



**BOLTON  
& MENK**

Real People. Real Solutions.

Engineer's Report for

# **Proposed Tile Improvements**

**Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
2019**

**Submitted by:**

Bolton & Menk, Inc.  
300 W. McKinley St.  
Jefferson, IA 50129  
Phone: 515-386-4101

# Certification

## Engineer's Report

for

## Proposed Tile Improvements

Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
P12.117166

2019



I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Iowa. My renewal date is December 31, 2020.

By:

Jonathan P. Rosengren  
Jonathan P. Rosengren, P.E.  
License No. 21661

Date:

March 6, 2019

# Table of Contents

I.	Introduction .....	1
A.	Scope of Work.....	1
B.	Location .....	1
C.	History.....	1
II.	Investigation .....	1
III.	Farm Program Compliance .....	2
A.	Farm Program Wetland Conservation Rules .....	2
B.	Converted Wetland Mitigation Alternatives.....	3
C.	Conservation Reserve Program Complications.....	3
D.	CRP Damage Waivers.....	3
E.	Nesting Season Restrictions.....	4
IV.	Clean Water Act Compliance .....	4
V.	Proposed Work .....	4
A.	Recommended Tile Improvement .....	5
B.	Alternative Lower Main Tile.....	5
C.	Utilities .....	6
E.	Work Limits.....	6
VI.	Existing Schedule Review.....	7
A.	Benefited Lands Not Now Assessed .....	7
B.	Existing Assessment Schedule Review.....	7
VII.	Discussions & Recommendations.....	8

## Tables

Existing Tile Capacities .....	2
Tile Road Crossings .....	6

## Appendices

Appendix A: Petition
Appendix B: Existing Schedule Review
Appendix C: Engineer's Opinion of Probable Cost
Proposed Plans

## I. INTRODUCTION

### A. Scope of Work

In August of 2018, a petition was filed requesting an investigation and report of recommended improvements of the Joint Drainage District No. 87-95 facilities. The Board appointed Bolton & Menk, Inc. to complete the necessary survey, study, plan and report. This report addresses the petitioners' request for improvements. A copy of the petition is included in Appendix A of this report.

### B. Location

The watershed of Joint Drainage District No. 87-95 covers approximately 1,375 acres in Sections 7-8 and 18 of Fremont Township in Hamilton County, and Sections 13 and 23-24 of Colfax Township in Webster County, Iowa. The district is about 3 miles northeast of the town of Duncombe.

Joint Drainage District No. 87-95 consists of a Main Tile, Lateral No. 1, and Lateral No. 2, totaling over 18,565 LF of tile ranging in size from 26" to 14". The Main Tile outlets into the Joint Drainage District No. 4-272 Lateral 1 Open Ditch in Section 23 of Colfax Township in Webster County. The lands currently listed for benefit by JDD 87-95 are listed on the current assessment schedule on file in the Auditor's Office.

### C. History

Joint Drainage District No. 87-95 history since the establishment of the district is listed below:

1909-6-14 Petition filed.

1909-11-12 Report of Engineer filed.

1910-7-28 Bids rejected.

1910-8-17 Classification filed.

1910-6-14 J.R. McCormick of Fort Dodge awarded construction contract for \$15,500.

1910-10-12 Assessment Schedule approved.

1912-5-18 Construction completed.

2014-2-26 Engineer's Report filed for repair.

2018-8-14 Petition filed for tile improvements.

## II. INVESTIGATION

Survey of the tile condition was made in the winter of 2019. The existing tile was surveyed in 2014, and the surveys were compared. The records of the district were reviewed and the original plans located. An equation between the historic datum and the current mean sea level datum was developed.

Surveying the existing tile and studying the original plans and profiles, we have estimated the drainage coefficient (Dc) for the existing tile system. The majority of the tile in this district were designed with a coefficient of approximately 1/5"/acre/day, which is 37.5% of the recommended minimum modern design.

The drainage coefficient represents the depth of excess water removed from the surface of the watershed in a 24-hour period. The modern standard of 1/2" of water removed from the surface area of the watershed in 24 hours (1/2" Dc) has been in use since the mid-1950's. This standard applies to

land with minor surface relief and some ponding. The size and coefficient of each tile in the district is shown on the table below.

Existing Tile Capacities			
Facility	Size & Grade (Diameter @ %)	D <sub>c</sub> * (Inches/Acre/Day)	% of ½" D <sub>c</sub> (Modern Standard)
Main	26" @ 0.15%	0.23	46%
Main	24" @ 0.10%	0.19	38%
Main	20" @ 0.30%	0.18	36%
Main	14" @ 0.32%	0.17	34%
Lateral No. 1	12" @ 0.20%	0.33	66%
Lateral No. 2	14" @ 0.10%	0.33	66%

The coefficients and percent of modern capacity above assume the tile is clean, straight and unrestricted. However, due to the age of this system, it is likely that the actual capacity of the existing system is roughly 80-90% of that shown on the table above. Paralleling the existing system is not recommended because the function of the system would rely upon a century old tile.

### III. FARM PROGRAM COMPLIANCE

#### A. Farm Program Wetland Conservation Rules

The farm program wetland conservation rules are regulated by the USDA Farm Service Agency. The USDA Natural Resources Conservation Service provides technical assistance. This technical assistance includes policing for program violations and making certified wetland determinations. We have made requests of landowners receiving benefits from the proposed improvements to secure certified wetland determinations from the USDA/NRCS and to provide them to the district. Only landowners or their authorized agents may request the determinations. Some have not yet provided this information.

The USDA has recently adopted a few new interpretations of the farm program wetland conservation rules which are applicable here.

- For any improvements constructed by a drainage district, the NRCS will make a rebuttable assumption that every farmed wetland in the drainage district will be converted. (This assumption can be appealed by the impacted landowners, but not by the drainage district.)
- Mitigation of converted farmed wetland must compensate for all lost wetland functions and must also be made at a minimum acre for acre basis.
- A plan for the mitigation of all converted farmed wetland in the drainage district must be approved by the NRCS prior to the beginning of the construction of the improvements. After all opportunities for appeals are exhausted, the farmed wetland not covered by that mitigation plan would be found converted and the landowner and tenant would be in technical violation of the farm program. Penalties can be avoided when a drainage district causes the conversion, but only at the price of abandoning farming of the converted farmed wetlands or ceasing to participate in the farm program.
- The planned mitigation must be in place and functioning no later than the completion of the project which converts the farmed wetlands.

If a landowner does not request a certified wetland determination and he happens to end up with a converted farmed wetland, he will find himself in technical violation of the farm program rules and be subject to a USDA claim for the forfeiture and possibly refund of farm program

payments when the work commences.

The Board of Supervisors may approve and authorize construction of the proposed improvements without accruing risk to the district from farm program wetland conservation rules violations. Obviously, the board will want to know the wetlands status of all landowners and to help to keep them all in farm program compliance, but the board cannot allow the failure of an individual landowner to share wetland information to influence the very important decisions it is charged to make for all of the benefitted landowners. However, by the rules, the program penalties will fall solely to the owners of the converted farmed wetlands for which compensatory mitigation is not secured. It is fully up to the landowner to cooperate with the district toward keeping himself/herself in farm program compliance.

#### B. Converted Wetland Mitigation Alternatives

Since 1987, the USDA has assumed jurisdiction over the conversion (or improved drainage) of what has become commonly termed “farmed wetland”. It being the rebuttable assumption of the current USDA policies that all farmed wetlands will be converted and that acre-for-acre mitigation will be necessary to put the converted farmed wetlands back into production, the decision process is made a little easier—although mitigation is much costlier.

Mitigation options include the purchase of wetland credits in a mitigation bank. Mitigation banks are not common and their credits are expensive. We understand that the Iowa Agriculture Mitigation Bank, Inc. has available credits for farmed wetlands in this area of the state. Another alternative is for the district to self-mitigate, wherein a mitigation plan to use a suitable site inside or outside the district on which to create wetlands for mitigation of impacted wetlands is developed for review and approval by the NRCS.

Farm program rules clearly provide that when a farmed wetland is converted by a drainage district the conversion act is attributed to the owner of the farmed wetland. However, the farm program rules also clearly provide that the owner of the converted farmed wetland may remain eligible for farm program benefits by opting to not farm the converted farmed wetland. If for some reason mitigation is delayed, this can be a temporary solution for the farmed wetland owners in a drainage district. It is also an option for those who choose not to report certified farmed wetland determinations and for which mitigation will not be provided.

#### C. Conservation Reserve Program Complications

We note that there may be areas of CRP along the proposed new drains alignments. There are some manageable drawbacks that must be addressed by the owners of affected CRP tracts.

The CRP includes an option to enroll farmed wetland and prior converted cropland where the underlying tile drains are disabled and a wetland cover is created. It has been our experience that if the disabled tile is not restored, the USDA may allow the land to stay in the CRP until the contract expires. However, only the landowner can seek and secure this waiver.

But, if a CRP site includes a certified farmed wetland and the USDA determines that it will be converted by the tile improvement project, the alternative of leaving the farmed wetland sit idle does not exist and mitigation will need to be secured immediately. The drainage district could make some reasonable accommodations, such as sealed pipe joints or an altered alignment, to help the owner, but it will be up to the owner to work with the USDA in securing immediate mitigation. Perhaps taking additional steps to make the CRP site wetter will be possible for the landowner.

#### D. CRP Damage Waivers

The destruction of CRP vegetation by construction activities places the landowner in technical violation of farm program conservation rules. The penalties can include loss of the CRP contract, forfeiture of back CRP payments and financial penalties. To avoid these penalties, landowners are advised to request a waiver from the USDA Farm Service Agency County

Committee. The county committee will grant waivers for ditch or tile work if CRP vegetation restoration, in compliance with NRCS requirements, is timely done after the work is complete. If the project is authorized, all CRP owners in the path of construction must independently seek the FSA County Committee waivers. This process should be initiated immediately if the project is authorized.

E. Nesting Season Restrictions

The CRP rules also restrict disturbances during the primary nesting season, which covers the period of May 15 to August 1 in Hamilton and Webster Counties. Recent relaxations of this rule, although specific to drainage district maintenance of open ditches having CRP buffers, likely would now favor allowing tile installation work without penalty on CRP during the primary nesting season. It makes no sense for a drainage district to wait for up to 3 months during ideal work weather. This is another situation where only the landowner can seek and secure the needed waiver.

#### IV. CLEAN WATER ACT COMPLIANCE

Dredging and filling of water of the United States (WOTUS) is regulated under Section 404 of the Clean Water Act. In the 1990's the USEPA & USACE adopted rules to extend Section 404 jurisdiction to isolated wetlands, including farmed wetlands. For a few years it became necessary to get CWA Section 404 permits for drainage district improvements where farmed wetland conversions were expected. Drainage districts were helped at the time with the issuance of a memorandum of understanding entered into by 4 regulatory agencies. This agreement gave the NRCS primacy in mapping and regulating wetlands on agricultural land. Great relief came in 2001 when the U.S. Supreme Court ruled that isolated wetlands were not subject to CWA Section 404 jurisdiction.

However, in 2012, the USEPA launched an aggressive rulemaking procedure to reestablish jurisdiction of isolated wetlands by revising the definition of "Waters of the United States" (WOTUS) to include isolated wetlands. This massive rule change became effective on August 28, 2015. However, a temporary stay was imposed by the Sixth Circuit Court of Appeals in October 2015 and that remains in effect for an unknown period.

The WOTUS rule: 1) expands CWA Section 404 jurisdiction to include all isolated farmed wetlands and even drained prairie potholes; 2) identifies more jurisdictional wetland than has the USDA has identified under the farm program; and 3) demands more stringent and costly mitigation for the conversion of farmed wetland. That is assuming drainage improvements will be allowed at all – a scary thought, but one that is applicable from a plain reading of the CWA Section 404(b)(1) guidelines.

Regardless of political leanings, the change of the administrations gives hope that the WOTUS rule will be abandoned. We are reasonably confident that there will be no CWA Section 404 jurisdictional wetlands found in the benefited area. But, this is a reminder that environmental regulations tend to get tougher over time and that consideration should be made in light when the opportunity for improvements are presented.

#### V. PROPOSED WORK

The investigation has confirmed the need for drainage relief within the district. Modern farming practices rely upon well drained soils to achieve maximum productivity. We recommend replacement of the existing Joint Drainage District No. 87-95 tile with a system designed according to the modern design standard.

The standard design for drainage tile in northern Iowa is ½" Dc. This standard is adequate for the majority of drainage districts in Hamilton and Webster County and is a cost-effective design to maximize the productivity of today's farming practices. The ½" Dc would provide nearly 2.5 times

the drainage capacity of the existing JDD 87-95 Main Tile and Branches and would be a substantial improvement for the lands in Joint Drainage District No. 87-95.

#### A. Recommended Tile Improvement

We are recommending the proposed tile closely follow the route of the existing tile following the low areas of the district. The routes of the Main and lateral tiles are included below. A detailed analysis of each tile's cost is included in Appendix C.

**Lower Main Tile-** This proposed Main Tile outlets into the JDD 4-272 Lateral 1 Open Ditch and runs east for 3,900 LF, then crosses D18 and heads east-northeasterly to the county line to proposed Station 76+00. This proposed route closely follows the route of the existing tile.

**Upper Main Tile-** At Station 76+00, the tile turns in a northeasterly direction following the valley and closely following the route of the existing tile. It continues to a large pothole in the SE NW of Section 18, and continues northeast crossing 190<sup>th</sup> St. and ending at Station 137+50.

**Lateral No. 1-** The proposed route generally follows the route of the existing Lateral No. 1. The proposed tile will connect to the Main Tile at Station 48+50 and head northeast for 700 LF, then northwesterly for 1,500 feet. At this point, the tile will turn back north for 1,100 feet to reach the center of a large pothole.

**Lateral No. 2-** The Lateral No. 2 tile outlets into the Main Tile at Station 118+00 and heads in a southeasterly direction for 1,800 LF, ending approximately 270' east of the Manure Lagoons. This route ends in the same pothole as the existing Lateral No. 2, but follows a different route to avoid the farm site in the NE SW of Section 18.

This plan serves the entire 1,375 acres in the JDD 87-95 watershed. The estimated cost of the proposed Main Tile and the two lateral tiles is \$1,363,000, or \$991 per benefited acre. This estimate includes construction, engineering, and legal costs.

As part of this investigation we have also studied an alternative route for the Lower Main Tile as part of our report.

#### B. Alternative Lower Main Tile

This option outlets in the JDD 4-272 Lateral 7 Open Ditch about 1.5 miles southeast of existing Main Tile outlet. From the outlet, the tile will head north crossing 200<sup>th</sup> St. and continue north for approximately 600 LF, then turn in a north-northeasterly direction closely following the route of the Lateral 1 Tile of Joint Drainage District No. 108-117. The tile will cross the watershed divide near County Road D18 and continue north. Then, the tile will cross Abbott St. to Station 76+00. Upstream of Station 76+00, the tile would be the same as previously described in the Upper Main Tile. Lateral No. 1 would not be constructed, though Lateral No. 2 could be constructed as previously described.

This alternative route serves the upper 880 acres of JDD 87-95 and will serve approximately 463 acres currently being served by the Lateral 1 Tile of JDD 108-117, totaling 1,343 acres. The estimated total cost of the Alternative Lower Main Tile is \$1,184,000, or \$848 per benefited acre.

The lower 495 acres of JDD 87-95 are not served directly by this new tile, but there would relief for these lower lands by removing the upper lands off the existing tile. The existing Main Tile outlet drainage coefficient when removing the 880 acres upstream is 0.63 inches/acre/day. Assuming the existing tile is at 80% of its service life, the benefit of removing the upstream lands would be the cost of 36" tile minus the cost of 24" tile (proposed vs. existing) multiplied by 20% for remaining life equaling \$45,600. The lower lands would then be assessed this \$45,600, or \$92 per acre, of the \$1,184,000 estimated total project cost.

The proposed tiles will cross the existing district tile at several locations. Where the existing tile is

crossed, the upstream end will be connected to the proposed main and the downstream end will be capped to allow the tile to continue functioning as a collector to bring smaller private tile to the new main. The function of the existing tile will be replaced by the new system, and it is recommended that the existing facilities be abandoned as district facilities. Maintenance of these tile will be turned over to the landowners following completion of the project.

It is recommended that this new tile be constructed using tongue and groove reinforced concrete pipe (RCP). RCP is recommended over dual wall HDPE pipe for several reasons, including, less demanding installation requirements, assured smooth walls, and proven longevity of the material.

To comply with the manufacturer's recommended installation methods, the dual wall HDPE pipe would need to be completely encased in crushed rock. The inclusion of this bedding envelope raises the cost of the dual wall HDPE installation above the typical installation cost of RCP. RCP also does not deform under the weight of the soil. In cases where dual wall HDPE has been used, such deformation stresses the liner, causing rippling and detachment. Finally, the existing rigid wall tile mains found throughout north central Iowa were constructed of clay or concrete, and these materials have shown their durability over the past 100 years. We expect a much longer service life from today's RCP products.

#### C. Utilities

Overhead and buried power lines and other utility lines likely parallel or cross the tile at various locations. Extra care will need to be taken when working under or near these utility lines. The contractor will be responsible to use Iowa One Call to notify utility companies and to cooperate in the locating, marking, and protection of these facilities.

#### D. Road Crossing

One paved county secondary road and three gravel county secondary road crossings are part of the recommended improvement. The alternative route requires one additional gravel county secondary road crossing. It is assumed that gravel road crossings will be open cut and the paved crossing will be bored. The table below summarizes the road crossings which are part of the proposed tile improvements.

