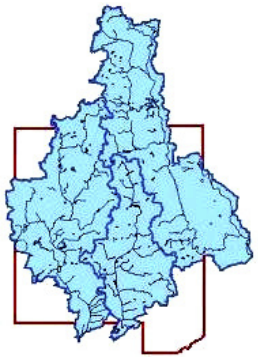
The DuPage River and Salt Creek (Illinois) Case Study



Introduction and Purpose

The DuPage River and Salt Creek, significant tributaries of the Des Plaines River, flow through rapidly urbanizing watersheds in the Chicago metropolitan area. In this area a group of local watershed stakeholders are working together to respond to Total Maximum Daily Loads (TMDLs) that address impairments caused by a number of sources, including municipal separate storm sewer systems (MS4s) regulated under the Phase II MS4 Stormwater Program and publicly owned treatment works (POTWs), as well as severe habitat alterations. This stakeholder group—the DuPage River Salt Creek Workgroup—is taking a distinctive approach to address the findings of the TMDL reports developed to address identified impairments in the watersheds. DRSCW participants are committed to an approach for attaining water quality standards that focuses on stakeholder involvement, monitoring, and locally led decision-making based on sound science.

This case study provides information on the water quality-related challenges being addressed and the activities initiated by the DRSCW to better determine the stressors causing impairments in the watersheds, obtain stakeholder support, and plan and implement measures to improve water quality, with a particular emphasis on stormwater as one of the sources of the impairments. The case study is organized as follows:

I. The DuPage River and Salt Creek Watersheds

II. The DuPage River Salt Creek Workgroup

III. Moving Toward Implementation of the TMDLs —DRSDW Monitoring and Technical Activities

IV. Lessons Learned from the DRSCW's Experiences to Date

V. Recommendations for Addressing Stormwater Issues through TMDL Implementation in the DuPage River and Salt Creek Watersheds

I. The DuPage River and Salt Creek Watersheds

The DuPage River and Salt Creek watersheds, shown in Figure 1, are in northeastern Illinois, west of the city of Chicago. The two watersheds combined encompass an area of approximately 360 square miles. The watersheds lie in two counties, and they are home to 55 municipal entities. There are 25 POTWs in the watersheds, which collectively discharge approximately 156 million gallons per day (MGD) of wastewater.

Land uses within the watersheds are predominantly urban, with significant portions of each watershed classified as residential land use. Impervious surfaces overlie much of the land. Table 1 provides additional detailed information on the watersheds.

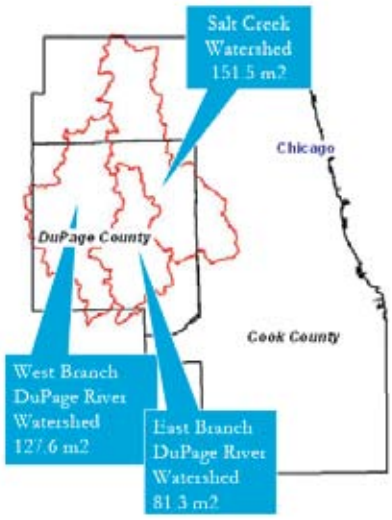


Figure 1. West and East Branches DuPage River and Salt Creek Watersheds

Table 1. Summary of DuPage River and Salt Creek Watersheds Land Uses and Impervious Surfaces

Watershed	Land Use	Impervious Surfaces
Salt Creek	49% of the watershed classified as residential land use.	23% of the watershed covered by impervious surfaces (Illinois EPA 2004a).
East Branch DuPage River	40% residential land use.	16% of the watershed covered by impervious surfaces (Illinois EPA 2004b).
West Branch DuPage River	33% residential land use; 17% agricultural land use. It is expected that over time a greater percentage of the land will be converted to residential use.	14% of the watershed covered by impervious surfaces (Illinois EPA 2004c).

With increasing urbanization and population growth over time, the watersheds have experienced a variety of impacts from several stressors. Increased impervious surfaces have led to increases in stormwater runoff, causing flooding, combined sewer overflows, and increased stormwater discharges. At least 21 dams have been constructed in the watersheds to address issues such as flooding and recreational needs. Over time the dams have changed the natural hydrology of the DuPage River and Salt Creek and have affected native aquatic species and habitat. The watersheds contain 41 permitted MS4s. Stormwater discharges from the MS4s contribute pollutants like nutrients, metals, and bacteria to the watersheds (DuPage County SMD 2006; MBI 2006). Impacts from these stressors can affect public health and safety, recreational opportunities, economics, aesthetics, and ecological health.

