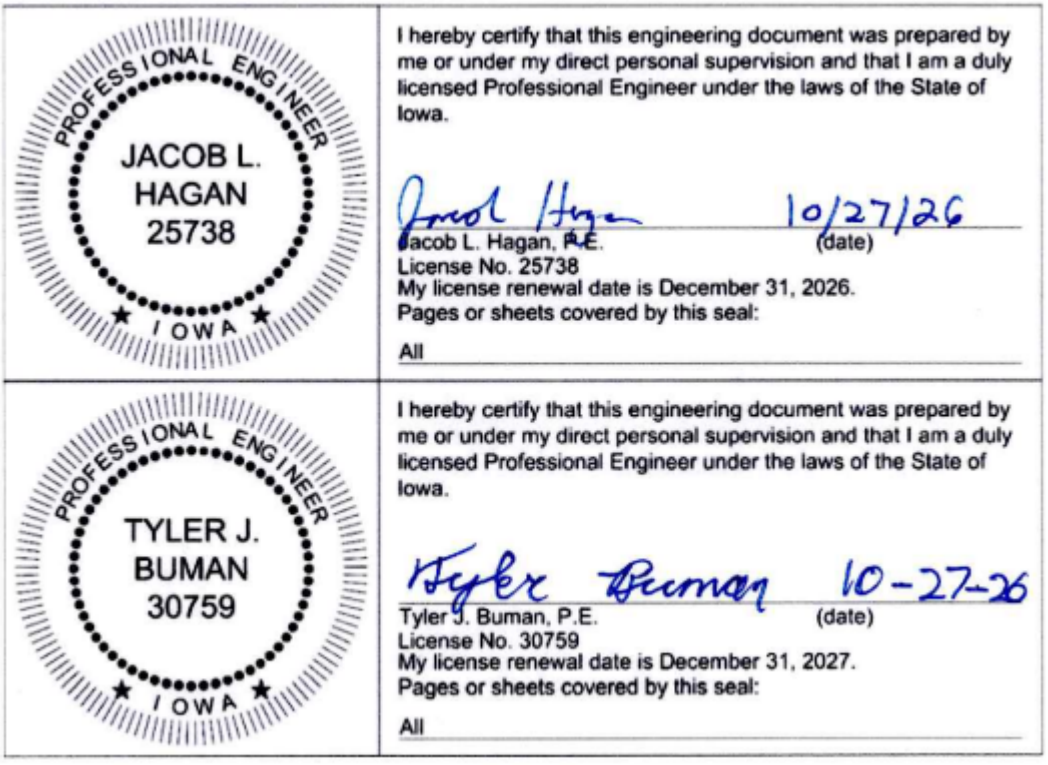
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Engineer's Report

Crane Intercounty Drainage District No. 2 Open Ditch Repairs

Monona & Harrison Counties, Iowa
2026



Project No. 2616-67

Executive Summary

Introduction
Following a petition submitted by a landowner on May 6, 2024, a comprehensive engineering study was conducted to evaluate the open ditch system of Crane Intercounty Drainage District in Monona and Harrison Counties. This report presents findings and recommendations to address long-standing maintenance needs and drainage deficiencies in the Main Open Ditch and to ensure the continued productivity of the district's 7,542-acre watershed.

Problem Assessment
The investigation found the Main Open Ditch in poor condition along its whole length. It is filled with sediment and vegetation; its bottom is too flat to move water (the surveyed flowline averages about 0.027%). Standing water, bank slumping, collapsed field-crossing bridges, and failing surface drains further reduce its effectiveness as the outlet for the district and the neighboring Fletcher Drainage District. Existing road culverts sit at or below the 1997 design elevations.

Proposed Solution
This report presents two options. Both rebuild the ditch with a 4-foot bottom from the outlet to Hemlock Avenue, replace 23 of 33 surface drains, add 17 new drains at gullies, and remove obstructions. Option 1, the Repair of Best Fit, grades the ditch to the existing culverts without lowering any of them. Option 2, the Improvement, lowers seven culverts at five locations to establish a deeper flowline. Through the middle reach, Option 1 holds about 73% of design flow before spilling over the bank, compared with 132% for Option 2. The plan also facilitates voluntary water quality conservation practices.

Project Cost and Economic Benefits
Option 1 is estimated at $611,366, or approximately $146 per acre, and Option 2 at $881,558, or approximately $210 per acre, based on 4,196 benefited acres. Option 2 costs $270,192 more, about $64 more per acre. Both are in line with previous open ditch repairs and are necessary to protect the land's agricultural value and prevent crop loss from inadequate drainage. County road crossing work under Option 2 ($40,419) is paid by the counties and is not included.

Implementation and Landowner Considerations
If approved, the project will be publicly bid in spring 2027, with construction to be completed by March 2028. Costs will be shared among landowners according to the district's assessment schedule, and we recommend the Board include the Fletcher Drainage District in the common outlet cost. Affected landowners will be compensated for crop damages and soil disturbance. The district will maintain a one-year warranty on all construction-related work.

Recommendation
The Main Open Ditch is operating well below its original design capacity. We recommend that the Board of Trustees accept this report and schedule a public hearing. We have no strong preference between the two options. Pending landowner input, we advise selecting an option, proceeding with detailed plans, and competitive bidding.

Table of Contents

Introduction **3**
Overview 3
Location 3
Historical Considerations **3**
Prehistoric and Geologic Background 3
State-wide Drainage System Overview 3
County-Wide Drainage System Overview 4
Crane Intercounty Drainage District Historical Overview 4
Historical Agricultural Demands 6
Environmental Considerations **6**
Climate and Weather Patterns 6
Watershed Characteristics **7**
District Landscape 7
Soils 8
Subsurface and Surface Water Flow Behavior 9
Private Drainage 9
Existing Infrastructure and Conditions **10**
Field Survey 10
Existing Culverts Compared to the 1997 Plans 11
Downstream Outlet 11
Proposed Project **12**
Project Design 12
Design Basis for the Repair of Best Fit 12
Work Common to Both Options 12
Option 1 – Repair of Best Fit 13
Option 2 – Improvement 14
Pipes and Obstructions 14
Preliminary Plans 15
Construction Considerations **15**
Ditch Construction Methods 15
Proposed Crossings 17
Utility Conflicts and Coordination 17
Construction Timeline 18
Estimated Costs and Analysis **18**
Cost Estimate 18
Historical Cost Comparison 18
Assessment Schedule Review 19
Installment Payment Options 19
Taxes 19
Permitting **19**
US Army Corps of Engineers (USACE) 19
Iowa Department of Natural Resources (DNR) 19
USDA Wetland Conservation Compliance (Swampbuster) 19
Water Quality Recommendations **20**
Conservation Practices 20
Iowa Nutrient Reduction Strategy 20
Edge-of-Field Practices 20
In-Field Practices 21
Maintenance and Long-Term Management **22**
Warranty Period 22
Work Orders 22
Landowner Considerations **22**
Public Hearing on Report 22
Objections 23
Landowner Construction Considerations 23
Right-of-Way and Work Limits 23
Construction Damages 23
Completion Hearing 24

Conclusion and Recommendations **24**
Conclusion 24
Recommendations 24
Appendices **26**
Appendix A – Petition Filed 26
Appendix B – Area of Study Map 27
Appendix C – Rainfall Chart: 1895–Present 28
Appendix D – Palmer Drought Severity Index: 1895–Present 29
Appendix E – Elevation Map 30
Appendix F – Soil Types 31
Appendix G – Soil Drainage Class 33
Appendix H – Soil Ksat 34
Appendix I – Depth to Water Table 35
Appendix J – Drone Survey Photos 36
Appendix K – Itemized Cost Estimate 40
Appendix L – Current Assessment Schedule Map 43
Appendix M – Twenty Benefits of Drainage (Ohio State Extension) 44
Appendix N – Nutrient Reduction Strategy Example 46
Appendix O – Existing Right-of-Way 47
Appendix P – Bridges and Crossings 48
Appendix Q – Pipe Table 50
Appendix R – Option 1 and Option 2 Profiles 52
Preliminary Plans

Introduction

Overview
Many Iowa landowners benefit from drainage infrastructure without day-to-day consideration of its operation. These systems, managed through legally established drainage districts, construct, repair, and maintain improvements such as tile lines and open ditches, allowing farmland to remain productive by controlling excess surface and subsurface water.

Crane Intercounty Drainage District in Monona and Harrison Counties, like many early 20th-century districts, was established to improve drainage in a wetter, less-developed landscape. The Monona and Harrison County Boards of Supervisors serve as trustees, overseeing maintenance and ensuring that improvements benefit all landowners within the district. Under Iowa Code Chapter 468, landowners have the right to petition for repairs or improvements. On May 6, 2024, a landowner submitted such a petition requesting an evaluation of the existing open ditch system (Appendix A).

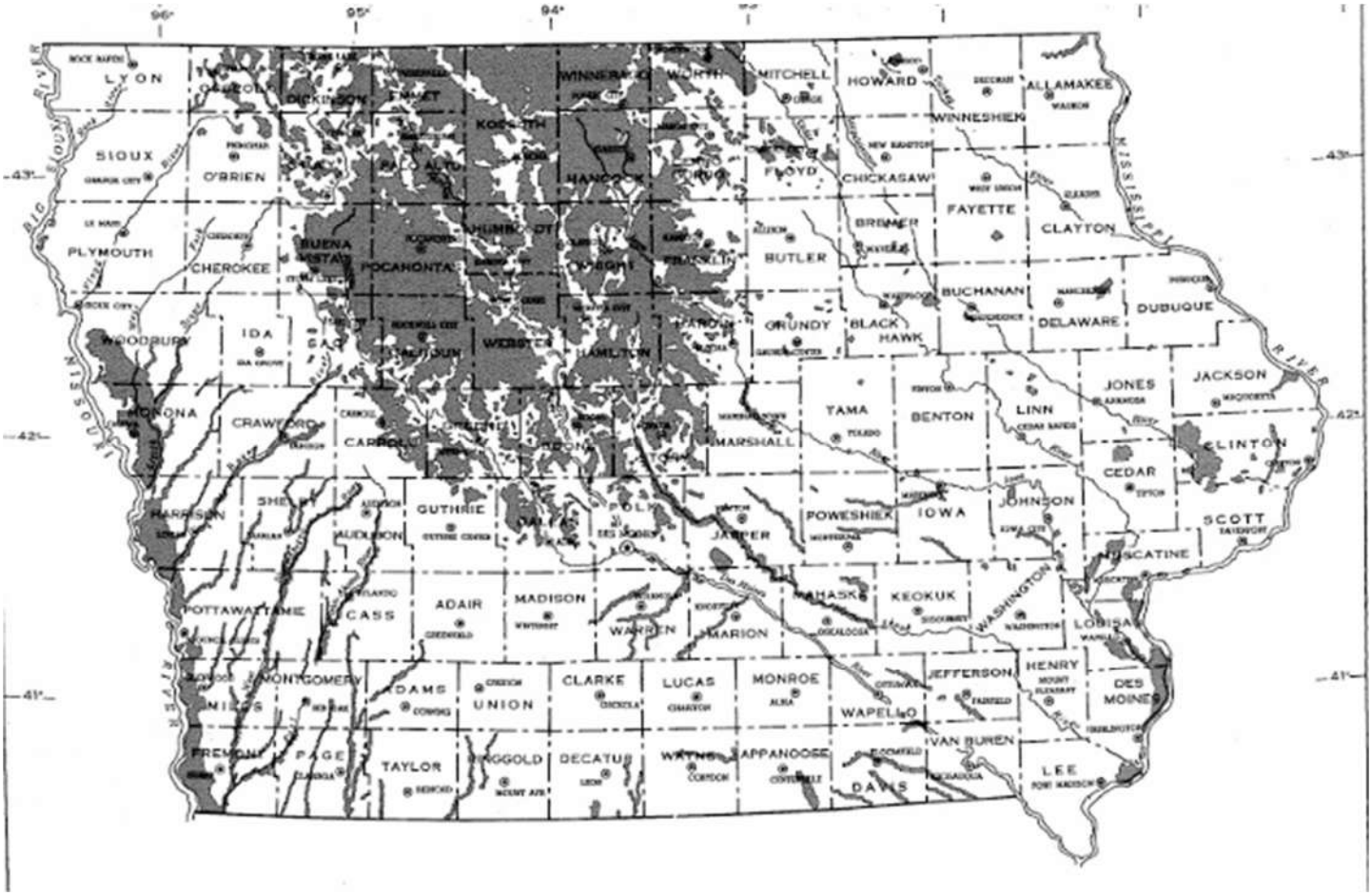
Once a valid petition is received, the Board hires a licensed engineer to conduct a preliminary survey and study and prepare a report outlining possible repairs or improvements and associated costs. This report presents the findings and recommendations resulting from that study and survey. The process is deliberate and transparent, with all landowners entitled to receive notice, review findings, attend hearings, and raise questions before any project proceeds.

Location
Crane Intercounty Drainage District spans lands in sections 21-22, 27-29, and 33-34 of Sherman Township in Monona County, and sections 3-5, 9-10, and 14-15 of Little Sioux Township of Harrison County. The district lies north and west of the town of Little Sioux and south of the town of Blencoe. A map of the area of study is included in Appendix B.

Historical Considerations

Prehistoric and Geologic Background
The bottom land in Monona and Harrison County is built entirely of alluvium: sediment deposited by the Missouri River and its tributaries as the channel migrated across the valley floor. That migration created three distinct zones, youngest to oldest: the bar area along the current channel, occupied by the river within roughly the last 100 years; the young bottom land, occupied within the past 100 to 300 years, where meander loops and abandoned channels were later filled by flood deposition; and the old bottom land, undisturbed by channel migration far longer. Because the old bottom land has been in place longest, its soils have had the most time to develop. Flooding governed this landscape until 1955, when Corps of Engineers dams upstream in the Dakotas cut off the periodic 8-to-10-foot floods that used to inundate the bar area; since then, flood frequency there is rated occasional and on the young bottom land rare, though the old bottom land still floods occasionally from backed-up tributaries rather than the Missouri itself. The hills bounding the valley, by contrast, are loess over glacial till, wind-blown silt mantling ice-age drift.

State-wide Drainage System Overview
Artificial drainage in Iowa began in the late 1800s as settlers converted wetlands into farmland. Steam- and later gasoline-powered machinery accelerated these efforts. A 1904 constitutional amendment enabled the creation of drainage districts, allowing landowners to fund and manage large-scale drainage projects. By 1930, more than nine million acres of wetlands had been converted to farmland.



Source: Iowa Drainage Districts (1950 US Census of Agriculture)

The scale of Iowa's drainage efforts is striking. By 1912, investments in drainage likely exceeded U.S. spending on the Panama Canal, highlighting the significant labor and engineering required to reshape the landscape. Today, approximately 3,800 drainage districts maintain networks of ditches and tiles statewide.

County-Wide Drainage System Overview

Monona and Harrison Counties are served by many drainage districts along the flat Missouri River bottomland and up further into the local river valleys. Monona County alone has nearly 540 miles of drainage district open ditches. Most districts were established before 1930 and are undersized to meet the needs of modern farming practices and require regular upkeep.

Crane Intercounty Drainage District Historical Overview

The Crane Intercounty Drainage District in Monona and Harrison Counties was established to address persistent flooding and wetland conditions that limited agricultural productivity. The original construction was $3,162.20 (1905). In 1975 the restated original-cost base was listed as $11,894.15. Key events in the district's development include:

- **1904**
  Landowners file bond and petition; Crane Outlet Drainage District No. 2 is established in Monona and Harrison Counties.
- **1904**
  Engineer C. L. Huff surveys the ditch; Fred M. Crane is awarded the original construction contract at 12¢/cu. yd.

- **1904**
  Commissioners classify benefits and levy the original special assessment of benefits totaling $4,556.01 (the estimated cost of the improvement as apportioned to lands).
- **1905**
  Original ditch construction is completed and accepted (Sept. 9, 1905); final construction cost $3,162.20 (~26,352 cu. yd. at 12¢) paid to F. M. Crane.
- **1908–17**
  Early cleanouts and enlargement work proceed (including W. H. Torrance; one later cleanout final estimate indexed at $460.35).
- **1916**
  Joint boards approve major cleanout, deepening, and outlet changes based on Engineer R. V. Fairchild's report (his estimate ~$12,911 including R/W, separate from original construction).
- **1926**
  Crane Outlet No. 2 is cleaned out under contract with M. B. Musgrave; a July 1926 profile documents the work.
- **1930s–40s**
  Repeated special assessments are levied to cover district overdrafts and maintenance costs.
- **1949**
  Joint board awards the drainage cleanout to Ewing & Lake of Onawa for $3,627.
- **1950**
  Petitions seek annexation of additional lands and further ditch cleanout/repair.
- **1951–53**
  A Crane–Fletcher combined district is proposed; 1952 Missouri River flood damage drives outlet relocation talks with the Highway Commission.
- **1963–70**
  Landowners petition for tree clearing, stump removal, and crossing improvements along the ditch.
- **1975**
  Boards restate original costs at establishment as Harrison $4,553.20 and Monona $7,340.95 (combined $11,894.15 administrative base); award major repair/cleanout to Shearer Contractors ($21,440).
- **1983–88**
  Brush and tree removal petitions continue; boards authorize limited cleanout and brush-control work.
- **1990**
  Virtue Engineering reports siltation and private-crossing problems and recommends channel/crossing fixes.
- **1995**
  Board approves J & J Ag-Air brush-control work on Crane ditch segments for an estimated project total of $4,450 (3.1 miles).
- **1997**
  Major ditch repairs and outlet-structure improvements are awarded to Nelson & Rock Contracting for $59,426.50 (Sundquist Engineering plans).

- **1997–99**
  Common-outlet cost issues with Fletcher, right-of-way, and change orders are settled; contract completion is accepted after a 1999 hearing.
- **2003–05**
  Highway K-45 bridge work at the outlet raises silting concerns and triggers engineer review and county agreements.
- **2010–12**
  Capacity analysis and further open-ditch repair proceedings are documented.
- **2017**
  Open-ditch repairs are completed under contract with Goslar Construction; certificate of completion is processed.
- **2020–26**
  A petition for cleanout is received in 2024, and ISG is appointed as engineer. In 2026, ISG is relieved of its duties and AgriVia is appointed.

Historical Agricultural Demands

In the early 20th century, farms in Monona and Harrison Counties were smaller and more diversified. They included a mix of row crops, small grains, hay, pasture, and livestock. Since then, agriculture in these counties has changed dramatically. Most farms today span several hundred acres and operate in a corn–soybean rotation, which now accounts for over 90% of row-cropped land. Looking at the 1950s aerial photo, we counted seventeen farmsteads, and today only seven farmsteads exist.

One historical land use change that appears to have impacted this district is the Conservation Reserve Program (CRP). Looking at recent Google Earth photos, it appears nearly 500 acres in the benefited area are set aside and not being farmed. It is likely at least some, if not most, of these acres have been retired due to poor drainage.

Environmental Considerations

Climate and Weather Patterns

Long-term weather records dating back to 1895 provide insight into shifting precipitation patterns, temperature trends, and drought cycles, all of which affect how water moves through fields and drainage systems.

Historically, Monona County receives anywhere from 15 to 44 inches of precipitation per year, averaging around 29 inches (Appendix C). In addition to rising totals, rainfall has become more intense and unevenly distributed. Short, high-intensity storms delivering 2 to 4 inches in a single day are increasingly common, especially in spring and early summer.

The Palmer Drought Severity Index (PDSI) reflects this variability. While Monona County experienced major droughts in the 1930s, 1950s, early 1970s, and late 1980s, recent decades show more frequent wet periods and positive PDSI values (Appendix D), indicating above-normal soil moisture. At the same time, temperature records show moderate warming, especially in winter and early spring, leading to earlier snowmelt, altered freeze-thaw cycles, and longer growing seasons.

Watershed Characteristics

District Landscape

Crane Intercounty Drainage District encompasses a watershed defined by old oxbows of the Missouri River. A large old oxbow stretches through Sections 10 and 4 of Little Sioux Township and Section 33 of Sherman Township extending further northeast but is cut by the railroad. Smaller, less defined oxbows sit farther north and higher in Sections 28 and 21 of Sherman Township. The highest land in the district is in Section 21. Overall, the district is very flat with little relief except for road ditches and constructed drainage swales. ISG found no tile outlets as part of the survey, suggesting very little tiling, if any, has been completed in this district, as is typical of Missouri River bottom drainage districts.

The watershed is long and narrow, about 8.8 miles from north to south and up to 2.8 miles wide across its western lobe (Appendix B). The open ditch occupies only the southern end. It begins at Hemlock Avenue in Section 21 and runs about 6.2 miles south-southeast to the Harrison Ditch in Section 15. About one third of the watershed, roughly 2,500 acres, lies north of Hemlock Avenue, upstream of the head of the ditch, and reaches about 3.6 miles north along the I-29 corridor. The rest of the upper watershed spreads west of the ditch toward the Missouri River.

The Fletcher ditch outlets into the Crane ditch at 325th Street. The Fletcher Drainage District, about 1,435 benefited acres, lies north and west of the Crane district and drains to this point, so the Crane ditch carries Fletcher's water for its lower 4.7 miles. The design flows in the capacity table reflect this, rising from 54 cfs at 325th Street to 190 cfs at 340th Street. Land to the north and west of the district, beyond both benefited areas, also drains to the ditch by surface flow. From the north, water moves south along the low corridor beside I-29 and Hemlock Avenue, and from the west it moves east across the western lobe of the watershed between Hazel and Gum Avenues.

We used LiDAR (Light Detection and Ranging) to map the surface topography of the district. This technology uses laser pulses from aircraft to create highly accurate elevation maps of the ground surface. These maps help us identify where water naturally collects and how it moves across the land. An elevation map is included in Appendix E.

Ground elevation falls only about 10 feet along the full length of the watershed, from about 1,042 feet at the north end to about 1,032 feet at the south end, roughly one foot per mile. Ninety percent of the watershed lies within a 12-foot band between elevations 1,029 and 1,041. Surface water on this ground moves slowly toward the oxbow depressions, road ditches, and constructed swales and stays there until it reaches an outlet.

The watershed covers approximately 7,542 acres that naturally drain to the district via surface flow. Of these, 2,760.94 acres are listed on the assessment schedule as benefiting from the facility. Adding the roughly 1,435 benefited acres of the Fletcher Drainage District, which shares the outlet, gives the 4,196 acres used for the per-acre costs in this report.

Drone video and photos taken in April 2026 show how the ditch sits in this landscape (Appendix J). From the outlet to about Station 62+00, the ditch is confined between the paved county road on the west and the railroad on the east, with dense brush and trees along the railroad and no room to spread into adjacent fields. Above that point, near 110th Street, it opens into cropland. Fields are farmed to the edge of the right-of-way on both sides, spoil from past cleanouts sits as grass-covered berms along the banks, and the low-flow channel is narrow, with standing water, sediment, brush, and fallen trees. From 325th Street to K45 it runs alongside a paved road in a wide, grass-filled channel. Above K45 it is a narrow channel of grass and brush through cropland and grassland, ending at Hemlock Avenue.

Historical aerial photos provide valuable insight into long-term drainage patterns and problem areas within the district. By examining past images, we can identify recurring issues such as drown-out spots, standing water, or poor crop growth, all of which are indicators of inadequate drainage.

Soils

Most of the soils within Crane Intercounty Drainage District are classified as silty clay loam and clay, which tend to retain water and present natural drainage limitations. The three dominant soil types, Albaton, Salix, and Onawa cover roughly three-fifths of the district.

According to the USDA, Albaton, Salix, and Onawa soils formed in alluvium deposited on the Missouri River floodplain. Albaton soils are poorly drained and formed in clayey alluvium. They have very slow permeability and a seasonally high-water table, and they are prone to ponding in low-lying areas. Salix and Onawa soils are somewhat poorly drained and formed in silty alluvium over clayey alluvium. Their silty upper layers are moderately permeable, but the clayey substratum restricts downward water movement and sustains a seasonally high-water table. Although all three soils are highly productive, wetness is their primary limitation, and crop yields improve significantly when they are supplemented with artificial drainage.

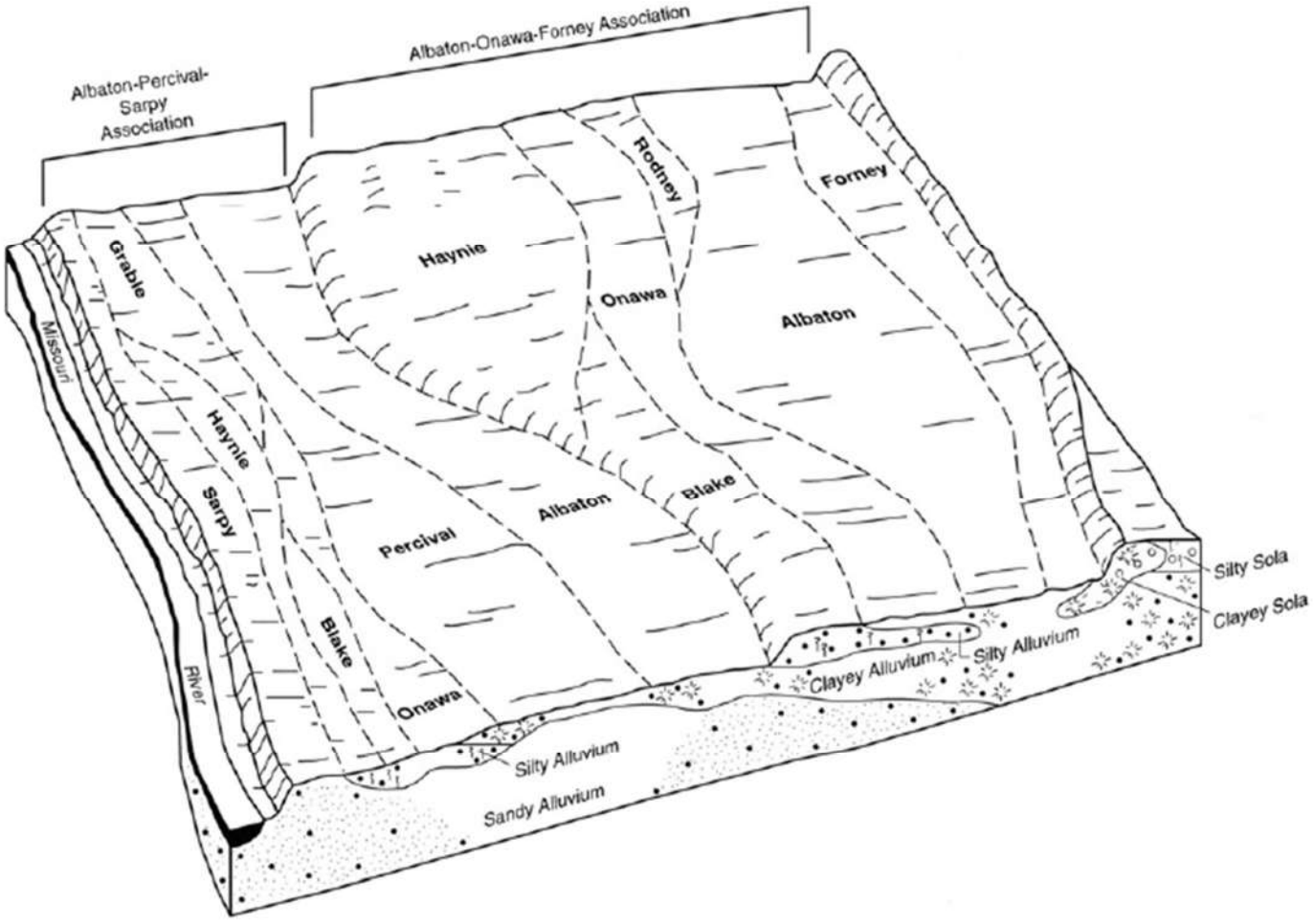


Figure 6.—Typical pattern of soils and parent material in the Albaton-Percival-Sarpy and Albaton-Onawa-Forney associations.
Source: U.S. Department of Agriculture, Soil Conservation Service. (2002). Soil survey of Monona County, Iowa. U.S. Government Printing Office.

A detailed soil drainage class table is included below and supporting soil type and soil drainage class maps are provided in Appendices F and G. Overall, over 81% of the soils in the watershed fall into the very poorly drained, poorly drained, or somewhat poorly drained categories. This highlights the critical need for artificial drainage to maintain productivity.

Soil Drainage Class		
Drain Class	**Acres**	**Percentage**
Very Poorly Drained	75	1.0%
Poorly Drained	4,663	61.8%
Somewhat Poorly Drained	1,412	18.7%
Moderately Well Drained	798	10.6%
Well Drained	255	3.4%
Somewhat Excessively Well Drained	0	0.0%
Excessively Well Drained	312	4.1%
Disturbed (Borrow Pits)	28	0.4%

Subsurface and Surface Water Flow Behavior

Subsurface drainage works by collecting water through perforated pipes or the gaps between clay tiles installed below ground. As the soil becomes saturated, water moves laterally through the soil's pore spaces until it reaches the tile line, then enters through small openings and is conveyed to the district main. This process lowers the water table, improves soil aeration, and reduces surface runoff.

A key factor in drainage design is saturated hydraulic conductivity (Ksat), which is a measure of how quickly water moves through saturated soil. Sandy soils have high Ksat values and drain quickly; clay soils, like those in Crane Intercounty Drainage District, have lower Ksat values and drain more slowly. Most soils in the district are silty clay with moderate to low Ksat values (Appendix H).

Surface water flow occurs when rainfall or snowmelt exceeds the soil's infiltration capacity, causing water to move downslope into channels or depressions. To model this, we use Curve Numbers (CN), a standard method for estimating runoff based on land use, soil type, and moisture conditions. In Crane Intercounty Drainage District, CN values for cultivated agricultural land with moderately and poorly drained soils typically range from 75 to 85, which is high. These values help in sizing ditches and evaluating erosion control needs.

A map of seasonal high-water tables (Appendix I), based on USDA NRCS data, provides a general overview of how close groundwater may rise to the surface during wet periods.

Private Drainage

The primary purpose of a drainage district is to provide a legal and reliable outlet for both surface and subsurface drainage, enabling coordinated water management across multiple properties. While the district maintains the shared infrastructure, individual landowners are responsible for installing and maintaining private ditch and tile systems that connect their land to the district outlet. We have included "Twenty Benefits of Drainage" prepared by the Ohio State Extension highlighting yield and non-yield benefits of drainage in Appendix M.

As part of this ditch repair project, every known surface drain outlet along the open ditch was located and surveyed by ISG. Defective or collapsed pipes will be replaced as part of the work. Damaged outlets do not function properly and can contribute to ditch bank failure through seepage and erosion. A table of all pipes surveyed is included in Appendix Q, and the pipes are shown on the preliminary plans.

Existing Infrastructure and Conditions

Field Survey

The initial field survey of Crane Intercounty Drainage District was completed by ISG in February of 2025. As part of this effort, they collected photographs of all major components and areas of interest throughout the Main Open Ditch. They measured the flowline elevations of the ditch at regular intervals. These elevation measurements help us compare existing conditions with the original engineering plans and serve as reliable reference points moving forward.

We flew a drone over the ditch in April of 2026. Photos taken during the field visit are included in Appendix J. The drone video can be found by searching AgriVia on YouTube, or via the following link.
https://www.youtube.com/watch?v=hhUhxqdTHQM

The Crane open ditch is in poor condition along its whole length. Our drone flight and the ISG flowline survey agree: the ditch is filled with sediment and vegetation, its bottom is too flat to move water, and the right-of-way has not been maintained consistently.

The surveyed flowline averages a grade of about 0.027%, which is flatter than recommended. Several stretches are essentially flat. The lower third of the ditch and a stretch near the upper end have grades of 0.00% to 0.02%. This matches what we saw from the air, standing water in the bottom with no visible flow.

Condition by reach.

- Outlet to 120th Street. The ditch runs along the railroad and the road in a narrow, steep-sided channel. Banks are covered in dead grass, and brush grows along the railroad side. The channel is mostly dry with small pockets of standing water.
- 120th Street to 110th Street. The channel is narrow with brush and small trees growing on both banks. Water stands in the bottom. Near the grain bins there is a fresh slump on the top of the left bank, and a small gully has formed at the edge of the field.
- 110th Street to 340th Street. The channel is choked with dead grass, and the left side is farmed right up to the top of the bank. Brush has grown in places in the bottom. The right-of-way is not mowed, burned or maintained consistently.
- 340th Street to 325th Street. This is the most overgrown reach. The channel is a solid mat of dead cattail and brush, with water barely visible. Several steel field-crossing bridges have collapsed into the channel. Water backs up behind a twin culvert crossing, and a downed tree lies in the channel.
- 325th Street to K45. The channel is filled with vegetation and sediment. The roadside ditch is shallow. The culvert at K45 is partly plugged with brush.
- K45 to Hemlock Avenue. Brush and small trees grow in the channel. Trash and brush have been dumped near the road crossing. Gullies run into the ditch from the adjacent field.

Existing Design

The district was established in 1904. The Main Open Ditch had a 2-foot bottom at the head and widened to 4 feet at the downstream end, with 1.5:1 side slopes.

In 1916, engineer Fairchild enlarged the Main Open Ditch. His design called for 4-, 6-, and 8-foot bottom widths, with 1.5:1 side slopes. The ditch was cut about 4 feet deeper than the 1904 channel.

In 1997, Sundquist Engineering completed a capacity design for the Main Open Ditch. The design flows came from the USGS regional equations for the 5-year storm and a 6,580-acre drainage area. They range from 194 cubic feet per second at the outlet to 166 at the county line and 19 near Highway K-45. The ditch was designed with 1.5:1 side slopes. The bottom width is 6 feet from the outlet to Station 107+06, 8 feet to Station 256+67,

and 4 feet above that (1997 plan stationing). The design grade is 0.0389 percent in the lower reach, flattening to 0.0346 and 0.0179 percent through the middle, with steeper grades in the upper reach.

The 2011 preliminary report and 2012 Engineer's Report by Kuehl and Payer looked at an enlarged channel with 2:1 side slopes and a regraded flowline of about 0.04 percent. Their proposed design would have relocated the outlet to a new channel west of County Road K-45, with a new box culvert under K-45 and the existing outlet ditch kept as a spillway. That proposal was never constructed. Those reports used a larger watershed, 8,842 acres, and the resulting flows were higher than the 1997 numbers. They also found that the reach along the railroad could not be widened without taking land outside the existing right-of-way.

Existing Culverts Compared to the 1997 Plans

The 1997 plans list invert elevations for each road crossing culvert, several of which were replaced during the 1997 cleanout. Those plans use NGVD 29; the 2025 survey and this report use NAVD 88. The local conversion adds 0.48 foot to NGVD 29 elevations, based on NOAA National Geodetic Survey data.

At five culverts, the 2025 elevations are 0.40 to 0.61 foot above the 2010 Kuehl and Payer survey elevations, an average of 0.50 foot, consistent with the datum shift. The table below adds 0.48 foot to the 1997 inverts for comparison with the 2025 survey.

Existing Culverts Compared to the 1997 Plans (NAVD 88)						
Crossing	**Station**	**1997 Plan Inverts (In / Out)**	**2025 Survey Inverts (In / Out)**	**Diff. In (ft)**	**Diff. Out (ft)**	**Pipe Grade (%)**
Outlet culvert (72")	1+66	1018.08 / 1014.38	1017.14 / 1014.02	-0.94	-0.36	0.94
120th St (72")	39+87	1019.58 / 1019.55	1019.30 / 1019.82	-0.28	+0.27	-0.57
110th St (72")	102+06	1022.24 / 1022.21	1022.20 / 1021.97	-0.04	-0.24	0.39
340th St (2 - 54")	162+69	1024.28 / 1024.33	1024.09 / 1023.98	-0.19	-0.35	0.17
Private crossing (2 - 48")	212+41	1025.25 / 1025.24	1025.01 / 1024.80	-0.24	-0.44	0.56
325th St (72")	251+36	1025.50 / 1025.41	1024.65 / 1024.90	-0.85	-0.51	-0.38
Private crossing (36")	284+40	1028.35 / 1028.30	1027.96 / 1027.46	-0.39	-0.84	0.42

Difference = 2025 survey minus 1997 plan; a negative value means the culvert is lower than the 1997 plan. Pipe grade is from the 2025 survey; a negative grade means the downstream end is higher than the upstream end.

Every surveyed culvert is at or below the invert shown on the 1997 plans, except the downstream end of the 120th Street culvert, which is 0.27 foot above it. The existing culverts were therefore not set higher than the 1997 design, and the 1997 flowline can be rebuilt without lowering them.

Downstream Outlet

Crane Intercounty Drainage District outlets into the Harrison Ditch, located in Section 15 of Little Sioux Township. The Harrison ditch is a significant tributary draining a watershed area of about 4,400 square miles. It flows southwest into the Missouri River approximately 1.5 miles downstream of the Crane Ditch.

Proposed Project

Project Design
As the engineer responsible for overseeing the repairs to the ditch system, we have followed established design and construction standards developed by the American Society of Agricultural and Biological Engineers (ASABE), the Natural Resources Conservation Service (NRCS), and Iowa State University Extension and Outreach.

Under the authority of Iowa Code Chapter 468, the district holds both the legal right and the obligation to maintain drainage facilities to their original design capacity. Existing ditch plans were reviewed to verify the original flowline elevation and channel cross-sections. This report presents two options to address sediment buildup, vegetation, ponding and bank slumping in the Crane open ditch. Option 1, the Repair of Best Fit, establishes the lowest practical flowline without lowering existing culverts. Option 2, the Improvement, lowers selected culverts to establish a deeper flowline and improve drainage.

Design Basis for the Repair of Best Fit
We compared the 1997 Sundquist plans with the 2010 Kuehl and Payer and 2025 ISG culvert surveys, adding 0.48 foot to convert the 1997 elevations to NAVD 88. The surveys agree after this conversion. Option 1 uses existing culverts as fixed points to establish the lowest practical flowline without lowering any culverts. Matching these culverts was the basis used to establish the grade line of the “repair of best fit”.

Work Common to Both Options
Both options rebuild the ditch with a 4-foot bottom from the outlet to Hemlock Avenue. The narrower bottom concentrates base flow to reduce sediment buildup, vegetation and meandering.

Side slopes remain at 1.5:1 from the outlet to Station 88+44 to accommodate the confined lower reach. Upstream, slopes flatten to 2:1 for greater stability in silty loess soils. Both options also replace failing surface drains, add drains at gullies, and remove channel obstructions.

Option 1, the Repair of Best Fit, fits the flowline to existing culverts without lowering them. Option 2, the Improvement, lowers culverts to establish a deeper, uniform grade from the outlet to Station 240+43. Neither option lowers the Hemlock Avenue culvert. The table below compares the options, with details in the following sections. A plan sheet is included in Appendix R.

Item	Option 1: Repair of Best Fit	Option 2: Improvement
Culverts	None lowered; all culverts cleaned out	7 culverts at 5 locations lowered and relaid; the rest cleaned out
Flowline grades	0.0657%, 0.0384%, 0.0315%, 0.0249%, 0.0669% and 0.0249%, outlet to Hemlock Ave	0.0325% to Sta. 240+43, 0.0703% to K-45, 0.0350% to Hemlock Ave
How much higher the ditch bottom is than Option 2	Up to 1.6 ft (1.0 ft on average)	–
Spots checked (every 100 ft, Sta. 103+00 to 249+00) where the ditch would spill over the bank before reaching design flow	124 of 145	19 of 145
Flow the ditch holds before spilling over the bank, as a % of design flow (average, Sta. 120+00 to 240+00)	73%	132%
Excavation	22,000 CY	56,900 CY
Construction cost (private lands)	$471,366	$718,558
Total cost to the District	$611,366	$881,558
Cost per acre benefited (4,196 acres)	$146	$210

Option 1 – Repair of Best Fit

Option 1 keeps the ditch as deep as existing culverts allow, but its flowline is up to 1.6 feet higher than Option 2 through the middle reach, leaving less capacity below the banks (Appendix R). Between Stations 103+00 and 249+00, capacity falls below the design flow at 124 of 145 locations checked, compared with 19 under Option 2. Between Stations 120+00 and 240+00, capacity averages 73% of design flow, compared with 132% under Option 2. At 110th and 340th Streets, Option 1 carries 89% and 71% of design flow before overtopping. Capacity exceeds design flow at the outlet, 120th Street, 325th Street and K-45.

Capacity checks use a 4-foot bottom, Manning's n = 0.040 and smoothed LiDAR elevations of the lower bank at roughly 100-foot intervals. Table depths are Manning normal depths based on the grade below each location; the 1997 sections use scaled flows. These calculations exclude culvert and K-45 box backwater.

Crane Design Capacity – Option 1 (Repair of Best Fit)					
Location	**Flow (cfs)**	**1997 Section**	**1997 Flow Depth (ft)**	**Option 1 Section**	**Option 1 Flow Depth (ft)**
Outlet, STA 3+32	222	6 ft / 1.5:1 / 0.0389%	7.31	4 ft / 1.5:1 / 0.0657%	7.01
120th St, STA 39+87	220	6 ft / 1.5:1 / 0.0389%	7.27	4 ft / 1.5:1 / 0.0657%	6.98
110th St, STA 102+06	215	8 ft / 1.5:1 / 0.0346%	6.91	4 ft / 2:1 / 0.0384%	7.01
340th St (County Line), STA 162+69	190	8 ft / 1.5:1 / 0.0179%	7.61	4 ft / 2:1 / 0.0315%	6.94
325th St, STA 251+36	54	8 ft / 1.5:1 / 0.0179%	4.10	4 ft / 2:1 / 0.0249%	4.23
Highway K-45, STA 303+36	22	4 ft / 1.5:1 / 0.0309%	2.87	4 ft / 2:1 / 0.0669%	2.22

Option 2 – Improvement
Option 2 starts at elevation 1017.14 at Station 3+32 and rises at 0.0325% to Station 240+43. This grade closely follows the existing ditch and limits deep cuts. It then rises at 0.0703% to K-45 to improve drainage through the flat, ponded upper reach. At the downstream face of the K-45 box (Station 303+04), the flowline reaches elevation 1029.25, 0.35 foot below the box invert. Above K-45, it rises at 0.0350% to elevation 1030.27 at Hemlock Avenue (Station 332+22).

Option 2 is an improvement because it lowers the flowline up to 2.0 feet below the 1997 design between 120th and 340th Streets and relays culverts to match. Its 4-foot bottom is narrower than the original 6- and 8-foot bottoms and addresses sediment buildup, vegetation, ponding and bank slumping.

Seven culverts at five locations must be lowered and re-laid to accommodate the deeper flowline (see Pipes and Obstructions). The K-45 box and Hemlock Avenue culverts remain unchanged, with a roughly 1.0-foot drop from the Hemlock culvert into the ditch.

Table depths are Manning normal depths (n = 0.040) at the scaled flows and exclude culvert and K-45 box backwater.

Crane Design Capacity – Option 2 (Improvement)					
Location	**Flow (cfs)**	**1997 Section**	**1997 Flow Depth (ft)**	**Option 2 Section**	**Option 2 Flow Depth (ft)**
Outlet, STA 3+32	222	6 ft / 1.5:1 / 0.0389%	7.31	4 ft / 1.5:1 / 0.0325%	8.16
120th St, STA 39+87	220	6 ft / 1.5:1 / 0.0389%	7.27	4 ft / 1.5:1 / 0.0325%	8.12
110th St, STA 102+06	215	8 ft / 1.5:1 / 0.0346%	6.91	4 ft / 2:1 / 0.0325%	7.27
340th St (County Line), STA 162+69	190	8 ft / 1.5:1 / 0.0179%	7.61	4 ft / 2:1 / 0.0325%	6.90
325th St, STA 251+36	54	8 ft / 1.5:1 / 0.0179%	4.10	4 ft / 2:1 / 0.0703%	3.34
Highway K-45, STA 303+36	22	4 ft / 1.5:1 / 0.0309%	2.87	4 ft / 2:1 / 0.0703%	2.18

Pipes and Obstructions
Existing roadway culverts are at or below the 1997 planned elevations. They sit above the Option 2 flowline because it is deeper than the 1997 design (see Existing Culverts Compared to the 1997 Plans).

