Minnesota Public Drainage Manual

Chapter 3 – III. Engineering and Environmental Considerations - Preliminary survey and engineer's preliminary report

Summary

Proposed drainage projects require a preliminary survey and investigation of site conditions and study of historical data to determine project feasibility and practicality (**Minn. Stat. § 103E.245**). The project engineer is responsible for selecting the appropriate level of detail at the preliminary survey stage to provide accurate estimates of the proposed project's cost, to meet the needs of the reviewing agencies, and also minimize surveying costs of the project. It is recommended that the preliminary survey be made as complete as possible and the work completed is close to the standards demanded during the final survey. **Section III** provides detail regarding the purpose and content of the preliminary survey as specified in Minnesota Statutes. Specific topics include:

- Objectives and limitations (**Section III, B**);
- Procedures (**Section III, C**);
- Preliminary survey report content (**Section III, D**); and
- Engineering Costs (**Section III E**).

The DNR must review and file a preliminary advisory report with the county or joint board drainage authority before the date set for the preliminary hearing. The preliminary advisory report must specify any additional investigations that should be completed and documented in the engineer's final report related to public waters that may be affected and the environmental, land use, and multipurpose water management criteria in section **Minn. Stat. § 103E.015**, and cite the specific sections of the report that are inadequate. (See **Section III, F**)

A. General

Determining the scope of preliminary and final surveys takes detailed consideration. Insufficient detail can lead to retracing work and extra costs, while too much detail in the preliminary survey can lead to work that is not used due to changes throughout the project.

The engineer must consider several factors when determining the relative scope of the preliminary and final surveys. If insufficient detail is taken during the preliminary survey, much of the previous work may be retraced during the final survey, resulting in extra costs. However, if the preliminary survey is too detailed, much of the work will not be utilized if substantial project changes are made during the hearing process. Likewise, regulatory and reviewing agencies may request additional field data during the preliminary survey stage. It is recommended that the preliminary survey be made as complete as possible, meaning that the work is completed close to the standards demanded during the final survey. It is the responsibility of the engineer to select the appropriate level of detail at the preliminary survey stage to provide accurate estimates of the proposed project's cost, to meet the needs of reviewing agencies, and at the same time minimize surveying costs of the project.

(Note: Caution must be exercised during the preliminary survey to ensure that costs do not exceed the petitioner's surety bond. As the preliminary survey becomes more detailed in nature, the engineer must keep the petitioners' attorney and the drainage authority informed about cumulative costs - including an estimate of costs yet to be incurred. Additional surety bonds may need to be provided as work progresses.)

Proposed drainage projects require a preliminary survey and investigation of site conditions and the study of historical data to determine project feasibility and practicality as required by **Minn. Stat. § 103E.245**. The extent of investigation required for each project depends on the engineer's experience in the area, project needs and objectives, environmental attributes of the area (wetlands, public waters, etc.) and the amount of data already available.

Where the project is small, and the problems and their solutions are obvious, the extent of the survey may be limited. Larger or complex projects and those involving more environmental attributes will require a more extensive survey and analysis. In either case, there is a specified minimum amount of information that needs to be collected under the drainage code (see **Minn. Stat. § 103E.245, Subds. 1 and 2**). However, the engineer and the drainage authority are ultimately responsible for deciding the type and intensity of surveys and investigations which are needed for planning, design, and evaluation of the drainage project to meet the objectives of the petitioners and requirements of laws and regulations.

The engineer's preliminary report is prepared in response to a petition for a “drainage project” which is defined in **Minn. Stat. § 103E.005** as a new drainage system, an improvement of a drainage system, an improvement of an outlet, or a lateral. Regardless of the type of drainage authority (county, joint county, or watershed district), the preliminary survey and investigation requirements are equivalent.

