

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In 2002, Illinois adopted a comprehensive set of regulations establishing its antidegradation policy. Though Illinois was one of the first states to adopt such regulations, **the implementation must be improved in order to accomplish the stated purpose:**

"TO PROTECT EXISTING USES OF ALL WATERS OF THE STATE OF ILLINOIS, MAINTAIN THE QUALITY OF WATERS WITH QUALITY THAT IS BETTER THAN WATER QUALITY STANDARDS, AND PREVENT UNNECESSARY DETERIORATION OF WATERS OF THE STATE."

With this guidebook, **Prairie Rivers Network** and the **Illinois Chapter of the Sierra Club** hope to promote a flexible, yet meaningful way to accomplish these goals for municipalities planning for new or expanding wastewater treatment plants.

ILLINOIS ANTIDEGRADATION POLICY SIMPLIFIED | The purpose of the antidegradation policy is to protect existing uses of all waters and maintain the quality of waters with higher quality than the minimum water quality standards. The language of the regulations can be found in **TITLE 35** of the **ILLINOIS ADMINISTRATIVE CODE, SUBTITLE C,** especially section **302.105.** The following is a simplified summary of these regulations.

EXISTING USES

- **All** existing uses attained on or after November 28, 1975, must be maintained. Such uses might include any recreational use, water supply use, or use by particular aquatic life such as fish or mussels

OUTSTANDING RESOURCE WATERS

- Outstanding resource waters *(ORWs)* are waters of "exceptional ecological or recreational significance" that are designated as such by the Illinois Pollution Control Board *(IPCB)*
- ORWs must not be lowered in quality *(a few exceptions are described in regulations)*
- Illinois has not yet designated any waters as ORWs

HIGH QUALITY WATERS

- Waters that are cleaner than required by the water quality standards must be maintained at high quality unless lowering the quality is necessary to accommodate important economic or social development
- Before Illinois EPA *(IEPA)* allows increased pollution into any high quality water, it must conduct an antidegradation assessment. The few activities that are not subject to this review are described in the regulations

ANTI-DEGRADATION ASSESSMENTS

Permit applications must include information for IEPA's use in making the assessment. This information includes:

- Identification of proposed pollutant load increases and potential impacts on uses (of the receiving streams)
- Fate and effect of parameters proposed for increased loading
- Purpose and anticipated benefits of the proposed activity
- Assessments of alternatives for less increase in loading or minimal environmental degradation
- Summary comments of the Illinois Department of Natural Resources, Regional Planning Commissisions, Zoning Boards or Other Entities
- Agency conclusion

IEPA must use this information to complete an antidegradation assessment. Before issuing the permit, IEPA must assure that:

- All water quality standards will be met and all existing uses will be fully protected
- All reasonable measures to avoid or minimize the increased pollution will be taken
- The activity that causes the increased pollution will benefit the community at large