Option 1 retains all culverts at their current elevations and sets the flowline to clear them. All culverts will be cleaned out.

Option 2 lowers and relays culverts where the existing invert is more than 0.25 foot above the proposed flowline. Seven culverts at five locations meet this criterion:

- The 72-inch culverts at 120th and 110th Streets
- The two 54-inch culverts at 340th Street
- The two 48-inch culverts at Station 212+41
- The 36-inch culvert at Station 297+82

The culverts at 325th Street and Station 284+40, the outlet culvert with flap gate, and the K-45 box remain in place. The 30-inch Hemlock Avenue culvert also remains, with a roughly 1.0-foot drop into the upstream end of the ditch. All retained culverts will be cleaned out.

Both options replace 23 of the 33 existing surface drains: 22 with 18-inch pipe and one with 24-inch pipe, totaling 770 feet. The remaining drains stay in place.

Seventeen new drains (G-01 through G-17) will carry runoff from filled gullies into the ditch to prevent bank erosion: 14 at 18 inches, two at 24 inches and one at 36 inches, totaling 500 feet. Locations and sizes will be field verified before construction. The minimum replacement size is 18 inches. Pipe lengths, listed in 10-foot increments, are provided in Appendix Q.

Other work includes removing islands, sloughed material, debris, abandoned bridges and other blockages, along with tree removal or clearing as needed.

Preliminary Plans

The proposed preliminary plans for the repair of best fit are enclosed with this report. These plans serve as a guide for the contractor and outline the expectations and standards for construction. Included in the plans are the existing right-of-way, proposed work limits and specific work expected to take place on each landowner's property. The plans also contain profile and cross section views showing the existing ditch and the Option 1 (Repair of Best Fit) flowline. The Option 2 flowline is shown in the profiles in Appendix R. These plans are preliminary and may be refined prior to final bidding.

Construction Considerations

Ditch Construction Methods

- **Excavation**
  The ditch will be repaired using established methods commonly employed throughout Iowa. Construction will begin at the downstream end and proceed upstream, allowing standing water in upstream sections to drain and helping to flush sediment and debris through the newly cleaned downstream channel. Tracked excavators will be utilized, operating from both sides of the ditch where conditions allow. This approach provides more effective cleaning of the ditch bottom and banks while allowing even spoil placement.

- **Clearing and Grubbing**
  All trees located within the right-of-way of the open ditch will be removed as a maintenance measure. Tree growth within the right-of-way shades out grass, increases erosion potential, drops debris into the channel, obstructs maintenance access, and provides material for beaver dam construction. Trees and stumps will be removed to ground level. All woody debris will be burned, and the resulting ashes and remnants will be buried within the ditch right-of-way. Landowners wishing to retain wood from trees marked for removal are encouraged to remove the tree prior to the start of construction.

- **Seeding and Fertilizing of Banks**
  All ditch banks disturbed during construction will be re-seeded by the contractor to minimize erosion and promote the establishment of desirable vegetation. According to NRCS guidance, the most cost-effective method for stabilizing exposed banks without additional seedbed preparation is to broadcast seed and fertilizer daily as work progresses. We call out that banks are to be scraped with an approved harrow to create ridges and a summer cover crop mixture is to be seeded with fertilizer. After completion of the project, the banks will be seeded with a permanent seed mixture via hydroseeding.

However, vegetation establishment is highly weather-dependent and often inconsistent. Some areas may experience weed growth or poor vegetative cover that will require additional maintenance or time to fully stabilize.

- **Spoil Leveling, Tillage and Debris Pick-up**
  Spoil generated from ditch excavation will be placed along the top of the ditch banks. After allowing the material to dry, the contractor will spread it about 6 inches thick on both banks, split evenly between the two sides regardless of which side it came from, across the right-of-way and the additional work area out to the work limits, which extend 100 feet each side of the ditch centerline. Dozers will push the spoil into smooth, gradual transitions rather than peaks, and spoil that does not fit within that width will be piled higher beyond it. Between Station 3+32 and Station 62+00 the ditch is confined by the railroad and the road, and the spoil will be hauled off instead. The spoil area will then be tilled, and all debris and rocks larger than softball size will be collected and removed. A temporary weed-control seed mix will be applied to establish initial cover. Final restoration of this area will be completed by the landowner according to their preference.

- **Surface Drains**
  Surface drainpipes were identified during the field survey and are shown on the plans. The project cost estimate includes replacement of any pipes requiring repair. Additional pipes are expected to be discovered during construction, as some may currently be buried, broken, or obscured by vegetation. Any damaged or deteriorated pipes will be replaced with new corrugated metal pipes (CMP) and marked with a flag at the top of the bank. All pipes will be installed so that their discharge ends are positioned above the ditch bottom, ensuring unrestricted flow under normal conditions.

- **Riprap**
  Existing riprap found in the ditch will be left in place if possible. Additional riprap may be installed in select areas to protect against bank scour during and after construction. Riprap is typically used in locations with sandy soils that are unstable, as well as at sharp bends or downstream of large tile outlets. The exact location and quantity of riprap will be determined in the field during construction. Where suitable, existing field stones found along the ditch may be utilized as riprap.

- **Pollution and Erosion Control**
  The contractor will be responsible for minimizing pollution and erosion during construction, under the engineer's direction.

  Excavation, removing vegetation, and placing spoil material along the banks temporarily increases erosion potential. To minimize the risk, a silt curtain will be installed at the beginning of the cleanout to allow sediment to settle before flowing downstream. The contractor will also perform daily seeding of exposed ditch banks and apply a temporary seed mix to the top of the banks upon completion. Some erosion is still expected; therefore, the ditch bottom will be over-excavated by six inches to ensure that minor sediment deposition does not reduce the designed capacity of the open ditch.

- **Removal of Fence**
  Fences crossed during repair works along the ditch will not be replaced. The fence will be removed and buried within the work limits.

- **Driveway Restoration**
  Once the project is complete, any driveways that were damaged will be restored to their original condition. Photos will be taken before and after to document the work.

- **Mobilization**
  Mobilization includes transporting equipment and materials to the site, setting up access, and preparing staging areas. After work is complete, all equipment will be removed and the site cleaned up.

Proposed Crossings
Road culverts will be cleaned out to ensure they are not impeding the function of the ditch. Under Option 2 the culverts at 120th Street, 110th Street and 340th Street are also removed and re-laid at ditch grade, as shown in the table below. The Hemlock Avenue culvert is not lowered in either option. The ditch is crossed by six public road crossings, owned by the Monona and Harrison County Secondary Roads.

In addition to the six public crossings, there are three private crossings and 22 irrigation bridges crossing the open ditch. The landowner is responsible for their bridge or culvert. We will be able to clean out under the irrigation bridges, and they will not need to be removed. We have included in Appendix P photos of some of the public and private crossings; all crossings are marked on the plans.

Under Iowa Code §468, the cost of work on the road crossings is the responsibility of the entity that controls the road, so the counties pay for it and it is not part of the District's cost in this report. The estimated cost of the road crossing work under Option 2 (Division 2 in Appendix K) is $40,419. Option 1 has no road crossing construction cost because the road culverts are only cleaned out. A table of all public crossings is provided below.

Public Road Ditch Crossings						
Station	**Control Entity**	**Road**	**Structure**	**Size**	**Option 1 Work**	**Option 2 Work**
39+87	Harrison County	120th St	CMP	72"	Clean out	Remove and relay
102+06	Harrison County	110th St	CMP	72"	Clean out	Remove and relay
162+69	Monona and Harrison County	340th St	CMP	2- 54"	Clean out	Remove and relay
251+36	Monona County	325th St	CMP	72"	Clean out	Clean out
303+36	Monona County	K45	RCB	4' x 3.5'	Clean out	Clean out
332+22	Monona County	Hemlock Ave	CMP	30"	Clean out	Clean out

Utility Conflicts and Coordination
A Design One Call was completed in February of 2025, identifying communications and electrical utilities within the project area.

Under Iowa Code §468.115, utilities within a drainage district's right-of-way must accommodate drainage work at the utility's cost. MidAmerican has an electrical line running within the ditch slope along Austin Ave. After a review of the records, we found no agreement permitting this power line in the district right-of-way, and we recommend the electrical line be moved as it impedes on the district's ability to do repairs. ISG started negotiations with MidAmerican and we have continued communications with MidAmerican to move their line to the other side of the road.

Before construction begins, the contractor will complete a Construction One Call to ensure all utilities are properly located and marked, helping prevent conflicts and maintain a safe worksite.

Construction Timeline
If approved, we anticipate the work to bid spring 2027 with a completion date of March 2028. While contractors must finish all work by this deadline, they are free to choose their own construction schedule. The timeline is intentionally flexible to attract more qualified contractors and encourage competitive bidding, which can lower project costs.

Estimated Costs and Analysis

Cost Estimate
The estimated cost of Option 1, the Repair of Best Fit, is $611,366, and the estimated cost of Option 2, the Improvement, is $881,558. The breakdown of related expenses for each option is as follows:

Activity	Option 1 Cost	Option 1 % of Total	Option 2 Cost	Option 2 % of Total
Main Open Ditch Repairs or Improvements (Private Lands)	$471,366	77.1%	$718,558	81.5%
Engineering, Legal, and Administrative	$80,000	13.1%	$80,000	9.1%
Construction Damages	$15,000	2.5%	$15,000	1.7%
Interest	$45,000	7.4%	$68,000	7.7%
Total	**$611,366**	**100.0%**	**$881,558**	**100.0%**

This is a preliminary engineer's estimate, prepared for planning purposes. Costs are based on recent bid tab data from comparable projects and include allowances for contingency and administrative expenses. Final construction costs will depend on market conditions at the time of bidding and may vary from this estimate. Option 2 costs $270,192 more than Option 1, or about $64 more per acre. The county road crossing work under Option 2 (Division 2 in Appendix K) is estimated at $40,419. The counties pay for it, so it is not included in these totals.

A detailed itemization of costs is provided in Appendix K.

Historical Cost Comparison
The all-inclusive estimated cost to landowners for the Main Open Ditch is $611,366, or approximately $146 per acre, for Option 1 and $881,558, or approximately $210 per acre, for Option 2. As shown in the table below, both are in line with previous open ditch repairs.

Crane Intercounty Drainage District Historical Comparison					
Year	Avg. Assessment Per Acre	Avg Land Value Per Acre	Assessment Relative to Land Value	Avg. Revenue Per Acre for Corn Crop	Assessment Relative to Yearly Corn Revenue
1904-1905	$1.15	$55	2.1%	$14	8%
1916	$4.70	$141	3.3%	$25	19%
1999	$52.21	$1,394	3.7%	$261	20%
2012 – Not Completed	$196	$8,005	2.4%	$882	22%
2026 – Option 1	$146	$10,670	1.4%	$832*	18%
2026 – Option 2	$210	$10,670	2.0%	$832*	25%

*2025 Corn Revenue Shown

Assessment Schedule Review
Any costs to the district are shared by landowners based on the benefit their property receives. To ensure fairness, an assessment schedule is maintained so all expenses are allocated proportionally to the level of benefit each parcel gains from the drainage system. The current schedule is on file at the Monona and Harrison County Auditor's Office.

Fletcher Drainage District drains into the Crane ditch. Under Iowa Code §468.132, when two neighboring districts share the same outlet, the cost of cleaning out that outlet can be split between them based on the benefit each district receives. Since Fletcher's water runs through the Crane ditch, we recommend the board treat this cleanout as a common outlet project and include Fletcher in the cost. We also recommend the board appoint a classification commission to determine Fletcher's share of the benefit. That share would be presented at a hearing, with notice given to Fletcher as required by law, before any costs are assessed. A common outlet charge was done for the 1999 repairs and proposed for the 2012 improvement proposal.

Installment Payment Options
Under Iowa drainage law, landowners who are assessed for substantial repairs and improvements may be eligible to pay their assessment over time. The Board of Trustees may authorize an installment payment plan with interest, allowing landowners to repay the assessment annually over a period of up to 20 years.

To take advantage of this option, a formal waiver request must be submitted. There is no penalty for early repayment, and landowners who wish to avoid interest may pay the full amount up front or consider private financing alternatives.

Taxes
While the district is not authorized to provide tax advice, landowners are encouraged to consult with their accountant or tax advisor to determine whether drainage assessments or related improvements may be deductible or eligible for depreciation under current tax laws.

Permitting

US Army Corps of Engineers (USACE)
Because the proposed work is a repair and the drainage area of Crane Intercounty Drainage District does not exceed 10,000 acres, a permit for repair work in the Waters of the United States is not required from the USACE. An improvement will likely require a permit however.

Iowa Department of Natural Resources (DNR)
All work on the ditch, including bank stabilization, must follow Iowa DNR floodplain regulations. The DNR Floodplain permit application has been submitted in advance to avoid delays.

USDA Wetland Conservation Compliance (Swampbuster)
As part of federal conservation compliance requirements under the Food Security Act of 1985, any landowner participating in USDA programs including crop insurance, commodity payments, or CRP must obtain a valid Certified Wetland Determination from the Natural Resources Conservation Service (NRCS) before undertaking drainage improvements that may affect wetland areas. These determinations identify areas that meet federal criteria for wetland protection based on hydric soils, vegetation, and hydrology.

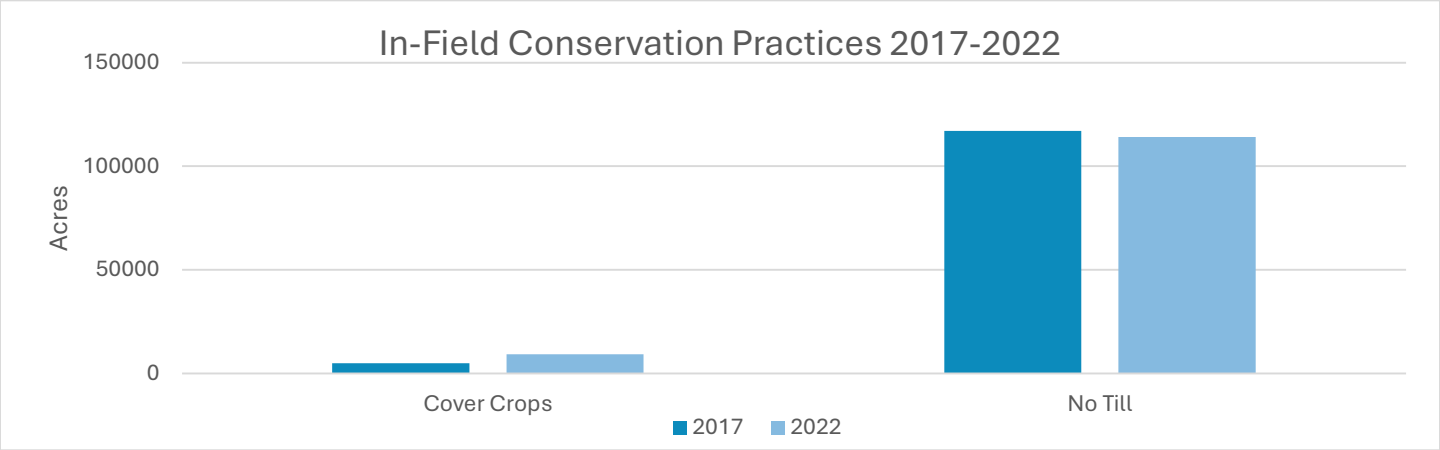
Option 2 does not increase the flow at the outlet of the ditch, but it lowers the ditch and improves flow through sections of the ditch compared to the 1997 plans. NRCS may therefore treat Option 2 as an improvement of the drainage system. It is the landowner's responsibility to obtain a determination if Option 2 is pursued.

Water Quality Recommendations

Conservation Practices
Farmers in Monona and Harrison Counties have made steady progress in adopting conservation practices that protect soil health and improve water quality. While most conservation measures aim to reduce in-field erosion, they also provide well-documented benefits to downstream water systems.

As of September 2025, about 21,791 acres are enrolled in CRP. These areas are planted with perennial vegetation to reduce erosion, slow runoff, and filter nutrients before they reach nearby waterways. Many include riparian buffers, filter strips, or wetland restorations, which help protect drainage outlets and reduce the movement of sediment and nutrients downstream.

Between 2017 and 2022, no-till acres decreased from 117,000 to 114,000, while cover crop use grew from 4,800 to 9,200 acres. These practices improve water infiltration, limit erosion, and help retain nutrients in the soil, particularly during snowmelt and heavy rains.



Iowa Nutrient Reduction Strategy
Iowa's Nutrient Reduction Strategy (NRS) aims to reduce nitrogen and phosphorus runoff from farmland using a combination of in-field practices (cover crops, nutrient management, reduced tillage) and edge-of-field practices (wetlands, bioreactors, controlled drainage).

Effectively designed drainage works with the NRS by moving water efficiently while allowing nutrient-reducing practices to function effectively. For example, drainage paired with controlled outlets or bioreactors can capture and treat nutrients before they leave the field. Appendix N includes a table of potential practices that can be used, showing options to meet nutrient reduction goals while maintaining productivity and soil health. If any landowner is interested, we can provide a copy of the spreadsheet for use on their farm.

Edge-of-Field Practices

- **Buffer Strips**
  Grass buffer strips along streambanks and ditches are one of the most effective ways to intercept runoff. These vegetated zones filter sediment, absorb nutrients like nitrogen and phosphorus, and reduce pesticide transport. They also stabilize stream banks, minimize erosion, and provide habitat for pollinators and wildlife.

- **Grassed Waterways**
  For fields with concentrated flow paths, grassed waterways help prevent gully formation and safely carry runoff away from cropland. Their dense vegetation reduces water velocity, limits soil loss, and improves downstream water quality. University of Illinois research (2018) showed that grassed waterways decreased gully erosion by up to 75%.

- **Constructed Wetlands**
  Constructed wetlands are engineered systems designed to intercept surface or subsurface drainage before it enters ditches or streams. By slowing water flow, they promote the natural removal of nitrates through microbial activity in the soil. In addition to improving downstream water quality, these systems provide valuable habitat for aquatic life, waterfowl, and other wildlife.

In-Field Practices

- **Cover Crops**
  Cover crops, such as cereal rye, clover, or radish, are planted after harvest to protect the soil during the off-season. Their root systems reduce erosion, improve soil structure, promote microbial activity, and capture residual nutrients, particularly nitrogen, before they leach into tile systems.

  A 2017–2021 University of Minnesota study found that cover crops reduced nitrate leaching by 30–60% in tile-drained fields and increased soil organic matter by 0.5–1% over five years, supporting both environmental and agronomic benefits.

- **Conservation Tillage or No-Till**
  Reducing tillage helps maintain soil structure, increase organic matter, and reduce erosion and runoff. Better soil structure improves water infiltration, and crop residue left on the surface protects the soil during rainfall events.

  An Ohio State University study examining conventional tillage, no-till, and strip-till systems found that conservation tillage performed best when paired with subsurface drainage. No-till and strip-till fields retained higher soil structure and moisture balance, reduced erosion, and improved crop trafficability. In drained fields, corn-soybean rotations under no-till produced the highest yield benefit, while continuous corn also showed consistent improvements. The study concluded that subsurface drainage not only improved yields directly but also enhanced the effectiveness of conservation tillage systems by improving field conditions.

- **Precision Nutrient Management**
  Precision agriculture tools like soil sampling, yield mapping, and variable rate technology (VRT) allow targeted application of fertilizers and pesticides. This approach reduces the risk of nutrient runoff, improves fertilizer use efficiency, and increases profit margins by applying inputs only where they are needed.

- **Diversified Crop Rotations**
  Rotating corn and soybeans with small grains (e.g., oats or wheat) or forage crops can improve soil health, break pest and disease cycles, and reduce nitrogen imbalances. These rotations increase biological diversity in the field and may open fresh marketing opportunities or enhance farm resilience. A 2019 Kansas State University study reported that diversified rotations reduced nitrogen leaching by 20–30% and improved soil health metrics by 15–25%.

- **Split Nitrogen Applications and Stabilizers**
  Applying nitrogen in multiple smaller doses throughout the growing season, instead of a single application, reduces the chance of leaching. Using nitrogen stabilizers or inhibitors further minimizes loss by keeping nutrients in forms more available for plant uptake.

Cost-share funding is often available to help implement these practices. The Iowa Agriculture Water Alliance hosts an online tool: https://costsharecompare.com/ where landowners can search for financial assistance by ZIP code, compare multiple programs, and identify opportunities to stack funding sources for greater return on investment.

Well-maintained drainage systems improve field conditions for conservation by reducing compaction and allowing timely planting, while conservation practices help drainage systems by limiting sediment buildup and nutrient loading. Although the drainage district cannot require conservation measures, we strongly encourage landowners to work with their local NRCS office to explore available options. In-field and edge-of-field practices can reduce erosion, improve water quality, lower input costs, and support long-term soil health. They are backed by research and may qualify for financial assistance through programs like EQIP, CSP, and the Iowa Water Quality Initiative.

Maintenance and Long-Term Management

Warranty Period
It is common for surface drains or tile outlets to be missed or for other issues to arise during or shortly after construction. To address this, the drainage district will maintain a one-year warranty with the contractor to cover construction-related errors or unforeseen problems. If a landowner observes an issue during this period, they should contact the Drainage Admin so the district can investigate and coordinate any necessary repairs.

Work Orders
After the one-year warranty period expires, any repairs must be initiated through a formal work order. A landowner may submit a work order to the Drainage Admin to request repairs to the district system. Common issues include collapsed outlets, bank erosion, or obstructions such as beaver dams.

Once a work order is reviewed and approved, a contractor will be assigned to complete the repair. The drainage district will pay the contractor's invoice, and the cost will be shared among landowners based on the existing assessment schedule. This process ensures that maintenance is managed in a timely, fair, and consistent manner.

Landowner Considerations

Public Hearing on Report
A public hearing will be scheduled to review this engineer's report and the proposed repairs or improvements. Per Iowa Code §468.14, all landowners in the district will be notified by mail, and notice will also be published in a local newspaper. At the hearing, we will present our findings, proposed plans, and cost estimates, and will be available to answer questions and address concerns. Topics such as construction impacts and crop damages may also be discussed.

The Board of Trustees will conduct the hearing and may continue it to a later date if more discussion or information is needed. No decision can be made until the hearing is held and all landowner input is considered. This report may be amended as needed in response to feedback received during the hearing, ensuring transparency and meaningful participation.

Objections
Landowners with concerns about the proposed project are encouraged to submit written objections before or during the hearing. Written submissions become part of the official record and help guide any revisions to the report.

Landowner Construction Considerations
If the project is approved, construction will proceed through the standard public bidding process. A bid letting will be held to obtain competitive proposals, and the lowest responsible bid will be submitted to the Board of Trustees for consideration and approval. Prior to construction, all affected landowners will be notified of the expected schedule and scope of work. Construction limits will be staked in the field and shown on the plans. Landowner cooperation, including preserving survey stakes and providing necessary access, will be critical to ensuring efficient completion of the project.

Throughout construction, we will coordinate directly with the contractor and function as the primary point of contact for all landowners. To ensure clear and consistent communication, landowners will be asked to direct any questions or concerns to us rather than contacting the contractor directly.

Right-of-Way and Work Limits
Drainage districts have the legal authority to enter private lands to construct, maintain, or improve drainage systems, including both open ditches and subsurface tile.

Open ditches require a formal right-of-way to allow for construction, future maintenance, and spoil placement. The Crane ditch maintains a sixty-foot-wide right-of-way from the Harrison Ditch to K45, and the right-of-way upstream of K45 is fifty feet wide. The existing right-of-way for each parcel is shown in Appendix O and is illustrated on the plans. Landowners retain the beneficial use of the right-of-way which includes the right to row crop, or enroll the land in a conservation program; however, these activities may not impede the drainage district's ability to perform maintenance. This includes constructing permanent structures or planting trees, for example.

Temporary construction limits beyond the existing right-of-way cover approximately 62 acres across forty-four parcels. These work limits are shown on the engineering plans and are intended as a boundary for the contractor. The actual area affected will be surveyed and documented during or after construction.

Construction Damages
In accordance with Iowa Code §468.103, landowners are entitled to compensation for damages resulting from construction activities outside the drainage district right-of-way, including crop loss, soil disturbance, and impacts to land use.

The following are recommendations regarding crop damage compensation:

- **Yield and Price Calculation**
  For crops damaged during the growing season we recommend using 110% of the five-year average county yield for the affected crop, multiplied by the average price received over the past 12 months. Both the yield data and average price are to be sourced from the Iowa State University Extension and Outreach and USDA-NASS databases.

- **Field Repair Work Compensation**
  In addition to crop losses during the growing season, we recommend payment for the following field work at rates consistent with the most recent Iowa State University Custom Rate Survey (per acre):
  - One pass of rock pickup
  - Two passes of tillage: one deep tillage and one shallow tillage

- **Other Damages**
  Landowners may submit claims for any additional damages not accounted for in this recommendation prior to the completion hearing.

Crop damages and other construction-related compensation will be paid by the drainage district and funded through the assessment schedule. As a result, all landowners within the district including those who incur damages will share in the cost of these payments through their proportionate assessments. The Board of Trustees retains the authority to amend, approve, or deny any such claims. Final decisions regarding crop damages will be made at the completion hearing.

Completion Hearing
Upon completion of construction, a Completion Hearing will be held in accordance with Iowa Code §468.101. This hearing gives landowners the opportunity to review the finished work, raise concerns about field conditions or project compliance, and submit any remaining claims for damages not previously addressed.

At the hearing, the Board of Trustees will consider all landowner input, evaluate whether the work has been completed in substantial compliance with the approved plans and specifications, and determine final compensation for any valid damage claims. The Board also has the authority to amend, approve, or deny claims based on the evidence presented.

All landowners within the district will be notified of the hearing in advance, as required by law, and are encouraged to attend to ensure their concerns are heard and properly documented before the project is closed out.

Conclusion and Recommendations

Conclusion
We have found the Crane Intercounty Drainage District Main Open Ditch in need of repairs. To address this, we have developed two options, and we recommend either one. Option 1, the Repair of Best Fit, grades the ditch to the existing culverts without lowering any of them and is estimated at $611,366, or about $146 per acre. Its flowline stays close to the 1997 flowline, but it leaves less room below the top of the bank in the middle of the ditch, where on average it holds about 73% of the design flow before water spills over the bank. Option 2, the Improvement, lowers seven culverts at five locations and sets the ditch bottom deeper than the 1997 flowline. It is estimated at $881,558, or about $210 per acre, which is $270,192 more than Option 1 (about $64 per acre), and holds about 132% of the design flow in the same stretch. Neither option lowers the Hemlock Avenue culvert, and both use the same cross section and surface drain work. We have no strong preference between the two.

Recommendations
We recommend that the Board accept the filing of this report and schedule a public hearing to formally present the findings and both options (Option 1, the Repair of Best Fit, and Option 2, the Improvement) to all affected landowners. The hearing will provide an opportunity for landowners to raise objections, ask questions, and express concerns.

If there are no substantial objections from the landowners at the hearing, we further recommend that the Board select Option 1 or Option 2, taking the landowners' input into account, and proceed with appointing an engineer to prepare detailed plans and specifications for the construction work.

If the Board of Trustees or landowners have any questions or concerns, please contact AgriVia at the phone numbers or emails listed.

Sincerely,

Jacob Hagan, P.E.
712-250-4318
jacob.agrivia@gmail.com

Tyler Buman, P.E.
712-579-5296
tyler.agrivia@gmail.com

Appendix A – Petition Filed

ISG Received 10/8/2024

PETITION

COPY

TO THE **BOARD OF SUPERVISORS** OF MONONA COUNTY, IOWA.

The undersigned, owners of following described lands in Monona County, Iowa, to-wit:

MATT DEHN

Subject to assessments in the CRANE Drainage District petition and request that: (describe District, issue and location)

THE CRANE DRAINAGE DISTRICT ADDRESS THE LACK OF WATER FLOW BETWEEN 340th St (COUNTY LINE) AND 110th St. IN HARRISON COUNTY

Signature of Petitioner: Matt Dehn

MATT DEHN, 24954 250th St. ONAWA, IA (712) 420-2198

(Name, Address, Contact information of Petitioner)

Dated this 10th **day of** May, **20** 24 **in Monona County, Iowa.**

Please list any other concerns, comments, or landowners' names and contact information:

1. *Filed:* _____

_____

(Drainage Clerk)

2. *Referred to Engineer for Investigation And report*
   Date: _____

_____

(Chairman, Board of Supervisors)

3. *Engineer's Report Filed:* _____

_____

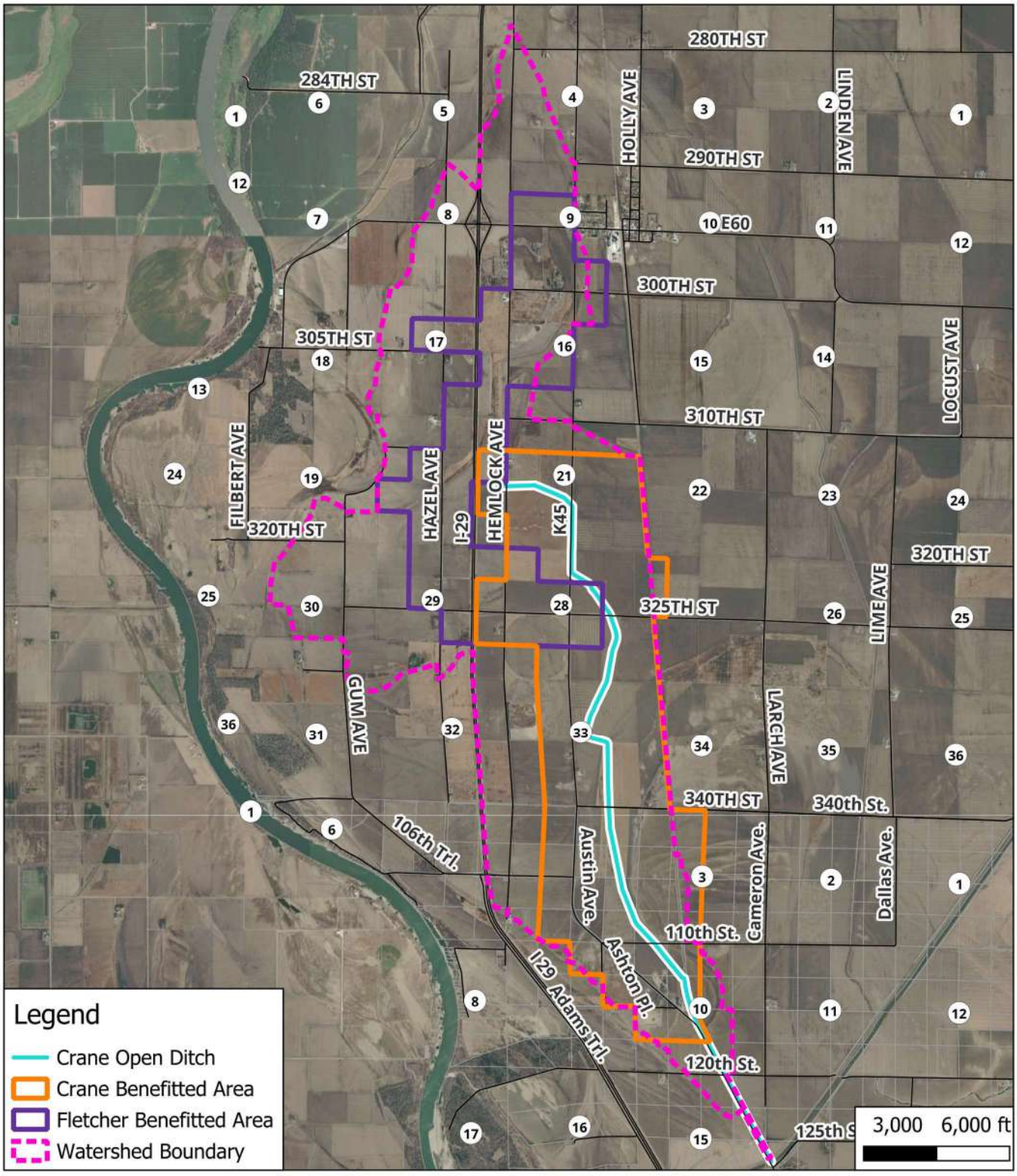
(Drainage Clerk)

4. *Board action taken on* _____
   _____, 20____.

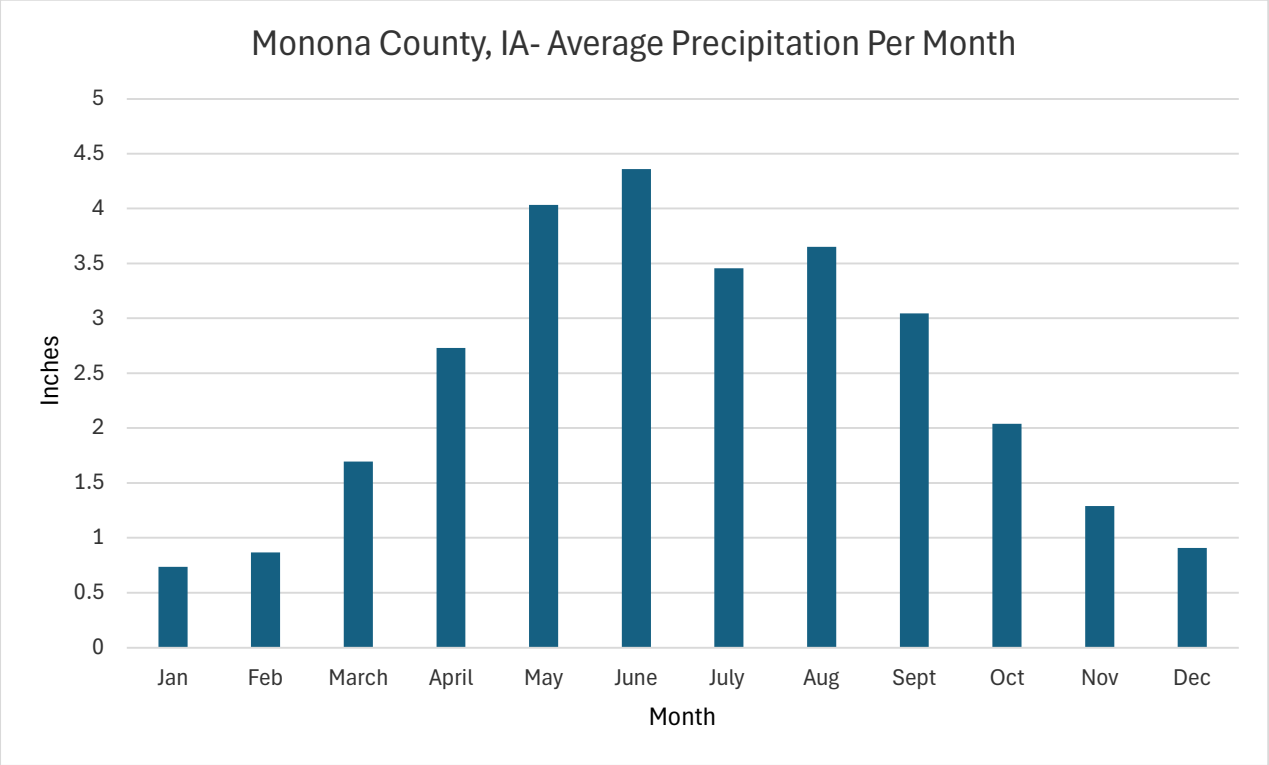
Appendix B – Area of Study Map

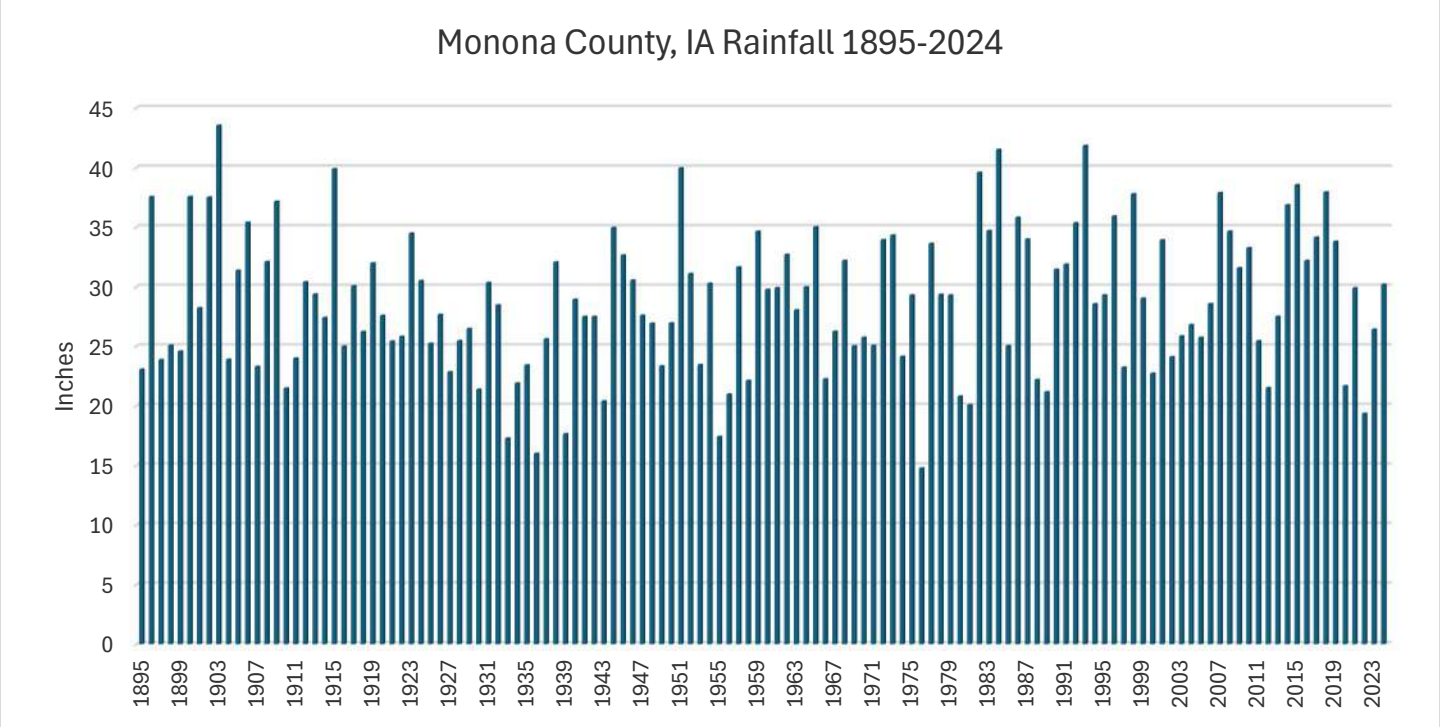
Crane Drainage District No. 2
Monona & Harrison County, IA

Area of Study
October 2026

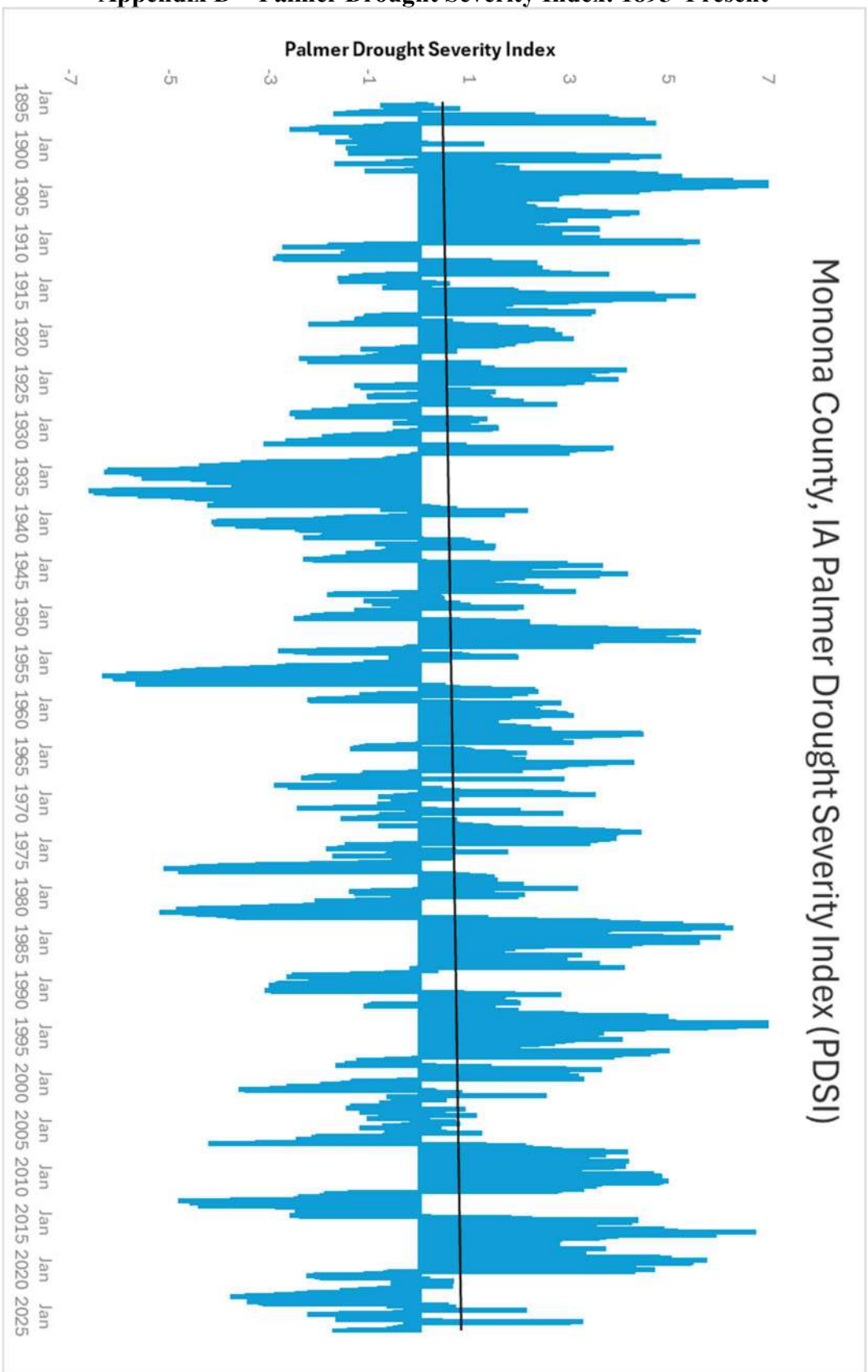


Appendix C – Rainfall Chart: 1895–Present





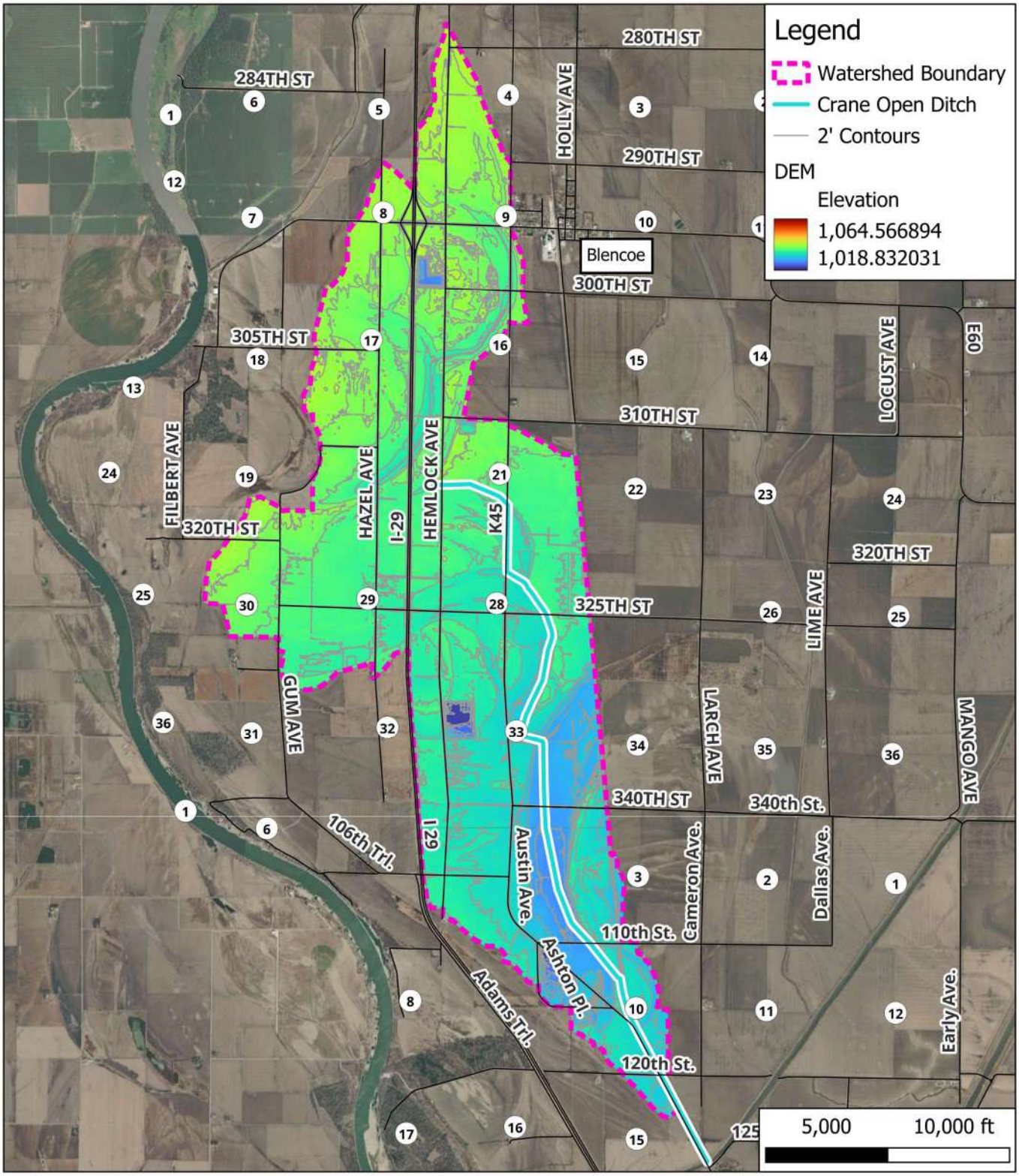
Appendix D – Palmer Drought Severity Index: 1895–Present