Tile Road Crossings					
Road	Road Crossing Type	Control Agency	Facility	Station	Diameter
Xavier Ave.	Open Cut	Webster County	Lower Main	18+25	36"
D18/ 190 <sup>th</sup> St.	Bored	Webster County	Lower Main	39+90	36"
Yankee Ave./ Abbott Ave.	Open Cut	Webster/Hamilton County	Lower Main	75+60	36"
200 <sup>th</sup> St.	Open Cut	Webster County	Alt. Lower Main	0+76	36"
D18/ 190 <sup>th</sup> St.	Bored	Webster County	Alt. Lower Main	67+28	30"
Yankee Ave./ Abbott Ave.	Open Cut	Webster/Hamilton County	Alt. Lower Main	75+60	30"
180 <sup>th</sup> St.	Open Cut	Hamilton County	Upper Main	136+90	24"

The estimated totals costs to the Hamilton and Webster County Secondary Roads is \$82,000 as recommended or \$79,000 for the alternative route. Iowa Code Section 468 requires that all costs of primary and secondary road crossings are to be paid from funds available to the entity that controls the road.

#### E. Work Limits

For the proposed work, the district will need a temporary work area to install the tile. The

extent of these work limits on the tile will be finalized when the final construction plans are developed, but it will typically be out to 50-100 feet from the tile centerline on the side or sides on which work will be done. Landowners will also be entitled to compensation for damages in the work area. It is recommended that in cropped areas, whenever possible, a landowner not crop the work area and instead accept fair rent for the land. Compensation for use of, and damages within the temporary work area, are normally determined at the project completion hearing.

## **VI. EXISTING SCHEDULE REVIEW**

### **A. Benefited Lands Not Now Assessed**

There are approximately 1,375 acres within the Joint Drainage District No. 87-95 watershed, of which 11.4 acres have never been assessed for benefits from district facilities. This area is shown on the Benefited Lands Map in Appendix B.

If the alternative Lower Main Tile route is pursued, the 463 acres in Joint Drainage District No. 108-117 would need to be annexed to be assessed for benefits of the new Main Tile.

It would be cost effective to do this annexation as part of the proposed project. Most landowners now in the district would likely support the annexation; those being annexed would likely be opposed. It should be emphasized to the owners of the annexed lands that assessments are based upon relative benefits, and that if this benefit is small, the assessment is also relatively small.

Annexation is expected to cost approximately \$5,000. For these lands to be assessed to help pay for future maintenance, there would be no better time to bring them into the district. It is recommended the 11.4 acres outside of Joint Drainage District No. 87-95 which would benefit from the proposed improvements be annexed into the district.

### **B. Existing Assessment Schedule Review**

Joint Drainage District No. 87-95 was last reclassified in 1910, and all facilities are included in this single assessment schedule. Appendix B contains a map showing the existing benefited units assessed per acre and classification for each parcel in the currently assessed area of JDD 87-95.

It has become common practice with reclassification to separate all facilities within a district into individual schedules to prevent landowners who receive no benefit from a particular named facility from having to pay to maintain that facility. It is recommended that the proposed tile be divided into separate maintenance schedules to make the cost of future repairs more equitable.

Before a decision is made, an estimate for the cost of a proposed project for each benefitted parcel can be made available. The Joint Board may direct the Engineer to develop a pre-classification similar to what the benefit commission would consider at the end of the project. A pre-classification of this type could be developed for approximately \$5,000. Please be reminded that a pre-classification is an estimate only. The final approved distribution would still be subject to review by the commission appointed by the Joint Board with adjustments made by the Joint Board at the reclassification hearing at the end of the project.

### **C. General Classification Methodology**

The process of reclassification uses several factors to equitably spread project costs based upon benefits received. The three common factors are: Use; Proximity; and Wetness.

The Use Factor considers how much of the facility is required to bring an outlet to a particular location. The more a facility is used by any given property, the higher the Use Factor on that property. A parcel using one mile of a facility should pay less than a parcel using 5 miles of

the facility.

The Proximity Factor considers the portion of the outlet provided. Lands nearer to the ditch receive a higher assessment because they have easy access to district facilities. Lands farther from the facility must invest in additional private drainage to access the facility. A 40 acre tract which is crossed by a ditch should pay more than a 40 acre tract a mile away which must build a private system to reach the open ditch.

The Wetness Factor accounts for the soil types' varying natural wetness and need for drainage. Wet soils in a pothole are high because the soils have more need for drainage than drier soils on the hill tops.

Other considerations may be necessary to achieve equitable assessments.

## VII. DISCUSSIONS & RECOMMENDATIONS

This report confirms the need to improve the drainage efficiency and capacity of the Joint Drainage District No. 87-95 drainage system. The work described herein can accomplish that improvement.

**Improvement Recommended.** The improvement proposed will provide the drainage capacity needed for modern farming practices. The estimated assessable cost of the recommended improvement is \$1,363,000. We find that the proposed improvement will be practicable, feasible, and beneficial to the public.

**Annexation Recommended.** Approximately 1% of the lands now served by Joint Drainage District No. 87-95 (11.4 acres) appear to benefit from district facilities, but have not been assessed for maintenance costs of the facilities. For these lands to now be assessed to help pay for future maintenance it is necessary to bring them into the Joint Drainage District No. 87-95 benefited area. The benefited lands listed in Appendix B include these lands.

**Reclassification Recommended.** The existing assessment schedule is inequitable and should be reclassified, separating the several district facilities into separate maintenance schedules at the same time. Reclassification is expected to cost approximately \$5 per acre for each schedule developed.

**Installment Payments.** Iowa drainage district law provides that large improvement assessments may be paid in no less than ten nor more than twenty annual installments at the discretion of the Board of Supervisors. We anticipate that the Board will spread assessments of the magnitude contemplated in this report over twenty years. If we assume that the Board will allow twenty annual installments at 6% interest, the costs for all benefited lands would be about \$81 per acre per year for either of the recommended improvements. Please be reminded that assessments are based upon benefits and that following reclassification some highly benefited parcels will likely bear 2 to 2½ times the average assessments.

Tiling is a long-term investment, the upfront costs are high, but the cost of operation tends to be low during its useful life. Included in Appendix C is a financial analysis of the probable costs and the likely payback period for different assessment thresholds at different yield increases resulting from this project. The financial analysis uses current commodity prices and average yields from the Agricultural Decision Maker website. Varying yield increases have been used to estimate pay back periods for a range of possible assessments. Iowa State University and University of Minnesota research indicates a likely average yield increase between 10% and 25% for an improvement of this type.

Assuming corn averages \$3.00/bushel over the next 20 years and using only the increase in revenue from an assumed 10% yield increase, an average assessment for the recommended ½" Dc could be repaid in approximately 16 years. These improvements would likely continue to function well for another century bringing continued benefit to future generations and owners.

It is recommended that the Joint Boards of Supervisors of Hamilton and Webster County, acting as

trustees for Joint Drainage District No. 87-95, take appropriate action with legal guidance to accomplish the following:

- Tentatively approve this Engineer's Report.
- Conduct a public hearing on the proposed improvements including discussions regarding annexation and reclassification.
- Adopt the recommended improvement plan, modified as deemed appropriate to satisfy the needs of the district.
- Direct the Engineer to prepare the necessary plans and specifications and to proceed toward a bid letting.
- Initiate procedures to annex benefited lands into Joint Drainage District No. 87-95.
- Initiate reclassification procedures.

Respectfully submitted,

**Bolton & Menk, Inc.**

## Appendix A: Petition

Approved 8-14-18

## DRAINAGE PETITION

TO THE BOARD OF SUPERVISORS OF HAMILTON COUNTY, IOWA:

The undersigned ask that Drainage District #87 Haire JT Hamilton County and #95 Webster County located in Section(s) 13, 14, 23 and 24 Colfax Township and Sections 7 and 18 Fremont Township be investigated for a new main, lateral 1 and lateral 2 to be installed.

\*\*\*\*\*

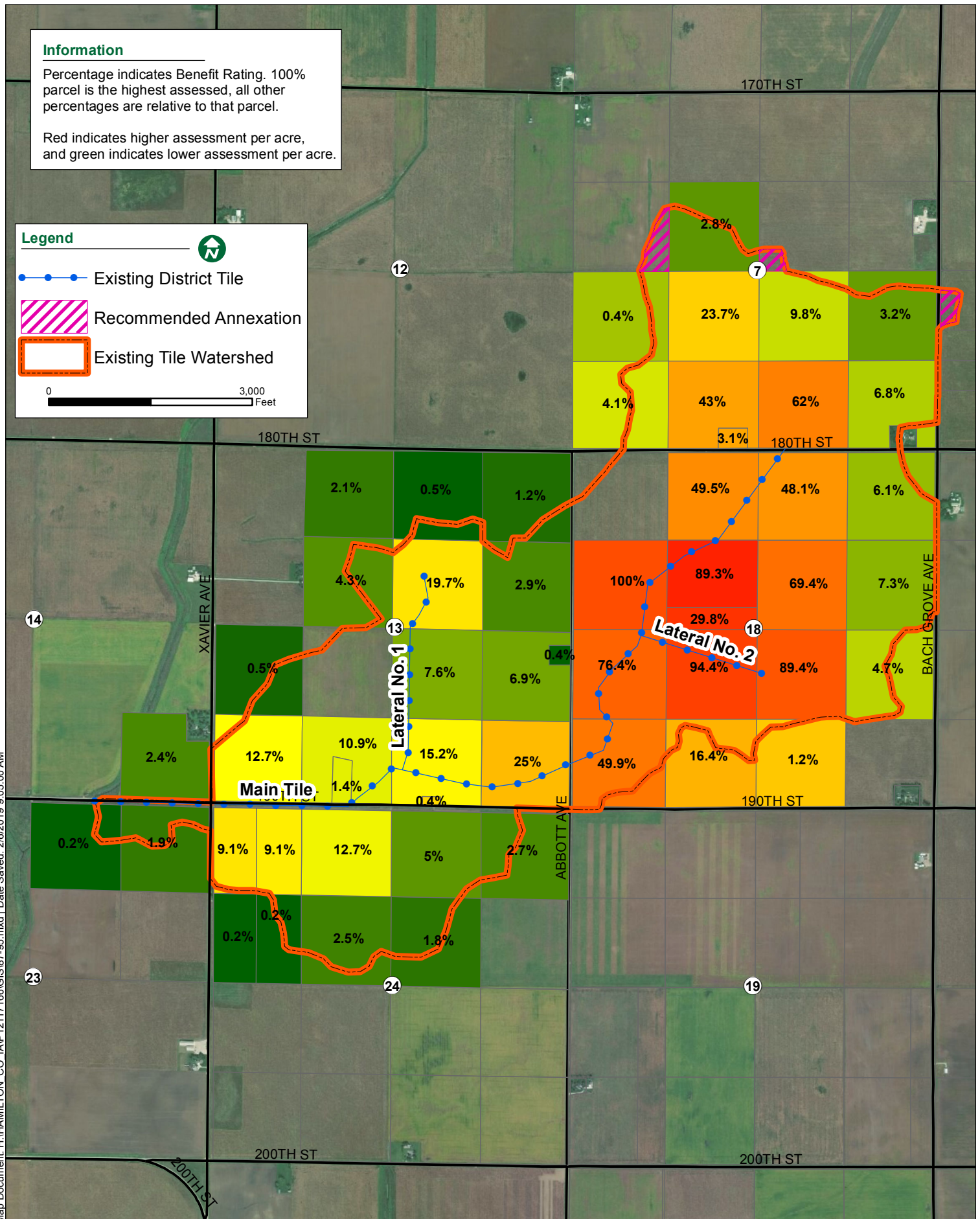
### SIGNATURES

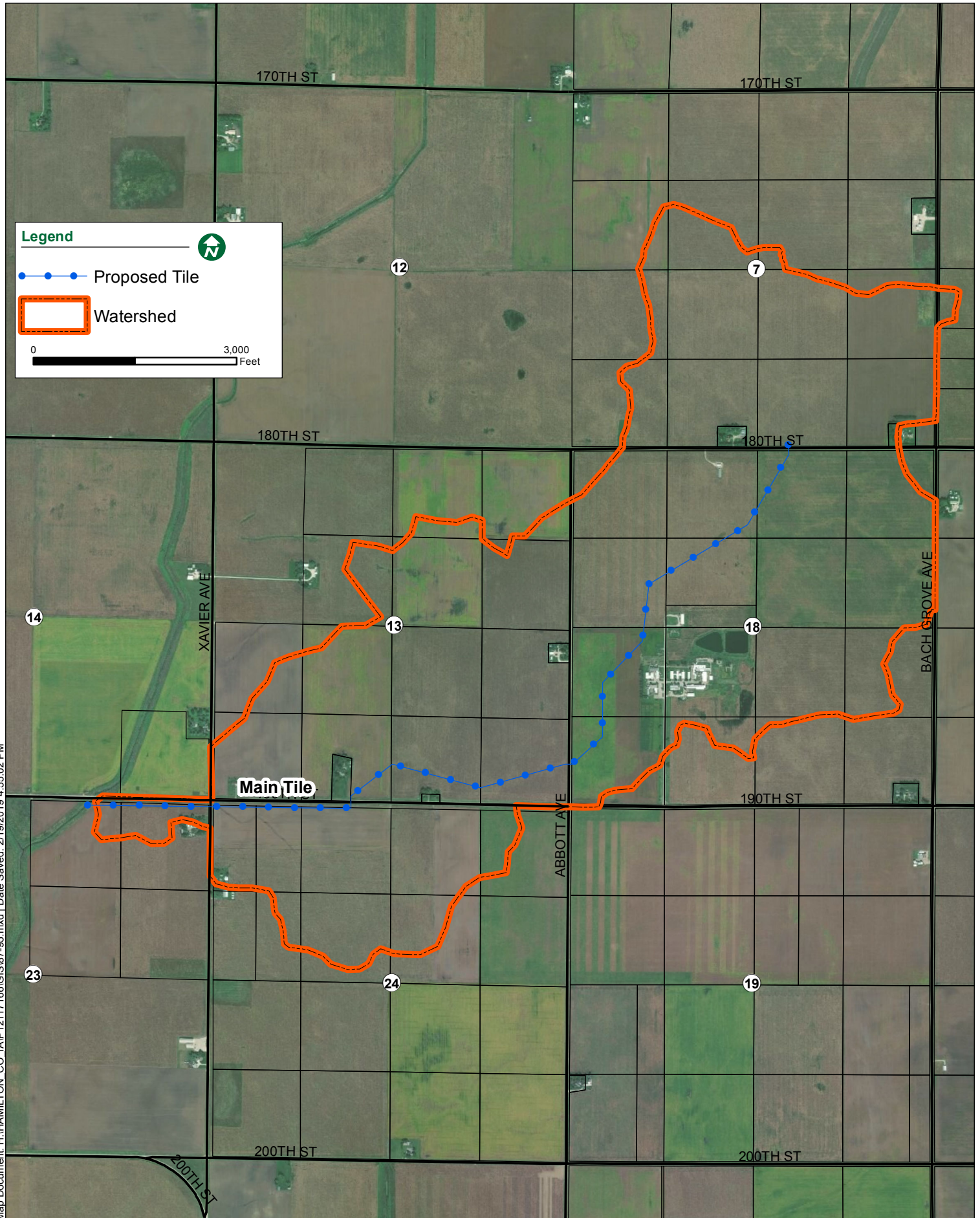
Richard Stark 5-22-18

Margaret Stark Life Estate - Richard Stark 5-26-18

Carol Stark 6-26-18  
Benny Gann 8-1-18

## Appendix B: Existing Schedule Review





**BENEFITED LANDS SCHEDULE  
PROPOSED MAIN TILE  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
BIRD, JOHN FAMILY LIMITED PARTNERSHIP	40892607300001	7-89-26	NW SW	9.0	
BIRD, JOHN FAMILY LIMITED PARTNERSHIP	40892607300003	7-89-26	SW SW	17.7	
				<b>26.7</b>	<b>1.94%</b>
BURNEY, JASON E & BURNEY, JENNIFER A	40892607400006	7-89-26	SE SE AUDITOR PARCEL B	1.2	0.09%
KENDALL YOUNG LIBRARY	40892607400002	7-89-26	NW SW EXC E12.25 A	30.7	
KENDALL YOUNG LIBRARY	40892607400005	7-89-26	SW SW EXC LT & EXC E12.25 A	32.8	
				<b>63.5</b>	<b>4.62%</b>
KOESTNER, DONALD D & CHRISTINE	40892618400001	18-89-26	NW SE	40.0	
KOESTNER, DONALD D & CHRISTINE	40892618400002	18-89-26	NE SE	20.8	
				<b>60.8</b>	<b>4.42%</b>
KOESTNER, JOHN WILLIAM & KATHLEEN A	40892618400003	18-89-26	SW SE	2.1	0.15%
MCDONALD, KATHERINE C LE ETAL	40892618200001	18-89-26	NW NE	39.0	
O'CONNOR FARM CO	40892618200002	18-89-26	NE NE	32.4	
MCDONALD, KATHERINE C LE ETAL	40892618200003	18-89-26	SW NE	40.0	
O'CONNOR FARM CO	40892618200004	18-89-26	SE NE	38.6	
				<b>150.0</b>	<b>10.91%</b>
MOENCK FAMILY FARM 1884 LLC	40892607100003	7-89-26	SW NW	5.9	0.43%
PETERMAN, DANIEL J	40892607300005	7-89-26	SE SW LT IN	2.66	0.19%
SNELL, WARREN LIFE ESTATE ETAL	40892607100004	7-89-26	SE NW	20.6	
SNELL, WARREN LIFE ESTATE ETAL	40892607200003	7-89-26	SW NE	2.7	
				<b>23.3</b>	<b>1.70%</b>

