

Minnesota Public Drainage Manual

Chapter 3 – Engineering and Environmental Considerations - Introduction

Summary

Engineering practices for public drainage projects continue to evolve with the advent of new technology, changes to regulatory requirements, and a better understanding of environmental considerations. Development of engineering and environmental data to support a drainage project can be very complex and require significant amounts of effort to establish communication with drainage authorities, agency reviewers, and landowners. The purpose of this chapter is to provide drainage authorities, engineers, agency reviewers, and other interested parties a better understanding and guidance on engineering and environmental analyses and review requirements of the drainage code with other applicable regulations related to public drainage projects. This chapter will give local water managers a framework for making decisions about public drainage projects. (**Section I, A.**)

The roles and responsibilities of the engineer for public drainage system projects are debriefed and outlined in **Section I, A.1.** with engineer's report requirements as prescribed in Minn. Stat. Chapter [103E](#) and [103D](#) briefed in **Section I, A.2.**

There are two (2) key topic areas to assess when considering proposing a drainage project: (1) environmental, land use, and multipurpose water management criteria (**Section I, B.1**); and (2) investigating external sources of funding and technical assistance (**Section I, B.2**).

[Minn. Stat. 103E.015, subd 1](#) sets the requirement that a drainage authority must consider at least nine (9) criteria related to land use and the environment for a 103E drainage project. These must be addressed regardless of whether a drainage project requires a permit or not; the project engineer should be requested by the drainage authority to summarize these considerations within the engineer's reports:

1. Private and public benefits and costs of the proposed drainage project;
2. Alternative measures, including measures identified in applicable state-approved and locally adopted water management plans;
3. The present and anticipated land use within the drainage project or system, including compatibility of the project with local land use plans;
4. Current and potential flooding characteristics of property in the drainage project or system and downstream for 5-, 10-, 25-, and 50-year flood events, including adequacy of the outlet for the drainage project;
5. The effects of the proposed drainage project on wetlands;
6. The effects of the proposed drainage project on water quality;
7. The effects of the proposed drainage project on fish and wildlife resources;
8. The effects of the proposed drainage project on shallow groundwater availability, distribution, and use; and
9. The overall environmental impact of all the above criteria.
10. These criteria are discussed in detail in **Section I, A.1.**

[Minn. Stat. 103E.015, subd. 1a](#) requires the project engineer to investigate the potential use of external funding sources to facilitate the purposes of wetland preservation or restoration, creation of water quality improvements, or flood control. There is a broad range of funding sources including local, state, federal, or private funding. Early coordination with the local Soil and Water Conservation District may aid to identify funding sources. (See **Section I, B.2** for additional detail)

A. Overview

The development of the *Minnesota Public Drainage Manual*, establishment of the Drainage Work Group and technological advances in computer models and design software have provided progress towards the uniformity of engineering practice. However, communication regarding regulatory expectations is still a work in progress and the need still exists to further improve the standardization of drainage engineering practice and the agency review of public drainage proceedings. Drainage engineers' analysis and reporting content remains non-uniform throughout the state. Development of engineering and environmental data to support a drainage project can be complex and require significant financial resources. As discussed in **Chapter 2**, drainage projects are financed by the benefitted landowners and it is in the financial interest of the project proposers to ensure that the engineering services performed are what is required to properly evaluate the project and complete the required regulatory and drainage authority process. Further, where project proposers are initiating proceedings and posting bonds, it is important for the engineer and proposers to manage financial risk exposure in expending their engineering budget. This is especially critical given that there is no guarantee that their project will be deemed feasible or permissible.

Regulatory agencies, on the other hand, have a valid need for certain types of information to enable adequate review of a drainage proposal while fulfilling their statutory duties. Regulatory agencies may play multiple roles in their review of a project and there may be information needed by the agencies when exercising their regulatory authority that is not required in an engineer's report for their role in reviewing the project under [Minn. Stat. § 103E](#) and other statutory authorities.

Likewise, drainage authorities may also have multiple roles to play in relation to a drainage project (e.g. Drainage authority, WCA LGU, road authority, environmental review RGU). Drainage authorities use engineering and environmental data provided in engineer's reports to make decisions on whether to order various actions related to the development of the project (e.g. survey, viewers, establishment, etc.). When engineer's reports on proposed drainage projects lack the required information, this affects the drainage authority's decisions-making process.

The drainage engineer often does not know all the types of information each reviewer needs. Because there is not a standard approach to requesting information, incomplete agency advisory reports to the drainage authorities and subsequently to other interested agencies/reviewers can result.

