

## Session 6: *Beginning your TMDL Project* *[Defining the Scope of your TMDL Project]* *[Conducting your Data Inventory]*

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### Acronyms

**AUID** – Assessment Unit Identification  
**GIS** – Geographical Information System  
**ISTS** – Individual Sewage Treatment Systems  
**MPCA** – Minnesota Pollution Control Agency  
**QA/QC** – Quality Assurance/Quality Control  
**NPDES** – National Pollutant Discharge Elimination System  
**TMDL** – Total Maximum Daily Load

### Planning Before You Begin Your TMDL

In the past, when conducting watershed studies, many environmental agencies focused on gathering as much monitoring data as possible, assuming that if brought to a statistician, useful information about water quality would magically emerge. Unfortunately, this approach seldom provided the answers to the questions being asked. Why? Because the projects often lacked clear data collection goals. Or, there may not have been a concerted attempt at gathering quality data.

\*Adapted from “Handbook for Developing Watershed Plans to Restore and Protect Our Waters”, EPA, October 2005

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Or, the focus of data collection efforts may have been solely on point sources to support permitting activities.

Data collected for TMDL studies will have to take a decidedly different approach. The data gathered for TMDL Studies must meet specific needs.

Data must:

1. help increase our understanding of the watershed and its tributaries as a system
2. be directly relevant to the impairment being studied
3. allow us to answer critical questions about the impairment and
4. be collected with sufficient scientific rigor such that it is able to withstand public and legal challenges

A common mistake made when conducting watershed projects has been to move too quickly into action (e.g. collecting new data or even jumping to implementing solutions), without taking the time up-front to scope the project, develop data collection goals, and compile and analyze existing information. A detailed work plan that will allow you to gather good quality and enough data will help you avoid this common mistake. A plan will keep people and programs focused and effective. Without adequate planning up-front, you may find yourself uncertain about what you are trying to accomplish.

Many of us have had some experience with a project that was poorly researched, conceived and executed. Inadequate planning at the front end of a project can result in frustrated and burned-out staff, ineffective use of resources, angry constituents, redundancy of effort, or inability to achieve goals. **At the beginning of your TMDL process, take the time to step back, gather all relevant existing information, and fully understand your project before committing any resources or staff time to solving problems.**

This chapter focuses on setting the stage for the TMDL study. It discusses the importance of scoping the project, gathering public and stakeholder ideas, conducting a data inventory, identifying data gaps, and beginning development of a Monitoring Plan to fill the gaps, if needed.

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Ultimately, the desired outcome of this effort is to have a project which operates within a systematic and comprehensive understanding of data needs and of the priorities for closing data gaps.

Worksheets provided at the end of this module should be completed by the TMDL Technical Team. These worksheets are designed to assist your planning and scoping activities and to encourage important dialogue among Technical Team members. The worksheets will also help to document your project from start to finish and likely will be very useful when writing the final TMDL study.

The intent of the chapter and associated worksheets is to provide some guidance for doing the important work ahead of you. If you take the time to carefully scope your project, chances are that you will have greater confidence in your conclusions and will feel comfortable communicating those to the public.

### **Planning and Completing a TMDL Requires Teamwork**

Scoping a project and writing a project plan requires a close partnership between MPCA and local organizations. There likely will be numerous challenges as you move through development and implementation of a TMDL. The combination of skilled individuals will prove invaluable and ensure that important issues are addressed and appropriate rigor is applied.

### **Getting Started**

Work with your Technical Team, Stakeholder Advisory Committee and the general public when you begin to gather existing data for your waterbody. Each group will bring something important to the process.

Stakeholders and members of the general public can help to brainstorm possible causes and sources of impairment, provide anecdotal information about the watershed, or provide a historic context for water quality problems. Your technical team can help you to sort through ideas and information and help to keep the project on track.

### **Defining the Scope of the TMDL Project**

Begin by identifying the scope of the project. Will your TMDL address one river reach or multiple reaches in an entire watershed or river basin? What land area will be included? Does it contribute water and possible pollutants to the impaired water?

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### **Factors that influence scope of project:**

- **regulatory factors**
  - **hydrologic location of impairments**
  - **logistical constraints**
  - **cost**
  - **personnel**
  - **stakeholder expectations**
  - **available data**
- USEPA, Stressor Identification Guidance**

Consider not only the size of the geographical area you intend to address, but the number of the impairments you intend to evaluate. Addressing multiple impairments in one TMDL project can increase efficiency and be more satisfying to stakeholders.

