HoustonEngineering Inc.

Maple Grove, MN | HEI No. 6255-0019
December 12, 2022

FINAL ENGINEERS REPORT

Faribault County Ditch 52 Improvement

FARIBAULT COUNTY
Minnesota EST. 1856

FINAL ENGINEERS REPORT

Faribault County Ditch 52

December 12, 2022
Maple Grove, MN

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I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Engineer under the laws of the State of Minnesota

Joseph Lewis
License No. 46215

December 12, 2022
Date

TABLE OF CONTENTS

TABLES

FIGURES

EXHIBITS

1 INTRODUCTION

The petitioned project consists of an improvement of Faribault County Ditch 52 (CD 52). The improvement will increase the capacity of the tile along the Main Trunk and Branches (excluding Branches 32 and 35). The proposed project location and its drainage area are shown in **Figure 1**. The proposed project is a result of a petition received by the Faribault County Board of Commissioners (Board), as the Drainage Authority for CD 52, from several landowners requesting the improvement. A copy of the petition for the improvement is included in **Exhibit A**.

The petition for the improvement of CD 52 states that the drainage system has insufficient capacity and is out of repair. Furthermore, it states the installation of larger and/or deeper tile is required to furnish sufficient drainage capacity and fulfill its original intended purpose; and the proposed improvement will be of public utility and promote the public health. The petition for the Improvement of CD 52 was filed with the Board in accordance with Minnesota Statute (Minn. Stat.) § 103E.215. The Board appointed Houston Engineering, Inc. (HEI) as project engineer and ordered the preparation of the Engineer's Preliminary Survey Report in accordance with Minn. Stat. § 103E.241and 103E.245. Following the Preliminary Hearing held in Blue Earth, MN on March 28, 2022, and in conjunction with Minn. Stat. § 103E.265, the Board ordered the Engineer to complete a Detailed Survey Report with plans and specifications, and appointed viewers to assess benefits and damages.

1.1 OVERVIEW OF EXISTING DRAINAGE SYSTEM

The CD 52 drainage system is located in Sections 30 and 31 of Blue Earth City Township (T102N, R27W); Section 6 of Elmore Township (T101N R27W); Sections 25, 26, 35, and 36 of Jo Daviess Township (T102N R28W); and Sections 1 and 2 of Pilot Grove Township (T101N R28W). The drainage system was established and constructed in 1916 and consists entirely of tile. CD 52 consists of a Main Trunk and several branches and laterals. Drainage areas, Section locations with Township and Range, and tile dimensions and lengths for each segment is listed in **Table 1**.

Table 1 –Tile Lengths by Branch and Dimension

Segment	Total Acres Drained	Section Township Range	Linear Feet of Tile by Size per Branch											
			4”	7”	8”	10”	12”	14”	16”	20”	22”	26”	28”	30”
Main Trunk	2,041	Sec. 1: T101N-R28W Sec. 36: T102N-R28W Sec. 31: T102N-R27W Sec. 6: T101N-R27W	1,012			2,201	345	290	3231	916	3,086	2,293	4,715	1,334
Branch 10	22	Sec. 1: T101N-R28W		190										
Branch 38	4	Sec. 36: T102N-R28W			622									
Branch 70	179	Sec. 36: T102N-R28W				2,230		601						
Branch 70+6	122	Sec. 36: T102N-R28W				2,008								
Branch 79	219	Sec. 36: T102N-R28W					100							
Branch 102	18	Sec. 36: T102N-R28W		200										
Branch 108	4	Sec. 36: T102N-R28W		200										
Branch 110	323	Sec. 31: T102N-R27W Sec. 30: T102N-R27W		1,420		500	2,301		481					
Branch 110+7	62	Sec. 31: T102N-R27W					474							
Branch 110+31	15	Sec. 30: T102N-R27W												
Branch 134	55	Sec. 36: T102N-R28W		800		886								
Branch 146	138	Sec. 1: T101N-R28W Sec. 6: T101N-R27W			1,800	700	700							
Branch 146+14	51	Sec. 1: T101N-R28W Sec. 6: T101N-R27W		787										
Branch 178	18	Sec. 6: T101N-R27W		1,100										

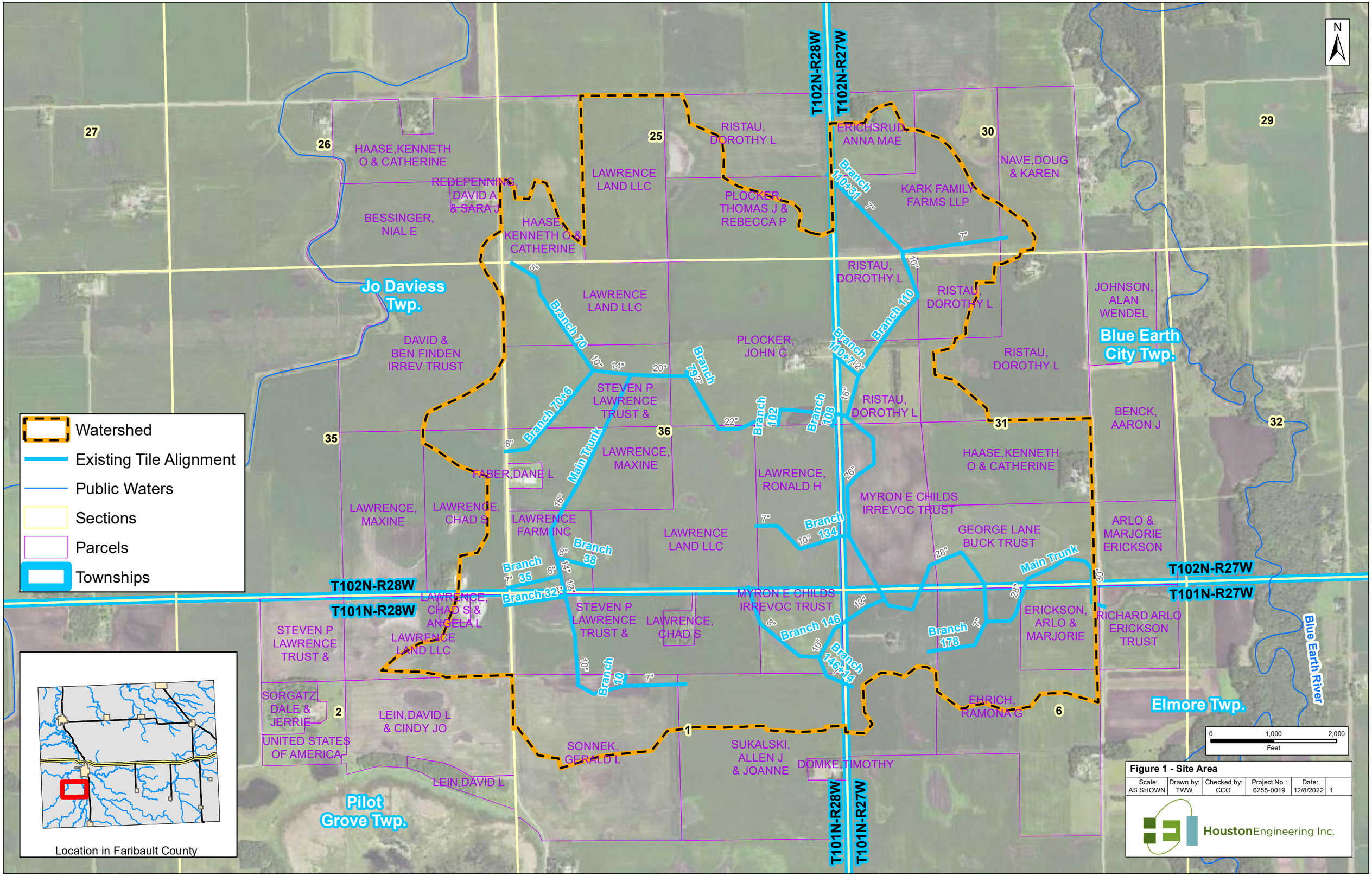

Figure 1 - Site Area

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

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2 PROJECT DESIGN AND SITE SURVEY

2.1 SITE SURVEY AND EXISTING CONDITIONS

Landowners have observed prolonged flooding of agricultural lands in the area drained by CD 52. An investigation of the problems being experienced within the drainage area, through examination of the drainage system record and field investigations, indicates that the problems are due to both insufficient capacity and disrepair of the tile system. There have been multiple failures per year over the past decade. The failures, primarily caused by separated joints or collapsed tile, result in repair costs and crop damage, depending on the timing of the failures.

Recently, approximately 2 miles of the Main Trunk tile, out of its 3.5-mile total length, was televised to evaluate the overall condition of CD 52 and identify locations of incoming laterals. The televised segments are shown in **Exhibit B**. The televising discovered 22 locations where the tile is either failing, broken, cracked, or has significant joint displacement. These findings were expected as the tile system was constructed in 1916 and is now over 100 years old. Though the entire system was not reviewed, the televising provides a representative sample of conditions that exist throughout the CD 52 drainage system. As a result of the tile's condition and age, it is past its functional life and cannot be effectively maintained and must be replaced in its entirety to restore it to the as-built condition capacity.

An on-site survey was completed by HEI in October 2021 to determine the location and elevation of the existing tile at the tile outlet and known tile intakes. LiDAR elevation data from the State of Minnesota was utilized to develop drainage patterns and catchment boundaries and determine tile-laying depths. The project site survey is displayed in **Exhibit B**. The survey also collected profile and channel cross sectional elevations in the unnamed tributary near the outlet of CD 52 which was used to assess the adequacy of the outlet (see Section 4.4.2). Historic plan and profile drawings identify the size and grade of the existing concrete tile. Tile sizes range from 4- to 30-inches, providing a theoretical capacity of 1/8 to 1/4 inches per day when it was originally constructed (see **Exhibit C**). Note that function of any given segment of tile is limited by the capacity of any given downstream tile segment.

A Gopher One 'design level locates' request was completed to identify areas of potential concern for utilities present in the immediate vicinity of the CD 52 tile. Based on this request, several copper and fiber optic lines will require crossing during construction. **Exhibit I** displays the results of the design level locates request. Gopher One shall be contacted prior to construction activities for field locates of these utilities.

2.2 PROJECT DESIGN

Plan and profile drawings, included as **Exhibit D** to this report, provide a graphical representation of the current system and recommended solution to correct existing flooding and drainage problems in the benefiting area for CD 52. The existing CD 52 tile will be crushed in place and capped so as to no longer convey water. This includes replacement of existing tile with new tile sized to provide a 1/2-inch drainage coefficient. The NRCS recommends a tile

drainage coefficient of 1/2-inch per day for most agricultural lands in this region. This will provide a substantial increase in function compared to existing conditions and will support modern row crop production. **Exhibit C** includes detailed design information regarding tile sizing and slopes. **Exhibit E** provides additional information on the analysis performed to evaluate downstream hydrologic impacts.

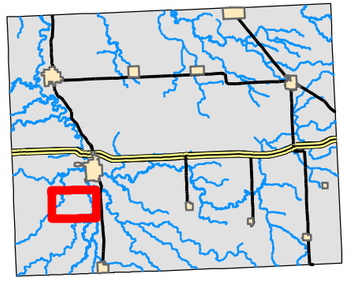
Along with providing the additional capacity needed, the proposed design also provides adequate cover for the system. Specifically, a minimum of 4 feet of cover is achieved throughout the project area. Portions of the existing system have limited cover, as little as 2 feet. To gain additional cover, one option is to reduce tile grades. This would require larger tile diameters to maintain necessary capacity and would result in higher project costs. To avoid this, the proposed improvement design includes a partial realignment of the Main Trunk to maintain similar grades but gain depth. The partial realignment is located near the downstream end of the tile system as displayed on **Figure 2**.

N

353RD AVE
85TH ST
80TH ST
377TH AVE
RIVER RD
385TH AVE
370TH AVE
70TH ST
350TH AVE
9

Branch 110-31
Branch 110
Branch 110-1
Branch 70
Branch 70-6
Branch 79
Main Trunk
Branch 102
Branch 108
Branch 134
Branch 38
Branch 35
Branch 32
Branch 10
Branch 146
Branch 146-14
Main Trunk
Branch 178
Blue Earth River

Watershed
Existing Tile Alignment
Proposed Tile Alignment
Storage Alternative Footprint
Public Waters



Location in Faribault County

0 1,000 2,000
Feet

Figure 2 - Site Design

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

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3 COMPATIBILITY WITH EXISTING PLANS AND STATE LAW

3.1 DRAINAGE LAW – MINN. STAT. CHAPTER 103E

The Board is exercising authority over the petitioned action pursuant to Minn. Stat. chapters 103E. Pursuant to Minn. Stat. § 103E.215, construction of improvements of existing drainage systems must be initiated by filing a petition with the Board. The proceedings for the construction or improvement of drainage systems must conform to Minn. Stat. chapter 103E. Under this, the Board must give special attention to both the procedural requirements for establishment and construction of a drainage project as well as the policy requirements for establishment as specifically outlined in Minn. Stat. § 103E.015 and 103E.341.

3.1.1 DETAILED SURVEY REPORT (AKA FINAL ENGINEER'S REPORT) REQUIRED CONTENTS

Minn. Stat. § 103E.265 requires the Engineer, if ordered by the drainage authority and following the filing of the preliminary hearing order, to make a detailed survey and submit a Detailed Survey Report. Minn. Stat. § 103E.285 requires that the Detailed Survey Report include the following information:

- Map. A complete map of the proposed drainage project and drainage system must be drawn to scale, showing:
  - The terminus and course of each drain and whether it is ditch or tile, and the location of other proposed drainage works;
  - The location and situation of the outlet;
  - The watershed of the proposed drainage project and the subwatershed of main branches, if any, with the location of existing highway bridges and culverts;
  - All property affected, with the names of the known owners;
  - Public roads and railways affected;
  - The outline of any lake basin, wetland, or public water body affected;
  - Other physical characteristics of the watershed necessary to understand the proposed drainage project and the affected drainage system; and
  - The area to be acquired to maintain a grass strip under Section 103E.021
- Profile of drainage lines.
- Bridge and culvert plans.
- Tabular statement of excavation, construction, and cost. A tabular statement must be prepared showing:
  - The number of cubic yards of excavation, linear feet of tile, and average depth of each tile line;
  - The bridges, culverts, and works to be constructed under the plans for the drainage project; and

- The estimated unit cost of each item, a summary of the total cost, and an estimate of the total cost of completing the proposed drainage project that includes engineering and other costs.

- Right-of-way acreage. The acreage must be shown that will be taken for ditch right-of-way on each government lot, 40-acre tract, or fraction of a lot or tract under separate ownership. The ditch right-of-way must include the area to be taken to maintain a grass strip under Section 103E.021.
- Drain tile specifications (if applicable).
- Soil survey report (if required).
- Recommendation for division of work.
- Other information on practicability and necessity of drainage project. Other data and information to inform the drainage authority of the practicability and necessity of the proposed drainage project must be made available including a comprehensive examination and the recommendation by the Engineer regarding the environmental and land use criteria in Section 103E.015, Subd. 1.

3.2 PERMITTING REQUIREMENTS

3.2.1 LOCAL

The project will require coordination with the Faribault County Soil and Water Conservation District (SWCD) as the Local Government Unit implementing the state Wetland Conservation Act (WCA). The National Wetland Inventory (NWI) and a series of years of aerial photography was reviewed to determine the presence of wetland resources within the drainage system (**Exhibit G**). There are several wetlands present. Based on a review of aerial photography, the wetlands appear to be cultivated annually and farmed Type 1 wetlands. Additionally, there is a constructed or restored wetland near Branch 110 in the SW quarter of the NW quarter of Section 31, Blue Earth City Township. This 40-acre tract is in a RIM easement and prohibited from being used for crop production.

There are several potential options for exemption from WCA permitting and mitigation for drainage system projects. The most suitable exemption is for Type 1 wetlands in an unincorporated area that has been assessed drainage benefits between the dates of January 1, 1972, and January 1, 1992 (Mn Rules 8420.0420 Subp. 3.C.2). This exemption is applicable to the project area and project type if records exist to document that landowners have been assessed costs for maintenance during the specified time period. The Drainage Authority does have records documenting that benefitting landowners have been assessed benefits over that time period. Therefore, the proposed work to improve the drainage system meets the exemption criteria.

Additionally, to avoid and minimize wetland impacts the project utilizes non-perforated pipe and limits the installation of surface inlets using Hickenbottom water quality inlets at roadside

ditches. An exemption application will be completed to verify with Faribault SWCD that the project does meet the exemption standards following the public hearing on the FER.

The project includes work in County Highway Right of Way, and crosses County and Township roads. Coordination with Faribault County Public Works Department is required for obtaining the roadway work permit.

3.2.2 STATE

A permit will not be required from the Minnesota Department of Natural Resources (MnDNR), since the proposed project does not involve working in any state listed Public Waters. The outlet channel is not a state listed Public Water, but is tributary to the Blue Earth River, which is a state listed Public Water. The MnDNR has provided an advisory review on the Preliminary Engineer's Report (see Section 4.12) and is required to review this Final Engineer's Report and provide an Advisory Report to the Drainage Authority.

A Stormwater Pollution Prevention Plan will be developed and a permit will be required from the Minnesota Pollution Control Agency, since construction activities will disturb more than five acres of land as part of a drainage project.

3.2.3 FEDERAL

Impacts to wetlands are regulated at the Federal level by the US Army Corps of Engineers, implementing Section 404 of the federal Clean Water Act (CWA). The proposed work is authorized under Nationwide Permit 40 (NWP 40), as issued by the U.S. Army Corps of Engineers in 2021. This permit authorizes the construction of drainage tile for agricultural activities. The project will be designed such that no new wetland drainage will result from the project and therefore, no mitigation will be required for the project.

The Swampbuster provision of the 1985 Farm Bill was aimed at reducing the conversion of wetlands for agricultural purposes. Farmers who drain, fill, level, clear stumps or otherwise alter a wetland may lose eligibility for U.S. Department of Agriculture (USDA) program benefits. As a result of the proposed improvement, farmers wishing to receive, or continue to receive, USDA program benefits or payments may need to complete Form AD-1026, which is available at the local Farm Service Agency (FSA) office.

3.2.4 THREATENED AND ENDANGERED SPECIES

Public drainage systems may encounter situations where Minnesota's Endangered Species Statute (Minn. Stat. § 84.0895) and the associated Rules apply. The endangered species program regulates activities that take, import, transport, or sell any portion of an endangered or threatened species and where these acts may be allowed by permit issued by the MnDNR. The statutes exempt the accidental, unknowing destruction of designated plants. However, it is the responsibility of the Engineer when preparing a final report to complete due diligence to avoid impacts to threatened and endangered species. Based on a review of the MnDNR's Natural

Heritage Information System (NHIS) data (Houston Engineering License Agreement LA-1049), there are no state-listed threatened or endangered species within or within a 1-mile radius of the CD 52 system.

The federally listed threatened mammal species, the northern long-eared bat, is protected under the federal Endangered Species Act. This species is found in Minnesota. However, there are no known roost trees or hibernacula found within Faribault County, and additionally, no tree removals will be proposed as a component of this project, therefore, we do not anticipate impacts to this federally protected species.

3.3 EXISTING WATER MANAGEMENT PLANS

Several local water management plans address water quantity and quality concerns at the county and watershed level inclusive of this project area. The following sections summarize water management issues, goals and activities identified in the local water plans.

3.3.1 FARIBAULT COUNTY WATER PLAN

The Faribault County Water Plan contains a number of goals, objectives and action steps to address priority water issues that are relevant to the proposed improvement project. The relevant goals include 1) Protect and restore the quality and manage the quantity of surface water, and 2) Protect drinking water supplies and groundwater quality and quantity. The relevant objectives and action steps identify specific measures to achieve the goals are summarized as follows:

Priority Concern 1; Goal 1:

Address impacts of altered hydrology, decreased evapotranspiration and storage due to vegetation, land use, and drainage changes. The following is an excerpt from the Faribault County Water Plan:

> *"While much of Faribault County and Minnesota's land use activities depend on artificial drainage, it can have negative environmental and flooding impacts downstream. For example, recent studies estimate the Le Sueur River's flow has doubled over the past 60 years. Roughly half of this flow originates from tile drainage. The increase in the Le Sueur River's flow is due to hydrologic alterations made by both humans (including installing artificial drainage and changing crop types) and climate (increased precipitation and temperatures). Several studies identify human changes as the primary cause and climatic changes as the secondary cause of this increased river flow. Furthermore, this watershed cannot improve without substantial mitigation of altered hydrology. In addition to high river flow, altered hydrology exhibited in excessively low river base flow is an identified stressor in the Le Sueur River watershed. Base flow is sustained by shallow groundwater and interflow. Simply put, low base flow is indicative of soils being too dry and water tables being too low, partly the result of draining excess water from the landscape. Therefore, these sources are unable to deliver ample water to rivers at dry times of year, when base flow is the only source of river flow.*

Adequate drainage is, however, a critical component to a successful farming operation. A key issue is how we look at drainage into the future, single purpose or multipurpose. Multipurpose drainage is engineered drainage systems that provide both private drainage benefits and public water management benefits. While traditional drainage removes excess water from fields through use of ditches and subsurface tile, today, resource professionals, such as SWCDs and the Natural Resource Conservation Service (NRCS), are encouraging utilization of multipurpose drainage practices designed to provide both the benefits of drainage while minimizing negative impacts downstream. The goals of multipurpose drainage are to:

1. *Provide adequate drainage for crop planting, productivity, and harvest;*
2. *Provide more adequate upstream to downstream drainage and protection;*
3. *Slow water down & reduce damage from flooding;*
4. *Reduce erosion and keep soil on the land; and*
5. *Protect and improve water quality.*

Since many drainage systems are already in place, addressing multipurpose drainage will likely occur in conjunction with a repair, replacement, or improvement project. Multipurpose drainage management goals can be achieved through on field and on drainage system practices. Goals will require a partnership between landowners, the County Drainage Authority, and local resource professionals such as SWCD and NRCS. Multipurpose drainage management efforts began several years ago in Faribault County by utilizing these partnerships to explore watershed water quality treatment systems using a mix of management and implementation practices targeted at locations which make the largest impact. This initiative with landowner engagement will continue to grow into the future to achieve multipurpose drainage management goals."

- Objective 1. Implement Multipurpose Drainage Management (MDM) practices to mitigate existing impacts from altered hydrology in agricultural areas.
  - Action: Provide cost share or incentives to implement strategies that reduce peak flow or store tile line water at locally prioritized locations.
  - Action: Implement water retention strategies such as controlled drainage, storage basins, and constructed wetlands at locally prioritized locations.
  - Action: Take drained wetland areas out of production through perpetual easement programs, wetland banking programs, or other financial assistance options.
  - Action: Implement structural practices to reduce, trap, and treat nutrients and sediment. (Goal 2, Objective 2, All Actions.)
- Objective 4. Prevent additional impacts of altered hydrology through regulatory controls and better planning of drainage activities.
  - Action: Continue Drainage Authority meetings to achieve greater consistency and increased communication well in advance of drainage activities.

- Action: Provide notification to state and local partners prior to repairs and improvements of drainage systems in order to obtain recommendations for mitigating altered hydrology.
- Action: Early coordination and planning regarding drainage projects to explore opportunities for MDM practices and leverage outside funds authorized by 103E.011, Subp 5.
- Action: Require MDM plans be prepared on 100% of improvement projects. Plan will include project identification, feasibility, cost estimation, and recommendations for a no net increase in flow.

- Objective 7. Information sharing, education, and outreach on strategies to mitigate the effects of altered hydrology.
  - Action: Present MDM plan to Drainage Authorities and landowners on 100% of improvement projects.
  - Action: Promote Minnesota's wetland bank for agriculture.
  - Action: Promote practices that reduce flow, store water, and increase vegetation.
  - Action: Engage and involve producers and landowners in identifying and selecting options to mitigate the effects of altered hydrology for their farm and drainage system.

Priority Concern 1; Goal 2:

Address the quality of surface water through strategies to conserve and manage soil health; strategies to reduce, trap, or treat nutrients and sediment; and information sharing on sustainable farming options. The following is an excerpt from the Faribault County Water Plan.

"…It will take many land and water best management practices combined to improve water quality, ranging from crop management to large scale water storage. Practices may include in field crop and soil management practices; drainage water management such as alternative tile inlets; surface flow management such as grassed waterways or buffer strips; water storage and infiltration such as saturated buffers, wetlands, or water and sediment control basins (WASCOBs); ditch channel water retention such as structures for water control or two stage ditch; and riparian area restoration and protection. The first of these practices, proper management of soil, is one of the most effective ways for farmers to increase productivity and profitability while improving the environment. Positive results are often realized within the first year and last long into the future. By farming using soil health principles and systems that include no-till, cover cropping and diverse crop rotations, more farmers are actually increasing their soil's organic matter and improving microbial activity. As a result, farmers are sequestering more carbon, increasing water infiltration, improving wildlife and pollinator habitat, all while harvesting higher yields and increased profitability."

- Objective 1. Implement management practices to conserve and manage soil health; and reduce, trap, and treat nutrients and sediment.

        - Provide cost share or incentives for landowners to implement buffers on "other waters" or around field intakes.
    - Objective 2. Implement structural practices to reduce, trap, and treat nutrients and sediment.
        - Replace open tile intakes with alternative tile intakes.
        - Replace side inlets with conservation-based inlets on county drainage systems.
        - Implement structural BMPs on prioritized sites to manage overland flow or field runoff.
        - Provide cost share or incentives to treat tile drainage water to reduce nutrient transport to surface waters.
        - Implement BMPs identified in MDM plans to reduce erosion and sedimentation and improve water quality.
        - Implement Multipurpose Drainage Management (MDM) practices (Goal 1, Objective 1, All Actions).

Many of the action steps are overlapping across the plan's goals and implementation of drainage BMPs to address the issues around water quality or quantity delivered to the natural watercourses in the county. The plan's implementation largely relies on external funding sources and voluntary landowner participation. Along with implementing BMPs, the Drainage Authority can and does hold public outreach meetings to increase awareness and education for local landowners regarding drainage law (Minn. Stat. § 103E). This helps achieve greater consistency across the watershed for drainage projects and practices. The Drainage Authority actively prepares Multipurpose Drainage Management plans and is proactive in the redetermination of benefits process. Later sections in this report specifically discuss the potential for field management and structural practices (in Section 4.11).

3.3.2 CONSISTENCY WITH WATER PLANS

The Faribault County Water Plan identifies its consistency with other water plans stating that "the priority concerns that were developed for Faribault County directly reflect the goals, objectives, and actions outlined in these other related plans and documents. Related plans include: the Faribault County Zoning Ordinance, Faribault County Comprehensive Plan 2018-2027, Greater Blue Earth River TSS TMDL, Blue Earth Fecal Coliform TMDL, BWSR's Nonpoint Priority Funding Plan 2014, MPCA Minnesota Nonpoint Source Management Program Plan 2013-2017, MPCA Nitrogen in Minnesota Surface Waters 2013, Nitrogen Fertilizer Management Plan 2013, and Sediment Reduction Strategy for the Minnesota River Basin". The Blue Earth River is listed on the Minnesota Pollution Control Agency's (MPCA) Impaired Waters List for aquatic life, aquatic consumption, and aquatic recreation.

The relevant water plans all identify and analyze the relationship between agricultural drainage and water quality at a watershed level. The specific water quality issues addressed include TSS or sediment, nitrogen, fecal coliform, and water quantity. The CD 52 improvement project has been shown to not increase the peak flow entering the Blue Earth River tributary (see Section

4.4) so a negative effect is not expected. In terms of TSS, the current deteriorated condition of the CD 52 tile is adding to the downstream impairments by releasing sediment via failures in the tile. The improvement will do two things: (1) by creating better subsurface drainage, infiltration capacity in the soil will increase and surface runoff will be reduced for smaller more frequent rainfalls, thus reducing TP and sediment delivery to the impaired water during these events; and (2) replacing the old, deteriorated tile having offset joints and cracks with plastic pipe will further reduce sediment delivery. It is clear that the current failing condition of the existing tile is adding to the impairments caused by high TSS loads and replacing this infrastructure will reduce TSS loading from the CD 52 watershed. Though the improvement is not a TMDL strategy in and of itself, the restoration aspects of the improvement inherently achieves an outcome consistent with TMDL goals.

Early coordination with state and local partners was initiated in late 2021. A meeting occurred on October 1, 2021 between Faribault County drainage staff, MnDNR staff and Houston Engineering to discuss the improvement project. The nature and condition of the outlet channel was discussed alongside of the stressors of the Blue Earth River that the outlet channel is a tributary to. During this call, exploration of specific alternative measures were identified while recognizing that the Drainage Authority can only include project components that provide a benefit to landowners, since they are assessed the cost of the system, unless external funding is available. To further the investigation of alternatives, Houston Engineering coordinated with the Faribault SWCD in December of 2021 regarding potential conservation BMPs in the CD 52 watershed and the availability of external funding. Implementation of BMPs such as wetland restoration can be implemented in conjunction with this project or independently following its completion. The County is actively seeking external funding for a wetland restoration component to the improvement project. The wetland restoration will help offset or alleviate issues related to altered hydrology in the Le Sueur River watershed by temporarily detaining runoff.

4 CONSIDERATIONS

4.1 PROJECT COSTS AND PUBLIC AND PRIVATE BENEFITS

Minn. Stat. § 103E.015, Subd 1(1) requires the Drainage Authority to consider private and public benefits and costs of proposed drainage projects.

4.1.1 PRIVATE BENEFIT

The private benefits expected from the project accrue mainly to agricultural lands that lie adjacent to the proposed improvement. These private benefits would be experienced through reduced overland flooding, reduced seepage, and erosion prevention. A secondary benefit would be reduced maintenance cost, as the project will replace a substantial amount of aging tile.

4.1.2 PUBLIC BENEFIT

Benefits to public transportation systems include improved drainage for 377th Ave, 370th Ave, 70th St, 80th St, and CSAH 9. The proposed project will reduce the duration of standing water adjacent to the roads by improving drainage capacity from the contributing drainage area. Additional public benefits include an increase in regional economic activity, and protection and preservation of tax base. The project will not adversely affect downstream surface water runoff rates and volumes, which in turn will not adversely affect sediment and phosphorus delivery to downstream waters.

4.1.3 COSTS

A detailed breakdown of the project costs is included as **Exhibit F** to this report. In addition to economic costs, there are other non-quantifiable factors to be considered. These include impacts on the environment, social costs, and cultural costs. Because the land use of the project area is predominantly agricultural, there will be some potential for adverse impacts in the area. These adverse impacts will include inconveniences caused by the construction operations, and other miscellaneous impacts associated with construction. Construction activities should not cause a significant amount of traffic impairment and construction inconvenience due to traffic rerouting and other related activities. In addition, typical noise and dust problems associated with the construction operations will likely occur but given the rural nature of the project location, minimal impact is anticipated.

4.1.4 DAMAGES

Damages are tabulated based on estimated acreage impacted per parcel. The alignment of CD 52 was buffered 50 feet on both sides to create a 100 foot right-of-way working corridor for proposed tile segments less than 10 feet deep. For areas where a deeper cut is required, more width of working corridor is required, and the right-of-way working corridor is widened to 75 feet on both sides for a total width of working corridor of 150 feet. Assuming that the entirety of this working corridor is utilized, the damaged acreage by parcel is presented in **Table *2*** and displayed visually within **Exhibit N**. Note that in some instances there may be need to deviate from the intended alignment, or complete work that is outside the limits of the working corridor, such as reconnecting a private lateral. Damaged locations will likely be out of crop production for one growing season and may have some reduction in crop yield the following growing season, depending on conditions. Total damages are estimated to be approximately 97 acres for the improvement project with associated costs to be assigned by viewers. Note that damaged acreage would be slightly different with either the repair alternative or storage alternative.

Table 2 – Damaged Acres by Parcel

Owner Name	Section	Township Range	Damaged Acres
EHRICH, RAMONA G	6	T102N R27W	5.3
GEORGE LANE BUCK TRUST	31	T102N R27W	7.8
HAASE, KENNETH O & CATHERINE	25	T102N R27W	0.2
KARK FAMILY FARMS LLP	30	T102N R27W	7.4
LAWRENCE FARM INC	36	T102N R27W	4.5
LAWRENCE LAND LLC	36	T102N R27W	6.3
LAWRENCE, CHAD S	35	T102N R27W	0.2
LAWRENCE, MAXINE	36	T102N R27W	7.0
LAWRENCE, RONALD H	36	T102N R27W	4.0
MYRON E CHILDS IRREVOC TRUST	6	T102N R27W	5.3
MYRON E CHILDS IRREVOC TRUST	1	T102N R27W	4.8
MYRON E CHILDS IRREVOC TRUST	31	T102N R27W	8.4
NAVE, DOUG & KAREN	30	T102N R27W	0.2
PLOCKER, JOHN C	36	T102N R27W	6.2
PLOCKER, THOMAS J & REBECCA P	25	T102N R27W	0.1
RICHARD ARLO ERICKSON TRUST	6	T102N R27W	0.6
RISTAU, DOROTHY L	25	T102N R27W	0.2
RISTAU, DOROTHY L	31	T102N R27W	8.4
SONNEK, GERALD L	1	T102N R27W	4.4
STEVEN P LAWRENCE TRUST &	1	T102N R27W	4.6
STEVEN P LAWRENCE TRUST &	36	T102N R27W	9.8
SUKALSKI, ALLEN J & JOANNE	1	T102N R27W	1.5

4.2 ALTERNATIVE MEASURES

Alternative measures must be considered before establishing a drainage project per Minn. Stat. § 103E.015, Subd 1(2). The alternative measures considered must include elements 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. Listed below are the feasible alternatives followed by the consideration given to each:

4.2.1 DO NOTHING

This alternative will maintain the status quo in terms of insufficient agricultural drainage which limits the economic viability of agriculture in the watershed. Due to the age of the system, it will continue to rapidly deteriorate, requiring significant cost to maintain until it is improved or repaired. Additionally, the current drainage system contributes excessive sediment and nutrients to downstream impaired stream reaches due to tile failures. For these reasons, the Do Nothing alternative is not recommended.

4.2.2 REPAIR

Repair of the drainage system would resolve, to some degree, the excessive contributions of sediment and nutrients to downstream impairments but would not enhance the economic viability of agriculture in the CD 52 watershed. Repair would also fail to resolve the issue with lack of cover depth over the existing tile. Therefore, it is not a feasible alternative.

4.2.3 IMPROVEMENT

Improvement of the drainage system will not adversely affect the contributions of sediment and nutrients to downstream impairments, reduce short and long-term maintenance needs, enable sufficient cover depth for long term viability, and enhance agricultural production.

4.2.3.1 PREFERRED ALTERNATE: 1/2-INCH DESIGN DRAINAGE COEFFICIENT

As detailed within Section 2.2 this Final Engineer's Report.

4.2.3.2 ALTERNATIVE MEASURE: 3/8-INCH DESIGN DRAINAGE COEFFICIENT

This alternative reduces the design drainage coefficient from 1/2-inch to 3/8-inch. It results in smaller tile diameter dimensions and therefore some lowering of project costs, but also provides a smaller increase in drainage benefit compared to sizing to the 1/2-inch drainage coefficient. A lesser drainage coefficient is typically considered when hydrologic changes are significant enough to make the adequacy of the outlet uncertain. The Drainage Authority should consider the reduction in improvement project cost as well as drainage performance resulting from this alternative along with the needs of the petitioners and the potential water quality effects of the project as detailed throughout this report.

4.2.3.3 ALTERNATIVE MEASURE: STORAGE

Consideration was given to incorporating temporary storage of runoff into the CD 52 improvement project. As a Multipurpose Drainage Management (MDM) solution, storage can offset increases in peak discharges from an improvement, provide water quality treatment or potentially wildlife habitat if appropriately designed. Since the proposed improvement project does not result in a peak discharge increase at its outlet, storage is not required for the adequacy of the outlet. Instead, this alternative allows for tile dimensions to be reduced due to

the storage while providing other public environmental benefits. If runoff is temporarily stored, the same drainage benefit can be provided even if downstream capacities are reduced. Incorporating storage into the drainage system project requires a landowner(s) voluntary participation.

A total of seven potential storage sites along CD 52 have been considered. The sites were initially identified based on topography, proximity to CD 52, and known or assumed private tile infrastructure. Using LiDAR elevation data, the upstream contributing drainage area, storage volume and associated surface area was approximated for each storage site location. **Exhibit M** presents a summary of the storage sites considered along with a schematic layout. In most cases, the concept is for the CD 52 tile to bypass the storage site until tile capacity is reached. Flow exceeding the tile's capacity is directed into the storage site. Several of the locations have potential to daylight the upstream tile into the storage site. This is accomplished by rerouting the tile, to gain adequate cover, with the ability to outlet the tile into the storage site at the surface, thus capturing that portion of the upstream drainage area.

An area near the intersection of Branch 110 with the Main Trunk (NW ¼ of Section 30, Blue Earth City Township) was explicitly analyzed to demonstrate the impacts of the improvement design see **Figure 2**, or "Site E" within **Exhibit M**. This site lies within an existing easement held by the Minnesota Board of Water & Soil Resources (BWSR). Faribault County Drainage staff has been in communication with BWSR staff, who indicated that an enhancement to the existing water storage feature meets the original objective of the easement to improve natural resource benefits and outcomes. While no written agreement is in place between the easement holder (BWSR) and the Drainage Authority, BWSR has indicated that the easement area is available for creation of new wetland restoration and enhancement of the existing storage feature. Due to the likelihood of land availability and ability to daylight Branch 110 tile into the surface depression at this site, it was selected as the preferred location for incorporating storage. The other locations may still be technically feasible but require acquisition of additional property rights to implement a water storage or wetland restoration project.

The storage feature has capacity to temporarily retain a volume equivalent to 1/2-inch runoff from the upstream drainage area of Branch 110. Specifically, the Branch 110 drainage area of 323 acres has a runoff volume of 13.5 acre-feet for the 1/2-inch runoff event and is effectively removed from the design calculations to size the Main Trunk tile segments downstream of Branch 110. The storage feature's outlet is conceptually analyzed as a small diameter pipe allowing for a gradual drawdown following the precipitation event. If the storage basin becomes full, a secondary outlet allows water to enter the Main Trunk tile or existing surface flow paths. Preliminary design of this alternative results in the conversion of 42-inch to 36-inch tile for a length of 6,080 feet. Additionally, approximately 740 feet of tile on Branch 110 would not be

installed in the improvement. An opinion of probable construction cost for this alternative is included in **Appendix F**.

Water quality benefits of the storage feature include capture of suspended sediments and other pollutants bound to sediment particles. Dissolved pollutants may also be reduced from vegetative uptake depending on the residence or drawdown time and overall design of the basin. Since the incorporation of storage via the wetland restoration does not increase overall costs while maintaining an equivalent drainage benefit to landowners of the CD 52 system while providing environmental benefits, it should be considered for incorporation into the drainage system project.

4.3 LAND USE

Per Minn. Stat. § 103E.015, Subd 1(3), the Drainage Authority must consider the present and anticipated land use including the compatibility of the project with local land use plans. Land within the project area is primarily zoned as 'General Agriculture District' according to the current Zoning Map. The Faribault County Land Use Ordinance has a stated purpose of allowing suitable areas of Faribault County to be retained in agricultural use. It considers applicable uses for flood control, watershed structures, farm drainage systems and erosion control structures. The proposed project falls squarely within the purpose of preserving viable agricultural land.

The present land use within the project area is, for the most part, agricultural. In general, land use will remain agricultural for the foreseeable future. Based on the Land Use Ordinance Section 7A-2 "Allow suitable areas of Faribault County to be retained in agricultural use", the project is compatible with local land use plans.

4.4 CURRENT AND POTENTIAL FLOODING

Per Minn. Stat. § 103E.015, Subd 1(4), the Drainage Authority must consider the current and potential flooding characteristics of property in the drainage project or system and downstream for the 5-, 10-, 25- and 50-year flood events, including the adequacy of the outlet for the drainage project. **Appendix E** gives a summary of the modeling approach and derivation of hydrologic inputs to analyze the CD 52 system in XPSWMM.

4.4.1 DRAINAGE SYSTEM

As a result of the poor existing drainage coefficient, even the 2-year, 24-hour rainfall (3.06-inches) results in extended surface pooling in depressional areas drained by CD 52. Additionally, portions of the CD 52 alignment generally follow natural surface conveyance patterns and when the existing tile is flowing at capacity, the excess runoff travels overland. When such a rainfall occurs during the late spring or early summer, planted crops will experience nearly total die-off in inundated areas or along surface flow paths and require

replanting. When a substantial rainfall occurs mid-summer, there is no chance for replanting and the entire crop in these areas may be lost for the season.

The drainage coefficient is determined through use of the Manning's Equation accounting for tile diameter, slope, roughness, and drainage area contributing to each inlet. The drainage coefficient is a representation of the amount of runoff volume the tile can convey in a 24-hour time period but does not account for details of the watershed such as infiltration, ponding and timing of precipitation. The current limiting drainage coefficient of CD 52 is calculated to be approximately 1/8-inch. The proposed improvement increases the capacity to a 1/2-inch drainage coefficient. A table of current and improved drainage coefficients is provided in **Exhibit C**.

4.4.2 DOWNSTREAM ADEQUACY

The improvement project watershed was evaluated with detailed hydrologic and hydraulic modeling methodologies in XP-SWMM to determine its effect on peak flows at the CD 52 outlet, approximately 150 feet east of 377th Ave. Reference **Appendix E** for further details regarding the hydrologic and hydraulic modeling approach. In addition to the CD 52 tile outlet, there is also a 60-inch CMP culvert through 377th Ave which outlets to the same tributary channel as the CD 52 tile. The flows passing through the culvert, CD 52 tile, and road overtopping (for larger rainfall events) combine to make up the existing discharges and peak flows from the CD 52 watershed. In addition, an HEC-RAS (v. 5.0.6) model was developed to represent the outlet channel, develop a rating curve to serve as an outlet condition in the XPSWMM model, and measure downstream changes in hydraulics. This model utilizes survey data in the channel and LiDAR in the overbank areas and is used to measure expected velocities of CD 52 outlet between existing and proposed conditions.

Following the improvement, the CD 52 drainage tile will have a larger capacity. In the eastern portion of the CD 52 watershed near the Main Trunk alignment, the topography does not have sizeable natural depressions and as a result, runoff from this area is conveyed overland on surface drainage paths when the tile capacity is exceeded. There are several natural depressions in upper portions of the watershed and upstream of road embankments. The hydrologic modeling incorporates temporary surface storage from these depressions for both the existing and improved scenarios.

With the improvement, a larger portion of runoff is carried via the larger tile as opposed to the surface flow paths. The tile's increased capacity is mitigated by a decrease in the amount of surface flow. Additionally, the runoff conveyed by the tile is travelling at a higher velocity compared to the overland surface flow path slightly accelerating the delivery of runoff to the CD 52 outlet. A combination of surface flow channels and weirs were utilized to represent the

overland flow conveyance. Application of each was selected to accurately simulate the drainage system, while not double counting storage within storage nodes, as detailed within **Appendix E**.

The resulting effect, as tabulated in **Table 3**, is that the peak discharge at the CD 52 outlet from the combined tile and the 60-inch CMP road crossing at 377th Ave. is reduced by approximately 10% for the 2-, 5-, 10-, 25-, 50- and 100-year, 24-hour events. **Figure 3** displays the combined CD 52 tile and 377th Ave. discharges for the same events. Noticeable in all events is that the peak discharge with the improvement occurs approximately 30-40 minutes later compared to the existing condition. This can be attributed to the CD 52 tile's more efficient conveyance compared to the overland surface flow path and the greater volume carried by the tile in the improvement leading to a separation of the timing of runoff delivered from the upper and lower portions of the watershed to the outlet.