The objective of this chapter is to provide drainage authorities, engineers, agency reviewers, and other interested parties a better understanding and guidance on engineering and environmental analyses and review requirements of the drainage code along with other applicable regulations related to public drainage projects. This chapter will give local water managers a framework for making decisions about public drainage projects.

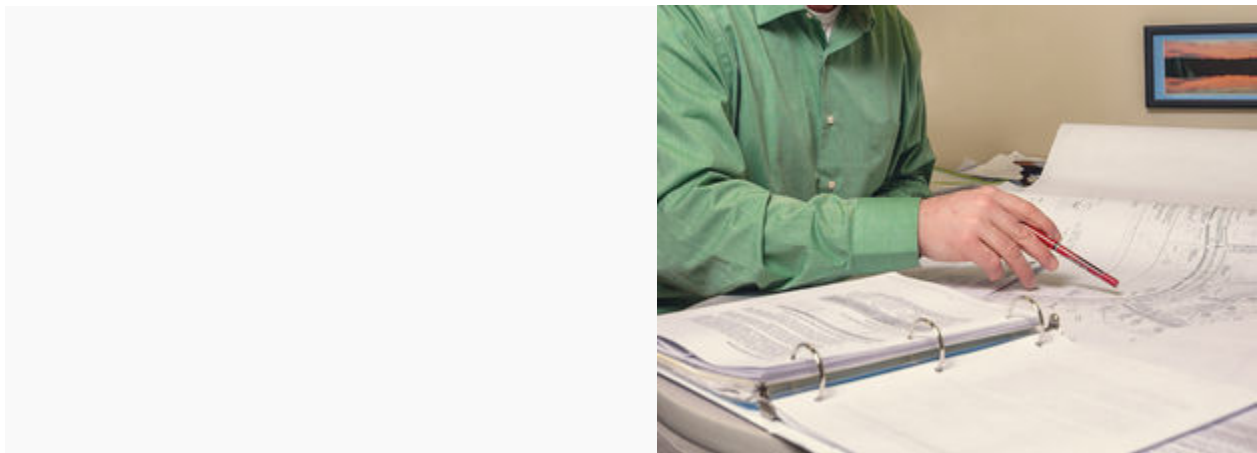
Specific goals of this chapter are as follows:

- Establish a framework for surveys and engineering and environmental investigations of proposed projects on § 103E drainage systems so that information developed and reported is consistent and sufficient for review purposes;
- Standardize the agency review of engineering documents pertaining to the establishment, improvement or petitioned repair of public drainage systems in Minnesota; and
- Emphasize the critical role of the review of environmental issues in public drainage proceedings;
- Provide a framework for enhanced communication among the public and all professional disciplines associated with public drainage in Minnesota.

1. Roles and Responsibilities of the Engineer

The primary role of the engineer for public drainage system projects is to be the key technical advisor for the drainage authority (and by extension, the benefited landowners). This role contains many facets, requiring a wide variety of technical expertise that is specific to the nature of the individual project, and may include:

- Technical application of drainage law;
- Surveying;
- Hydrology and hydraulics;
- Culvert, roadway, and structural design;
- Construction plan development;
- Construction management and observation;
- Erosion and sediment control design;
- Wetland delineation;
- Water quality analysis;
- Communication/liaison between drainage authority and other decision-makers and/or reviewers;
- Environmental review and permitting; and
- Soil and water conservation.



The engineer-of-record must have a basic working knowledge of each technical specialization used to create and supplement the engineer's report and have a thorough understanding of drainage law.

Few individuals have extensive expertise in all of these categories. For this reason, the engineer-of-record may be required to utilize the services of multiple individuals and/or organizations to assist him/her in preparing content within the engineer's report including engineers, legal counsel and environmental consultants. However, the engineer-of-record must have a basic working knowledge of each technical specialization used to create and supplement the engineer's report and have a thorough understanding of drainage law, particularly as it pertains to development of engineer's reports.

[Minn. Stat. § 103E](#) defines specific content that is to be provided by the engineer within the engineer's reports. Ideally, the engineer's reports should address **all** of the deliberations and decisions required of the drainage authority under [Minn. Stat. § 103E](#). But since the engineer's reports form the basis for many of the subsequent environmental or regulatory decisions, it is prudent to include this additional content within the engineer's report. To enable the drainage authority to make responsible decisions on behalf of the benefitting landowners, both the drainage authority and the engineer need to have a mutual understanding of the expected duties of the engineer and the content of the engineer's report prior to appointing the engineer.