Identified Impairments (2000–2004)

Salt Creek

Impairments: copper, conductivity, chloride, and dissolved oxygen

East Branch of the DuPage River

Impairments: conductivity, chloride, and dissolved oxygen

West Branch of the DuPage River

Impairments: chloride and copper

All streams classified as general use. TMDLs completed in 2004 for listed impairments, with the exception of copper.

Despite improvements in water quality attributable to point source discharge controls, data collected by the Illinois Environmental Protection Agency (Illinois EPA) indicated that several segments in the watersheds were not meeting water quality standards (see box at right; Illinois EPA 2004 a, 2004b, 2004c). Illinois EPA began work on TMDL reports to address impairments in the watersheds, and three reports were finalized in 2004. The reports presented the analyses and findings for meeting water quality standards for dissolved oxygen (DO) and chloride.

The DO problems in the watersheds have both wet weather and dry weather components. The dry weather components relate to biological oxygen demand (BOD), nutrient loadings into the watershed, and in-stream conditions. For example, there are identifiable DO sags near several of the dams in the watershed. The TMDL report presented two approaches that could be used to increase in-stream DO levels and meet water quality standards:

- Reduce effluent limits for POTW discharges to 8 mg/L BOD5 and 1 mg/L ammonia—permit limits that would require POTWs to make costly upgrades, estimated at between $18 million and $48 million for Salt Creek alone
- Alternative activities to improve DO levels, including the removal of a dam in Salt Creek and in-stream aeration (Illinois EPA 2004d).

The DRSCW's monitoring work has indicated there are also DO concerns related to wet weather flows. Further investigation is needed, but stormwater discharges appear to be contributing to reduced DO levels in some areas during and after storms.

The chloride impairments in the watershed are related to runoff, including discharges from MS4s.

The primary source of chloride loadings appears to be runoff from paved surfaces after deicing with salts. The recommendations for action in the TMDL reports focus on reducing chloride in all three watersheds through more targeted road salt applications by municipalities. The reports cite the NPDES Phase II MS4 stormwater permit requirements as a mechanism for implementing the necessary deicing best management practices (BMPs).

II. The DuPage River Salt Creek Workgroup

Illinois EPA held public meetings during the development of the TMDL reports in January 2001 and September 2003; however, a strong watershed group did not exist in the area when the TMDL reports were written. With the completion of the TMDL reports, questions immediately arose: Who would do the further assessment and planning work needed to implement the TMDLs? Who would decide what approaches would be taken to restore uses? The DRSCW was formed to take on the important work to be done.

The DRSCW is a collaborative effort by sanitary districts, municipalities, counties, forest preserve districts, state and federal agencies, and private environmental organizations to address the water quality impairments identified in the TMDL reports. The goal of the group is to "achieve attainment of water quality standards and designated uses in these three streams in a rational and cost-efficient manner" (DRSCW 2006).

Among the factors motivating municipalities and POTWs to form and actively participate in the DRSCW were issues and concerns related to the analysis and allocation scenarios in the TMDL reports, including the estimated costs for wastewater treatment plant upgrades and the need for a better understanding of sources of the impairments. Stakeholders affected by the TMDL allocations wanted an opportunity to "substantiate" implementation strategies and determine whether there were other cost-effective options for achieving water quality standards (DRSCW 2004). Representatives from municipalities affected by the TMDL reports

Mission:

To bring together a diverse coalition of stakeholders to work together to preserve and enhance water quality in the East Branch DuPage River, West Branch DuPage River, Salt Creek and their tributaries.

Objectives:

- Develop and implement a dynamic plan that will achieve attainment of water quality standards and designated uses for the East Branch DuPage River, West Branch DuPage River, Salt Creek and their tributaries.
- Develop and implement a comprehensive, long-term monitoring program that will include chemical, physical and biological components to accurately identify the quality of the river ecosystems as well as stressors associated with non-attainment of water quality standards and designated uses.
- Develop and implement long-term viable management strategies that accurately address water quality problems identified by the monitoring program.
- Identify point and nonpoint source pollution issues and develop and implement short-term and long-term strategies to address these issues.
- Develop and maintain appropriate computer models of the watersheds to assess attainment of these objectives.

discussed forming the workgroup to collect data and carry out other technical activities to move forward with implementing the TMDLs. It was also envisioned that the DRSCW could help stakeholders establish a solid foundation for future TMDLs, contribute to the development of nutrient criteria, and address other water quality or regulatory issues in the watersheds. A core group of municipalities generated support for the workgroup concept by emphasizing the importance of locally led decisions on where and how to spend local money to address water quality issues.