However, if your project's scope is too broad, it may become unwieldy and more difficult to successfully address pollution sources. It may also limit the number of impairments you can investigate. You could end up spreading your limited resources too far, making it difficult to complete tasks effectively.

On the other hand, you do not want to define the scope so narrowly that you fail to address legitimate land use or water quality problems contributing to the impairment. Therefore, it is important to consider financial and human resources available for the project, the geography, hydrology, and social factors when setting the scope of the project.

After you have determined the project's scope, be prepared to explain why you have included or excluded certain river reaches in the TMDL study. If you decide to limit the study to a single reach, you will need to create a defensible case for exclusion of upstream listed reaches. However, it is likely that you will want to include upstream reaches that have been listed for the same impairment in your project scope.

Where there are multiple impairments listed in the same watershed, you will also need to decide if the TMDL study will focus on one particular parameter or address all of them. For example, if a watershed has impaired stream reaches due to fecal coliform bacteria, turbidity levels, and low dissolved oxygen levels, you will have to decide if the TMDL study will address all three of these parameters, or only address one or two of them.

### **Understand the "Big Picture" First**

With your scope defined, you can begin to collect preliminary data. An important first step in the planning process is to familiarize yourself in a very general way with the river reach(es) you are working on. Start by identifying the impaired river reach by its Assessment Unit Identification (AUID) number and map its general location. Next, determine where your impaired water fits into a specific geographical context by identifying how your water body is part of the greater surface water system in Minnesota.

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You will want to understand and describe the reach's/reaches':

- (1) drainage basin
- (2) watershed
- (3) sub-watersheds
- (4) tributaries that affect it and downstream waters that it affects
- (5) other impairments in the watershed
- (6) ground water system that may influence it

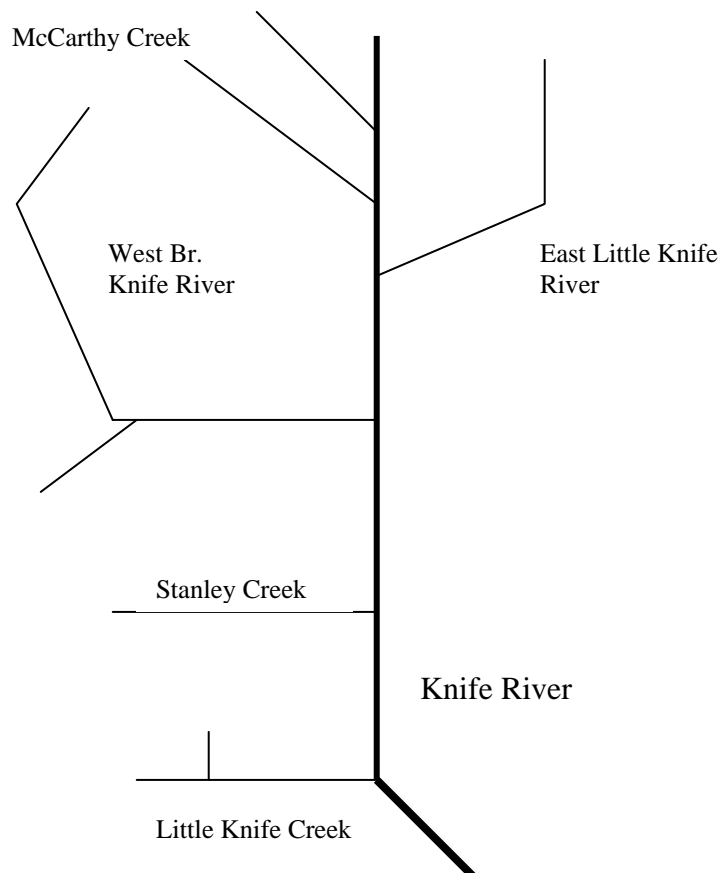
Once you have defined these things, it is helpful to display this information on a map or diagram, whether drawn by hand or by using GIS mapping software.

Detailed maps will be valuable educational tools in almost any setting where you are communicating with the public about water quality issues. They can also be invaluable for strategizing and decision-making purposes.

