REPAIR REPORT FOR:

COUNTY DITCH NO. 3 REPAIR:
FARIBAULT COUNTY, MINNESOTA

December, 2019

Project No. 18-21589

REPORT FOR:
Faribault County Drainage Authority
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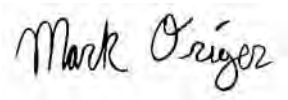
ISG

ARCHITECTURE + ENGINEERING + ENVIRONMENTAL + PLANNING

Signature Sheet

I HEREBY CERTIFY THAT THESE CALCULATIONS WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.



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County Ditch No. 3 Repair
Faribault County, Minnesota

Engineer's Project Number: 18-21589
Dated this 30th day of December, 2019

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APPENDICES

PETITION AND PROJECT SCOPE

The Petition for Faribault County Ditch No. 3 (CD 3) includes repairing the open ditch portions of the system to originally constructed or subsequently improved hydraulic capacity by repairing the open ditch. This includes maintenance of the Main Open Ditch from the southern boundary of Section 1 of Barber Township through the City of Easton to the norther boundary of Section 36 of Lura Township. A watershed map showing the petitioned area of the open ditch is included in Appendix A.

The Faribault County Drainage Authority appointed ISG as the engineer to address the Petition for CD 3. The request was for analyzing the CD 3 system at the Petition area to determine the extents of the repairs. This included a more thorough analysis outside the Petition area to analyze the effects of repairs to the remainder of the CD 3 Main Open Ditch. Some additional analysis was completed on the CD 3 open ditch to determine legal ditch grade and the extents of necessary repairs to the system.

PRIORITY WATERSHED ASSESSMENT

A more detailed analysis of the CD 3 drainage system was completed through a Clean Water Fund grant through the Minnesota Board of Water and Soil Resources. This grant allowed the Drainage Authority and Faribault SWCD to review the CD 3 watershed as a priority watershed for watershed assessment and create a detailed watershed assessment with prioritized Best Management Practices (BMPs) based on practicality, feasibility, reduction measures, and cost effective solutions. Through this grant, the entire CD 3 watershed was analyzed which allowed for more of the open ditch to be analyzed for potential repairs or other (BMPs) that could be included with future repairs. This report is included in Appendix E for reference.

LOCATION + WATERSHED

Faribault County Ditch No. 3 (CD 3) is an approximately 8,340 acre watershed located in north central Faribault County. CD 3 watershed lies in Sections 4, 5, 8, 9, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, and 35 of Lura Township; Section 36 of Easton Township; Section 30 and 31 of Minnesota Lake Township; Sections 1, 2, 10, 11, 12, 13, 14, 23, 24, and 25 of Barber Township and Section 7, 18, 19, and 30 of Walnut Lake Township of Faribault County. The watershed is drained by the CD 3 Main Open Ditch. Ten other drainage systems flow into CD 3 including Faribault County Ditch 7, 10, 11, 16, 19, 20, 43, 70, 89 and Blue Earth-Faribault County Judicial Ditch 9. Therefore, CD 3 outlet serves a 42,940 acre greater watershed.

The CD 3 Main Open Ditch begins in Section 30 of Walnut Lake Township and flows north. The outlet for CD 3 is an unnamed tributary of the Maple River located in Section 4 of Lura Township. CD 3 and its greater watershed contributes to the Le Sueur River Watershed.

The hydrological soil classification of CD 3 watershed is predominantly type "C/D" soils which are considered a dual hydrological soil group. The means that the soil has the potential to be adequately drained. The "D" in the group corresponds to the soil having over 40 percent clay and restricted water movement with high runoff potential. The "C" represents the drained condition which if drained, the soil would have moderate runoff potential when saturated.

The watershed consists primarily of agricultural farmland. The topography throughout the watershed is rolling with an elevation difference of approximately 130 feet. Figure 1 shows the CD 3 direct watershed while additional watershed maps are included in Appendix A to illustrate the total contributing watershed for CD 3 as well as other generic watershed information.

Figure 1: Faribault CD 3 Watershed Map

HISTORY

Faribault County Ditch No. 3 was first established in 1904. There are no original profiles from establishment in 1904. The original County Ditch No. 3 was constructed with a branch extruding to the east at station 532+50 at the current day CD 20 junction called the "Quimby Branch". A decade later County Ditch No. 20 was established with an outlet into the Quimby Branch. However, the upstream elevations of the Quimby Branch were too high to provide an adequate outlet for County Ditch No. 20, therefore 5,950 feet of the CD 3 Main Open Ditch from Stations 473+00 to 532+50 and all of Quimby Branch were incorporated into the CD 20 system and were reconstructed at a lower and flatter grade. This is the current day Main Open Ditch in Section 1 of Barber Township between TH 109 and the junction of CD 3 and CD 20.

In 1916, 7,200 linear feet in Sections 13 and 24 of Barber Township beginning from Stations 635+00 to 707+00 of the ditch was cleaned. A clean out was planned in 1944 from Stations 528+00 to 778+00 but there are no records indicating whether this was completed or not. In 1952 a cleanout was completed beginning at Station 652+00 and ending at Station 703+00 in Sections 13 and 24 of Barber Township. The original ditch width was 5-feet, but in 1952 the ditch was cleaned to a 6-foot bottom. A repair project was completed in 1964 from Highway 19 in Section 13 of Barber Township to the beginning of the Main Open Ditch that consisted tree removals and ditch cleanout from Stations 596+00 to 781+00. In 1980 an improvement was completed from the outlet to TH 109 from Stations 0+00 to 473+00 which included widening the ditch and deepening the ditch where JD 9 outlets into CD3. Figure 2 and Figure 3 show watershed maps with the history of repairs and improvements to the CD 3 Main Open Ditch open ditch.

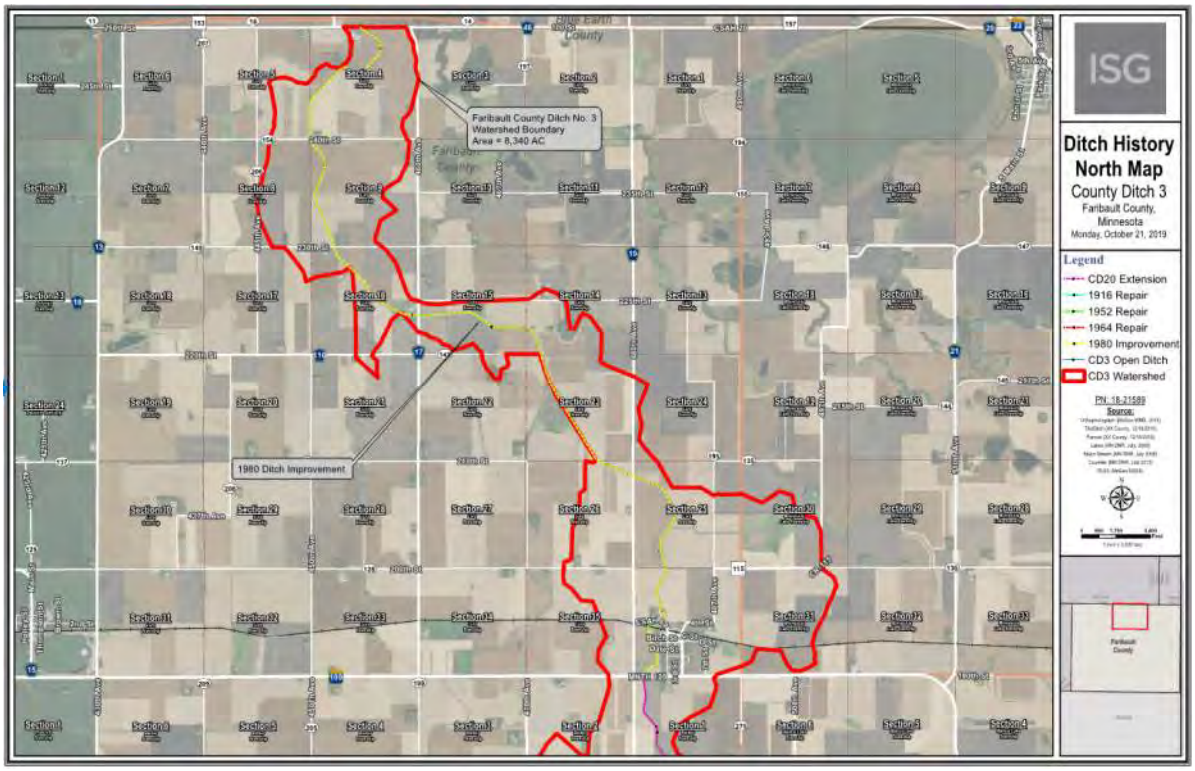


Figure 2: CD 3 History Map (North)

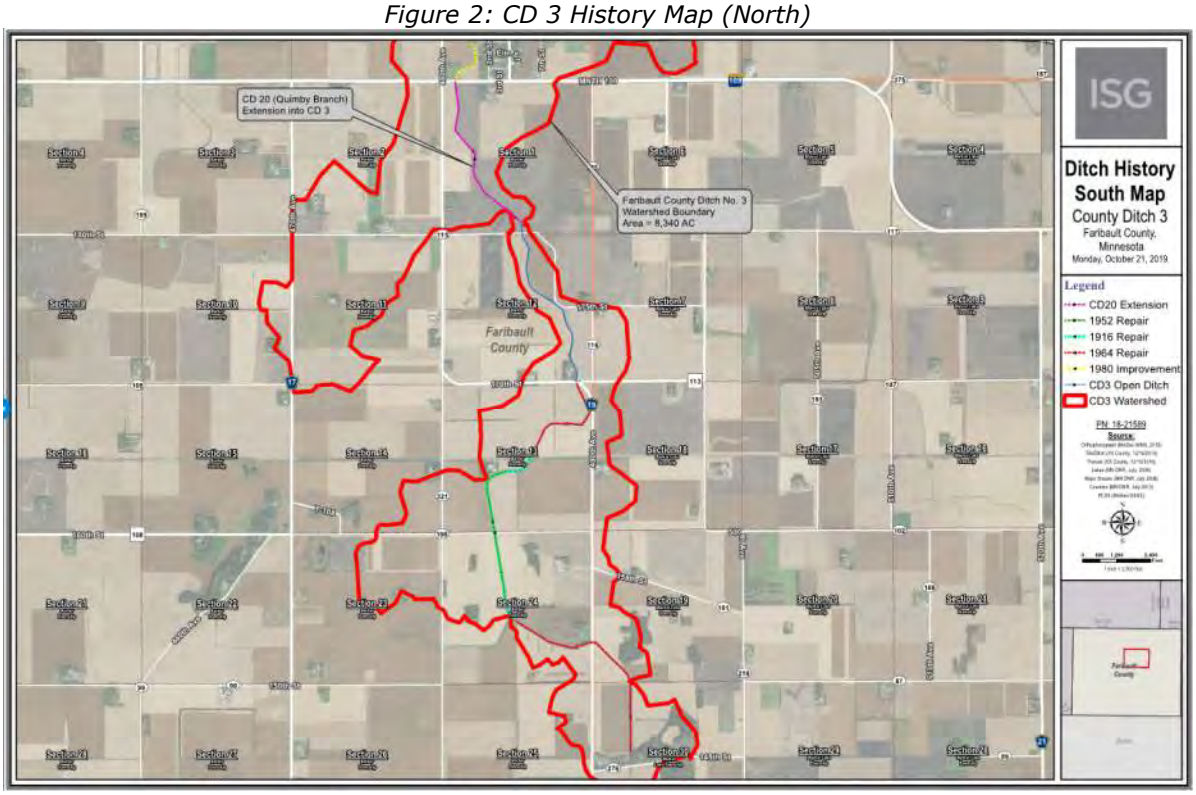


Figure 3: CD 3 History Map (South)

EXISTING CONDITIONS

The information in this document has been prepared from CD 3 profile drawings, topographic survey of the existing ditch, alignment maps provided by Faribault County, LiDAR contours, Minnesota Department of Natural Resources (DNR) Watershed lines, aerial photographs, drone aerials, and soil borings.

Sediment Accumulation and Vegetation Growth

After an analysis of the topographic survey, site visits, and drone aerial photos, it was determined that the majority of CD 3 has accumulated sediment and vegetation growth above legal ditch grade. The depth of sediment and vegetation varies between 6-inches and 3-feet with the deepest accumulations near the petitioned area and in the upstream portion of the Main Open Ditch.

The effects of vegetation in the open ditch vary depending on what type is present. Some types of vegetation can impede water flow. The growth of vegetation also causes the open ditch to start to meander and erode the channel banks. The majority of the vegetation within the open channel is related to sediment accumulation or sloughing. There were no areas within the open channel where dense broadleaves or cattails restricted or impeded flow. Figure 4 through Figure 6 show areas within the open channel with vegetation was observed.

Figure 4: Vegetation in Channel in the NW ¼ of Section 36 Easton Township

Figure 5: Vegetation in Channel in NW ¼ of Section 1 Barber Township

Figure 6: Vegetation in Channel in NE 1/4 of Section 12 Barber Township

Accumulated sediment can lead to vegetative growth and bank erosion within the channel. This can impede flow, therefore any sediment buildups such as the one shown in Figure 7 will be removed to achieve legal ditch grade. Figure 8 shows an area of the open ditch with accumulated sediment above the legal ditch grade.

Figure 7: Sediment Buildup in the SW 1/4 of Section 36 Easton Township

Figure 8: Sediment Buildup in NW 1/4 of Section 1 Barber Township

Buffers

The Minnesota Buffer Law requires a 50-foot buffer along all public waters and a 16.5-foot (1-rod) buffer along public ditches. Buffer strips help prevent sloughing and sediment from entering into the open ditch. The majority of CD 3 contains the appropriate buffer and in some cases the buffer extends well beyond the 1-rod requirement as shown in Figure 9. However some areas during the drone flyover did not contain an adequate buffer as shown in Figure 10. The buffer law was implemented in 2018 and CD 3 falls into the 1-rod buffer requirement. If any buffers are not compliant or are disturbed during construction, the 1-rod area will be re-seeded to be compliant.

Figure 9: Wide Buffer in Section 25 of Lura Township

Figure 10: Lack of Buffer in the NW ¼ of Section 16 Lura Township

Tree Removal

Excessive tree and shrub growth noticed in the open ditch contributes to erosion, sediment deposition, and flow restrictions. A portion of the open ditch system flows through a dense tree cover along the ditch bank through the City of Easton. There are also other areas of tree growth within the buffer of the open ditch. Tree removals are recommended to be completed along the ditch bank and through the 1-rod buffer easement area. Figure 11 and Figure 12 show examples of trees along the open ditch.

There are three types of tree removal that will be used; clearing and grubbing, heavy, and light tree removal. Clearing and grubbing consist of wooded areas with dense tree cover, canopy coverage, and large diameter trees. Heavy tree removal consisted of large diameter trees in isolated groups along the banks throughout the ditch system. Light tree removal is comprised of smaller trees and shrubs that are sporadic on the ditch bank. At any time trees can lose limbs or even fall into the open ditch causing flow restrictions. The trees also provide a canopy across the ditch banks that create instabilities more susceptible to erosion. Perennial grasses along the ditch bank and buffer provide dense root growth, creating stable banks less susceptible to erosion. The trees are also blocking sunlight and not allowing preferred vegetation to grow on the banks.

Figure 11: Tree Removals Needed in the SW ¼ of Section 36 Easton Township

Figure 12: Tree Removals Needed in the SE 1/4 of Section 15 Lura Township

Tile Outlets and Intakes

Tile outlets into the open ditch can lead to erosion and bank failures if not properly protected. The outlets create a scour point from both tile and open channel flow which erodes away the ditch bank. In some cases, this can lead to full bank failure along the tile or side inlet channel as shown in Figure 13 and Figure 14. Corrosion of CMP tile outlets can also lead to degradation of the ditch bank and the adjacent ditch buffer.

Figure 13. Unprotected Tile in the SW ¼ of Section 15 Lura Township

Figure 14: Unprotected Tile in the NE 1/4 of Section 12 Barber Township

Sloughing

Sloughing was identified at various locations along the ditch. Sloughing occurs when the bank of the open ditch shears and collapses into the open ditch. The main causes of sloughing include overland flow overtopping the ditch bank, lack of buffer vegetation, steep side slopes, and meandering alignment of the open ditch. The sloughing deposits sediment into the CD 3 open ditch which restricts flow and requires maintenance. Figure 15 and Figure 16 shows examples of sloughing along the Main Open Ditch.

Figure 15: Sloughing Along Slope in NW ¼ of Section 25 Lura Township

Figure 16: Sloughing Along Slope in the NE ¼ of Section 12 Barber Township

Washouts

Gully erosion through the banks of the ditch were identified and are causing substantial deposition of sediment to the open ditch and adjacent landscape. Gully erosion occurs when large surface flow enters a localized area not capable of conveying flow across the bank and appear similar to small ravines through the ditch bank. Sheet erosion is also present on the open ditch. The sheet erosion is due to the lack of a buffer and the water runs overt the banks and washes the sediment into the open ditch. Figure 17 shows a washout along the open ditch.

Figure 17: Washout in the NE ¼ of Section 16 Lura Township

Bank Stability

A review of the bank stability of CD 3 was completed along the Main Open Ditch to determine stable side slopes for repairs. The limiting velocity method was used to determine suitable velocities with corresponding cross sections throughout the ditch. The Limiting Velocity Method determines a maximum recommended velocity based on the type of soil present. For CD 3, soil textures along the open ditch were identified as silty clay loam or clay loam from the Natural Resources Conservation Services (NRCS) Web Soil Survey (WSS). Using, Table 1 the permissible velocity for this soil type is 3-5 feet per second when fair vegetation is present. This was the design factor for the given conditions on the CD 3 open ditch.

Table 1: NRCS Permissible Velocities

Soil Texture	Bare channel m/s (ft/s)	Retardance*	Permissible velocity Channel Poor (ftls)	Vegetation Fair	Condition Good
Sandy, silt,		B	0.61 (2.0)	0.91 (3.0)	1.22 4.0)
sandy loam,	0.45 (1.5)	C	0.45 (1.5)	0.76 (2.5)	1.07 (3.5)
and silty loam		D	0.45 (1.5)	0.61 (2.0)	0.91 (3.0)
Silty clay loam and	0.61 (2.0)	B	0.91 (3.0)	1.22 (4.0)	1.52 (5.0)
sandy clay loam		C	0.76 (2.5)	1.07 (3.5)	1.37 5.0)
D		D	0.61 (2.0)	0.91 (3.0)	1.22 (4.0)
		B	1.07 (3.5)	1.52 (5.0)	1.83 (6.0)
Clay	0.76 (2.5)	C	0.91 (3.0)	1.37 (4.5)	1.68 (5.5)
D			0.76 (2.5)	1.22 (4.0)	1.52 (5.0)
Coarse Gravel	1.52 (5.0)	B, C, orD	1.52 (5.0)	1.83 (6.0)	2.13 (7.0)
Cobbles and shale	1.83 (6.0)	B, C, orD	1.83 (6.0)	2.13 (7.0)	2.44(8.0)

*The choice of retardance B, C, or D will depend on the vegetation and maintenance planned for the diversion channel. Refer to the Handbook for Channel Design, SCS-TP-61, or similar information in the field office technical gUide, to select the vegetal retardance.

Figure 7. Permissible velocities for diversions

Peak flow rates were inputted through USGS Streamstats for the 10-year and 25-year rainfall frequencies. The velocities were calculated based on these flow rates and the properties of varying open channel geometries which included side slopes from 1:1 to 3:1. The resulting velocities showed stable conditions with 2:1 side slopes for under the 10-year frequency and the majority of the ditch under the 25-year frequency. The main area that is susceptible to erosion with 2:1 side slopes is in Section 12 of Barber Township upstream of the junction of CD 20. Repairs to the open ditch will follow the design of a 2:1 side slope as much as practical and discussed in the repair section.

Culvert Crossings

CD 3 contains 16 crossings, 5 of which are culverts, and 11 are bridges. A field visit was completed to analyze the current condition, size, and slope of these crossings. Many of the bridge crossings are in good shape and will only need the legal ditch grade and width restored to restore flow. Of the culvert crossings there are 2 box culvert crossing, 1 round culvert, and 2 arch culverts. Culvert elevations were analyzed to ensure they are not set above legal grade, and capacities were calculated to ensure that the correct size is in place. Crossings can cause flow restriction if they are not sized or maintained properly. Figure 18 shows the triple box culvert under CSAH 17 filled with sediment and debris while Figure 19 shows a culvert under CSAH 19 that is currently above legal ditch grade.

Figure 18: Box Culverts filled with sediment on CSAH 17

Figure 19: Culvert set above ditch grade on CSAH 19

Existing Capacities

The capacity of agricultural drainage is expressed as a drainage coefficient in inches per day (in/day), and is defined as the depth of water over the entire area of the upstream watershed that a tile can drain in a 24-hour period. For a system like CD 3, the industry standard recommends a drainage coefficient of 1.00 in/day for crossings along open ditch systems. In some designs, culverts may be sized based on flood potential to protect roadways from erosion which results in a larger drainage coefficient.

Table 2 summarizes the existing open ditch culvert capacities along the Main Open Ditch. Also included in the table is the depth each culvert is above legal ditch grade. Crossing locations can be identified on the crossings map in Appendix A.

Table 2: Existing Open Ditch Culvert Capacities

Crossing #	Station	Location	Existing Type	Existing Size	Existing Slope (%)	Drainage Area (Acres)	Existing Drainage Coefficient (in/day)	Total Drainage Coefficient (in/day)	Depth Above Legal Grade (ft)
5	198+00	CSAH 17	RCP Box Culvert	10x10	0.02%	30983	*0.49*	2.25	0.8
5	198+00	CSAH 17	RCP Box Culvert	10x12	0.14%	30983	*0.74*		
5	198+00	CSAH 17	RCP Box Culvert	10x10	0.27%	30983	1.02		
12	536+00	Field Crossing	CMP Arch Culvert	83"x128"	1.31%	4305	3.79	3.79	2.0
13	596+00	CSAH 19	CMP Arch Culvert	83"x128"	0.28%	4071	2.85	2.85	2.1
15	675+00	160th St	RCP Box Culvert	8x14	0.18%	3393	8.12	8.12	0.9
16	737+00	CSAH 19	CMP Round Culvert	72"	0.60%	1083	3.76	3.76	1.5

All of the culvert crossings along the Main Open Ditch are above the 1.0 in/day drainage coefficient, however the majority are over 1-feet above legal ditch grade.

SOIL BORINGS

Methodology

Soil borings were performed in the center of the open channel to determine the original or subsequently improved excavation depth of the channel bottom. The goal of the soil borings was to analyze the soil profile in the bottom of the ditch, looking for textural changes between loose material (accumulated sediment) and a firm bottom (original channel bottom/legal grade). The identified transition between the two can be spatially referenced and will be utilized to determine the legal ditch bottom.

Tools utilized included a Dutch soil auger, tape measure, and a Trimble GPS unit. The auger was inserted into the ground, through the sediment layer, until there was noticeable resistance. The auger was then rotated clockwise for several revolutions and removed so the sample could be collected. Once the sample was obtained, it was evaluated for color and texture changes. A noticeable difference was seen in the soil profile from the sediment and clay layer.

The soil auger had markings around the shaft indicating six inch increments to approximate initial depths when searching for the bottom. After obtaining a representative sample of the silt-clay transition, the depth of the clay source was determined by measuring the auger with the tape measure from the top of the water surface. The water depth to the top of the sediment was also recorded with the tape measure. The water surface elevation was then recorded by using a Trimble GPS unit and stored.

The data collected at each soil boring location included the water depth, depth to clay layer, and accumulated silt/sediment depth. Soil boring locations were chosen in each stretch of the ditch, away from culvert or crossings with erosion, in straight line segments of open ditch away from bank sloughs,

and/or where verification of legal grade was necessary based on legal grade from original profile drawings.

Soil Boring Analysis

The soil borings began near the outlet of CD 3 in the northwest ¼ of Section 4 of Lura Township to investigate the outlet conditions. Additional soil borings began near the City of Easton in the southwest ¼ of Section 25 of Lura Township and continued upstream to TH 109 in the southwest ¼ of Section 36 of Lura Township. Soil borings were then collected approximately every 500 feet from the City of Easton to the beginning of the open ditch in Section 30 of Walnut Lake Township. Soil borings were also taken near all the remaining crossings of the ditch. The soil borings were taken on June 4th, September 17th, and November 7th 2018.

The soil borings were graphed into the profile drawings of the open ditch for further analysis. The soil borings were then compared to the legal ditch grade determined from the original profiles, improvement profiles from 1980, and the culvert crossings to determine the correct placement of the legal grade line. Elevations of the soil borings can be found in the plan profile sheets in Appendix C.

Figure 20: Soil Boring Sample showing Clay Layer

Legal Grade

The legal grade for CD3 was determined utilizing the topographic survey, soil borings, and repair and improvement documents. The grades originated from construction documents from several different sources and are referenced based on the stationing provided in the preliminary construction plans in Appendix C.

Grades from the outlet of CD 3 to TH 109 (Station 0+00 through 473+00) were recovered from construction documents of the 1980 CD3 improvement project. The grades in Section 12 of Barber Township (station 473+00 through 532+50) were recovered from construction documents from a 1962

CD20 repair project while the remaining portion of the upstream CD 3 ditch (station 532+50 through 781+50) were determined from construction documents of a 1964 CD3 repair project. The profile of the legal grade was then set using soil borings and topographic survey as reference and adjusted the profile to a line of best fit through the soil boring elevation.

It should be noted that it is believed that in the 1964 repair the ditch was not excavated to the grades listed in the construction plans. Those plans called for a grade of 0.33% from Stations 552+00 to 622+00, 0.20% from Stations 622+00 to 642+00, 0.05% from Stations 642+00 to 662+00, 0.10% from Stations 662+00 to 682+00, 0.13% from Stations 682+00 to 712+00, 0.30% from Stations 712+00 to 732+00, 0.05% from Stations 732+00 to 752+00, 0.06% from Station 752+00 to 768+00, and 0.40% from Stations 768+00 to 781+50. Based off of the soil borings and topographic survey the ditch appears that it was instead dug at a grade 0.33% from Stations 552+00 to 628+00, 0.20% from Stations 628+00 to 662+00, 0.05% from Stations 662+00 to 706+00, 0.30% form Station 706+00 to 746+00, 0.05% from Stations 746+00 to 776+50, and 0.40% from Stations 776+50 to 781+50. This indicates the open ditch portion in Section 1 between TH 109 and the CD 20 outlet was not fully excavated to the designed elevation likely due to deep cuts of the ditch and perhaps confusion between the CD 3 legal grade and the Quimby Branch extension.

REPAIRS

The petition for repair included Section 36 of Lura Township and Section 1 of Barber Township. After review and analysis of the entire CD 3 open ditch, it is recommend to repair a longer stretch of the Main Open Ditch. This includes portions on the ditch spanning from Section 25 of Lura Township to the beginning of the open ditch in Section 30 of Walnut Lake Township. Figure 21 shows the locations of the petitioned area and the recommended repair areas.

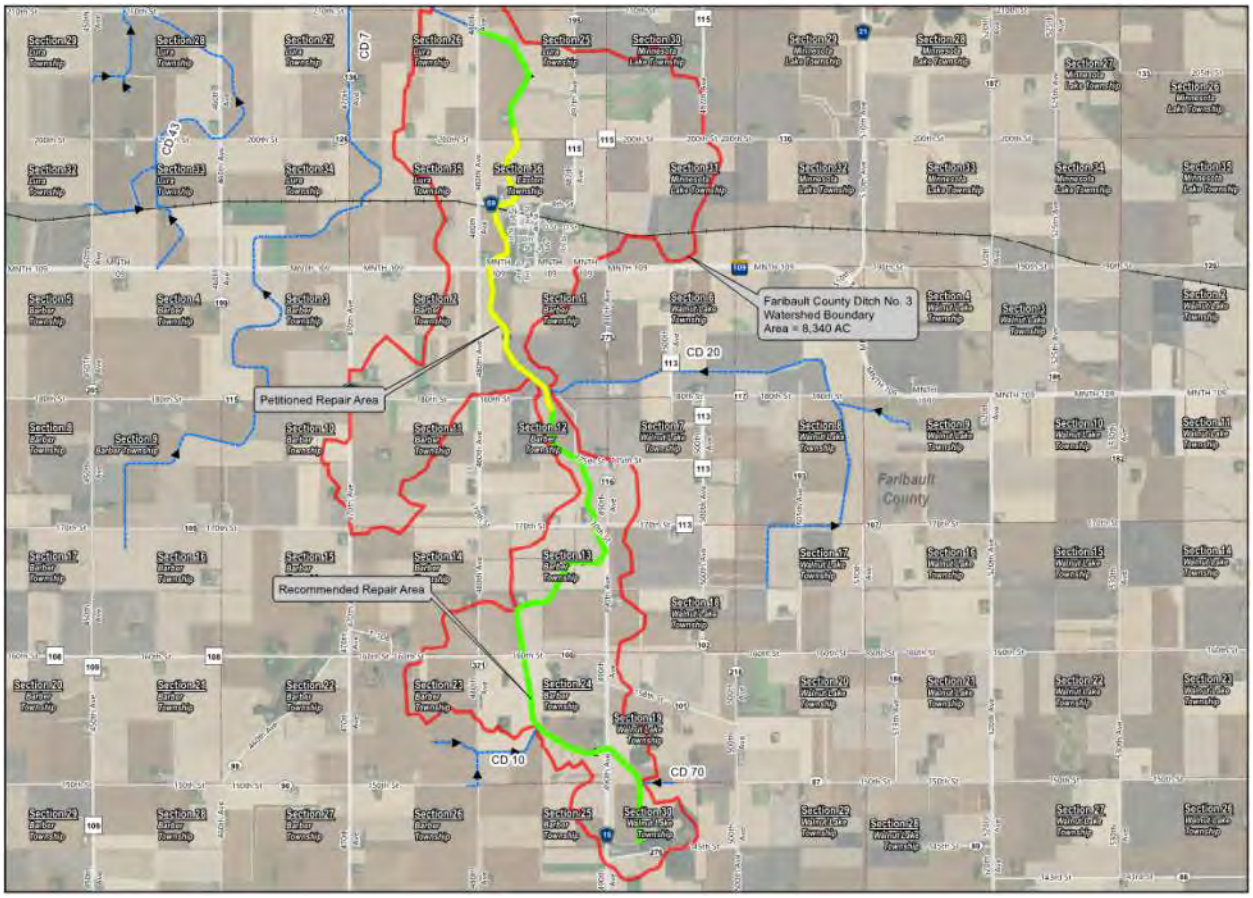


Figure 21: Repair Location Map

An informational meeting was held with landowners in the CD 3 watershed in December of 2019 where repairs of the system were discussed. After thorough review and discussions, an alternative was prepared by the landowners based on their review and analysis of flow through the CD 3 open ditch. Figure 22 shows a map of the repair areas developed by the landowners.

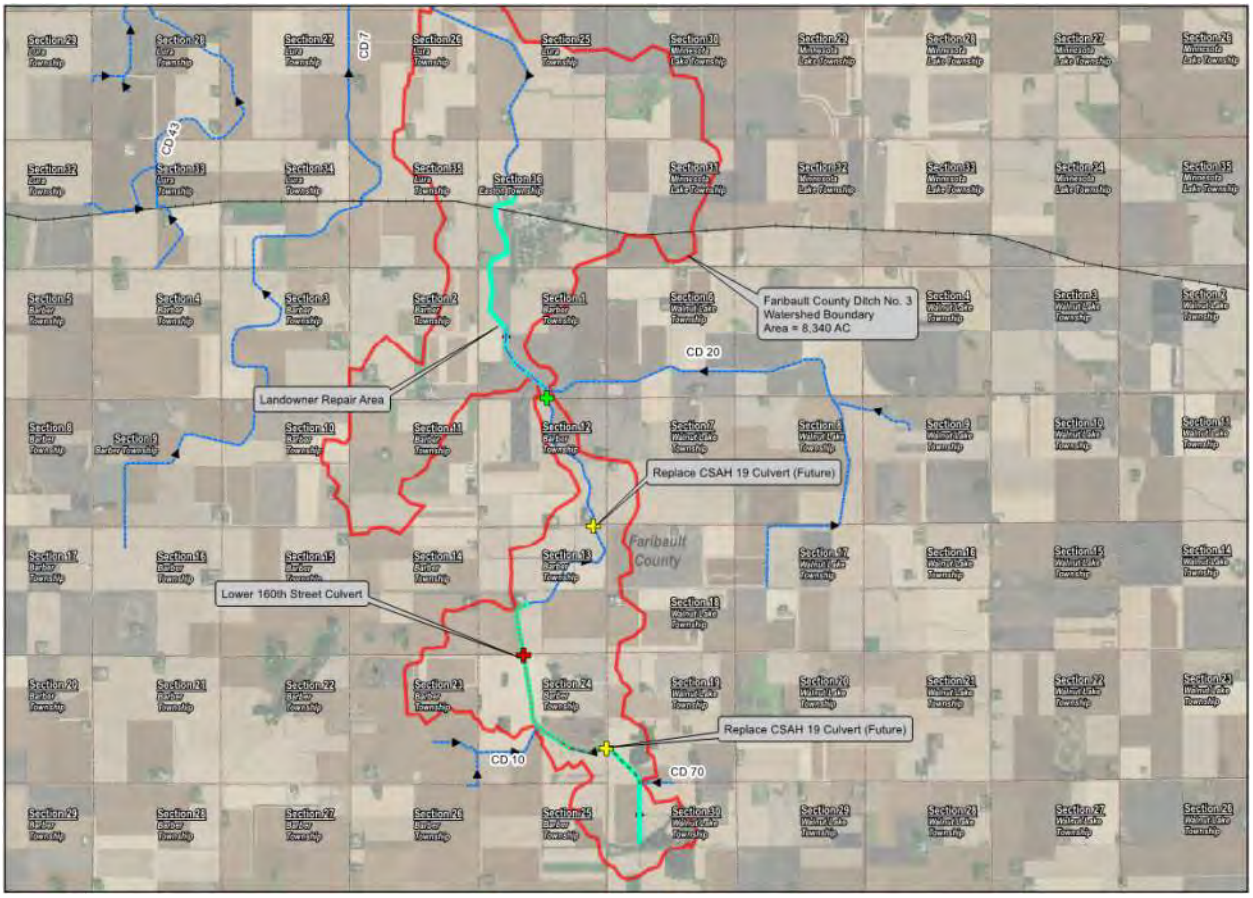


Figure 22: Landowner Repair Map

The following paragraphs summarize the repairs for the CD 3 system for the indicated portions. Preliminary construction plans are included in Appendix C.

Open Ditch Cleaning

For open ditch systems like CD 3, cleaning is recommended every 10 to 15 years. The last major cleaning on CD 3 was in 1980 when the northern half of the ditch was improved. Prior to that, the previous repairs to the upstream portion of CD 3 was in 1964.

After reviewing the topographic survey and legal grade of the open ditch, the open ditch from the outlet to CSAH 19 in Section 26 of Lura Township has accumulated sediment between 6- and 12-inches. While this provides some restricted capacity, conveyance will still be provided with upstream repairs and a full cleanout of this stretch is not required at this time.

The petitioned repair area shows accumulated sediment between 6-inches and 3-feet with a portion of the ditch not fully cleaned to the legal grade in past repairs. This portion does restrict flow from the upstream CD 3 Main Open Ditch and the recently repaired CD 20.

Areas upstream of the petitioned area from the CD 20 open ditch to the beginning of CD 3 also have accumulated sediment between 6-inches and 2-feet with other necessary repairs that will regain the capacity of the ditch. Therefore it is recommended to clean this portion of the open ditch as the last major repair was over 50 years ago. Open ditch cleaning will occur from the lower side of the ditch bank as practical given available field crossings.

Cleaning is not recommend from the field crossing at Station 541+00 to CSAH 19 at 596+40 in Section 12 of Barber Township. In this stretch, sloughing and bank failures have occurred in the past as shown in Figure 23. Many of these areas have reestablished with vegetation and appear to be in stable condition as shown in Figure 24. The soils in this area are silty clay and have the potential to erode. Given the majority of this stretch is at or slightly above legal grade, cleaning of the open ditch is not recommended at this time to avoid major erosion. Some areas of this stretch can be maintained and included repairing tile outlets, slough repairs, and stabilizing ditch banks.

Figure 23: Section 12 of Barber Township

Figure 24: Stable Slough Area

In two areas along the Main Open Ditch, cleaning to legal ditch grade not recommended. This includes 3,050 linear feet in Section 1 of Barber Township and 900 linear feet in Section 13 of Barber Township.

In Section 1 near the CD 20 confluence, the legal grade cleaning shows over 3 feet of excavation required. Excavating this amount of material with steep existing side slopes creates potentially unstable ditch banks and also requires large volumes of excavation. Cleaning to the legal ditch grade in this area does not significantly benefit drainage either as there is adequate depth and grade in the open ditch. It is recommended to clean the open ditch at a grade starting at the outlet of CD 20 and carrying the legal ditch slope of 0.04 percent 2,700 feet downstream to a tie in point where the existing grade closely matches the proposed cleaning grade (Station 505+00). Upstream of the CD 20 confluence, it is recommended to clean at a 1.05 percent grade to match the existing upstream township culvert invert elevations. In both cases, 6-inches to 2 feet of material will be cleaned in lieu of cleaning 3-4 feet of material to legal grade in areas.

In Section 13 approximately 2,000 downstream of 160th Street, the open ditch becomes very deep and the sediment accumulation is over 2-feet. Under the landowner repair option, the 160th Street box culvert will be lowered to legal grade to restore drainage upstream. In lieu of cleaning to legal grade in the deep ditch area, it is recommended to continue the 0.05 percent grade from 160th Street downstream 2,230 feet into the deep ditch area 900 feet. This will allow the grade from the lowered culvert elevation to flow into the existing ditch bottom to prevent any downstream restrictions. This will also limit the need to clean large sediment depths in the deep ditch area which will require flattening side slopes for bank stability.

Both of these recommendations are shown in the preliminary construction plans on sheets 15, 16, and 21 in a purple line on the profile view.

Tree, Brush and Shrub Clearing

Well established trees, brush, and shrubs were identified along the banks of the open ditch throughout the watershed. The majority of cleaning consist of clearing brush, shrubs and trees. The repair will include removing these obstructions to prevent future erosion of the ditch banks. Removals shall be based on the condition of the vegetation along the ditch banks at the time of construction.

An estimated 7,000 linear feet of tree clearing and grubbing is necessary for the recommended repair area and an estimated 4,500 linear feet in the landowner repair option. The ditch may need additional removals based on the condition when construction is occurring. The tree clearing can be completed either with this construction project or separately if contractors are available.

Slough Repairs

The drone and topographic survey revealed significant ditch bank sloughing and erosion throughout the entire open ditch. Slough repairs will include reestablishing a stable ditch bank where a slough or erosion is occurring and will also include seeding the repaired area.

Approximately 3,200 linear feet of slough repair necessary for the outlined repairs to CD 3. Additional slough repairs may be necessary based on the condition of the banks when construction is occurring and is included with the cost estimates. Portions of the open ditch will require side slope flattening to create stable banks with open ditch cleaning. In these areas, sloughs will not be fixed as the shape of the side slope will be reconstructed as an alternative to standard slough repairs.

In the stretch in Section 12 of Barber Township where the open ditch is not recommended to be cleaned, large sloughs and shear walls in the bank exist and will require more than a standard slough repair. For these areas, it is recommended to reshape the bank, install rip rap at the toe of the slough, and bench the buffer area down slightly to create a stable bank. Figure 25 shows an example of a slough that has cut back into the bank creating a sheared bank that would utilize the bench slope repair. Figure 26 shows a detail of the bench slope repair while Figure 27 shows an example repair. An estimated 1,050 linear feet of benched side slope slough repairs are necessary in the recommend repair area.

Figure 25: Slough with Sheared Bank

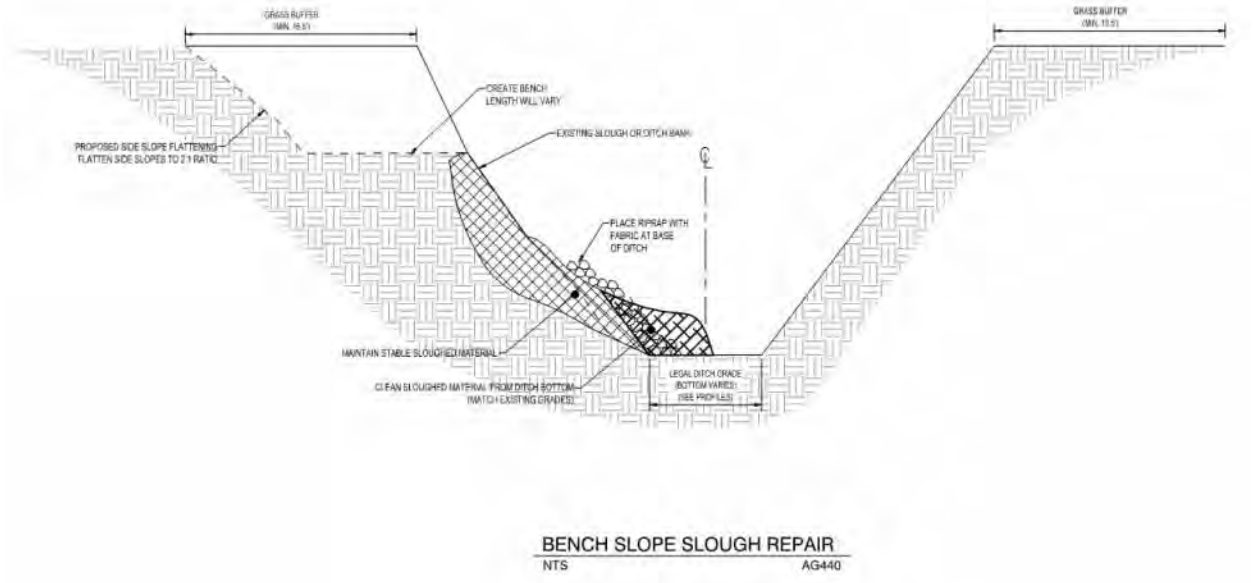


Figure 26: Bench Side Slope Slough Repair Detail

Figure 27: Repaired Slough with Bench Slope

Tile Outlet Repair

All tile outlets into the open ditch will be replaced or repaired as part of this project in the selected repair areas. Some of the tile outlets are in good shape and only require riprap protection on geotextile fabric; however some tiles are bent, broken, or completely washed away causing erosion to the ditch banks. The repair of damaged tiles will consist of replacing the damaged outlets into the ditch with a section of new tile and protecting the tile from erosion with rip rap and seeding.

Alternative Side Inlets

Alternative Side Inlets (ASI) were installed previously with a grant through the Greater Blue Earth River Watershed Basin Alliance and included 24 inlets ranging in size from 8-inch to 24-inch and intake types of standard hickenbottom, slotted hickenbottom, and trash grates. These ASIs were installed where there are large concentrated flows with potential to cause erosion or where existing standard side inlets were in place and were damaged or causing erosion. Additional ASIs will be necessary with the flattening of side slopes as the location of the ASI will change with a change in channel geometry.

Topsoil Stripping

Topsoil stripping is recommended in areas where large volumes of sediment are necessary to be cleaned from the open ditch and where high banks exist. With large volumes of sediment to be cleaned, the spoils will not be able to be piled up within the buffer area and retain a stable bank. In order to accomplish a clean out with large volumes at a deep depth and to maintain stable banks, the spoils will be spread outside the buffer area to a distance up to 50-feet from the top of the bank.

The topsoil will be stripped 12-inches deep or the depth of the existing topsoil from the edge of the buffer to the 50-foot offset from the top of the ditch bank. The lower side of the ditch bank will be selected for topsoil stripping to avoid over piling spoils on the higher and potentially unstable side. Spoils from ditch cleaning will be placed and graded in these areas and the stripped topsoil will be reclaimed on top of the spread spoils. If little to no topsoil exists in these areas and the sediment removal is purely

organic, topsoil stripping may be adjusted and spoils will be spread out to the 50-foot offset per landowner's permission.

Temporary damages will be paid for the areas where topsoil stripping and spoil placement occurs for disturbance to the agricultural land. This area is estimated at 15.1 acres and includes land from Section 1, 12, 13 and 24 of Barber Township and Section 19 of Walnut Lake Township for the recommended repair option and 7.6 acres for the landowner repair option.

Side Slope Flattening

Most of the open ditch cleaning in CD 3 will scoop accumulated sediment out of the bottom of the channel. However, some areas specifically in Sections 1, 12, 13, and 24 of Barber Township require over 2-feet of sediment removal and are in areas where the existing side slopes are very steep. With this deep of cleaning and the current cross section of the open channel, side slope flattening will be required to maintain stable side slopes at this depth. As described in the soil stability section, for the soils along the Main Open Ditch - side slopes of 2:1 are required for stable conditions given the anticipated flow rates and channel geometry.

In order to achieve the 2:1 side slopes, in areas where side slopes need to be flattened, one side of the open channel will remain in place while the opposite side will be flattened to gain the depth to the legal ditch grade. This will re-shape the existing open channel geometry by moving one side of the top of the ditch further into the adjacent field. This will require an addition buffer easement as the top of the ditch bank will be shifted further into the adjacent field. Figure 28 shows the detail of the proposed flattening of side slopes for the open ditch. Erosion control blanket, blended fiber matrix, or hydro seeding will also be required with seeding to establish vegetation on the newly excavated ditch bank. Dressing of the side slopes will not be required with this detail as erosion is likely to slide the material back into the open ditch.

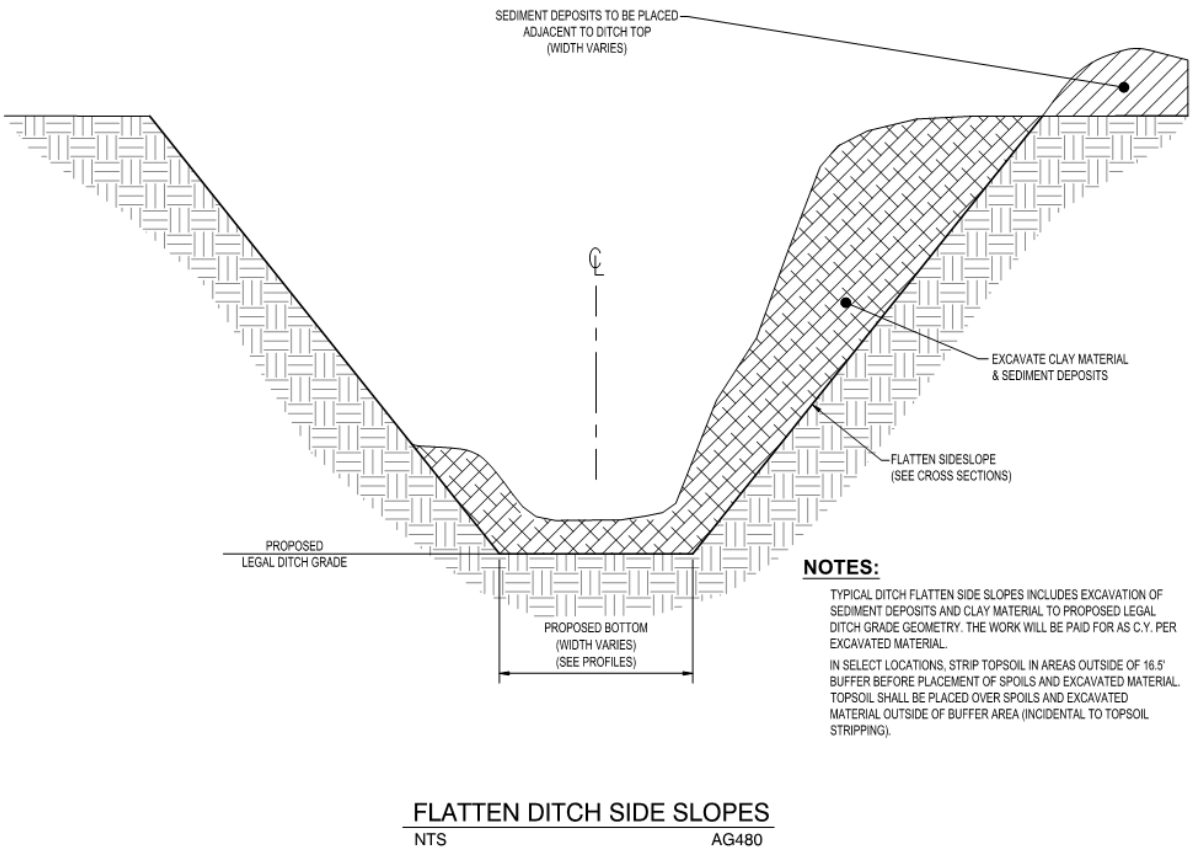


Figure 28: Flattened Side Slope Detail

The following areas are recommended to flatten side slopes with open ditch cleaning to legal grade. In the landowner repair option, if the below areas are not cleaned, side slope flattening is not required at this time for bank stability.

- Section 1 of Barber Township: Station 505+00 to 536+00 upstream of TH 109 to CD 20
- Section 12 of Barber Township: Station 536+00 to 541+00 upstream of CSAH 19
- Section 13 of Barber Township: Station 597+50 to 628+00 upstream of CSAH 19 (Figure 29)
- Section 13 of Barber Township: Station 628+00 to 675+00
- Section 24 of Barber Township: Station 675+80 to 736+00 (Figure 30)

Figure 29: Tall Banks and Deep Excavation Requiring Side Slope Flattening in Section 13 of Barber Township

Figure 30: Steep Banks requiring Side Slope Flattening in Section 24 of Barber Township

Buffer Acquisition and Seeding

The buffer strips for CD 3 have previously been acquired and vegetation establishment is nearly 100 percent. The majority of CD 3 has the minimum 16.5-foot buffer in place while other areas have buffers much wider than the requirement. With construction to CD 3, some of the buffer areas may be disturbed from spoil placement, tree removals, intake reconstruction, and equipment tracking. Those areas will be re-seeded as part of this project and are estimated at 28 acres for the recommended area and 17 acres for the landowner repair option.

Areas along CD 3 where the side slopes are proposed to be flattened for bank stabilization will require an additional buffer acquisition to establish the 16.5-foot easement. This area is approximately 2.7 acres and will be seeded upon completion. For the landowner repair option, approximately 1.3 acres are will require an additional easement for flattening of side slopes located in Section 13 and 24 of Barber Township.

Seeding will include seeding the buffer strip, side slopes of slough repairs or tile outlet repairs, and side slopes from side slope flattening. Seeding of side slopes will require either blended fiber matrix or erosion control blanket for proper vegetation establishment and erosion control. The recommended seed mixtures and specifications will be included with the construction plans. However, it may not be bid with the rest of the construction project.

Culvert Crossings

The triple box culvert under CSAH 17 contains sediment and debris that restricts flow. While the culverts are above legal grade by 0.80 feet, the upstream effects are minimal and it is more cost effective to clean the three culverts in lieu of lowering the culverts. Cleaning under the bridge crossings will also occur as necessary to regain legal ditch elevation.

Three other culvert crossings are proposed to be repaired as they are in poor condition and above legal ditch grade. They include the road crossing under CSAH 19 in Section 13 of Barber Township, the 160th Street box culvert, and under CSAH 19 in Section 24 of Barber Township. The existing sizes at these locations have adequate capacity per today's drainage standards and can either follow those same sizes or the recommended sizes as show in Table 3. The proposed culverts are recommended to be placed on the same legal ditch slope to prevent head and down cutting of the open channel.

Table 3: Proposed Culvert Replacements

Crossing #	Station	Location	Existing Size	Proposed Type	Proposed Size	Proposed Slope (%)	Drainage Area (Acres)	Proposed Drainage Coefficient (in/day)
13	596+00	CSAH 19	83"x128"	RCP Round Culvert	72	0.33%	4071	1.43
15	675+00	160th St	8x14	RCP BOX Culvert	8' x 14'	0.05%	3393	4.29
16	737+00	CSAH 19	72"	RCP Round Culvert	60	0.30%	1083	3.14

The RCP box culvert under 160th Street is above legal ditch grade, however the condition and size is excellent and the culvert is recommended to be removed and lowered to legal grade. The two CSAH 19 road crossings are also above legal grade, but are not significantly restricting flow upstream. These crossings are recommended to be lowered in the future when repairs to CSAH 19 are made. Rip rap can be place to prevent scour and erosion until the culverts are lowered.

While the township crossing along old 180th Street just upstream of the CD 20 junction in Section 1 of Barber Township is above legal grade, it is recommended to leave it in place as it provides channel stability for the upstream Section 12 open ditch where the open ditch is experiencing erosion. Future repairs to this culvert crossing should consider keeping it near the same existing elevation for channel stability.

Erosion Control

Erosion control for the repair of CD 3 includes riprap at tile outlets and near culvert crossings to prevent erosion and washouts from the high flow rates. Sloughing and erosion areas stated to be repaired will be regraded and reseeded with blended fiber matrix or erosion control blanket as part of the repair. Spoils from ditch cleaning will be piled to create a soil berm along the edge of the buffer area, graded into the buffer easement and adjacent fields, and seeded upon completion of the repair. It is recommended that seeding occur within 7-days of exposure from repairs to prevent future erosion of the repair areas. In extreme cases where other major repairs may arise as part of construction; riprap, perimeter control, erosion control blanket, or other similar practices will be applied as necessary to prevent erosion.

COST ESTIMATES

Cost estimates were generated for the above outlined repairs to CD 3. Detailed cost estimates are included in Appendix B. Table 4 below shows the cost estimate for the petitioned area only. This includes open ditch cleaning with topsoil stripping and flattening side slopes to clean to legal ditch grade in the petitioned area. Also included is tree clearing, slough repairs, erosion control and seeding, and tile outlet repairs.

