

DATE: August 2, 2021
TO: Merissa Lore, Faribault County
FROM: Mark Origer, ISG
SUBJECT: Faribault CD 40 Tile Reroute

ISG was requested to review the feasibility of rerouting the outlet of Faribault County Ditch No. 40 (CD 40) into the open ditch portion of Faribault County Ditch No. 46 (CD 46) (See attached map). This would reduce the number of drainage system outlets into the Blue Earth River (East Branch) and also provide a better outlet for CD 40 with less future maintenance.

The existing size and capacity of the CD 40 outlet was reviewed and calculated to determine the legal capacity of the drainage system outlet and potential reroute sizes. The topographic survey and historic records indicate the existing CD 40 tile outlet is a 22-inch pipe at a 0.10% grade. The watershed draining to this pipe is 595 acres, which calculates out to a 0.23 inch/day drainage coefficient. Since 22-inch pipes are no longer manufactured, the tile can be replaced with a 24-inch pipe. This larger tile increases the capacity to 7.2 cubic feet per second (cfs) and the drainage coefficient to 0.29 inch/day.

The historic documents were also used to determine the legal ditch capacity and legal grade. The 32-inch CD 46 main tile outlets into the open ditch 0.50 feet above the end of the legal ditch grade. From that point, the open ditch is a 4-foot-wide bottom at 0.05% grade, ranging in depth from 3 to 6 feet deep for 650 feet until it eventually drains into the Blue Earth River. The original legal capacity of the open ditch is estimated at 70 cfs.

Since the CD 46 open ditch lies several feet above its overall outlet into the Blue Earth River; significant downcutting of the channel bottom has occurred over the past 100-years. This has deepened the open ditch between 1 and 3 feet which increases the existing capacity to approximately 425 cfs.

The USGS StreamStats program was consulted to estimate the peak flows within the CD 46 watershed for the 2-year through 100-year rainfall events. The capacity of the proposed CD 40 outlet was used to determine the percent increase in flows should the CD 40 watershed drain into the CD 46 system (see Table 1). The original open ditch was likely not designed to carry the entire overland flow from the watershed within its banks. Historic evidence suggests that flooding has occurred outside of the ditch banks when the open ditch reached capacity. However in its current conditions, the open ditch has significant capacity to carry the overland flow and the additional tile flow from CD 40 through the open ditch.

Table 1: Flow Percent Increase

Event	CD 46 Peak Flow (cfs)	Combined CD 40 and CD 46 Flow (cfs)	% Increase
2-Year	45.6	52.8	16%
5-Year	89.4	96.6	8%
10-Year	127	134.2	6%
25-Year	183	190.2	4%
50-Year	231	238.2	3%
100-Year	287	294.2	2%

Survey data from both Faribault County and ISG was utilized to determine if the CD 40 tile had sufficient grade to outlet into the CD 46 open ditch. The existing CD 40 tile outlet elevation was surveyed at 1094.51 while the end of the CD 46 open ditch legal elevation is 1095.07. Therefore in order for CD 40 to legally outlet into CD 46, the CD 40 tile will need to be chased back and installed at a flatter grade to make up elevation.

In order to catch grade, the CD 40 tile is proposed to be rerouted approximately 360 feet upstream of its outlet. At this point, the elevation of the existing tile is estimated at 1094.87 and the 22-inch tile is at a 0.10% grade. The reroute would extend 400 feet southeast and then approximately 360 feet to the northeast where it would outlet into the CD 46 open ditch 410 feet downstream of the 32-inch tile outlet or 240 feet upstream of the legal ditch outlet. At this location, the proposed tile reroute elevation is 1094.42 while the legal ditch elevation is 1094.36. Due to the downcutting and erosion, the existing CD 46 open ditch elevation at this point is 1092.90.

There are two options to reroute the tile with capacities that are acceptable from a legal drainage capacity standpoint. Option 1 includes rerouting a 24-inch tile at 0.06% in order to legally outlet in CD 46 above the legal ditch elevation. The capacity of this option results in a 0.22 inch/day drainage coefficient, which is the same as the existing conditions.