Appendix E – Elevation Map

Crane Drainage District No. 2
Monona & Harrison County, IA

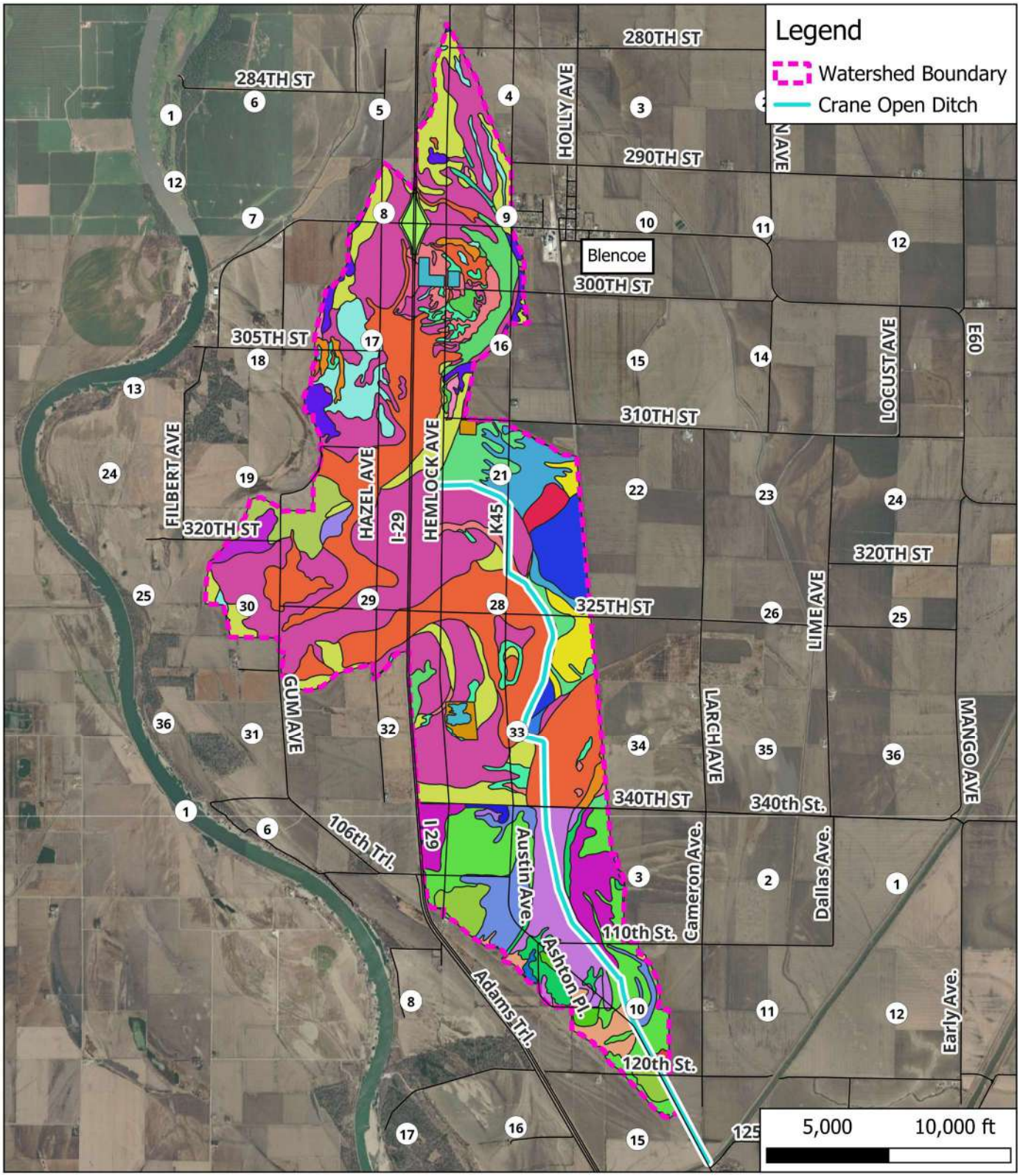
Elevation
October 2026

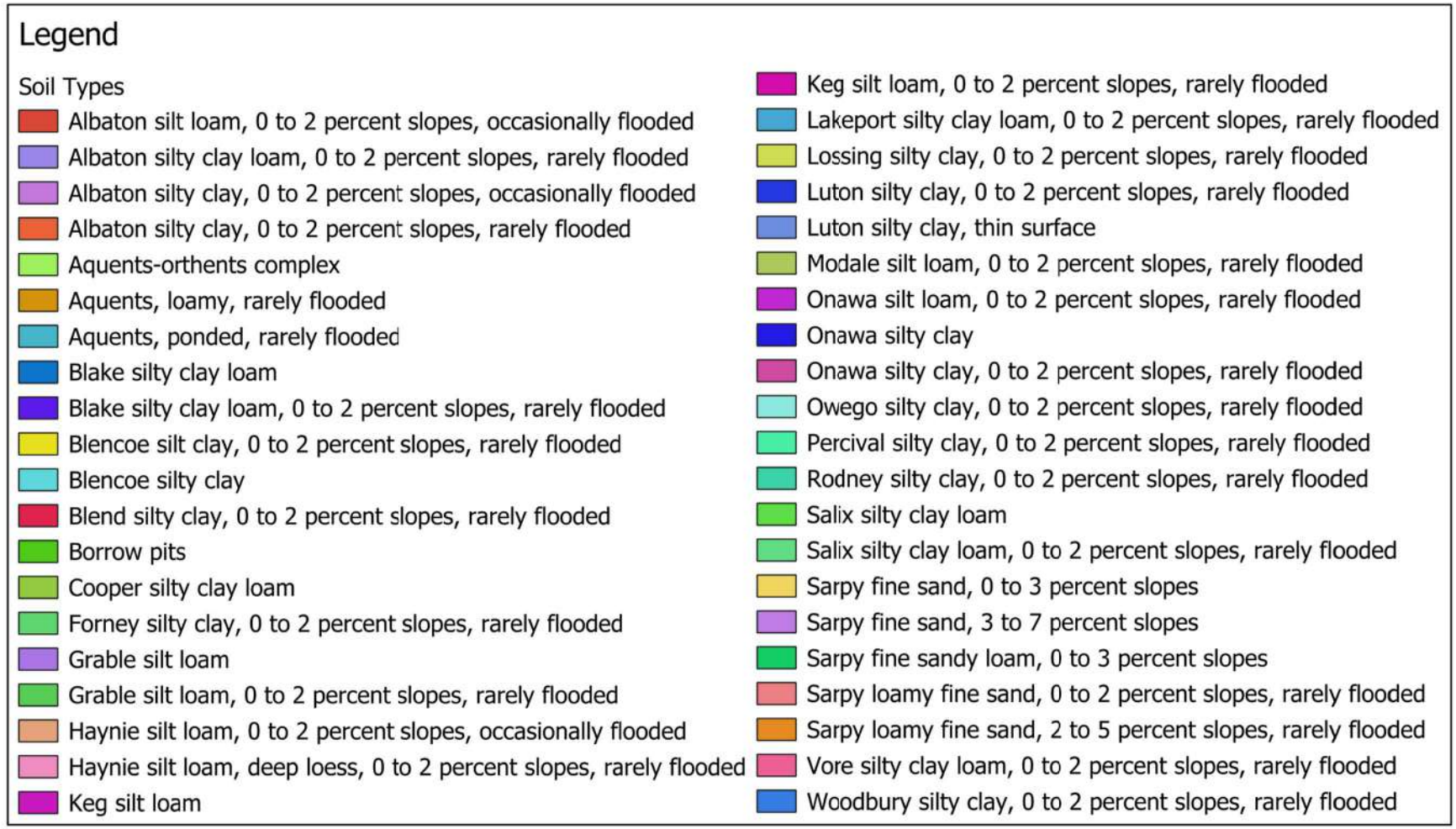


AgriVia

Crane Drainage District No. 2
Monona & Harrison County, IA

Soil Types
October 2026

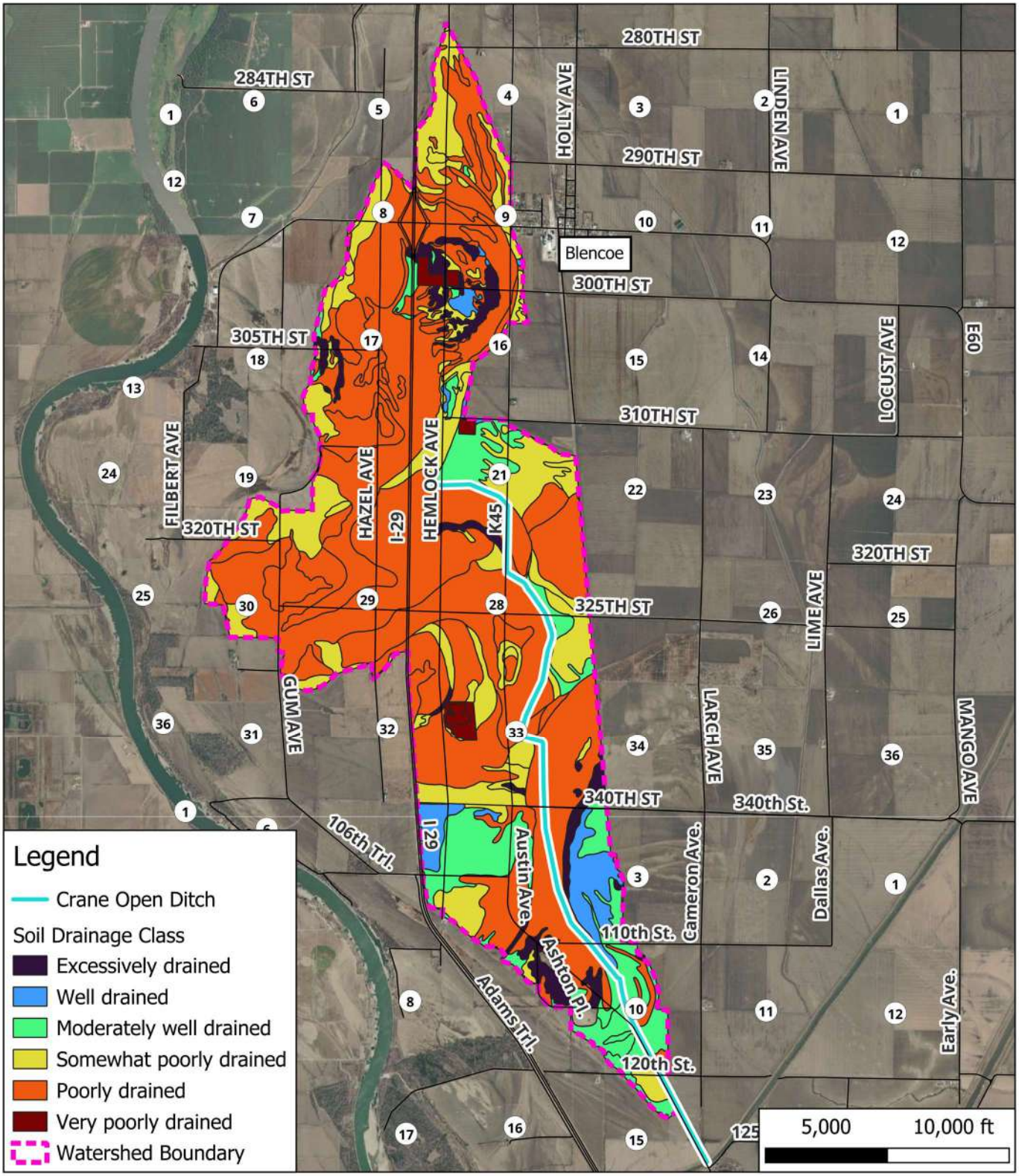



Legend
Soil Types
Albaton silt loam, 0 to 2 percent slopes, occasionally flooded
Albaton silty clay loam, 0 to 2 percent slopes, rarely flooded
Albaton silty clay, 0 to 2 percent slopes, occasionally flooded
Albaton silty clay, 0 to 2 percent slopes, rarely flooded
Aquents-orthents complex
Aquents, loamy, rarely flooded
Aquents, ponded, rarely flooded
Blake silty clay loam
Blake silty clay loam, 0 to 2 percent slopes, rarely flooded
Blencoe silt clay, 0 to 2 percent slopes, rarely flooded
Blencoe silty clay
Blend silty clay, 0 to 2 percent slopes, rarely flooded
Borrow pits
Cooper silty clay loam
Forney silty clay, 0 to 2 percent slopes, rarely flooded
Grable silt loam
Grable silt loam, 0 to 2 percent slopes, rarely flooded
Haynie silt loam, 0 to 2 percent slopes, occasionally flooded
Haynie silt loam, deep loess, 0 to 2 percent slopes, rarely flooded
Keg silt loam
Keg silt loam, 0 to 2 percent slopes, rarely flooded
Lakeport silty clay loam, 0 to 2 percent slopes, rarely flooded
Lossing silty clay, 0 to 2 percent slopes, rarely flooded
Luton silty clay, 0 to 2 percent slopes, rarely flooded
Luton silty clay, thin surface
Modale silt loam, 0 to 2 percent slopes, rarely flooded
Onawa silt loam, 0 to 2 percent slopes, rarely flooded
Onawa silty clay
Onawa silty clay, 0 to 2 percent slopes, rarely flooded
Owego silty clay, 0 to 2 percent slopes, rarely flooded
Percival silty clay, 0 to 2 percent slopes, rarely flooded
Rodney silty clay, 0 to 2 percent slopes, rarely flooded
Salix silty clay loam
Salix silty clay loam, 0 to 2 percent slopes, rarely flooded
Sarpy fine sand, 0 to 3 percent slopes
Sarpy fine sand, 3 to 7 percent slopes
Sarpy fine sandy loam, 0 to 3 percent slopes
Sarpy loamy fine sand, 0 to 2 percent slopes, rarely flooded
Sarpy loamy fine sand, 2 to 5 percent slopes, rarely flooded
Vore silty clay loam, 0 to 2 percent slopes, rarely flooded
Woodbury silty clay, 0 to 2 percent slopes, rarely flooded

AgriVia

Crane Drainage District No. 2 **Soil Drainage Class**

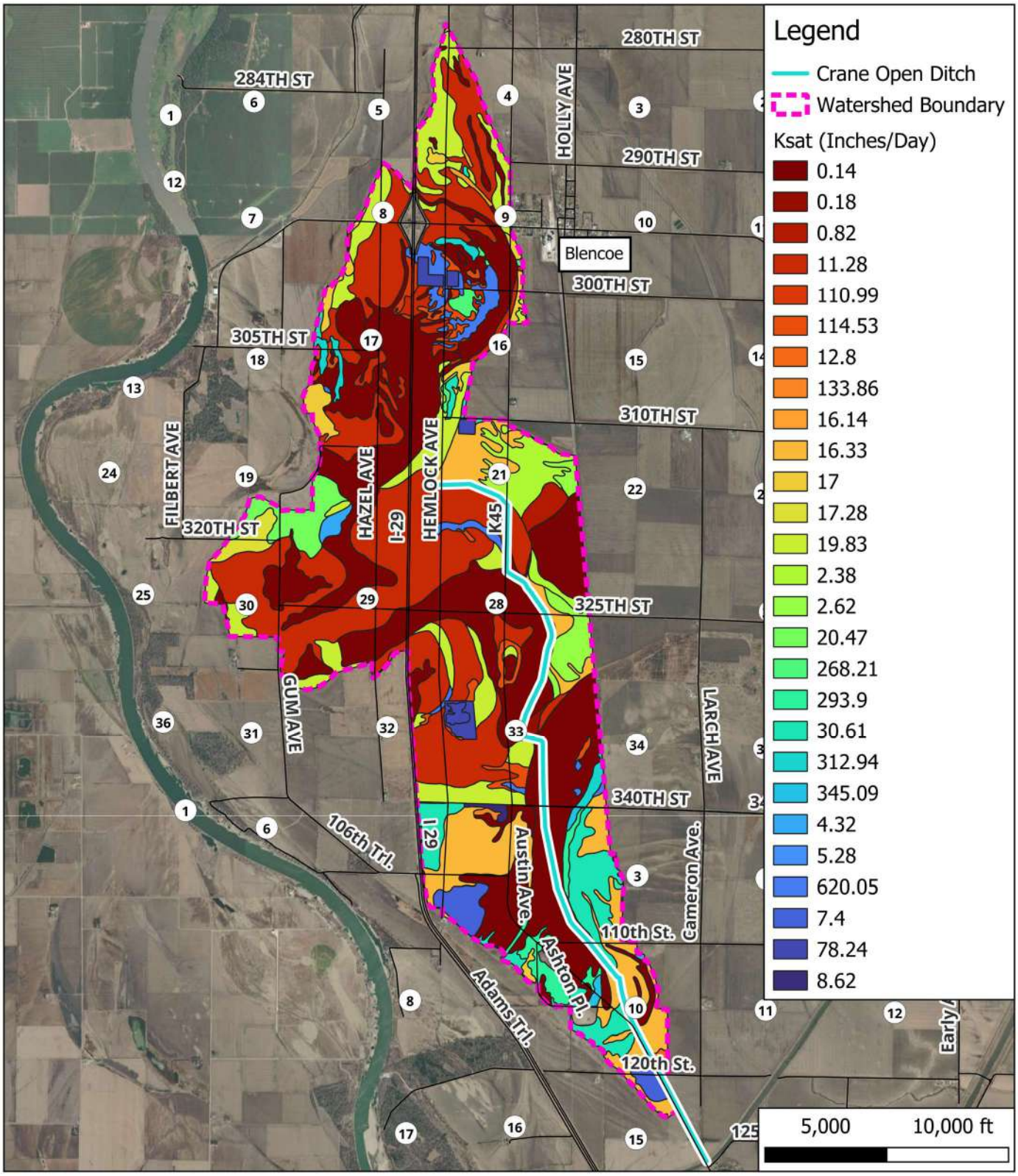
Monona & Harrison County, IA **October 2026**



AgriVia

Crane Drainage District No. 2
Monona & Harrison County, IA

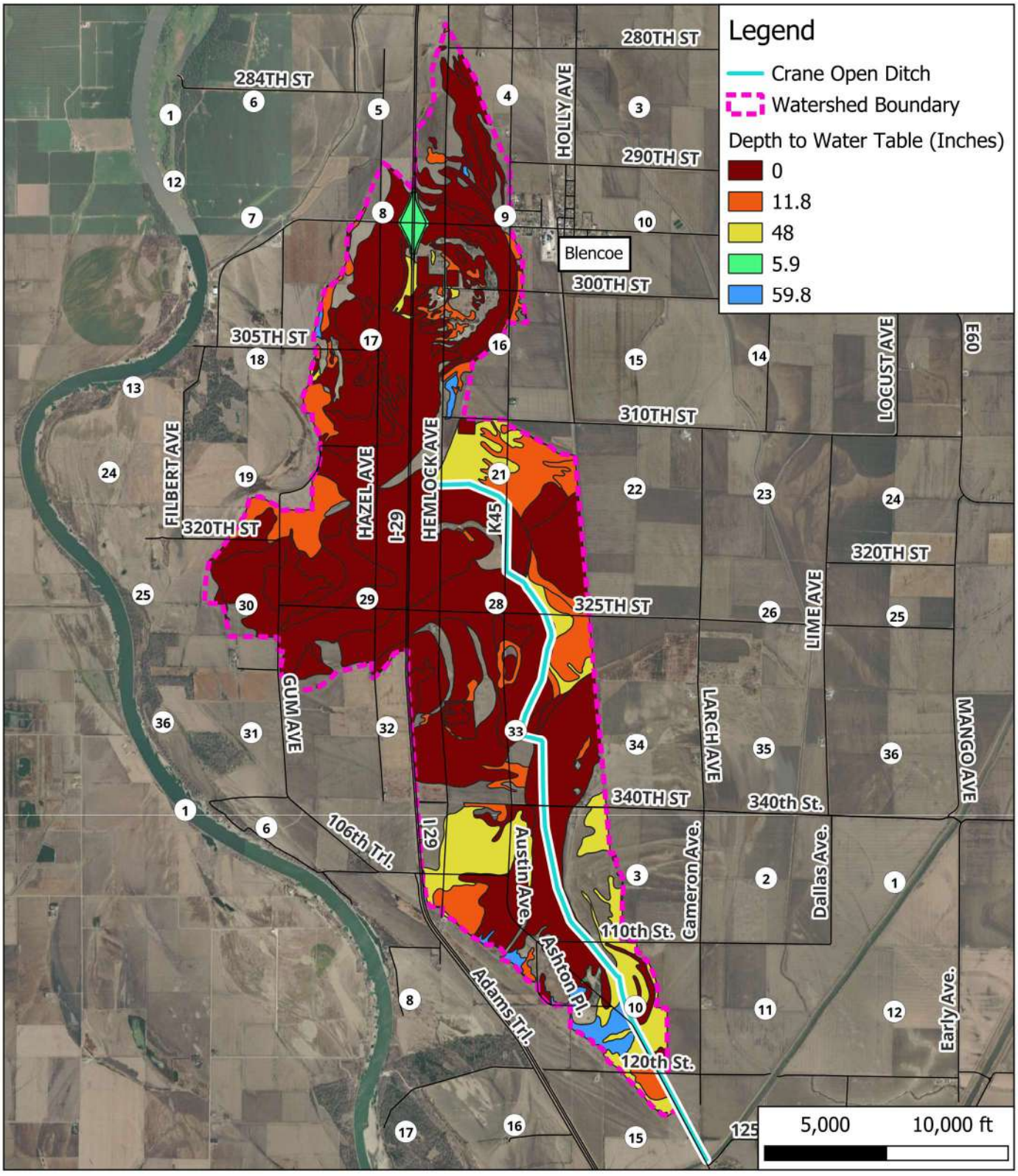
Soil Ksat
October 2026



AgriVia

Crane Drainage District No. 2
Monona & Harrison County, IA

Depth to Water Table
October 2026



Appendix J – Drone Survey Photos



Crane Main Open Ditch between Austin Ave and the railroad in Section 15



Bank erosion and tree growth in Section 10



Ponding in Section 10



Ponding in Section 33



Meandering in Section 28



Road ditch along K45



Upper end of the ditch



Ditch in Section 4

Appendix K – Itemized Cost Estimate

Estimated Costs – Option 1: Repair of Best Fit (no culverts lowered)
Open Ditch Repairs
Crane Intercounty Open Ditch
Harrison and Monona Counties, IA

Division 1 – Work on Private Lands: Main Open Ditch Construction Cost					
Item No.	Bid Item	Est. Units	Unit	Est. Unit Price	Est. Amount
101	EXCAVATION	22,000	CY	$4.30	$ 94,600
102	HAUL OFF SPOIL (STA 3+32 TO 62+00)	59	STA	$1,590.00	$ 93,810
103	SPOIL LEVELING (BOTH SIDES)	222	STA	$151.00	$ 33,522
104	SPOIL LEVELING (ONE SIDE ONLY)	48	STA	$106.00	$ 5,088
105	DAILY SEED & FERTILIZE BANKS	329	STA	$85.00	$ 27,965
106	HYDROSEEDING	329	STA	$179.00	$ 58,891
107	SPOIL TILLAGE AND ROCK PICK UP	270	STA	$34.00	$ 9,180
108	SURFACE DRAIN, 18" CMP	1,160	LF	$52.00	$ 60,320
109	SURFACE DRAIN, 24" CMP	80	LF	$69.00	$ 5,520
110	SURFACE DRAIN, 36" CMP	30	LF	$86.00	$ 2,580
111	CLEARING AND GRUBBING	1	LS	$10,000.00	$ 10,000
112	RIPRAP, CLASS E	100	TN	$68.00	$ 6,800
113	SEDIMENT BAFFLE	1	LS	$2,090.00	$ 2,090
114	TRAFFIC CONTROL	1	LS	$10,000.00	$ 10,000
115	MOBILIZATION	1	LS	$22,000.00	$ 22,000
				5% Construction Contingency	$ 22,000
				10% Extra Pipe Contingency	$ 7,000
				Subtotal Division 1 Construction Cost	**$ 471,366.00**

Additional Non-Construction Project Costs	
Expense	Est. Amount
Survey, Permitting, Engineer's Report, and Preliminary Plans	$ 40,000
Specifications and Construction Engineering	$ 35,000
Legal and Administrative	$ 5,000
Construction Damages	$ 15,000
Interest	$ 45,000
Subtotal Non-Construction Cost	**$ 140,000.00**

Total Project Costs	
Expense	Est. Amount
Division 1 – Private Lands Construction	$ 471,366
Additional Non-Construction Project Costs	$ 140,000
Total Open Ditch Repairs Cost to Crane Intercounty Drainage District	**$ 611,366**
Average Cost per Acre Benefitted (4,196 Acres)	**$ 146**

Estimated Costs – Option 2: Improvement
Open Ditch Improvement
Crane Intercounty Open Ditch
Harrison and Monona Counties, IA

Division 1 – Work on Private Lands: Main Open Ditch Construction Cost					
Item No.	Bid Item	Est. Units	Unit	Est. Unit Price	Est. Amount
101	EXCAVATION	56,900	CY	$4.30	$ 244,670
102	HAUL OFF SPOIL (STA 3+32 TO 62+00)	59	STA	$2,670.00	$ 157,530
103	SPOIL LEVELING (BOTH SIDES)	222	STA	$151.00	$ 33,522
104	SPOIL LEVELING (ONE SIDE ONLY)	48	STA	$106.00	$ 5,088
105	DAILY SEED & FERTILIZE BANKS	329	STA	$85.00	$ 27,965
106	HYDROSEEDING	329	STA	$179.00	$ 58,891
107	SPOIL TILLAGE AND ROCK PICK UP	270	STA	$34.00	$ 9,180
108	SURFACE DRAIN, 18" CMP	1,160	LF	$52.00	$ 60,320
109	SURFACE DRAIN, 24" CMP	80	LF	$69.00	$ 5,520
110	SURFACE DRAIN, 36" CMP	30	LF	$86.00	$ 2,580
111	ROTATE & RELAY 36" CMP, PRIVATE (1 EA)	90	LF	$45.00	$ 4,050
112	ROTATE & RELAY 48" CMP, PRIVATE (2 EA)	72	LF	$60.00	$ 4,320
113	CLASS A ROADSTONE, PRIVATE CROSSINGS	24	TN	$43.00	$ 1,032
114	CLEARING AND GRUBBING	1	LS	$10,000.00	$ 10,000
115	RIPRAP, CLASS E	100	TN	$68.00	$ 6,800
116	SEDIMENT BAFFLE	1	LS	$2,090.00	$ 2,090
117	TRAFFIC CONTROL	1	LS	$10,000.00	$ 10,000
118	MOBILIZATION	1	LS	$34,000.00	$ 34,000
				5% Construction Contingency	$ 34,000
				10% Extra Pipe Contingency	$ 7,000
				Subtotal Division 1 Construction Cost	**$ 718,558.00**

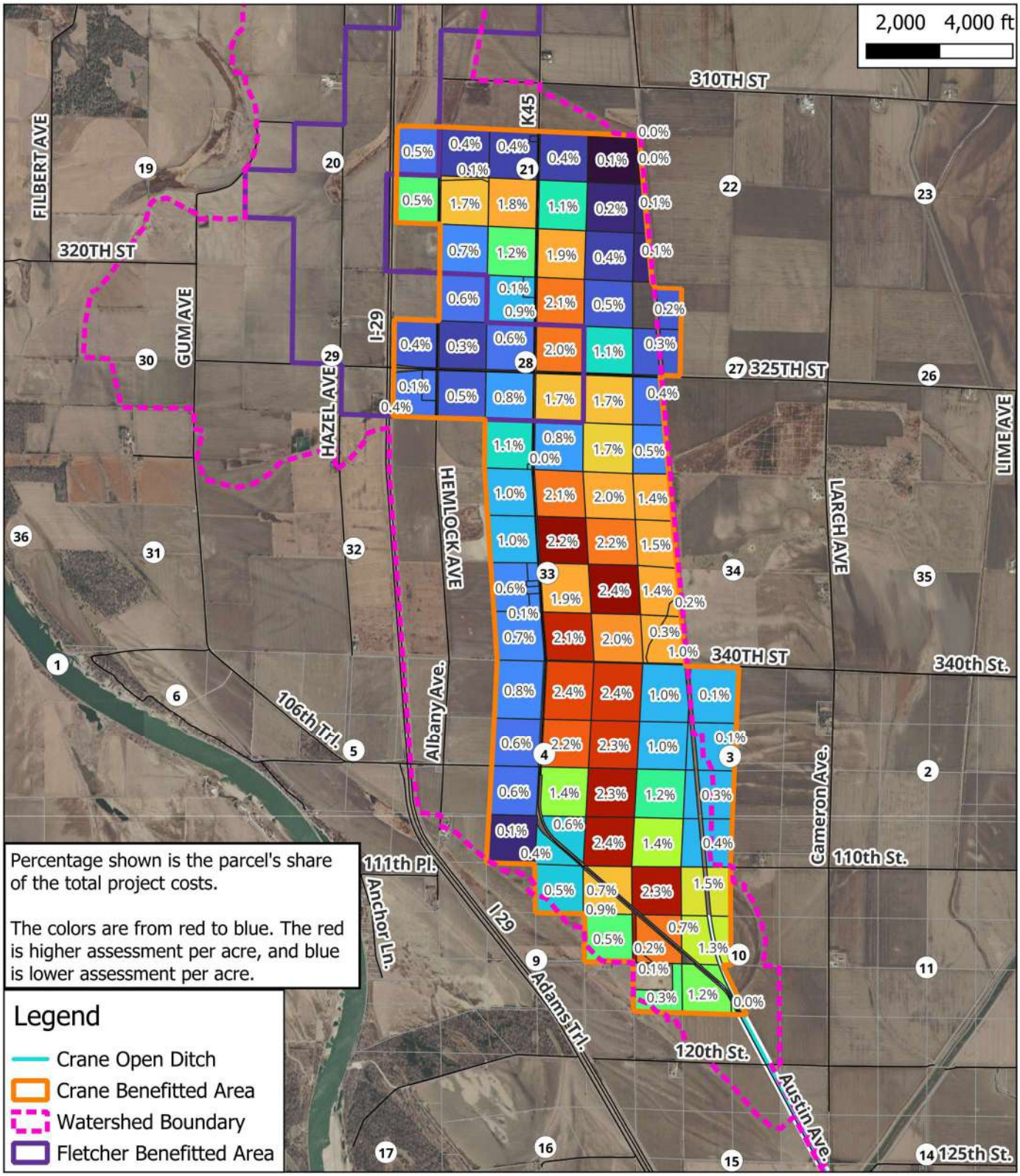
Division 2 – County Secondary Road Crossings: Remove, Rotate and Relay					
Item No.	Bid Item	Est. Units	Unit	Est. Unit Price	Est. Amount
201	REMOVE, ROTATE & RELAY 54" CMP (2 EA)	120	LF	$65.00	$ 7,800
202	REMOVE, ROTATE & RELAY 72" CMP (2 EA)	151	LF	$95.00	$ 14,345
203	CLASS A ROADSTONE AT ROAD CROSSINGS	161	TN	$43.00	$ 6,923
204	TRAFFIC CONTROL	3	EA	$2,017.00	$ 6,051
205	MOBILIZATION (ROAD CROSSINGS)	1	LS	$3,300.00	$ 3,300
				5% Construction Contingency	$ 2,000
				Subtotal Division 2 Construction Cost	**$ 40,419.00**

Additional Non-Construction Project Costs		
Expense		Est. Amount
Survey, Permitting, Engineer's Report, and Preliminary Plans	$	40,000
Specifications and Construction Engineering	$	35,000
Legal and Administrative	$	5,000
Construction Damages	$	15,000
Interest	$	68,000
Subtotal Non-Construction Cost	**$**	**163,000.00**

Estimated Costs – Option 2: Improvement
Open Ditch Improvement
Crane Intercounty Open Ditch
Harrison and Monona Counties, IA

Total Project Costs		
Expense		**Est. Amount**
Division 1 – Private Lands Construction	$	718,558
Division 2 – County Road Crossings Construction	$	40,419
Additional Non-Construction Project Costs	$	163,000
Total Open Ditch Repairs Cost to Crane Intercounty Drainage District	**$**	**881,558**
Average Cost per Acre Benefitted (4,196 Acres)	**$**	**210**

Appendix L – Current Assessment Schedule Map



AGRICULTURAL ENGINEERING
Serves Ohio
Cooperative Extension Service
The Ohio State University
Agricultural Engineering
2073 Neil Avenue
Columbus, Ohio 43210

SOIL AND WATER NO. 31

JULY 1982

TWENTY BENEFITS OF DRAINAGE

Many of the best soils in the United States and throughout the world have drainage problems that need to be solved before efficient agricultural production can be achieved. This discussion of drainage benefits is based on an earlier paper by the author entitled "Ten Benefits of Drainage" and several reports from other agricultural engineers in the United States, Canada, and England. Some of these drainage benefits are difficult to measure precisely, and many are interrelated, but their combined effect has been observed in numerous drainage studies.

1. Better soil aeration results from good drainage (surface water and free water in the root zone removed within 24 hours after heavy rainfall). This permits more extensive root development and a more favorable environment for beneficial soil microorganisms and earthworms. When soil aeration is reduced, the severity of soil-borne root diseases is increased.

2. Better soil moisture conditions with good drainage permit more efficient operation of tillage, planting, and harvesting equipment.

3. Better soil structure can be developed and maintained with good drainage, since there is less chance of destroying soil tilth due to compaction when working soil that is too wet.

4. Soils warm up more quickly in the spring when free water is removed by a drainage system. This results in better seed germination and an increased rate of plant growth.

5. An increased supply of nitrogen can be obtained from the soil when drainage lowers the water table in the root zone. Denitrification often occurs in soils with poor drainage.

6. Longer growing seasons can be achieved with good drainage due to earlier possible planting dates. This also permits the use of higher-yielding crop varities or extended grazing periods for livestock.

7. Certain toxic substances and disease organisms are removed from the soil due to better drainage and soil aeration. In wet soil, roots can be injured by toxic substances produced in the reduction of iron and manganese salts and the reduction of nitrates to nitrites.

8. Winds are less liable to uproot plants growing in soils that have been properly drained, since root systems are deeper.

9. Soil erosion and sediment loss can be reduced by subsurface drainage, since drained soils have a greater capacity to absorb rainfall and the soil filters out suspended sediment.

10. Good drainage saves fuel that would be used in working around wet areas in fields

(over)

College of Agriculture and Home Economics of The Ohio State University and The United States Department of Agriculture Cooperating

that are not properly drained. Also, since drained land is easier to work, there is less need for dual wheels or four-wheel drive tractors.

11. Good drainage reduces winter crop damage such as frost heaving of alfalfa and smothering of wheat under patches of ice.

12. Good drainage promotes earlier crop maturity and earlier fall harvests when climatic conditions are better for natural drying of grain in the field, thereby saving artificial drying costs.

13. A greater variety of crops can be grown on a farm that has good drainage. Alfalfa and sweet corn are examples of those that a farmer may choose.

14. Weed control is easier with good drainage since shallow-rooted weeds and undesirable grasses often thrive in wet soil, crowding out the planted crop.

15. Well-drained grazing land supports more livestock, with less compaction damage to vegetation and soil from animal traffic.

16. Good drainage reduces diseases that thrive on wet land. These include foot rot and liver fluke that infect livestock, and diseases carried by mosquitoes to both livestock and people.

17. Valuable livestock water supplies can be obtained by draining hillside seeps and piping the water to stock water tanks.

18. Plants are better able to withstand summer droughts with good drainage, since lower water tables in the spring permit deeper root development for extraction of soil moisture and nutrients.

19. Drainage is essential for salinity control in drier regions where irrigation is needed for permanent agricultural production.

20. Overall, good drainage results in higher crop yields, improved crop quality, and reduced risk of crop loss due to waterlogged soil. Also, fewer acres are required to produce our needed food supplies.

Several years of drainage research in Ohio has compared corn and soybean yields from undrained, surface drained only, tile drained only, and combined tile plus surface drained plots. Annual benefit/cost ratios were also calculated for these alternative drainage systems. It was shown that the average annual return per $100 invested in drainage ranged from $120 to $210 for soybeans, and from $170 to $220 for corn. Further details on this research are reported in Soil and Water No. 23 (DRAINAGE--What is it Worth on CORN Land?" and Soil and Water No. 24 (DRAINAGE--What is it Worth for SOYBEAN Land?"). These leaflets are available from Extension Agricultural Engineers, 2073 Neil Avenue, Columbus, OH 43210.

Actual returns on a drainage investment for a particular farm will vary with factors such as soil type, weather conditions, cost of the drainage system, crops grown, and management. Drainage improvements may involve surface drainage, subsurface drainage, outlet ditches, or a combination of practices. Changes in soil and crop management techniques may also be desirable to improve soil structure and water movement in the soil. Almost 60 percent of Ohio's cropland and 25 percent of all U. S. cropland is in need of drainage.

Melville L. Palmer

Melville L. Palmer
Extension Agricultural Engineer

All educational programs and activities conducted by the Ohio Cooperative Extension Service are available to all potential clientele on a non-discriminatory basis without regard to race, color, national origin, sex, handicap or religious affiliation.

Appendix N – Nutrient Reduction Strategy Example

Nutrient Reduction Calculator							
Practice	Nitrogen Reduction	Phosphorus Reduction	Acres	Avg. Annual Cost ($/Acre)	Total Annual Cost ($)	Practice Type	Notes
Wetlands	52%	0%	1886	$15.00	$ 28,282.50	Edge-of-Field	Highly effective for nitrate removal from tile drainage. P reduction varies.
Bioreactors	43%	0%	0	$10.00	$ -	Edge-of-Field	Trenches with woodchips that treat tile drainage water.
Saturated Buffers	91%	58%	0	$231.00	$ -	Edge-of-Field	This high N reduction only applies to water that interacts with the buffer's active root zone.
Drainage Water Mgt.	33%	0%	0	$10.00	$ -	Edge-of-Field	Load reduction achieved by reducing flow volume, not concentration.
Terraces	0	77%	0		$ -	Edge-of-Field	An erosion control practice highly effective at reducing sediment and P loss.
Sediment Control	0	85%	0		$ -	Edge-of-Field	Includes practices like sedimentation basins or ponds.
Reduce N Rate to MRTN	10%	0%	3771	-$2.00	$ (7,542.00)	In-Field	MRTN is the Maximum Return to Nitrogen rate, an economically optimal amount.
Nitrification Inhibitor	9%	0%	1508	-$3.00	$ (4,525.20)	In-Field	Used with fall-applied anhydrous ammonia.
Move Fall N to Spring	6%	0%	3771	-$20.00	$ (75,420.00)	In-Field	Moves fall fertilizer application to pre-plant in the spring.
Sidedress N Application	7%	0%	3771	$0.00	$ -	In-Field	Compares sidedress application to a single pre-plant application.
Cover Crops	31%	29%	0	$49.00	$ -	In-Field	One of the most effective in-field practices for reducing both N and P.
No-Till	0%	90%	2898	$12.00	$ 34,772.40	In-Field	Compares no-till to a chisel plow system. Very effective for P reduction.
Conservation Tillage	0%	33%	2382	-$1.00	$ (2,381.70)	In-Field	Compares chisel plowing to more intensive moldboard plowing.
Extended Rotations	42%	0%	3358	$30.00	$ 100,740.00	Land Use	Involves a 4- or 5-year rotation with at least two years of alfalfa.
Land Retirement (CRP)	85%	75%	0	$192.00	$ -	Land Use	Converts cropland to perennial vegetation.
					$ 73,926.00		

This Example Reduction	
Nitrogen Reduction	45%
Phosphorus Reduction	45%

"This spreadsheet is for illustrative purposes only. All acreage figures are examples and not intended to reflect actual values."