The same amount of temporary storage is available for both the existing and improved scenarios. In general, the depressional areas and areas upstream of road embankments see similar water levels for both scenarios but the duration of storage is shorter with the improvement as expected. This shorter duration of storage with the improvement does not influence the peak discharges at the outlet due to their location in the watershed. The reduction in storage duration does increase discharges following the peak.

Table 3 – Summary of Peak Discharges at CD 52 Outlet

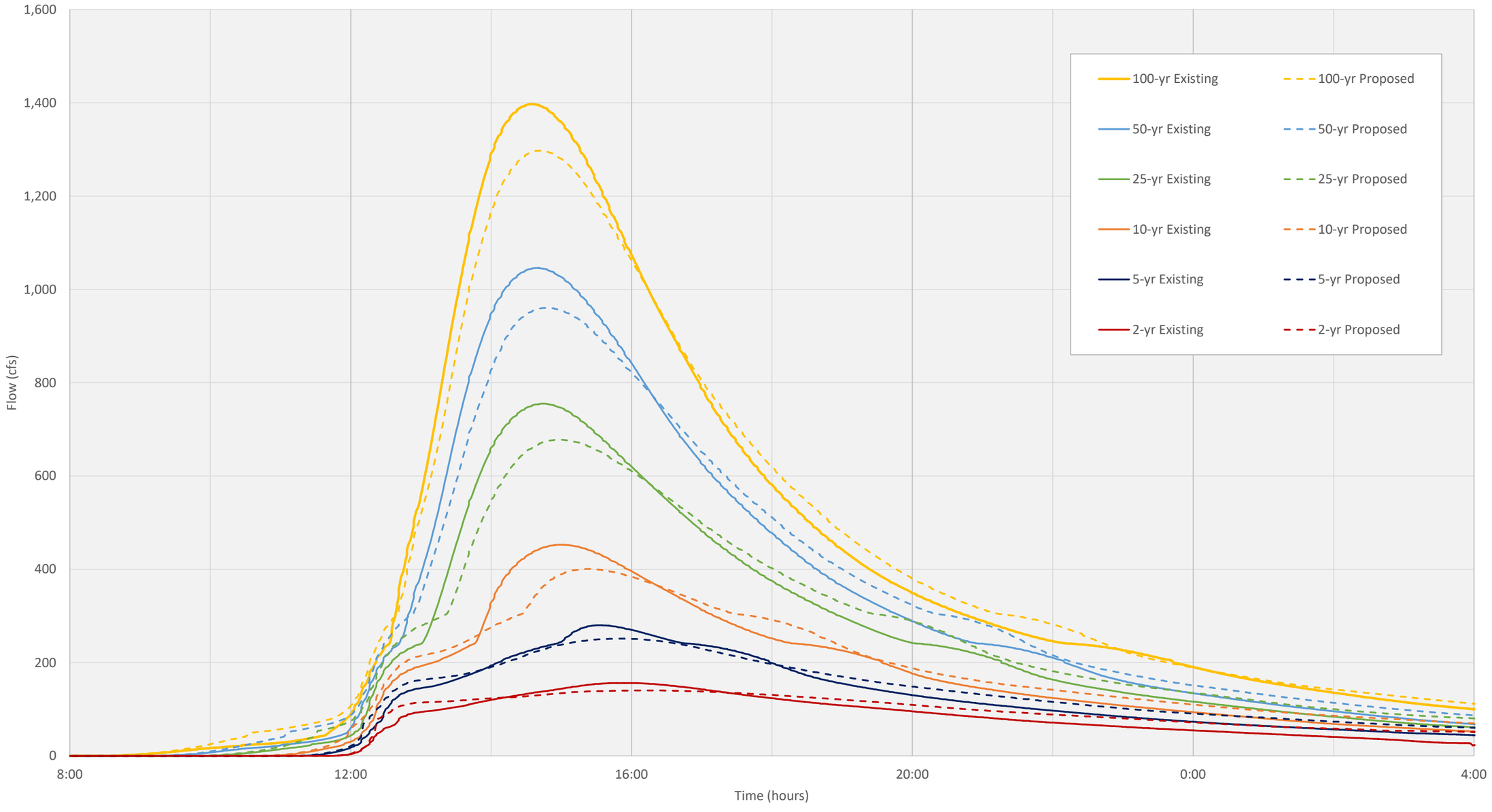
Event	Tile Flow (cfs)			Culvert Flow + Roadway Overflow (cfs)			Total Flow (cfs)		
	Existing	Proposed	Difference	Existing	Proposed	Difference	Existing	Proposed	Difference
2-year	50	88	+38	106	52	-54	156	140	-16
5-year	59	111	+52	221	141	-80	280	251	-29
10-year	61	125	+64	392	276	-116	452	400	-52
25-year	61	128	+67	694	553	-141	755	680	-75
50-year	63	130	+67	983	830	-153	1,046	960	-85
100-year	66	136	+70	1,331	1,162	-170	1,397	1,297	-100

Smaller, more frequent events than the 2-year rainfall were not evaluated. During these smaller events, a larger percentage of the water is flowing through the tile system compared to the natural surface runoff patterns as described above. To determine if there is scour and erosion potential in the outlet channel from a hydrologic change during smaller events, the current 2-year peak discharge was used to calculate velocity and shear stresses in the channel. Based on the hydraulic model results, the maximum velocity is 2.8 feet per second and the shear stress is 0.3 pounds / square foot. Similarly with the flow hydrographs, the proposed conditions velocity and shear stress see a slight reduction compared to the existing. The Minnesota Drainage Guide recommends a maximum velocity of 4 feet per second (for the clay loam soils present in this area according to the SSURGO soils database), indicating that there is minimal risk for

scour or erosion issues in the outlet channel for rainfall events less than the 2-year. Because the project decreases peak outflow rates for rainfall events equal to or greater than a 2-year recurrence; and it results in low-scouring velocities for rainfall events less than a 2-year recurrence; the existing outlet is adequate for the project.

The unnamed tributary outlets into the Blue Earth River approximately 1/2 mile east of the CD 52 outlet. Detailed hydrologic analysis of the Blue Earth River was not completed, as the scale and nature of the project does not have the potential to negatively impact peak flows and velocities on the river. The river has a watershed of approximately 333 square miles. CD 52's watershed is less than 1% of that area. The drastic difference in size means the timing of peak flows from CD 52 will not likely coincide with peak flows on the Blue Earth River. The proposed hydrologic changes on the CD 52 watershed from the improvement project will not result in increases in the frequency or magnitude of flood damages.

Figure 3 - Outlet Hydrograph
(Total Combined Flow from Tile + Overland and Culvert)



4.5 WETLANDS

Minn. Stat. § 103E.015, Subd 1(5) requires the Drainage Authority to consider the effects on wetlands. The petitioned project bisects several wetlands identified on the National Wetland Inventory (NWI) database (see **Exhibit G**). Based on a review of aerial photography, these appear to be cultivated annually and are cultivated Type 1 wetlands. These wetlands are currently highly degraded by cultivation practices and existing drainage, and no new wetlands will be impacted by the improvement project. The project will qualify for a federal Nation Wide Permit 40 (concerning agricultural practices) and a WCA Drainage exemption, as detailed in Section 3.2. In addition, reference Section 3.2.3 for the USDA form AD-1026 regarding the Swampbuster provision of the 1985 Farm Bill and the local landowner's benefits.

4.6 WATER QUALITY

Minn. Stat. § 103E.015, Subd 1(6) requires that the Drainage Authority consider the effects of the proposed drainage project on water quality. The occurrence of an extreme runoff condition during project construction could cause an increased sediment load into the downstream channel system. However, a Stormwater Pollution Prevention Plan will be prepared for the project, which will minimize the likelihood of a substantial sediment discharge following rainfall events. The downstream water quality following completion of the project will change little from the current condition. The improved tile will be clean and free of sediment blockages. Inlets sized for televising/inspection will be incorporated into the project design which do not currently exist and will allow future potential maintenance issues to be identified and addressed. The project will not drain new lands downstream, and thus the discharge of nutrients will remain similar or decrease in volume from an increase of infiltration potential due to a likely increase in water holding capacity of the soil.

4.7 FISH AND WILDLIFE RESOURCES

Minn. Stat. § 103E.015, Subd 1(7) requires the Drainage Authority to consider the effects of the proposed project on fish and wildlife resources. The proposed improvement project does not contemplate any major excavation in any existing natural watercourse or lakes, thus effects on fish resources will be insignificant. There is no destruction of prairie or wooded wildlife habitat contemplated as part of this project. Reference Section 3.2.4 for discussion on the NHIS review as well as Federally listed threatened mammal species.

4.8 GROUNDWATER

Minn. Stat. § 103E.015, Subd 1(8) requires the Drainage Authority to consider the effects of the proposed drainage project on shallow groundwater availability, distribution and use. The average pipe depth of the improvement is approximately 8 feet, the maximum depth is nearly 14 feet, and the shallowest depths are approximately 4 feet. The elevation profile of the improvement is lowered along low segments to achieve a minimum cover of 4 feet. The project pipe depth will generally be at or below that of the existing pipe elevations. This is critical for the reconnection of laterals and outlet adequacy for private tiling. Because of these factors, the

proposed improvement project should have little or no impact on existing shallow ground water resources within the project drainage area.

4.9 ENVIRONMETAL IMPACT

Minn. Stat. § 103E.015, Subd 1(9) requires the Drainage Authority to consider the effects on the overall environmental impact of the proposed drainage project. The project engineer anticipates no long-term adverse effects on the environment beyond the potential for wetland drainage. While construction operations will result in some downstream deposition of sediment, these effects are small in magnitude and temporary in comparison to the long-term benefits anticipated from the project operation.

4.10 EXTERNAL FUNDING

In accordance with Minn. Stat. § 103E.015, Subd. 1a., the Engineer on behalf of the Drainage Authority investigated the potential use of external sources of funding to facilitate the purposes of Minn. Stat. § 103E.011, subd. 5., which are for wetland preservation or restoration or creation of water quality improvements or flood control. The types of projects that meet the Minn. Stat. § 103E.011, subd. 5, purposes of wetland, water quality or flood control improvements include wetland restoration, grass waterways, water and sediment control basins, alternative tile intakes, denitrifying bioreactors, drainage water management and several other types.

A request was sent to the Faribault County SWCD (see **Exhibit H**) during development of PER that they identify both funding sources and specific project opportunities within the CD 52 watershed. SWCD staff have completed or intend to take the following steps during the improvement proceeding:

- Facilitated a discussion during a joint committee meeting of SWCD and Faribault County Board;
- Submitted a copy of the PER to the SWCD Board for comment;
- Attended public hearings on the improvement project and promoted conservation practice opportunities (see Exhibit H);
- Developed a written response to the request for external funding; and
- Pursue implementation of practices based on interest from landowners.

Construction of these BMPs requires voluntary landowner participation and is subject to the availability of the funding. These BMP's may coincide with the improvement project but are not required for implementation.

In addition, a Clean Water Fund grant application has been submitted by the Drainage Authority to BWSR for a Projects and Practices Grant. If selected, the grant funds would supplement the cost of a proposed wetland restoration. This report demonstrates that the wetland restoration is

not required to mitigate project hydrologic impacts but rather is an additional effort by the Drainage Authority to further enhance the water quality of the region.

4.11 MULTI PURPOSE DRAINAGE MANAGEMENT PLAN

4.11.1 INTRODUCTION

This section addresses the requirement within the Faribault County Water Plan to develop a Multipurpose Drainage Management (MDM) plan anytime a drainage system improvement is petitioned for. This MDM Plan identifies potential locations for implementing MDM practices to increase storage or reduce, trap, and treat nutrients or sediment prior to runoff exiting the CD 52 system. Implementation of practices will require field verification, availability of funding and landowner participation.

4.11.2 METHODOLOGY

This analysis of alternative methods was completed using the Prioritize, Target, and Measure Application (PTMApp), version 3.1.0289. PTMApp (https://bwsr.state.mn.us/ptmapp-theory-and-documentation) was created as a tool by BWSR to utilize a large amount of geospatial data to find suitable locations for best management practices or conservation practices that are commonly implemented within agricultural areas.

The tool utilizes publicly available geographic information system (GIS) data in conjunction with NRCS suitability guidance to locate areas within the watershed that may be feasible for the installation or implementation of a wide variety of practices. Practices located using PTMApp are intended for planning and discussion purposes only, and any practices that are presented through PTMApp should be field verified to determine if they are indeed plausible. The presence or absence of a practice as presented by PTMApp does not imply that a location is guaranteed to be suitable or unsuitable for conservation or management practice placement. PTMApp also does not account for existing management or conservation practices already on the landscape.

PTMApp considers up to twenty-four different common management and conservation practice types for suitable placement. They are all listed in the NRCS Field Office Technical Guide. The set of practices is divided into two broad categories.

1. Management practices - These are land management strategies that can be implemented on a farmed field. Examples include: Nutrient Management for Phosphorus, Nitrogen, or groundwater protection, Tillage Management, Reduced Tillage, No Tillage, Cover Crops and Critical Area Planting
2. Structural practices - These are constructed practices that can be installed within a farm field, at the field edge, or along a drainage channel. Examples include: Water and

Sediment Control Basin (WASCOB), Farm pond, Drainage water management, Grassed Waterway, and Denitrifying Bioreactor

The practices within each broad category are based on a larger set of practices that have been shown through research to be effective at improving water quality and/or increasing water holding capacity on the landscape. **Table 4** provides the general purpose and PTMApp's suitability criteria for practices. PTMApp often offers more suitable practice locations than other conservation planning models (e.g., ACPF), but spatial placement of practices are typically very similar as shown in comparison studies.

Many other management and structure practice types were also analyzed within PTMApp but were excluded from this review due to characteristics of the CD 52 watershed. For example, practices relying on the presence of a stream of ditch channel were not evaluated since a channel is not present in the watershed. Specifically, the following practices were not evaluated: filter strips, riparian buffers, saturated buffers, multi-stage ditches, grade stabilizations, streambank and shoreline restorations, large wetland restorations, regional wetlands, infiltration trenches, perennial crops, prescribed grazing, and forage/biomass planting.

4.11.3 POTENTIAL PRACTICE LOCATIONS

Management and structural practice locations identified by the PTMApp tool are presented on maps in **Exhibit J.** Several management practices (nutrient management for phosphorus, nutrient management for nitrogen, reduced tillage, no tillage, and cover crops) can be applied to any cultivated farm field and are not explicitly displayed on the maps.

Suitable locations for water and sediment control basins (WASCOBs) are output from PTMApp as linear features that show concentration flow channels on the landscape along which a WASCOB could be positioned. The drainage area to each potential WASCOB location has also been presented in **Exhibit J** but does not represent the extent of the potential ponded area.

Locations that are presented by PTMApp as suitable for drainage water management represent only small areas on the landscape, and likely do not show the entire spatial extent of a manageable subsurface tile drain system. PTMApp provides a general area where drainage water management could be feasible, however on-the-field analysis is required to verify suitability and extent.

Interested landowners should contact the Faribault County SWCD for more information about the management and structural practice implementation opportunities.

Table 4 – PTMApp Structural and Management Practices

Practice	NRCS code	Definition	Purpose	PTMApp Suitability Criteria
Nutrient management for phosphorus or nitrogen	590	Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.	Budget, supply, and conserve nutrients for plant production. Minimize pollution of surface and groundwater resources. Properly utilize manure and other organic byproducts as plant nutrient sources. Maintain or improve the physical, chemical, and biological condition of soil.	Cultivated Cropland
Nutrient management of groundwater for nitrate	590	Same as above	Reduce infiltration of nitrogen to the groundwater system	Cultivated Cropland, depth to groundwater is >10 ft.
Reduced tillage	345	Managing the amount, orientation and distribution of crop and other plant residue on the soil surface year round while limiting the soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting.	Reduce sheet, rill, and wind erosion. Maintain or increase soil quality and organic matter content. Increase plant-available moisture.	Cultivated Cropland
No tillage	329	Limiting soil disturbance to manage the amount, orientation and distribution of crop and plant residue on the soil surface year around.	Reduce sheet, rill and wind erosion and excessive sediment in surface waters. Maintain or increase soil health and organic matter content. Increase plant-available moisture.	Cultivated Cropland

Practice	NRCS code	Definition	Purpose	PTMApp Suitability Criteria
Cover crops	340	Planting grasses, legumes, and forbs for seasonal vegetative cover.	Reduce erosion from wind and water. Maintain or increase soil health and organic matter content. Reduce water quality degradation by utilizing excessive soil nutrients. Improve soil moisture use efficiency. Minimize soil compaction.	Cultivated Cropland
Critical area planting	342	Establishing permanent vegetation on sites that have, or are expected to have, high erosion rates, and on sites that have physical, chemical, or biological conditions that prevent the establishment of vegetation with normal practices.	Stabilize areas with existing or expected high rates of soil erosion by wind or water. Rehabilitate and revegetate degraded sites that cannot be stabilized using normal establishment techniques.	Cultivated cropland, drainage area to the location is greater than 5 acres and less than 100 acres, SPI* > 0.5
Water and sediment control basin (WASCOB)	638	Constructing an earth embankment or a combination ridge and channel across the slope of a minor drainageway.	Reduce gully erosion. Trap sediment. Reduce and manage runoff.	Cultivated cropland, areas prone to receiving high volume of sediment, contributing drainage area >40 acres, SPI* > 0.8, >0.1 ac-ft of water storage potential
Farm pond/ Wetland	378	Establishing a water impoundment by excavating a pit/dugout or by constructing an embankment to trap excess water.	To provide water for livestock, fish and wildlife, recreation, fire control, develop renewable energy systems, and other related uses, and to maintain or improve water quality.	Minimum depth of 0.5 ft, minimum surface area of 1 acre, not in the location of any national wetland inventory (NWI) wetland, contributing drainage area <500 acres, volume must be greater than the volume delivered to the pond during a 10yr, 24hr precipitation event.

Practice	NRCS code	Definition	Purpose	PTMApp Suitability Criteria
Drainage water management	554	Managing subsurface drainage volume and water table elevation by regulating the flow from a surface or subsurface agricultural drainage system.	Reduce nutrient, pathogen, and pesticide loading from drainage systems into downstream receiving waters. Improve productivity, health, and vigor of plants. Reduce oxidation of organic matter in soils.	Cultivated cropland, slope <1%, non-hydric soils#, depth to groundwater >3ft.
Grassed waterway	412	Establishing suitable vegetation within a shaped or graded channel to convey surface water at a non-erosive velocity using a broad and shallow cross section to a stable outlet.	To convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding. To prevent gully formation. To protect/improve water quality.	Cultivated cropland, slope >3% and <12%, contributing drainage area >5 acres and <100 acres
Denitrifying bioreactor	605	Installing a structure that uses a carbon source (e.g., woodchips) to reduce the concentration of nitrate in subsurface agricultural drainage flow.	Improve water quality by reducing the concentration of nitrate in flow from subsurface agricultural drainage systems	Cultivated cropland, average slope of surrounding area >1%, non-hydric soils#, contributing drainage area >15 acres and <100 acres

Notes:

* SPI - Stream Power Index, a measure of the erosive power of flowing water. Calculated based on land slope and upstream drainage area.

Non-hydric soils - soils that are not frequently flooded or saturated at the soil surface during the growing season

4.12 DNR ADVISORY REPORT ON THE PRELIMINARY ENGINEER'S REPORT

The Preliminary Engineer's Report dated 2/11/2022 was distributed to various staff at the MnDNR prior to the Public Hearing held on March 28, 2022. Todd Kolander, MnDNR Region 4, EWR North District Manager, provided a letter dated March 24, 2022 with several comments regarding the PER. The letter comments and responses to the comments are summarized in a tabular format following the MnDNR letter in **Exhibit K**. In addition, during a follow up conversation the MnDNR requested further details be provided regarding the XPSWMM model and development, including submittal of the model for in-depth review. Once reviewed, the MnDNR provided a comment letter dated August 5, 2022 which included several items of concern. These additional model comments, and HEI's response, are also included within **Exhibit K**.

5 PUBLIC UTILITY, BENEFIT OR WELFARE

In accordance with Minn. Stat. § 103E.015, Subd 2, consideration was given to the conservation of soil, water, forests, wild animals, and related natural resources, and to other public interests affected, together with other material matters as provided by law in determining whether the project will be of public utility, benefit, or welfare, the project engineers provide the following observations.

- Presently, the area drained by CD 52 is not utilized for municipal, industrial, or irrigation purposes within the project area. It is not anticipated that these uses will materialize in the foreseeable future with or without the proposed improvements.
- Recreational activities are currently limited within the project area. There is no anticipated adverse effect on recreation in this area.
- Since the drainage system consists entirely of drain tile, there is no anticipated public navigation potential.
- The project elements as proposed in this report include no drainage opportunities of existing lakes, wetlands, or other protected water environments. Therefore, the proposed project will have little or no effect on fish resources.
- Regarding the federally listed threatened Northern Long-Eared Bat, there are no known roost trees or hibernacula located within the project area. Additionally, no tree removal is proposed, therefore the project will not result in a taking of this federally listed species.

The proposed improvement will be of public utility and benefit and will promote the public health and welfare. Public utility and benefit is achieved by providing more efficient drainage to agricultural properties and public roads within the drainage area. The improvement will protect property values and improve the economy of agricultural production. Public health and welfare is achieved by reducing the frequency of wet and overflowed land which will improve the general sanitary condition of the community, relieve low wet or stagnant and unhealthful conditions, and protect the overflowed property – just as was sought to be achieved in the original proceedings to establish CD 52.

6 OPINION OF PROBABLE CONSTRUCTION COST

The estimated total project costs for the ditch improvement described in this report are as follows:

Table 5 – Opinion of Probable Construction Costs

Proposed Improvements	Construction Cost*	Other Costs**	Total Cost
Improvement of CD 52 (½-inch Drainage Coefficient)	$2,552,000	$463,000	$3,015,000
Improvement of CD 52 (Including Storage)	$2,475,000	$466,000	$2,941,000

*Includes 20% construction contingency.
**Other costs include: Viewing at 0.5%, engineering based on 5% of construction cost, televising at $0.75 per LF, and legal and other administrative costs estimated at 1% of construction costs, construction management at 11% of construction costs, and temporary damages at $625 per acre.

A detailed breakdown of the project costs is included as **Exhibit F** to this report, Project Itemized Cost Estimate.

7 SEPARABLE MAINTENANCE

In its order initiating proceedings and appointing the engineer to prepare a preliminary survey report, the Drainage Authority instructed the engineer to include an investigation of the current condition of the portion of the drainage system proposed to be improved and provide a recommendation on the propriety of a separable maintenance allocation of project costs. The Drainage Authority has indicated that the existing tile is in poor condition based upon the recent amount and types of repairs that have been required to maintain function of CD 52, the items observed within the portion of CD 52 that was televised and given the general age of the system, originally constructed in 1916, it is recommended that the existing tile be replaced regardless of improvement proceedings. The cost to repair existing main trunk tile and branches by replacement at its current sizing (including engineering, legal, and administrative cost) was separately estimated from the improvement cost and found to be **$2,376,037** (see **Exhibit F**). It is recommended that the Viewers consider these as separable maintenance costs relative to the improvement in further ditch proceedings.

8 RECOMMENDATIONS

In the opinion of the Project Engineer, the proposed project outlined herein is necessary, feasible, and practical. It is recommended that the Drainage Authority order the Improvement of CD 52 to the 1/2-inch drainage coefficient alternative or the storage alternative as described in Sections 4.2.3.1 and 4.2.3.3 respectively. Both alternatives provide drainage equivalent to the 1/2-inch coefficient.

As required by Minn. Stat. § 103E, construction plans for the improvement to the 1/2-inch drainage coefficient are provided in **Exhibit D** and specifications for tile material and its installation are provided in **Exhibit L**.

8.1 POTENTIAL PROJECT MODIFICATIONS

The project alternatives described in this FER include the segments initially identified in the petition for improvement. During development of the FER, several potential modifications were identified that may potentially reduce overall project cost. Several of the potential modifications include excluding branches from the improvement project as they do not serve as a drainage outlet for more than one property and are located on property that has adequate connection to the public system without need of the branch.

8.1.1 EXCLUDE BRANCH 79

Branch 79 is approximately 120 feet in length and located in Section 35 of Jo Daviess Township. It is entirely contained on one property. If it serves as an outlet for private drainage infrastructure, the private tile can be connected directly to the Main Trunk during the improvement project. It is recommended that Branch 79 be excluded from the improvement project if the landowner is in agreement.

8.1.2 EXCLUDE BRANCH 110+31

Branch 110+31 is approximately 1,800 feet in length and extends from Branch 110 near 80th St to 370th Ave. Private tile on property across or west of 370th Ave (in Section 25 of Jo Daviess Township) is known to outlet to the JD 20F. Therefore, Branch 110+31 is only providing a drainage outlet for one property in Section 30 of Blue Earth City Township. It is recommended that Branch 110+31 be excluded from the improvement project if the landowner is in agreement.

8.1.3 EXCLUDE BRANCH 10

Branch 10 is approximately 200 feet in length and extends from the Main Trunk to the boundary of a property. Tile maps have been provided that show Branch 10 is not being utilized by private drainage tile. Instead, the private tile outlets into the Main Trunk further to the west on the same property. It is recommended that Branch 10 be excluded from the improvement project if the landowner is in agreement.

8.1.4 UTILIZE PRIVATE TILE AS MAIN TRUNK

According to the property owner in Section 1 of Pilot Grove Township, a 12-inch dual-wall HDPE tile was installed parallel to the CD 52 Main Trunk between stations 192+00 and 204+00. Since the improvement design is also a 12-inch dual wall HDPE tile, utlizing this existing tile could potentially be utilized in lieu of installing a another 12-inch tile as the CD 52 Main Trunk. The elevation of the tile is not known nor is the quality of the installation. Field exploration is necessary to determine elevations and televising to inspect the condition of the tile to determine if it's feasible. This modification to the improvement project is not recommended primarily due to

the unknown nature of installation due to the tight vertical tolerances for the grades proposed on the improved system. Nor is it likely that the tile elevations will allow for adequate drainage upstream of this location on the Main Trunk. Further investigating this alternative will add project cost that will likely not be recouped. The currently proposed plan will enable the private 12-inch tile to provide value to the improvement project as it serves as a submain and limits the amount of lateral connections to the Main Trunk.

EXHIBIT A – IMPROVEMENT PETITION

PETITION FOR IMPROVEMENT OF DRAINAGE SYSTEM

TO: FARIBAULT COUNTY BOARD OF COMMISSIONERS, AS DRAINAGE AUTHORITY FOR FAIRBAULT COUNTY DITCH NO. 52

Petitioners respectfully represent, state and request the following:

1. Jurisdiction.

The undersigned Petitioners constitute: (1) at least 26% of the owners of the property affected by the proposed improvement; (2) at least 26% of the owners of property that the proposed improvement passes over; (3) the owners of at least 26% of the property area affected by the proposed improvement; or (4) the owners of at least 26% of the property area that the proposed improvement passes over.

2. Designation of Drainage System.

This Petition requests the improvement of the drainage system known by and designated as Faribault County Ditch No. 52 ("CD 52") located in Faribault County, Minnesota.

3. Need for Improvement.

The drainage system has insufficient capacity or needs enlarging or extending to furnish sufficient capacity or a better outlet. The drainage system is out of repair and the improvement petitioned for herein is for a separable portion of the drainage system. Therefore, a portion of the cost may be assessed as a repair.

4. Description of Proposed Improvement.

The proposed improvement would consist of improving, enlarging, and deepening the entirety of CD 52 and branch lines (with the exception of Branch 35, and Branch 32), which currently consists of buried tile, as well as realigning certain portions of CD 52. CD 52 would be enlarged and its capacity increased, either by replacing existing buried tile or installing tile parallel to existing buried tile, to provide an increased drainage coefficient consistent with recommended drainage capacity of tile systems for modern agricultural practices. The improvement would consist of realigning and straightening the main trunk line of CD 52 from its outlet into the unnamed tributary of the Blue Earth River in Section 5 of Elmore Township to its intersection with Branch 146 near the northwest corner of Section 6 of Elmore Township. In addition, the following tile lines would be enlarged and their capacity increased: CD 52 Main Trunk, Branch 178, Branch 146, Branch 146+14, Branch 134, Branch 110, Branch 110+7, Branch 108, Branch 102, Branch 79, Branch 70, Branch 70+6, Branch 38, and Branch 10. If deemed feasible and prudent by the project engineer, the improvement may include, in addition to or as an alternative to the straightening of the main trunk line of CD 52, flattening tile grades in combination with larger tile sizes, or lowering and extending the outlet of CD 52 further downstream into the unnamed creek currently serving as an outlet. Preliminary designs of the proposed improvement, subject to any alterations deemed prudent or necessary by the project

engineer, and the location of the improvement and affected area, is depicted in the preliminary feasibility study describing the proposed improvement attached hereto as Exhibit A.

Set forth below is a list of the 40-acre tracts or government lots that the proposed improvement would pass over, together with the names and addresses of the owners of those tracts; to-wit:

	Owner	Address	PID	Description	Sec	Twp	Rge	County
1.	Kark Family Farms Llp	C/O Farmers National CO #16472 PO Box 542016 Omaha, NE 68154	020301400	SW¼ SW¼	30	102N	27W	Faribault
2.	Kark Family Farms Llp	C/O Farmers National CO #16472 PO Box 542016 Omaha, NE 68154	020301400	SE¼ SW¼	30	102N	27W	Faribault
3.	Doug & Karen Nave	34899 30th St Elmore, MN 56027	020300700	SW¼ SE¼	30	102N	27W	Faribault
4.	Lawrence Land LLC	1120 Highland Dr Blue Earth, MN 56013	100360100	NW¼ NW¼	36	102N	28W	Faribault
5.	Dorothy L Ristau Life Estate Etal	37620 80th St Blue Earth, MN 56013	020310400	NW¼ NW¼	31	102N	27W	Faribault
6.	Steven P Lawrence Trust & Berneda J Lawrence Disc Tr	1120 Highland Drive Blue Earth, MN 56013	100360102	SW¼ NW¼	36	102N	28W	Faribault
7.	Steven P Lawrence Trust & Berneda J Lawrence Disc Tr	1120 Highland Drive Blue Earth, MN 56013	100360102	SE¼ NW¼	36	102N	28W	Faribault
8.	Thomas J Plocker	118 South Holland Street Blue Earth, MN 56013	100360800	SW¼ NE¼	36	102N	28W	Faribault
9.	Thomas J Plocker	118 South Holland Street Blue Earth, MN 56013	100360800	SE¼ NE¼	36	102N	28W	Faribault
10.	Dorothy L Ristau Life Estate Etal	37620 80th St Blue Earth, MN 56013	020310401	SW¼ NW¼	31	102N	27W	Faribault
11.	Maxine Lawrence	1025 Highland Dr Blue Earth, MN 56013	100360300	NW¼ SW¼	36	102N	28W	Faribault

	Owner	Address	PID	Description	Sec	Twp	Rge	County
12.	Maxine Lawrence	1025 Highland Dr Blue Earth, MN 56013	100360300	NE¼ SW¼	36	102N	28W	Faribault
13.	Lawrence Land LLC	1120 Highland Dr Blue Earth, MN 56013	100360600	NW¼ SE¼	36	102N	28W	Faribault
14.	Myron E Childs Irrevoc Trust Denise L Wolf Trustee	PO Box 194 Elmore, MN 56027	020310700	NW¼ SW¼	31	102N	27W	Faribault
15.	Myron E Childs Irrevoc Trust Denise L Wolf Trustee	PO Box 194 Elmore, MN 56027	020310700	SW¼ SW¼	31	102N	27W	Faribault
16.	Lawrence Farm Inc	1120 Highland Dr Blue Earth, MN 56013	100360200	SW¼ SW¼	36	102N	28W	Faribault
17.	Ronald H Lawrence	1025 Highland Drive Blue Earth, MN 56013	100360700	SE¼ SE¼	36	102N	28W	Faribault
18.	George Lane Buck Trust	15 Oak Park Court Bettendorf, IA 52722	020310200	SE¼ SW¼	31	102N	27W	Faribault
19.	George Lane Buck Trust	15 Oak Park Court Bettendorf, IA 52722	020310200	SW¼ SE¼	31	102N	27W	Faribault
20.	Steven P Lawrence Trust & Berneda J Lawrence Disc Tr	1120 Highland Drive Blue Earth, MN 56013	140010701	NW¼ NW¼	01	101N	28W	Faribault
21.	Steven P Lawrence Trust & Berneda J Lawrence Disc Tr	1120 Highland Drive Blue Earth, MN 56013	140010701	NW¼ NE¼	01	101N	28W	Faribault
22.	Myron E Childs Irrevoc Trust Denise L Wolf Trustee	PO Box 194 Elmore, MN 56027	140010100	NE¼ NE¼	01	101N	28W	Faribault
23.	Myron E Childs Irrevoc Trust Denise L Wolf Trustee	PO Box 194 Elmore, MN 56027	070060200	NW¼ NW¼	06	101N	27W	Faribault
24.	Myron E Childs Irrevoc Trust Denise L Wolf Trustee	PO Box 194 Elmore, MN 56027	070060200	SW¼ NW¼	06	101N	27W	Faribault
25.	Ramona G Ehrich	6471 377th Avenue Blue Earth, MN 56013	070060300	NE¼ NW¼	06	101N	27W	Faribault

	Owner	Address	PID	Description	Sec	Twp	Rge	County
26.	Arlo & Marjorie Erickson Revocable Trust	20490 Parallel Rd C/O Richard Erickson Tonganoxie, KA 66086	070060500	NW¼ NE¼	06	101N	27W	Faribault
27.	Richard Arlo Erickson Trust Richard Arlo Erickson Trustee	PO Box 1008 Tonganoxie, KS 66086	070060600	NE¼ NE¼	06	101N	27W	Faribault
28.	Gerald L Sonnek	58214 240th St Mankato, MN 56001	140010200	SW¼ NW¼	01	101N	28W	Faribault
29.	Gerald L Sonnek	58214 240th St Mankato, MN 56001	140010200	SE¼ NW¼	01	101N	28W	Faribault
30.	Allen J & Joanne Sukalski	5966 385th Ave Blue Earth, MN 56013	140010400	SW¼ NE¼	01	101N	28W	Faribault

5. Public Utility and Health.

The proposed improvement will be of public utility and will promote the public health.

6. Agreement by Petitioners.

The undersigned Petitioners have been informed and understand that they may not withdraw as a petitioner at any time after this Petition is accepted by the drainage authority, except with the written consent of all other Petitioners on the filed Petition. Also, the undersigned Petitioners acknowledge and agree that they will pay all costs and expenses that may be incurred if the improvement proceedings are dismissed.

7. Cost Bond.

One or more petitioners shall cause a bond to be filed or a check to be delivered in the amount of at least $10,000.00 payable to the drainage authority. The bond or payment will be conditioned to pay the costs incurred if the proceedings are dismissed or if a contract is not awarded to construct the proposed improvement described in the petition.

WHEREFORE, the Petitioners respectfully request the following:

a. That the drainage authority accept this Petition, review it and determine that it is legally adequate; and

b. That the drainage authority appoint Joe Lewis of Houston Engineering, or another qualified engineer, as the project engineer for purposes of the proposed improvement and direct the engineer to prepare an engineer's preliminary report for the proposed improvement, including allowing the engineer to analyze other

potential routes for the proposed improvement and whether separable maintenance may be employed.

Dated: July 29, 2020.

Dean M. Zimmerli #0396791
dzimmerli@gislason.com
GISLASON & HUNTER LLP
Attorneys for Petitioners
2700 South Broadway
P. O. Box 458
New Ulm, MN 56073-0458
Phone: 507-354-3111
Fax: 507-354-8447

[Signature pages to follow]

SIGNATURE PAGES FOR
PETITION FOR IMPROVEMENT TO FARIBAULT COUNTY DITCH NO. 52

Name of Petitioner(s) (please print or type):

Lawrence Farm INC

Ownership (check one):

_____ Individual
_____ Co-Owners (# of co-owners: _____)
_____ Partner (name of partnership: _____)
__X__ Corporation or limited liability company (name of corporation or LLC: _____)
_____ Trust (complete name of trust: _____)
_____ Other (explanation: _____)

Statement of Authority:

The undersigned states and represents that if he or she is executing in a representative capacity, he or she has the authority to execute on behalf of the respective partnership, corporation, limited liability company, trust or other such entity.

The above-named Petitioner(s) owns the following tract(s) which the proposed improvement will pass over or which is affected by the proposed improvement.

Tract Description	Section	Township	Range	County
SW ¼ SW ¼	36	102N	28W	Faribault

Dated: 7/20/21

Lawrence Farm Inc
by Its Lawrence Pres
(signature)

Dated: _____

_____
(signature)

Dated: _____

_____
(signature)

[Signature pages to follow]

SIGNATURE PAGES FOR
PETITION FOR IMPROVEMENT TO FARIBAULT COUNTY DITCH NO. 52

Name of Petitioner(s) (please print or type):

Steven P. Lawrence Trust
Bernedia J Lawrence Disclaimer Trust

Ownership (check one):

____ Individual
____ Co-Owners (# of co-owners: _____)
____ Partner (name of partnership: _____)
____ Corporation or limited liability company (name of corporation or LLC: _____)
X Trust (complete name of trust: Steven P Lawrence Trust)
____ ~~Other (explanation:~~ Bernedia J Lawrence Disclaimer Trust

Statement of Authority:

The undersigned states and represents that if he or she is executing in a representative capacity, he or she has the authority to execute on behalf of the respective partnership, corporation, limited liability company, trust or other such entity.

The above-named Petitioner(s) owns the following tract(s) which the proposed improvement will pass over or which is affected by the proposed improvement.

Tract Description	Section	Township	Range	County
SW¼ NW¼	36	102N	28W	Faribault
SE¼ NW¼	36	102N	28W	"
NW¼ NW¼	01	101N	28W	"
NW¼ NE¼	01	101N	28W	"

Dated: 7/21/21

Steven P Lawrence
(signature) as Trustee for the Steven Lawrence Trust

Dated: 7/21/21

Steven P Lawrence
(signature) as Trustee for the Bernedia J Lawrence Disclaimer Trust

Dated: _____

_____
(signature)

[Signature pages to follow]

SIGNATURE PAGES FOR
PETITION FOR IMPROVEMENT TO FARIBAULT COUNTY DITCH NO. 52

Name of Petitioner(s) (please print or type):

Lawrence Land LLC

Ownership (check one):

_____ Individual
_____ Co-Owners (# of co-owners: _____)
_____ Partner (name of partnership: _____)
__X__ Corporation or limited liability company (name of corporation or LLC: Lawrence Land LLC)
_____ Trust (complete name of trust: _____)
_____ Other (explanation: _____)

Statement of Authority:

The undersigned states and represents that if he or she is executing in a representative capacity, he or she has the authority to execute on behalf of the respective partnership, corporation, limited liability company, trust or other such entity.

The above-named Petitioner(s) owns the following tract(s) which the proposed improvement will pass over or which is affected by the proposed improvement.

Tract Description	Section	Township	Range	County
NW¼ NW¼	36	102N	28W	Faribault
NW¼ SE¼	36	102N	28W	"

Dated: 7/20/21

Lawrence Land LLC
By Stan Lawrence Pres
(signature)

Dated: _____

_____
(signature)

Dated: _____

_____
(signature)

[Signature pages to follow]

SIGNATURE PAGES FOR
PETITION FOR IMPROVEMENT TO FARIBAULT COUNTY DITCH NO. 52

Name of Petitioner(s) (please print or type):

Chad Lawrence

Angela Lawrence

Ownership (check one):

___ Individual
_✓_ Co-Owners (# of co-owners: 2)
___ Partner (name of partnership: _____)
___ Corporation or limited liability company (name of corporation or LLC: _____)
___ Trust (complete name of trust: _____)
___ Other (explanation: _____)

Statement of Authority:

The undersigned states and represents that if he or she is executing in a representative capacity, he or she has the authority to execute on behalf of the respective partnership, corporation, limited liability company, trust or other such entity.

The above-named Petitioner(s) owns the following tract(s) which the proposed improvement will pass over or which is affected by the proposed improvement.

Tract Description	Section	Township	Range	County
E½ SE¼	35	102N	R28W	Faribault

Dated: 7-20-21

Chad S. Lawrence
(signature)

Dated: 7-20-21

Angela Lawrence
(signature)

Dated: _____

_____
(signature)

[Signature pages to follow]

SIGNATURE PAGES FOR
PETITION FOR IMPROVEMENT TO FARIBAULT COUNTY DITCH NO. 52

Name of Petitioner(s) (please print or type):

Ronald H. Lawrence

Ownership (check one):

- X Individual
- ____ Co-Owners (# of co-owners: ____)
- ____ Partner (name of partnership: ____)
- ____ Corporation or limited liability company (name of corporation or LLC: ____)
- ____ Trust (complete name of trust: ____)
- ____ Other (explanation: ____)

Statement of Authority:

The undersigned states and represents that if he or she is executing in a representative capacity, he or she has the authority to execute on behalf of the respective partnership, corporation, limited liability company, trust or other such entity.

The above-named Petitioner(s) owns the following tract(s) which the proposed improvement will pass over or which is affected by the proposed improvement.

Tract Description	Section	Township	Range	County
SE¼ SE¼	36	102N	28W	Faribault

Dated: 7-21-21

Ronald H Lawrence
(signature)

Dated: ____

____
(signature)

Dated: ____

____
(signature)

[Signature pages to follow]

SIGNATURE PAGES FOR
PETITION FOR IMPROVEMENT TO FARIBAULT COUNTY DITCH NO. 52

Name of Petitioner(s) (please print or type):

Maxine Lawrence

Ownership (check one):

X Individual
____ Co-Owners (# of co-owners: _____)
____ Partner (name of partnership: _____)
____ Corporation or limited liability company (name of corporation or LLC: _____)
____ Trust (complete name of trust: _____)
____ Other (explanation: _____)

Statement of Authority:

The undersigned states and represents that if he or she is executing in a representative capacity, he or she has the authority to execute on behalf of the respective partnership, corporation, limited liability company, trust or other such entity.

The above-named Petitioner(s) owns the following tract(s) which the proposed improvement will pass over or which is affected by the proposed improvement.

Tract Description	Section	Township	Range	County
NW¼ SW¼	36	102N	28W	Faribault
NE¼ SW¼	36	102N	28W	"

Dated: 7/21/21

Ronald E Lawrence
POA for Maxine A Lawrence
(signature)

Dated: _____

_____
(signature)

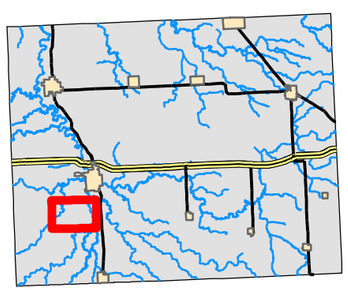
Dated: _____

_____
(signature)

EXHIBIT B – SITE SURVEY

Survey

- OUTLET
- Tile Inlet and Alignment Locations
- Outlet Channel
- Culvert / Roadway
- Watershed
- Existing Tile Alignment
- Public Waters
- 10ft Contours
- 2ft Contours



Location in Faribault County

0 1,000 2,000 Feet

Exhibit B - Site Survey

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

HoustonEngineering Inc.