The scope of the engineer's analysis required of the drainage project includes environmental regulation and environmental considerations. The engineer should understand the environmental regulations pertinent to the project and should inform the drainage authority of its responsibilities in complying with these regulations. Additionally, the engineer should provide technical guidance regarding the environmental aspects required for consideration by the drainage authority under [Minn. Stat. § 103E.015](#). Given the nonregulatory nature of nonpoint sources of pollution in an agricultural setting, watershed plans such as Watershed Restoration and Protection Strategies (WRAPS) and Total Maximum Daily Load (TMDL) plans may incorporate conditions for the project watershed that apply to agricultural drainage. The level of detail needed by the drainage authority will vary based on the type of project, magnitude of the proposed actions, jurisdiction of regulatory programs, and geographic setting.

2. Chapter 103E and Chapter 103D Engineer's Report Requirements

Public drainage systems that are located totally within one county (and not within an established watershed district) are administered by the county board of commissioners. Joint county ditches are systems located in two or more counties. Judicial ditches are public drainage systems established through court order and may be administered either by a single county or multiple counties.

Administration of county, joint county, and judicial systems are regulated under [Minn. Stat. § 103E](#) (commonly referred to as the drainage code).



The contents of the engineer's preliminary report and engineer's final report are not substantially different.

Watershed districts are established in many areas of Minnesota and subject to [Minn. Stat. § 103D](#). Watershed districts become the drainage authority for drainage systems within their boundaries for new drainage systems when an improvement proceeding is initiated or when the current drainage authority (county board or joint county ditch authority) voluntarily transfers an existing system to the watershed district. **Chapter 2** of this manual provides additional detail regarding determining the drainage authority.

For watershed districts that are acting as the drainage authority, [Minn. Stat. § 103D](#) directs the watershed district to follow the procedures for drainage proceedings found within [Minn. Stat. § 103E](#). Therefore, the function of the appointed drainage engineer, with the exception listed below, is identical for projects related to public drainage systems under the authority of a county or a watershed district. Consequentially, the material in this chapter is focused on the language found in [Minn. Stat. § 103E](#).

There is one procedural difference in the administration of drainage law by watershed districts in comparison to other drainage authorities. Per [Minn. Stat. § 103D.711](#) and [Minn. Stat. § 103D.745](#), watershed districts technically only require submittal of one engineer's report and hold one hearing on the matter. By contrast, [Minn. Stat. § 103E.245](#) and [Minn. Stat. § 103E.271](#) call for an engineer's preliminary survey report (hereinafter referred to as the "**engineer's preliminary report**") and an engineer's final detailed survey report (hereinafter referred to as the "**engineer's final report**"). The contents of the engineer's preliminary report and engineer's final report are not substantially different. The required information within the two reports under [Minn. Stat. 103E](#) is also consistent with the requirements of watershed law for the single engineer's report. For Chapter 3, no further distinction will be made between the two types of drainage authorities. However, to avoid confusion between the requirements of either type of drainage authority, it is recommended that [Minn. Stat. § 103E](#) be followed with regard to the content and administration of engineer's reports for any drainage project as it provides compliance with watershed law and additional clarity.

B. Environmental, Land Use, and Multipurpose Water Management Criteria

[Minn. Stat. § 103E.015, subd. 1](#) requires that the drainage authority “must consider” nine criteria relating to land use and the environment for a [103E](#) drainage project. **How** these criteria are to be considered is not prescribed in law. However, individuals, organizations or agencies may be able to provide input on a site by site basis to support the drainage authority’s decisions. Permits may be required for portions or all of a drainage project. However, the environmental considerations in [103E.015](#) must be addressed regardless of whether a drainage project requires a permit or not. The engineer should be requested by the drainage authority to summarize these considerations within the engineer’s reports. The drainage authority may provide the engineer specific expectations as to the content and level of detail to be provided in the engineer’s report beyond the minimum statutory requirements.

Some general guidelines for the scope and application of these considerations are described as follows, as described in [Minn. Stat. § 103E.015, Subd. 1](#):

1. Private and public benefits and costs of the proposed drainage project; This discussion should be more global in nature, addressing such non-quantifiable factors as environmental costs, public costs, cultural costs, etc. where applicable. Discussion of benefits and costs should not be limited to financial considerations alone.

2. Alternative measures, including measures identified in applicable state-approved and locally adopted water management plans, to:

- (i) Conserve, allocate, and use drainage waters for agriculture, stream flow augmentation, or other beneficial uses;
- (ii) Reduce downstream peak flows and flooding;
- (iii) Provide adequate drainage system capacity;
- (iv) Reduce erosion and sedimentation; and
- (v) Protect or improve water quality.