**BENEFITED LANDS SCHEDULE  
PROPOSED MAIN TILE  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

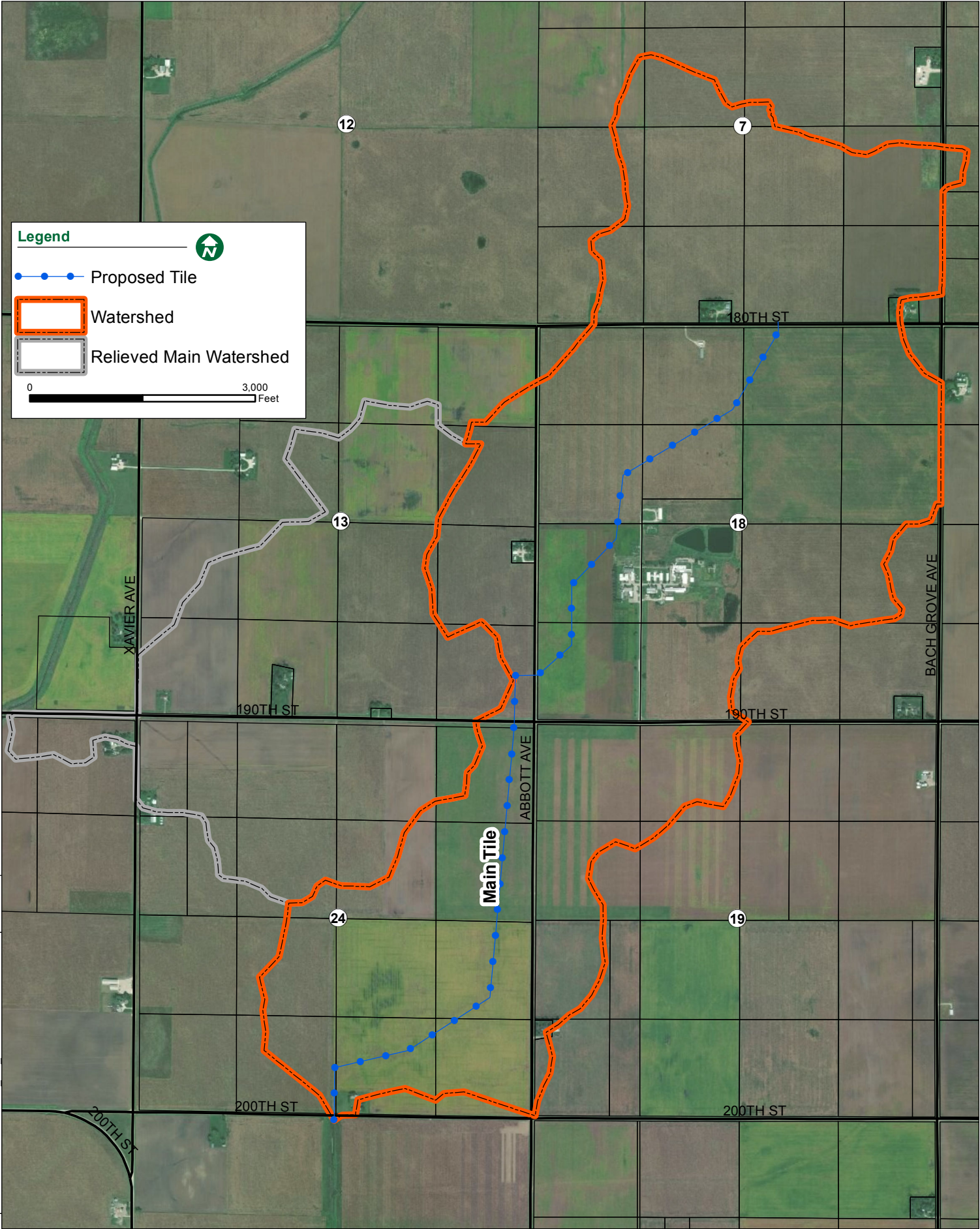
<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
STARK AGRICULTURE INC	40892607300002	7-89-26	NE NW	40.4	
STARK AGRICULTURE INC	40892607300004	7-89-26	SE SW EXC LT	36.34	
STARK AGRICULTURE INC	40892607400001	7-89-26	NW SE	37.3	
STARK AGRICULTURE INC	40892607400003	7-89-26	SW SE	39.0	
				<b>153.04</b>	<b>11.13%</b>
STARK LAND COMPANY	40892618100001	18-89-26	NW NW	34.7	
STARK LAND COMPANY	40892618100002	18-89-26	NE NW	39.0	
STARK LAND COMPANY	40892618100003	18-89-26	SW NW	41.8	
STARK LAND COMPANY	40892618100005	18-89-26	SE NW EXC LT	30.0	
				<b>145.5</b>	<b>10.58%</b>
VANDIEST FAMILY LLC	40892608300001	8-89-26	NW SW N880'	<b>2.8</b>	<b>0.20%</b>
WW SWINE FARMS INC	40892618100006	18-89-26	SE NW AUDITOR PARCEL B	10.0	
WW SWINE FARMS INC	40892618300001	18-89-26	NW SW	41.73	
WW SWINE FARMS INC	40892618300002	18-89-26	NE SW	39.99	
WW SWINE FARMS INC	40892618300003	18-89-26	SW SW	33.4	
WW SWINE FARMS INC	40892618300004	18-89-26	SE SW	10.8	
				<b>135.92</b>	<b>9.89%</b>
ANDERSON JEFFREY	0813400007	13-89-27	NE SE TR 327'X290'	<b>1.96</b>	<b>0.14%</b>
EICH CAROL A TR	0813200004	13-89-27	SE NE	38.0	
EICH CAROL A TR	0813400006	13-89-27	NE SE (EX TR 327' X 290')	37.04	
				<b>75.04</b>	<b>5.46%</b>
GROVES GEORGE N & GALENE M	0813300002	13-89-27	NE SW	36.3	
GROVES GEORGE N & GALENE M	0813300005	13-89-27	SE SW EX IRR TR	34.00	
				<b>70.30</b>	<b>5.11%</b>
HANSCH LEANNA R & HANSCH GERALD L	0823200001	23-89-27	NW NE	4.4	
HANSCH LEANNA R & HANSCH GERALD L	0823200002	23-89-27	NE NE	12.7	
				<b>17.1</b>	<b>1.24%</b>

**BENEFITED LANDS SCHEDULE  
PROPOSED MAIN TILE  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
HJ & AA SNELL FAMILY TRUST	0824100002	24-89-27	NE NW	38.33	
HJ & AA SNELL FAMILY TRUST	0824100004	24-89-27	SE NW	29.6	
HJ & AA SNELL FAMILY TRUST	0824100006	24-89-27	NW NW E1/2	19.16	
HJ & AA SNELL FAMILY TRUST	0824100008	24-89-27	SW NW E1/2	6.1	
				<b>93.19</b>	<b>6.78%</b>
JOHNSON ERNEST R JR & JUDY JANE	0813400003	13-89-27	SW SE E269.50' W724.53' S174'	<b>0.74</b>	<b>0.05%</b>
MICKELSON BETTY JEAN LF EST	0813300006	13-89-27	SE SW IRR TR	<b>4.33</b>	<b>0.32%</b>
MICKELSON LEONARD & NORMA J	0813300001	13-89-27	NW SW	11.2	
MICKELSON LEONARD & NORMA J	0813300003	13-89-27	SW SW	34.9	
				<b>46.1</b>	<b>3.35%</b>
ROYSTER DENNIS & CAROL & ROYSTER DONALD TR	0813100004	13-89-27	SE NW	13.1	
ROYSTER DENNIS & CAROL & ROYSTER DONALD TR	0813200001	13-89-27	NW NE	6.4	
ROYSTER DENNIS & CAROL & ROYSTER DONALD TR	0813200002	13-89-27	NE NE	5.7	
ROYSTER DENNIS & CAROL & ROYSTER DONALD TR	0813200003	13-89-27	SW NE	39.7	
				<b>64.9</b>	<b>4.72%</b>
SNELL ROGER D TRUST NO 1	0824100005	24-89-27	NW NW W1/2	17.3	
SNELL ROGER D TRUST NO 2	0824200007	24-89-27	NW NE	37.1	
SNELL ROGER D TRUST NO 3	0824200008	24-89-27	SW NE	16.2	
				<b>70.6</b>	<b>5.14%</b>
STARK AGRICULTURE INC	0824200003	24-89-27	NE NE	<b>10.8</b>	<b>0.79%</b>
ZEIHAN JOHN	0813400001	13-89-27	NW SE	40.00	
ZEIHAN JOHN	0813400002	13-89-27	SW SE EX E269.50' W724.53' S174'	37.59	
ZEIHAN JOHN	0813400005	13-89-27	SE SE	37.33	
				<b>114.92</b>	<b>8.36%</b>

**BENEFITED LANDS SCHEDULE  
PROPOSED MAIN TILE  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
HAMILTON COUNTY SECONDARY ROADS				13.2	0.96%
WEBSTER COUNTY SECONDARY ROADS				18.0	1.31%
<b>Totals of all Benefiting Lands</b>				<b>1374.6</b>	<b>100.00%</b>



**BENEFITED LANDS SCHEDULE  
PROPOSED ALTERNATIVE MAIN TILE  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
BIRD, JOHN FAMILY LIMITED PARTNERSHIP	40892607300001	7-89-26	NW SW	9.0	
BIRD, JOHN FAMILY LIMITED PARTNERSHIP	40892607300003	7-89-26	SW SW	17.7	
				<b>26.7</b>	<b>1.99%</b>
BURNEY, JASON E & BURNEY, JENNIFER A	40892607400006	7-89-26	SE SE AUDITOR PARCEL B	<b>1.2</b>	<b>0.09%</b>
CHRISTOPHERSON, MARVIN & CHRISTOPHERSON, DONALD	40892619300001	19-89-26	NW SW EXC E12.25 A	24.4	
CHRISTOPHERSON, MARVIN & CHRISTOPHERSON, DONALD	40892619300005	19-89-26	SW SW EXC LT & EXC E12.25 A	3.7	
				<b>28.1</b>	<b>2.09%</b>
CHRISTOPHERSON, MARVIN P & DEBRA J	40892619300004	19-89-26	SW SW LOT IN	<b>1.1</b>	<b>0.08%</b>
KENDALL YOUNG LIBRARY	40892607400002	7-89-26	NE SE	30.7	
KENDALL YOUNG LIBRARY	40892607400005	7-89-26	SE SE EXC LT	32.8	
				<b>63.5</b>	<b>4.73%</b>
KOESTNER, DONALD D & CHRISTINE	40892618400001	18-89-26	NW SE	40.0	
KOESTNER, DONALD D & CHRISTINE	40892618400002	18-89-26	NE SE	20.8	
				<b>60.8</b>	<b>4.53%</b>
KOESTNER, JOHN WILLIAM & KATHLEEN A	40892618400003	18-89-26	SW SE	<b>2.1</b>	<b>0.16%</b>
MCDONALD, KATHERINE C LE ETAL O'CONNOR FARM CO	40892618200001	18-89-26	NW NE	39.0	
MCDONALD, KATHERINE C LE ETAL O'CONNOR FARM CO	40892618200002	18-89-26	NE NE	32.4	
MCDONALD, KATHERINE C LE ETAL O'CONNOR FARM CO	40892618200003	18-89-26	SW NE	40.0	
MCDONALD, KATHERINE C LE ETAL O'CONNOR FARM CO	40892618200004	18-89-26	SE NE	38.6	
				<b>150.0</b>	<b>11.17%</b>

**BENEFITED LANDS SCHEDULE  
PROPOSED ALTERNATIVE MAIN TILE  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
MOENCK FAMILY FARM 1884 LLC	40892607100003	7-89-26	SW NW	5.9	0.44%
PETERMAN, DANIEL J	40892607300005	7-89-26	SE SW LT IN	2.66	0.20%
SNELL, WARREN LIFE ESTATE ETAL	40892607100004	7-89-26	SE NW	20.6	
SNELL, WARREN LIFE ESTATE ETAL	40892607200003	7-89-26	SW NE	2.7	
				<b>23.3</b>	<b>1.74%</b>
STARK AGRICULTURE INC	40892607300002	7-89-26	NE NW	40.4	
STARK AGRICULTURE INC	40892607300004	7-89-26	SE SW EXC LT	36.34	
STARK AGRICULTURE INC	40892607400001	7-89-26	NW SE	37.3	
STARK AGRICULTURE INC	40892607400003	7-89-26	SW SE	39.0	
				<b>153.04</b>	<b>11.40%</b>
STARK LAND COMPANY	40892618100001	18-89-26	NW NW	34.7	
STARK LAND COMPANY	40892618100002	18-89-26	NE NW	39.0	
STARK LAND COMPANY	40892618100003	18-89-26	SW NW	41.8	
STARK LAND COMPANY	40892618100005	18-89-26	SE NW EXC LT	30.0	
STARK LAND COMPANY	40892619100001	19-89-26	NW NW	40.78	
STARK LAND COMPANY	40892619100002	19-89-26	NE NW	33.3	
STARK LAND COMPANY	40892619100003	19-89-26	SW NW	28.6	
STARK LAND COMPANY	40892619100004	19-89-26	SE NW	1.8	
				<b>250.0</b>	<b>18.62%</b>
VANDIEST FAMILY LLC	40892608300001	8-89-26	NW SW N880'	2.8	0.21%
WW SWINE FARMS INC	40892618100006	18-89-26	SE NW AUDITOR PARCEL B	10.0	
WW SWINE FARMS INC	40892618300001	18-89-26	NW SW	41.73	
WW SWINE FARMS INC	40892618300002	18-89-26	NE SW	39.99	
WW SWINE FARMS INC	40892618300003	18-89-26	SW SW	40.69	
WW SWINE FARMS INC	40892618300004	18-89-26	SE SW	38.1	
				<b>170.51</b>	<b>12.70%</b>
ANDERSON JEFFREY	0813400007	13-89-27	NE SE TR 327'X290'	1.96	0.15%
CLAMAN DOUGLAS C	0824400003	24-89-27	SW SE E438' W488' S308'	1.6	0.12%

**BENEFITED LANDS SCHEDULE  
PROPOSED ALTERNATIVE MAIN TILE  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

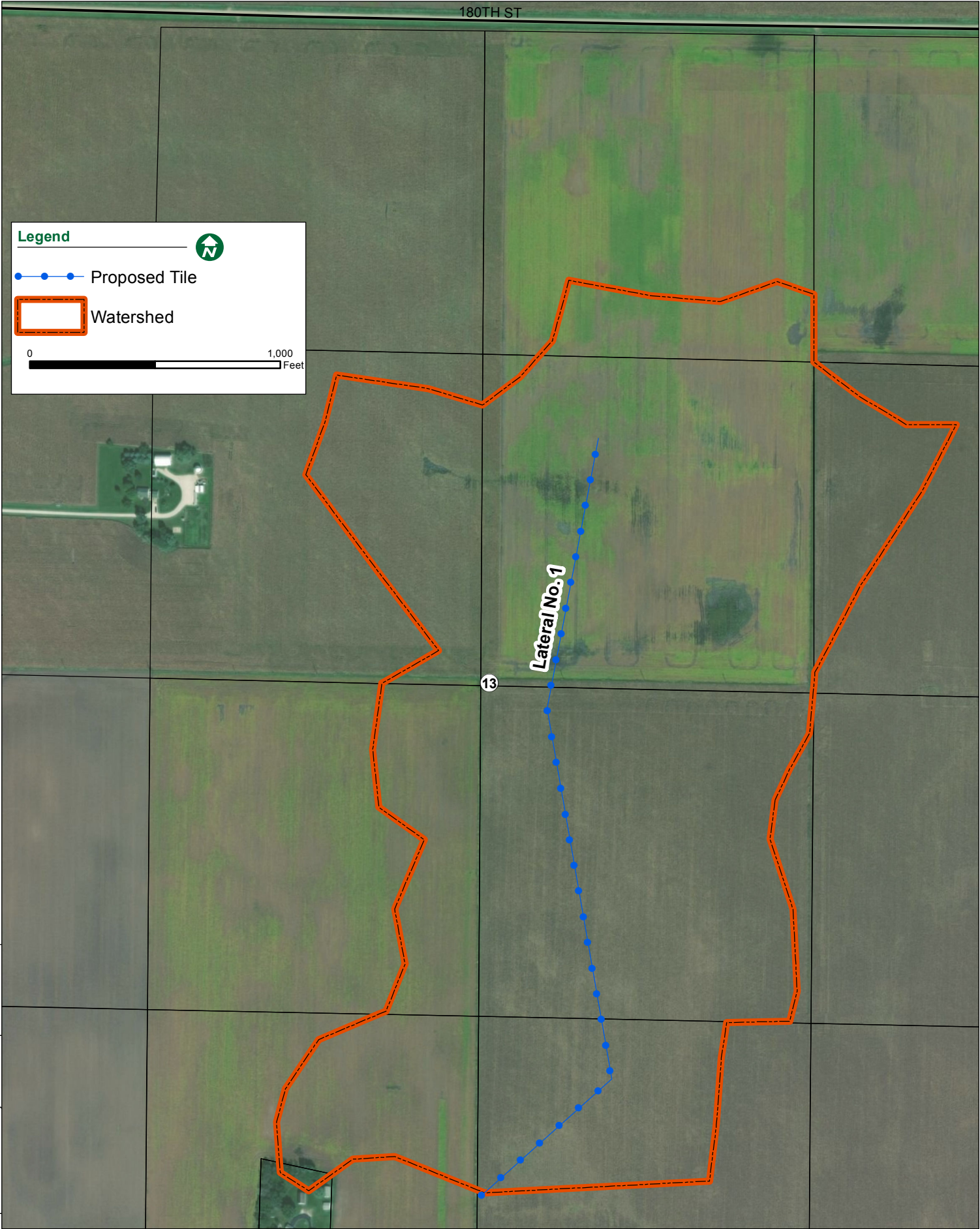
<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
EAKS KYLE LLC	0824400001	24-89-27	NW SE	40.0	
EAKS KYLE LLC	0824400002	24-89-27	NE SE	39.0	
EAKS KYLE LLC	0824400004	24-89-27	SW SE EX E438' W488' S308'	31.1	
EAKS KYLE LLC	0824400005	24-89-27	SE SE	32.2	
				<b>142.3</b>	<b>10.60%</b>
EICH CAROL A TR	0813200004	13-89-27	SE NE	30.5	
EICH CAROL A TR	0813400006	13-89-27	NE SE (EX TR 327' X 290')	37.04	
				<b>67.54</b>	<b>5.03%</b>
HJ & AA SNELL FAMILY TRUST	0824100004	24-89-27	SE NW	4.9	0.37%
ROYSTER DENNIS & CAROL & ROYSTER DONALD TR	0813200002	13-89-27	NE NE	5.7	0.42%
SNELL ROGER D TRUST NO 1	0824200007	24-89-27	NW NE	1.2	
SNELL ROGER D TRUST NO 1	0824200008	24-89-27	SW NE	23.8	
				<b>25.0</b>	<b>1.86%</b>
STARK AGRICULTURE INC	0824200003	24-89-27	NE NE	26.5	
STARK AGRICULTURE INC	0824200006	24-89-27	SE NE	39.0	
				<b>65.5</b>	<b>4.88%</b>
VAN DIEST FAMILY LLC	0824300002	24-89-27	NE SW	25.6	
VAN DIEST FAMILY LLC	0824300004	24-89-27	SE SW	18.8	
				<b>44.4</b>	<b>3.31%</b>
ZEIHAN JOHN	0813400001	13-89-27	NW SE	2.5	
ZEIHAN JOHN	0813400005	13-89-27	SE SE	13.7	
				<b>16.2</b>	<b>1.21%</b>
HAMILTON COUNTY SECONDARY ROADS				<b>19.4</b>	<b>1.45%</b>
WEBSTER COUNTY SECONDARY ROADS				<b>6.2</b>	<b>0.46%</b>
<b>Totals of all Benefiting Lands</b>				<b>1342.39</b>	<b>98.14%</b>