### **Graphically Display the Watershed and Project Area**

One way to do this is to draw a "stick diagram" of the drainage area within which the impaired water is located. Enlarge it and place it on a poster board to use as an information tool. This is an inexpensive, simple way to convey the idea of watersheds, subwatersheds, tributaries and mainstems of rivers. If you choose to, symbols can be included to represent feedlots, septic systems, wastewater treatment plants, industrial facilities, residences, etc. These can be overlaid onto the stick diagram to show the locations of possible sources of impairment. An example of a stick diagram follows.

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**Stick Diagram**

### Develop Basic GIS Maps

In addition to a stick diagram, if you have GIS mapping capabilities, develop some basic GIS maps for educational purposes. These can be quite simple or very complex, depending on the amount of data that is available to you.

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### **Begin to Expand Your Search for Data**

With some basic information gathering behind you, you can begin to delve a bit deeper into existing information about the waterbody. A good next step is to gather the water quality data used by the MPCA to place the water body on the 303(d) List, as well as other data in the STORET database. MPCA staff may also be aware of previously completed studies on the waterbody (e.g. biomonitoring reports that may have been developed), or other sources of information that could be prove valuable to your effort.

Armed with this basic background information, it would then be appropriate to bring the general public and your Stakeholder Advisory Committee members into the process. Stakeholders and the public can be invaluable in helping to locate existing studies, data sets, and other information that can enhance your understanding of the watershed. The technical and anecdotal information from the public may provide valuable insights into the ways a watershed or water body has changed over the years, how it has being impacted and by what pollution sources.

### **Meet with the Public to Gather Additional Information**

#### **Public Involvement**

Early in your planning process, meet with members of the public to gather basic information about possible causes and sources of pollution in the watershed. Open houses can be used to disseminate information about the TMDL process while also providing a venue for gathering information from participants. If you choose to hold an open house, plan the event carefully and be certain to articulate clearly in written materials and press releases what you hope to accomplish. Be certain to:

- Design the event so that it is informal and conversational
- Develop maps and visual aids about the impaired water body
- Provide basic information about the TMDL process
- Create simple mechanisms for gathering ideas. (You might want to pose a unique set of questions in small group settings that will stimulate conversation)
- Be available to listen and to write down ideas
- Have members of your Technical and Stakeholder Advisory Committees available to answer questions and to listen
- Create several different ways for citizens to provide input – e.g. in writing and verbally
- Document their ideas and describe how they will be used

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The information provided by the public may corroborate what you suspect may be causing water quality impairments. In some cases, it may not. In any case, the public will provide a valuable “reality check” on your assumptions.

#### **Stakeholder Input (where applicable)**

After the public has been engaged in the process, you will need to convene your Stakeholder Advisory Committee members. Early in the stakeholder involvement process, take them into the field on a stream walk, boat ride or bus tour of the watershed. While in the field, participants will be able to directly observe some of the causes and sources of pollution in the watershed. This experience will likely stimulate a great deal of discussion among committee members.

Later, at a Stakeholder Advisory Committee meeting, present them with a summary of public comments from the open house and ask stakeholders to brainstorm answers to the following questions. Be sure to take good notes.

- 1. What are the known or perceived impairments and problems in the watershed?**  
Examples: High water temperatures, low dissolved oxygen, muddy water, eutrophic conditions, etc.
- 2. What land uses likely contribute to the impairment?**
- 3. What specifically might be contributing to the impairment?**  
Examples: Non-conforming sewer systems, small businesses, feedlots, ISTSs, etc.
- 4. Do we already know the potential causes and sources of water quality impairments in the watershed (previous studies, projects, etc.)? If so, with what certainty?**  
Examples: Feedlots, urban runoff, inadequate wastewater treatment, ISTSs, etc.
- 5. What information is already available, and what analyses have been performed to support development of a TMDL?**  
Example: Previous studies, Clean Water Partnership reports, GIS mapping, etc.



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6. **Have any previous studies been done that quantify the causes of source inputs? If so, with what certainty? Have specific portions of the watershed been identified as delivering more pollutant load than others?**

Example: Have previous studies quantified loads?

7. **Are there any historical or ongoing management efforts aimed at controlling the problem pollutants or stressors?**

Example: Are there existing programs in place which may be addressing or reducing pollutants impairing water quality, such as cost-share programs, wastewater treatment facility upgrades, etc.?