Note:
*Petitions for **Minn. Stat. § 103E.227** Impounding, Rerouting, and Diverting Drainage System Waters generate different requirements for investigation and reporting. Those reports are discussed in **Section VI** of this chapter.*

*An engineer's repair report as required in **Minn. Stat. § 103E.715** Procedure for Repair by Petition also generates different survey and report requirements and is discussed separately in the **Section VII** of this chapter relating to Repairs of drainage systems.*

*If a petition falls under the authority of an established watershed district as a drainage authority, **Minn. Stat. § 103D.625** stipulates that all proceedings must follow Drainage Law.*

B. Preliminary Survey: Objectives and Limitations

Remember that early coordination with the reviewing/permitting authorities can help scope the survey needed and limit additional information requests that may delay the project and/or add additional costs.

The engineer commences the preliminary survey after receiving the drainage authority's order issued in response to a petition for a **Minn. Stat. § Chapter 103E** drainage project. An initial task is to clearly identify the objectives of the work leading to the preliminary survey and survey report.

These objectives can be of two types:

1. Goals and objectives of the petitioners and drainage authority found in the petition and order which are consistent with **Minn. Stat. § 103E** Drainage Law; and
2. Objectives related to the considerations of **Minn. Stat. § 103E.015**, or as expressed through applicable law or rule.

Following are the preliminary survey tasks as outlined in **Minn. Stat. § 103E.245** Preliminary Survey and Preliminary Survey Report:

Note: Early coordination with reviewing/permitting authorities prior to any significant engineering is highly recommended to help the engineer scope the drainage project and the subsequent preliminary survey and report, limit additional information requests that may delay the project, and control costs.

1. Examine the drainage petition and order:

- To ensure that the objectives of the petitioners and the drainage authority are clearly understood; and
- To determine the type of improvements required (e.g., flood prevention, surface drainage, or subsurface drainage).

2. Make a preliminary survey of the area likely affected by the proposed drainage project:

- To determine whether the proposed drainage project is necessary and feasible with reference to the environmental, land use, and multipurpose water management criteria in **Minn. Stat. § 103E.015, Subd. 1**, including but not limited to the consideration of alternate measures identified in applicable state-approved and locally adopted water management plans, (ie., a watershed district's overall plan (if applicable), a county water plan (greater Minnesota), or a water management organization (WMO) plan (7-county Twin Cities Metro area), if available), and consideration of the public utility, benefit, or welfare of the proposed drainage project as directed in **Minn. Stat. § 103E.015, Subd. 2**; and

- To determine preliminary project costs in support of the drainage authority's required investigation of potential use of external sources of funding and technical assistance per **Minn. Stat. § 103E.015, Subd. 1a**.

3. Examine and gather information related to determining whether the proposed drainage project substantially affects areas that are public waters:
*The petitioners for a proposed drainage project or the drainage authority may apply to the commissioner for permission to do work in public waters or for the determination of public waters status of a water body or watercourse. See **Minn. Stat. § 103E.011, Subd. 3.3b.***

- To determine if permission from the Commissioner is required as specified in **Minn. Stat. § 103E.011, Subd. 3**; or

- To determine whether the proposed drainage project will require any local, state or federal permits or permission (i.e. in compliance with zoning regulations or standards adopted by a local government unit; the Minnesota Wetland Conservation Act, adopted in 1991 and amended; Section 404 (Federal -- see **Chapter 2** of this manual) which requires mitigation for impacts to most wetlands; "Farm Bill" implications as discussed in Chapter 2; the National Pollutant Discharge Elimination System (NPDES); and **103G.245**).

- To determine what buffers are required under **Minn. Stat. § 103E.021** and **Minn. Stat. § 103F.48**.

4. If the proposed drainage project requires construction of an open channel, examine the nature and capacity of the outlet and any necessary extension:

- To determine the adequacy of the outlet(s) for the needed drainage.

*Note: Although this clause in **Minn. Stat. § 103E.245** is specific to open channel construction, the nature and capacity of the outlet are pertinent to tile projects as well.*

C. Preliminary Survey: Recommended Procedure

1. General Requirements

The following tasks are aligned with the objectives discussed above. However, they should be understood as common elements for Chapter 103E drainage projects. Modifications may be needed for a specific project under consideration.