Spreadsheet Created by: AgriVia

Appendix O – Existing Right-of-Way

Main Open Ditch Right-of-Way			
Deedholder	**S-T-R**	**Legal**	**Acres**
Heisterkamp, Mary Joanne	21-82-45	PT NW SW	0.85
Marley, D S Family	20-82-45	PT NE SE	0.43
Alexander, Peter	21-82-45	PT NW SW	0.67
Sorenson, Mary Jane	21-82-45	NE SW	1.72
Dehn, Michael L	21-82-45	NW SE	0.38
Dehn, Michael L	21-82-45	SW SE	1.07
Benson Ranch, LLC	28-82-45	NW NE	1.90
Benson Ranch, LLC	28-82-45	SW NE	1.40
Benson Ranch, LLC	28-82-45	SE NE	0.80
Dehn, Matthew; Dehn, Mark &	28-82-45	NE SE	1.88
Dehn, Matthew; Dehn, Mark &	28-82-45	SE SE	1.86
Dehn, Matthew	33-82-45	NW NE	1.28
Dehn, Matthew	33-82-45	NE NE	0.61
Dehn, Matthew	33-82-45	SW NE	2.71
Dehn, Matthew	33-82-45	SE NE	0.04
Schulz, Donna R-1/2; Schulz Farm	33-82-45	NW SE	0.03
Schulz, Donna R-1/2; Schulz Farm	33-82-45	NE SE	1.88
Schulz, Donna R-1/2; Schulz Farm	33-82-45	PT SW SE	0.83
Schulz, Donna R-1/2; Schulz Farm	33-82-45	PT SE SE	0.98
Schulz, Ronald C Schulz, Sheri L	4-81-45	NW NE	0.23
Schulz, Ronald C Schulz, Sheri L	4-81-45	NE NE	1.98
Schulz, Ronald C Schulz, Sheri L	4-81-45	SE NE	1.86
Schulz, Ronald C Schulz, Sheri L	4-81-45	PT NE SE	1.94
Schulz, Ronald C Schulz, Sheri L	4-81-45	SE SE	0.70
Ruffcorn Trust, Jln	3-81-45	SW SW	1.63
Atwell Farms Partnership C/O Jennifer Mumm Atwell Residual Trust, Sara trustee; Jesse Render	10-81-45	NW NW NE HWY	1.15
Ruffcorn Family Trust	10-81-45	NE NW	1.21
Ruffcorn Family Trust	10-81-45	SE NW	1.87
Ruffcorn Family Trust, James & Mary Diane	10-81-45	W RR NE SW	1.17
Ruffcorn Family Trust, James & Mary Diane	10-81-45	W RR NW SE	0.46
Ruffcorn Family Trust, James & Mary Diane	10-81-45	W RR SW SE	1.07
Sones Family Trust, Marilyn E Sones Family Trust, Charles W	15-81-45	NW NE	0.53
RGBRAY Services, LLC	15-81-45	NE NE	1.16
RGBRAY Services, LLC	15-81-45	SE NE PT	0.63
Wiley, Jack	15-81-45	PT SE COR SE NE	0.07
Daly-Z Family Farms c/o Radka Daly	15-81-45	PT NE SE	0.36
Wallis, Dorothy B	14-81-45	W RR W 1/2 SW	0.39
		Total Acres	**39.74**



340th Street - Two 54" CMP



Private Crossing and irrigation pivot bridges



110th Street - 72" CMP

Appendix Q – Pipe Table

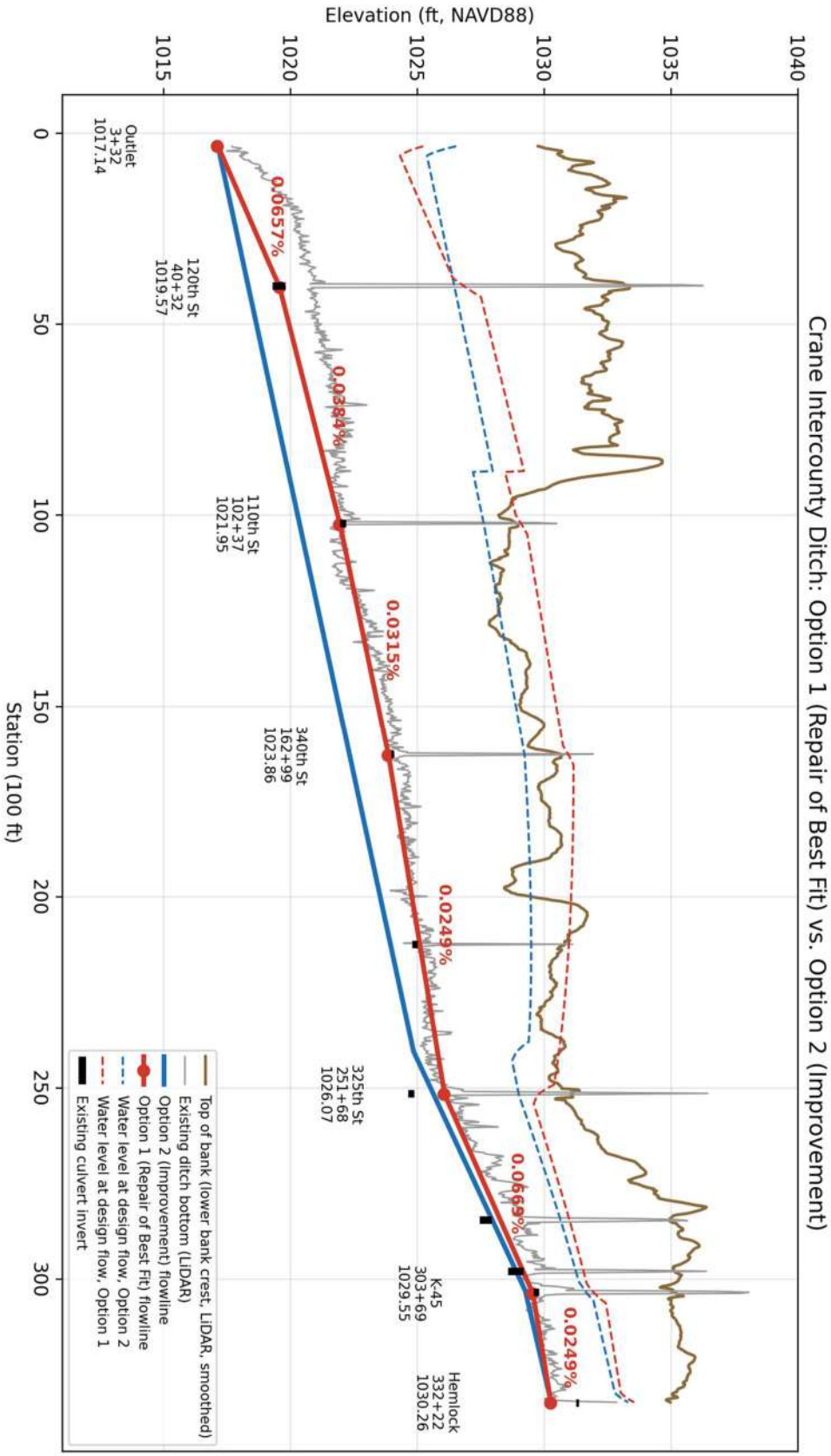
The relay notes in this table apply to Option 2. Under Option 1 every pipe stays at its present elevation, and the road and private culverts are cleaned out.

Main Open Ditch					
Station	**Existing Size**	**Length**	**Type**	**Side**	**Additional Replacement Notes**
1+66	72" CMP	332 LF	XING	CL	Existing outlet culvert with flap gate. Protect existing.
18+11	36"x24" RCB	41 LF	SD	LT	Existing-to-remain.
39+87	72" CMP	91 LF	XING	CL	120th St. Remove and relay at ditch grade: invert in 1018.34 (existing 1019.30), out 1018.31 (existing 1019.82).
40+36	30" CMP	77 LF	SD	LT	Existing-to-remain.
71+05			SD	LT	Fill gully and install new 30 LF 18" CMP SD.
83+09			SD	RT	Fill gully and install new 50 LF 18" CMP SD.
92+66	18" CMP	30 LF	SD	LT	Replace with one 40 LF 18" CMP SD.
94+36			SD	RT	Fill gully and install new 40 LF 18" CMP SD.
100+79			SD	RT	Fill gully and install new 30 LF 18" CMP SD.
101+55	18" CMP	19 LF	SD	RT	Existing-to-remain.
101+81	18" CMP	30 LF	SD	LT	Existing-to-remain.
102+06	72" CMP	60 LF	XING	CL	110th St. Remove and relay at ditch grade: invert in 1020.36 (existing 1022.20), out 1020.34 (existing 1021.97).
112+23	15" CMP	22 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
119+13			SD	RT	Fill gully and install new 30 LF 36" CMP SD.
119+74	12" CMP	40 LF	SD	LT	Replace with one 40 LF 18" CMP SD.
128+34	15" CMP	24 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
130+33	18" CMP	23 LF	SD	LT	Replace with one 30 LF 18" CMP SD.
133+68	18" CMP	24 LF	SD	LT	Replace with one 30 LF 18" CMP SD.
134+07	18" CMP	24 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
148+42	12" CMP	40 LF	SD	RT	Replace with one 40 LF 18" CMP SD.
149+89	12" CMP	40 LF	SD	LT	Replace with one 40 LF 18" CMP SD.
162+36	24" CMP	24 LF	SD	LT	Existing-to-remain.
162+69	54" CMP	60 LF	XING	LT	340th St (1 of 2). Remove and relay at ditch grade: invert in 1022.33 (existing 1024.09), out 1022.31 (existing 1023.98).
162+69	54" CMP	60 LF	XING	RT	340th St (2 of 2). Remove and relay at ditch grade: invert in 1022.33 (existing 1024.11), out 1022.31 (existing 1024.02).
163+02	24" CMP	36 LF	SD	RT	Existing-to-remain.
163+04	24" CMP	24 LF	SD	LT	Existing-to-remain.
176+50	12" CMP	39 LF	SD	LT	Replace with one 40 LF 18" CMP SD.
176+55	12" CMP	39 LF	SD	RT	Replace with one 40 LF 18" CMP SD.
189+80	18" CMP	57 LF	SD	RT	Replace with one 70 LF 18" CMP SD.
198+39	18" CMP	24 LF	SD	LT	Replace with one 30 LF 18" CMP SD.
199+87			SD	LT	Fill gully and install new 20 LF 24" CMP SD.
212+41	48" CMP	36 LF	XING	LT	Crossing (2 of 2). Remove and relay at ditch grade: invert in 1023.94 (existing 1025.01), out 1023.93 (existing 1024.80).
212+42	48" CMP	36 LF	XING	RT	Crossing (1 of 2). Remove and relay at ditch grade: invert in 1023.94 (existing 1025.00), out 1023.93 (existing 1024.90).
221+54	18" CMP	28 LF	SD	LT	Replace with one 30 LF 18" CMP SD.

Main Open Ditch					
Station	**Existing Size**	**Length**	**Type**	**Side**	**Additional Replacement Notes**
223+24			SD	LT	Fill gully and install new 30 LF 18" CMP SD.
223+73			SD	LT	Fill gully and install new 30 LF 18" CMP SD.
228+12			SD	RT	Fill gully and install new 30 LF 18" CMP SD.
229+90			SD	RT	Fill gully and install new 20 LF 18" CMP SD.
235+49			SD	RT	Fill gully and install new 20 LF 18" CMP SD.
235+70			SD	LT	Fill gully and install new 30 LF 18" CMP SD.
242+35			SD	RT	Fill gully and install new 30 LF 18" CMP SD.
242+56			SD	LT	Fill gully and install new 30 LF 18" CMP SD.
247+44			SD	LT	Fill gully and install new 30 LF 18" CMP SD.
251+36	72" CMP	64 LF	XING	CL	325th St. Existing invert at or below the Option 2 design flowline; existing-to-remain.
252+84	12" CMP	12 LF	SD	LT	Replace with one 20 LF 18" CMP SD.
254+28	15" CMP	24 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
258+75	15" CMP	26 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
260+02			SD	LT	Fill gully and install new 20 LF 18" CMP SD.
262+39	12" CMP	8 LF	SD	LT	Replace with one 20 LF 18" CMP SD.
267+78	24" CMP	26 LF	SD	RT	Replace with one 30 LF 24" CMP SD.
275+76	24"x24" RCB	50 LF	SD	LT	Existing-to-remain.
276+44	15" CMP	24 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
279+61	15" CMP	24 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
284+40	36" CMP	120 LF	XING	CL	Private crossing. Existing invert at or below the Option 2 design flowline; existing-to-remain.
285+34	15" CMP	26 LF	SD	RT	Existing-to-remain.
297+82	36" CMP	90 LF	XING	CL	Private crossing. Remove and relay at ditch grade: invert in 1028.91 (existing 1029.21), out 1028.85 (existing 1028.59).
302+60	18" CMP	22 LF	SD	RT	Existing-to-remain.
303+36	4'x3.5' RCB	64 LF	XING	CL	K-45. Existing-to-remain.
305+09			SD	RT	Fill gully and install new 30 LF 24" CMP SD.
312+78	18" CMP	28 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
315+54	18" CMP	30 LF	SD	RT	Replace with one 30 LF 18" CMP SD.
332+22	30" CMP	42 LF	XING	CL	Hemlock Ave. Not lowered in either option; existing-to-remain and cleaned out. Water drops about 1.0 ft from the pipe (invert out 1031.27) into the ditch flowline (about 1030.3).

Appendix R – Option 1 and Option 2 Profiles

This profile compares the Option 1 and Option 2 ditch bottoms (flowlines) with the existing ditch bottom, the top of the bank (the lower bank) and the water level at design flow.



PRELIMINARY PLANS FOR
MONONA-HARRISON CRANE DRAINAGE DISTRICT
OPEN DITCH REPAIRS
MONONA & HARRISON COUNTIES, IA
2026

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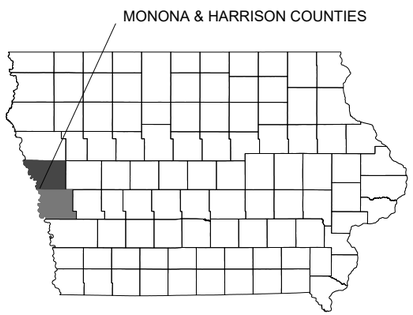
Utilities shown are estimates only. The Engineer makes no guarantee of the location or existence of those shown or not shown on the plans. The Contractor shall field verify exact locations prior to commencing construction as required by state law. Notify Iowa One Call, 811 or 1-800-292-8989.

Specifications

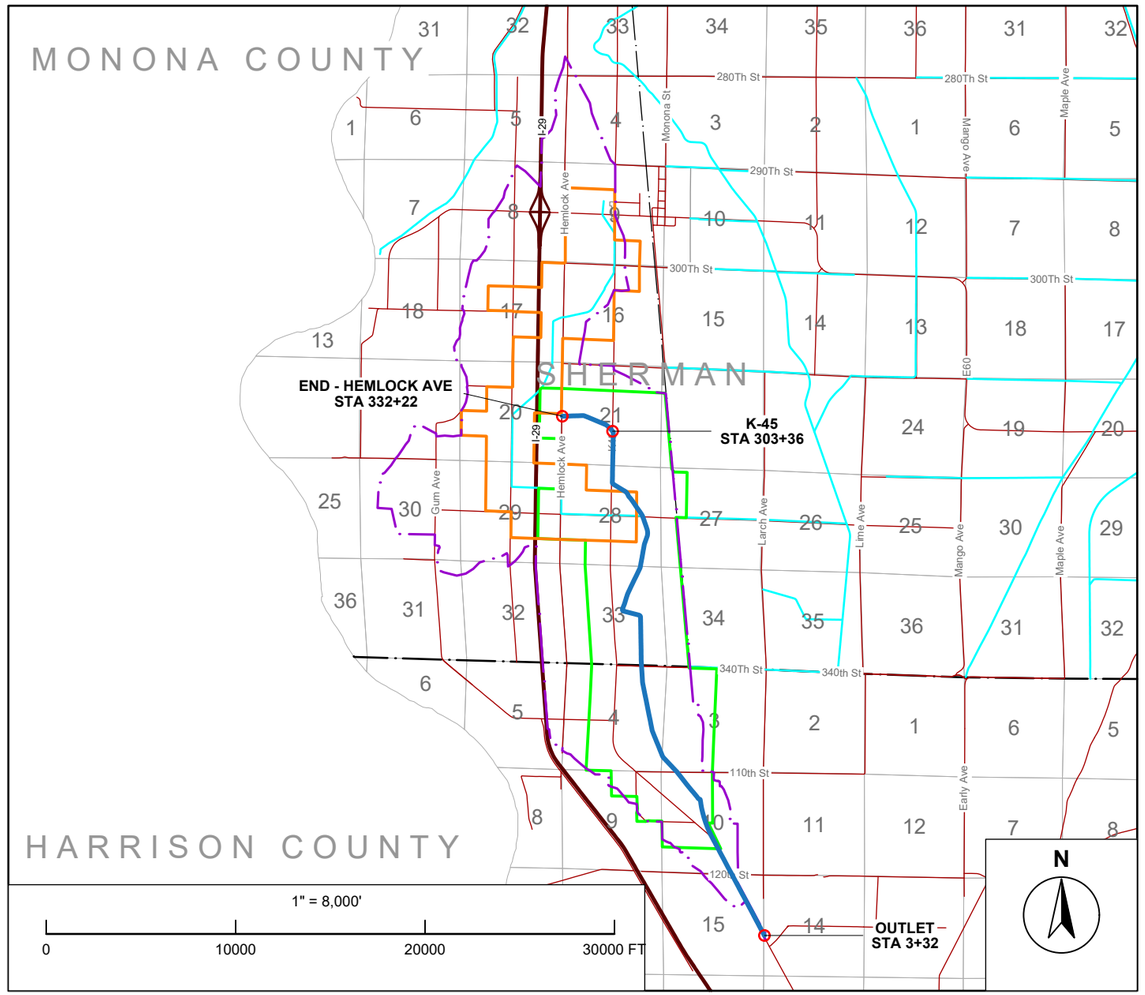
Unless otherwise noted, the governing standards for this project shall be the 2026 edition of the Iowa Statewide Urban Design and Specifications (SUDAS) for Public Improvements, supplemented where referenced by the Iowa Department of Transportation's Standard Specifications for Highway and Bridge Construction, Series 2023, along with all active general supplemental specifications, materials, instructional memoranda, and relevant special provisions.

Where conflicts arise, the stricter requirement shall take precedence. Complete compliance with all applicable federal, state, and local laws, ordinances, and regulations is mandatory throughout the project's execution.

MONONA & HARRISON COUNTIES



PROJECT LOCATION MAP



Sheet List

Number	Title
A.01	Title Sheet
A.02	District Plat
B.01	General & Pipe Details
B.02	Excavation Details
C.01	Pipe Table
C.02	Volume Table
D.01	Plan & Profile Sta 0+00 to 20+00
D.02	Plan & Profile Sta 20+00 to 40+00
D.03	Plan & Profile Sta 40+00 to 60+00
D.04	Plan & Profile Sta 60+00 to 80+00
D.05	Plan & Profile Sta 80+00 to 100+00
D.06	Plan & Profile Sta 100+00 to 120+00
D.07	Plan & Profile Sta 120+00 to 140+00
D.08	Plan & Profile Sta 140+00 to 160+00
D.09	Plan & Profile Sta 160+00 to 180+00
D.10	Plan & Profile Sta 180+00 to 200+00
D.11	Plan & Profile Sta 200+00 to 220+00
D.12	Plan & Profile Sta 220+00 to 240+00
D.13	Plan & Profile Sta 240+00 to 260+00
D.14	Plan & Profile Sta 260+00 to 280+00
D.15	Plan & Profile Sta 280+00 to 300+00
D.16	Plan & Profile Sta 300+00 to 320+00
D.17	Plan & Profile Sta 320+00 to 332+22

PROFESSIONAL ENGINEER
JACOB L. HAGAN
25738
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Jacob L. Hagan, P.E. (date)
License No. 25738
My license renewal date is December 31, 2026.
Pages or sheets covered by this seal:
All

PROFESSIONAL ENGINEER
TYLER J. BUMAN
30759
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Tyler J. Buman, P.E. (date)
License No. 30759
My license renewal date is December 31, 2027.
Pages or sheets covered by this seal:
All

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Drafter JLH
Checker TJB

PLAN LEGEND
- Proposed Ditch Repair
- Other Drainage District Facilities
- Crane Assessed (Benefited) Area
- Fletcher Assessed (Benefited) Area
- Watershed Boundary

Project Datum:
NAD83(2011) Iowa RCS Zone 6
(US Survey Feet)
NAVD 88

No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name: Title Sheet

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project: 2616-67
Date: 2026-10-20
Plan Scale: 1" = 8000'
Sheet: A.01

DISTRICT PLAT 1" = 3,000'

0 3000 6000 9000 FT

Benchmark	Northing	Easting	Elevation	Description
1	7188492.99	16411191.21	1031.91	CCPIB
2	7188490.22	16411155.09	1029.66	CBM MAG IN CULV
3	7188337.98	16414962.07	1024.34	CBM MAG IN CULV
4	7188329.40	16415563.18	1031.08	CCPIB
5	7188737.69	16404574.50	1031.09	CCPIB
6	7188741.83	16404498.37	1031.44	CCPIB
7	7188697.58	16404427.26	1030.08	CBM SPIKE IN PP
8	7188689.55	16404665.54	1030.79	CBM BENCH TIE IN PP

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PLAN LEGEND
- Proposed Ditch Repair
- Crane Assessed (Benefited) Area
- Fletcher Assessed (Benefited) Area
- Watershed Boundary
- Other Drainage District Facilities
- Parcel Lines

No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name: District Plat

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project: 2616-67
Date: 2026-10-20
Plan Scale: 1" = 3000'
Sheet: A.02

GENERAL PROVISIONS & PRE-CONSTRUCTION

1. **WORK AREA:** THE PLANS SHOW THE WORK AREA. STANDARD WORK AREA IS 100 FEET FROM THE CENTERLINE OF THE OPEN DITCH UNLESS OTHERWISE NOTED. THE CONTRACTOR MUST STAY WITHIN THIS AREA. ANY DAMAGE OUTSIDE THE WORK AREA WILL BE DEDUCTED FROM FINAL PAYMENT. ALL STAGING AND STORAGE SHALL BE WITHIN THE WORK AREA. NO STORAGE OR STAGING SHALL TAKE PLACE ON ROADWAYS.

2. **ACCESS:** ACCESS TO THE WORK AREA IS LIMITED TO PUBLIC ROAD INTERSECTIONS AND DRIVEWAYS CALLED OUT ON THE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR SECURING ANY ADDITIONAL TEMPORARY ACCESS AGREEMENTS WITH LANDOWNERS OR THE COUNTY ENGINEER FOR ROAD ROW ENTRY. LOCATIONS OF CONSTRUCTION ENTRANCES ARE MARKED ON THE PLANS. OBTAIN APPROVAL FROM THE ENGINEER PRIOR TO USING ANY OTHER ENTRANCES

   2.1 **TEMPORARY ACCESS DRIVEWAYS:** PLACE 12 TONS OF CLASS A ROADSTONE ON EACH TEMPORARY ENTRANCE (INCIDENTAL TO TEMPORARY ACCESS DRIVEWAY). CONTRACTOR SHALL FOLLOW THE REQUIREMENTS OF THE COUNTY ROADS DEPARTMENT. THE DRIVEWAY IS REQUIRED TO BE REMOVED AT PROJECT COMPLETION. THE LENGTH TO BE COVERED SHALL BE FROM THE FIELD EDGE TO THE ROAD SHOULDER.

3. **UTILITIES & LOCATES:** THE CONTRACTOR SHALL NOTIFY IOWA ONE CALL (811) PRIOR TO EXCAVATION. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR PROTECTING ALL MARKED AND UNMARKED UTILITIES.

4. **TILE OUTLET AND SURFACE DRAIN PIPE EXPLORATION:** EXISTING TILE AND SURFACE DRAIN PIPES IS APPROXIMATELY LOCATED ON THE PLANS. THERE LIKELY ARE ADDITIONAL TILE OUTLETS MISSED DURING THE SURVEY ALONG WITH LOCATIONS THAT WILL NEED SURFACE DRAIN PIPES. CONTRACTOR SHALL NOTE ALL MISSED PIPES AND ENGINEER MAY DIRECT THOSE PIPES TO BE REPAIRED OR INSTALLED.

5. **AS-BUILT DOCUMENTATION:** THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH A COMPLETE SET OF DRAWINGS SUITABLY MARKED TO SHOW ANY DEVIATIONS FROM THE ORIGINAL PLANS, INCLUDING BUT NOT LIMITED TO ACTUAL PIPE ALIGNMENTS, DEPTHS, CONNECTION LOCATIONS, AND ANY FIELD MODIFICATIONS. THIS DOCUMENTATION SHALL BE PROVIDED PRIOR TO FINAL ACCEPTANCE.

6. **THE LANDOWNERS** WHERE THE OPEN DITCH BEING REPAIRED ARE PAYING FOR THIS PROJECT. AT COMPLETION OF THE PROJECT, THOSE LANDOWNERS ARE INVITED TO A PUBLIC HEARING AND CAN FILE CLAIMS FOR DAMAGES. THESE SPECIFICATIONS AND PLANS EXIST AS MUCH TO GUIDE AND PROTECT THE CONTRACTOR AS TO PROTECT THE LANDOWNERS. REGULAR DOCUMENTATION ALONG WITH OPEN COMMUNICATION WITH THE ENGINEER IS ESSENTIAL TO A SMOOTH PROJECT FOR ALL PARTIES.

ROADWAY CULVERT CLEANING

1. **PERMITS & NOTIFICATIONS:** THE CONTRACTOR SHALL OBTAIN ALL NECESSARY OCCUPANCY PERMITS FROM THE COUNTY ENGINEER OR IOWA DOT. NOTIFY THE RESPECTIVE AGENCY AND THE PROJECT ENGINEER AT LEAST 48 HOURS PRIOR TO COMMENCING ANY WORK WITHIN THE ROW.

2. **TRAFFIC CONTROL:** THE CONTRACTOR IS RESPONSIBLE FOR ALL TRAFFIC CONTROL, INCLUDING SIGNAGE, BARRICADES, AND FLAGGERS. ALL SETUPS MUST STRICTLY ADHERE TO THE LATEST MUTCD (MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES) STANDARDS AND ANY SPECIFIC REQUIREMENTS SET BY THE COUNTY OR DOT PERMIT.

3. **UTILITY VERIFICATION:** ALL UTILITIES WITHIN THE ROW (FIBER OPTIC, GAS, WATER) MUST BE DAYLIGHTED VIA POTHOLING PRIOR TO THE ARRIVAL OF THE BORING OR TRENCHING EQUIPMENT.

4. **STORAGE AND PARKING:** NO STORAGE OR PARKING OF EQUIPMENT IN PUBLIC RIGHT-OF-WAY. NO CROSSING PAVED ROADS WITH TRACKED EQUIPMENT.

5. **CULVERT CLEANING:** CONTRACTOR SHALL REMOVE SILT AND DEBRIS FROM THE CULVERT VIA ANY METHOD THE CONTRACTOR CHOOSES SUBJECT TO APPROVAL BY THE ENGINEER TO NOT DAMAGE THE CULVERT, DITCH OR ROAD WAY.

6. **SHOULDER REPAIR:** ANY DAMAGE TO THE ROAD SHOULDERS OR SIDE SLOPES SHALL BE RESHAPED TO MATCH THE ORIGINAL PROFILE AND IMMEDIATELY SEEDED/MULCHED.

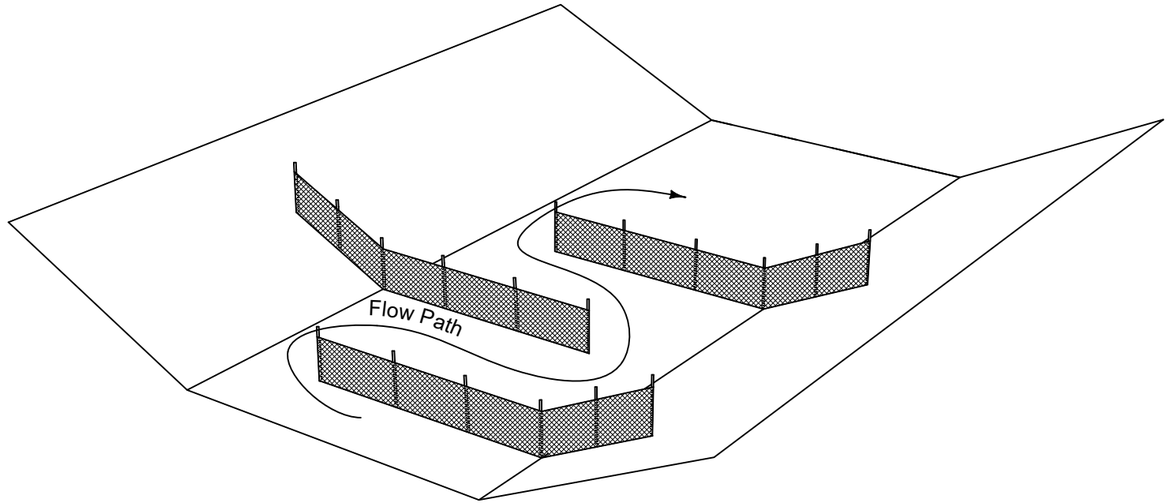
7. **ROAD CLOSURE:** IF THE ROAD NEEDS TO BE CLOSED. THE ROAD SHALL ONLY BE CLOSED FROM SUN RISE TO SUN SET. BY SUN SET THE ROAD SHALL BE OPEN TO TRAFFIC.

SEDIMENT BAFFLE DETAIL

ALL ITEMS AND NOTES SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED

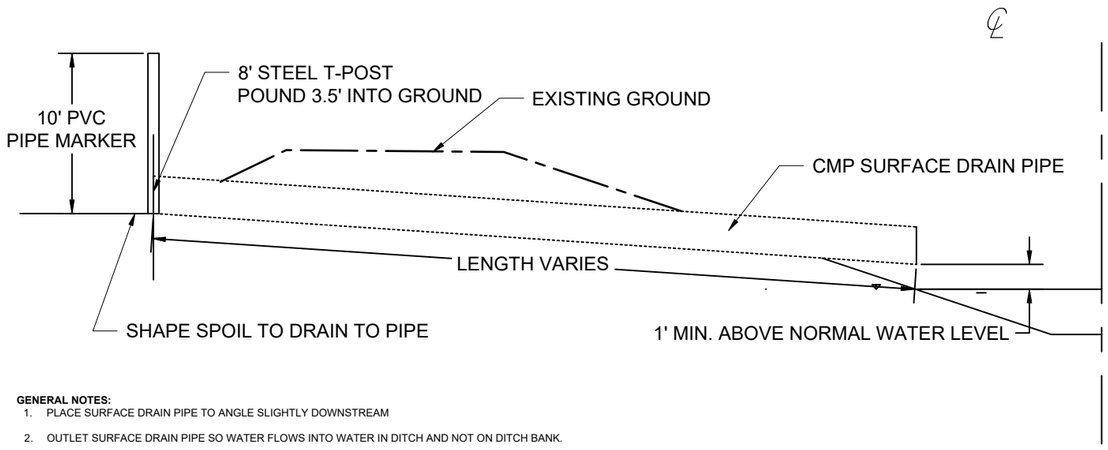
GENERAL NOTES:

1. CONSTRUCT SEDIMENT BAFFLE BY INSTALLING THREE ROWS OF SILT FENCE ACROSS THE BOTTOM OF THE OPEN DITCH AT THE OUTLET LEAVING AN OPENING EQUAL TO 25% OF THE BOTTOM WIDTH ON ALTERNATING SIDES.
2. SPACE EACH SILT FENCE 4' FROM EACH OTHER.
3. REMOVAL OF THE SILT FENCES AT THE END OF THE PROJECT IS INCIDENTAL TO INSTALLATION.



SURFACE DRAIN PIPE DETAIL

ALL ITEMS AND NOTES SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED

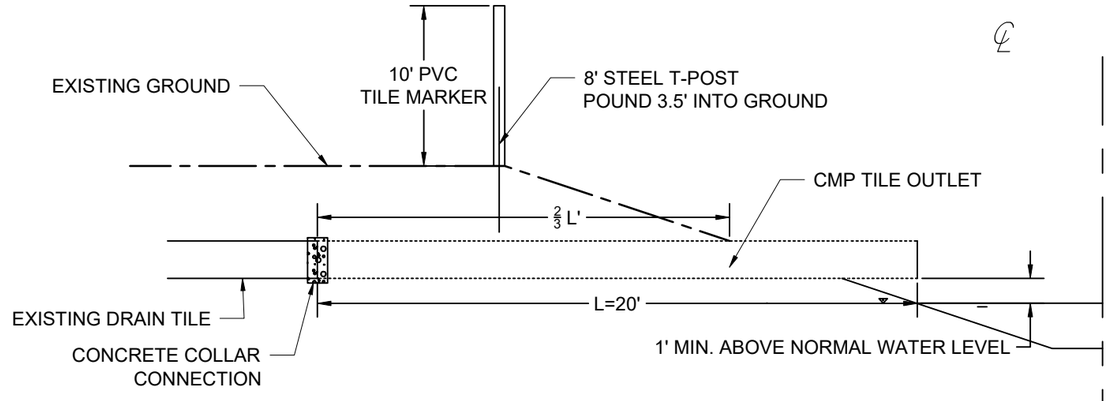


GENERAL NOTES:

1. PLACE SURFACE DRAIN PIPE TO ANGLE SLIGHTLY DOWNSTREAM
2. OUTLET SURFACE DRAIN PIPE SO WATER FLOWS INTO WATER IN DITCH AND NOT ON DITCH BANK.
3. SHAPE TO DRAIN TO INLET. THIS WORK IS INCIDENTAL TO SURFACE DRAIN PIPE INSTALLATION.

TILE OUTLET DETAIL

ALL ITEMS AND NOTES SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED



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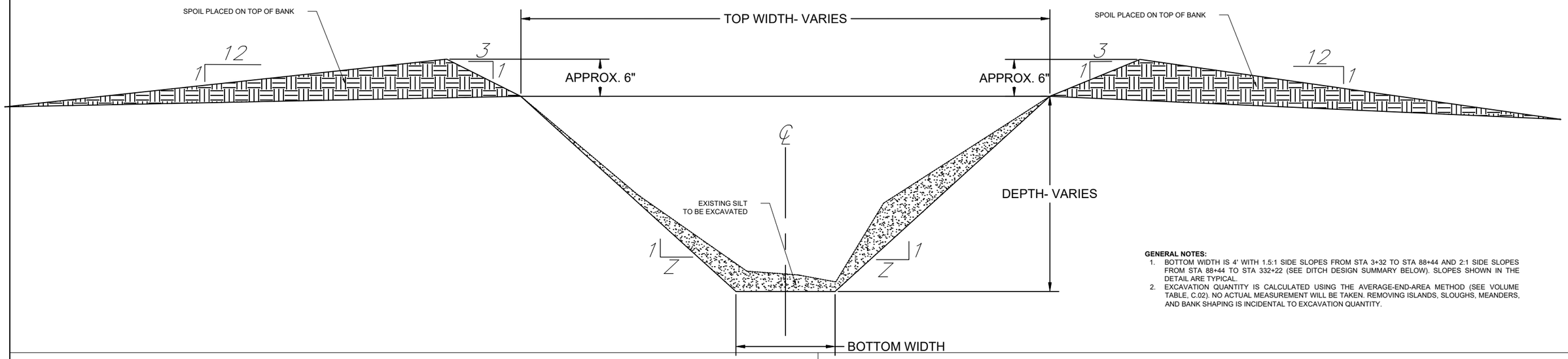
Sheet Name: General & Pipe Details

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project: 2616-67
Date: 2026-10-20
Plan Scale: NTS
Sheet: B.01

TYPICAL OPEN DITCH EXCAVATION AND SPOIL LEVELING DETAIL

ALL ITEMS AND NOTES SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED



GENERAL NOTES:

1. BOTTOM WIDTH IS 4' WITH 1.5:1 SIDE SLOPES FROM STA 3+32 TO STA 88+44 AND 2:1 SIDE SLOPES FROM STA 88+44 TO STA 332+22 (SEE DITCH DESIGN SUMMARY BELOW). SLOPES SHOWN IN THE DETAIL ARE TYPICAL.
2. EXCAVATION QUANTITY IS CALCULATED USING THE AVERAGE-END-AREA METHOD (SEE VOLUME TABLE, C.02). NO ACTUAL MEASUREMENT WILL BE TAKEN. REMOVING ISLANDS, SLOUGHS, MEANDERS, AND BANK SHAPING IS INCIDENTAL TO EXCAVATION QUANTITY.

DITCH DESIGN SUMMARY - REPAIR OF BEST FIT

FLOWLINE AND GRADE BY REACH (FLOWLINE IS CARRIED STRAIGHT THROUGH ROAD / CULVERT CROSSINGS)

Reach	From STA	To STA	Length (LF)	Start FL (ft)	End FL (ft)	Grade (%)	Bottom Width	Side Slopes
Outlet to 120th St	3+32	40+32	3700	1017.14	1019.57	0.0657	4'	1.5:1
120th St to 110th St	40+32	102+37	6205	1019.57	1021.95	0.0384	4'	1.5:1 / 2:1
110th St to 340th St	102+37	162+99	6062	1021.95	1023.86	0.0315	4'	2:1
340th St to 325th St	162+99	251+68	8869	1023.86	1026.07	0.0249	4'	2:1
325th St to K-45	251+68	303+69	5201	1026.07	1029.55	0.0669	4'	2:1
K-45 to Hemlock	303+69	332+22	2854	1029.55	1030.26	0.0249	4'	2:1

SIDE SLOPES CHANGE FROM 1.5:1 TO 2:1 AT STA 88+44 (REACH 120TH ST TO 110TH ST).
GRADE % IS THE FLOWLINE SLOPE BETWEEN THE LISTED STATIONS (FT/FT x 100).

DITCH REPAIR NOTES

1. ALL ITEMS AND NOTES SHOWN IN THESE DETAILS ARE INCIDENTAL UNLESS OTHERWISE NOTED.
2. REPAIR THE DITCH TO THE REPAIR OF BEST FIT FLOWLINE SHOWN ON THE PLAN AND PROFILE SHEETS (D.01 - D.17). THE FLOWLINE IS A STRAIGHT GRADE BETWEEN PROFILE GRADE BREAKS (PVI), CARRIED STRAIGHT THROUGH ROAD AND FIELD CROSSING CULVERTS. PVI STATIONS AND ELEVATIONS ARE LABELED ON THE PROFILE.
3. EXISTING CROSSING CULVERTS NOTED "ETR" SHALL REMAIN IN PLACE AND BE PROTECTED. NO CROSSING CULVERT IS REMOVED OR RELAID.
4. FROM STA 3+32 TO STA 62+00 EXCAVATED SPOIL IS HAULED OFF. FROM STA 62+00 TO STA 332+22 SPOIL IS PLACED AND LEVELED ON THE TOP OF BANK AS SHOWN IN THE TYPICAL DETAIL.
5. FILL GULLIES AND INSTALL NEW SURFACE DRAIN PIPES AT THE LOCATIONS LISTED IN THE PIPE TABLE (C.01). SURFACE DRAIN INSTALLATION IS PER THE SURFACE DRAIN PIPE DETAIL (B.01). NO PIPE SHALL BE RELAID BELOW THE PROPOSED DITCH BOTTOM; RELAY PIPES WITH THE OUTLET INVERT AT A MINIMUM OF 1.0 FT ABOVE THE PROPOSED DITCH BOTTOM.
6. WORK LIMITS ARE 100 FEET EACH SIDE OF THE DITCH CENTERLINE, EXCEPT THAT NO LIMITS ARE SHOWN AT ROAD OR RAILROAD CROSSINGS. ALONG THE LOWER REACH (STA 3+32 TO APPROX. STA 64+50) THE LIMIT ON THE ROAD SIDE IS THE ROAD CENTERLINE, AND (TO APPROX. STA 82+50) THE LIMIT ON THE RAILROAD SIDE IS THE RAILROAD RIGHT-OF-WAY. ALONG K-45 (STA 275+50 TO STA 303+50) THE LIMIT ON THE ROAD SIDE IS THE EDGE OF THE ROAD AND NO WORK IS PERFORMED ON THE ROAD SIDE.
7. CROSS SECTIONS SHOW THE PROPOSED DITCH ONLY TO THE POINT WHERE THE PROPOSED SIDE SLOPE MEETS EXISTING GROUND. THE DITCH IS NOT CLEANED OUT ABOVE THAT POINT; EXISTING GROUND ABOVE IT IS LEFT UNDISTURBED.
8. UTILITIES SHOWN (IN RED) ARE FROM SURVEY AND IOWA ONE CALL LOCATES. THE CONTRACTOR SHALL VERIFY LOCATIONS BEFORE EXCAVATING.

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No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name: Excavation Details

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project: 2616-67
Date: 2026-10-20
Plan Scale: NTS
Sheet: B.02

ID	Station	Side	Type	Existing Size	Proposed Size	Work LF	Inlet FL (ft)	Outlet FL (ft)	Notes
P-001	1+66	CL	CX	72" CMP	-	-	1017.14	1014.02	Existing outlet culvert with flap gate. Protect existing.
P-002	18+11	LT	SD	36"x24" RCB	-	-	1029.46	1025.60	Existing-to-remain.
P-003	39+87	CL	CX	72" CMP	-	-	1019.30	1019.82	120th St. Existing culvert to remain (ETR): higher invert is within 0.25 ft of the repair-of-best-fit flowline.
P-004	40+36	LT	SD	30" CMP	-	-	1029.24	1021.89	Existing-to-remain.
G-01	71+05	LT	SD	-	18" CMP	30	1025.62	1021.75	Fill gully and install new 30 LF 18" CMP SD.
G-02	83+09	RT	SD	-	18" CMP	50	1035.62	1022.21	Fill gully and install new 50 LF 18" CMP SD.
P-005	92+66	LT	SD	18" CMP	18" CMP	40	1025.74	1022.58	Replace with one 40 LF 18" CMP SD.
G-03	94+36	RT	SD	-	18" CMP	40	1027.62	1022.64	Fill gully and install new 40 LF 18" CMP SD.
G-04	100+79	RT	SD	-	18" CMP	30	1027.28	1022.89	Fill gully and install new 30 LF 18" CMP SD.
P-006	101+55	RT	SD	18" CMP	-	-	1024.84	1024.59	Existing-to-remain.
P-007	101+81	LT	SD	18" CMP	-	-	1026.47	1023.96	Existing-to-remain.
P-008	102+06	CL	CX	72" CMP	-	-	1022.20	1021.97	110th St. Existing culvert to remain (ETR): higher invert is within 0.25 ft of the repair-of-best-fit flowline.
P-009	112+23	RT	SD	15" CMP	18" CMP	30	1025.11	1023.26	Replace with one 30 LF 18" CMP SD.
G-05	119+13	RT	SD	-	36" CMP	30	1026.27	1023.48	Fill gully and install new 30 LF 36" CMP SD.
P-010	119+74	LT	SD	12" CMP	18" CMP	40	1024.90	1024.26	Replace with one 40 LF 18" CMP SD.
P-011	128+34	RT	SD	15" CMP	18" CMP	30	1025.07	1023.77	Replace with one 30 LF 18" CMP SD.
P-012	130+33	LT	SD	18" CMP	18" CMP	30	1024.84	1023.83	Replace with one 30 LF 18" CMP SD.
P-013	133+68	LT	SD	18" CMP	18" CMP	30	1024.34	1023.94	Replace with one 30 LF 18" CMP SD.
P-014	134+07	RT	SD	18" CMP	18" CMP	30	1024.86	1023.95	Replace with one 30 LF 18" CMP SD.
P-015	148+42	RT	SD	12" CMP	18" CMP	40	1025.10	1024.87	Replace with one 40 LF 18" CMP SD.
P-016	149+89	LT	SD	12" CMP	18" CMP	40	1025.24	1024.72	Replace with one 40 LF 18" CMP SD.
P-017	162+36	LT	SD	24" CMP	-	-	1027.26	1026.85	Existing-to-remain.
P-018	162+69	LT	CX	54" CMP	-	-	1024.09	1023.98	340th St (1 of 2). Existing culvert to remain (ETR): higher invert is within 0.25 ft of the repair-of-best-fit flowline.
P-019	162+69	RT	CX	54" CMP	-	-	1024.11	1024.02	340th St (2 of 2). Existing culvert to remain (ETR): higher invert is within 0.25 ft of the repair-of-best-fit flowline.
P-020	163+02	RT	SD	24" CMP	-	-	1026.23	1025.39	Existing-to-remain.
P-021	163+04	LT	SD	24" CMP	-	-	1026.01	1025.21	Existing-to-remain.
P-022	176+50	LT	SD	12" CMP	18" CMP	40	1026.62	1026.04	Replace with one 40 LF 18" CMP SD.
P-023	176+55	RT	SD	12" CMP	18" CMP	40	1026.75	1025.25	Replace with one 40 LF 18" CMP SD.
P-024	189+80	RT	SD	18" CMP	18" CMP	70	1025.90	1025.53	Replace with one 70 LF 18" CMP SD.
P-025	198+39	LT	SD	18" CMP	18" CMP	30	1025.86	1025.74	Replace with one 30 LF 18" CMP SD.
G-06	199+87	LT	SD	-	24" CMP	20	1027.24	1025.78	Fill gully and install new 20 LF 24" CMP SD.