EXHIBIT C – DESIGN CALCULATIONS

Start Sta (along proposed alignment)	End Sta	Cumulative Area[1] (acres)	Current System Tile Diameter (inches)	Current System Discharge (cfs)	Current System Drainage Coefficient[2] (inches/day)	Improvement Tile Diameter (inches)	Improvement Discharge (cfs)	Improvement Drainage Coefficient (inches/day)
Main Trunk								
26+98	29+50	2,041	30	21.1	0.25	42	40.3	0.47
29+50	33+50	1,972	30	21.1	0.25	42	40.5	0.49
33+50	46+75	1,851	28	13.7	0.18	42	40.4	0.52
46+75	51+99	1,633	28	13.8	0.2	42	40.3	0.59
51+99	75+71	1,633	28	9.7	0.14	42	40.4	0.59
75+71	86+71	1,445	26	8.2	0.13	42	40.4	0.67
86+71	112+80	1,390	26	8.3	0.14	42	40.3	0.69
112+80	113+42	1,066	22	7.2	0.17	36	27.6	0.62
113+42	120+24	1,010	22	7.2	0.17	36	26.7	0.63
120+24	128+94	993	22	6	0.14	36	26.9	0.64
128+94	143+93	873	22	5.9	0.16	36	26.7	0.73
143+93	146+93	654	20	5.3	0.19	30	16.4	0.62
146+93	152+12	525	20	5.3	0.24	30	16.4	0.62
152+12	159+15	347	16	2.7	0.19	30	16.5	0.62
159+15	185+74	347	16	2.4	0.17	24	9.1	0.62
185+74	188+64	281	14	0.7	0.12	24	9.1	0.77
188+64	192+09	259	12	0.7	0.12	24	10.5	0.96
192+09	194+24	149	10	0.7	0.12	18	4.8	0.77
194+24	204+58	66	10	1.2	0.43	12	1.6	0.59
204+58	214+14	66	10	0.7	0.24	12	1.6	0.59
214+14	224+27	11	4	0.1	0.21	8	0.7	1.5
Branch 178								
0+00	9+25	18	7	1	1.23	8	1.0	1.3
9+25	16+26	8	7	0.8	2.45	8	1.4	4.3
Branch 146+14								
0+00	4+29	51	7	0.5	0.22	10	1.4	0.65
4+29	8+97	5	7	0.6	2.71	8	1.6	4.1
Branch 146								
0+00	7+52	138	12	1.5	0.26	12	3.4	0.6
7+2	14+52	114	10	1.4	0.3	12	2.9	0.6
14+52	31+83	68	8	0.6	0.2	12	1.6	0.58
Branch 134								
0+00	1+00	55	10	1.1	0.46	12	5.8	2.5
1+00	7+75	55	10	0.9	0.38	12	1.5	0.6
7+75	14+75	40	7	0.9	0.38	8	1.2	0.7
14+75	16+75	10	7	1.1	0.48	8	1.9	4.4
Branch 110+7								

			Current System			Improvement		
0+00	5+00	62	12	2.3	0.9	10	1.3	0.5
Branch 110+31								
0+00	17+54	15	7	N/A[3]	N/A[3]	8	0.8	1.3
Branch 110								
0+00	5+40	323	16	3.1	0.23	15	6.2	0.5
5+40	7+40	195	10	1.7	0.2	15	4.9	0.6
7+40	17+69	133	12	2.6	0.48	15	5.2	0.9
17+69	30+48	133	12	1.5	0.27	15	3.4	0.6
30+48	32+94	113	10	0.7	0.16	15	3.4	0.7
32+94	42+92	113	7	0.1	0.02	15	3.4	0.7
42+92	47+12	113	7	0.9	0.18	12	3.5	0.7
Branch 108								
0+00	1+82	4	7	1.2	6.76	8	1.7	9.8
Branch 102								
0+00	1+38	18	7	0.7	0.93	8	1.8	2.4
Branch 79								
0+00	1+20	219	12	1.5	0.16	12	5	0.5
Branch 70+6								
0+00	12+11	122	10	0.8	0.15	18	3.8	0.7
12+11	19+18	88	10	0.8	0.21	15	2.3	0.6
19+18	20+18	88	10	2	0.54	10	3.8	1
Branch 70								
0+00	6+02	179	14	2.7	0.36	15	5.8	0.77
6+02	10+13	57	10	1.1	0.46	12	2.3	0.94
10+13	22+36	57	10	0.6	0.24	12	1.6	0.67
22+36	29+20	35	10	1	0.72	10	0.7	0.47
29+20	30+20	35	10	2	1.39	8	1.3	0.9
Branch 38								
0+00	6+22	4	8	0.7	4.21	8	1.0	6.2
Branch 35								
		22	7	0.4	0.39	N/A	N/A	N/A
		22	8	0.9	0.96	N/A	N/A	N/A
Branch 32								
		10	8	0.6	1.48	N/A	N/A	N/A
Branch 10								
0+00	1+90	23	7	0.3	0.36	8	1.1	1.2

[1]Drainage boundaries and total area determined by viewer's vary compared to the drainage areas utilized in design analysis based on viewer's field work.

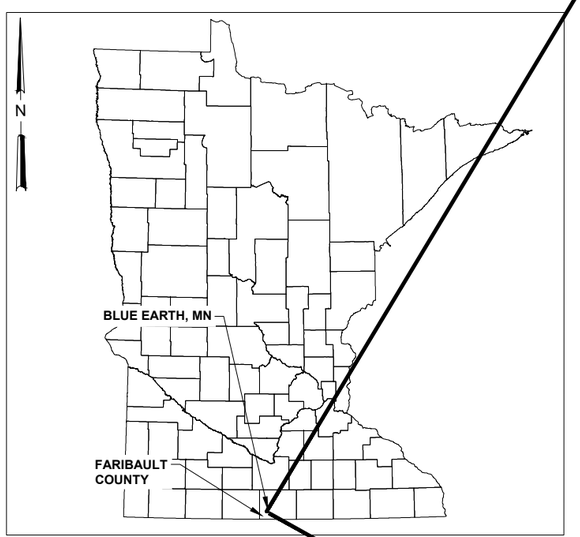
[2]Drainage coefficient is based on the as-constructed condition, not the current deteriorated conditions.

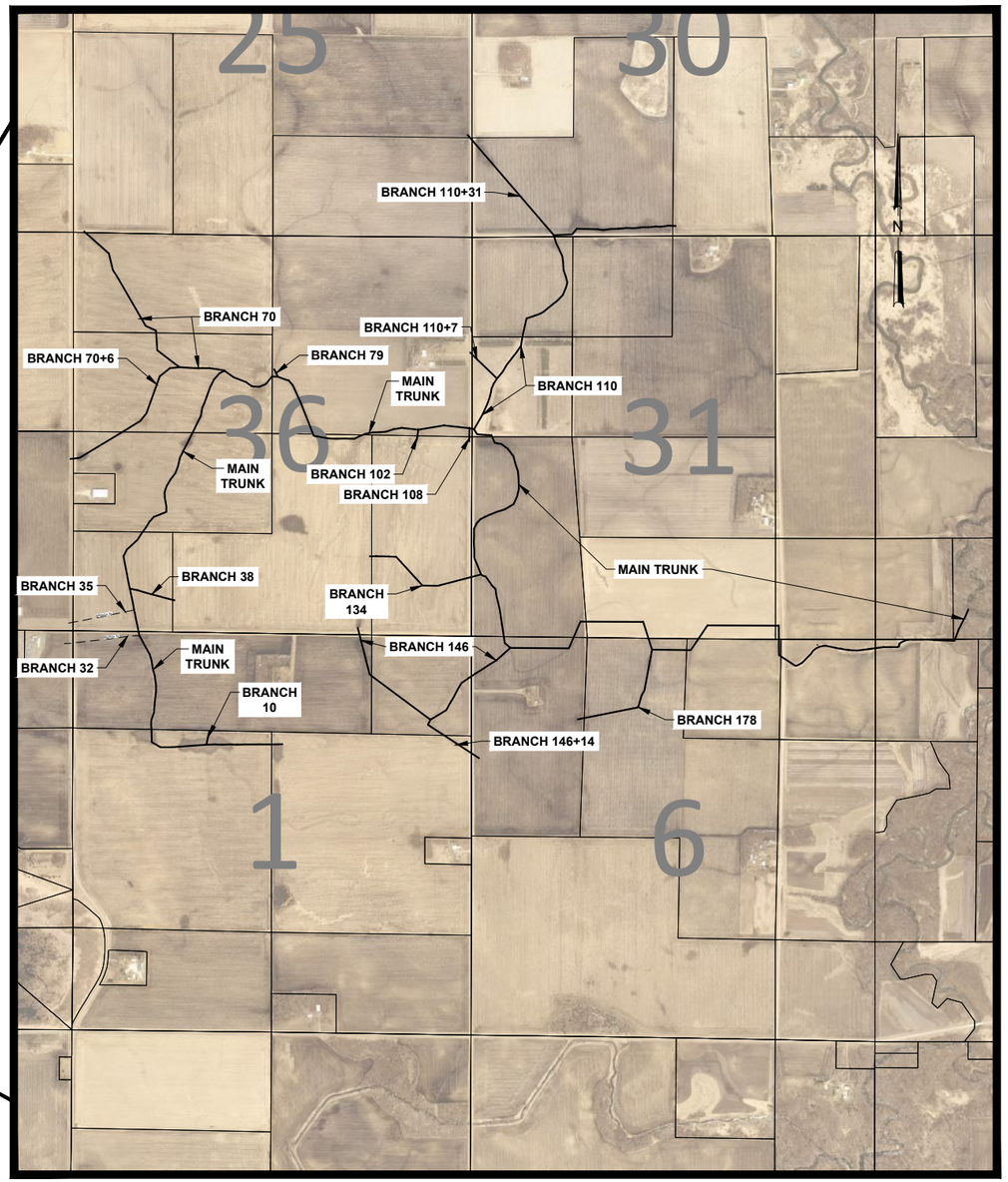
[3]Invert and slope data unavailable to calculate capacity and Discharge Coefficient

EXHIBIT D – DESIGN PLANS

FARIBAULT COUNTY DITCH 52 IMPROVEMENT

FARIBAULT COUNTY
JO DAVIESS, BLUE EARTH CITY, PILOT GROVE & ELMORE TOWNSHIPS
DECEMBER 2022





DRAWING INDEX	
SHEET #	SHEET TITLE
1	COVER SHEET
2	PLAN & PROFILE MAIN TRUNK
3	PLAN & PROFILE MAIN TRUNK
4	PLAN & PROFILE MAIN TRUNK
5	PLAN & PROFILE MAIN TRUNK
6	PLAN & PROFILE BRANCHES 178 & 146
7	PLAN & PROFILE BRANCHES 146+14 & 134
8	PLAN & PROFILE BRANCHES 110 & 110+7
9	PLAN & PROFILE BRANCHES 110+31
10	PLAN & PROFILE BRANCHES 108, 102 & 79
11	PLAN & PROFILE BRANCHES 70 & 70+6
12	PLAN & PROFILE BRANCHES 38 & 10
13	DETAILS
14	DETAILS
15	DETAILS

GENERAL CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL LIMIT CONSTRUCTION ACTIVITY TO WITHIN THE 100-FOOT OR 150-FOOT WIDTH AS SHOWN ALONG THE TILE ALIGNMENTS AND THE WIDTH SHALL GENERALLY BE CENTERED OVER THE TILE ALIGNMENT. ACCESS ROADS SHOULD FOLLOW THE PROPOSED ALIGNMENT WITHIN THE CONSTRUCTION LIMITS. AREAS DISTURBED ALONG ROADWAYS, DRIVEWAYS AND ROADSIDE DITCHES MUST BE RESTORED BY GRADING AND SEEDING.
2. CONTRACTOR MUST VERIFY EXISTING TILE LOCATIONS AND ELEVATIONS PRIOR TO CONSTRUCTION. PAID FOR AS 'TILE INVESTIGATION' BY THE HOUR.
3. ANY ALIGNMENT CHANGES MADE DUE TO TILE INVESTIGATION SHALL BE APPROVED BY THE ENGINEER DURING CONSTRUCTION. THE CONTRACTOR WILL ONLY BE COMPENSATED FOR ADDITIONAL LINEAR FOOTAGE OF INSTALLED TILE DUE TO THE ALIGNMENT CHANGE PER THE UNIT BID PRICE. ANY INCREASE OR DECREASE IN THE QUANTITY OR TYPE OF BENDS NECESSARY DUE TO ALIGNMENT CHANGES WILL NOT BE COMPENSATED FOR.
4. NON-PERFORATED CP PIPE MEETING REQUIREMENTS OF ASTM F2648 WITH SOIL TIGHT JOINTS MEETING REQUIREMENTS OF ASTM F2306 WILL BE THE ONLY ACCEPTABLE MATERIALS FOR ALL TILE INSTALLATION UNLESS NOTED.
5. BACKFILL AND TOPSOIL AT FINISH GRADE SHALL MATCH GRADES SURROUNDING TRENCH TO NOT IMPEDE SURFACE DRAINAGE OR CAUSE ISSUES FOR NORMAL AGRICULTURAL PRACTICES. GRADING OVER TRENCH SHALL BE ROUNDED TO ACCOUNT FOR SETTLEMENT. FINISH GRADING SHALL HAVE 2 PASSES WITH FIELD CULTIVATOR, DISK OR SIMILAR AG EQUIPMENT. RIPPER SHANKS MOUNTED ON CONSTRUCTION EQUIPMENT ARE NOT ADEQUATE FOR TILLAGE OF FINAL BACKFILL.
6. AT NO TIME SHALL MORE THAN 1,250 FEET OF TRENCH BE UN-BACKFILLED. ADDITIONAL LENGTHS OF CHANNEL MUST BE BACKFILLED PRIOR TO EXCAVATING ADDITIONAL TRENCH LENGTHS.
7. EXISTING TILE SHALL BE CRUSHED AND CAPPED AT EVERY PUBLIC LATERAL CONNECTION OR AT LEAST EVERY 750' AND IS INCIDENTAL TO TILE INSTALLATION. AT EACH LOCATION, AT LEAST 20' OF TILE MUST BE CRUSHED AND AT EITHER END OF THE CRUSHED TILE ROUTE MUST PLACED 1' FOOT INTO TILE, FABRIC INSTALLED OVER THE END AND BACKFILLED WITH CLAY MATERIAL OVER THE FABRIC.

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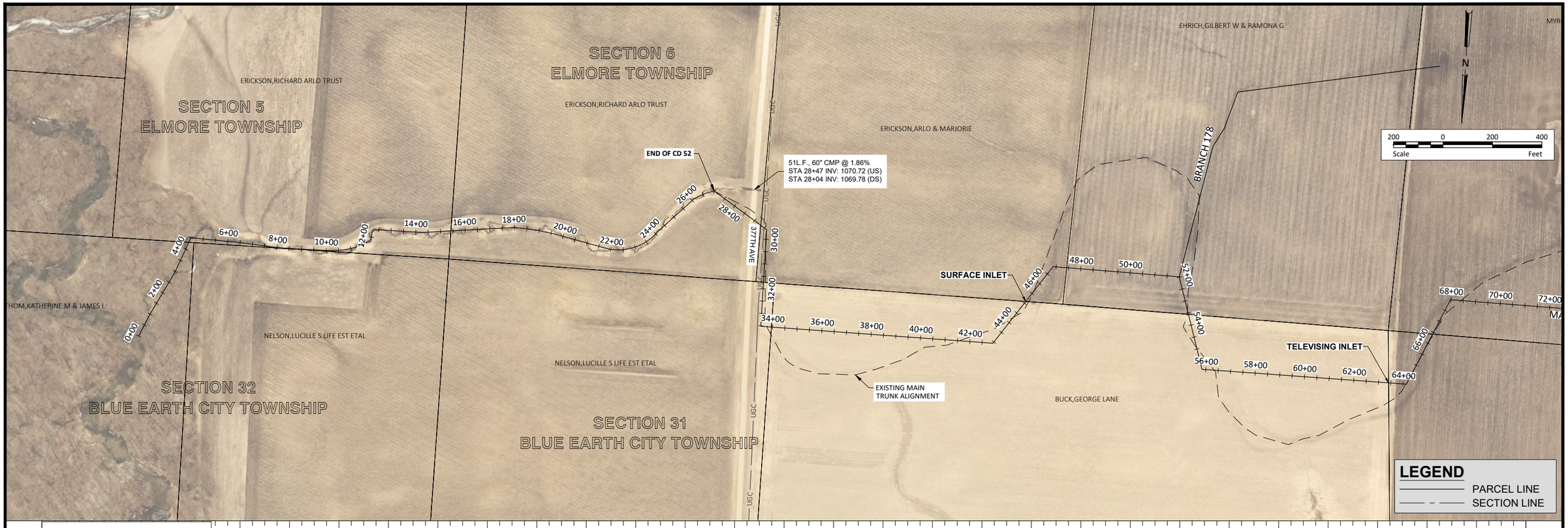
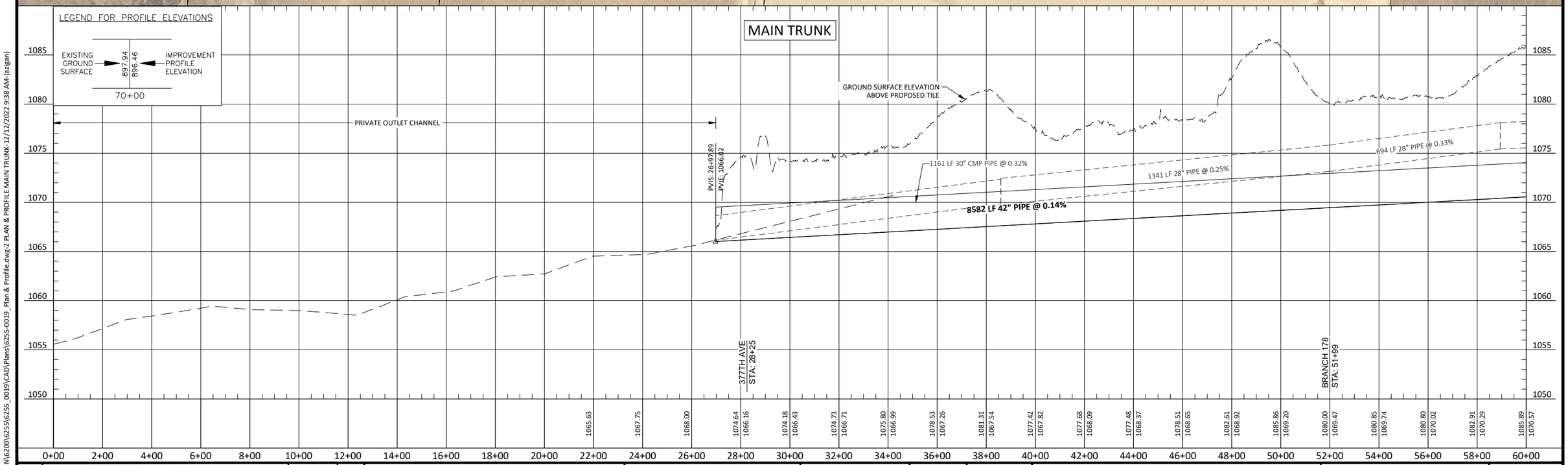
MAPLE GROVE, MINNESOTA





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FARIBAULT COUNTY DITCH 52
JO DAVIESS, BLUE EARTH CITY, PILOT GROVE, & ELMORE TWP

PLAN & PROFILE
MAIN TRUNK
PROJECT NO. 6255-0019

SHEET
2 of 15

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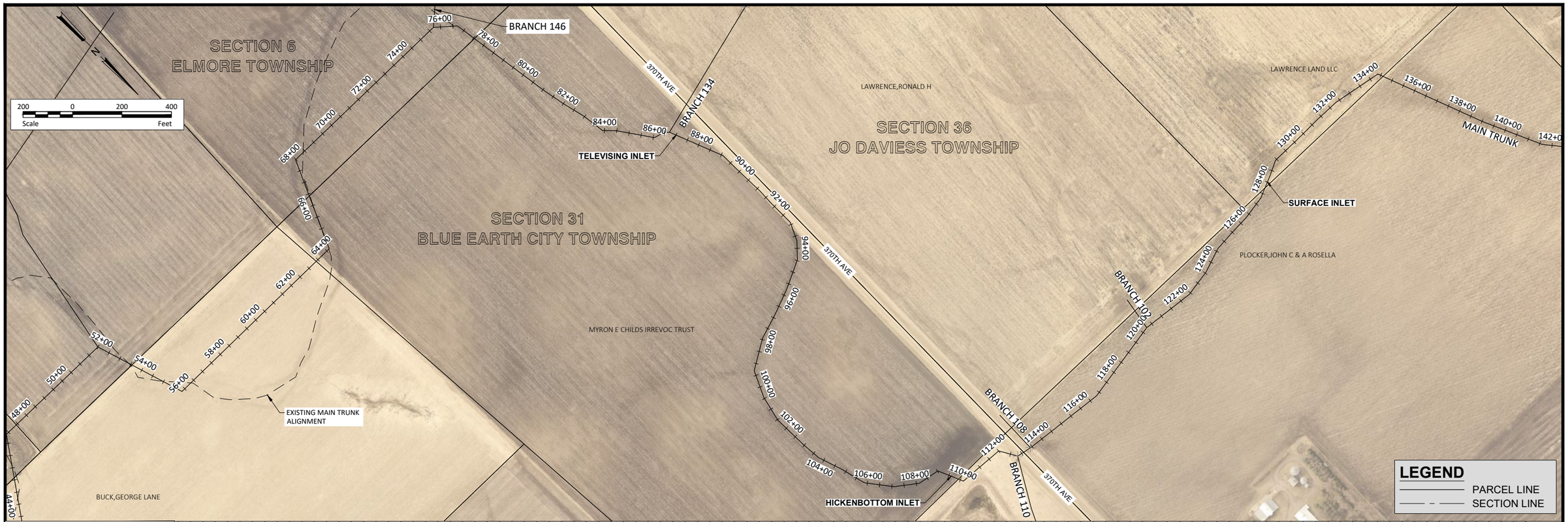

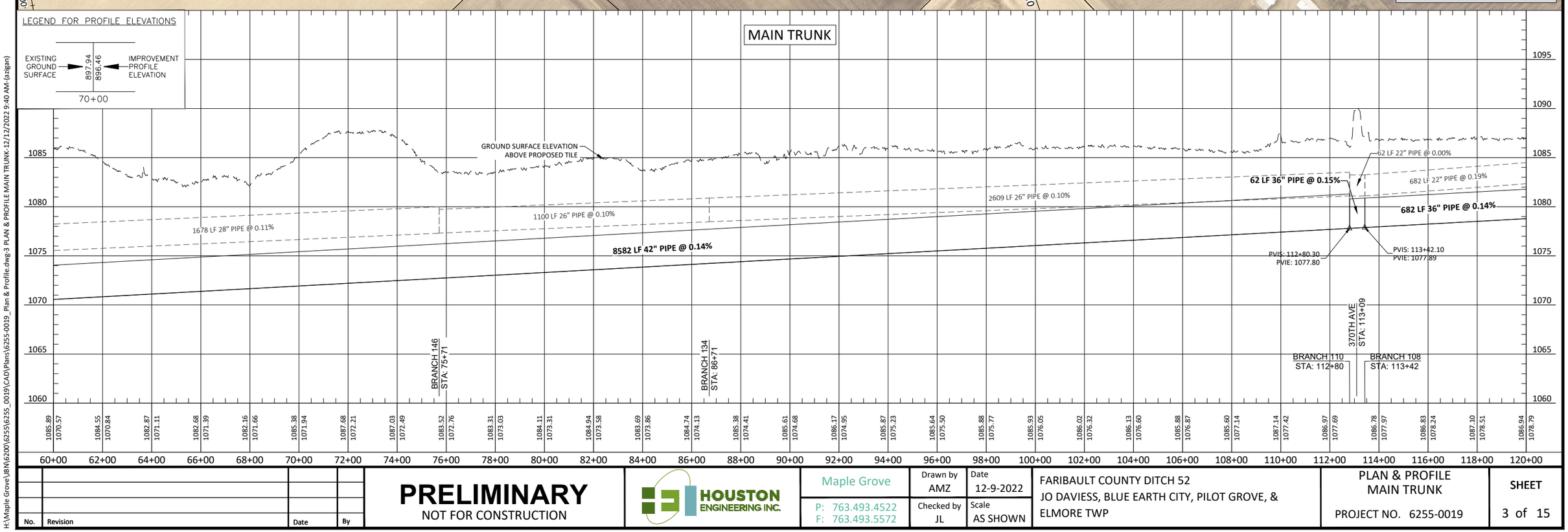

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MAIN TRUNK

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SHEET
3 of 15

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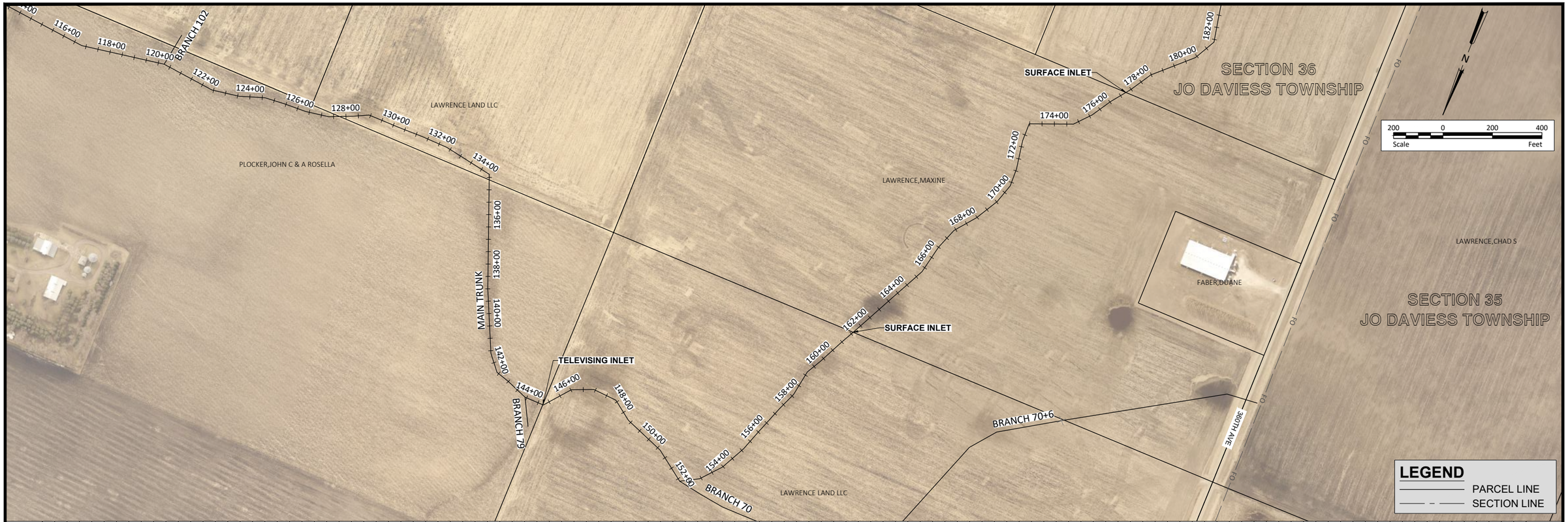

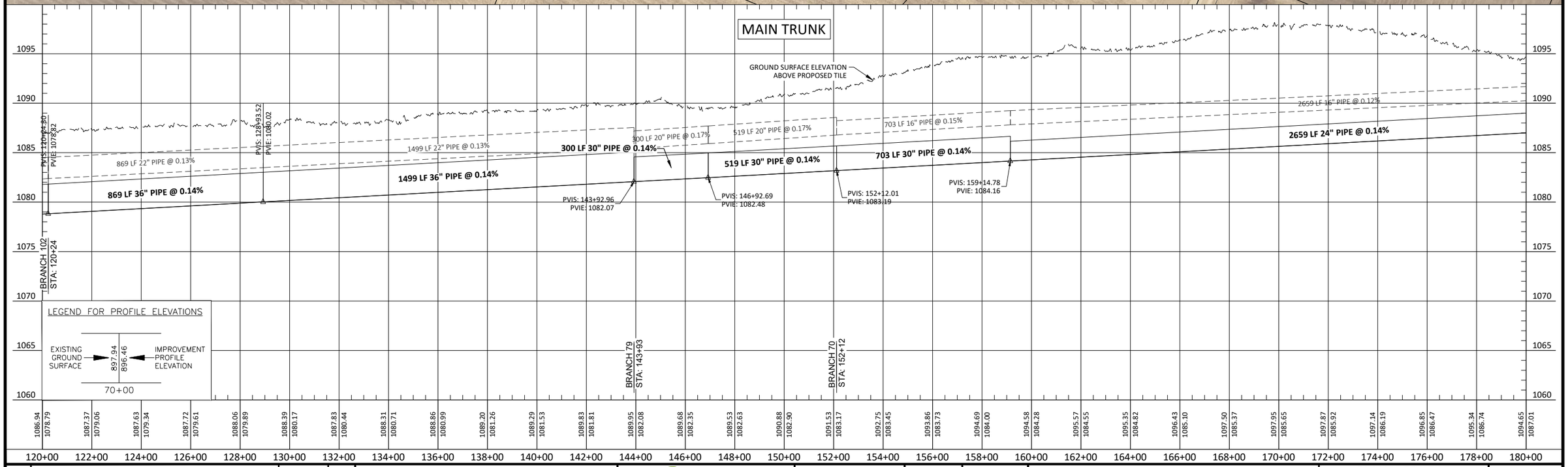

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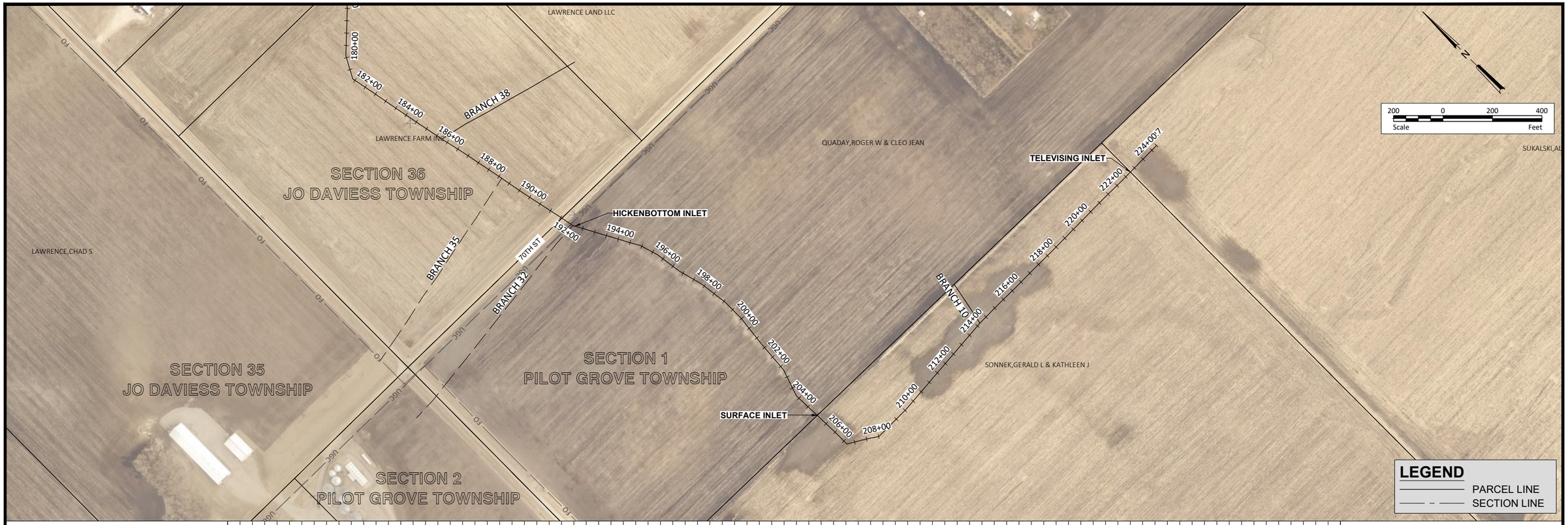
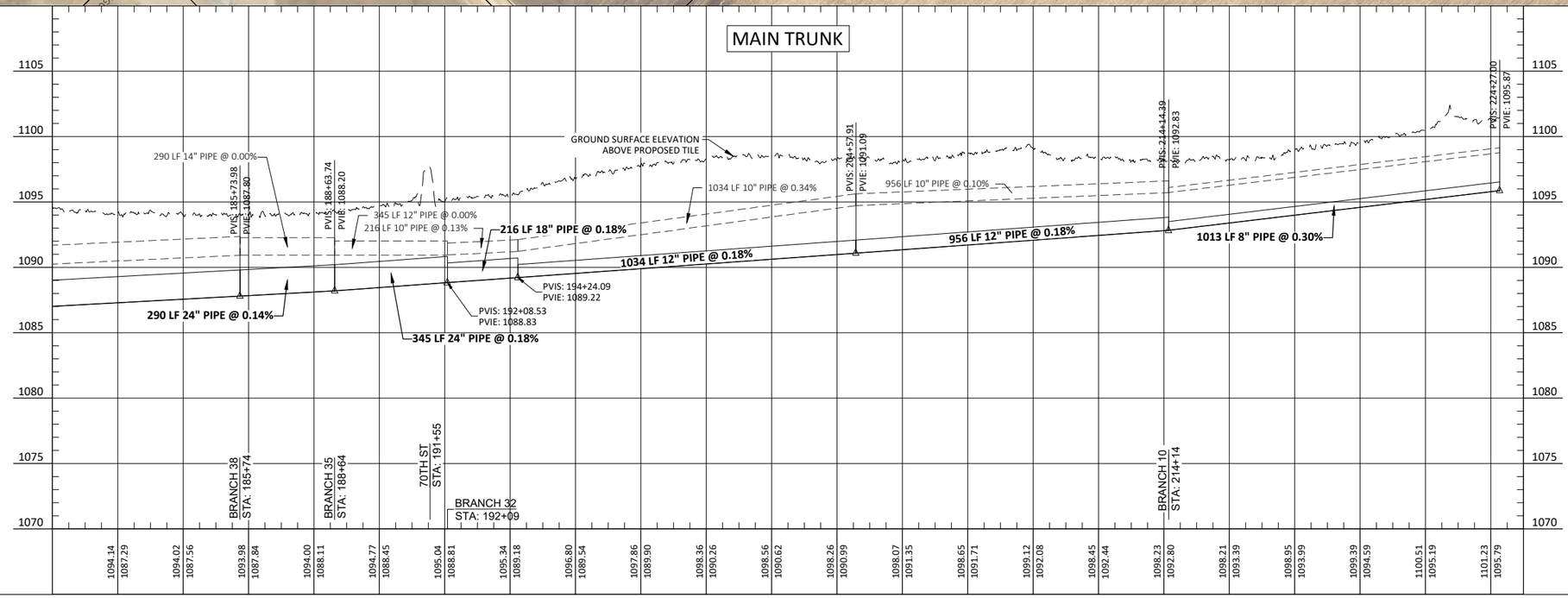
SHEET
4 of 15





LEGEND FOR PROFILE ELEVATIONS

EXISTING GROUND SURFACE 897.94 / 896.46 IMPROVEMENT PROFILE ELEVATION

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SHEET
5 of 15

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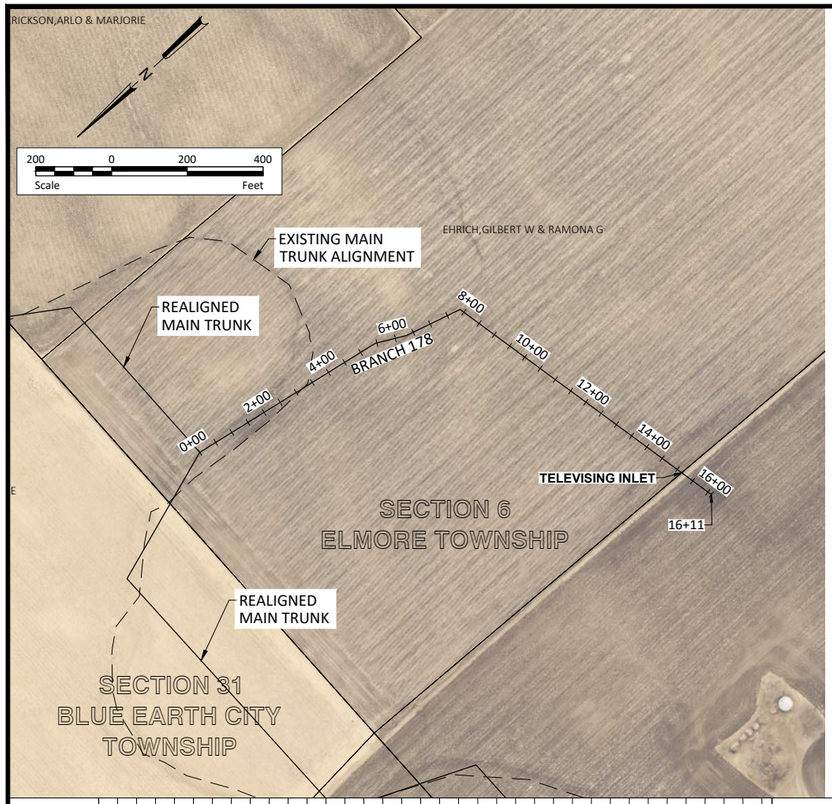

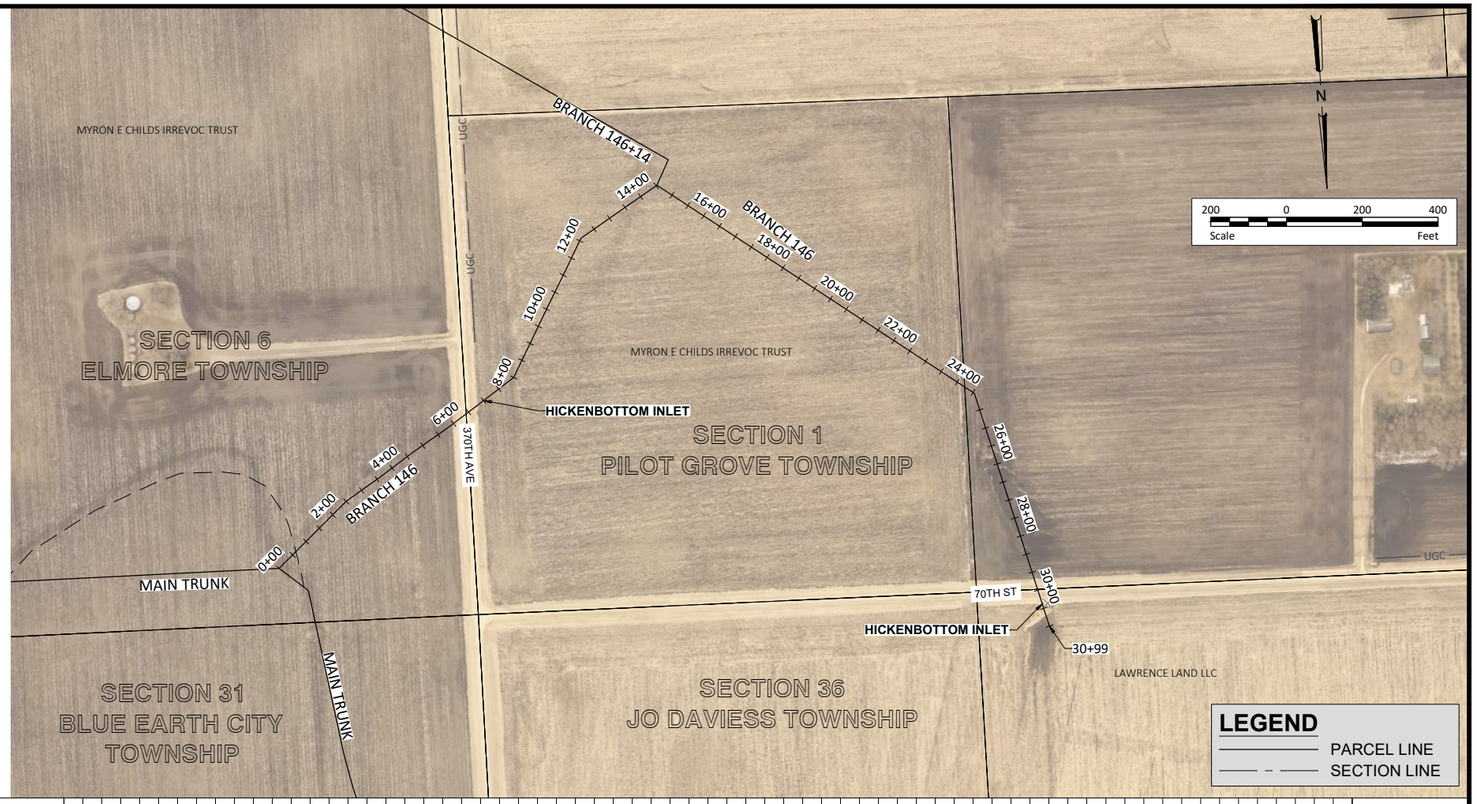

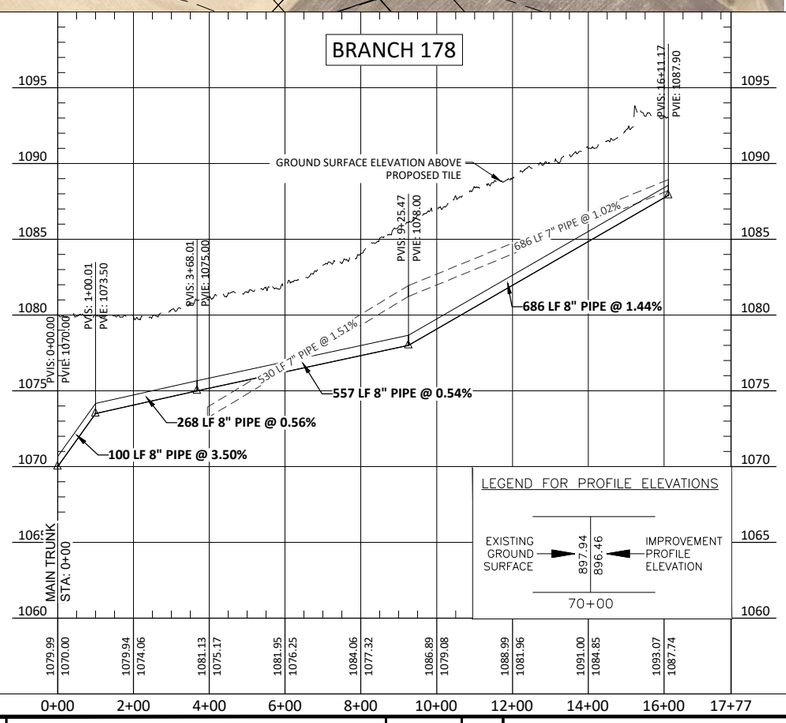

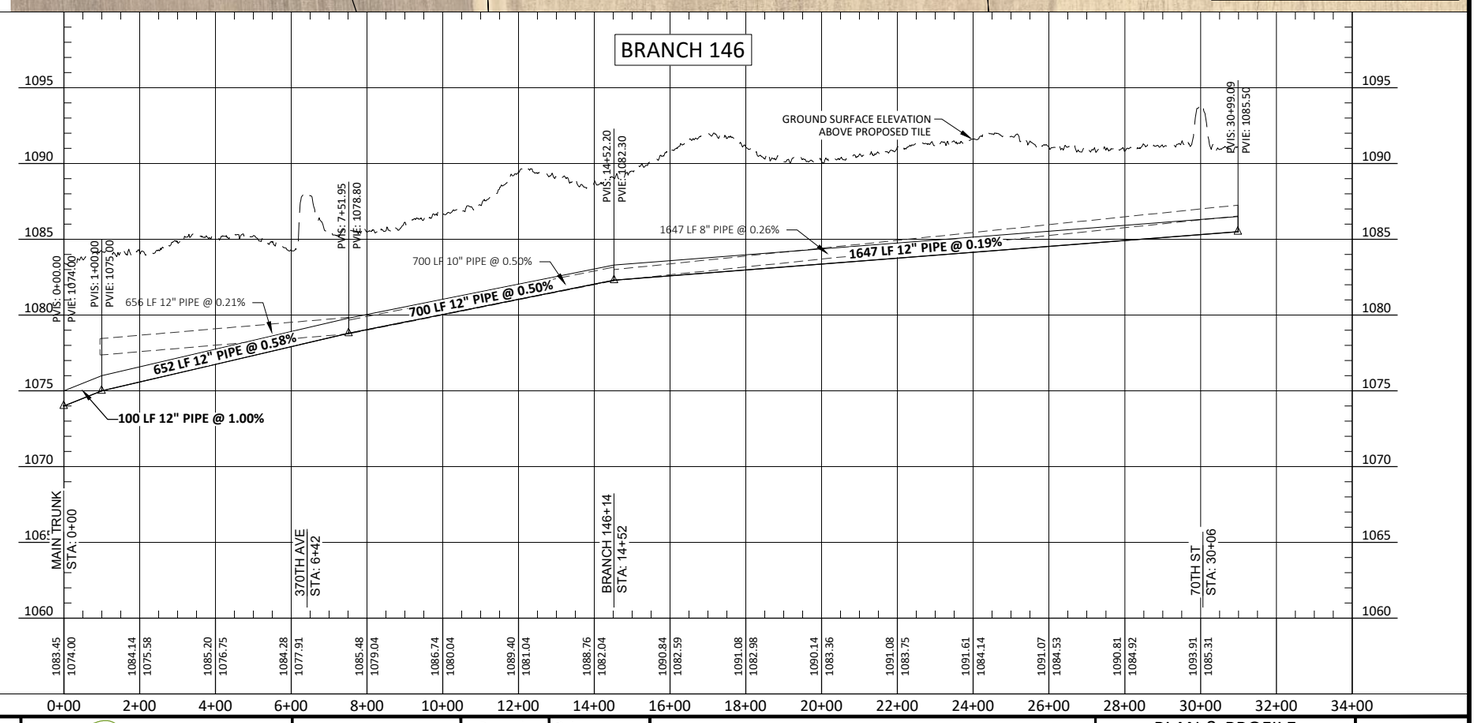

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BRANCHES 178 & 146

PROJECT NO. 6255-0019

SHEET
6 of 15

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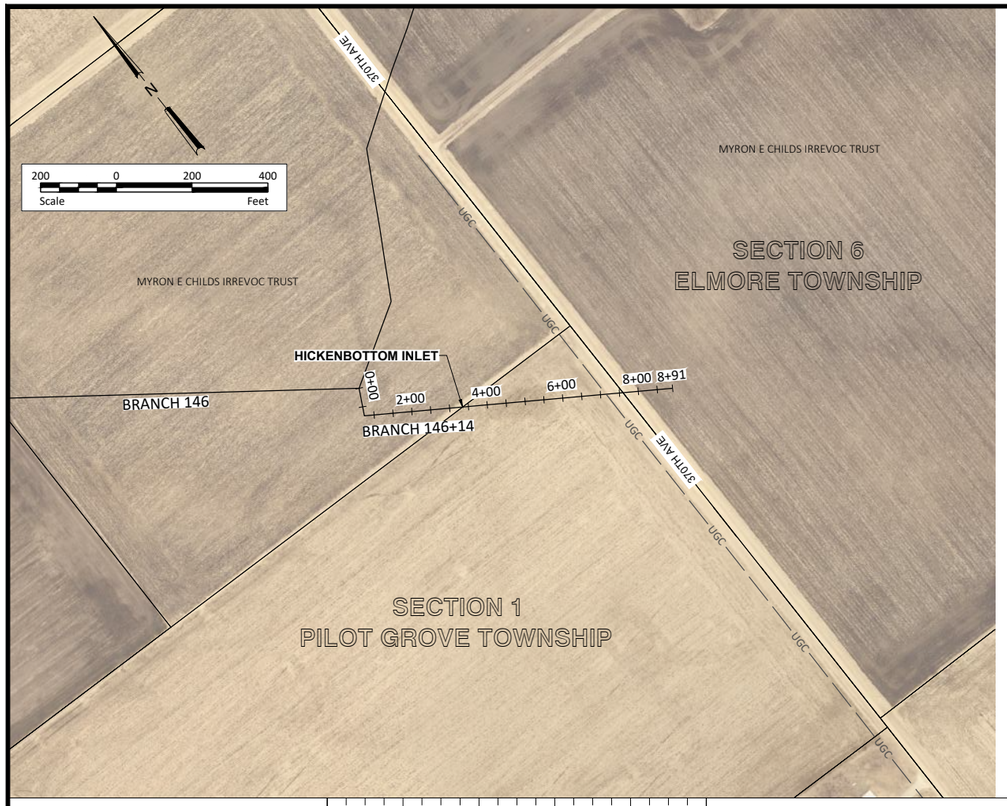

