Technical Memorandum

To: Mark Loidolt, PE
Benton County Engineer

From: Joe Lewis, PE
Houston Engineering, Inc.

Subject: Benton County Ditch 14 Repair Report

Date: March 28, 2023

Project: 6183-0003

INTRODUCTION AND EXECUTIVE SUMMARY

Benton County Ditch 14 (CD 14) is in disrepair and in need of repair. The channel is poorly defined in several areas, several culverts are perched and/or undersized, and there is significant sedimentation in some reaches of the ditch system. The Benton County Drainage Authority has contracted with Houston Engineering, Inc. (HEI) to prepare a repair report for the CD 14 public drainage system. The purpose of this report is to provide a description of current conditions and analysis of repair alternatives, including hydrologic and hydraulic analyses and a preliminary opinion of probable cost for recommended repairs.

To restore the function of CD 14, we recommend the County complete a repair of the County Ditch 14 open channel. This would include excavation of the majority of the channel length to the As-Constructed and Subsequently Improved Condition (ACSIC) depth with the exception of some reaches within wetlands where impacts may occur that are not exempt from the mitigation requirements of the Wetland Conservation Act. Within those reaches, with consideration of the significant cost of mitigation, we recommend repairs be completed to a depth less than the ACSIC or excluded from the repairs. Additionally, the repair recommendations include replacement of several culverts and removal of trees adjacent to the open channel ditch. We conclude the proposed repairs are necessary to restore the function of the drainage system, and they are in the best interest of benefitted property owners.

To assist the County, concept-level design and cost information are provided in this report (see **Attachments A and B**). However, final construction plans, bid documents, and specifications will need to be prepared subsequent to the County establishing and ordering a repair be completed. Benton County retains the decision whether to accept, reject, or modify the Engineer's recommendation.

CURRENT SYSTEM

LOCATION OF THE PUBLIC DRAINAGE SYSTEM

CD 14, shown in **Figure 1**, is 9.0-miles in length consisting of a 3.9-mile Main Trunk, 2.1- mile Branch 1, 1.1-mile Branch 2 tributary to Branch 1, 0.8-mile Branch 3, 0.8-mile Branch 5, 0.1-mile Branch 6, and 0.2-mile Branch 7. The system is located southeast of Oak Park in Sections 2, 3, 10, 11, 14, 15, 16, 21, 22, 23, and 26 of Maywood Township (T37N, R28W) in Benton County.

The Main Trunk flows north to south from 107th Street NE to 400 feet south of CR 52 where it drains into CD 9. Branch 1 flows west to east from MN-23 to its confluence with the Main Branch near CR 52. Branch 2 flows generally south from 170th Avenue NE near Oak Park before draining into Branch 1 near CR 7. Branch 3 flows southeast from 700 feet north of 90th Street NE before draining into the Main Trunk near 85th Street. Branch 5 flows southwest from MN 23 before draining into the Main Trunk north of 90th Street NE. Branch 6 flows east for 750 feet before draining into the Main Trunk in Section 14. Branch 7 flows west for 1,000 feet before draining into the Main Trunk near 175th Avenue NE. The system consists entirely of open ditch sections.

The total drainage area tributary to CD 14 is approximately 5.2 square miles (3,340 acres) located in Maywood Township. The 1916 historical benefitted area includes 4.6 square miles (2,920 acres). Current land use in the tributary watershed is agricultural along with wetland, forest, and rural residential.

HEI completed an Engineer's Report dated June 26, 2020 documenting the ACSIC of CD 14, which was adopted by the Benton County Drainage Authority on August 18, 2020 through a record reestablishment proceeding. The Record Reestablishment serves to establish the ACSIC of the ditch for the purposes of this report.

FIELD SURVEY

Field survey data, including photographs and elevations, were collected in October, November, and December of 2019 and May of 2020. The survey data established the existing conditions and elevations of the open channel system and located culverts and other crossings along the ditch system. Additionally, soil borings were completed to assist in determining the As-Constructed and Subsequently Improved Condition (ACSIC) profile. All survey data was referenced to the North American Vertical Datum 1988 (NAVD88). (Note: Unless otherwise noted, all elevations provided herein are based on the NAVD88 datum).

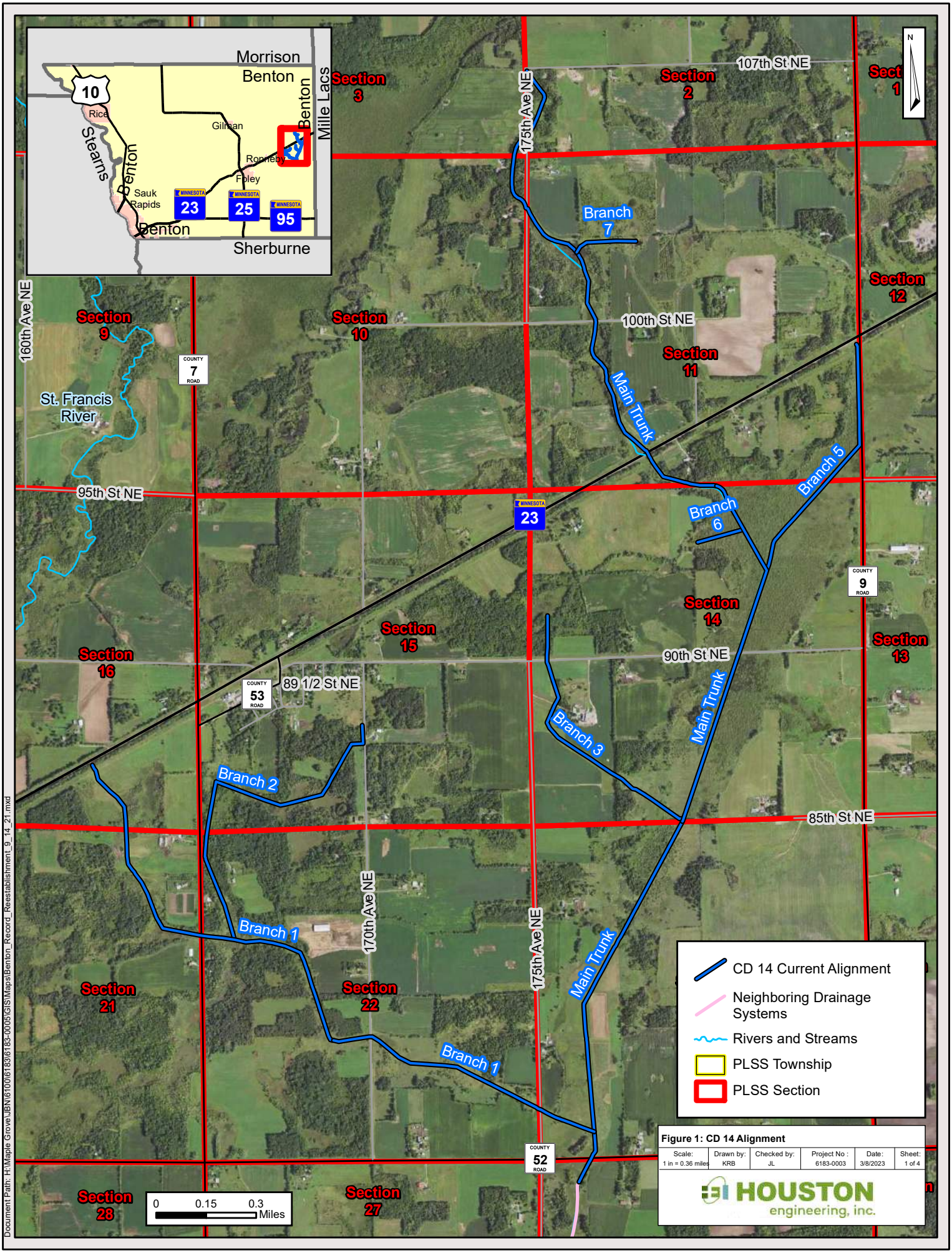

Figure 1: CD 14 Alignment

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CURRENT CONDITION OF THE SYSTEM

The physical field survey completed by HEI and ACSIC established during the Record Reestablishment show parts of the CD 14 system are in disrepair. **Table 1** summarizes the field observations and comparison of the current and ACSIC elevation profiles.

Table 1: Summary of Current Conditions

Location	Description
Main Trunk	
0+00 to 54+00	• Limited accumulated sediment (0.5-foot or less on average) above the ACSIC • Downstream of STA 40+00 has limited tree growth. Upstream of STA 40+00 there are trees on both sides of the channel • Minimal trees along the segment
54+00 to 104+00	• Varying depths of accumulated sediment, ranging from 2.5-foot above the ACSIC to 1-foot below the ACSIC • Limited trees adjacent to the channel
104+00 to 204+24	• Accumulated sediment above the ACSIC for most of the segment with some portions having 2 to 3-foot of sediment depth. • Poorly defined in multiple locations • Trees intermittent on both sides of the channel throughout the segment
Branch 1	
0+00 to 111+73	• Fluctuating amounts of accumulated sediment depth. The most significant amount is upstream of STA 96+00 where there is approximately 2-foot of sediment. • Poorly defined throughout the segment • Minimal trees along the channel
Branch 2	
0+00 to 57+44	• Limited depth of accumulated sediment (0.5-foot or less on average) above the ACSIC upstream of STA 13+00. The most significant amount is downstream of STA 13+00 where there is up to 2-feet of sediment depth. • Relatively shallow open channel ditch through pasture • Poorly defined throughout the segment with some spots with dense woods surrounding the channel
Branch 3	
0+00 to 44+49	• Limited depth of accumulated sediment above the ACSIC of 0.5-foot or less on average • Relatively shallow channel through pasture and row crops

Location	Description
	• Limited trees adjacent to the channel except upstream of 90th St NE (STA 38+00 to 44+49)
Branch 5	
0+00 to 41+17	• Approximately 1-foot of accumulated sediment above the ACSIC on average • No trees along the segment
Branch 6	
0+00 to 7+59	• Less than a foot of sediment above the ACSIC • Channel is poorly defined
Branch 7	
0+00 to 10+05	• 2-foot of sediment accumulated above the ACSIC elevation

EXISTING CULVERT ANALYSIS

Existing culverts were analyzed to determine if the provided capacity meets drainage design standards. Additionally, the current culvert inverts were compared to the ACSIC profile. If culverts are not properly sized or are above the ACSIC profile, they can impair the efficiency of the drainage system. **Table 2** summarizes the condition of the current culverts on CD 14.

For the analysis of culvert capacities, county road crossings were evaluated based on the ability to pass the 50-year peak discharge without overtopping the roadway and township road crossings were evaluated based on the ability to pass the 10-year peak discharge without overtopping the roadway. Culverts at field crossings were evaluated based on the ability to pass the 2-year discharge and without overtopping the banks. Peak discharges were calculated using USGS Regression Equations[1].

PROPOSED REPAIR

The purpose of the proposed repair is to restore the drainage system function to a level of service consistent with the ACSIC which includes removing any blockages, restoring the bottom width and depth of the channel and addressing bank erosion. The Drainage Authority, when considering a repair, may evaluate various alternatives to the scope and nature of repairs. This report evaluates two alternatives: 1) a repair of the entire ditch to the ACSIC for the entire length of CD 14, and 2) a partial repair of the ditch to a depth at, or in some locations above, ACSIC grade. The purpose of a partial repair is to restore the drainage system capacity as nearly to the ACSIC as practicable while minimizing costly regulatory compliance.

[1] Lorenz, D.L., Sanocki, C.A., and Kocian, M.J., 2010, Techniques for estimating the magnitude and frequency of peak flows on small streams in Minnesota based on data through water year 2005: U.S. Geological Survey Scientific Investigations Report 2009–5250, 54 p.

DESCRIPTION OF REPAIR ALTERNATIVES

Alternative 1 – This alternative consists of a repair to the ACSIC grade throughout the entire length of the system. This includes excavation of the open channel and replacing several crossings as necessary to restore the capacity of the system. Trees and brush will also be cleared from within the channel and within the Right-of-Way (ROW) of the drainage system to enable access to complete the repairs and for future inspection and maintenance activities. Spoils from channel excavation would be placed and leveled adjacent to the channel on the existing spoil banks within the ROW of the drainage system. **Figure 2** provides a summary of the repair work locations proposed in Alternative 1.

Public road crossing replacements will have their proposed size and material confirmed by the road authority and their replacement coordinated with the road authority to determine whether the crossing will be replaced as part of the repair with the cost assessed to the road authority, or if the crossing will be replaced by the road authority at their cost at a time of their choosing. The proposed culvert repairs for this alternative can be seen in **Table 2.**

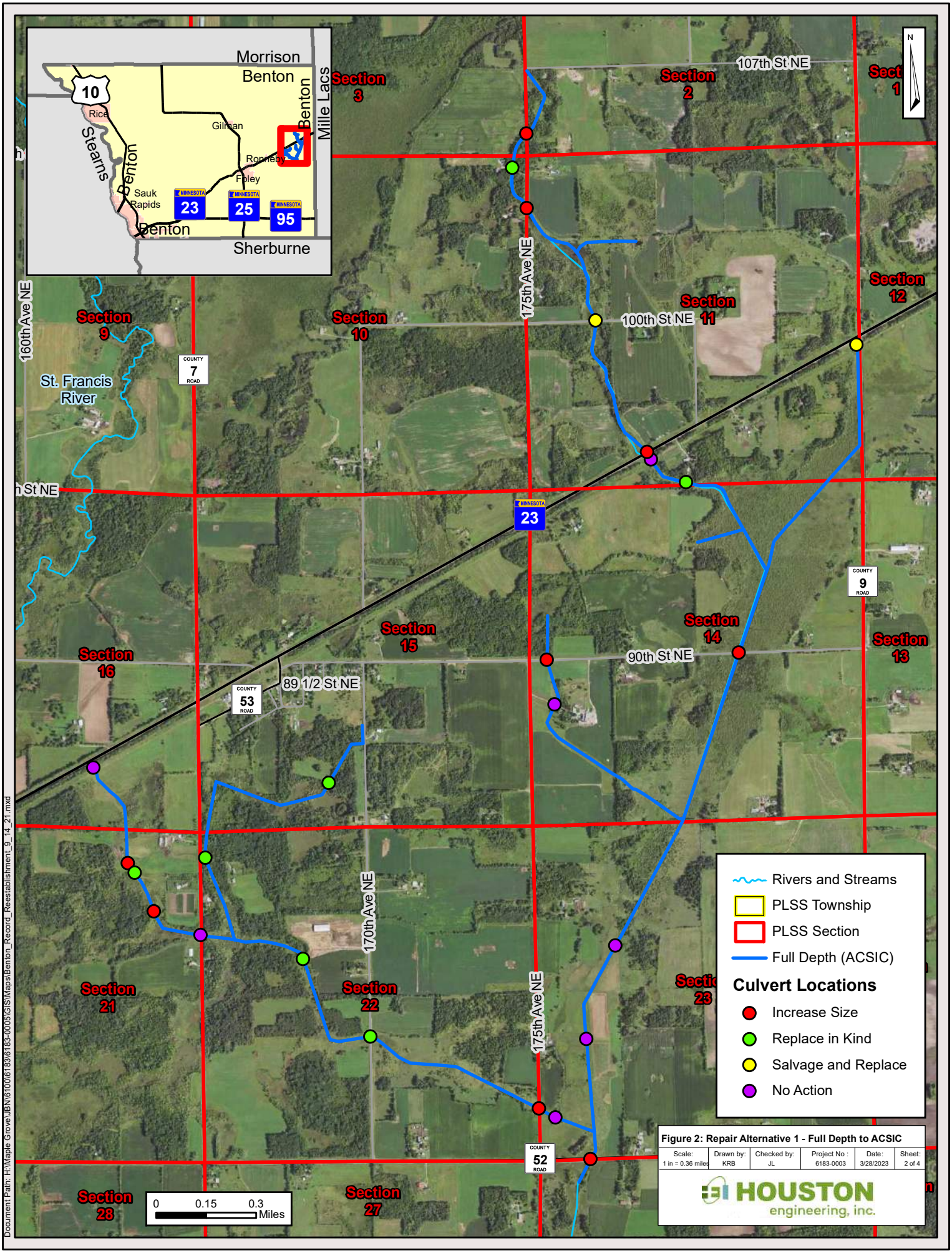
These field crossings and public road crossings are either above the ACSIC channel grade, too small to adequately convey flows in the public drainage system, and/or in disrepair.