These general requirements for survey are critical to a successful public drainage system project.

General Notes:

- The engineer should be familiar with the limitations of the preliminary survey found in Minn. Stat. § 103.E.245, Subd. 2. The extent of area to be surveyed cannot be increased without consulting the petitioners and convening a public hearing (see **Chapter 2**).
- Minn. Stat. § 103E.245, Subd 3 states: When a project of the United States relating to drainage or flood control is within the proposed drainage project area, the engineer may accept data, plats, plans, or information relating to the project furnished by the United States engineers. If the accepted materials is sufficient for the engineer to make the preliminary report, the engineer does not have to make the preliminary survey.
- When preparing to do a preliminary survey, the engineer should keep in mind the need for future, more intensive surveys and reports. Permitting/regulating agencies require information that has historically been reserved for the final survey and report. Therefore, it is recommended that the preliminary survey include as much of the elements of the final survey as possible.
- In all cases, the engineer of record is responsible to conduct the preliminary survey in a manner in accordance with the order of the drainage authority.

The following is offered as guidance only:

- Gather and evaluate existing data such as maps, plans, aerial photographs, surveys, and records of previous drainage proceedings. If the project is for an Improvement, Lateral, or Petitioned Repair, the ditch records (hearing findings, plans, correspondence, etc.) for the existing drainage system will form the basis of the proposed drainage project. All data should be evaluated to determine if it is current, applicable to the project area, and accurate. Limitations on data use should be indicated in the preliminary report.
- Conduct all field surveys based upon specific project requirements. Soil investigations (not specifically required in the preliminary survey but may be required under the conditions specified in Minn. Stat. § 103E.281) may be needed to accomplish the considerations of Minn. Stat. § 103E.015, the engineer may find it necessary to obtain or develop a generalized soil and (simple) land use map of the project area. Soil survey data has been developed by the Natural Resources

Conservation Service (NRCS) across the entire state, and is available in an online browser on the NRCS website. Land use maps can be obtained from county zoning or planning personnel and/or from the Minnesota Geospatial Information Office (MnGEO) Land Use/Cover web page (identifies modern land use/cover data and maps).

- If the project is an improvement or petitioned repair where a public ditch system has perennial low flow and a 2-stage ditch is present or applicable, evaluate the feasibility and benefits with regard to reduced ditch maintenance, habitat and water quality of designing a permanent 2-stage ditch cross section and profile. Refer to Minn. Stat. 103E.715, Subd. 6 and Minn. Stat. 103E.701, Subd. 1 for applicable authority for a petitioned repair.
- Evaluate the drainage project in light of environmental, land use, and multipurpose water management criteria outlined in Minn. Stat. § 103E.015, Subd. 1.
- Evaluate the drainage project in light of public utility, benefit, or welfare per Minn. Stat. § 103E.015, Subd. 2 (see **Appendix 1**).
- Evaluate best management practices (both on system and off system (within the watershed of the drainage system)) that might benefit the effected drainage system and address issues raised by the consideration process of Minn. Stat. § 103E.015.
- Investigate potential use of external sources of funding and technical assistance per Minn. Stat. § 103E.011, Subd. 5 and Minn. Stat. § 103E.015, Subd. 1a. (see **Appendix 2**).
- Evaluate any potential impact(s) to nearby water basins, wetlands, or watercourses.
- Assess the adequacy of the outlet(s) for any proposed drainage projects (discussed in **Section V** of this chapter).

If the engineer finds the proposed drainage project in the petition is feasible and complies with the environmental, land use, and multipurpose water management criteria in section Minn. Stat. § 103E.015, Subd. 1, the engineer shall include in the preliminary survey report a preliminary plan of the drainage project.