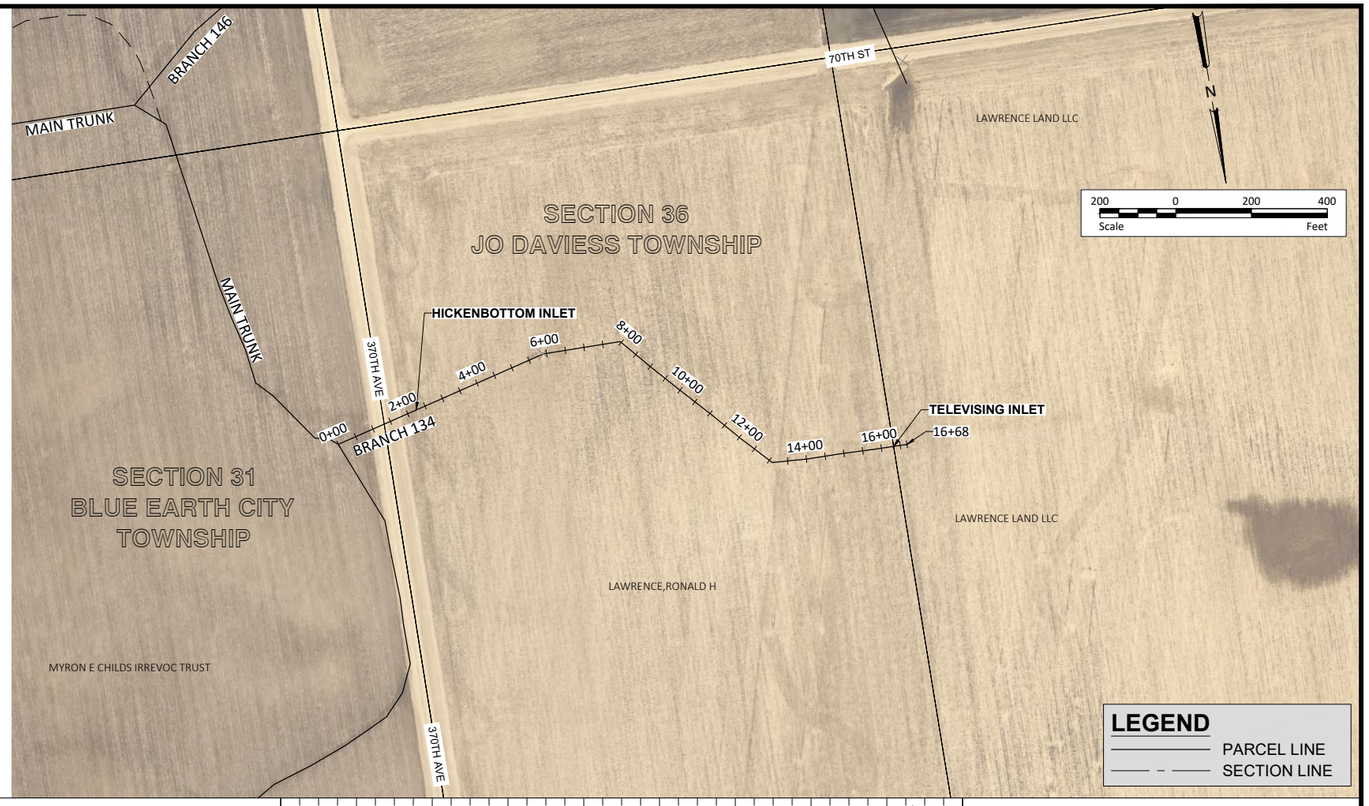

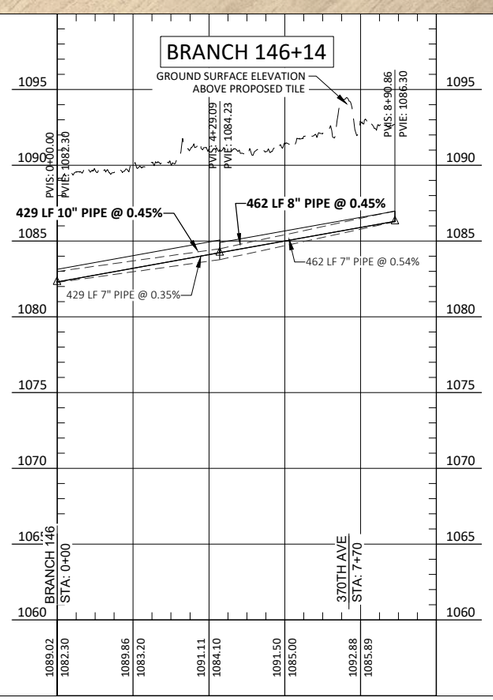

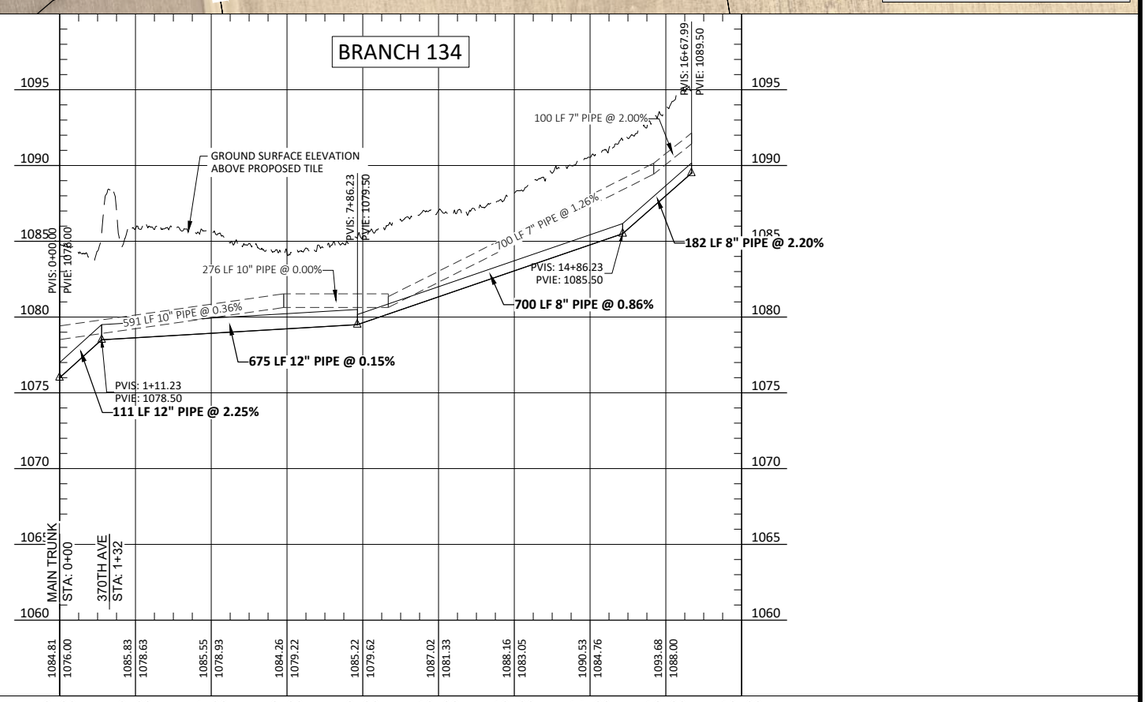

LEGEND FOR PROFILE ELEVATIONS

EXISTING GROUND SURFACE 897.94 / 896.46 IMPROVEMENT PROFILE ELEVATION

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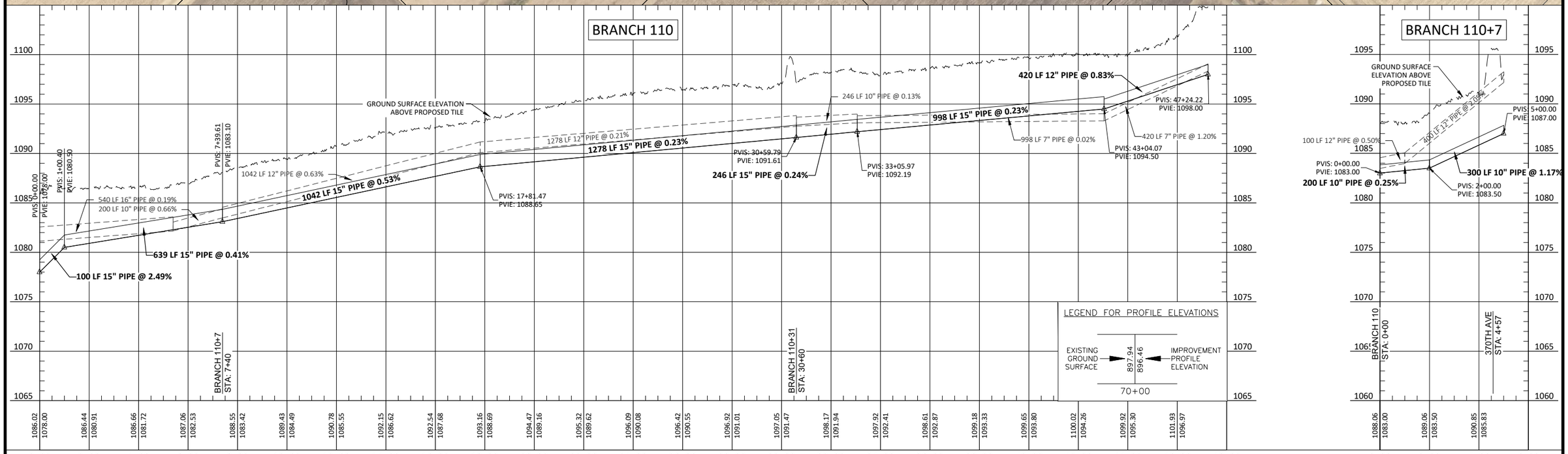
PLAN & PROFILE
BRANCHES 146+14 & 134

PROJECT NO. 6255-0019

SHEET 7 of 15



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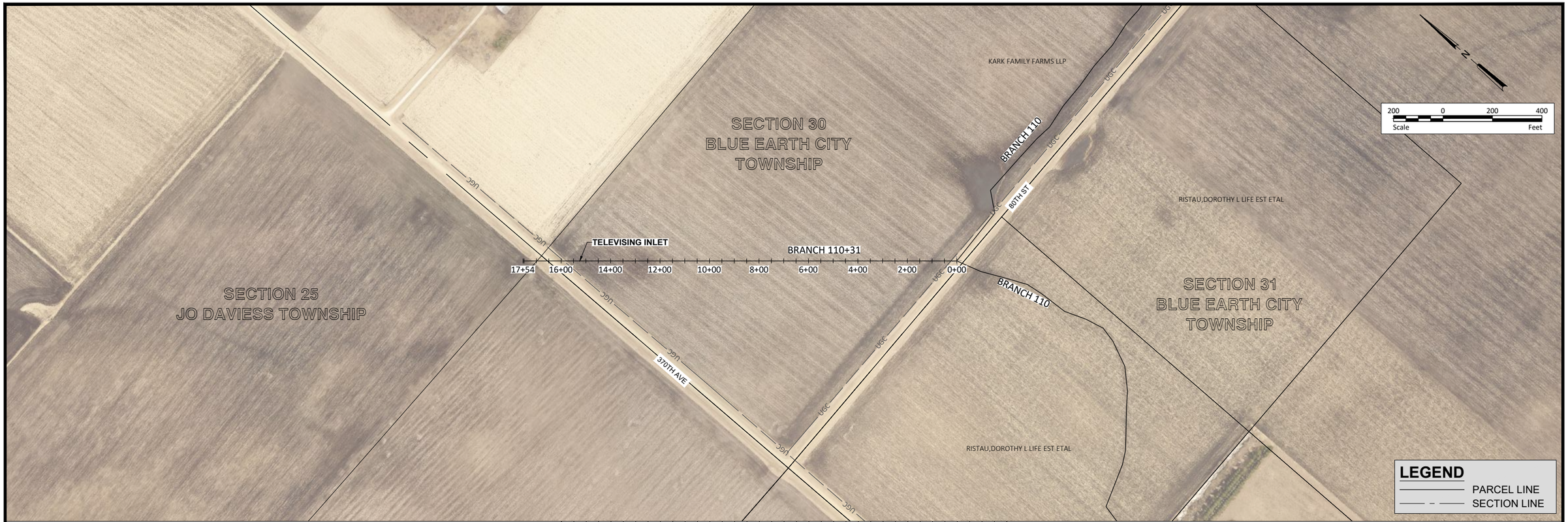
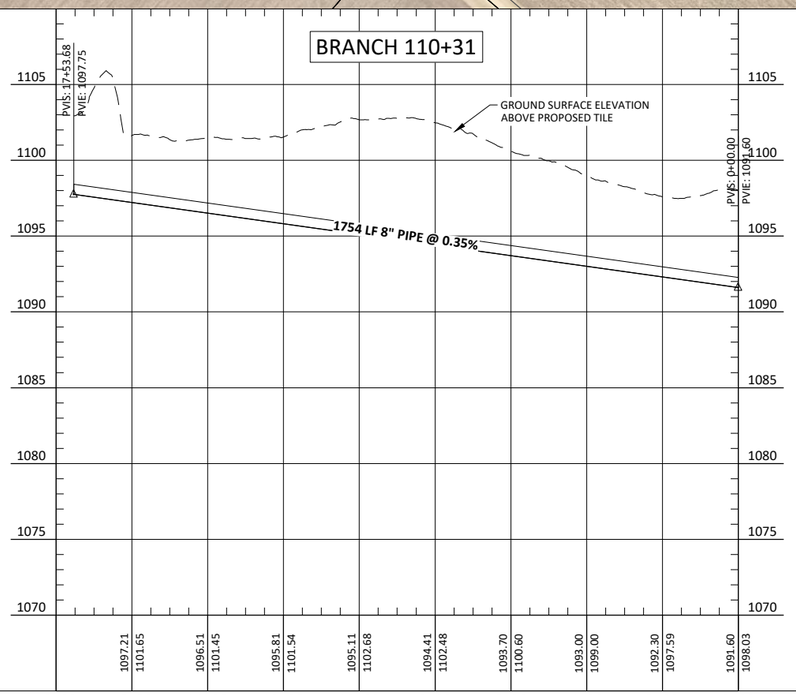
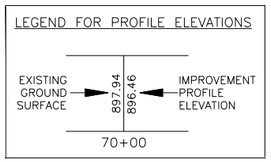
PLAN & PROFILE
BRANCHES 110 & 110+7

PROJECT NO. 6255-0019

SHEET
8 of 15







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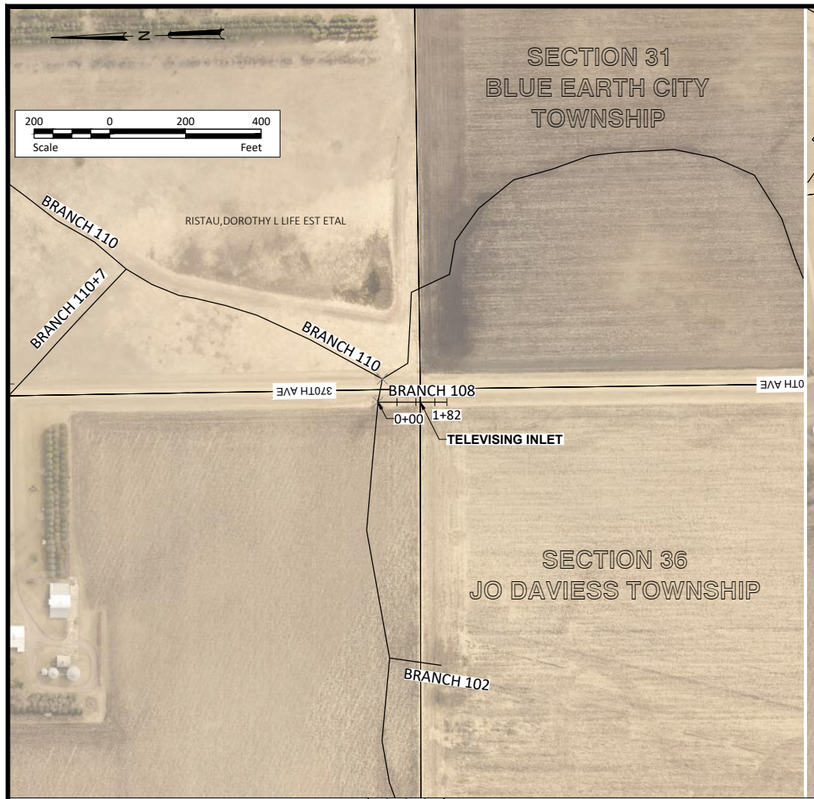
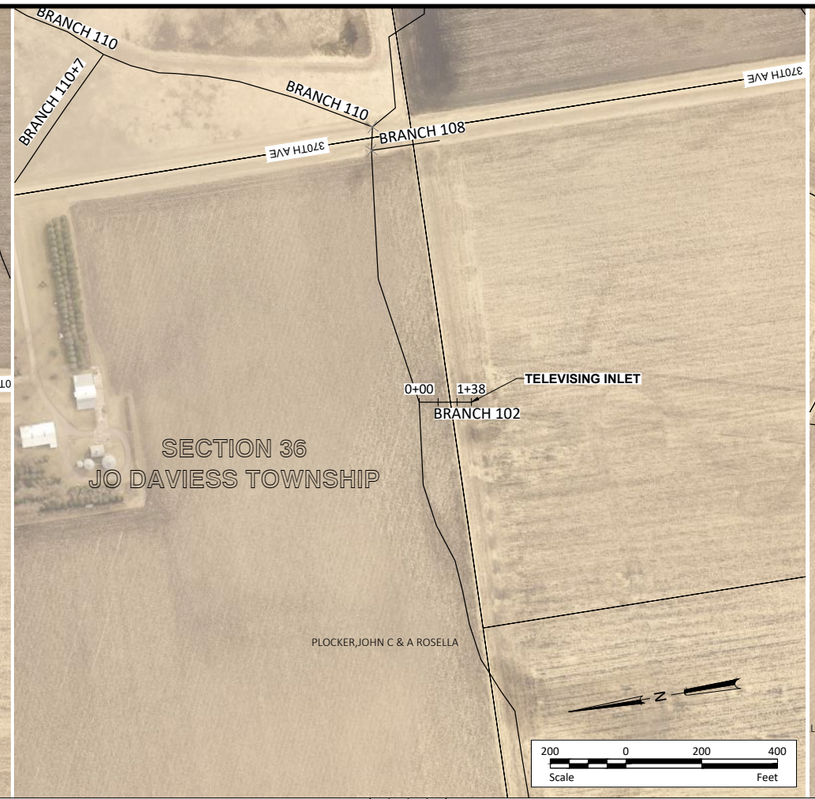
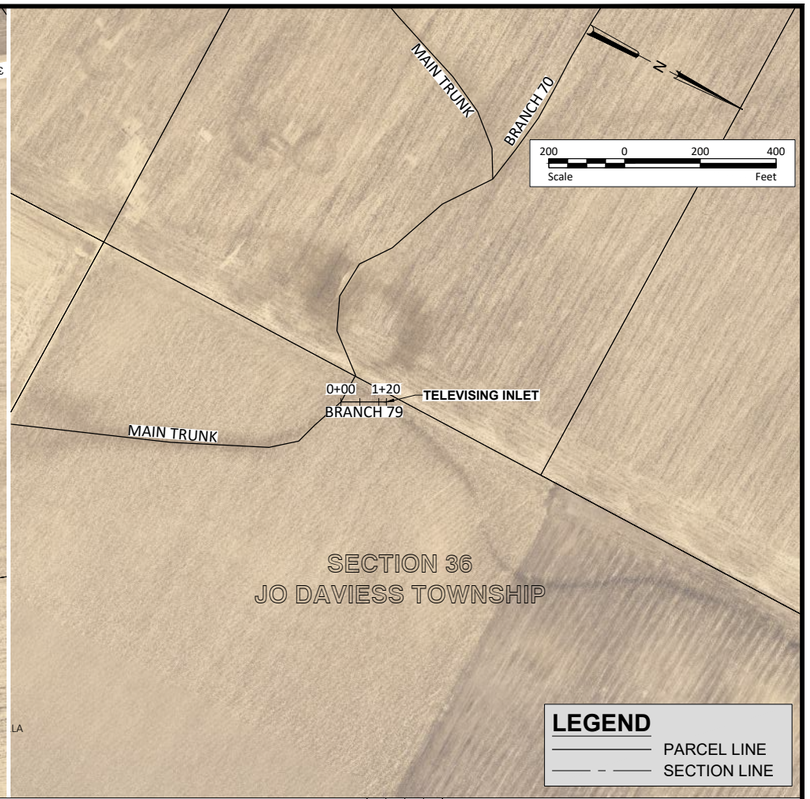
JO DAVIESS, BLUE EARTH CITY, PILOT GROVE, &
ELMORE TWP

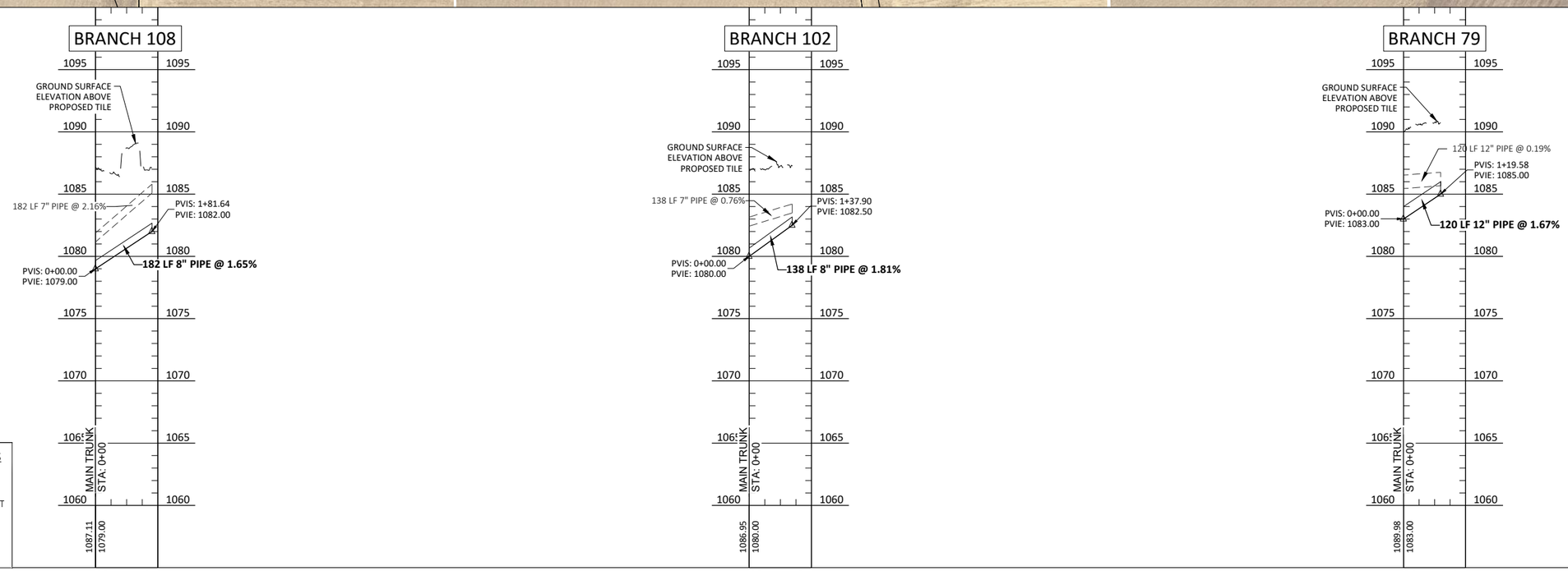
PLAN & PROFILE
BRANCHES 110+31

PROJECT NO. 6255-0019









LEGEND FOR PROFILE ELEVATIONS

EXISTING GROUND SURFACE 897.94 / 896.46 IMPROVEMENT PROFILE ELEVATION

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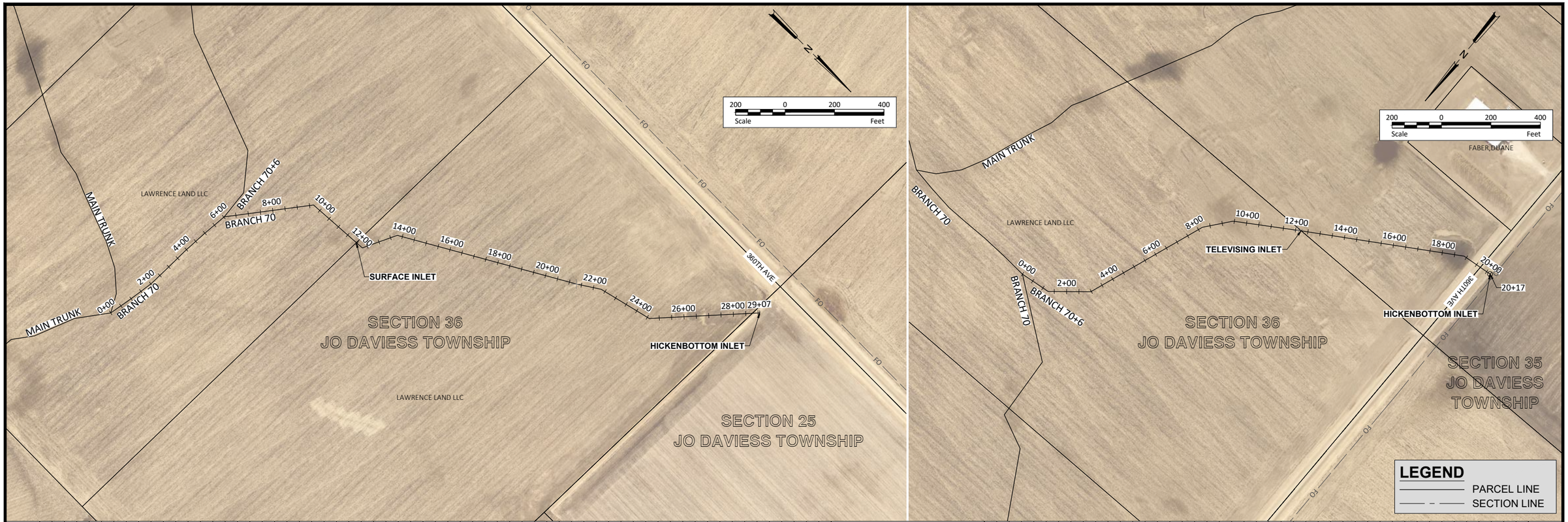
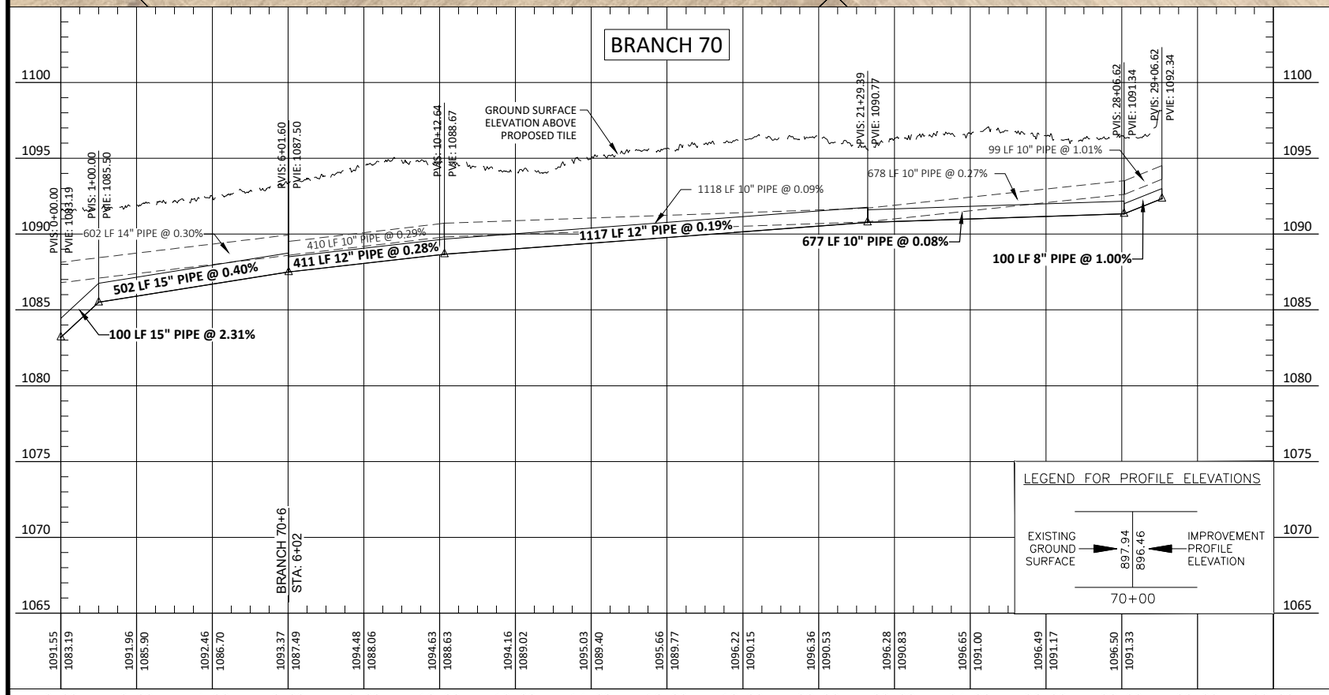
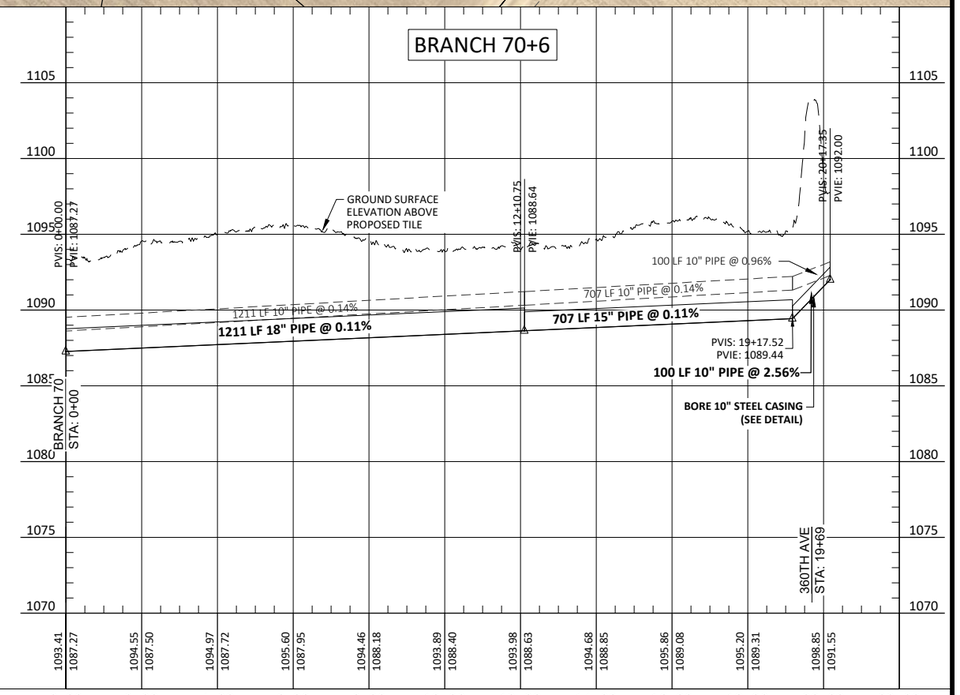
PLAN & PROFILE BRANCHES 108, 102 & 79

PROJECT NO. 6255-0019

SHEET 10 of 15







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FARIBAULT COUNTY DITCH 52
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PLAN & PROFILE
BRANCHES 70 & 70+6

PROJECT NO. 6255-0019

SHEET
11 of 15

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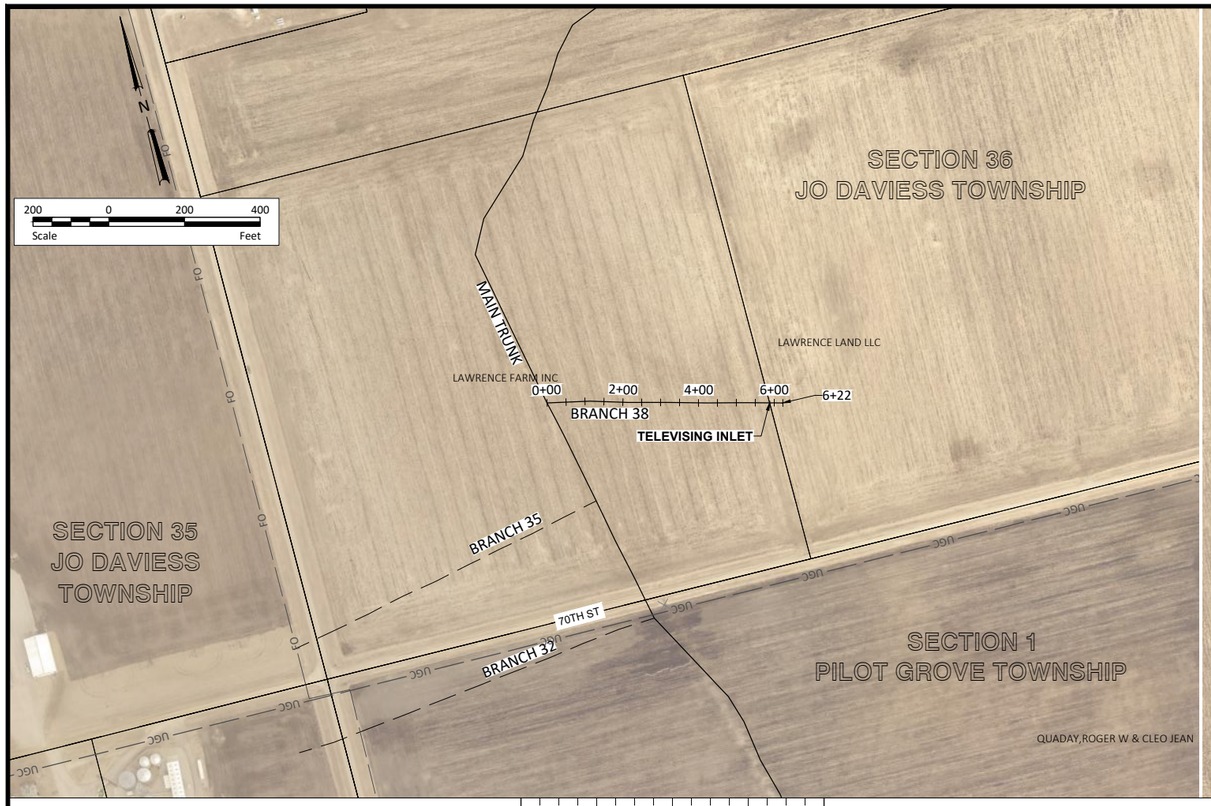

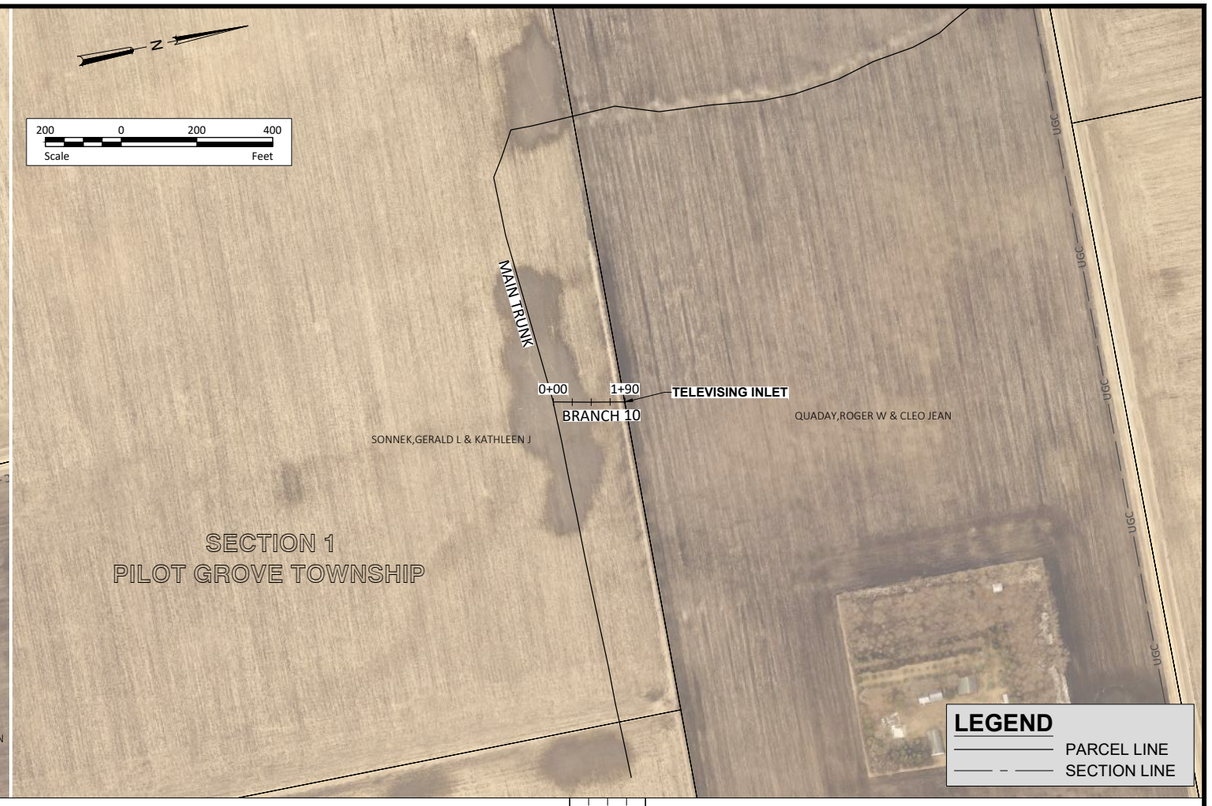

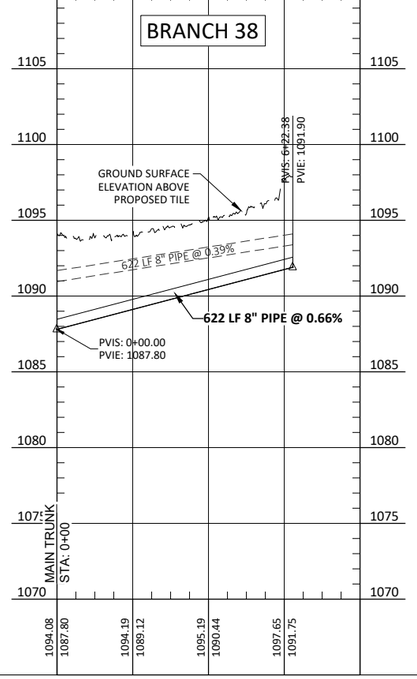

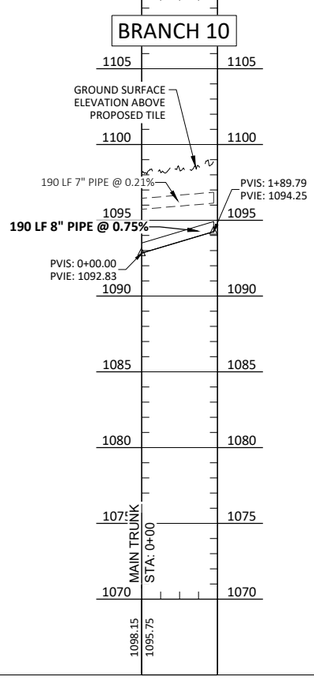

LEGEND FOR PROFILE ELEVATIONS

EXISTING GROUND SURFACE → 897.94 / 896.46 ← IMPROVEMENT PROFILE ELEVATION

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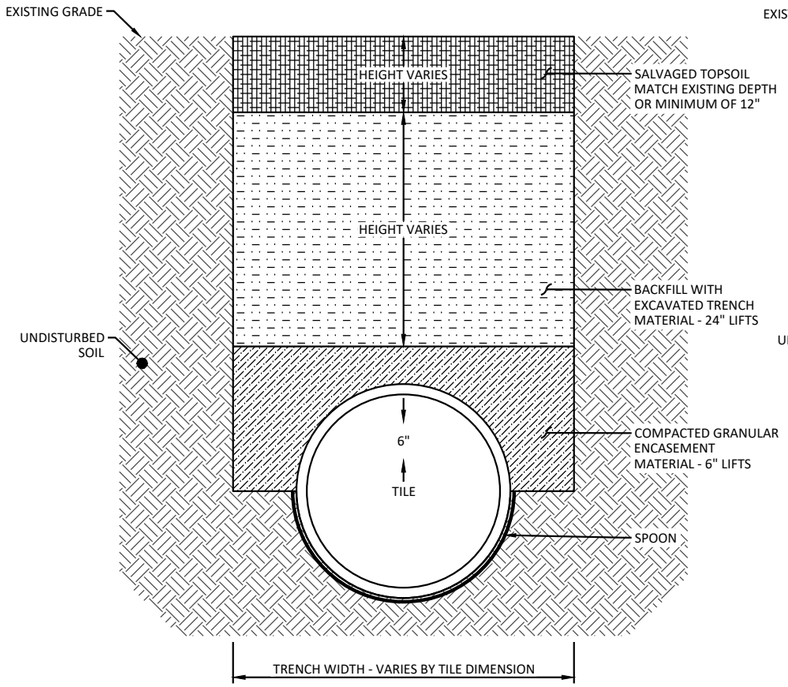
ELMORE TWP

PLAN & PROFILE
BRANCHES 38 & 10

PROJECT NO. 6255-0019

SHEET
12 of 15



NOTE:
WHEN MAXIMUM FILL HEIGHTS IN TABLE 1 ARE EXCEEDED, GRANULAR FOUNDATION MATERIAL MUST BE USED FOR BEDDING AND ENCASEMENT.