**BENEFITED LANDS SCHEDULE  
PROPOSED ALTERNATIVE MAIN TILE  
RELIEVED EXISTING MAIN  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
EICH CAROL A TR	0813200004	13-89-27	SE NE	7.5	1.52%
GROVES GEORGE N & GALENE M	0813300002	13-89-27	NE SW	36.3	
GROVES GEORGE N & GALENE M	0813300005	13-89-27	SE SW EX IRR TR	34	
				<b>70.3</b>	<b>14.21%</b>
HANSCH LEANNA R & HANSCH GERALD L	0823200001	23-89-27	NW NE	4.4	
HANSCH LEANNA R & HANSCH GERALD L	0823200002	23-89-27	NE NE	12.7	
				<b>17.1</b>	<b>3.46%</b>
HJ & AA SNELL FAMILY TRUST	0824100002	24-89-27	NE NW	38.33	
HJ & AA SNELL FAMILY TRUST	0824100004	24-89-27	SE NW	29.6	
HJ & AA SNELL FAMILY TRUST	0824100006	24-89-27	NW NW E1/2	19.16	
HJ & AA SNELL FAMILY TRUST	0824100008	24-89-27	SW NW E1/2	6.1	
				<b>93.19</b>	<b>18.84%</b>
JOHNSON ERNEST R JR & JUDY JANE	0813400003	13-89-27	SW SE E269.50' W724.53' S174'	0.74	0.15%
MICKELSON BETTY JEAN LF EST	0813300006	13-89-27	SE SW IRR TR	4.33	0.88%
MICKELSON LEONARD & NORMA J	0813300001	13-89-27	NW SW	11.2	
MICKELSON LEONARD & NORMA J	0813300003	13-89-27	SW SW	34.9	
				<b>46.1</b>	<b>9.32%</b>
ROYSER DENNIS & CAROL & ROYSER DONALD TR	0813100004	13-89-27	SE NW	13.1	
ROYSER DENNIS & CAROL & ROYSER DONALD TR	0813200001	13-89-27	NW NE	6.4	
ROYSER DENNIS & CAROL & ROYSER DONALD TR	0813200003	13-89-27	SW NE	39.7	
				<b>59.2</b>	<b>11.97%</b>
SNELL ROGER D TRUST NO 1	0824100005	24-89-27	NW NW W1/2	17.3	
SNELL ROGER D TRUST NO 1	0824200007	24-89-27	NW NE	37.1	
SNELL ROGER D TRUST NO 1	0824200008	24-89-27	SW NE	16.2	
				<b>70.6</b>	<b>14.27%</b>

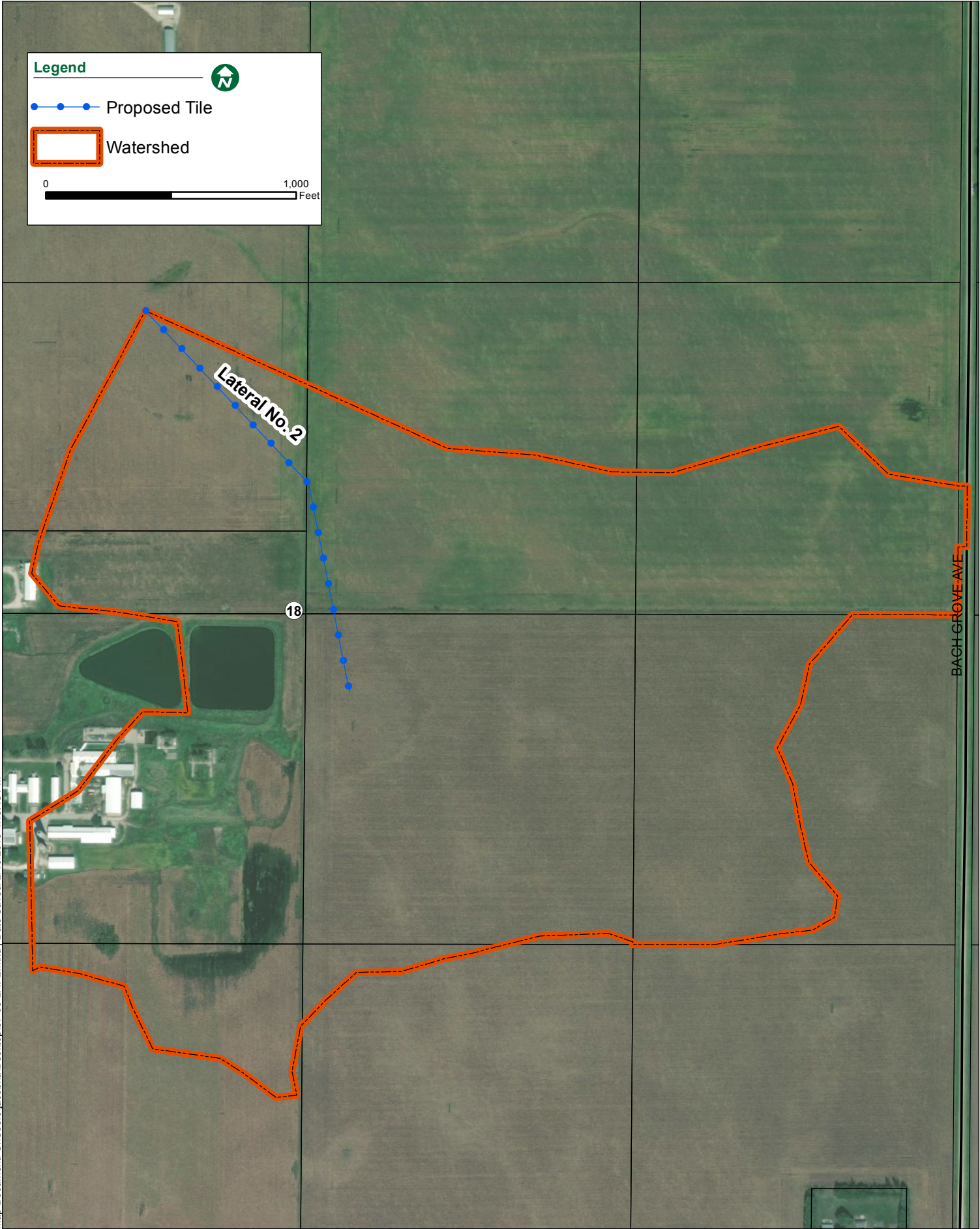
**BENEFITED LANDS SCHEDULE  
PROPOSED ALTERNATIVE MAIN TILE  
RELIEVED EXISTING MAIN  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON AND WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
STARK AGRICULTURE INC	0824200003	24-89-27	NE NE	10.8	2.18%
ZEIHAN JOHN	0813400001	13-89-27	NW SE	37.5	
ZEIHAN JOHN	0813400002	13-89-27	SW SE EX E269.50' W724.53' S174'	37.59	
ZEIHAN JOHN	0813400005	13-89-27	SE SE	23.6	
				<b>98.69</b>	<b>19.95%</b>
WEBSTER COUNTY SECONDARY ROADS				16.2	3.27%
<b>Totals of all Benefiting Lands</b>				<b>494.75</b>	<b>100.00%</b>



**BENEFITED LANDS SCHEDULE  
PROPOSED LATERAL NO. 1  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
EICH CAROL A TR	0813200004	13-89-27	SE NE	7.5	5.36%
GROVES GEORGE N & GALENE M	0813300002	13-89-27	NE SW	10.5	
GROVES GEORGE N & GALENE M	0813300005	13-89-27	SE SW EX IRR TR	10.1	
				<b>20.6</b>	<b>14.72%</b>
MICKELSON BETTY JEAN LF EST	0813300006	13-89-27	SE SW IRR TR	0.3	0.21%
ROYSTER DENNIS & CAROL & ROYSTER DONALD TR	0813100004	13-89-27	SE NW	13.1	
ROYSTER DENNIS & CAROL & ROYSTER DONALD TR	0813200001	13-89-27	NW NE	6.4	
ROYSTER DENNIS & CAROL & ROYSTER DONALD TR	0813200003	13-89-27	SW NE	39.7	
				<b>59.2</b>	<b>42.32%</b>
ZEIHAN JOHN	0813400001	13-89-27	NW SE	37.6	
ZEIHAN JOHN	0813400002	13-89-27	SW SE EX E269.50' W724.53' S174'	14.7	
				<b>52.3</b>	<b>37.38%</b>
<b>Totals of all Benefiting Lands</b>				<b>139.9</b>	<b>100.00%</b>



**BENEFITED LANDS SCHEDULE  
PROPOSED LATERAL NO. 2  
JOINT DRAINAGE DISTRICT NO. 87-95  
HAMILTON WEBSTER COUNTY, IOWA**

<b>Landowner(s)</b>	<b>Parcel No.</b>	<b>Sec-Twp-Rng</b>	<b>Description</b>	<b>Benefited Acres</b>	<b>Percent of Total Benefiting Area</b>
KOESTNER, DONALD D & CHRISTINE	892618400001	18-89-26	NW SE	39.5	
KOESTNER, DONALD D & CHRISTINE	892618400002	18-89-26	NE SE	20.8	
				<b>60.3</b>	<b>38.12%</b>
KOESTNER, JOHN WILLIAM & KATHLEEN A	892618400003	18-89-26	SW SE	<b>2.0</b>	<b>1.26%</b>
MCDONALD, KATHERINE C LE ETAL O'CONNOR FARM CO	892618200003	18-89-26	SW NE	20.9	
MCDONALD, KATHERINE C LE ETAL O'CONNOR FARM CO	892618200004	18-89-26	SE NE	17.9	
				<b>38.8</b>	<b>24.53%</b>
STARK LAND COMPANY	892618100005	18-89-26	SE NW EXC LT	<b>15.4</b>	<b>9.73%</b>
WW SWINE FARMS INC	892618100006	18-89-26	SE NW AUDITOR PARCEL B	7.9	
WW SWINE FARMS INC	892618300002	18-89-26	NE SW	25.2	
WW SWINE FARMS INC	892618300004	18-89-26	SE SW	8.6	
				<b>41.7</b>	<b>26.36%</b>
<b>Totals of all Benefiting Lands</b>				<b>158.2</b>	<b>100.00%</b>

## Appendix C: Engineer's Opinion of Probable Cost

**Engineer's Opinion of Probable Cost  
Proposed Drainage Improvements  
Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
2019**

**Construction Division 1--Lower Main Tile on Private Lands**

<b>Item</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Total</b>
100	Outlet Shaping and Seeding	LS	1	\$5,000	\$5,000
101	Riprap, IDOT Class D	TN	20	\$50	\$1,000
102	CI III R.C.P., 36" Dia.	LF	7,368	\$70	\$515,760
103	CI III R.C.P., 12" Dia.	LF	73	\$30	\$2,190
104	36" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	5	\$992	\$4,960
105	24" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	1	\$629	\$629
106	36" Dia., R.C.P. Elbow Section, Fabrication Only	EA	9	\$765	\$6,885
107	30" Dia., R.C.P. Reducer, Fabrication Only	EA	1	\$535	\$535
108	Lateral Tile Connections, 10" Dia. or Smaller	EA	25	\$250	\$6,250
109	Lateral Tile Connections, 12" Dia. or Larger	EA	5	\$400	\$2,000
110	Tile Trench Stabilization and Cradling Rock	TN	135	\$25	\$3,375
111	Administration of Erosion Management Plan	LS	1	\$1,000	\$1,000
112	Spot Tile Exploration	HR	8	\$200	\$1,600
113	Mobilization	LS	1	\$45,500	\$45,500

**Estimated Lower Main Subtotal      \$597,000**

**Construction Division 1--Upper Main Tile on Private Lands**

<b>Item</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Total</b>
114	CI III R.C.P., 30" Dia.	LF	4,200	\$50	\$210,000
115	CI III R.C.P., 24" Dia.	LF	1,884	\$40	\$75,360
116	CI III R.C.P., 12" Dia.	LF	288	\$30	\$8,640
117	30" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	4	\$835	\$3,340
118	24" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	3	\$629	\$1,887
119	15" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	2	\$448	\$896
120	30" Dia., R.C.P. Elbow Section, Fabrication Only	EA	10	\$595	\$5,950
121	24" Dia., R.C.P. Elbow Section, Fabrication Only	EA	2	\$470	\$940
122	24" Dia., R.C.P. End Cap, Fabrication Only	EA	1	\$390	\$390
123	Lateral Tile Connections, 10" Dia. or Smaller	EA	15	\$250	\$3,750
124	Lateral Tile Connections, 12" Dia. or Larger	EA	4	\$400	\$1,600
125	Tile Trench Stabilization and Cradling Rock	TN	115	\$25	\$2,875
126	Spot Tile Exploration	HR	6	\$150	\$900

**Estimated Upper Main Subtotal      \$317,000**

**Engineer's Opinion of Probable Cost  
Proposed Drainage Improvements  
Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
2019**

**Construction Division 2--Lateral 1 Tile on Private Lands**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
200	CI III R.C.P., 12" Dia.	LF	3,300	\$30	\$99,000
201	12" Dia., R.C.P. Elbow Section, Fabrication Only	EA	3	\$355	\$1,065
202	12" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	1	\$418	\$418
203	12" Dia., R.C.P. End Cap, Fabrication Only	EA	1	\$390	\$390
204	Lateral Tile Connections, 10" Dia. or Smaller	EA	11	\$250	\$2,750
205	Lateral Tile Connections, 12" Dia. or Larger	EA	2	\$400	\$800
206	Tile Trench Stabilization and Cradling Rock	TN	59	\$25	\$1,475
207	Spot Tile Exploration	HR	3	\$150	\$450
208	Mobilization	LS	1	\$4,000	\$4,000

**Estimated Division 2 Subtotal      \$110,000**

**Construction Division 3--Lateral 2 Tile on Private Lands**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
300	CI III R.C.P., 18" Dia.	LF	1,800	\$35	\$63,000
301	18" Dia., R.C.P. Elbow Section, Fabrication Only	EA	1	\$390	\$390
302	18" Dia., R.C.P. End Cap, Fabrication Only	EA	1	\$390	\$390
303	Lateral Tile Connections, 10" Dia. or Smaller	EA	7	\$250	\$1,750
304	Lateral Tile Connections, 12" Dia. or Larger	EA	1	\$400	\$400
305	Tile Trench Stabilization and Cradling Rock	TN	35	\$25	\$875
306	Spot Tile Exploration	HR	2	\$150	\$300
307	Mobilization	LS	1	\$2,500	\$2,500

**Estimated Division 3 Subtotal      \$70,000**

**Engineer's Opinion of Probable Cost  
Proposed Drainage Improvements  
Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
2019**