The following information must be provided in the preliminary survey:

- The location, beginning and ending points, course, and type of conveyance (ditch or tile) of existing (or other proposed) public or private drainage infrastructure;
- The horizontal and vertical location and character of the outlet and its adequacy;
- The size and character of any new infrastructure in the petitioned drainage project ie ditches, tiles, laterals, improvements, BMPs, etc.) necessary to make the plan practicable and feasible;
- The watershed of the proposed drainage project and the subwatersheds of main branches, if any, including topography, locations of existing bridges, culverts, and known tile inlets (the watershed delineation may change for the final report as a result of viewer findings);
- All property likely to be affected, with the names of the known owners;
- All utilities, public roads, and railways affected;

- The outline of any lake basin, wetland, calcareous fen, public water body, or public lands affected (recommended but not required);

  Note: The engineer should contact appropriate local, state, and federal officials concerning any waterbody within the project area to ascertain who has regulatory jurisdiction, determine survey needs (e.g. OHWL surveys and wetland delineations) and apply for any required permit(s).

- A cost estimate for the proposed project elements shown on the plan;
- All property in permanent conservation easements;
- Other information, data, and physical characteristics of the watershed necessary to understand the proposed drainage project and the affected drainage systems or as ordered by the drainage authority; and
- The area to be acquired to maintain a grass strip as required by **Minn. Stat. § 103E.021** and **Minn. Stat. § 103F.48**.

While the order of the drainage authority will define the extent of the preliminary survey, the following sections give some specific recommended survey elements to help the engineer define the feasibility and practicability of surface and/or subsurface drainage projects.

2. Surface Drainage Project Recommendations

In addition to the common elements of all projects, surface drainage projects have additional specific needs:

- Topographic surveys showing all physical features, both natural (e.g., rivers, ridges, etc.) and constructed features (e.g., roads, railroads, channels, dikes, etc.) which affect the design of the drainage project.
- Hydrologic and hydraulic analysis including determination of land use, cropping patterns along with precipitation and runoff investigations, etc.

Your topographic survey will show all physical features that affect the design of the drainage project, including natural features....

- Profiles and cross sections (not required for the preliminary survey) of the drainage ditch. The profiles should show the original (when known) and proposed (design) bottom slopes and channel dimensions (bottom width and side slopes). The cross sections of the existing ditch must be taken at minimum 100 foot intervals for the engineer's detailed survey and report, with elevations using National Geodetic Vertical Datum of 1929 (NGVD 29) or 1988 NAVD (based on mean sea level datum) (Geodetic database products for vertical control available from

and constructed features

the Minnesota Department of Transportation) , if practical (Minn. Stat. § 103E.271, Subd. 2). Depending on the existing topographic conditions, practicality may allow this cross section interval to be widened, based on the judgment of the engineer.

Note: The engineer may utilize alternatives to a traditional ground survey, such as LiDAR topography, to supplement field data collected. However, caution must be exercised with the use of this data, as the accuracy of the data decreases dramatically in areas with dense vegetation or rapidly varying terrain (e.g. wetlands and open channels).

- Sizes and controlling inverts of bridges and culverts along the course of the proposed drainage project.
- Locations of all utilities (e.g., power, telephone, cable TV, etc.) which would be affected by construction of the drainage project.
- Right-of-way acreage requirements, including the acreage for required grass strips (Minn. Stat. § 103E.021 and Minn. Stat. § 103F.48).

3. Subsurface Drainage Project Recommendations

In addition to the investigations common to all drainage projects, additional information may be necessary where a need has been indicated for new subsurface drainage. Subsurface drainage investigations involve most of the items pertinent to surface drainage, plus more detailed information on soil, subsoil and groundwater conditions. Surveys and investigations for subsurface drainage may include:

- **Topographic surveys:**
  - Detailed topographic surveys; and
  - Partial or strip topography.
- **Soils investigations:**
  - Standard soil survey maps; and
  - Data on salinity and alkalinity.
- **Investigations of existing subsurface drainage systems,**
  - Including alignment, depth, grade, and size of tile.
- **Subsurface explorations:**
  - Logs of soil and subsoil materials; and
  - Hydraulic conductivity measurements.
- **Groundwater investigations:**
  - Position of water table relative to ground surface;

- Water table fluctuations; and
- Salinity of groundwater.