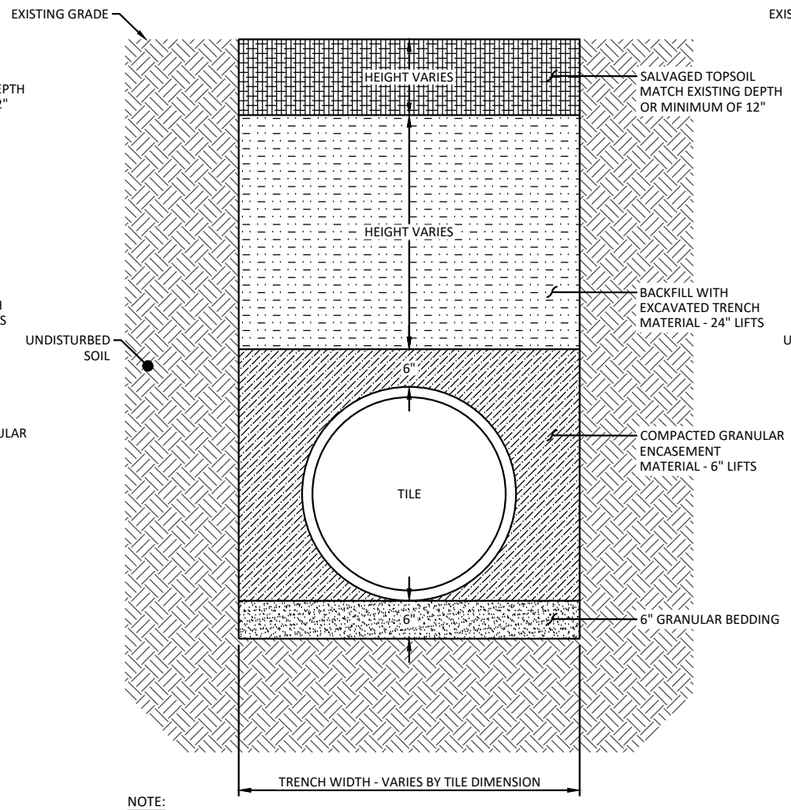
TILE INSTALLATION - SPOON TRENCH

NOT TO SCALE

TABLE 1 - MAXIMUM FILL HEIGHT FOR ROUNDED TRENCH CONSTRUCTION WITH CLASS 2 (GRANULAR ENCASEMENT MATERIAL) (90% SPD COMPACTION)

PIPE DIAMETER (INCHES)	MAXIMUM FILL HEIGHT (FEET)
10	20
12	21
15	20
18	21
24	18
30	19
36	15
42	16
48	14
60	11

USE GRANULAR FOUNDATION MATERIAL (CLASS 1) WHEN MAXIMUM FILL HEIGHTS ARE EXCEEDED.



NOTE:
WHEN MAXIMUM FILL HEIGHTS IN TABLE 2 FOR GRANULAR BEDDING AND ENCASEMENT MATERIAL (CLASS 2) ARE EXCEEDED, GRANULAR FOUNDATION MATERIAL (CLASS 1) MUST BE USED FOR BEDDING AND ENCASEMENT.

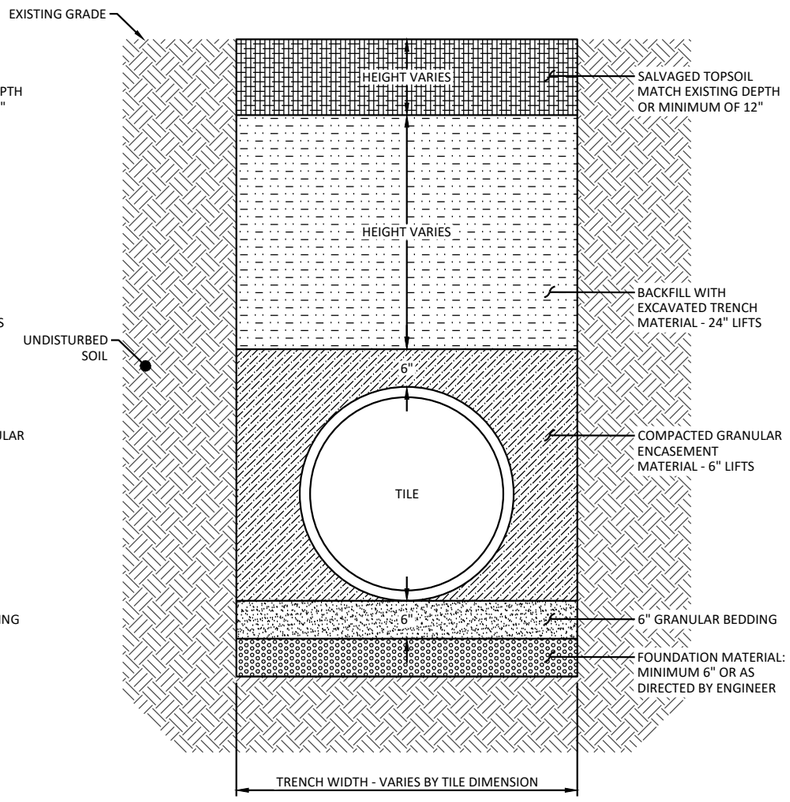
TILE INSTALLATION - RECTANGULAR TRENCH

NOT TO SCALE

TABLE 2 - MAXIMUM FILL HEIGHT FOR RECTANGULAR TRENCH CONSTRUCTION WITH (90% SPD COMPACTION)

PIPE DIAMETER (INCHES)	MAXIMUM FILL HEIGHT (FEET)	
	CLASS 1 FOUNDATION MATERIAL	CLASS 2 GRANULAR BEDDING AND ENCASEMENT MATERIAL
10		
12	39	20
15	42	21
18	36	18
24	31	16
30	33	17
36	32	16
42	32	15
48	48	15
60	34	16

USE GRANULAR FOUNDATION MATERIAL (CLASS 1) WHEN MAXIMUM FILL HEIGHTS ARE EXCEEDED FOR GRANULAR MATERIAL (CLASS 2).



TILE INSTALLATION - RECTANGULAR TRENCH WITH FOUNDATION MATERIAL

NOT TO SCALE

TILE INSTALLATION NOTES:

1. INSTALLATION OF TILE SHALL FOLLOW ASTM D2321.
2. GRANULAR BEDDING AND GRANULAR ENCASEMENT MATERIAL (CLASS 2) SHALL MEET THE REQUIREMENTS OF MNDOT 3149.2F.
3. FOUNDATIONAL MATERIAL SHALL MEET THE REQUIREMENTS IN ASTM D2321 FOR CLASS 1 SOIL (100% CRUSHED ROCK BETWEEN ¾" TO 1-1/2").
4. TRENCH WIDTH AND SPOON TRENCH DIMENSIONS SHALL FOLLOW MANUFACTURER'S RECOMMENDATIONS.
5. ALL PIPE BEDDING MATERIAL, ENCASEMENT MATERIAL AND BACKFILL AND TOPSOIL SALVAGING AND PLACEMENT IS INCIDENTAL TO TILE INSTALLATION.
6. GRANULAR FOUNDATION MATERIAL SHALL BE USED IF UNSUITABLE OR UNSTABLE SOILS ARE PRESENT. THE USE OF FOUNDATION MATERIAL SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT AND WILL BE PAID FOR BY THE CUBIC YARD.
7. USE OF NATIVE SOIL MATERIAL FOR BEDDING OR ENCASEMENT IS NOT ALLOWED.
8. ENCASEMENT MATERIAL MUST BE KNIFED INTO THE HAUNCH OF THE TILE AND IN BETWEEN CORRUGATIONS.
9. ENCASEMENT MATERIAL SHALL BE COMPACTED IN 6" LIFTS AND MEET MANUFACTURER'S COMPACTION REQUIREMENTS.
10. IF TRENCH IS OVER-EXCAVATED WITHOUT PRIOR APPROVAL BY ENGINEER, USE OF GRANULAR BEDDING IS INCIDENTAL.
11. ALL BENDS, FITTINGS, CONNECTIONS, AND TEES SHALL BE BEDDED AND ENCASED IN GRANULAR FOUNDATION MATERIAL, BANDED, AND WRAPPED IN GEOTEXTILE FABRIC. THESE ITEMS ARE INCIDENTAL TO RESPECTIVE BID ITEM.
12. ALL BENDS SHALL BE PRE-FABRICATED BENDS, UNLESS APPROVED BY THE ENGINEER. BENDS LARGER THAN 45° MUST BE CONSTRUCTED WITH MULTIPLE BENDS WITH AT LEAST 10 FEET IN BETWEEN EACH BEND. 45° BENDS SHALL NOT BE USED ON TILE 18 INCHES AND SMALLER.
13. INSTALLED TILE SHOULD BE IMMEDIATELY COVERED BY ENCASEMENT MATERIAL AND COMPACTED PRIOR TO THE INSTALLATION OF ADDITIONAL TILE. A MINIMUM OF 24 INCHES OF BACKFILL MATERIAL SHOULD BE PLACED WHEN THERE IS RISK OF FLOTATION.
14. BACKFILL SHALL BE PLACED SO THAT THE IMPACT OF MATERIAL DOES NOT ALTER THE VERTICAL OR HORIZONTAL POSITION OF THE TILE OR INJURE THE STRUCTURE OF THE TILE MATERIAL.

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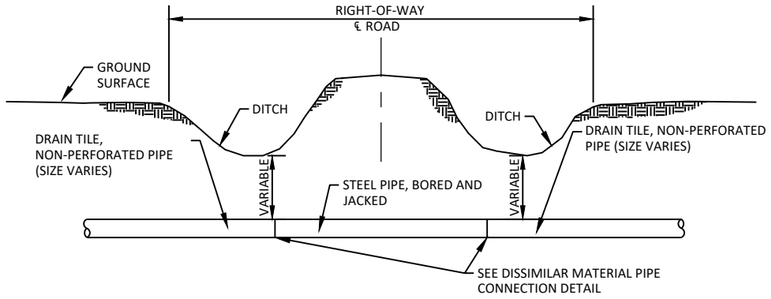
FARIBAULT COUNTY DITCH 52
JO DAVIESS, BLUE EARTH CITY, PILOT GROVE, & ELMORE TWP

DETAILS
PROJECT NO. 6255-0019

SHEET
13 of 15

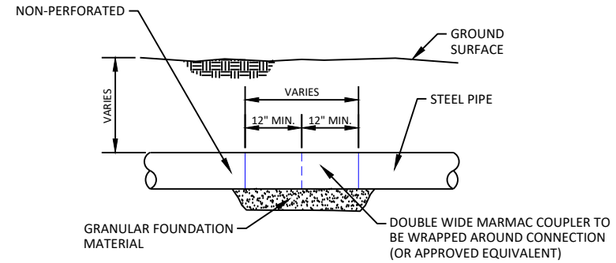


SCH. 40 STEEL PIPE DIMENSIONS				
NOMINAL PIPE SIZE	OUTSIDE DIA. (INCHES)	INSIDE DIAMETER (INCHES)	PIPE WALL THICKNESS (INCHES)	(LBS/FT)
10"	10.75	9.75	0.50	54.786

SOURCE = HTTP://WWW.FRANKBLACKPIPE.COM/UPLOADS/PIPE_WEIGHT_CHART.PDF

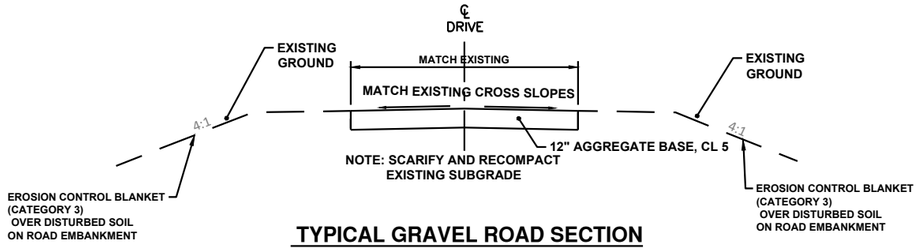
TYPICAL STEEL PIPE CROSSING

NOT TO SCALE



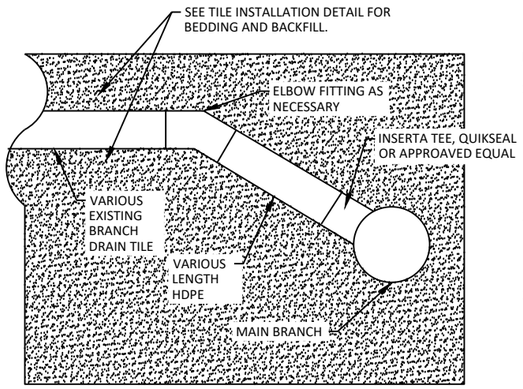
DISSIMILAR MATERIAL PIPE CONNECTION (MARMAC) DETAIL

NOT TO SCALE



TYPICAL GRAVEL ROAD SECTION

NOT TO SCALE



PROFILE VIEW

LATERAL CONNECTION NOTES:

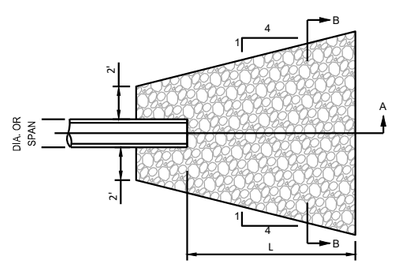
1. TILE CONNECTIONS SHALL BE CONSTRUCTED WITH TILE THE SAME SIZE OR THE NEXT SIZE LARGER THAN THE EXISTING TILE, UNLESS OTHERWISE SPECIFIED OR APPROVED BY THE ENGINEER. HDPE SHALL BE USED FOR THE CONNECTION OF ALL EXISTING PUBLIC TILES AS WELL AS ALL PRIVATE TILES WHERE THE FILL HEIGHT OVER THE PROPOSED TILE IS GREATER THAN 10 FEET. PE SHALL ONLY BE ALLOWED FOR PRIVATE TILE WITH A PROPOSED FILL HEIGHT LESS THAN OR EQUAL TO 10 FEET. (SEE CONNECT TO EXISTING TILE DETAIL).
2. THE CONNECTION OF DISSIMILAR MATERIAL PIPE TYPES SHALL BE BEDDED AND ENCASED IN GRANULAR FOUNDATION MATERIAL AND BE MADE WITH A WATERTIGHT COUPLER APPROVED OF BY THE ENGINEER. THE CONNECTION SHALL BE INCIDENTAL TO TILE INSTALLATION OR LATERAL CONNECTION.
3. ALL BENDS, FITTINGS, CONNECTIONS, AND TEES SHALL BE BEDDED AND ENCASED IN GRANULAR FOUNDATION MATERIAL, BANDED, AND WRAPPED IN GEOTEXTILE FABRIC. THESE ITEMS ARE INCIDENTAL TO RESPECTIVE BID ITEM.

LATERAL CONNECTION DETAIL

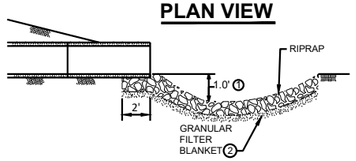
NOT TO SCALE

TABLE OF QUANTITIES
RIPRAP AT TILE OUTLETS

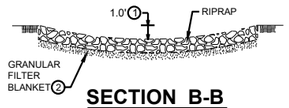
		CLASS II d_{50}= 6"		CLASS III d_{50}= 9"		CLASS IV d_{50}= 12"	
DIA. OF ROUND PIPE (IN.)	L (FT.)	12" DEPTH RIPRAP (CU. YDS.)	6" DEPTH GRANULAR FILTER (CU. YDS.)	18" DEPTH RIPRAP (CU. YDS.)	9" DEPTH GRANULAR FILTER (CU. YDS.)	24" DEPTH RIPRAP (CU. YDS.)	12" DEPTH GRANULAR FILTER (CU. YDS.)
12	8	2.8	1.4	4.1	2.1	5.5	2.8
15	8	2.9	1.5	4.4	2.2	5.8	2.9
18	10	3.9	2.0	5.9	3.0	7.8	3.9
21	10	4.2	2.1	6.3	3.2	8.4	4.2
24	12	5.5	2.8	8.3	4.2	11.0	5.5
27	12	5.8	2.9	8.7	4.4	11.6	5.8
30	14	7.3	3.7	10.9	5.5	14.5	7.3
36	16	9.2	4.6	13.8	6.9	18.3	9.2
42	18	10.9	5.5	16.3	8.2	21.7	10.9
48	20	12.9	6.5	19.4	9.7	25.8	12.9



PLAN VIEW



SECTION A-A



SECTION B-B

NOTES:

① FOR PIPES GREATER THAN OR EQUAL TO 30", USE 1.5'.

② THE CONTRACTOR, AT HIS OPTION, MAY SUBSTITUTE A GEOTEXTILE FABRIC FOR THE GRANULAR FILTER BLANKET UNLESS OTHERWISE SPECIFIED IN THE PLANS. THE FABRIC SHOULD COVER THE AREA OF THE RIPRAP AND EXTEND UNDER THE APRON 3 FT.

RIPRAP AT TILE OUTLETS

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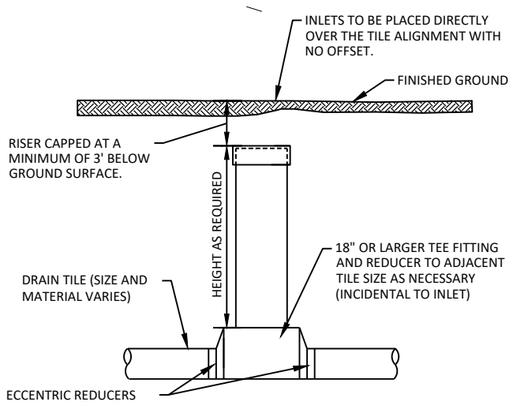
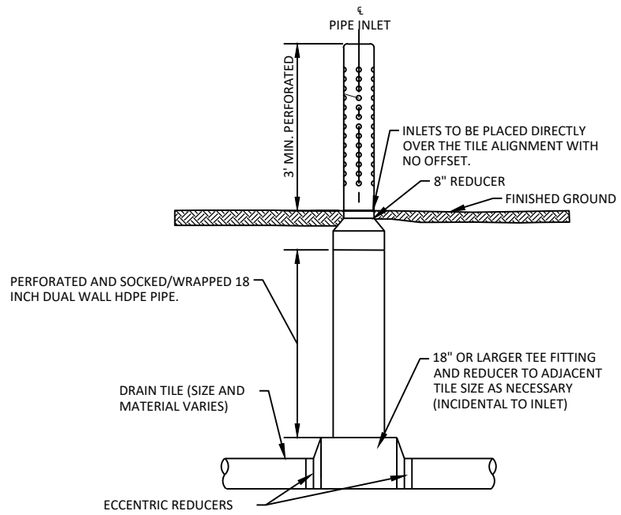
DETAILS
PROJECT NO. 6255-0019

SHEET 14 of 15



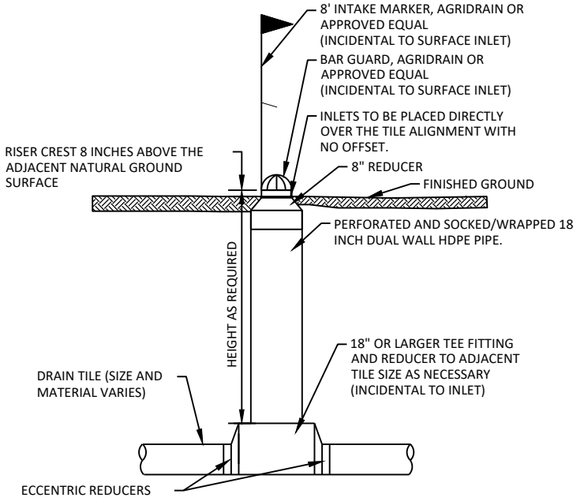
TELEVISING INLET

NOT TO SCALE



HICKENBOTTOM INLET

NOT TO SCALE



SURFACE INLET

NOT TO SCALE

INLET NOTES:

1. INLET LOCATIONS MAY VARY FROM WHAT IS SHOWN ON PLANS. ENGINEER WILL APPROVE LOCATION PRIOR TO INSTALLATION.
2. ALL BENDS, FITTINGS, CONNECTIONS, AND TEES SHALL BE BEDDED AND ENCASED IN GRANULAR FOUNDATION MATERIAL, BANDED, AND WRAPPED IN GEOTEXTILE FABRIC. THESE ITEMS ARE INCIDENTAL TO RESPECTIVE BID ITEM.
3. TELEVISING INLETS SHALL BE CUT DOWN, CAPPED AND BURIED 3 FEET BELOW FINISH GRADE AFTER FINAL TELEVISING AND DIRECTED BY THE ENGINEER.

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DETAILS

PROJECT NO. 6255-0019

SHEET 15 of 15

EXHIBIT E – HYDROLOGIC ANALYSIS SUMMARY

OVERVIEW OF APPROACH

The analysis was performed using XPSWMM (version 2018.2.1) hydrologic modeling software. All modeled scenarios used Curve Number (CN) hydrologic theory, which estimates runoff volumes based on the combination of rainfall input, soil type, and land use at any given location (NRCS TR55). Once runoff volumes are calculated for individual catchments, a hydrograph, which translates the runoff volume into a time-series dataset describing the timing of the runoff from the catchment, is generated. The catchment hydrographs are then routed through the various components of the CD 52 drainage system and other landscape features including tile, culverts, depressional storage, and ground surfaces. The following sections describe how the various inputs were developed.

HYDROLOGIC ANALYSIS

The following inputs are used in the hydrologic portion of the CD 52 analysis. The hydrologic calculations determine the amount of runoff volume and the timing of that runoff generated from specific precipitation events.

PRECIPITATION DEPTHS AND DISTRIBUTION

Rainfall depth amounts were obtained from the Atlas-14 Point Precipitation Frequency database. The rainfall depths, consistent for both existing and proposed model scenarios, are displayed in the table below. The 24-hour storm duration is a commonly used duration for anlayzing watersheds of this size using the NRCS Curve Number method.

Return Period (Years)	Rainfall (inches)
2	3.06
5	3.84
10	4.60
25	5.80
50	6.85
100	8.01

CATCHMENT DELINEATION

The catchment boundaries were delineated by utilizing the CD 52 tile locations along with Light Detection and Ranging (LiDAR) topography. Catchments were delineated to known or assumed surface intake locations along the public drainage system. The XPSWMM model includes a total of 33 catchments, spanning approximately 2,040 acres. Catchment sizes range from approximately 4 acres to 218 acres. The catchment boundaries and inputs are consistent across all scenarios.

CURVE NUMBERS

The Curve Number (CN) inputs were created using 2016 National Land Cover Database (NLCD) Land Use data with Soil Survey Geographic Database (SSURGO) soils data. More specifically, the land use classification and hydrologic soil types were cross referenced with the Natural Resources Conservation Service (NRCS) Technical Release-55 (TR-55) guidance to determine the CN for unique combinations of land use and hydrologic soil group.

In all modeled scenarios, the hydrologic soil groups assigned were assumed as “drained” condition, meaning that soils are assumed to not be saturated and therefore have a higher infiltrability than an undrained condition. A weighted average CN value was assigned to each delineated catchment area.

TIME OF CONCENTRATION

Time of concentration for development of catchment runoff hydrographs was determined using the Velocity Method described in the NRCS National Engineering Handbook. This methodology estimates travel time for a catchment area as the sum of the sheet flow time, shallow concentrated flow time, and open channel flow time, from the hydrologically furthest point to the outlet of an individual catchment. All component travel times are calculated based on the length, slope, and surface roughness of the flow path. Time of concentration inputs are consistent for all modeling scenarios.

Standard runoff depth calculations were performed in the XPSWMM model using the inputs described above. The following table displays the input parameters utilized for the nodes in XPSWMM.

Node Name	Area (acres)	Time of Concentration (minutes)	Pervious Area Curve Number	Total Runoff Depth (in) 2-yr 24-hr
P2	11.13	10.00	78.00	1.10
P3	198.67	196.07	76.00	0.99
P6	82.92	70.86	78.00	1.10
P8	61.74	48.36	77.70	1.08
P12	11.55	10.00	78.30	1.12
P15	51.62	35.20	78.80	1.15
P18	121.47	116.30	77.50	1.07
P19	31.91	21.41	78.00	1.10
P20	23.15	30.25	77.30	1.06
P21	17.52	24.00	77.70	1.08
P22	4.07	10.00	77.70	1.08
P24	62.13	45.00	78.90	1.15

Node Name	Area (acres)	Time of Concentration (minutes)	Pervious Area Curve Number	Total Runoff Depth (in) 2-yr 24-hr
P25	55.18	30.50	76.70	1.03
P26	67.77	32.50	77.30	1.06
P27	5.05	10.00	78.40	1.12
P28	7.62	10.00	78.00	1.10
P29	110.12	75.36	77.90	1.10
P31	3.96	10.00	73.80	0.87
P34	218.82	252.55	78.20	1.11
P38	132.73	59.69	76.80	1.03
P42	10.85	29.00	77.90	1.10
P43	46.02	50.00	79.30	1.18
P44	46.13	46.87	78.10	1.11
P45	23.70	25.00	77.90	1.10
P49	34.75	25.89	77.00	1.04
P52	87.55	79.41	77.00	1.04
P53	21.70	37.28	80.50	1.25
P101	68.65	50.00	75.20	0.95
P106	34.04	18.00	78.00	1.10
P105	128.94	65.20	77.70	1.08
P102	116.99	122.53	75.20	0.95
P103	119.72	75.74	77.60	1.08
P104	22.46	14.00	78.00	1.10

HYDRAULIC ANALYSIS

Once hydrologic calculations are completed in the XPSWMM model, the runoff volume is routed through the network of storage areas, tile, and overflow links to the CD 52 outlet.

STORAGE NODES

Numerous surface depressional storage areas are incorporated to represent the temporary ponding that occurs on the landscape once runoff is generated in the hydrologic calculations. Stage-area relationship tables were developed using LiDAR data for natural surface basins and the upstream sides of road crossings. The stage-area inputs are consistent for all of the modeled scenarios.

The modeling options were not set to account for infiltration or evaporation within storage nodes during temporary ponding as the duration is limited to several days and does not represent a substantial volume. During ponding, the underlying soils become saturated and limited

infiltration will occur. What infiltration does occur in this timeframe is going to be similar for both existing and proposed conditions. With this methodology, the overall runoff volume delivered to the outlet is identical for all analyzed conditions. Only the timing of the runoff volume is altered due to modifications made to the pipes and other links that convey runoff to the outlet.

To verify the minimal infiltration potential within surface ponding during the timeframe of the model, a sensitivity analysis was performed at several storage nodes to determine the potential infiltration volume for ACSIC and improvement modeling scenarios. A static infiltration rate of 0.1 inch per hour (based on the Hydrologic Soil Group “C” soils) was used regardless of depth or duration of ponding, ignoring potential saturation limits and water table levels. The infiltration rate is multiplied by ponded surface area for each timestep to produce a volume of water infiltrated over the full hydrograph. Based on the calculations, there is an estimated 3% reduction in total infiltrated volume between the ACSIC and improvement scenarios due to the decreased ponded duration for the proposed improvement conditions. This volume is over the entire hydrograph which occurs over a relatively short time period with the modeling set to run over a 20 day time period. Ponded areas show flooding durations from 2 days to 2 weeks depending on event, location, and modeling scenario. This basic analysis of infiltration does not account for the availability of subsurface storage in the soil profile or the potential for infiltrated water to be intercepted by perforated tile systems. Both items would further reduce the volume difference between modeling scenarios. More detailed analysis of a potential infiltration volume at surface ponding locations is not warranted due to its expected minor impact on results and overall uncertainty created by modeling a complex interaction between surface runoff, groundwater and tile systems.

PIPES

The CD 52 tile and several culverts at roadway crossings were simulated in XPSWMM as pipes. No private tile has been incorporated into the modeling. It is assumed that runoff generated can enter CD 52 tile without limitation from inlet capacity. Once tiles are at capacity, the temporary storage from storage nodes is utilized.

Tile dimensions and inverts in the existing modeling scenario were obtained from a combination of field survey or the original design plans and were modified to reflect the improvement design in the proposed conditions modeling scenarios. Culvert data was either estimated or obtained from field survey. Existing condition drain tile was modeled using a roughness coefficient of 0.014. Proposed conditions drain tile was modeled using a roughness coefficient of 0.012 based on material supplier recommendation.

CHANNELS

When the pipe capacity is exceeded and water levels in storage nodes reach an overflow elevation, additional links were added to represent surface conveyance. Locations of necessary overflow channels were determined from review of LiDAR topographic data combined with surcharge locations within the pipe system of the model. Inverts and lengths of the channel links

were derived in GIS. Channel geometries are represented by a trapezoidal-shaped channel with a bottom width of 10 feet and a channel side slope of 1:50. Roughness was assumed to be 0.035 for row crop surfaces.

The potential for double counting of temporary storage where storage nodes overlap surface channels was eliminated by modifying the surface channel within the footprint of the temporary storage represented in storage nodes.

WEIRS

Weirs are also used to allow storage areas to spill into adjacent nodes or storage areas when water levels in storage nodes reach an overflow elevation. These weir overflow elevations were determined using GIS tools to analyze the storage depressions. Weirs in the models are generally oversized (sharp-crested with a length of approximately 100 feet) to allow transfer of water from one storage node to another. They were used in locations where distances between nodes were relatively short and it was determined not to be necessary to account for the travel time between these nodes. Weirs and channels are identical between existing and proposed conditions modeling.

CONTINUITY ERROR

The overall continuity error for each modeled scenarios is less than 1%. The largest continuity error for any individual node is 0.6%.

EXHIBIT F – OPINION OF PROBABLE COST

REPAIR COST

Item	Item Description	Unit	Quantity	Unit Cost	Extension
1	MOBILIZATION	LUMP SUM	1	$65,000.00	$65,000.00
2	WATER CONTROL	LUMP SUM	1	$25,000.00	$25,000.00
3	6" TILE	LIN FT	1,012	$15.00	$15,180.00
4	8" TILE	LIN FT	9,113	$20.00	$182,260.00
5	10" TILE	LIN FT	8,707	$21.00	$182,847.00
6	12" TILE	LIN FT	3,936	$22.00	$86,592.00
7	15" TILE	LIN FT	891	$24.00	$21,384.00
8	18" TILE	LIN FT	3,900	$30.00	$117,000.00
9	24" TILE	LIN FT	3,932	$42.00	$165,144.00
10	30" TILE	LIN FT	10,060	$60.00	$603,600.00
11	HICKENBOTTOM SURFACE INLET	EACH	10	$1,200.00	$12,000.00
12	STANDARD SURFACE INLET	EACH	8	$1,000.00	$8,000.00
13	TELEVISING INLET	EACH	13	$1,500.00	$19,500.00
14	4-8" - CONNECT TO EXISTING TILE	EACH	80	$600.00	$48,000.00
15	10-15" - CONNECT TO EXISTING TILE	EACH	20	$1,200.00	$24,000.00
16	TRAFFIC CONTROL	LUMP SUM	1	$5,000.00	$5,000.00
17	OPEN CUT GRAVEL ROADWAY	EACH	10	$4,000.00	$40,000.00
18	JACK AND BORE 10” STEEL CASING	LIN FT	80	$300.00	$24,000.00
19	RIP RAP	CU YDS	10	$100.00	$1,000.00
20	SEEDING AND MULCH	ACRES	8	$2,000.00	$16,000.00
		CONSTRUCTION ESTIMATE			$1,661,507.00
		CONTIGENCY		20%	$332,300.00
		CONSTRUCTION SUBTOTAL			$1,993,807.00
	Temporary Damages (acre)		97.7	625.00	$61,062.50
		Engineering (Reports and Specifications)		5%	$83,075.35
		Viewing		0.50%	$8,307.54
		Televising $0.75 per LF		40,539	$30,404.25
		Legal and Administrative		1%	$16,615.07
		Construction Management		11%	$182,765.77
		TOTAL			$2,376,037.48

IMPROVEMENT COST

Item	Item Description	Unit	Quantity	Unit Cost	Extension
1	MOBILIZATION	LUMP SUM	1	$65,000.00	$65,000.00
2	WATER CONTROL	LUMP SUM	1	$25,000.00	$25,000.00
3	8” TILE	LIN FT	6,954	$20.00	$139,080.00
4	10” TILE	LIN FT	1,706	$21.00	$35,826.00
5	12” TILE	LIN FT	7,943	$22.00	$174,746.00
6	15” TILE	LIN FT	5,613	$24.00	$134,712.00
7	18” TILE	LIN FT	1,427	$30.00	$42,810.00
8	24” TILE	LIN FT	3,294	$42.00	$138,348.00
9	30” TILE	LIN FT	1,522	$60.00	$91,320.00
10	36” TILE	LIN FT	3,112	$72.00	$224,064.00
11	42” TILE	LIN FT	8,582	$100.00	$858,200.00
12	HICKENBOTTOM SURFACE INLET	EACH	10	$1,200.00	$12,000.00
13	STANDARD SURFACE INLET	EACH	8	$1,000.00	$8,000.00
14	TELEVISING INLET	EACH	13	$1,500.00	$19,500.00
15	4-8” – CONNECT TO EXISTING TILE	EACH	80	$600.00	$48,000.00
16	10-15” – CONNECT TO EXISTING TILE	EACH	20	$1,200.00	$24,000.00
17	TRAFFIC CONTROL	LUMP SUM	1	$5,000.00	$5,000.00
18	OPEN CUT GRAVEL ROADWAY	EACH	10	$4,000.00	$40,000.00
19	JACK AND BORE 10” STEEL CASING	LIN FT	80	$300.00	$24,000.00
20	RIP RAP	CUBIC YARDS	10	$100.00	$1,000.00
21	SEEDING AND MULCH	ACRES	8	$2,000.00	$16,000.00
			CONSTRUCTION ESTIMATE		$2,126,606.00
			CONTIGENCY	20%	$425,300.00
			CONSTRUCTION SUBTOTAL		$2,551,906.00
		Temporary Damages (acre)	97.2	625.00	$60,750.00
			Engineering (Reports and Specifications)	5%	$106,330.30
			Viewing	0.50%	$10,633.03
			Televising $0.75 per LF	40,153	$30,114.75
			Legal and Administrative	1%	$21,266.06
			Construction Management	11%	$233,926.66
			TOTAL		$3,014,926.80

IMPROVEMENT WITH STORAGE COST

Item	Item Description	Unit	Quantity	Unit Cost	Extension
	TILE IMPROVEMENT (½-INCH DRAINAGE COEFFICIENT DESIGN)				
1	MOBILIZATION	LUMP SUM	1	$65,000.00	$65,000.00
2	WATER CONTROL	LUMP SUM	1	$25,000.00	$25,000.00
3	8" TILE	LIN FT	6,954	$20.00	$139,080.00
4	10" TILE	LIN FT	1,706	$21.00	$35,826.00
5	12" TILE	LIN FT	7,943	$22.00	$174,746.00
6	15" TILE	LIN FT	4,874	$24.00	$116,976.00
7	18" TILE	LIN FT	1,427	$30.00	$42,810.00
8	24" TILE	LIN FT	3,294	$42.00	$138,348.00
9	30" TILE	LIN FT	1,522	$60.00	$91,320.00
10	36" TILE	LIN FT	9,192	$72.00	$661,824.00
11	42" TILE	LIN FT	2,502	$100.00	$250,200.00
12	HICKENBOTTOM SURFACE INLET	EACH	10	$1,200.00	$12,000.00
13	STANDARD SURFACE INLET	EACH	7	$1,000.00	$7,000.00
14	TELEVISING INLET	EACH	13	$1,500.00	$19,500.00
15	4-8" – CONNECT TO EXISTING TILE	EACH	80	$600.00	$48,000.00
16	10-15" – CONNECT TO EXISTING TILE	EACH	20	$1,200.00	$24,000.00
17	TRAFFIC CONTROL	LUMP SUM	1	$5,000.00	$5,000.00
18	OPEN CUT GRAVEL ROADWAY	EACH	10	$4,000.00	$40,000.00
19	JACK AND BORE 10" STEEL CASING	LIN FT	80	$300.00	$24,000.00
20	RIP RAP	CUBIC YARDS	10	$100.00	$1,000.00
21	SEEDING AND MULCH	ACRES	8	$2,000.00	$16,000.00
	CONSTRUCTION SUBTOTAL – TILE IMPROVEMENT				$1,937,630.00
			CONTIGENCY	20%	$387,500.00
			CONSTRUCTION SUBTOTAL		$2,325,130.00
	Temporary Damages (acre)		95.5	$625.00	$59,687.50
	Engineering (Reports and Specifications)			5%	$96,881.50
			Viewing	0.50%	$9,688.15
			Televising $0.75 per LF	39414	$29,560.50
			Legal and Administrative	1%	$19,376.30
			Construction Management	11%	$213,139.30
			TILE IMPROVEMENT TOTAL		$2,753,463.25

WETLAND RESTORATION					
1	MOBILIZATION	LS	1	$15,000.00	$15,000.00
2	DEMOLITION AND CLEARING	LS	1	$2,000.00	$2,000.00
3	EXCAVATION/BORROW FOR EMBANKMENT (CV)	CY	5,722	$5.00	$28,610.00
4	EMBANKMENT CLAY CORE (BORROW) (CV)	CY	1,922	$30.00	$57,660.00
5	RIPRAP	CY	40	$100.00	$4,000.00
6	OUTLET STRUCTURE	LS	1	$7,500.00	$7,500.00
7	SEEDING AND MULCH	AC	5	$2,000.00	$10,000.00
			CONSTRUCTION SUBTOTAL		$124,770.00
			CONTIGENCY	20%	$24,954.00
			CONSTRUCTION SUBTOTAL		$149,724.00
			Engineering (Reports and Specifications)		$20,000.00
			Legal and Administrative		$5,000.00
			Construction Management	10%	$12,477.00
			WETLAND RESTORATION IMPROVEMENT TOTAL		$187,201.00
			TOTAL ALTERNATIVE COST		**$2,940,664.25**

EXHIBIT G – NATIONAL WETLAND INVENTORY

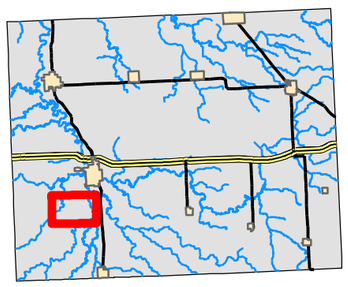
N

353RD AVE
85TH ST
RIVER RD
385TH AVE
80TH ST
347TH AVE
370TH AVE
377TH AVE
70TH ST
350TH AVE

27
26
25
30
29
34
35
36
31
32
9
2
1
6

Branch 110+31
Branch 110
Branch 70
Branch 79
Branch 70+6
Branch 110+7
Branch 102
Branch 108
Main Trunk
Branch 134
Branch 38
Branch 35
Branch 32
Branch 146
Branch 146+14
Branch 178
Main Trunk
Branch 10
Blue Earth River

Watershed
Existing Tile Alignment
Public Waters
National Wetland Inventory



Location in Faribault County

0 1,000 2,000
Feet

Exhibit G - NWI

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

Houston Engineering Inc.

EXHIBIT H – REQUEST FOR EXTERNAL FUNDING

Technical Memorandum

To: Nate Carr
SWCD Program Administrator

From: Joe Lewis, PE
Houston Engineering, Inc.

Cc: Merissa Lore
Drainage Inspector

Subject: County Ditch 52 Improvement

Date: December 9, 2021

INTRODUCTION

This memorandum is regarding the potential improvement of the Faribault County Ditch 52 (CD 52) drainage system. The petitioned project will increase capacity of the drainage system allowing for increased utilization of lands within the drainage system's watershed. The location and extents of CD 52 are shown in **Figure 1**. The system is generally located 3 miles south and 1 mile west of the City of Blue Earth in portions of Jo Daviess, Blue Earth City, Pilot Grove and Elmore Townships. The watershed area of CD 52 is approximately 2,000 acres and outlets into an unnamed tributary to the Blue Earth River approximately ½ mile west of the river. The CD 52 system was originally established in 1916 and consists of tile for its entire length of approximately 7.7 miles. The Main Trunk is approximately 3.9 miles and the remaining 3.8 miles is on 12 laterals. The system currently provides an 1/8-inch drainage coefficient, and the proposed improvement is considering increasing it to ½-inch. The tile will also be deepened to provide additional cover over the pipe which is shallow in several areas.