**Construction Division 4--Secondary Roads Crossings (Webster County)**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
400	CI IV R.C.P., 30" Dia. (Open Cut)	LF	132	\$100	\$13,200
401	CI IV R.C.P., 36" Dia. (Jack/Bore)	LF	100	\$500	\$50,000
402	IDOT Gradation 11, Class A Roadstone	TN	100	\$25	\$2,500
403	Geogird	SY	200	\$5	\$1,000
404	Seeding and Fertilizing (Rural)	EA	2	\$500	\$1,000
405	Traffic Control	EA	2	\$500	\$1,000
406	Mobilization	LS	1	\$4,000	\$4,000
<b>Estimated Division 4 Subtotal</b>					<b>\$73,000</b>

**Construction Division 5--Open Cut Secondary Roads Crossings (Hamilton County)**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
500	CI IV R.C.P., 24" Dia.	LF	66	\$90	\$5,940
501	IDOT Gradation 11, Class A Roadstone	TN	50	\$25	\$1,250
502	Geogird	SY	100	\$5	\$500
503	Seeding and Fertilizing (Rural)	EA	1	\$500	\$500
504	Traffic Control	EA	1	\$500	\$500
505	Mobilization	LS	1	\$500	\$500
<b>Estimated Division 5 Subtotal</b>					<b>\$9,000</b>

**Engineer's Opinion of Probable Cost  
Proposed Drainage Improvements  
Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
2019**

	<b>Subtotal of Construction Divisions 1-5</b>	<b><u>\$1,176,000</u></b>
	<b>Construction Contingency</b>	<b><u>\$58,800</u></b>
	<b>Total Estimated Construction Cost</b>	<b>\$1,234,800</b>
	<b>Less Estimated Secondary Roads Construction Costs Paid by Others</b>	<b><u>\$82,000</u></b>
	<b>Total Estimated Assessable Construction Cost</b>	<b>\$1,152,800</b>
Construction Related Damages		
Work Area Rental (61.1 ac)		\$24,400
Other Damages		\$31,000
Basic Engineering Services		
Survey, Study & Report. Meetings & Hearing		\$25,000
Wetland Regulations Administration		\$1,500
Construction Plans, Specifications, & Bid Letting		\$18,000
Construction Engineering Services		\$40,000
Legal Services, Publications, Mailings, Etc..		\$5,000
Finance, Interest & Contingency		<b><u>\$64,900</u></b>
	<b>Total Estimated Assessable Project Cost</b>	<b>\$1,363,000</b>
Estimated Average Cost Per Benefited Acre (1,375 ac)		\$991
Estimated Average Cost Per Acre Per Year (10 years)		\$132
Estimated Average Cost Per Acre Per Year (20 years)		\$81

**Engineer's Opinion of Probable Cost  
Proposed Drainage Improvements  
Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
2019**

**Construction Division 1--Lower Main Tile on Private Lands**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
100	Oulet Shaping and Seeding	LS	1	\$5,000	\$5,000
101	Riprap, IDOT Class D	TN	20	\$50	\$1,000
102	CI III R.C.P., 36" Dia.	LF	4,934	\$70	\$345,380
103	CI III R.C.P., 30" Dia.	LF	2,434	\$50	\$121,700
104	CI III R.C.P., 12" Dia.	LF	240	\$30	\$7,200
105	36" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	2	\$992	\$1,984
106	30" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	2	\$835	\$1,670
107	12" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	3	\$418	\$1,254
108	36" Dia., R.C.P. Elbow Section, Fabrication Only	EA	7	\$765	\$5,355
109	30" Dia., R.C.P. Elbow Section, Fabrication Only	EA	4	\$595	\$2,380
110	30" Dia., R.C.P. Reducer, Fabrication Only	EA	1	\$535	\$535
111	Lateral Tile Connections, 10" Dia. or Smaller	EA	25	\$250	\$6,250
112	Lateral Tile Connections, 12" Dia. or Larger	EA	5	\$400	\$2,000
113	Tile Trench Stabilization and Cradling Rock	TN	135	\$25	\$3,375
114	Administration of Erosion Management Plan	LS	1	\$1,000	\$1,000
115	Spot Tile Exploration	HR	8	\$200	\$1,600
116	Mobilization	LS	1	\$43,500	\$43,500

**Estimated Lower Main Subtotal      \$551,000**

**Construction Division 1--Upper Main Tile on Private Lands**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
117	CI III R.C.P., 30" Dia.	LF	4,200	\$50	\$210,000
118	CI III R.C.P., 24" Dia.	LF	1,884	\$40	\$75,360
119	CI III R.C.P., 12" Dia.	LF	288	\$30	\$8,640
120	30" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	4	\$835	\$3,340
121	24" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	3	\$629	\$1,887
122	15" on XX" Dia. R.C.P. Tee, Fabrication Only	EA	2	\$448	\$896
123	30" Dia., R.C.P. Elbow Section, Fabrication Only	EA	10	\$595	\$5,950
124	24" Dia., R.C.P. Elbow Section, Fabrication Only	EA	2	\$470	\$940
125	24" Dia., R.C.P. End Cap, Fabrication Only	EA	1	\$390	\$390
126	Lateral Tile Connections, 10" Dia. or Smaller	EA	15	\$250	\$3,750
127	Lateral Tile Connections, 12" Dia. or Larger	EA	4	\$400	\$1,600
128	Tile Trench Stabilization and Cradling Rock	TN	115	\$25	\$2,875
129	Spot Tile Exploration	HR	6	\$150	\$900

**Estimated Upper Main Subtotal      \$317,000**

**Engineer's Opinion of Probable Cost  
Proposed Drainage Improvements  
Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
2019**

**Construction Division 2--Lateral 2 Tile on Private Lands**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
200	CI III R.C.P., 18" Dia.	LF	1,800	\$35	\$63,000
201	18" Dia., R.C.P. Elbow Section, Fabrication Only	EA	1	\$390	\$390
202	18" Dia., R.C.P. End Cap, Fabrication Only	EA	1	\$390	\$390
203	Lateral Tile Connections, 10" Dia. or Smaller	EA	7	\$250	\$1,750
204	Lateral Tile Connections, 12" Dia. or Larger	EA	1	\$400	\$400
205	Tile Trench Stabilization and Cradling Rock	TN	35	\$25	\$875
206	Spot Tile Exploration	HR	2	\$150	\$300
207	Mobilization	LS	1	\$3,500	\$3,500

**Estimated Division 2 Subtotal      \$71,000**

**Construction Division 3--Secondary Roads Crossings (Webster County)**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
300	CI IV R.C.P., 36" Dia. (Open Cut)	LF	66	\$120	\$7,920
301	CI IV R.C.P., 30" Dia. (Open Cut)	LF	66	\$100	\$6,600
302	CI IV R.C.P., 30" Dia. (Jack/Bore)	LF	100	\$450	\$45,000
303	IDOT Gradation 11, Class A Roadstone	TN	100	\$25	\$2,500
304	Geogird	SY	200	\$5	\$1,000
305	Seeding and Fertilizing (Rural)	EA	3	\$500	\$1,500
306	Traffic Control	EA	3	\$500	\$1,500
307	Mobilization	LS	1	\$3,500	\$3,500

**Estimated Division 3 Subtotal      \$70,000**

**Construction Division 4--Open Cut Secondary Roads Crossings (Hamilton County)**

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
400	CI IV R.C.P., 24" Dia.	LF	66	\$90	\$5,940
401	IDOT Gradation 11, Class A Roadstone	TN	50	\$25	\$1,250
402	Geogird	SY	100	\$5	\$500
403	Seeding and Fertilizing (Rural)	EA	1	\$500	\$500
404	Traffic Control	EA	1	\$500	\$500
405	Mobilization	LS	1	\$500	\$500

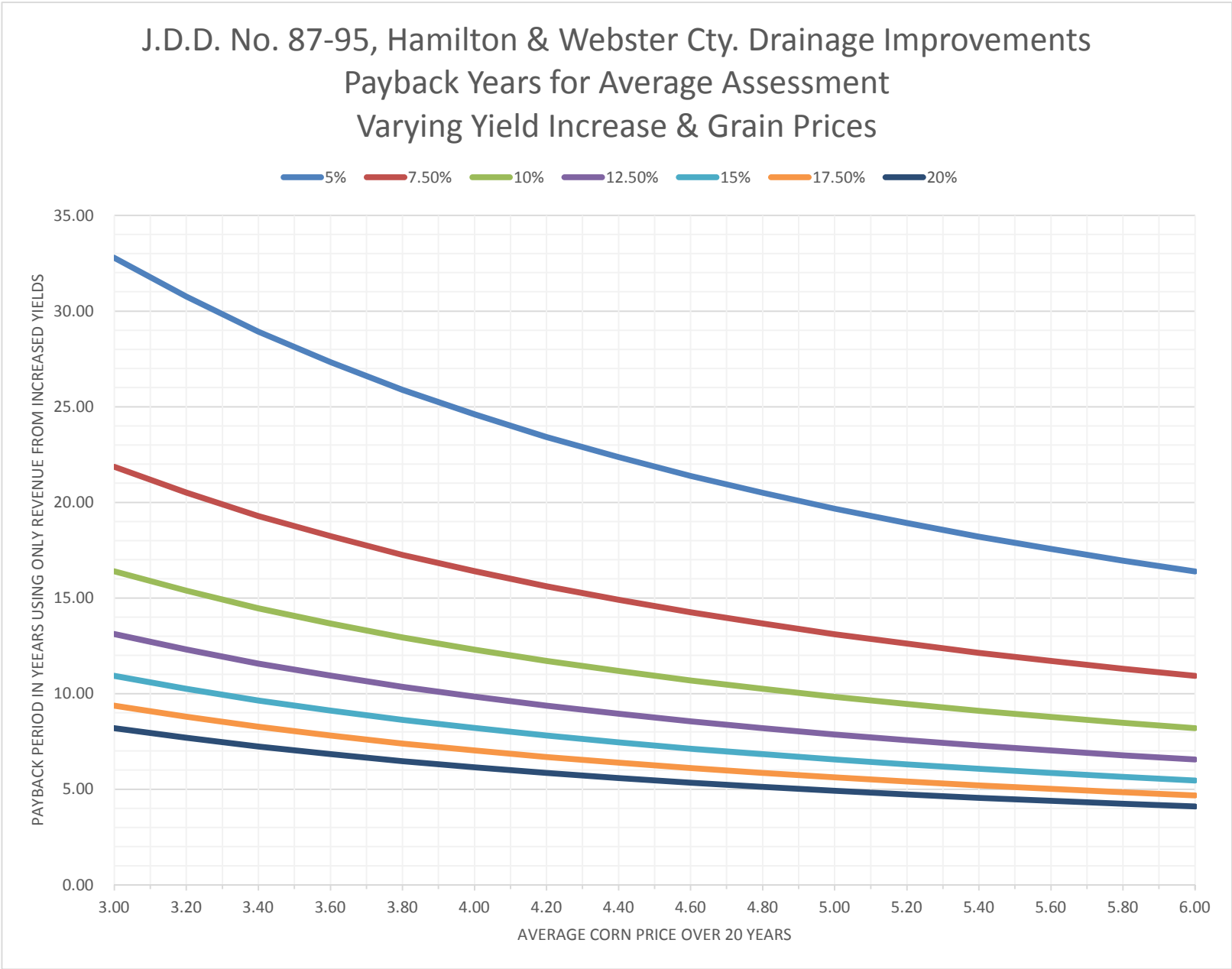
**Estimated Division 4 Subtotal      \$9,000**

**Engineer's Opinion of Probable Cost  
Proposed Drainage Improvements  
Joint Drainage District No. 87-95  
Hamilton & Webster County, Iowa  
2019**

<b>Subtotal of Construction Divisions 1-4</b>		<b><u>\$1,018,000</u></b>
<b>Construction Contingency</b>		<b><u>\$50,900</u></b>
<b>Total Estimated Construction Cost</b>		<b>\$1,068,900</b>
<b>Less Estimated Secondary Roads Construction Costs Paid by Others</b>		<b><u>\$79,000</u></b>
<b>Total Estimated Assessable Construction Cost</b>		<b>\$989,900</b>
Construction Related Damages		
Work Area Rental (53.2 ac)		\$21,300
Other Damages		\$27,000
Basic Engineering Services		
Survey, Study & Report. Meetings & Hearing		\$25,000
Wetland Regulations Administration		\$1,500
Construction Plans, Specifications, & Bid Letting		\$18,000
Construction Engineering Services		\$40,000
Legal Services, Publications, Mailings, Etc..		\$5,000
Finance, Interest & Contingency		<u>\$56,400</u>
<b>Total Estimated Project Cost</b>		<b>\$1,184,000</b>
<b>Less One-Time Payment from JDD 87-95 Relieved Lower Main</b>		<b>\$45,600</b>
<b>Total Estimated Assessable Project Cost</b>		<b>\$1,138,400</b>
Estimated Average Cost Per Benefited Acre (1,343 ac)*		\$848
Estimated Average Cost Per Acre Per Year (10 years)		\$113
Estimated Average Cost Per Acre Per Year (20 years)		\$69

\* Does not Include Relieved Watershed Acres

# Appendix C - Payback Analysis of Drainage District System Replacement Costs



Assumed Rotation CCB: Soybean Price: 260% of Corn.

## Appendix C

This worksheet is based upon one prepared by Dr. Stewart Melvin, ISU Extension Agricultural Engineer, Retired

# Appendix C - Payback Analysis of Drainage District System Replacement Costs

Drainage District:

JDD 87-95

ACRES IN DD	Enter>	1,375	ac
% Corn Acreage	Enter>	63	%
% Soybeans Acreage	Enter>	33	%
% Other (Roads, Etc)		4	%
Base Corn Yield	Enter>	195	bu/a
Base Soybeans Yield	Enter>	57	bu/a

Total Increase in Yield, Corn bu  
Total Increase in Yield, Soybeans bu

Enter Estimated Average Annual Yield Increase Over the Next 20 Years, % (See Footnote)	1.5%
Avg Price of Corn Next 20 Years	\$ 4.02
Avg Price of Soybeans Next 20 Years	\$ 9.72

From Corn

From Soybean

Total

Increased Revenue/acre

Increased Revenue/acre over the anticipated life of the facility (100 years)

Very High Assessment		
\$2,478	per ac	250% of Avg
High Assessment		
\$1,982	per ac	200% of Avg
Above Average Assessment		
\$1,487	per ac	150% of Avg
Average Assessment		
\$991	per ac	100% of Avg
Low Assessment		
\$496	per ac	50% of Avg
Very Low Assessment		
\$248	per ac	25% of Avg

Average Yield Improvement Due to Better Drainage Outlet, %

2.5	5	7.5	10	12.5	15	17.5	20
4,223	8,446	12,669	16,892	21,115	25,338	29,561	33,784
647	1,293	1,940	2,586	3,233	3,880	4,526	5,173

<< The historic annual yield increase for corn in Iowa has been 2.1% since the 1930's, using less is a conservative assumption

Annual Increase in Revenue

\$ 16,976	\$ 33,953	\$ 50,929	\$ 67,905	\$ 84,882	\$ 101,858	\$ 118,834	\$ 135,811
\$ 6,285	\$ 12,570	\$ 18,855	\$ 25,140	\$ 31,424	\$ 37,709	\$ 43,994	\$ 50,279
\$ 23,261	\$ 46,522	\$ 69,784	\$ 93,045	\$ 116,306	\$ 139,567	\$ 162,829	\$ 186,090
\$ 17	\$ 34	\$ 51	\$ 68	\$ 85	\$ 102	\$ 118	\$ 135
\$ 1,692	\$ 3,383	\$ 5,075	\$ 6,767	\$ 8,459	\$ 10,150	\$ 11,842	\$ 13,534

Payback Period For Revenues From Only Yield Increase (Years)

146.4	73.2	48.8	36.6	29.3	24.4	20.9	18.3
117.2	58.6	39.1	29.3	23.4	19.5	16.7	14.6
87.9	43.9	29.3	22.0	17.6	14.6	12.6	11.0
58.6	29.3	19.5	14.6	11.7	9.8	8.4	7.3
29.3	14.6	9.8	7.3	5.9	4.9	4.2	3.7
14.6	7.3	4.9	3.7	2.9	2.4	2.1	1.8
2.5	5	7.5	10	12.5	15	17.5	20

Average Yield Improvement Due to Better Drainage Outlet, %

## Appendix C

This worksheet is based upon one prepared by Dr. Stewart Melvin, ISU Extension Agricultural Engineer, Retired

# Appendix C - Payback Analysis of Drainage District System Replacement Costs

## Drainage District Law Allows For Payment of Assessments in 20 Annual Installments

Assuming a 1.5% annual yield improvement over 20 years for corn currently priced at \$3.43 and soybeans at \$8.28

A <b>very high</b> cost assessment (250% of average) would be paid off in	24.4	years on a 15% average yield increase.
A <b>high</b> cost assessment (200% of average) would be paid off in	23.4	years on a 12.5% average yield increase.
An <b>above avg</b> cost assessment (150% of average) would be paid off in	22.0	years on a 10% average yield increase.
An <b>average</b> cost assessment (100% of average) would be paid off in	19.5	years on a 7.5% average yield increase.
A <b>low</b> cost assessment (50% of average) would be paid off in	14.6	years on a 5% average yield increase.
A <b>very low</b> cost assessment (25% of average) would be paid off in	14.6	years on a 2.5% average yield increase.