ID	Station	Side	Type	Existing Size	Proposed Size	Work LF	Inlet FL (ft)	Outlet FL (ft)	Notes
P-026	212+41	LT	CX	48" CMP	-	-	1025.01	1024.80	Crossing (2 of 2). Existing culvert to remain (ETR): higher invert is within 0.25 ft of the repair-of-best-fit flowline.
P-027	212+42	RT	CX	48" CMP	-	-	1025.00	1024.90	Crossing (1 of 2). Existing culvert to remain (ETR): higher invert is within 0.25 ft of the repair-of-best-fit flowline.
P-028	221+54	LT	SD	18" CMP	18" CMP	30	1028.23	1026.32	Replace with one 30 LF 18" CMP SD.
G-07	223+24	LT	SD	-	18" CMP	30	1028.89	1026.36	Fill gully and install new 30 LF 18" CMP SD.
G-08	223+73	LT	SD	-	18" CMP	30	1029.00	1026.37	Fill gully and install new 30 LF 18" CMP SD.
G-09	228+12	RT	SD	-	18" CMP	30	1028.52	1026.48	Fill gully and install new 30 LF 18" CMP SD.
G-10	229+90	RT	SD	-	18" CMP	20	1028.20	1026.53	Fill gully and install new 20 LF 18" CMP SD.
G-11	235+49	RT	SD	-	18" CMP	20	1028.60	1026.67	Fill gully and install new 20 LF 18" CMP SD.
G-12	235+70	LT	SD	-	18" CMP	30	1028.89	1026.67	Fill gully and install new 30 LF 18" CMP SD.
G-13	242+35	RT	SD	-	18" CMP	30	1028.95	1026.84	Fill gully and install new 30 LF 18" CMP SD.
G-14	242+56	LT	SD	-	18" CMP	30	1029.01	1026.84	Fill gully and install new 30 LF 18" CMP SD.
G-15	247+44	LT	SD	-	18" CMP	30	1029.96	1026.96	Fill gully and install new 30 LF 18" CMP SD.
P-029	251+36	CL	CX	72" CMP	-	-	1024.65	1024.90	325th St. Existing culvert to remain (ETR): invert is at or below the repair-of-best-fit flowline.
P-030	252+84	LT	SD	12" CMP	18" CMP	20	1029.07	1027.99	Replace with one 20 LF 18" CMP SD.
P-031	254+28	RT	SD	15" CMP	18" CMP	30	1029.14	1027.24	Replace with one 30 LF 18" CMP SD.
P-032	258+75	RT	SD	15" CMP	18" CMP	30	1029.67	1027.54	Replace with one 30 LF 18" CMP SD.
G-16	260+02	LT	SD	-	18" CMP	20	1029.51	1027.72	Fill gully and install new 20 LF 18" CMP SD.
P-033	262+39	LT	SD	12" CMP	18" CMP	20	1030.11	1029.72	Replace with one 20 LF 18" CMP SD.
P-034	267+78	RT	SD	24" CMP	24" CMP	30	1030.36	1028.15	Replace with one 30 LF 24" CMP SD.
P-035	275+76	LT	SD	24"x24" RCB	-	-	1031.31	1029.34	Existing-to-remain.
P-036	276+44	RT	SD	15" CMP	18" CMP	30	1031.59	1029.11	Replace with one 30 LF 18" CMP SD.
P-037	279+61	RT	SD	15" CMP	18" CMP	30	1030.94	1028.94	Replace with one 30 LF 18" CMP SD.
P-038	284+40	CL	CX	36" CMP	-	-	1027.96	1027.46	Road crossing. Existing culvert to remain (ETR): invert is at or below the repair-of-best-fit flowline.
P-039	285+34	RT	SD	15" CMP	-	-	1032.84	1029.59	Existing-to-remain.
P-040	297+82	CL	CX	36" CMP	-	-	1029.21	1028.59	Road crossing. Existing culvert to remain (ETR): higher invert is within 0.25 ft of the repair-of-best-fit flowline.
P-041	302+60	RT	SD	18" CMP	-	-	1031.34	1030.68	Existing-to-remain.
P-042	303+36	CL	CX	4'x3.5' RCB	-	-	1029.80	1029.60	K-45. Existing-to-remain.
G-17	305+09	RT	SD	-	24" CMP	30	1034.89	1030.82	Fill gully and install new 30 LF 24" CMP SD.
P-043	312+78	RT	SD	18" CMP	18" CMP	30	1033.60	1030.78	Replace with one 30 LF 18" CMP SD.
P-044	315+54	RT	SD	18" CMP	18" CMP	30	1033.92	1030.84	Replace with one 30 LF 18" CMP SD.
P-045	332+22	CL	CX	30" CMP	-	-	1031.38	1031.27	Hemlock Ave. Existing culvert to remain (ETR): higher invert is within 0.25 ft of the repair-of-best-fit flowline.

CX = EXISTING CROSSING CULVERT (ROAD / FIELD CROSSING) SD = SURFACE DRAIN FL = FLOWLINE (INVERT) ELEVATION, FT

FL ARE SURVEYED EXISTING INVERTS, EXCEPT OUTLET FL OF NEW / REPLACEMENT SD, WHICH IS THE HIGHER OF THE SURVEYED INVERT AND 1.0 FT ABOVE THE PROPOSED DITCH BOTTOM. WORK LF = NEW / REPLACEMENT SD LENGTH (ROUNDED UP TO 10 FT).

NOTE: NO PIPE SHALL BE RELAID BELOW THE PROPOSED DITCH BOTTOM. RELAY AND INSTALL ALL PIPES WITH THE OUTLET INVERT AT A MINIMUM OF 1.0 FT ABOVE THE PROPOSED DITCH BOTTOM.

AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter JLH
Checker TJB

No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name: Pipe Table

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project: 2616-67
Date: 2026-10-20
Plan Scale: NTS
Sheet: C.01

Crane Open Ditch (3+32 to 69+00)

Station	Length (LF)	Avg. Cut Area (SF)	Cut Vol. (CY)	Cumul. (CY)
3+32 - 4+00 *	68	59.6	150	150
4+00 - 5+00	100	59.8	222	372
5+00 - 6+00	100	68.3	253	625
6+00 - 7+00	100	64.3	238	863
7+00 - 8+00	100	70.5	261	1,124
8+00 - 9+00	100	77.5	287	1,411
9+00 - 10+00	100	38.4	142	1,553
10+00 - 11+00	100	46.8	174	1,727
11+00 - 12+00	100	64.4	238	1,965
12+00 - 13+00	100	104.6	388	2,353
13+00 - 14+00	100	97.0	359	2,712
14+00 - 15+00	100	91.4	338	3,050
15+00 - 16+00	100	58.2	216	3,266
16+00 - 17+00	100	101.5	376	3,642
17+00 - 18+00	100	98.1	363	4,005
18+00 - 19+00	100	91.3	339	4,344
19+00 - 20+00	100	108.6	402	4,746
20+00 - 21+00	100	106.3	394	5,140
21+00 - 22+00	100	75.9	281	5,421
22+00 - 23+00	100	72.3	267	5,688
23+00 - 24+00	100	80.4	298	5,986
24+00 - 25+00	100	83.2	308	6,294
25+00 - 26+00	100	60.3	224	6,518
26+00 - 27+00	100	61.9	229	6,747
27+00 - 28+00	100	76.5	283	7,030
28+00 - 29+00	100	63.4	235	7,265
29+00 - 30+00	100	54.6	202	7,467
30+00 - 31+00	100	68.5	254	7,721
31+00 - 32+00	100	76.4	283	8,004
32+00 - 33+00	100	62.8	232	8,236
33+00 - 34+00	100	57.1	212	8,448
34+00 - 35+00	100	50.2	186	8,634
35+00 - 36+00	100	59.8	221	8,855
36+00 - 37+00	100	62.7	232	9,087
37+00 - 38+00	100	56.4	209	9,296
38+00 - 39+00	100	57.7	214	9,510
39+00 - 40+00 *	100	55.3	82	9,592
40+00 - 41+00 *	100	40.5	90	9,682
41+00 - 42+00	100	37.8	140	9,822
42+00 - 43+00	100	41.3	153	9,975
43+00 - 44+00	100	30.4	112	10,087
44+00 - 45+00	100	37.2	138	10,225
45+00 - 46+00	100	33.0	123	10,348
46+00 - 47+00	100	23.6	87	10,435
47+00 - 48+00	100	29.3	108	10,543
48+00 - 49+00	100	20.1	75	10,618
49+00 - 50+00	100	22.0	81	10,699
50+00 - 51+00	100	21.4	80	10,779
51+00 - 52+00	100	21.8	80	10,859
52+00 - 53+00	100	25.0	93	10,952
53+00 - 54+00	100	14.6	54	11,006
54+00 - 55+00	100	22.1	82	11,088
55+00 - 56+00	100	21.2	78	11,166
56+00 - 57+00	100	16.7	62	11,228
57+00 - 58+00	100	15.0	56	11,284
58+00 - 59+00	100	13.5	50	11,334
59+00 - 60+00	100	15.4	57	11,391
60+00 - 61+00	100	39.0	144	11,535
61+00 - 62+00 *	100	31.6	117	11,652
62+00 - 63+00	100	38.7	143	11,795
63+00 - 64+00	100	17.3	65	11,860
64+00 - 65+00	100	13.5	49	11,909
65+00 - 66+00	100	13.7	51	11,960
66+00 - 67+00	100	15.1	56	12,016
67+00 - 68+00	100	14.7	54	12,070
68+00 - 69+00	100	15.8	59	12,129

Crane Open Ditch (69+00 to 135+00)

Station	Length (LF)	Avg. Cut Area (SF)	Cut Vol. (CY)	Cumul. (CY)
69+00 - 70+00	100	11.4	42	12,171
70+00 - 71+00	100	27.3	101	12,272
71+00 - 72+00	100	8.8	33	12,305
72+00 - 73+00	100	12.8	47	12,352
73+00 - 74+00	100	7.5	28	12,380
74+00 - 75+00	100	8.6	32	12,412
75+00 - 76+00	100	14.2	52	12,464
76+00 - 77+00	100	14.9	55	12,519
77+00 - 78+00	100	15.1	56	12,575
78+00 - 79+00	100	17.1	63	12,638
79+00 - 80+00	100	13.7	51	12,689
80+00 - 81+00	100	21.1	78	12,767
81+00 - 82+00	100	11.4	43	12,810
82+00 - 83+00	100	11.0	40	12,850
83+00 - 84+00	100	5.2	19	12,869
84+00 - 85+00	100	19.2	72	12,941
85+00 - 86+00	100	21.7	80	13,021
86+00 - 87+00	100	21.4	79	13,100
87+00 - 88+00	100	18.7	69	13,169
88+00 - 89+00 *	100	31.5	117	13,286
89+00 - 90+00	100	41.0	152	13,438
90+00 - 91+00	100	33.3	123	13,561
91+00 - 92+00	100	32.4	120	13,681
92+00 - 93+00	100	21.4	79	13,760
93+00 - 94+00	100	20.6	77	13,837
94+00 - 95+00	100	19.7	73	13,910
95+00 - 96+00	100	27.3	101	14,011
96+00 - 97+00	100	26.6	99	14,110
97+00 - 98+00	100	19.1	70	14,180
98+00 - 99+00	100	17.1	63	14,243
99+00 - 100+00	100	19.1	71	14,314
100+00 - 101+00	100	18.0	67	14,381
101+00 - 102+00 *	100	18.3	47	14,428
102+00 - 103+00 *	100	3.9	7	14,435
103+00 - 104+00	100	3.2	12	14,447
104+00 - 105+00	100	7.4	28	14,475
105+00 - 106+00	100	3.7	13	14,488
106+00 - 107+00	100	3.0	12	14,500
107+00 - 108+00	100	1.4	5	14,505
108+00 - 109+00	100	1.4	5	14,510
109+00 - 110+00	100	1.5	6	14,516
110+00 - 111+00	100	1.4	5	14,521
111+00 - 112+00	100	1.3	5	14,526
112+00 - 113+00	100	0.7	2	14,528
113+00 - 114+00	100	2.7	10	14,538
114+00 - 115+00	100	6.9	26	14,564
115+00 - 116+00	100	7.7	28	14,592
116+00 - 117+00	100	5.1	19	14,611
117+00 - 118+00	100	6.2	23	14,634
118+00 - 119+00	100	4.4	16	14,650
119+00 - 120+00	100	6.4	24	14,674
120+00 - 121+00	100	7.6	28	14,702
121+00 - 122+00	100	10.7	40	14,742
122+00 - 123+00	100	10.5	39	14,781
123+00 - 124+00	100	7.8	29	14,810
124+00 - 125+00	100	9.9	36	14,846
125+00 - 126+00	100	11.5	43	14,889
126+00 - 127+00	100	9.3	35	14,924
127+00 - 128+00	100	6.4	23	14,947
128+00 - 129+00	100	5.0	19	14,966
129+00 - 130+00	100	4.3	16	14,982
130+00 - 131+00	100	7.4	27	15,009
131+00 - 132+00	100	8.0	30	15,039
132+00 - 133+00	100	2.9	10	15,049
133+00 - 134+00	100	5.4	20	15,069
134+00 - 135+00	100	13.1	49	15,118

Crane Open Ditch (135+00 to 201+00)

Station	Length (LF)	Avg. Cut Area (SF)	Cut Vol. (CY)	Cumul. (CY)
135+00 - 136+00	100	14.6	54	15,172
136+00 - 137+00	100	18.5	68	15,240
137+00 - 138+00	100	18.9	70	15,310
138+00 - 139+00	100	18.3	68	15,378
139+00 - 140+00	100	18.8	70	15,448
140+00 - 141+00	100	18.6	69	15,517
141+00 - 142+00	100	24.7	91	15,608
142+00 - 143+00	100	19.4	72	15,680
143+00 - 144+00	100	17.5	65	15,745
144+00 - 145+00	100	17.5	65	15,810
145+00 - 146+00	100	16.8	62	15,872
146+00 - 147+00	100	17.2	64	15,936
147+00 - 148+00	100	17.9	67	16,003
148+00 - 149+00	100	15.6	57	16,060
149+00 - 150+00	100	15.5	58	16,118
150+00 - 151+00	100	12.6	47	16,165
151+00 - 152+00	100	12.9	47	16,212
152+00 - 153+00	100	12.7	48	16,260
153+00 - 154+00	100	13.2	48	16,308
154+00 - 155+00	100	12.2	45	16,353
155+00 - 156+00	100	13.0	49	16,402
156+00 - 157+00	100	19.1	70	16,472
157+00 - 158+00	100	17.0	63	16,535
158+00 - 159+00	100	14.1	52	16,587
159+00 - 160+00	100	7.4	28	16,615
160+00 - 161+00	100	5.6	21	16,636
161+00 - 162+00	100	7.9	29	16,665
162+00 - 163+00 *	100	10.0	11	16,676
163+00 - 164+00 *	100	13.6	41	16,717
164+00 - 165+00	100	21.2	78	16,795
165+00 - 166+00	100	22.5	83	16,878
166+00 - 167+00	100	21.7	81	16,959
167+00 - 168+00	100	18.6	69	17,028
168+00 - 169+00	100	19.6	72	17,100
169+00 - 170+00	100	25.4	94	17,194
170+00 - 171+00	100	21.8	81	17,275
171+00 - 172+00	100	15.9	59	17,334
172+00 - 173+00	100	14.0	52	17,386
173+00 - 174+00	100	13.5	50	17,436
174+00 - 175+00	100	10.6	39	17,475
175+00 - 176+00	100	14.4	53	17,528
176+00 - 177+00	100	20.1	75	17,603
177+00 - 178+00	100	17.4	64	17,667
178+00 - 179+00	100	21.1	78	17,745
179+00 - 180+00	100	21.0	78	17,823
180+00 - 181+00	100	21.1	78	17,901
181+00 - 182+00	100	18.2	68	17,969
182+00 - 183+00	100	14.3	53	18,022
183+00 - 184+00	100	12.2	45	18,067
184+00 - 185+00	100	10.7	39	18,106
185+00 - 186+00	100	11.5	43	18,149
186+00 - 187+00	100	15.4	57	18,206
187+00 - 188+00	100	13.5	50	18,256
188+00 - 189+00	100	10.3	38	18,294
189+00 - 190+00	100	2.5	9	18,303
190+00 - 191+00	100	0.4	1	18,304
191+00 - 192+00	100	1.1	5	18,309
192+00 - 193+00	100	2.0	7	18,316
193+00 - 194+00	100	6.3	24	18,340
194+00 - 195+00	100	7.5	27	18,367
195+00 - 196+00	100	11.7	44	18,411
196+00 - 197+00	100	6.1	22	18,433
197+00 - 198+00	100	1.1	4	18,437
198+00 - 199+00	100	0.0	1	18,438
199+00 - 200+00	100	1.8	6	18,444
200+00 - 201+00	100	4.1	16	18,460

Crane Open Ditch (201+00 to 267+00)

Station	Length (LF)	Avg. Cut Area (SF)	Cut Vol. (CY)	Cumul. (CY)
201+00 - 202+00	100	1.7	6	18,466
202+00 - 203+00	100	3.4	12	18,478
203+00 - 204+00	100	1.9	7	18,485
204+00 - 205+00	100	1.8	7	18,492
205+00 - 206+00	100	2.1	8	18,500
206+00 - 207+00	100	6.1	22	18,522
207+00 - 208+00	100	4.7	18	18,540
208+00 - 209+00	100	7.7	28	18,568
209+00 - 210+00	100	5.8	22	18,590
210+00 - 211+00	100	3.2	12	18,602
211+00 - 212+00	100	1.8	7	18,609
212+00 - 213+00 *	100	3.3	3	18,612
213+00 - 214+00	100	2.7	10	18,622
214+00 - 215+00	100	2.0	8	18,630
215+00 - 216+00	100	1.9	7	18,637
216+00 - 217+00	100	2.3	8	18,645
217+00 - 218+00	100	5.0	19	18,664
218+00 - 219+00	100	5.7	21	18,685
219+00 - 220+00	100	1.8	7	18,692
220+00 - 221+00	100	2.7	10	18,702
221+00 - 222+00	100	4.2	16	18,718
222+00 - 223+00	100	3.6	13	18,731
223+00 - 224+00	100	4.0	14	18,745
224+00 - 225+00	100	3.9	15	18,760
225+00 - 226+00	100	3.8	14	18,774
226+00 - 227+00	100	4.7	18	18,792
227+00 - 228+00	100	3.6	13	18,805
228+00 - 229+00	100	4.1	15	18,820
229+00 - 230+00	100	4.6	17	18,837
230+00 - 231+00	100	3.3	12	18,849
231+00 - 232+00	100	1.7	7	18,856
232+00 - 233+00	100	2.2	8	18,864
233+00 - 234+00	100	1.7	6	18,870
234+00 - 235+00	100	1.5	6	18,876
235+00 - 236+00	100	4.6	17	18,893
236+00 - 237+00	100	2.4	9	18,902
237+00 - 238+00	100	1.4	5	18,907
238+00 - 239+00	100	1.1	4	18,911
239+00 - 240+00	100	0.1	0	18,911
240+00 - 241+00	100	0.0	0	18,911
241+00 - 242+00	100	0.0	0	18,911
242+00 - 243+00	100	0.3	2	18,913
243+00 - 244+00	100	0.0	0	18,913
244+00 - 245+00	100	0.0	0	18,913
245+00 - 246+00	100	0.0	0	18,913
246+00 - 247+00	100	0.0	0	18,913
247+00 - 248+00	100	0.0	0	18,913
248+00 - 249+00	100	0.1	0	18,913
249+00 - 250+00	100	1.0	4	18,917
250+00 - 251+00 *	100	4.5	14	18,931
251+00 - 252+00 *	100	–	0	18,931
252+00 - 253+00	100	2.6	10	18,941
253+00 - 254+00	100	1.2	4	18,945
254+00 - 255+00	100	4.6	18	18,963
255+00 - 256+00	100	1.7	6	18,969
256+00 - 257+00	100	1.9	7	18,976
257+00 - 258+00	100	1.3	5	18,981
258+00 - 259+00	100	3.4	12	18,993
259+00 - 260+00	100	7.6	29	19,022
260+00 - 261+00	100	6.6	24	19,046
261+00 - 262+00	100	3.2	12	19,058
262+00 - 263+00	100	2.7	10	19,068
263+00 - 264+00	100	9.4	35	19,103
264+00 - 265+00	100	13.6	50	19,153
265+00 - 266+00	100	9.9	36	19,189
266+00 - 267+00	100	8.8	33	19,222

Crane Open Ditch (267+00 to 332+22)

Station	Length (LF)	Avg. Cut Area (SF)	Cut Vol. (CY)	Cumul. (CY)
267+00 - 268+00	100	17.0	63	19,285
268+00 - 269+00	100	30.1	111	19,396
269+00 - 270+00	100	32.6	121	19,517
270+00 - 271+00	100	35.1	130	19,647
271+00 - 272+00	100	27.9	103	19,750
272+00 - 273+00	100	27.5	102	19,852
273+00 - 274+00	100	30.8	114	19,966
274+00 - 275+00	100	32.0	119	20,085
275+00 - 276+00	100	35.5	131	20,216
276+00 - 277+00	100	30.5	113	20,329
277+00 - 278+00	100	12.0	44	20,373
278+00 - 279+00	100	6.4	24	20,397
279+00 - 280+00	100	7.9	29	20,426
280+00 - 281+00	100	16.2	60	20,486
281+00 - 282+00	100	14.5	54	20,540
282+00 - 283+00	100	15.4	57	20,597
283+00 - 284+00 *	100	10.4	23	20,620
284+00 - 285+00 *	100	–	0	20,620
285+00 - 286+00 *	100	11.9	35	20,655
286+00 - 287+00	100	14.3	53	20,708
287+00 - 288+00	100	11.6	43	20,751
288+00 - 289+00	100	7.6	28	20,779
289+00 - 290+00	100	3.0	12	20,791
290+00 - 291+00	100	4.6	17	20,808
291+00 - 292+00	100	6.6	24	20,832
292+00 - 293+00	100	15.9	59	20,891
293+00 - 294+00	100	19.5	72	20,963
294+00 - 295+00	100	18.7	69	21,032
295+00 - 296+00	100	8.2	31	21,063
296+00 - 297+00	100	14.0	52	21,115
297+00 - 298+00 *	100	16.3	12	21,127
298+00 - 299+00 *	100	12.3	23	21,150
299+00 - 300+00	100	3.9	14	21,164
300+00 - 301+00	100	4.7	18	21,182
301+00 - 302+00	100	9.4	35	21,217
302+00 - 303+00 *	100	16.3	48	21,265
303+00 - 304+00 *	100	11.8	4	21,269
304+00 - 305+00	100	12.7	48	21,317
305+00 - 306+00	100	8.3	30	21,347
306+00 - 307+00	100	2.0	8	21,355
307+00 - 308+00	100	1.7	6	21,361
308+00 - 309+00	100	1.0	4	21,365
309+00 - 310+00	100	8.9	33	21,398
310+00 - 311+00	100	7.7	28	21,426
311+00 - 312+00	100	7.9	30	21,456
312+00 - 313+00	100	12.0	44	21,500
313+00 - 314+00	100	8.7	32	21,532
314+00 - 315+00	100	10.0	37	21,569
315+00 - 316+00	100	9.3	34	21,603
316+00 - 317+00	100	3.8	14	21,617
317+00 - 318+00	100	5.3	20	21,637
318+00 - 319+00	100	2.9	11	21,648
319+00 - 320+00	100	4.4	16	21,664
320+00 - 321+00	100	4.1	15	21,679
321+00 - 322+00	100	12.0	45	21,724
322+00 - 323+00	100	14.3	53	21,777
323+00 - 324+00	100	16.9	62	21,839
324+00 - 325+00	100	9.9	37	21,876
325+00 - 326+00	100	5.9	22	21,898
326+00 - 327+00	100	6.6	25	21,923
327+00 - 328+00	100	8.8	32	21,955
328+00 - 329+00	100	8.1	30	21,985
329+00 - 330+00	100	3.0	12	21,997
330+00 - 331+00	100	1.1	4	22,001
331+00 - 332+00	100	2.9	11	22,012
332+00 - 332+22 *	22	–	0	22,012

*** NOTES**

TOTAL (STA 3+32 TO 332+22): 22,012 CY NET CUT, EXISTING GROUND TO REPAIR OF BEST FIT

3+32 - 4+00: Start of design (inv. 1017.14). Haul-off reach: spoil hauled off.

39+00 - 40+00: Culvert crossing zone excluded, 120th St (39+86) (39+31 to 40+41).

40+00 - 41+00: Grade change at 120th St: 0.0657% to 0.0384%. Culvert crossing zone excluded, 120th St (39+86) (39+31 to 40+41).

61+00 - 62+00: End of haul-off reach at 62+00. Spoil leveling begins.

88+00 - 89+00: Side slopes change from 1.5:1 to 2:1 at 88+44.

101+00 - 102+00: Culvert crossing zone excluded, 110th St (101+94) (101+66 to 102+57).

102+00 - 103+00: Grade change at 110th St: 0.0384% to 0.0315%. Culvert crossing zone excluded, 110th St (101+94) (101+66 to 102+57).

162+00 - 163+00: Grade change at 340th St: 0.0315% to 0.0249%. Culvert crossing zone excluded, 340th St (162+55) (162+21 to 163+21).

163+00 - 164+00: Culvert crossing zone excluded, 340th St (162+55) (162+21 to 163+21).

212+00 - 213+00: Culvert crossing zone excluded, crossing (212+17) (212+08 to 212+88).

250+00 - 251+00: Culvert crossing zone excluded, 325th St (251+09) (250+81 to 252+01).

251+00 - 252+00: Grade change at 325th St: 0.0249% to 0.0669%. Culvert crossing zone excluded, 325th St (251+09) (250+81 to 252+01).

283+00 - 284+00: Culvert crossing zone excluded, crossing (284+05) (283+54 to 285+24).

284+00 - 285+00: Culvert crossing zone excluded, crossing (284+05) (283+54 to 285+24).

285+00 - 286+00: Culvert crossing zone excluded, crossing (284+05) (283+54 to 285+24).

297+00 - 298+00: Culvert crossing zone excluded, crossing (297+47) (297+14 to 298+54).

298+00 - 299+00: Culvert crossing zone excluded, crossing (297+47) (297+14 to 298+54).

302+00 - 303+00: Culvert crossing zone excluded, K-45 (302+98) (302+74 to 303+96).

303+00 - 304+00: K-45 box, downstream face (303+04). Grade change at K-45: 0.0669% to 0.0249%. Culvert crossing zone excluded, K-45 (302+98) (302+74 to 303+96).

332+00 - 332+22: Culvert crossing zone excluded, Hemlock Ave (331+81) (331+94 to 332+22). End of design at Hemlock Ave (332+22).

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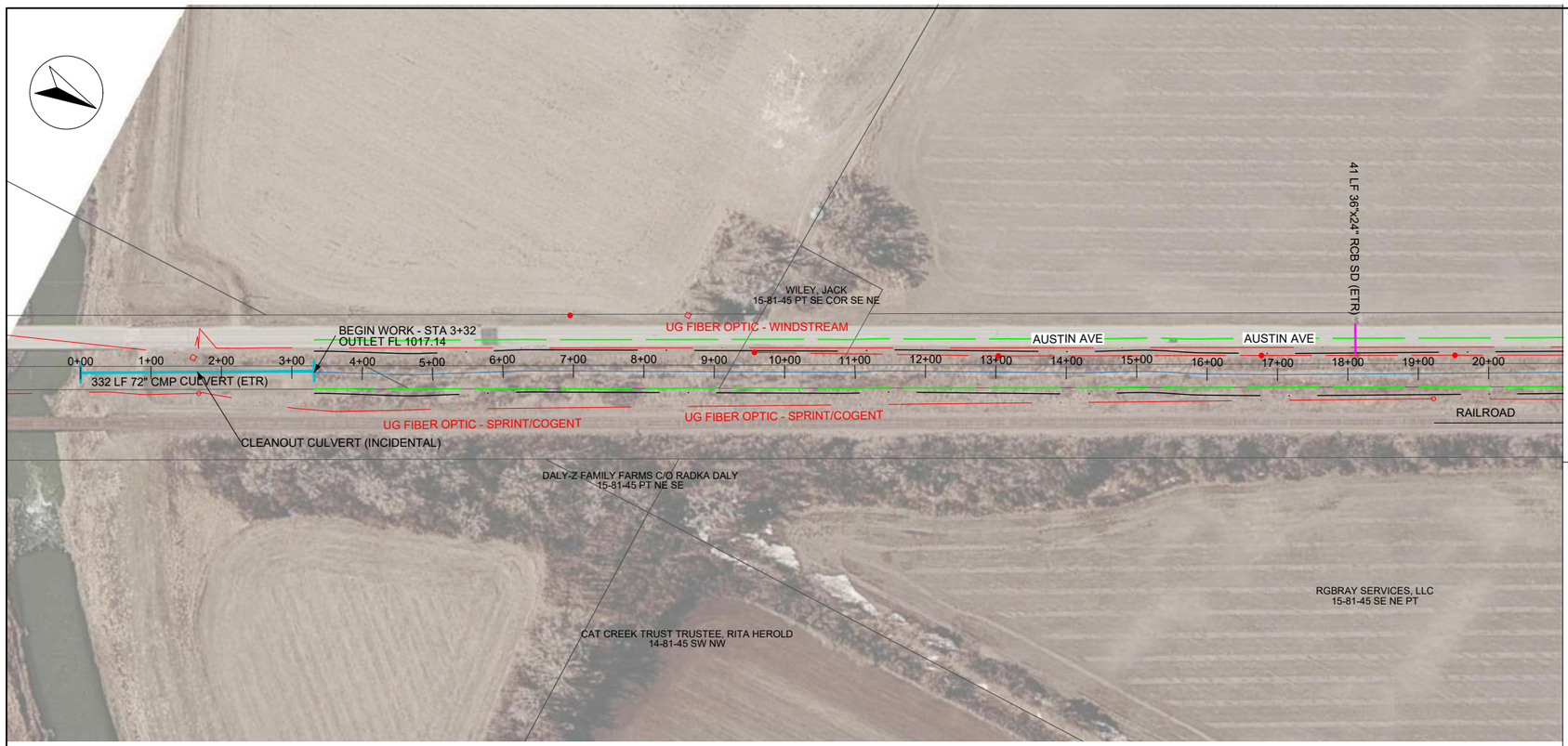
Designer JLH
Drafter JLH
Checker TJB

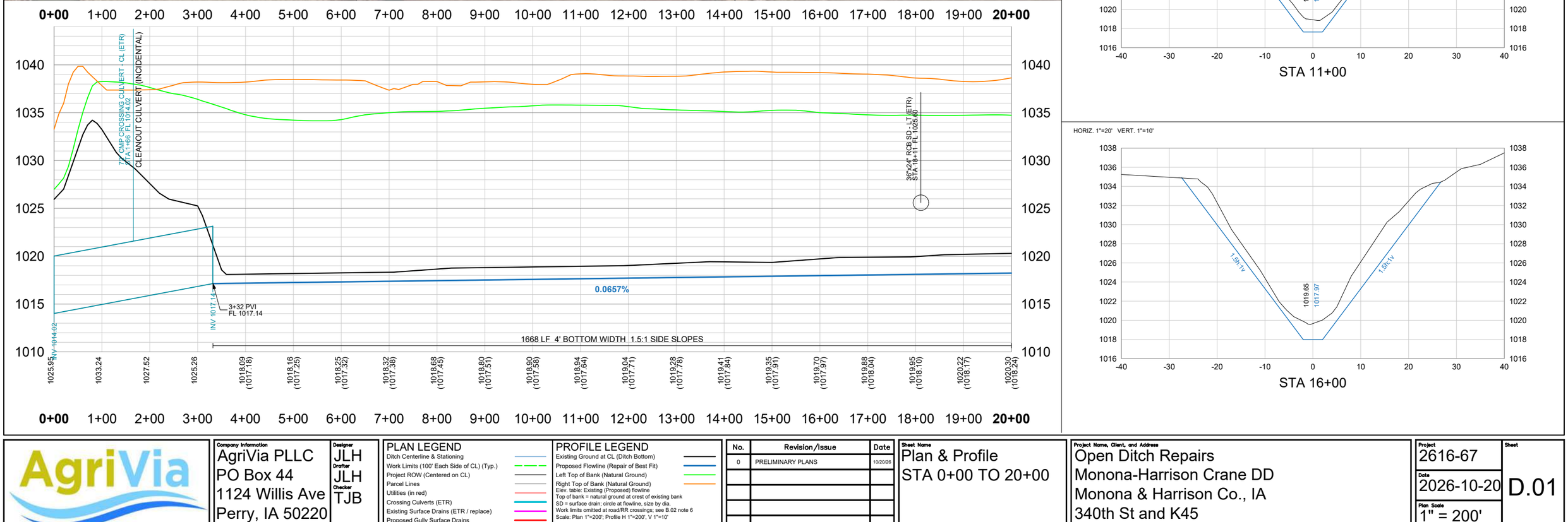
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

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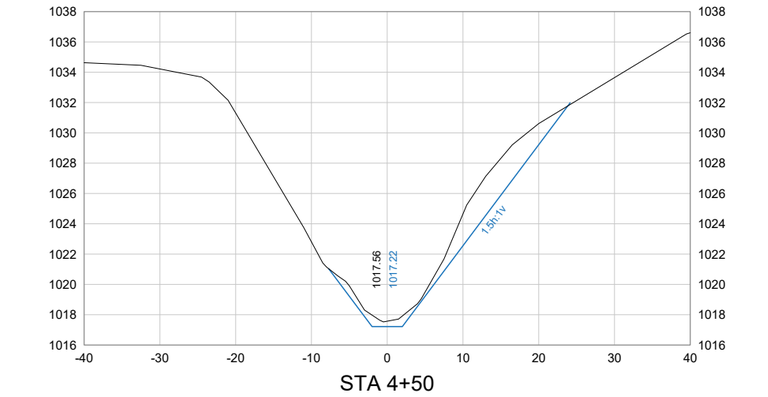
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project: 2616-67
Date: 2026-10-20
Plan Scale: NTS
Sheet: C.02

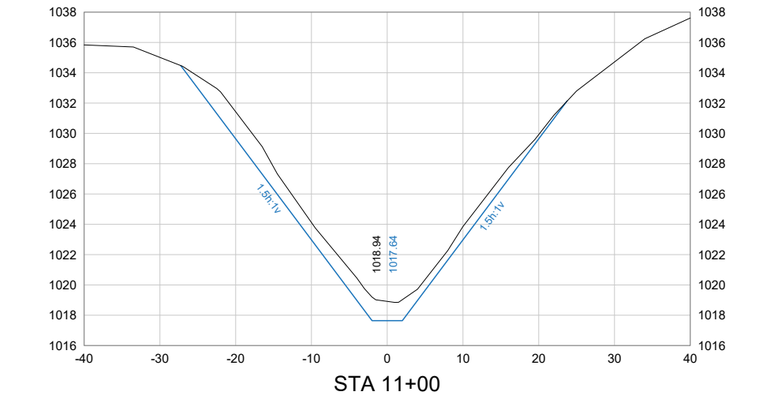




HORIZ. 1"=20' VERT. 1"=10'



HORIZ. 1"=20' VERT. 1"=10'



HORIZ. 1"=20' VERT. 1"=10'

AgriVia

Company Information
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Designer JLH
Drafter JLH
Checker TJB

PLAN LEGEND

- Ditch Centerline & Stationing
- Work Limits (100' Each Side of CL) (Typ.)
- Project ROW (Centered on CL)
- Parcel Lines
- Utilities (in red)
- Crossing Culverts (ETR)
- Existing Surface Drains (ETR / replace)
- Proposed Gully Surface Drains

PROFILE LEGEND

- Existing Ground at CL (Ditch Bottom)
- Proposed Flowline (Repair of Best Fit)
- Left Top of Bank (Natural Ground)
- Right Top of Bank (Natural Ground)

Elev. table: Existing (Proposed) flowline
Top of bank = natural ground at crest of existing bank
SD = surface drain; circle at flowline, size by dia.
Work limits omitted at road/RR crossings; see B.02 note 6
Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

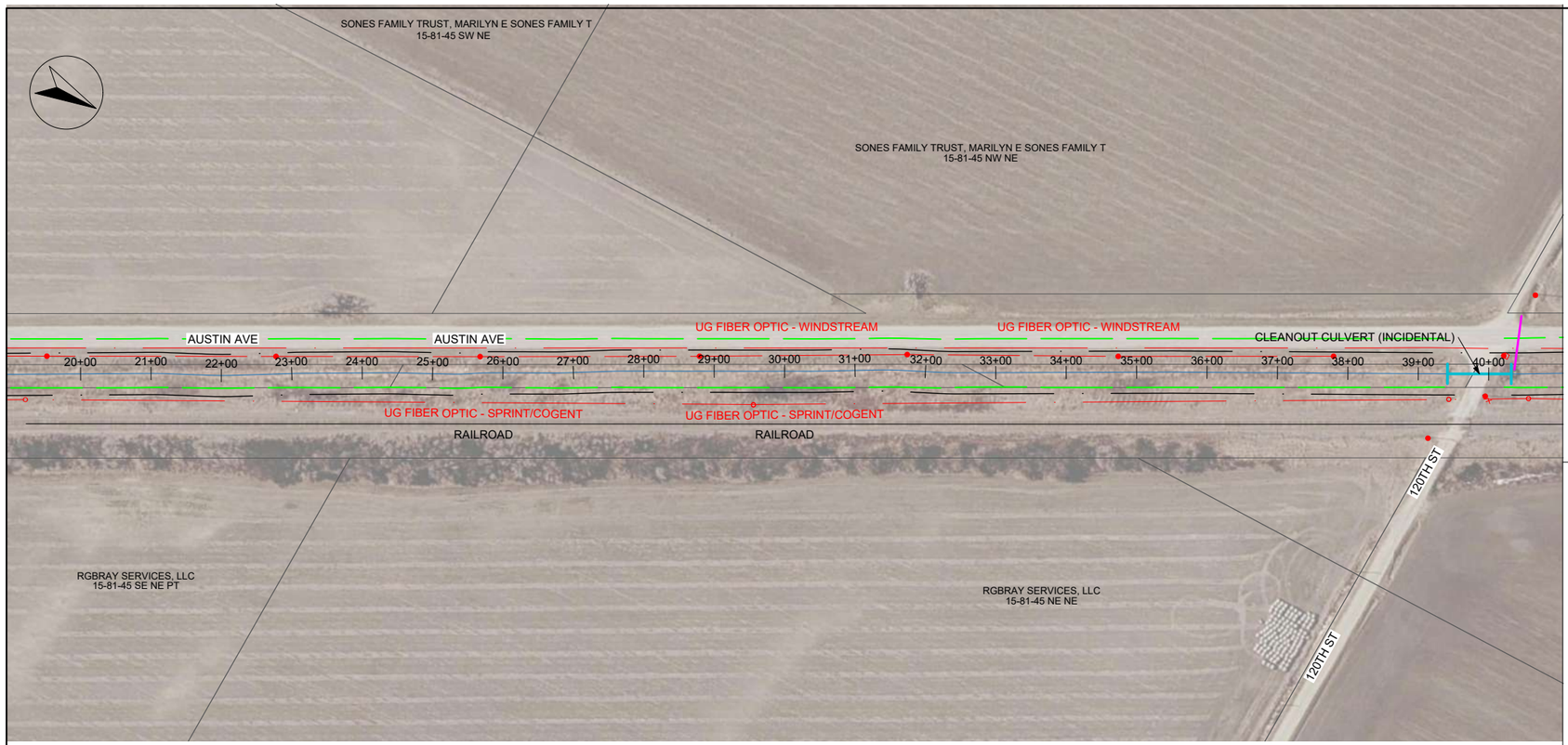
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0	PRELIMINARY PLANS	10/20/26

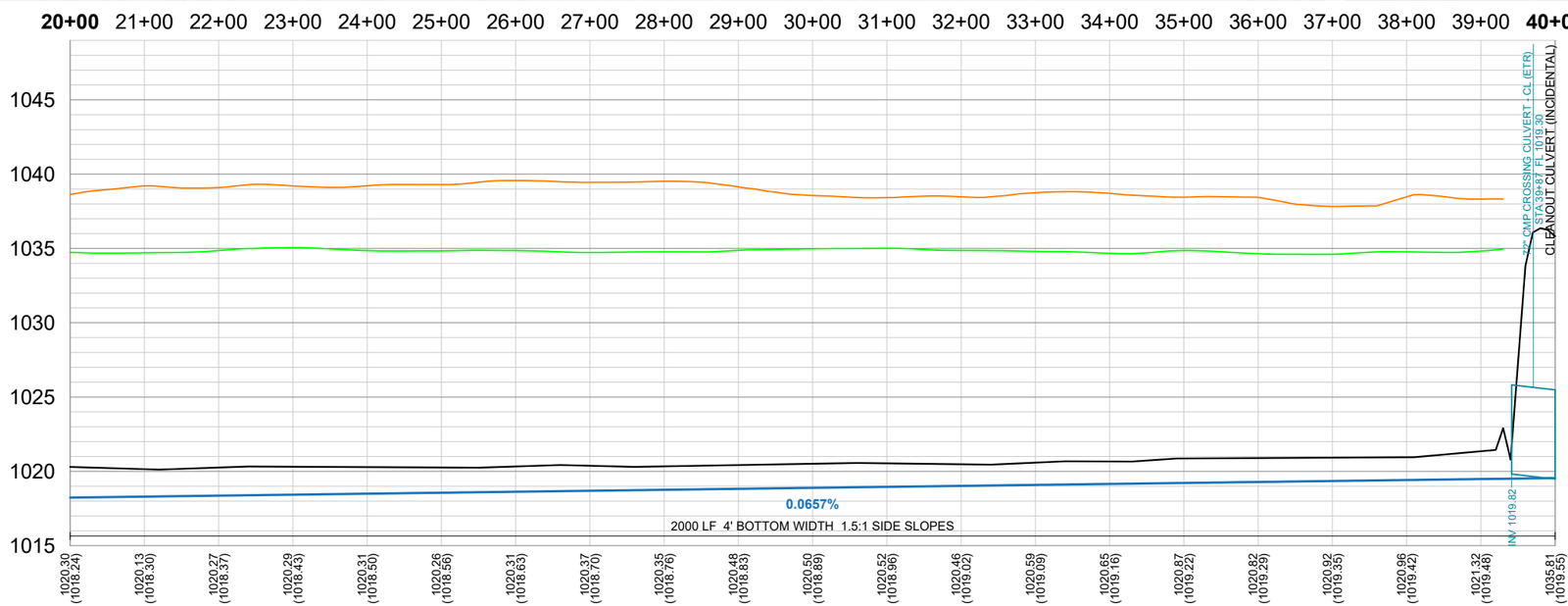
Sheet Name
Plan & Profile
STA 0+00 TO 20+00

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

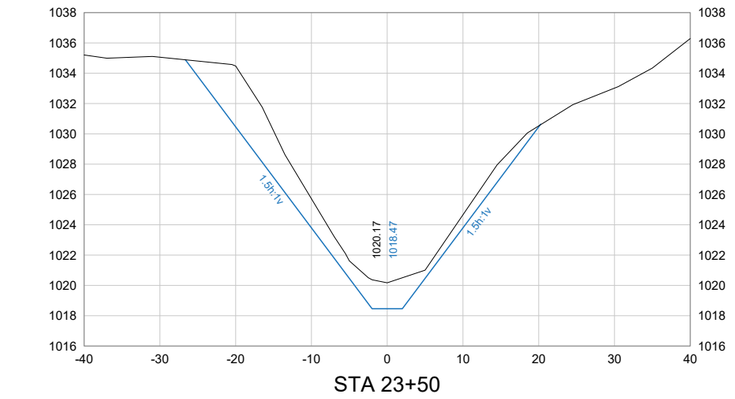
Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.01



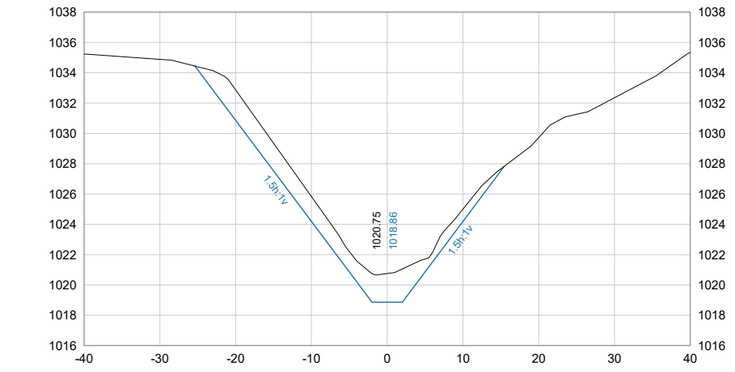


HORIZ. 1"=20' VERT. 1"=10'