Option 2 includes rerouting the tile in the same alignment, however utilizing a 27-inch reinforced concrete pipe at a 0.05% grade. This capacity matches the As Constructed or Subsequently Improvement Condition (ACSIC) capacity of 0.28 inch/day making the reroute match the legal drainage conditions. Table 2 below summarizes the drainage capacities for all scenarios of the CD 40 tile outlet.

Table 2: CD 40 Outlet Drainage Capacities

Option	Size (in)	Slope (%)	Drainage Area (Acres)	Drainage Coefficient (in/day)
Existing Conditions	22	0.10%	595	0.23
ACSIC	24	0.10%	595	0.29
Proposed Option 1 (24-inch)	24	0.06%	592	0.22
Proposed Option 2 (27-inch)	27	0.05%	592	0.28

Both reroute options will have shallow tile in areas with less than 4-feet of cover which is recommended by the pipe manufactures. Further survey and design is needed to determine the actual cover over the pipe and the necessary earthwork needed to provide sufficient cover.

Cost estimates were generated for both options which include tile/pipe installation, tile connections, grading/filling, tree removals, and seeding. Construction costs for Option 1 were estimated at \$50,000 and \$70,000 for Option 2.

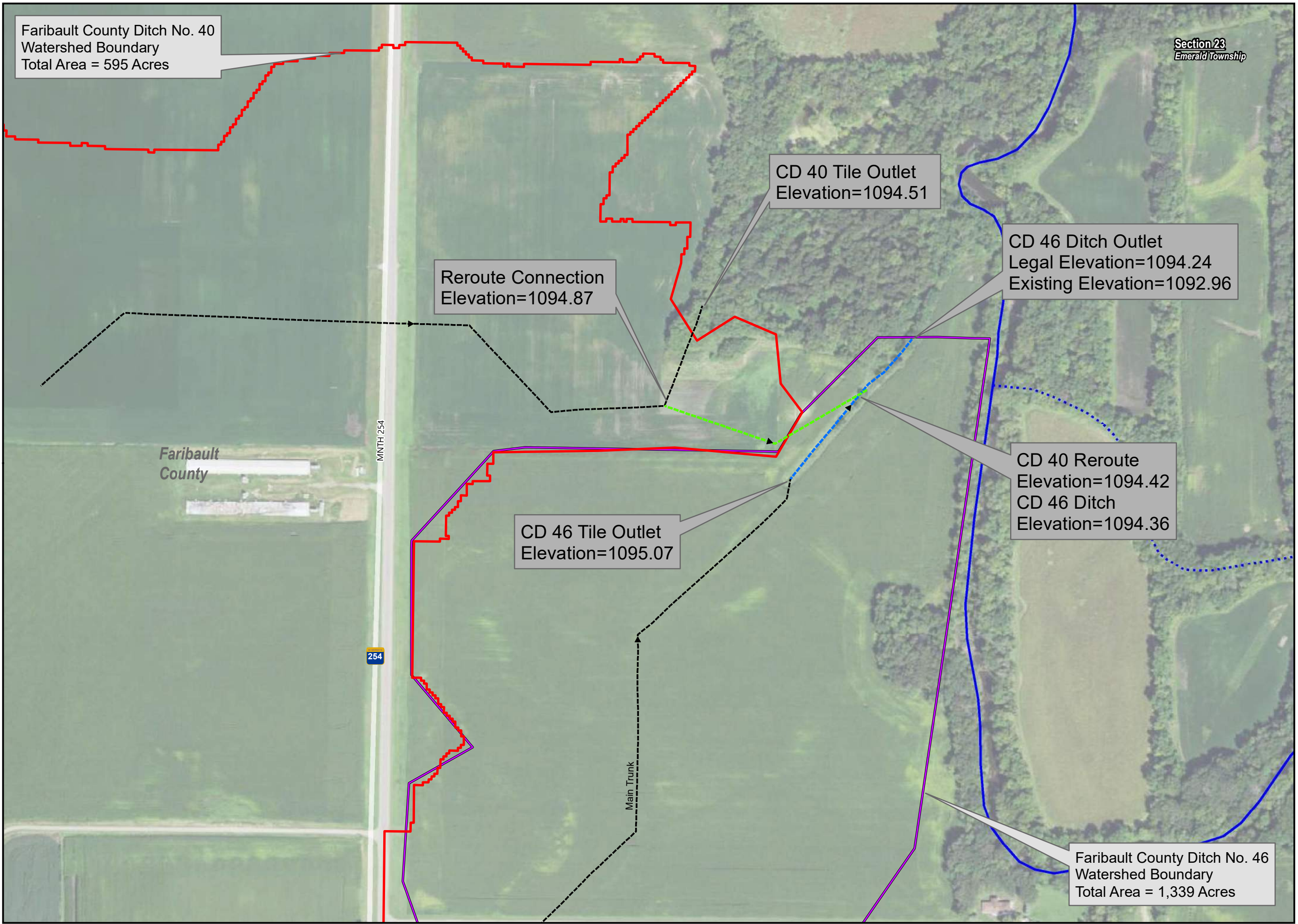
Based on preliminary review, the conditions of the CD 46 open ditch do allow for the CD 40 tile to be rerouted into the open ditch while meeting the legal drainage conditions and providing sufficient capacity. An overall map and preliminary profiles of the ditch and tiles are included in the attachments.