Alternative 2 – This alternative is similar to Alternative 1, except at areas where a repair to the ACSIC may result in wetland impacts requiring mitigation. In portions of the ditch that cross or are adjacent to Type 3, 4 and 5 wetlands, where impacts that will require mitigation may occur, the channel will be excavated to a partial depth instead of the ACSIC grade. This will reduce or eliminate the need for mitigation of wetland impacts to save cost and preserve water resources while providing a sufficient level of function to benefitted landowners. **Figure 3** also provides a summary of the repair work locations proposed in Alternative 2. The portions of the ditch that would have a reduced excavation depth are shown in the repair profile seen in **Attachment A**. They are also listed in the hydraulic impacts section of the evaluation of repair later in this report.

In addition to wetland mitigation avoidance, Alternative 2 offers an opportunity for cost savings by reducing the cost of replacing existing culverts at some locations. A summary of these differences between Alternatives 1 and 2 are listed below in **Table 2.** Details of the culvert replacements are included in **Attachment A**. The following section also describes a summary of the culvert analysis and criteria used to develop recommendations.

At several locations throughout the drainage system, ‘no repair’ is recommended in Alternative 2 - meaning there would be no excavation of accumulated sediment from the channel. This is recommended either because the excavation results in limited drainage benefit or the cost is

significant. This includes locations where the open channel has a sufficient slope and the sediment is not currently impairing drainage to upstream areas. No repair is also recommended at locations where removing sediment could incur wetland restoration costs which add a significant overall cost to the repair.


Morrison
Benton
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Mille Lacs
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23
25
95
N
107th St NE
Section 3
Section 2
Sect 1
175th Ave NE
100th St NE
Section 11
Section 12
160th Ave NE
Section 9
Section 10
St. Francis River
COUNTY 7 ROAD
23
COUNTY 9 ROAD
Section 15
Section 14
Section 13
Section 16
90th St NE
89 1/2 St NE
COUNTY 53 ROAD
170th Ave NE
Section 21
Section 22
Section 23
COUNTY 52 ROAD
Section 28
Section 27
0 0.15 0.3 Miles
Rivers and Streams
PLSS Township
PLSS Section
Full Depth (ACSIC)
Culvert Locations
Increase Size
Replace in Kind
Salvage and Replace
No Action
Figure 2: Repair Alternative 1 - Full Depth to ACSIC
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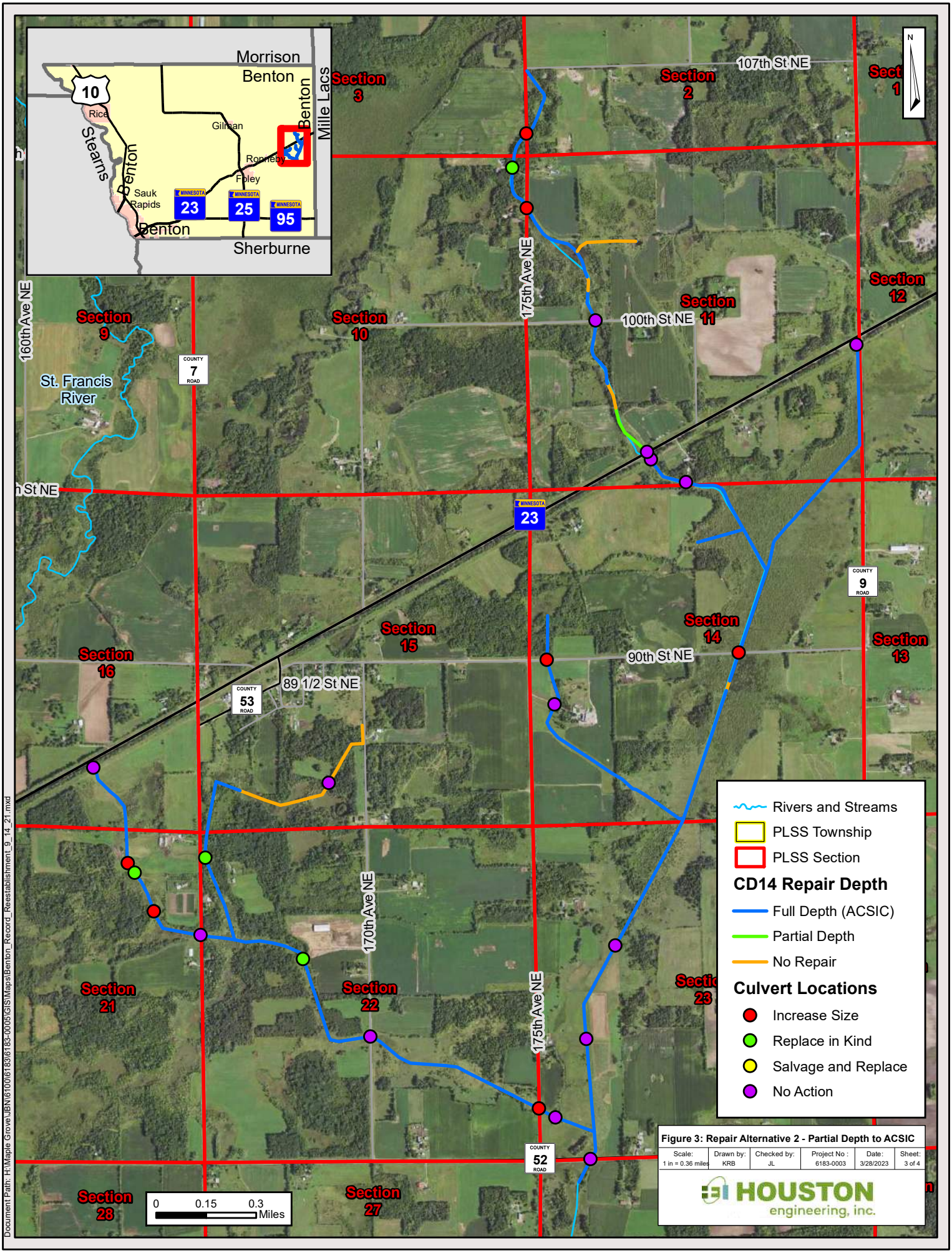

Figure 3: Repair Alternative 2 - Partial Depth to ACSIC

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Table 2: County Ditch 14 Culvert Conditions

Road Authority	Road Name	Location (Station)	Existing	Existing Capacity	Current and ACSIC Elevation Comparison	Alternative 1 Culvert Action	Alternative 2 Culvert Action
Main Trunk							
Benton County	CR 52/ 75th St NE	4+02	72" RCP	Undersized	At the ACSIC grade.	Add a 72" and a 48" RCP at ACSIC grade	No Action[1]
Private	Field Crossing	23+32	72" CMP	Appropriately Sized	1' Below the ACSIC grade.	No Action	No Action
Private	Field Crossing	39+41	(2) 48" CMP	Appropriately Sized	At the ACSIC grade.	No Action	No Action
Maywood Township	90th St NE	89+96	54" CMP	Undersized	1' above the ACSIC grade.	Replace with 72" CMP at ACSIC grade	Replace with 72" CMP at ACSIC grade
Private	Field Crossing	124+33	42" RCP 15" CMP	Appropriately Sized	Culverts are 2.5' and 4' above the ACSIC grade.	Replace with 42" CPP at ACSIC grade	No Action[2]
Private	Field Crossing	131+39	(2) 24" CIP	Appropriately Sized	At the ACSIC grade.	No Action	No Action
MnDOT	MN-23	132+64	42" RCP	Undersized	Culvert is 1' above the ACSIC grade.	Replace with 54" RCP at ACSIC grade	No Action[1,2,3]
Maywood Township	100th St NE	156+50	42" RCP	Appropriately Sized	0.5' above the ACSIC grade.	Salvage and replace at ACSIC grade	No Action[2,3]
Maywood Township	175th Ave NE	179+13	30" CMP	Undersized	Culvert is 2' above the ACSIC grade.	Replace with 36" CMP at ACSIC grade	Replace with 36" CMP at ACSIC grade
Private	Private Driveway	186+53	30" CMP	Appropriately Sized	Culvert is 2' above the ACSIC grade.	Replace with 30" CPP at ACSIC grade	Replace with 30" CPP at ACSIC grade
Maywood Township	175th Ave NE	192+60	24" RCP	Undersized	Culvert is 2' above the ACSIC grade.	Replace with 30" CMP at ACSIC grade	Replace with 30" CMP at ACSIC grade

Road Authority	Road Name	Location (Station)	Existing	Existing Capacity	Current and ACSIC Elevation Comparison	Alternative 1 Culvert Action	Alternative 2 Culvert Action
Branch 1							
Private	Field Crossing	6+54	48” RCP	Appropriately Sized	At the ACSIC grade.	No Action	No Action
Maywood Township	175th Ave NE	9+45	48” CMP	Undersized	At the ACSIC grade.	Replace with 60” CMP at ACSIC grade	Replace with 60” CMP at ACSIC grade
Maywood Township	170th Ave NE	39+14	48” RCP	Appropriately Sized	Culvert is 0.5’ above the ACSIC grade.	Replace with 48” RCP at ACSIC grade	No Action[2]
Private	Field Crossing	58+57	42” CMP	Appropriately Sized	1.5’ above the ACSIC grade.	Replace with 42” CPP at ACSIC grade	Replace with 42” CPP at ACSIC grade
Benton County	CR 7/165th Ave NE	76+25	48” RCP	Appropriately Sized	Culvert 2’ below the ACSIC grade.	No Action	No Action
Private	Field Crossing	85+45	15” CMP	Undersized	At the ACSIC grade.	Implement a low flow crossing or add a 15” CPP at ACSIC grade	Implement a low flow crossing or add a 15” CPP at ACSIC grade
Private	Field Crossing	92+32	(2) 15” CMP	Undersized	Culvert is 1’ above the ACSIC grade.	Implement a low flow crossing or install (2) 15” CPP culverts at ACSIC grade	Implement a low flow crossing or install (2) 15” CPP culverts at ACSIC grade
Private	Field Crossing	94+19	15” CMP	Undersized	At the ACSIC grade.	Implement a low flow crossing or install a 15” CPP at ACSIC grade	Implement a low flow crossing or install a 15” CPP at ACSIC grade
Private	Field Crossing	111+24	30” RCP	Appropriately Sized	At the ACSIC grade.	No Action	No Action
Branch 2							
Private	Private Driveway	13+68	36” CMP	Appropriately Sized	Culvert is 2’ above the ACSIC grade	Replace with 36” CPP at ACSIC grade	Replace with 36” CPP at ACSIC grade

Road Authority	Road Name	Location (Station)	Existing	Existing Capacity	Current and ACSIC Elevation Comparison	Alternative 1 Culvert Action	Alternative 2 Culvert Action
Private	Field Crossing	45+82	24" CMP	Appropriately Sized	Culvert is 1.7' above the ACSIC grade	Replace with 24" CPP at ACSIC grade	No Action[3]
Branch 3							
Private	Private Driveway	29+89	24" CMP	Appropriately Sized	At the ACSIC grade	No Action	No Action
Maywood Township	90th St NE	37+40	24" CMP	Undersized	Culvert is 1' above the ACSIC grade	Replace with 30" CMP at ACSIC grade	Replace with 30" CMP at ACSIC grade
Branch 5							
Private	Trail Crossing	40+96	36" RCP	Appropriately Sized	Culvert is 2' above the ACSIC grade	Salvage and replace at ASCIC grade	No Action – Drainage restoration is limited by US Highway 23 immediately upstream

[1]Meets or exceeds capacity for drainage system design but may not meet traditional road overtopping standards.
[2]Upstream grade from the culvert is such that the invert does not significantly impair upstream drainage.
[3]Culvert invert is recommended to be above ACSIC to avoid wetland impacts requiring mitigation.

SUMMARY OF CULVERT REPLACEMENTS IN REPAIR ALTERNATIVES

A total of 25 crossings are located along the CD 14 alignment, and 18 and 11 are recommended for replacement in Alternatives 1 and 2, respectively. Ten of the existing crossings are located at public roadways, and of those, 9 and 5 are recommended for replacement in Alternatives 1 and 2, respectively. **Table 2** lists the CD 14 culverts and the proposed replacement actions, culvert sizes, and materials for both Alternative 1 and 2. **Figure 2** and **Figure 3** shows the locations of CD 14 culverts and the proposed repair actions.