## Yield Improvements on 40 acres if Drowned Areas

		Percent Increase over Current Conditions					
		Percent of Average Yield Achieved by Improvements					
Drowned Area ac		50%	60%	70%	80%	90%	100%
	1	1.3%	1.5%	1.8%	2.1%	2.3%	2.6%
	2.5	3.3%	4.0%	4.7%	5.3%	6.0%	6.7%
	5	7.1%	8.6%	10.0%	11.4%	12.9%	14.3%
	7.5	11.5%	13.8%	16.2%	18.5%	20.8%	23.1%
	10	16.7%	20.0%	23.3%	26.7%	30.0%	33.3%
	15	30.0%	36.0%	42.0%	48.0%	54.0%	60.0%

Assumes Avg. Co. Yield on Non-Drowned Area

## Future Prices to Reflect Annual Yield Change Trend

Corn Today	\$3.43	Date
Beans Today	\$8.28	2/25/2019
Price Adj. for Yield Change		
Average Annual Yield Change	CORN 20-Year Avg. Price	SOYBEANS 20-Year Avg Price
0.0%	\$3.43	\$8.28
0.5%	\$3.61	\$8.71
1.0%	\$3.81	\$9.19
1.5%	\$4.02	\$9.72
2.0%	\$4.26	\$10.29
2.5%	\$4.53	\$10.92
3.0%	\$4.81	\$11.62
3.5%	\$5.13	\$12.38

## Existing Farm Yield vs. Potential Farm Yield

		Current Average Corn Yield over Entire Field bu/ac					
Average Field Yield with Improvement bu/ac		90	110	130	150	170	190
	90	0.0%					
	100	11.1%					
	110	22.2%	0.0%				
	120	33.3%	9.1%				
	130	44.4%	18.2%	0.0%			
	140	55.6%	27.3%	7.7%			
	150	66.7%	36.4%	15.4%	0.0%		
	160	77.8%	45.5%	23.1%	6.7%		
	170	88.9%	54.5%	30.8%	13.3%	0.0%	
	180	100.0%	63.6%	38.5%	20.0%	5.9%	
	190	111.1%	72.7%	46.2%	26.7%	11.8%	0.0%
	200	122.2%	81.8%	53.8%	33.3%	17.6%	5.3%

# Appendix C - Payback Analysis of Drainage District System Replacement Costs

## Payback Years for Average Yield Improvements for Range of Average Grain Prices

Proposed Drainage Improvements in Hamilton- Webster County Joint Drainage District No. 87-95

### Assumptions

Long-term Soybean/Corn price ratio is 2.6

Average assessment of \$991/acre

1.5% average annual yield improvement due to causes other than better drainage.

A flat grain price is assumed in this analysis.

### Average Current Grain

#### Price Used Over

#### Payback Period

Corn	Soybeans	Average Yield Response Due to Drainage Improvements						
		5%	7.50%	10%	12.50%	15%	17.50%	20%
3.00	7.80	32.79	21.86	16.39	13.11	10.93	9.37	8.20
3.20	8.32	30.76	20.51	15.38	12.31	10.25	8.79	7.69
3.40	8.84	28.92	19.28	14.46	11.57	9.64	8.26	7.23
3.60	9.36	27.34	18.23	13.67	10.94	9.11	7.81	6.83
3.80	9.88	25.88	17.25	12.94	10.35	8.63	7.39	6.47
4.00	10.40	24.60	16.40	12.30	9.84	8.20	7.03	6.15
4.20	10.92	23.41	15.61	11.71	9.36	7.80	6.69	5.85
4.40	11.44	22.36	14.91	11.18	8.94	7.45	6.39	5.59
4.60	11.96	21.37	14.25	10.69	8.55	7.12	6.11	5.34
4.80	12.48	20.50	13.66	10.25	8.20	6.83	5.86	5.12
5.00	13.00	19.66	13.11	9.83	7.87	6.55	5.62	4.92
5.20	13.52	18.92	12.61	9.46	7.57	6.31	5.40	4.73
5.40	14.04	18.21	12.14	9.10	7.28	6.07	5.20	4.55
5.60	14.56	17.56	11.71	8.78	7.02	5.85	5.02	4.39
5.80	15.08	16.95	11.30	8.47	6.78	5.65	4.84	4.24
6.00	15.60	16.39	10.93	8.19	6.56	5.46	4.68	4.10

### Footnotes:

It is important to note that after it is paid for, the drainage system will continue to foster improved crop yields for more than a century

No credit is given in the above calculations for an immediate increase in land value resulting from the improved productivity

The average annual yield increase is intended to reflect through price adjustment the long term historic yield increase trend rather than to predict future grain price changes. In effect this analysis uses a stagnant current grain price tied to a reliable yield improvement trend. An entry of 0% assumes no average yield improvement or price increase over the next twenty years.

### Appendix C

This worksheet is based upon one prepared by Dr. Stewart Melvin, ISU Extension Agricultural Engineer, Retired

## Proposed Plans

PRELIMINARY PLANS FOR

# TILE IMPROVEMENTS

## JOINT DRAINAGE DISTRICT No. 87-95

HAMILTON & WEBSTER COUNTY, IOWA

2019

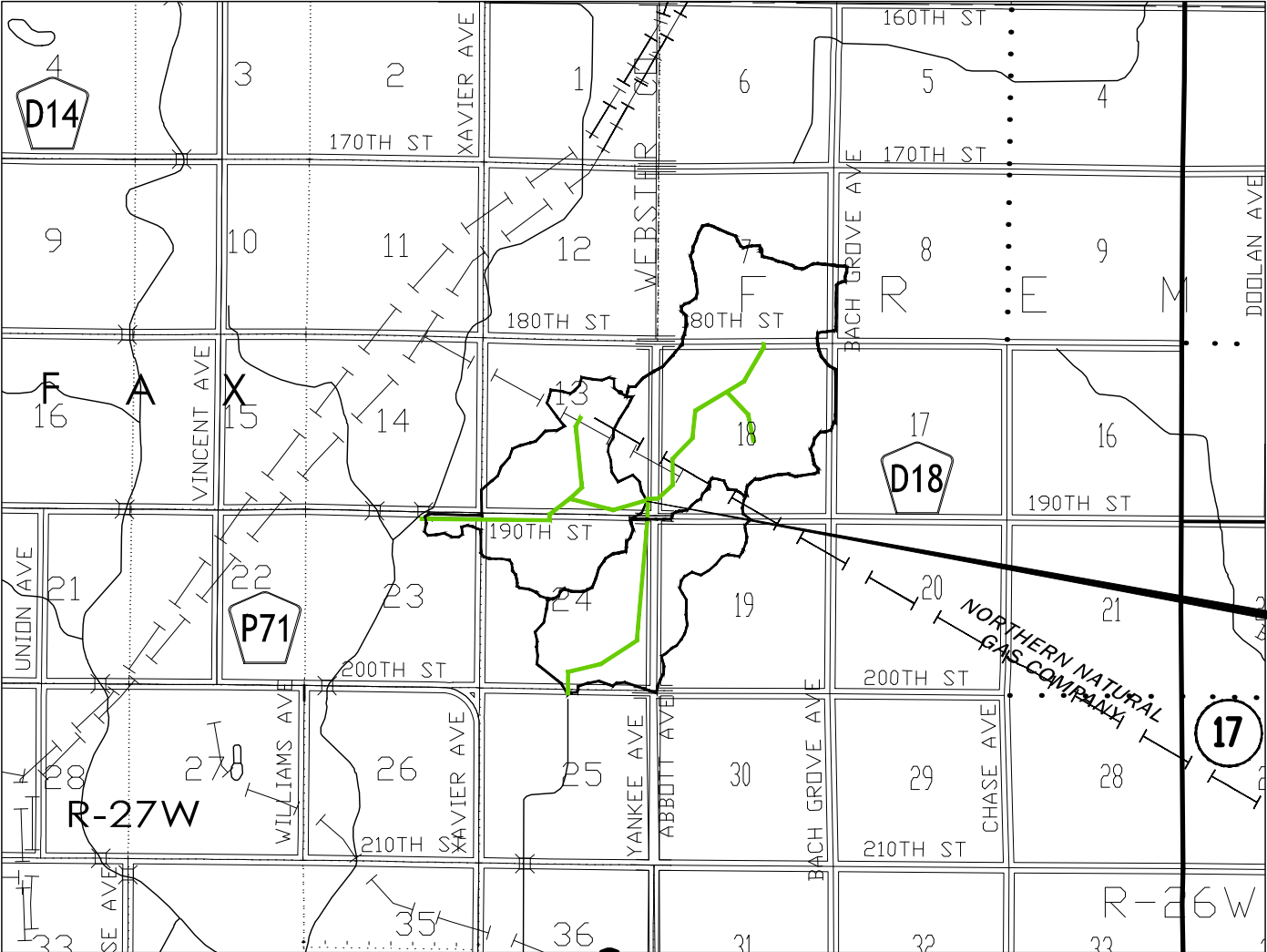
PLAN REVISIONS		
REV	ISSUED FOR	DATE
-	-	-

Sheet List Table	
Sheet Number	Sheet Title
A.01	TITLE SHEET
A.02	LANDOWNERS PLAT
D.01	LOWER MAIN PLAN & PROFILE
D.02	LOWER MAIN PLAN & PROFILE
D.03	LOWER MAIN PLAN & PROFILE
D.04	ALTERNATIVE LOWER MAIN PLAN & PROFILE
D.05	ALTERNATIVE LOWER MAIN PLAN & PROFILE
D.06	ALTERNATIVE LOWER MAIN PLAN & PROFILE
D.07	UPPER MAIN PLAN & PROFILE
D.08	UPPER MAIN PLAN & PROFILE
D.09	UPPER MAIN PLAN & PROFILE
D.10	LATERAL NO. 1 PLAN & PROFILE
D.11	LATERAL NO. 1 PLAN & PROFILE
D.12	LATERAL NO. 2 PLAN & PROFILE
G.01	ALIGNMENT GEOMETRY

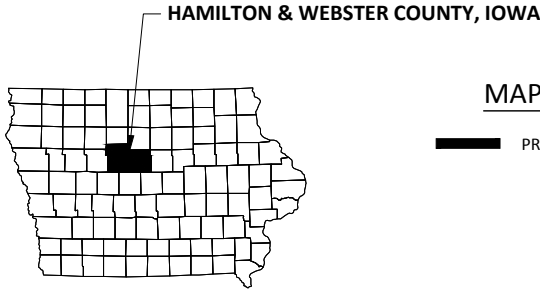


NOTE: THE CONTRACTOR SHALL FIELD VERIFY EXACT LOCATIONS PRIOR TO COMMENCING CONSTRUCTION AS REQUIRED BY STATE LAW. NOTIFY IOWA ONE CALL, 811 OR 1-800-292-8989

THE SUBSURFACE UTILITY INFORMATION IN THIS PLAN IS UTILITY QUALITY LEVEL D. THIS UTILITY QUALITY LEVEL WAS DETERMINED ACCORDING TO THE GUIDELINES OF C/ASCE 38-02, ENTITLED "STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA."

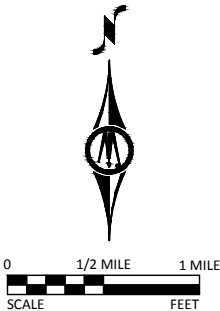


PROJECT LOCATION



MAP LEGEND

PROJECT LIMITS



DRAINAGE DISTRICT NO. 87-95

PROJECT DATUM: STATE PLANE

HORIZONTAL: IOWA NORTH

VERTICAL: NAD 1983

DESIGNED	NO.	ISSUED FOR	DATE
JLH			
DRAWN			
JLH			
CHECKED			
JPR			
CLIENT PROJ. NO.			
P12.117166			

JDD 87-95 TILE IMPROVEMENTS

HAMILTON & WEBSTER COUNTY, IOWA

TITLE SHEET

SHEET

A.01



300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: [Jefferson@bolton-menk.com](mailto:Jefferson@bolton-menk.com)  
[www.bolton-menk.com](http://www.bolton-menk.com)

LEGEND

- PROPOSED TILE ALIGNMENTS
- EXISTING DISTRICT TILE
- PARCEL LINES
- WATERSHED BOUNDARY
- ASSESSMENT BOUNDARY
- PROPOSED ANNEXATION



JDD 4-272 LAT. NO. 7 OPEN DITCH  
BEGIN PROPOSED  
ALTERNATIVE LOWER MAIN

BEGIN PROPOSED  
LOWER MAIN

JDD 4-272 LAT. NO. 1 OPEN DITCH

PROPOSED MAIN TILE

PROPOSED LATERAL NO. 1 TILE

PROPOSED ALTERNATIVE MAIN TILE

PROPOSED LATERAL NO. 2 TILE

© Bolton & Menk, Inc. 2019. All Rights Reserved.  
P:\117166\117166.dwg 3/6/2019 9:33:19 AM



300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: [Jefferson@bolton-menk.com](mailto:Jefferson@bolton-menk.com)  
[www.bolton-menk.com](http://www.bolton-menk.com)

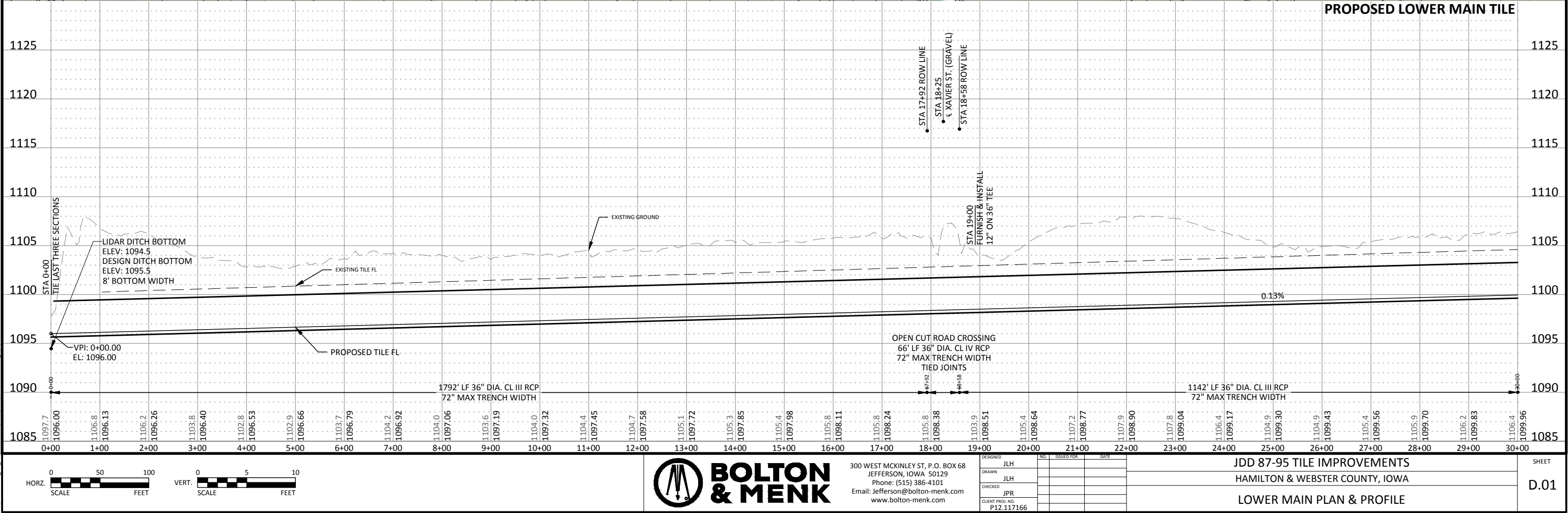
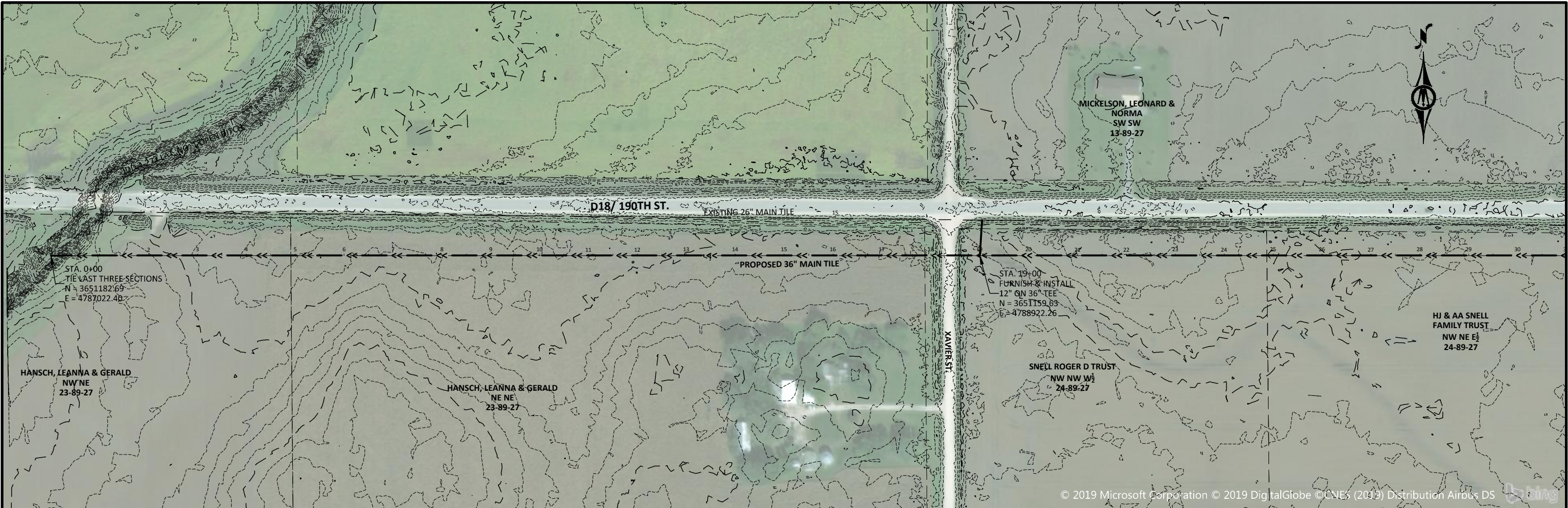
DESIGNED	JLH	NO.	ISSUED FOR	DATE
DRAWN	JLH			
CHECKED	JPR			
CLIENT PROJ. NO.	P12.117166			