Table 4. Cost Estimate for Petitioned Repairs

OPTION 1 REPAIR COST (PETITIONED REPAIR)

Mainline

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 11,360.00	$ 11,360
102	TREE CLEARING AND REMOVAL	LS	1	$ 25,000.00	$ 25,000
103	STANDARD DITCH CLEANING (10' WIDE DITCH BOTTOM)	LF	3,200	$ 3.80	$ 12,160
104	STANDARD DITCH CLEANING (8' WIDE DITCH BOTTOM)	LF	7,300	$ 3.40	$ 24,820
105	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (10' WIDE DITCH BOTTOM)	LF	2,750	$ 5.00	$ 13,750
106	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (6' WIDE DITCH BOTTOM)	LF	750	$ 3.50	$ 2,625
107	SLOUGH REPAIR	LF	2,395	$ 5.25	$ 12,574
108	TOP SOIL STRIP & PLACE SPOILS	AC	4.0	$ 4,010.00	$ 16,040
109	36-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,339.20	$ 2,339
110	30-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,050.90	$ 2,051
111	24-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	4	$ 1,658.60	$ 6,634
112	18-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	10	$ 1,427.20	$ 14,272
113	15-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	14	$ 1,170.70	$ 16,390
114	12-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	22	$ 1,094.00	$ 24,068
115	10-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	4	$ 1,041.10	$ 4,164
116	8-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	6	$ 970.20	$ 5,821
117	6-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	4	$ 782.10	$ 3,128
118	4-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 606.20	$ 606
119	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	250	$ 75.90	$ 18,975
120	16.5' BUFFER STRIP SEEDING(SEED MIX: BUFFER BLEND WITH TYPE 3 MULCH)	AC	11	$ 1,368.20	$ 14,517
121	STANDARD SIDESLOPE SEEDING (SEED MIX: BUFFER BLEND WITH TYPE 8 MULCH)	AC	6	$ 2,958.50	$ 19,023
122	BUFFER STRIP MOWING	AC	21	$ 195.50	$ 4,149
123	WEED SPRAYING	AC	28	$ 331.30	$ 9,160
				TOTAL	**$ 263,700**
				10% UNFORSEEN	$ 26,370
				SUBTOTAL	**$ 290,070**
	TEMPORARY DAMAGES	AC	4.48	$ 650.00	$ 2,912
	LAND ACQUISTION/ PERMANENT DAMAGES	AC	0.80	$ 6,500.00	$ 5,200
				COUNTY ADMINISTRATION COSTS	$ 14,504
				TOPOGRAPHIC SURVEY	$ 24,300
				REPORTS, PLANS AND SPECIFICATIONS	$ 60,100
				CONSTRUCTION STAKING & ADMINISTRATION	$ 46,908
				TOTAL MAINLINE REPAIR COST	**$ 443,994**

Table 5 shows the cost estimate for the recommended repairs which spans from CSAH 19 in Section 25 of Lura Township to the beginning of the open ditch in Section 30 of Walnut Township. This includes open ditch cleaning with topsoil stripping and flattening side slopes to clean to legal ditch grade in all areas as describe previously. Also included is bench side slope repairs, tree clearing, slough repairs, erosion control and seeding, and tile outlet repairs.

Table 5: Cost Estimate for Recommended Repairs

OPTION 2 REPAIR COST (RECOMMENDED REPAIRS)

Mainline

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 33,370.00	$ 33,370
102	TREE CLEARING AND REMOVAL	LS	1	$ 60,000.00	$ 60,000
103	STANDARD DITCH CLEANING (10' WIDE DITCH BOTTOM)	LF	3,200	$ 3.80	$ 12,160
104	STANDARD DITCH CLEANING (8' WIDE DITCH BOTTOM)	LF	12,410	$ 3.40	$ 42,194
105	STANDARD DITCH CLEANING (6' WIDE DITCH BOTTOM)	LF	4,350	$ 2.30	$ 10,005
106	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (10' WIDE DITCH BOTTOM)	LF	3,600	$ 5.00	$ 18,000
107	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (6' WIDE DITCH BOTTOM)	LF	13,860	$ 3.50	$ 48,510
108	SLOUGH REPAIR	LF	3,600	$ 5.25	$ 18,900
109	BENCHED SIDE SLOPE SLOUGH REPAIR	LF	1,050	$ 40.00	$ 42,000
110	TOP SOIL STRIP & PLACE SPOILS	AC	19.6	$ 4,010.00	$ 78,596
111	INSTALL 12-INCH ASI RISER ASSEMBLY W/TRASH GRATE	EA	4	$ 1,165.70	$ 4,663
112	INSTALL 12-INCH ASI OUTLET ASSEMBLY	EA	4	$ 2,146.60	$ 8,586
113	36-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,339.20	$ 2,339
114	30-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,050.90	$ 2,051
115	24-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	15	$ 1,658.60	$ 24,879
116	18-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	20	$ 1,427.20	$ 28,544
117	15-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	35	$ 1,170.70	$ 40,975
118	12-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	60	$ 1,094.00	$ 65,640
119	10-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	24	$ 1,041.10	$ 24,986
120	8-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	32	$ 970.20	$ 31,046
121	6-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	24	$ 782.10	$ 18,770
122	4-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	5	$ 606.20	$ 3,031
123	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	400	$ 75.90	$ 30,360
124	16.5' BUFFER STRIP SEEDING(SEED MIX: BUFFER BLEND WITH TYPE 3 MULCH)	AC	28	$ 1,368.20	$ 38,788
125	STANDARD SIDESLOPE SEEDING (SEED MIX: BUFFER BLEND WITH TYPE 8 MULCH)	AC	17	$ 2,958.50	$ 50,857
126	BUFFER STRIP MOWING	AC	57	$ 195.50	$ 11,085
127	WEED SPRAYING	AC	74	$ 331.30	$ 24,480
				TOTAL	**$ 774,900**
				10% UNFORSEEN	$ 77,490
				SUBTOTAL	**$ 852,390**
TEMPORARY DAMAGES		AC	15.1	$ 650.00	$ 9,829
LAND ACQUISTION/ PERMANENT DAMAGES		AC	2.7	$ 6,500.00	$ 17,355
				COUNTY ADMINISTRATION COSTS	$ 42,620
				TOPOGRAPHIC SURVEY	$ 24,300
				REPORTS, PLANS AND SPECIFICATIONS	$ 60,100
				CONSTRUCTION STAKING & ADMINISTRATION	$ 93,763
				TOTAL MAINLINE REPAIR COST	**$ 1,100,357**

A cost estimate was prepared for the landowner repair alternative that was based on landowner input during an informational meeting held in December of 2019. This alternative includes the majority of the petitioned repair area, and repairs in Section 13 and 24 of Barber Township and Sections 19 and 30 of Walnut Lake Township. A portion of the cleaning of the ditch in the deep sections that would require side slope flattening was removed from this option as well as repairs in Section 12 of Barber Township. Table 6 below shows the cost estimate for the landowner developed repair option.

Table 6: Landowner Repair Cost Estimate

OPTION 3 REPAIR COST (LANDOWNER RECOMMENDED REPAIRS)

Mainline

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 22,150.00	$ 22,150
102	TREE CLEARING AND REMOVAL	LS	1	$ 50,000.00	$ 50,000
103	STANDARD DITCH CLEANING (10' WIDE DITCH BOTTOM)	LF	3,270	$ 3.80	$ 12,426
104	STANDARD DITCH CLEANING (8' WIDE DITCH BOTTOM)	LF	3,630	$ 3.40	$ 12,342
105	STANDARD DITCH CLEANING (6' WIDE DITCH BOTTOM)	LF	4,370	$ 2.30	$ 10,051
106	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (10' WIDE DITCH BOTTOM)	LF	2,750	$ 5.00	$ 13,750
107	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (6' WIDE DITCH BOTTOM)	LF	7,100	$ 3.50	$ 24,850
108	SLOUGH REPAIR	LF	3,200	$ 5.25	$ 16,800
109	TOP SOIL STRIP & PLACE SPOILS	AC	9.8	$ 4,010.00	$ 39,298
110	INSTALL 12-INCH ASI RISER ASSEMBLY W/TRASH GRATE	EA	3	$ 1,165.70	$ 3,497
111	INSTALL 12-INCH ASI OUTLET ASSEMBLY	EA	3	$ 2,146.60	$ 6,440
112	36-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,339.20	$ 2,339
113	30-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,050.90	$ 2,051
114	24-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	14	$ 1,658.60	$ 23,220
115	18-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	17	$ 1,427.20	$ 24,262
116	15-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	32	$ 1,170.70	$ 37,462
117	12-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	40	$ 1,094.00	$ 43,760
118	10-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	24	$ 1,041.10	$ 24,986
119	8-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	28	$ 970.20	$ 27,166
120	6-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	21	$ 782.10	$ 16,424
121	4-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	5	$ 606.20	$ 3,031
122	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	300	$ 75.90	$ 22,770
123	16.5' BUFFER STRIP SEEDING(SEED MIX: BUFFER BLEND WITH TYPE 3 MULCH)	AC	17	$ 1,368.20	$ 23,273
124	STANDARD SIDESLOPE SEEDING (SEED MIX: BUFFER BLEND WITH TYPE 8 MULCH)	AC	10	$ 2,958.50	$ 30,514
125	BUFFER STRIP MOWING	AC	34	$ 195.50	$ 6,651
126	WEED SPRAYING	AC	44	$ 331.30	$ 14,688
				TOTAL	**$ 514,300**
				10% UNFORSEEN	$ 51,430
				SUBTOTAL	**$ 565,730**
TEMPORARY DAMAGES		AC	7.6	$ 650.00	$ 4,914
LAND ACQUISTION/ PERMANENT DAMAGES		AC	1.3	$ 6,500.00	$ 8,678
				COUNTY ADMINISTRATION COSTS	$ 28,287
				TOPOGRAPHIC SURVEY	$ 24,300
				REPORTS, PLANS AND SPECIFICATIONS	$ 60,100
				CONSTRUCTION STAKING & ADMINISTRATION	$ 55,231
				TOTAL MAINLINE REPAIR COST	**$ 747,240**

Table 7 below summarizes the costs for each option and the Road Authority costs for 160th Street and for the two CSAH 19 road crossings. Also included is the cost for cleaning the triple box culvert under CSAH 17. The costs for all options are practical for a watershed of this size.

Table 7: Repair Options Summary

COST ESTIMATES SUMMARY

Area	Repair Cost
OPTION 1 REPAIR COST (PETITIONED REPAIR)	$ 443,994
OPTION 2 REPAIR COST (RECOMMENDED REPAIRS)	$ 1,100,357
OPTION 3 REPAIR COST (LANDOWNER RECOMMENDED REPAIRS)	$ 747,240

ROAD CROSSINGS

CROSSING #5 REPAIR COST - CSAH 17	$ 5,255
CROSSING #13 REPAIR COST - CSAH 19	$ 85,282
CROSSING #15 REPAIR COST - 160TH STREET	$ 48,551
CROSSING #16 REPAIR COST - CSAH 19	$ 78,209
Total Road Authority Costs	**$ 212,042**

MULTI-PURPOSE DRAINAGE MANAGEMENT

Multi-purpose drainage management incorporates Best Management Practices (BMPs) which utilize effective measures aimed at reducing sediment and nutrient loading, and improving water quality. A MDM Plan is included in Appendix D.

Watershed Assessment and Prioritization Report

The downstream portion of CD 3 after the outlet of JD 9, the unnamed tributary of the Maple River that CD 3 outlets into, the Maple River itself, and the Le Sueur River which CD 3 is part of the greater watershed of are all listed by the MPCA as impaired for turbidity. Due to impairment and goals set by the Watershed Approach to Restoring and Protecting Strategy (WRAPs) and Watershed Total Maximum Daily Load (TMDL) studies, CD 3 has been identified as a target watershed for conservation planning and implementation for improved water quality. ISG has conducted a watershed based assessment of CD 3 and completed a Watershed Assessment Report in which conservation practices project locations have been identified. Sediment delivery and potential reductions from each practice were calculated and costs were estimated for construction and implementation of practice. The practices were then prioritized based on practicality, feasibility, reduction performance, and cost effectiveness. This report is included in Appendix E.

Preventative Measures

Preventative measures that can be applied throughout the watershed include crop rotation, cover crops, residue management, and nutrient management. These measures are aimed at controlling sediment, minimizing erosion and nutrient loss, and sustaining the soils health, all without dramatically changing the current land use of the landscape.

Control Measures

Control measures are practices aimed at improving water quality directly associated with the flow of water by reducing peak flow and providing in-stream storage, sedimentation, and nutrient uptake. Examples of control measures include alternative tile intakes, grassed waterways, two stage ditches, water control structures, and controlled subsurface drainage. These practices are directly linked to the conveyance of subsurface tile water or open channel ditch flow.

Treatment Measures

The function of treatment measures is to improve water quality by directly removing sediment and nutrients from the subsurface or surface water flow throughout a watershed. Examples of treatment measures include surge basins (storage ponds), filter/buffer strips, wetland restorations, woodchip bioreactors, and water and sediment control basins (WASCOBs). These practices may be incorporated to either the public or private drainage systems.

Conservative Drainage Practices

Conservative drainage practices, such as construction of controlled drainage systems, provide an option for improving the water quality within a drainage system. Through utilization of control structures, these systems are designed to allow agricultural producers to regulate water levels in their fields. The water level in the ground can be lowered during planting and harvest seasons and allowed to rise during the growing season. Water and nutrients stored in the soil during the growing season can then be used by the crops during drier periods, potentially increasing yields.

Funding

There are several outside sources of funding to potentially help pay for water quality improvements implemented in a ditch improvement project such as this. A main source of funding for this type of

project is through the Minnesota Board of Water and Soil Resources (BWSR) Clean Water Fund (CWF). The primary purpose of activities funded with grants associated with the CWF is to restore, protect and enhance water quality. One CWF grant program is the Multipurpose Drainage Management Grant. This grant is geared towards implementing practices that will reduce the transport of sediment and nutrient loads. Some practices that have been funded in the past include grade stabilization, grassed waterways, water and sediment control basins, alternative side inlets, saturated buffers, storage wetlands, denitrifying bioreactors, etc.

Another potential source is the Legislative-Citizen Commission on Minnesota Resources (LCCMR) Environment and Natural Resources Trust Fund (ENRTF) which was established to provide funding for activities that protect, conserve, preserve, and enhance Minnesota's "air, water, land, fish, wildlife, and other natural resources." The LCCMR prioritizes innovative ideas that provide multiple benefits.

If landowners are interested in pursuing practices that go beyond this project scope, a few programs may be a source for funding. The Agriculture Best Management Practices (BMP) Loan Program provides loans to rural landowners to encourage BMPs that help counteract pollution problems.

Another option for individual landowners that are interested in pursuing additional practices is the Environmental Quality Incentives Program (EQIP) is a voluntary program through the NRCS that provides financial assistance to individual landowners for various conservative practices as identified above.

In addition, the BWSR Community Partners Grant may be an option. This grant leverages the interest of non-governmental partners such as lake and river associations, boy/girl scout troops and other civic groups to install on-the ground projects that reduce runoff and keep water on the land. It also allows for multiple local government units to work together on a project that involves the Community Partners Grant. Projects installed with the Community Partners Grant are intended to be structural or vegetative practices designed to reduce runoff and/or keep water on the land.

All of the water quality measures proposed with this project are applicable for some source of outside funding. The sources listed above are grants that could be a good fit for this project and if the timing of the project works in conjunction with the grant schedule. These grants can be applied for, if there is support from the drainage authority and/or interest from landowners.

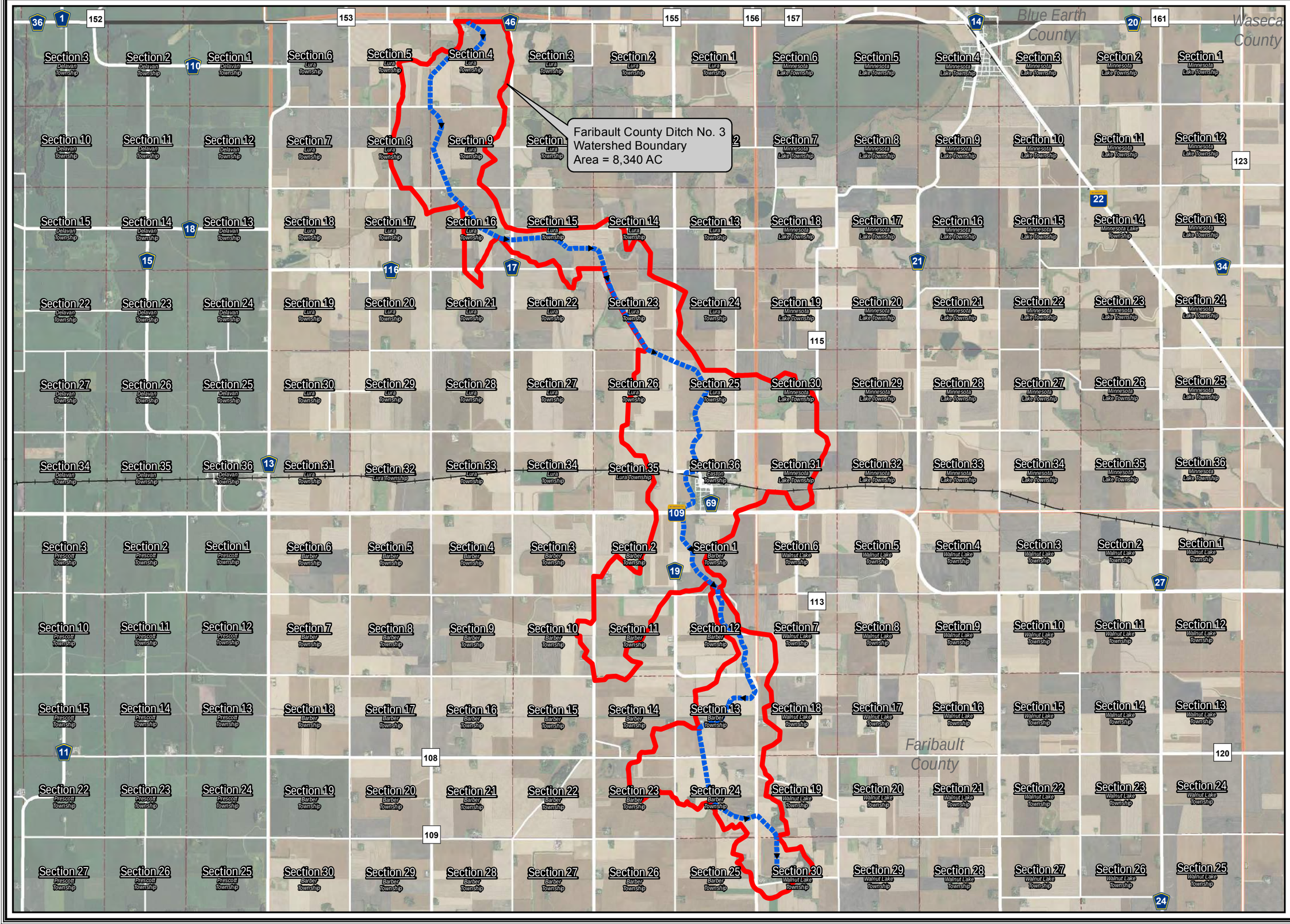
Currently, this project already constructed Alternative Side Inlets and proposed to flatten ditch side slopes for stability and erosion control. The majority of the ditch currently contains the required buffer strip while several areas along the ditch have much wider buffers that leads to reduced erosion and bank stabilization.

CONCLUSIONS + RECOMMENDATIONS

The upstream potion of CD 3 starting at CSAH 19 in Section 25 of Lura Township is in need of repair as the majority of the ditch is well above legal grade, tile outlets are in poor conditions, and many areas are sloughing and eroding. Based on the review of CD 3, it is suggested at a minimum to repair the petitioned area. The landowner developed repair option is also recommended as it accomplishes drainage needs for the areas affected. The remainder of the repair items outlined in the recommended upstream repair option will likely need to be addressed in the future but are not completely necessary to restore drainage at this time.

The outlined cost estimates are practical for a repair of this size. It is recommended to hold a public hearing and receive input from the landowners to aid the Drainage Authority it making its decision on repairs to CD 3.

APPENDIX A:
EXHIBITS



Watershed Map

County Ditch 3

Faribault County, Minnesota

Monday, October 21, 2019

Legend

- CD3 Open Ditch
- CD3 Watershed

PN: 18-21589

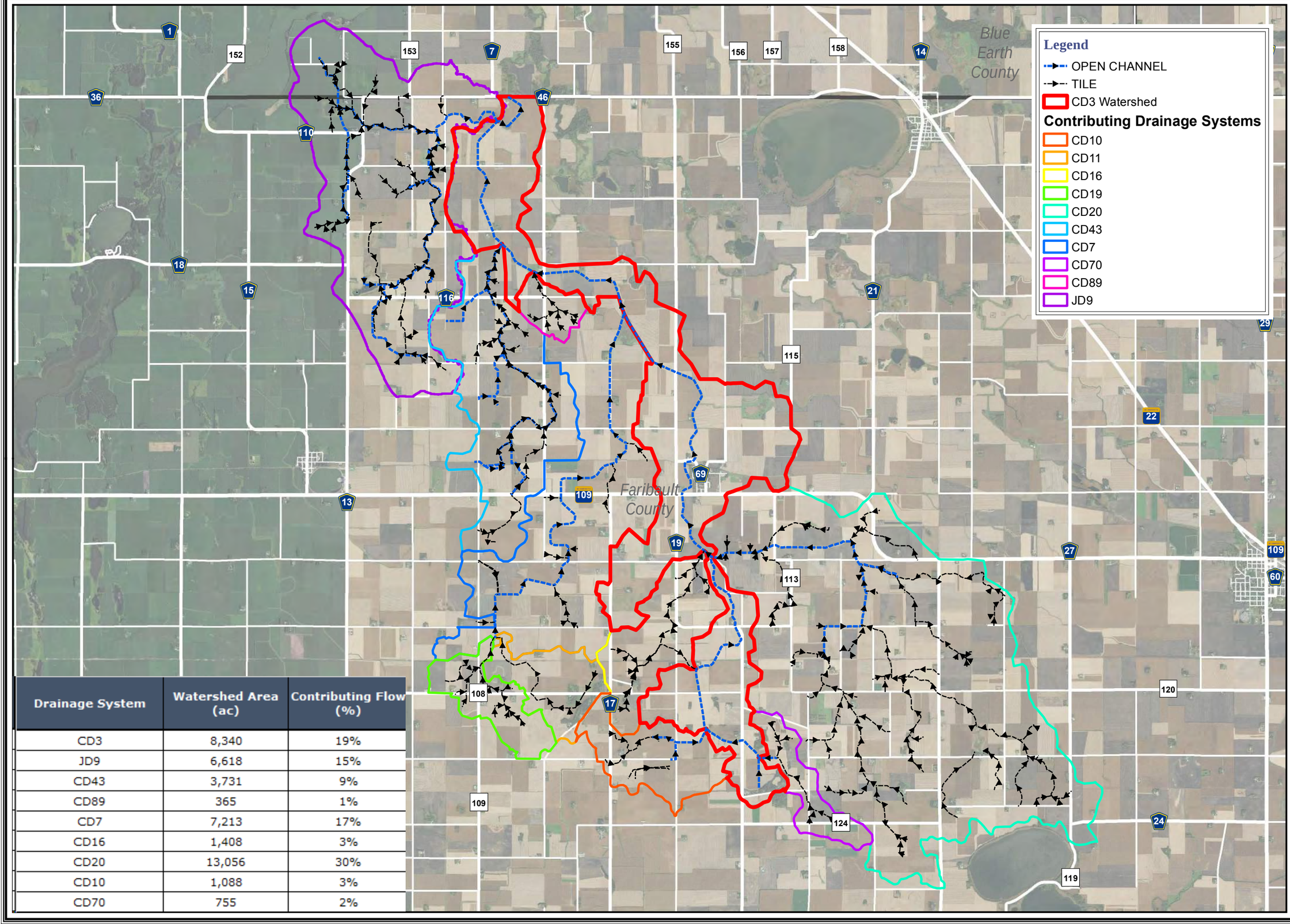
Source:

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

N W E S

0 1,350 2,700 5,400 Feet

1 inch = 5,667 feet



Drainage System	Watershed Area (ac)	Contributing Flow (%)
CD3	8,340	19%
JD9	6,618	15%
CD43	3,731	9%
CD89	365	1%
CD7	7,213	17%
CD16	1,408	3%
CD20	13,056	30%
CD10	1,088	3%
CD70	755	2%

ISG

Overall Watershed Map

County Ditch 3

Faribault County, Minnesota

Thursday, October 18, 2018

PN: 18-21589

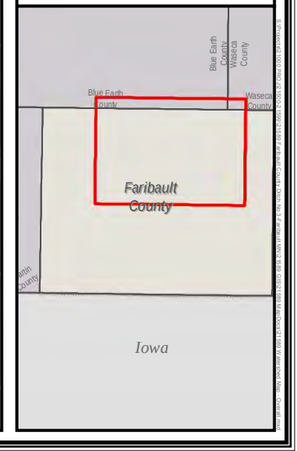
Source:

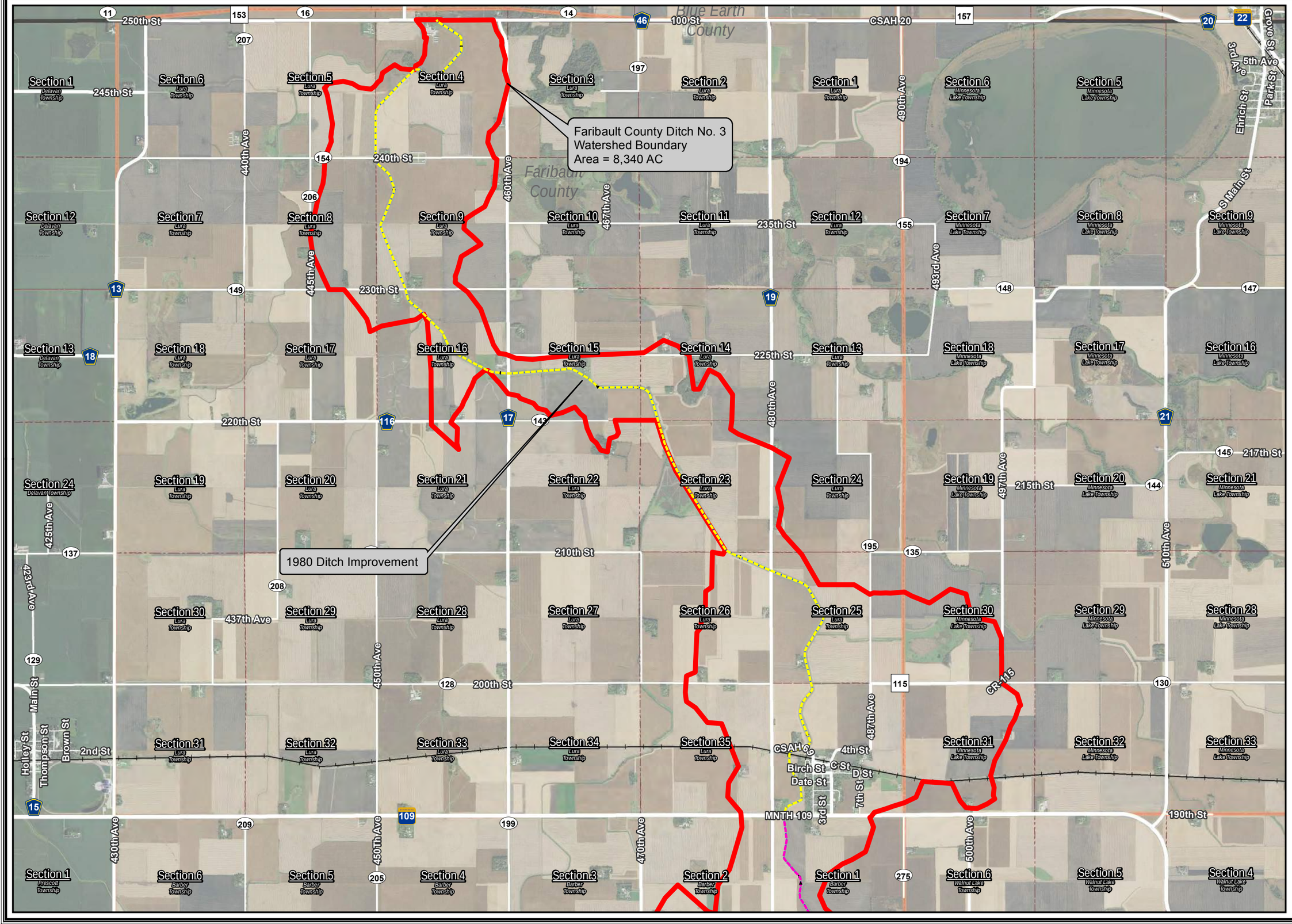
Orthophotograph (MnGeo WMS, 2015)
Tile/Ditch (Faribault County, 12/16/2016)
Parcels (Faribault County, 12/16/2016)
Lakes (MN DNR, July, 2008)
Major Stream (MN DNR, July 2008)
Counties (MN DNR, July 2013)
PLSS (MnGeo/USGS)

N
W E
S

0 1,650 3,300 6,600 Feet

1 inch = 7,000 feet





Ditch History North Map

County Ditch 3

Faribault County, Minnesota

Monday, October 21, 2019

Legend

- CD20 Extension
- 1916 Repair
- 1952 Repair
- 1964 Repair
- 1980 Improvement
- CD3 Open Ditch
- CD3 Watershed

PN: 18-21589

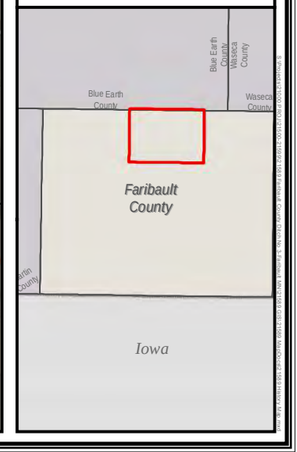
Source:

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

N W E S

0 850 1,700 3,400 Feet

1 inch = 3,500 feet



CD 20 (Quimby Branch)
Extension into CD 3

Faribault County Ditch No. 3
Watershed Boundary
Area = 8,340 AC

Faribault
County

Section 4 Barber Township
Section 3 Barber Township
Section 2 Barber Township
Section 1 Barber Township
Section 6 Walnut Lake Township
Section 5 Walnut Lake Township
Section 4 Walnut Lake Township
Section 9 Barber Township
Section 10 Barber Township
Section 11 Barber Township
Section 12 Barber Township
Section 7 Walnut Lake Township
Section 8 Walnut Lake Township
Section 9 Walnut Lake Township
Section 16 Barber Township
Section 15 Barber Township
Section 14 Barber Township
Section 13 Barber Township
Section 18 Walnut Lake Township
Section 17 Walnut Lake Township
Section 16 Walnut Lake Township
Section 21 Barber Township
Section 22 Barber Township
Section 23 Barber Township
Section 24 Barber Township
Section 19 Walnut Lake Township
Section 20 Walnut Lake Township
Section 21 Walnut Lake Township
Section 28 Barber Township
Section 27 Barber Township
Section 26 Barber Township
Section 25 Barber Township
Section 30 Walnut Lake Township
Section 29 Walnut Lake Township
Section 28 Walnut Lake Township

MNTH 109
180th St
170th St
160th St
150th St
158th St
145th St
175th St
430th Ave
440th Ave
470th Ave
490th Ave
500th Ave
505th Ave
510th Ave
513th Ave
520th Ave
2nd St
3rd St
7th St
Elm
T-108

Ditch History South Map

County Ditch 3

Faribault County,
Minnesota
Monday, October 21, 2019

Legend

- CD20 Extension
- 1952 Repair
- 1916 Repair
- 1964 Repair
- 1980 Improvement
- CD3 Open Ditch
- CD3 Watershed

PN: 18-21589

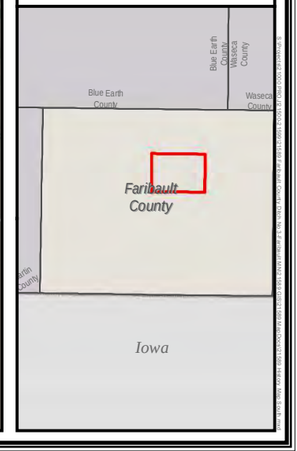
Source:

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

N W E S

0 600 1,200 2,400 Feet

1 inch = 2,500 feet



Repair Overview Map
County Ditch No 3
Faribault County, Minnesota
Wednesday, December 18, 2019

Faribault County Ditch No. 3
Watershed Boundary
Area = 8,340 AC

Petitioned Repair Area

Replace CSAH 19 Culvert

Replace CSAH 19 Culvert

Recommended Repair Area

Legend
- Open Ditch
- CD3 Watershed
- Tree Removals
- Side Slope Flattening
- Bench Slope Repairs
- Deep Cleaning
- Petitioned Repair
- Recommended Repair

Crossings

Replace
- No
- Yes

PN: 18-21589

Source:
Orthophotograph (MnGeo WMS, 2015)
Tile/Ditch (Faribaultt County, August 2018)
Parcels (Faribault County, October 2017)
Lakes (MN DNR, July, 2008)
Major Stream (MN DNR, July 2008)
Counties (MN DNR, July 2013)
PLSS (MnGeo/USGS)

N W E S

0 875 1,750 3,500 Feet
1 inch = 3,500 feet

Faribault County
Iowa

Landowner Repair
Overview Map
County Ditch No 3
Faribault County,
Minnesota
Tuesday, December 24, 2019

Faribault County Ditch No. 3
Watershed Boundary
Area = 8,340 AC

Landowner Repair Area

Replace CSAH 19 Culvert (Future)

Lower 160th Street Culvert

Replace CSAH 19 Culvert (Future)

CD 7
CD 43
CD 20
CD 10
CD 70

Faribault County

Legend
- CD3 Watershed
- Open Ditch

Culverts
- Future
- Lower
- No

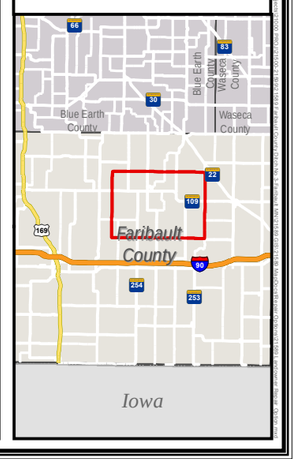
- Side Slope Flattening
- Tree Removals
- Deep Cleaning
- Landowner Repair

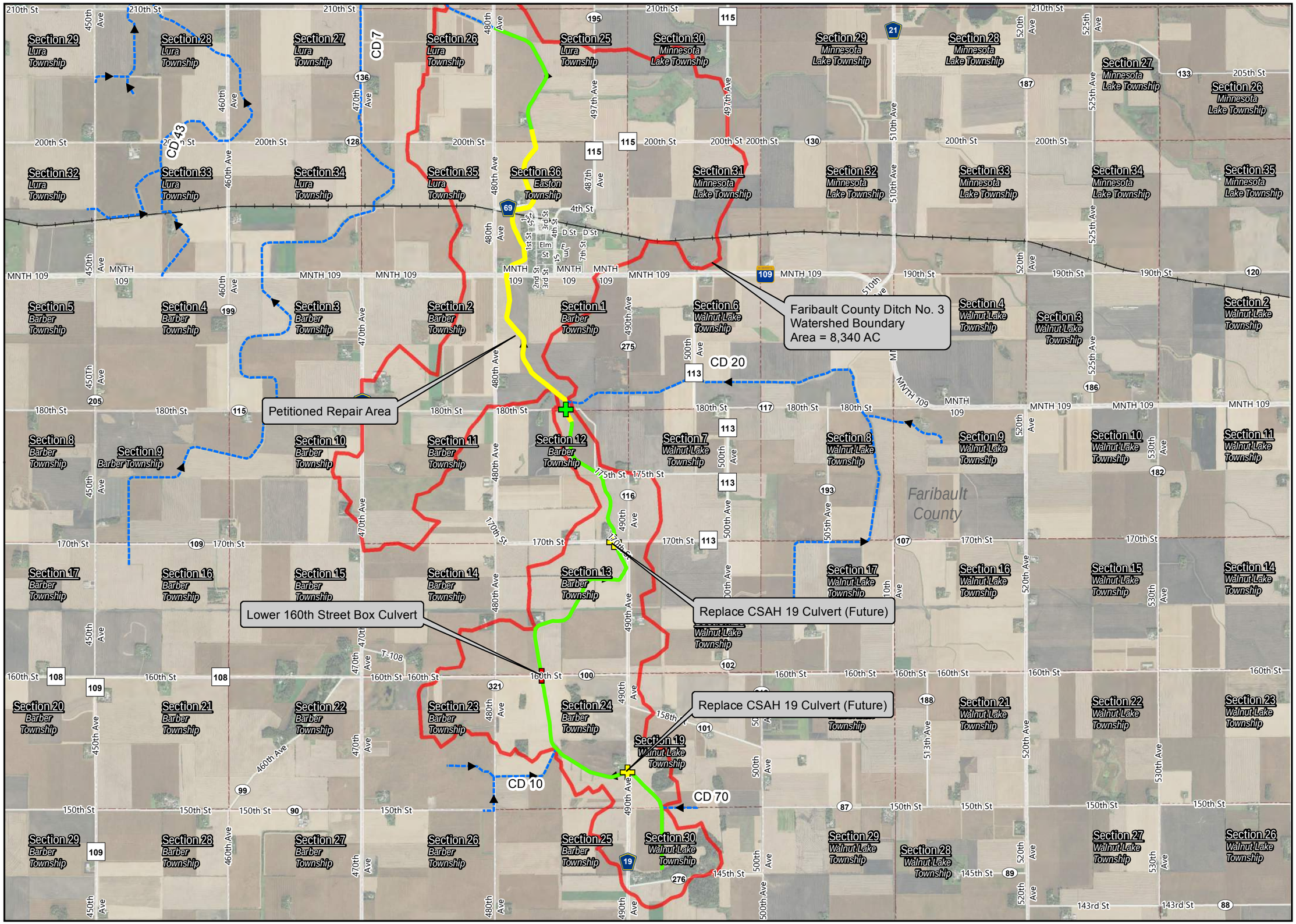
PN: 18-21589

Source:
Orthophotograph (MnGeo WMS, 2015)
Tile/Ditch (Faribaultt County, August 2018)
Parcels (Faribault County, October 2017)
Lakes (MN DNR, July, 2008)
Major Stream (MN DNR, July 2008)
Counties (MN DNR, July 2013)
PLSS (MnGeo/USGS)

N W E S

0 875 1,750 3,500 Feet
1 inch = 3,500 feet





Culvert Repair Map

County Ditch No 3

Faribault County, Minnesota

Monday, December 30, 2019

Legend

- CD3 Watershed
- Open Ditch

Crossings

Culverts

- Future
- Lower
- No
- Petitioned Repair
- Recommended Repair

PN: 18-21589

Source:

Orthophotograph (MnGeo WMS, 2015)
Tile/Ditch (Faribaultt County, August 2018)
Parcels (Faribault County, October 2017)
Lakes (MN DNR, July, 2008)
Major Stream (MN DNR, July 2008)
Counties (MN DNR, July 2013)
PLSS (MnGeo/USGS)

N W E S

0 875 1,750 3,500 Feet

1 inch = 3,500 feet

APPENDIX B:
PRELIMINARY COST ESTIMATE

COUNTY DITCH NO. 3
FARIBAULT COUNTY
December 30, 2019

ISG

OPTION 1 REPAIR COST (PETITIONED REPAIR)

Mainline

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 11,360.00	$ 11,360
102	TREE CLEARING AND REMOVAL	LS	1	$ 25,000.00	$ 25,000
103	STANDARD DITCH CLEANING (10' WIDE DITCH BOTTOM)	LF	3,200	$ 3.80	$ 12,160
104	STANDARD DITCH CLEANING (8' WIDE DITCH BOTTOM)	LF	7,300	$ 3.40	$ 24,820
105	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (10' WIDE DITCH BOTTOM)	LF	2,750	$ 5.00	$ 13,750
106	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (6' WIDE DITCH BOTTOM)	LF	750	$ 3.50	$ 2,625
107	SLOUGH REPAIR	LF	2,395	$ 5.25	$ 12,574
108	TOP SOIL STRIP & PLACE SPOILS	AC	4.0	$ 4,010.00	$ 16,040
109	36-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,339.20	$ 2,339
110	30-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,050.90	$ 2,051
111	24-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	4	$ 1,658.60	$ 6,634
112	18-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	10	$ 1,427.20	$ 14,272
113	15-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	14	$ 1,170.70	$ 16,390
114	12-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	22	$ 1,094.00	$ 24,068
115	10-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	4	$ 1,041.10	$ 4,164
116	8-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	6	$ 970.20	$ 5,821
117	6-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	4	$ 782.10	$ 3,128
118	4-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 606.20	$ 606
119	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	250	$ 75.90	$ 18,975
120	16.5' BUFFER STRIP SEEDING(SEED MIX: BUFFER BLEND WITH TYPE 3 MULCH)	AC	11	$ 1,368.20	$ 14,517
121	STANDARD SIDESLOPE SEEDING (SEED MIX: BUFFER BLEND WITH TYPE 8 MULCH)	AC	6	$ 2,958.50	$ 19,023
122	BUFFER STRIP MOWING	AC	21	$ 195.50	$ 4,149
123	WEED SPRAYING	AC	28	$ 331.30	$ 9,160
				TOTAL	**$ 263,700**
				10% UNFORSEEN	$ 26,370
				SUBTOTAL	**$ 290,070**
	TEMPORARY DAMAGES	AC	4.48	$ 650.00	$ 2,912
	LAND ACQUISTION/ PERMANENT DAMAGES	AC	0.80	$ 6,500.00	$ 5,200
				COUNTY ADMINISTRATION COSTS	$ 14,504
				TOPOGRAPHIC SURVEY	$ 24,300
				REPORTS, PLANS AND SPECIFICATIONS	$ 60,100
				CONSTRUCTION STAKING & ADMINISTRATION	$ 46,908
				TOTAL MAINLINE REPAIR COST	**$ 443,994**

COUNTY DITCH NO. 3
FARIBAULT COUNTY
December 30, 2019

ISG

OPTION 2 REPAIR COST (RECOMMENDED REPAIRS)

Mainline

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 33,370.00	$ 33,370
102	TREE CLEARING AND REMOVAL	LS	1	$ 60,000.00	$ 60,000
103	STANDARD DITCH CLEANING (10' WIDE DITCH BOTTOM)	LF	3,200	$ 3.80	$ 12,160
104	STANDARD DITCH CLEANING (8' WIDE DITCH BOTTOM)	LF	12,410	$ 3.40	$ 42,194
105	STANDARD DITCH CLEANING (6' WIDE DITCH BOTTOM)	LF	4,350	$ 2.30	$ 10,005
106	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (10' WIDE DITCH BOTTOM)	LF	3,600	$ 5.00	$ 18,000
107	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (6' WIDE DITCH BOTTOM)	LF	13,860	$ 3.50	$ 48,510
108	SLOUGH REPAIR	LF	3,600	$ 5.25	$ 18,900
109	BENCHED SIDE SLOPE SLOUGH REPAIR	LF	1,050	$ 40.00	$ 42,000
110	TOP SOIL STRIP & PLACE SPOILS	AC	19.6	$ 4,010.00	$ 78,596
111	INSTALL 12-INCH ASI RISER ASSEMBLY W/TRASH GRATE	EA	4	$ 1,165.70	$ 4,663
112	INSTALL 12-INCH ASI OUTLET ASSEMBLY	EA	4	$ 2,146.60	$ 8,586
113	36-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,339.20	$ 2,339
114	30-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,050.90	$ 2,051
115	24-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	15	$ 1,658.60	$ 24,879
116	18-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	20	$ 1,427.20	$ 28,544
117	15-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	35	$ 1,170.70	$ 40,975
118	12-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	60	$ 1,094.00	$ 65,640
119	10-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	24	$ 1,041.10	$ 24,986
120	8-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	32	$ 970.20	$ 31,046
121	6-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	24	$ 782.10	$ 18,770
122	4-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	5	$ 606.20	$ 3,031
123	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	400	$ 75.90	$ 30,360
124	16.5' BUFFER STRIP SEEDING(SEED MIX: BUFFER BLEND WITH TYPE 3 MULCH)	AC	28	$ 1,368.20	$ 38,788
125	STANDARD SIDESLOPE SEEDING (SEED MIX: BUFFER BLEND WITH TYPE 8 MULCH)	AC	17	$ 2,958.50	$ 50,857
126	BUFFER STRIP MOWING	AC	57	$ 195.50	$ 11,085
127	WEED SPRAYING	AC	74	$ 331.30	$ 24,480
				TOTAL	**$ 774,900**
				10% UNFORSEEN	$ 77,490
				SUBTOTAL	**$ 852,390**
	TEMPORARY DAMAGES	AC	15.1	$ 650.00	$ 9,829
	LAND ACQUISTION/ PERMANENT DAMAGES	AC	2.7	$ 6,500.00	$ 17,355
				COUNTY ADMINISTRATION COSTS	$ 42,620
				TOPOGRAPHIC SURVEY	$ 24,300
				REPORTS, PLANS AND SPECIFICATIONS	$ 60,100
				CONSTRUCTION STAKING & ADMINISTRATION	$ 93,763
				TOTAL MAINLINE REPAIR COST	**$ 1,100,357**

COUNTY DITCH NO. 3
FARIBAULT COUNTY
December 30, 2019

ISG

OPTION 3 REPAIR COST (LANDOWNER RECOMMENDED REPAIRS)

Mainline

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 22,150.00	$ 22,150
102	TREE CLEARING AND REMOVAL	LS	1	$ 50,000.00	$ 50,000
103	STANDARD DITCH CLEANING (10' WIDE DITCH BOTTOM)	LF	3,270	$ 3.80	$ 12,426
104	STANDARD DITCH CLEANING (8' WIDE DITCH BOTTOM)	LF	3,630	$ 3.40	$ 12,342
105	STANDARD DITCH CLEANING (6' WIDE DITCH BOTTOM)	LF	4,370	$ 2.30	$ 10,051
106	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (10' WIDE DITCH BOTTOM)	LF	2,750	$ 5.00	$ 13,750
107	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (6' WIDE DITCH BOTTOM)	LF	7,100	$ 3.50	$ 24,850
108	SLOUGH REPAIR	LF	3,200	$ 5.25	$ 16,800
109	TOP SOIL STRIP & PLACE SPOILS	AC	9.8	$ 4,010.00	$ 39,298
110	INSTALL 12-INCH ASI RISER ASSEMBLY W/TRASH GRATE	EA	3	$ 1,165.70	$ 3,497
111	INSTALL 12-INCH ASI OUTLET ASSEMBLY	EA	3	$ 2,146.60	$ 6,440
112	36-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,339.20	$ 2,339
113	30-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1	$ 2,050.90	$ 2,051
114	24-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	14	$ 1,658.60	$ 23,220
115	18-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	17	$ 1,427.20	$ 24,262
116	15-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	32	$ 1,170.70	$ 37,462
117	12-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	40	$ 1,094.00	$ 43,760
118	10-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	24	$ 1,041.10	$ 24,986
119	8-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	28	$ 970.20	$ 27,166
120	6-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	21	$ 782.10	$ 16,424
121	4-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	5	$ 606.20	$ 3,031
122	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	300	$ 75.90	$ 22,770
123	16.5' BUFFER STRIP SEEDING(SEED MIX: BUFFER BLEND WITH TYPE 3 MULCH)	AC	17	$ 1,368.20	$ 23,273
124	STANDARD SIDESLOPE SEEDING (SEED MIX: BUFFER BLEND WITH TYPE 8 MULCH)	AC	10	$ 2,958.50	$ 30,514
125	BUFFER STRIP MOWING	AC	34	$ 195.50	$ 6,651
126	WEED SPRAYING	AC	44	$ 331.30	$ 14,688
				TOTAL	**$ 514,300**
				10% UNFORSEEN	$ 51,430
				SUBTOTAL	**$ 565,730**
	TEMPORARY DAMAGES	AC	7.6	$ 650.00	$ 4,914
	LAND ACQUISTION/ PERMANENT DAMAGES	AC	1.3	$ 6,500.00	$ 8,678
				COUNTY ADMINISTRATION COSTS	$ 28,287
				TOPOGRAPHIC SURVEY	$ 24,300
				REPORTS, PLANS AND SPECIFICATIONS	$ 60,100
				CONSTRUCTION STAKING & ADMINISTRATION	$ 55,231
				TOTAL MAINLINE REPAIR COST	**$ 747,240**

COUNTY DITCH NO. 3
FARIBAULT COUNTY
December 30, 2019

ISG

ROAD CROSSINGS

CROSSING #5 TRIPLE BOX-CSAH 17

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 1,000.00	$ 1,000
102	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	30	$ 75.90	$ 2,277
103	CLEAN BOX CULVERTS	LS	1	$ 1,500.00	$ 1,500
				TOTAL	**$ 4,777**
				10% CONTINGENCY	$ 478
				SUBTOTAL	**$ 5,255**

CROSSING #13 REPAIR COST - CSAH 19

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 8,000.00	$ 8,000
102	REMOVE RC ARCH CULVERT	EA	1	$ 925.00	$ 925
103	OPEN CUT & RESTORE PAVED ROADWAY (MATCH EXISTING SECTION)	EA	1	$ 10,000.00	$ 10,000
104	72-INCH CLASS III RCP PIPE	LF	110	$ 440.00	$ 48,400
105	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	50	$ 75.90	$ 3,795
106	GRANULAR PIPE FOUNDATION	CY	25	$ 24.30	$ 608
				TOTAL	**$ 71,120**
				10% CONTINGENCY	$ 7,112
				SUBTOTAL	**$ 78,232**
				COUNTY ADMINISTRATION COSTS	$ 1,450
				REPORTS, PLANS AND SPECIFICATIONS	$ 3,360
				CONSTRUCTION STAKING & ADMINISTRATION	$ 2,240
				ESTIMATED CROSSING #13 REPAIR COST - CSAH 19	**$ 85,282**

CROSSING #15 REPAIR COST - 160TH STREET

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 20,000.00	$ 20,000
102	REMOVE 8' X 14' RCP BOX CULVERT	LF	50	$ 90.00	$ 4,500
103	INSTALL 8' X 14' RCP BOX CULVERT	LF	50	$ 110.00	$ 5,500
	REMOVE AND INSTALL END SECTION	EA	2	$ 2,500.00	$ 5,000
104	OPEN CUT & RESTORE GRAVEL ROAD OR DRIVEWAY	EA	1	$ 1,710.30	$ 1,710
105	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	50	$ 75.90	$ 3,795
106	GRANULAR PIPE FOUNDATION	CY	40	$ 24.30	$ 972
				TOTAL	**$ 36,710**
				10% CONTINGENCY	$ 3,671
				SUBTOTAL	**$ 40,381**
				COUNTY ADMINISTRATION COSTS	$ 1,450
				REPORTS, PLANS AND SPECIFICATIONS	$ 4,480
				CONSTRUCTION STAKING & ADMINISTRATION	$ 2,240
				ESTIMATED CROSSING #15 REPAIR COST - 160TH STREET	**$ 48,551**

CROSSING #16 REPAIR COST - CSAH 19

Item No.	Item	Unit	Quantity	Unit Price	Amount
101	MOBILIZATION	LS	1	$ 8,000.00	$ 8,000
102	REMOVE CMP CULVERT	EA	1	$ 489.58	$ 490
103	OPEN CUT & RESTORE PAVED ROADWAY (MATCH EXISTING SECTION)	EA	1	$ 10,000.00	$ 10,000
104	60-INCH CLASS III RCP PIPE	LF	120	$ 385.00	$ 46,200
105	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	50	$ 75.90	$ 3,795
106	GRANULAR PIPE FOUNDATION	CY	25	$ 24.30	$ 608
				TOTAL	**$ 64,690**
				10% CONTINGENCY	$ 6,469
				SUBTOTAL	**$ 71,159**
				COUNTY ADMINISTRATION COSTS	$ 1,450
				REPORTS, PLANS AND SPECIFICATIONS	$ 3,360
				CONSTRUCTION STAKING & ADMINISTRATION	$ 2,240
				ESTIMATED CROSSING #16 REPAIR COST - CSAH 19	**$ 78,209**

COUNTY DITCH NO. 3
FARIBAULT COUNTY
December 30, 2019

COST ESTIMATES SUMMARY

Area	Repair Cost
OPTION 1 REPAIR COST (PETITIONED REPAIR)	$ 443,994
OPTION 2 REPAIR COST (RECOMMENDED REPAIRS)	$ 1,100,357
OPTION 3 REPAIR COST (LANDOWNER RECOMMENDED REPAIRS)	$ 747,240

ROAD CROSSINGS

CROSSING #5 REPAIR COST - CSAH 17	$ 5,255
CROSSING #13 REPAIR COST - CSAH 19	$ 85,282
CROSSING #15 REPAIR COST - 160TH STREET	$ 48,551
CROSSING #16 REPAIR COST - CSAH 19	$ 78,209
Total Road Authority Costs	**$ 212,042**

APPENDIX C:
PRELIMINARY CONSTRUCTION PLANS

FARIBAULT COUNTY
COUNTY DITCH No. 3

FARIBAULT COUNTY, MINNESOTA **PRELIMINARY CONSTRUCTION PLANS** **ISG PROJECT # 18-21589**

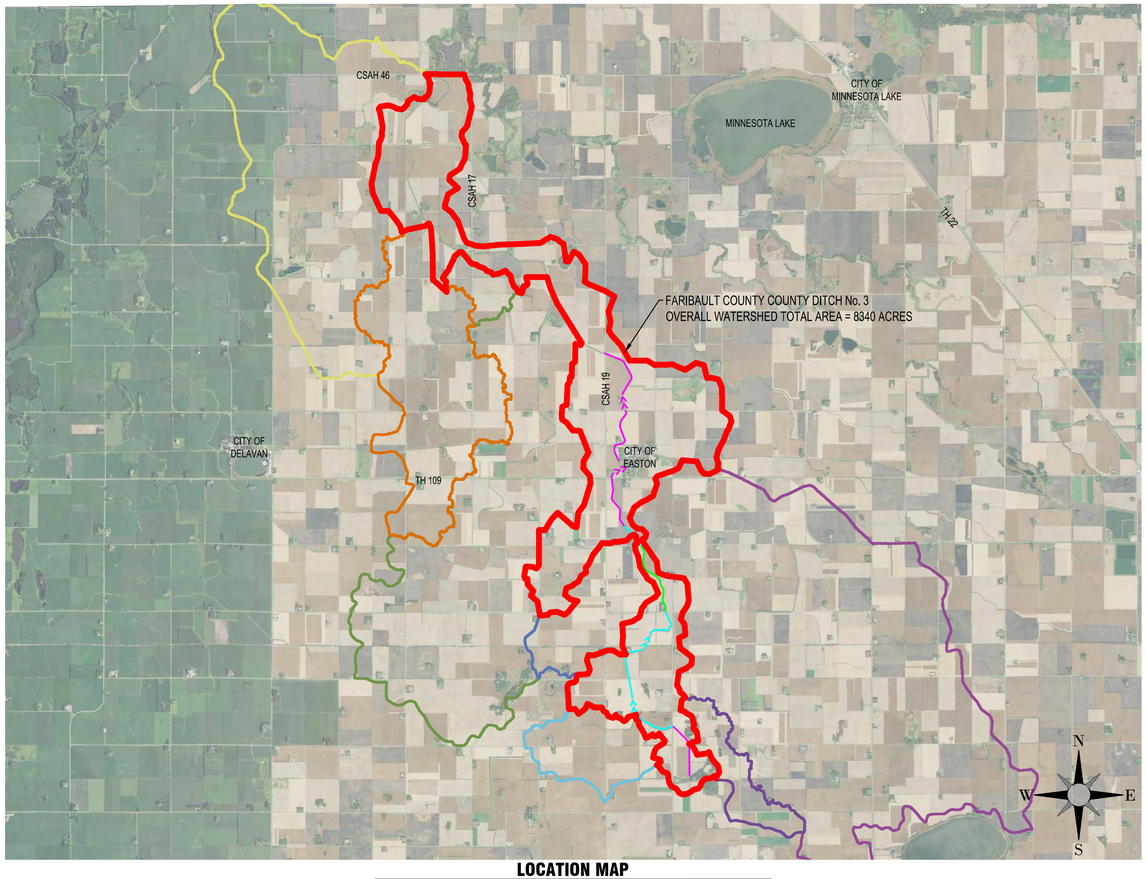
LEGEND

EXISTING

- WATERSHED BOUNDARY
- CITY LIMITS
- SECTION LINE
- QUARTER SECTION LINE
- RIGHT OF WAY LINE
- PROPERTY / LOTLINE
- EASEMENT LINE
- ACCESS CONTROL
- WATER EDGE
- WETLAND BOUNDARY
- FENCE LINE
- EXISTING OPEN DITCH
- CULVERT
- DITCH TILE
- PRIVATE TILE
- WATER
- GAS
- OVERHEAD ELECTRIC
- UNDERGROUND ELECTRIC
- UNDERGROUND TELEPHONE
- UNDERGROUND TV
- OVERHEAD UTILITY
- UNDERGROUND UTILITY
- UNDERGROUND FIBER OPTIC
- CONTOUR (MAJOR)
- CONTOUR (MINOR)
- DECIDUOUS TREE
- CONIFEROUS TREE
- TREE LINE
- DROP INTAKE
- HYDRANT
- POWER POLE

PROPOSED

- EASEMENT
- PROPOSED OPEN DITCH
- OPEN DITCH REPAIR
- CULVERT (RCP)
- CULVERT (CMP)
- TILE
- TILE (PIPE WIDTH)
- WATER
- GAS
- OVERHEAD ELECTRIC
- UNDERGROUND ELECTRIC
- UNDERGROUND TV
- CONTOUR (MAJOR)
- CONTOUR (MINOR)
- DROP INTAKE
- SLOUGH REPAIR
- SPOIL PLACEMENT
- TREE CLEARING
- REMOVE TREE
- BUFFER



LOCATION MAP

SCALE IN FEET

0 6000 12000

SHEET INDEX

GIS DISCLAIMER:

INFORMATION FOR THE BOUNDARY / LOT LINES, AND UNDERGROUND UTILITIES SHOWN WAS DERIVED FROM DIGITAL DATABASES AND IS FOR INFORMATIONAL PURPOSES ONLY. DATA MAY NOT HAVE BEEN PREPARED FOR, OR BE SUITABLE FOR: LEGAL, ENGINEERING, OR SURVEYING PURPOSES.