The general criteria used to make a recommendation is as follows:

- Is the current culvert invert significantly above the ACSIC elevation? If yes, then the culvert is recommended to be replaced unless there is significant grade in the upstream ditch profile which limits the potential drainage impairment for upstream property owners.
- Does the culvert have adequate capacity to pass the design flow without road overtopping (for public roadways) or without overtopping the ditch banks for field crossings?
    - If a field crossing is undersized based on the drainage design criteria (2-year event design), a larger culvert is recommended to meet the design criteria.
    - If a Township road crossing is undersized based on road sizing criteria (10-year event) a replacement is recommended to meet the 10-year event.
    - If a County road crossing is undersized based on road sizing criteria (50-year event) a replacement is recommended to meet the 50-year event.

The CR 52 culvert over the Main Trunk is not shown as recommended for replacement in Alternative 2 although it doesn't meet the design criteria listed above. The existing culvert has a limited amount of cover over the pipe leading to overtopping during the 25- and 50-year events. If the culvert is replaced by the Highway Department, its likely that a grade raise of the roadway would be considered which would alter the hydraulic analysis of the crossing. The current CR 52 culvert passes the drainage design flow and generally matches the capacity of upstream and downstream crossings. Its recommended that the current culvert not be replaced as part of a drainage system repair project and that the Highway Department evaluate the need for modifying the crossing in the future.

An additional consideration is the potential for wetland impacts which is discussed further in the Regulatory section of this memo.

EXTERNAL FUNDING FOR ALTERNATIVE MEASURES AND TECHNICAL ASSISTANCE

M.S. 103E.015 requires a Drainage Authority to investigate the potential of external funding sources and technical assistance during a petitioned repair, specifically for the purposes of wetland

preservation or restoration, water quality improvements, reducing erosion and sedimentation, reducing downstream peak flows and flooding, and conserving, allocating and using drainage waters for agriculture, streamflow augmentation or other beneficial uses.

Construction of these measures requires voluntary landowner participation and is subject to the availability of funding. Implementation of these measures may coincide with the repair project but may also occur independently of the repairs. Coordination with the Benton County Soil and Water Conservation District will occur prior to the drainage system repairs. Through this coordination, the potential for external funding applications such as the Board of Water and Soil Resources Clean Water Fund's Multi-purpose Drainage Management grant program will be evaluated.

EVALUATION OF REPAIR

HYDRAULIC IMPACTS

CD 14 has significant sedimentation and several culverts located above the ACSIC grade. The proposed repair would remove these obstructions to open channel flow and restore the hydraulic efficiency of the system. The proposed repairs will reduce peak water levels for smaller rain events, but they are not expected to significantly impact peak water levels for the 100-year flood event. The differences in hydraulic performance or efficiency between Alternative 1 and 2 are described below. For segments of CD 14 not listed below, the ACSIC profile will be restored in both Alternative 1 and 2 and therefore have equivalent drainage efficiency. More information regarding the wetlands adjacent to the segments listed below and in **Table 3** can be found in the Regulatory section below.

In several locations, we are recommending that the channel be excavated to the ACISC depth within the wetland basin but a segment near the outlet of the basin be not repaired. This will limit changes in normal water levels and wetland quality while allowing the drainage system to more efficiently convey water during runoff periods. The drainage benefit restored from this approach in Alternative 2 is achieved from the reduction in elevated water levels and durations during wet periods. The segments of the ditch that utilize this approach are listed below:

- Main Trunk STA 84+00 to 86+00
- Main Trunk STA 142+00 to 146+00
- Main Trunk STA 162+00 to 164+00

In several locations, we are recommending that a segment of open channel be excluded from the current repair due to the likelihood of wetland impacts and limited amount of drainage benefit that would be restored. The drainage authority may still evaluate the feasibility of repairing these segments in the future. The specific locations that use this method in Alternative 2 are listed below:

- Branch 2 STA 29+00 to 57+58
- Branch 7 STA 0+00 to 10+05

At Main Trunk STA 131+60 to 142+00 a partial depth repair profile is recommended for Alternative 2 that would remove sediment but not to the full ACSIC depth. The significant channel slope in this location will still provide sufficient drainage.

REGULATORY CONSIDERATIONS

Wetlands

There are three regulatory programs that may be triggered by a drainage system repair project, including the Minnesota Department of Natural Resources (MnDNR) Public Waters Permitting Program, the federal Clean Water Act (CWA) implemented by the US Army Corps of Engineers (USACE), and the state Wetland Conservation Act (WCA) implemented by the Local Government Unit, in this case Benton County. The following is a review of the repair project relative to these three regulatory programs.

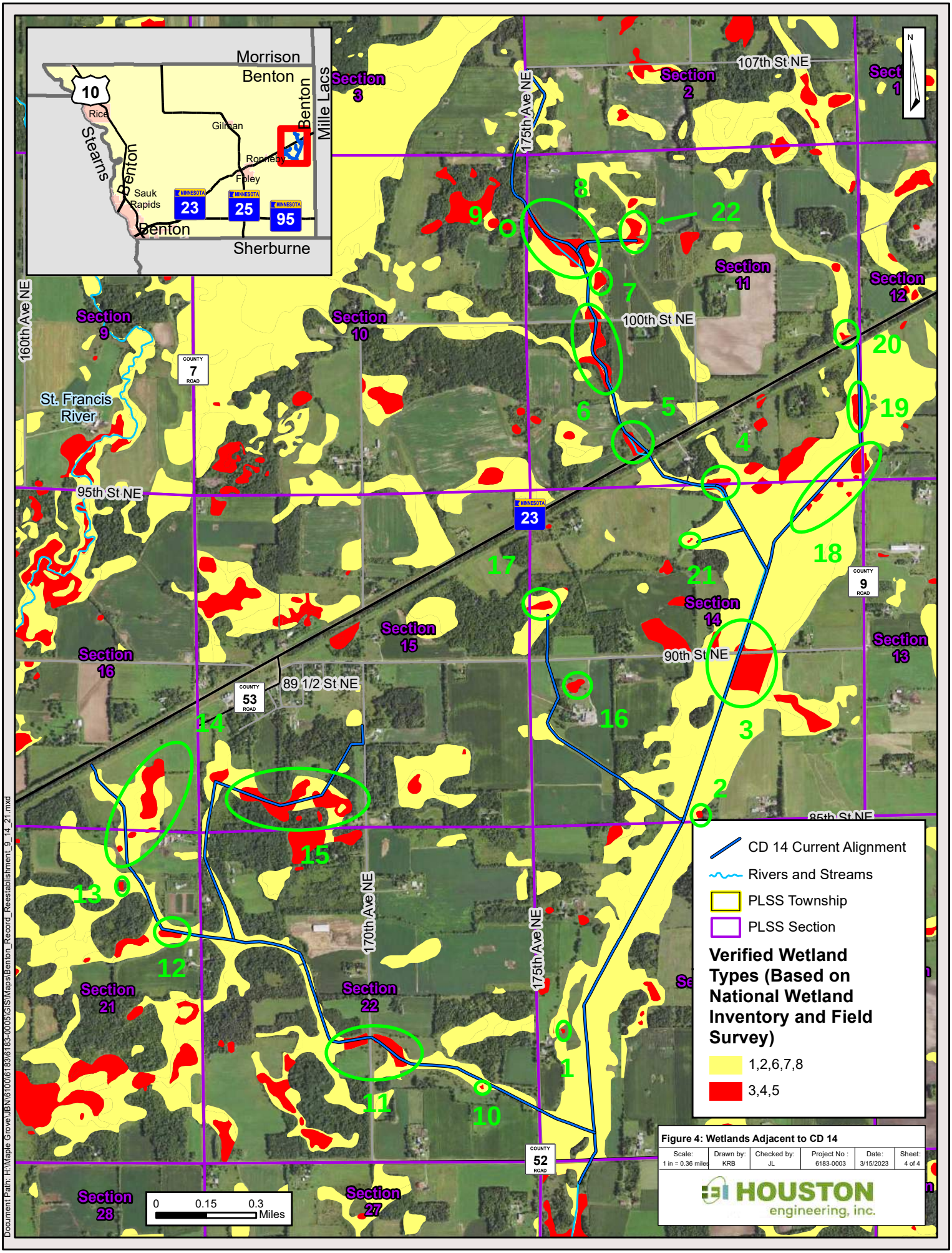
As seen in **Figure 4** CD 14 does not intersect any state-listed Public Waters or Public Water Wetlands (PWI). The main trunk of CD 14 channel is listed as a Public Watercourse but is categorized as a "Public Ditch / Altered Natural Watercourse", which does not typically require any Public Waters permitting coordination with the MnDNR. Branches 1, 2, 3, 5 ,6 and 7 are not listed as a PWI or a Public Ditch / Altered Natural Watercourse.

The CD 14 public drainage system intersects wetlands identified in the National Wetland Inventory (NWI) as shown in **Figure 4**. Under the two wetland regulatory programs, (Minnesota WCA and Federal CWA) activities related to repair of a public drainage system are generally exempt from permitting and mitigation requirements. These activities are related to public drainage system maintenance and repair, and include:

- Excavation in wetlands when limited to removal of accumulated sediment or debris such as trees, logs, stumps, beaver dams, blockage of culverts, and trash, provided the removal does not result in alteration of the original cross-section of the wetland or watercourse;
- Removing those materials placed by beaver;
- Removing or moving materials blocking installed roadway culverts and related drainage structures; and
- Temporary or seasonal water level management activities done for the purpose of performing maintenance.

Under the federal CWA, drainage system maintenance or repair is exempt from regulation. Under the state WCA, activities related to maintenance or repair of a public drainage system are exempt from replacement, include:

- Maintenance or repair of a public drainage system which drains Type 1, 2, 6, 7, or 8 wetlands; and
- Maintenance or repair of a public drainage system which drains Type 3, 4, or 5 wetlands that have existed for 25 years or less.


Morrison
Benton
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Mille Lacs
Stearns
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Rice
Gilman
Ronneby
Foley
Sauk Rapids
Benton
Sherburne
10
23
25
95
Section 3
Section 2
Section 1
107th St NE
175th Ave NE
Section 11
Section 12
100th St NE
160th Ave NE
Section 9
Section 10
St. Francis River
95th St NE
Section 16
Section 15
Section 14
Section 13
90th St NE
89 1/2 St NE
Section 21
Section 22
Section 27
Section 28
170th Ave NE
85th St NE
52
0 0.15 0.3 Miles
CD 14 Current Alignment
Rivers and Streams
PLSS Township
PLSS Section
Verified Wetland Types (Based on National Wetland Inventory and Field Survey)
1,2,6,7,8
3,4,5
Figure 4: Wetlands Adjacent to CD 14
Scale: 1 in = 0.36 miles
Drawn by: KRB
Checked by: JL
Project No : 6183-0003
Date: 3/15/2023
Sheet: 4 of 4
HOUSTON engineering, inc.
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To verify the actual type and approximate extent of Type 3, 4 and 5 wetlands, HEI scientists visited the site on September 13th, 2022. Prior to visiting the site, the NWI and a series of years of aerial photography was reviewed to understand potential wetland types within the area. Once at the site, a 150-foot corridor was viewed. Using this field information, and the NWI as a baseline dataset, the NWI shapefiles were edited to incorporate the results of the field survey (as shown in **Figure 4**).

Based on a review of the NWI data and field inventory work to confirm wetland types, there are 22 locations on the ditch system where Type 3, 4, and 5 wetlands are present. **Table 3** provides a description of these sites and specifies locations where repair work has the potential for wetland impacts. Specifically, there are 7 locations on the system have the potential for impacts to Type 3, 4, and 5 wetlands if the repair work is implemented to the ACSIC. As such, the drainage system repair project may not meet the exemption criteria of the state WCA for all wetlands near the proposed repairs. Recommendations are provided in **Table 3** that indicate where repair work should vary from the ACSIC to minimize potential wetland impacts.

Table 3: Wetland Impact Notes

Wetland Area	Station	Evaluation	Recommendation
Main Trunk			
1	25+00	This basin is a stock pond located approximately 350 west of the ditch channel	Repair to ACSIC
2	65+00	Two excavated stock ponds are located approximately 250 feet east of the ditch channel.	Repair to ACSIC
3	87+00	This is a large natural basin located on the ditch channel, a second smaller area is also identified 400 feet west of the channel.	Partial repair to avoid wetland impact
4	120+00	This is a natural basin located on the ditch channel. Only minimal amounts of accumulated sediment (<0.5') are present at the location of the ditch serving as the outlet for the wetland basin.	Repair to ACSIC
5	135+00	This is a natural type 3 basin against the roadway on the channel	Partial repair to avoid wetland impact
6	147+00 to 158+00	A number of natural type 3 basins adjacent and on the channel	Partial repair to avoid wetland impact
7	163+00	This is a natural type 3 basin located approximately 100 feet east on the channel	Partial repair to avoid wetland impact
8	170+00	This is a natural type 3 basin against the roadway on the channel	Partial repair to avoid wetland impact
9	178+00	This is a small basin mapped as a type 3 wetland located approximately 500 feet west and is highly unlikely to be impacted by the ditch repair work	Repair to ACSIC
Branch 1			
10	18+00	This site is a stock pond located approximately 50 feet west of the ditch channel.	Repair to ACSIC
11	35+00	This is a natural Type 3 basin adjacent to the channel. The outlet of basin appears to have been altered by construction of embankments.	Repair to ACSIC
12	81+00	This is a natural Type 3 basin on and adjacent to the channel. No excavation is planned at this location as the profile is currently at or below the ACSIC.	Repair to ACSIC

13	92+00	This is a natural type 3 basin 225 feet west of the channel and is highly unlikely to be impacted by the ditch repair work	Repair to ACSIC
14	97+00	4 natural basins are located at this site adjacent to the ditch channel. Due to a combination of distance from the ditch and depth of accumulated sediment, the basins are not expected to be impacted by the ditch repair.	Repair to ACSIC
Branch 2			
15	35+00	Three natural basins are located at this site adjacent to the ditch channel.	No repair within basins
Branch 3			
16	32+00	This site is a natural PEMC basin approximately 225 feet east of the ditch channel, minimal ditch excavation is planned at this location	Repair to ACSIC
17	44+49	This site is a large natural basin located 50 feet north of the ditch system.	Repair to ACSIC
Branch 5			
18	15+00	This site has a large natural basin located on the ditch channel. Only minimal amounts of accumulated sediment (<0.5') are present at the location of the ditch serving as the outlet for the wetland basin.	Repair to ACSIC
19	30+00	This is a natural basin located adjacent to the ditch channel.	Repair to ACSIC
20	40+00	This is a natural type 3 basin located across the highway from the ditch channel and therefore will not be impacted by the ditch repair work.	Repair to ACSIC
Branch 6			
21	7+59	This site is a stock pond located approximately 350 west of the ditch channel	Repair to ACSIC
Branch 7			
22	8+00	This is a natural type 3 basin located on the ditch channel that also includes a stock pond within its mapped extent.	No repair within basin

Threatened and Endangered Species

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

Based on the MnDNR's Natural Heritage Information System (NHIS) data (Houston Engineering License Agreement LA-1049), there are no state-listed threatened or endangered species identified within the CD 14 area.