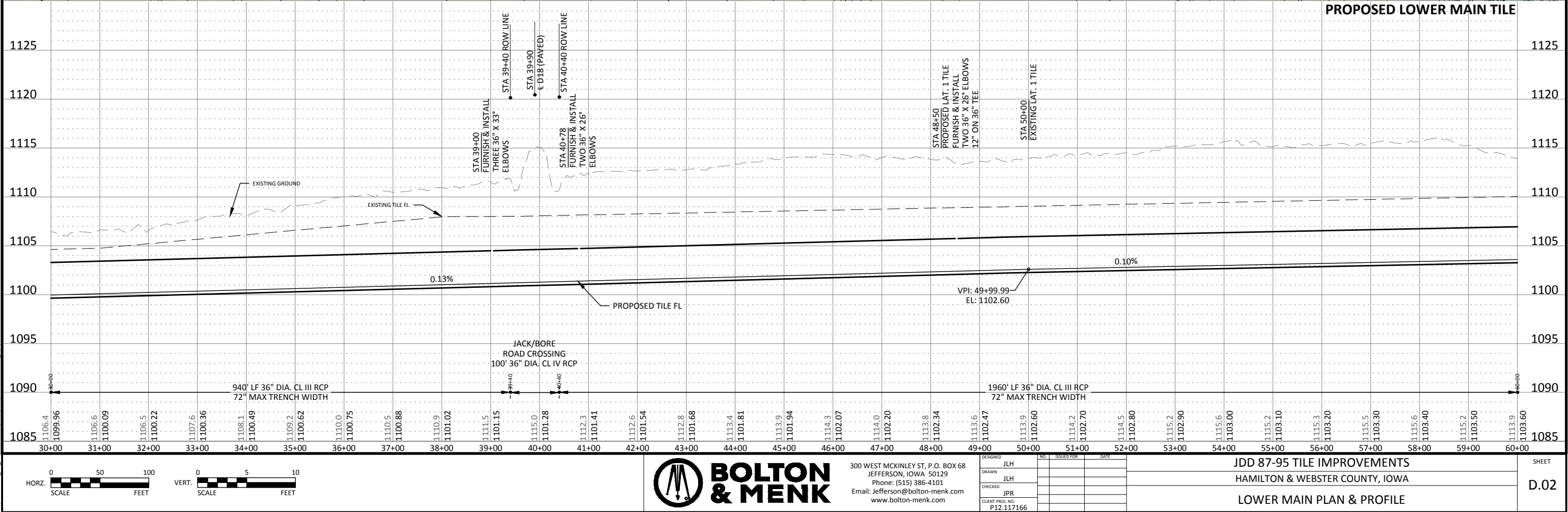
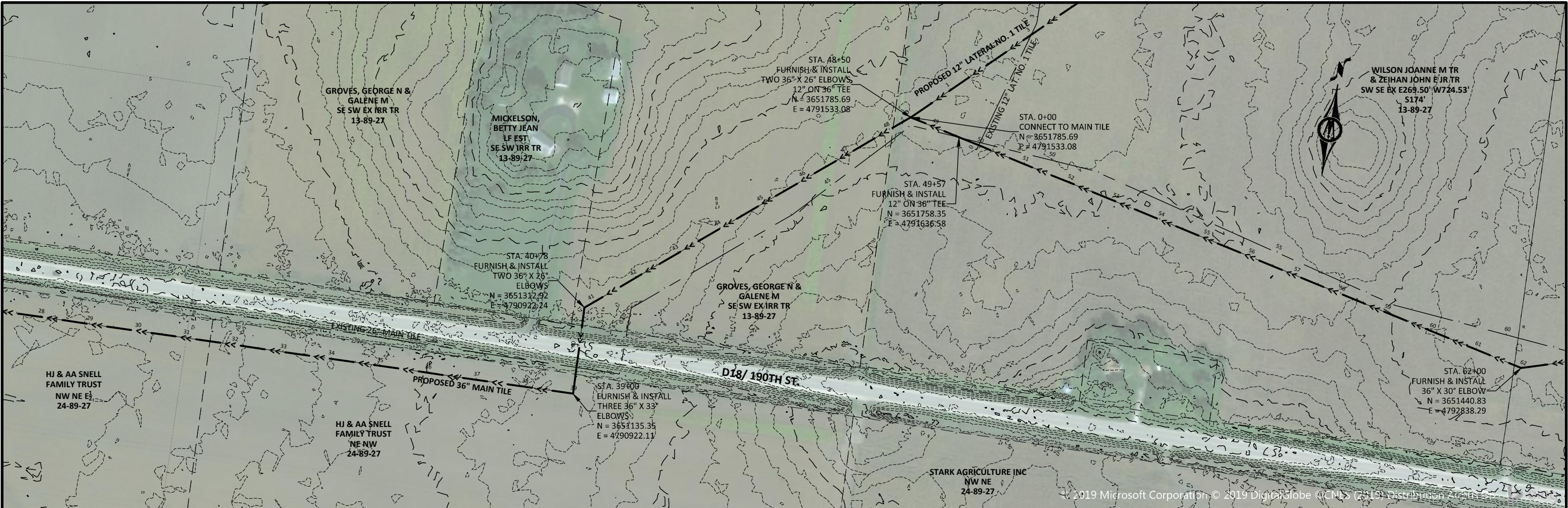
JDD 87-95 TILE IMPROVEMENTS  
HAMILTON & WEBSTER COUNTY, IOWA

LANDOWNER PLAT

SHEET

A.02





© Bolton & Menk, Inc. 2019. All Rights Reserved. 11/17/2019 11:17:16 AM C:\117166\CS0\117166.dwg 3/6/2019 9:31:47 AM

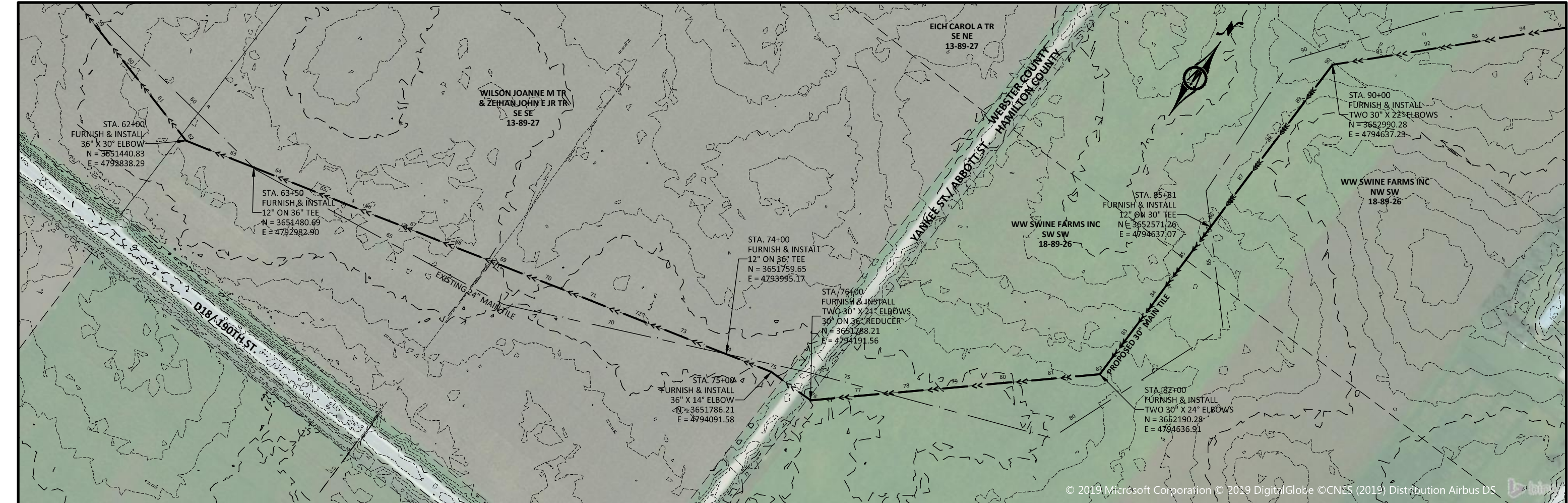


300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: jefferson@bolton-menk.com  
www.bolton-menk.com

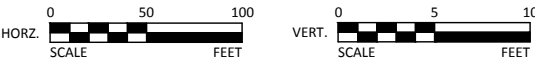
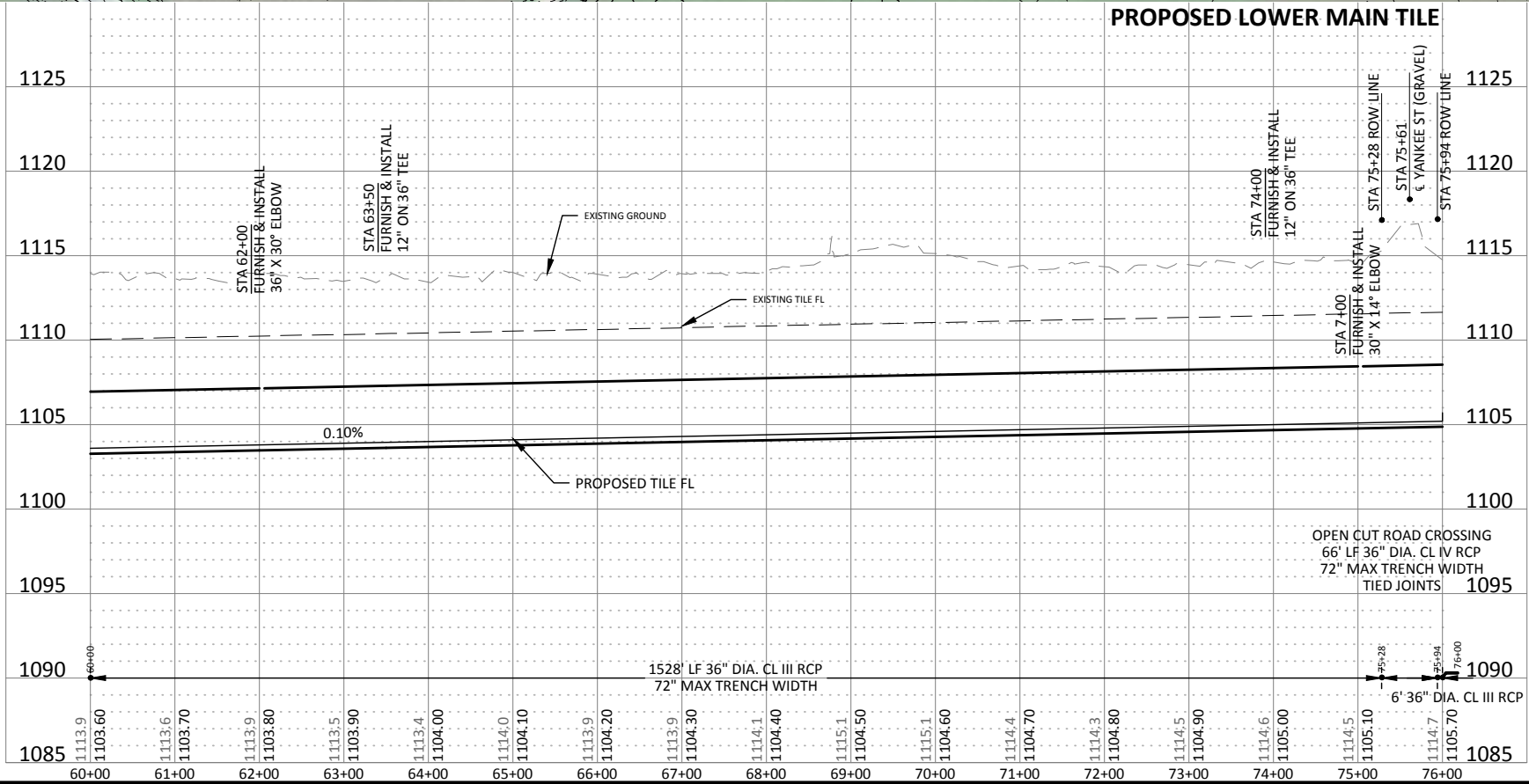
DESIGNED	NO.	ISSUED FOR	DATE
JLH			
DRAWN			
JLH			
CHECKED			
JPR			
CLIENT PROJ. NO.			
P12.117166			

JDD 87-95 TILE IMPROVEMENTS  
HAMILTON & WEBSTER COUNTY, IOWA  
LOWER MAIN PLAN & PROFILE

SHEET  
D.02



© 2019 Microsoft Corporation © 2019 DigitalGlobe © CNES (2019) Distribution Airbus DS



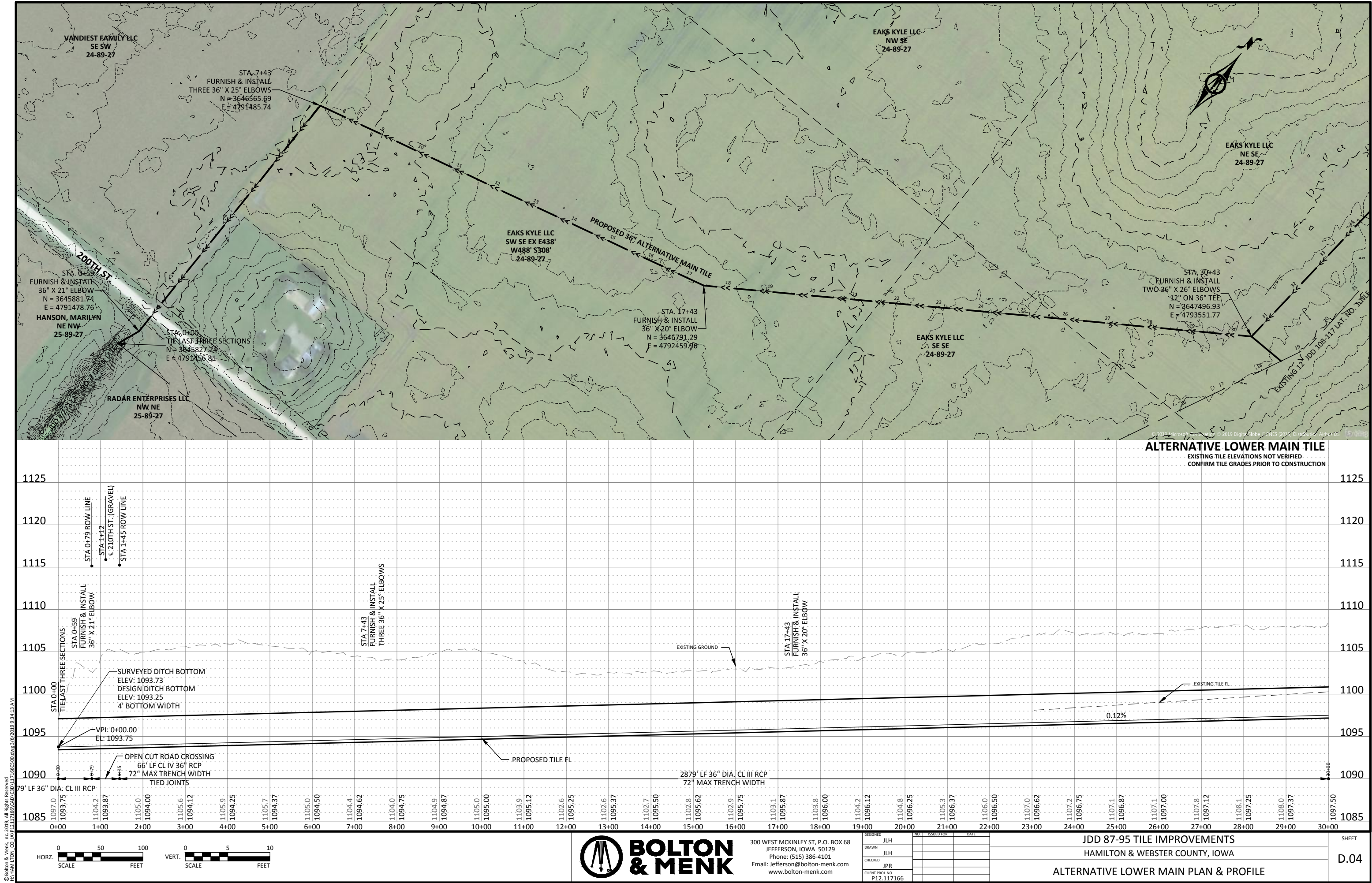
300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: jefferson@bolton-menk.com  
www.bolton-menk.com