In addition to generating interest from and participation by local stakeholders, the core group of municipalities worked with Illinois EPA to identify a fair, open-minded, collaborative organization to facilitate the efforts of a workgroup. The Conservation Foundation, a nonprofit working in the DuPage River watershed for nearly 15 years, agreed to accept the role of collaborative group facilitator. In April 2004 the DRSCW met for the first time with participation and interest from 25 agencies and organizations in the watersheds. By fall 2006 the DRSCW had grown to 40 members, with an executive board of 7 and a staff of 1.

One of the initial activities of the DRSCW focused on establishing a group structure, goals, and funding sources. The DRSCW Bylaws document the group's goals and objectives; describe its membership, officers, and committees; and establish requirements for membership dues. The DRSCW allows for three categories of membership, although members currently participate in only two of them:

- *Agency members* are public agencies that hold National Pollutant Discharge Elimination System (NPDES) permits for POTWs or public separate storm sewer systems that discharge to any of the three watersheds. Agency members have four votes and are the only category eligible to hold an elected office on the executive board.
- *Associate members* are agencies, organizations, and companies that are not eligible to participate as agency members. Participants in this category have two votes.

The DRSCW is incorporated as a not-for-profit organization. As of fall 2006, the DRSCW had 28 agency members and 12 associate members. Individuals are also eligible to participate and are entitled to one vote under the individual member category.

A mix of membership dues and grants funds the DRSCW's activities. Members pay annual dues calculated on the basis of their discharges to the watersheds: POTWs pay dues that are based on average design flow, and communities with stormwater discharges pay dues that are based on drainage area. As a result, POTWs represent two-thirds of the DRSCW's membership dues and communities with MS4s represent the other third. Membership dues have provided the necessary local match for section 319 grants from Illinois EPA. To date, the DRSCW has received approximately $677,000 in section 319 grant funding to support technical activities, such as monitoring, and workgroup coordination (DRSCW 2006).

During DRSCW meetings, members take on issues related to TMDL development and implementation, including water quality standards, NPDES permitting, water quality and watershed modeling, and monitoring. Members also participate in writing grants, reviewing reports and issue papers, administering contracts, and attending public meetings.

III. Moving Toward Implementation of the TMDLs—DRSCW Monitoring and Technical Activities

The development of the TMDLs and the need to plan appropriate implementation actions were the catalyst prompting DRSCW members to participate in an adaptive management approach to TMDL implementation. At the outset, DRSCW members acknowledged the need for better data to make informed decisions. As a result, establishing and implementing a monitoring program have been the DRSCW's highest priorities and have helped to unify the group. Better monitoring data will allow the DRSCW to understand the sources of impairment in the three watersheds, identify priority restoration activities and track implementation

effectiveness, calibrate water quality and watershed models, determine progress toward achieving water quality standards, and assess the overall health of the watersheds. The DRSCW works cooperatively to make monitoring decisions, as well as to review and analyze monitoring data. Using this collaborative, science-based approach to decision-making helps to achieve buy-in from DRSCW members, ensuring credibility, trust, and transparency.

DRSCW Monitoring Activities

The objectives of water quality monitoring in the watersheds are multi-faceted and include the following:

- Characterize water quality conditions and trends throughout the watershed.
- Support the development of water quality standards and in-stream targets.
- Provide technical information to help guide implementation efforts.
- Document the effectiveness of water quality management strategies.

Routine fixed-station monitoring has been conducted in the watersheds by the Illinois EPA and the Metropolitan Water Reclamation District (MWRD) of Greater Chicago since the 1970s. Sampling usually occurs monthly for a suite of field and lab parameters. In addition, the U.S. Geological Survey (USGS) operates a network of stream gauges in the watershed and has also conducted some water quality sampling.

To augment routine fixed-station monitoring, the DRSCW established a network of continuous monitoring probes throughout the watersheds. To date, the monitoring network includes ten submerged probes located throughout the watersheds. These probes measure DO and also collect hourly data on pH, conductivity, and temperature (DRSCW 2006). Agency members of the DRSCW also contribute data from their probes to supplement the data collected by the DRSCW probes. As a result, the DRSCW has data from a total of 15 probes.