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

A Preliminary Opinion of Probable Construction Cost (POPCC) was developed for Alternative 1 and Alternative 2 and a detailed breakdown is included as **Attachment B**. The estimated POPCC and other costs are summarized in **Table 4**. The public drainage infrastructure cost includes open channel excavation, replacement of private culverts, tree clearing, and seeding and stabilization in the ditch right-of-way.

Table 4: Preliminary Opinion of Probable Construction Cost Summary

Category	Alternative 1	Alternative 2
Drainage System Cost	$932,328	$854,480
Road Authority Cost	$291,129	$123,735
Wetland Mitigation Cost	$2,073,000	$0
Total Repair Project Cost	**$3,296,457**	**$978,215**

If wetland mitigation credits are purchased through the BWSR wetland credit bank, additional projects costs of approximately $2,073,000 are expected.

CONCLUSION / RECOMMENDATION

To restore the function of the CD 14 public drainage system to the condition as it was originally constructed, we recommend the County complete a functional repair of the system as described above as Alternative 2 and depicted in **Attachment A**. We conclude that the proposed repairs are necessary to meet the current and future drainage needs, and that the repairs are in the best interest of the property owners. The recommended repairs are believed to provide the best value alternative, balancing the need to provide serviceable drainage while minimizing costly wetland impacts.

We further recommend the Drainage Authority and their staff begin coordination with the County Highway Department and Townships to determine their preference for roles and timelines in completing the culvert replacements under public roadways.

To assist the Drainage Authority, concept-level design and cost information are provided in this memorandum. However, detailed construction plans, bid documents, and specifications will need to be prepared subsequent to the Drainage Authority establishing and ordering a project. The Drainage Authority retains the decision whether to accept, reject or modify the Engineer's Recommendation.

Should the Drainage Authority choose to order a project, we further recommend that an in-depth investigation of wetlands be completed to quantify wetland impacts and required mitigation to assist with WCA permitting.

LIST OF ATTACHMENTS

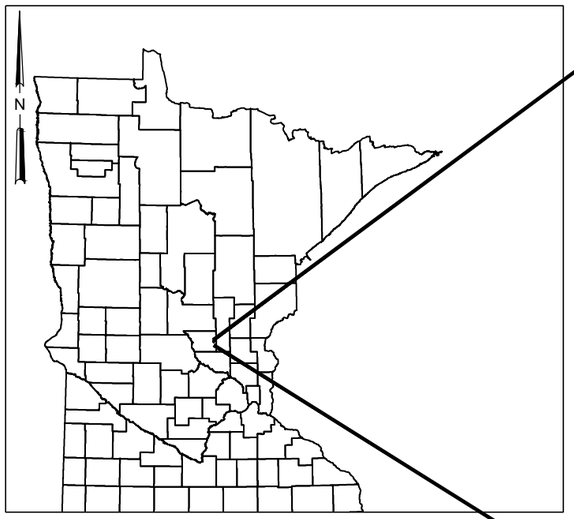
Attachment A: Benton County Ditch 14 Repair Plans
Attachment B: Preliminary Opinion of Probable Construction Cost

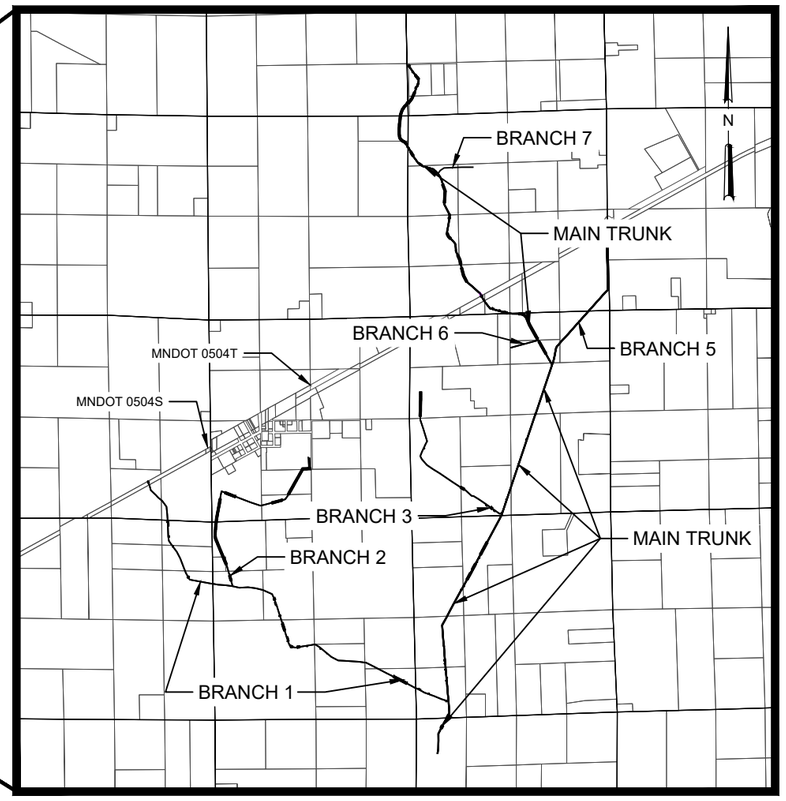
ATTACHMENT A – BENTON COUNTY DITCH 14 REPAIR PLANS

BENTON COUNTY

REPAIR REPORT
FOR
BENTON COUNTY DITCH NO. 14

MAYWOOD TOWNSHIP IN BENTON COUNTY
MARCH 2023





PRELIMINARY
Not for Construction

Sheet List Table	
1	TITLE SHEET
2	PLAN AND PROFILE MAIN TRUNK
3	PLAN AND PROFILE MAIN TRUNK
4	PLAN AND PROFILE MAIN TRUNK
5	PLAN AND PROFILE MAIN TRUNK
6	PLAN AND PROFILE BRANCH 1
7	PLAN AND PROFILE BRANCH 1
8	PLAN AND PROFILE BRANCH 2
9	PLAN AND PROFILE BRANCH 3
10	PLAN AND PROFILE BRANCH 5
11	PLAN AND PROFILE BRANCH 6
12	PLAN AND PROFILE BRANCH 7
13	DETAILS

NOTES:

1. GEODETIC CONTROL

   VERTICAL: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

   HORIZONTAL: COUNTY COORDINATES (MNDOT), BENTON COUNTY, US FOOT

   BENCHMARK: MNDOT 0504S, SW QUARTER, SECTION 15, TOWNSHIP 37N, RANGE 28W

   IN OAK PARK, AT THE JUNCTION OF TRUNK HIGHWAY 23 AND COUNTY ROAD 7 IN OAK PARK, AT TRUNK HIGHWAY 23 MILEPOINT 226.25, 101.7 FEET SOUTH-SOUTHEAST OF TRUNK HIGHWAY 23, 27.7 FEET EAST OF COUNTY ROAD 7 (165TH AVENUE NORTHEAST), 22.0 FEET NORTH-NORTHWEST OF A DRIVEWAY, 1.5 FEET NORTH-NORTHWEST OF A WITNESS POST.

   FIELD SURVEY COMPLETED BY HOUSTON ENGINEERING STAFF IN OCTOBER, NOVEMBER, AND DECEMBER OF 2019 AND MAY OF 2020.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VISIT THE SITE TO INFORM THEMSELVES AS TO ALL EXISTING CONDITIONS AND LIMITATIONS.
2. THE CONTRACTOR IS RESPONSIBLE UNDER MINNESOTA STATE STATUTE 216D AND MINNESOTA RULES CHAPTER 7560 TO CONTACT GOPHER STATE ONE CALL FOR THE LOCATION OF UNDERGROUND UTILITY FACILITIES IN PROXIMITY TO THE EXCAVATION SITE. THE CONTRACTOR AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MAY RESULT FROM ITS FAILURE TO LOCATE AND PRESERVE ANY AND ALL UTILITIES.
3. CONSTRUCTION LIMITS TO BE VERIFIED IN FIELD BY ENGINEER.
4. CONTRACTOR SHOULD BE AWARE OF EROSION CONTROL SPECIFICATIONS, AND WILL BE RESPONSIBLE FOR IMPLEMENTATION AND MAINTENANCE OF SAID CONTROL MEASURES. IN ADDITION, THE CONTRACTOR WILL BE REQUIRED TO APPLY AS A CO-PERMITTEE FOR A MPCA GENERAL STORM WATER PERMIT FOR CONSTRUCTION ACTIVITIES. AS A CO-PERMITEE THE CONTRACTOR WILL ACCEPT AND ENSURE ALL TERMS OF THE SAID PERMIT ARE IMPLEMENTED AND MAINTAINED.

PREPARED BY:

Houston Engineering Inc.

MAPLE GROVE, MINNESOTA

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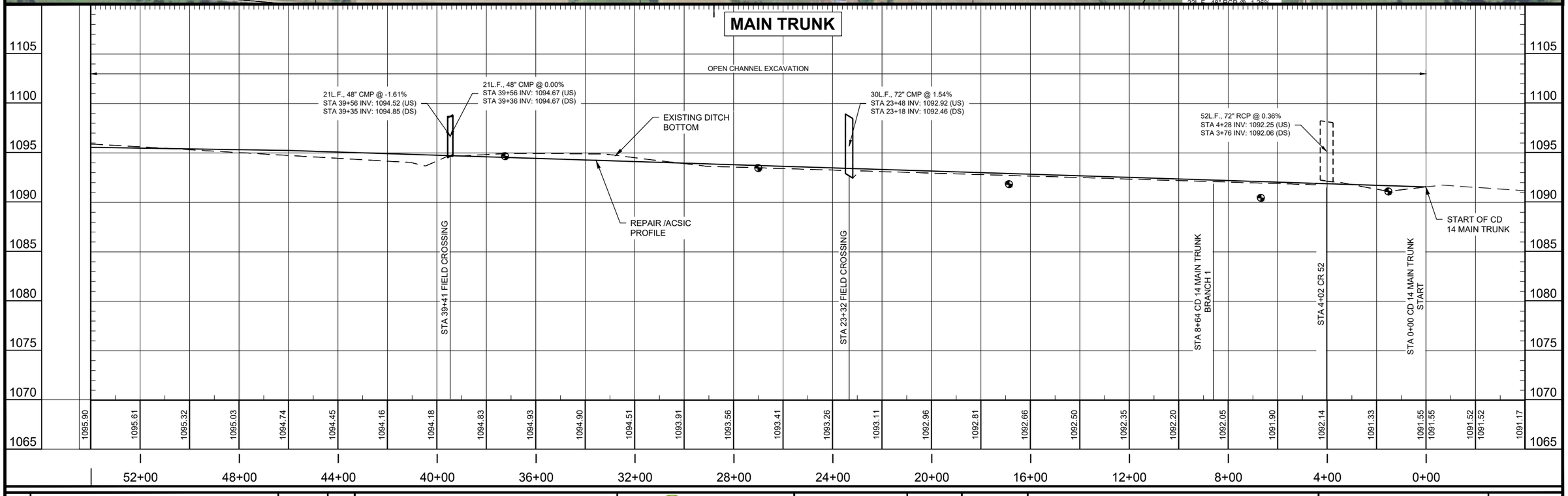

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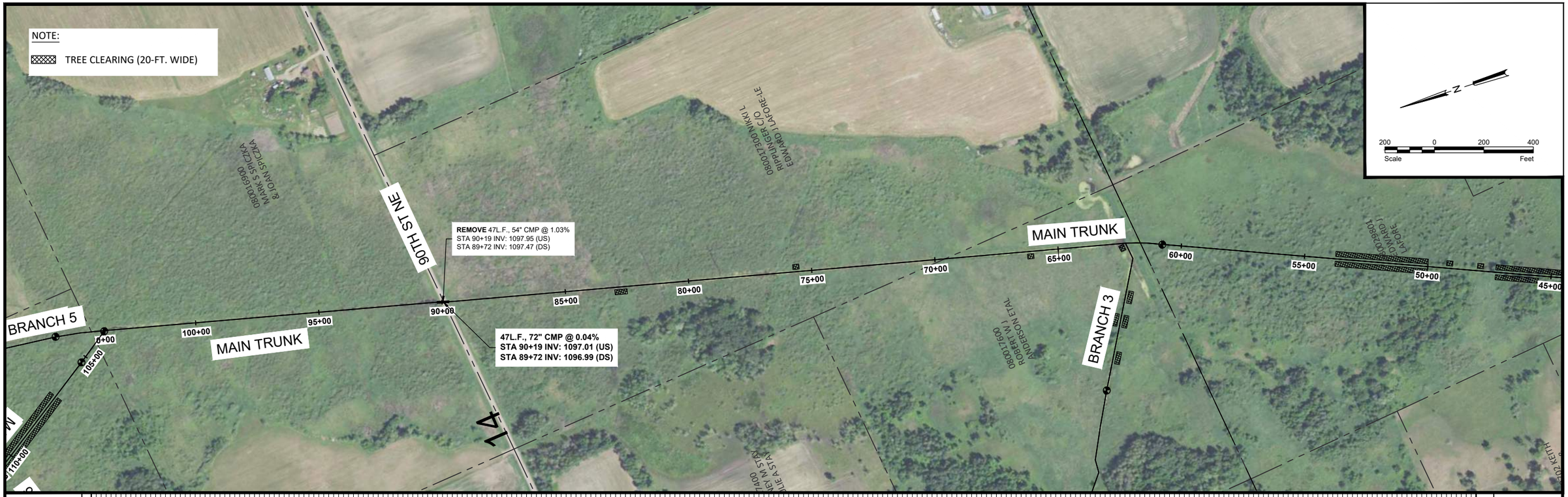
BENTON COUNTY DITCH 14 REPAIR
BENTON COUNTY
MAYWOOD TOWNSHIP, MN