Sincerely,



Mark A. Origer, PE
Civil Engineer

Attachments



Elevation Map
County Ditch No 40
Faribault County,
Minnesota
Wednesday, July 28, 2021

Legend

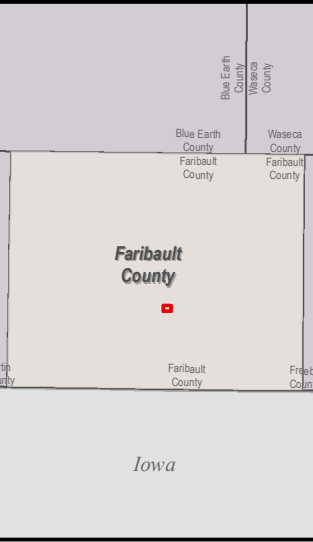
- CD 40 Reroute
- Existing Open Ditch
- Existing Tile
- CD 40 Watershed
- CD 46 Watershed
- Public Water Watercourse
- Public Ditch/Altered
- Natural Watercourse

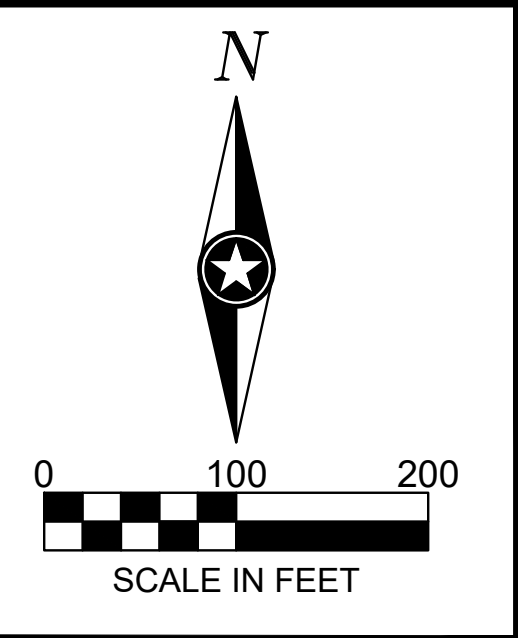
Source:

Orthophotograph (MnGeo WMS, 2015)
Tile/Ditch (Faribault County, 12/16/2016)
Parcels (Faribault County, 12/16/2016)
Lakes (MN DNR, July, 2008)
Major Stream (MN DNR, July 2008)
Counties (MN DNR, July 2013)
PLSS (MnGeo/USGS)