The TMDL reports addressed the impact that sediment oxygen demand can have on low DO levels. The DRSCW conducted a one-time sediment oxygen demand study that involved monitoring at 16 sites throughout the watersheds. The data from this monitoring project will also feed into the updated water quality model and help the DRSCW to better understand the sources affecting DO levels. The DRSCW might conduct further sediment oxygen demand sampling on Salt Creek before coming to a conclusion regarding the DO situation on that stream.

The current DO data collection, data analysis, and modeling efforts focus primarily on dry weather conditions. Given that data have also revealed DO concerns in wet weather conditions, the DRSCW is considering organizing a new committee to focus on wet weather impacts and issues, and initiating work focused on the impacts of wet weather events on DO levels in the watersheds.

In 2006 the Workgroup also initiated an extensive bioassessment program across DuPage County. The DRSCW hired a consultant with expertise in bioassessment to develop and conduct bioassessment sampling in the watersheds. This component of the monitoring work will provide expanded information about water quality conditions across the watersheds from a spatial perspective. Through bioassessment sampling, the DRSCW will establish baseline information on fish, macroinvertebrates, and habitat, as well as water and sediment chemistry, at approximately 120 sampling sites through-

out the watersheds (DRSCW 2006). Bioassessment sampling on the West Branch of the DuPage River took place at 41 sites during summer 2006. Sampling of Salt Creek and the East Branch of the DuPage River will take place during summer 2007. To track trends in each of the watersheds, subsequent sampling will be conducted in each watershed every three years on a rotating basis (DRSCW 2006).

A geometric site selection design that selects sites on the basis of a declining watershed area scale has been used. This method has been complemented with a targeted method, placing sites in and around natural and human features of interest (e.g., dams, outfalls, tributary mouths). Benefits of the approach include cost-effective sampling on a watershed scale, development of a stratified database, and an enhanced ability to capture previously unassessed streams. Figure 2 shows the location of monitoring sites throughout the watersheds.

Developing and implementing a monitoring program that produces credible data for decision-making purposes involved various activities. They included establishing and documenting quality assurance procedures; training or hiring certified staff; purchasing and maintaining sampling equipment; collecting and managing samples; conducting quality assurance/quality control; and managing, analyzing, and reporting data. To date the DRSCW has prepared and Illinois EPA has approved Quality Assurance Project Plans for the continuous DO monitoring program and the bioassessment sampling program.

The DRSCW relies on a spreadsheet for tracking monitoring data; however, the group intends to develop a more sophisticated database for managing and analyzing data in the near future. Illinois EPA receives a copy of the DRSCW's data each year. By 2009 the group would like to develop a publication that presents water quality data.

Addressing Chloride Impairments

The TMDL reports contain chloride allocations that directly affect the regulated MS4s in the watersheds. To address the chloride allocations, the

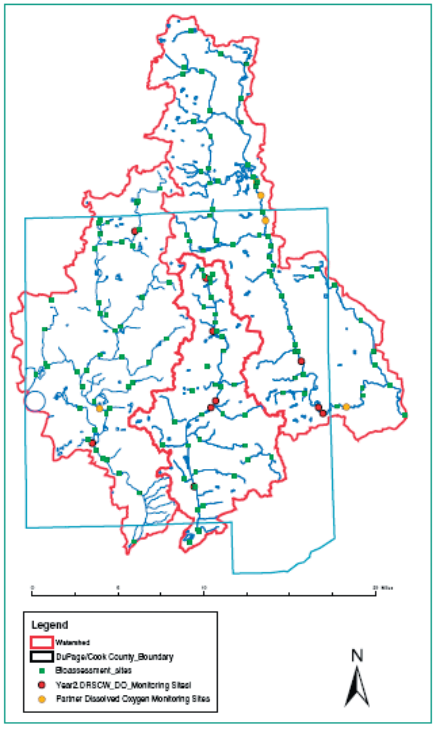


Figure 2. Monitoring Sites in the DuPage River and Salt Creek Watersheds

DRSCW initiated a chloride education and usage study. The Chloride Usage Education and Reduction Program Study report was completed in August 2007. Through this study, the DRSCW hopes to catalyze changes in deicing practices, reducing salt applications while still protecting public safety.

To determine current road salting practices in the watersheds, a questionnaire was sent to approximately 80 public entities that conduct deicing operations. Responses were received from 39 public entities, which reported a total annual salt use of 126,000 tons. In addition, 8 of approximately 130 private snow removal companies in the watershed area were contacted.