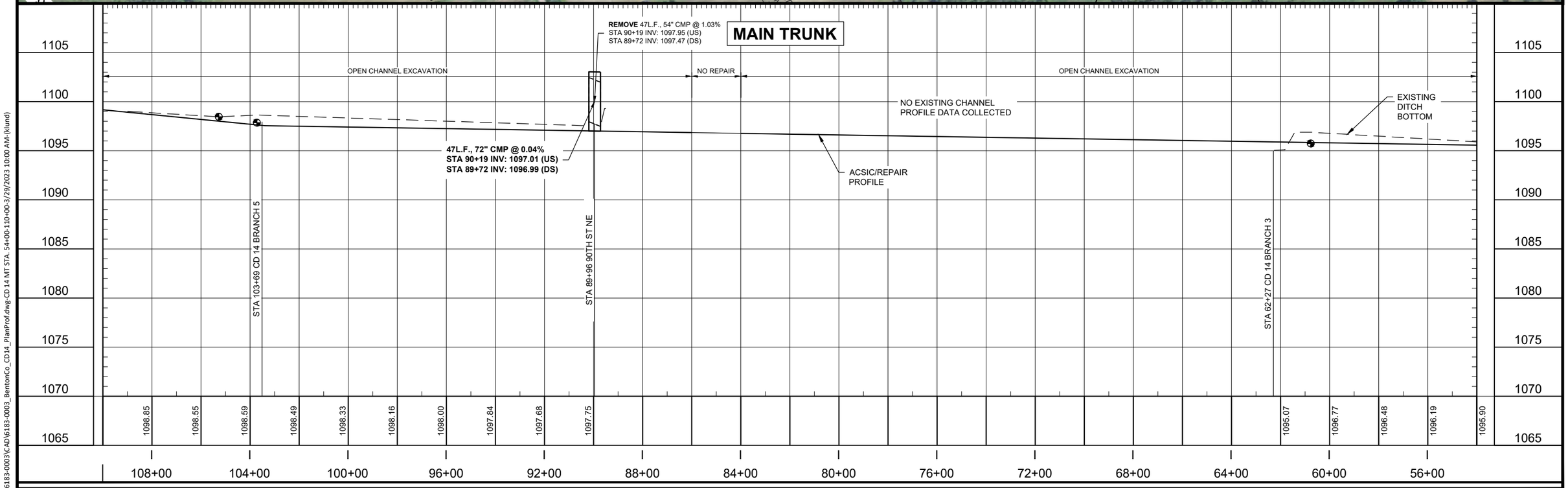
BENTON COUNTY DITCH 14
STA. 0+00 - 54+00
PROJECT NO. 6183-0003

SHEET
2 of 13

NOTE:

TREE CLEARING (20-FT. WIDE)





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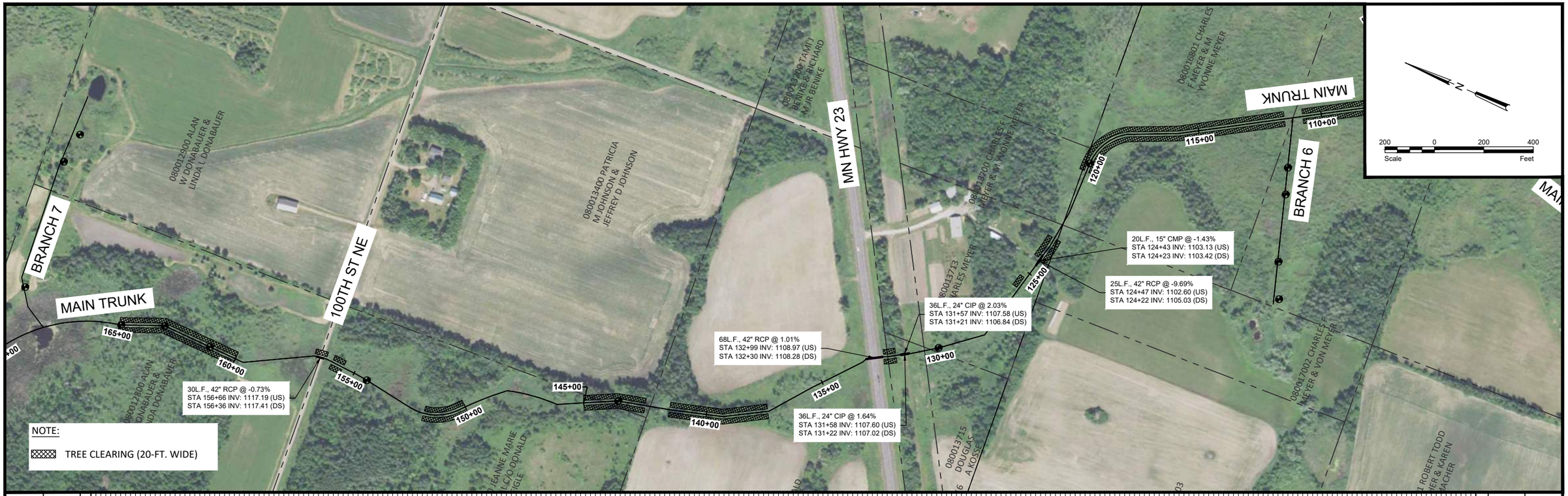

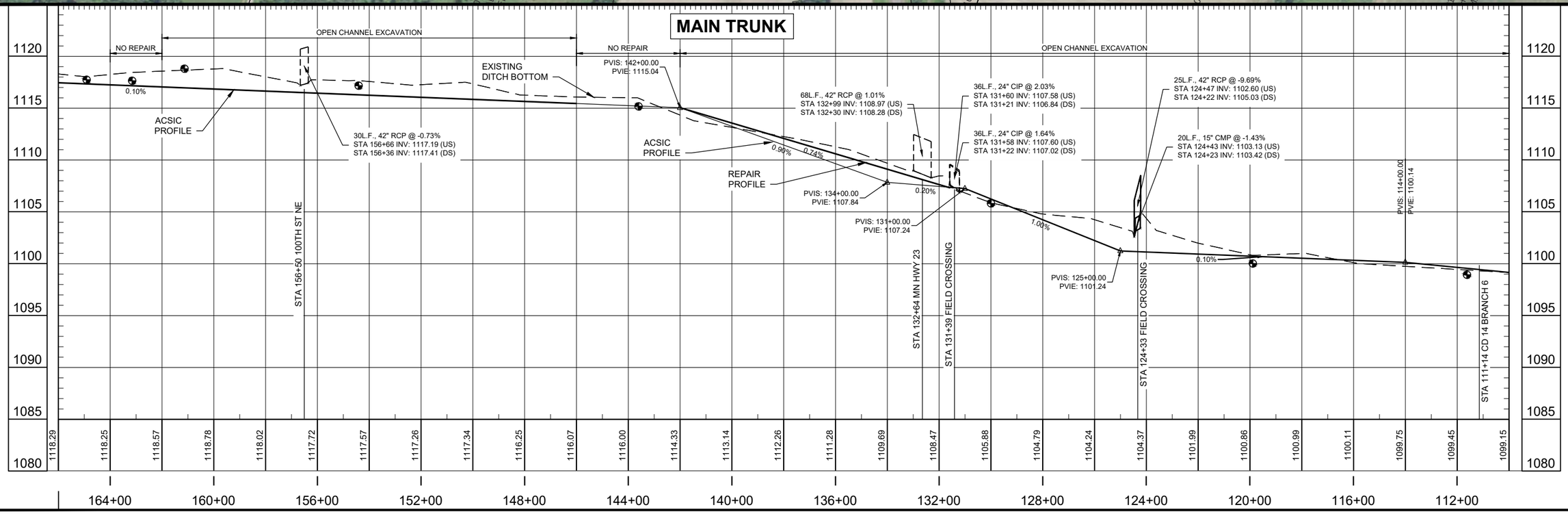

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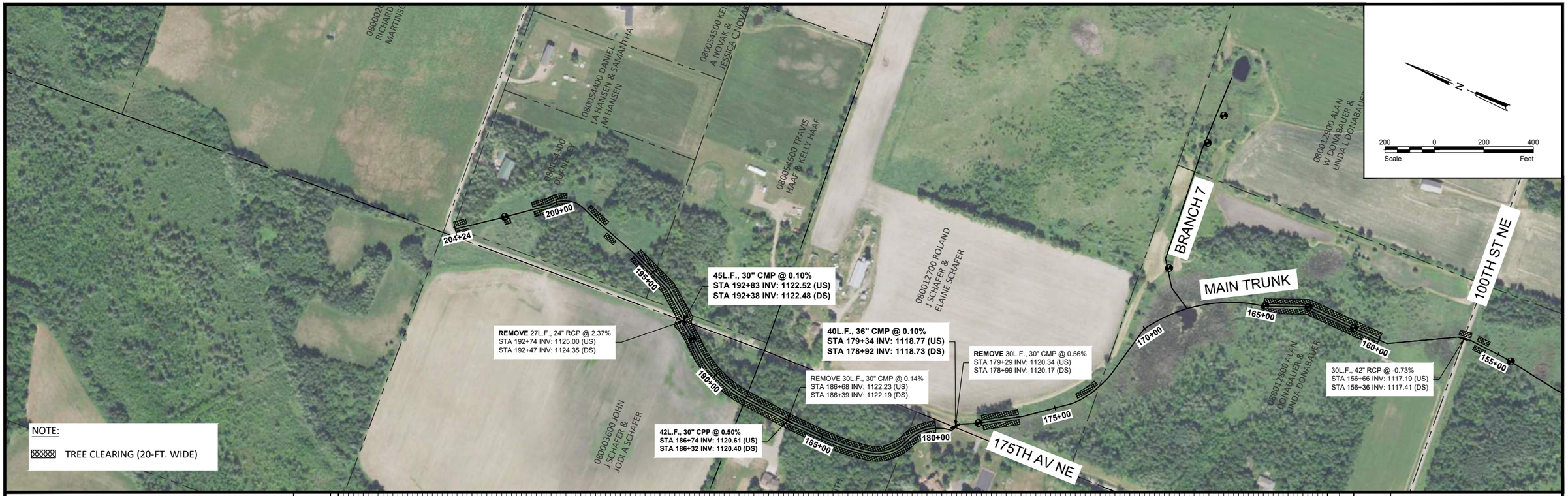

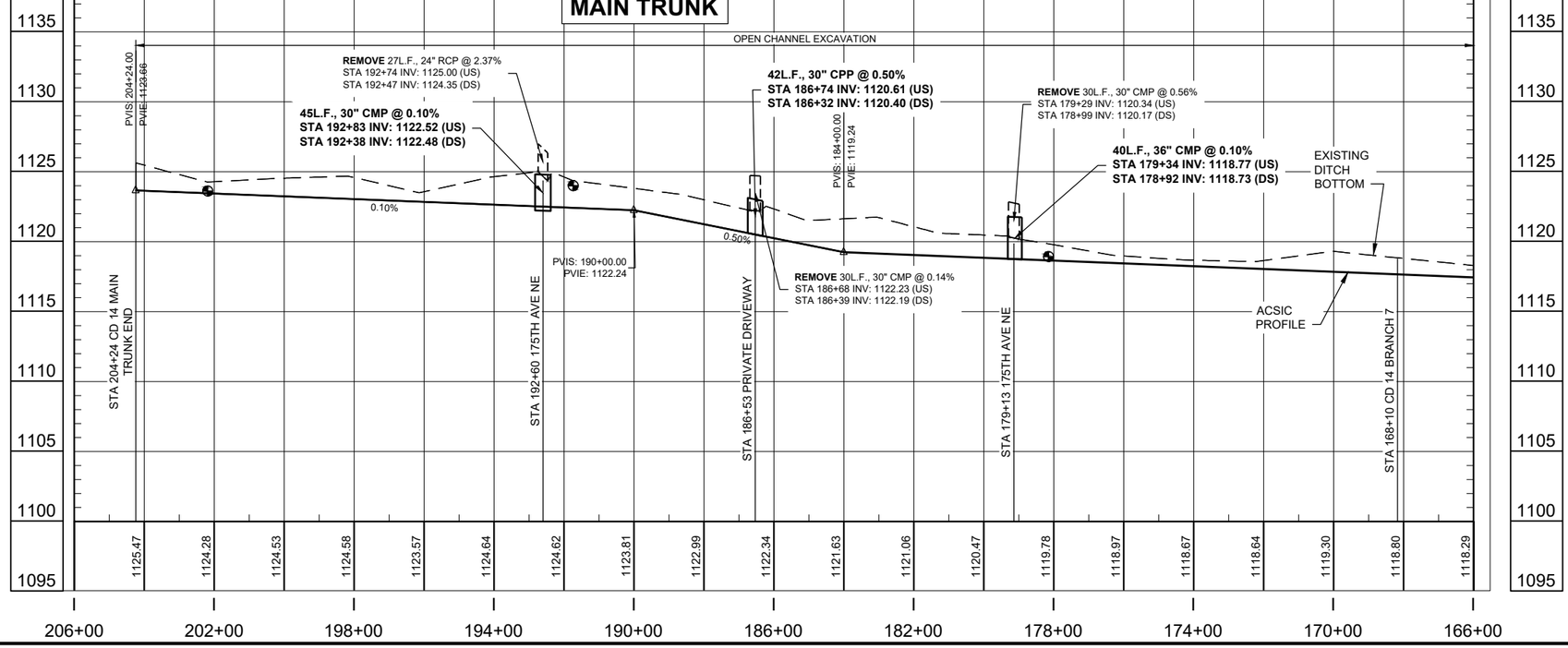

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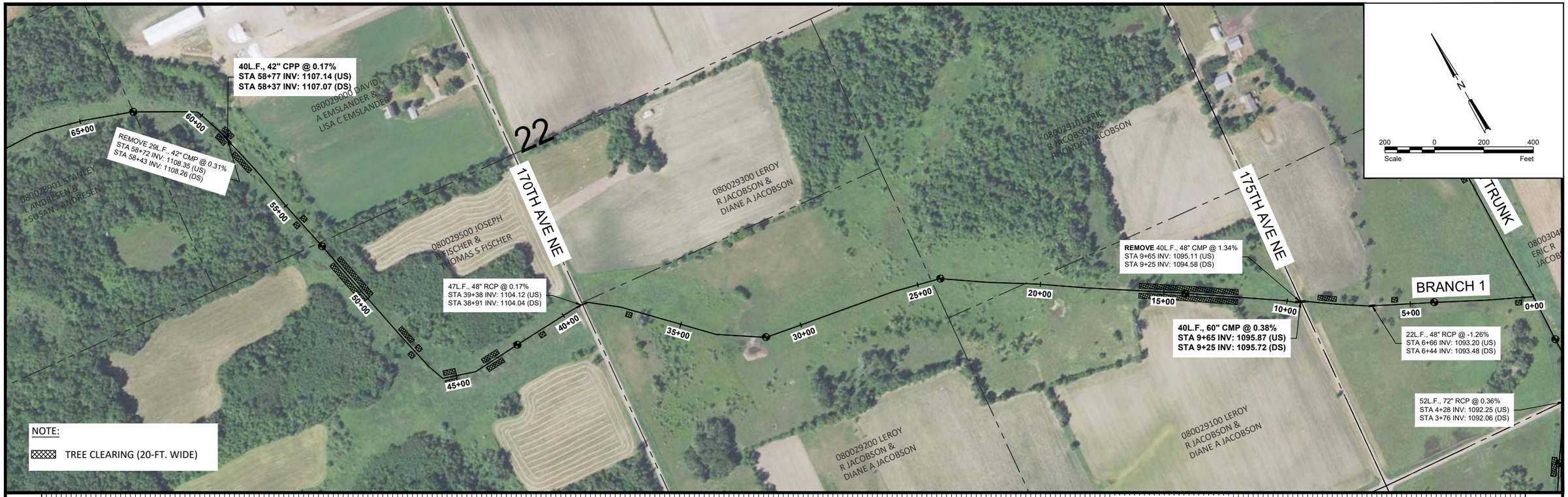