The Sewage Treatment Process

PRIMARY TREATMENT

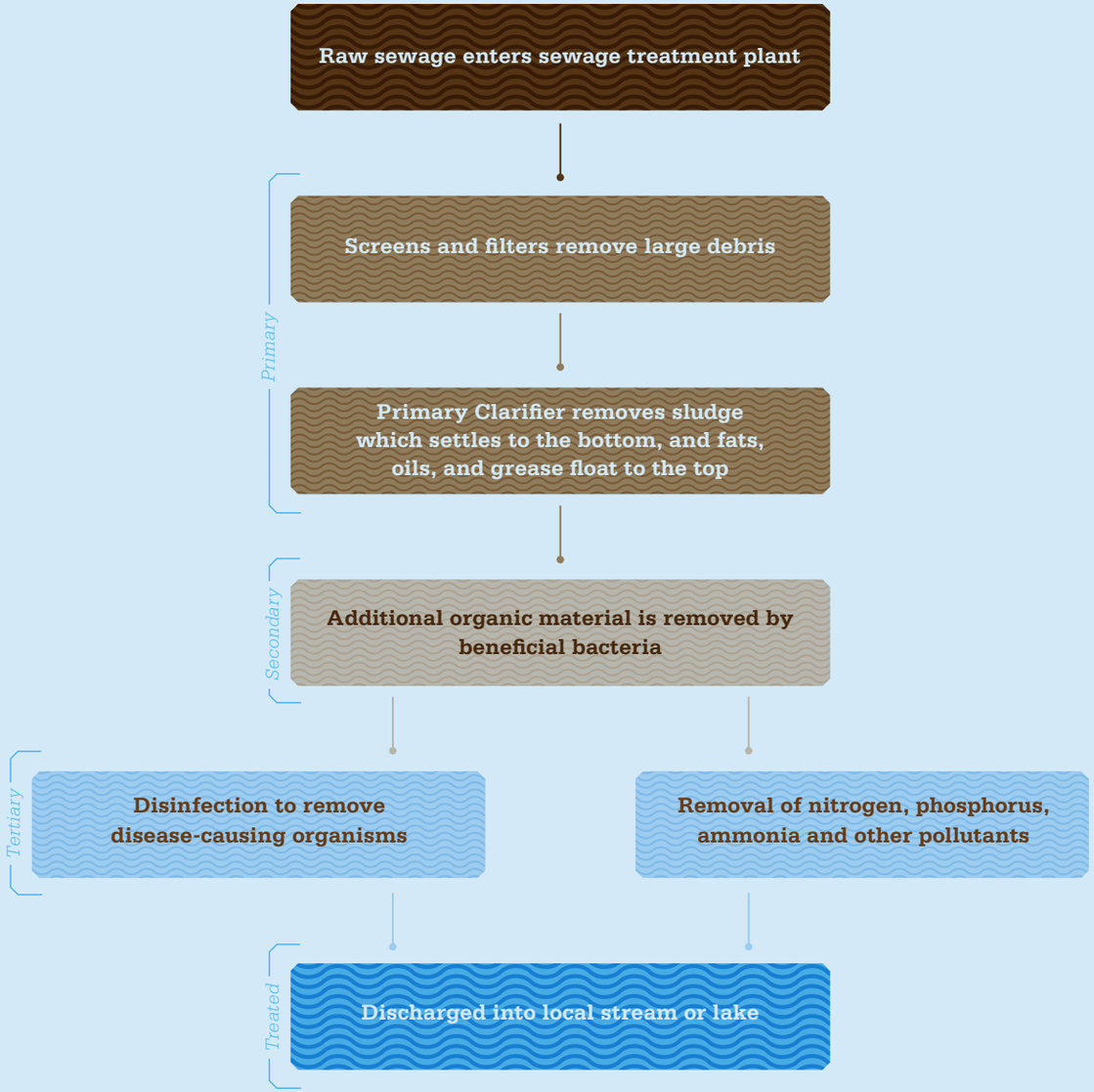
is generally defined as removing 30% of conventional pollutants from sewage. In practice, primary treatment refers to separating large solids from sewage through the use of screens or tanks that allow solids to settle out of the water. Otherwise known as the sedimentation stage, the main purpose is to produce both a generally homogeneous liquid capable of being treated biologically and a sludge that can be separately treated or processed.

SECONDARY TREATMENT

is designed to substantially breakdown the biological content of the sewage, including human waste, food waste, soaps and detergent. There are various types of secondary treatment techniques but all of them combine bacteria, waste, and oxygen in order to remove floating and settleable solids, oxygen-demanding substances and suspended solids. By law, most sewage treatment plants have to provide a minimum level of treatment called secondary treatment as set out in federal regulations.

TERTIARY TREATMENT

is any advanced treatment beyond the minimum requirements for secondary treatment. The purpose of tertiary treatment, also called effluent polishing, is to further remove pollutants prior to discharging to the receiving environment (sea, river, lake, ground, etc.) Disinfection, the elimination of bacteria and pathogens, is another component of tertiary treatment. Other tertiary treatment options range from biological removal of phosphorus to physical-chemical separation techniques such as filtration, carbon adsorption, distillation and reverse osmosis.