PROJECT GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE CONTRACT DOCUMENTS, WHICH INCLUDE, BUT ARE NOT LIMITED TO, THE OWNER - CONTRACTOR AGREEMENT, THE PROJECT MANUAL (WHICH INCLUDES GENERAL SUPPLEMENTARY CONDITIONS AND SPECIFICATIONS), DRAWINGS OF ALL DISCIPLINES AND ALL ADDENDA, MODIFICATIONS AND CLARIFICATIONS ISSUED BY THE ARCHITECT/ENGINEER.
2. CONTRACT DOCUMENTS SHALL BE ISSUED TO ALL SUBCONTRACTORS BY THE GENERAL CONTRACTOR IN COMPLETE SETS IN ORDER TO ACHIEVE THE FULL EXTENT AND COMPLETE COORDINATION OF ALL WORK.
3. WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALED DIMENSIONS. NOTIFY ARCHITECT/ENGINEER OF ANY DISCREPANCIES OR CONDITIONS REQUIRING INFORMATION OR CLARIFICATION BEFORE PROCEEDING WITH THE WORK.
4. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. NOTIFY ARCHITECT/ENGINEER OF ANY DISCREPANCIES OR CONDITIONS REQUIRING INFORMATION OR CLARIFICATION BEFORE PROCEEDING WITH THE WORK.
5. DETAILS SHOWN ARE INTENDED TO BE INDICATIVE OF THE PROFILES AND TYPE OF DETAILING REQUIRED THROUGHOUT THE WORK. DETAILS NOT SHOWN ARE SIMILAR IN CHARACTER TO DETAILS SHOWN. WHERE SPECIFIC DIMENSIONS, DETAILS OR DESIGN INTENT CANNOT BE DETERMINED, NOTIFY ARCHITECT/ENGINEER BEFORE PROCEEDING WITH THE WORK.
6. ALL MANUFACTURED ARTICLES, MATERIALS AND EQUIPMENT SHALL BE APPLIED, INSTALLED, CONNECTED, ERECTED, CLEANED AND CONDITIONED ACCORDING TO MANUFACTURERS' INSTRUCTIONS. IN CASE OF DISCREPANCIES BETWEEN MANUFACTURERS' INSTRUCTIONS AND THE CONTRACT DOCUMENTS, NOTIFY ARCHITECT/ENGINEER BEFORE PROCEEDING WITH THE WORK.
7. ALL DISSIMILAR METALS SHALL BE EFFECTIVELY ISOLATED FROM EACH OTHER TO AVOID GALVANIC CORROSION.
8. THE LOCATION AND TYPE OF ALL INPLACE UTILITIES SHOWN ON THE PLANS ARE FOR GENERAL INFORMATION ONLY AND ARE ACCURATE AND COMPLETE TO THE BEST OF THE KNOWLEDGE OF I & S GROUP, INC. (ISG). NO WARRANTY OR GUARANTEE IS IMPLIED. THE CONTRACTOR SHALL VERIFY THE SIZES, LOCATIONS AND ELEVATIONS OF ALL INPLACE UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL IMMEDIATELY NOTIFY ENGINEER OF ANY DISCREPANCIES OR VARIATIONS FROM PLAN.
9. THE CONTRACTOR IS TO CONTACT "GOPHER STATE ONE CALL" FOR UTILITY LOCATIONS, MINIMUM 2 BUSINESS DAYS PRIOR TO ANY EXCAVATION / CONSTRUCTION (1-800-252-1166).

PROJECT INDEX:

OWNER:

FARIBAULT COUNTY DRAINAGE AUTHORITY
415 S GROVE STREET, SUITE 8
BLUE EARTH, MN 56013
PH: (507) 526-2388

PROJECT ADDRESS / LOCATION:

SEC: 4-5, 8-9, 14-16, 23, 25-26, 36 LURA TWP
SEC: 1, 12, 13, 24 BARBER TWP
SEC: 19, 30 WALNUT LAKE TWP

FARIBAULT COUNTY, MINNESOTA

MANAGING OFFICE:

MANKATO OFFICE
115 EAST HICKORY STREET
SUITE 300
MANKATO, MN 56001
PHONE: 507.387.6651
FAX: 507.387.3583

PROJECT MANAGER: MARK ORIGER
EMAIL: MARK.ORIGER@ISGINC.COM

SPECIFICATIONS REFERENCE

ALL CONSTRUCTION SHALL COMPLY WITH THE COUNTY OF FARIBAULT REQUIREMENTS AND MnDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION, 2018 EDITION, AND THE STANDARD SPECIFICATIONS FOR SANITARY SEWER, STORM DRAIN AND WATERMAIN AS PROPOSED BY THE CITY ENGINEERS ASSOCIATION OF MINNESOTA 2013, UNLESS DIRECTED OTHERWISE.

PROJECT DATUM

HORIZONTAL COORDINATES HAVE BEEN REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83), 1996 ADJUSTMENT (NAD83(1996)) ON THE FARIBAULT COUNTY COORDINATE SYSTEM, IN U.S. SURVEY FEET.
ELEVATIONS HAVE BEEN REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
RTK GPS METHODS WERE USED TO ESTABLISH HORIZONTAL AND VERTICAL COORDINATES FOR THIS PROJECT.

B.M. ELEVATION=1063.88

1.2 MI E OF EASTON, 1.05 MI EAST ALONG TH 109 FROM THE JCT. OF TH 109 & CR 69 IN EASTON, AT TH 109 MILEPOINT 14.45, 100 FT S OF TH 109, 45 F W OF CR 113, 1.6 FT N OF A WITNESS POST

TOPOGRAPHIC SURVEY

THIS PROJECT'S TOPOGRAPHIC SURVEY CONSISTS OF DATA COLLECTED IN JUNE, 2018 BY ISG.

NOTE:
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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 TITLE
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

TITLE

SHEET

1 OF 41

GENERAL OPEN DITCH NOTES:

1. DURING CONSTRUCTION, CONTRACTOR SHALL MAINTAIN A DRAINAGE OUTLET FOR THE ENTIRE FARIBAULT COUNTY DITCH 3 PROJECT AREA.
2. ALL PIPE DIMENSIONS REFERENCED IN THE PLANS REFER TO THE INSIDE DIAMETER.
3. UNLESS OTHERWISE NOTED, CONTRACTOR SHALL LIMIT CONSTRUCTION ACTIVITY TO WITHIN A 33-FOOT WIDE AREA ALONG TOP OF DITCH ALIGNMENTS. DISTURBANCE THROUGH ROAD CROSSINGS, ROAD DITCHES, AND GRASS BUFFERS SHALL BE LIMITED TO THE TRENCH WIDTH NECESSARY FOR SAFE CONSTRUCTION PRACTICES.
4. A 16.5-FOOT GRASS STRIP SHALL BE ESTABLISHED IN AREAS THAT DO NOT HAVE AN EXISTING 16.5-FOOT GRASS STRIP. SEEDING SHALL OCCUR AFTER ALL WORK HAS BEEN COMPLETED IN THE AREA AND SHALL COMPLY WITH THE CONTRACT DOCUMENTS. THESE AREAS WILL BE DETERMINED BY THE ENGINEER.
5. DITCH CLEANING SHALL BE PERFORMED ON THE SIDE OF THE DITCH THAT IS THE LOWEST FOR THE GREATEST DISTANCE ALONG THE OPEN DITCH SEGMENT. DITCH CLEANING SPOILS SHALL BE PLACED WITHIN 16.5-FOOT WIDE GRASS STRIP FROM THE TOP OF DITCH SLOPE UNLESS OTHERWISE DETERMINED BY THE ENGINEER.
6. TOPSOIL IN SPOIL AREAS AS SPECIFIED ON PLANS SHALL BE STRIPPED PRIOR TO SPOIL PLACEMENT.
7. SHAPING AROUND SIDE INLETS, WASCOBs, AND CULVERT INLETS SHALL BE INCIDENTAL TO THEIR RESPECTIVE PAY ITEMS.
8. ALL SPOIL LEVELING, GRADING, AND RESTORATION OF DISTURBED AREAS SHALL BE IN ACCORDANCE TO THE CONTRACT DOCUMENTS AND SHALL BE INCIDENTAL TO THE WORK PERFORMED.
9. ALL EXISTING TILE OUTLETS INTO THE OPEN DITCH, INCLUDING ANY NOT SHOWN ON THE PLANS, SHALL BE REPAIRED. UNLESS SPECIFICALLY NOTED, HDPE OR PVC SHALL BE ACCEPTABLE MATERIAL FOR ALL TILE REPAIRS (SEE DETAILS).
10. EXISTING TILE OUTLETS MAY BE SALVAGED, REUSED, AND PROTECTED WITH RIPRAP IF THE OUTLET IS DETERMINED TO BE IN GOOD CONDITION BY THE ENGINEER. TILE REPAIR AT THESE LOCATIONS SHALL BE PAID FOR AS PAY ITEM "ARMOR TILE OUTLET" (SEE DETAILS).
9. ALL ROAD CROSSING REPAIRS SHALL BE CONSTRUCTED WITH CLASS III RCP ONLY, UNLESS OTHERWISE SPECIFIED ON PLANS OR APPROVED BY THE ENGINEER. TIE ALL PIPE SECTIONS UNDER ROAD CROSSINGS (INCIDENTAL).
10. CONTRACTOR MUST NOTIFY ENGINEER OF ANY CULVERT SECTIONS DEEMED NOT SALVAGEABLE PRIOR TO REMOVAL AND SHALL BE ADDRESSED BEFORE CULVERT WORK IS DONE.
11. MISCELLANEOUS TREE CLEARING SHALL BE INCIDENTAL TO DITCH CLEANING PAY ITEM(S).
12. TREE CLEARING FOR ALL TREES WITHIN THE 1-ROD BUFFER STRIP ARE REQUIRED TO BE REMOVED AND WILL BE PAID FOR AS A LUMP SUM UNIT. APPROXIMATE LOCATIONS ARE INCLUDED ON THE MAP FOR REFERENCE. TREES SHALL BE CLEARED AND GRUBBED AND SPRAY THE AREA AROUND TREE AFTER COMPLETE.
13. ALL TREE REMOVALS MUST BE COMPLETED BY MAY 1, 2020.

TOTAL ESTIMATED QUANTITIES

Item Code	Item	Unit	Estimated Quantity
2021.501	MOBILIZATION	LS	1
2101.511	TREE CLEARING AND REMOVAL	LS	1
2105.603	STANDARD DITCH CLEANING (10' WIDE DITCH BOTTOM)	LF	3,200
2105.603	STANDARD DITCH CLEANING (8' WIDE DITCH BOTTOM)	LF	12,410
2105.603	STANDARD DITCH CLEANING (6' WIDE DITCH BOTTOM)	LF	4,350
2105.603	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (10' WIDE DITCH BOTTOM)	LF	3,600
2105.603	STANDARD DITCH CLEANING W/ SIDE SLOPE FLATTENING (6' WIDE DITCH BOTTOM)	LF	13,860
2105.603	SLOUGH REPAIR	LF	2,100
2105.603	BENCHED SIDE SLOPE SLOUGH REPAIR	LF	1,050
2106.501	TOP SOIL STRIP & PLACE SPOILS	AC	19.60
2501.511	72-INCH CLASS III RCP PIPE	LF	0
2506.603	36-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1
2506.603	30-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	1
2506.603	24-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	15
2506.603	18-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	20
2506.603	15-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	35
2506.603	12-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	60
2506.603	10-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	24
2506.603	8-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	32
2506.603	6-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	24
2506.603	4-INCH TILE OUTLET (20 LF OF PIPE & RIPRAP ON GEOTEXTILE FABRIC)	EA	5
2511.501	CLASS III RIPRAP WITH GEOTEXTILE FABRIC	CY	300
2575.501	16.5' BUFFER STRIP SEEDING (SEED MIX: BUFFER BLEND WITH TYPE 3 MULCH)	AC	28
2575.501	STANDARD SIDESLOPE SEEDING (SEED MIX: BUFFER BLEND WITH TYPE 8 MULCH)	AC	17
2575.541	BUFFER STRIP MOWING	AC	57
2575.545	WEED SPRAYING	AC	74

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

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CAD FILE NAME	21589 TITLE
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DESIGNED BY	CJB
REVIEWED BY	CJB
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CLIENT PROJECT NO.	-

TITLE

NOTES & QUANTITIES

SHEET

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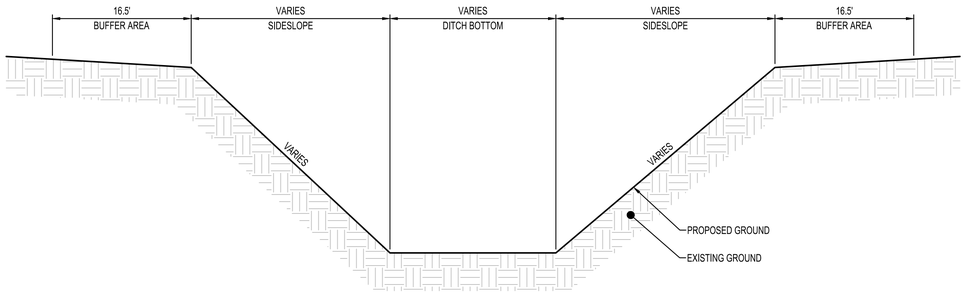
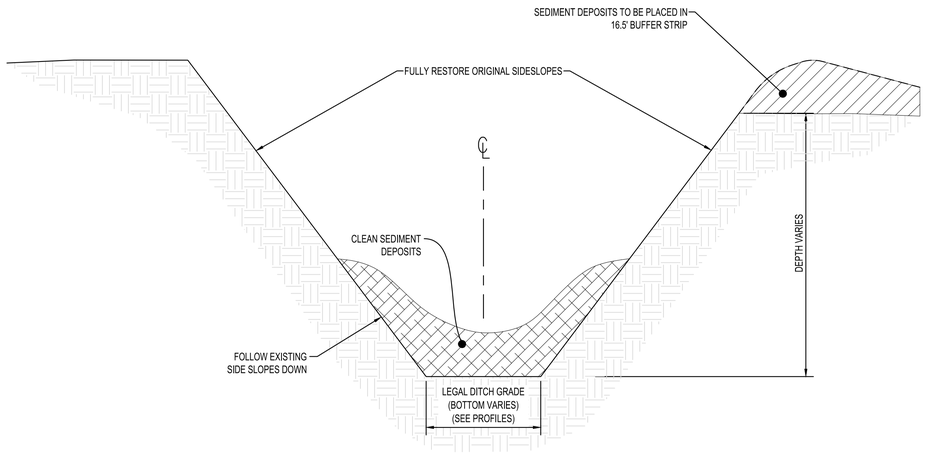


TRAPEZOIDAL DITCH SECTION

NTS AG400



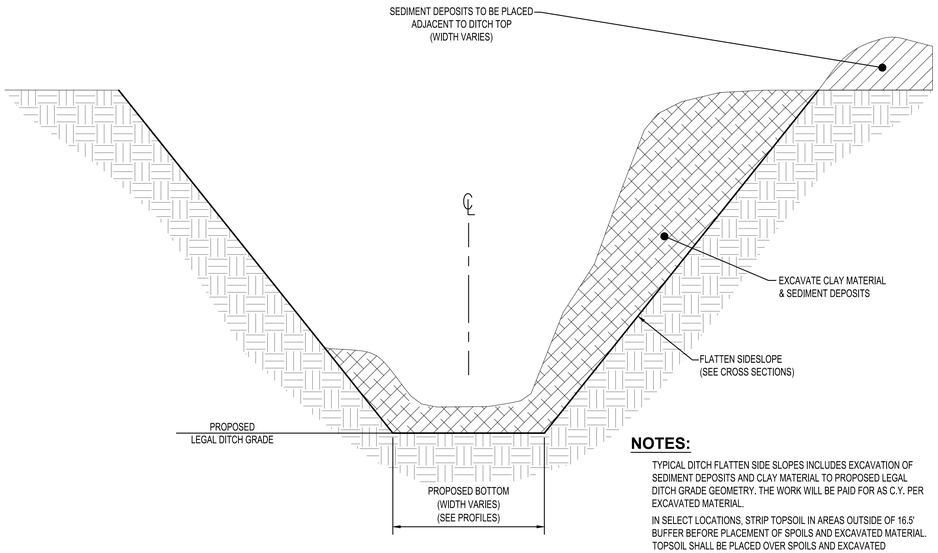
NOTES:

BOTTOM ½ NEED NOT BE RESEEDED.

ONLY CLEAN TO LEGAL DITCH BOTTOM. ENTIRE DITCH BOTTOM NEED NOT BE CLEANED UNLESS SPECIFIED.

TYPICAL DITCH CLEANING

NTS AG420



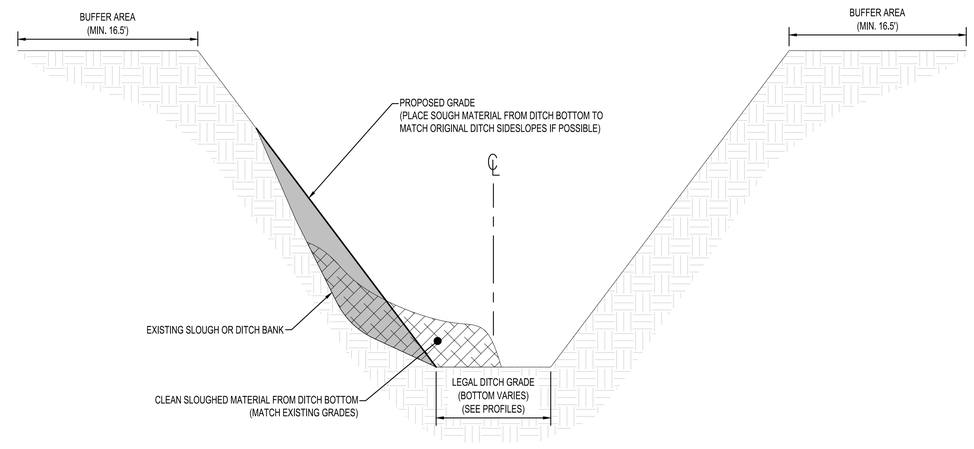
NOTES:

TYPICAL DITCH FLATTEN SIDE SLOPES INCLUDES EXCAVATION OF SEDIMENT DEPOSITS AND CLAY MATERIAL TO PROPOSED LEGAL DITCH GRADE GEOMETRY. THE WORK WILL BE PAID FOR AS C.Y. PER EXCAVATED MATERIAL.

IN SELECT LOCATIONS, STRIP TOPSOIL IN AREAS OUTSIDE OF 16.5' BUFFER BEFORE PLACEMENT OF SPOILS AND EXCAVATED MATERIAL. TOPSOIL SHALL BE PLACED OVER SPOILS AND EXCAVATED MATERIAL OUTSIDE OF BUFFER AREA (INCIDENTAL TO TOPSOIL STRIPPING).

FLATTEN DITCH SIDE SLOPES

NTS AG480



NOTE:
ORIGINAL SIDESLOPE/SLOUGHED MATERIAL SHALL BE USED TO REESTABLISH DITCH BANK SIDESLOPES.

TYPICAL DITCH SIDESLOPE REPAIR

NTS AG440

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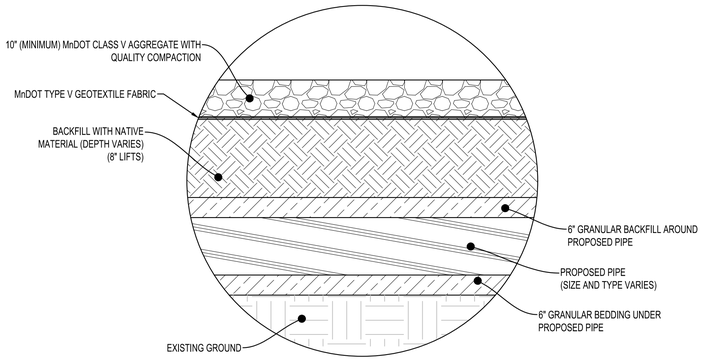
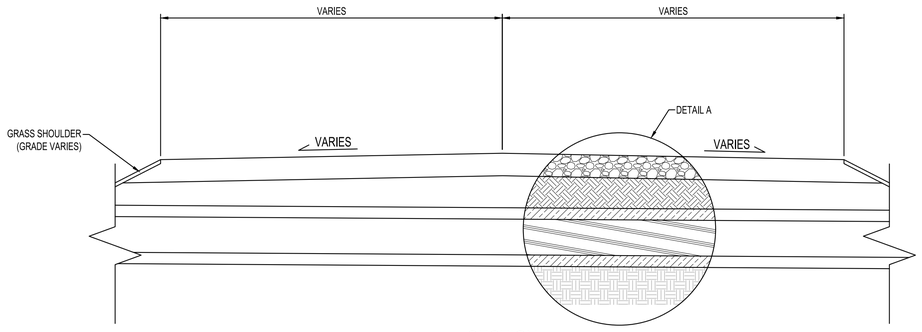
3 OF 41



DETAIL A



SECTION

NOTES:

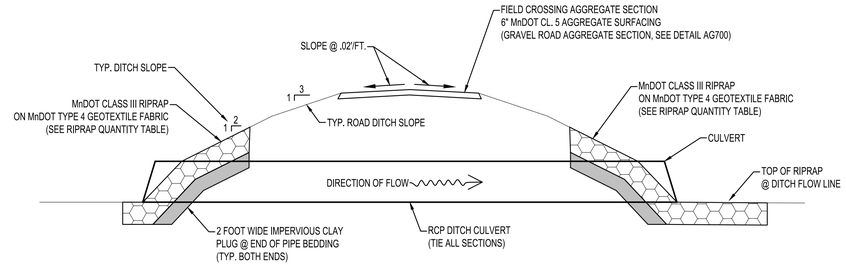
SALVAGE & REPLACE EXISTING CROSSING SURFACE MATERIAL. ADDITIONAL CLASS III AGGREGATE MAY BE NEEDED TO MEET MINIMUM 10" DEPTH.

SEED DISTURBED GRASS SHOULDER WITH MnDOT 25-142 WITH MnDOT CATEGORY 3 EROSION CONTROL BLANKET.

CONTRACTOR IS RESPONSIBLE TO MAINTAIN THE DISTURBED ROADS UNTIL THE PROJECT IS COMPLETED OR ROAD AUTHORITY HAS RESUMED CONTROL; WHICHEVER IS SOONER.

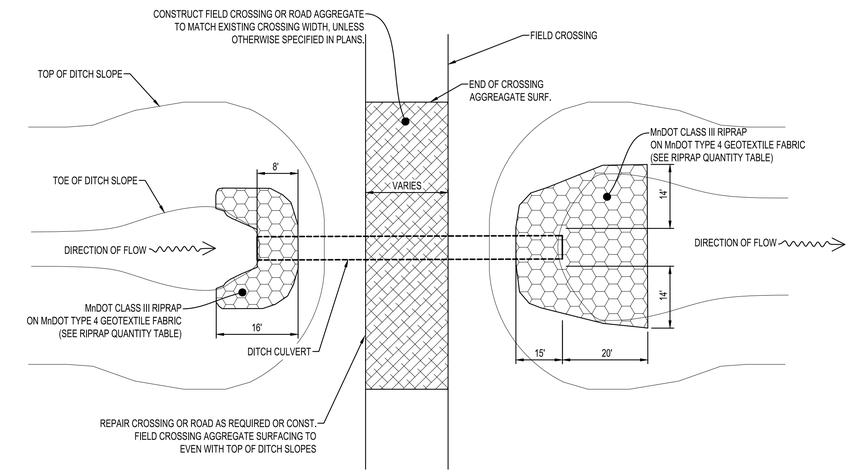
TYPICAL ROADWAY SECTION

NTS AG700



SECTION

NTS



PLAN

NTS

RIPRAP QUANTITY	
EQUIVALENT SIZE	UPSTREAM - DOWNSTREAM
<48"	10 CY - 20 CY

NOTES:

OPEN DITCH CULVERTS MUST BE WATERTIGHT, GASKETED, AND TONGUE AND GROOVE DESIGN CONFORMING TO MnDOT 3006F.

SEE TYPICAL ROAD SECTION DETAIL AG700.

AGGREGATE SURFACE IS INCIDENTAL TO CROSSING OR ROAD RESTORATION.

TIE ALL RCP PIPE SECTIONS (INCIDENTAL TO CROSSING).

RIPRAP QUANTITIES ESTIMATED (AS SHOWN IN TABLE). ADDITIONAL QUANTITY MAY BE REQUIRED BY ENGINEER AND/OR SHOWN ON PLANS. ALL RIPRAP QUANTITIES SHALL BE PAID BY CY INSTALLED.

ADDITIONAL RIPRAP NEEDED FOR CULVERTS LARGER THAN 48". REFER TO SCHEDULE FOR DIMENSIONS.

TYPICAL FIELD OR ROAD CROSSING

NTS AG710

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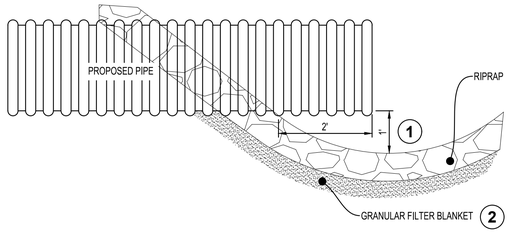
DIMENSIONS	
PIPE DIA	RIPRAP
12" TO 18"	4 CY CLASS III
21" TO 27"	8 CY CLASS III
30" TO 36"	12 CY CLASS III
42" TO 48"	16 CY CLASS III
54" & UP	20 CY CLASS IV



NOTES:

1. 1' MIN. ABOVE RIPRAP. FOR PIPES GREATER THAN OR EQUAL TO 30", USE 1.5' - 2'.
2. THE CONTRACTOR, AS AN OPTION, MAY SUBSTITUTE A GEOTEXTILE FABRIC, SPEC. 3601, FOR THE GRANULAR FILTER BLANKET. THE FABRIC SHOULD EXTEND BEYOND THE RIPRAP BY 3' IN ALL DIRECTIONS.

FOR PIPES LESS THAN 18", INSTALL RODENT GUARD (INCIDENTAL TO TILE OUTLET)

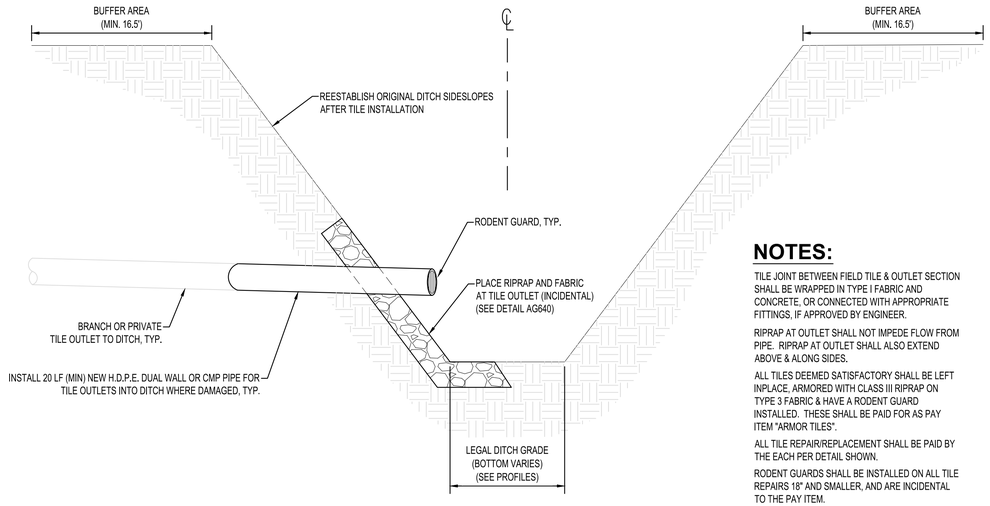
RIPRAP AT OUTLET SHALL NOT IMPEDE FLOW FROM PIPE, OR RECEIVING BODY. RIPRAP AT OUTLET SHALL ALSO EXTEND ABOVE AND ALONG SIDES OF PIPE.

ADDITIONAL RIPRAP MAY BE NECESSARY BASED ON ELEVATIONS (PAID FOR BY CY)

RIPRAP AT TILE OUTLET

NTS AG620

NOTE: ALL TILE OUTLETS AND FIELD INTAKES SHALL BE REPAIRED OR PROTECTED



NOTES:

TILE JOINT BETWEEN FIELD TILE & OUTLET SECTION SHALL BE WRAPPED IN TYPE I FABRIC AND CONCRETE, OR CONNECTED WITH APPROPRIATE FITTINGS, IF APPROVED BY ENGINEER.

RIPRAP AT OUTLET SHALL NOT IMPEDE FLOW FROM PIPE. RIPRAP AT OUTLET SHALL ALSO EXTEND ABOVE & ALONG SIDES.

ALL TILES DEEMED SATISFACTORY SHALL BE LEFT INPLACE, ARMORED WITH CLASS III RIPRAP ON TYPE 3 FABRIC & HAVE A RODENT GUARD INSTALLED. THESE SHALL BE PAID FOR AS PAY ITEM "ARMOR TILES".

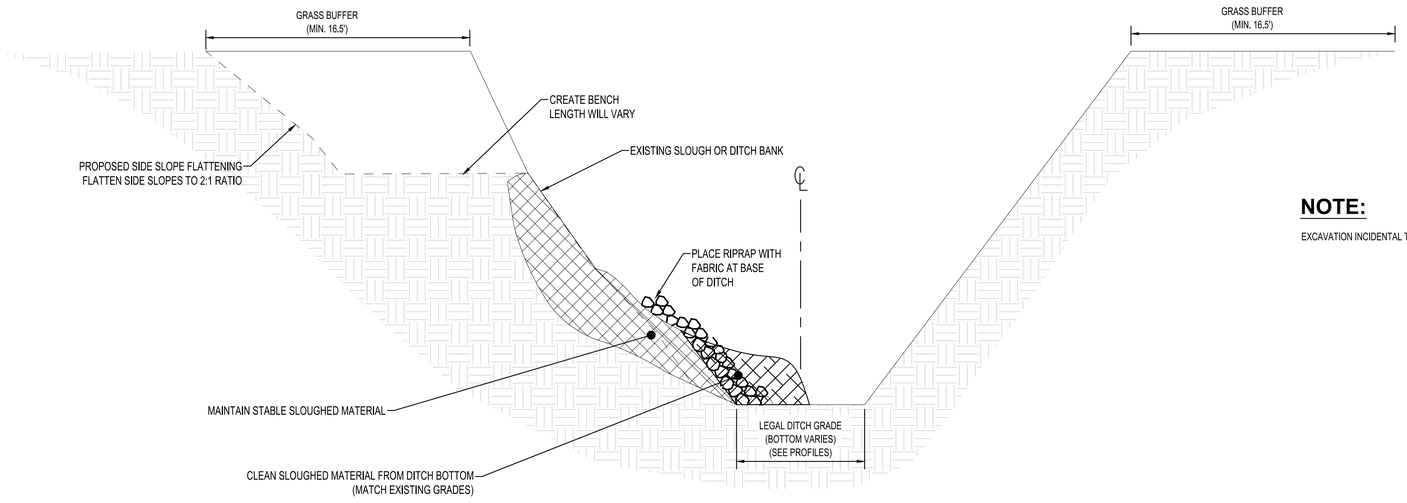
ALL TILE REPAIR/REPLACEMENT SHALL BE PAID BY THE EACH PER DETAIL SHOWN.

RODENT GUARDS SHALL BE INSTALLED ON ALL TILE REPAIRS 18" AND SMALLER, AND ARE INCIDENTAL TO THE PAY ITEM.

ALL FITTINGS TO CONNECT EXISTING TILE SHALL BE INCIDENTAL TO TILE OUTLET REPAIR.

TYPICAL TILE OUTLET REPAIR

NTS AG450



NOTE:

EXCAVATION INCIDENTAL TO LF OF REPAIR

BENCH SLOPE SLOUGH REPAIR

NTS AG440

ISG

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

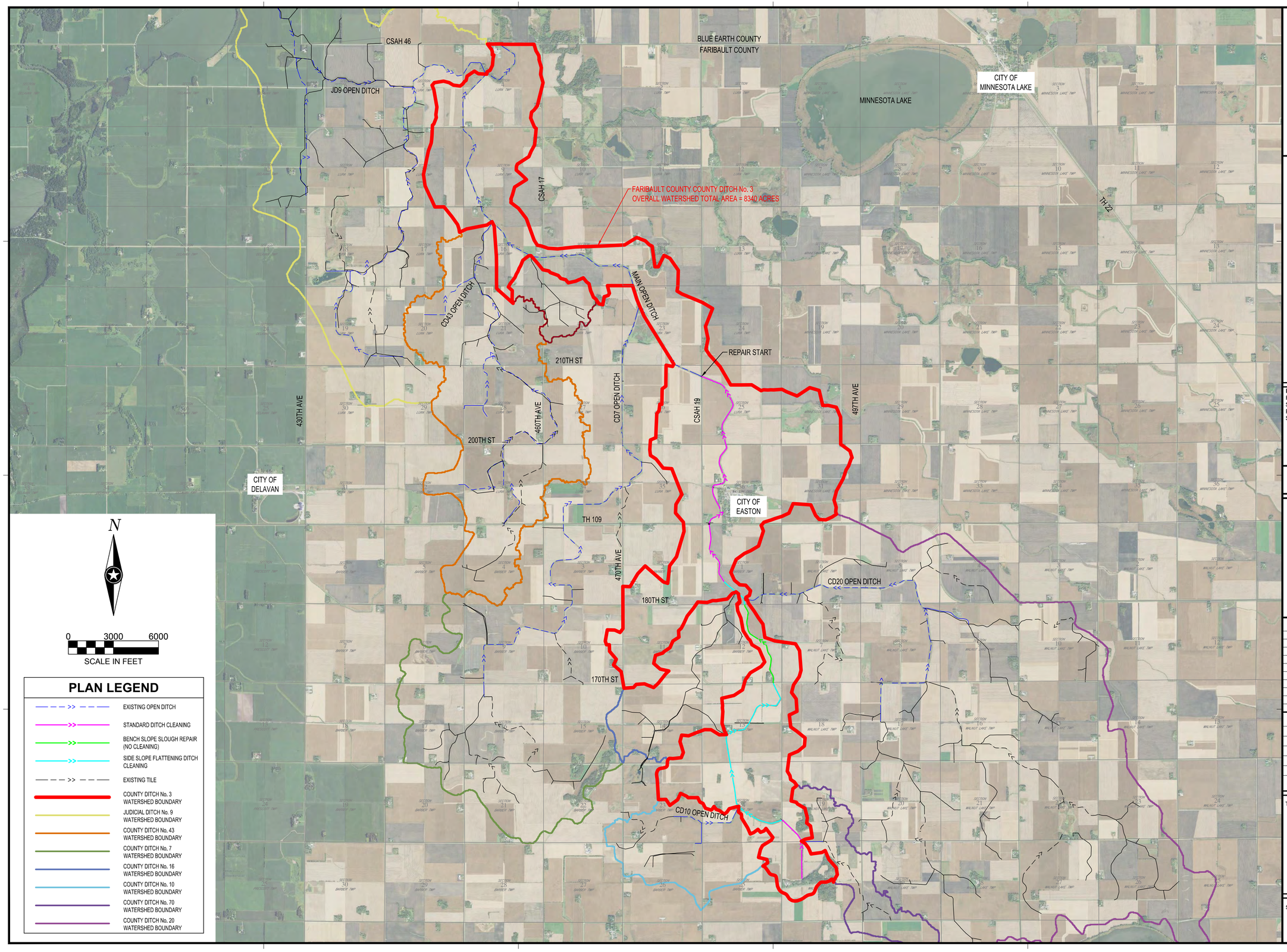
PROJECT NO.	18-21589
CAD FILE NAME	21589 DETAILS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

DETAILS

SHEET

5 OF 41



N

0 3000 6000

SCALE IN FEET

PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE
- COUNTY DITCH No. 3 WATERSHED BOUNDARY
- JUDICIAL DITCH No. 9 WATERSHED BOUNDARY
- COUNTY DITCH No. 43 WATERSHED BOUNDARY
- COUNTY DITCH No. 7 WATERSHED BOUNDARY
- COUNTY DITCH No. 16 WATERSHED BOUNDARY
- COUNTY DITCH No. 10 WATERSHED BOUNDARY
- COUNTY DITCH No. 70 WATERSHED BOUNDARY
- COUNTY DITCH No. 20 WATERSHED BOUNDARY

ISG

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

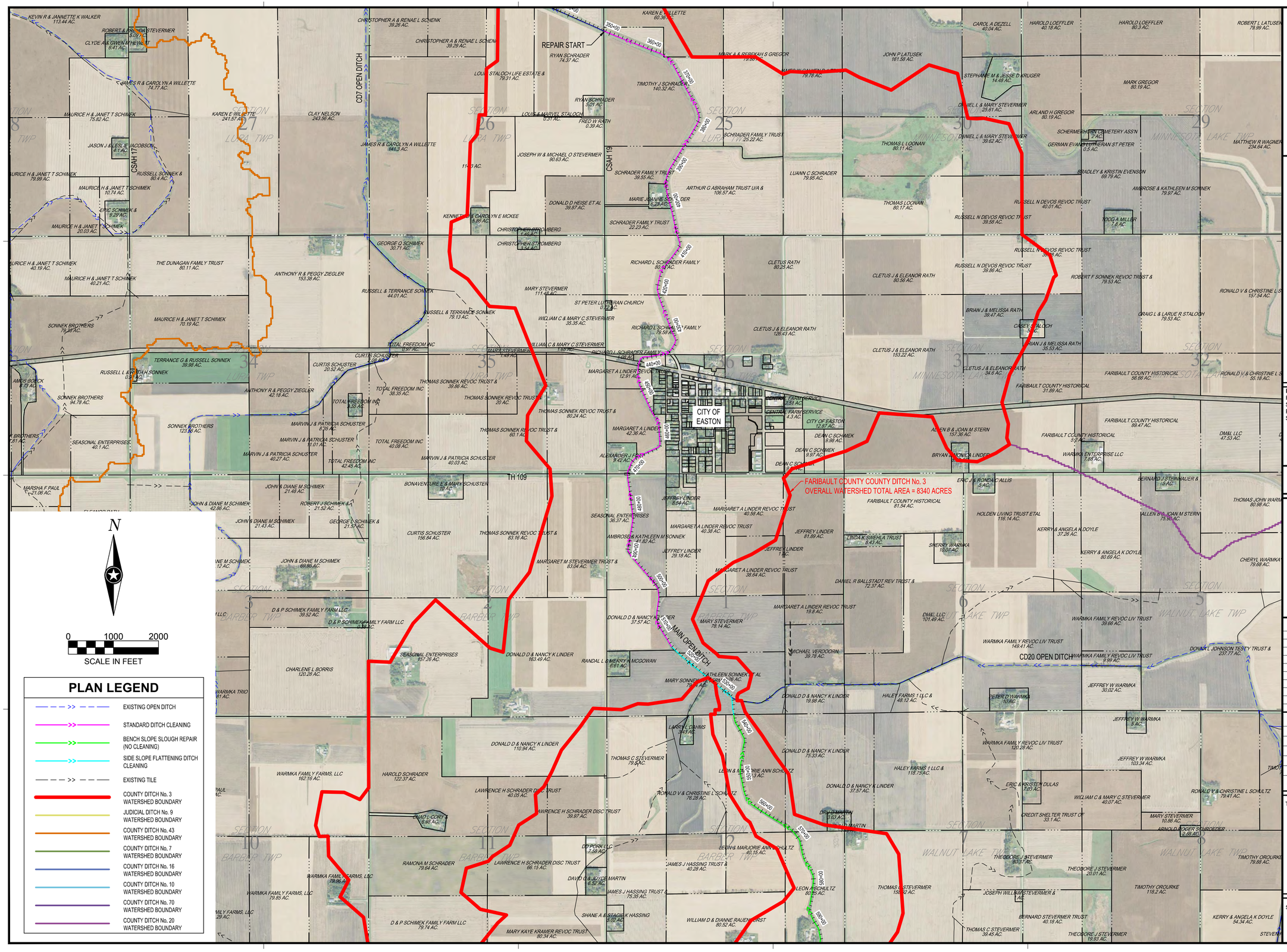
PROJECT NO.	18-21589
CAD FILE NAME	21589 WATERSHED
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

OVERALL WATERSHED

SHEET

6 OF 41



PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE
- COUNTY DITCH No. 3 WATERSHED BOUNDARY
- JUDICIAL DITCH No. 9 WATERSHED BOUNDARY
- COUNTY DITCH No. 43 WATERSHED BOUNDARY
- COUNTY DITCH No. 7 WATERSHED BOUNDARY
- COUNTY DITCH No. 16 WATERSHED BOUNDARY
- COUNTY DITCH No. 10 WATERSHED BOUNDARY
- COUNTY DITCH No. 70 WATERSHED BOUNDARY
- COUNTY DITCH No. 20 WATERSHED BOUNDARY

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 WATERSHED
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

LAND OWNER MAP (N)

SHEET

7 OF 41

FARIBAULT COUNTY COUNTY DITCH No. 3
OVERALL WATERSHED TOTAL AREA = 8340 ACRES

MAIN OPEN DITCH

CD10 OPEN DITCH

CSAH 19

N

0 1000 2000
SCALE IN FEET

PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE
- COUNTY DITCH No. 3 WATERSHED BOUNDARY
- JUDICIAL DITCH No. 9 WATERSHED BOUNDARY
- COUNTY DITCH No. 43 WATERSHED BOUNDARY
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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

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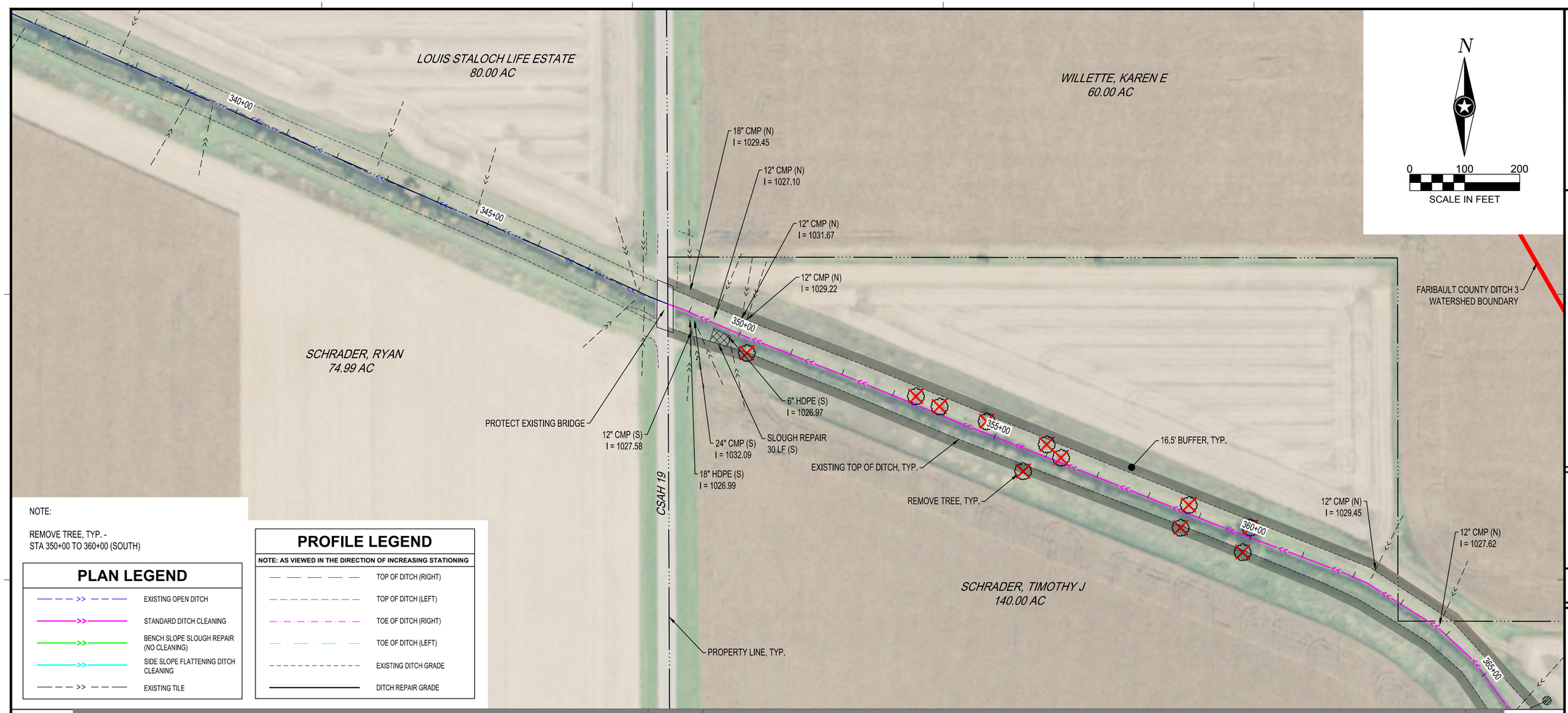
CAD FILE NAME	21589 WATERSHED
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

LAND OWNER MAP (S)

SHEET

8 OF 41



NOTE:

REMOVE TREE, TYP. -
STA 350+00 TO 360+00 (SOUTH)

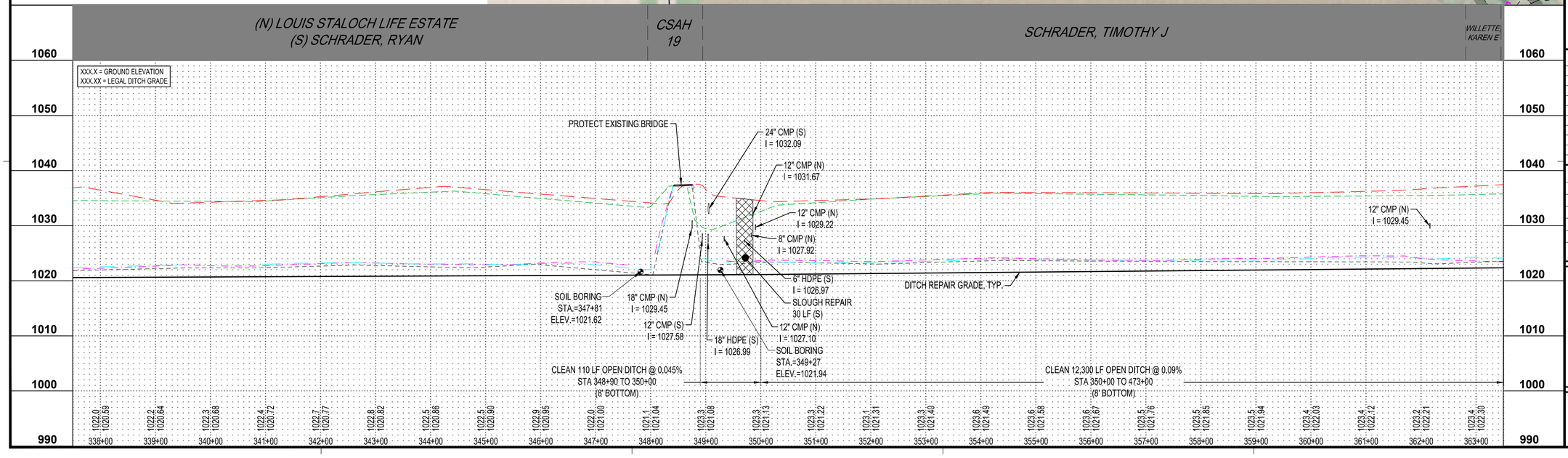
PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 PROFILES (2)
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

9 OF 41

PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

NOTE:

REMOVE TREE, TYP. -
STA 370+00 TO 386+00 (BOTH SIDES)
TREE CLEARING, TYP. -
STA 374+00 TO 375+00 (NORTHEAST)
STA 377+60 TO 379+50 (WEST)

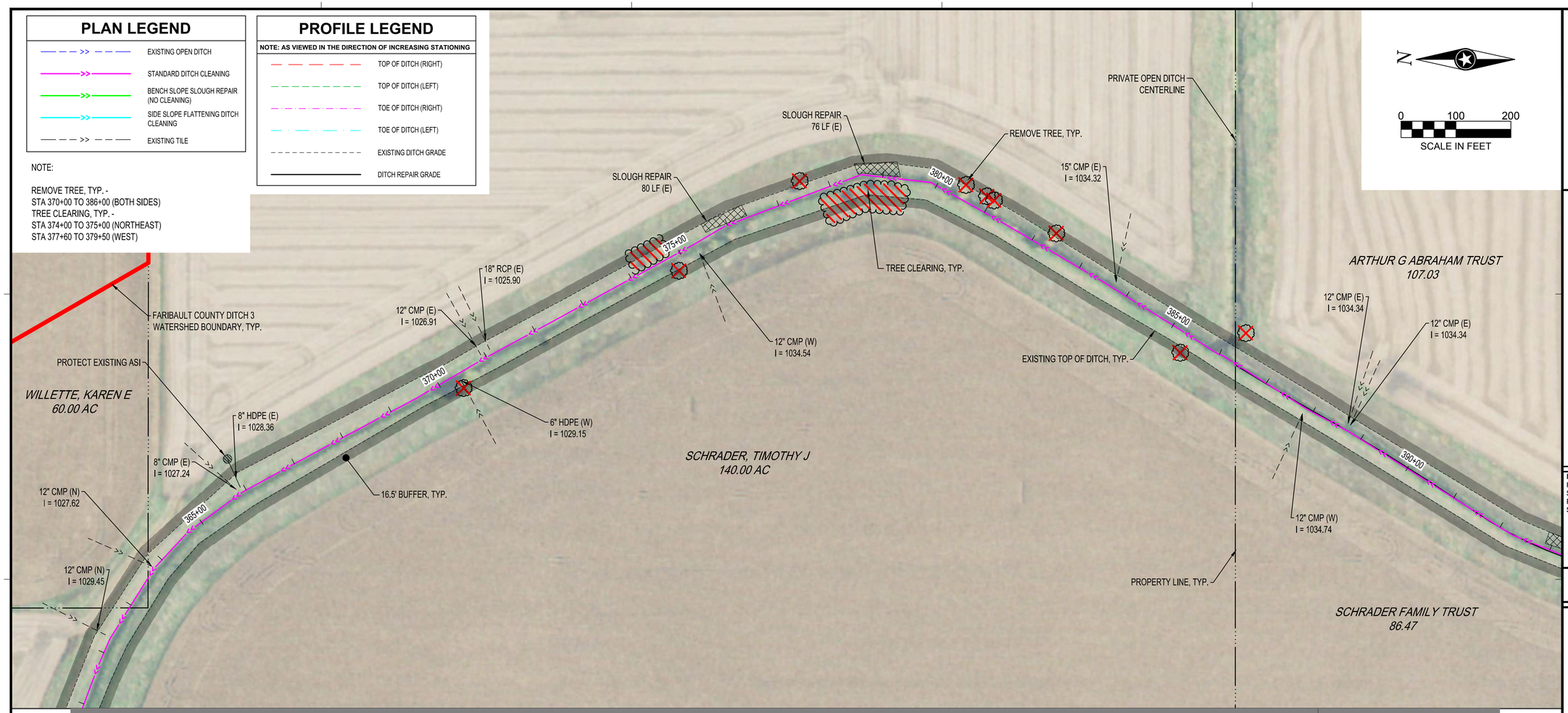
PROFILE LEGEND

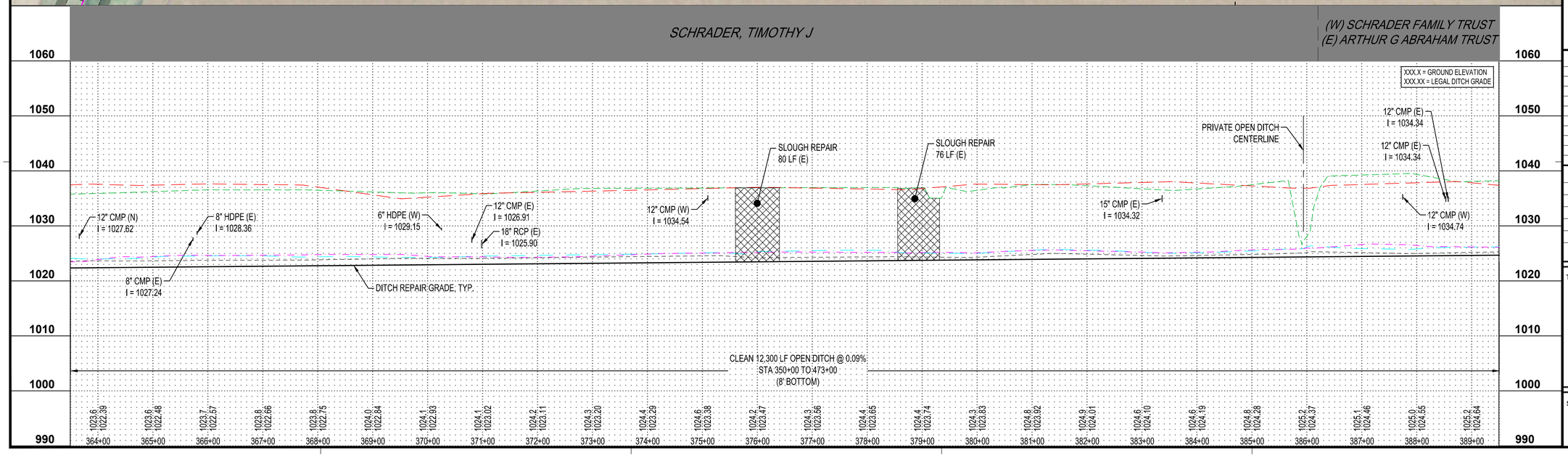
NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE

N

0 100 200
SCALE IN FEET





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FARIBAULT COUNTY

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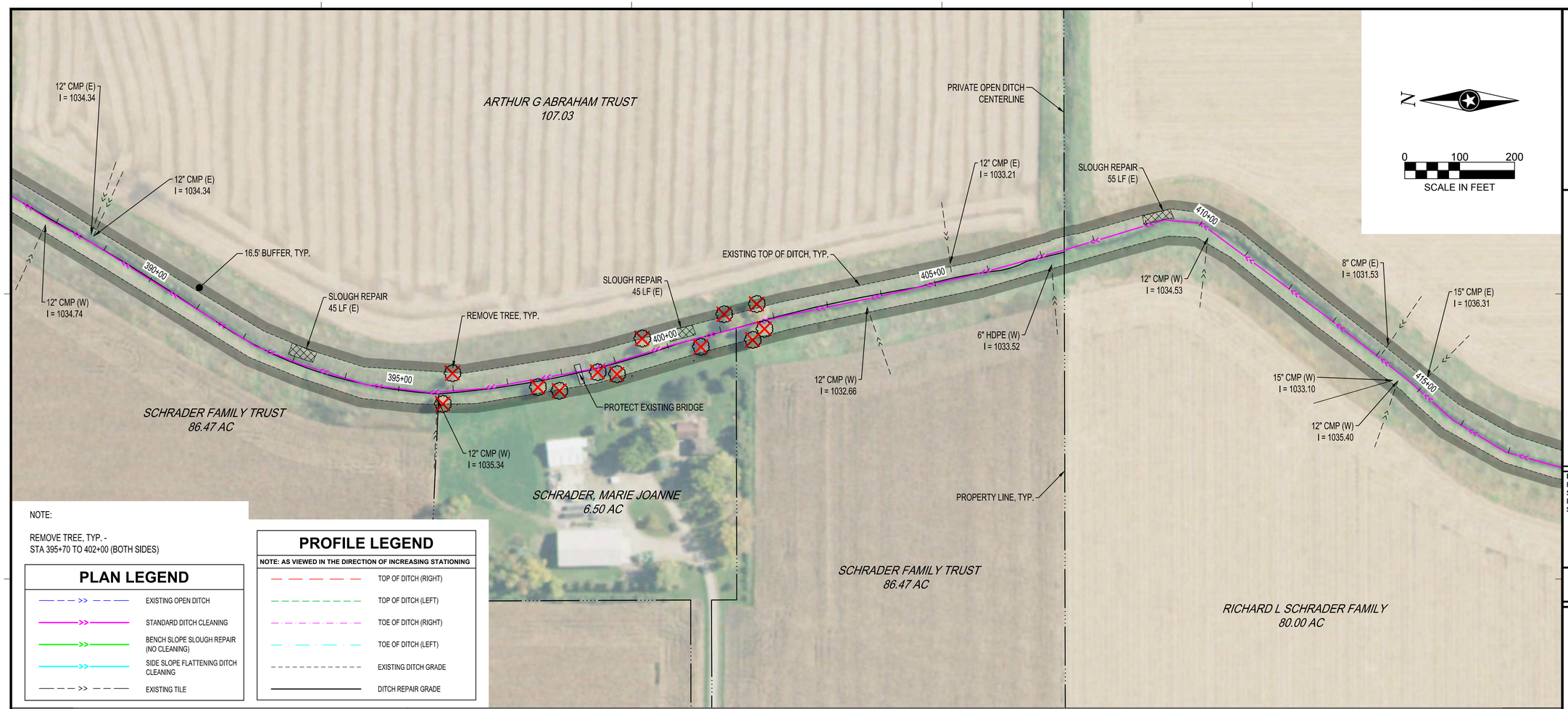
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

10 OF 41



NOTE:

REMOVE TREE, TYP. -
STA 395+70 TO 402+00 (BOTH SIDES)

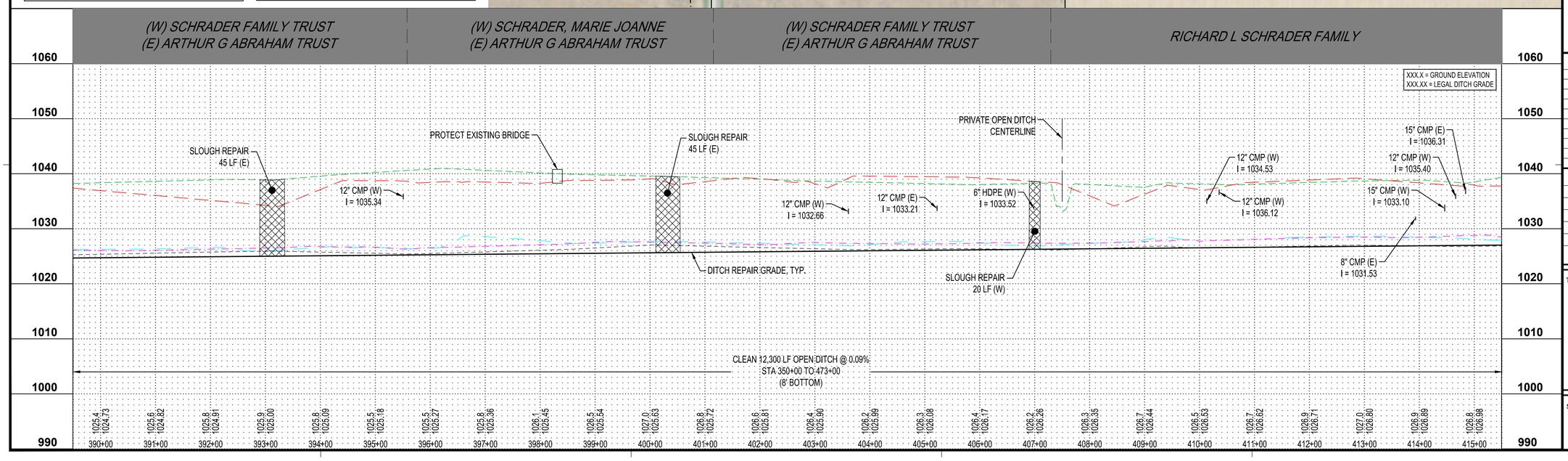
PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

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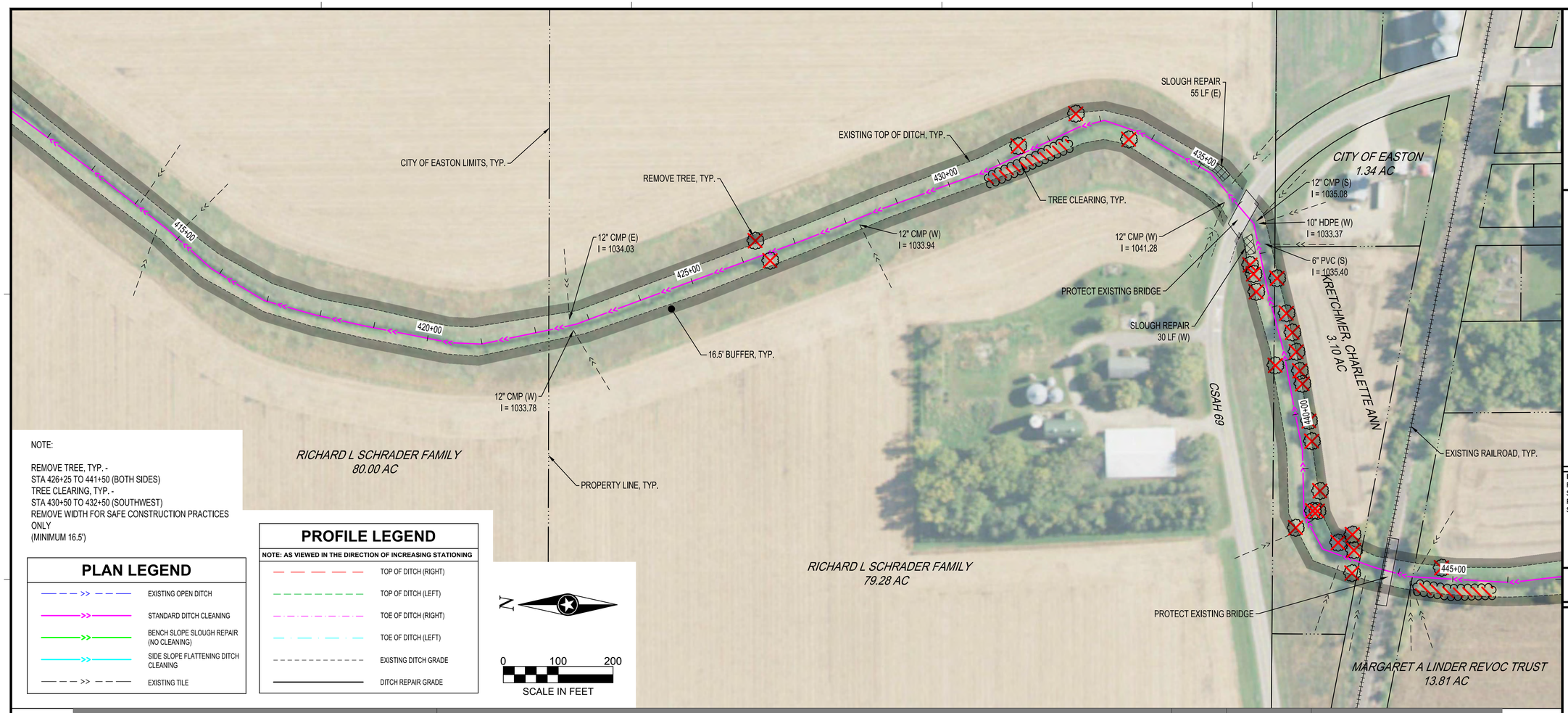
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

11 OF 41



NOTE:

REMOVE TREE, TYP. -
STA 426+25 TO 441+50 (BOTH SIDES)
TREE CLEARING, TYP. -
STA 430+50 TO 432+50 (SOUTHWEST)
REMOVE WIDTH FOR SAFE CONSTRUCTION PRACTICES ONLY
(MINIMUM 16.5')

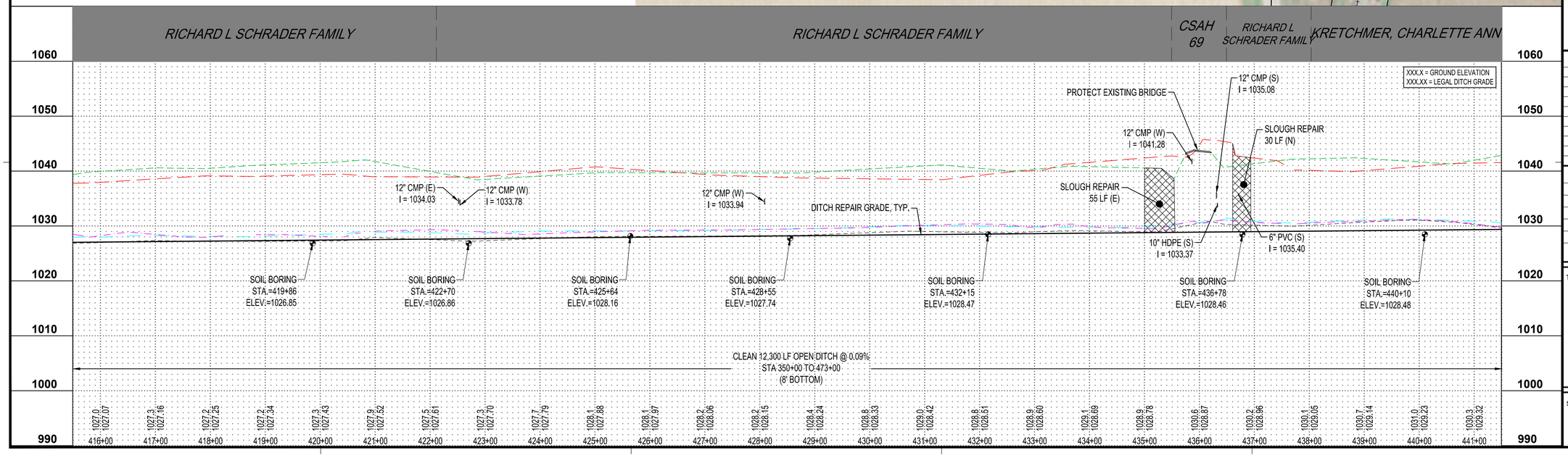
PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

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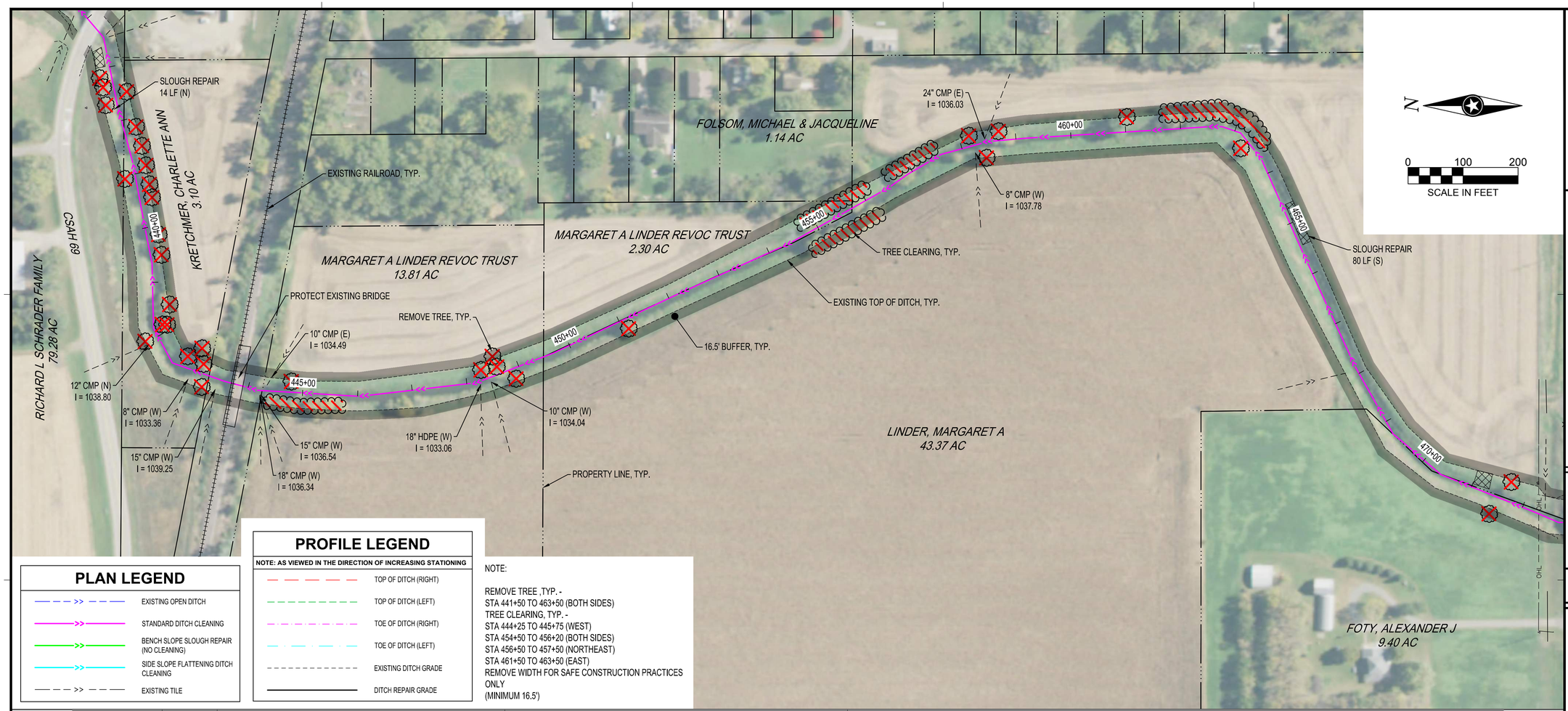
PROJECT NO.	18-21589
CAD FILE NAME	21589 PROFILES (3)
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

12 OF 41



PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

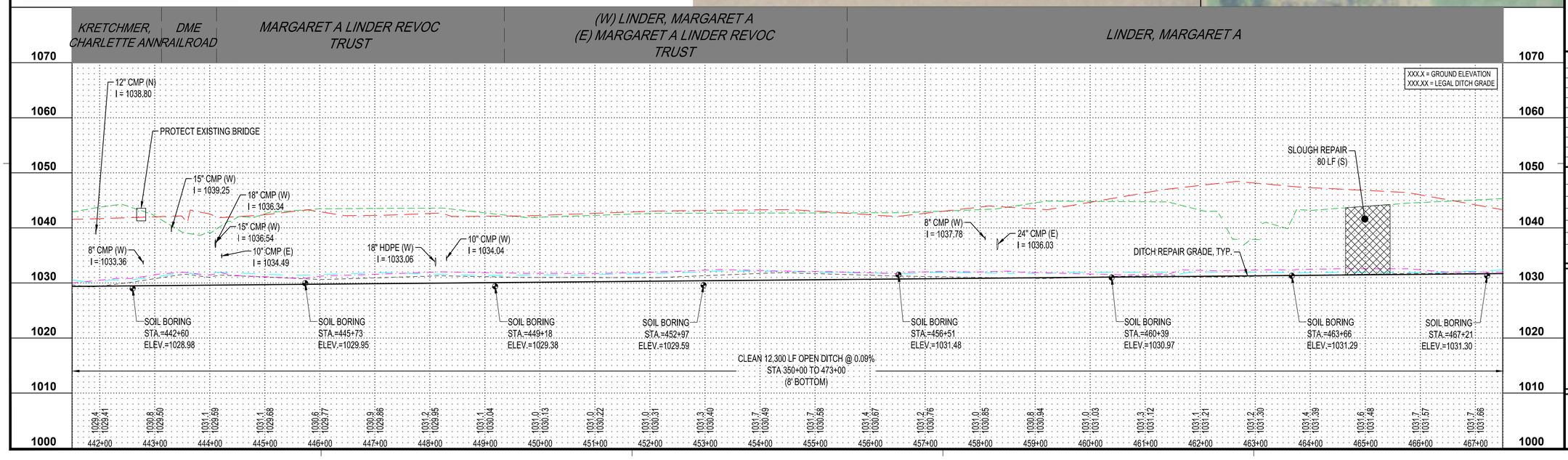
PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE

NOTE:

REMOVE TREE ,TYP. -
STA 441+50 TO 463+50 (BOTH SIDES)
TREE CLEARING, TYP. -
STA 444+25 TO 445+75 (WEST)
STA 454+50 TO 456+20 (BOTH SIDES)
STA 456+50 TO 457+50 (NORTHEAST)
STA 461+50 TO 463+50 (EAST)
REMOVE WIDTH FOR SAFE CONSTRUCTION PRACTICES ONLY
(MINIMUM 16.5')



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

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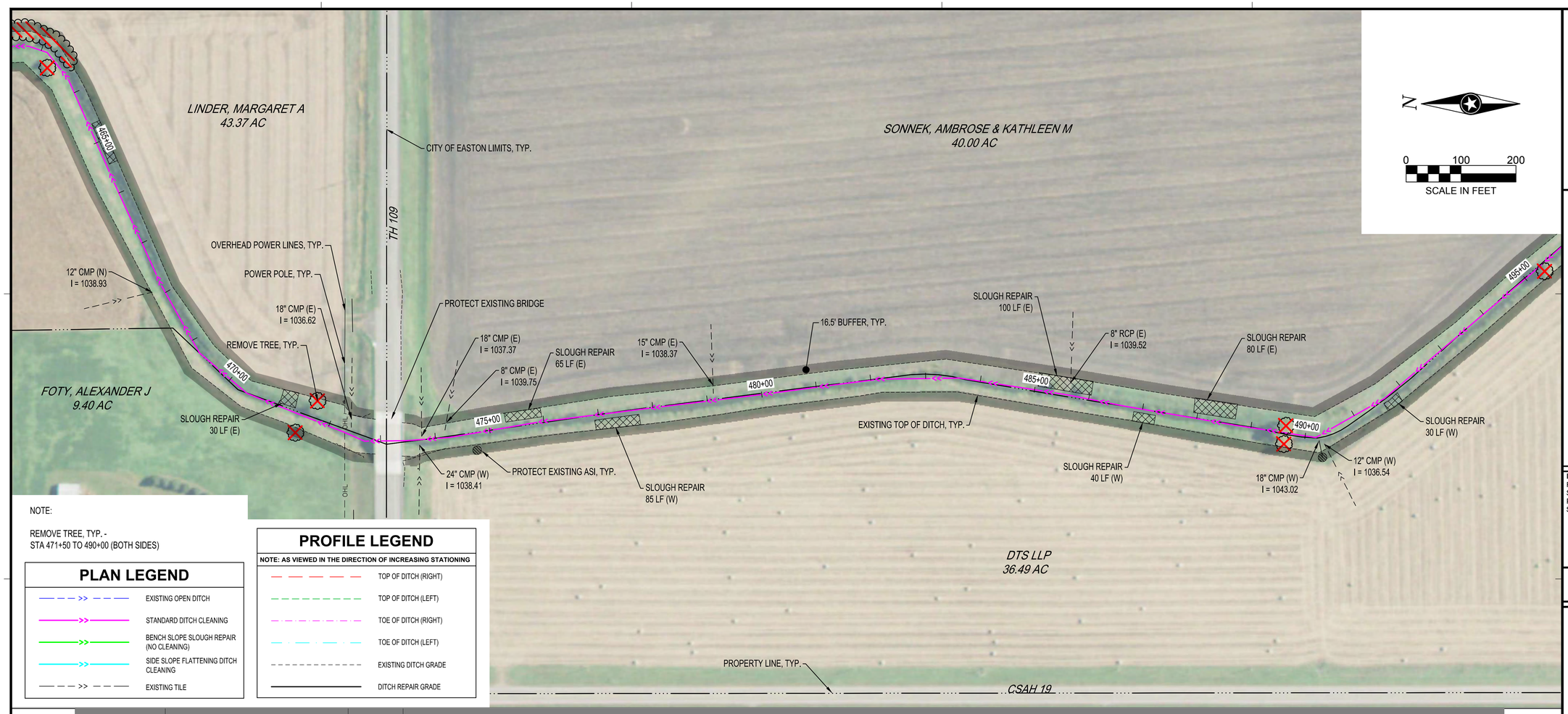
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

13 OF 41



NOTE:

REMOVE TREE, TYP. -
STA 471+50 TO 490+00 (BOTH SIDES)

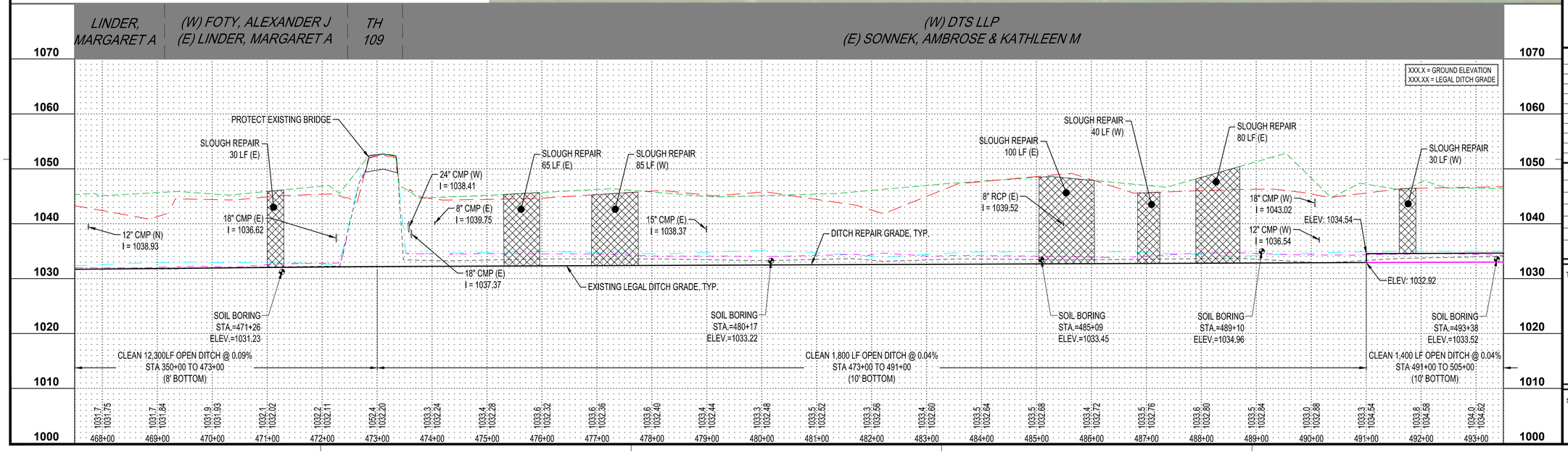
PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

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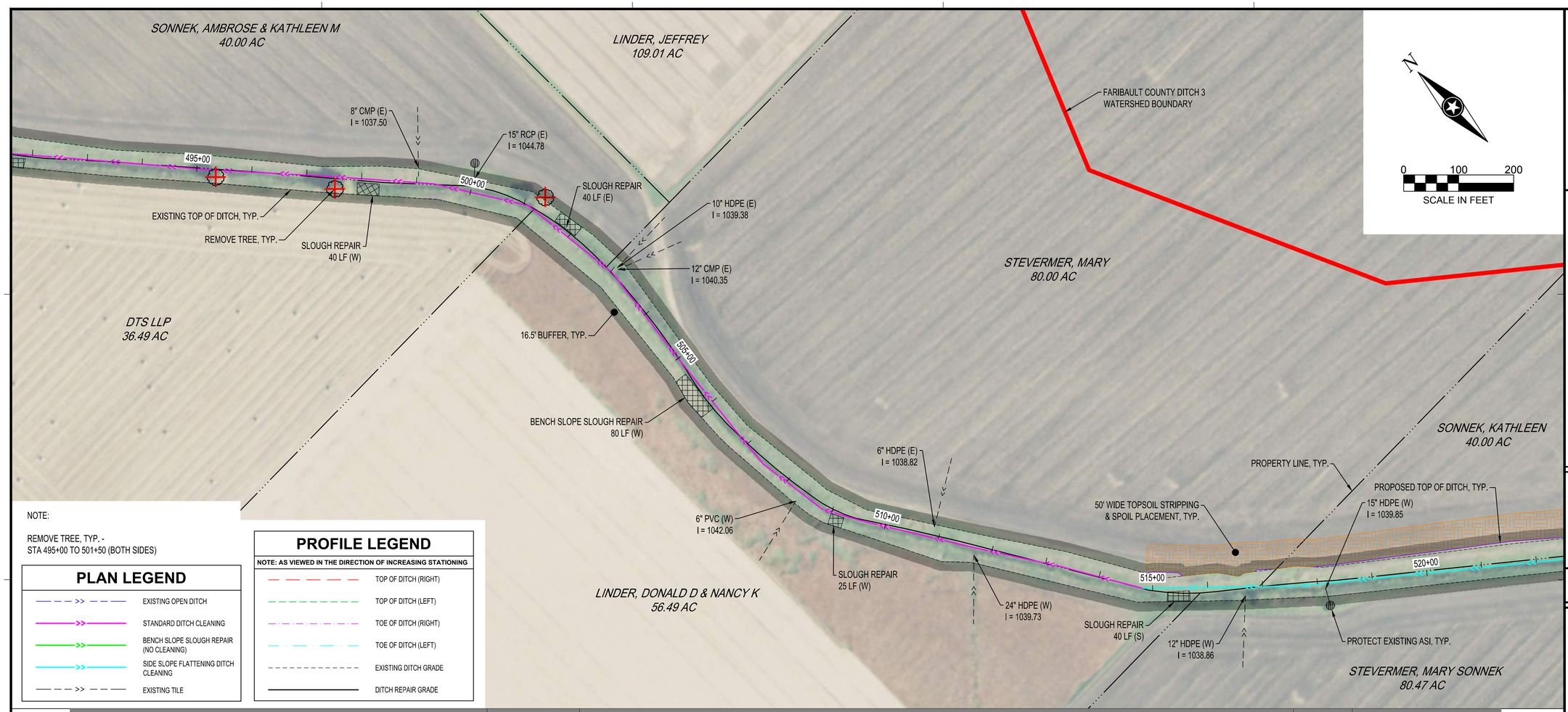
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

14 OF 41



NOTE:

REMOVE TREE, TYP. -
STA 495+00 TO 501+50 (BOTH SIDES)

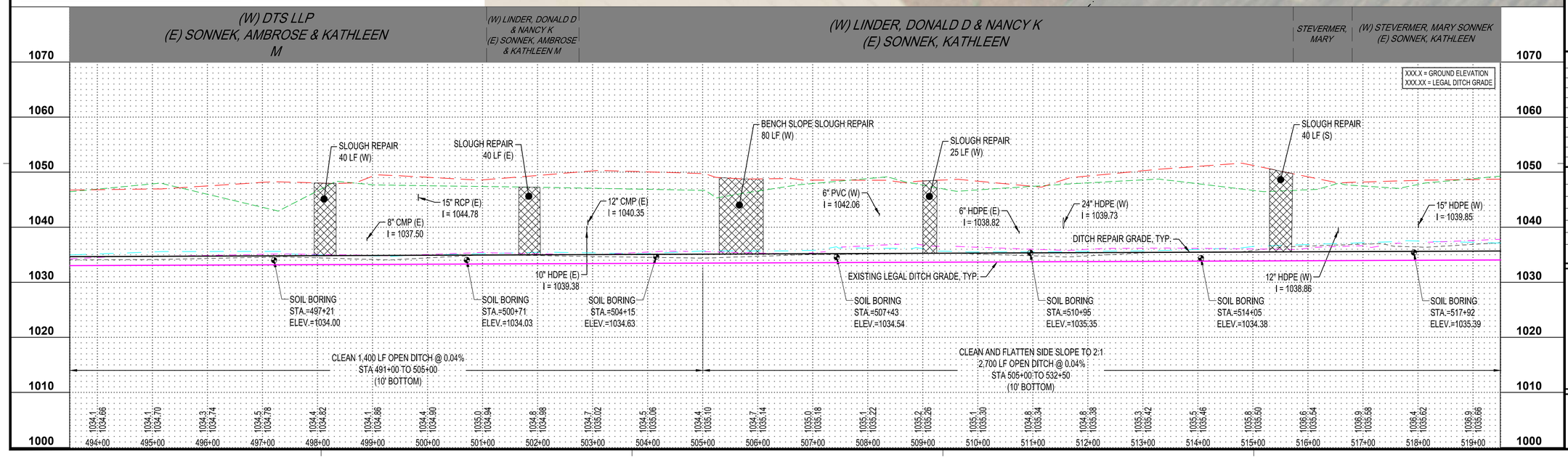
PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

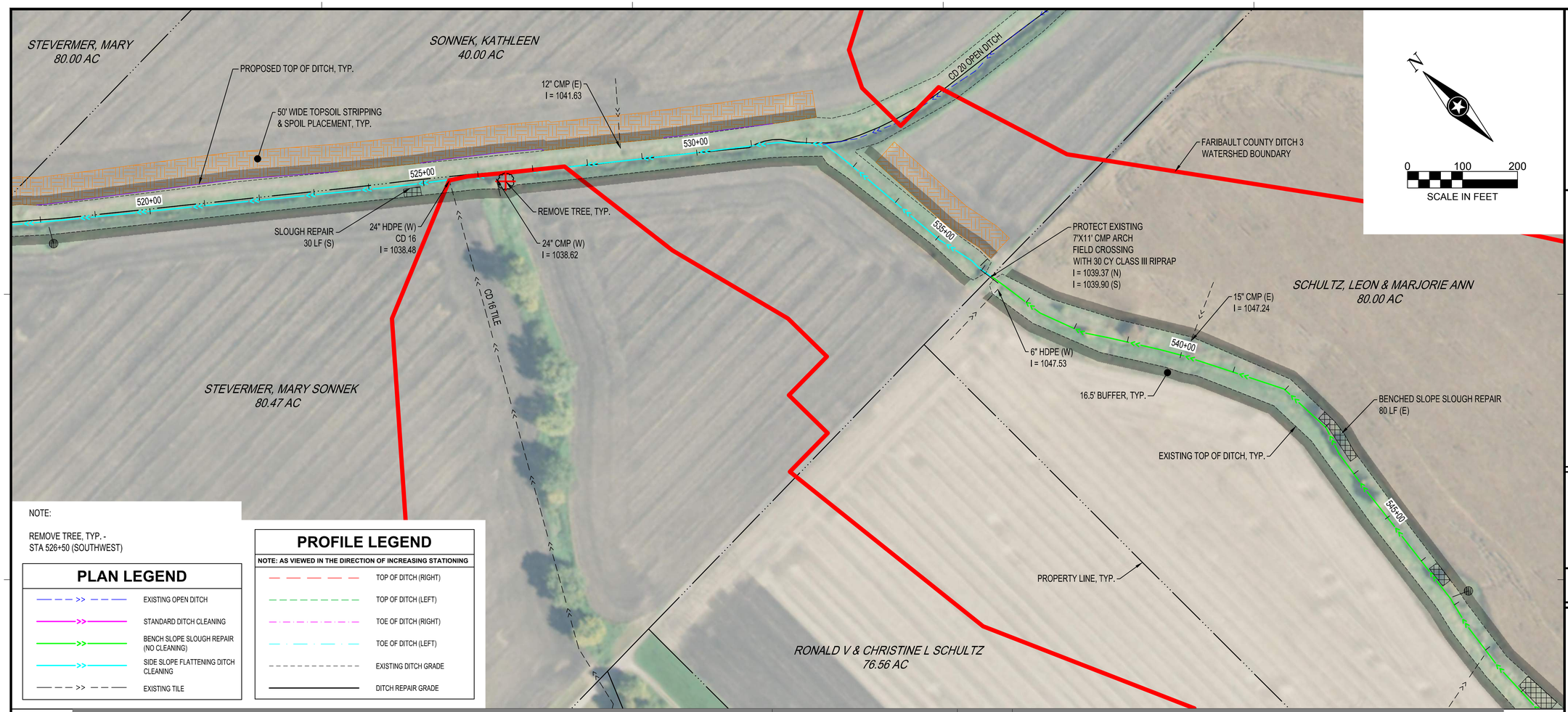
PROJECT NO.	18-21589
CAD FILE NAME	21589 PROFILES (3)
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

15 OF 41



NOTE:

REMOVE TREE, TYP. -
STA 526+50 (SOUTHWEST)

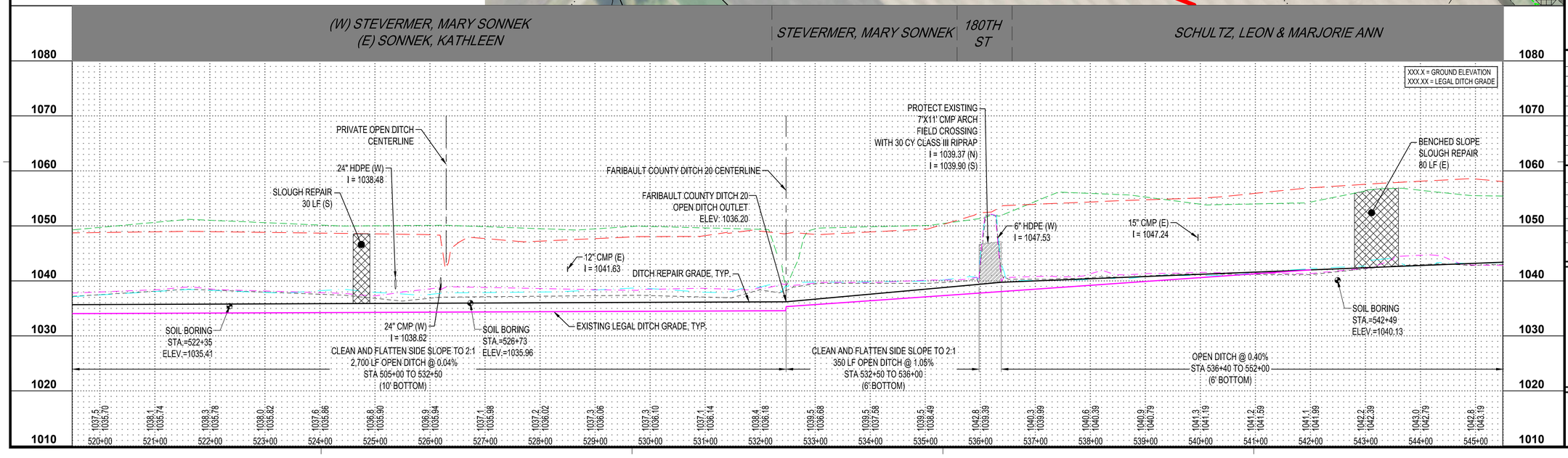
PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE



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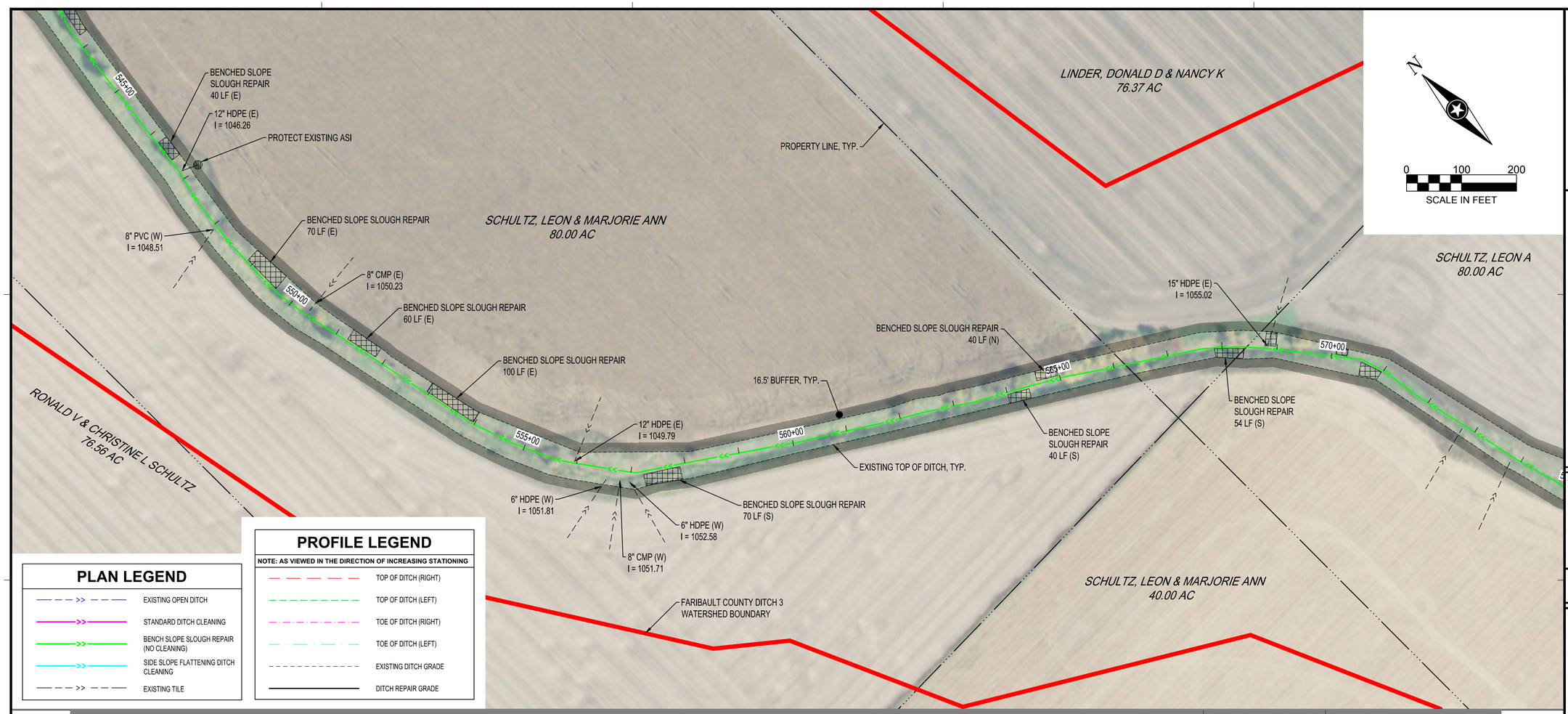

PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
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- EXISTING TILE

PROFILE LEGEND

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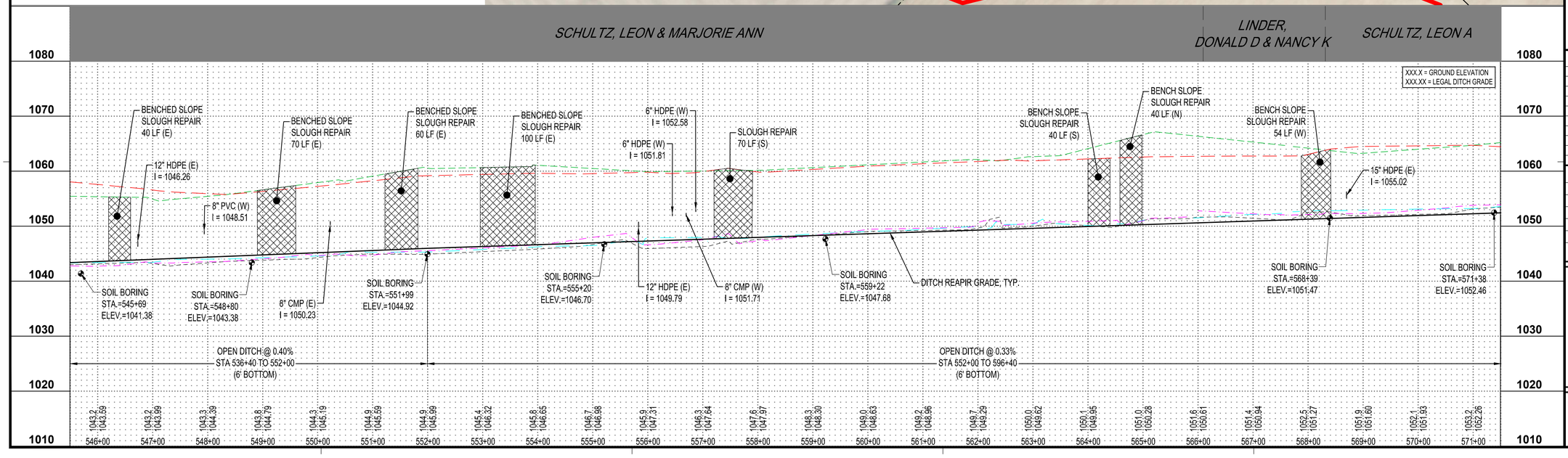

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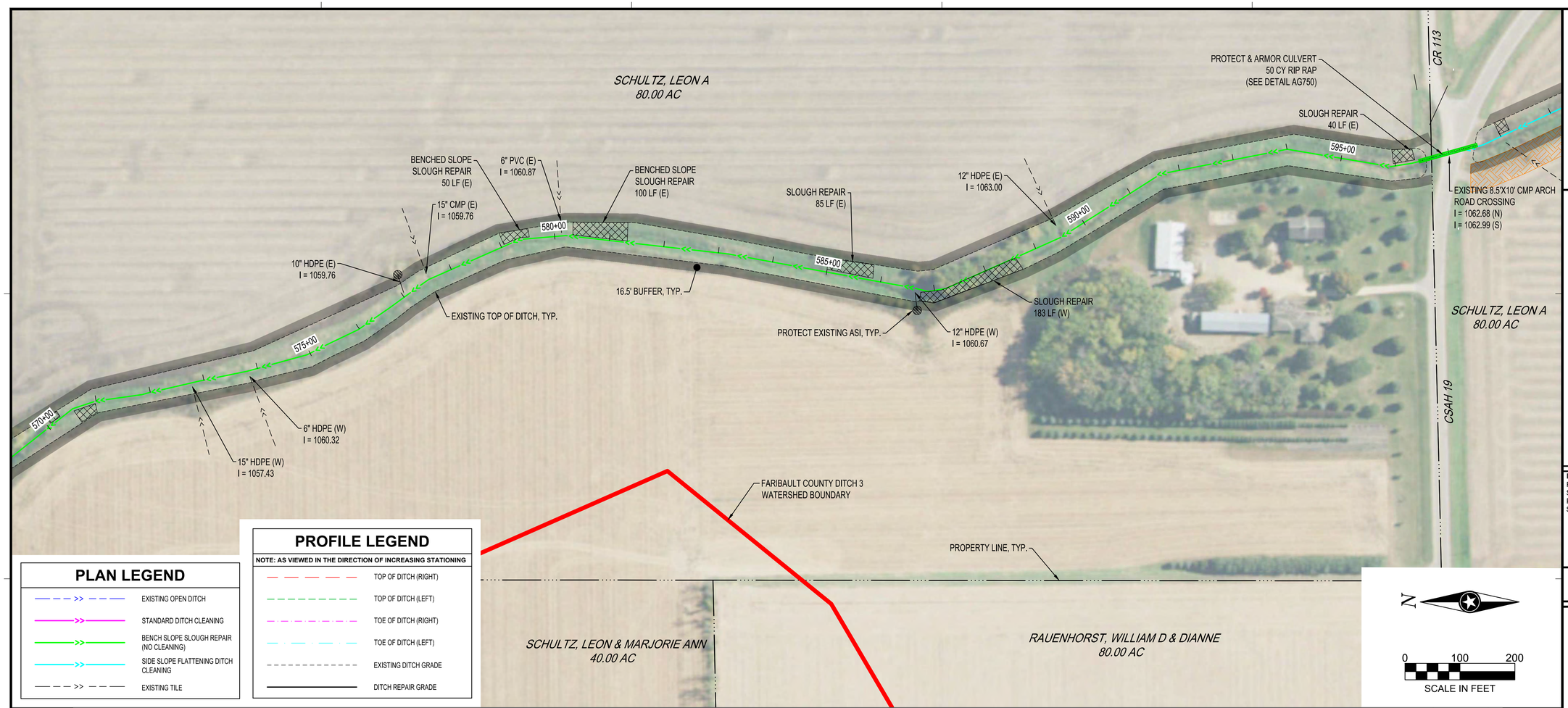

PLAN LEGEND

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PROFILE LEGEND

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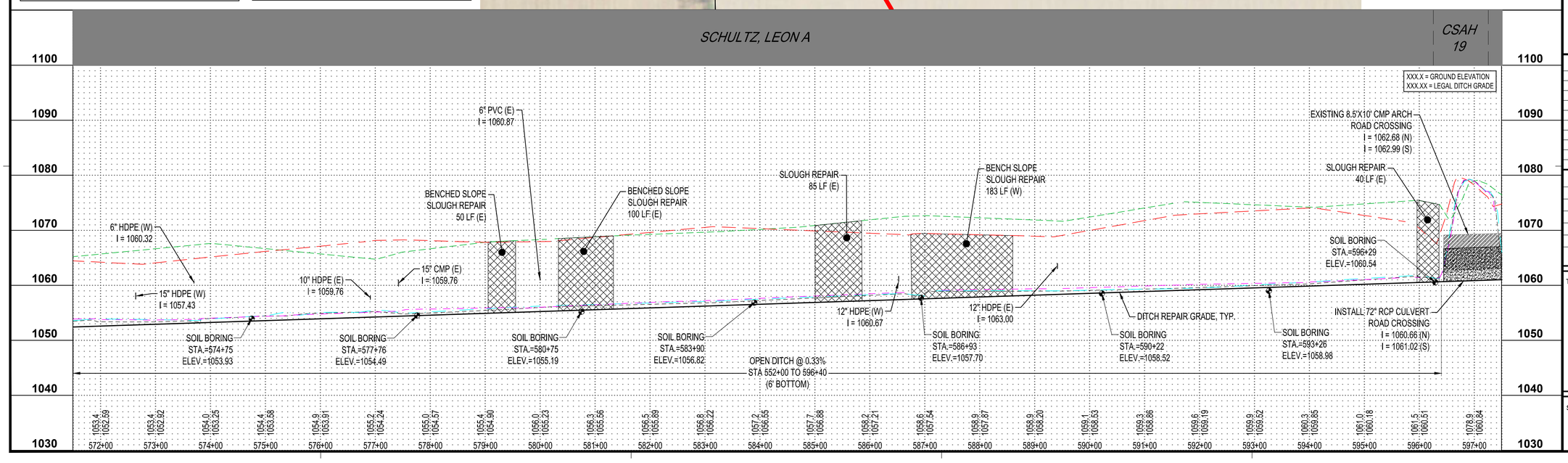

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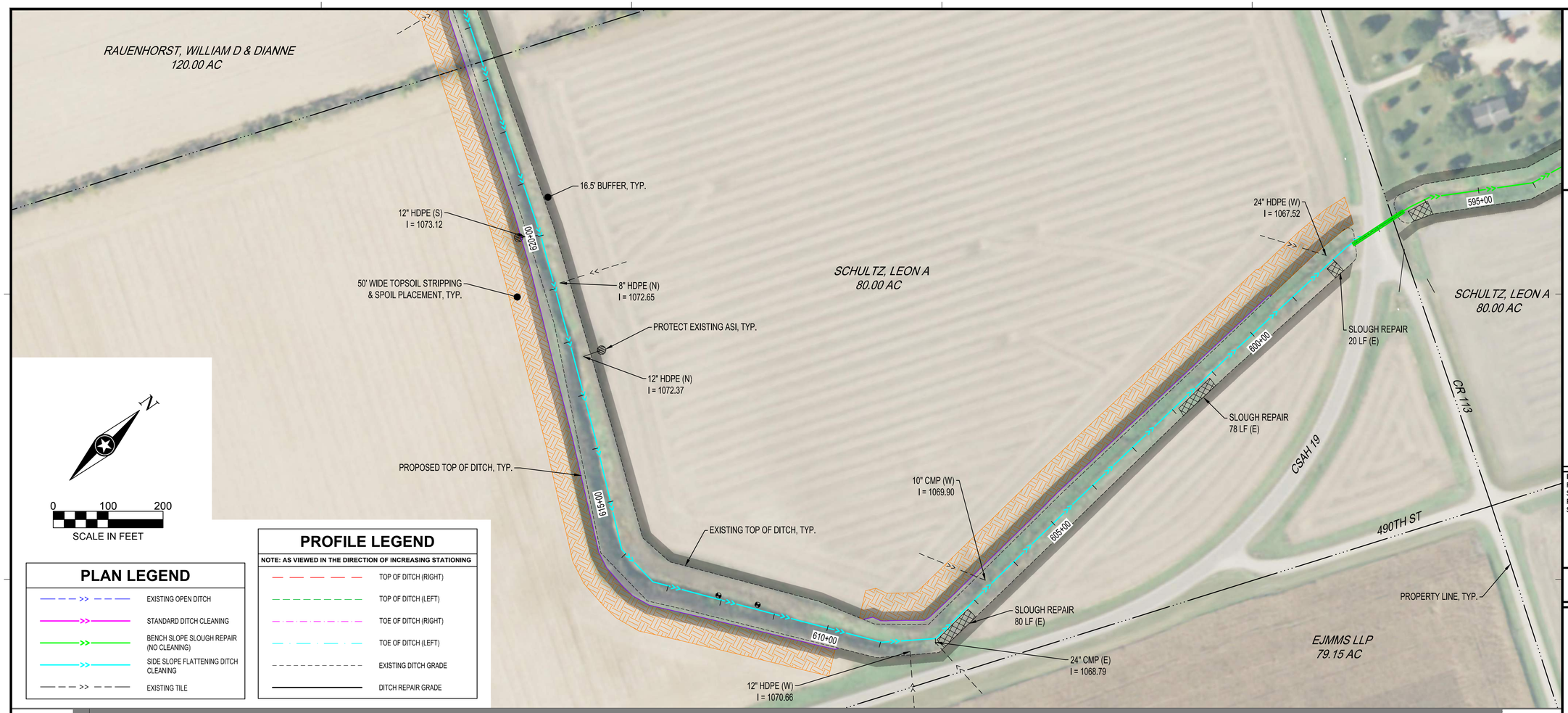

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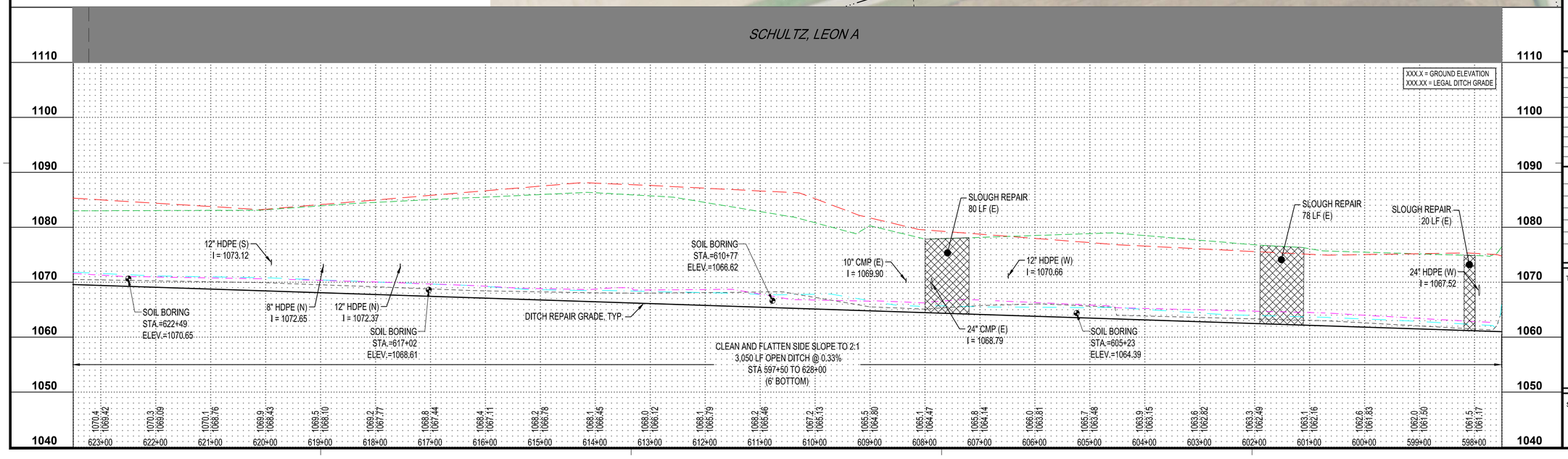