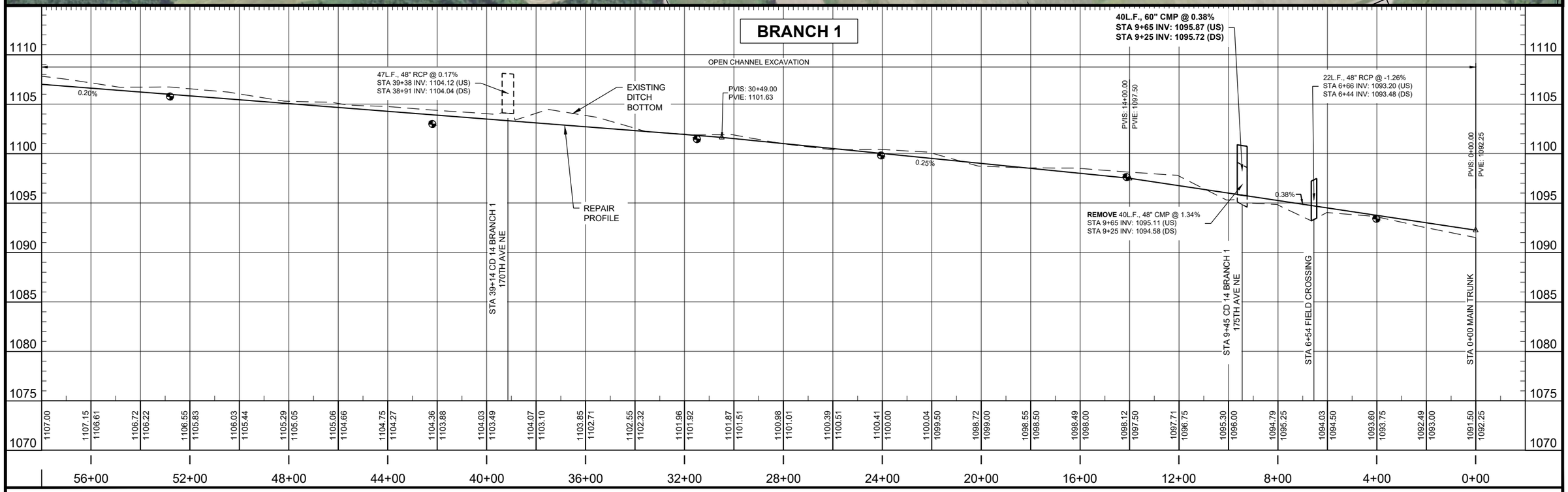

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PROJECT NO. 6183-0003

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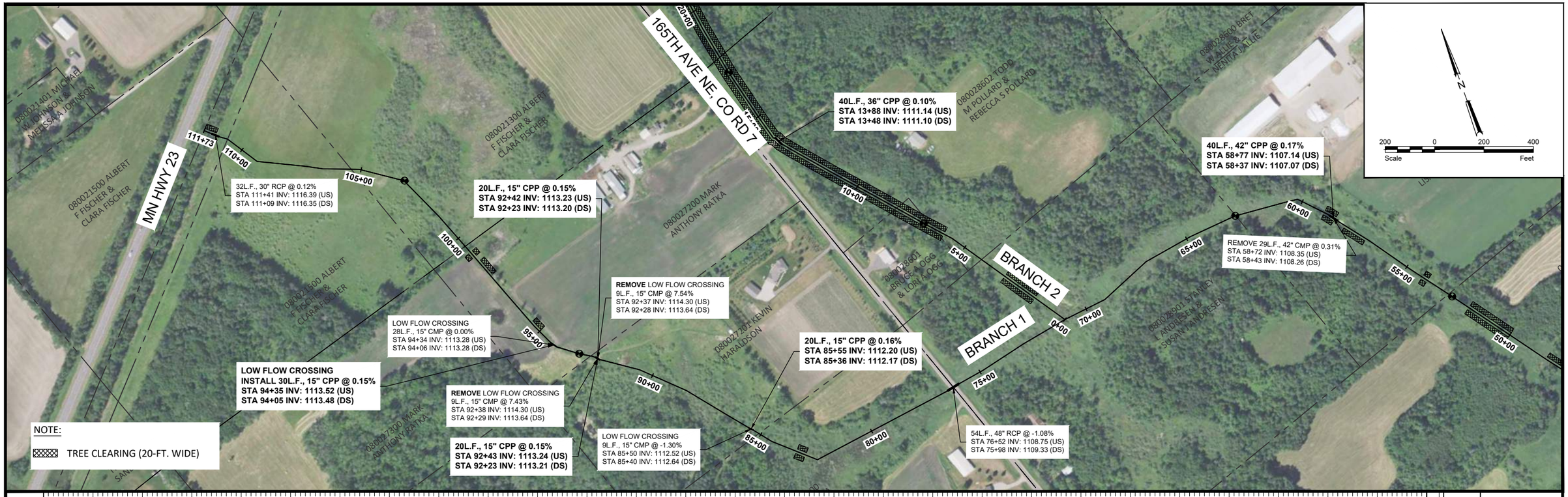

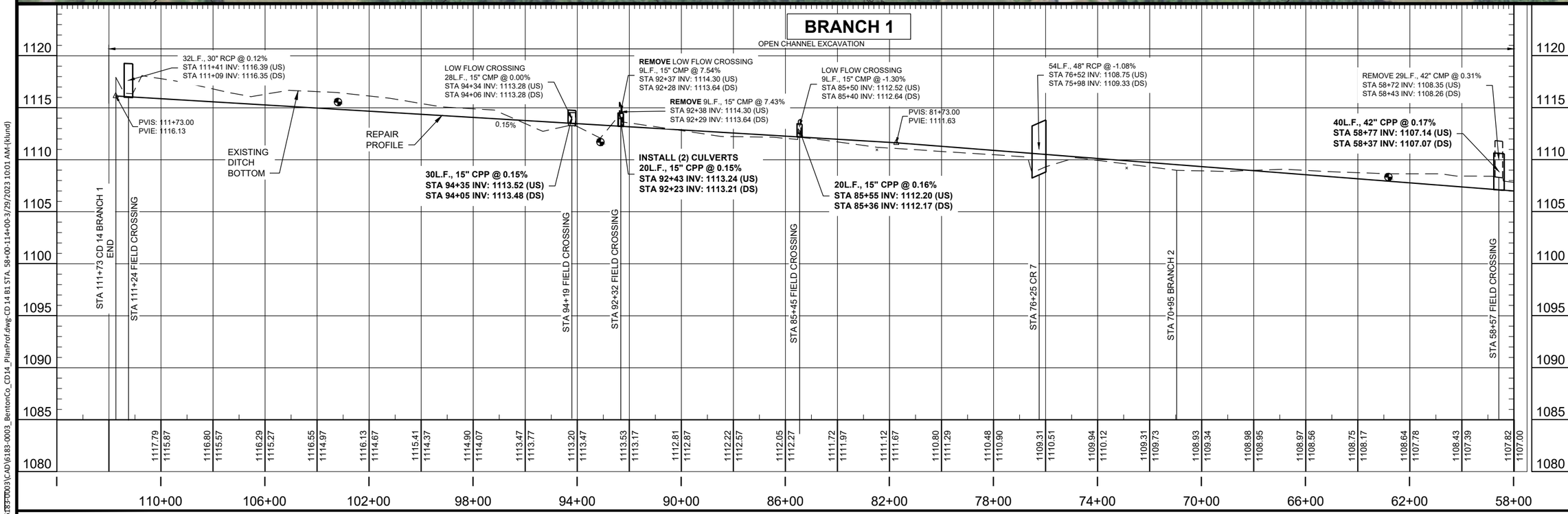

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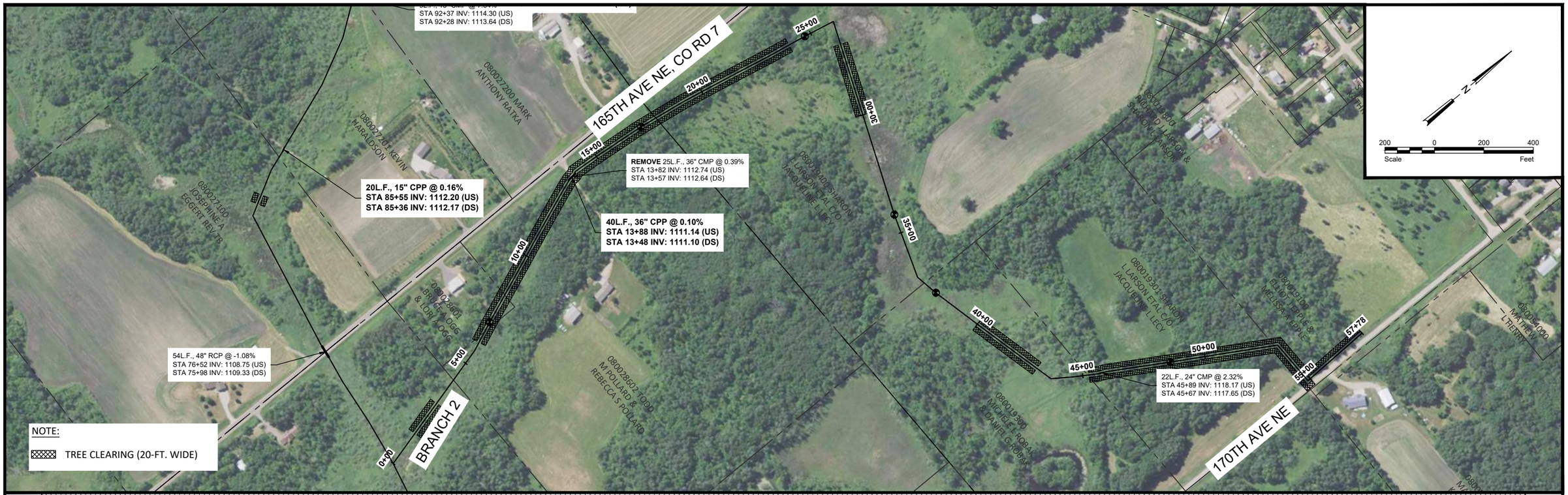