Above From Left: **Irrigation of golf course from no-discharge system at Fox Mill, IL, example of agricultural spray irrigation from wastewater treatment plants.**
Bottom: **Fox Mill, a mixed use development community and no-discharge municipal sanitary district in Wasco, Illinois.**

OPTIONS FOR WASTEWATER TREATMENT | As the population of Illinois continues to grow, the need to provide wastewater service for new residents will increase. Increases in direct discharges of wastewater into streams should be avoided or minimized to prevent degradation. **FOR MUNICIPAL FACILITIES CONSIDERING WASTEWATER TREATMENT EXPANSIONS, THE FOLLOWING HIERARCHY OF WASTEWATER TREATMENT ALTERNATIVES SHOULD BE CONSIDERED:**

OPTION 1: NO-DISCHARGE WASTEWATER TREATMENT SYSTEMS

The ILLINOIS ENVIRONMENTAL PROTECTION AGENCY has stated "Any discharge of treated wastewater to surface waters has the potential to cause the quality of the receiving water to become degraded. Therefore, systems that do not discharge should be considered and must be deemed not feasible before a discharging system can be considered." - McSwiggin, Thomas G., IEPA Permit Section Manager (Letter to municipal design engineers. July 18, 2002).

Non-discharging spray irrigation systems often utilize aerated treatment lagoons, aerated storage lagoons, and spray irrigation systems to treat and recycle wastewater.

These systems can be used by:

- Subdivisions
- Municipalities
- Recreational Facilities
- Industrial Parks
- Business Campuses
- Correctional Facilities
- Schools
- Hospitals

The treated wastewater can be for:

- Irrigation of farmland, parks, landscaping, golf courses
- Washing Equipment
- Air Cooling
- Process Cooling
- Interior Grey Water
- Decorative Fountains

Benefits include:

- No discharge to surface waterways
- Groundwater recharge
- Additional filtering and treatment by the land
- Irrigation and fertilization of adjacent lands
- Preservation of open space

OPTION 2: IMPROVED WASTEWATER TREATMENT

New or expanded systems should be designed to:

- Minimize discharges of biological oxygen-demanding waste (BOD), total suspended solids, ammonia (especially in the presence of sensitive mussels), total phosphorus and total nitrogen.
- Include treatment that addresses the presence of organic wastewater contaminants (OWCs) such as drugs, hormones, detergents and disinfectants. **This may include:**
  - Activated carbon
  - Longer residence time in holding pond
  - Ultraviolet radiation, ozone and membrane systems

OPTION 3: WASTEWATER POLISHING

Create wetlands for additional treatment

- Adds time to the treatment process for:
  - Breakdown of organic wastewater contaminants
  - Uptake of nutrients
  - Equilibration to ambient temperature

Below L to R: **Example of created wetlands; Examples of improved wastewater treatment with the use of a sequencing batch reactor (left) and membrane filters (right).**





OPTION 4: OFFSETS TO INCREASED LOADING OF POLLUTANTS

Any increases in wastewater discharges should be offset by other efforts to limit pollution entering the receiving waters. These could include the following:

Wastewater Reuse

- Objective is to divert treated wastewater from discharge.
- Examples include:
  - Seasonal irrigation of golf courses, parks, and farmland
  - Industrial uses
  - Non-potable uses

Improved Controls on Nonpoint Source Pollution

- Objective is to offset increases in wastewater pollution by improving control of nonpoint pollution to receiving stream.
- Examples include:
  - A ban on use of phosphorus-containing lawn fertilizers
  - Minimize road salt use using calibrated spreaders, anti-icing measures or alternative de-icers
  - Retrofits of stormdrain outlets to capture pollutants
  - Repair of problematic streambank erosion
  - Installation of streamside buffers of native vegetation
  - Stormwater infiltration practices including bioswales, rain gardens and permeable pavement