The total amount of chloride applied to the watersheds annually, in the form of road salt, was estimated from the questionnaire responses. The estimated load includes salt from municipalities, townships, the Illinois State Toll Highway Authority, and county transportation departments; private snow removal companies and the Illinois Department of Transportation are not accounted for. Table 2 provides the estimated chloride loads per watershed.

Table 2. Estimated Current Chloride Load Per Watershed

Watershed	Estimated Current Chloride Load (tons per year)
Salt Creek	32,600
East Branch	16,900
West Branch	21,200
Total	70,700

A literature search conducted for this study revealed a variety of potential measures that could reduce chloride loading to the watersheds. The measures were evaluated for feasibility and potential effectiveness in reducing chloride, and implementing them was discussed with local deicing program managers. As a result of this study, the following measures to reduce chloride loading from deicing practices are recommended:

- Public education, staff training, and improved salt storage and handling practices
- Watershed-wide implementation of pre-wetting and anti-icing programs
- Consideration of alternative non-chloride products, such as acetate deicers and beet and corn derivatives
- Chloride monitoring in streams to demonstrate program effectiveness

A noteworthy finding from the work done on chloride loadings is that private deicers (e.g., contractors that provide deicing services at hotels, schools, stores, and the like), a group initially assumed to have minimal impact, apply very significant amounts of salt and thereby are significantly contributing to chloride loadings. Addressing these activities will likely require different approaches and different implementation tools. For example, municipalities might adopt licensing programs or ordinances governing operations to induce private companies to implement the identified BMPs.

Monitoring and Assessment—Looking Forward

In October 2006 DuPage County and the DRSCW became aware of data assessment tools being used to connect stormwater management plans, developed and implemented pursuant to stormwater permits, with TMDLs intended to address water quality problems. Following some discussions with U.S. EPA and USGS, the DRSCW became interested in the use of basic hydrology in the form of duration curves as a way to expand its use of water quality monitoring data. The DRSCW subsequently hosted a workshop on the use of duration curves as a tool to characterize water quality concerns in terms of flow conditions, linking these concerns to key watershed processes, prioritizing source assessment efforts, and identifying potential solutions. Bruce Cleland from U.S. EPA, a national expert on using flow duration curves to analyze watersheds and plan restoration measures, was the workshop instructor.

The DRSCW recognizes that it is important for the public to understand the relationship between proposed actions and documented water quality concerns. The DRSCW is interested in pursuing use of the duration curve framework as a simple communication tool to help answer a broad range of basic questions. Benefits include not only TMDL development, but also water quality assessment efforts (enhanced description of concerns using available data) and implementation planning (focus on meaningful solutions through understanding key watershed processes that deliver pollutants).

One overall objective of the DRSCW is to add the dimension of connecting specific implementation activities—both TMDLs and stormwater management programs—to actual watershed data. This objective is illustrated using MWRD water quality monitoring data collected on Salt Creek at Wolf Road (see Figure 3).

Municipalities have been implementing combined sewer overflow controls, as well as illicit discharge detection and elimination programs, under their MS4 stormwater management programs. Based on ambient data, significant reductions in bacteria concentrations observed in Salt Creek have occurred over the past 15 years in response to these efforts. Water quality improvements are reflected using the duration curve framework, and they are noticeable across all flow conditions. This illus-

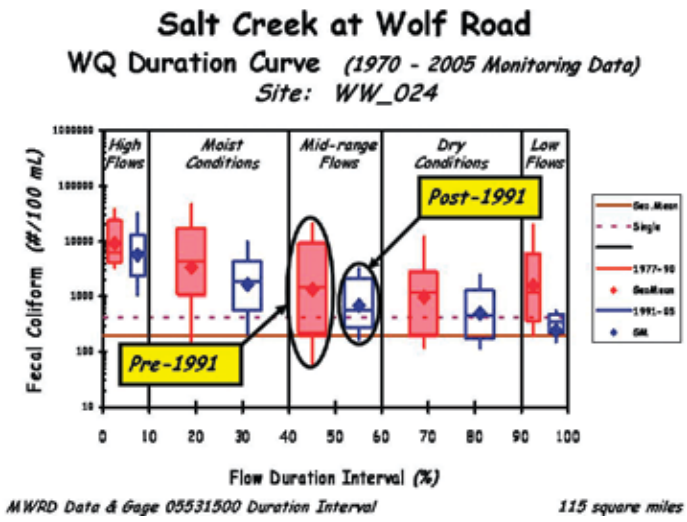


Figure 3. Flow Duration Curve Developed Using Salt Creek Watershed Monitoring Data

trates one way in which DRSCW stakeholders and the public can see a "return on their investment" in terms of documented program results based on monitoring information, a key part of the problem-solving framework.