- **Irrigation practices and requirements (where applicable):**
  - Quality of irrigation water;
  - Frequency and type of irrigation;
  - Amount of water applied during each irrigation application;
  - Leaching requirement and deep percolation losses;
  - Field ditch losses; and
  - Source of water supply.

There are a variety of situations where surveys and investigations may be needed for subsurface drainage.

D. Engineer's Preliminary Survey Report

The engineer's preliminary survey report is the avenue designated for the Engineer to report the results of the preliminary survey and associated investigations to the drainage authority. As required by **Minn. Stat. § 103E.245, subd 4**, "The report must give sufficient information, in detail, to inform the drainage authority on issues related to feasibility, and show changes necessary to make the proposed plan practicable and feasible including extensions, laterals, and other work".

Central to the preliminary survey report is the statement of the engineer's assessment of the feasibility of the proposed drainage project and any potential impacts in regard to the environmental, land use and multipurpose water management considerations specified in **Minn. Stat. § 103E.015, Subd. 1**. The engineer's preliminary report should also include the pertinent information gathered during the preliminary survey along with preliminary plans as outlined above.

*Note: Drainage Law requires that certain project features must be shown on the preliminary plans and discussed in the engineer's preliminary report. These mandates can be found in **Minn. Stat. § 103E.245, Subd. 4**. These items have been summarized previously in this chapter.*

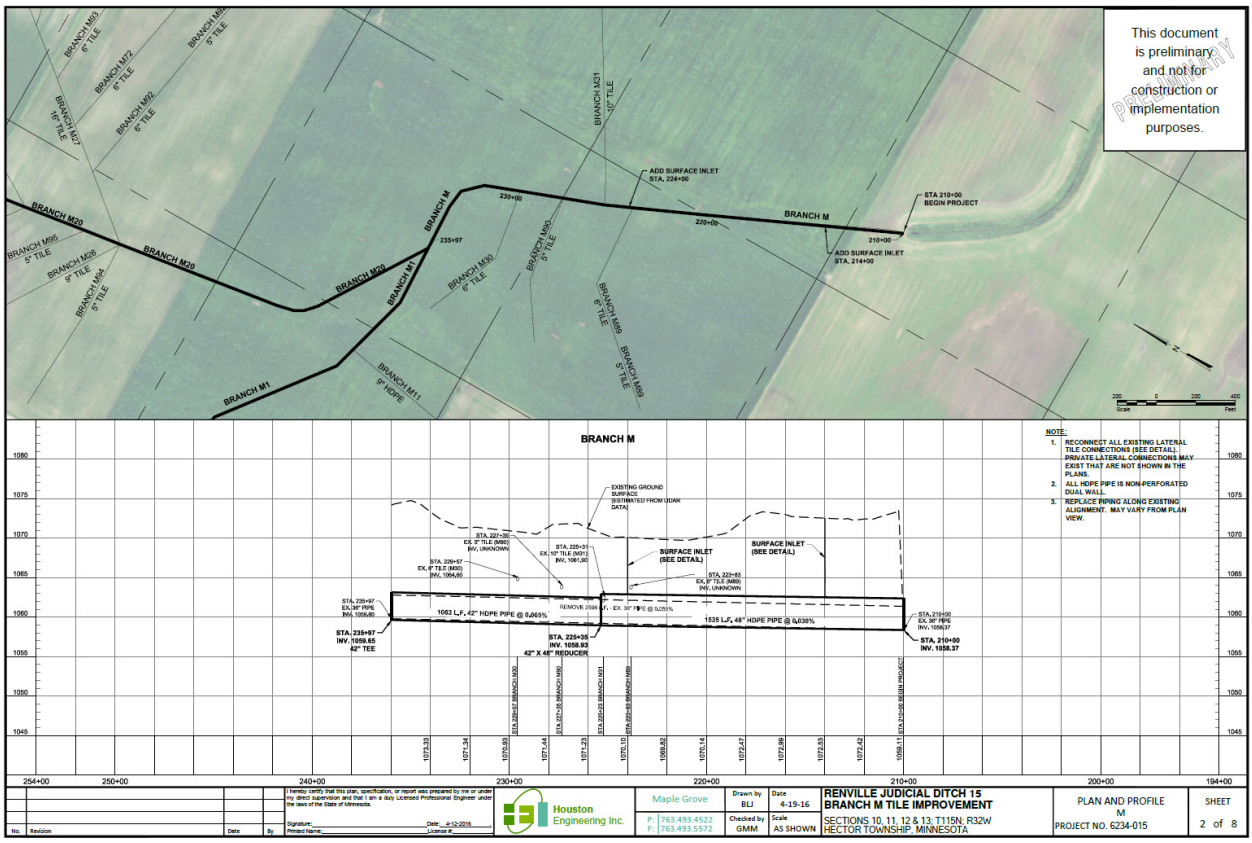
It is important to emphasize an important feature of the engineer's preliminary survey report. It is the statements by the Engineer related to the sufficiency (or adequacy) of the outlet. The drainage authority must make a finding at the preliminary hearing that the outlet is adequate in order to proceed with the project. This finding should be based on the engineer's analysis and conclusions as to outlet adequacy. There is no similar requirement in the final hearing. Therefore, outlet adequacy must be fully addressed in the engineer's preliminary report.