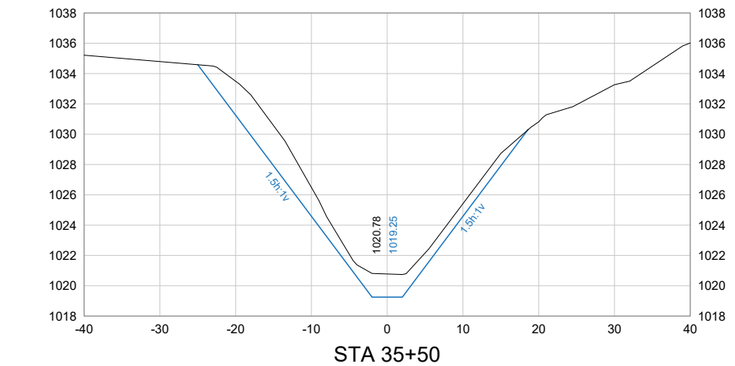
STA 23+50

HORIZ. 1"=20' VERT. 1"=10'



STA 29+50

HORIZ. 1"=20' VERT. 1"=10'



STA 35+50

AgriVia

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Designer JLH
Drafter JLH
Checker TJB

PLAN LEGEND

- Ditch Centerline & Stationing
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PROFILE LEGEND

- Existing Ground at CL (Ditch Bottom)
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Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

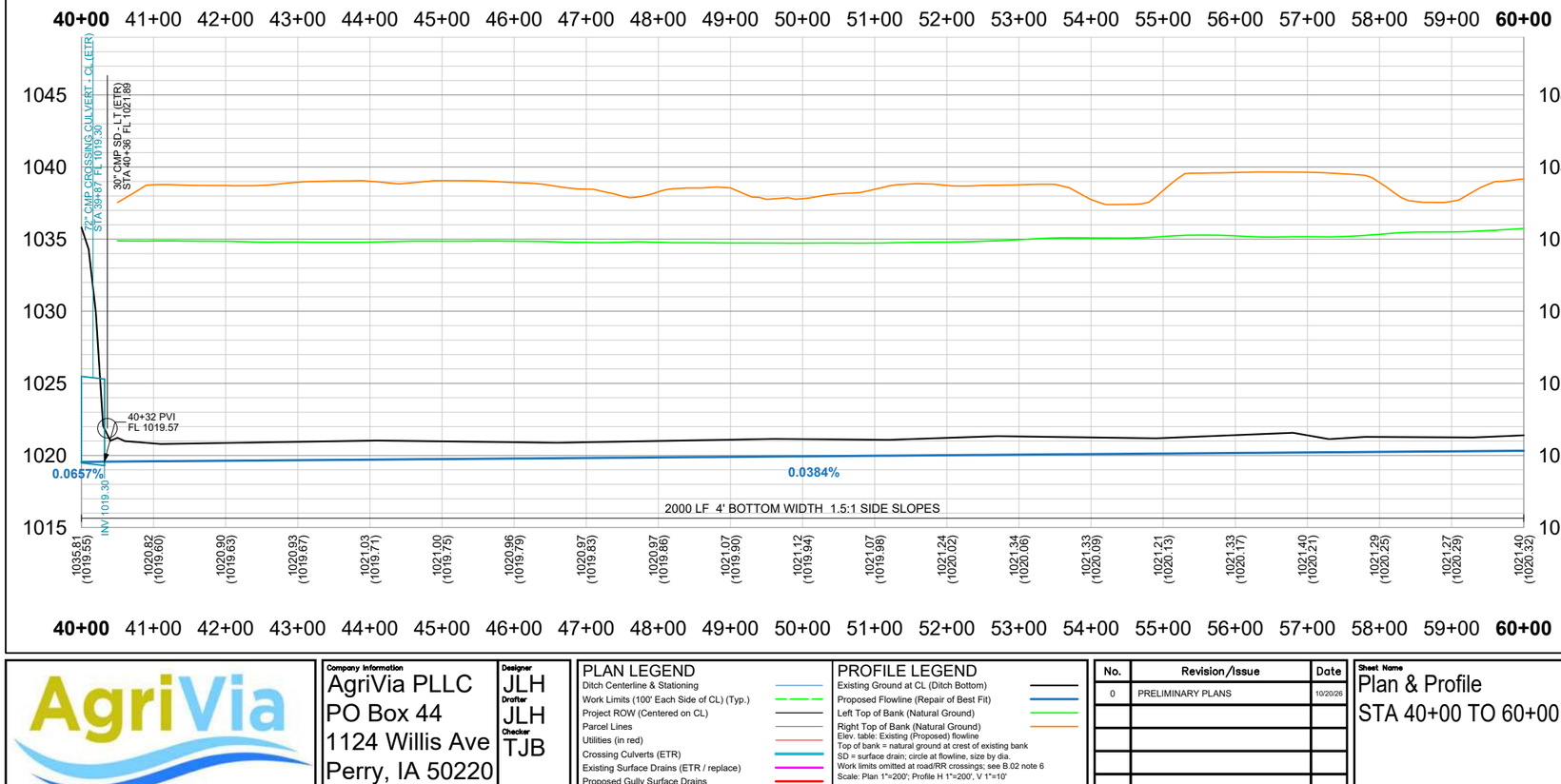
Sheet Name
Plan & Profile
STA 20+00 TO 40+00

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

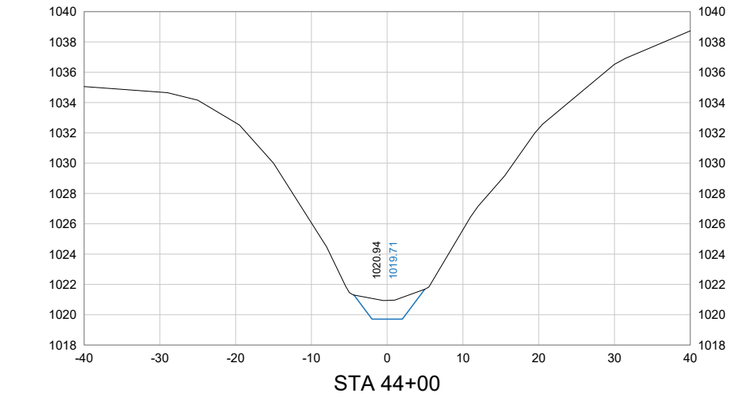
Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.02

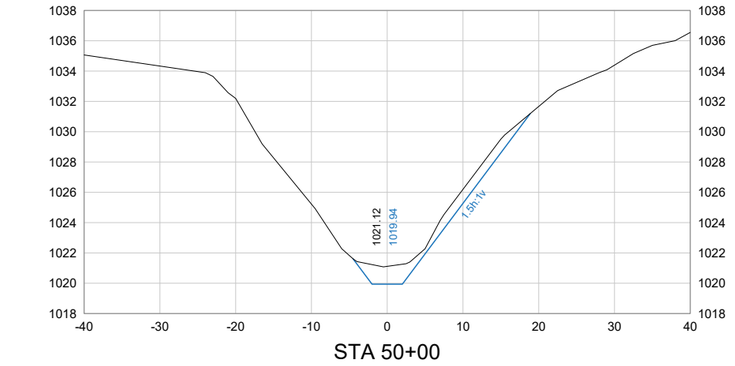




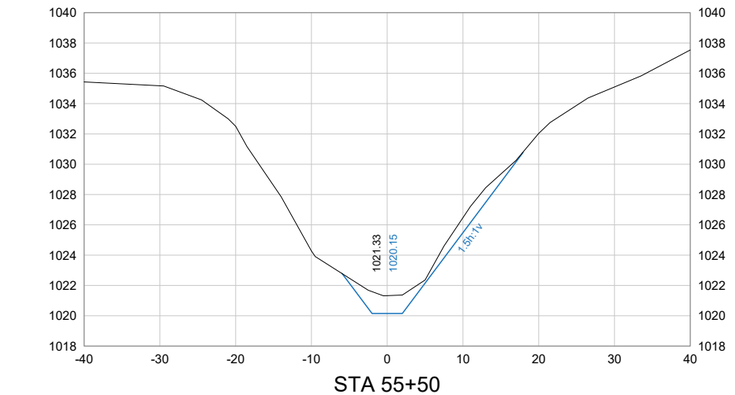
HORIZ. 1"=20' VERT. 1"=10'



HORIZ. 1"=20' VERT. 1"=10'



HORIZ. 1"=20' VERT. 1"=10'



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Drafter JLH
Checker TJB

PLAN LEGEND
- Ditch Centerline & Stationing
- Work Limits (100' Each Side of CL) (Typ.)
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PROFILE LEGEND
- Existing Ground at CL (Ditch Bottom)
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- Right Top of Bank (Natural Ground)

Elev. table: Existing (Proposed) flowline
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Work limits omitted at road/RR crossings; see B.02 note 6
Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

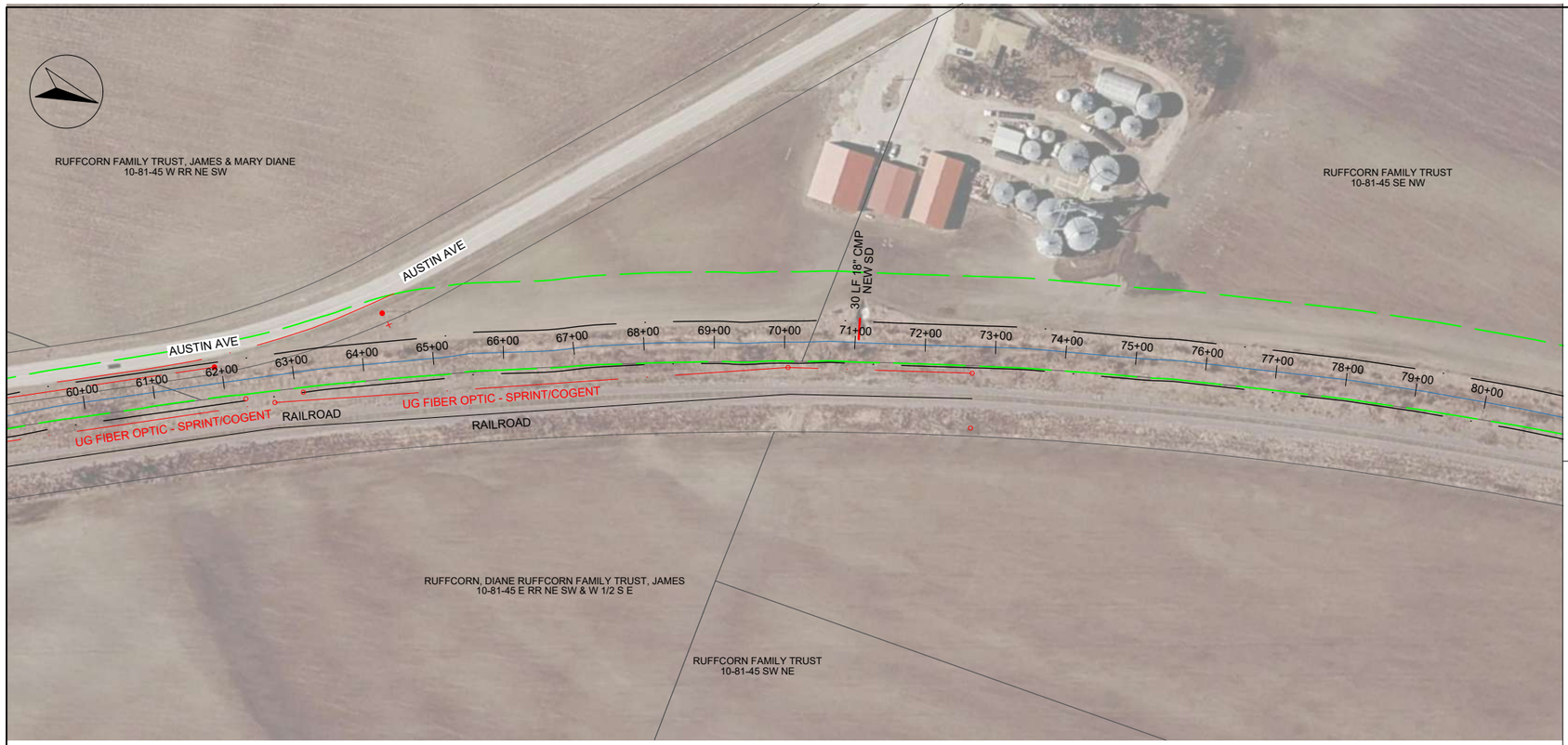
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

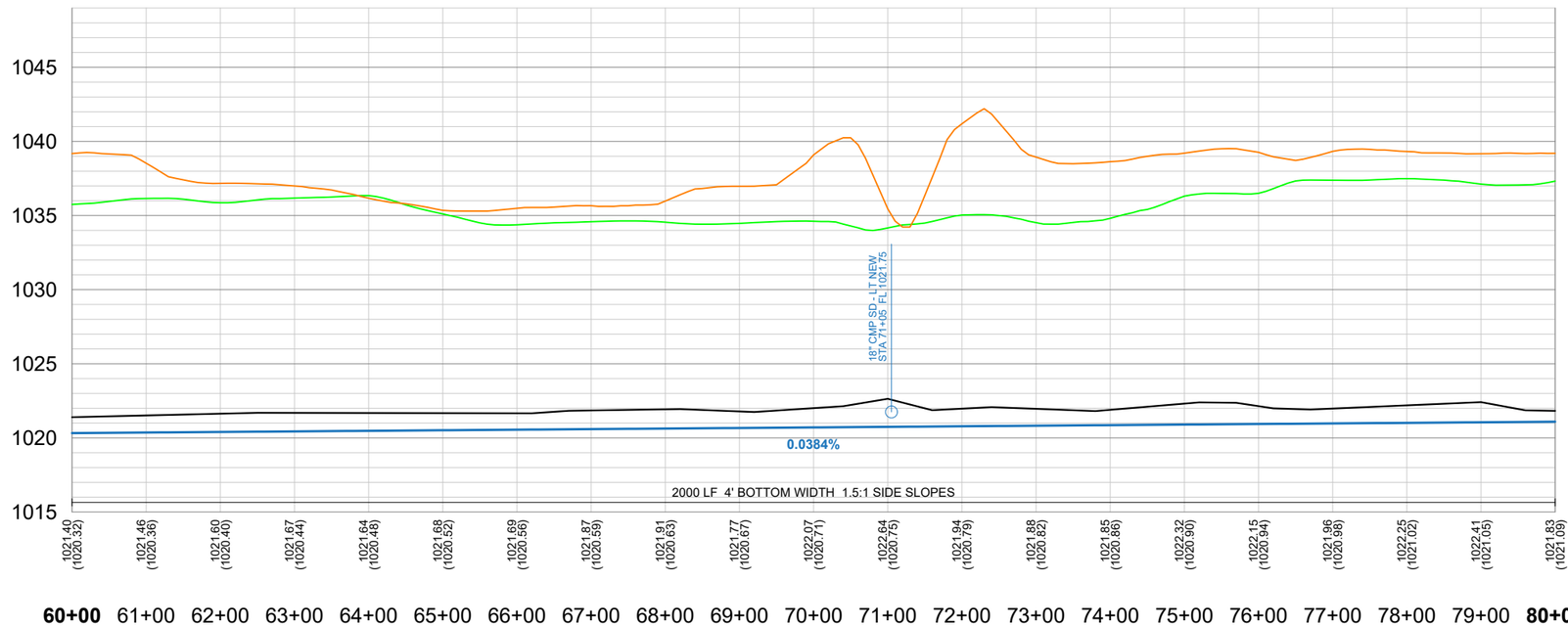
Sheet Name
Plan & Profile
STA 40+00 TO 60+00

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

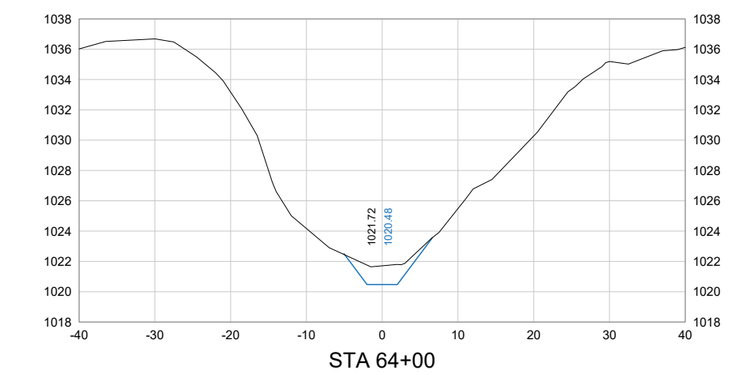
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Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.03



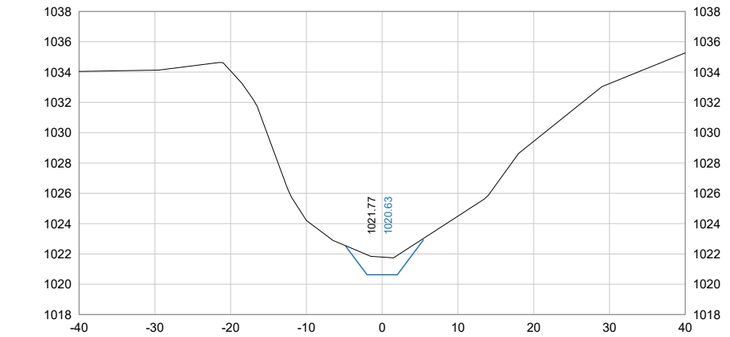


HORIZ. 1"=20' VERT. 1"=10'



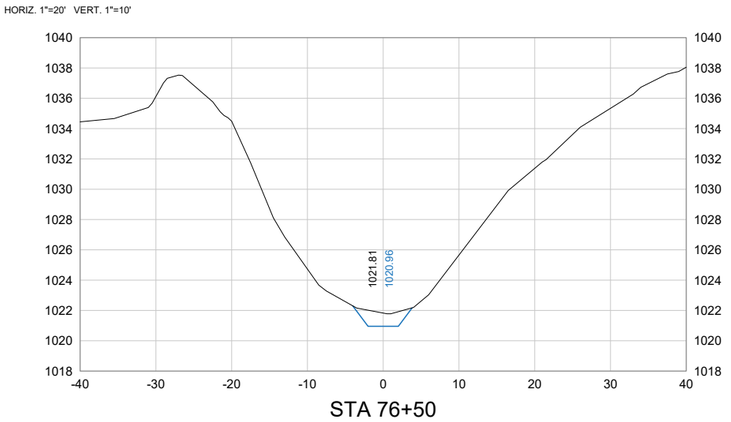
STA 64+00

HORIZ. 1"=20' VERT. 1"=10'



STA 68+00

HORIZ. 1"=20' VERT. 1"=10'



STA 76+50

PLAN LEGEND

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- Proposed Gully Surface Drains

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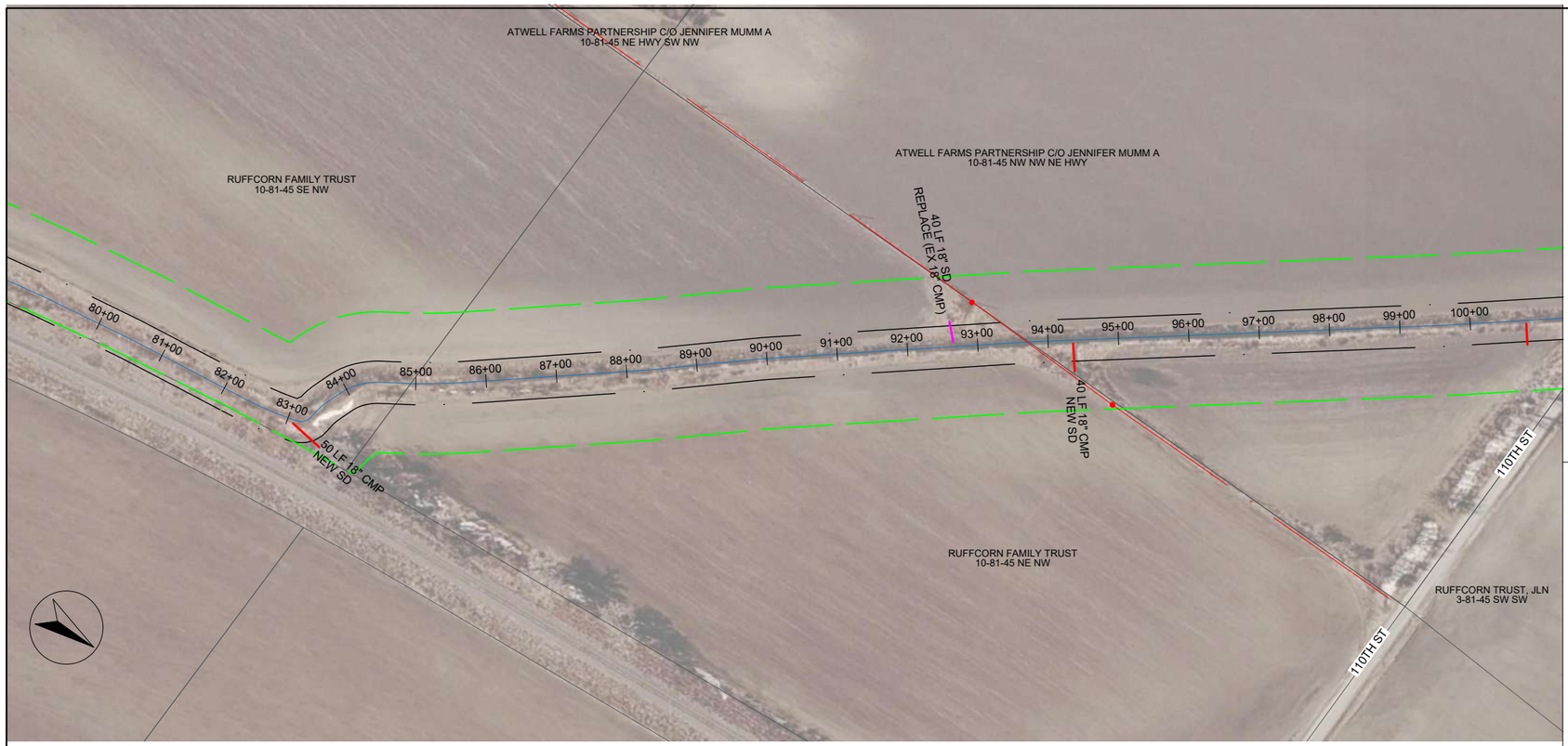
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

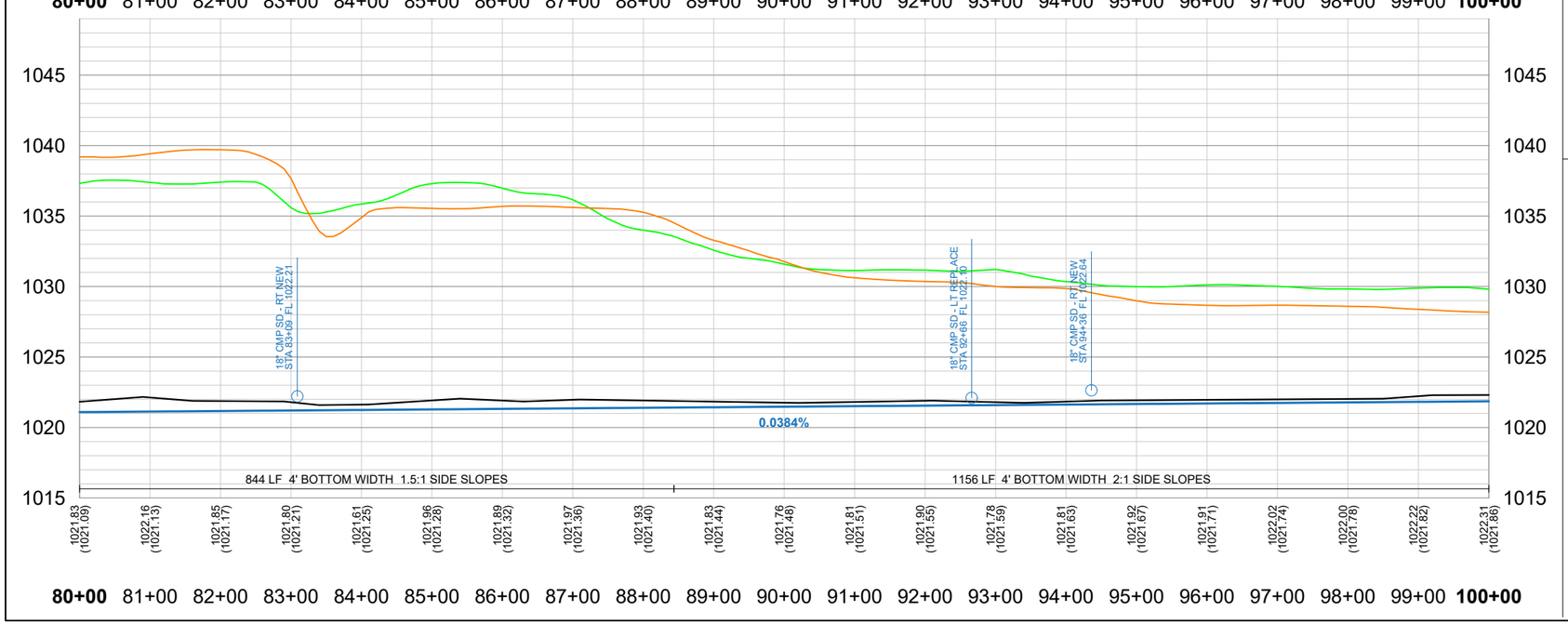
AgriVia
Company Information
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PO Box 44
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Perry, IA 50220
Designer JLH
Drafter JLH
Checker TJB

Sheet Name
Plan & Profile
STA 60+00 TO 80+00

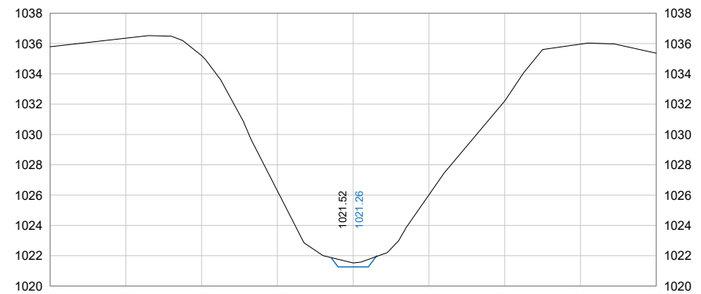
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'
Sheet D.04



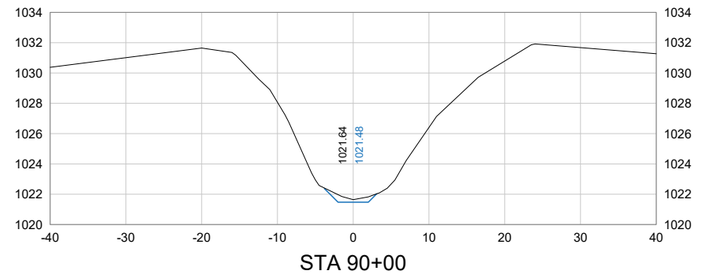


HORIZ. 1"=20' VERT. 1"=10'



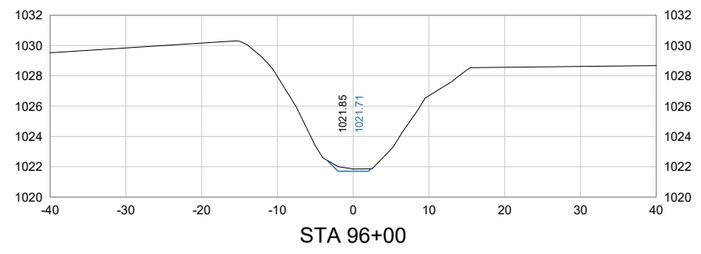
STA 84+50

HORIZ. 1"=20' VERT. 1"=10'



STA 90+00

HORIZ. 1"=20' VERT. 1"=10'



STA 96+00

AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter JLH
Checker TJB

PLAN LEGEND
- Ditch Centerline & Stationing
- Work Limits (100' Each Side of CL) (Typ.)
- Project ROW (Centered on CL)
- Parcel Lines
- Utilities (in red)
- Crossing Culverts (ETR)
- Existing Surface Drains (ETR / replace)
- Proposed Gully Surface Drains

PROFILE LEGEND
- Existing Ground at CL (Ditch Bottom)
- Proposed Flowline (Repair of Best Fit)
- Left Top of Bank (Natural Ground)
- Right Top of Bank (Natural Ground)

Elev. table: Existing (Proposed) flowline
Top of bank = natural ground at crest of existing bank
SD = surface drain; circle at flowline, size by dia.
Work limits omitted at road/RR crossings; see B.02 note 6
Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

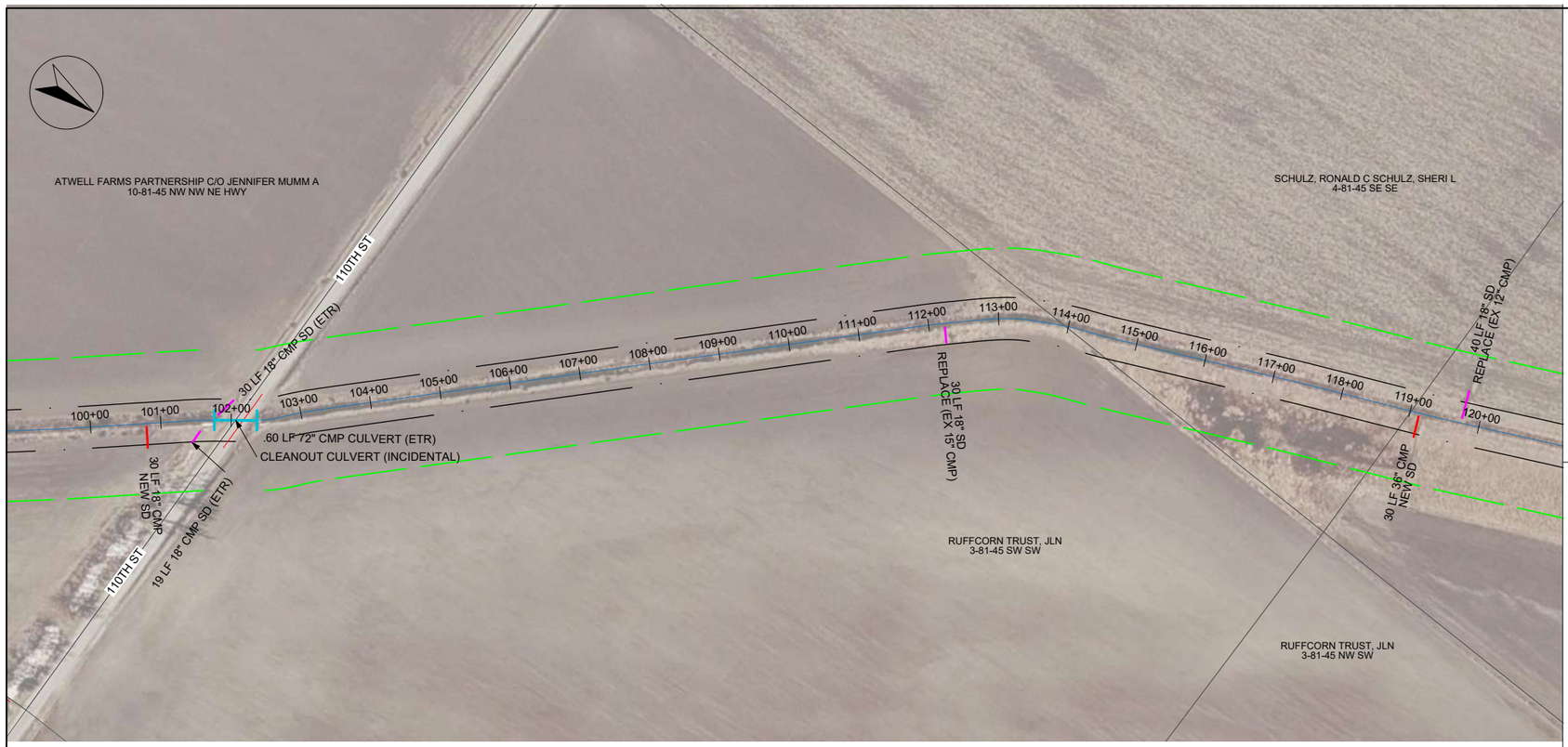
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name
Plan & Profile
STA 80+00 TO 100+00

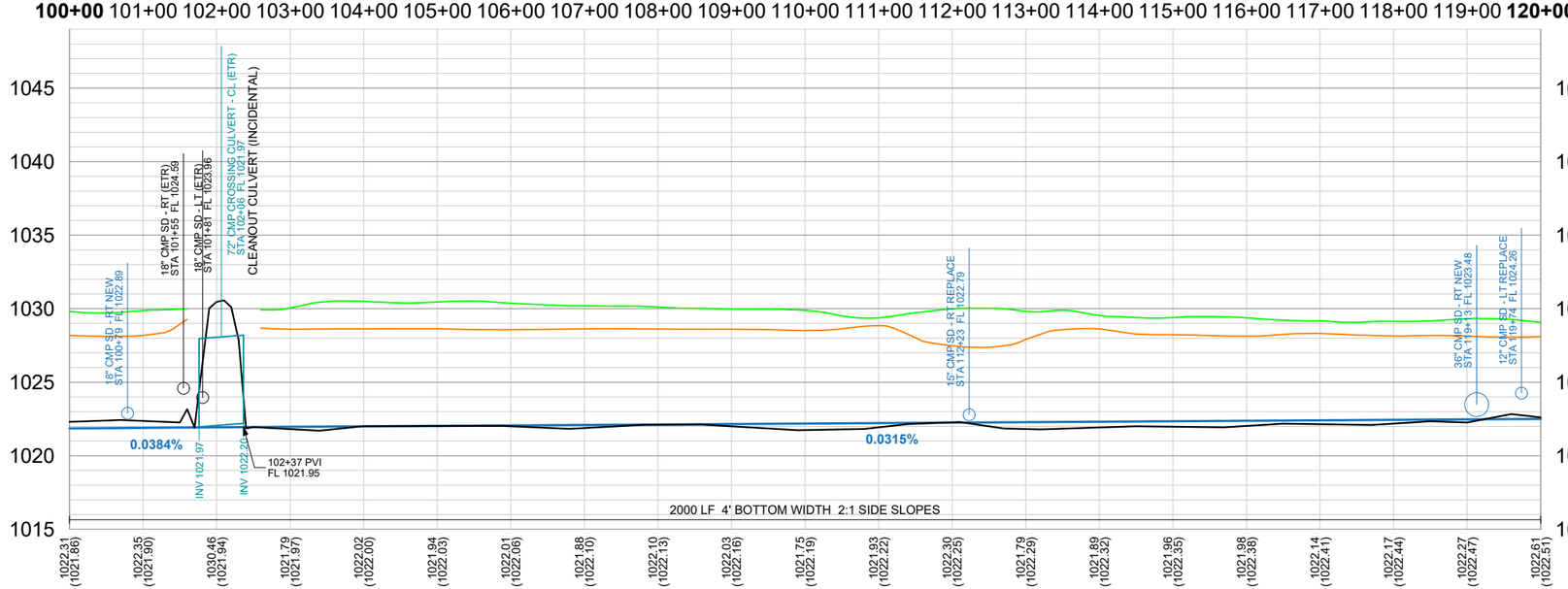
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.05

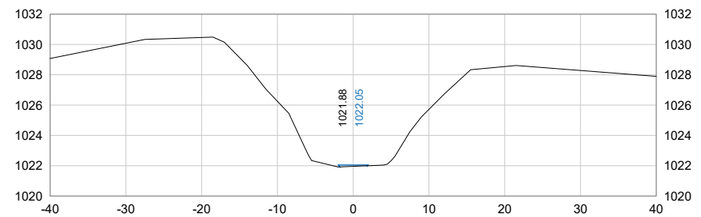


100+00 101+00 102+00 103+00 104+00 105+00 106+00 107+00 108+00 109+00 110+00 111+00 112+00 113+00 114+00 115+00 116+00 117+00 118+00 119+00 **120+00**



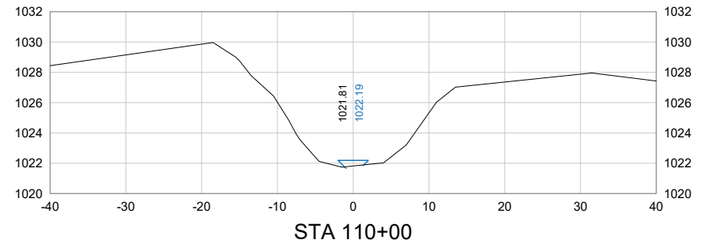
100+00 101+00 102+00 103+00 104+00 105+00 106+00 107+00 108+00 109+00 110+00 111+00 112+00 113+00 114+00 115+00 116+00 117+00 118+00 119+00 **120+00**

HORIZ. 1"=20' VERT. 1"=10'



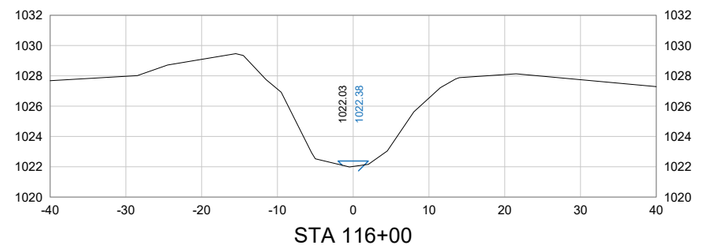
STA 105+50

HORIZ. 1"=20' VERT. 1"=10'



STA 110+00

HORIZ. 1"=20' VERT. 1"=10'



STA 116+00

AgriVia

Company Information
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PLAN LEGEND
- Ditch Centerline & Stationing
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- Existing Ground at CL (Ditch Bottom)
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No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name
Plan & Profile
STA 100+00 TO 120+00

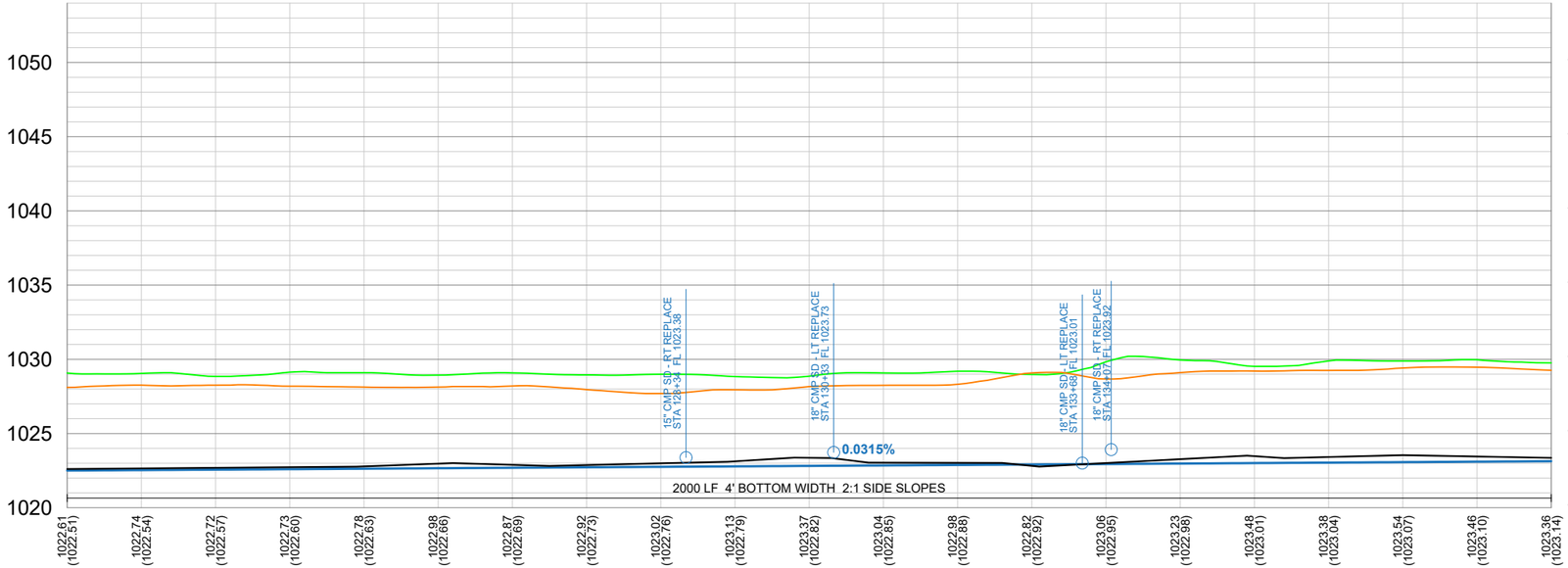
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.06

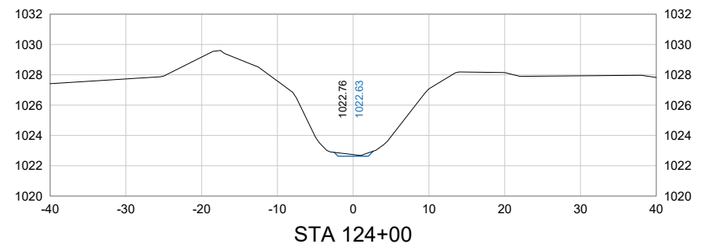


120+00 121+00 122+00 123+00 124+00 125+00 126+00 127+00 128+00 129+00 130+00 131+00 132+00 133+00 134+00 135+00 136+00 137+00 138+00 139+00 **140+00**



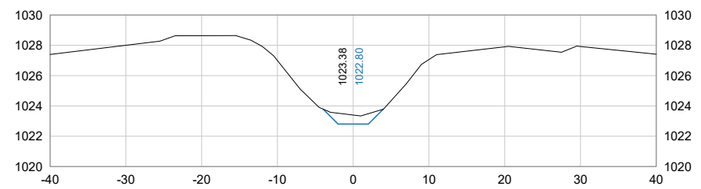
120+00 121+00 122+00 123+00 124+00 125+00 126+00 127+00 128+00 129+00 130+00 131+00 132+00 133+00 134+00 135+00 136+00 137+00 138+00 139+00 **140+00**

HORIZ. 1"=20' VERT. 1"=10'



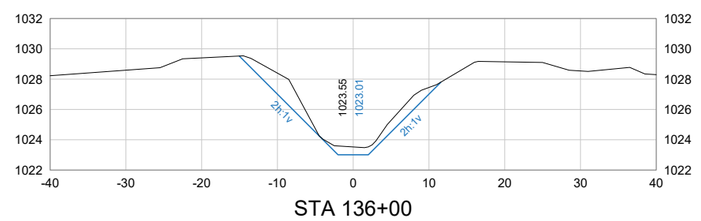
STA 124+00

HORIZ. 1"=20' VERT. 1"=10'



STA 129+50

HORIZ. 1"=20' VERT. 1"=10'



STA 136+00

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Company Information
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Checker TJB

PLAN LEGEND
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PROFILE LEGEND
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Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