Riparian Zone Restoration

- Objective is to offset the impacts of increased pollution through restoration efforts to enhance habitat in the riparian corridor
- Examples include:
  - Wetland restoration
  - Stream dechannelization
  - Ripple and pool restoration
  - Stream buffer enhancements

Above L: **Bioswale**
Middle: **Example of streambank stabilization to reduce erosion.**
Above R: **Example of stormdrain outlet designed to capture pollutants.**

MEETING ANTIDEGREDATION REGULATIONS
AT NEW AND EXPANDING SEWAGE TREATMENT FACILITIES

ILLINOIS CASE STUDIES

SADDLEBROOK FARMS // PLANO // ITASCA // LASALLE

CASE STUDY NO. 1

SADDLEBROOK FARMS NO-DISCHARGE SYSTEM

Operating Since	1987
Residential Units	3,800
Average Flow	595,000 GPD
Total Area	700 acres
Irrigated Area	159 acres
Facility Footprint	17 acres

Saddlebrook Farms is a planned community in Round Lake Park, Illinois featuring 3,800 homes and many additional amenities including parks, trails, gardens, lakes and recreation halls. Almost half of the 700-acre site is considered open space, with meadows, lakes, a wildlife refuge and a working farm. Instead of using traditional sewage treatment technologies with an onsite treatment plant, the developer chose to recycle wastewater on the 159-acre farm. This was made possible by using the Sheaffer Modular Reclamation and Reuse System to treat and reclaim the wastewater in deep, heavily aerated treatment cells. The cells, or ponds, provide at least 30 days of high-oxygen treatment, after which the reclaimed water is filtered and disinfected prior to irrigation. In contrast to conventional sewage treatment, the clean reclaimed water and nutrients are resources available for use in irrigating and fertilizing the on-site working farm.

This residential/commercial development has been operating since 1987 with no discharge to a waterway. In addition, an ecologically-sound stormwater management system has been installed in which a network of shallow grassy swales and stormwater detention areas are used to store, filter, and treat polluted urban runoff on-site. Nuisance odors are not a problem since the raw sewage is injected 15 feet below the water's surface in the treatment cells, near the static tube aerators. The use of warm, compressed air at this depth assures effective biological treatment year-round.

Partners in this cooperative effort included: Sheaffer International, L.L.C and DWG, Inc.

CASE STUDY NO. 2

CITY OF PLANO WASTEWATER TREATMENT PLANT EXPANSION

	Current	Expanded
Design Avg. Flow (MGD)	2.44	4.88
BOD (mg/L)	10	10
TSS (mg/L)	12	12
Am. Nit. (mg/L)	1.4, 2.3	1.4, 2.3
Total Phosphorus (mg/L)	No limit	1.0
Total Nitrogen (mg/L)	No limit	Operate to remove
Dissolved Oxygen (mg/L)	No limit	Mar-Jul, 5.0mg/L min. Aug-Feb, 3.5mg/L min.
Fecal Coliform	No limit	UV Disinfection
Additional		Endocrine Disruptor Monitoring

The existing facility discharged 2.4 MGD of treated wastewater to Big Rock Creek. This stream is considered by the Illinois Department of Natural Resources to be a biologically significant stream. The stream is inhabited by two state threatened and endangered species, the River Redhorse *(Moxostoma carinatum)* and the Greater Redhorse *(Moxostoma valenciennesi).* In addition, aquatic plant stands and a variety of mussels can be found throughout the stream and downstream of the discharge. The community is experiencing and projecting growth requiring a facility expansion and a discharge twice the volume of the existing treatment plant.

Though the concentrations of several parameters will be maintained at current levels, the loading levels of all permitted pollutants were proposed to increase as well as additional organic wastewater contaminants such as drugs, hormones, detergents and disinfectants. The City of Plano and their consultants, Walter E. Deuchler Associates, proposed a seasonal no-discharge system by conveying all of the wastewater to an adjacent golf course for irrigation during the months of April through October. In order to address the additional nutrients in the wastestream, an advanced system using biological nutrient removal will be employed. Stormwater best management practices will be implemented throughout the community to address pollutants typical of urban runoff.