In accordance with Minn. Stat. § 103E.015, Subd. 1a., the Engineer on behalf of the Faribault County Drainage Authority must investigate the potential use of external sources of funding to facilitate the purposes of Minn. Stat. § 103E.011, subd. 5., which are for wetland preservation or restoration, or creation of water quality improvements or flood control. This memorandum is part of the early coordination effort required in Minn. Stat. § 103E.015 for identification of potential external sources of funding and technical assistance from the SWCD.

COORDINATION

As you know, incorporating measures would require voluntary landowner participation and be subject to the timing of the availability of the funding to coincide with a potential improvement project. As an initial step in coordination with the SWCD, the Drainage Authority is requesting that the SWCD consider providing responses on the following items:

- Are funds currently available to implement measures in the CD 52 watershed, for the purposes of wetland preservation or restoration, creation of water quality improvements or flood control?
- If so, is the SWCD interested in and able of obtain additional external funds to implement measures in the CD 52 watershed?

If funding is or will be available:

- Has the SWCD been engaged with landowners draining to this system regarding BMP implementation?
- What is the potential amount of external funding?
- What are the schedule constraints to acquire and expend external funding?
- What types of measures does the SWCD think are suitable and appropriate?
- Are there advantages to incorporating these measures into the CD 52 improvement rather than completing them independently.

As part of the development of a Preliminary Engineer's Report (PER), Houston Engineering Inc. (HEI) is currently evaluating the proposed improvement project's environmental effects on land use, flooding, wetlands, water quality, fish and wildlife resources, and groundwater as required by Minn. Stat. § 103E.015, Subd. 1. There may be measures incorporated into the improvement project for the purpose of mitigating adverse effects on any of the items.

Measures beyond those that mitigate adverse effects and are to preserve or restore wetlands, improve water quality or install flood control measures are not likely to show direct benefit to the benefiting landowners on the system and therefore cannot be included in the drainage system project unless external funding is provided. Project costs assessed to the drainage system landowners must benefit them. It is through this lens that the SWCD should consider this request for external funding.

The PER is expected to be completed in early 2022 followed by a Public Hearing. Should a Final Engineers Report (FER) be ordered, it will likely be completed in mid-2022 and again be followed by a Public Hearing. The SWCD is welcome to attend either hearing to provide information on the availability of external funding or technical assistance. We are also available for meeting to review and discuss the project in more detail. We will follow-up with a phone call to discuss with you in greater detail.

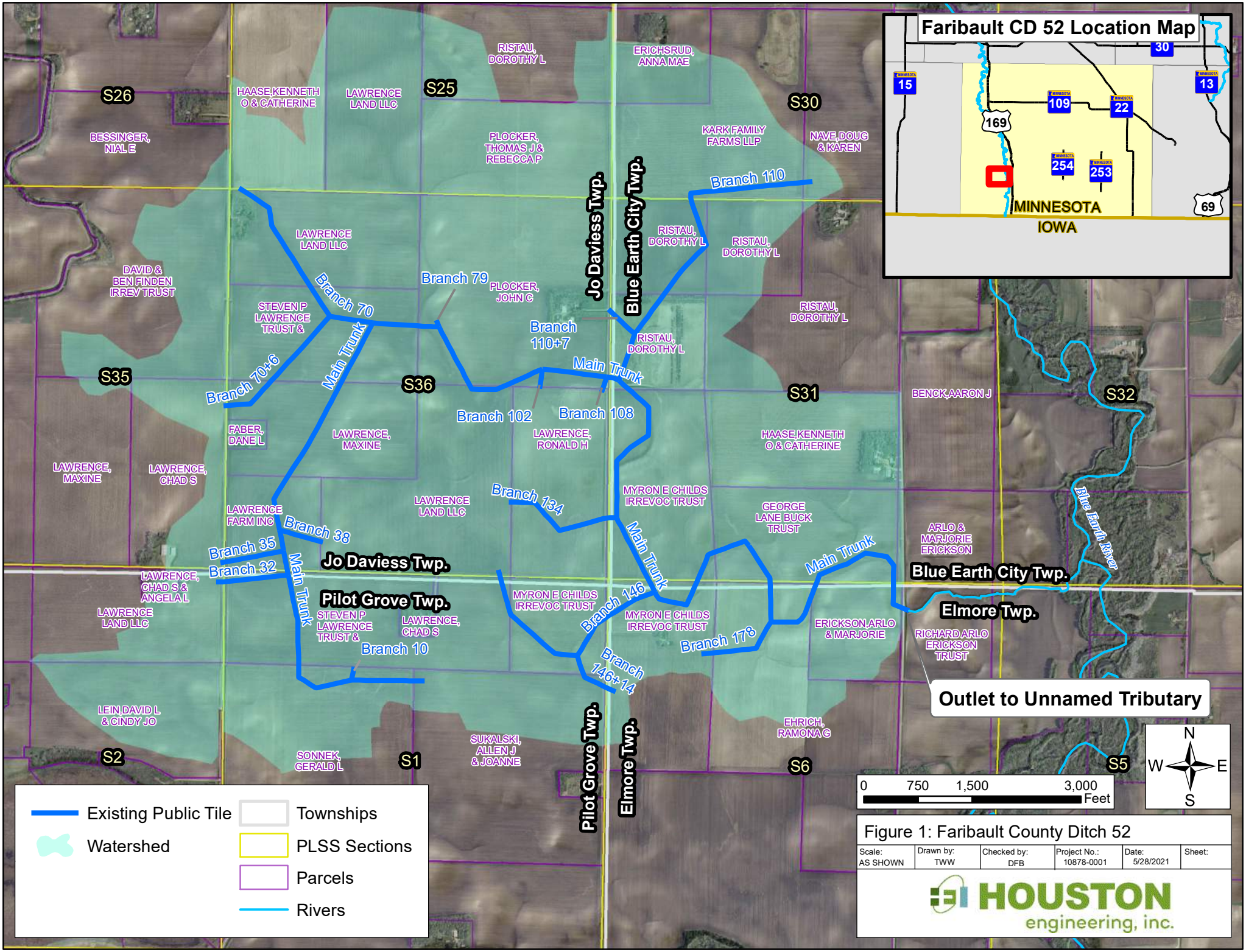


Figure 1: Faribault County Ditch 52

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HOUSTON engineering, inc.

Conclusion:

The proposed improvement, with no storage augmentation, continues to result in no negative hydraulic impacts that have the potential to result in damages. Therefore, the outlet of CD 52 is adequate for the proposed improvement with no storage augmentation. This conclusion will be included in a forthcoming Final Engineer's Report for consideration by the Drainage Authority.

To augment storage in the Blue Earth River watershed, reduce sediment delivery and improve water quality, we recommend the Drainage Authority pursue a multipurpose drainage management grant for the storage basin along Branch 110. Though unnecessary for the proposed improvement, the storage basin will reduce long term maintenance efforts for the system while supporting regional and state-wide water quality goals.

FARIBAULT COUNTY
SOIL & WATER CONSERVATION DISTRICT

Blue Earth Ag Center | 415 South Grove Street, Suite 8
Blue Earth, Minnesota 56013 | www.faribaultcountyswcd.com
Phone (507) 526-2388 | Fax (507) 526-2508

March 21, 2022

Faribault County Drainage Authority
415 S Grove Street, Suite 8
Blue Earth, MN 56013
Merissa.lore@co.faribault.mn.us

RE: Preliminary Engineers Report Faribault County Ditch 52 Improvement

Dear Faribault County Drainage Authority,

Thank you for the opportunity to review the proposed improvement of Faribault County Ditch 52. The Faribault County SWCD board and staff have reviewed the preliminary engineers report and have comments that will be explained below.

In the report on 3.3.1 priority concern; goal 1; which references the Faribault County Water plan; but the report leaves out an important paragraph prior to the excerpt listed which reads as follows:

"While much of Faribault County and Minnesota's land use activities depend on artificial drainage, it can have negative environmental and flooding impacts downstream. For example, recent studies estimate the Le Sueur River's flow has doubled over the past 60 years. Roughly half of this flow originates from tile drainage. The increase in the Le Sueur River's flow is due to hydrologic alterations made by both humans (including installing artificial drainage and changing crop types) and climate (increased precipitation and temperatures). Several studies identify human changes as the primary cause and climatic changes as the secondary cause of this increased river flow. Furthermore, this watershed cannot improve without substantial mitigation of altered hydrology. In addition to high river flow, altered hydrology exhibited in excessively low river base flow is an identified stressor in the Le Sueur River watershed. Base flow is sustained by shallow groundwater and interflow. Simply put, low base flow is indicative of soils being too dry and water tables being too low, partly the result of draining excess water from the landscape. Therefore, these sources are unable to deliver ample water to rivers at dry times of year, when base flow is the only source of river flow."

Also in the report is a map of BMP practices that could be implemented in the watershed. The SWCD believes it would be beneficial to include the National Wetland Inventory layer on the BMP map. This would show possible wetland restoration areas that would be beneficial to the system due to increased water storage.

Faribault County SWCD has funds available for BMP practices within the CD52 watershed. This would include SWCD cost share along with partner programs in which the SWCD is involved. Cost share for structural practices include but are not limited to; grassed waterways, water and sediment control basins, terraces, bioreactors, etc... Cost-Share is also available for nonstructural practices including strip-till, no-till and cover crops. Faribault County SWCD partners with BWSR to implement conservation easement programs that would potentially give financial assistance to landowners who would like to restore a wetland on their parcel.

If you have any questions about this letter or would like to set up a meeting to discuss this, please contact the Co-Program Administrator Nathan Carr at nathan.carr@co.faribault.mn.us.

We look forward to working with you on this project along with future projects.

Sincerely

Randy Feist

Randy Feist
Faribault County SWCD Board Chair

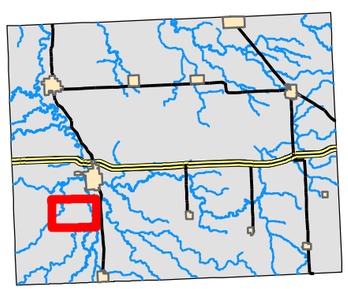
CC: Greg Young, Faribault County Board Chair
Darren Esser, Faribault County Auditor
Joe Lewis, Houston Engineering, Project Engineer

EXHIBIT I – DESIGN LEVEL LOCATES REQUEST FOR UTILITIES

353RD AVE
85TH ST
80TH ST
70TH ST
350TH AVE
370TH AVE
385TH AVE
RIVER RD
9
Branch 70
Branch 70-6
Branch 79
Main Trunk
Branch 102
Branch 108
Branch 110-31
Branch 110
Branch 110-7
Branch 134
Branch 38
Branch 35
Branch 32
Branch 10
Branch 146
Branch 146-14
Branch 178
Main Trunk
Blue Earth River
N
0
1,000
2,000
Feet

Utilities

- Copper Enclosure
- Fiber Enclosure
- Buried Copper Cable
- Buried Fiber Cable
- Watershed
- Existing Tile Alignment
- Public Waters



Location in Faribault County

Exhibit I - Design Level Locates Utilities

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AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

HoustonEngineering Inc.

EXHIBIT J – PTMAPP STRUCTURAL AND MANAGEMENT PRACTICES

Additional Practice Information

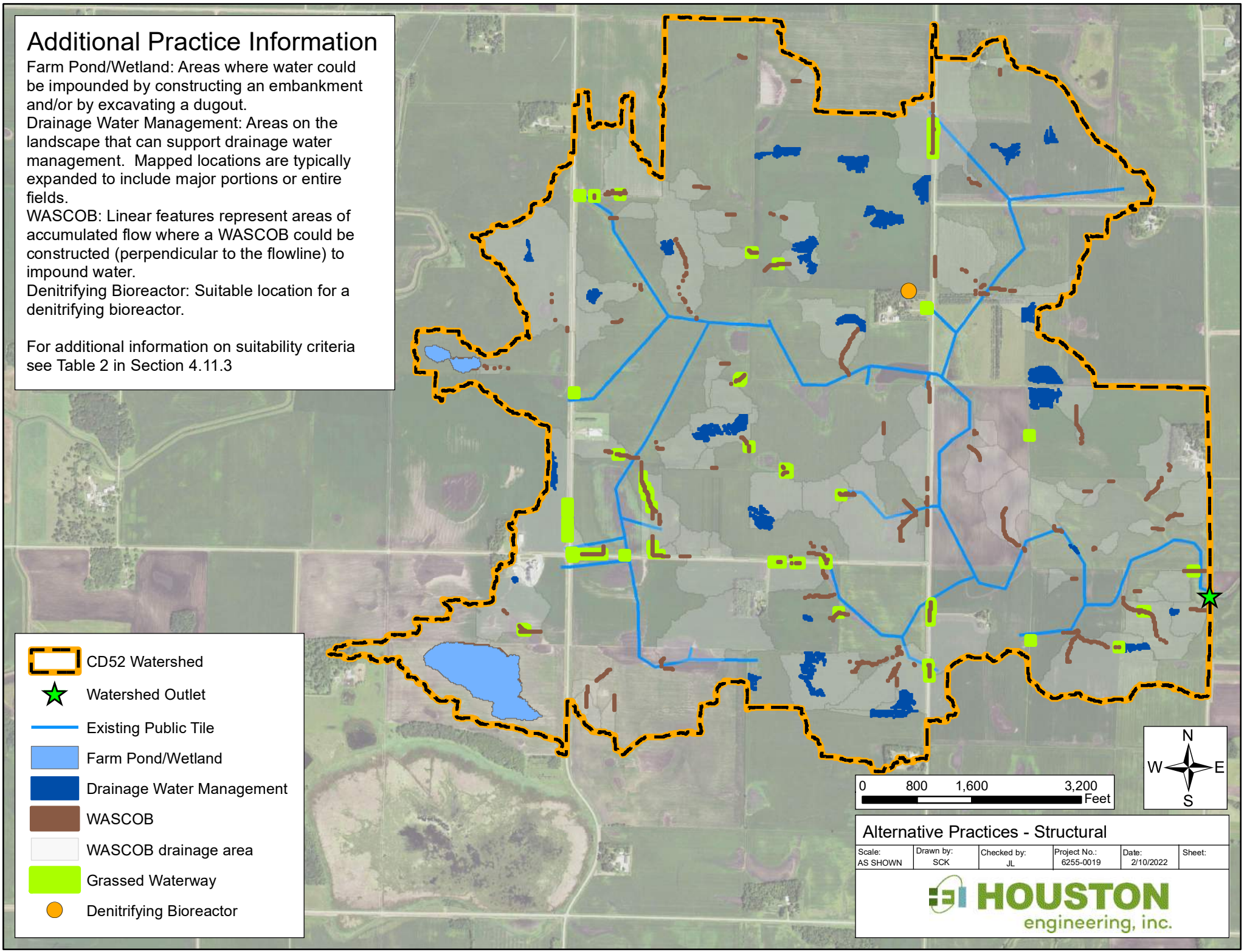
Farm Pond/Wetland: Areas where water could be impounded by constructing an embankment and/or by excavating a dugout.

Drainage Water Management: Areas on the landscape that can support drainage water management. Mapped locations are typically expanded to include major portions or entire fields.

WASCOB: Linear features represent areas of accumulated flow where a WASCOB could be constructed (perpendicular to the flowline) to impound water.

Denitrifying Bioreactor: Suitable location for a denitrifying bioreactor.

For additional information on suitability criteria see Table 2 in Section 4.11.3



Alternative Practices - Structural

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AS SHOWN	SCK	JL	6255-0019	2/10/2022	

HOUSTON engineering, inc.

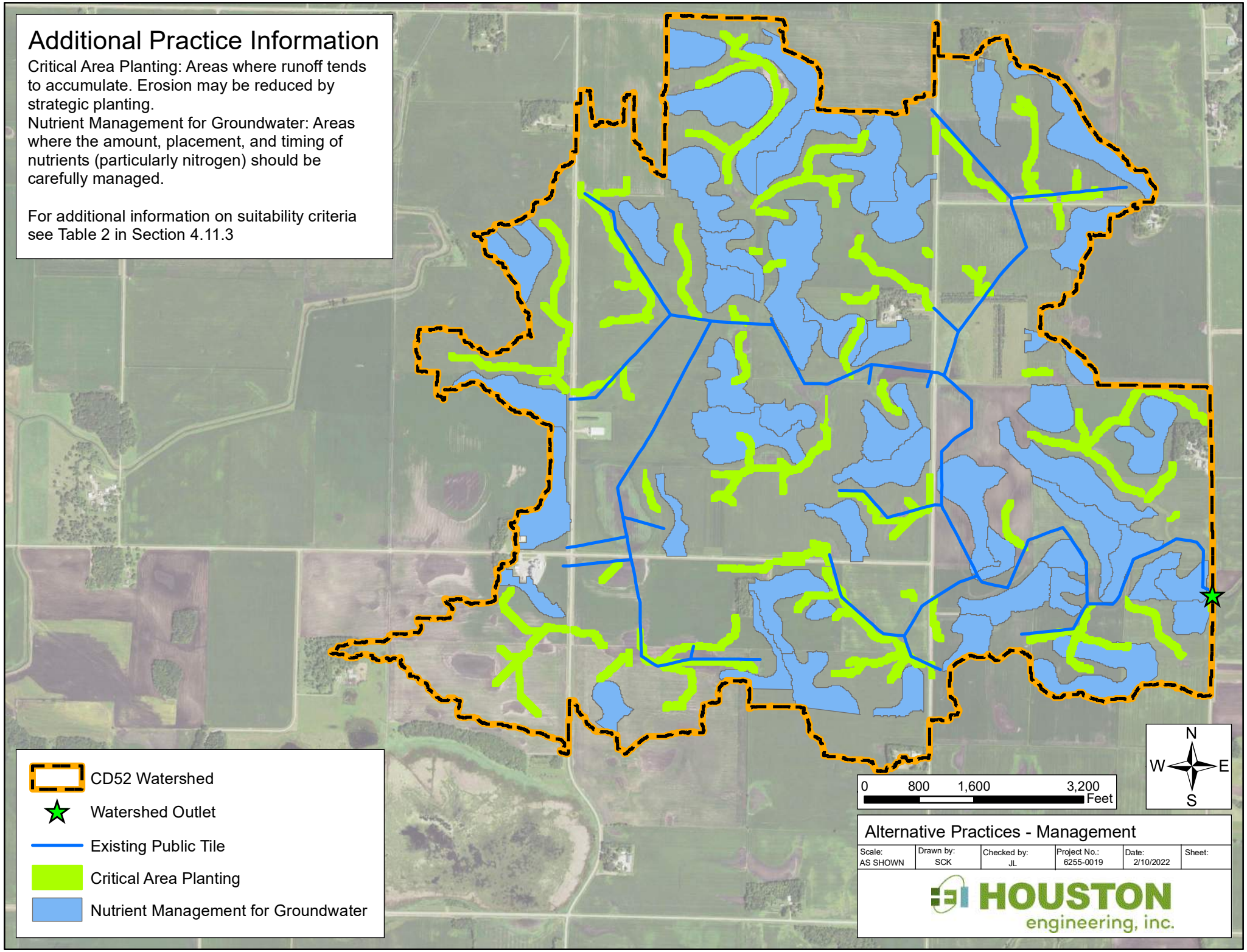

Additional Practice Information
Critical Area Planting: Areas where runoff tends to accumulate. Erosion may be reduced by strategic planting.
Nutrient Management for Groundwater: Areas where the amount, placement, and timing of nutrients (particularly nitrogen) should be carefully managed.
For additional information on suitability criteria see Table 2 in Section 4.11.3
CD52 Watershed
Watershed Outlet
Existing Public Tile
Critical Area Planting
Nutrient Management for Groundwater
0 800 1,600 3,200 Feet
N
W
E
S
Alternative Practices - Management
Scale: AS SHOWN
Drawn by: SCK
Checked by: JL
Project No.: 6255-0019
Date: 2/10/2022
Sheet:
HOUSTON engineering, inc.

EXHIBIT K – MN DNR COMMENTS ON PRELIMINARY ENGINEERS REPORT

DEPARTMENT OF NATURAL RESOURCES
Division of Ecological & Water Resources
Region 4 (Southern Region)
21371 Highway 15 South
New Ulm, MN 56073

March 24, 2022

Faribault County Drainage Authority
c/o Merissa Lore, Drainage Manager
merissa.lore@co.faribault.mn.us

Re: Preliminary Engineer's Report for Proposed Improvement of Faribault CD52

Dear Faribault County Drainage Authority,

Thank you for the opportunity to review the proposed improvement of Faribault County Ditch 52. We offer a summary and context of the project as well as comments following Minnesota Statute 103E.255 on behalf of the Commissioner of the Minnesota Department of Natural Resources (DNR). Our advisory letter requires that we "identify any additional investigation and evaluation that should be done relating to public waters that may be affected and environmental, land use, and multipurpose water management criteria in section 103E.015, subdivision 1, and cite specific portions of the preliminary survey report that are determined inadequate". The drainage authority is the legal decision-maker for drainage improvement projects (i.e., guiding, approving, or dismissing drainage improvements). The drainage authority should also be aware of how and when drainage projects fall within the jurisdiction of other governmental agencies (i.e., public water, wetland, listed species, etc.) which may require permits or review before approving a drainage improvement project.

We also want to thank the drainage authority staff and engineer for reaching out to the DNR for early coordination work. While we still have several concerns about the project and hope to encourage the project to adopt mitigating practices, this early coordination work is a helpful and needed step forward.

Project Summary

This project proposes to enhance the tile drainage network in the 2,041-acre CD52 watershed by adding a larger, steeper, and deeper tile network. The existing system, if it were in a repaired state, offers a 0.25 in/day drainage coefficient at the outlet. The proposed system would provide a 0.47 in/day drainage coefficient at the outlet. The current functional (disrepaired) capacity of the system is not provided. The estimated cost of the project is approximately $3-million, or about $1,450 per acre on average. The report identifies that the existing system is in significant disrepair and estimates a repair cost of approximately $2.4 million.

Context & Overall Impact

The project outlets into a half-mile-long unnamed natural channel before reaching the Blue Earth River. As such, the project lies within the Blue Earth River Watershed. The Blue Earth River watershed is one of the most erosive and sediment and nutrient-laden watersheds in the State of Minnesota. The Blue Earth River reach that receives this water is already polluted and stressed by excessive sediment and erosion, low dissolved oxygen, excess nutrients and bacteria, degraded habitat, and driving many of these: altered hydrology. Altered

hydrology has occurred from drainage, land use, and evapotranspiration changes and is further exasperated by climatic changes and increased precipitation.

We are concerned that this project will increase the total flow volume and alter the flow timing, further contributing to altered hydrology and the numerous pollutants and stressors already occurring in the Blue Earth River. These pollutants and stressors are already reducing the amount and diversity of aquatic life in this river and limiting the river's use for safe recreation. We are concerned that this project will further contribute to these conditions.

Hydraulics & Modeling

The feasibility report provided during early coordination work stated that "The increase in peak flow from CD 52 following an improvement will result in a significant change in peak flows on the ½ mile-long unnamed tributary channel serving as CD 52's outlet and may lead to increased risk of erosion in the tributary channel." Based on extensive observation and analytical review of drainage improvements, an increase in the total flow volumes and the peak flow was expected. As an example, modeling of a similar drainage improvement project for a watershed of this size, with approximately the same degree of drainage improvement, showed enormous increases in the proposed system storm event flows [see table at right showing 2-year (top) through 100-year (bottom) storm events]. In this similar case, the 2-year storm event contributes 87% more water at the outlet. Increases in flow volumes like this, particularly when considered in the context of multiple improvements in the watershed, would have serious consequences to receiving waters and lands downstream.

Total Volume Routed Through Downstream Link (cu-ft)		
Existing	Proposed	[2]Difference (cu-ft)
2,639,459	4,952,651	+87% 2,313,192
3,767,569	7,099,961	+88% 3,332,392
5,011,767	8,943,020	+78% 3,931,254
7,001,326	11,800,000	+68% 4,798,674
8,871,818	14,200,000	+60% 5,328,182
10,900,989	17,016,033	+56% 6,115,043

The engineer's report presents summarized modeling results showing that the peak flow will be reduced, and stating that the total flow volume will not increase. Unfortunately, sufficient details or files to evaluate this modeling are not provided. To effectively comment, we need more details on these results and the associated methods as detailed below.

We note that the presented modeling shows 1) the repaired or ACSIC system and 2) the proposed improved system. Modeling does not show the existing (disrepaired) system. We request that the existing (disrepair) system is modeled, and the report is modified to indicate that what is currently identified as the existing system is the repaired condition. In other words, at least three scenarios should be provided for comparison: 1) the existing conditions, 2) repaired conditions, and 3) proposed improved conditions. Additional scenarios under consideration (e.g. the 3/8 inch/day coefficient and any storage scenarios) could also be provided to better understand the outcomes of various alternatives.

Identify what will become of the existing system if a new system is installed. If the existing tile system remains functional at the outlet, then the drainage coefficients could be additive, and this additional capacity should be modeled in the proposed system hydraulics.

Models can be highly sensitive to various input parameters, assumptions, and methods. We request that the full modeling files be viewable in XPSWMM Viewer and a detailed and comprehensive modeling report are submitted for review. Sufficient model information should be supplied to assess the model setup and results. The modeling report should provide a narrative description and interpretation of the model assumptions, details, and nuances including but not limited to:

- A map indicating the modeled systems and the mapped locations corresponding to output data
- Any changes to the model between the existing, repaired, and proposed improved systems
- How the model is routing and storing water
- How private tile is/is not incorporated into the model
- References for what sources were used for input parameters to the model
- How optional modeling methods were selected (e.g. infiltration method)
- Why any standard model inputs were altered (if applicable)
- How the critical storm duration was determined
- Estimates for surface runoff, subsurface drainage, and total runoff volume, for the design storm events for the existing, repaired and proposed improvement system
- Output hydrographs of the existing, repaired and proposed improved systems for the design storm events along with the total volume of runoff associated with each scenario and storm event

Impacts to Wetlands

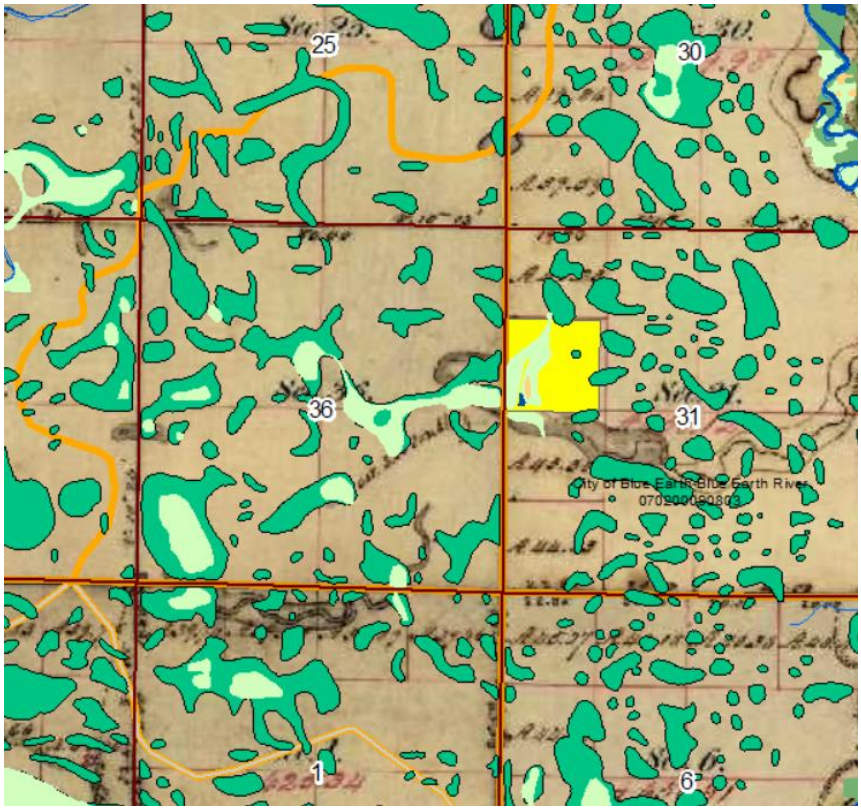
The engineering report identifies several wetlands throughout the drainage watershed. We are concerned that this project will impact these wetlands; please explain how drainage will be improved in these wet spots but this will not impact these wetlands.

When the project connects private tile and open intakes to an improved system, this will likely alter the hydrology of these NWI wetlands. The report states that the number of intakes will be limited, but the cost tables show the same number and type in the existing and proposed system. The report and plans need to indicate the existing and proposed intakes.

The report states that non-perforated pipes will be used under wetlands. The non-perforated pipe needs to be used not only under but also within the zone of lateral influence. Update the plans to show where non-perforated and perforated pipes are proposed.

As stated in the Drainage Manual section on wetlands, “the drainage authority should inform landowners and agricultural producers of potential implications to land use resulting from the project, including Swampbuster provisions.” Furthermore, following the Wetlands Conservation Act, the WCA authority must be consulted, and

those results need to be appended to the engineering report. For reference, a map of the NWI wetlands (light green), restorable wetlands (emerald, green), the RIM easement (yellow), and the historic plat map (underlying imagery) are included.



The subsoil and surface storage that remains in the proposed project area will likely be eliminated with the proposed drainage improvements. These effects contribute to additional flow into the Blue Earth River. Instead of working to eliminate these farmed wetlands and the storage they provide, we urge the project to consider wetland restorations as discussed further in the alternative measures section of this report.

Alternative Measures and Compatibility with Local Plans

The Blue Earth River watershed does not yet have a One Watershed, One Plan. Water quality reports are available on the MPCA's Blue Earth River Watershed webpage. Goals and objectives to improve Faribault County surface waters are presented in the 2018-2027 Faribault County Water Plan. The engineer's report includes a discussion of several factors; we ask the drainage authority to carefully consider these plans and 103E requirements.

While the engineering report mentions that other BMPs can be adopted by individual landowners working with the SWCDs, we believe that the drainage authority should work with the project to mitigate impacts to hydrology by adopting sufficient BMPs. In a watershed already so stressed and polluted, practices that mitigate improvement impacts should be adopted to be consistent with the Environmental Considerations within Minn. Stat. §103E.015.

The drainage manual recently underwent a substantial revision, in which an extensive amount of information on BMPs was added. The drainage manual states: "Other BMPs are located off the Minn. Stat. 103E drainage system, and consequently, not within the traditional purview of the drainage authority. However, as a result of efforts related to Minn. Stat. § 103E.015, a drainage authority may find that there are practices that can be applied on fields and farms in the watershed of the system which will provide significant benefits downslope to the drainage system. Typical structural off-system BMPs might include water and sediment control basins, grass waterways, and Drainage Water Management (DWM) to name a few. Typical non-structural off-system BMPs would be nutrient management, cover crops, conservation tillage, etc. that are applied on lands within the

watershed of the system. It is important for both the drainage inspector and the drainage system engineer to become aware of the potential for off-system BMPs to solve on-system problems."

Soil health practices (cover crops, conservation tillage, crop rotation, etc.) improve the soil and increase the water-holding capacity, infiltration, and evapotranspiration as well as improve the soil structure and strength. Producers have documented how these practices can help reduce water problems and improve field conditions. These practices could help with current conditions and help mitigate the hydrologic impacts of a drainage system repair or improvement.

The engineer's design uses alternative intakes as a mitigating practice. However, the cost estimate tables show that the same number and types of intakes are in the existing and proposed system. The locations of these existing and proposed open intakes are not shown. Please update the engineering report to show where open intakes will be implemented. Open intakes allow sediment and pollutants to wash directly into the system. We urge the drainage authority to require blind intakes rather than open intakes as they can significantly reduce surface sediment from washing into the system.

One alternative considered in the engineer's report is a storage area. However, the storage area identified in the engineering report is already a RIM easement and restored wetland. As such, this is already land in conservation, under a program, and may not be eligible or offer much mitigation above what it is already doing. We suggest that the project consider some of the existing farmed wetlands for storage and wetland restoration.

If drainage systems are to reduce their impacts to downstream waters, they must start adopting practices to mitigate their impact. Any work that the SWCD or drainage authority has done to integrate BMPs into the project and any BMPs that will be adopted alongside this project should be reported.

Additional Clarifications

In addition to requesting more information on the project as discussed in the sections above, the engineer's report should include the additional clarifications:

- Is work planned for in or adjacent to the unnamed stream, whether the project considers it part of this project or not? We note that the engineer's plans show stationing that extends somewhat parallel to the unnamed stream to the Blue Earth River, although the unnamed stream is noted as private. What do the small circles on the plan in this area indicate?
- Update or include a project map that shows the proposed and the existing system along with the proposed pipe sizes. The existing figure 2 does not show the whole proposed improvement.
- Is there a cost to the Road Authority due to this project?
- Outlet adequacy should discuss current conditions in the Blue Earth River since it receives the project's water.
- The engineering report indicates the existing drainage coefficient is about 1/8 inch/day. Please clarify if this is the functional (disrepaired) condition or if this is the limiting factor on the repaired system.
- What area does the 60-inch CMP culvert currently serve? Just the drainage watershed?
- Include a specific reference to the Drainage Manual where it states the maximum design flow velocity is 4 feet per second to prevent streambank erosion.
- Include a specific reference to NRCS documentation where a half-inch drainage coefficient is recommended.

- The engineer's report states that drainage systems are not directly addressed. The Blue Earth River TMDL extensively discusses the connection between drainage systems, altered hydrology, and increased erosion and sediment delivery. Therefore, we find this statement inaccurate.
- The engineer's report claims that some of the practices associated with the drainage improvement are a reasonable TMDL strategy. We find this statement inaccurate and encourage a closer review of the TMDL and the Stressor Identification report.

Conclusion

Several aspects of this project require closer inspection to their adherence to drainage statute. Drainage statute requires the Drainage Authority to ensure several criteria are met or a project must be dismissed. MN Statutes 103E.261 Subd. 4 and 103E.341 Subd. 1 states that a project must be dismissed if "the adverse environmental impact is greater than the public benefit and utility after considering the environmental, land use, and multipurpose water management criteria in section 103E.015, subdivision 1, and the engineer has not reported a plan to make the proposed drainage project feasible and acceptable" and "the proposed drainage project is not practicable after considering the environmental, land use, and multipurpose water management criteria in section 103E.015, subdivision 1."

The drainage authority should seek resolve on the following issues before moving forward:

- Improved modeling documentation and transparency
- Adequacy of outlet and impact to downstream waters and mitigating/preventing flow increases
- Impact on wetlands
- RIM easement if pursued for storage
- All additional questions and clarifications within this report

We encourage the Drainage Authority and the project proposers to implement projects and management practices that work to mitigate altered hydrology and water quality impacts within the watershed. Soil health practices and other BMPs could be used to store and evapotranspiration water from the landscape while also supporting sustainable farmland and healthy watersheds. Cover crops and residue management could increase soil organic matter and soil water and nutrient holding capacity; these and other practices are detailed in Chapter 5 of the MN Public Drainage Manual. Restoring drained and farmed wetlands would add storage, evapotranspiration, and habitat within this area. All of these practices would help mitigate heavy rains and help store, infiltrate, and evapotranspiration water.

Please send the response to this letter, as well as the meeting minutes, Finding of Fact, Viewer's Report, and any Order issued by the Drainage Authority regarding this proposed improvement to the DNR when they become available. Please submit these documents to Region4Drainage.dnr@state.mn.us.

Sincerely,

Todd Kolander
DNR Southern Region, EWR North District Manager

cc: Joanne Boettcher, DNR Regional Environmental Assessment Ecologist
Dan Girolamo, DNR Area Hydrologist
Tim Gieseke, Korey Woodley, Scott Roemhildt, DNR Regional Management
Paul Davis and Scott MacLean, MPCA
Ed Lenz and Rita Weaver, BWSR
Joseph Lewis, Houston Engineering

DEPARTMENT OF NATURAL RESOURCES
Division of Ecological & Water Resources
Region 4 (Southern Region)
21371 Highway 15 South
New Ulm, MN 56073

August 5, 2022

Faribault County Drainage Authority
c/o Merissa Lore, Drainage Manager
merissa.lore@co.faribault.mn.us

Re: Modeling Review for Proposed Improvement of Faribault CD52

Dear Faribault County Drainage Authority,

Thank you for working with the project engineer to provide modeling results as requested in the DNR PER Advisory letter. The DNR is the only outside agency that is responsible for providing feedback to the drainage authority on a project's adherence to drainage statute and in particular, the environmental considerations in 103E.015. The drainage authority is ultimately responsible to determine whether a project meets the many requirements of 103E and should be approved or dismissed.

DNR modeling staff have reviewed the model in detail; specific comments about the model for the engineer's and drainage authority's reference are attached to this letter. First, we want to provide a high-level summary of these comments and our related concerns. These concerns are summarized as 1) the model generally is not well-adapted to representing agricultural drainage systems; 2) this model application appears to have several issues, and 3) the model analyzes the constructed or improved conditions versus the proposed conditions and does not analyze the system in its dilapidated/disrepaired state.

This model, XP-SWMM, is developed for urban stormwater systems, which function differently than agriculture tile systems. Our DNR modelers have noted several issues that indicate that the model may not function as close to real-world conditions as possible. The model does not model drainage systems with reasonable accuracy, although this model is often used for this purpose. This project used the 1-D form of the model, but the 2-D form could provide better analysis. We understand that finding a better model for these systems is a continuing challenge for all interested parties.

The model appears to over-estimate surface flow, which has the effect of "diluting" the impact of the increased drainage through the tile. In other words, the model estimates that so much surface flow is occurring in the "existing conditions", that the effect of the "proposed system" is to simply capture some of the surface flow into the pipe. In reality, much of this water is likely held within the remaining storage areas of the watershed: in soils and depressional surface storage, much of this held water can infiltrate or evapotranspirate. When a drainage improvement project is installed, improved drainage to the soils and depressional areas results in more water reaching the drainage system and outlet. Hence, these projects typically result in substantially higher flow at the outlet, peak and total flow volumes. These changes to hydrology from drainage improvement projects have been identified in source assessment and drainage impact studies, are consistent with hydrologic principles

and can be observed in the real-world as downstream waters receive more water and experience accelerated erosion.

This modeling work does not include an analysis of the existing (disrepaired) system. We have recently been requesting that drainage modeling include "existing conditions," which is different than the as-constructed and subsequently improved conditions (ACSIC) because the actual existing conditions are dilapidated compared to the as-constructed conditions. The provided modeling for this system does not include a scenario of the existing conditions but includes the ACSIC system, referred to as the "existing conditions." The actual current functional capacity of the system is an essential consideration for a few reasons: 1) a repair alone could recover sufficient drainage capacity; 2) the change in peak flows and total flow volumes of the existing condition will be more significant than the reported changes to peak flow and total flow since that modeling used the as-constructed conditions, and 3) because of this, downstream environmental impacts and the outlet analysis could be underestimated.

Due to the above factors, our concerns about the impact on the receiving stream and cumulative effects as identified in the PER persist. However, we have determined that the project does not require a public waters work permit, and no other DNR jurisdictional resources appear to be directly impacted. Furthermore, we understand that the modeling process is time-consuming and costly. Therefore, we are not insisting that additional modeling is performed for our review. However, if the drainage authority requests additional modeling work by the engineer to better estimate potential impacts related to outlet adequacy or downstream effects, DNR staff may be available to provide a technical review of the model results. Furthermore, the engineer should consider these comments for future modeling work on drainage systems. We found it essential to provide feedback on this modeling application because this was the first time we had reviewed drainage modeling work from this consultant.

We can be available to discuss these high-level comments or the detailed modeling review comments. Please note that Anne (the lead model reviewer on this project) is on vacation through late August. Please continue to route contact requests through region4drainage.dnr@state.mn.us.

Sincerely,

Todd Kolander
DNR Southern Region, EWR North District Manager

cc: Joanne Boettcher, DNR Regional Environmental Assessment Ecologist
Dan Girolamo, DNR Area Hydrologist
Tim Gieseke, Korey Woodley, DNR EWR Regional Management
Anne Toftegaard and Jeff Weiss, DNR Engineering and Modeling Review
Joseph Lewis, Houston Engineering

DNR Detailed Modeling Review

The following review was provided by Anne Toftegaard, PE, and Jeff Weiss, PE, DNR modeling staff.

Purpose and Scope

This hydraulic model review aims to summarize the findings of Houston Engineering, Inc's modeling of the Faribault County Ditch 52 (CD52) system. A proposed project to modify CD52 is under review by the Minnesota Department of Natural Resources (DNR) and Faribault County. The proposed improvements to the CD52 system include replacing the existing tile with a larger tile and partial realignment of the main trunk.

This memorandum summarizes the review of the models 'Existing_CD52.xp' and 'Proposed_CD52.xp'. The review consisted of the following:

- Confirming the model's compatibility with the proposed design
- Evaluating the acceptability of modeling parameters and approach
- Evaluating the model's accuracy in evaluating the impacts on the downstream system

Summary

Our review of the submitted modeling identified several concerns over the modeling results. The provided modeling appears to be overestimating overland flow. The reported 2-year peak flow overland flow upstream of 377th Ave is 134 cfs. A survey of the channel downstream of 377th Ave was included; however, estimated dimensions from aerial photography indicate that the bankfull flow (assumed to be the 1.5-year flow) is significantly less than 134 cfs. With no existing downstream gauge data to calibrate the model, a comparison to USGS StreamStats peak flow statistics was performed. Comparison to USGS Stream Stats for this area shows modeled peak flows are much higher in the model at the outlet than predicted in Stream Stats. Overestimation of overland flow could mask the impact of upsizing the draintile on peak flows at the outlet. Thus, minimizing the perceived effects of the proposed project.

The proposed project was modeled in 1D XPSWMM. XPSWMM is a good model for urban systems or in situations where immediate runoff from the landscape is the primary concern. In such agricultural settings, the model typically does a poor job of capturing infiltration and recapture by the underground tile system. In addition, the model was developed as a 1D model with overland flow routes following the underground tile system; however, this does a poor job of simulating storage and breakout flows that do not follow the underground system. These interactions are essential to understanding how the project will change the dynamics of this watershed and the potential for changes to downstream water bodies.

Specific Comments

Comment 1: Comparison to USGS Stream Stats for this area shows peak flows are much higher in the model at the outlet than the Stream Stats estimated peak flows. The Stream Stats computed drainage area of 1,850 acres is 10% smaller than the modeled drainage area of 2,041 acres. However, the peak flow at the outlet in the model for the 100-yr storm is 1,296 cfs, which is 3.4 times the maximum projected peak flow in Stream Stats of 379 cfs. Overestimation of overland flow could mask the impact of upsizing the draintile on peak flows at the outlet.

Comment 2: Both models contain weirs throughout to represent the ground over the draintile. Using weirs instead of natural channels to represent long reaches could underestimate the time to peak of the overland

flow. Throughout the model, the time to peak for the weirs is 3 to 4 times less than the time to peak for the drain tile running parallel. The modeler should justify using weirs versus natural channels in these locations.

Comment 3: On page 19 of the preliminary engineering report, the maximum velocity at the outlet for the 2-year event was reported as 2.8 ft/s. This is much lower than the modeled maximum 2-yr velocity of 10.07 ft/s through the 2.5-ft diameter culvert under 377th Ave, Link M1. While it is expected for the culvert to have a higher velocity than the channel, adding a link downstream of the culvert representing the channel in the model is recommended. This would allow a more accurate estimation of shear stress and erosion potential in the downstream channel.

Comment 4: The weir in Link P102 appears to be too high. The roadway elevation representing the weir should be verified to ensure that the model is not underestimating the amount of flow going downstream.

Comment 5: There appears to be double counting of storage at Node P12; the natural channel intersects with the storage contours. The modeler should verify if storage is being double counted at this location.

Comment 6: The outfall to the model is a rating curve of the downstream open channel that drains into the Blue Earth River. The modeler should provide documentation of the source of this rating curve data.