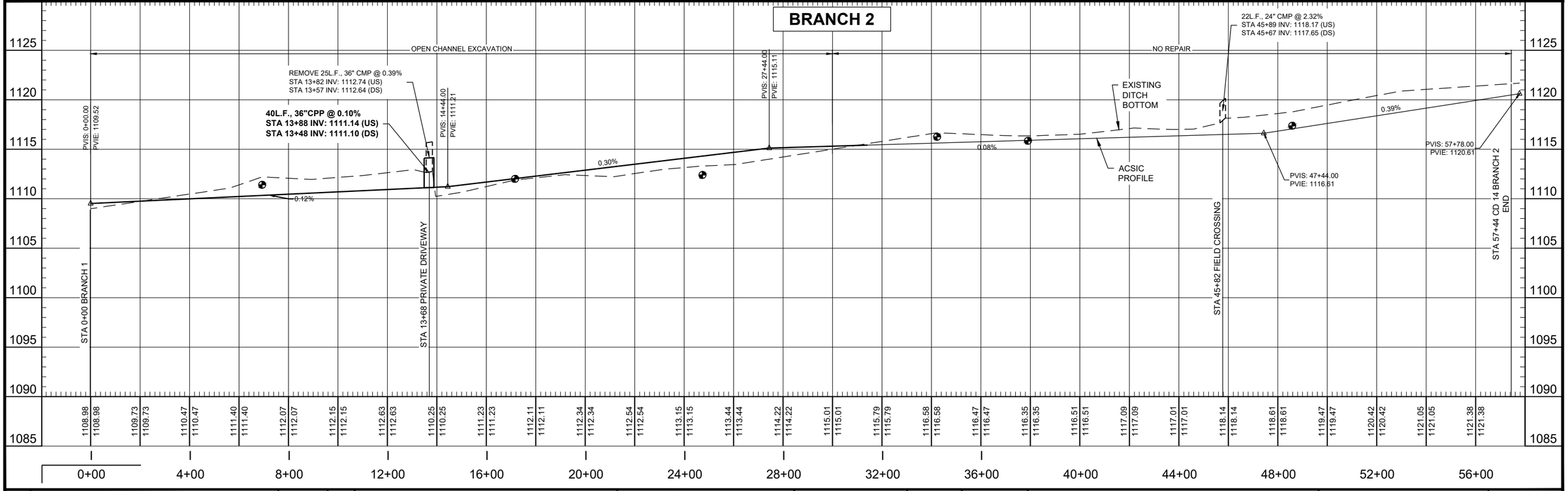

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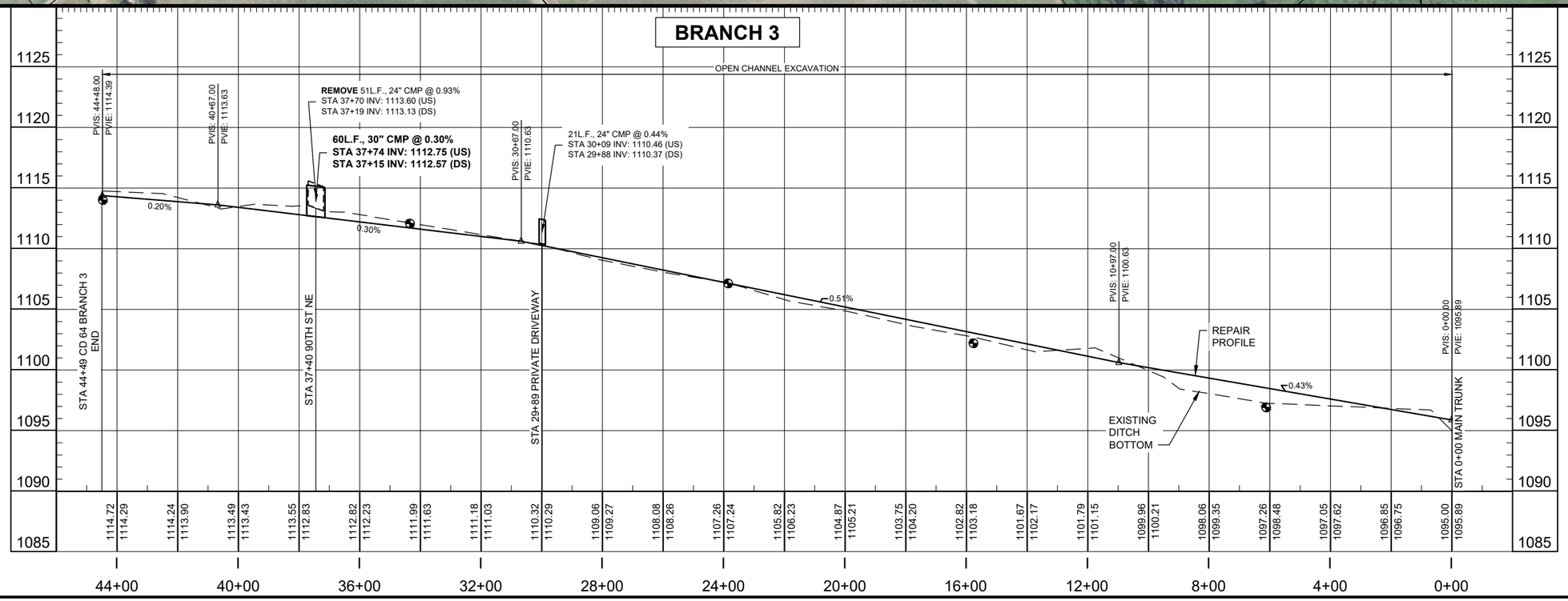

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BRA. 3 STA. 0+00 - 44+49
PROJECT NO. 6183-0003

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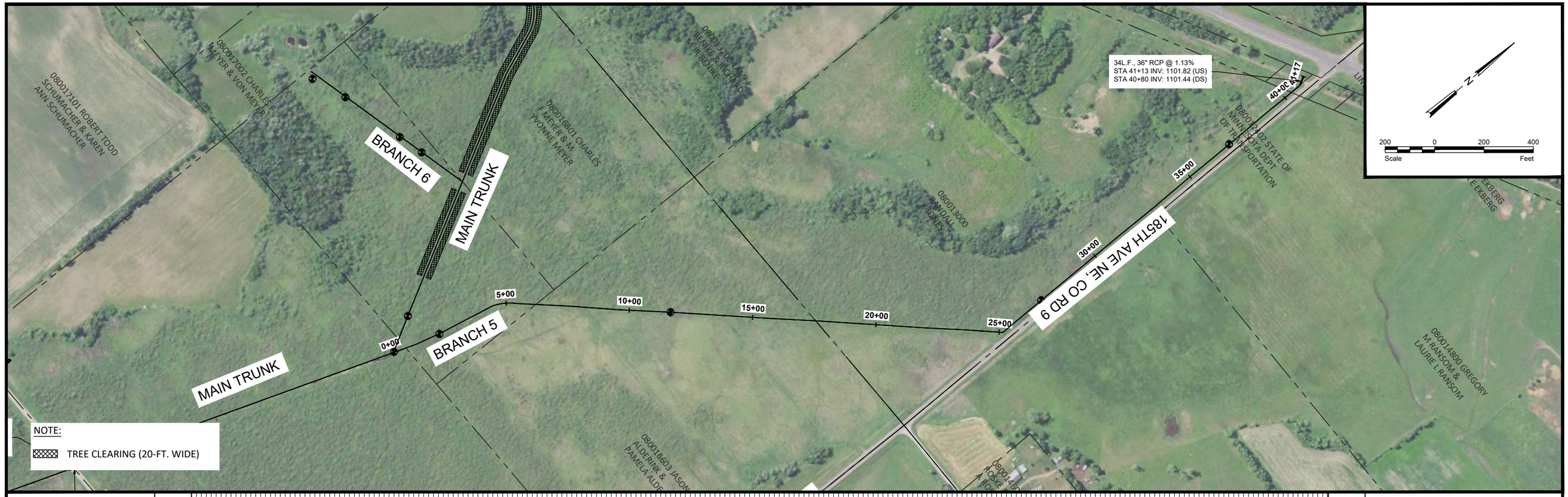

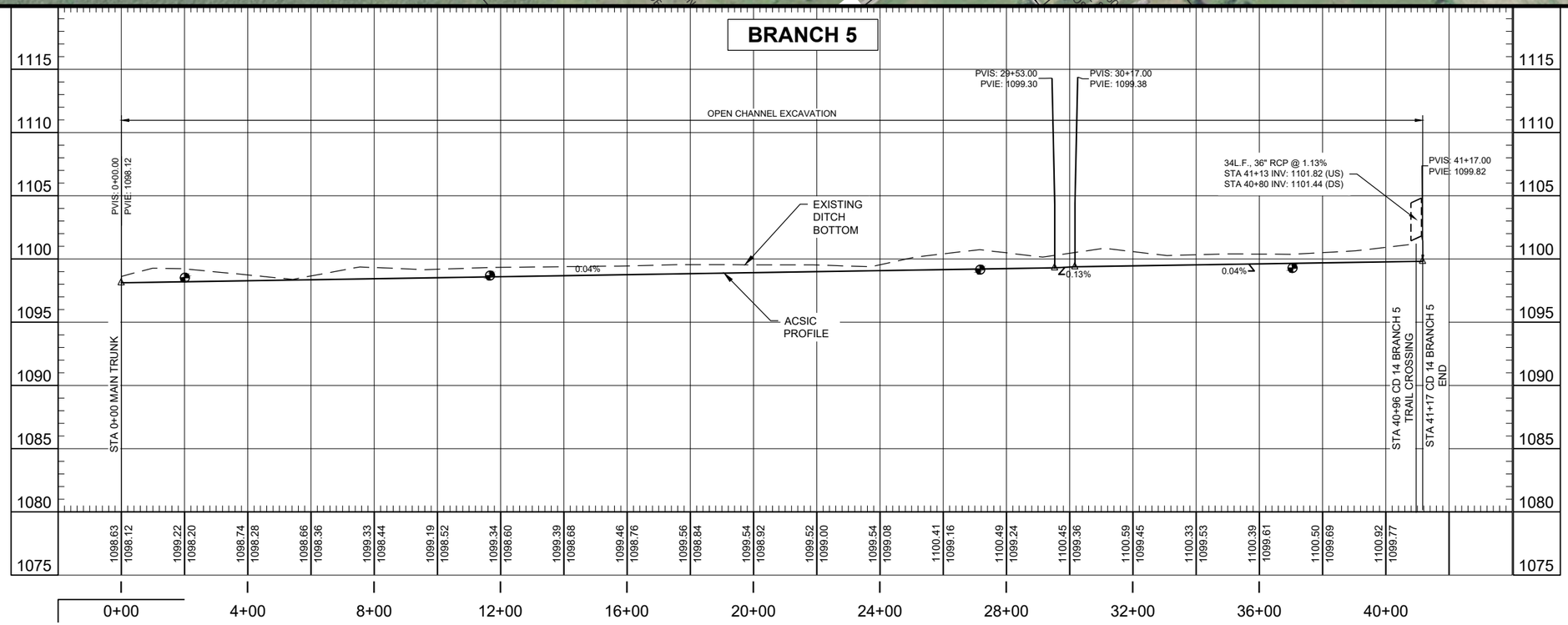

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BRA. 5 STA. 0+00 - 41+17
PROJECT NO. 6183-0003

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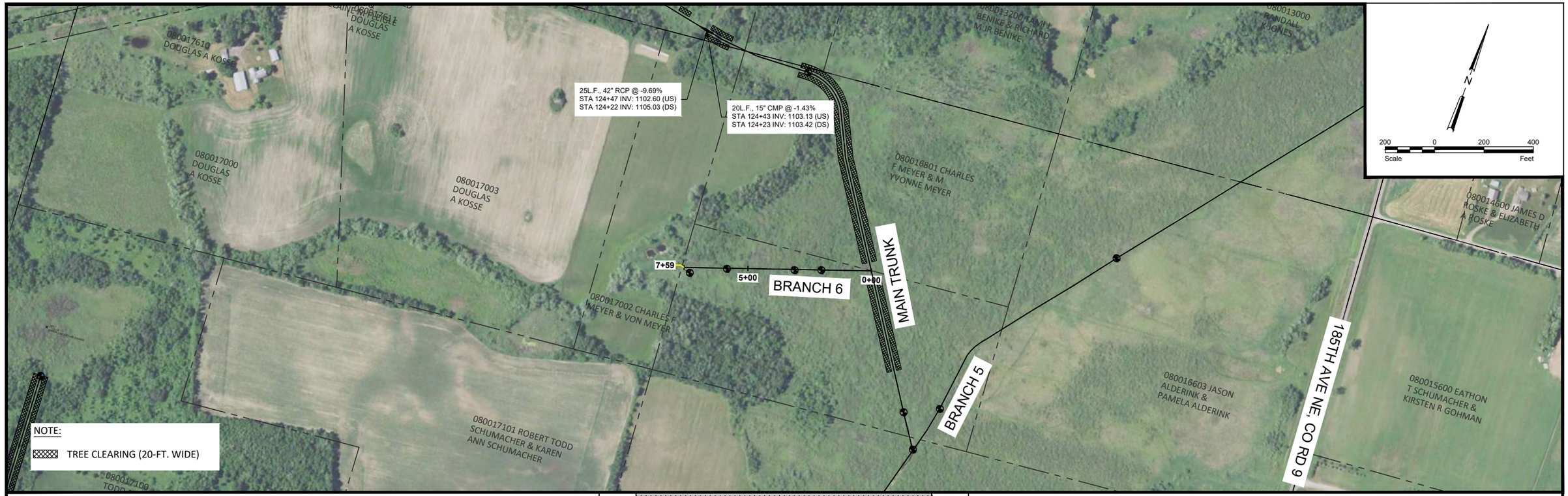

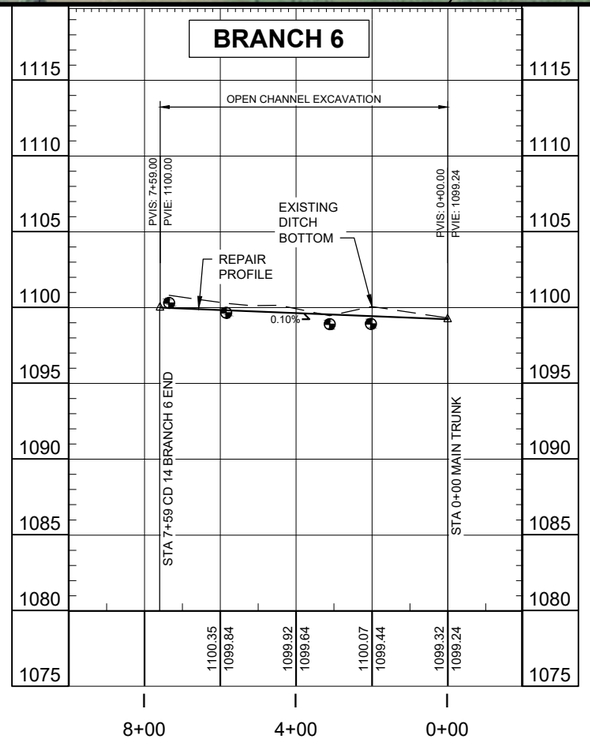

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BENTON COUNTY DITCH 14
BRA. 6 STA. 0+00 - 7+59
PROJECT NO. 6183-0003