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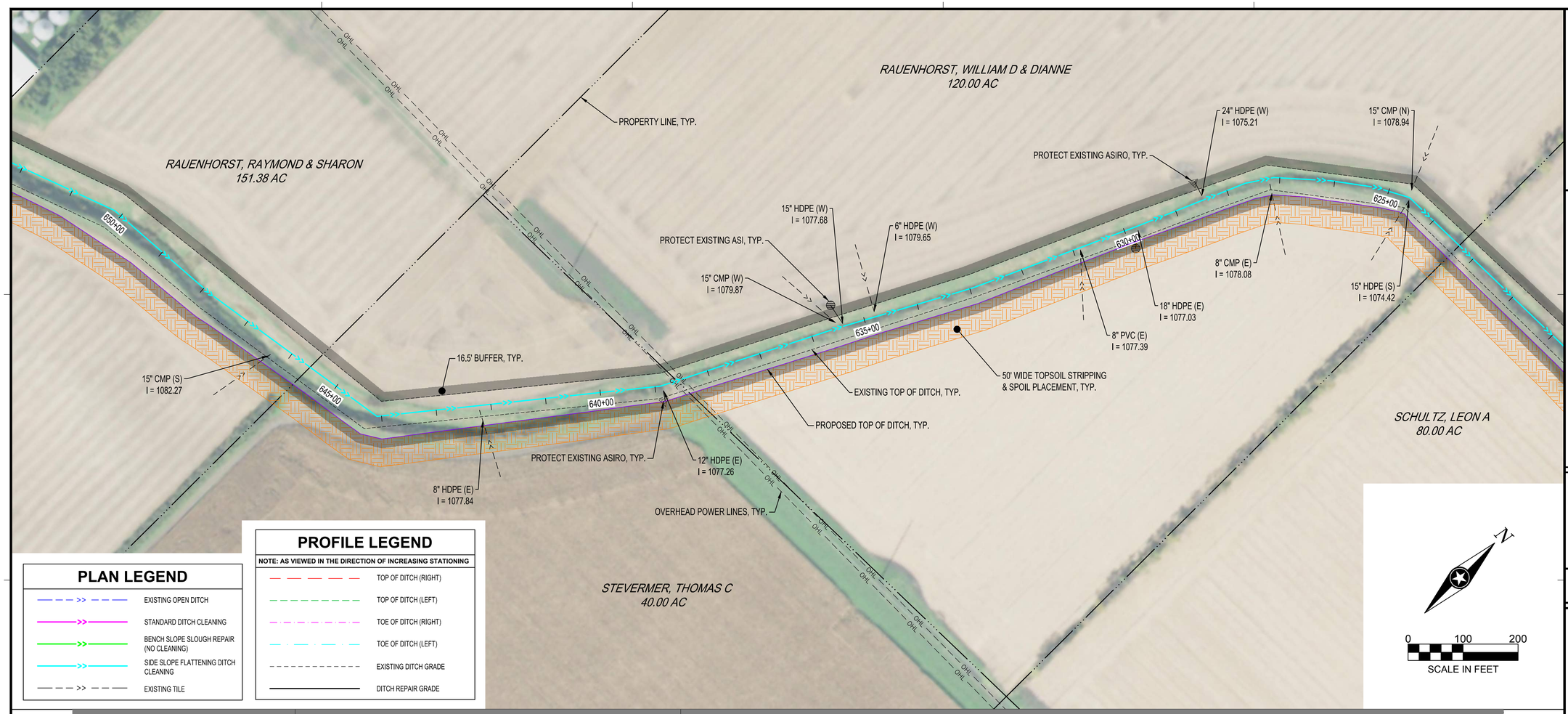

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PROFILE LEGEND

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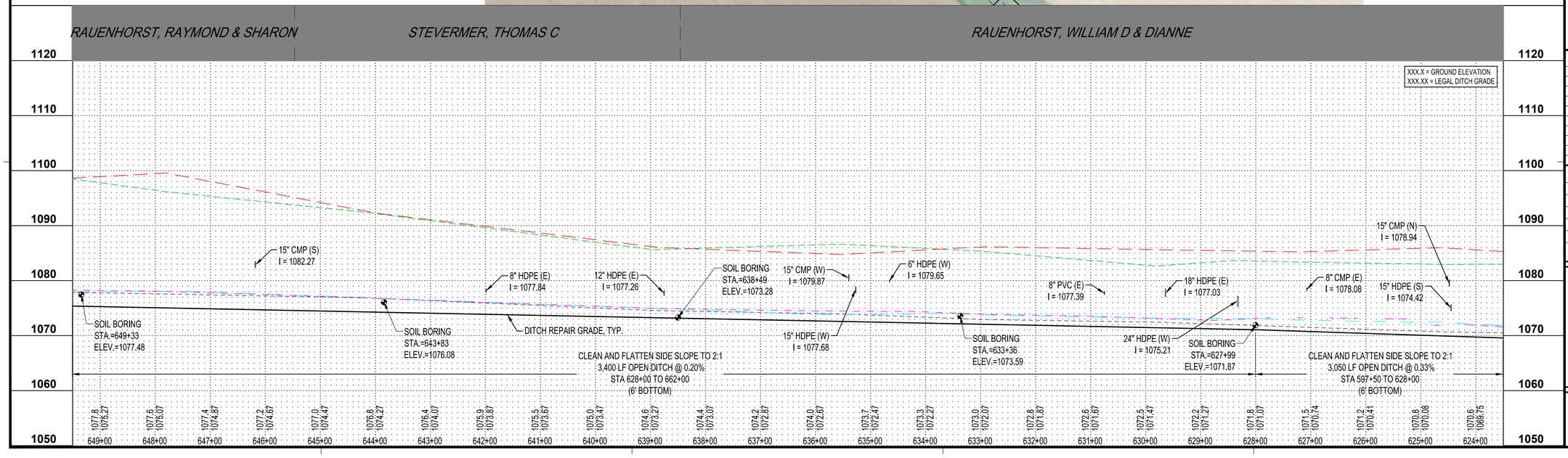

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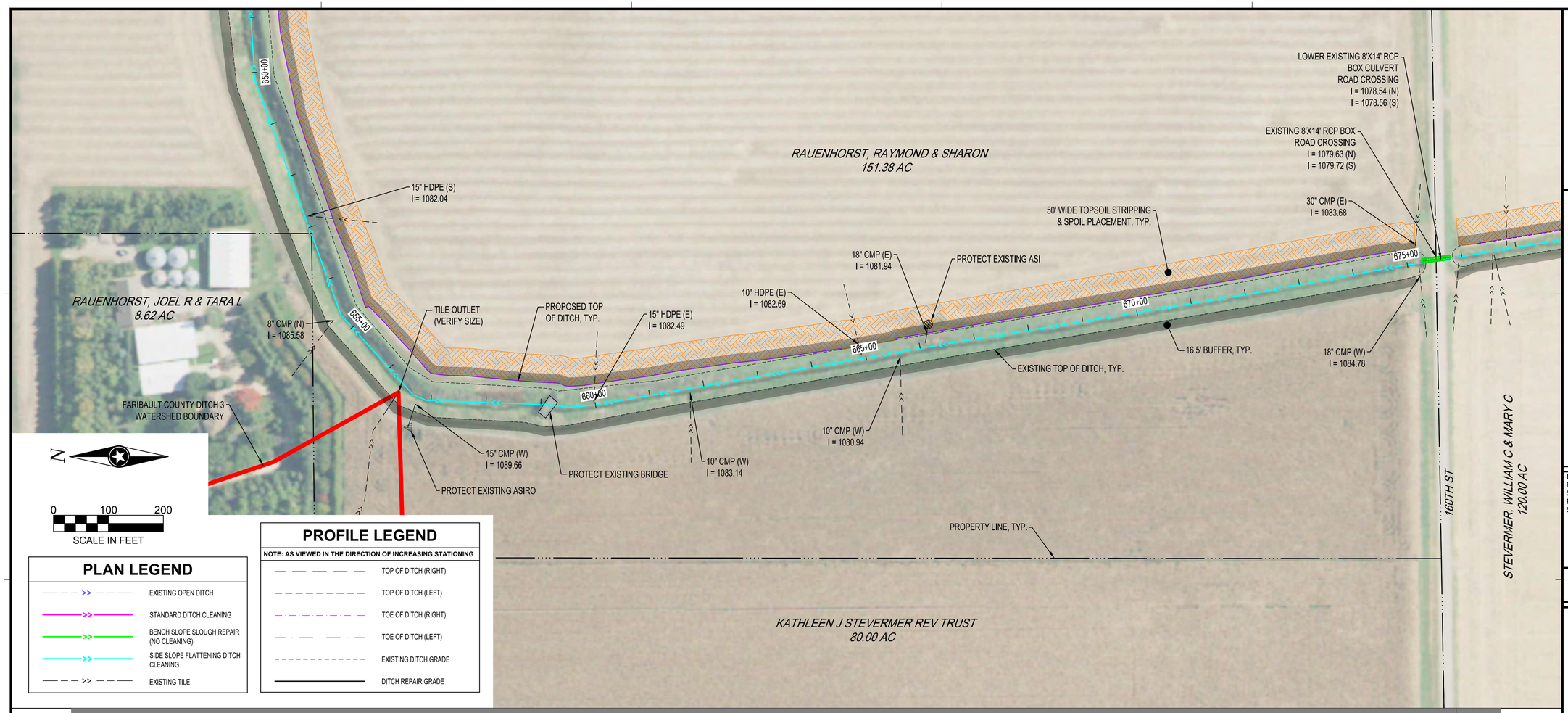

PLAN LEGEND

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PROFILE LEGEND

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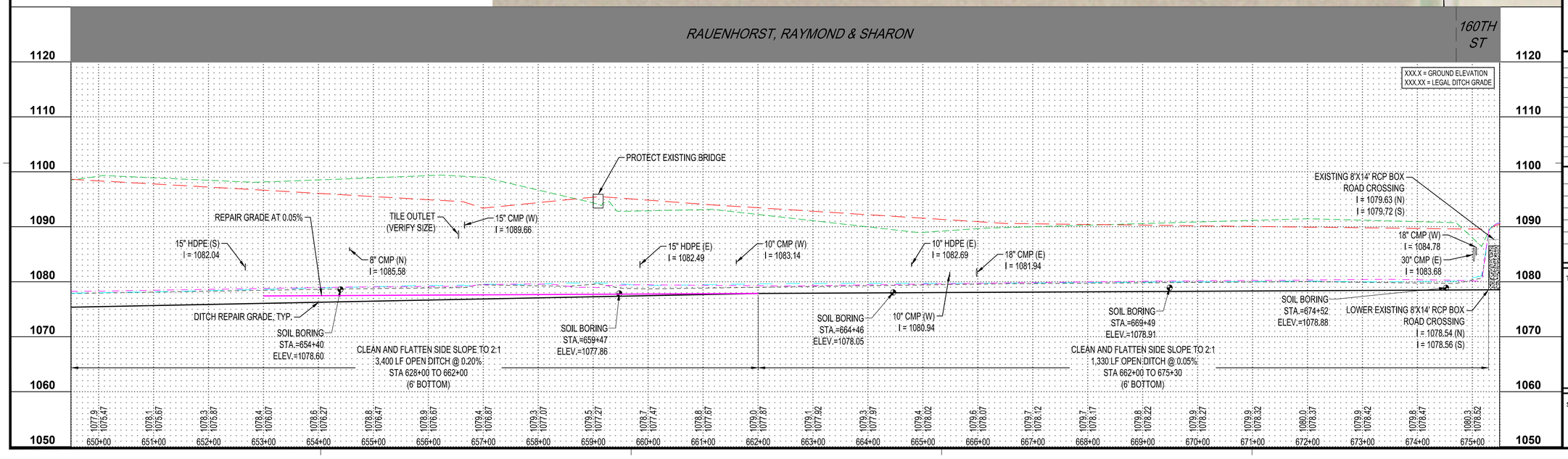

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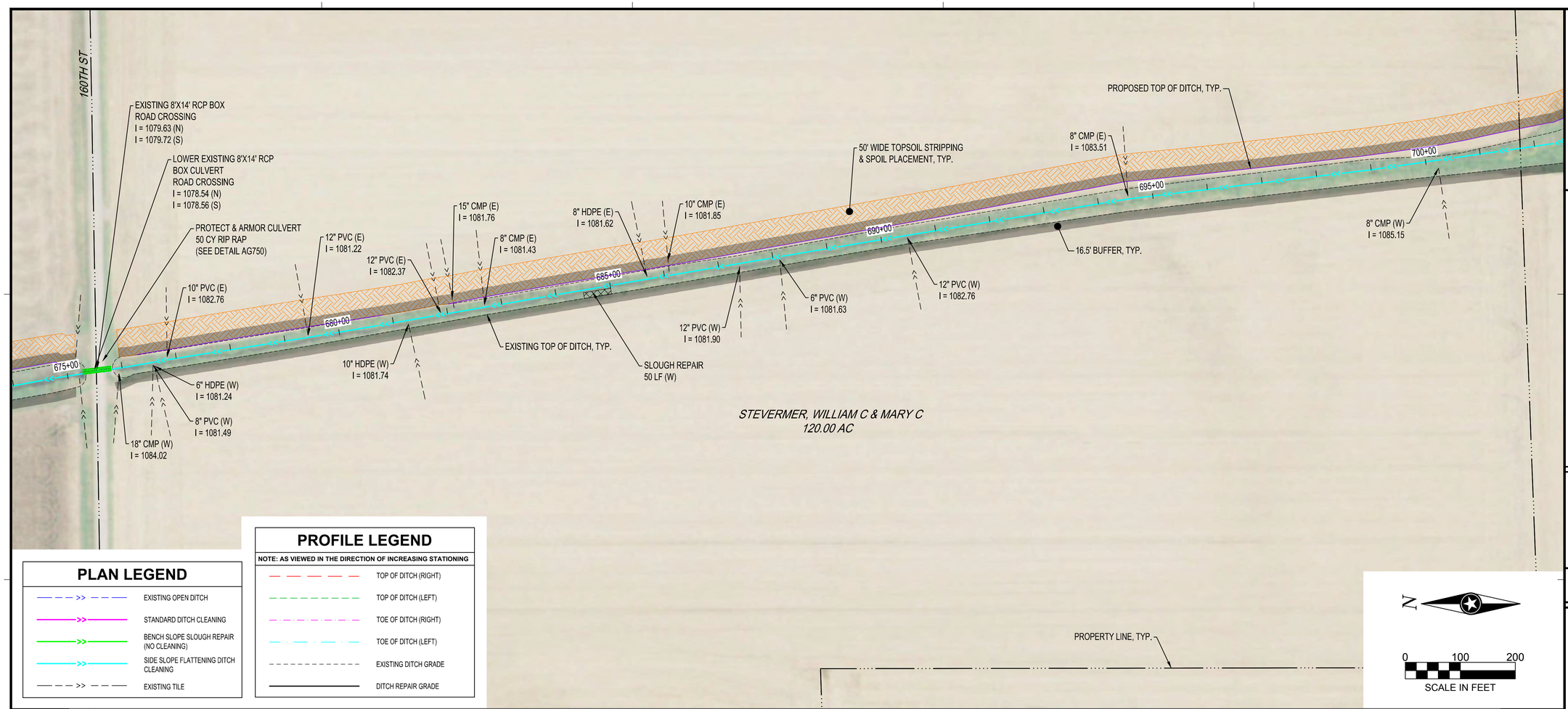

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PROFILE LEGEND

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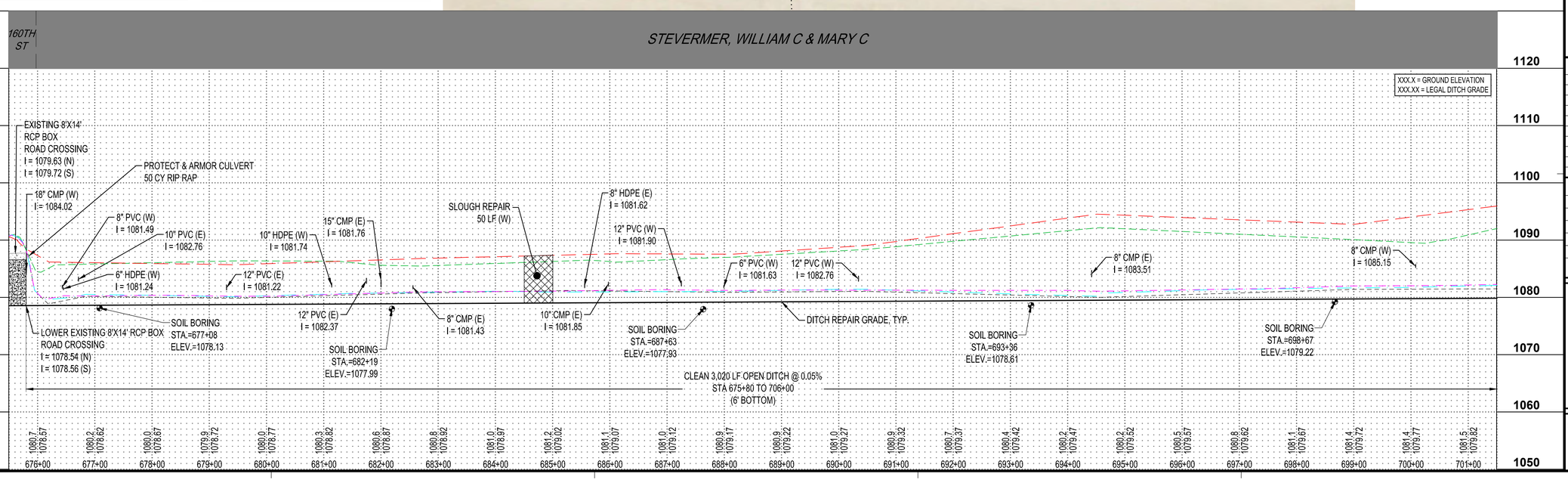

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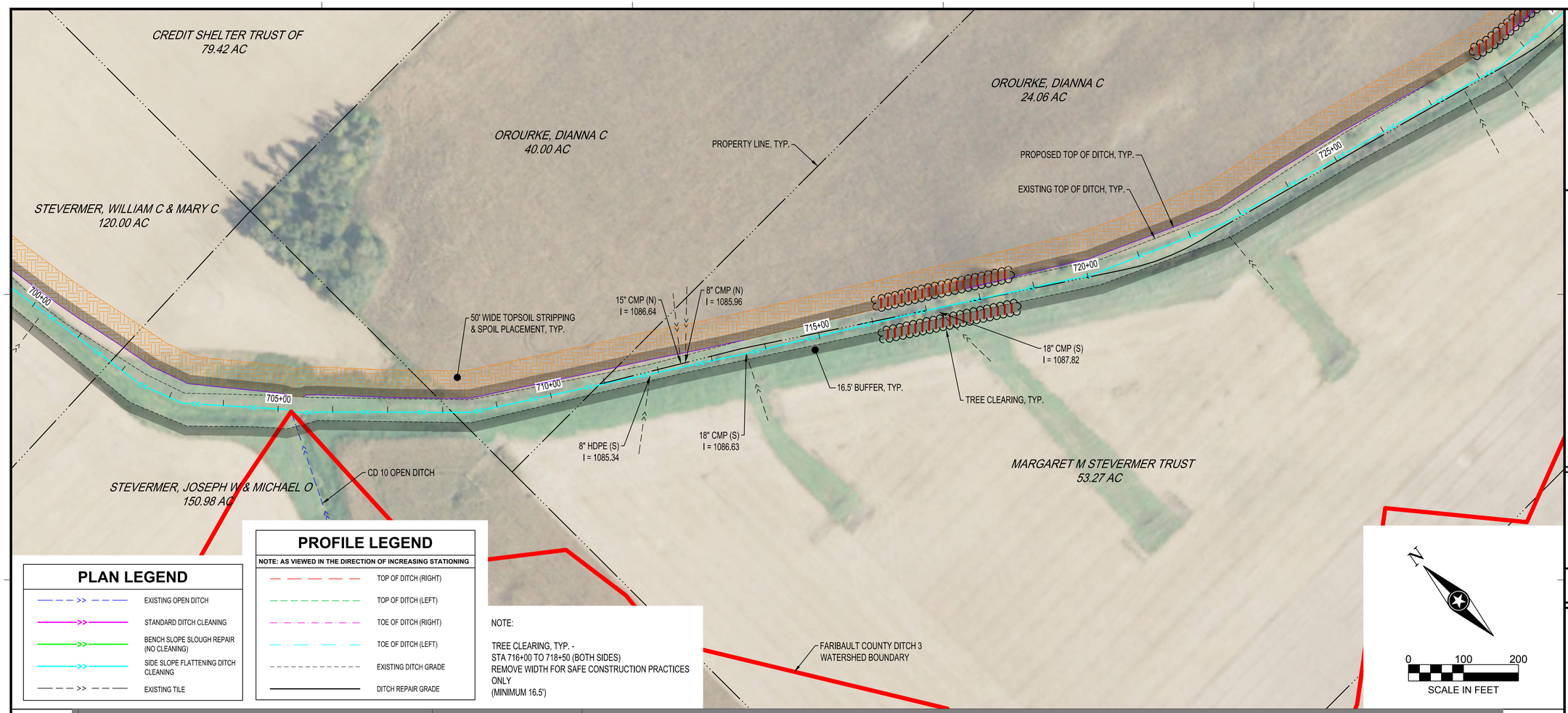

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PROFILE LEGEND

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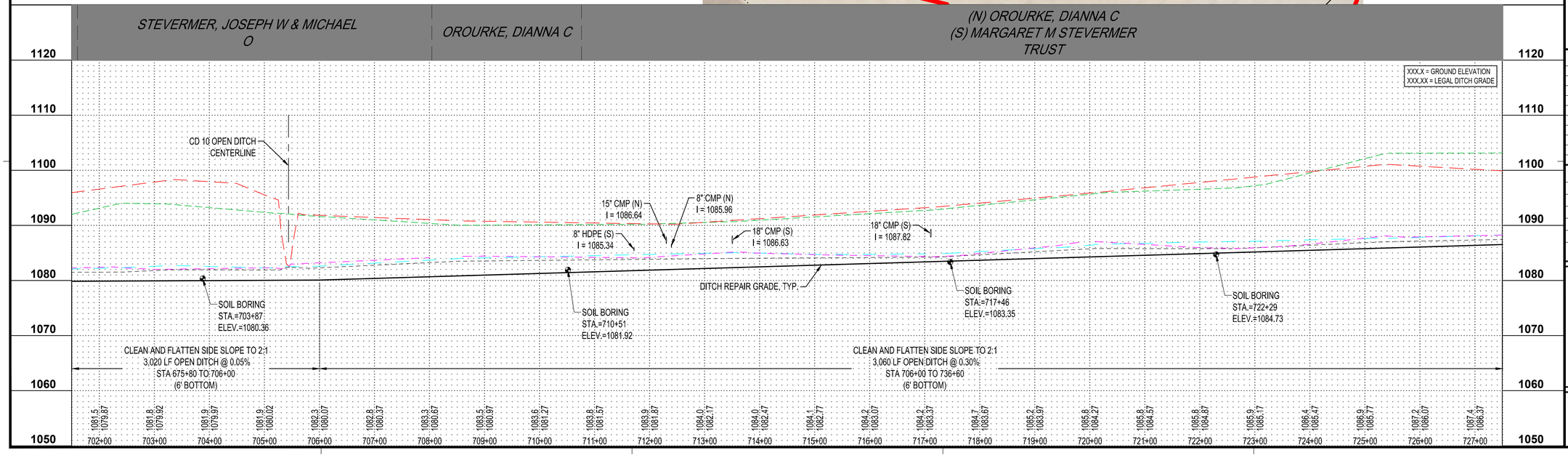
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE

NOTE:

TREE CLEARING, TYP. -
STA 716+00 TO 718+50 (BOTH SIDES)
REMOVE WIDTH FOR SAFE CONSTRUCTION PRACTICES ONLY
(MINIMUM 16.5')



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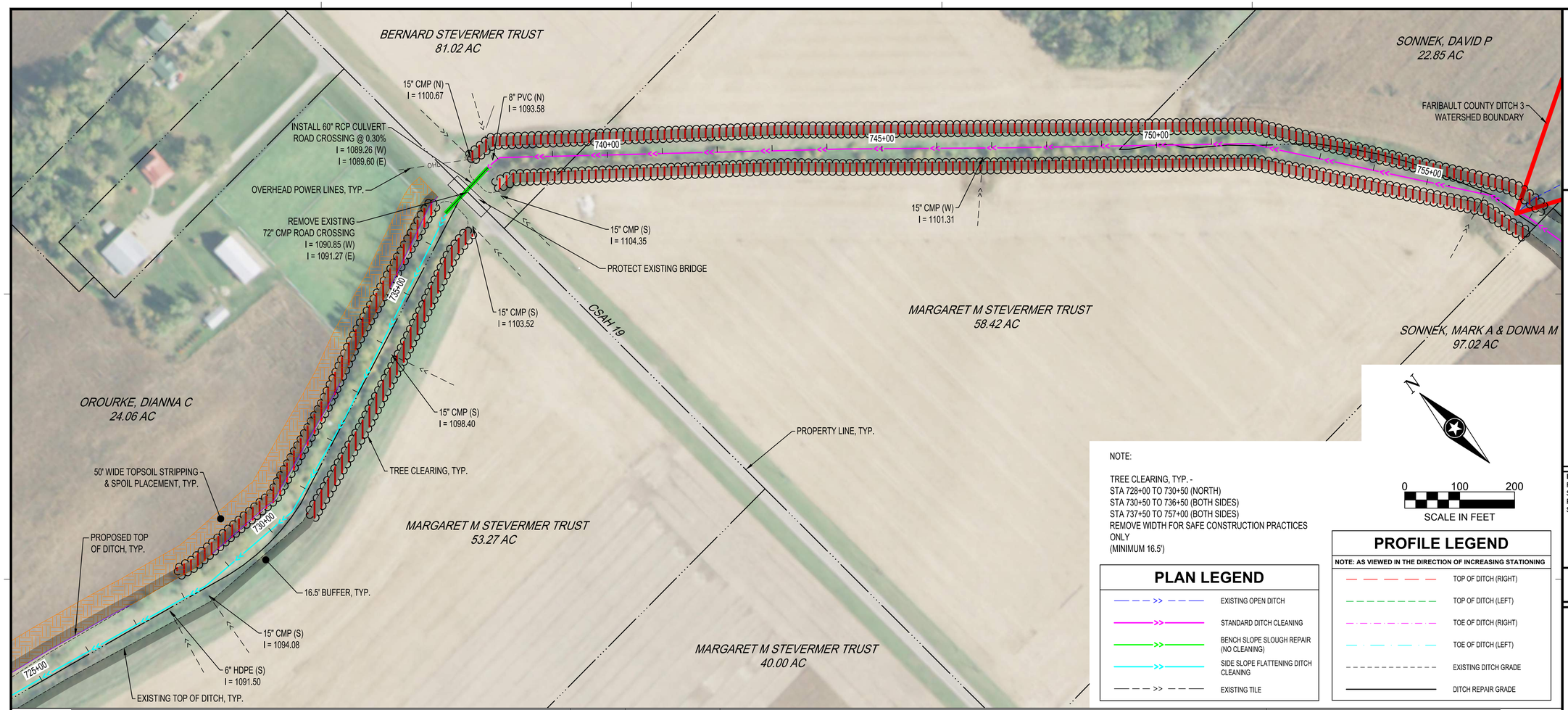

NOTE:

TREE CLEARING, TYP. -
STA 728+00 TO 730+50 (NORTH)
STA 730+50 TO 736+50 (BOTH SIDES)
STA 737+50 TO 757+00 (BOTH SIDES)
REMOVE WIDTH FOR SAFE CONSTRUCTION PRACTICES ONLY
(MINIMUM 16.5')

PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

N

0 100 200

SCALE IN FEET

PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
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- EXISTING DITCH GRADE
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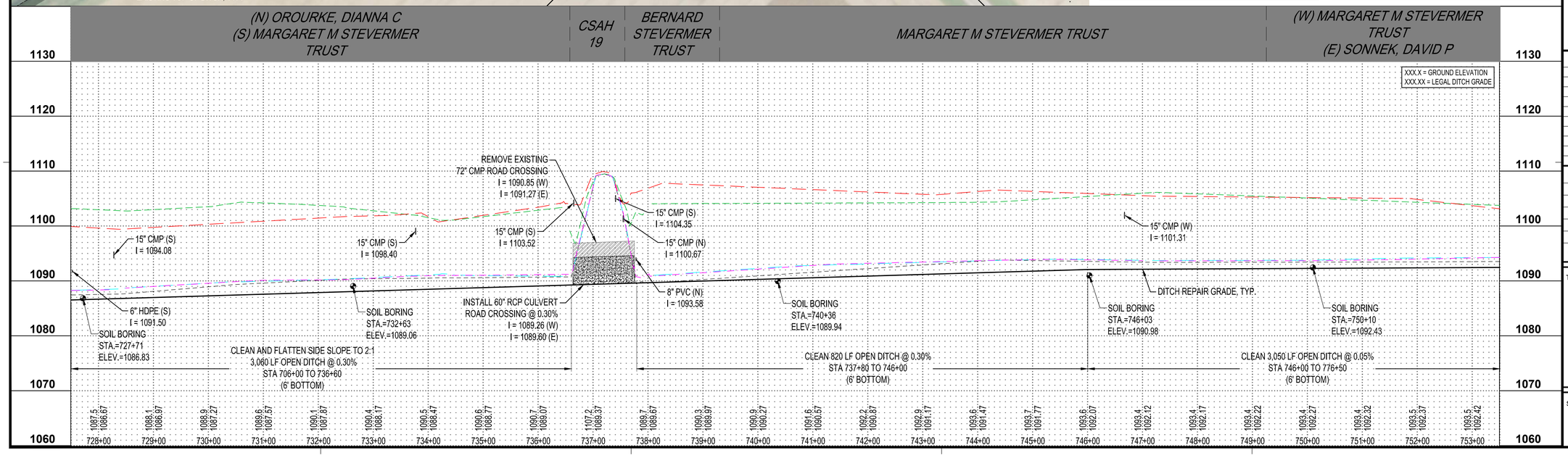

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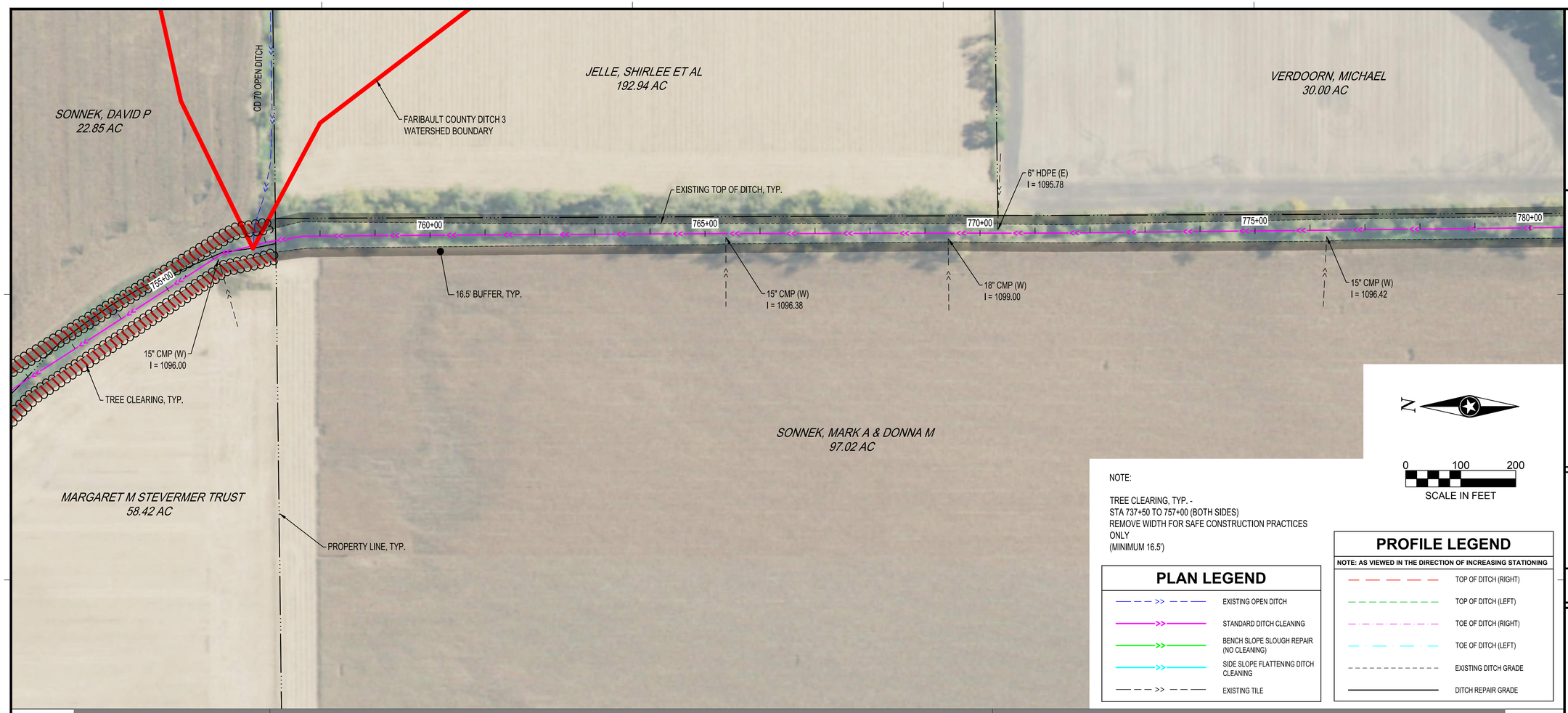

NOTE:

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REMOVE WIDTH FOR SAFE CONSTRUCTION PRACTICES ONLY
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N

0 100 200
SCALE IN FEET

PLAN LEGEND

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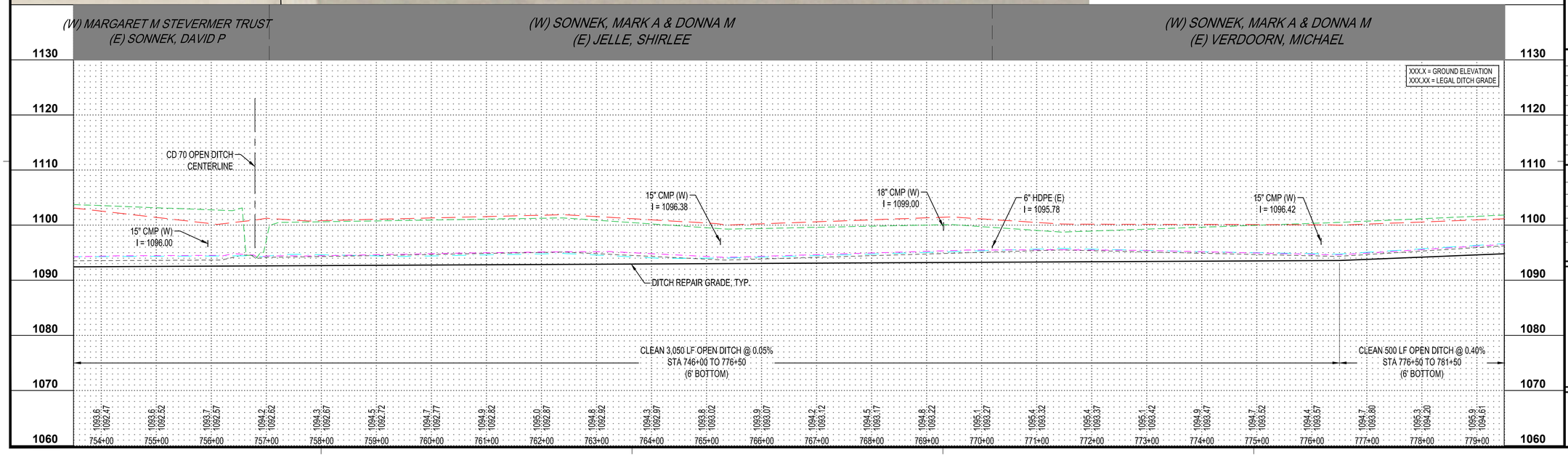

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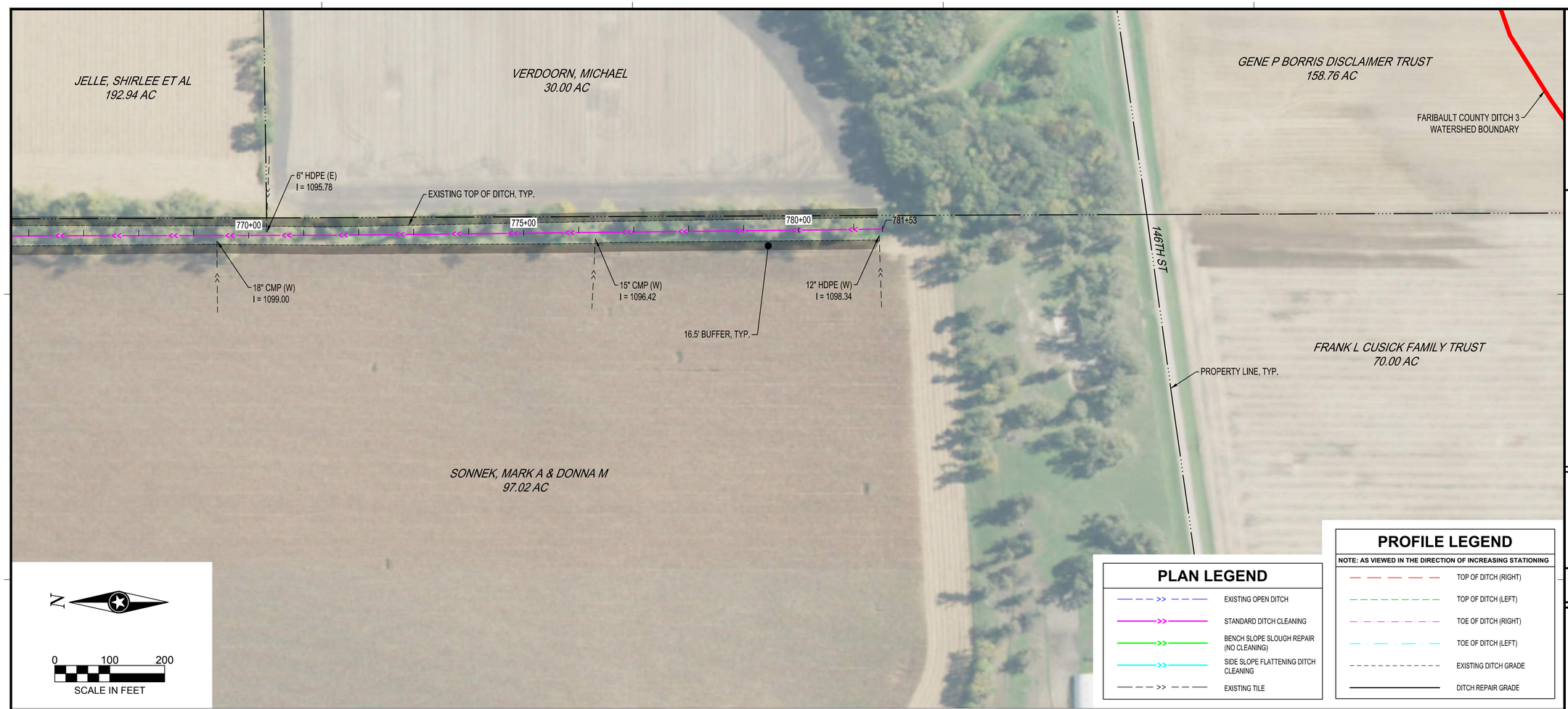
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

25 OF 41



N

0 100 200

SCALE IN FEET

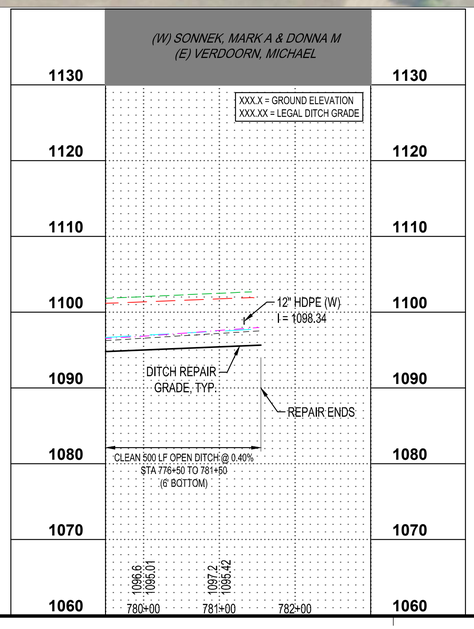
PLAN LEGEND

- EXISTING OPEN DITCH
- STANDARD DITCH CLEANING
- BENCH SLOPE SLOUGH REPAIR (NO CLEANING)
- SIDE SLOPE FLATTENING DITCH CLEANING
- EXISTING TILE

PROFILE LEGEND

NOTE: AS VIEWED IN THE DIRECTION OF INCREASING STATIONING

- TOP OF DITCH (RIGHT)
- TOP OF DITCH (LEFT)
- TOE OF DITCH (RIGHT)
- TOE OF DITCH (LEFT)
- EXISTING DITCH GRADE
- DITCH REPAIR GRADE



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DATE_____ LIC. NO._____

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 PROFILES (4)
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

MAINLINE OPEN DITCH PROFILES

SHEET

26 OF 41

NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

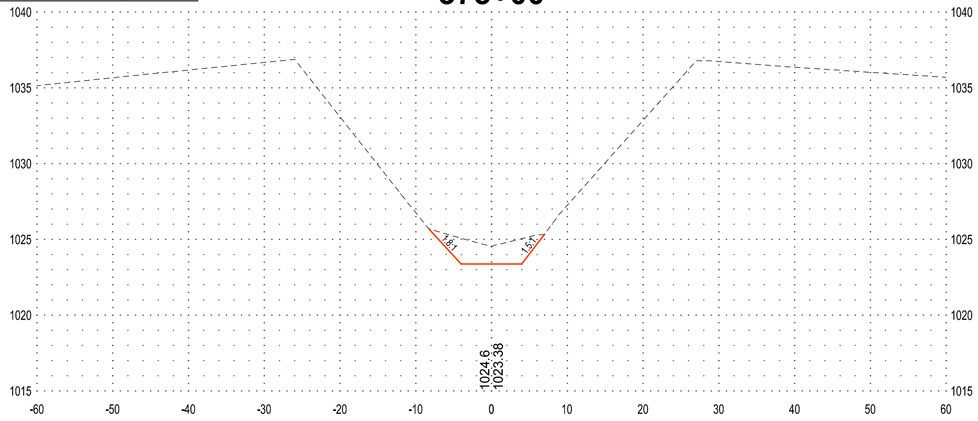
OPEN DITCH REPAIR LEGEND

STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
348+90 TO 350+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.045%
350+00 TO 473+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.09%

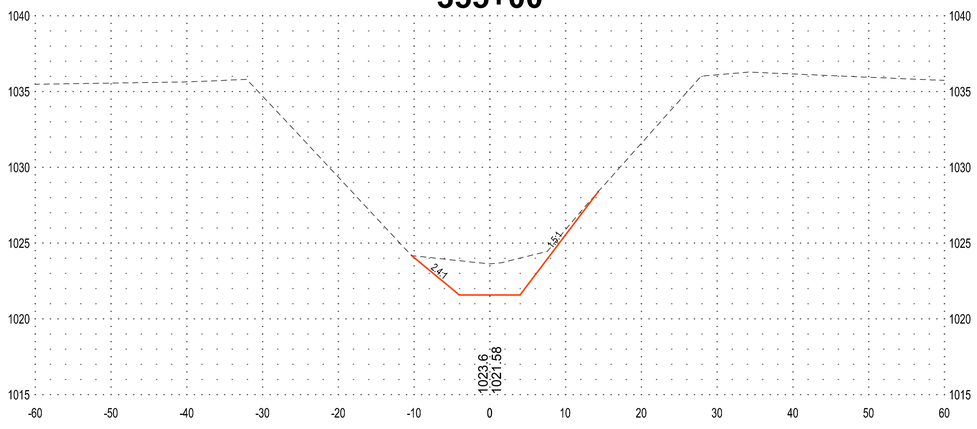
0 10 20
SCALE IN FEET

360+00

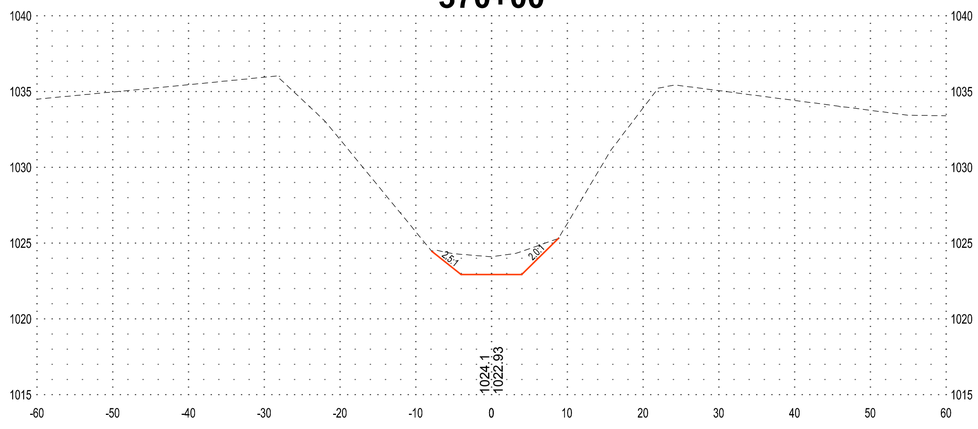
375+00



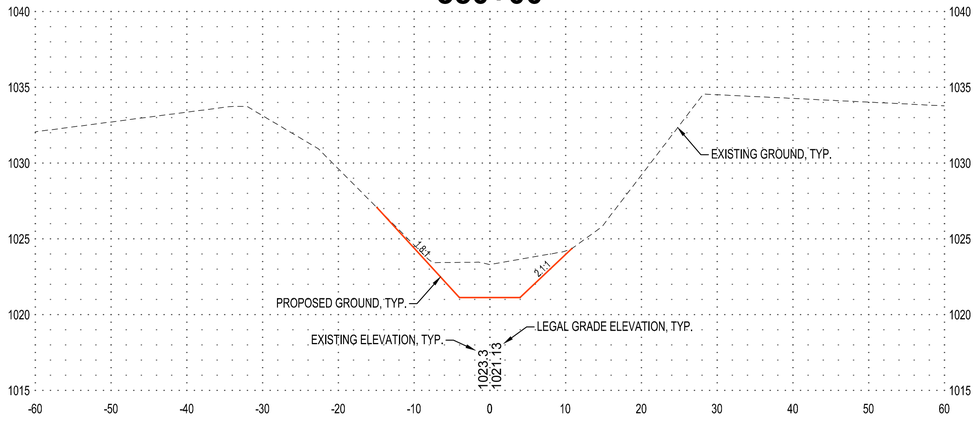
355+00



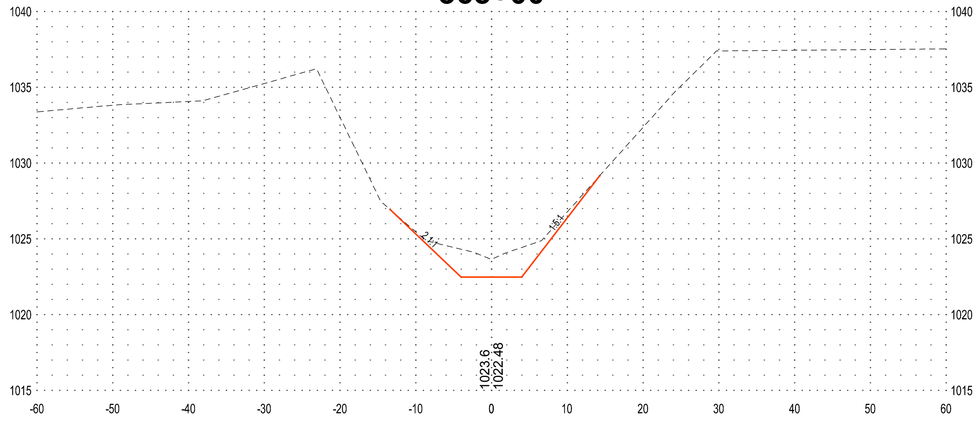
370+00



350+00



365+00



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

27

OF 41

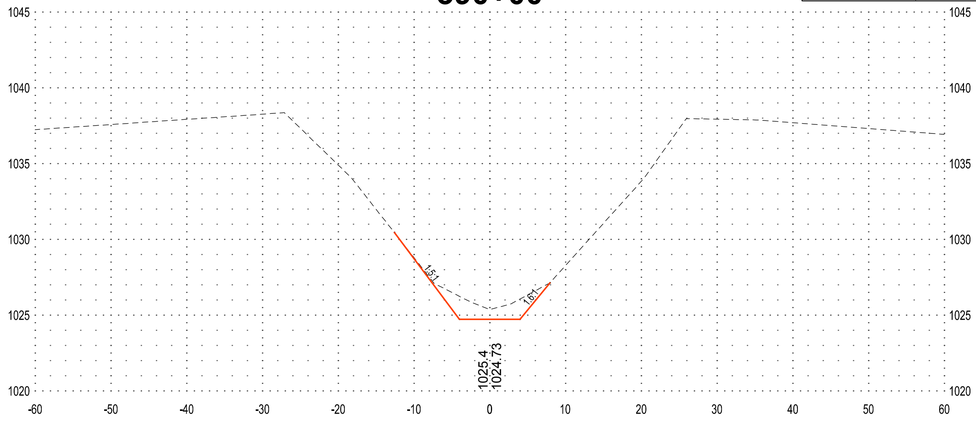
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
348+90 TO 350+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.045%
350+00 TO 473+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.09%

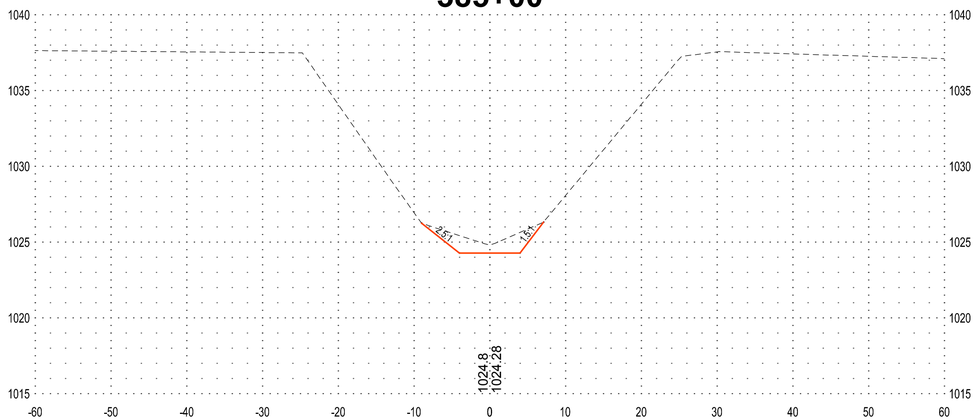
0 10 20
SCALE IN FEET

390+00

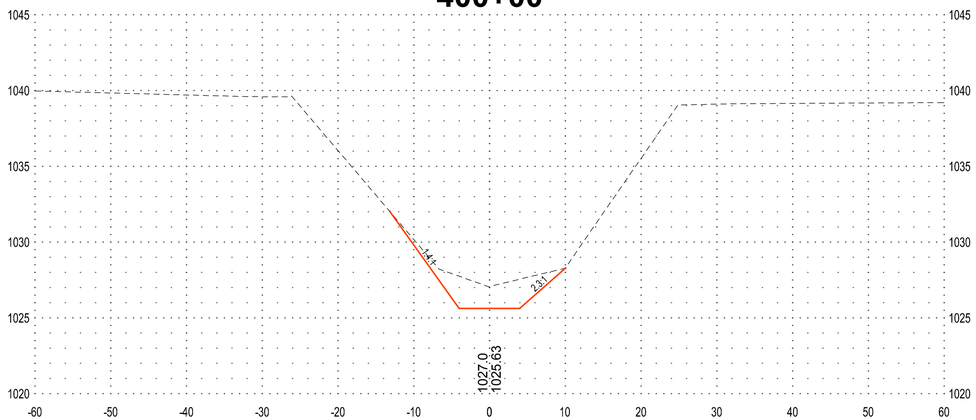


405+00

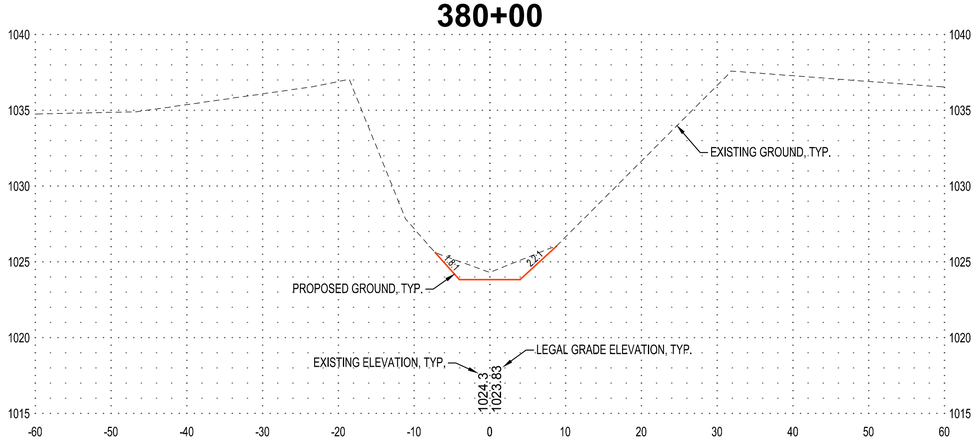
385+00



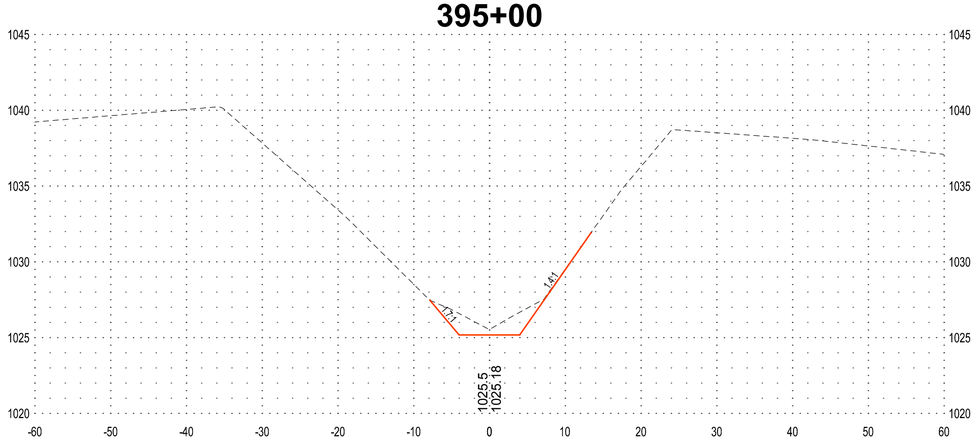
400+00



380+00



395+00



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

28

OF 41

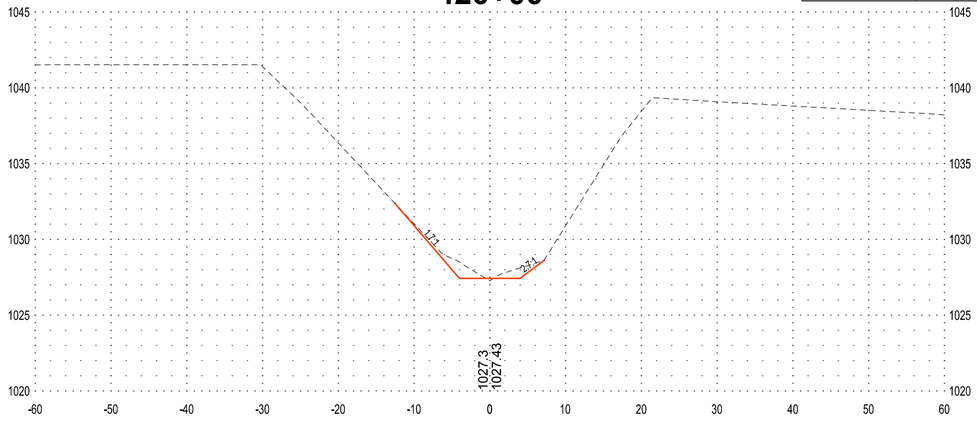
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