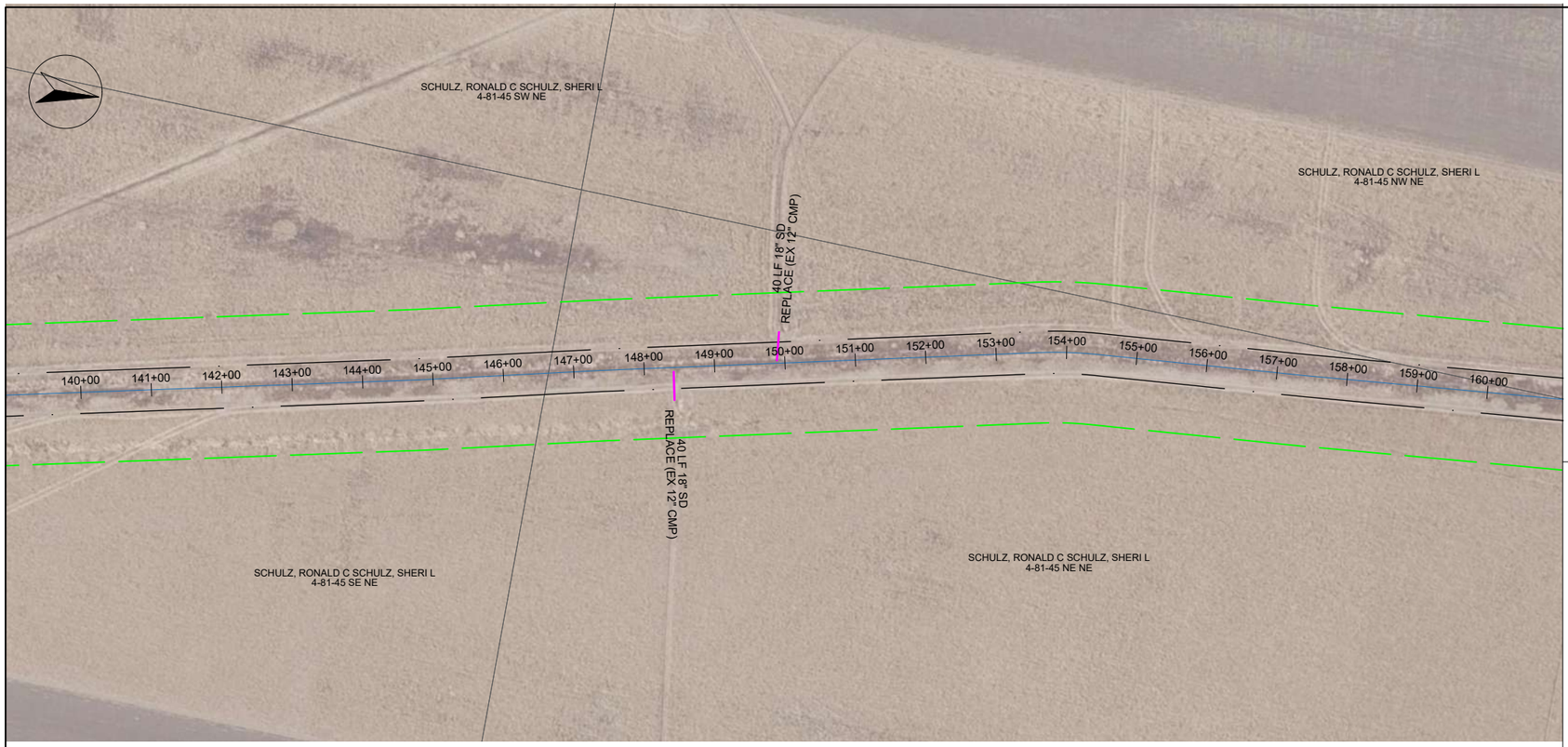
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

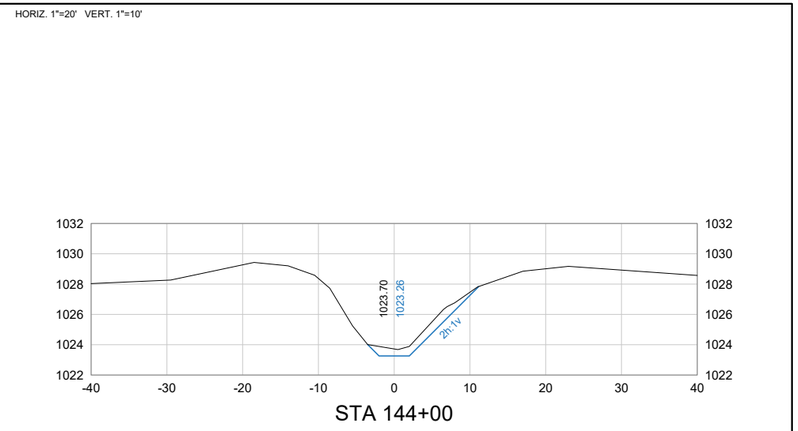
Sheet Name
Plan & Profile
STA 120+00 TO 140+00

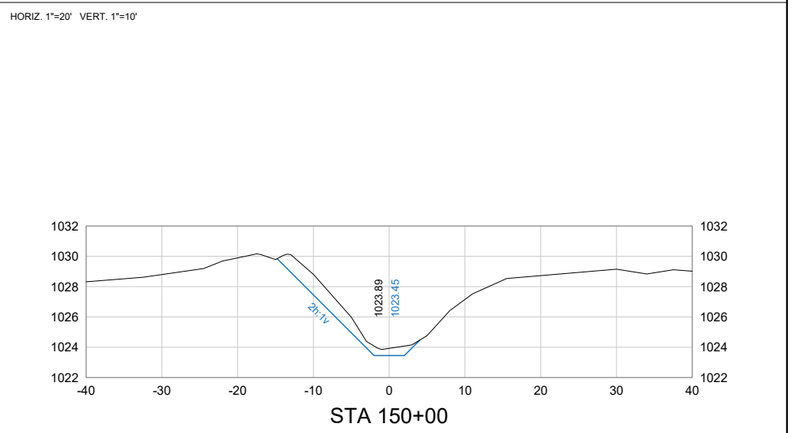
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

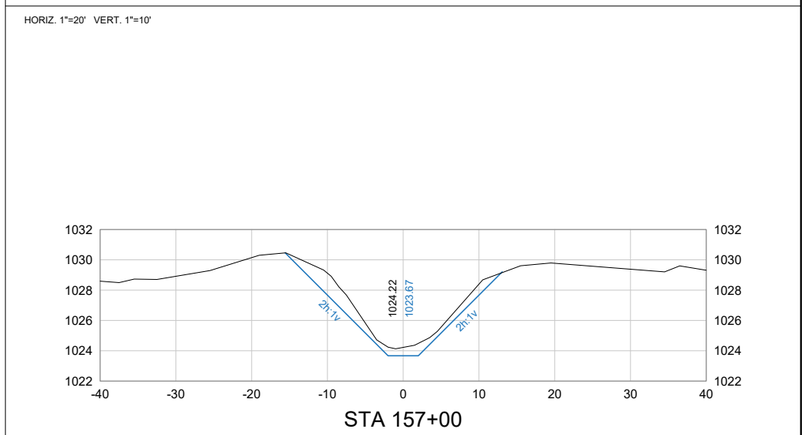
Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.07

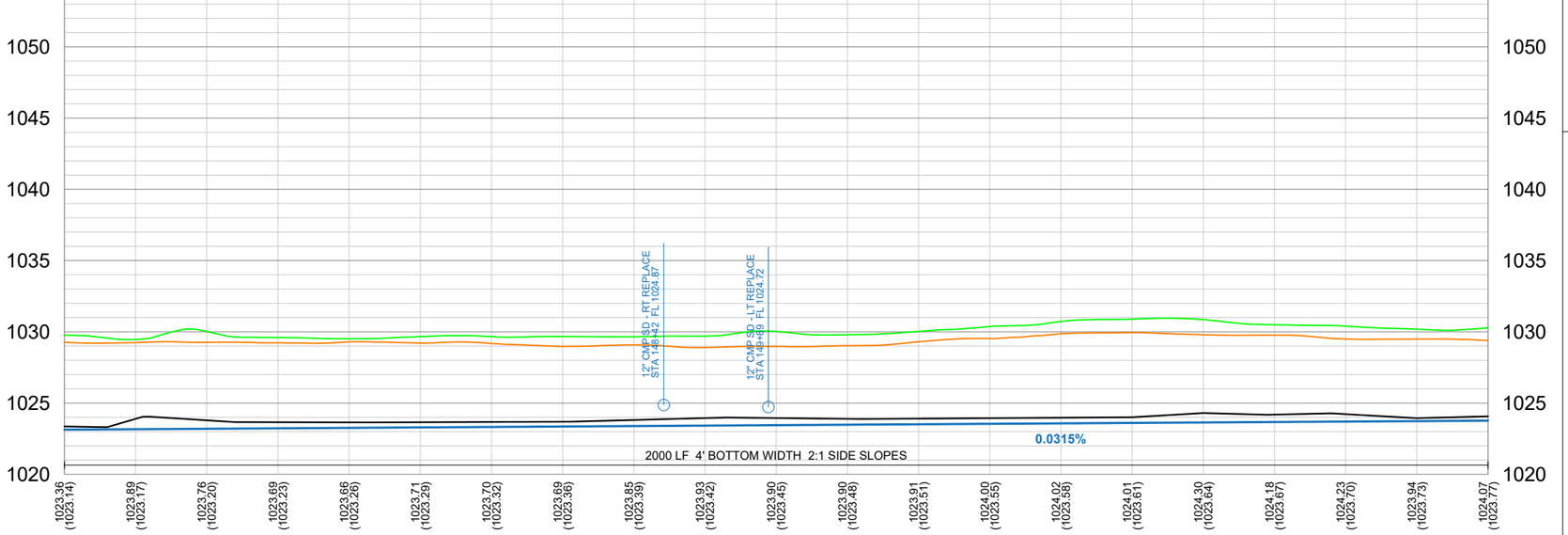








140+00 141+00 142+00 143+00 144+00 145+00 146+00 147+00 148+00 149+00 150+00 151+00 152+00 153+00 154+00 155+00 156+00 157+00 158+00 159+00 **160+00**



140+00 141+00 142+00 143+00 144+00 145+00 146+00 147+00 148+00 149+00 150+00 151+00 152+00 153+00 154+00 155+00 156+00 157+00 158+00 159+00 **160+00**

AgriVia

Company Information
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Designer JLH
Drafter JLH
Checker TJB

PLAN LEGEND
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PROFILE LEGEND
- Existing Ground at CL (Ditch Bottom)
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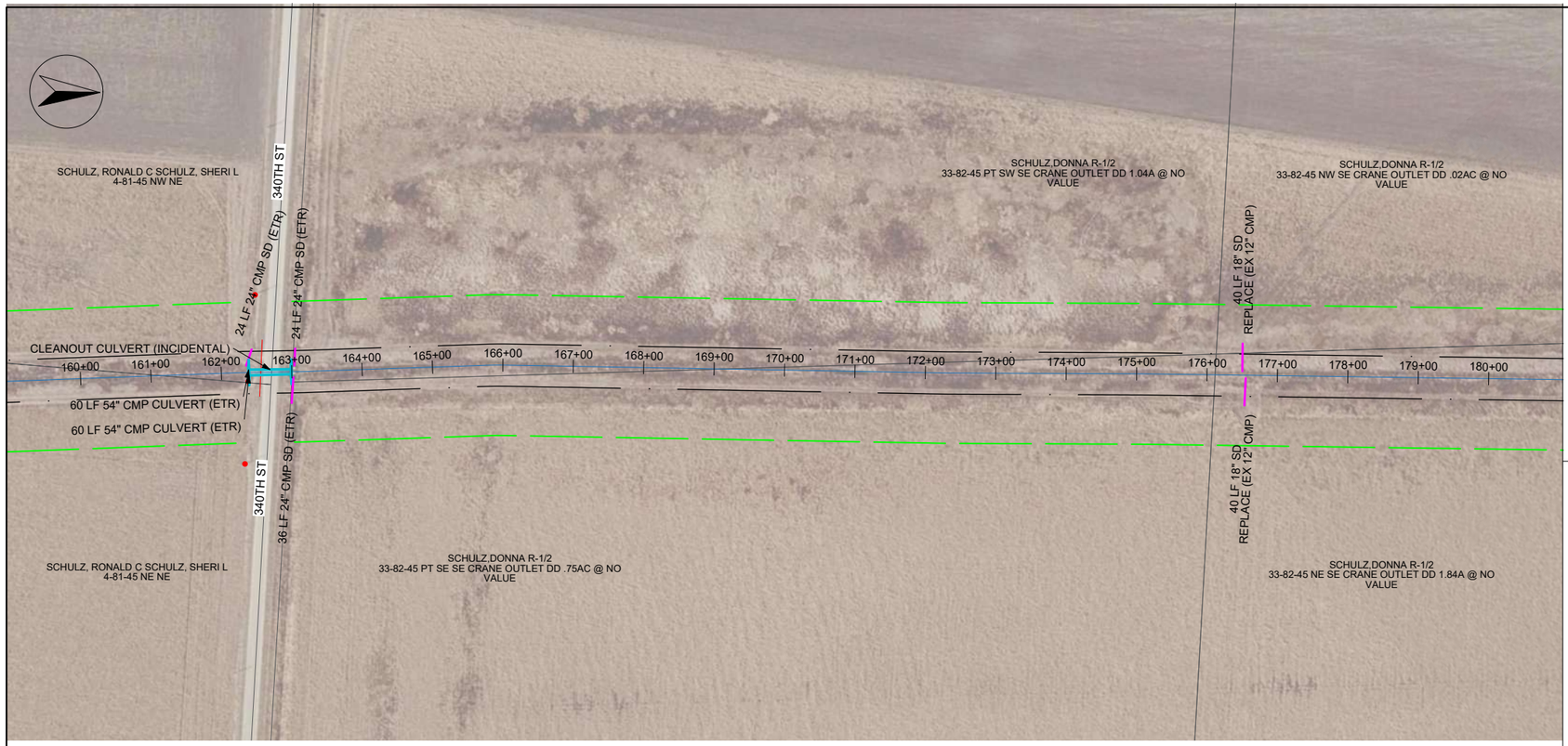
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

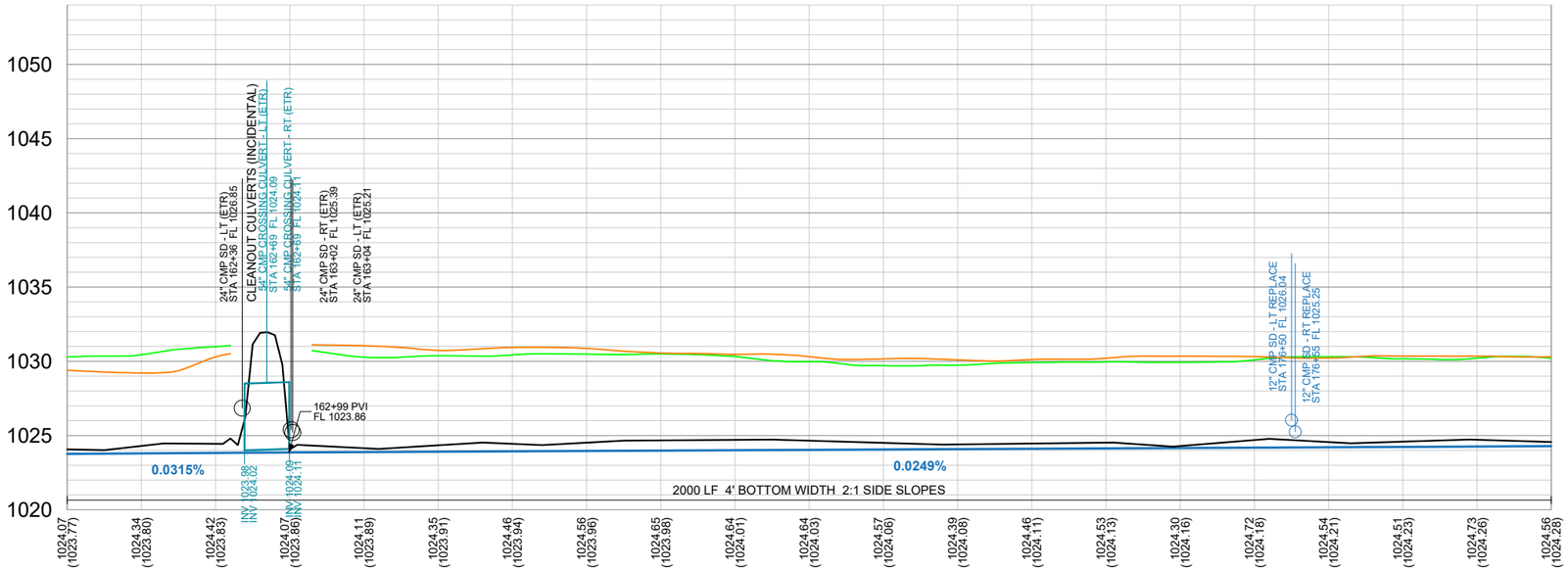
Sheet Name
Plan & Profile
STA 140+00 TO 160+00

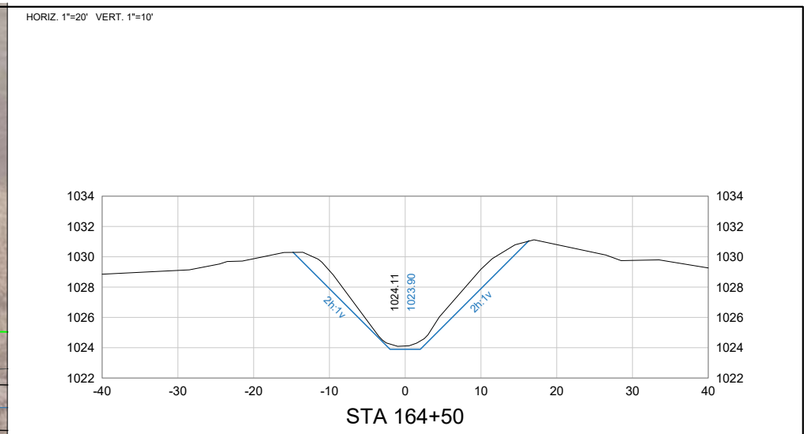
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

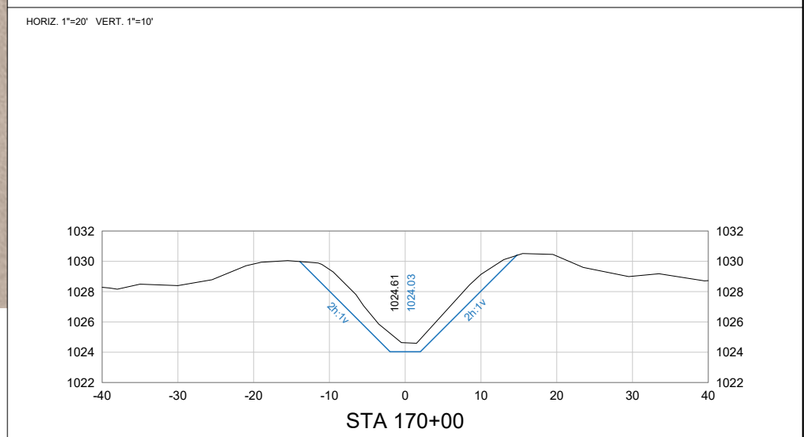
Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

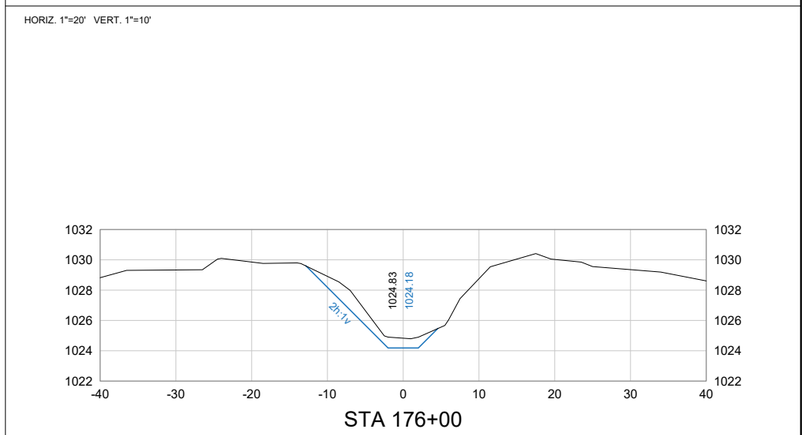
Sheet D.08











160+00 161+00 162+00 163+00 164+00 165+00 166+00 167+00 168+00 169+00 170+00 171+00 172+00 173+00 174+00 175+00 176+00 177+00 178+00 179+00 **180+00**

160+00 161+00 162+00 163+00 164+00 165+00 166+00 167+00 168+00 169+00 170+00 171+00 172+00 173+00 174+00 175+00 176+00 177+00 178+00 179+00 **180+00**

AgriVia

Company Information
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PO Box 44
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Designer JLH
Drafter JLH
Checker TJB

PLAN LEGEND
- Ditch Centerline & Stationing
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PROFILE LEGEND
- Existing Ground at CL (Ditch Bottom)
- Proposed Flowline (Repair of Best Fit)
- Left Top of Bank (Natural Ground)
- Right Top of Bank (Natural Ground)

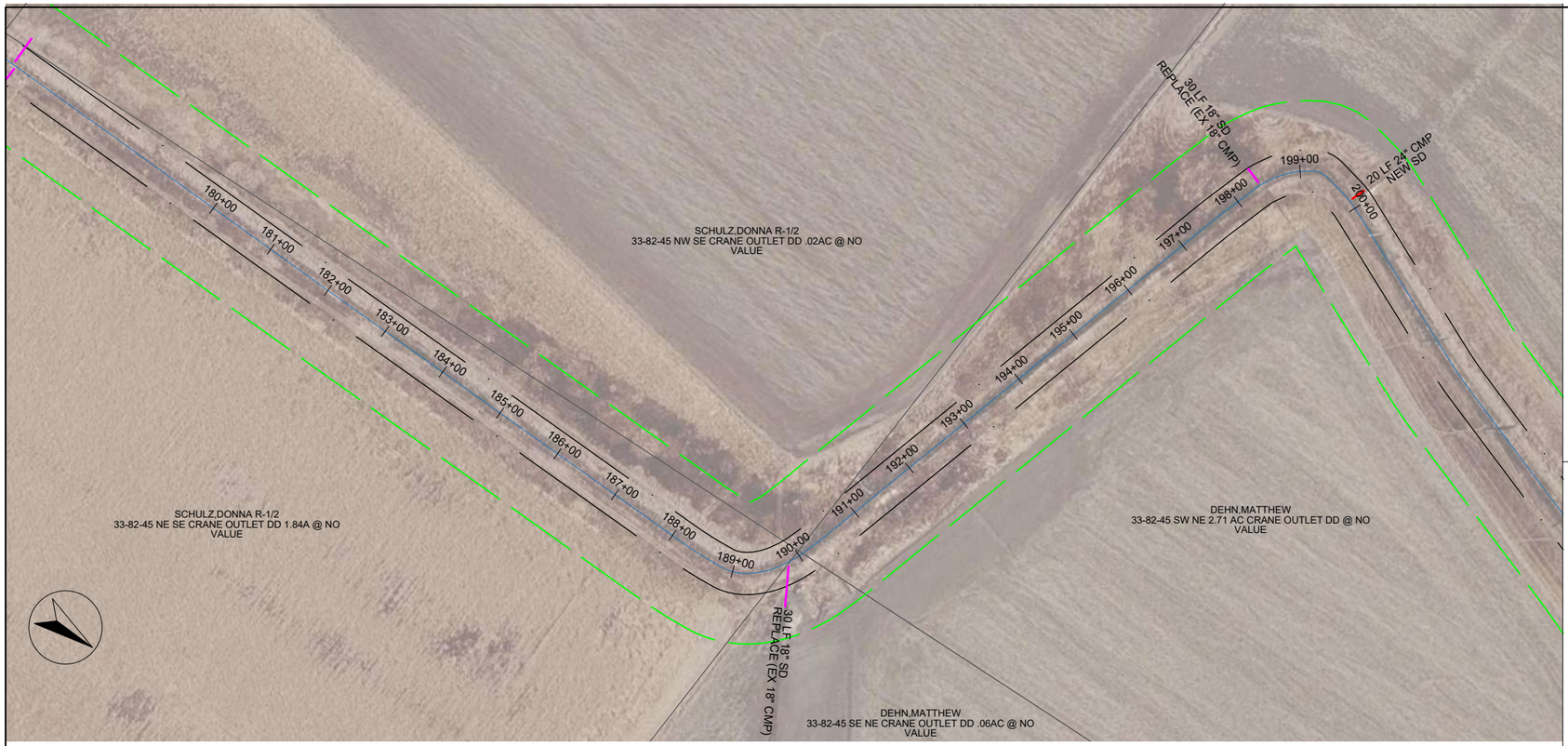
Elev. table: Existing (Proposed) flowline
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Work limits omitted at road/RR crossings; see B.02 note 6
Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

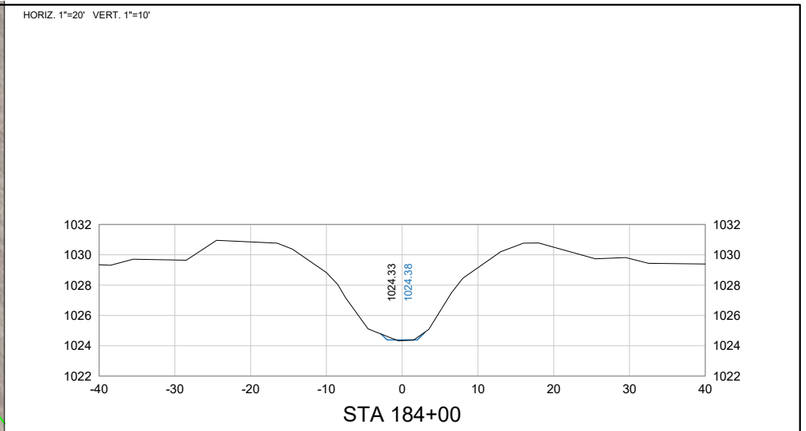
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

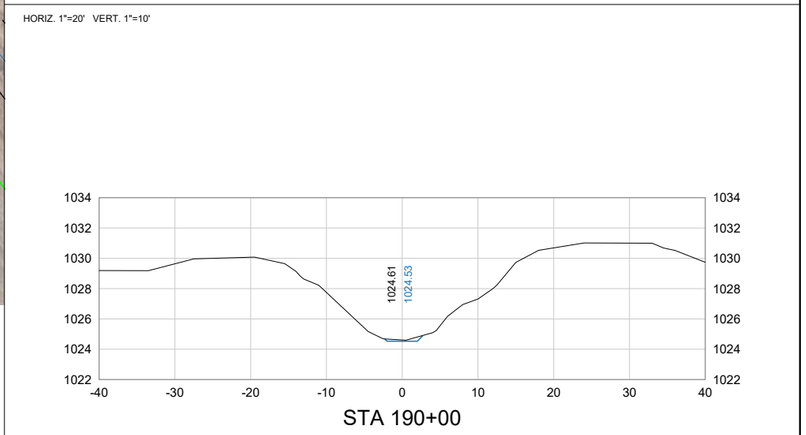
Sheet Name
Plan & Profile
STA 160+00 TO 180+00

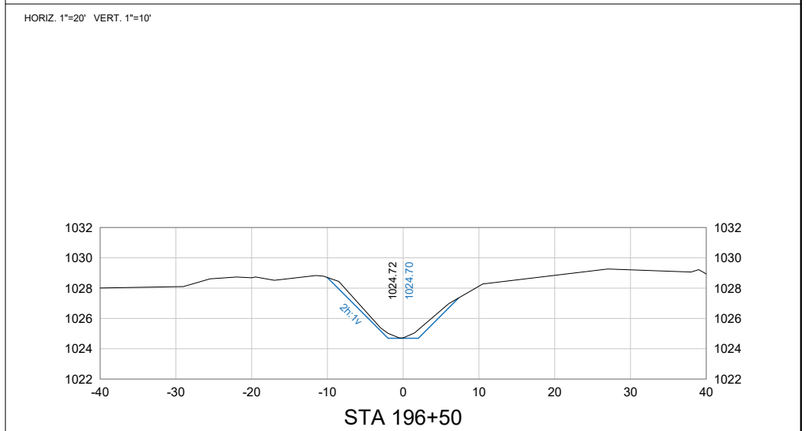
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

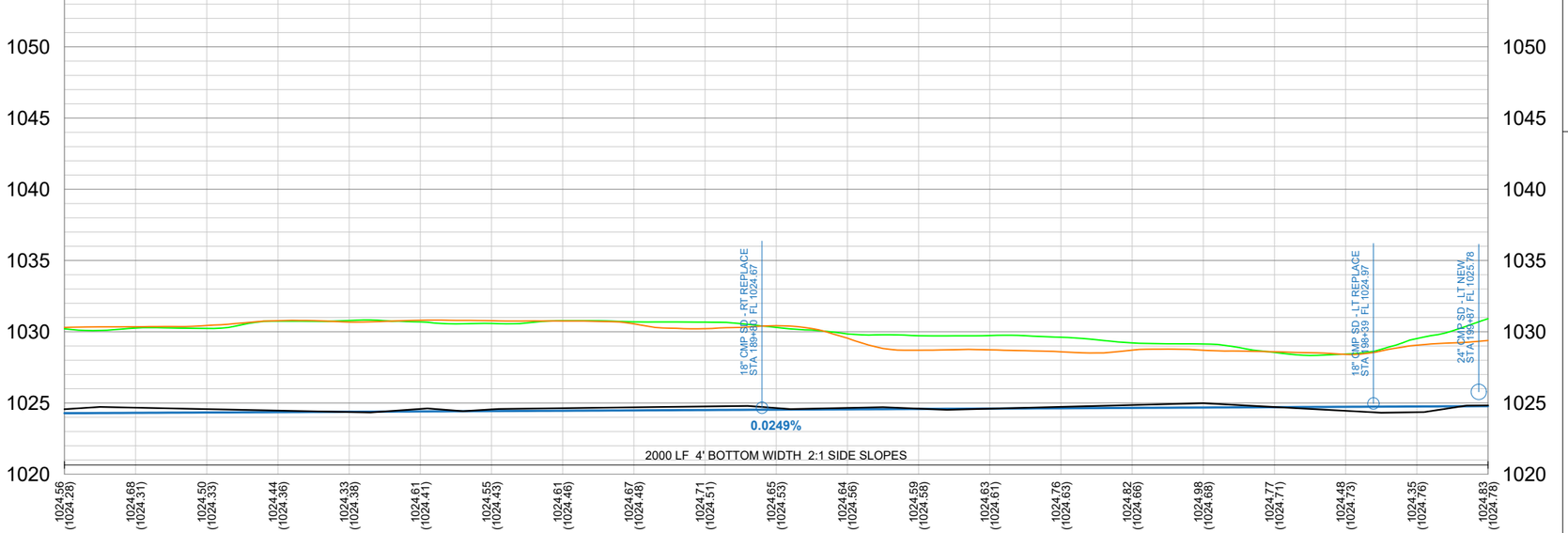
Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'
Sheet D.09











Company Information	Designer
AgriVia PLLC PO Box 44 1124 Willis Ave Perry, IA 50220	JLH Drafter JLH Checker TJB

PLAN LEGEND

- Ditch Centerline & Stationing
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- Utilities (in red)
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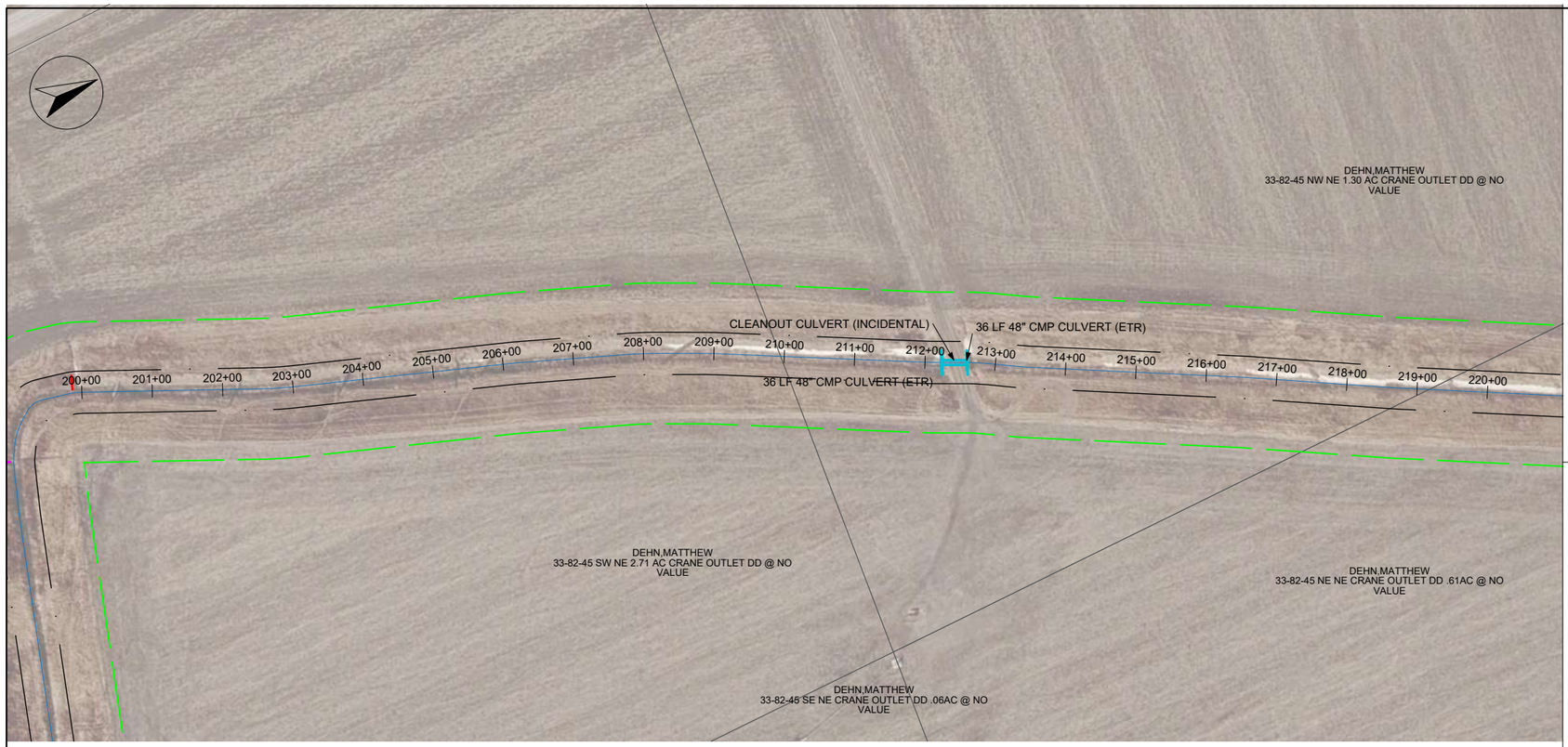
PROFILE LEGEND

- Existing Ground at CL (Ditch Bottom)
- Proposed Flowline (Repair of Best Fit)
- Left Top of Bank (Natural Ground)
- Right Top of Bank (Natural Ground)

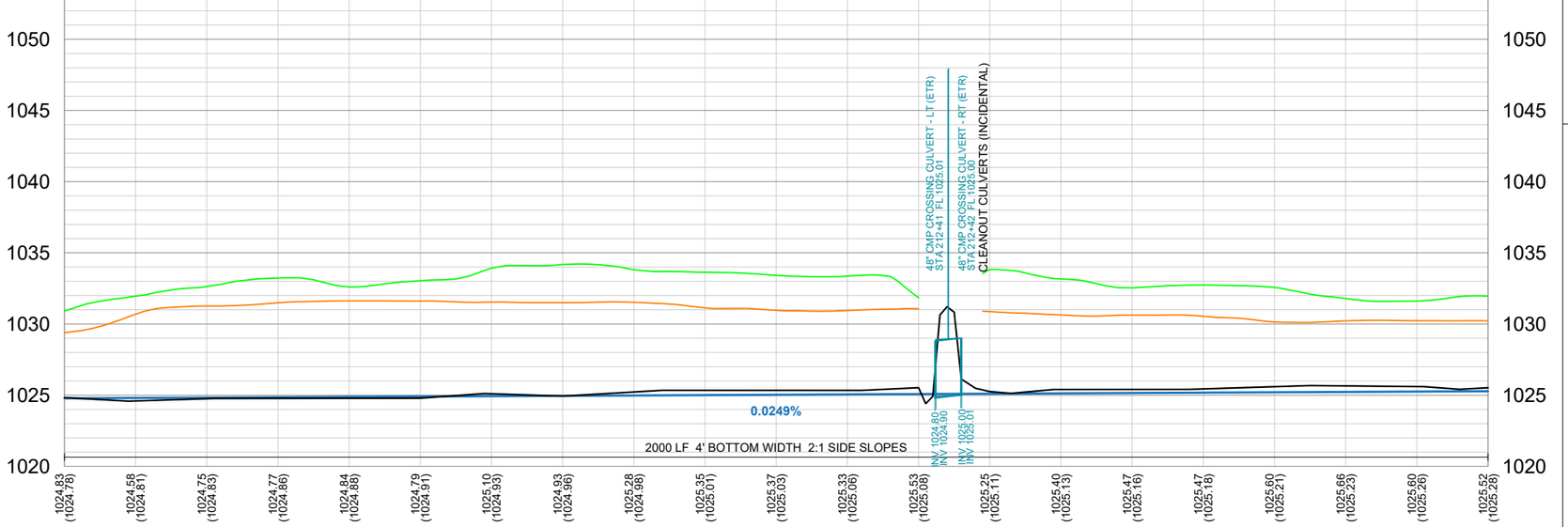
Elev. table: Existing (Proposed) flowline
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Work limits omitted at road/RR crossings; see B.02 note 6
Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name	Project Name, Client, and Address	Project	Sheet
Plan & Profile STA 180+00 TO 200+00	Open Ditch Repairs Monona-Harrison Crane DD Monona & Harrison Co., IA 340th St and K45	2616-67 Date 2026-10-20 Plan Scale 1" = 200'	D.10

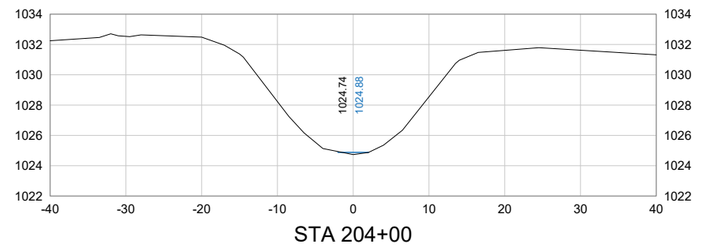


200+00 201+00 202+00 203+00 204+00 205+00 206+00 207+00 208+00 209+00 210+00 211+00 212+00 213+00 214+00 215+00 216+00 217+00 218+00 219+00 **220+00**



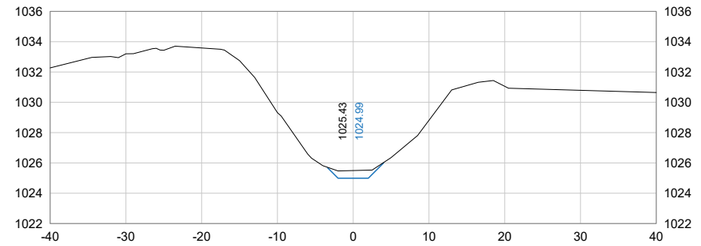
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HORIZ. 1"=20' VERT. 1"=10'



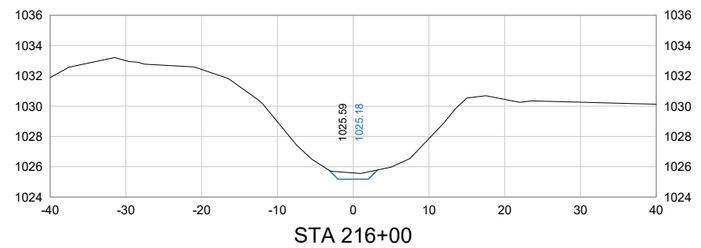
STA 204+00

HORIZ. 1"=20' VERT. 1"=10'



STA 208+50

HORIZ. 1"=20' VERT. 1"=10'



STA 216+00

AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
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Designer JLH
Drafter JLH
Checker TJB

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No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

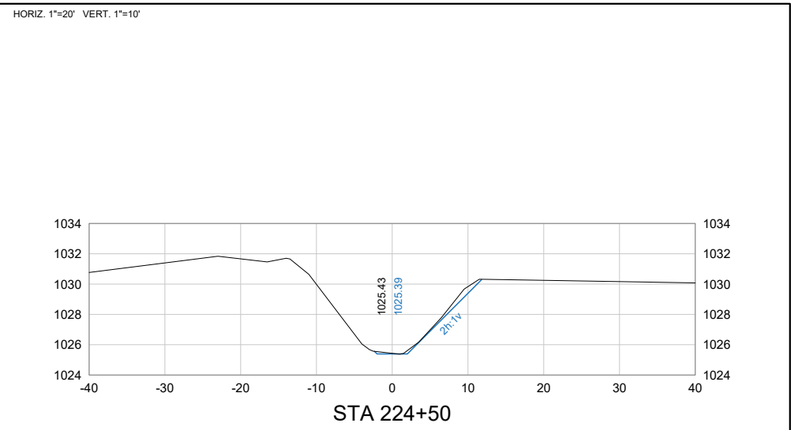
Sheet Name
Plan & Profile
STA 200+00 TO 220+00

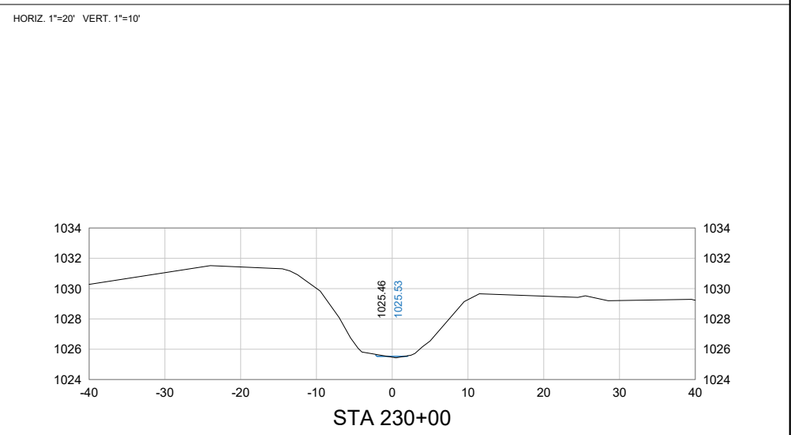
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

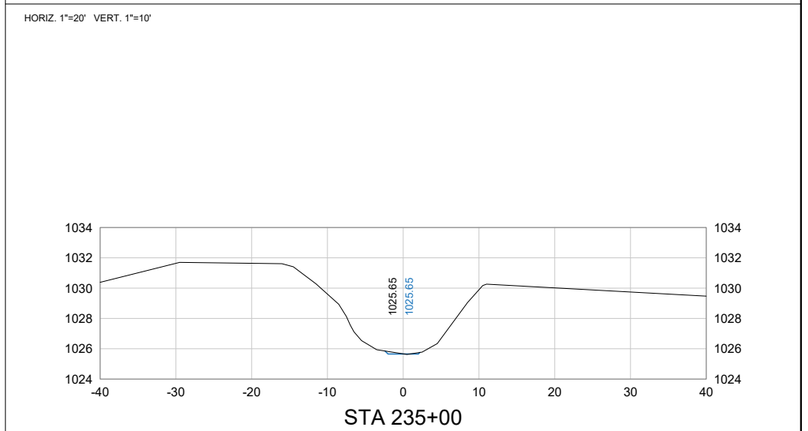
Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