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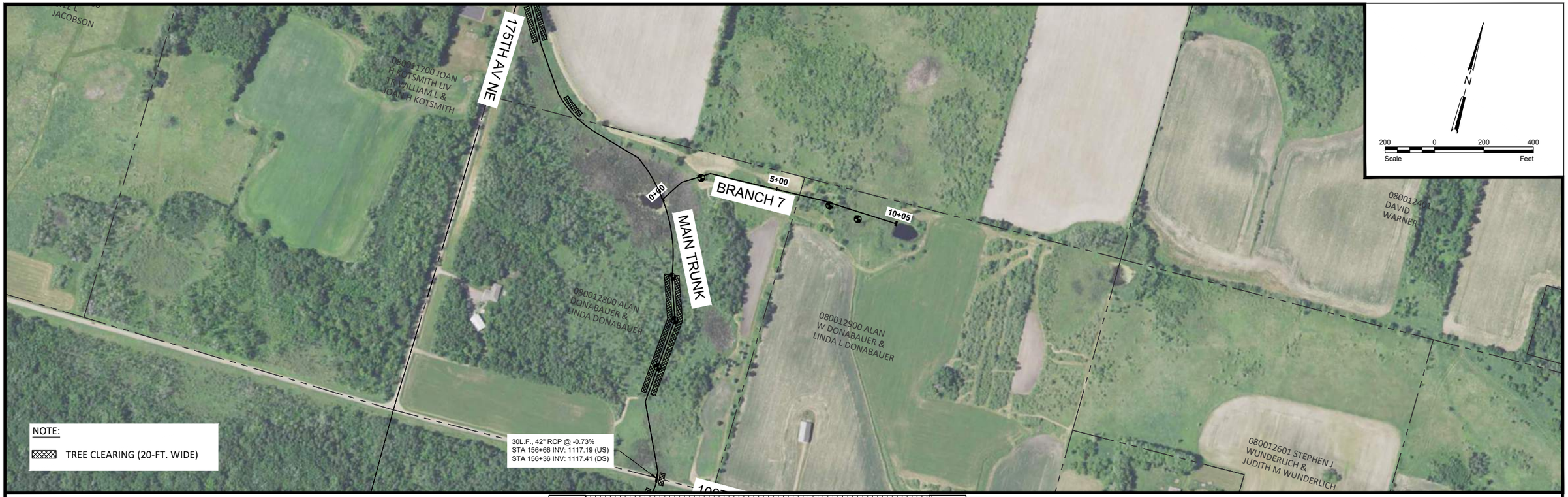
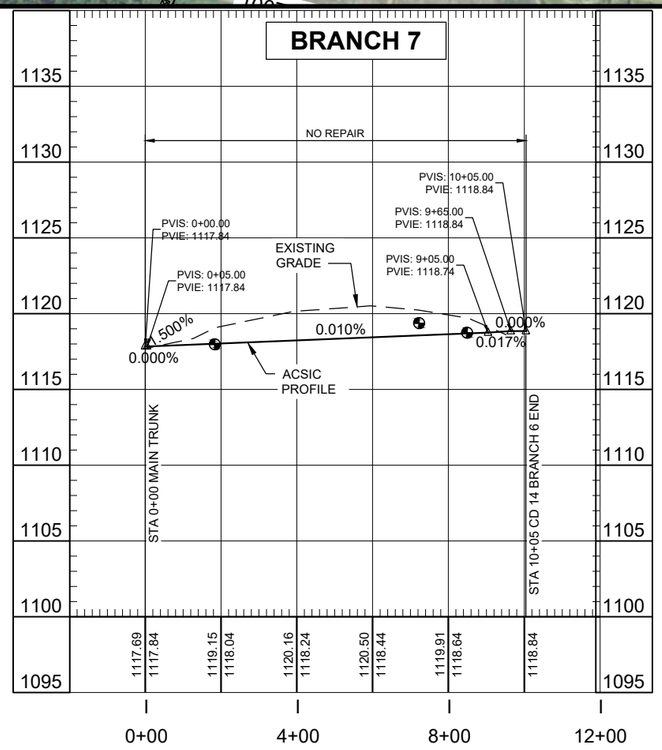
11 of 13





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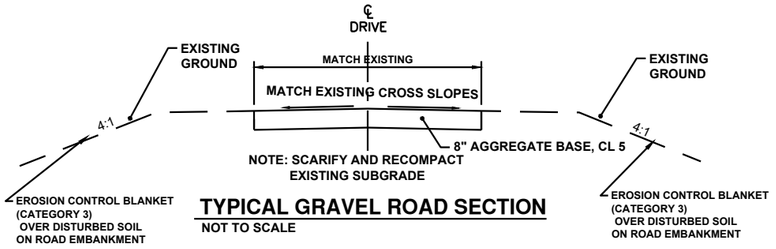
MAYWOOD TOWNSHIP, MN

BENTON COUNTY DITCH 14
BRA. 7 STA. 0+00 - 10+05
PROJECT NO. 6183-0003



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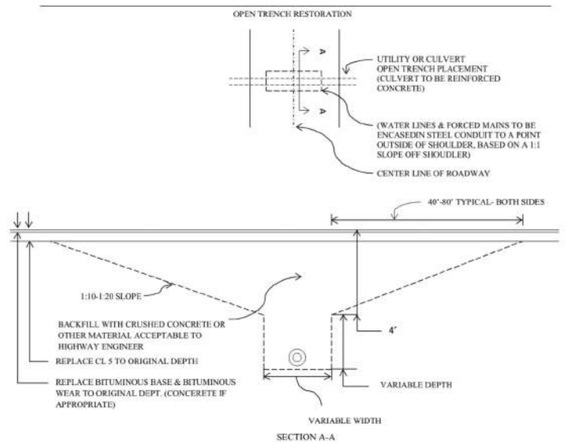

TYPICAL CROSSING OF COUNTY ROAD/TOWNSHIP ROAD

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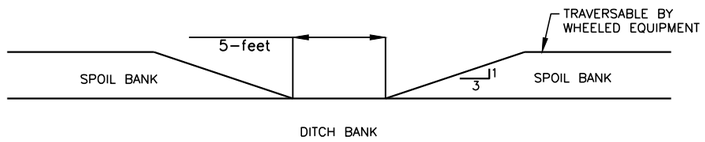

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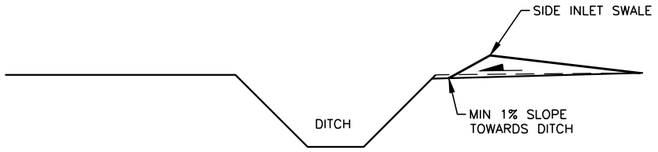

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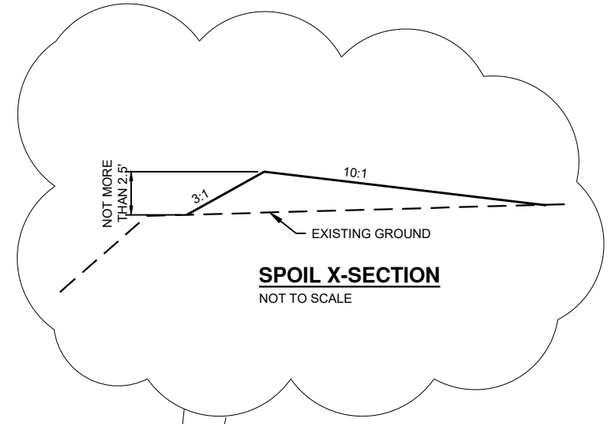

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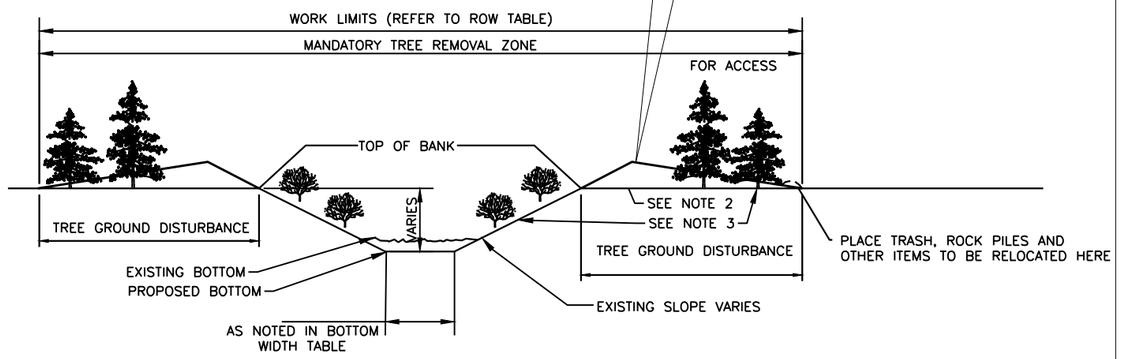

*NOTES:

1) WORK LIMITS EXTEND FROM TOP OF BANK TO WORK LIMIT STAKES OR AS SHOWN, ON EITHER SIDE OF THE DITCH.
2) EXISTING SPOILS TO BE SPREAD AND SMOOTHED
3) TREES CUT TO 2" OR LESS ABOVE GROUND SURFACE PER SPECIFICATIONS.
4) LEAVE SIDE INLET SWALE OR INSTALL SIDE INLET PIPE IN LOW AREAS TO PROVIDE DRAINAGE AND AS DIRECTED BY ENGINEER.
5) WHEN SEDIMENT REMOVAL DEPTH IS GREATER THAN 1.5', PLACE SPOIL ON BOTH SIDES OF DITCH UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
6) SIDE SLOPES ARE NOT TO BE DISTURBED UNLESS INDICATED IN THE PLANS.
7) TREES AND BRUSH FROM CLEARING OPERATIONS MUST BE DISPOSED OF OFF-SITE AT CONTRACTOR'S EXPENSE.

DITCH CLEANING, SPOIL PLACEMENT, AND WORK LIMITS

NOT TO SCALE

No.	Revision	Date	By

PRELIMINARY
Not for Construction

HOUSTON ENGINEERING INC.
Maple Grove
P: 763.493.4522
F: 763.493.5572

Drawn by	Date
KJL	03-28-2023
Checked by	Scale
JL	AS SHOWN

BENTON COUNTY DITCH 14 REPAIR
BENTON COUNTY
MAYWOOD TOWNSHIP

DETAILS
PROJECT NO. 6183-0003

SHEET
13 of 13

ATTACHMENT B – PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

Alternative 1 Preliminary Opinion of Probable Construction Cost					
Public Drainage System Infrastructure					
Item Number	**Description**	**Units**	**Est'd Quantity**	**Unit Price**	**Extension**
1	Mobilization	Lump Sum	1	$20,000	$20,000
2	Traffic Control	Lump Sum	1	$10,000	$10,000
3	Temporary and Permanent Removals	Lump Sum	1	$2,000	$2,000
4	Excavation of Open Channel (P)	Linear Foot	47671	$5	$238,355
5	Spoil Management (P)	Linear Foot	47671	$2	$95,342
6	Tree Clearing, Chipping, and Removal	Acre	10.8	$15,000	$162,000
7	Removal and Disposal of Existing Culvert	Linear Foot	169	$15	$2,535
8	Salvage and Reinstall Culvert	Linear Foot	34	$75	$2,550
9	15" CP Pipe Culvert	Linear Foot	70	$50	$3,500
10	24" CP Pipe Culvert	Linear Foot	35	$80	$2,800
11	30" CP Pipe Culvert	Linear Foot	42	$90	$3,780
12	36" CP Pipe Culvert	Linear Foot	40	$105	$4,200
13	42" CP Pipe Culvert	Linear Foot	90	$140	$12,600
14	Gravel Roadway Patch	Each	3	$5,000	$15,000
15	SWPPP Documentation & Reporting	Lump Sum	1	$2,500	$2,500
16	Seeding and Mulch (P)	Acre	22.00	$3,500	$77,000
17	Silt Fence; Type PA	Linear Foot	100	$5	$500
18	Sediment Control Log	Linear Foot	100	$4	$400
				Public Drainage Subtotal	**$655,062**
				20% Contingency	$131,012
				Engineering	$131,012
				Legal/Admin	$15,241
				Wetland Mitigation	$2,073,000
				Public Drainage Total	**$3,005,328**
Public Road Crossings					
Item Number	**Description**	**Units**	**Est'd Quantity**	**Unit Price**	**Extension**
1	Removal and Disposal of Existing Culvert	Linear Foot	320	$15	$4,800
2	Salvage and Reinstall Culvert	Linear Foot	30	$75	$2,250
3	30" CM Pipe Culvert	Linear Foot	105	$100	$10,500
4	36" CM Pipe Culvert	Linear Foot	40	$125	$5,000
5	60" CM Pipe Culvert	Linear Foot	40	$300	$12,000
6	72" CM Pipe Culvert	Linear Foot	60	$400	$24,000
7	48" RC Pipe Culvert	Linear Foot	110	$250	$27,500
8	48" RC Apron	Each	4	$2,000	$8,000
9	54" RC Pipe Culvert	Linear Foot	75	$280	$21,000
10	54" RC Apron	Each	2	$2,500	$5,000
11	72" RC Pipe Culvert	Linear Foot	55	$400	$22,000
12	72" RC Apron	Each	2	$3,250	$6,500
13	Gravel Roadway Patch	Each	8	$5,000	$40,000
14	Bituminous Roadway Patch	Each	1	$12,000	$12,000
15	Seeding and Mulch (P)	Acre	0.4	$5,000	$2,000
16	Erosion Control Blanket Cat. 3	Square Yard	500	$4	$2,000
				Public Road Crossings Subtotal	**$204,550**
				20% Contingency	$40,910
				Engineering	$40,910
				Legal/Admin	$4,759
				Public Road Crossings Total	$291,129
				TOTAL PROJECT COST	**$3,296,457**

Alternative 2 Preliminary Opinion of Probable Construction Cost					
Public Drainage System Infrastructure					
Item Number	**Description**	**Units**	**Est'd Quantity**	**Unit Price**	**Extension**
1	Mobilization	Lump Sum	1	$20,000	$20,000
2	Traffic Control	Lump Sum	1	$10,000	$10,000
3	Temporary and Permanent Removals	Lump Sum	1	$2,000	$2,000
4	Excavation of Open Channel (P)	Linear Foot	43122	$5	$215,610
5	Spoil Management (P)	Linear Foot	43122	$2	$86,244
6	Tree Clearing, Chipping, and Removal	Acre	10.8	$15,000	$162,000
7	Removal and Disposal of Existing Culvert	Linear Foot	102	$15	$1,530
8	15" CP Pipe Culvert	Linear Foot	70	$50	$3,500
9	30" CP Pipe Culvert	Linear Foot	42	$90	$3,780
10	36" CP Pipe Culvert	Linear Foot	40	$105	$4,200
11	42" CP Pipe Culvert	Linear Foot	40	$140	$5,600
12	Gravel Roadway Patch	Each	2	$5,000	$10,000
13	SWPPP Documentation & Reporting	Lump Sum	1	$2,500	$2,500
14	Seeding and Mulch (P)	Acre	20.00	$3,500	$70,000
15	Silt Fence; Type PA	Linear Foot	100	$5	$500
16	Sediment Control Log	Linear Foot	100	$4	$400
				Public Drainage Subtotal	**$597,864**
				20% Contingency	$119,573
				Engineering	$119,573
				Legal/Admin	$17,470
				Wetland Mitigation	$0
				Public Drainage Total	**$854,480**
Public Road Crossings					
Item Number	**Description**	**Units**	**Est'd Quantity**	**Unit Price**	**Extension**
1	Removal and Disposal of Existing Culvert	Linear Foot	205	$15	$3,075
2	30" CM Pipe Culvert	Linear Foot	105	$100	$10,500
3	36" CM Pipe Culvert	Linear Foot	40	$125	$5,000
4	60" CM Pipe Culvert	Linear Foot	50	$300	$15,000
5	72" CM Pipe Culvert	Linear Foot	60	$400	$24,000
6	Gravel Roadway Patch	Each	5	$5,000	$25,000
7	Seeding and Mulch (P)	Acre	0.4	$5,000	$2,000
8	Erosion Control Blanket Cat. 3	Square Yard	500	$4	$2,000
				Public Road Crossings Subtotal	**$86,575**
				20% Contingency	$17,315
				Engineering	$17,315
				Legal/Admin	$2,530
				Public Road Crossings Total	$123,735
				TOTAL PROJECT COST	**$978,215**