Additionally, the Mayor of Plano agreed to:

- Participate with the Fox River Study Group (FRSG) efforts to study and improve water quality in the Fox River Watershed with annual support of $0.25 per capita
- Engage in monthly stream monitoring coordinated with FRSG
- Create an unwanted medicines take-back program for the community
- Implement a ban on phosphorus-based lawn fertilizers
- Participate in stream restoration projects with the Illinois Department of Natural Resources.

Partners in this cooperative effort include: Bill Roberts, Mayor of Plano; Phillipe Moreau, Walter E. Deuchler Associates; Prairie Rivers Network and the Illinois Chapter of the Sierra Club.

CASE STUDY NO.3

VILLAGE OF ITASCA WASTEWATER TREATMENT PLANT RELOCATION AND EXPANSION

	Current	Expanded
Design Avg. Flow (MGD)	2.6	4.0
BOD (mg/L)	20	10
TSS (mg/L)	25	12
Am. Nit. (mg/L)	1.5, 4.0	1.2, 2.6, 2.3
Total Phosphorus (mg/L)	No limit	1.0
Total Nitrogen (mg/L)	No limit	Operate to remove
Dissolved Oxygen (mg/L)	No Limit	Mar-Jul, 5.0mg/L min. Aug-Feb, 3.5mg/L min.
Fecal Coliform	Chlorination	UV Disinfection
Additional		Endocrine Disruptor Monitoring

The existing facility discharged 2.6 MGD of treated wastewater to Salt Creek, a major tributary to the Des Plaines River. This stream is considered by the Illinois Environmental Protection Agency to be impaired in its ability to support its designated use for aquatic life due to excessive levels of chlorides and total dissolved solids and insufficient levels of dissolved oxygen. The community is experiencing and projecting growth requiring a facility expansion and increased discharge.

With this expansion, it will be possible to reduce the concentration levels of several pollutants including biological oxygen demand (BOD), total suspended solids (TSS) and ammonia nitrogen, thereby reducing the loading as well. Because this stream is already impaired in its ability to support aquatic life, it was necessary to consider any additional stresses including those impacting dissolved oxygen levels including nutrients and organic wastewater contaminants such as drugs, hormones, detergents and disinfectants. The Village of Itasca and their consultants, Baxter and Woodman, proposed sequencing batch reactors for treatment. Reuse of wastewater on adjacent municipal lands will be employed as much as practical by acreage and season. Wetland and stream bank restoration will emphasize habitat limitations identified in recent evaluations. The Village of Itasca is also working on developing and approving ordinances to promote conservation design throughout the community to reduce the amount and improve the quality of stormwater runoff, with a particular focus on eliminating use of coal tar-containing products, a major source of polycyclic aromatic hydrocarbons (PAHs), which are toxic to aquatic life.

Additionally, the Mayor of Itasca agreed to:

- Continue the village's involvement in and financial support of the DuPage River and Salt Creek Workgroup (DRSCW) which is working to improve the quality of Salt Creek
- Encourage the proper disposal of unwanted medicines by citizens
- Develop "green education" materials and provide annual reports to the Illinois EPA.

Partners in this cooperative effort include: Dave Williams, Mayor of Itasca; Carl Fischer, Baxter and Woodman; Prairie Rivers Network; Illinois Chapter of the Sierra Club; Environmental Law and Policy Center; the Conservation Foundation and the Salt Creek Watershed Network.