The engineer's preliminary report should contain a tabulation of hydraulic data on the proposed improvements, a tabulation of required right-of-way, an itemized project cost estimate, and a copy of the petition for the drainage project.

Note: Elements of the engineer's preliminary report are utilized for decision making purposes by different agencies with varying levels of interest and expertise. However, the primary audience of the preliminary

report remains the drainage authority. It is recommended that the engineer be explicit in identifying components that are specifically called out for use by other decision makers than the drainage authority.

It is recommended that the engineer provide an executive summary at the front of the engineer's preliminary report. The executive summary should contain a brief description of the project, an overview of public benefits, land requirements, a brief outline of pertinent project data, anticipated environmental impacts, permit requirements and a summary of project costs.



E. Engineering Costs for Preliminary Survey and Report

At this point in a drainage proceeding, substantial financial commitments may have been incurred in developing the preliminary survey and the engineer's preliminary survey report. Therefore, it is recommended that the engineer keep the drainage authority informed as to the costs accrued at various points throughout the preliminary survey and reporting process. At no time can these costs exceed the amount of the bond provided by the petitioners. Additional surety bonds may be needed as work progresses.

F. Advisory Reviews

As required by **Minn. Stat. § 103E.255**, the Commissioner (DNR) must file a preliminary advisory report with the county or joint board drainage authority before the date set for the preliminary hearing. The drainage authority may grant an extension of time for review and evaluation to the DNR if requested. The purpose of the advisory report is to advise the drainage authority on the adequacy of the engineer's preliminary report. The report should include the full contact information (name, address, email, phone

number) for the drainage authority and engineer. The commissioner's preliminary advisory report must specify any additional investigations that should be completed and documented in the engineer's final report related to public waters that may be affected and the environmental, land use, and multipurpose water management criteria in section **Minn. Stat. § 103E.015**, and cite the specific sections of the report that are inadequate. The preliminary and final reports should be sent electronically to the **Regional Environmental Assessment Ecologist** for the DNR Region where the project occurs so they can coordinate the advisory report.

> *Note: While not required in Drainage Law an amended preliminary engineer's report may be recommended if the commissioner does not consider the engineer's evaluation of the adequacy of the outlet to be sufficient.*
>
> *The commissioner's preliminary advisory report will comment on applicable public water permit requirements for the proposed drainage project.*

If the drainage authority is a watershed district, **Minn. Stat. § 103D.711** requires DNR and BWSR ("director" and "board") to prepare an advisory report prior to the public hearing. The primary focus of this review is to determine whether the report is complete and the drainage project is practical, and if it is not practical, provide recommendations for changes.