0 75 150 300 Feet





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PROJECT

**FARIBAULT
COUNTY**

**COUNTY DITCH No.
40 REPAIR**

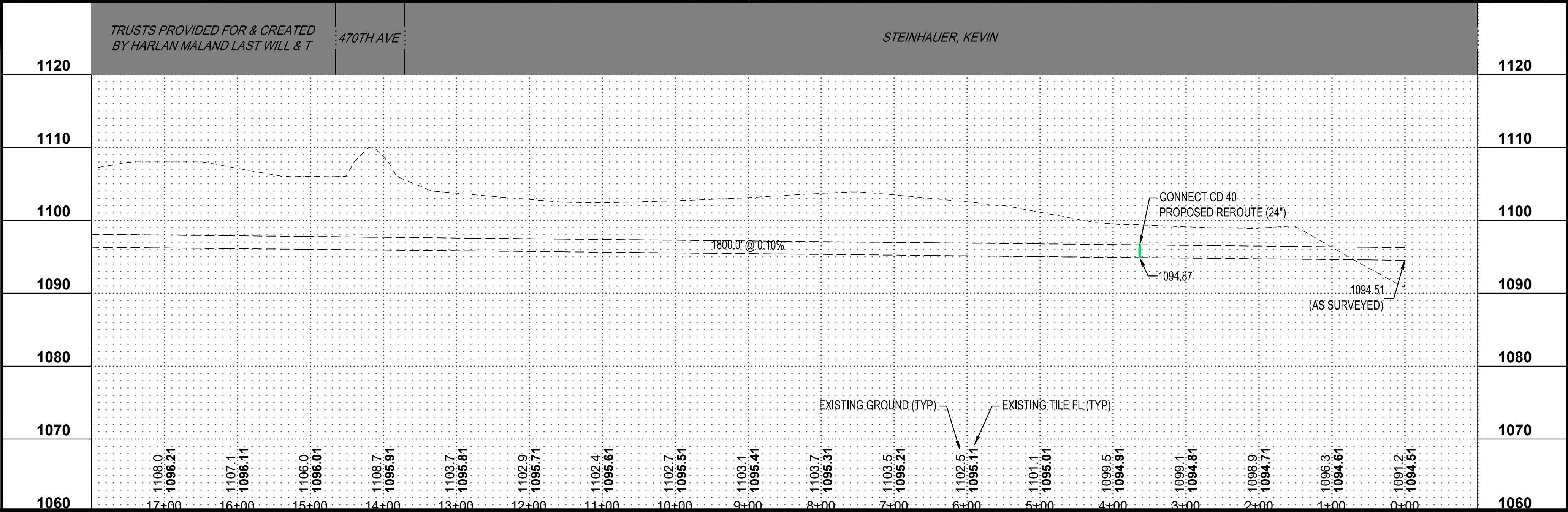
FARIBAULT COUNTY MN

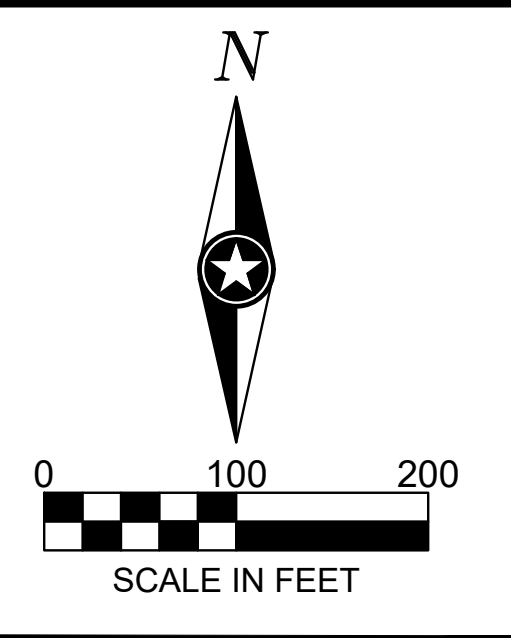
REVISION SCHEDULE		
DATE	DESCRIPTION	BY

PROJECT NO.	21-25314
FILE NAME	25314 PROF
DRAWN BY	AAH
DESIGNED BY	AAH
REVIEWED BY	MAO
ORIGINAL ISSUE DATE	--/--
CLIENT PROJECT NO.	-