Other DRSCW Technical Activities

Although monitoring is the DRSCW's highest priority, the group conducts several other activities that will assist with implementing TMDLs and attaining water quality standards. Geographic information system (GIS) capabilities are key to the technical projects that the DRSCW conducts. DRSCW members, including the Forest Preserve District of DuPage County and DuPage County, as well as the USGS, provide GIS data essential for understanding the location of key features, including dams, point source dischargers, and monitoring sites.

The DRSCW has initiated two projects focused on updating water quality and hydraulic modeling using data from the continuous DO monitoring network. The water quality model used during the TMDL development process (QUAL2K) will run updated allocation scenarios based on the more recent, more comprehensive data set. The TMDL reports with DO allocation scenarios identified alternative restoration activities to achieve the DO standard in the East Branch DuPage River and Salt Creek: (1) dam removal/modification and (2) in-stream aeration. To determine the feasibility of these alternative restoration strategies, the DRSCW initiated the Stream Dissolved Oxygen Improvement Feasibility Study. The study involves an updated hydraulic model that uses the most recent DO monitoring data, as well as POTW discharge data, to determine impacts from potential projects (DRSCW 2006). The findings of this study will allow the DRSCW to make recommendations on priority restoration strategies to achieve the DO standard based on modeled impacts, regulatory issues, project costs, and public input (DRSCW 2006).

IV. Lessons Learned from the DRSCW's Experiences to Date

As more watersheds face water quality impairments that involve a mix of point and nonpoint sources, more watershed stakeholders will likely face complex—and potentially controversial and expensive—TMDLs similar to those developed for the DuPage River and Salt Creek watersheds. The collaborative, locally led approach initiated by DRSCW members focuses on data collection to set priorities, make informed decisions, and evaluate the effects of selected restoration activities. This approach, while still in its beginning phases, has several early indicators of success, including support from state and federal regulatory agencies, financial support from all levels of watershed stakeholders, membership that continues to grow, and more watershed monitoring data to facilitate science-based collaborative decision-making. The formation of the DRSCW and the group's efforts provide several lessons learned that can assist stakeholders in other watersheds in TMDL implementation.

- *Enhance credibility for the TMDL development process through meaningful stakeholder involvement.* DRSCW members see great value in the work being done to plan for the implementation of the TMDL. Some of this work could have been done as part of the TMDL development process, which might

have strengthened the technical components of the TMDLs and better facilitated TMDL implementation. Future TMDL development efforts in the watersheds will involve DRSCW members at the outset and will benefit from the group's recent data collection efforts. As a result, TMDL reports generated with DRSCW support will more closely reflect watershed conditions and have a greater potential for implementation success.

- *TMDLs can be catalysts for action.* The DRSCW came together to address impairments identified on the Illinois 303(d) list and addressed in a TMDL. The DRSCW members recognized they would be best served by working collaboratively, and by working actively to better understand and address the impairments. The TMDLs catalyzed action on the part of key stakeholders in the watershed.

- *Identify champions to lead the effort.* The DRSCW came to fruition largely as a result of representatives from a small number of agencies who championed the idea and advocated the value of this approach to other municipalities in the watersheds. The leadership of two municipalities helped to generate support and enthusiasm for the DRSCW, identifying and securing the elements necessary to set the group in motion—funding, coordination, and credibility.

- *Capitalize on preexisting relationships.* Although DRSCW members represent municipalities within common watershed boundaries, the shared boundaries did not automatically translate into the communities' working together to solve watershed problems. Fortunately, many of the municipalities within the watersheds already had relationships formed through participation in the Illinois Association of Wastewater Agencies, and they used this affiliation as a means for communicating about the DRSCW concept.

- *Bring in a trusted facilitator to coordinate the group.* Part of the original DRSCW concept was to have a fair, credible, and open-minded organization serve as the group facilitator and coordinator. Although DRSCW members give time and money to the group, it is essential to have an organization that is focused on the day-to-day coordination of the group's activities and keeps the technical and administrative responsibilities on track. The Conservation Foundation serves in this capacity for the DRSCW, and it has emerged as a trusted group facilitator, technical resource, and project coordinator.

- *Collect and analyze data to drive decisions. DRSCW members state that they are "led by science."* The group minimizes conflict and controversy by allowing data to drive its priorities and decisions. For example, data have helped to put environmental groups and agencies on the same page. Allowing data to drive decisions is essential not only to collaborative decision-making but also to a successful adaptive management approach.