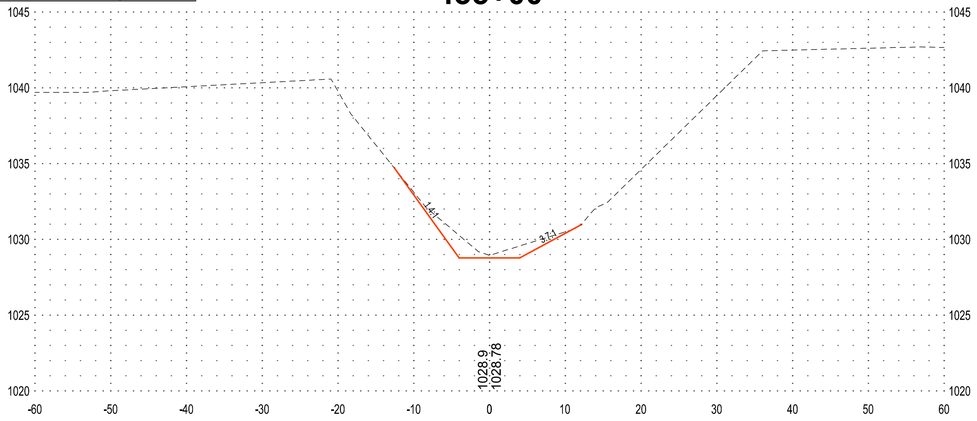
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
348+90 TO 350+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.045%
350+00 TO 473+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.09%

0 10 20
SCALE IN FEET

420+00

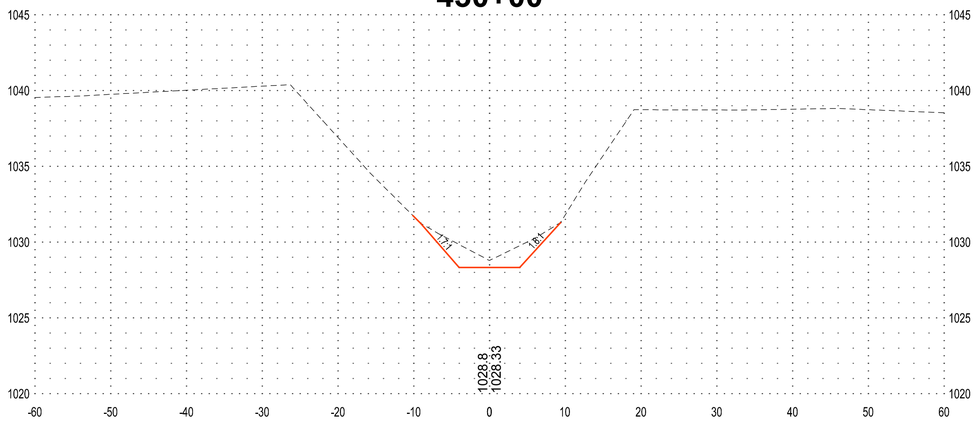


435+00

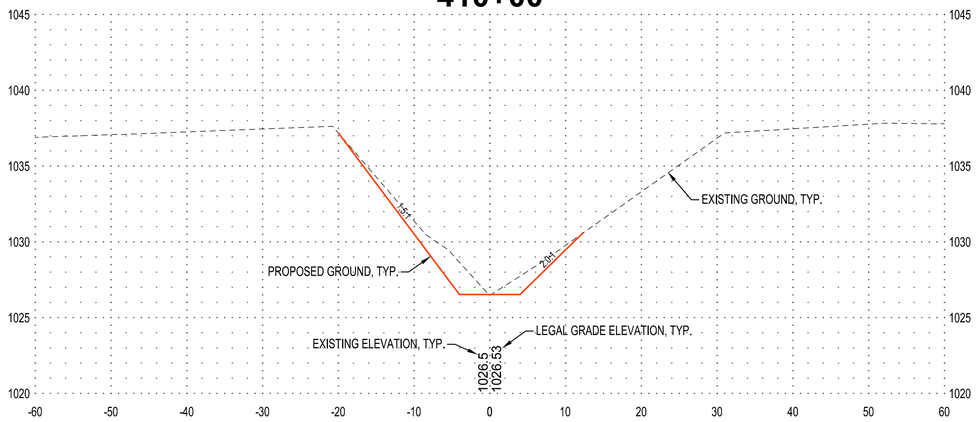


415+00

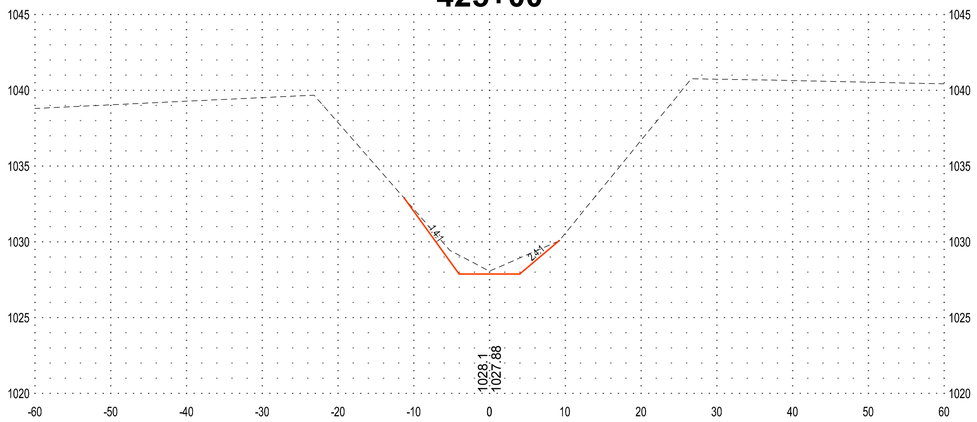
430+00



410+00



425+00



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

29

OF 41

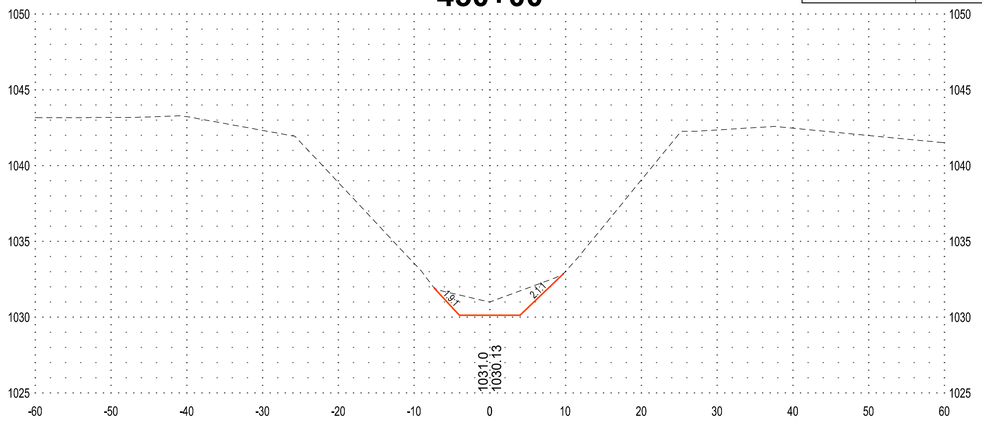
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

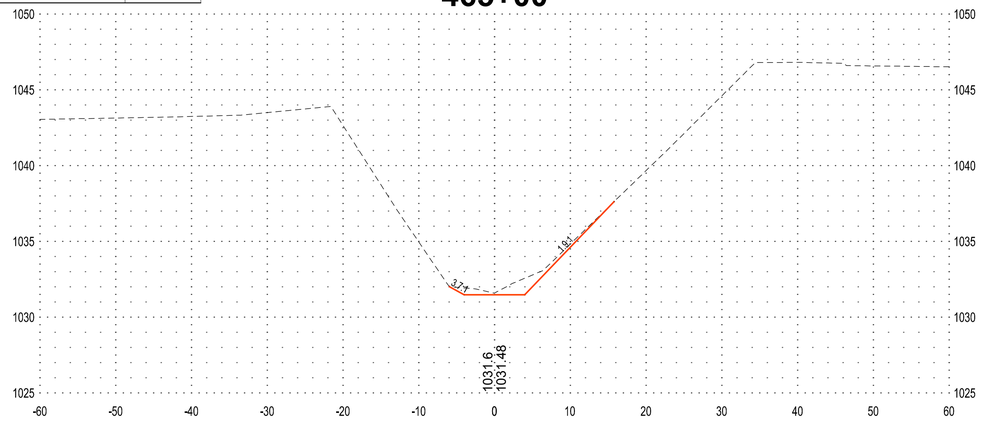
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
348+90 TO 350+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.045%
350+00 TO 473+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.09%

0 10 20
SCALE IN FEET

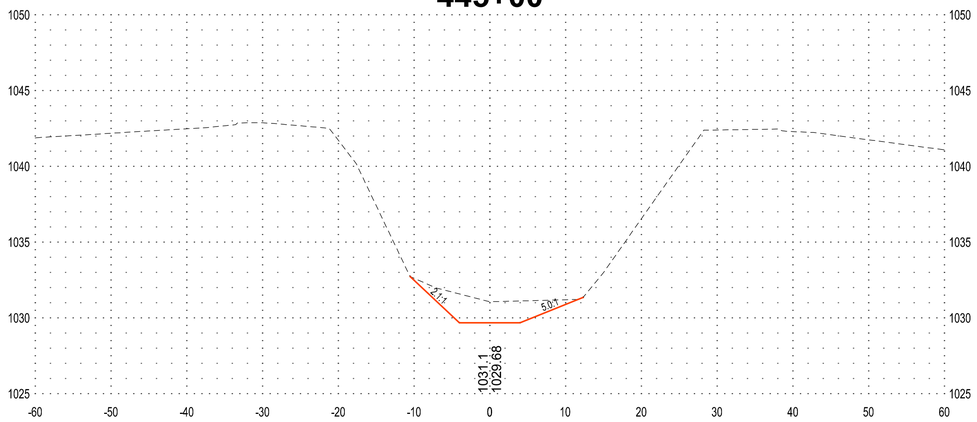
450+00



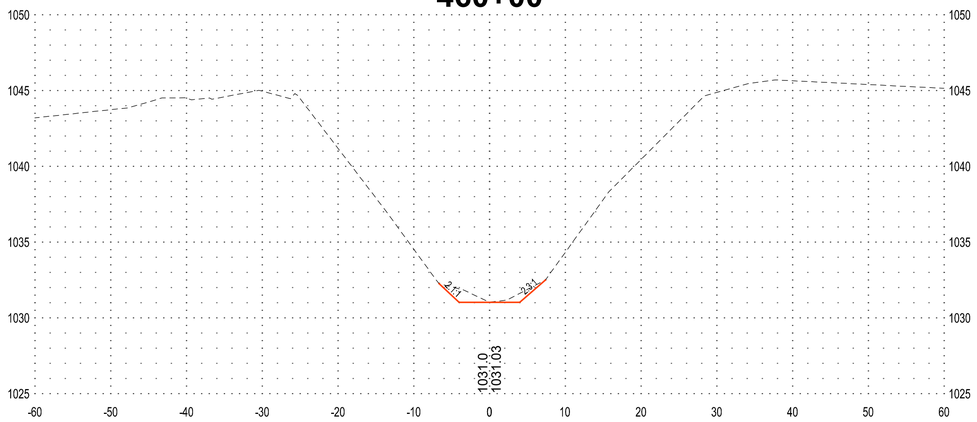
465+00



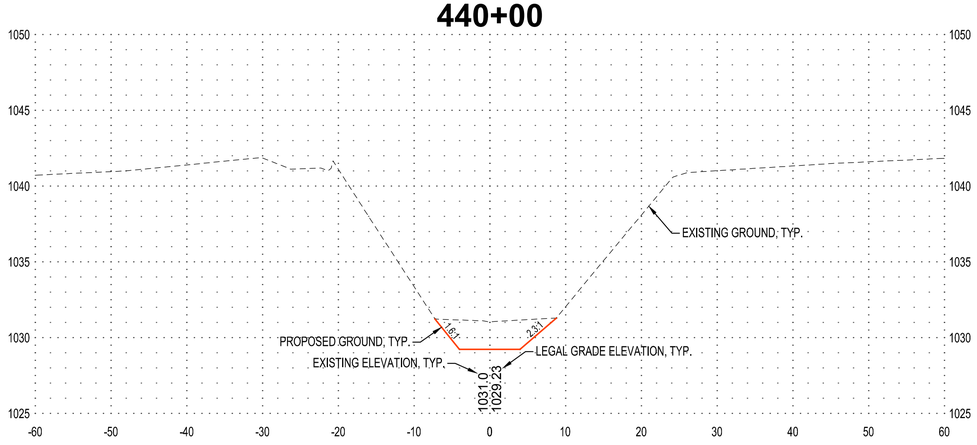
445+00



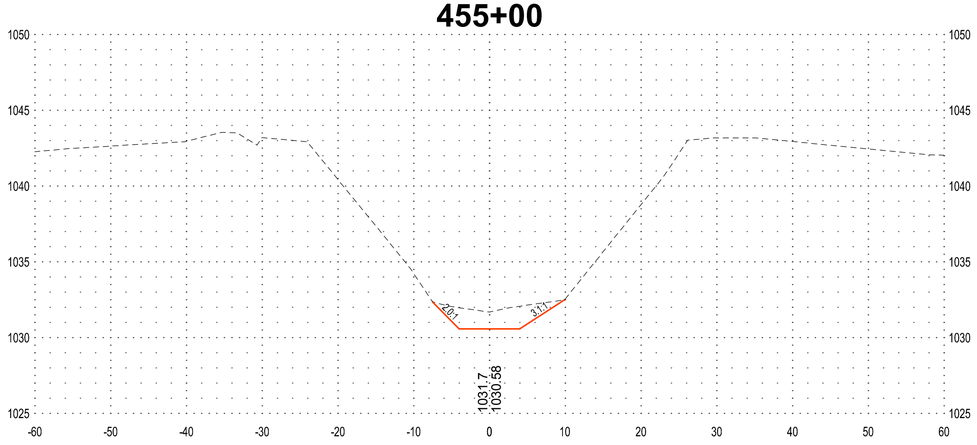
460+00



440+00



455+00



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

30

OF 41

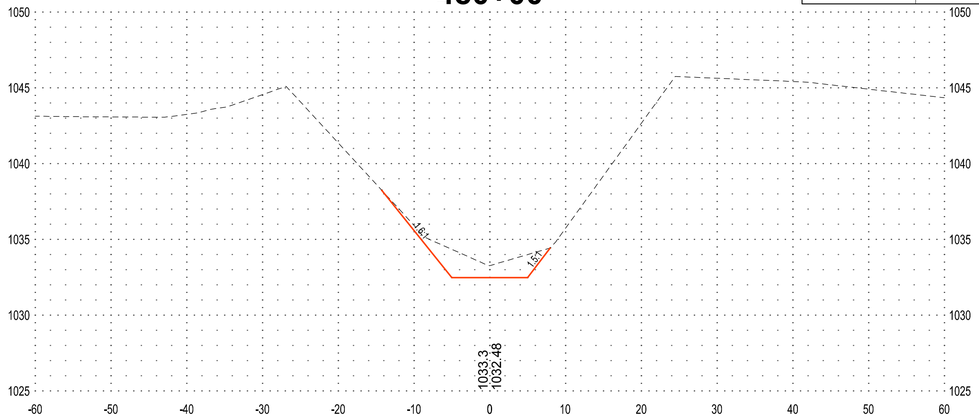
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

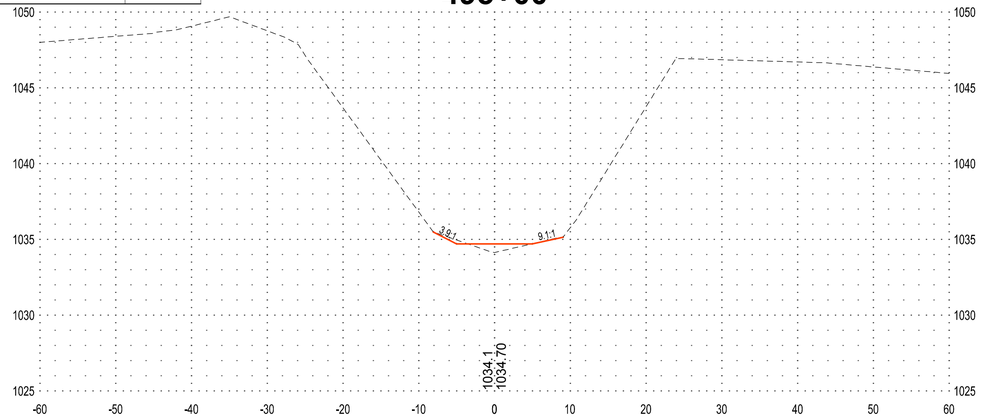
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
350+00 TO 473+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.09%
473+00 TO 532+50	STANDARD OPEN DITCH/ 10' BOTTOM	0.04%

0 10 20
SCALE IN FEET

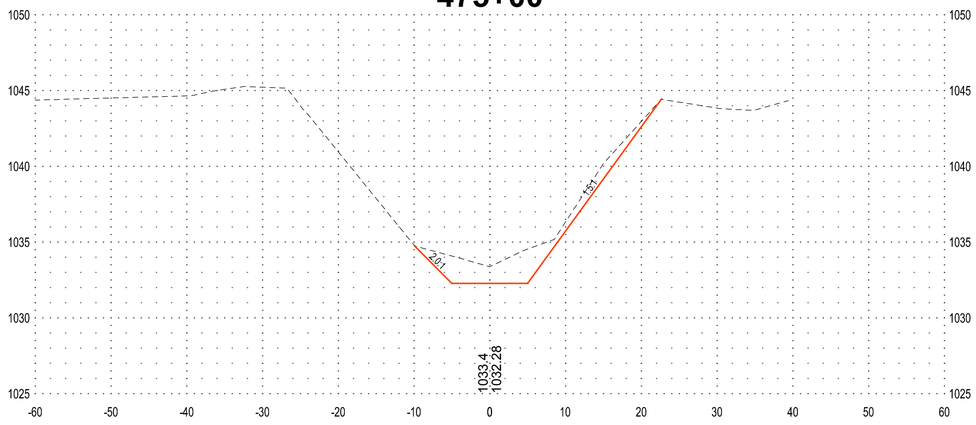
480+00



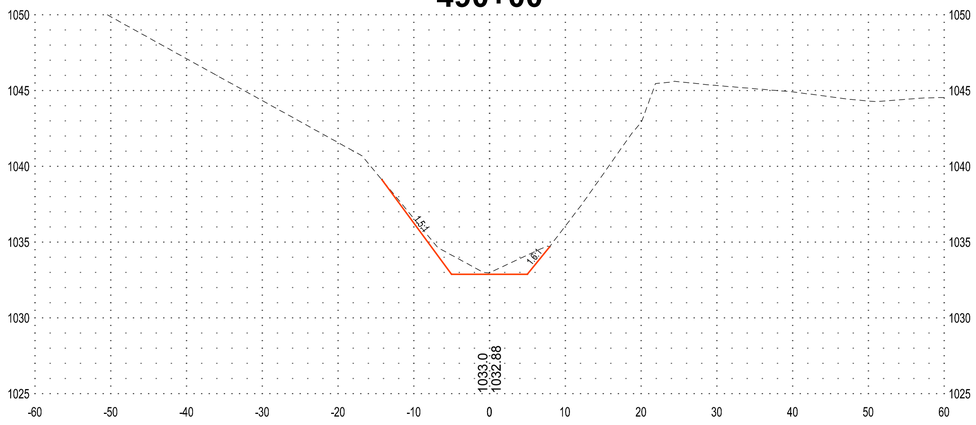
495+00



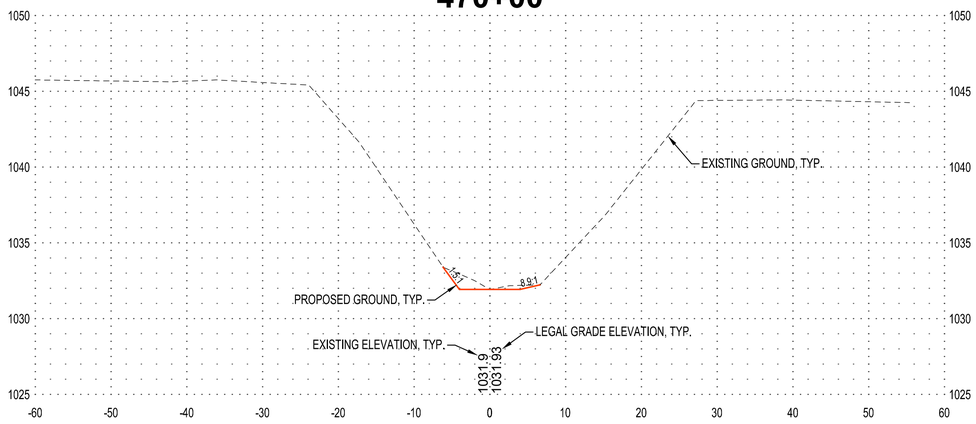
475+00



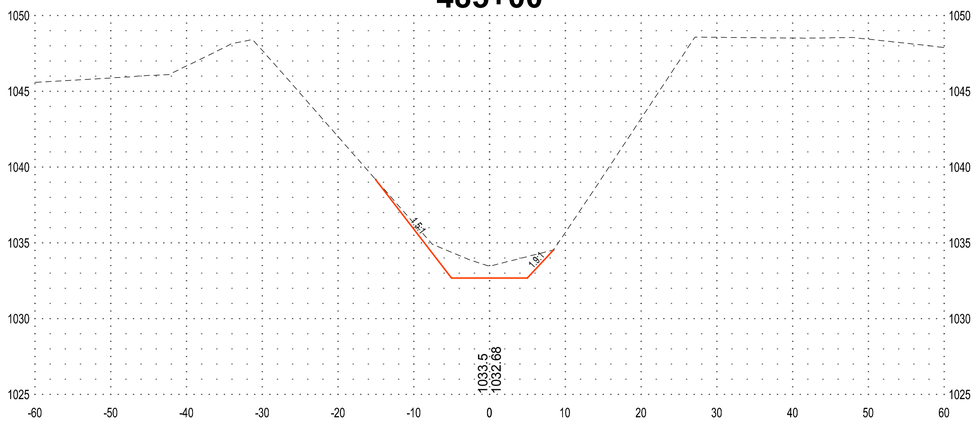
490+00



470+00



485+00



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

31

OF 41

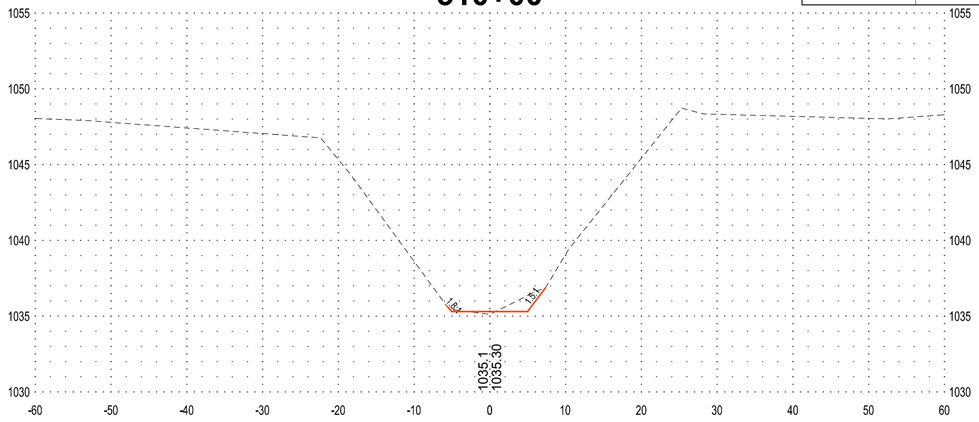
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

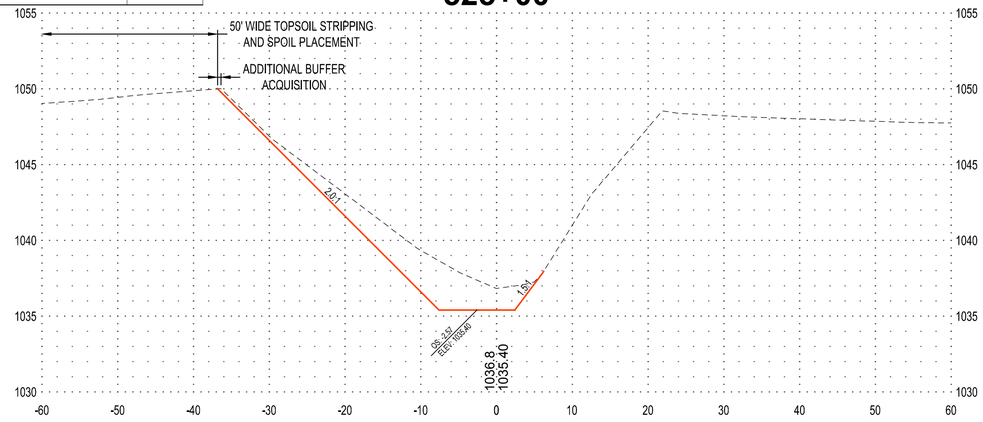
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
350+00 TO 473+00	STANDARD OPEN DITCH/ 8' BOTTOM	0.09%
473+00 TO 532+50	STANDARD OPEN DITCH/ 10' BOTTOM	0.04%

0 10 20
SCALE IN FEET

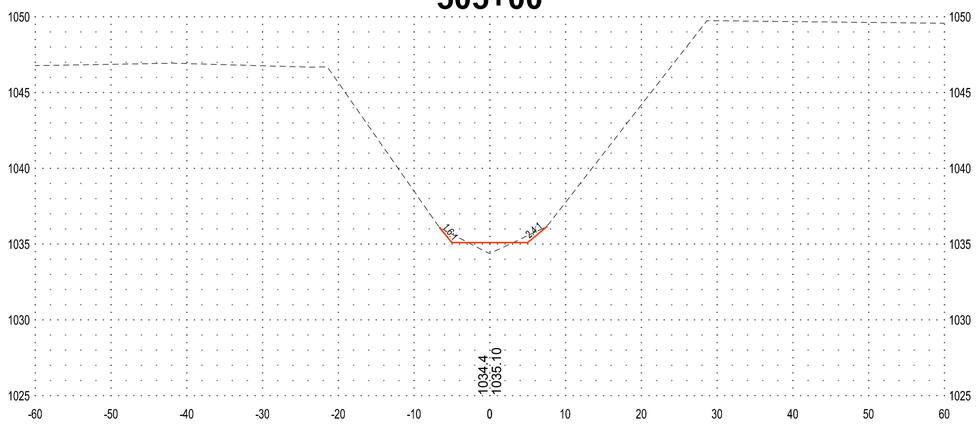
510+00



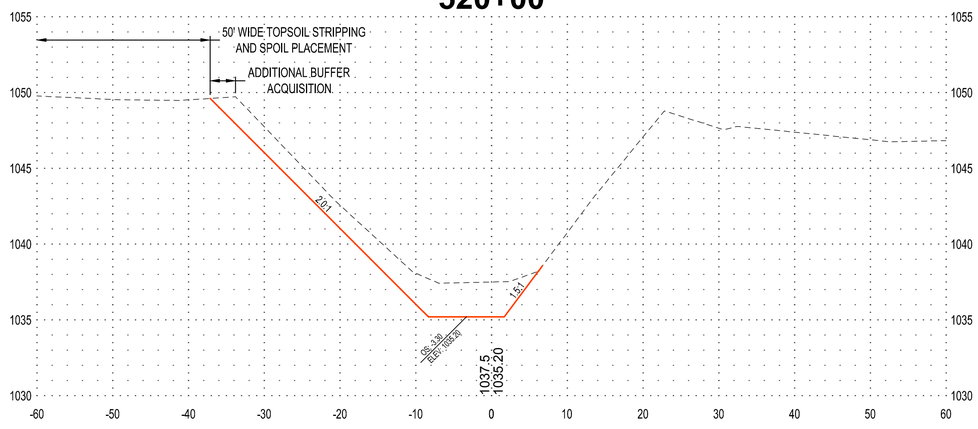
525+00



505+00



520+00



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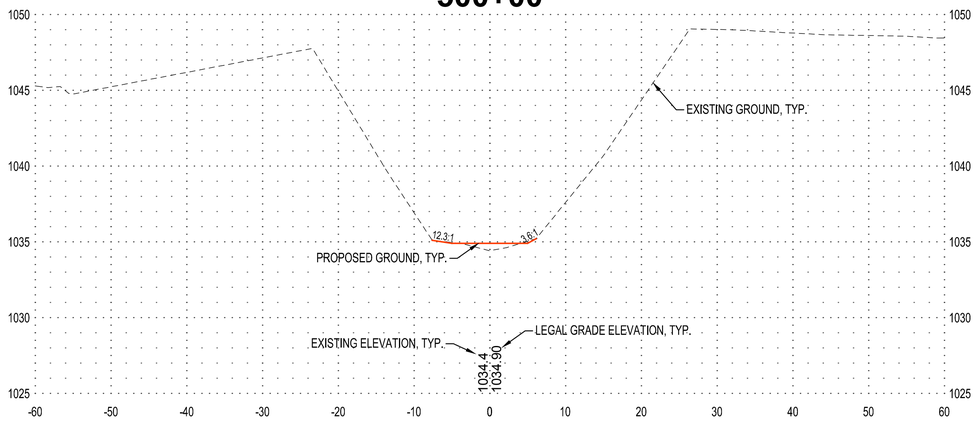
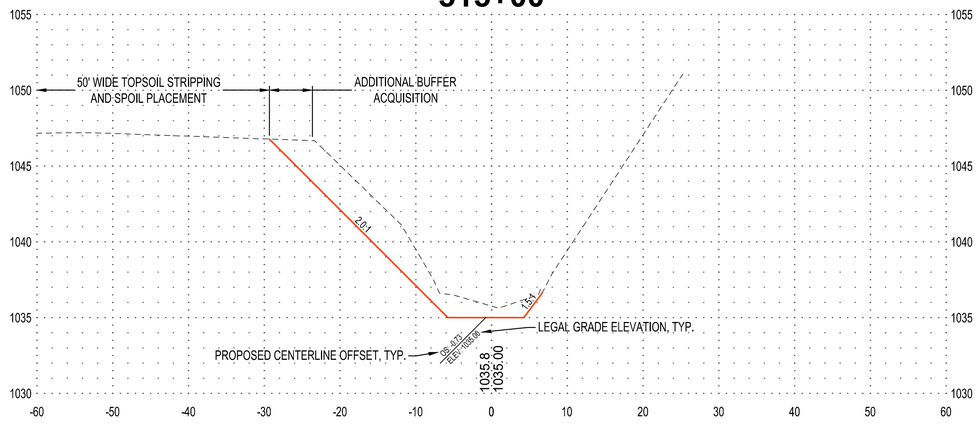


515+00



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

32

OF 41

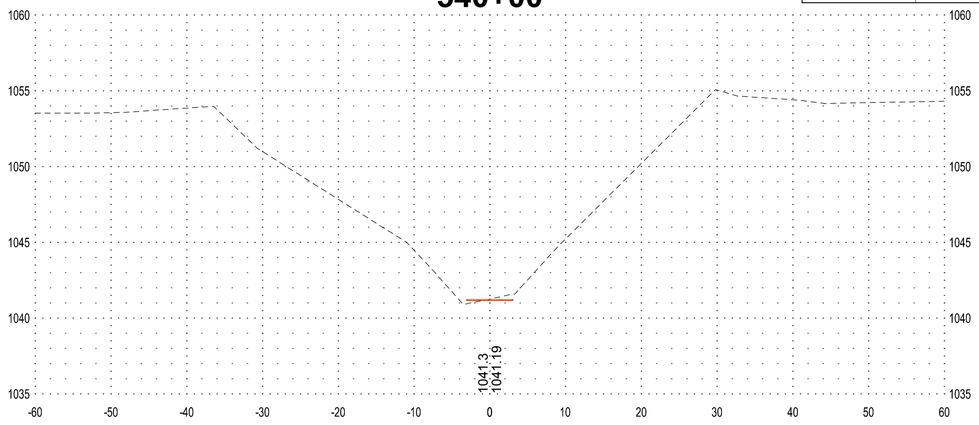
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

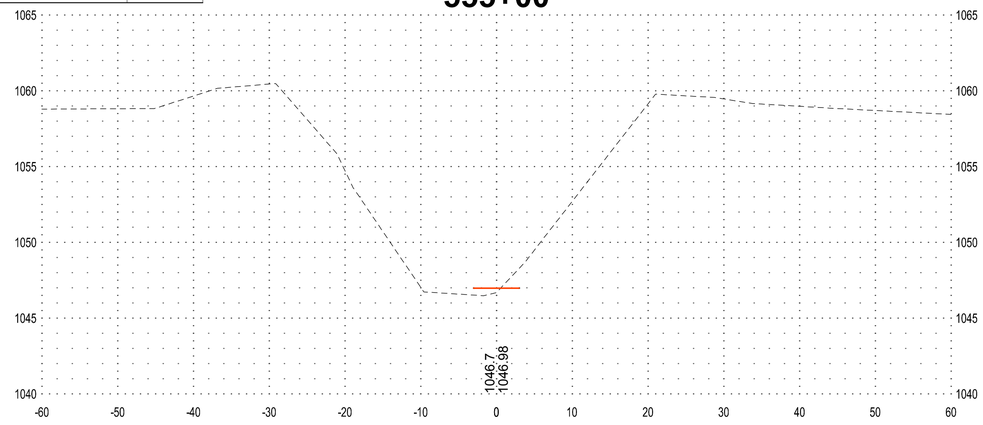
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
473+00 TO 532+50	STANDARD OPEN DITCH/ 10' BOTTOM	0.04%
532+50 TO 535+90	STANDARD OPEN DITCH/ 6' BOTTOM	0.70%
536+40 to 541+00	STANDARD OPEN DITCH/ 6' BOTTOM	0.70%

0 10 20
SCALE IN FEET

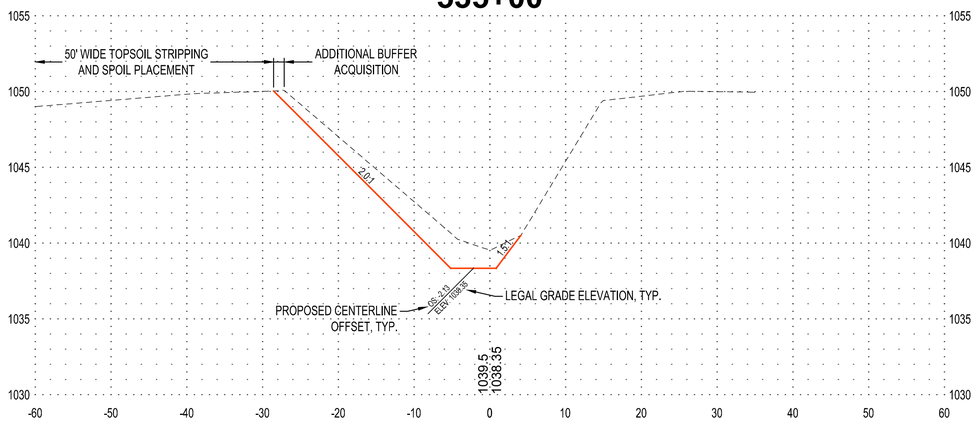
540+00



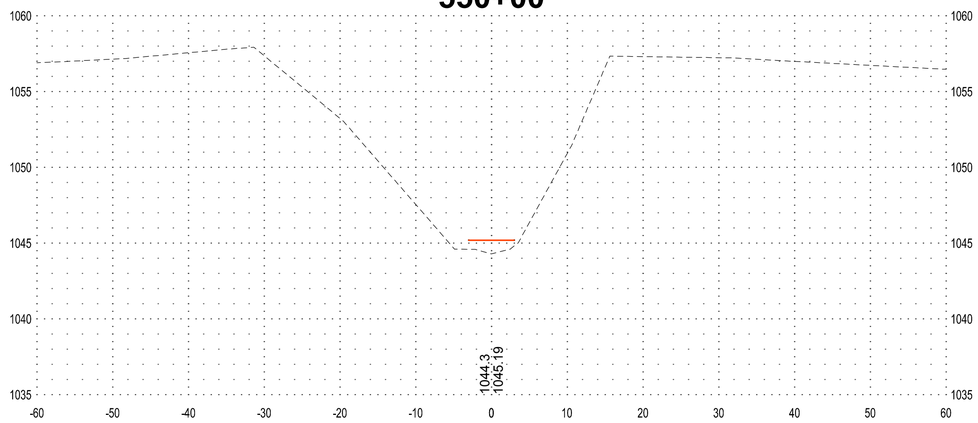
555+00



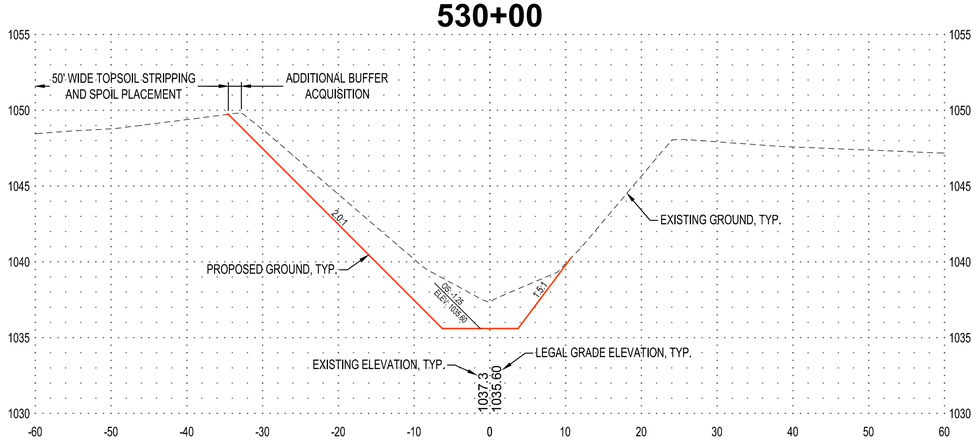
535+00



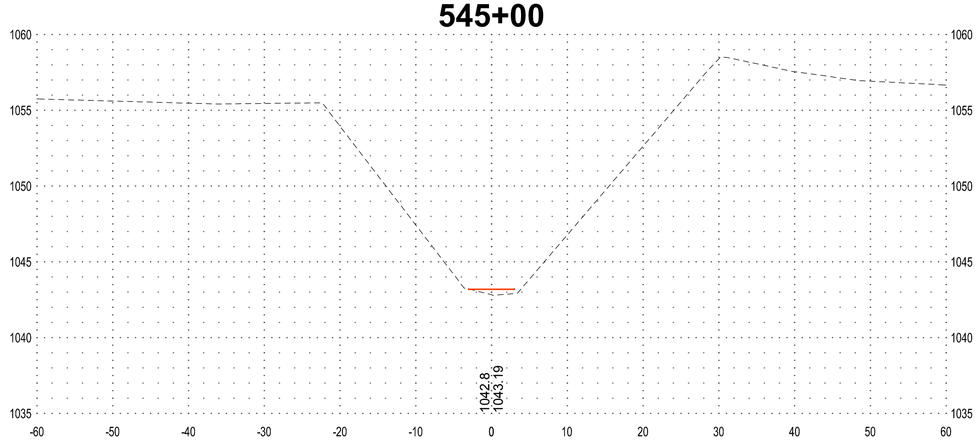
550+00



530+00



545+00



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PRELIMINARY - NOT FOR CONSTRUCTION

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

33

OF 41

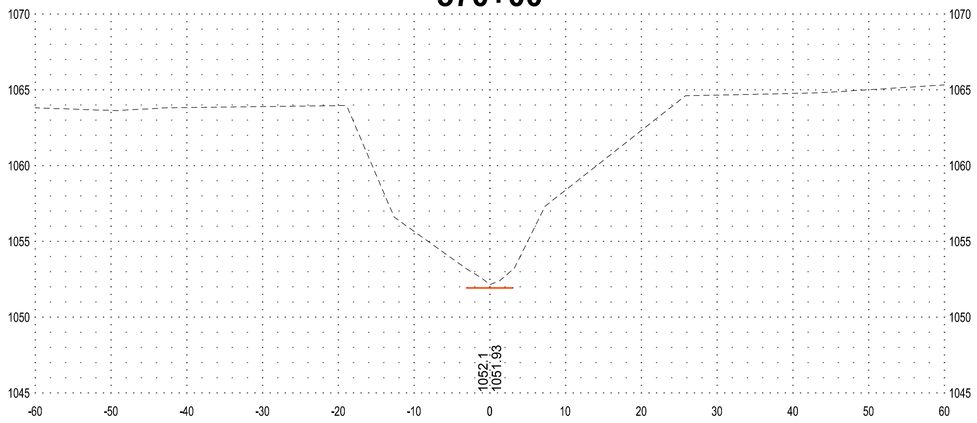
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

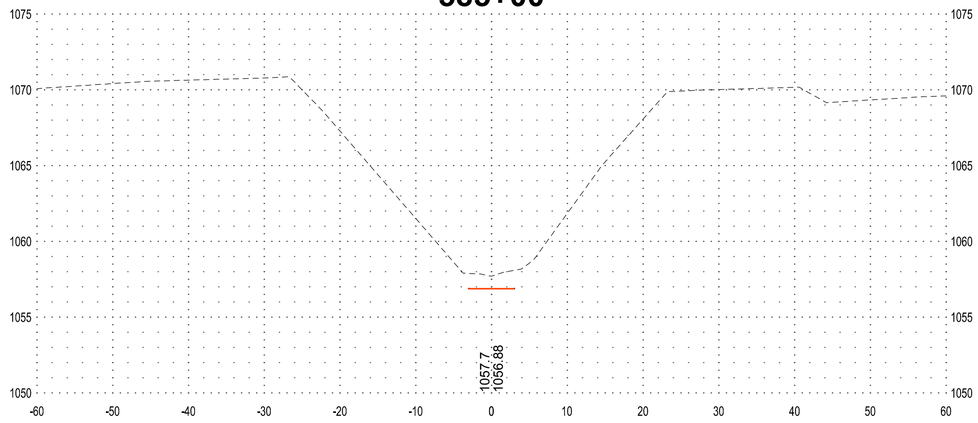
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
541+00 TO 596+40	BENCHED SLOPE SLOUGH REPAIR (NO CLEANING)	-

0 10 20
SCALE IN FEET

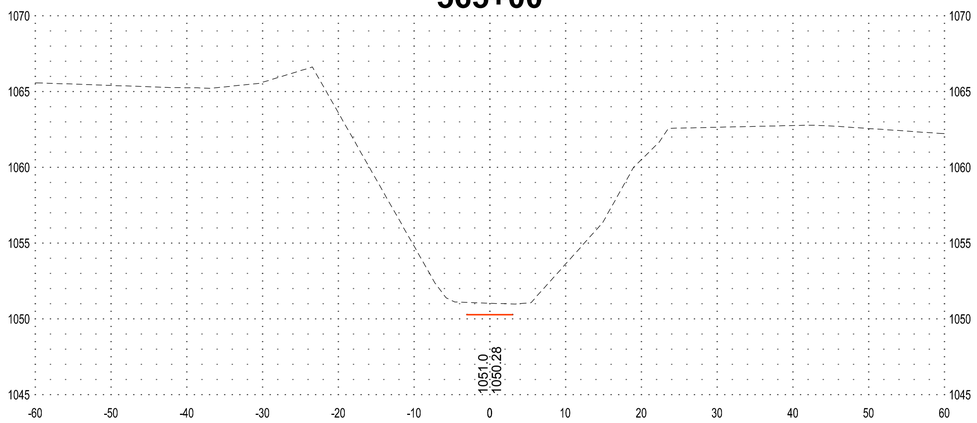
570+00



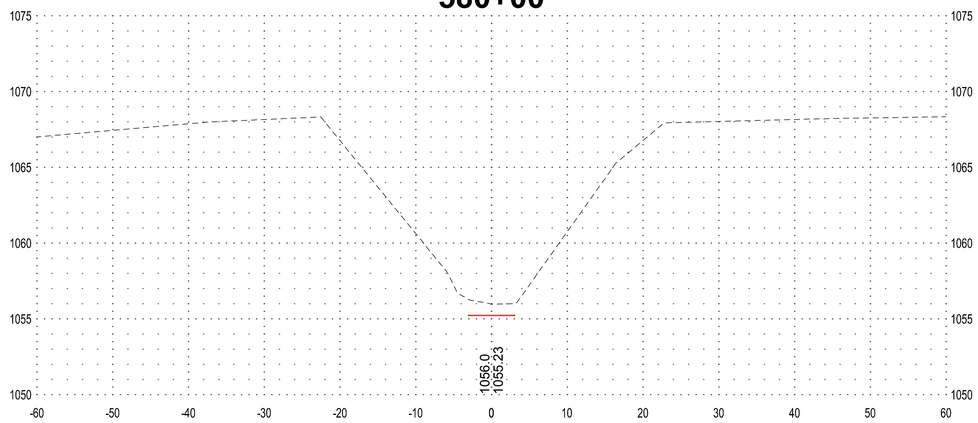
585+00



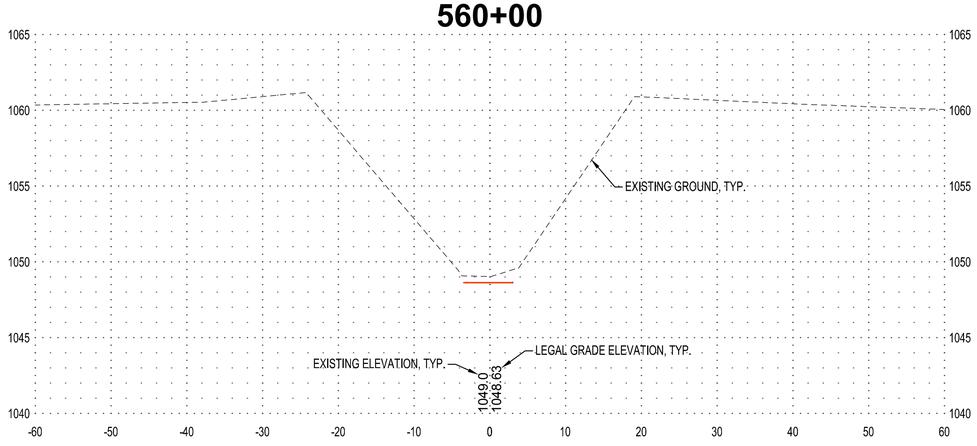
565+00



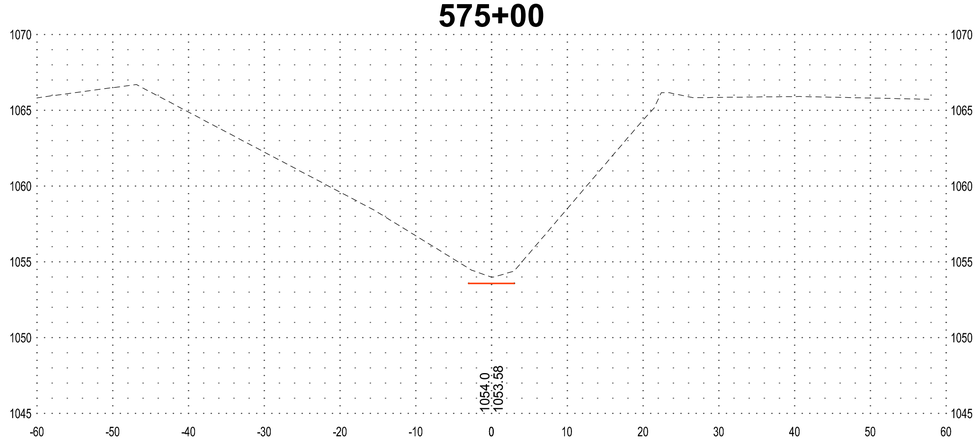
580+00



560+00



575+00



ISG

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
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ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

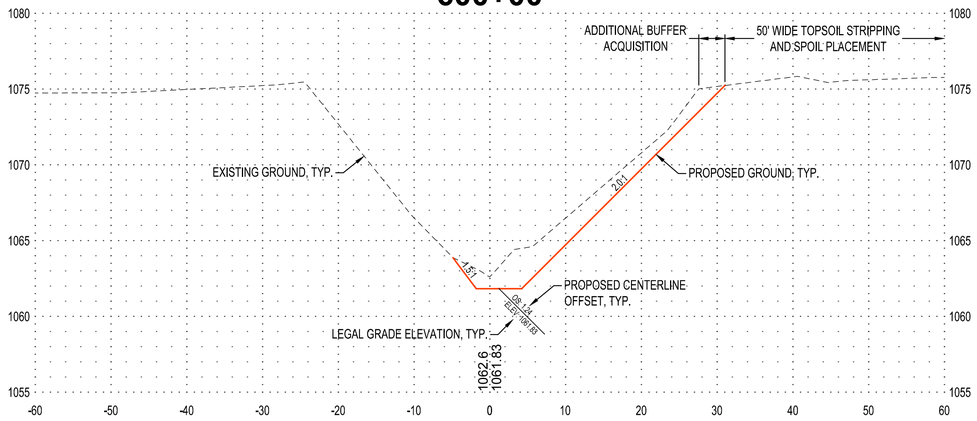
CROSS-SECTIONS

SHEET

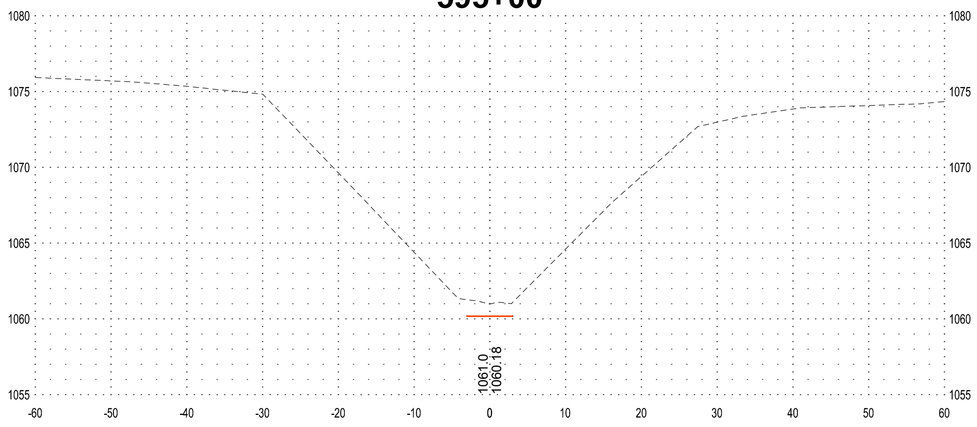
34

OF 41

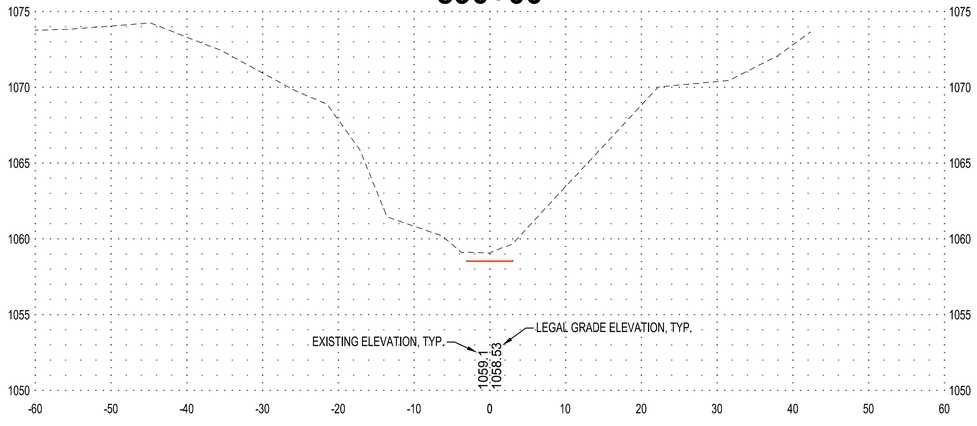
600+00



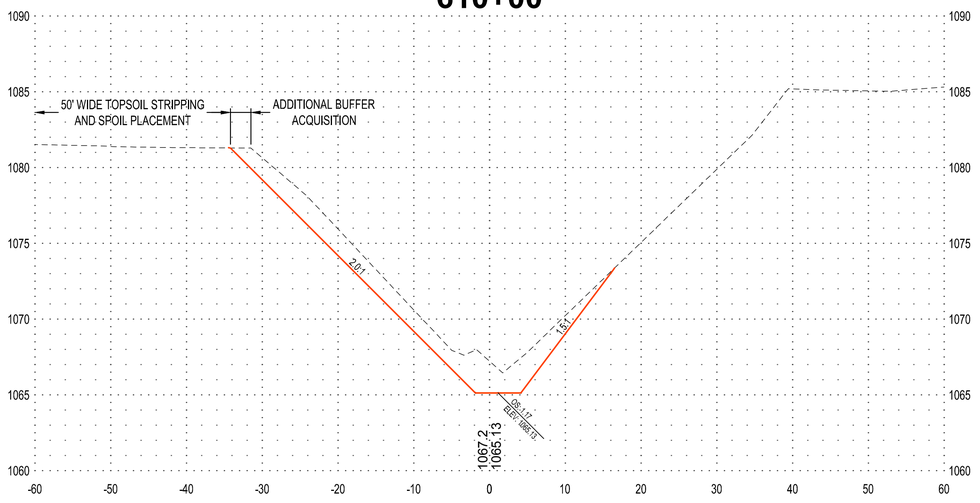
595+00



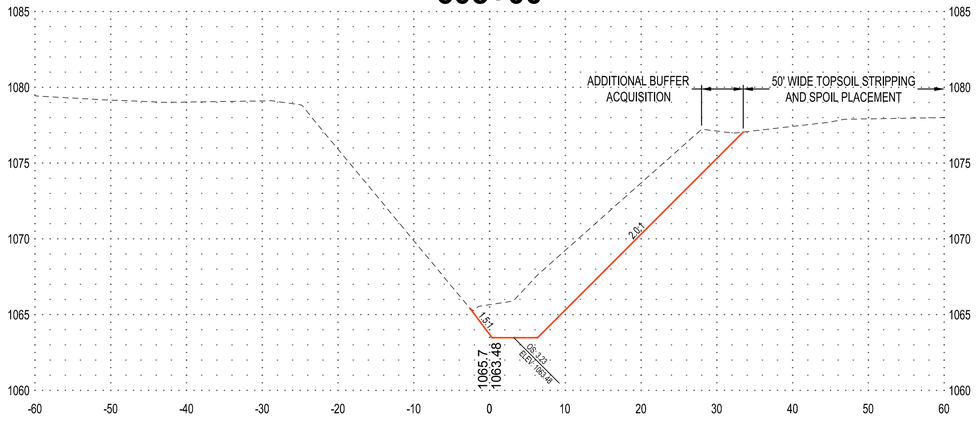
590+00



610+00



605+00



OPEN DITCH REPAIR LEGEND

STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
541+00 TO 596+40	BENCHED SLOPE SLOUGH REPAIR (NO CLEANING)	-
597+50 TO 628+00	STANDARD OPEN DITCH/ 6' BOTTOM	0.33%

NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

0 10 20
SCALE IN FEET

ISG

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

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DRAWN BY	JEG
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ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

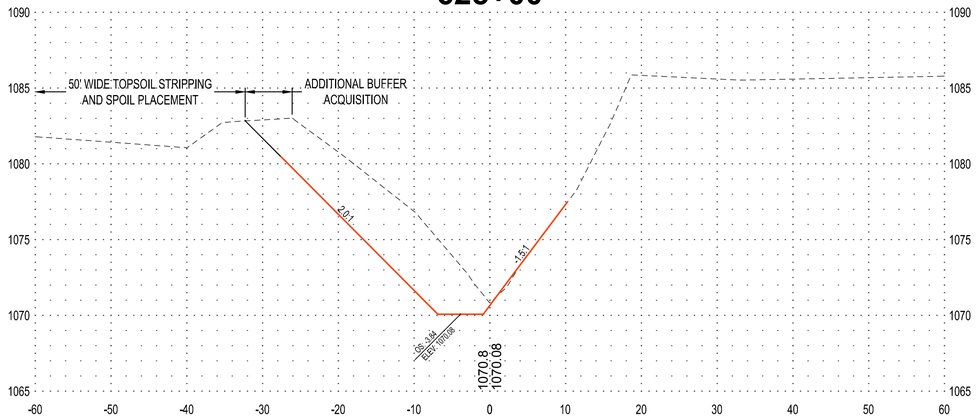
CROSS-SECTIONS

SHEET

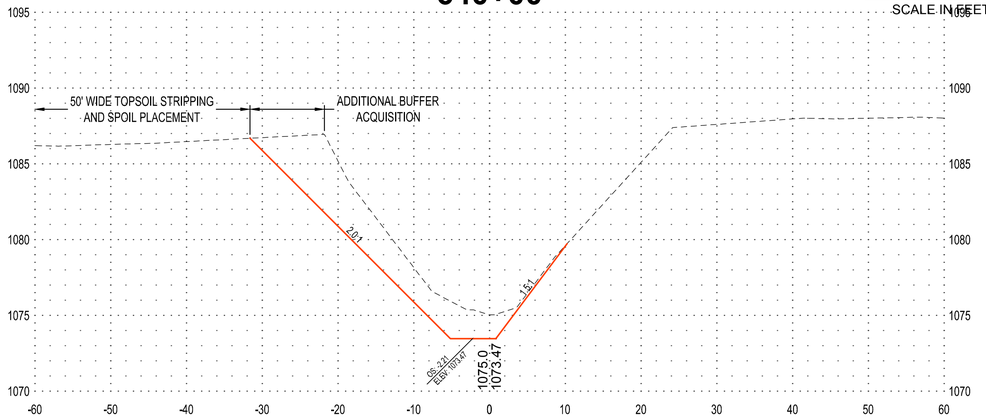
35

OF 41

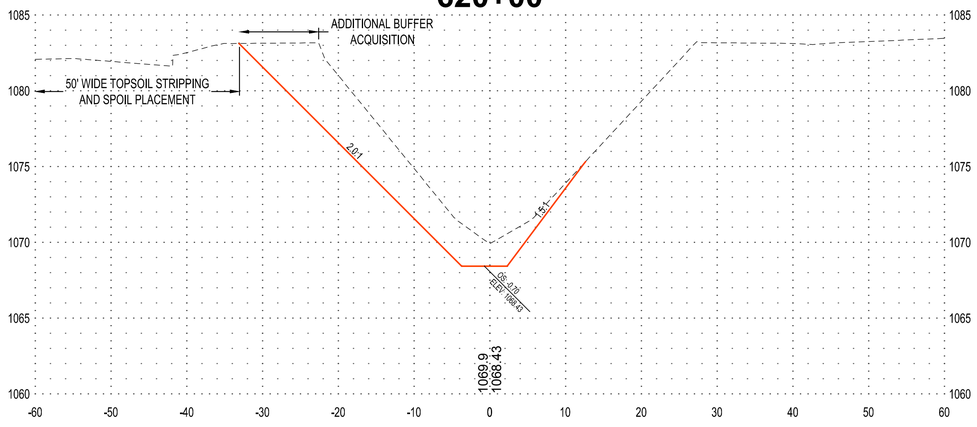
625+00



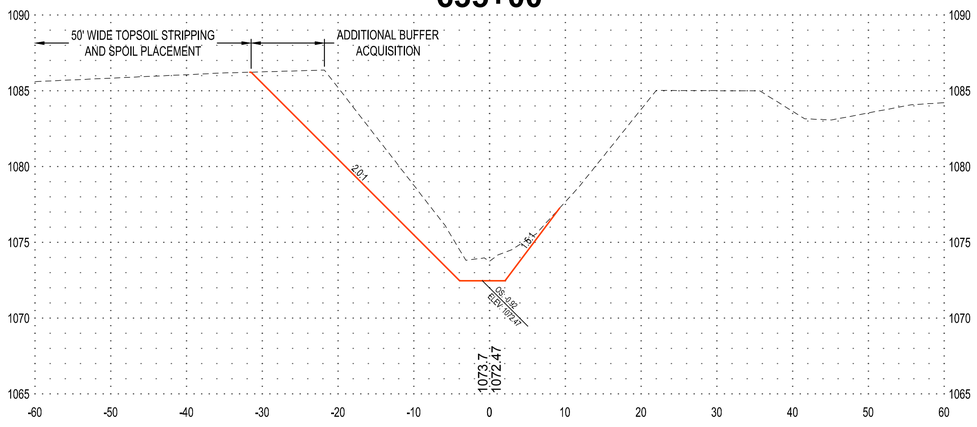
640+00



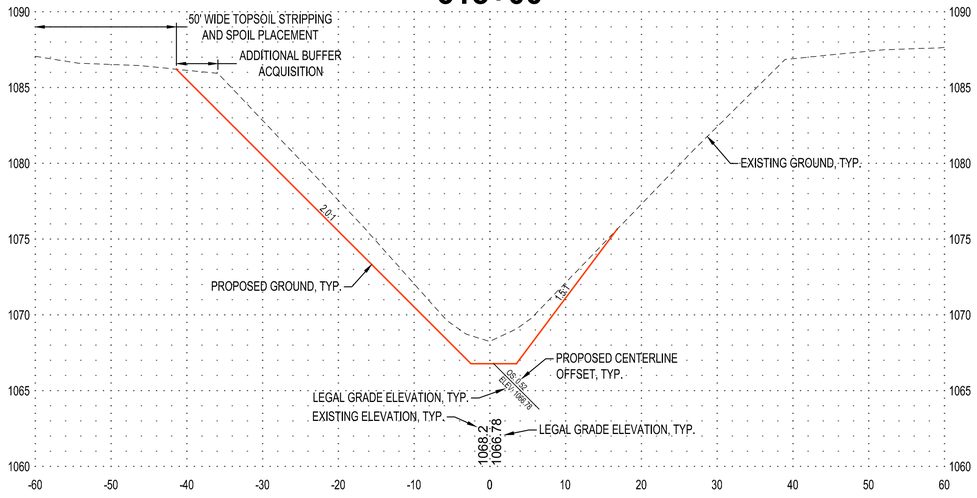
620+00



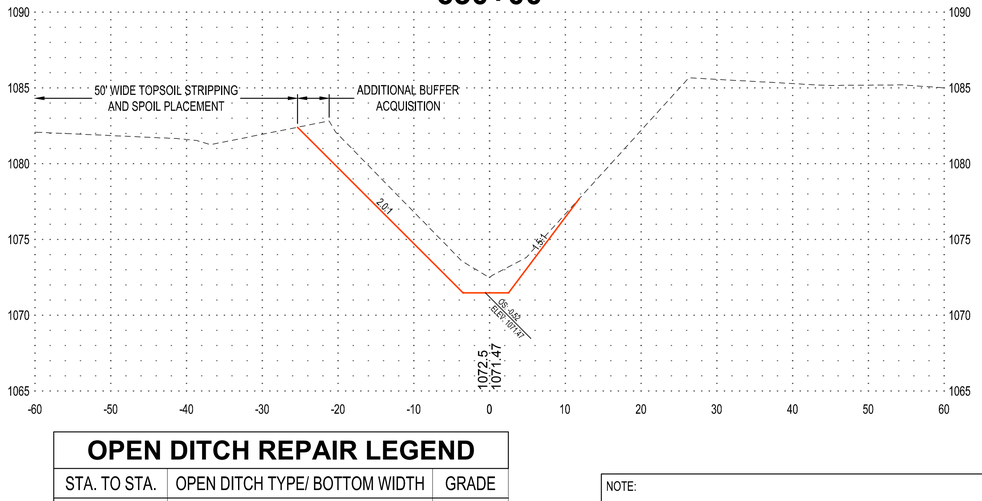
635+00



615+00



630+00



OPEN DITCH REPAIR LEGEND

STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
597+50 TO 628+00	STANDARD OPEN DITCH/ 6' BOTTOM	0.33%
628+00 TO 662+00	STANDARD OPEN DITCH/ 6' BOTTOM	0.20%

NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

ISG

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

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CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
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ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

36 OF 41

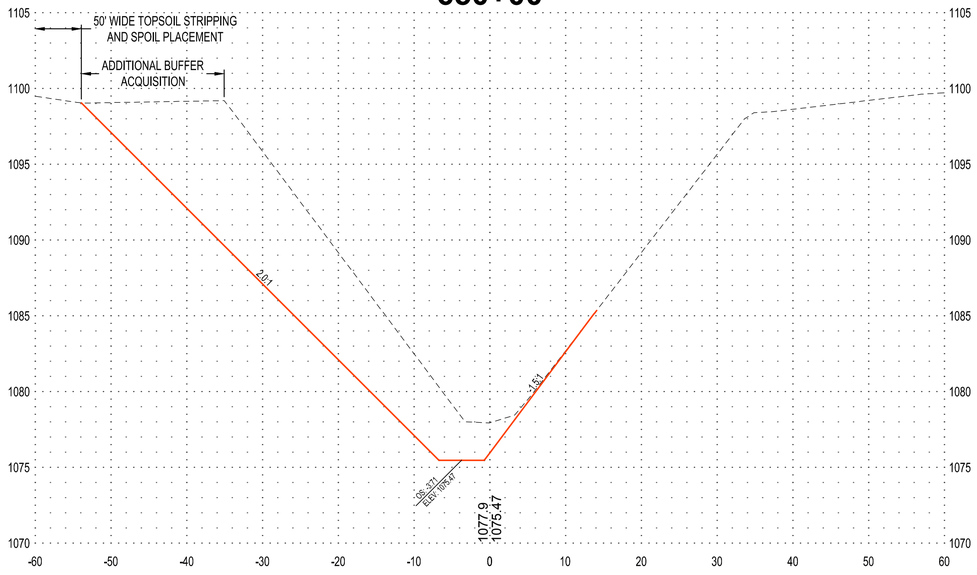
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

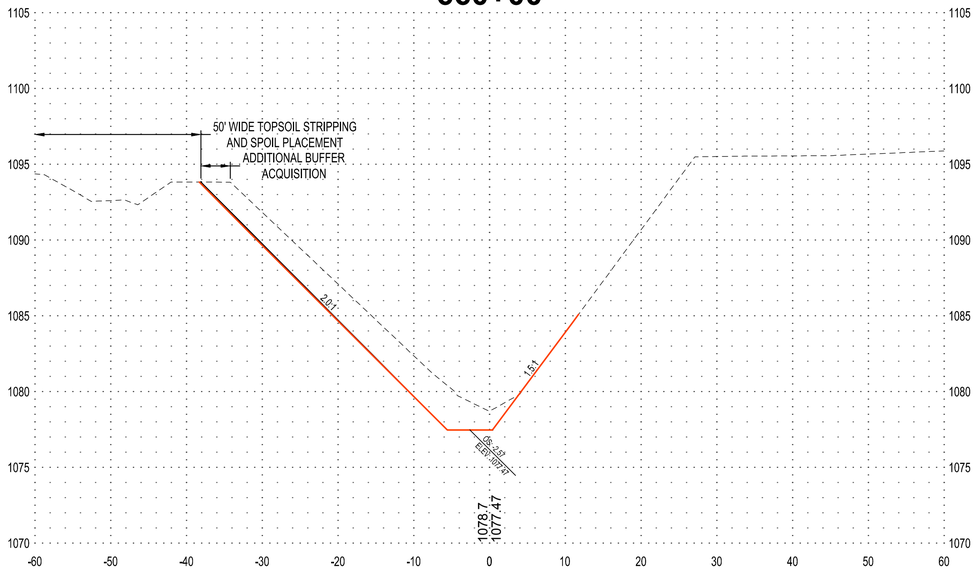
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
628+00 TO 662+00	STANDARD OPEN DITCH/ 6' BOTTOM	0.20%

0 10 20
SCALE IN FEET

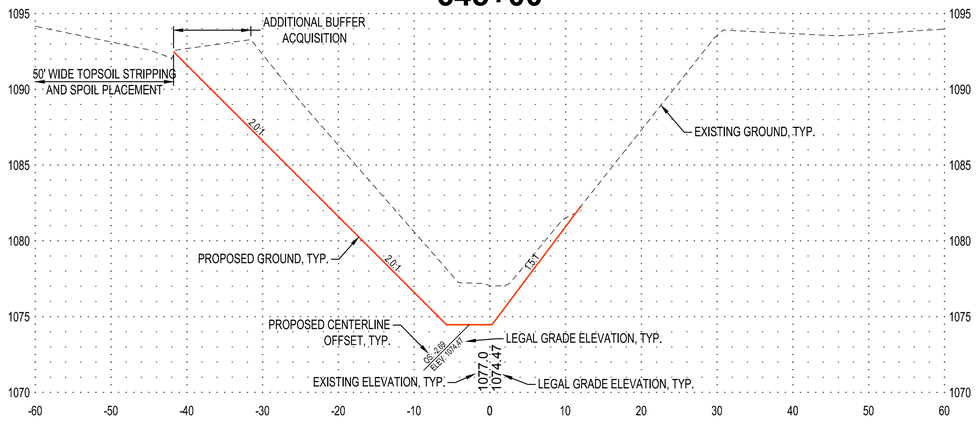
650+00



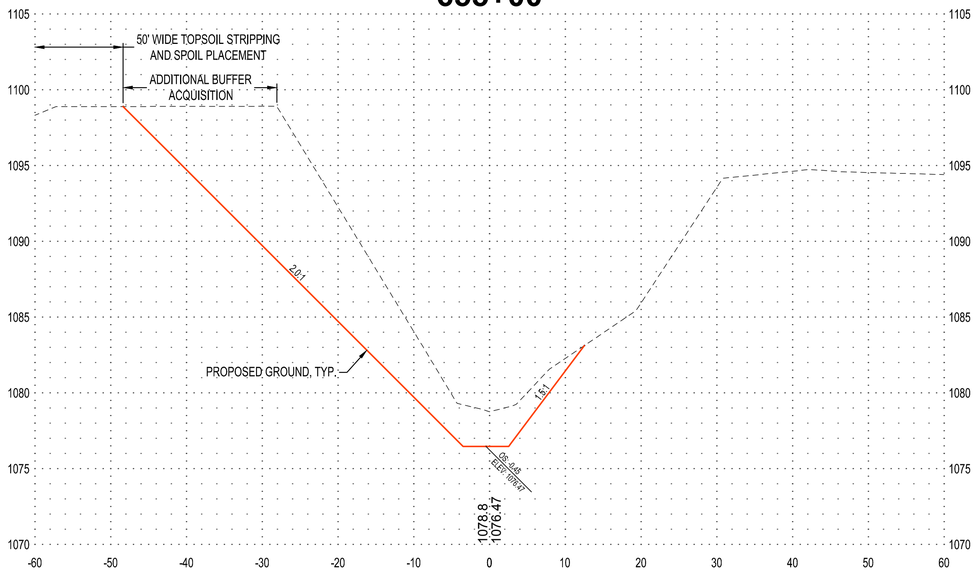
660+00



645+00



655+00



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

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CAD FILE NAME	21589 X-SECTIONS
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DESIGNED BY	CJB
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CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

37

OF 41

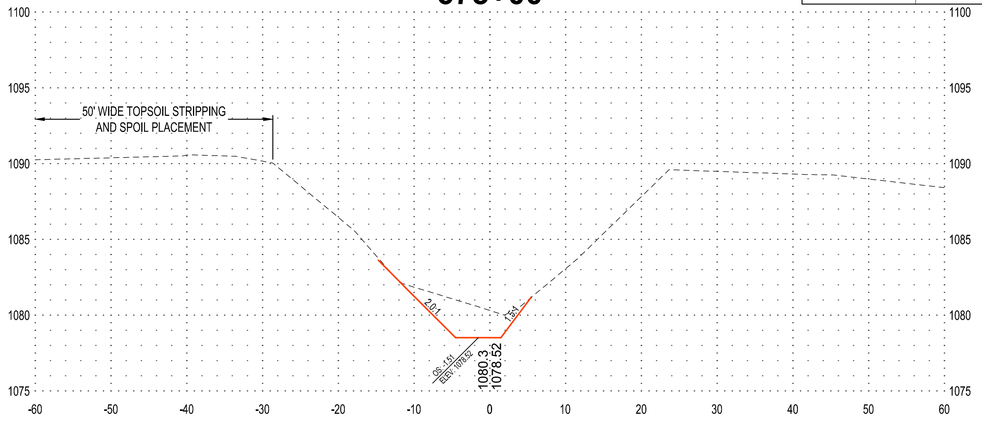
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

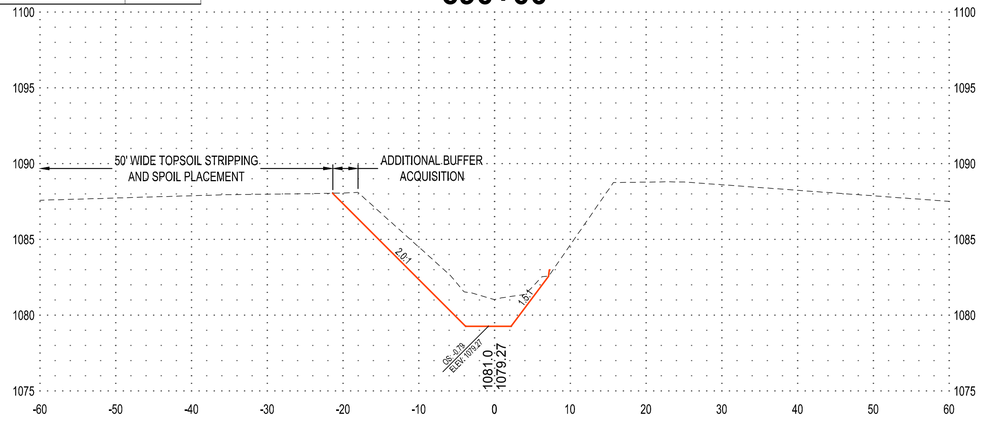
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
662+00 TO 675+30	STANDARD OPEN DITCH/ 6' BOTTOM	0.05%
675+80 TO 706+00	STANDARD OPEN DITCH/ 6' BOTTOM	0.05%

0 10 20
SCALE IN FEET

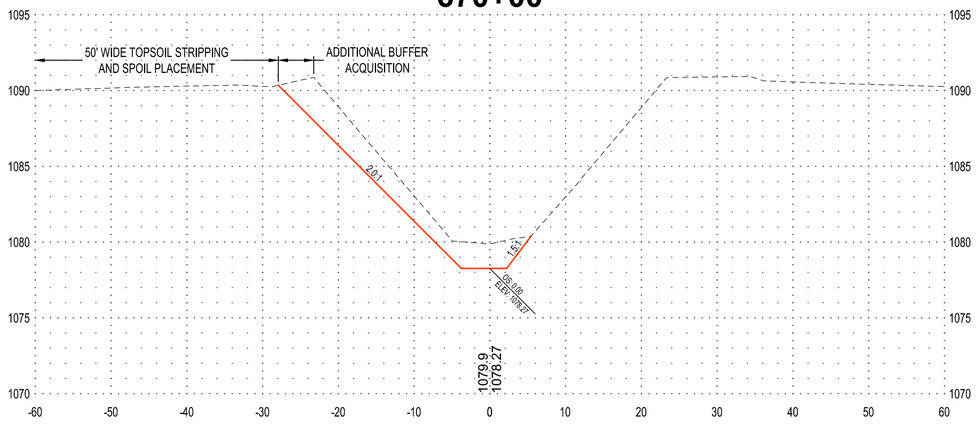
675+00



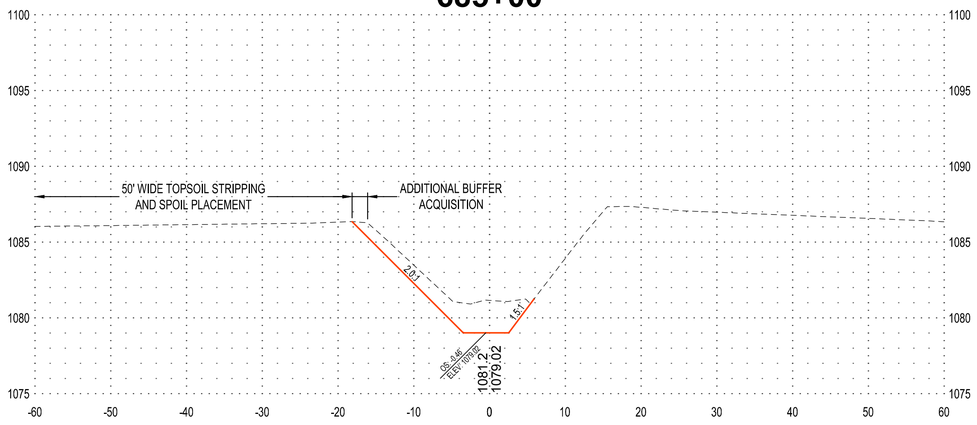
690+00



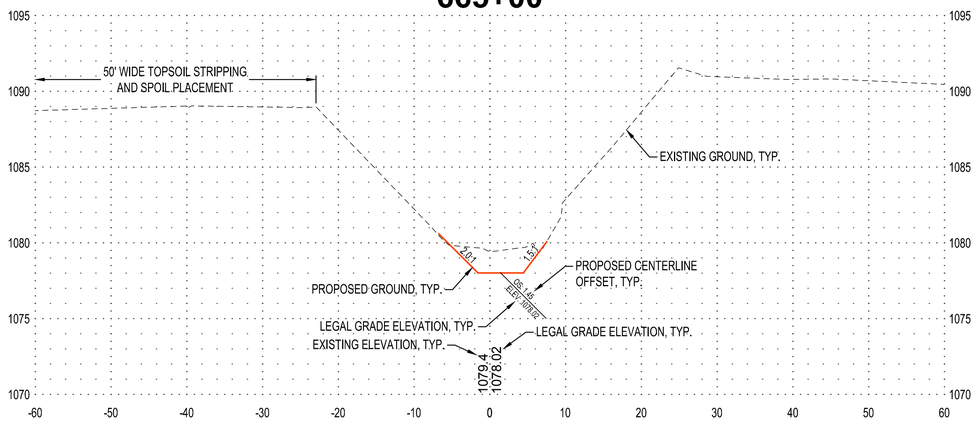
670+00



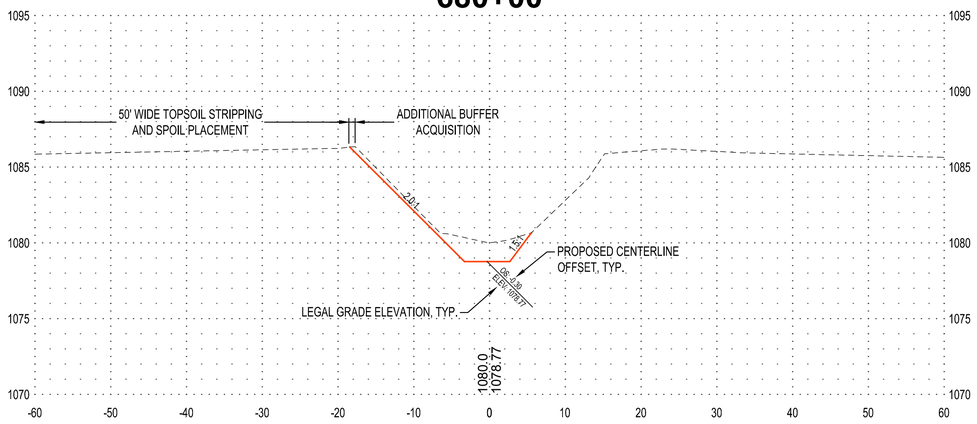
685+00



665+00



680+00



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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

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CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

38

OF 41

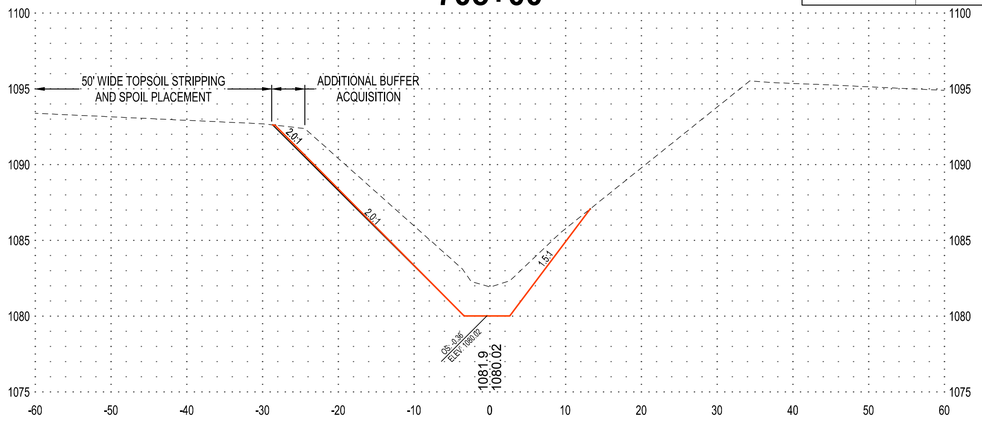
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

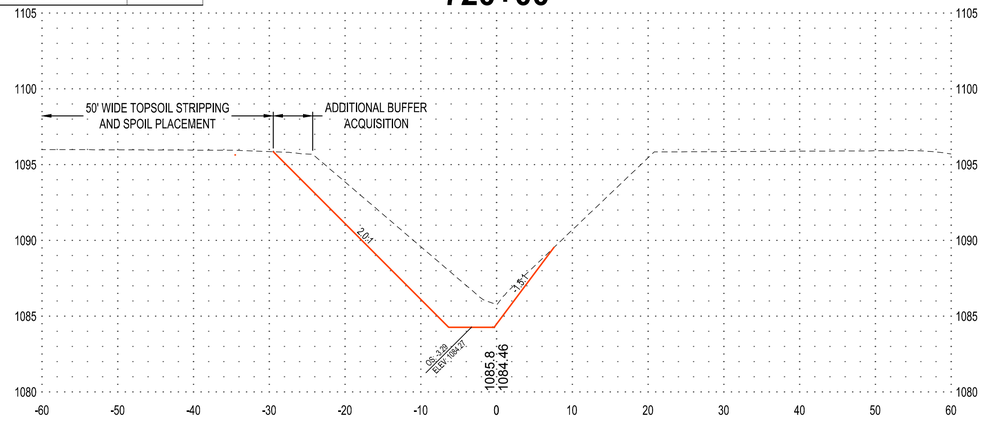
STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
675+80 TO 706+00	STANDARD OPEN DITCH/ 6' BOTTOM	0.05%
706+00 TO 736+60	STANDARD OPEN DITCH/ 6' BOTTOM	0.30%

0 10 20
SCALE IN FEET

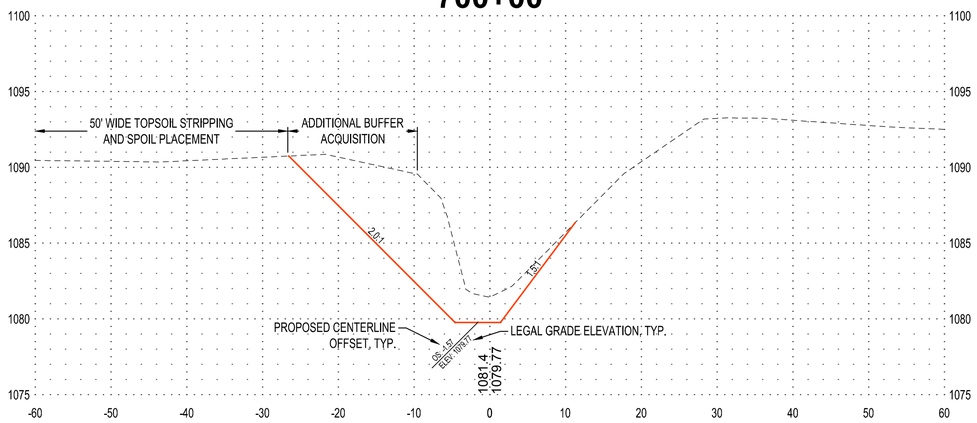
705+00



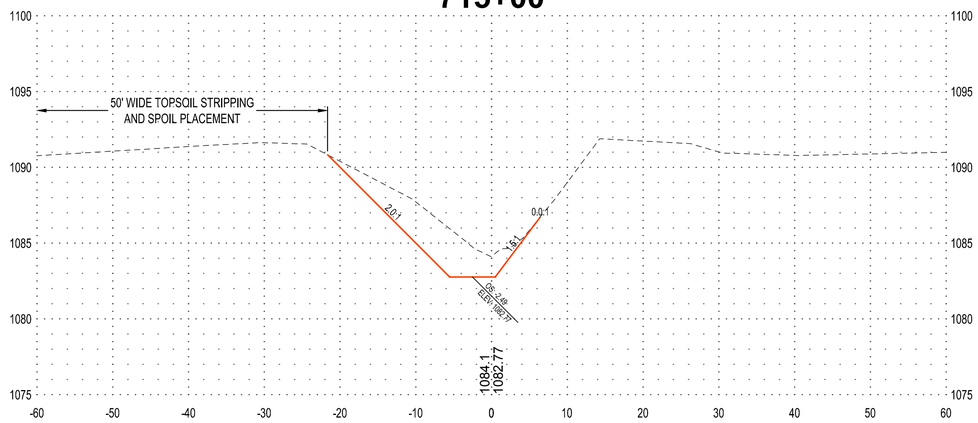
720+00



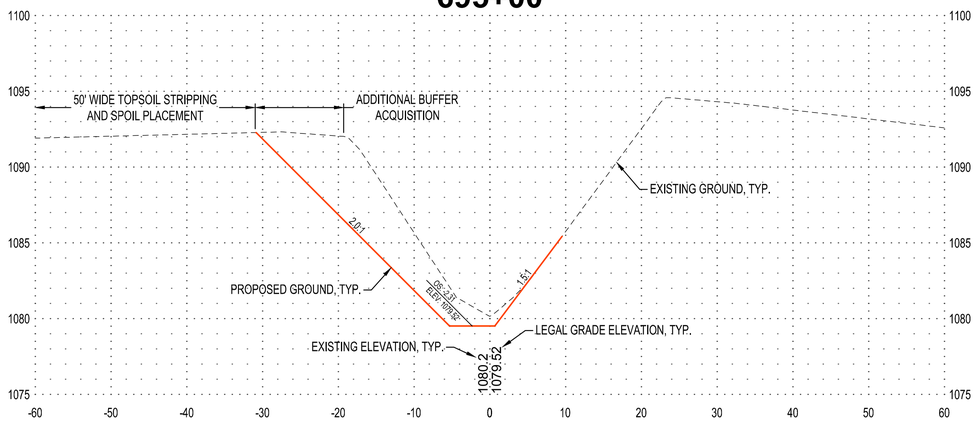
700+00



715+00



695+00



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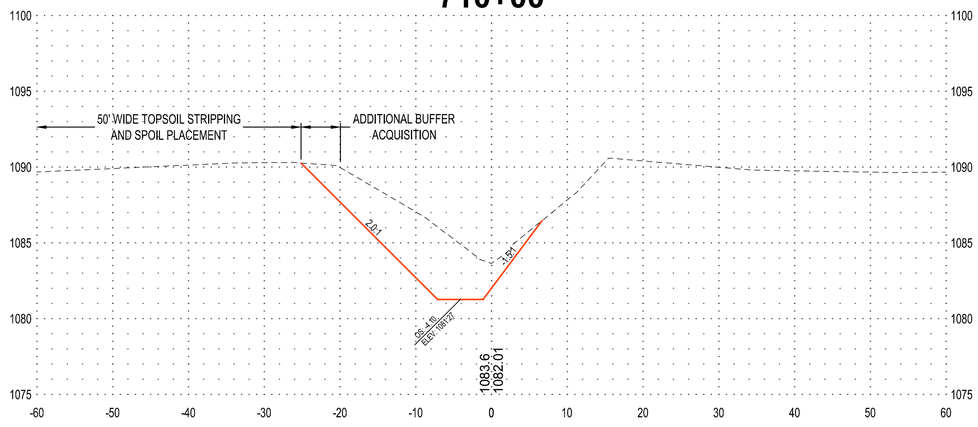

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PROJECT

FARIBAULT COUNTY

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

39

OF 41

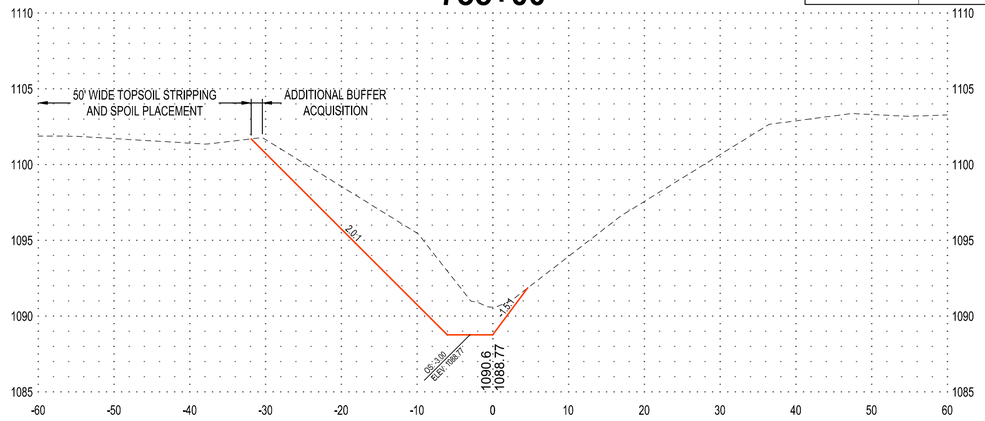
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
706+00 TO 736+60	STANDARD OPEN DITCH/ 6' BOTTOM	0.30%
736+60 TO 746+00	STANDARD OPEN DITCH/ 6' BOTTOM	0.30%
746+00 TO 776+50	STANDARD OPEN DITCH/ 6' BOTTOM	0.05%

0 10 20
SCALE IN FEET

735+00



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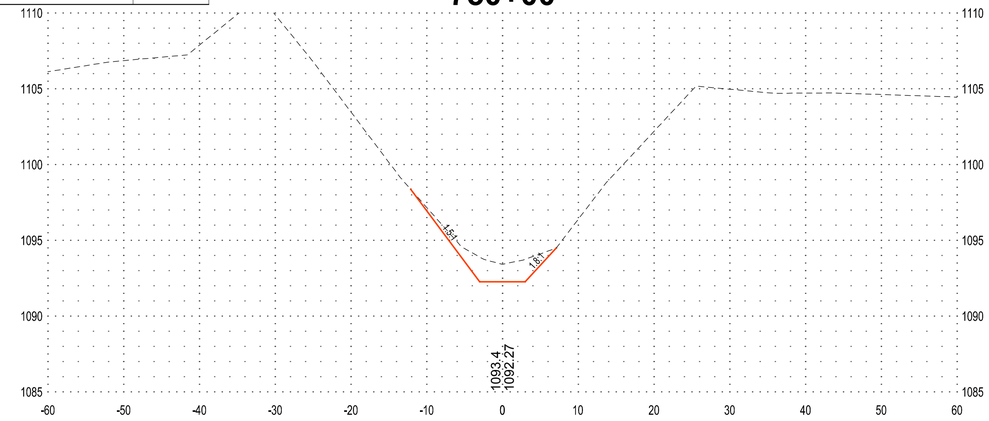

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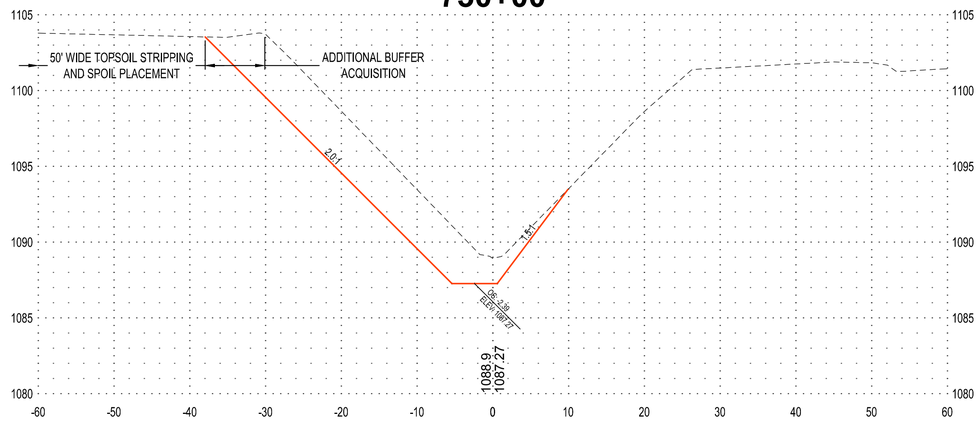

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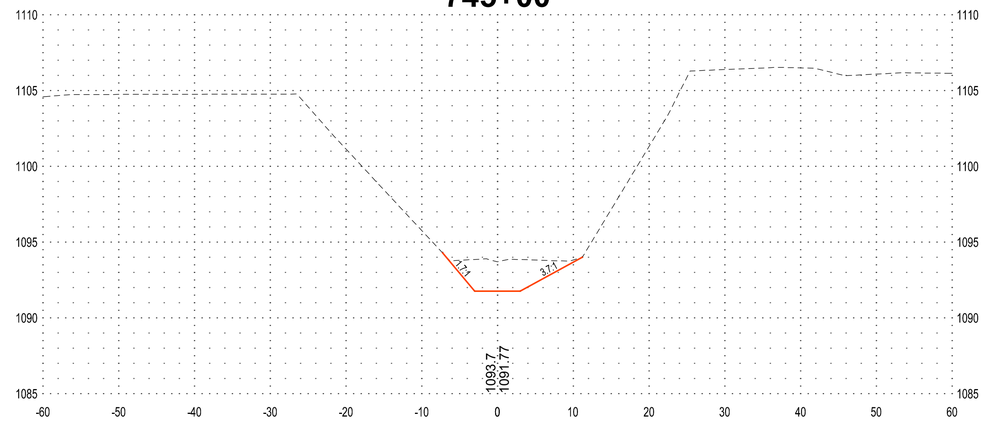

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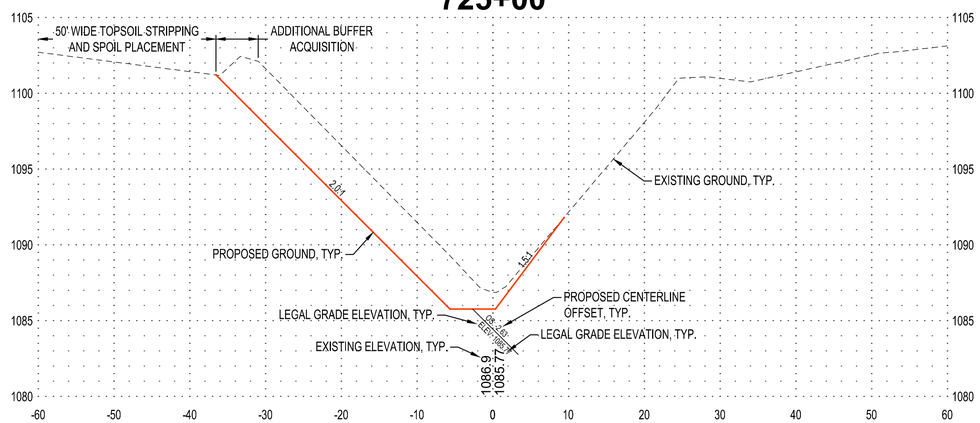

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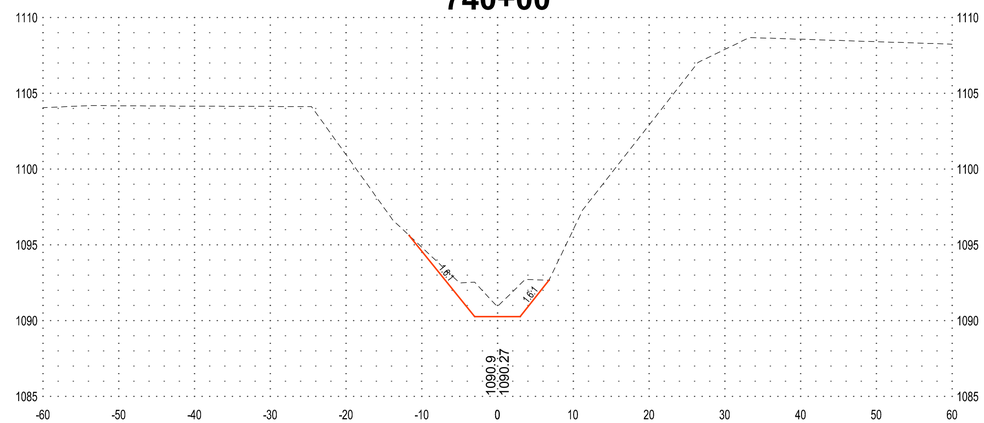

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PROJECT **FARIBAULT COUNTY**

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

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DRAWN BY	JEG
DESIGNED BY	CJB
REVIEWED BY	CJB
ORIGINAL ISSUE DATE	--/--/--
CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET **40** OF 41

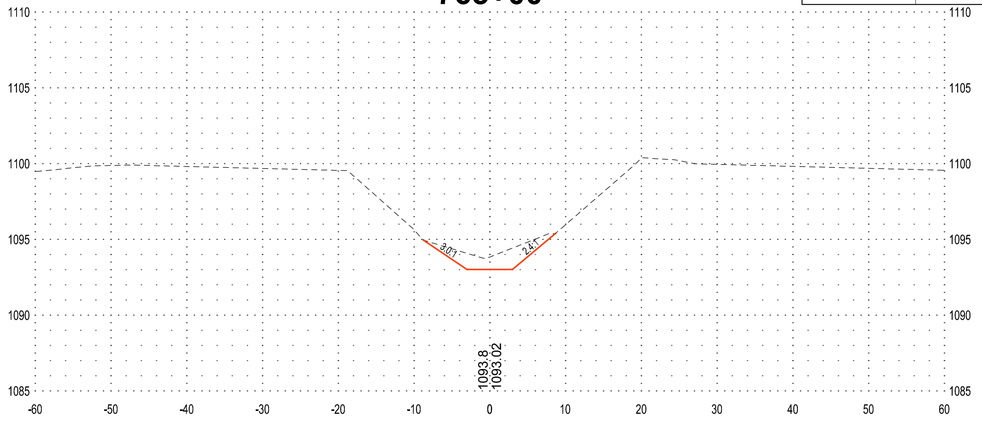
NOTE:
CROSS SECTIONS AS VIEWED IN THE DIRECTION OF INCREASING STATIONING.
PROPOSED CENTERLINE OFFSET MEASURED FROM CENTERLINE OF EXISTING DITCH.

OPEN DITCH REPAIR LEGEND

STA. TO STA.	OPEN DITCH TYPE/ BOTTOM WIDTH	GRADE
746+00 TO 776+50	STANDARD OPEN DITCH/ 6' BOTTOM	0.05%
776+50 TO 781+50	STANDARD OPEN DITCH/ 6' BOTTOM	0.40%

0 10 20
SCALE IN FEET

765+00



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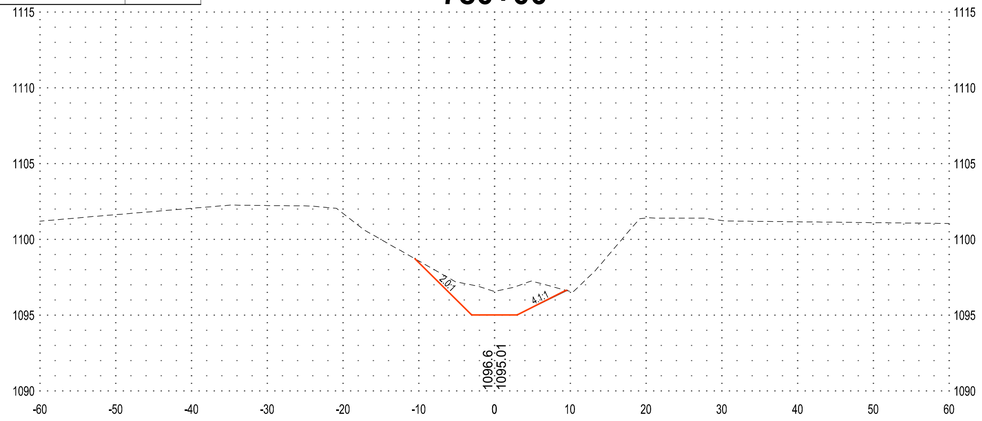

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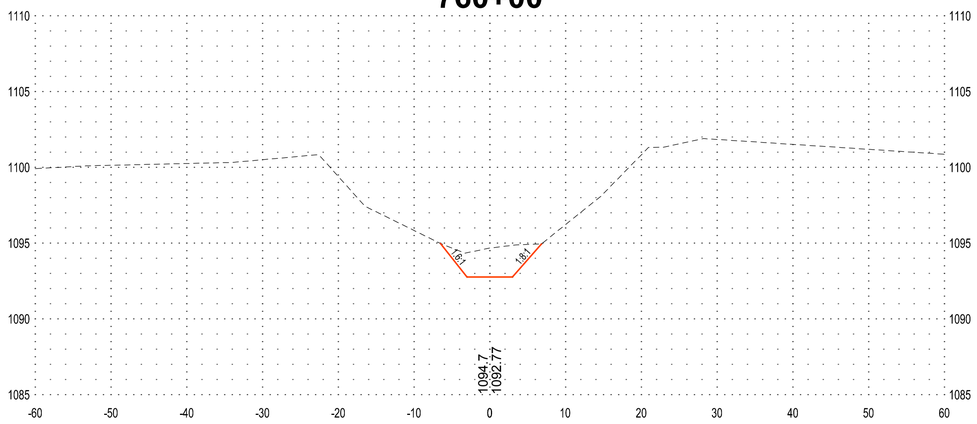

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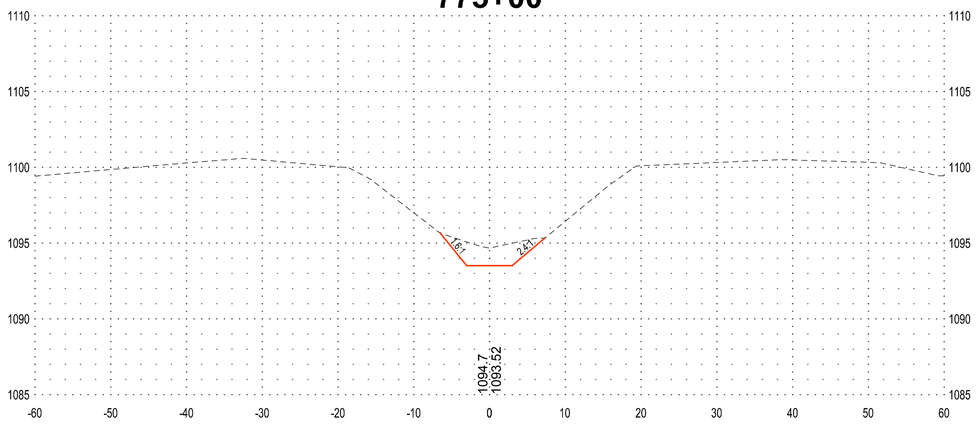

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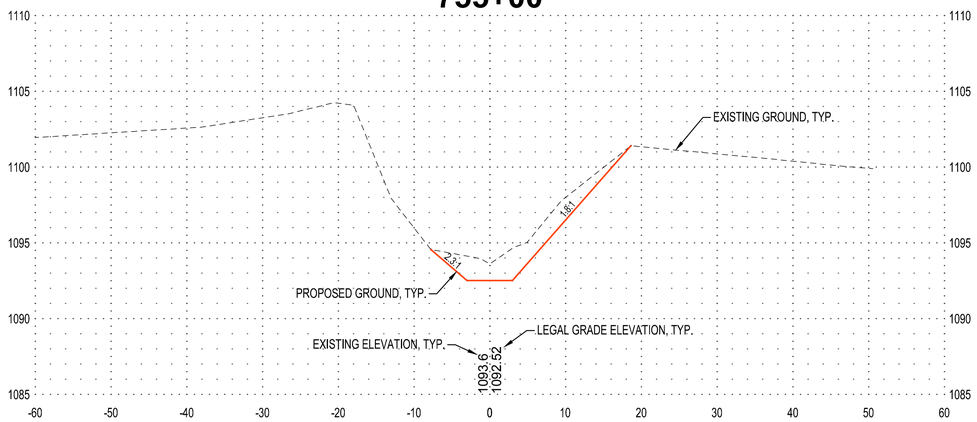

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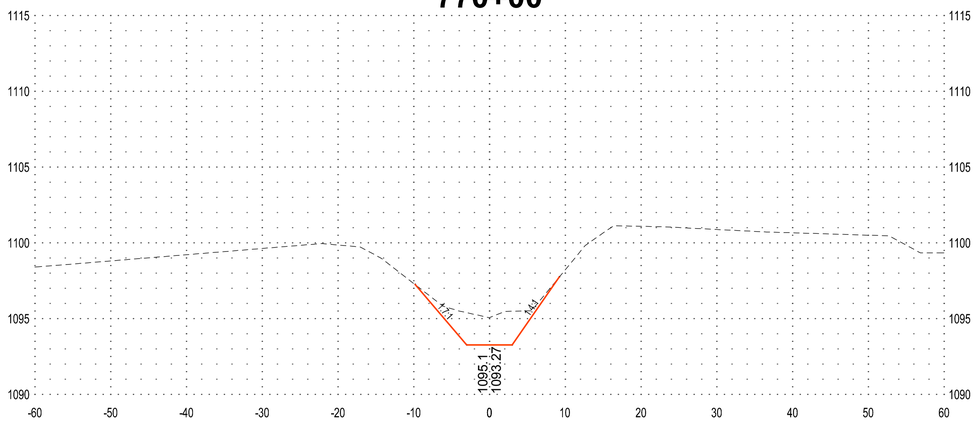

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PROJECT **FARIBAULT COUNTY**

COUNTY DITCH No. 3

FARIBAULT COUNTY MINNESOTA

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	18-21589
CAD FILE NAME	21589 X-SECTIONS
DRAWN BY	JEG
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CLIENT PROJECT NO.	-

TITLE

CROSS-SECTIONS

SHEET

41

OF 41

APPENDIX D:
MULTI-PURPOSE DRAINAGE MANAGEMENT PLAN

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MDM Map (North)

County Ditch 3

Faribault County, Minnesota

Thursday, October 18, 2018

Legend

- Watershed Boundary
- CD3 Open Ditch
- Alternative Side Intakes
- Potential WASCOBs
- Bioreactors
- Grassed Waterways
- Storage Treatment
- Wetland Restorations
- Nutrient Removal Wetlands
- Controlled Drainage
- NWI
- Lakes

PN: 18-21589

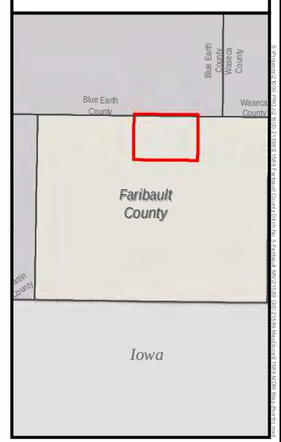
Source:

Orthophotograph (MnGeo WMS, 2017)
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)

N W E S

0 750 1,500 3,000 Feet

1 inch = 3,000 feet



Faribault County Ditch No. 3
Watershed Boundary
Area = 8,340 AC

Faribault County Ditch No. 3
Watershed Boundary
Area = 8,340 AC

MDM Map (South)

County Ditch 3

Faribault County, Minnesota

Thursday, October 18, 2018

Legend

- Watershed Boundary
- CD3 Open Ditch
- Alternative Side Intakes
- Potential WASCOBs
- Bioreactors
- Grassed Waterways
- Storage Treatment
- Wetland Restorations
- Nutrient Removal Wetlands
- Controlled Drainage
- NWI
- Lakes

PN: 18-21589

Source:

Orthophotograph (MnGeo WMS, 2017)
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)

N W E S

0 750 1,500 3,000 Feet

1 inch = 3,000 feet

Blue Earth County
Waseca County
Faribault County
Iowa

APPENDIX E:
WATERSHED ASSESSMENT AND PRIORITIZATION

WATERSHED ASSESSMENT AND PRIORITIZATION FOR:

COUNTY DITCH 3 AND GREATER WATERSHED:

FARIBAULT COUNTY, MINNESOTA

June, 2018

Project No. 18-21589

REPORT FOR:
John Thompson
Faribault County Drainage Authority
415 North Mankato
P.O. Box 130
Blue Earth, MN 56013
507.526.6211
john.thompson@co.faribault.mn.us

FROM:
Chuck Brandel PE
Principal + Senior Civil Engineer
ISG
115 East Hickory Street, Suite 300
Mankato, MN 56001
507.387.6651
chuck.brandel@is-grp.com

ISG

ARCHITECTURE + ENGINEERING + ENVIRONMENTAL + PLANNING

Signature Sheet

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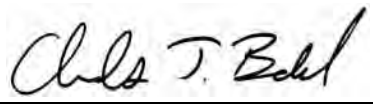


Charles J. Brandel, PE
Project Engineer
Reg. No. 43359

ISG
115 East Hickory Street, Suite 300
Mankato, Minnesota 56001

Watershed Assessment and Prioritization for County Ditch No. 3 and Greater Watershed Faribault County, Minnesota

Engineer's Project Number: 18-21589
Dated this 30th day of June, 2018

TABLE OF CONTENTS

APPENDICES

SCOPE

Faribault County Ditch No. 3 (CD 3) has been chosen as a priority watershed for watershed assessment in Faribault County. The goal of the project is to create a document that will be beneficial and engaging to local staff and landowners on Best Management Practices (BMPs) that will be practical, feasible, and cost effective to help improve water quality. This project will:

1. Determine existing conditions of CD 3 and contributing watersheds
2. Identify practices through ACPF within the CD 3 greater watershed
3. Compile drone footage for use in engaging landowners
4. Create detailed watershed assessment of CD 3 with prioritization based on practicality, feasibility, reduction performance, and cost effectiveness.