TITLE

**EXISTING CD 40
PLAN & PROFILE**





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**FARIBAULT
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**COUNTY DITCH No.
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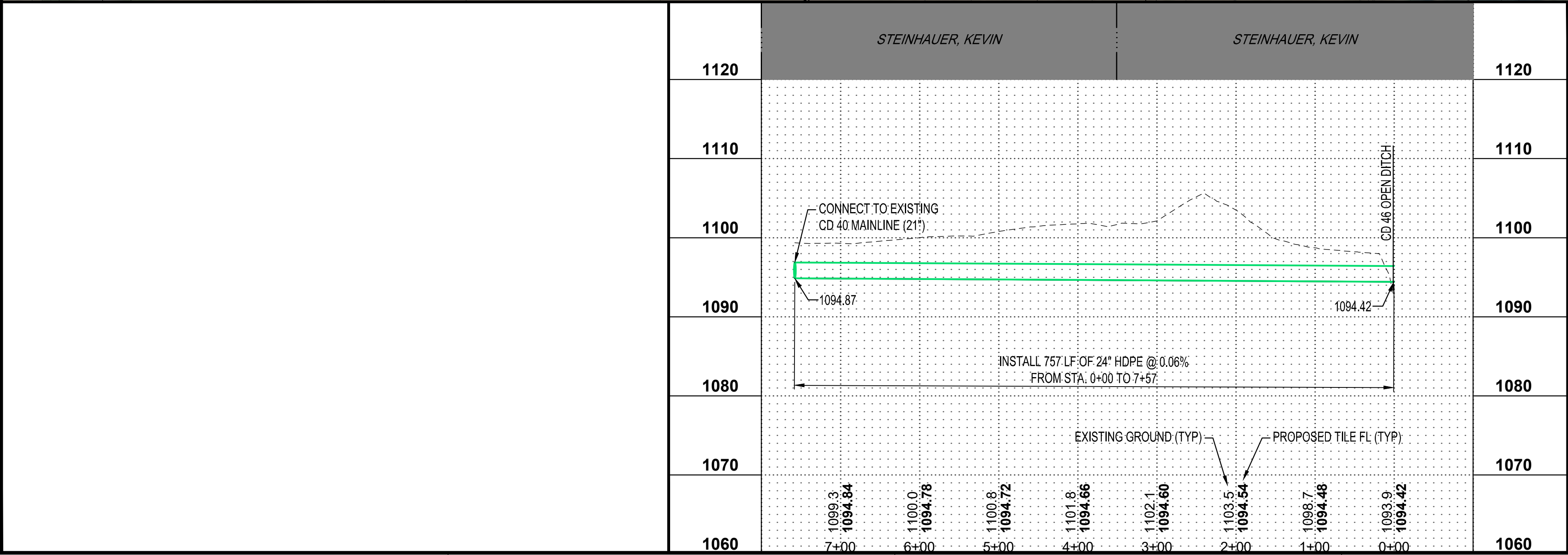
FARIBAULT COUNTY MN

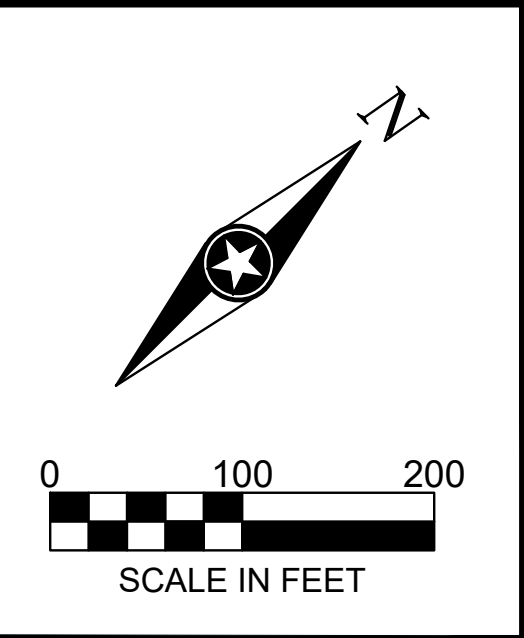
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DESIGNED BY	AAH
REVIEWED BY	MAO
ORIGINAL ISSUE DATE	11-1-21
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TITLE

**PROPOSED CD 40
PLAN & PROFILE**





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PROJECT

**FARIBAULT
COUNTY**

**COUNTY DITCH No.
40 REPAIR**

FARIBAULT COUNTY MN

REVISION SCHEDULE		
DATE	DESCRIPTION	BY

PROJECT NO.	21-25314
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TITLE

**CD 46 MAIN DITCH
PLAN & PROFILE**