- *A technically sound, tailored dataset is valuable to better understand impairments and plan restoration measures.* Illinois EPA had sufficient data to list the waterbodies on the state section 303(d) list of impaired waters and to preliminarily identify the changes needed to restore uses. However, the DRSCW has conducted further monitoring to fully understand the impairments, including concerns related to wet weather and dry weather conditions; to better identify sources of loadings; and to plan actions to restore uses. Collecting and analyzing data on land uses, runoff characteristics, habitat, biota, and water chemistry will help the DRSCW to plan and implement cost-effective measures that will fully restore uses.

- *Evaluate and implement alternative restoration strategies through a phased, adaptive management approach.* The DRSCW is an important component in the overall phased, adaptive management approach for TMDL implementation, as described in Illinois EPA's technical paper on links between TMDLs and NPDES permitting (*The Link Between*

TMDLs and NPDES Permits for Salt Creek and the East Branch DuPage River: Practical Application of Adaptive Management and a Phased Approach for Meeting the Dissolved Oxygen Standard, November 2004; see box on page 11). Through the monitoring activities of the DRSCW, watershed stakeholders have the opportunity to evaluate and implement alternative restoration strategies, such as dam modification and in-stream aeration, as means to achieving DO standards. Special conditions incorporated into NPDES permits for POTWs in the watersheds authorize this adaptive management approach, providing DRSCW members with sufficient time to implement and assess alternative strategies. If monitoring data indicate that alternative strategies are not adequate to achieve the DO standard, DRSCW members allow data to drive decisions and, therefore, undertake the necessary steps to comply with new effluent limitations deemed necessary to attain water quality standards. A well-planned monitoring program is a crucial component of implementing adaptive management approaches for water quality restoration.

V. Recommendations for Addressing Stormwater Issues through TMDL Implementation in the DuPage River and Salt Creek Watersheds

Since the group's inception, the DRSCW members have focused on addressing DO impairments through monitoring and modeling projects analyzing DO levels under dry weather conditions. The TMDL reports, as well as recent monitoring data, indicate that stormwater sources also affect DO levels in the watersheds. The DRSCW recognizes the need to better understand the impact of wet weather discharges on DO levels. As a DRSCW Agency Member, and the primary Phase II MS4 permittee in the watersheds, DuPage County has a vested interest in expanding the group's focus to include more analysis and discussion of stormwater impacts and NPDES permitting issues related to TMDL implementation. Recommendations for incorporating stormwater issues into the DRSCW's TMDL implementation activities are provided below.

- ***Develop a comprehensive water monitoring strategy.*** Develop a comprehensive, long-term watershed monitoring strategy that integrates surface water quality monitoring, stormwater monitoring, bioassessment sampling, and POTW discharge monitoring. The DRSCW has established an extensive monitoring network that includes sites for both continuous DO monitoring and bioassessment throughout the watersheds. With future TMDLs for fecal coliform bacteria and various metals on the horizon, as well as the development of nutrient criteria, it is likely that the DRSCW will continue to expand its monitoring activities over time. Other monitoring activities in the watersheds include POTW discharge monitoring and, in the near future, Phase II MS4 monitoring required by NPDES permits. To avoid duplication of effort and ensure efficiencies and strategic data collection to track a variety of watershed and water quality goals, the DRSCW should consider developing a comprehensive, long-term watershed monitoring strategy that integrates all ongoing and planned monitoring activities. This type of strategy would examine watershed-wide monitoring needs and develop a scientifically sound road map for addressing these needs effectively and efficiently. The timing for such a strategy is particularly appropriate as DuPage County and its Phase II MS4 co-permittees begin developing a stormwater monitoring program to comply with the Phase II MS4 general permit requirements. The DRSCW can assist DuPage County in developing an effective stormwater monitoring program that identifies strategically located monitoring sites and establishes appropriate procedures for not only tracking stormwater management program effectiveness but also determining the impacts of stormwater discharges on water quality conditions.

Using Adaptive Management to Implement TMDLs Through NPDES Permitting

The dissolved oxygen TMDLs for Salt Creek and East Branch DuPage River provide allocation scenarios that involve more stringent permit limits for POTWs or alternative approaches involving dam removal and in-stream aeration to achieve water quality standards. Each approach has the potential to improve water quality conditions, but with significantly different associated costs. Using an adaptive management process to implement the dissolved oxygen TMDLs would allow watershed stakeholders to collect more data on the sources of impairment in the watershed, implement less-costly restoration strategies, monitor results to determine progress toward meeting water quality standards, and adjusting restoration strategies based on monitoring data.