This project has received funds through the Minnesota Board of Water and Soil Resources (BWSR) Clean Water Fund. CD 3 is planned to be repaired in the near future and implement many of the BMPs identified throughout the watershed assessment.

BACKGROUND

Faribault County Ditch No. 3 (CD 3) is approximately 8,340 acre watershed located in north central Faribault County. CD 3 watershed lies in Sections 4, 5, 8, 9, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, and 35 of Lura Township; Section 36 of Easton Township; Section 30 and 31 of Minnesota Lake Township; Sections 1, 2, 10, 11, 12, 13, 14, 23, 24, and 25 of Barber Township and Section 7, 18, 19, and 30 of Walnut Lake Township of Faribault County. The watershed is drained by CD 3 public Main open ditch. Ten other drainage systems flow into CD 3 including Faribault County Ditch 7, 10, 11, 16, 19, 20, 43, 70, 89 and Blue Earth-Faribault County Judicial Ditch 9. Therefore, CD 3 outlet serves a 42,940 acre greater watershed.

The CD 3 Main open ditch begins in Section 30 of Walnut Lake Township and flows north. The outlet for CD 3 is located in Section 4 of Lura Township in Faribault County into the Maple River. CD 3 and its greater watershed contributes to the Le Sueur River Watershed. The most downstream portion of CD 3 after the outlet of JD 9, Maple River, and Le Sueur River are listed as impaired for turbidity by the MPCA. There are additional impairments in the waters which CD 3 contributes to including E.coli, macroinvertebrate bioassessments, fish bioassessments, and fecal coliform. Due to impairment and goals set by the Watershed Approach to Restoring and Protecting Strategy (WRAPs) and Watershed Total Maximum Daily Load (TMDL) studies, CD 3 has been identified as a target watershed for conservation planning and implementation for improved water quality.

The watershed consists primarily of agricultural farmland and open ground pasture as well as the City of Easton with a population of approximately 200. The topography throughout the watershed is gently rolling with an elevation difference of approximately 130 feet. Watershed maps are included in Appendix A to illustrate the total contributing watershed for CD 3 and the sub-watersheds for each contributing public drainage system.

WATERSHED ASSESSMENT

A watershed approach was used for the assessment of CD 3. A watershed based assessment focuses on the existing water quality conditions as a starting point for assessment, planning, and implementation. A Watershed Approach to Restoring and Protecting Strategy (WRAPs) Report which includes a broad assessment for Le Sueur River Watershed that includes Watershed Monitoring and Assessment Report, Assessment Report of Selected Lakes within Watershed, Watershed Biotic Stressor Identification Report, and Watershed Total Maximum Daily Load (TMDL) Report was completed. Although these reports broadly assess the Le Sueur River Watershed, it provided available data to use as a starting point when assessing the CD 3 watershed.

To further understand the watershed, water quality assessment and flow analysis was completed on the greater CD 3 watershed. Monitoring data from the WRAPs Report and StreamStats were used to determine the flow and sediment delivery from sub-watersheds draining into CD 3. Water quality map

is included in Appendix A which identifies the areas within the greater CD 3 watershed that water quality monitoring data was collected and the sub-watersheds that were modeled for the WRAPs Report.

Table 1: Contributing Flows and Sediment to CD 3

Drainage System	Watershed Area (ac)	Contributing Flow (%)
CD3	8,340	19%
JD9	6,618	15%
CD43	3,731	9%
CD89	365	1%
CD7	7,213	17%
CD16	1,408	3%
CD20	13,056	30%
CD10	1,088	3%
CD70	755	2%

Drainage System	Basin Loading Rate (tons/acre/yr)	Watershed Area (ac)	Contributing Sediment (%)
CD 3 Outlet	0.077	734	17%
JD9	0.074	6,601	16%
Middle CD 3, CD 43, CD 89	0.103	6,205	23%
CD 7, CD 11, CD 19	0.101	7,218	22%
Upstream CD 3, CD 20, CD 70, CD 16, CD 10	0.093	22,639	21%

Since CD 3 watershed is over 90% agricultural land with relatively flat and poorly drained soils, much of the surround land utilizes subsurface drainage tiles. Therefore, a multi-purpose drainage management was considered. Multi-purpose drainage management incorporates Best Management Practices (BMPs) which utilize effective measures aimed at reducing sediment and nutrient loading, and improving water quality; all while protecting or improving drainage. BMPs were identified from the drainage manual and NRCS practice standards. These BMPs are divided into three areas: preventative measures, control measures, and treatment measures.

Preventative Measures

Preventative measures that can be applied throughout the watershed include crop rotation, cover crops, residue management, and nutrient management. These measures are aimed at controlling sediment, minimizing erosion and nutrient loss, and sustaining the soils health, all without dramatically changing the current land use of the landscape. Soil conservation and soil health are the foundation to watershed management within agricultural settings.

Preventative measures can be implemented throughout the CD 3 watershed to create more organic matter within the soil profile, increase infiltration capacity, and create more sustainable soils all in an effort to reduce erosion. Residue management and cover crops were identified as needed in many areas throughout CD 3 watershed as well as its greater contributing watershed. Soil health and management will need to be analyzed on a field by field basis. Faribault County Soil and Water Conversation District (SWCD) and Natural Resource Conservation Service (NRCS) representatives can assist landowners in individualized assessment for conservation land management opportunities. It will continue to be a goal of the Faribault County to promote these practices and conversations with landowners as it is one of the major contributors to the sediment loading in CD 3 as well as downstream in the Maple and Le Sueur River.

Ditch Bank Stabilization
Ditch Bank Stabilization consists of reconfiguring channel geometry or installing a structure to control the grade and head cutting of water. Large areas of erosion were identified along the ditch channel where there were bends, limited buffer strips, and/or erosive soils. In areas where under cutting of banks takes place due to existing channel geometry or erosive soils, side slope flattening and reconfiguring of channel geometry is recommended. In areas where channel geometry and soils are appropriate, sloughs will be repaired and seeded with vegetation.

Control Measures

A structure for water control in a drainage management system either conveys water, controls flow direction and rate, or maintains a desired water elevation. Examples of control measures include alternative tile intakes, grassed waterways, contour buffer strips, two stage ditches, water control structures, and controlled subsurface drainage. These practices are directly linked to the conveyance of subsurface tile water or open channel ditch flow.

Grassed Waterways
Grassed waterways are installed to reduce the risk of concentrated flow (gully) erosion. This practice is effective in preventing gully erosion as the growing grasses can reduce mean velocity of runoff, which discourages soil detachment. Grass vegetation also provides a physical barrier to prevent gully formation and the fibrous root systems of grasses lead to increased soil strength, which can limit detachment of soil particles. Grassed waterways are typically placed in steep sloped areas with concentrated flows subject to erosion.

Controlled Drainage
A controlled drainage system is a water table management practice that raises the in-field water table during year, thereby reducing overall tile drainage volume. There are several locations within this watershed where controlled subsurface drainage is feasible and would have beneficial impacts towards water quality and crop production. The locations have ideal characteristics such as an elevation variation of 1 to 2 feet over an average of 10 acres. Controlled subsurface drainage areas would contain tiling placed between 3 and 4 feet below the ground surface. The tiling would be placed parallel with the contours rather than perpendicular like traditional tiling. A water control structure would be placed on the field tile mainline and would be spaced at every 1 to 2 foot elevation difference. The structures would contain adjustable stop logs which hold water in the tile during the growing season while allowing drainage during the spring plant and fall harvest.

Treatment Measures

The function of treatment measures is to improve water quality by directly removing sediment and nutrients from the subsurface or surface water flow throughout a watershed. Examples of treatment measures include storage ponds/flood plain storage, filter/buffer strips, wetland restorations, wetland enhancements, woodchip bioreactors, and water and sediment control basins (WASCOBs). These practices may be incorporated to either public or private drainage systems.

Wetland Restoration
Wetland restorations are re-establishing basins that were prehistoric wetlands and were drained for agricultural production. Benefits of a wetland restoration include reduced peak flow rates, sedimentation, nutrient reductions, wildlife enhancement, and overall improved water quality. There are many programs available for wetland restorations and include wetland banking, RIM-WRP, CREP, and through various NRCS programs.

Constructed Treatment Wetland
Constructed treatment wetlands are generally located in low-lying areas that would otherwise be saturated during rain events. Constructed wetlands use embankments such as berms or overflow weirs to hold agricultural drainage water to be treated. Constructed wetland benefits are similar to wetland restorations in that they include reduced peak flow rates, sedimentation, nutrient reductions, wildlife

enhancement, and overall improved water quality. There are many programs available for constructed treatment wetlands and include wetland banking, RIM-WRP, CREP, and through various NRCS programs.

Wetland Enhancements
Wetland Enhancements are implemented to enhance existing wetland areas. Wetland enhancements include but are not limited to increasing wetland storage by adding additional hydrology to the site, expanding the wetland footprint, or allowing agricultural drainage water treatment. By enhancing the wetland, it can add additional water quality benefits including increased sedimentation, nutrient reduction, and reduced peak flows.

Storage Ponds/Flood Plain Storage
A storage pond or flood plain storage is an excavated area or existing low lying basin designed to hold water, trap sediment, and reduce peak flowrates. Many variation of storage pond and flood plain storage can be engineered to allow water to enter and exit in a controlled manner to produce these benefits. For example, a surge storage pond can be excavated to treat subsurface drainage water to temporarily store water and help reduce peak flowrates. Storage can also be design within an existing low lying basin in which water is control to only enter during large rain event for additional flood storage.

Water and Sediment Control Basins (WASCOBs)
Water and sediment control basins (WASCOBs) are an earth embankment placed perpendicular to the water flow direction on a moderate to steep hillside of an agricultural area. The primary goal of a WASCOB is to improve the ability to farm steep sloped areas of farmland by reducing gully erosion. They are placed in areas that experience gully erosion and steep side slopes or can be placed adjacent to ditch banks experience gully erosion. They are designed to temporarily pool water on the hillside behind the embankment, thus reducing peak surface flow, reduce erosion, and provide an area for sedimentation.

Woodchip Bioreactor
The use of a woodchip bioreactor is method of removing nitrate from a subsurface drainage waters. Carbon from the woodchip is used by bacteria to break down nitrates through the process of denitrification. Construction of a woodchip bioreactor includes excavating a trench in line with the drainage tile system, filling the trench with woodchips, and installing water control structures to manage water levels in the trench. Woodchip bioreactors typically reduce nitrate loading by 30-60 percent and can reduce up to 90 percent under base flow conditions.

Alternative Side Inlets
Alternative side inlet structures replace open surface intakes that are level with the existing ground and convey water through the ditch bank. They are also placed along open ditches where gully erosion is occurring through the ditch bank. The goal of an alternative side inlet is to prevent erosion through the ditch bank and keep sediment and debris from entering the open channel. An alternative side inlet contains a drop structure behind the ditch bank with a later pipe entering the open channel. Various intakes can be place on the drop structure and include Hickenbottom, trash grate, perforated risers, or rock inlets. Alternative side inlets are recommended for areas with existing surface inlets, where gully erosion occurs through the ditch bank, or where large surface flow enters the ditch.

Methods

An analysis was performed on the greater CD 3 watershed using the Agricultural Conservation Planning Framework (ACPF). ACPF uses compiled data including topography, field boundary, land management, and soils to determine where BMPs may be implemented. Practices were identified through the greater CD 3 watershed to identify upstream opportunities throughout the entire contributing watershed. Practices identified through ACPF include: grassed waterways, water and sediment control basins, contour buffer strips, bioreactors, controlled drainage, and nutrient reduction wetlands. Although, a very useful tool, field verification is needed to determine feasibility and practicality of implementation. A geodatabase was compiled with all the results produced from ACPF for the greater CD 3 watershed.

Through CD 3 a more detailed analysis was completed. Drone flight was completed on CD 3 to analysis "on-ditch" practices. Further review was completed by analyzing LIDAR contours to identify low lying areas for storage and wetland restoration and areas of large slope where erosive, concentrated flow may take place. These practices were identified and combined with the feasible outputs from ACPF.

Reduction Potential Analysis

Sediment reductions were calculated using the BWSR Pollution Reduction Calculator and RUSLE2. RUSLE2 takes into consideration the geographic rainfall characteristics, soil type, slope, slope length, cropping practices, and conservation measures. The inputs for RUSLE2 were gathered using LIDAR and NRCS Web Soil Survey. Available studies on reduction potential and monitoring data from project implemented in the area were used as a reference when conservation practices were not an available input in RUSLE2 or BWSR Pollution Reduction Calculator.

Although pollution reduction can be estimated using tools such as BWSR Pollution Reduction Calculator and RUSLE2, actual reductions greatly depend on correct size and location of installation and maintenance of the practice. Pollution reduction estimations are a very useful tool in prioritization of watershed planning, but should not be used to represent actual reduction of total loads after the installation of the practice.

Cost Estimates

Estimated cost for each project includes the cost of materials, construction, and installation of the practice. Costs were determined using average prices from similar projects and materials. Costs were generally determined on a per linear foot or acre basis and also includes mobilization and contingency cost. Cost structures are outlined below.

Table 2: Cost Layout

Grassed Waterway		
Grassed Waterway	$ 8.00	LF
10% Contingency	$ 0.80	LF
Subtotal	$ 8.80	LF
Mobilization	$ 1,500.00	LS
Alternative Side Inlets		
24-Inch Trash Grate	$ 2,460.00	EA
18-Inch Trash Grate	$ 2,230.00	EA
15-Inch Trash Grate	$ 2,000.00	EA
12-Inch Trash Grate	$ 1,700.00	EA
12-Inch Hickenbottom	$ 1,820.00	EA
10-Inch Hickenbottom	$ 1,530.00	EA
8-Inch Hickenbottom	$ 1,440.00	EA
24-Inch Trash Grate w/ Riprap Overflow	$ 3,700.00	EA
18-Inch Trash Grate w/ Riprap Overflow	$ 3,470.00	EA
10% Contingency	Price Varies	LS
Mobilization	$ 1,500.00	LS
Water and Sediment Control Basins		
WASCOBS	$ 3,430.00	EA
10% Contingency	$ 343.00	EA
Mobilization	$ 2,000.00	LS

Ditch Bank Stabilization		
Slough Repair	$ 4.25	LF
Flattening Slide Slopes	$ 2.30	LF
10% Contingency	$ 0.66	LF
Subtotal	$ 7.21	LF
Mobilization	$ 1,000.00	LS
Wetlands		
Wetland	$ 2,770.00	AC
Land Acquisition	$ 6,500.00	AC
10% Contingency	$ 277.00	AC
Subtotal	$ 9,547.00	AC
Mobilization	$ 6,500.00	LS
Storage Pond/Flood Plain Storage		
Pond/Flood Plain Storage	$35,000.00	AC
Land Acquisition	$ 6,500.00	AC
10% Contingency	$ 4,150.00	AC
Subtotal	$45,650.00	AC
Mobilization	$15,000.00	LS

Prioritization

Prioritization of practices identified were determined based on its likelihood to be implemented. Practices likely to be implemented within CD 3 will have low cost for large amount of sediment removal and feasible project design. Each practice within the CD 3 watershed was given a rank based on the criteria listed above to prioritize the practices.

Practices identified and prioritized within the CD 3 watershed include practices that help to reduce sediment load to receiving waters. Due to phosphorus affinity to bind to sediment, the practices also help to remove phosphorus and, therefore, also reduce nutrient load to receiving waters. Practices included in prioritization include: grassed waterways, alternative side inlets (ASI), water and sediment control basins (WASCOB), ditch bank stabilization, wetland restorations, and storage ponds/flood plain storage. Although additional outputs such as controlled drainage and denitrifying bioreactors were identified through ACPF, these practices are not aimed at sediment removal, and therefore, did not receive a rank. The outputs locations are still available in the included geodatabase to be used and promoted to landowners as these practices still provide water quality benefits.

FUNDING

There are several outside funding sources available to assist in paying for practices that help to improve water quality. A main source of funding for this type of project is through the BWSR Clean Water Fund (CWF). The primary purpose of activities funded with grants associated with the CWF is to restore, protect and enhance water quality. One CWF grant program is the Multipurpose Drainage Management Grant. This grant is geared towards implementing practices that will reduce the transport of sediment and nutrient loads. Some practices that have been funded in the past include grade stabilization, grassed waterways, water and sediment control basins, alternative side inlets, saturated buffers, storage wetlands, denitrifying bioreactors, etc.

Faribault County is a part of the Greater Blue Earth River Basin Alliance (GBERBA). GBERBA is a watershed alliance made up of ten counties that work collectively to improve water quality throughout the Blue Earth River watershed. Using the watershed approach and knowledge base of commissioners, local water management staff, SWCD staff, and other government agencies, the alliance works to secure funding for its watershed. Currently, GBERBA has funding to support projects with Conservation Drainage, TMDL implementation, Multi-Purpose Drainage, and Minnesota Agricultural Water Quality Certification.

Another potential source is the Legislative-Citizen Commission on Minnesota Resources (LCCMR) Environment and Natural Resources Trust Fund (ENRTF) which was established to provide funding for activities that protect, conserve, preserve, and enhance Minnesota's "air, water, land, fish, wildlife, and other natural resources." The LCCMR prioritizes innovative ideas that provide multiple benefits.

For practices that are not directly associated with public drainage systems, individual landowners may pursue financial assistance. The Agriculture Best Management Practices (BMP) Loan Program provides loans to rural landowners to encourage BMPs that help counteract pollution problems. Another option for individual landowners that are interested in pursuing additional practices is the Environmental Quality Incentives Program (EQIP) is a voluntary program through the NRCS that provides financial assistance to individual landowners for various conservative practices as identified above.

In addition, the BWSR Community Partners Grant may be an option. This grant leverages the interest of non-governmental partners such as lake and river associations, boy/girl scout troops and other civic groups to install on-the ground projects that reduce runoff and keep water on the land. It also allows for multiple local government units to work together on a project that involves the Community Partners Grant. Projects installed with the Community Partners Grant are intended to be structural or vegetative practices designed to reduce runoff and/or keep water on the land.

All of the water quality measures proposed with this project are applicable for some source of outside funding. These grants can be applied for, if there is support from the drainage authority and/or interest from individual landowners.

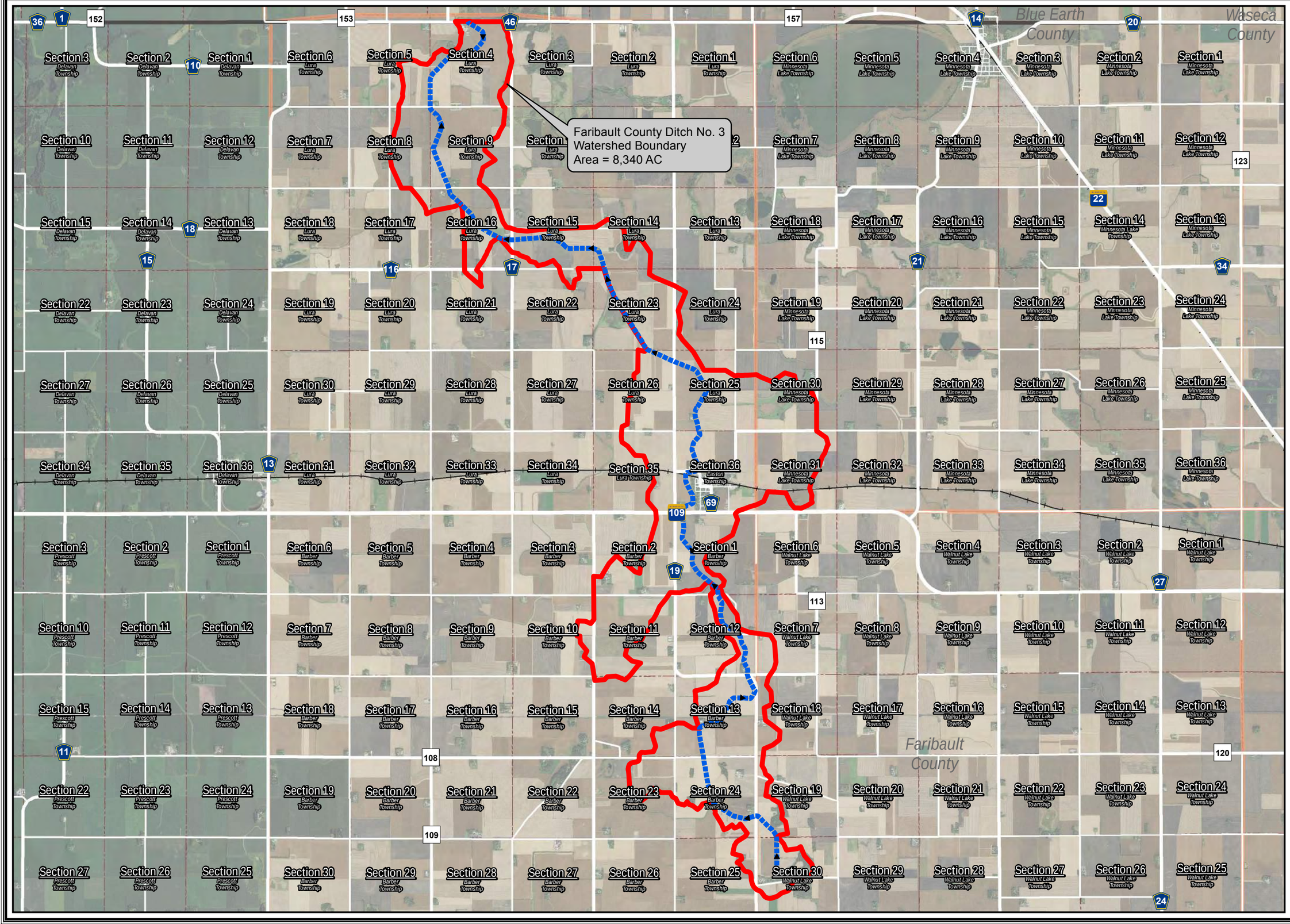
RECOMMENDATIONS

CD 3, a priority watershed, has been assessed and conservation practices project locations have been identified. Practices that have been identified that will help to meet Le Sueur River Watershed water quality goals by reducing sediment delivery. The ACPF tool has been run on the CD 3 greater watershed and a geodatabase has been complied with the identified practice locations. By analyzing the upper

watershed for CD 3, upstream practices are identified to help prevent sediment delivery to the CD 3 watershed. A more detailed analysis of CD 3 was completed which complied outputs from ACPF and additional practices identified through drone video and LIDAR review. Sediment delivery and potential reductions from each practice were calculated and costs were estimated for construction and implementation of practice. The practices were then prioritized based on practicality, feasibility, reduction performance, and cost effectiveness. The practice prioritization will help to engage local staff and landowners on targeting practices that will have the most impact on the watershed at the lowest cost.

CD 3 is planned to be repaired in the near future. During this time, this information can be shared with the landowners within the watershed to help promote implementation. "On-ditch" practices that can be implemented during the CD 3 repair can be selected and conversations to gain support from landowners can being. Funding opportunities can be sought after for all the practices outlined through the prioritization to assist with cost. This document and geodatabase can be continued to be utilized to continue promotion of conservation practices and implementation.

APPENDIX A: EXHIBITS



Watershed Map

County Ditch 3

Faribault County, Minnesota

Tuesday, August 28, 2018

Legend

- CD3 Open Ditch
- CD3 Watershed

PN: 18-21589

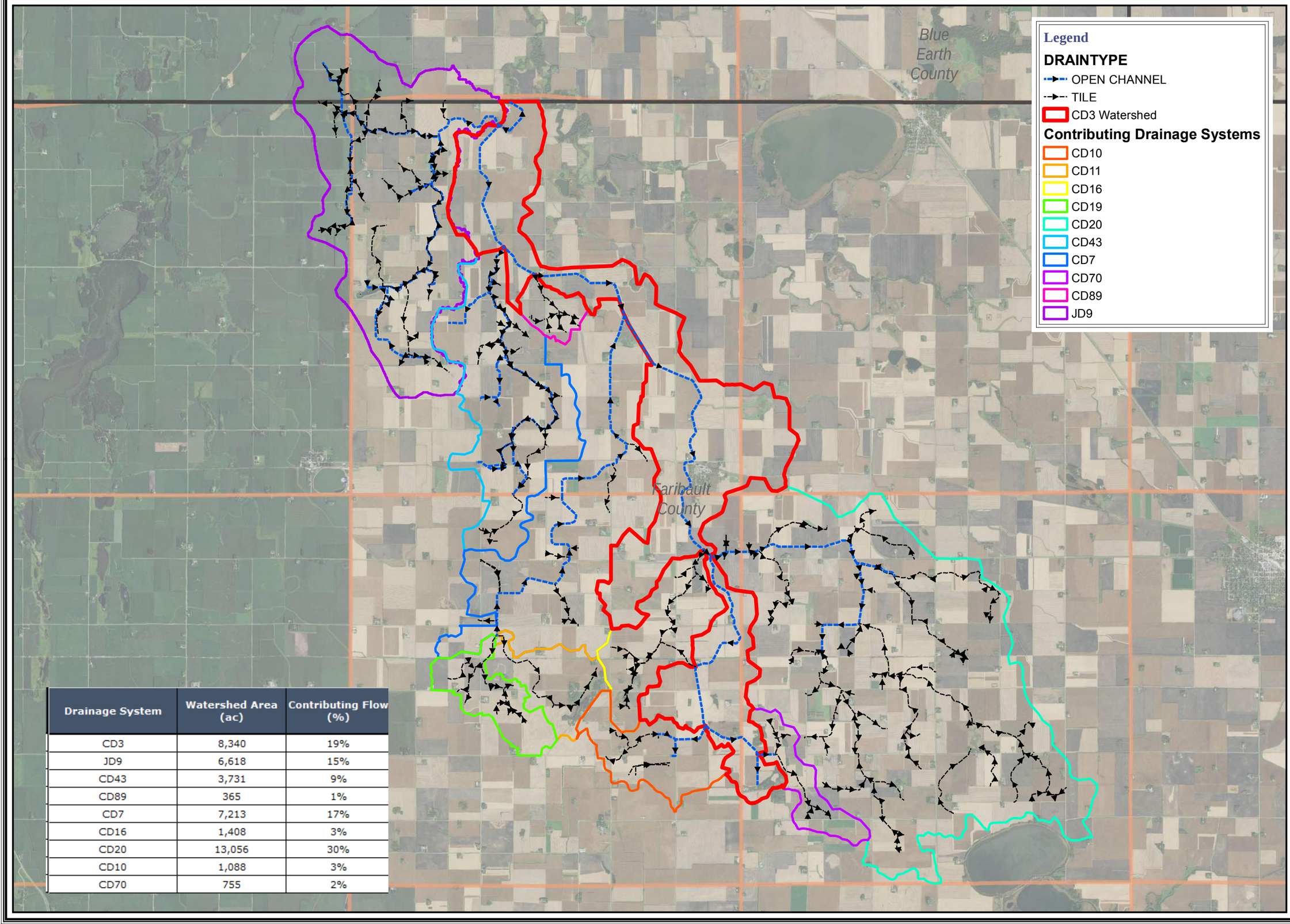
Source:

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

N W E S

0 1,300 2,600 5,200 Feet

1 inch = 5,667 feet



Drainage System	Watershed Area (ac)	Contributing Flow (%)
CD3	8,340	19%
JD9	6,618	15%
CD43	3,731	9%
CD89	365	1%
CD7	7,213	17%
CD16	1,408	3%
CD20	13,056	30%
CD10	1,088	3%
CD70	755	2%

ISG

Watershed Map

County Ditch 3

Faribault County, Minnesota

Thursday, July 26, 2018

PN: 18-21589

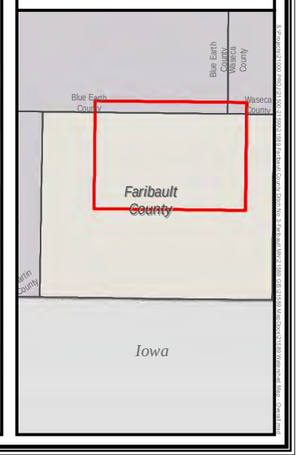
Source:

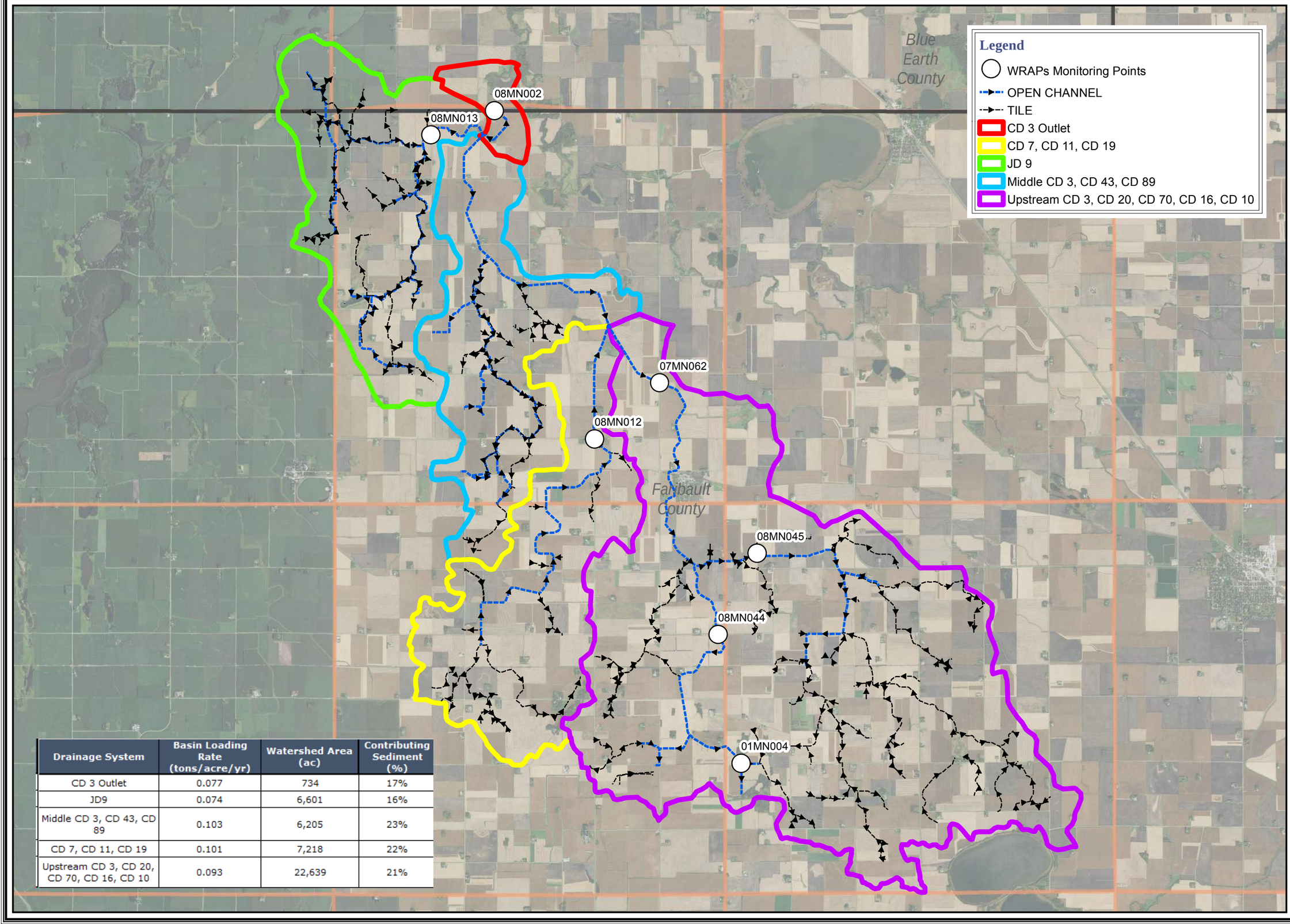
Orthophotograph (MnGeo WMS, 2015)
Tile/Ditch (XX County, 12/16/2016)
Parcels (XX County, 12/16/2016)
Lakes (MN DNR, July, 2008)
Major Stream (MN DNR, July 2008)
Counties (MN DNR, July 2013)
PLSS (MnGeo/USGS)

N
W E
S

0 1,700 3,400 6,800 Feet

1 inch = 7,083 feet





Drainage System	Basin Loading Rate (tons/acre/yr)	Watershed Area (ac)	Contributing Sediment (%)
CD 3 Outlet	0.077	734	17%
JD9	0.074	6,601	16%
Middle CD 3, CD 43, CD 89	0.103	6,205	23%
CD 7, CD 11, CD 19	0.101	7,218	22%
Upstream CD 3, CD 20, CD 70, CD 16, CD 10	0.093	22,639	21%

WRAPs Water Quality Monitoring

County Ditch 3

Faribault County, Minnesota

Thursday, July 26, 2018

PN: 18-21589

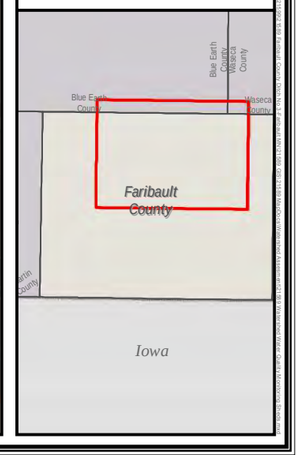
Source:

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

N
W E
S

0 1,700 3,400 6,800 Feet

1 inch = 7,083 feet



APPENDIX B:
PRACTICE PRIORITIZATION

Faribault County
County Ditch No. 3

PRIORITIZATION

Rank	Practice ID	Practice Type	Size	Units	Sediment Reduction (ton/yr)	Cost	Cost Per Sediment Reduction ($/ton/yr)
1	DS-1	Ditch Bank Stabilization	126	LF	32.2	$ 1,825	$ 56.69
2	DS-2	Ditch Bank Stabilization	100	LF	25.0	$ 1,425	$ 57.00
3	DS-3	Ditch Bank Stabilization	135	LF	32.9	$ 1,884	$ 57.22
4	DS-4	Ditch Bank Stabilization	83	LF	27.3	$ 1,698	$ 62.20
5	DS-5	Ditch Bank Stabilization	92	LF	22.1	$ 1,391	$ 62.94
6	ASI-1	Alternative Side Inlets	12" Trash Grate	LS	50.0	$ 3,370	$ 67.37
7	ASI-2	Alternative Side Inlets	15'' Trash Grate	LS	50.0	$ 3,370	$ 67.37
8	DS-6	Ditch Bank Stabilization	80	LF	22.5	$ 1,524	$ 67.73
9	ASI-3	Alternative Side Inlets	12" Standard Hickenbottom	LS	48.9	$ 3,502	$ 71.57
10	ASI-4	Alternative Side Inlets	15" Trash Grate	LS	50.0	$ 3,700	$ 73.96
11	DS-7	Ditch Bank Stabilization	125	LF	20.0	$ 1,531	$ 76.56
12	GW-1	Grassed Waterways	297	LF	53.5	$ 4,116	$ 76.98
13	GW-2	Grassed Waterways	609	LF	89.0	$ 6,859	$ 77.04
14	ASI-5	Alternative Side Inlets	24'' Trash Grate	LS	71.8	$ 5,570	$ 77.56
15	GW-3	Grassed Waterways	536	LF	73.7	$ 6,221	$ 84.42
16	WETLAND-1	Wetland	5	AC	118.5	$ 55,062	$ 87.21
17	DS-8	Ditch Bank Stabilization	151	LF	21.1	$ 1,989	$ 94.09
18	DS-9	Ditch Bank Stabilization	93	LF	17.1	$ 1,609	$ 94.32
19	DS-10	Ditch Bank Stabilization	50	LF	12.5	$ 1,213	$ 97.00
20	GW-4	Grassed Waterways	176	LF	31.0	$ 3,050	$ 98.29
21	WETLAND-2	Wetland	5	AC	71.8	$ 58,349	$ 99.79
22	ASI-6	Alternative Side Inlets	12" Trash Grate	LS	33.5	$ 3,370	$ 100.66
23	GW-5	Grassed Waterways	324	LF	43.1	$ 4,355	$ 100.95
24	DS-11	Ditch Bank Stabilization	65	LF	12.3	$ 1,276	$ 104.01
25	DS-12	Ditch Bank Stabilization	68	LF	12.3	$ 1,289	$ 104.54
26	DS-13	Ditch Bank Stabilization	50	LF	11.2	$ 1,213	$ 108.16
27	GW-6	Grassed Waterways	200	LF	30.0	$ 3,260	$ 108.75
28	GW-7	Grassed Waterways	166	LF	27.0	$ 2,963	$ 109.75
29	DS-14	Ditch Bank Stabilization	313	LF	27.4	$ 3,050	$ 111.36
30	ASI-7	Alternative Side Inlets	18" Trash Grate	LS	46.2	$ 5,317	$ 115.20
31	DS-15	Ditch Bank Stabilization	25	LF	9.5	$ 1,106	$ 117.06
32	GW-8	Grassed Waterways	233	LF	30.3	$ 3,553	$ 117.30
33	DS-16	Ditch Bank Stabilization	25	LF	9.4	$ 1,106	$ 117.44
34	GW-9	Grassed Waterways	420	LF	43.1	$ 5,196	$ 120.42
35	DS-17	Ditch Bank Stabilization	85	LF	11.2	$ 1,361	$ 121.32
36	DS-18	Ditch Bank Stabilization	120	LF	14.6	$ 1,786	$ 122.25
37	DS-19	Ditch Bank Stabilization	234	LF	20.5	$ 2,533	$ 123.67
38	ASI-8	Alternative Side Inlets	10" Standard Hickenbottom	LS	37.5	$ 4,683	$ 125.03
39	DS-20	Ditch Bank Stabilization	25	LF	8.8	$ 1,106	$ 125.85
40	DS-21	Ditch Bank Stabilization	62	LF	11.2	$ 1,406	$ 126.11
41	DS-22	Ditch Bank Stabilization	55	LF	10.8	$ 1,360	$ 126.18
42	DS-23	Ditch Bank Stabilization	85	LF	12.3	$ 1,557	$ 126.77
43	DS-24	Ditch Bank Stabilization	72	LF	9.9	$ 1,306	$ 132.45
44	DS-25	Ditch Bank Stabilization	78	LF	10.9	$ 1,511	$ 138.36
45	DS-26	Ditch Bank Stabilization	60	LF	8.9	$ 1,255	$ 141.33
46	DS-27	Ditch Bank Stabilization	168	LF	14.7	$ 2,100	$ 142.88
47	DS-28	Ditch Bank Stabilization	75	LF	9.2	$ 1,319	$ 143.03
48	ASI-9	Alternative Side Inlets	10" Slotted Hickenbottom	LS	22.2	$ 3,183	$ 143.38
49	GW-10	Grassed Waterways	250	LF	25.8	$ 3,699	$ 143.50
50	DS-29	Ditch Bank Stabilization	60	LF	8.6	$ 1,255	$ 146.78
51	DS-30	Ditch Bank Stabilization	25	LF	7.5	$ 1,106	$ 147.50
52	ASI-10	Alternative Side Inlets	12'' Trash Grate	LS	21.9	$ 3,370	$ 153.74
53	DS-31	Ditch Bank Stabilization	55	LF	7.9	$ 1,234	$ 156.57
54	DS-32	Ditch Bank Stabilization	65	LF	9.1	$ 1,426	$ 156.68
55	ASI-11	Alternative Side Inlets	12'' Standard Hickenbottom	LS	22.0	$ 3,502	$ 159.18
56	DS-33	Ditch Bank Stabilization	62	LF	8.8	$ 1,406	$ 159.42
57	DS-34	Ditch Bank Stabilization	75	LF	9.2	$ 1,491	$ 162.98
58	ASI-12	Alternative Side Inlets	10" Slotted Hickenbottom	LS	19.2	$ 3,183	$ 165.82
59	DS-35	Ditch Bank Stabilization	25	LF	6.5	$ 1,106	$ 170.19
60	GW-11	Grassed Waterways	294	LF	23.9	$ 4,089	$ 170.72

Faribault County
County Ditch No. 3

PRIORITIZATION

Rank	Practice ID	Practice Type	Size	Units	Sediment Reduction (ton/yr)	Cost	Cost Per Sediment Reduction ($/ton/yr)
61	ASI-13	Alternative Side Inlets	12" Standard Hickenbottom	LS	20.3	$ 3,502	$ 172.51
62	DS-36	Ditch Bank Stabilization	65	LF	8.2	$ 1,426	$ 173.87
63	DS-37	Ditch Bank Stabilization	35	LF	6.5	$ 1,149	$ 176.73
64	GW-12	Grassed Waterways	454	LF	31.0	$ 5,495	$ 177.23
65	DS-38	Ditch Bank Stabilization	45	LF	7.2	$ 1,295	$ 179.83
66	GW-13	Grassed Waterways	195	LF	17.6	$ 3,219	$ 183.10
67	GW-14	Grassed Waterways	567	LF	35.1	$ 6,493	$ 185.19
68	DS-39	Ditch Bank Stabilization	51	LF	7.1	$ 1,334	$ 186.84
69	WETLAND-3	Wetland	23	AC	137.7	$ 222,172	$ 188.12
70	DS-40	Ditch Bank Stabilization	45	LF	6.9	$ 1,295	$ 188.74
71	WETLAND-4	Wetland	22	AC	88.4	$ 218,128	$ 192.75
72	GW-15	Grassed Waterways	361	LF	24.1	$ 4,679	$ 193.85
73	GW-16	Grassed Waterways	354	LF	23.7	$ 4,617	$ 194.51
74	DS-41	Ditch Bank Stabilization	95	LF	8.2	$ 1,622	$ 197.11
75	DS-42	Ditch Bank Stabilization	35	LF	5.7	$ 1,149	$ 201.54
76	GW-17	Grassed Waterways	296	LF	20.2	$ 4,107	$ 202.94
77	ASI-14	Alternative Side Inlets	12" Standard Hickenbottom	LS	16.5	$ 3,502	$ 212.24
78	GW-18	Grassed Waterways	474	LF	26.5	$ 5,671	$ 213.86
79	DS-43	Ditch Bank Stabilization	25	LF	5.0	$ 1,106	$ 221.25
80	DS-44	Ditch Bank Stabilization	25	LF	5.0	$ 1,106	$ 221.25
81	DS-45	Ditch Bank Stabilization	25	LF	5.0	$ 1,106	$ 221.25
82	WASCOB-1	Water and Sediment Control Basins	1	LS	25.7	$ 5,775	$ 224.89
83	ASI-15	Alternative Side Inlets	24" Trash Grate	LS	24.4	$ 5,570	$ 228.23
84	ASI-16	Alternative Side Inlets	15" Trash Grate	LS	16.1	$ 3,700	$ 230.10
85	GW-19	Grassed Waterways	550	LF	27.5	$ 6,340	$ 230.26
86	ASI-17	Alternative Side Inlets	10" Slotted Hickenbottom	LS	13.6	$ 3,183	$ 233.70
87	ASI-18	Alternative Side Inlets	18" Trash Grate	LS	22.3	$ 5,317	$ 238.70
88	GW-20	Grassed Waterways	236	LF	14.9	$ 3,578	$ 240.08
89	GW-21	Grassed Waterways	190	LF	13.1	$ 3,172	$ 242.25
90	GW-22	Grassed Waterways	660	LF	29.2	$ 7,308	$ 249.89
91	GW-23	Grassed Waterways	380	LF	18.5	$ 4,845	$ 261.76
92	WASCOB-2	Water and Sediment Control Basins	1	LS	21.8	$ 5,775	$ 264.70
93	ASI-19	Alternative Side Inlets	12" Trash Grate	LS	12.6	$ 3,370	$ 266.72
94	WASCOB-3	Water and Sediment Control Basins	1	LS	20.5	$ 5,775	$ 281.10
95	GW-24	Grassed Waterways	179	LF	10.5	$ 3,073	$ 293.66
96	GW-25	Grassed Waterways	980	LF	34.4	$ 10,124	$ 293.95
97	GW-26	Grassed Waterways	266	LF	12.8	$ 3,841	$ 300.87
98	WASCOB-4	Water and Sediment Control Basins	1	LS	18.5	$ 5,775	$ 312.83
99	GW-27	Grassed Waterways	231	LF	11.0	$ 3,532	$ 321.87
100	GW-28	Grassed Waterways	178	LF	9.4	$ 3,065	$ 327.44
101	GW-29	Grassed Waterways	168	LF	8.7	$ 2,976	$ 341.21
102	GW-30	Grassed Waterways	385	LF	14.2	$ 4,888	$ 343.32
103	ASI-20	Alternative Side Inlets	12" Trash Grate	LS	9.4	$ 3,370	$ 359.47
104	WASCOB-5	Water and Sediment Control Basins	1	LS	15.1	$ 5,775	$ 383.15
105	GW-31	Grassed Waterways	246	LF	9.1	$ 3,668	$ 404.18
106	ASI-21	Alternative Side Inlets	12" Slotted Hickenbottom	LS	8.5	$ 3,502	$ 413.46
107	GW-32	Grassed Waterways	480	LF	13.5	$ 5,724	$ 425.10
108	ASI-22	Alternative Side Inlets	12" Slotted Hickebottom	LS	8.1	$ 3,502	$ 433.15
109	GW-33	Grassed Waterways	383	LF	10.9	$ 4,870	$ 446.51
110	WETLAND-5	Wetland	2	AC	53.5	$ 23,947	$ 447.70
111	GW-34	Grassed Waterways	1143	LF	24.6	$ 11,558	$ 469.29
112	GW-35	Grassed Waterways	1550	LF	32.0	$ 15,140	$ 472.57
113	GW-36	Grassed Waterways	265	LF	7.0	$ 3,832	$ 549.36
114	GW-37	Grassed Waterways	194	LF	5.5	$ 3,208	$ 579.43
115	WASCOB-6	Water and Sediment Control Basins	1	LS	9.9	$ 5,775	$ 581.55
116	GW-38	Grassed Waterways	270	LF	6.4	$ 3,874	$ 601.21
117	GW-39	Grassed Waterways	206	LF	5.0	$ 3,315	$ 659.36
118	GW-40	Grassed Waterways	305	LF	6.0	$ 4,181	$ 700.37
119	GW-41	Grassed Waterways	548	LF	9.0	$ 6,327	$ 702.03
120	WETLAND-6	Wetland	4	AC	59.1	$ 41,904	$ 708.62

Faribault County
County Ditch No. 3

PRIORITIZATION

Rank	Practice ID	Practice Type	Size	Units	Sediment Reduction (ton/yr)	Cost	Cost Per Sediment Reduction ($/ton/yr)
121	GW-42	Grassed Waterways	173	LF	4.3	$ 3,022	$ 710.16
122	GW-43	Grassed Waterways	361	LF	6.6	$ 4,673	$ 710.82
123	ASI-23	Alternative Side Inlets	12" Trash Grate	LS	4.7	$ 3,370	$ 717.02
124	GW-44	Grassed Waterways	1010	LF	14.1	$ 10,388	$ 735.67
125	ASI-24	Alternative Side Inlets	10" Slotted Hickenbottom	LS	4.3	$ 3,183	$ 740.23
126	GW-45	Grassed Waterways	316	LF	4.9	$ 4,284	$ 878.18
127	GW-46	Grassed Waterways	410	LF	5.8	$ 5,108	$ 878.72
128	POND-1	Storage Pond/Flood Plain Storage	4	AC	193.9	$ 176,082	$ 907.95
129	WASCOB-7	Water and Sediment Control Basins	1	LS	6.2	$ 5,775	$ 926.44
130	GW-47	Grassed Waterways	338	LF	4.8	$ 4,473	$ 939.08
131	GW-48	Grassed Waterways	537	LF	6.6	$ 6,222	$ 947.63
132	POND-2	Storage Pond/Flood Plain Storage	3	AC	143.5	$ 136,488	$ 950.95
133	ASI-25	Alternative Side Inlets	8" Slotted Hickenbottom	LS	3.2	$ 3,088	$ 969.58
134	GW-49	Grassed Waterways	1105	LF	11.1	$ 11,224	$ 1,008.76
135	POND-3	Storage Pond/Flood Plain Storage	8	AC	295.6	$ 306,750	$ 1,037.69
136	GW-50	Grassed Waterways	170	LF	2.7	$ 2,996	$ 1,122.32
137	WASCOB-8	Water and Sediment Control Basins	1	LS	4.7	$ 5,775	$ 1,233.80
138	POND-4	Storage Pond/Flood Plain Storage	8	AC	255.4	$ 319,492	$ 1,250.87
139	WETLAND-7	Wetland	3	AC	27.6	$ 34,498	$ 1,251.25
140	WASCOB-9	Water and Sediment Control Basins	1	LS	4.6	$ 5,775	$ 1,264.44
141	WASCOB-10	Water and Sediment Control Basins	1	LS	4.3	$ 5,775	$ 1,338.36
142	WASCOB-11	Water and Sediment Control Basins	1	LS	4.3	$ 5,775	$ 1,346.45
143	GW-51	Grassed Waterways	814	LF	6.4	$ 8,666	$ 1,347.45
144	WETLAND-8	Wetland	12	AC	87.2	$ 118,035	$ 1,354.20
145	POND-5	Storage Pond/Flood Plain Storage	1	AC	29.7	$ 40,209	$ 1,354.51
146	WETLAND-9	Wetland	10	AC	66.6	$ 98,990	$ 1,486.39
147	WASCOB-12	Water and Sediment Control Basins	1	LS	3.8	$ 5,775	$ 1,535.24
148	POND-6	Storage Pond/Flood Plain Storage	7	AC	189.2	$ 292,482	$ 1,546.23
149	WASCOB-13	Water and Sediment Control Basins	1	LS	3.7	$ 5,775	$ 1,548.83
150	WASCOB-14	Water and Sediment Control Basins	1	LS	3.4	$ 5,775	$ 1,683.44
151	GW-52	Grassed Waterways	387	LF	2.7	$ 4,906	$ 1,806.34
152	WASCOB-15	Water and Sediment Control Basins	1	LS	3.1	$ 5,775	$ 1,862.52
153	WASCOB-16	Water and Sediment Control Basins	1	LS	3.0	$ 5,775	$ 1,903.23
154	GW-53	Grassed Waterways	747	LF	4.1	$ 8,074	$ 1,953.25
155	GW-54	Grassed Waterways	400	LF	2.6	$ 5,020	$ 1,959.98
156	WETLAND-10	Wetland	19	AC	93.1	$ 187,816	$ 2,017.35
157	GW-55	Grassed Waterways	745	LF	3.9	$ 8,056	$ 2,076.43
158	WASCOB-17	Water and Sediment Control Basins	1	LS	2.6	$ 5,775	$ 2,248.28
159	GW-56	Grassed Waterways	527	LF	2.7	$ 6,136	$ 2,289.47
160	WASCOB-18	Water and Sediment Control Basins	1	LS	2.4	$ 5,775	$ 2,380.05
161	WETLAND-11	Wetland	36	AC	148.1	$ 354,057	$ 2,390.95
162	WASCOB-19	Water and Sediment Control Basins	1	LS	2.3	$ 5,775	$ 2,494.64
163	WASCOB-20	Water and Sediment Control Basins	1	LS	1.8	$ 5,775	$ 3,164.21
164	WASCOB-21	Water and Sediment Control Basins	1	LS	1.8	$ 5,775	$ 3,184.70
165	WASCOB-22	Water and Sediment Control Basins	1	LS	1.7	$ 5,775	$ 3,349.55
166	WETLAND-12	Wetland	13	AC	36.2	$ 119,655	$ 4,756.10
167	WASCOB-23	Water and Sediment Control Basins	1	LS	0.9	$ 5,775	$ 6,272.26
168	WETLAND-13	Wetland	18	AC	25.2	$ 177,861	$ 7,069.74
169	WASCOB-24	Water and Sediment Control Basins	1	LS	0.8	$ 5,775	$ 7,438.75
170	GW-57	Grassed Waterways	280	LF	0.4	$ 3,965	$ 10,002.90

APPENDIX C:
ACPF PARAMETERS

ACPF PARAMETERS

Below outlines the tools used in the ACPF Toolbox Version 2.2. Default or general inputs were used for each step in ACPF. User specified parameters are outline below.

Stream Network Development

1a) D8 Terrain Processing
1b) Flow Network Definition- Area Threshold
    Area Threshold: 40 acres/ 30 acres
1c) Identify Impeded Flow (Depression Depth)
1d) Manual Cutter/Dam Builder
    Cut lines provided by Faribault County from hyroanalysis study
1d) Stream Reach & Catchments
    Created new watershed and used as watershed boundary for remaining ACPF tool.

Field Characterization

2a) By-Field Slope Statistics
2b) Tile-Drainage Classification
    Condition 1: >=90% of the field is < 5% slope
    OR
    Condition 2: Field has a mean hydric soils percentage >10%
2c) D8 Distance to Stream
2d) Runoff Risk Assessment
    High 3rd Quartile: 8%
    Medium 3rd Quartile Slope: 6%

Precision Conservation Practice Siting

3a) Depression Identification
    Minimum Percent Hydric: 60
    Minimum depth: 30
    Minimum surface area: 0.25
3b) Depression Drainage Area
3c) Drainage Water Management
    Contour Interval: 1
    Minimum Acreage: 20
3d) Moore Terrain Derivatives
3e) Grassed Waterways – SPI Threshold
    Standard Deviation Threshold: 3
3f) Contour Buffer Strips
    Buffer Strip width: 16.5
3g) Edge-of-field Bioreactors

Impoundment Siting

4a) Nutrient Removal Wetland
    Spacing: 150
    WI Height: 1.2
    WB Height: 1
4b) WASCOB
    Embankment height: 1
4c) WASCOB basins

Riparian Assessment

5a) Height above Channel

5b) Generate Riparian Analysis Polygons