Comment Number	Comment	Comment Response(s)
MN Department of Natural Resources (DNR); Todd Kolander, DNR Ecological and Water Resources; in a letter dated March 24, 2022 to Faribault County Drainage Authority		
DNR – 1	We are concerned that this project will increase the total flow volume and alter the flow timing, further contributing to altered hydrology and the numerous pollutants and stressors already occurring in the Blue Earth River. These pollutants and stressors are already reducing the amount and diversity of aquatic life in this river and limiting the river's use for safe recreation. We are concerned that this project will further contribute to these conditions.	The hydrologic and hydraulic analysis performed in XPSWMM to evaluate adequacy of the outlet, consisted of flood event based simulations. Specifically, only the 5-, 10- 25- and 50-year events are required by MS103E but the 2- and 100-year events were also analyzed and included in PER. These events simulate specific rainfall amounts and intensities over a discrete duration of 24-hours following industry standards. Excess precipitation (i.e., runoff) predicted by the hydrologic portion of the model is carried through the various tile, culverts, surface flow paths, and over roadways until the runoff reaches the outlet. Analysis of the movement of excess precipitation through the drainage system is referred to as the hydraulic portion of the model. The hydraulic simulation period extends beyond the 24-hour rainfall duration. When considering impacts to "total flow volume", it is important to acknowledge that the hydrologic portion of the XPSWMM model is unchanged between the ACSIC and Improvement conditions analysis. This means the total volume discharged from the CD 52 outlet is the same for both conditions. Since the timing of how quickly the runoff reaches the CD 52 outlet is changed, differences in flow amounts are seen during the simulation period. At the relatively short temporal scale of the flood event based simulations, the incorporation of functions to modify evapotranspiration is not warranted since it is an inconsequential factor for the short temporal scale. Likewise, the XPSWMM model does not account for the interaction between the soil and tile lines which is assumed to not significantly impact results of the flood events based since discharge from infiltrated precipitation captured by tile systems will occur later than excess precipitation at the surface. Conversely, at a season-long scale, evapotranspiration and tile/soil moisture interaction has the potential to have a more significant effect on downstream volumes. Providing an improved outlet for adjacent pattern tiling could redirect some water downstream, that otherwise would result in groundwater recharge. This is generally beyond XPSWMM model capabilities. The improvement project generally reduces peak flows and volumes travelling overland during flood events, in a trade-off for increases in tile flow and volume. Under current conditions, excess surface water runoff is delivering sediment and nutrients to the Unnamed tributary to the Blue Earth River contributing to the impairments. The poor condition of the existing, sectional tile allows for the introduction of sediment through the tile system. The improvement, when combined with planned surface intake BMPs will do two things: (1) by creating better subsurface drainage, water holding capacity in the soil will be greater and surface runoff will be reduced for smaller more frequent rainfalls, thus reducing TP and sediment delivery on an annual basis to the impaired water; (2) replacing the old, deteriorated, section tile which allows sediment to enter the tile at joints with plastic pipe, will further reduce sediment delivery to the impaired water.

Comment Number	Comment	Comment Response(s)
DNR – 2	The feasibility report provided during early coordination work stated that “The increase in peak flow from CD 52 following an improvement will result in a significant change in peak flows on the ½ mile-long unnamed tributary channel serving as CD 52’s outlet and may lead to increased risk of erosion in the tributary channel.” Based on extensive observation and analytical review of drainage improvements, an increase in the total flow volumes and the peak flow was expected. As an example, modeling of a similar drainage improvement project for a watershed of this size, with approximately the same degree of drainage improvement, showed enormous increases in the proposed system storm event flows [see table at right showing 2-year (top) through 100-year (bottom) storm events]. In this similar case, the 2-year storm event contributes 87% more water at the outlet. Increases in flow volumes like this, particularly when considered in the context of multiple improvements in the watershed, would have serious consequences to receiving waters and lands downstream.	The feasibility report was completed prior to any detailed hydrologic or hydraulic modeling being performed. Certain assumptions were made at that time about the proposed system such as – the increase in tile capacity when flowing full would translate to an equivalent increase in the peak flow to the CD 52 outlet. Detailed modeling of the CD 52 system has shown the improvement will reduce peak flow during flood events, which is due to the amount of surface flow above the tile in existing conditions and the reduction of surface flow due to the improvement. This change alters the timing of peak flows at the CD 52 outlet. Comparison of the hydrologic analysis results from the CD 52 system to another system is not useful unless the watershed characteristics are also compared.

Comment Number	Comment	Comment Response(s)
DNR-3	The engineer's report presents summarized modeling results showing that the peak flow will be reduced, and stating that the total flow volume will not increase. Unfortunately, sufficient details or files to evaluate this modeling are not provided. To effectively comment, we need more details on these results and the associated methods as detailed below. Models can be highly sensitive to various input parameters, assumptions, and methods. We request that the full modeling files be viewable in XPSWMM Viewer and a detailed and comprehensive modeling report are submitted for review. Sufficient model information should be supplied to assess the model setup and results. The modeling report should provide a narrative description and interpretation of the model assumptions, details, and nuances including but not limited to: • A map indicating the modeled systems and the mapped locations corresponding to output data • Any changes to the model between the existing, repaired, and proposed improved systems • How the model is routing and storing water • How private tile is/is not incorporated into the model • References for what sources were used for input parameters to the model • How optional modeling methods were selected (e.g. infiltration method) • Why any standard model inputs were altered (if applicable) • How the critical storm duration was determined • Estimates for surface runoff, subsurface drainage, and total runoff volume, for the design storm events for the existing, repaired and proposed improvement system • Output hydrographs of the existing, repaired and proposed improved systems for the design storm events along with the total volume of runoff associated with each scenario and storm event	XPSWMM modeling files and supporting GIS layers were provided to the DNR following a meeting after the PER hearing. Comments provided by the DNR regarding their detailed review of the model are listed further below in this table along with a response.
DNR - 4	We note that the presented modeling shows 1) the repaired or ACSIC system and 2) the proposed improved system. Modeling does not show the existing (disrepaired) system. We request that the existing (disrepair) system is modeled, and the report is modified to indicate that what is currently identified as the existing system is the repaired condition. In other words, at least three scenarios should be provided for comparison: 1) the existing conditions, 2) repaired conditions, and 3) proposed improved conditions. additional scenarios under consideration (e.g. the 3/8 inch/day coefficient and any storage scenarios) could also be provided to better understand the outcomes of various alternatives.	Modeling of current existing conditions (disrepair) is not a statutory requirement and will not be completed. The current conditions are also ever-changing as additional failures occur and are repaired, making it difficult to accurately analyze.

Comment Number	Comment	Comment Response(s)
DNR - 5	Identify what will become of the existing system if a new system is installed. If the existing tile system remains functional at the outlet, then the drainage coefficients could be additive, and this additional capacity should be modeled in the proposed system hydraulics.	The existing system will be replaced. The existing tile will be either removed, or crushed in place and capped so as to no longer convey water.
DNR - 6	The engineering report identifies several wetlands throughout the drainage watershed. We are concerned that this project will impact these wetlands; please explain how drainage will be improved in these wet spots but this will not impact these wetlands.	There are no new wetlands proposed to be drained. The existing wetlands intersecting CD 52 alignment are currently drained and considered to be highly degraded. The CD 52 improvement project falls under WCA drainage exemptions and is authorized under a CWA Section 404 nationwide permit. Functionally, the CD 52 improvement project will shorten periods of surface inundation following significant precipitation events. Given the current condition of the drained wetlands, this will not result in a significant impact to the wetland.
DNR – 7	When the project connects private tile and open intakes to an improved system, this will likely alter the hydrology of these NWI wetlands. The report states that the number of intakes will be limited, but the cost tables show the same number and type in the existing and proposed system. The report and plans need to indicate the existing and proposed intakes.	The exact locations and quantities of intakes will be included in the construction planset. The Opinion of Probable Construction Cost (OPCC) and plan-profile drawings within the FER has been updated to reflect the final design more closely. Generally, no new open intakes are proposed except in or near roadside ditches. Hickenbottom intakes will be utilized where applicable. The NWI wetlands identified are already drained and actively cropped. No new wetlands are proposed to be drained.
DNR – 8	The report states that non-perforated pipes will be used under wetlands. The non-perforated pipe needs to be used not only under but also within the zone of lateral influence. Update the plans to show where non-perforated and perforated pipes are proposed.	All tile installed as part of an improved CD 52 will be non-perforated.
DNR – 9	As stated in the Drainage Manual section on wetlands, “the drainage authority should inform landowners and agricultural producers of potential implications to land use resulting from the project, including Swampbuster provisions.” Furthermore, following the Wetlands Conservation Act, the WCA authority must be consulted, and those results need to be appended to the engineering report. For reference, a map of the NWI wetlands (light green), restorable wetlands (emerald, green), the RIM easement (yellow), and the historic plat map (underlying imagery) are included.	Through the public hearing process, the Drainage Authority is informing landowners and producers of potential land use changes and their implications. This is also acknowledged in Section 3.2.3 of the PER.
DNR – 10	The subsoil and surface storage that remains in the proposed project area will likely be eliminated with the proposed drainage improvements. These effects contribute to additional flow into the Blue Earth River. Instead of working to eliminate these farmed wetlands and the storage they provide, we urge the project to consider wetland restorations as discussed further in the alternative measures section of this report.	Wetland restorations have been explored in more depth since completion of the PER. See Section 4.2.3.3 and Exhibit M in the FER for further detail.

Comment Number	Comment	Comment Response(s)
DNR – 11	While the engineering report mentions that other BMPs can be adopted by individual landowners working with the SWCDs, we believe that the drainage authority should work with the project to mitigate impacts to hydrology by adopting sufficient BMPs. In a watershed already so stressed and polluted, practices that mitigate improvement impacts should be adopted to be consistent with the Environmental Considerations within Minn. Stat. §103E.015.	The drainage authority has and will continue to encourage landowners to adopt land conservation practices, but does not have the authority to mandate these private practices or to include off-system BMP's in the project. The project endeavors to install on-system BMPs where practical and where they provide sufficient benefit to the system. The Drainage Authority will be considering a wetland restoration in the CD 52 watershed in conjunction with the improvement. See Section 4.2.3.3 for further detail.
DNR – 12	Is work planned for in or adjacent to the unnamed stream, whether the project considers it part of this project or not? We note that the engineer's plans show stationing that extends somewhat parallel to the unnamed stream to the Blue Earth River, although the unnamed stream is noted as private. What do the small circles on the plan in this area indicate?	The only portion of work to be conducted near the unnamed stream is the roughly 150 feet (Station 27+00 to 28+50) required to complete tile installation. For that portion, the unnamed stream channel will be restored to its present day conditions following installation of the tile. The unnamed stream was surveyed with cross sections for analyzing the adequacy of this outlet. At the time of survey, several soil borings were collected. The small circles indicate where soil borings were taken which have no relevance to the project and are removed for the FER.
DNR – 13	Update or include a project map that shows the proposed and the existing system along with the proposed pipe sizes. The existing figure 2 does not show the whole proposed improvement.	Figure 2 was intended to only show the portion of the proposed tile that will be realigned relative to the existing tile. Everywhere else on the system, the proposed tile will be located in approximately the same location as the existing tile (accounting for construction offset).
DNR – 14	Is there a cost to the Road Authority due to this project?	All costs incurred to construct the improvement will be borne by the benefiting landowners. The Viewers Report will dictate what portion of the cost is assigned to road authorities based on the benefits. For the boring costs, the road authority will typically bear the additional cost over and above the cost to install tile via an open cut, since it is out of convenience to keep the road open during construction and avoids disturbing the paved driving surface.
DNR – 15	Outlet adequacy should discuss current conditions in the Blue Earth River since it receives the project's water.	Discussion on the Blue Earth River conditions has been added to this FER. See Section 4.4.2 for further detail.
DNR – 16	The engineering report indicates the existing drainage coefficient is about 1/8 inch/day. Please clarify if this is the functional (disrepaired) condition or if this is the limiting factor on the repaired system.	The existing modeling was completed for the As Constructed and Subsequently Improved condition, as that is the statutory requirement. An estimate of the 'existing' drainage coefficient was not made.
DNR – 17	What area does the 60-inch CMP culvert currently serve? Just the drainage watershed?	The drainage area for the 60-inch CMP is effectively the same as the CD 52 drainage area.
DNR – 18	Include a specific reference to the Drainage Manual where it states the maximum design flow velocity is 4 feet per second to prevent streambank erosion.	Table 6-1: Maximum Allowable Velocities for Given Soil Textures, Minnesota Drainage Guide, USDA Soil Conservation Service (https://apps.extension.umn.edu/agriculture/water/planning/docs/minnesota-drainage-guide.pdf)
DNR – 19	Include a specific reference to NRCS documentation where a half-inch drainage coefficient is recommended.	Table 4-1: Drainage Coefficients for Subsurface Drainage Only, Minnesota Drainage Guide, USDA Soil Conservation Service (https://apps.extension.umn.edu/agriculture/water/planning/docs/minnesota-drainage-guide.pdf)

Comment Number	Comment	Comment Response(s)
DNR – 20	The engineer's report states that drainage systems are not directly addressed. The Blue Earth River TMDL extensively discusses the connection between drainage systems, altered hydrology, and increased erosion and sediment delivery. Therefore, we find this statement inaccurate.	The Greater Blue Earth River Basin TSS TMDL Study focuses on the total suspended solids contributing stressors within the overall Minnesota River basin, of which the Blue Earth River is part of. Since CD 52 outlets to a small tributary to the Blue Earth River, it is reasonable to investigate opportunities to improve the TSS impairments revealed within the Study. This project has been shown to not increase the peak flow entering the small tributary river relative to the ACSIC of the tile. The deteriorated tile will be replaced, significantly reducing the intrusion of sediment into the current tile system. The Drainage Authority may investigate further opportunities for BMPs on the landscape in conjunction with, or outside of this project.
DNR – 21	The engineer's report claims that some of the practices associated with the drainage improvement are a reasonable TMDL strategy. We find this statement inaccurate and encourage a closer review of the TMDL and the Stressor Identification report.	Maintenance of drainage system infrastructure is a critical component of a sediment and nutrient reduction strategy, as failing infrastructure is a significant contributor of downstream sediment. In this case, the failing CD 52 tile currently allows excess sediment and nutrients to enter unchecked into the unnamed tributary to the Blue Earth River. The existing drainage coefficient is lower than modern design standards for current agricultural practices with lower benefits compared to improvement. Given the relative cost to repair the tile versus the improvement costs, the repair alternative is less desirable from an economic perspective than the improvement.
DNR Model – 1	Comparison to USGS Stream Stats for this area shows peak flows are much higher in the model at the outlet than the Stream Stats estimated peak flows. The Stream Stats computed drainage area of 1,850 acres is 10% smaller than the modeled drainage area of 2,041 acres. However, the peak flow at the outlet in the model for the 100-yr storm is 1,296 cfs, which is 3.4 times the maximum projected peak flow in Stream Stats of 379 cfs. Overestimation of overland flow could mask the impact of upsizing the draintile on peak flows at the outlet.	While engineers utilize the USGS Stream Stats application and regression equations on many projects for analyzing hydrology, the detailed modeling completed in this study represents a more robust representation of the runoff that can be expected in this location.
DNR Model – 2	Both models contain weirs throughout to represent the ground over the draintile. Using weirs instead of natural channels to represent long reaches could underestimate the time to peak of the overland flow. Throughout the model, the time to peak for the weirs is 3 to 4 times less than the time to peak for the drain tile running parallel. The modeler should justify using weirs versus natural channels in these locations.	Using weirs allows the water to transfer between nodes without accounting for travel time, this is more accurate in spots where there is not a defined channel and water does not travel in a channelized flow. Weirs were utilized in part to prevent the double counting of storage in the storage nodes vs the available volume within the channel links. The three longest reaches analyzed by weirs in this modeling are approximately 1,000 feet long. Assuming an average velocity of 2 fps, the time differential is less than 10 minutes using weirs vs. channels. With the 24-hour storm duration setup in this modeling, this minor time difference will not likely make a substantial change in the outcome of the modeling results at the outlet. Each of the locations that utilize weirs to transfer flows contribute to storage nodes downstream, which will provide further attenuation of any potential time differential. The clearly channelized portions on the downstream half of the CD 52 alignment were modeled as channels, accounting for the overland conveyance in exceedance of what the subsurface tile system is able to handle. The existing and proposed conditions were modeled in an identical way in regards to which nodes are weirs and which are channelized.

Comment Number	Comment	Comment Response(s)
DNR Model – 3	On page 19 of the preliminary engineering report, the maximum velocity at the outlet for the 2-year event was reported as 2.8 ft/s. This is much lower than the modeled maximum 2-yr velocity of 10.07 ft/s through the 2.5-ft diameter culvert under 377th Ave, Link M1. While it is expected for the culvert to have a higher velocity than the channel, adding a link downstream of the culvert representing the channel in the model is recommended. This would allow a more accurate estimation of shear stress and erosion potential in the downstream channel.	The higher XPSWMM velocities represent the velocity within the existing tile, not in the outlet channel. While not described in the PER, a HEC-RAS model was developed to analyze the downstream hydraulics of the open channel serving as the outlet of CD 52. The existing and proposed peak flow rates from the XPSWMM were evaluated when determining outlet adequacy. Specifically, the outlet channel using field survey data in the channel and LiDAR overbanks were utilized in the HEC-RAS model to estimate downstream velocities in the channel. The velocities listed in the PER were from the HEC-RAS model rather than the XPSWMM model.
DNR Model – 4	The weir in Link P102 appears to be too high. The roadway elevation representing the weir should be verified to ensure that the model is not underestimating the amount of flow going downstream.	The weir in this link is not the roadway. It represents an existing earthen berm/embankment that reaches an elevation of 1091 feet and is approximately 200 feet east of the roadway within the current RIM land. The roadway weir link is lower than the berm/embankment elevation.
DNR Model – 5	There appears to be double counting of storage at Node P12; the natural channel intersects with the storage contours. The modeler should verify if storage is being double counted at this location.	The natural channel referenced in this comment represents the downstream channel. The storage curve developed for Node P12 is generated upstream of the node and does not double count storage. The upstream multi-link connections coming into Node P12 all utilize the weir function for overflow to prevent double counting of storage.
DNR Model – 6	The outfall to the model is a rating curve of the downstream open channel that drains into the Blue Earth River. The modeler should provide documentation of the source of this rating curve data.	A HEC-RAS model was developed using field surveyed cross sections of the outlet channel at the outlet of CD 52 down to the Blue Earth River. A range of steady state flows were simulated in the HEC-RAS model and the corresponding water surface results from the model (i.e., rating curve) were entered into the XPSWMM model to account for the tailwater interaction.

EXHIBIT L – TILE SPECIFICATION

SECTION 01120
SPECIAL PROVISION

PART 1 - GENERAL

1.01 RELATED DOCUMENT

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 1 and 2 Specification Sections, apply to this Section.

B. The Mn/DOT Standard Specifications for Construction, 2018 Edition.

C. The City Engineers Association of Minnesota, (CEAM), *STANDARD UTILITIES SPECIFICATIONS*, 1999 Edition.

1.02 EXISTING UTILITIES

A. It shall be the Contractor's responsibility to verify the location of all existing utilities prior to the commencement of any excavation operations. Any utilities damaged or disturbed by the Contractor's operation shall be repaired by the Contractor, at its expense, to the satisfaction of the Utility Owner and the Engineer.

1.03 RIGHT OF WAY PERMITS

A. It shall be the Contractor's responsibility to comply with all conditions of applicable right-of-way “ROW” work permits from the various government agencies (City, County & State) having jurisdiction over the road ROW’s adjacent to the project limits. ROW work permits will be administered by OWNER.

1.04 STORMWATER

A. The CONTRACTOR will submit and pay for all fees to apply for an NPDES Stormwater Permit for Construction for the project. The CONTRACTOR shall sign the permit and accept all terms of the permit as the project CONTRACTOR.

1.05 INSPECTION AND TESTING

A. The Owner may employ, and pay for, services of an independent testing laboratory to perform testing. The Contractor shall furnish at its own expense such labor, materials, and facilities as may be required by the Engineer for compaction and other inspection. This shall not include the expense of the project observer or representative of the Engineer.

B. Decision as to the quality of materials and workmanship shall rest with the Owner on the basis of the Engineer's evaluation and any portion of the work rejected shall be replaced by the Contractor with approved work at no additional cost to the Owner in accordance with the General Conditions.

C. Any inspections, tests, or approvals, or waiver of tests will in no way relieve the Contractor of full responsibility for meeting the guaranteed performance and requirements of the Contract.

D. Televising: See Section 02503 for requirements for televising installed drain tile 8-inches or greater in diameter.

1.06 BENCHMARKS AND CONSTRUCTION STAKING

A. ENGINEER will provide benchmark, staking, and site coordinate information necessary for construction of the Work. Once provided, it is CONTRACTOR's responsibility to protect the information. CONTRACTOR shall request such information from ENGINEER a minimum of two days prior to the time when such information is needed.

B. The Engineer will set construction stakes, as applicable, as follows:

- Control: The Engineer will provide a series of perimeter control points around the site sufficient for use with machine control.

- Pipe Alignment and Grade: The Engineer will furnish one set of line and grade stakes for segments of pipe between manholes and outlets. Alignment is approximated based on historic design plans and needs to be field verified during construction activities.

C. The contractor shall give the Engineer 48-hour notice of its need for establishment of line or grade so that the Engineer may have time to provide stakes.

D. CONTRACTOR shall conduct operations so as to preserve benchmarks, survey reference points, and stakes existing or established by ENGINEER for the construction and so as to conform the Work to horizontal and vertical specifications in the Contract Drawings and Technical Specifications. CONTRACTOR will be charged the expense of repairing or replacing survey markers and shall be responsible for mistakes or lost time that result due to damage or destruction of survey markers due to CONTRACTOR'S operations.

E. It shall be the Contractor's responsibility to periodically check the stakes for accuracy of alignment and grade as construction proceeds, and to construct the Work in conformance with alignment and grade stipulated in Contract Drawings and Technical Specifications.

1.07 OWNER SUPPLIED EQUIPMENT

This section is not applicable to this project.

1.08 CONTRACTOR USE OF PREMISES

A. Definition of Site: The Site is defined as the area within the work limits shown on the Project Drawings. CONTRACTOR shall limit operations, including material and equipment storage, to within those work limits shown on the Project Drawings.

B. Hours of Operation: CONTRACTOR'S operations shall be limited to the hours allowed by the County, the City, and other applicable requirements.

C. Protection and Repair of Existing Utilities: CONTRACTOR shall perform operations carefully and in such a manner as to protect existing structures, underground facilities, and utilities. Obstructions not shown on the Project Drawings may exist and shall be exposed by CONTRACTOR without damage. CONTRACTOR shall be solely responsible for damage to existing structures, underground Facilities, and utilities resulting from CONTRACTOR'S operations (unless otherwise noted within the project plans and specifications) and shall repair or replace damaged items to OWNER'S satisfaction. Special care should be taken to protect existing bituminous trails and roadways. The CONTRACTOR is also responsible for calling Gopher One for project utility locations before starting construction.

D. Unfavorable Construction Conditions: When unfavorable weather, soil, drainage, or other unsuitable construction conditions exist, CONTRACTOR shall immediately notify ENGINEER and confine operations to work which will not be adversely affected by such conditions. No portion of the Work shall be constructed under conditions that would adversely affect the quality of the Work, unless special means or precautions are taken to perform the Work in a proper and satisfactory manner. All CONTRACTOR vehicles leaving and entering the site will comply with all local regulation concerning tracking mud and other construction debris onto public or private properties. Nothing in this paragraph alters CONTRACTOR’s responsibility to timely and properly complete the work as provided for by the Contract Documents.

E. The CONTRACTOR is fully responsible for control and protection of the site until Final Completion of the Work.

1.09 HEALTH AND SAFETY REQUIREMENTS

A. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for job site conditions and safety procedures and programs, including safety and health of all persons and property, on those portions of the site affected by or used by Contractor, Contractor’s employees, subcontractors, agents,

and others during performance of the Work. This requirement will apply continuously and not be limited to normal working hours. Observation of the Work and Contractor's performance by Owner and Engineer is not intended to include review of the adequacy of the Contractor's safety and health procedures and programs on or near the construction site. The Contractor is solely responsible for the protection of property and the safety and health of its employees, Subcontractors, Suppliers, agents and others on or near the site.

B. Contractor shall submit three copies of a site health and safety plan (HASP) addressing the safety and health of all personnel involved in the Work. Safety plan shall be submitted a minimum of 7 days prior to Contractor's mobilization. **Submittal of the Contractor's HASP shall neither impose on the Engineer responsibility for adequacy of the HASP nor relieve the Contractor from the full responsibility for the HASP and HASP implementation.** The Engineer will not review the HASP for adequacy or compliance with relevant regulatory requirements.

1.10 PROJECT ACCESS POINTS

A. The CONTRACTOR is solely responsible for damage to adjacent road surfaces, crops, vegetation and landscaping beyond the project identified "work limits."

B. The CONTRACTOR may implement protective measures, at its own expense, to avoid damage(s) to adjacent road surfaces, vegetation and landscaping beyond the project identified "work limits." The ENGINEER will observe project access points before, during and after construction to determine if damage has occurred. Historically these damages include pavement cracking and cosmetic surface markings ("cat-tracks") as well as soil rutting. Acceptable protective measures include, but are not limited to, the following:

- Temporary placement of rubber and/or wood access mats
- Temporary placement of earthen berm(s)

Implementation of measures to protect the access points shall be considered incidental and no direct payment shall be made thereof.

1.11 DEMOLITION, REMOVAL, AND PROTECTION

A. The existing pipe is to be crushed at the location of each existing lateral, both public and private, and each existing intake or at least every 750 feet. Pipe shall be crushed at each location for a minimum of twenty (20) feet, centered on the lateral or intake. At the downstream end of the project, the lowest 200-feet of existing tile must be crushed and/or removed to allow the installation of the new tile to outlet in the same location. The crushed pipe shall not be located within the bedding or encasement zone of the new pipe trench. The Contractor may alternatively remove the existing pipe.

At locations where the tile has been crushed or removed, the Contractor shall cap the existing draintile upstream and downstream tile segments. Capping shall consist of placing crushed tile pieces within the mouth of the remaining tile, grouting a minimum of one foot into the end of the tile, installation of fabric over the mouth of the tile, and backfill and compaction of clay material over the installed fabric. All work shall be contained within the project limits designated in the Plans. **Crushing and capping of tile shall be considered incidental, and no additional payment shall be made thereof.**

B. Removal of tile and other debris shall include off-site disposal of all portions of the structures. All such materials shall be property of CONTRACTOR on removal and disposed of in accordance with all applicable laws.

1.12 TRAFFIC CONTROL

A. Access must be maintained to all public roadways. This allows for the temporary closure of a road provided access is maintained through an alternate route. The Contractor shall be responsible for all traffic control within areas subject to construction operations. **The Contractor must submit a traffic control plan to the Engineer for review and approval prior to start of construction.**

B. A sufficient number of barricades, direction and warning signs shall be in place at all times to adequately accommodate free and safe passage of pedestrians and vehicles. Signage shall include signs denoting "Construction Ahead" for any active access point in the project corridor. Barricades and signage shall be placed in accordance with the provisions of the Minnesota Manual of Uniform Traffic Control Devices.

C. The Contractor may temporarily close a lane of traffic in a public roadway only for off-loading of construction equipment, replacement of culverts, and patching of the roadway surface. Once equipment is off-loaded, the Contractor shall immediately remove all vehicles from the roadway travel lanes. No equipment shall be left in the public road right-of-way (including road shoulders and ditches) overnight.

1.13 TEMPORARY EROSION CONTROL

A. Silt fencing and erosion control blanketing shall be installed in locations as directed by the Engineer. Silt fence and erosion control blanket shall meet requirements of Mn/DOT 3886 and Mn/DOT 3885, respectively. Silt fence must be removed after project completion.

1.14 DRAIN TILING AND APPURTANENCES

A. SCOPE

This section of the specifications covers the work related to furnishing all plant, labor, equipment, appliances, and materials, and in performing all operations in connection with the construction or repair of subsurface drains, installed to drain ground water and surface water, as shown on the plans or as directed by the Engineer.

B. Guarantee: The Contractor must guarantee the tile work under the contract for three years after the date of substantial completion against any fault or negligence on the part of the Contractor.

C. Materials: Pipe materials and installation shall be in conformance with Section 02503.

D. Installation of Subsurface Drains: Drain tile shall be installed, blinded, and backfilled in accordance with Section 02503.

1.15 SEEDING & MULCH

A. Seeding shall be performed in accordance with Mn/DOT 2575 and Mn/DOT 2007 Seeding Manual.

B. All disturbed areas outside of cultivated cropland shall be seeded and mulched

C. Seeding

- Work shall include the following operations:
  a. Soil preparation.
  b. Broadcast seeding.
  c. Permanent Seed Mixture 25-121 at a rate of 61 pounds per acre

D. Mulch

- Work shall include the following operations:
  a. Type 1 Straw Mulch
     (i) Placement of mulch materials at rate of 4,000 pounds per acre
     (ii) Disc anchoring
  b. Type Bonded Fiber Matrix
     (i) Placement of mulch materials at rate of 4,200 pounds per acre

E. Temporary Seeding and Mulch

- To accommodate the Contractor's work schedule, Contractor shall provide temporary seeding and mulch as necessary to meet NPDES permit requirements.

Temporary seeding and mulch shall be considered incidental, and no additional payment shall be made thereof.

1.16 SPREADING AND SMOOTHING OF BACKFILLED TRENCH

A. Final spreading and smoothing of backfilled trench shall occur during non-frozen conditions and shall result in finished grade even with surrounding ground. A minimum of 1 foot of backfill must be topsoil material salvaged and separately spoiled from subsoil material during trench excavation.

PART 2 – PRODUCTS

2.01 GENERAL

A. Unless otherwise stated, all materials related to grading, erosion control, and turf establishment shall meet the requirements of DIVISION III, MATERIALS of the Mn/DOT *Standard Specifications for Construction,* 2018 Edition.

2.02 APPROVED EQUAL

A. Whenever, in any Contract Documents, an item of material or equipment is defined by describing a proprietary product or by using the name of a manufacturer or vendor, the term "or approved equal," if not inserted, shall be implied. The specified items of materials or equipment mentioned shall be understood as establishing a standard of type, function, efficiency, minimum basis of design and quality desired. Other manufacturer's products of comparable quality, design and efficiency and suitable for the service intended will be considered. No substitute materials or equipment shall be bid or ordered without the written approval of the Engineer who shall be the judge of equality.

B. A prospective Bidder may request "or equal" status for materials and equipment up to seven calendar days before the day set for the Bid Opening. The Bidder shall submit the request for "or equal" status to the Engineer with complete information that will demonstrate the item to be considered will fit within the provided space limitations. Detailed drawings and specifications will be required.

C. At least four calendar days before the day set for the Bid Opening, the Engineer may issue an Addendum to all plan holders wherein acceptable "or equal" materials will be listed. This Addendum will include only acceptable “or equal” materials and equipment and will not address unsatisfactory or non-approved items. The Bidder shall prepare and submit their bid using only originally specified materials and equipment or Engineer approved equals as stated in the Addendum.

D. By executing the Contract, the Contractor represents that he/she has understood the requirements of the Contract Documents.

PART 3 – EXECUTION (See Division 2)

****END OF SECTON****

SECTION 02503
DRAINAGE TILE

PART 1 - GENERAL

1.01 SECTION INCLUDES

SCHEDULE 0 - Piping, inlets, and manholes.

SCHEDULE 1 - Riprap and other erosion control measures.

1.02 RELATED SECTIONS

A. Document: Minnesota Department of Transportation (Mn/DOT), "Standard Specifications for Highway Construction", 2018 Edition, including Supplements current as of bid date.

1.03 SUBMITTALS

A. Submit the following:

1. Manufacturer's Literature: Materials description and installation instructions for;

a. Drain tile, fittings and bends.

b. Inlet materials.

c. Jacked pipe materials.

1.04 QUALITY ASSURANCE

A. Comply with all codes, laws, ordinances and regulations of governmental authorities including, but not limited to, local municipalities and sanitary districts having jurisdiction over this part of the work.

1.05 REFERENCES

A. Comply with the cited sections of the following codes, specifications and standards except where more stringent requirements are shown on the Drawings as specified herein:

1. City ENGINEERs Association of Minnesota (CEAM), “Standard Utilities Specifications”, 1999 Edition
2. Minnesota Department of Transportation (Mn/DOT), "Standard Specifications for Highway Construction", 2018 Edition, including Supplements current as of bid

date.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Corrugated Polyethylene Pipe:

Corrugated Polyethylene Pipe and Corrugated Polypropylene Pipe: Tile shall be dual wall smooth interior Corrugated Polyethylene Pipe. The Pipe, along with couplings and fittings, shall meet the requirements of ASTM F2648. Joints shall be bell and spigot push-on type, soil-tight joints in accordance with ASTM F2306. Tile shall be non-perforated unless otherwise specified.

B. Granular Bedding and Encasement Material:

Material furnished for Granular Bedding and Encasement shall conform to the specifications of MnDOT 3149.2F. Granular Bedding and Encasement will be used as shown in the bedding, backfill and trench details and tables in the plans or as directed by the ENGINEER. No adjustment in unit price will be made for increases or decreases in quantities of Granular Bedding and Encasement. Granular Bedding and Encasement is considered incidental to the installation of draintile and other drain features.

C. Foundational Material:

Material furnished for Foundational Material shall ¾" to 1-1/2", 100 percent crushed rock.

D.Inlets

Material furnished for Surface and Televising Inlets shall include the Tee fitting on the subsurface tile, non-perforated riser pipe of the size specified, reducers, a metal trash rack/rodent guard, Hickenbottom (or approved equal), riser cap, geotextile fabric, foundational material as bedding and backfill and a tile inlet marker flag as shown on the plans. The Tee fitting and riser pipe material shall be the same as the subsurface tile.

E. Connect to Existing Private Pipe Drain

Material furnished for the item "Connect to Existing Private Pipe Drain" shall include the Tee or Wye fitting on the subsurface tile, CPP pipe of the size of the existing private pipe drain, and a coupler as shown in the plans. The Tee or Wye fitting material shall be the same as the subsurface tile.

F. Geotextiles

Drain Tile Sock shall be Mn3733 Geotextile Fabric Type I or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Establishing Line and Grade

1. The primary line and grade will be established by the ENGINEER. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at an appropriate offset as will best serve the CONTRACTOR's operations wherever practical. Location of existing pipe is approximate and shall be field verified during construction.

2. The CONTRACTOR shall arrange their operations to avoid unnecessary interference with the establishment of the primary line and grade stakes; and shall render whatever assistance may be required by the ENGINEER in accomplishing the staking.

3. The CONTRACTOR shall be responsible for preservation of the primary stakes and shall bear the full cost of any re-staking.

4. The CONTRACTOR shall be solely responsible for the correct transfer of the primary line and grade to all working points and for construction of the work to the prescribed lines and grades as established by the ENGINEER.

B. Protection of Underground and Surface Structures.

1. Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the CONTRACTOR at their own expense. When necessary to determine the location of existing pipes, valves or other underground structures, the CONTRACTOR, after an examination of available records, shall perform all explorations and excavation for such purposes.

2. Whenever existing utility structures, main sewer, drains, or other conduits, ducts, pipes or other structures present obstructions to the grade or alignment of the pipe, such structures shall be permanently supported, removed, relocated or reconstructed by the CONTRACTOR through cooperation with the OWNER of the structures involved. In those instances where relocation or reconstruction is impractical, a change in line and/or grade will be ordered by the ENGINEER and the change shall be made in the manner directed. No deviation shall be made from the required line or grade except by written consent of the ENGINEER.

3. Obstructions such as street signs, guard posts, small culverts, and other items of prefabricated construction may be temporarily removed during construction

provided that essential service is maintained in a relocated setting as approved by the ENGINEER and that non-essential items are properly stored for the duration of construction. Upon completion of the underground work, all such items shall be replaced at their proper setting at the sole expense of the CONTRACTOR.

4. In the event of damage to any surface improvements, either privately or publicly owned, in the absence of construction necessity, the CONTRACTOR will be required to replace or repair the damaged property to the satisfaction of the ENGINEER and without cost to the OWNER.

5. The CONTRACTOR shall promptly repair at their expense any break or damage to other utility mains, or to house service connections for water, sewer, and gas caused by their work.

C. Handling

1. All materials for subsurface drains will be new and unused. All foreign material will be cleaned from inside the pipe and joints will be clean prior to installation.

3.02 EXCAVATION AND PREPARATION OF TRENCH

A. The trench shall be dug using either a shaped (rounded) trench bedding method or a rectangular trench with granular bedding and encasement material as shown in the plans. The pipe shall be no more than 15 feet offset from the existing tile without prior approval from the Engineer. Existing tile locations must be field verified during construction. Sections of realigned tile shall be constructed as shown on plans. All pipe bedding shall comply with manufacturer's guidance.

The trench shall be dug only so far in advance of construction as the ENGINEER shall permit. The sides of the trench shall be sloped and/or braced and the trench drained so that workers can work safely and efficiently. It is essential that discharge pumps be directed toward natural drainage channels or to drain sewers.

B. Where open trenches will be excavated, topsoil to a depth of 1 foot must be salvaged and stockpiled prior to trench excavation. Topsoil must be replaced following backfilling. Once topsoil has been replaced, all excavated areas must be tilled to smooth the surface, break up soil clods, and restore the seed bed. This tillage shall include 2 passes with a field cultivator, disk, or similar ag implement. Use of solely ripper point shanks or similar devices on construction equipment does not meet this requirement.

Unless otherwise specified, excavation for and subsequent installation of each tile line shall begin at the outlet end and progress upstream. The trench or excavation for the tile shall be constructed to the depths and cross-section shown on the plans. The trench width may be increased at the point 1 foot above the top of the tile, at the option of the CONTRACTOR.

Trench boxes or shields, shoring and bracing, or other methods necessary to safeguard the workers and the work and to prevent damage to existing improvements shall be furnished, placed, and subsequently removed by the CONTRACTOR incidental to the tile item.

C. Material excavated from the trench below the salvaged topsoil will not be allowed as granular bedding and encasement material. All granular bedding used for rectangular trench method must be non-native.

   All suitable materials shall be reserved for backfill to the extent needed, and any surplus remaining shall be utilized for other construction on the project as may be specified or ordered by the ENGINEER. Unless otherwise specified in the Plans, Specifications, and Special Provisions, material handling as described above shall be considered incidental with no additional compensation provided therefor.

D. All excavated materials reserved for backfill or other use on the project shall be stored at locations approved by the ENGINEER that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavations as would create hazardous conditions, nor shall any material be placed so as to block the access to emergency services. All materials considered unsuitable by the ENGINEER, for any use on the project, shall be immediately removed from the project and be disposed of as arranged for by the CONTRACTOR at no extra cost to the Contract.

   1. All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing roadways, field roads and will not impede water flow to create excess ponding, as far as practical.

   2. While any open excavations are maintained, the CONTRACTOR shall have available a supply of steel plates suitable for temporary bridging of open trench sections where either vehicular or pedestrian traffic must be maintained. Use of the plates shall be as directed or approved by the ENGINEER and where installed they shall be secured against possible displacement and be replaced with the permanent structure as soon as possible.

E. Trench excavating shall be to a depth that will permit preparation of the foundation as specified and installation of the pipeline and appurtenances at the prescribed line and grade, except where alterations are specifically authorized. Trench widths shall follow manufacturer's specifications and generally be sufficient to permit the pipe to be laid and joined properly and the granular bedding and encasement material to be placed and compacted as specified. Extra width shall be provided as necessary to permit convenient placement of sheeting and shoring and to accommodate placement of appurtenances.

   1. Where no other grade controls are indicated or established for the pipeline, the excavating and foundation preparations shall be such as to provide a minimum cover over the top of the pipe as specified. Trench widths shall allow for at least

six inches of clearance on each side of the joint hubs. The maximum allowable width of the trench at the top of pipe level shall be the outside diameter of the pipe plus two feet, subject to the considerations for alternate pipe loading set forth below. The width of the trench at the ground surface shall be held to a minimum to prevent unnecessary destruction of the surface structures.

2. The maximum allowable trench width at the level of the top of pipe may be exceeded only by approval of the ENGINEER, after consideration of pipe strength and loading relationships. Any alternate proposals made by the CONTRACTOR shall be in writing, giving the pertinent soil weight data and proposed pipe strength alternate, at least seven days prior to the desired date of decision. Approval of alternate pipe designs shall be with the understanding that there will be no extra compensation allowed for any increase in material or construction costs.

3. If the trench is excavated to a greater width than that authorized, the ENGINEER may direct the CONTRACTOR to provide a higher class of bedding and/or a higher strength pipe than that required by the Plans, Specifications, and Special Provisions in order to satisfy design requirements, without additional compensation therefor.

F. Excavations shall be extended below the bottom of structure as necessary to accommodate any required Granular Foundation material. When rock or unstable foundation materials are encountered at the established grade, additional materials shall be removed as specified or ordered by the ENGINEER to produce an acceptable foundation. Unless otherwise indicated or directed, rock shall be removed to an elevation at least six inches below the bottom surface of the pipe barrel and below the lowest projection of joint hubs. All excavations below grade shall be to a minimum width equal to the outside pipe diameter plus two feet. Rock shall be removed to such additional horizontal dimensions as will provide a minimum clearance of six inches on all sides of appurtenant structures such as valves, housings, access structures, etc.

1. All costs of excavating below grade and placing foundation or bedding aggregates as required shall be included in the bid prices for pipe items to the extent that the need for such work is indicated in the Contract provisions and the Proposal does not provide for payment therefore under separate Contract Items.

2. If examination by the ENGINEER reveals that the need for placement of foundation aggregate was caused by the CONTRACTOR's manipulation of the soils in the presence of excessive moisture or lack of proper dewatering, the cost of the corrective measures shall be borne by the CONTRACTOR.

G. Rock encountered within the excavation shall be removed to a minimum width equal to the outside diameter of the pipe plus 4 inches and to a minimum depth of 4 inches below the pipe. The backfill to foundation elevation may be made with suitable material removed from elsewhere in the excavation, which shall be compacted

uniformly to provide a proper foundation.

If the bottom of the trench does not provide a sufficiently stable or firm foundation for the drain tile, dewatering shall be used to stabilize the bottom of the trench. Crushed Rock Bedding may also be furnished and installed to stabilize the foundation as directed by the ENGINEER.

In stable soils, the tile shall be firmly and uniformly bedded throughout its entire length to the specified depth and in the specified manner.

H. Blasting: Blasting will not be allowed.

I. The CONTRACTOR shall be responsible for all on-site drainage and shall provide sedimentation basins to limit sediments from reaching the natural drainage course.

3.03 LAYING OF PIPE

A. Pipe shall be laid according to plan inverts and elevations. Maximum deviations from planned elevations is 0.15 feet. All junctions and bends shall be made with wyes, tees, and bends fabricated from the same material as the pipe. 90-degree elbows shall not be permitted.

Communication from CONTRACTOR to the ENGINEER is essential to avoid costly errors or delays.

B. The interiors of the pipes shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operations by means of tight plugs or other approved methods. No trench water shall be allowed to enter the pipes or fittings. Drain outlets to the surface shall be as shown on the plans with a trash guard. The ends and inside surfaces of all tiles shall be kept clean during laying. All earth or other extraneous material in the tile shall be removed before laying the next tile.

At the end of each day's work and when laying of pipe has been temporarily suspended, the inlet end shall be blocked so earth, stormwater, or other extraneous materials will not enter the tile. The upper end of the line shall be blocked with permanent type materials on completion of the line.