Upon completing the TMDL reports in October 2004, IEPA drafted a paper entitled, "The Link Between TMDLs and NPDES Permits for Salt Creek and the East Branch DuPage River: Practical Application of Adaptive Management and a Phased Approach for Meeting the Dissolved Oxygen Standard." This paper outlines the key steps for phasing-in TMDL implementation using an adaptive management approach that concurrently evaluates alternative restoration activities for achieving the dissolved oxygen standard. Forming the DRSCW is the first step of the phased-in approach identified by the IEPA. The second step focuses on investigating and implementing several alternative restoration approaches, as prioritized by the DRSCW, that might achieve dissolved oxygen standards more efficiently and cost-effectively. If alternative restoration activities implemented under the second step do not achieve dissolved oxygen standards, IEPA will work with the DRSCW to incorporate appropriate effluent limitations into NPDES permits by January 1, 2008.

In the interim, IEPA is deferring the imposition of more stringent permit limits to provide sufficient time for alternative restoration activities to improve dissolved oxygen levels. All existing NPDES permits in the three watersheds will contain a special provision that acknowledges potential changes to existing effluent limitations for CBOD5 and ammonia-N if necessary upon completion of an "alternate Salt Creek/EBDR Water Quality Study (IEPA 2004e)."

- *Update stormwater management programs to address water quality impairments and TMDL allocations based on analysis of recent monitoring data and study results.* The current Phase II MS4 general permit contains special conditions requiring the review and, if necessary, modification of stormwater management programs to meet TMDL allocations. Information and data generated by the DRSCW will assist DuPage County and its Phase II MS4 co-permittees in conducting the review of each Phase II MS4 stormwater management program to determine whether activities currently meet TMDL allocations. For example, findings from the Chloride Education and Usage Study will help DuPage County and its Phase II MS4 co-permittees to determine whether current road salt storage and application practices meet the chloride allocations in the TMDL reports or whether specific deicing best management strategies are necessary to meet the chloride allocation in each watershed. Once the DRSCW convenes a wet weather committee to address wet weather impacts on DO levels, DuPage County and its Phase II MS4 co-permittees will also have the opportunity to integrate information and data generated by this committee into their stormwater management program. As these efforts get under way, DuPage County and its Phase II MS4 co-permittees should consider referencing the special conditions under Part III.C of the Phase II MS4 general permit and cite the related activities of the DRSCW to demonstrate compliance with these TMDL-related requirements.

- *Evaluate watershed-based NPDES permitting options that integrate POTW and stormwater permitting requirements.* DRSCW members are interested in analyzing potential watershed-based NPDES permitting options for point source discharges in the watersheds. A variety of options that could generate administrative efficiencies while producing environmental benefits are available for the DRSCW

to consider. POTWs discharging to the watersheds share a common special condition in their respective NPDES permits that acknowledges ongoing watershed-based water quality studies that could affect future permit effluent limitations; this shared permit condition is an example of a watershed-based permit requirement. The Phase II MS4 general permit that covers the Phase II MS4s in the watersheds does not contain any specific watershed-based conditions because the provisions of the permit apply to Phase II MS4s throughout Illinois. The DRSCW can consider working with Illinois EPA to identify other watershed-based NPDES permitting opportunities that could more comprehensively integrate POTW NPDES permit requirements and possibly incorporate stormwater permit provisions tailored to the unique conditions of the watersheds.

One option for watershed-based NPDES permitting could involve a single, streamlined general permit that covers POTW discharges for parameters with wasteload allocations under approved TMDLs for the watersheds. This approach is similar to that taken by Connecticut Department of Environmental Protection for POTWs discharging to the Long Island Sound. A second option could involve a watershed general permit that covers a variety of point sources within a watershed boundary. Under this option, POTWs and Phase II MS4s within, for example, the East Branch DuPage River could obtain permit coverage under a watershed general permit that contains the effluent limitations (expressed numerically for POTWs and as BMPs for Phase II MS4s) necessary to achieve watershed-based TMDL allocations and other water quality standards. A third option might involve the DRSCW's working with Illinois EPA to develop and issue a watershed-based Phase II MS4 general permit for DuPage County and its Phase II MS4 co-permittees that contains watershed-specific language when the statewide Phase II MS4 general permit expires February 29, 2008.

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