8. **Are there any threats to future conditions, such as imminent increases in development in the watershed?**

9. **Are there any other concerns?**

Debate, then  
Document  
Probable Water  
Quality  
Impairments and  
Their Causes

Using all of the information that you have collected from the general public, stakeholders, and your own sources, bring together your TMDL Technical Team for an initial brainstorming session. Your goal should be to identify all of the **known** (realistically possible) water quality impairments in the watershed, and describe their causes and sources as best you can. This is an important early conversation to have to ensure that everyone is “on the same page” and that each team member is working under similar assumptions. This exercise relies to a large degree upon the best professional judgment of your Technical Team members and represents your best effort to characterize the water body’s problems using the information you have at the present time. With additional time and information, things may change. You will have to apply a flexible frame of mind to your TMDL project, from beginning to end. Be open to surprises and the need to change course in mid-stream.

STOP –  
Complete  
worksheets 6-1

**NOTE: Use Worksheet 6-1 to help you begin your conversation with your colleagues.**

Once you have developed an exhaustive list of possible impairments and probable causes of those impairments, you will want to pare down the list to the most likely candidates. If you remove any potential causes or sources of pollution from the list, be certain to document your reasons for doing so on the worksheet(s).

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### Review Worksheet(s) 6-1 and Pare Them Down, as Needed

Keep these worksheets as a record of your thinking processes as a team. Not only will they be helpful to you as you later develop your monitoring plan, but they are an important record for any staff that may take the project over in the future.

### Conduct a Data Inventory

Now, you can significantly broaden your search for data and information about the impaired water body. The collection of existing data may allow you to either validate initial hypotheses about causes and sources of impairment or may force you to reconsider initial assumptions completely. In some cases, available data may be sufficient to allow you to make recommendations based on general evidence (Strength of Evidence). In other cases, a lack of data may require that you go into the field to gather additional evidence. This is when a monitoring plan becomes important.

**Designing a TMDL study requires the same kind of deductive reasoning used by doctors when diagnosing an illness. In both cases, the investigator may only have access to limited, disjointed or sketchy sources of information. However, he/she must use multiple lines of evidence to build a convincing diagnosis.**

Developing a TMDL requires the technical team to be in a continuous process of investigation and discovery. The data you have been able to gather to this point is only the beginning. Now, you will want to expand your knowledge by conducting a data inventory. Note that MPCA's basin planners and local water planners may be helpful in locating important sources of information.

Data you gather should help you to:

- Understand historical conditions
- Characterize your water body's health
- Identify specific pollution sources
- Support quantification of pollutant loads
- Assist in tracking progress in improving water quality over time

A data inventory is about gathering a good deal of data, looking at it carefully, and determining what additional information is needed. Data gathering can quickly become overwhelming if some limitations are not placed on the process. **To make it manageable, you will want to limit your search to information that is directly related to the impairments you have identified in the previous exercise.**

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For example, if you have identified high levels of fecal coliform bacteria in your water body, you will want to limit your data collection to that information that will help to characterize the likely pollution sources, such as:

- Livestock operations
- Wildlife populations
- Septic systems
- Noncompliant wastewater treatment facilities
- Stormwater

Because bacteria are not typically related to other water quality parameters (with the exception of sediment), you may not need to gather additional monitoring data. On the other hand, some water quality impairments are related to several parameters and affected by many factors, requiring more data to better understand the problem. For example, excess nutrients can increase algal growth (chlorophyll a) and lead to processes that deplete dissolved oxygen, lower pH and produce ammonia at potentially toxic levels. Since these parameters are related, you may often have to evaluate all of them.

If you decide to collect additional information, be certain to gather as much data as possible on the specific impairments of concern. By doing so, your database will be expanded while you also increase efficiency.

### Useful Data for Watershed Characterization

Where possible, gather data in each of the following areas:

#### **Physical and natural features**

- **Watershed boundaries**
  - identify geographic boundaries
  - delineated drainage areas
  - determine boundary conditions (scope of project)
- **Hydrology**
  - locate of water bodies
  - locate of springs or karst areas
  - identify spatial relationships of water bodies
  - delineate subwatersheds
- **Topography**
  - evaluate elevation changes
  - identify slope of stream segments and watersheds

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- **Soils**
  - identify erosion rates, poor drainage or steep slopes
- **Climate**
  - identify factors affecting runoff and loading (eg. precipitation, temperature, etc.)
- **Habitat**
  - describe areas' ability to support fish and wildlife
  - identify riparian cover
  - support defining stressors that could be contributing to impairment
  - define biological communities
- **Wildlife**
  - identify special wildlife species to be protected
  - estimate the number of those species within the impaired reach
- **Ecoregions**
  - identify the ecoregion in which your project is located

### **Land Use and Population Characteristics (GIS as source)**

- **Land use and land cover**
  - characterize land use of project area
  - identify potential pollution sources (ex. feedlot inventories)
  - identify point sources
  - identify nonpoint sources
  - describe natural background contributions

(Natural background means pollution resulting from the multiplicity of factors in nature, including climate and ecosystem dynamics that affect the physical, chemical, and biological conditions in a water body but does not include measurable and distinguishable pollution that is attributable to human activity or influence.)