C. Lateral connections shall be made as indicated in the plans or as indicated in this section. All perforated laterals and connections shall be socked or wrapped in fabric that is physically secured to the tile, in locations where it is bedded in sand.

For lateral connections less than 8-inches, either an Inserta Tee or approved equal such as a "collared field fitting" may be used. This consists of a minimum 1 linear foot collar made of drain tile with the same diameter as the lateral being connected with a lengthwise cut to allow it to slip over the lateral being connected. Collars are

layered with the opening at the bottom of the tile until they fill the receiving tile that will be connected to the mainline. The entire collar is to be inserted into the receiving tile and wrapped in fabric that extends a minimum of 3-feet upstream and downstream of the connection. The fabric is to be physically secured in place. QuikSeal is an approved equal to Inserta Tee.

For dissimilar material pipe connections where commercially manufactured adapters are unavailable, a "concrete encasement" may be used. This consists of encasement of the pipe in quick-set concrete. The concrete is to extend a minimum of 1 linear foot in length alone the pipe on both sides from the connection point. No excavation shall take place directly under the connection and the foundation below the connection must be stable and firm. The connection is to first be wrapped in fabric that is physically secured in place.

The Contractor shall allow the Engineer to record the location of each lateral tile prior to backfill.

D. Plowing of the tile in accordance with pipe manufacturer recommendations is permitted for drain tile with a diameter of 18-inches or less. All other installation requirements remain, except that the required granular backfill need not be compacted.

E. Remove areas of poor soil and install Granular Aggregate material special foundation material.

F. Depending on pipe diameter, material, and soil classification, a shaped trench bedding method is preferred. Tables listing maximum fill height requirements for various pipe sizes are included in the plans. CONTRACTOR shall conform to the pipe material-specific bedding method as indicated on the plans and as required by the pipe manufacturer.

In the shaped trench bedding method, the trench will be shaped as shown in the plans using either a tile plow or a "spoon" attachment for a backhoe bucket. It is acceptable to excavate to remove overburden to facilitate tile installation with a tile plow or a "spoon" attachment provided excavation is completed with tracked equipment that does not overly compact the topsoil in the agricultural fields. However, if burial depths exceed maximum allowable, installation must follow standard rectangular trench methods with granular bedding and encasement. It is the responsibility of the CONTRACTOR to confirm that bedding and cover depths conform to the requirements set by the tile manufacturer.

For deeper burial depths and for road crossings, the acceptable installation method shall be the rectangular trench with granular bedding and encasement method. The granular bedding and encasement materials shall be installed as shown in the bedding, backfill, and trench details and tables in the plans and compacted to 85% or 90% Standard Proctor Density (SPD) depending upon the depth of cover over the pipe. Tables listing the SPD compaction required for various pipe sizes and depths of cover

area included in the plans.

Compaction of materials placed within the pipe bedding and encasement zones shall be accomplished with portable or hand equipment methods, so as to achieve thorough consolidation under and around the pipe and avoid damage to the pipe.

3.04 BACKFILLING AND GRADING

A. Installed pipe shall be blinded immediately following installation in the trench. The pipe shall be covered by a depth of 6 inches of granular bedding and encasement material and 3-feet of backfill. Backfill material used for blinding shall not be frozen and shall contain no rocks or stones that, when dropped, may cause tile damage. All tile placed during any day shall be blinded at the completion of the work activities that day.

B. No more than 1,250 feet of trench may be open (without final backfill) at any time. No new trench excavation will be allowed if this limit is exceeded.

C. All excavation in trenches shall be backfilled to the original ground surface or to such grades as specified or shown on the Drawings. Backfilling shall be done as completely as possible so as to attain complete filling and using the best materials available for this purpose, free from boulders, rubbish, frozen lumps, and similar materials. Depositing of the backfill shall be done so the shock of falling material will not injure the structure, lowering the bucket to the level of the pipe, and making sure no large chunks of earth are dropped on the pipe. Grading over and around all parts of the work shall be done as directed by the ENGINEER.

D. The backfilling of the trench shall be completed as rapidly as consistent with the soil conditions. Under saturated soil conditions, each pipe section must be backfilled to a depth of 3 feet of cover prior to proceeding with the next pipe segment. Above the cover zone material, the use of heavy roller-type compaction equipment shall be limited to safe pipe loading.

   Backfill materials shall be carefully placed in uniform loose thickness layers up to 24 inches thick, spread over the full width and length of the trench section to provide simultaneous support on both sides of the pipeline. Compaction of trench backfill in agricultural fields is not required above the bedding and encasement zone, and backfill shall extend above the ground surface in these areas and be well-rounded over the trench to provide for settlement of the trench backfill.

E. The requirements for backfilling in agricultural fields shall vary, depending on the portion of trench concerned.

   a. Bottom Portion of Trench. For tile placed in a square-bottom trench, granular material, free from rocks and boulders, shall be deposited in the trench simultaneously on both sides of the pipe for the full width of the trench to a height of at least 6 inches above the top of the pipe, shovel-placed and tamped to

completely fill all spaces under and adjacent to the conduit.

b. Mid- and Upper Portion of Trench. Backfill materials shall be carefully placed in uniform loose thickness layers up to 24 inches thick, spread over the full width and length of the trench section to provide simultaneous support on both sides of the pipeline. Compaction of trench backfill in agricultural fields is not required above the bedding and encasement zone, and backfill shall extend above the ground surface in these areas and be well-rounded over the trench to provide for settlement of the trench backfill.

E. Compaction of backfill within roadbed areas shall meet the density requirements of MnDOT Specification 2105.3F2. Any settlement of road surfaces placed under this Contract and that are within the guarantee period that are in excess of 1 inch, as measured by a 10-foot straight edge shall be considered failure of the mechanical compaction. The CONTRACTOR shall be required to repair such settlement without cost to the OWNER. Compaction of backfill in all other areas shall be required in the Special Provisions.

F. CONTRACTOR shall inform ENGINEER when backfilling on a pipe branch will begin to allow ENGINEER to coordinate observation to ensure proper installation.

3.05 EROSION CONTROL

A. The CONTRACTOR shall provide erosion control for the entire project as shown on the plans, directed in the field and as required by the appropriate permitting agencies. The CONTRACTOR shall provide holding areas and settling basins as necessary to control the suspended solids in construction dewatering discharges as required by the regulating agencies. Payment for holding areas and settling basins shall not be made directly but shall be considered incidental to the project.

B. Riprap shall be installed as indicated in the plans and per Mn/DOT Spec. 2511.

3.06 TELEVSING

A. Upon completion of the tile installation, The CONTRACTOR shall clean the tile to ensure that it is free of sand, rubble, and debris. All runs of tile between fittings and bends shall be straight and true.

B. The CONTRACTOR shall allow televising by the ENGINEER before placing backfill over televising inlets. Televising will commence, at a minimum, at least 30 days after the Date of Completion (unless otherwise authorized by OWNER), but no later than the substantial completion date. The ENGINEER may elect to televise segments of tile at any time during the project.

C. The CONTRACTOR is responsible at their expense for replacement of inadequate tile not conforming to the manufacturer's specification. The ENGINEER will televise repaired segments to confirm correction work is completed.

END OF SECTION

SECTION 02105
EARTHWORK

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Preparing of subgrade for walks and pavements.

2. Excavating and backfilling for underground utilities.

1.03 DEFINITIONS

A. Subgrade: The undisturbed earth or the compacted soil layer immediately below aggregate base, drainage fill, or topsoil materials.

B. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent backfill and/or disposal of materials removed.

C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

1. In locations under pavements, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

D. Subgrade Correction: When excavation has reached required subgrade elevations, notify Engineer, who will make an inspection of conditions. If Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer. When the depth of unsuitable material exceeds two feet below subgrade elevations, any additional excavation below said two foot level shall be considered subgrade correction. The Contract Sum may be adjusted by an appropriate Contract Modification.

1. Compensation for subgrade correction, as directed by the Engineer, will be paid on basis of Conditions of the Contract relative to changes in work.

E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Owner may employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations.

C. Retests of materials failing initial testing shall be paid for by the Contractor.

1.05 PROJECT CONDITIONS

A. Site Information: Data provided in the project plans was used for the basis of the design and is available to the Contractor for information only. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

    a. Provide minimum of 48-hour notice to Engineer and receive written notice to proceed before interrupting any utility.

C. Use of Explosives: Use of explosives is not permitted.

D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

3. All barricades and traffic control devices required due to excavations in proximity to existing and/or newly constructed roadways shall be incidental to the site grading or common excavation quantities.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Aggregate Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, and natural or crushed sand per Specification Section 01120 Special Provisions.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.

C. Control Fill: Material shall consist of well-graded natural earth materials that are free of organics and other deleterious materials. Controlled fill shall consist of soil materials classified as GW, GP, GM, GC, SC, SP, SM, SW, CL-ML, or CL under the Unified Soils Classification System, ASTM D2487, and having a plasticity index (PI) less than 20 (for cohesive soils). Controlled fill soils should be capable of producing a maximum dry density of not less than 100 pounds per cubic foot using the Standard Proctor effort (ASTM-D698). All Controlled fill shall be free of cobbles or boulders greater than 6-inches in any dimension and shall have an organic content that does not exceed 5% by weight. The Contractor will provide materials from on-site and/or off-site sources.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

3.02 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.03 DEWATERING

A. See Specification Section 02240 Control of Water

3.04 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

3.05 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and clearance on both sides of pipe or conduit following manufacture's specifications.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

1. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.

2. For pipes or conduit less than 6 inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

3. For pipes 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 60 degrees (bottom 1/6 of the circumference). Fill depressions with tamped sand backfill.

3.06 SUBGRADE CORRECTION

A. The presence of unsuitable and/or saturated subgrade soils, not anticipated in the design process, will require removal if so directed by the Engineer. Compensation for subgrade correction will be based on a negotiated price in accordance Conditions of the Contract relative to changes in work.

B. Subgrade Correction is defined in paragraph 1.03D. In general, subgrade correction will consist of removal of unsuitable and/or saturated soils to a depth as directed by the Engineer, placement Type V geotextile fabric at the bottom of the excavation and replacement of unsuitable soils with granular bedding or granular foundation material to the prescribed subgrade elevations.

3.07 BACKFILL AND FILL

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section, and as noted in the Plans.

1. Under grassed areas, use excavated material.

2. Under piping and conduit and equipment, use aggregate materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 60 degrees of cylinder if rectangular trench is utilized.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.

2. Removal of concrete formwork.

3. Removal of trash and debris from excavation.

3.08 PLACEMENT AND COMPACTION

A. Place backfill and fill materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

C. Control soil and fill compaction in accordance with the Method of Quality Compaction (Visual Inspection). Correct improperly compacted areas or lifts as directed by Engineer if soil density is inadequate.

1. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

    a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

    b. Stockpile or spread soil material that has been removed due to moisture content too high for compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.09 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas to allow drainage of water across graded areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.

2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.

3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section in accordance with the provisions of Mn/DOT 2105.

C. Compaction: After grading, compact subgrade surfaces in accordance with the Method of Quality Compaction (Visual Inspection).

3.10 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow ENGINEER or ENGINEER'S representative to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

3.11 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

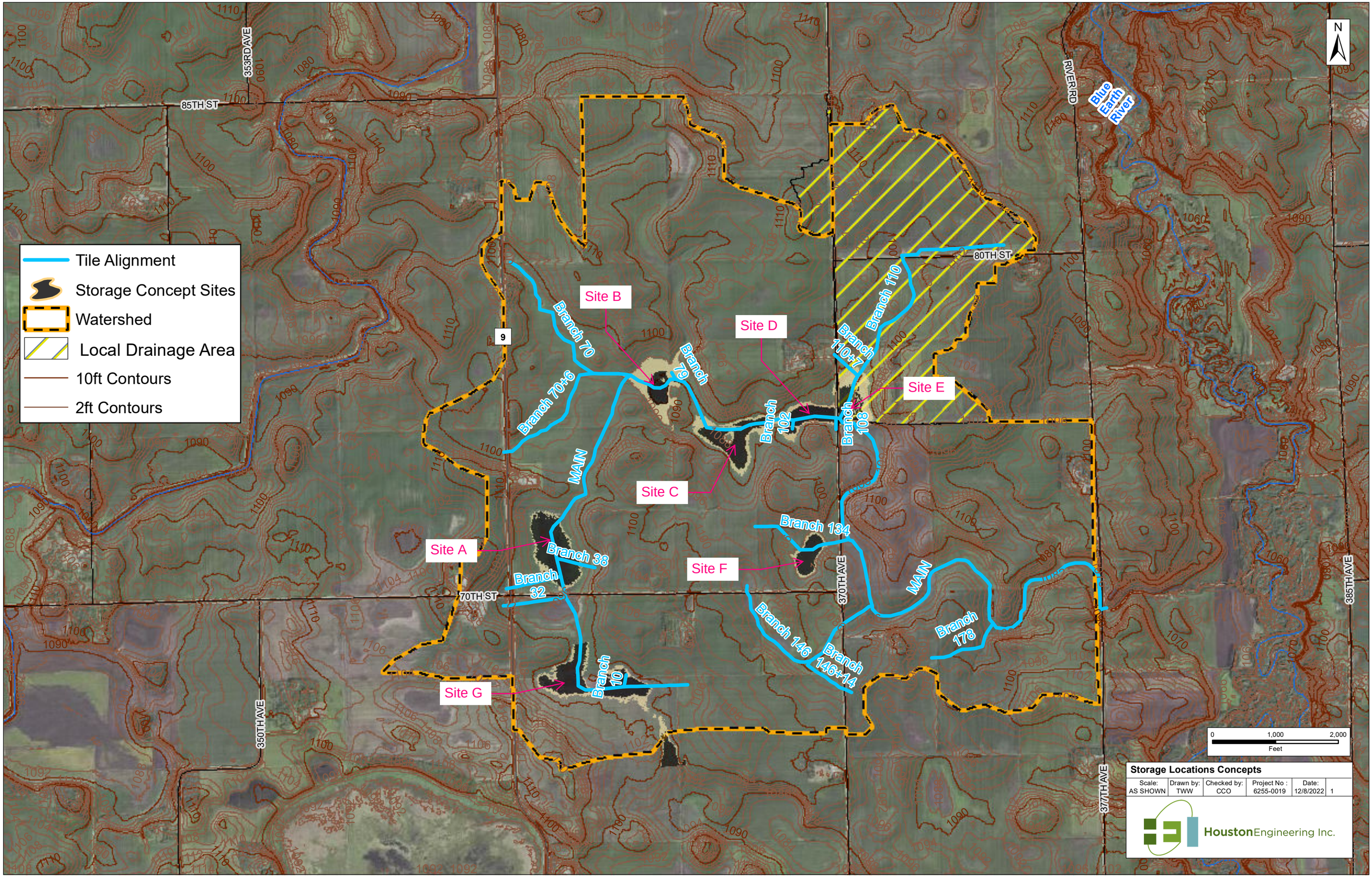
D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

3.12 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

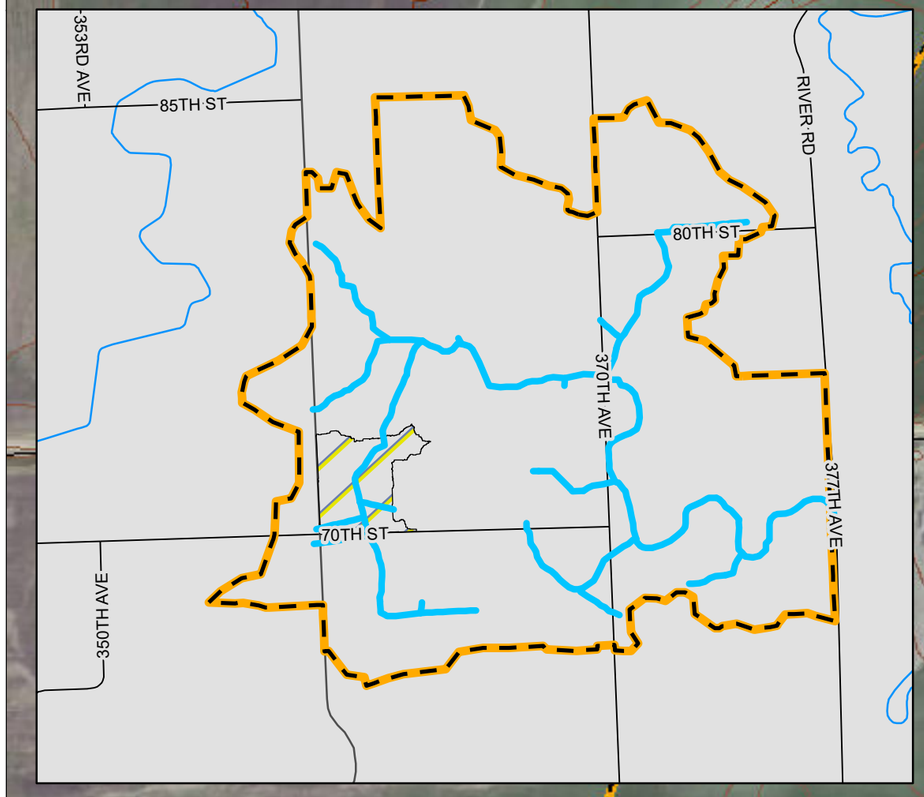
****END OF SECTION****

EXHIBIT M – POTENTIAL STORAGE SITES


Tile Alignment
Storage Concept Sites
Watershed
Local Drainage Area
10ft Contours
2ft Contours
N
85TH ST
353RD AVE
80TH ST
RIVER RD
Blue Earth River
9
Site A
Site B
Site C
Site D
Site E
Site F
Site G
Branch 70
Branch 70-6
Branch 79
Branch 102
Branch 108
Branch 110
Branch 110-7
MAIN
Branch 134
Branch 38
Branch 32
Branch 10
Branch 146
Branch 146-14
Branch 178
70TH ST
370TH AVE
350TH AVE
377TH AVE
385TH AVE
0
1,000
2,000
Feet
Storage Locations Concepts
Scale: AS SHOWN
Drawn by: TWW
Checked by: CCO
Project No : 6255-0019
Date: 12/8/2022
1
HoustonEngineering Inc.

	Elevation (ft NAVD88)	Volume (ac-ft)	Surface Area (acres)
Bottom	1093.7	-	-
Primary	1094.7	5.1	12
Secondary	1094.9 (+0.2')	7.6	15

- Tile Alignment
- Storage Concept Sites
- Watershed
- Local Drainage Area
- 10ft Contours
- 2ft Contours



Site "A"

Approximately 60 acres contributing to storage basin

MAIN

Disconnect private tile currently providing drainage to the basin

Branch 38

Branch 35

Branch 32

70TH ST

CD 52 MT and public laterals bypasses storage basin.

Limited potential to route significant volume to basin via gravity. MT and laterals profiles have limited slope upstream and cannot be daylighted.

N

0 250 500
Feet

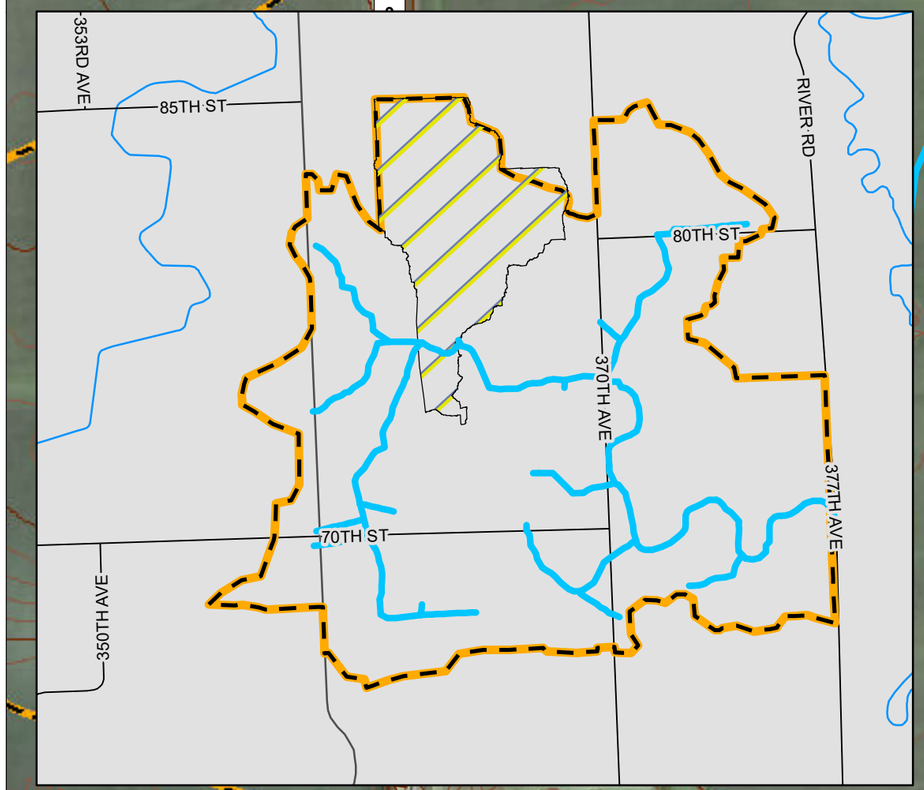
Storage Locations Concepts

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

Houston Engineering Inc.

	Elevation (ft NAVD88)	Volume (ac-ft)	Surface Area (acres)
Bottom	1089.3	-	-
Primary	1090.3	1.5	3
Secondary	1091.7 (+1.4')	12.0	11

Tile Alignment
Storage Concept Sites
Watershed
Local Drainage Area
10ft Contours
2ft Contours



Branch 70

Approximately 250 acres contributing to storage basin

Potential private lateral connecting to Branch 79 or MT may have adequate slope to daylight.

Field survey and/or information from landowner is necessary to verify feasibility.

Site "B"

Berm

Branch 79

MAIN

CD 52 MT bypasses storage basin.

Site "C"

N

0 250 500
Feet

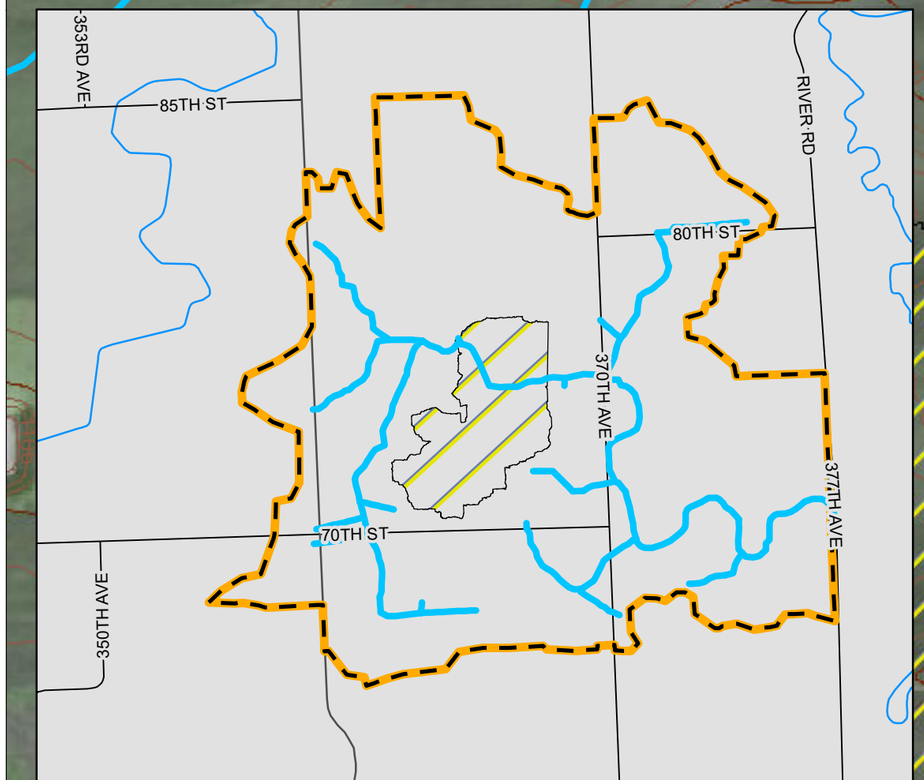
Storage Locations Concepts

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

HoustonEngineering Inc.

	Elevation (ft NAVD88)	Volume (ac-ft)	Surface Area (acres)
Bottom	1087.4	-	-
Primary	1088.4	3.6	8
Secondary	1089 (+0.6')	9.8	13

Tile Alignment
Storage Concept Sites
Watershed
Local Drainage Area
10ft Contours
2ft Contours



Potential private lateral connecting to Branch 79 or MT. It may have adequate slope to daylight.

FIeld survey or information from landowner is necessary to verify.

Site "B"

Site "C"

Site "D"

Berm

Potential grading to limit footprint of inundated area.

Approximately 150 acres contributing to storage basin

Private lateral connecting to MT may have adequate slope to daylight.

Field survey or information from landowner is necessary to verify.

Branch 79
MAIN
Branch 102
Branch 108
370TH AVE

N

0 250 500
Feet

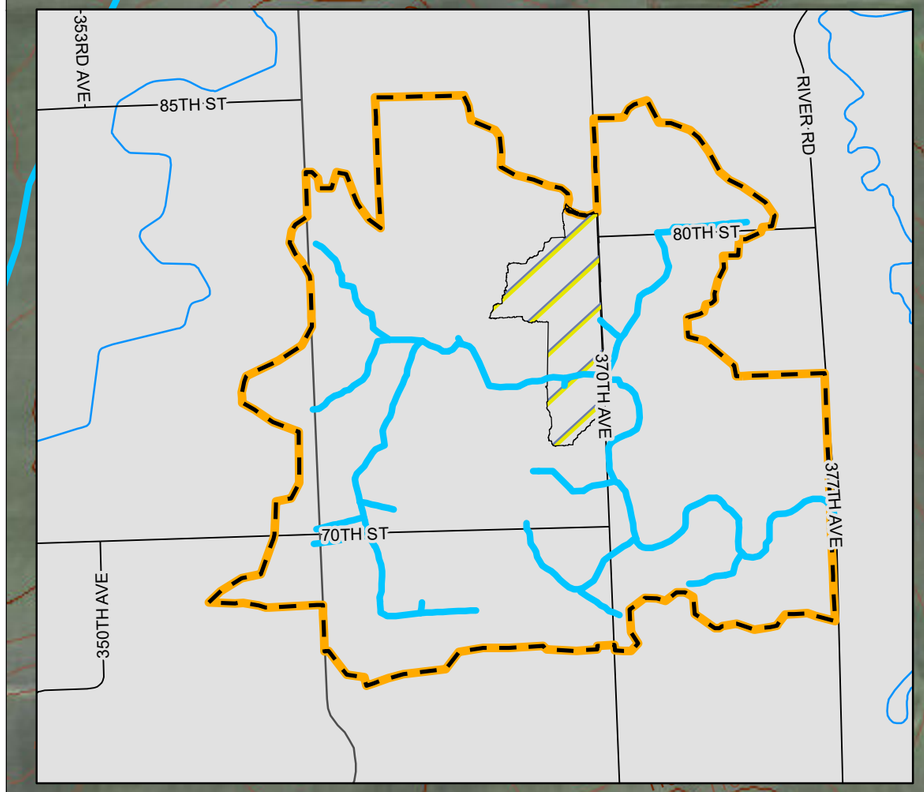
Storage Locations Concepts

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

HoustonEngineering Inc.

	Elevation (ft NAVD88)	Volume (ac-ft)	Surface Area (acres)
Bottom	1086.5	-	-
Primary	1087.5	2.3	5
Secondary	1088.3 (+0.8')	7.7	8

- Tile Alignment
- Storage Concept Sites
- Watershed
- Local Drainage Area
- 10ft Contours
- 2ft Contours



Site "B"

Site "C"

Site "D"

Approximately 130 acres contributing to storage basin

Berm

Branch 110+7

Branch 110

Branch 102

Branch 108

MAIN

370TH AVE

N

0 250 500
Feet

Storage Locations Concepts

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

HoustonEngineering Inc.

	Elevation (ft NAVD88)	Volume (ac-ft)	Surface Area (acres)
Bottom	1086.0	-	-
Primary	1087.0	1.2	4
Secondary	1088.7 (+1.7')	12.0	9

Realign tile to daylight into storage basin.

Approximately 260 acres contributing to storage basin

Site "E"

Site "D"

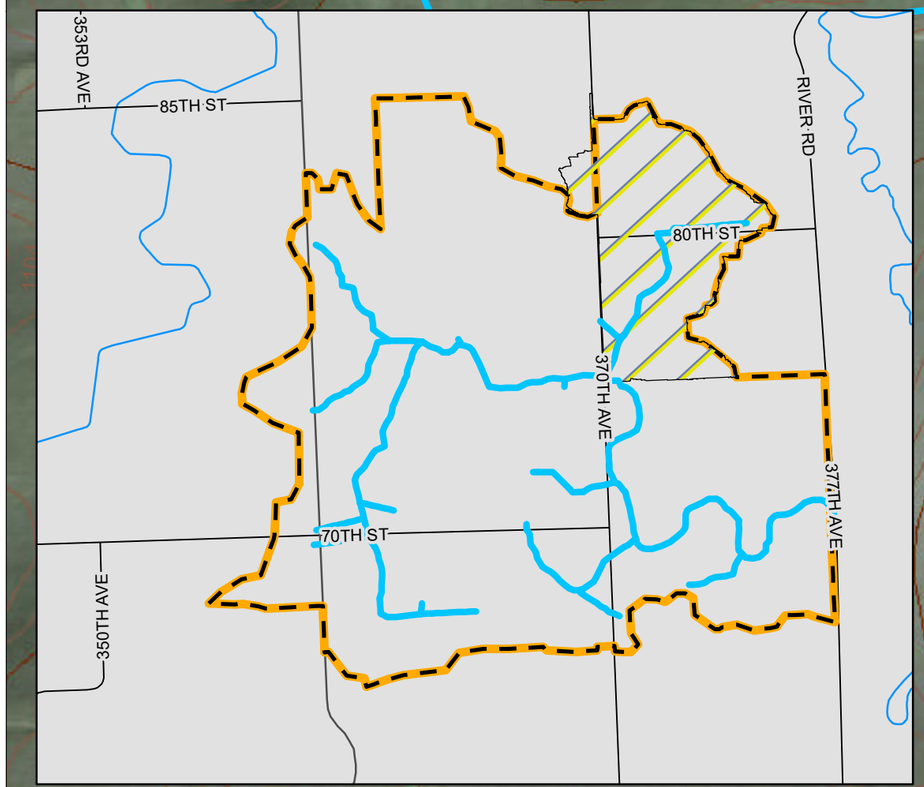
Berm

Abandon portion of Branch 110

Current wetland feature is non-functioning. Drainage system project could be installed independently or as part of repair of current feature

Berm

Tile Alignment
Storage Concept Sites
Watershed
Local Drainage Area
10ft Contours
2ft Contours



Branch 110-7
Branch 110
Branch 102
Branch 108
MAIN
370TH AVE

N

0 250 500
Feet

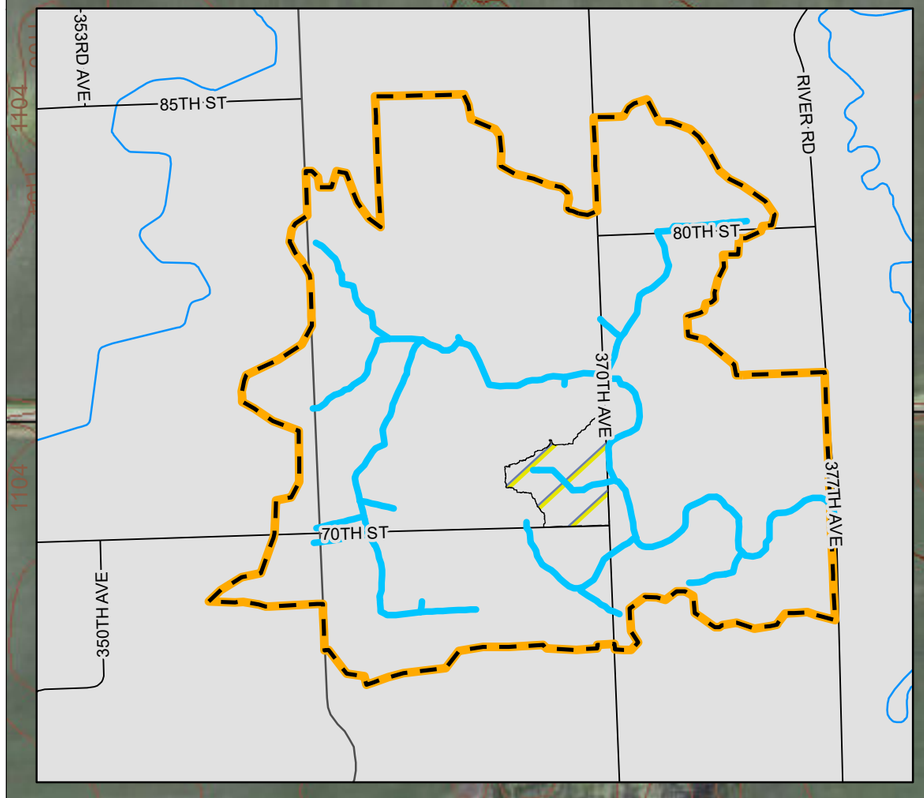
Storage Locations Concepts

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

HoustonEngineering Inc.

	Elevation (ft NAVD88)	Volume (ac-ft)	Surface Area (acres)
Bottom	1084.1	-	-
Primary	1085.1	2.1	4
Secondary	1085.6 (+0.5')	4.1	5

- Tile Alignment
- Storage Concept Sites
- Watershed
- Local Drainage Area
- 10ft Contours
- 2ft Contours



Rrealign pipe and daylight to storage basin

Approximately 50 acres contributing to storage basin

Site "F"

370TH AVE

70TH ST

Branch 134

MAIN

Branch 146

Branch 146

N

0 250 500
Feet

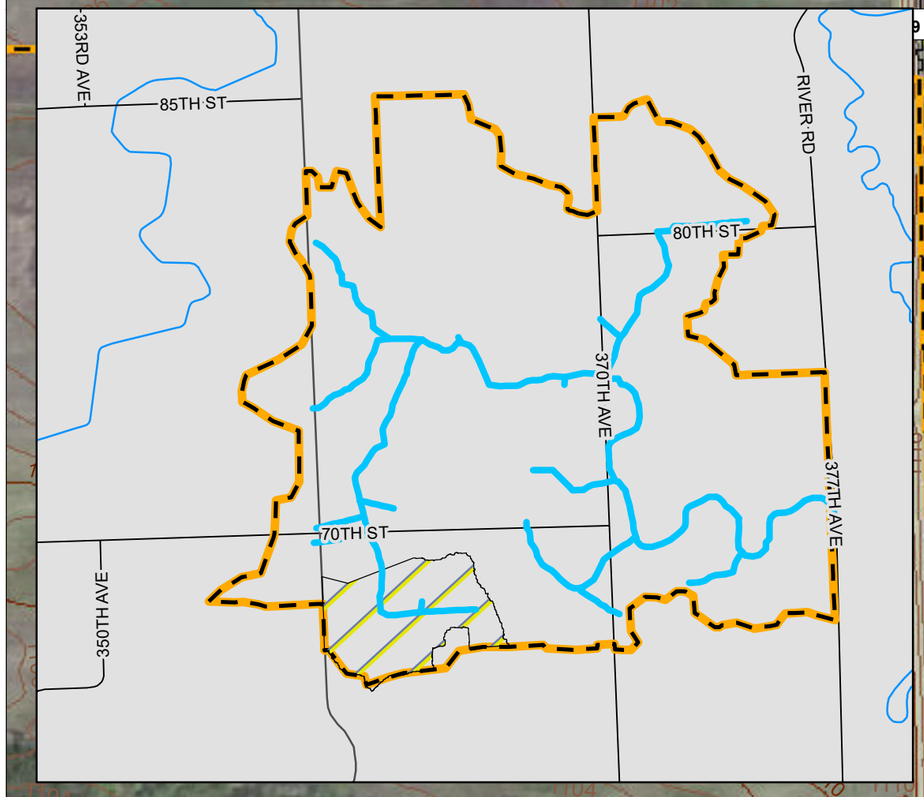
Storage Locations Concepts

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

HoustonEngineering Inc.

	Elevation (ft NAVD88)	Volume (ac-ft)	Surface Area (acres)
Bottom	1097.9		
Primary	1098.9	4.9	12
Secondary	1099.2 (+0.3')	9.9	19

Tile Alignment
Storage Concept Sites
Watershed
Local Drainage Area
10ft Contours
2ft Contours



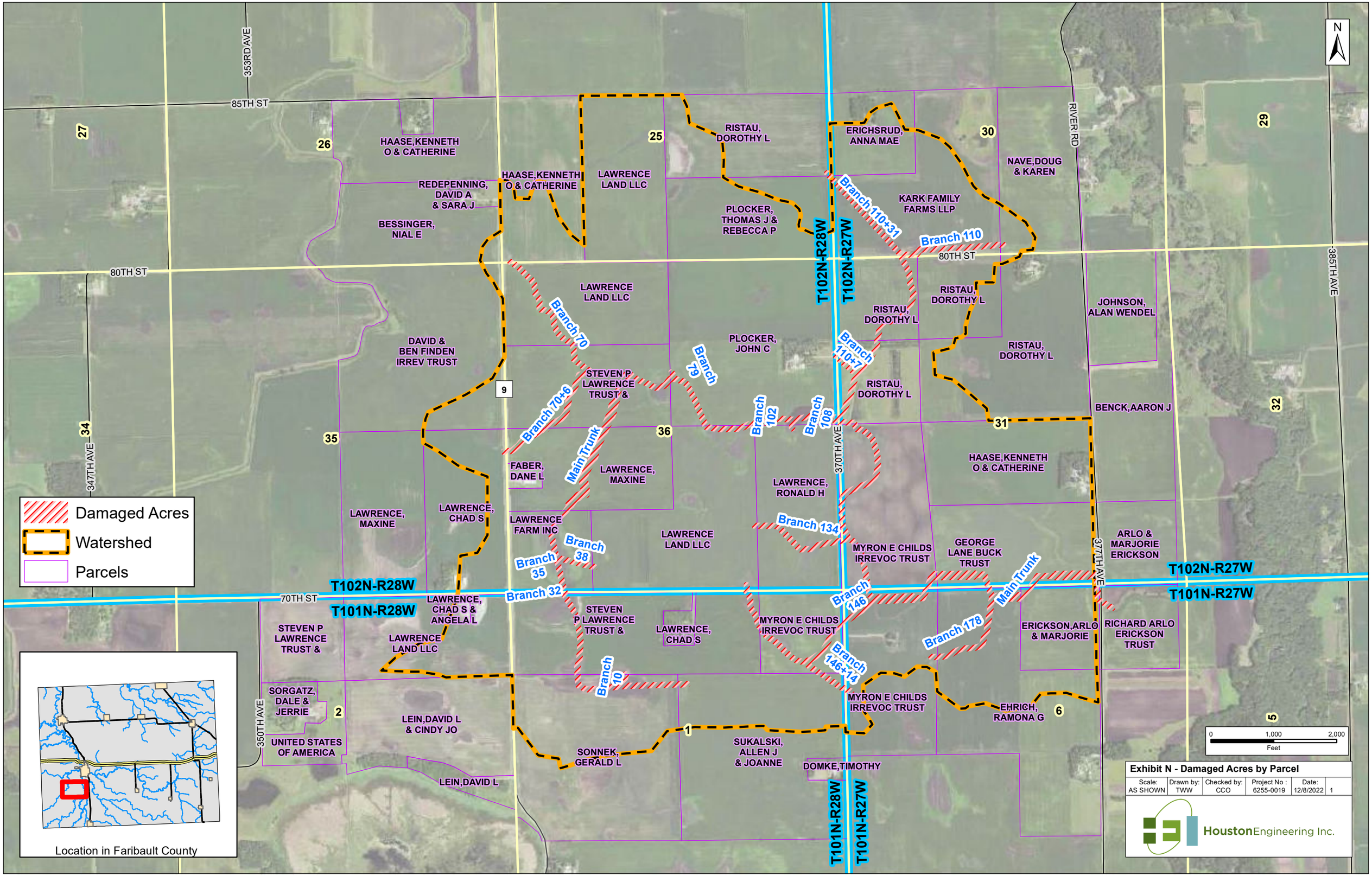
Site "A"
Branch 35
70TH ST
Branch 32
Berm
Site "G"
MAIN
Branch 10
Approximately 120 acres contributing to storage basin
N
0 250 500
Feet

Storage Locations Concepts

Scale:	Drawn by:	Checked by:	Project No :	Date:	
AS SHOWN	TWW	CCO	6255-0019	12/8/2022	1

HoustonEngineering Inc.

EXHIBIT N – TEMPORARY DAMAGES


N
353RD AVE
85TH ST
27
26
25
30
29
RIVER RD
385TH AVE
HAASE,KENNETH O & CATHERINE
REDEPENNING, DAVID A & SARA J
BESSINGER, NIAL E
HAASE,KENNETH O & CATHERINE
LAWRENCE LAND LLC
RISTAU, DOROTHY L
PLOCKER, THOMAS J & REBECCA P
ERICHSRUD, ANNA MAE
NAVE,DOUG & KARK
KARK FAMILY FARMS LLP
Branch 110+31
Branch 110
80TH ST
T102N-R28W
T102N-R27W
80TH ST
LAWRENCE LAND LLC
RISTAU, DOROTHY L
RISTAU, DOROTHY L
JOHNSON, ALAN WENDEL
Branch 70
DAVID & BEN FINDEN IRREV TRUST
PLOCKER, JOHN C
Branch 110+7
RISTAU, DOROTHY L
RISTAU, DOROTHY L
Branch 79
STEVEN P LAWRENCE TRUST &
9
Branch 70+6
Branch 102
Branch 108
BENCK,AARON J
31
34
35
36
32
347TH AVE
370TH AVE
Main Trunk
FABER, DANE L
LAWRENCE, MAXINE
LAWRENCE, RONALD H
HAASE,KENNETH O & CATHERINE
LAWRENCE, MAXINE
LAWRENCE, CHAD S
LAWRENCE FARM INC
Branch 134
LAWRENCE LAND LLC
Branch 38
Branch 35
MYRON E CHILDS IRREVOC TRUST
GEORGE LANE BUCK TRUST
ARLO & MARJORIE ERICKSON
377TH AVE
T102N-R27W
T101N-R27W
T102N-R28W
T101N-R28W
70TH ST
Branch 32
Main Trunk
Branch 146
LAWRENCE, CHAD S & ANGELA L
STEVEN P LAWRENCE TRUST &
LAWRENCE LAND LLC
STEVEN P LAWRENCE TRUST &
LAWRENCE, CHAD S
MYRON E CHILDS IRREVOC TRUST
Branch 178
ERICKSON,ARLO & MARJORIE
RICHARD ARLO ERICKSON TRUST
Branch 146+14
Branch 10
SORGATZ, DALE & JERRIE
2
MYRON E CHILDS IRREVOC TRUST
EHRICH, RAMONA G
6
5
350TH AVE
LEIN,DAVID L & CINDY JO
1
UNITED STATES OF AMERICA
SONNEK, GERALD L
SUKALSKI, ALLEN J & JOANNE
DOMKE,TIMOTHY
LEIN,DAVID L
T101N-R28W
T101N-R27W
Damaged Acres
Watershed
Parcels
Location in Faribault County
0
1,000
2,000
Feet
Exhibit N - Damaged Acres by Parcel
Scale: AS SHOWN
Drawn by: TWW
Checked by: CCO
Project No : 6255-0019
Date: 12/8/2022
1
HoustonEngineering Inc.