The engineer should be aware of (and, where applicable, specify within the preliminary engineer’s report) local water management plans such as WRAPS, TMDLs, watershed plans, and county water plans (See **Appendix 13**) and their applicability for the drainage project. **Chapter 5** of this manual provides a matrix for Best Management Practice selection to assist in BMP implementation within the context of a public drainage system and/or its watershed.

3. The present and anticipated land use within the drainage project or system, including compatibility of the project with local land use plans;

Change in land use can have substantial effects on the performance of a public drainage system. Local land use plans should be considered prior to the start of project design.

4. Current and potential flooding characteristics of property in the drainage project or system and downstream for 5-, 10-, 25-, and 50-year flood events, including adequacy of the outlet for the drainage project;

The preliminary engineering report should identify particular flooding issues (e.g., high ground water, spring flooding, crop damage from summer storms, inadequate outlet, etc.). The engineer should consider estimating the number of acres directly affected by the identified flooding problems. Section 5 of this chapter provides additional detail for considerations of the adequacy of the outlet.

5. The effects of the proposed drainage project on wetlands;

Drainage projects must comply with a variety of state and federal wetland regulations (see **Section 2.B Wetland Regulation**). The engineer should consider avoidance of impacts to wetlands (including those considered “exempt”) and/or wetland enhancements in development of project alternatives. Avoidance measures might include utilizing non-perforated tile under wetlands, realignment of the public drainage system around a wetland, or utilizing risers to maintain or increase wetland hydrology.

6. The effects of the proposed drainage project on water quality;

Water quality issues pertinent to drainage projects include erosion potential (before and after), sediment transport, and non-point pollution (e.g. nutrients, pesticides, and bacteria), etc. Chapter 5 of this manual can help the engineer select BMPs (including wetland restoration and creation) that can address these issues based on the source/ symptom/ causes encountered during the engineering survey. See **Section 2.F. Water Quality** for more detail.

7. The effects of the proposed drainage project on fish and wildlife resources;

Fishery impacts include sedimentation along downstream areas after construction, blockage of fish movement due to grade control structures, and excessive water velocities created by hydraulic structures. Wildlife may be impacted by potential land use changes, including the destruction of prairie and wooded habitat. The grass buffer strip requirement for drainage systems should not be suggested as providing adequate mitigation for the destruction of other wildlife habitat. The DNR fisheries and wildlife managers and other natural resource professionals are a source to consult for assistance in identifying potential project impacts and mitigation measures.

8. The effects of the proposed drainage project on shallow groundwater availability, distribution, and use; and

Where shallow ground water conditions exist, either on a sustained or a seasonal basis, it is possible for a drainage project to have significant impact on normally experienced water levels. As with any other affected resource, impacts should be discussed, and possible alternatives evaluated.

9. The overall environmental impact of all the above criteria.

Potential negative impacts of the proposed drainage project should be clearly identified and discussed for the benefit of the drainage authority.

These criteria will be referred to frequently in the remaining sections of this chapter. It should be noted that these criteria encompass much more than engineering related concerns. They

provide a framework for evaluating project impacts, including engineering, social, economic and environmental issues. The engineer should review these criteria and assess their impact on a proposed drainage project as soon as possible after the project is initiated (see **Appendix 1** for a checklist of [Minn. Stat. 103E.015](#) criteria).

C. Investigating External Sources of Funding and Technical Assistance



There are many external funding sources to complete projects, including the Clean Water Fund, administered through BWSR, DNR, MDA, and MPCA.

[Minn. Stat. § 103E.015, Subd. 1a](#) requires the drainage authority and, therefore, the Engineer, to investigate the potential use of external sources of funding to facilitate the purposes of wetland preservation or restoration, creation of water quality improvements, or flood control, as authorized in [Minn. Stat. § 103E.011, Subd. 5](#) (see **Appendix 2** for an external funding sources checklist).

Note that [Minn. Stat. § 103E.011, subd 5](#) also authorizes the use of external funding and drainage system assessed funds within the watershed of the drainage system (not just the benefited area) for the purposes specified.

The sources of external funding may include local, state, federal, or private funding. Potential sources of state funding may include the [Clean Water Fund](#) (administered through the Board of Soil and Water Resources, Department of Natural Resources, Department of Agriculture, and Minnesota Pollution Control Agency), [Outdoor Heritage Fund](#) (administered by the Lessard-Sams Outdoor Heritage Council), and [Flood Hazard Mitigation Grants](#) (administered by the Department of Natural Resources). Potential federal funding sources may include the [Environmental Quality Incentives Program \(EQIP\)](#) and [Wetland Reserve Easements Program \(WREP\)](#), both administered by the Natural Resources Conservation Service. Early coordination with the local soil and water conservation district is recommended to help identify potential and likely funding sources.