- **Existing management practices**
  - identify current control practices
  - identify potential targets for future management
- **Demographics**
  - identify future growth and development rates
  - identify population centers
- **Waterbody characteristics**
  - define critical conditions
  - define seasonal effects on impairment
  - define temporal extent of impairment

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- **Water quality standards**
  - identify beneficial uses and numeric criteria (if available)
- **305(b) Report**
  - identify status of designated use support
  - identify potential causes and sources of pollution
- **Source Water Assessments**
  - Identify water supply areas to be protected
- **Remote Sensing data**
  - Assesses lake clarity, stream clarity, wetland plant diversity
- **Biomonitoring data**
  - Understand extent of aquatic life impairments
- **Geomorphology**
- **Water chemistry**
- **Flow data**

### Where to Find Data for Your TMDL

Consider the following sources of information as you begin to collect data for your watershed:

#### Local Government Sources

##### When you begin:

- **Check first for locally derived data sets.**
- **Be aware of age and accuracy of data.**
- **Update the data to reflect changes in land use, and land management.**
- **Compare data with what you and your stakeholders know about the watershed**

**Regional, county and city planning offices** – master plans, zoning ordinances (examples: Metropolitan Council Environmental Services, Watershed Districts )

**Environmental Departments** – water quality monitoring programs, feedlot inventories, septic system inventories

**Soil and Water Conservation Districts** – agricultural land use information, topographic maps, soil surveys, erosion control plans

**Health Departments** – septic system inventories, records of outbreaks of illness or ailments from poor water quality

**Transportation Departments** – transportation master plans, permits, road and bridge construction

Each year,  
approximately 40-50%  
of the data used by  
MPCA to assess  
waterbodies comes  
from other agencies.

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### **State Government Sources**

#### **Minnesota Pollution Control Agency**

Basin Information Documents, Clean Water Partnership Reports, NPDES Permits, Clean Lakes Program Reports, Volunteer Lake Monitoring Program Reports, Stormwater Pollution Prevention Plans, 303(d) Listing Data Set, GIS data sources, DELTA database, STORET water quality database, HYDSTRA water quantity database, feedlot database, ISTS database

#### **Minnesota Department of Natural Resources**

Flow studies, mining and forestry reports, fish and wildlife surveys, Natural Heritage Database

#### **Minnesota Department of Health**

Fish consumption advisories

#### **Minnesota Department of Agriculture**

Pesticide Monitoring Data

#### **Minnesota Extension Service**

Water Resources Center

#### **Minnesota Colleges, Universities**

Modeling, data analysis

### **Federal Government Sources**

#### **US Environmental Protection Agency**

STORET database

#### **US Fish and Wildlife Service**

National Wetlands Inventory

#### **US Geological Survey**

National Hydrography Dataset

#### **US Department of Agriculture (NRCS)**

Soil data, agricultural land use information, topographic maps, soil surveys, erosion control plans, Natural Resources Inventory (NRI)

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**Federal Emergency Management Agency**  
Floodplain Maps

**National Climatic Data Center**

**Enter  
Information into  
a Database for  
Ease of use**

Data often can be gathered, organized and visually displayed using Geographical Information Systems (GIS). This tool supports data analysis by creating watershed maps and displaying a variety of spatial information that is helpful for characterizing a watershed.

If resources are available, you may want to consider entering this data into a GIS database for ease of use. If this is not possible, you will want to be sure that the information you used as the basis for your TMDL is organized and easy to review. Spreadsheets may prove adequate for the task.

**Review and  
Evaluate  
Existing Data**

When data is organized, it is often easier to recognize gaps or weaknesses in the data sets. As you analyze the data, some data points may stand out as unusual or improbable. When this occurs, take the time to look more carefully at the data. There may be a problem with its quality. Do not assume that if the data comes from a certified laboratory it is accurate. Conversely, do not delete data unless you are certain that an error exists.