CASE STUDY NO.4

CITY OF LASALLE, EASTSIDE WASTEWATER TREATMENT PLANT RELOCATION AND EXPANSION

	Current	Expanded
Design Avg. Flow (MGD)	.5	1.0 (Additional Expected)
BOD (mg/L)	20	10
TSS (mg/L)	25	12
Am. Nit. (mg/L)	No limit	1.0
Total Phosphorus (mg/L)	No limit	1.0
Total Nitrogen (mg/L)	No limit	Operate to remove
Dissolved Oxygen (mg/L)		Mar-Jul, 5.0mg/L min. Aug-Feb, 3.5mg/L min.
Fecal Coliform	UV Disinfection	UV Disinfection

The existing facility discharged 0.5 MGD of treated wastewater to the Illinois River. Instead of expanding the conveyance and distribution system to the Illinois River, the City of LaSalle preferred a plan of relocation and an expanded discharge to the Little Vermilion River. This stream is considered by the Illinois EPA to be impaired in its ability to support its designated use for aquatic life and primary contact recreation due to zinc, total suspended solids, pH, total nitrogen, total phosphorus, dissolved oxygen and fecal coliform. The community is experiencing growth requiring a facility expansion in phases, the first one requiring a doubling of the wastewater discharge. Relocating and expanding the wastewater discharge to a smaller and already impaired stream required a significant commitment to advanced treatment.

Again, with this expansion, it was possible to reduce the concentration levels of several pollutants including biological oxygen demand (BOD), total suspended solids (TSS) and add permit limits for ammonia nitrogen and phosphorus, thereby reducing the loadings as well. Because this stream is already impaired in its ability to support aquatic life, it was necessary to consider any additional stresses including those impacting dissolved oxygen levels, nutrients, suspended solids and organic wastewater contaminants such as drugs, hormones, detergents and disinfectants. The City of LaSalle and their consultants, Crawford, Murphy and Tilly, proposed a membrane biological removal system with vertical loop reactors to address nutrient and solids removal. Effluent will be aerated to improve dissolved oxygen levels in the receiving stream. Because contaminated sediments are present in the receiving stream, the outfall will be designed to dissipate energy in order to prevent instream erosion and resuspension of the contaminants. In addition, special monitoring for metals and suspended solids will be undertaken for the first year of operation. Stormwater best management practices would be implemented throughout the community to address suspended solids and pollutants typical of urban runoff.

Partners in this cooperative effort include: Sam McNeilly, Superintendant of Public Works for the City of LaSalle; Scott Knight, Crawford, Murphy & Tilly; Prairie Rivers Network; Illinois Chapter of the Sierra Club and Save Our Little Vermilion River (SOLVE).

ADDITIONAL RESOURCES

For more information on antidegradation regulations in Illinois:

Chapter 4: Antidegradation (40 CFR 131.12), USEPA's Water Quality Handbook
www.epa.gov/waterscience/standards/handbook/chapter04.html
or
Contact U.S. Environmental Protection Agency's Region 5 Water Quality Standards Section at 312/ 353-9024

Title 35 of the Illinois Administrative Code; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302: Water Quality Standards' Subpart A: General Water Quality Provisions; Section 302.105: Antidegradation
www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.asp
or
Contact Illinois Environmental Protection Agency's Bureau of Water at 217/ 782-3362

For more information on municipal wastewater treatment technologies:

USEPA Municipal Wastewater Technology Fact Sheets
www.epa.gov/owm/mtb/mtbfact.htm

USEPA Municipal Nutrient Removal Technologies Reference Document
www.epa.gov/OW-OWM.html/mtb/publications.htm

USEPA Report "Emerging Technologies for Wastewater Treatment and In-Plant Wet Weather Management" Emerging Technologies Report on Wastewater Treatment
http://www.wef.org/NR/rdonlyres/A555689C-8D26-49D7-A546-6BB0E803C3E0/6565/emerging_technologies.pdf

Schaeffer International, LLC, non-discharging wastewater treatment systems
www.sheafferinternational.com

For more information on best management practices to reduce pollution:

Illinois Urban Manual
www.aiswcd.org/Programs/ium.html

USEPA's Guide to Key Best Management Practices and Resources
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5

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