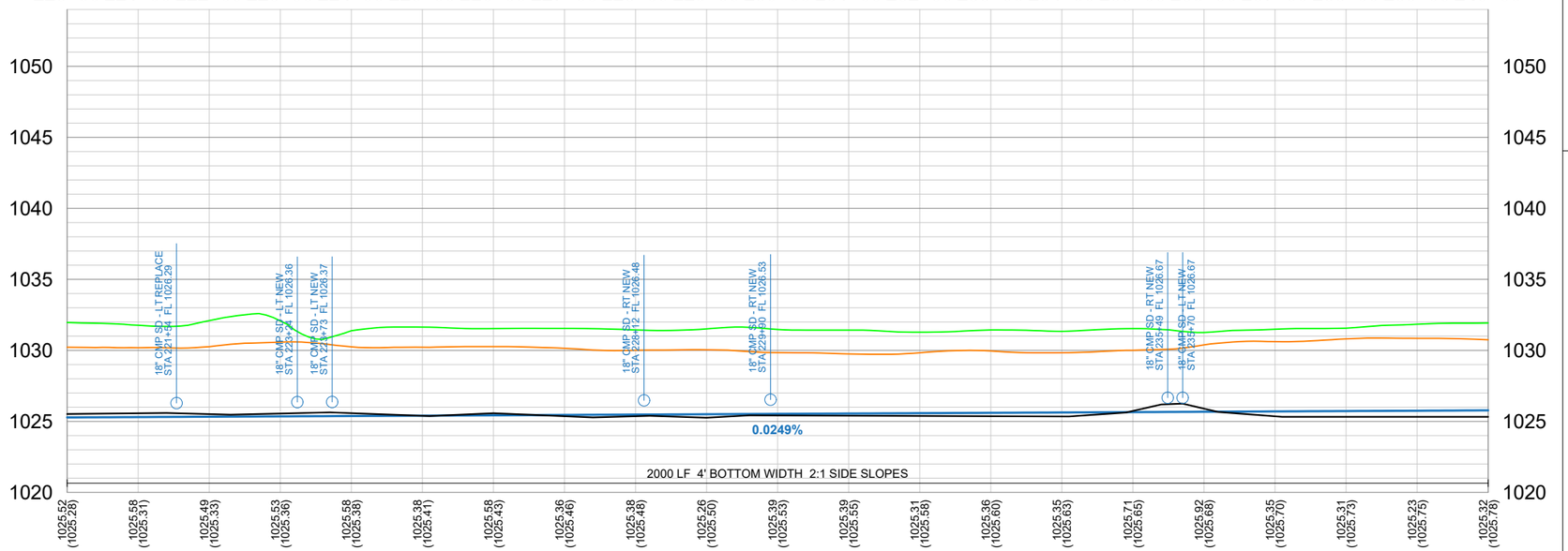
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220+00 221+00 222+00 223+00 224+00 225+00 226+00 227+00 228+00 229+00 230+00 231+00 232+00 233+00 234+00 235+00 236+00 237+00 238+00 239+00 240+00

AgriVia

Company Information
AgriVia PLLC
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Designer JLH
Drafter JLH
Checker TJB

PLAN LEGEND
- Ditch Centerline & Stationing
- Work Limits (100' Each Side of CL) (Typ.)
- Project ROW (Centered on CL)
- Parcel Lines
- Utilities (in red)
- Crossing Culverts (ETR)
- Existing Surface Drains (ETR / replace)
- Proposed Gully Surface Drains

PROFILE LEGEND
- Existing Ground at CL (Ditch Bottom)
- Proposed Flowline (Repair of Best Fit)
- Left Top of Bank (Natural Ground)
- Right Top of Bank (Natural Ground)

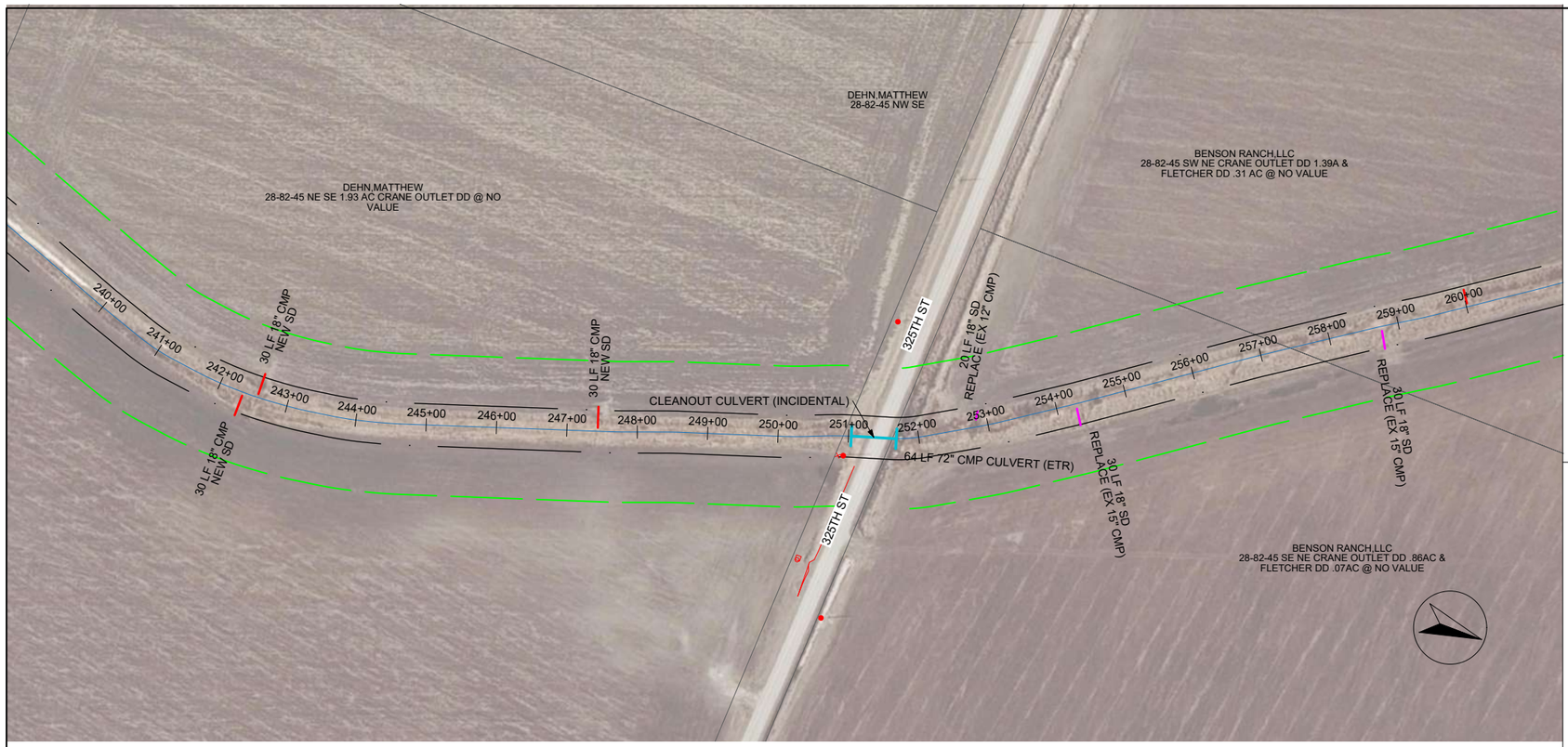
Elev. table: Existing (Proposed) flowline
Top of bank = natural ground at crest of existing bank
SD = surface drain; circle at flowline, size by dia.
Work limits omitted at road/RR crossings; see B.02 note 6
Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

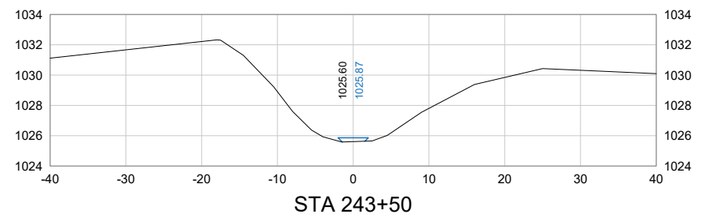
Sheet Name
Plan & Profile
STA 220+00 TO 240+00

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

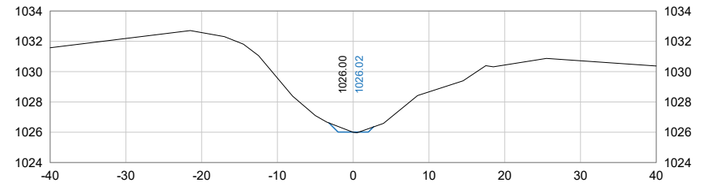
Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'
Sheet D.12



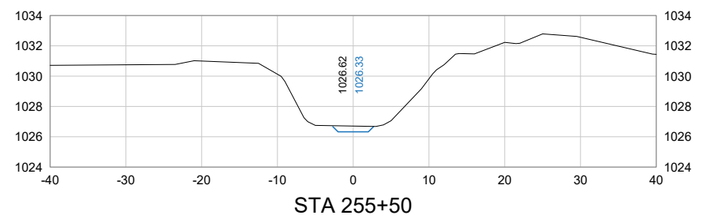
HORIZ. 1"=20' VERT. 1"=10'



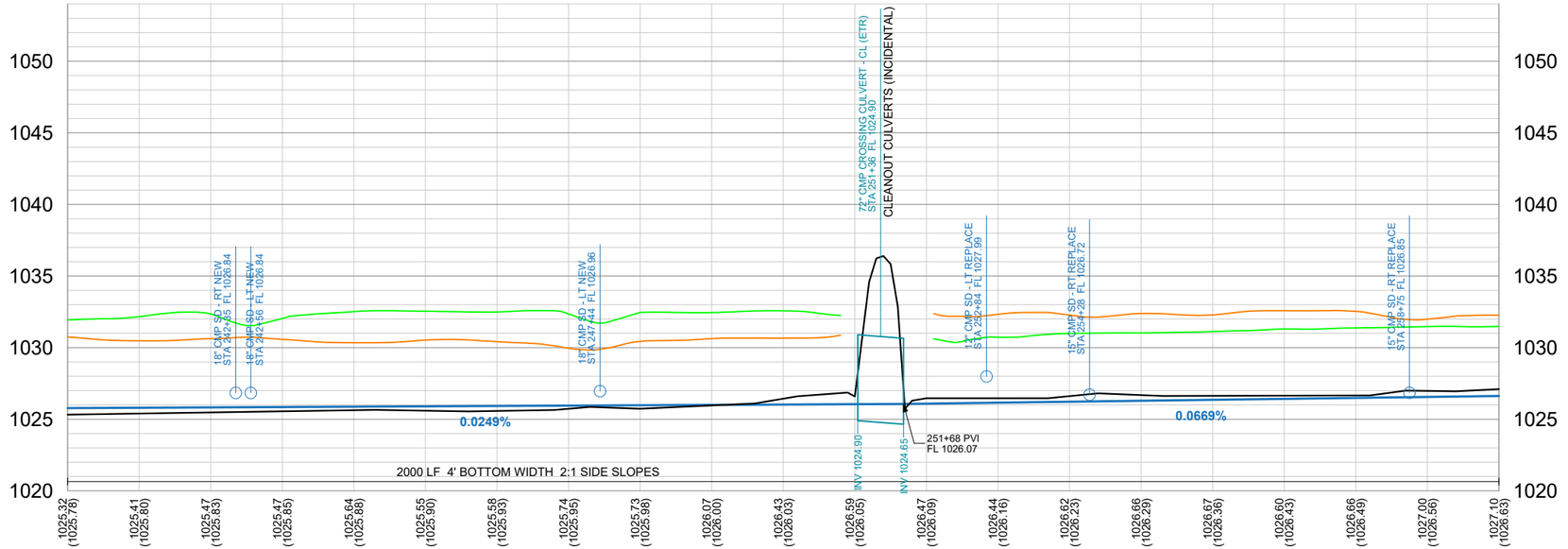
HORIZ. 1"=20' VERT. 1"=10'



HORIZ. 1"=20' VERT. 1"=10'



240+00 241+00 242+00 243+00 244+00 245+00 246+00 247+00 248+00 249+00 250+00 251+00 252+00 253+00 254+00 255+00 256+00 257+00 258+00 259+00 **260+00**



240+00 241+00 242+00 243+00 244+00 245+00 246+00 247+00 248+00 249+00 250+00 251+00 252+00 253+00 254+00 255+00 256+00 257+00 258+00 259+00 **260+00**

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PLAN LEGEND
- Ditch Centerline & Stationing
- Work Limits (100' Each Side of CL) (Typ.)
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PROFILE LEGEND
- Existing Ground at CL (Ditch Bottom)
- Proposed Flowline (Repair of Best Fit)
- Left Top of Bank (Natural Ground)
- Right Top of Bank (Natural Ground)

Elev. table: Existing (Proposed) flowline
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Scale: Plan 1"=200'; Profile H 1"=200', V 1"=10'

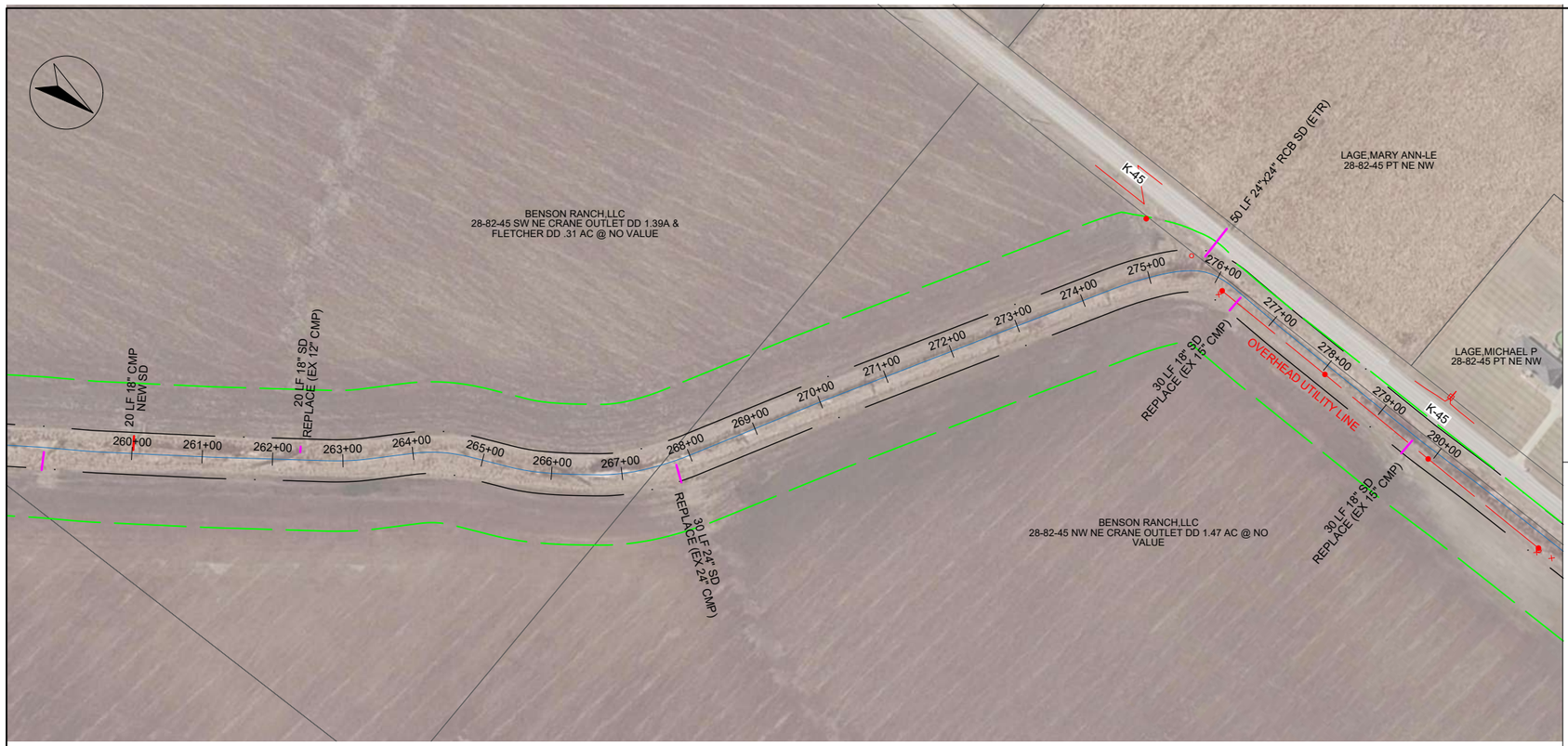
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

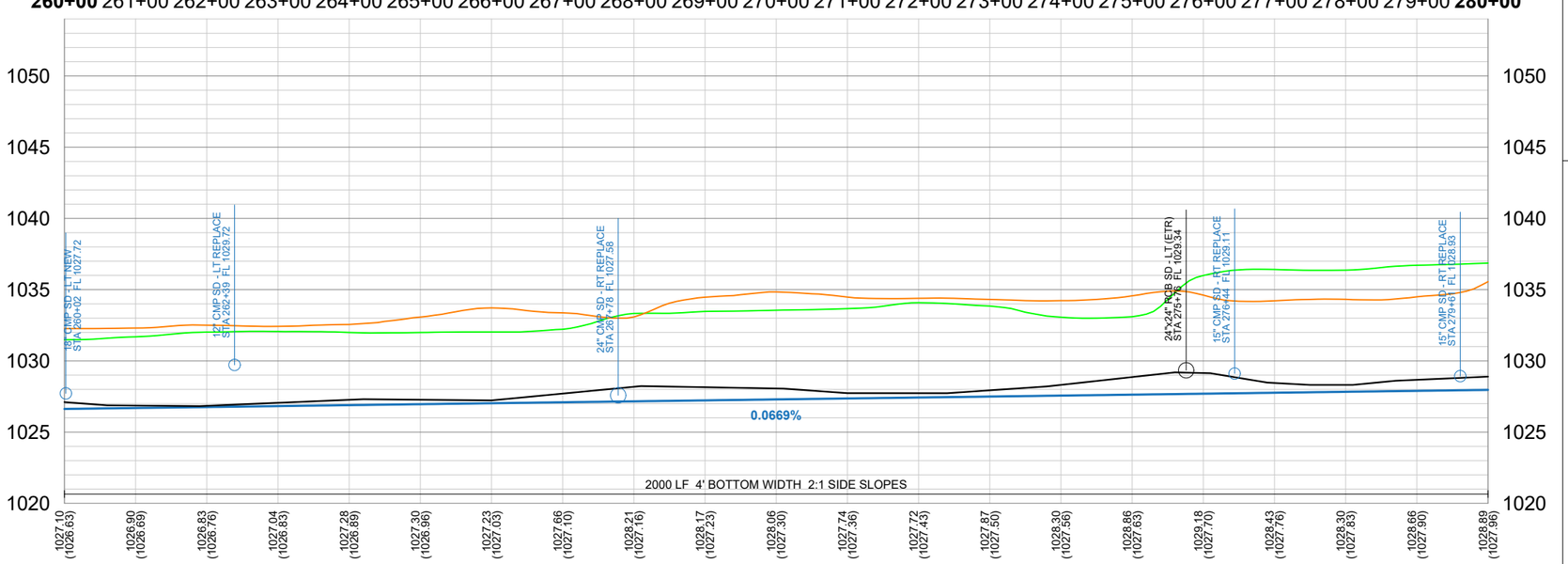
Sheet Name
Plan & Profile
STA 240+00 TO 260+00

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

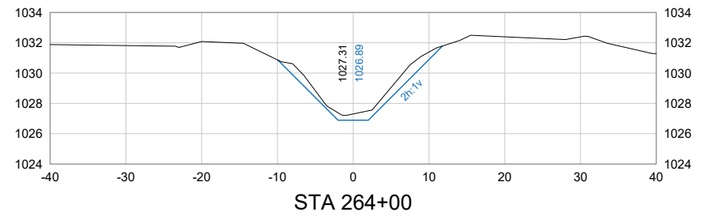
Project
2616-67
Date
2026-10-20
Plan Scale
1" = 200'

Sheet
D.13



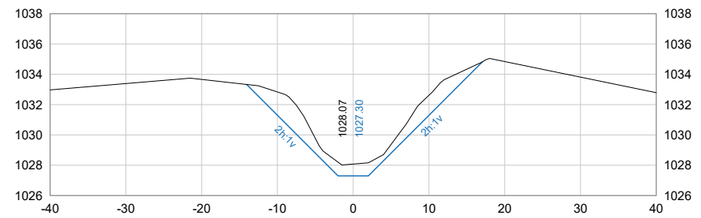


HORIZ. 1"=20' VERT. 1"=10'



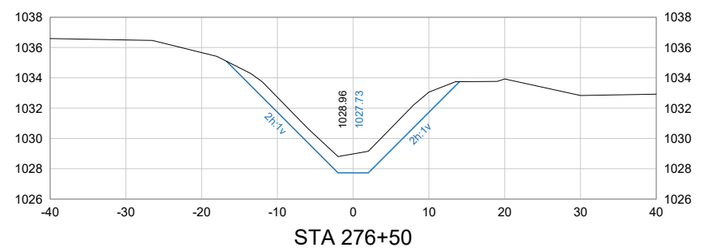
STA 264+00

HORIZ. 1"=20' VERT. 1"=10'



STA 270+00

HORIZ. 1"=20' VERT. 1"=10'



STA 276+50

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- Existing Ground at CL (Ditch Bottom)
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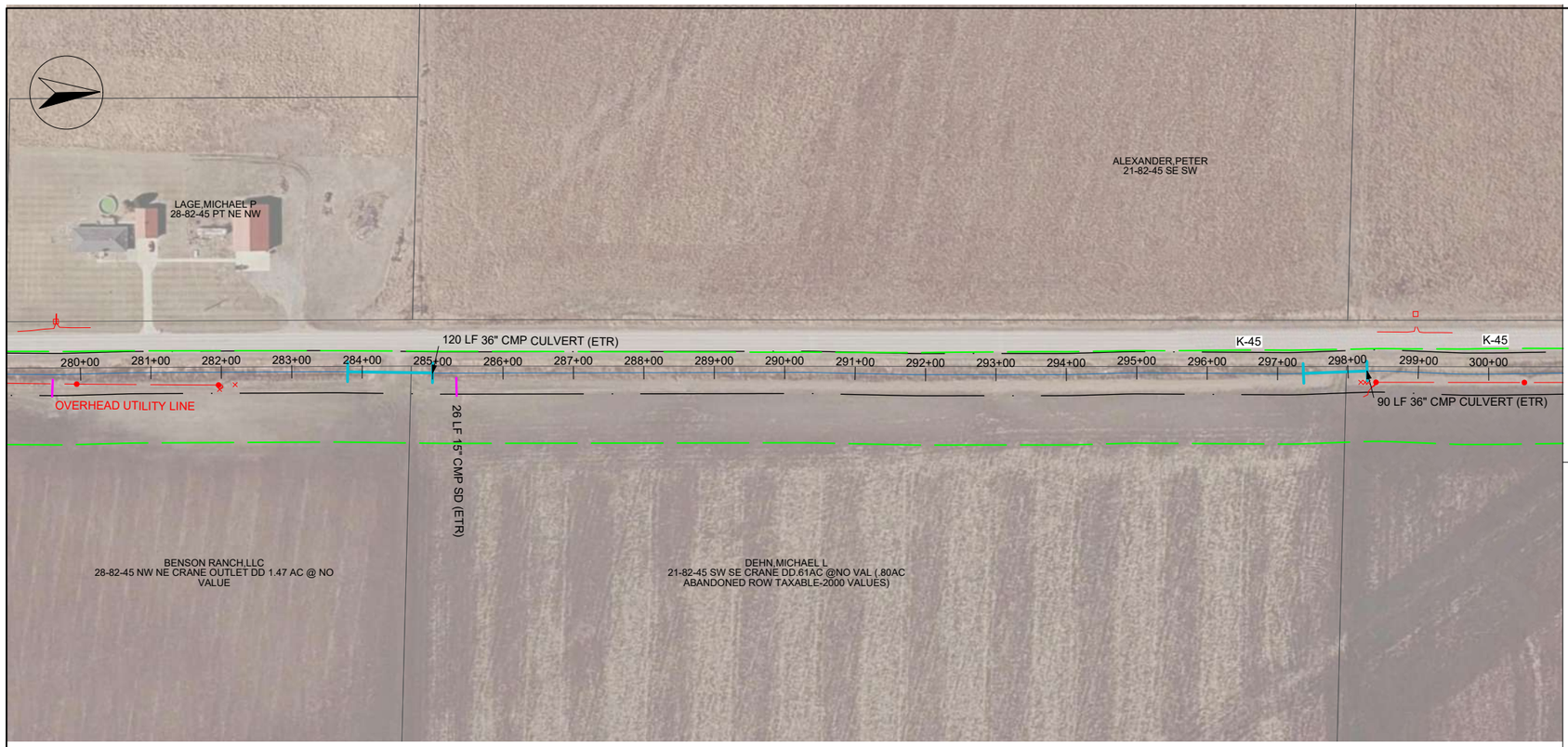
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name
Plan & Profile
STA 260+00 TO 280+00

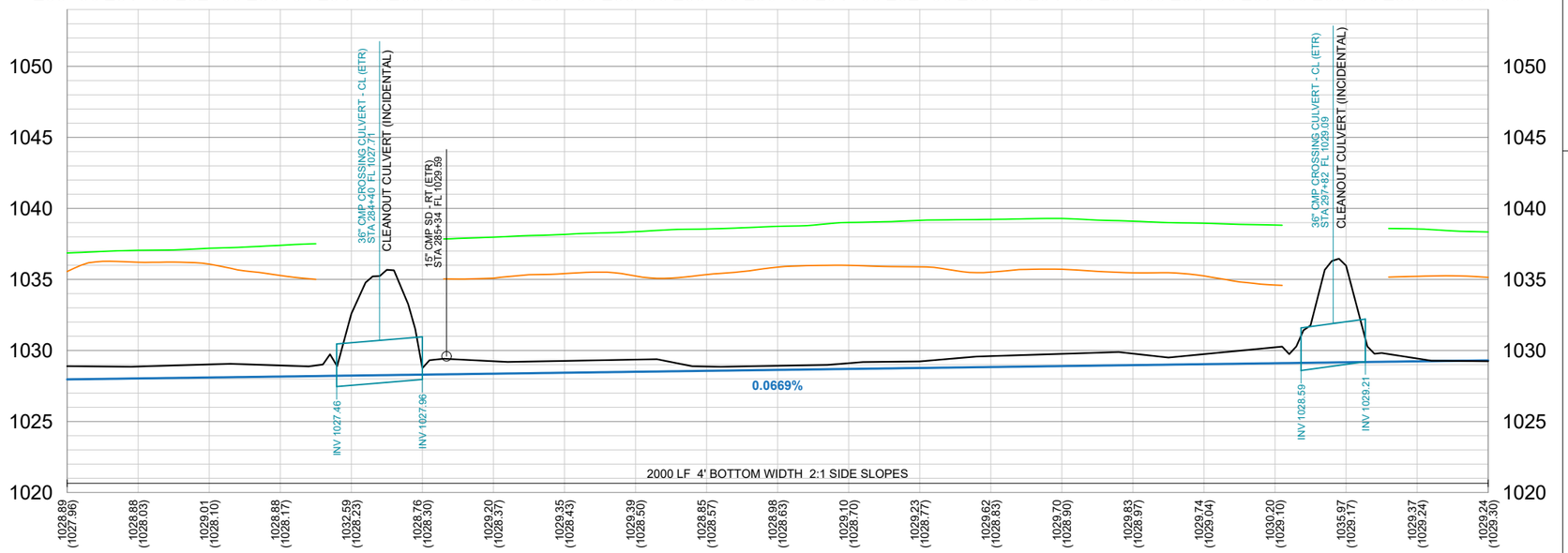
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.14

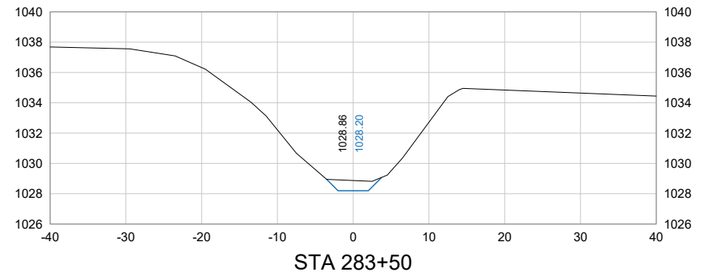


280+00 281+00 282+00 283+00 284+00 285+00 286+00 287+00 288+00 289+00 290+00 291+00 292+00 293+00 294+00 295+00 296+00 297+00 298+00 299+00 **300+00**



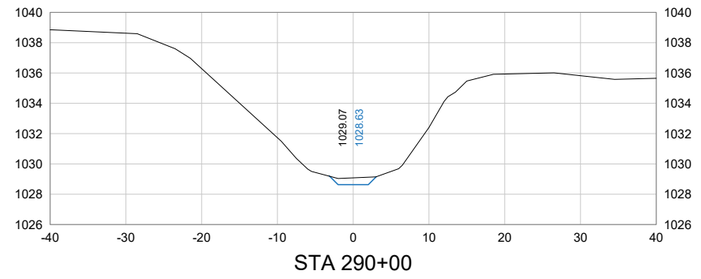
280+00 281+00 282+00 283+00 284+00 285+00 286+00 287+00 288+00 289+00 290+00 291+00 292+00 293+00 294+00 295+00 296+00 297+00 298+00 299+00 **300+00**

HORIZ. 1"=20' VERT. 1"=10'



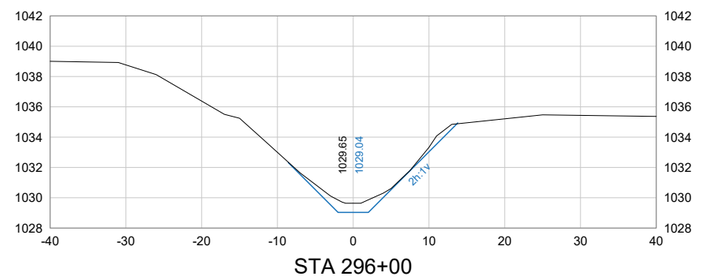
STA 283+50

HORIZ. 1"=20' VERT. 1"=10'



STA 290+00

HORIZ. 1"=20' VERT. 1"=10'



STA 296+00

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No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name
Plan & Profile
STA 280+00 TO 300+00

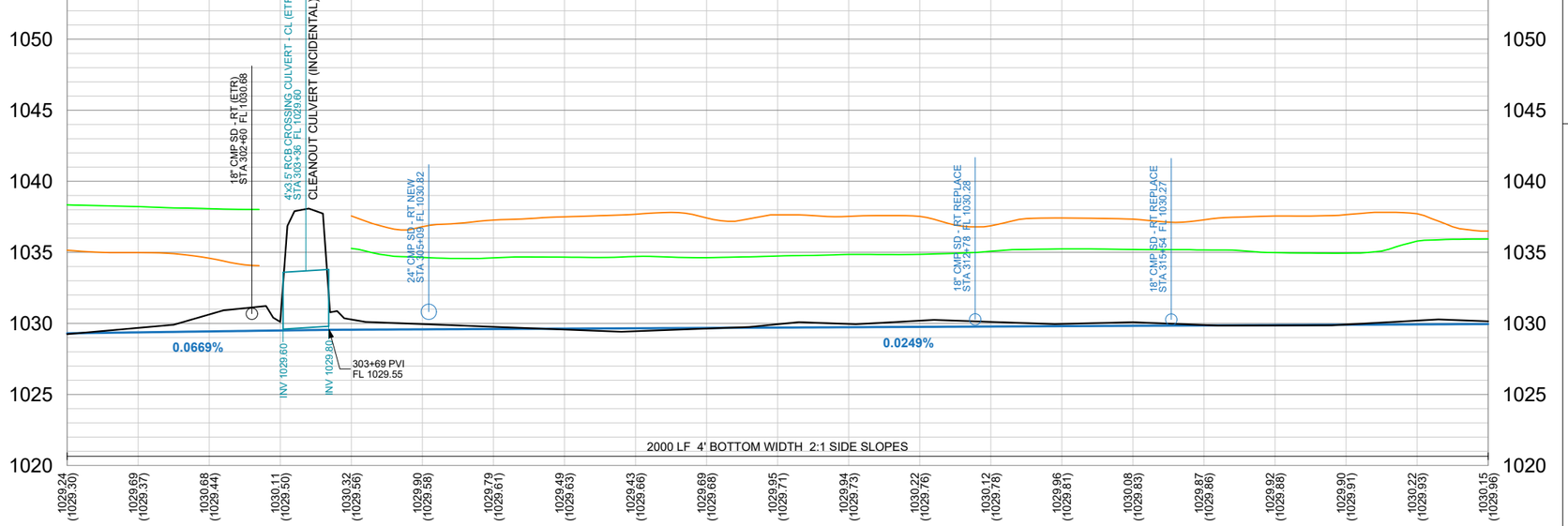
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.15

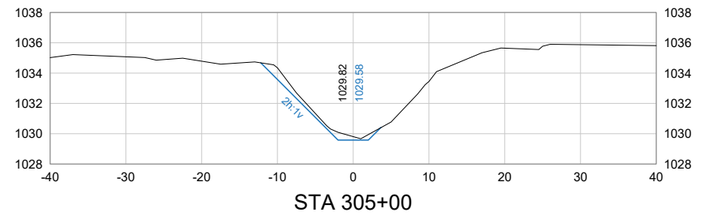


300+00 301+00 302+00 303+00 304+00 305+00 306+00 307+00 308+00 309+00 310+00 311+00 312+00 313+00 314+00 315+00 316+00 317+00 318+00 319+00 **320+00**



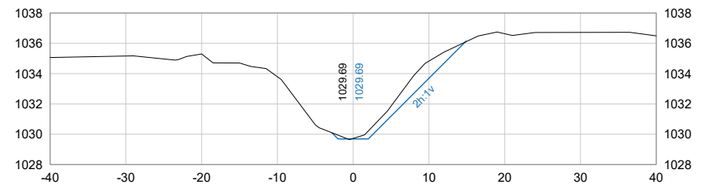
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HORIZ. 1"=20' VERT. 1"=10'



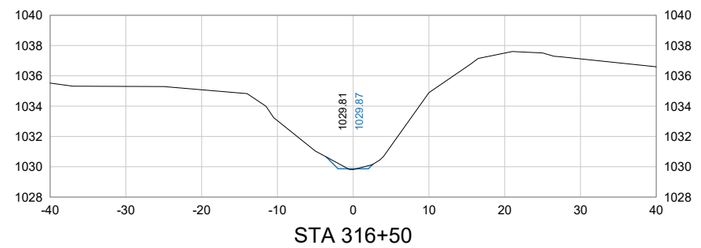
STA 305+00

HORIZ. 1"=20' VERT. 1"=10'



STA 309+50

HORIZ. 1"=20' VERT. 1"=10'



STA 316+50

AgriVia

Company Information
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Checker TJB

PLAN LEGEND
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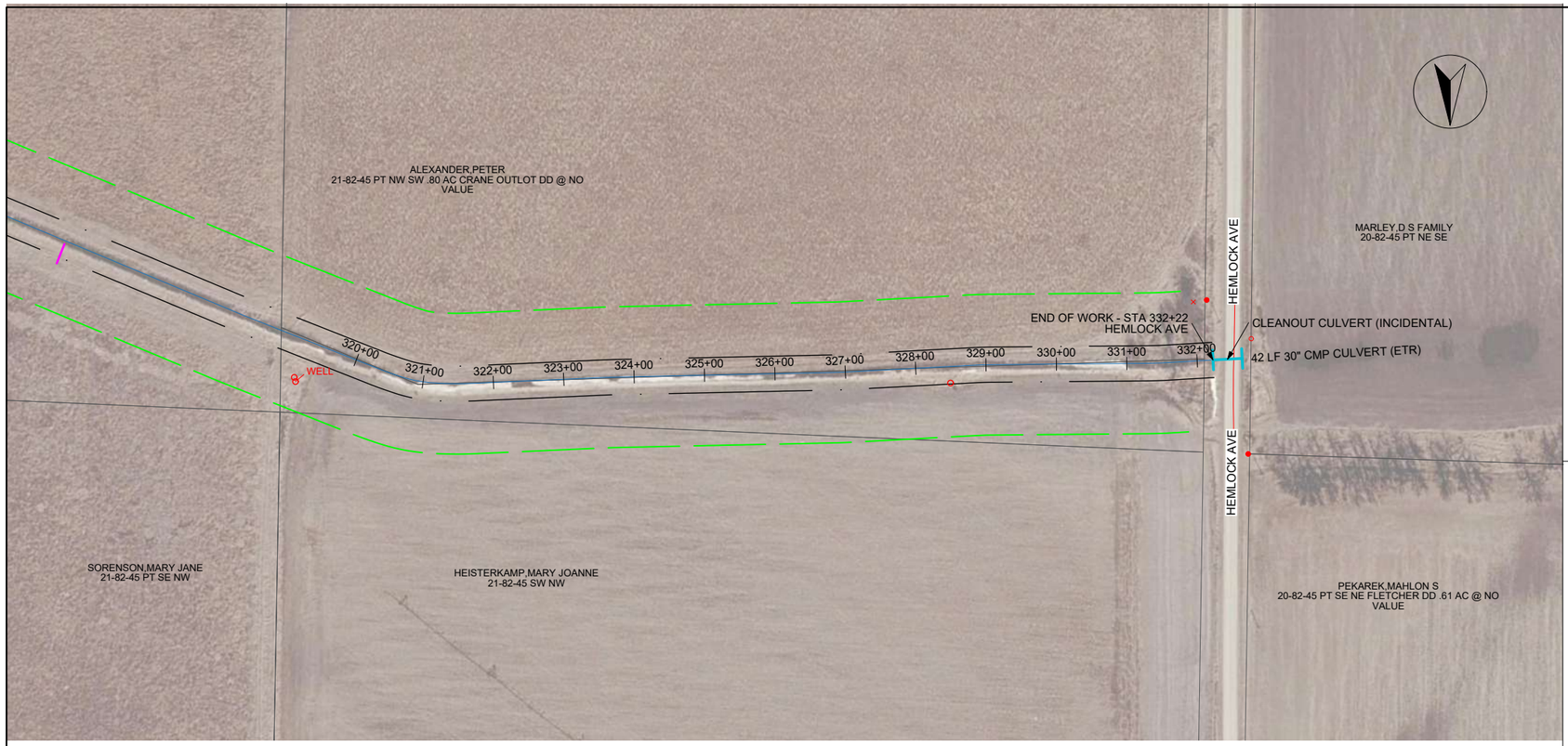
No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

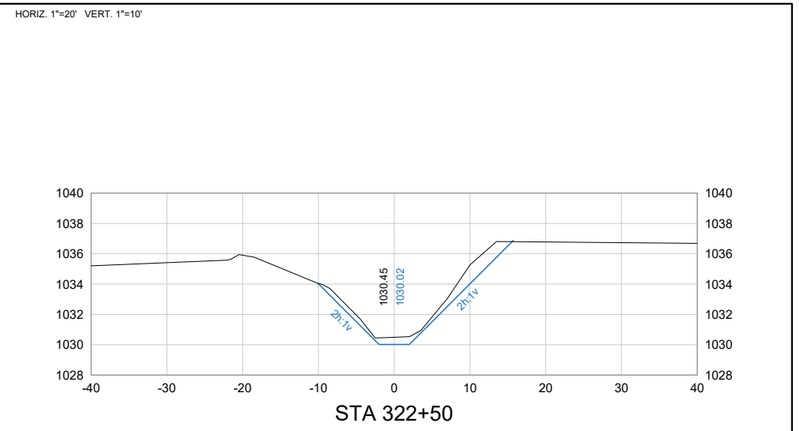
Sheet Name
Plan & Profile
STA 300+00 TO 320+00

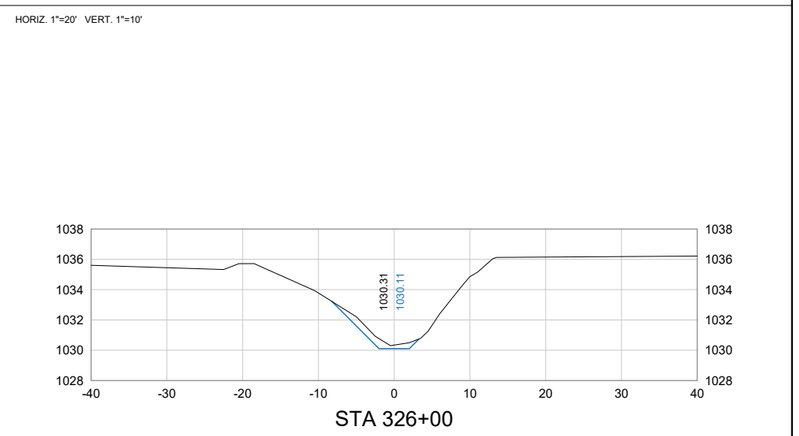
Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

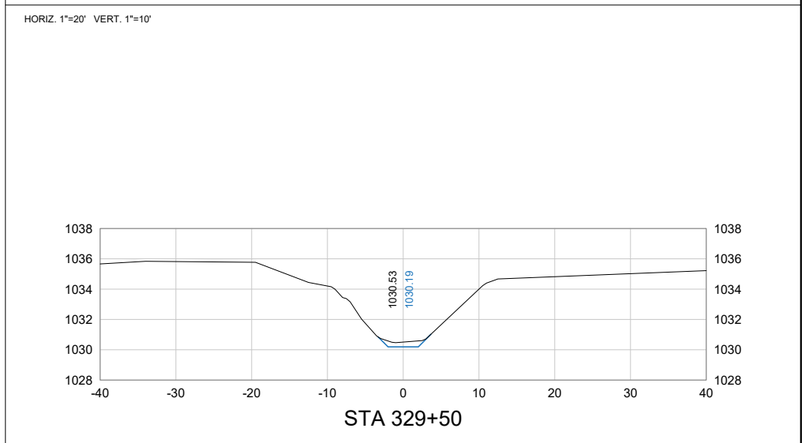
Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

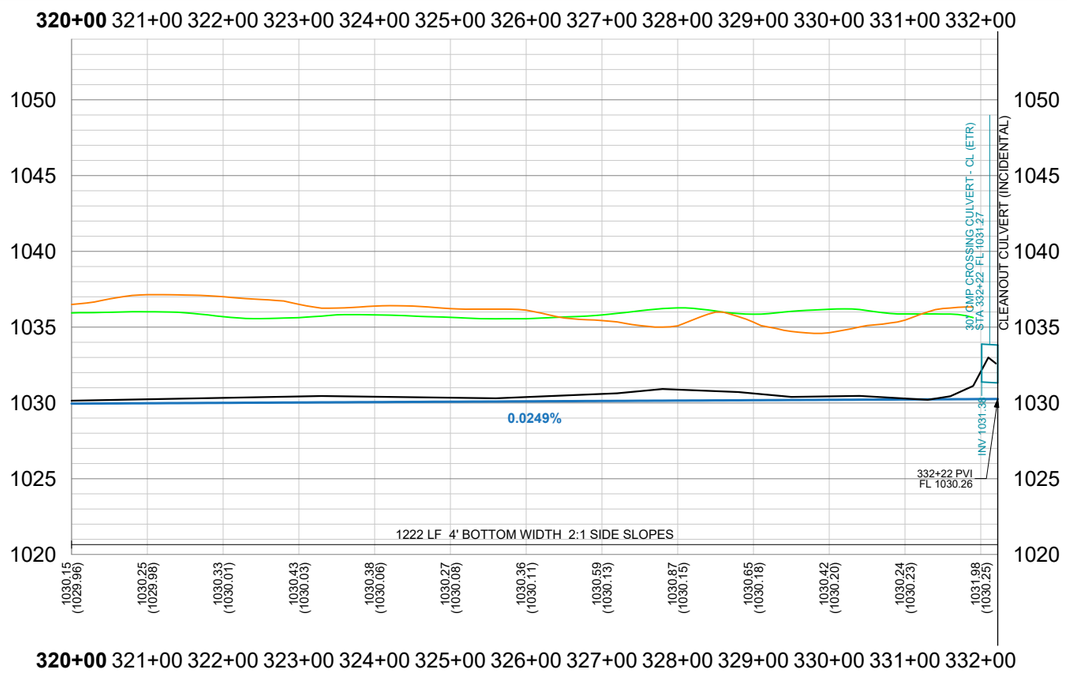
Sheet D.16











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Drafter JLH
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No.	Revision/Issue	Date
0	PRELIMINARY PLANS	10/20/26

Sheet Name
Plan & Profile
STA 320+00 TO 332+22

Project Name, Client, and Address
Open Ditch Repairs
Monona-Harrison Crane DD
Monona & Harrison Co., IA
340th St and K45

Project 2616-67
Date 2026-10-20
Plan Scale 1" = 200'

Sheet D.17