Document all data decisions. Explain why you have chosen to include or exclude data from the TMDL analysis.

**Expected Time  
Commitment**

Collecting existing data is not a quick or linear process. To develop a plan for gathering existing data and completing a data inventory will likely take months to years.

**Revisit Initial  
Assumptions**

Once you have completed the Data Inventory and conducted an initial analysis of the data, review Worksheet 6-1. Did you learn anything new? Were your initial assumptions correct? Do you need to change the direction of your project? What new data is needed?

Identify those data gaps that require development of a monitoring plan and those that could be satisfied by conducting a literature review, etc.

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### **Prepare to Develop a Monitoring Plan**

TMDL studies typically require a targeted data collection effort in order to fill critical data gaps. Before beginning to gather additional data, a monitoring plan should be developed. A monitoring plan should be more than just a list of monitoring tasks that “sound good.” Serious consideration must be given to each portion of the plan.

Monitoring plans encourage project staff to think the project through carefully before any work is done in the field. The monitoring plan establishes a plan of action so that field work is efficient and effective at gathering the critical information needed to complete the TMDL study. The monitoring plan is a working, living document that is revisited throughout the duration of the project.

The monitoring plan:

- Describes the water body
- Describes the basic TMDL study design
- Outlines reasons for collecting additional data (if applicable)
- Describes means by which data will be interpreted
- Identifies data reporting mechanisms
- Provides statistical means of testing new ideas
- Ensures project purpose remains clear despite personnel changes

**The monitoring plan allows you to test a working hypothesis about water quality impairments, with an expectation that your hypothesis could be wrong.**



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#### Summary

When developing a monitoring plan, you should document your decisions regarding what data you decided to gather or not to gather. For example, gathering some kinds of data may be cost prohibitive. Documenting your decisions will allow others to follow your thinking and understand why the study may have had certain limitations. Chapter 7 addresses monitoring plans in much greater detail.

- Planning is a critical component of the TMDL process.
- It is important to define the scope of the TMDL project early in the process.
- Describe water body impairments based on what you know now.
- Gather existing information from all known, reliable sources.
- Begin to identify data gaps.
- Revisit initial assumptions about causes and sources of impairment.
- Prepare to develop a monitoring plan as a prelude to collecting new water quality data in the field.

## **Worksheet 6-1**

### **Preliminary discussion: Identifying potential impairments/ causes / sources**

**(Copy this worksheet and use as many times as needed) Be brief, at least in your first draft!**

**What is:**

**The impairment(s)?**

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**What might be causing stress on the system? (list all factors)**

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**The pollutant of concern?**

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**The AUID of the river reach?**

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**The reach description?**

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**What chemical or physical parameters (DO, temperature, etc.) are thought to be driving the impairment?**

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**What are the effects of this impairment?**

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**What do you believe may be the sources of the impairment (ex. feedlots, septic tanks, urban runoff, etc.)?**

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**Based on best professional judgment, rank these potential sources (with 1 being the most significant sources of the impairment and 5 being the least significant sources)**

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**Based on the information you have at this time, how would you describe your confidence in the information you have about this impairment: (Circle one answer)**

- a) **Confident about the information. No additional data needed to complete TMDL.**
- b) **Reasonably confident; however, more data is needed to increase the weight of evidence for the TMDL.**
- c) **Not confident in available information. More information is needed to complete TMDL.**
- d) **No information is available, so more data must be gathered for the TMDL.**

## **Worksheet 6-2**

### Data inventory documentation

#### **1. List agencies and databases that will be queried during your data inventory**

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#### **2. Will accessing data require any special agreements/authorities?**

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#### **3. Who will collect, catalogue and maintain data?**

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#### **4. List actual databases from which data is collected**

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## **Revisit initial assumptions about impairments**

Based on the new information in hand from your data inventory and your analysis, reexamine the list of impairments you identified on Worksheet 6-1. New information you have collected and examined may allow you to remove some potential causes and sources of impairment from consideration. Or, you may have found potential new causes or sources that should be evaluated.

Working with your Technical Advisory Committee, ask yourselves if your initial assumptions and information were correct or whether new information requires changing directions or assumptions.

Make any changes needed to your worksheet to reflect new information and hypotheses. This worksheet will be valuable when developing a monitoring plan.