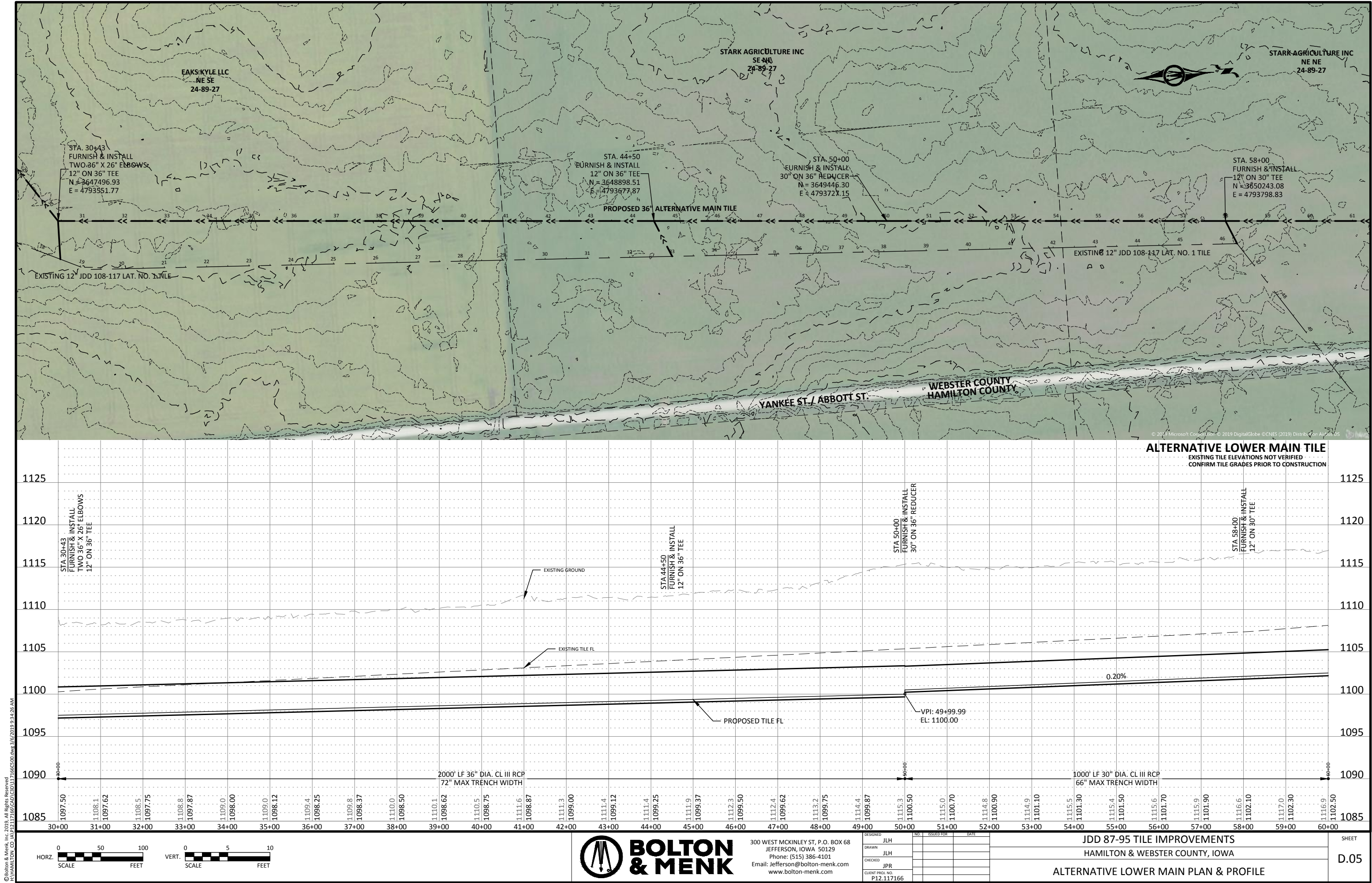
DESIGNED	NO.	ISSUED FOR	DATE
JLH			
DRAWN			
JLH			
CHECKED			
JPR			
CLIENT PROJ. NO.			
P12.117166			

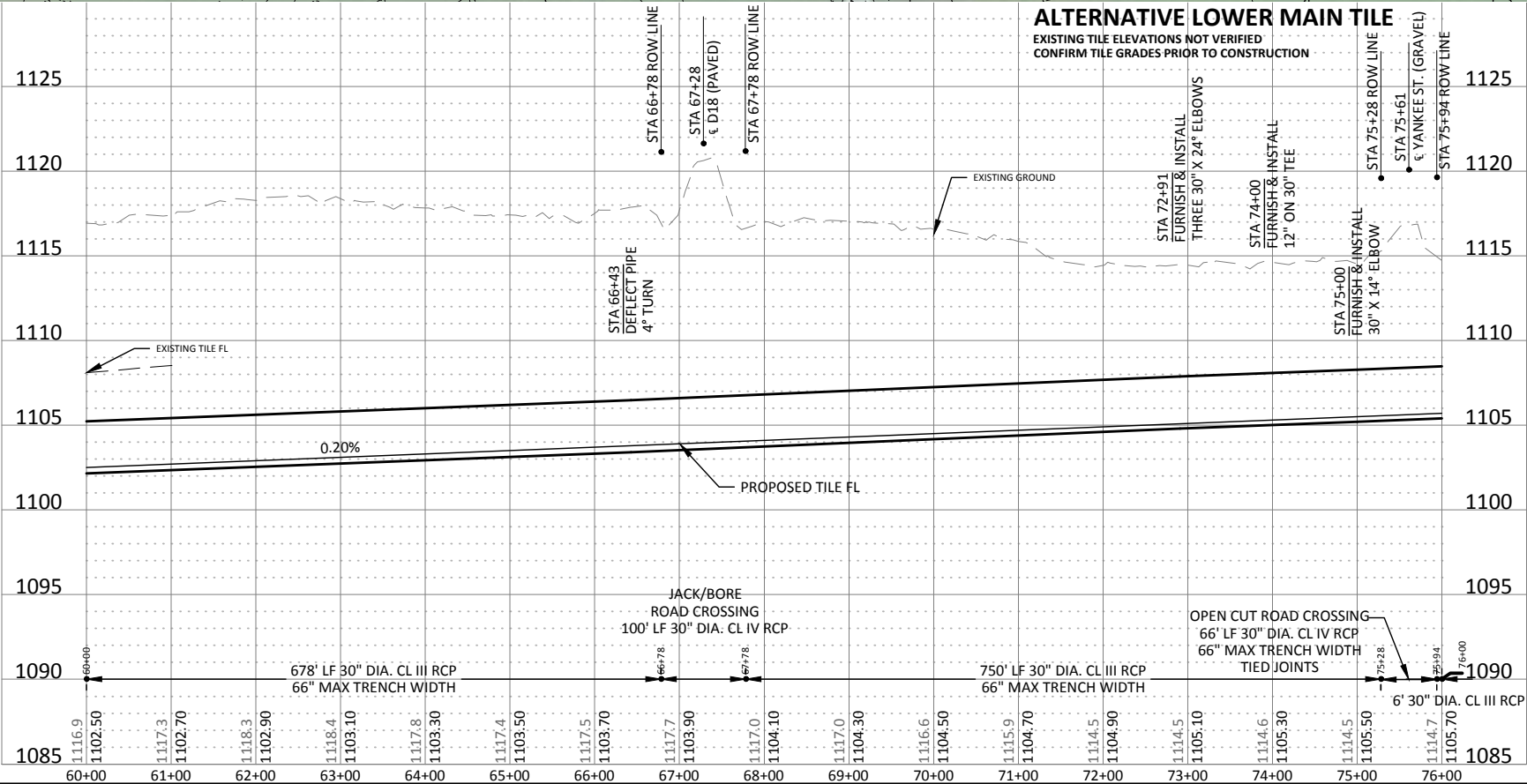
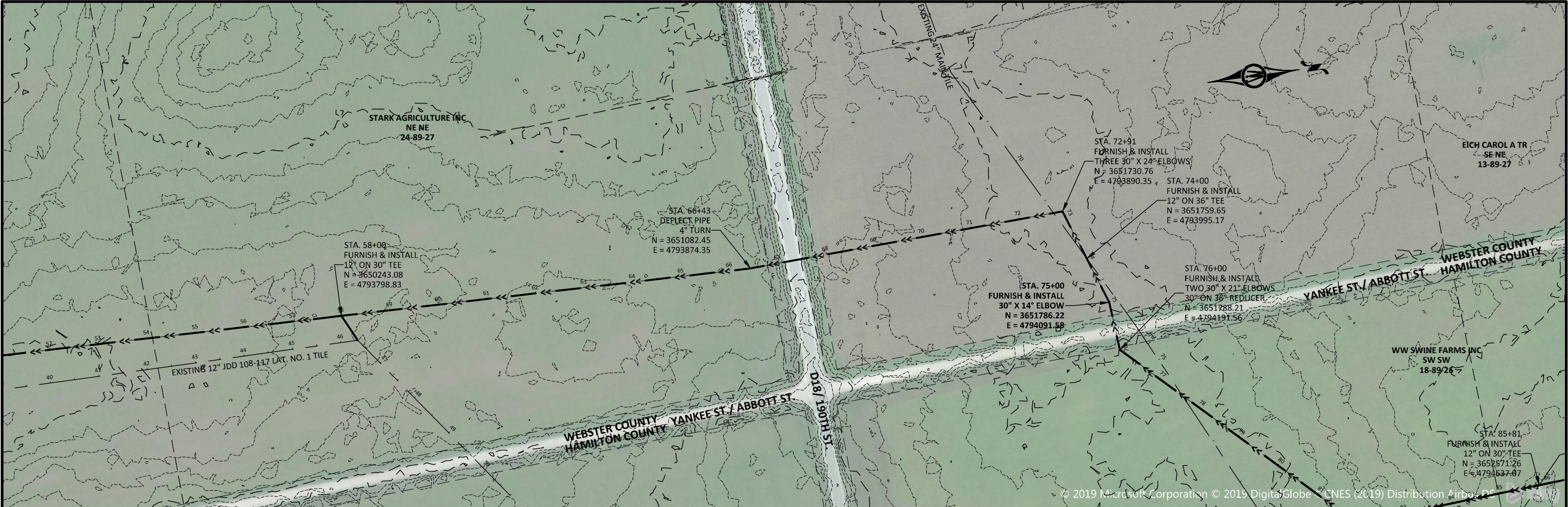
JDD 87-95 TILE IMPROVEMENTS  
HAMILTON & WEBSTER COUNTY, IOWA  
LOWER MAIN PLAN & PROFILE

SHEET

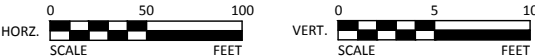
D.03







© Bolton & Menk, Inc. 2019. All Rights Reserved.  
P:\1117166\1117166.dwg 3/6/2019 9:24:35 AM



300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: [Jefferson@bolton-menk.com](mailto:Jefferson@bolton-menk.com)  
[www.bolton-menk.com](http://www.bolton-menk.com)

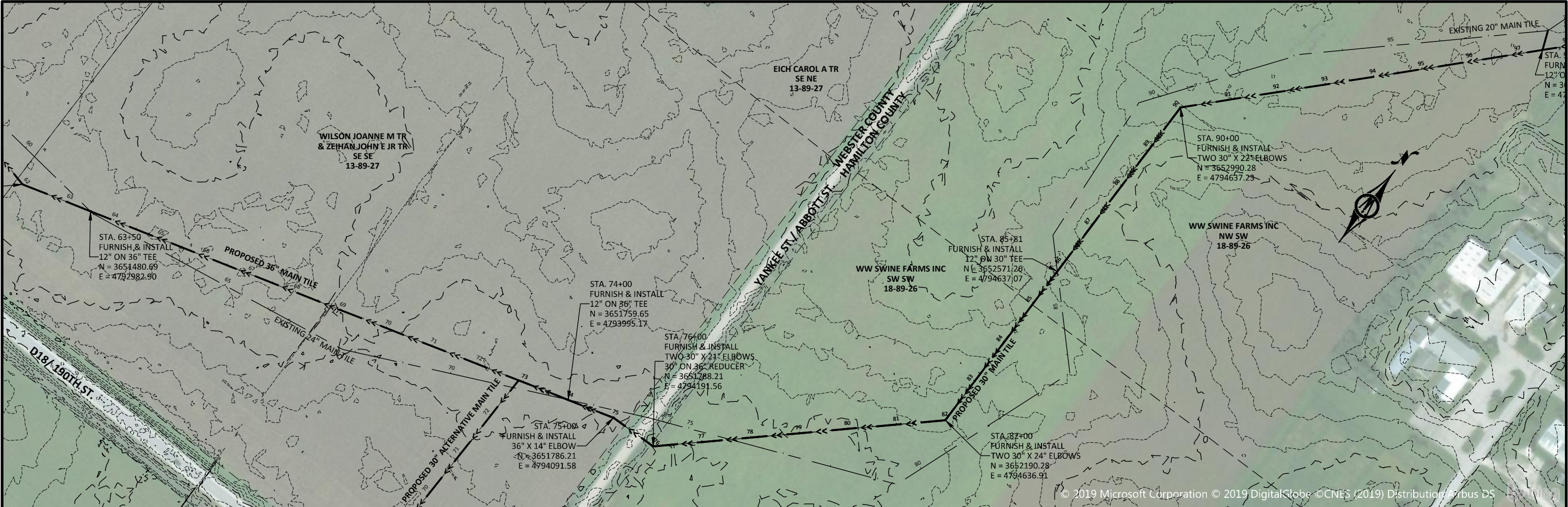
DESIGNED	JLH	NO.	ISSUED FOR	DATE
DRAWN	JLH			
CHECKED	JPR			
CLIENT PROJ. NO.	P12.117166			

JDD 87-95 TILE IMPROVEMENTS  
HAMILTON & WEBSTER COUNTY, IOWA

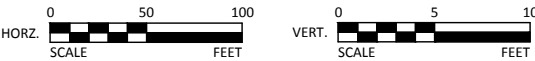
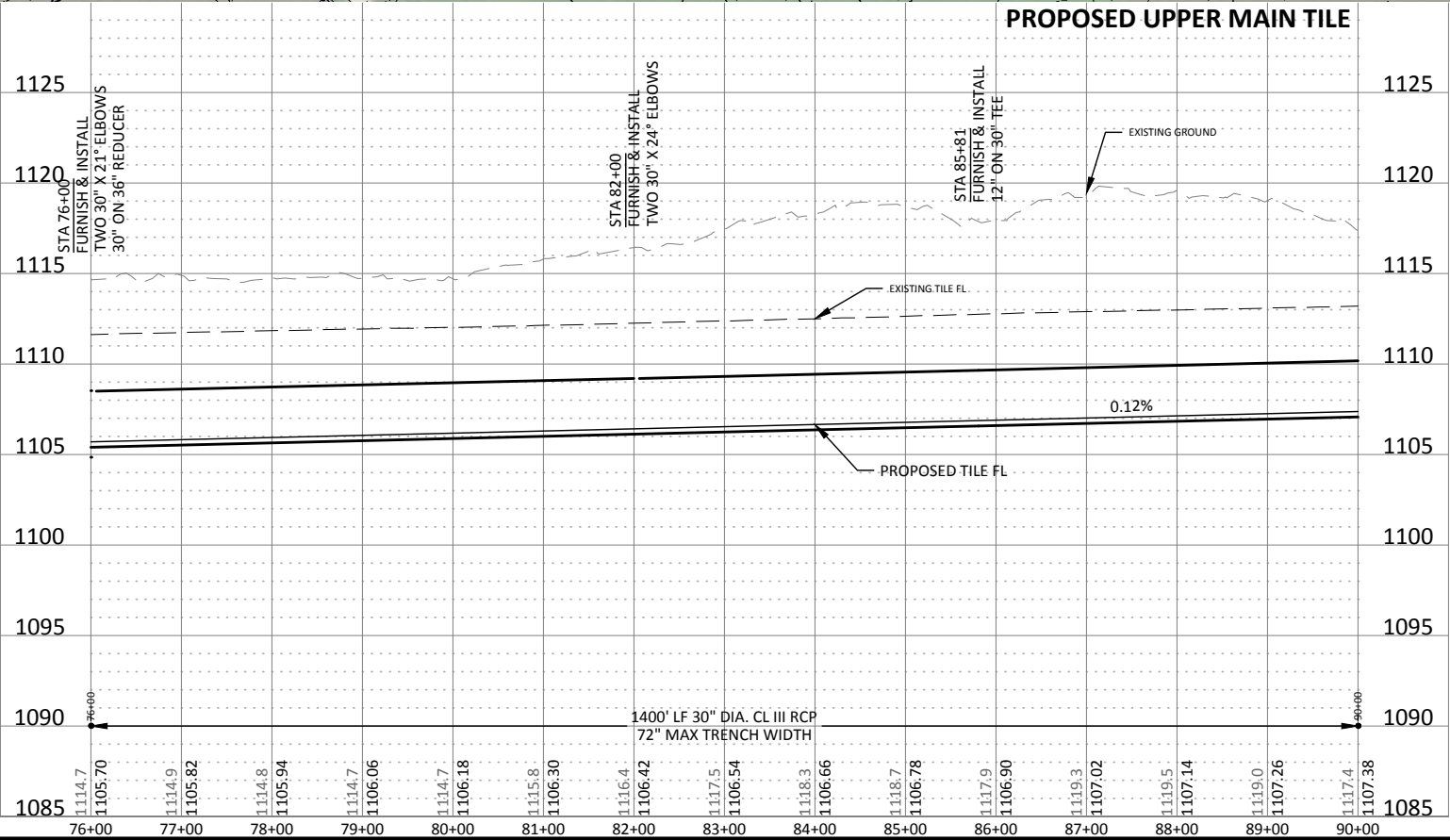
ALTERNATIVE LOWER MAIN PLAN & PROFILE

SHEET

D.06



© 2019 Microsoft Corporation © 2019 DigitalGlobe © CNES (2019) Distribution Airbus DS



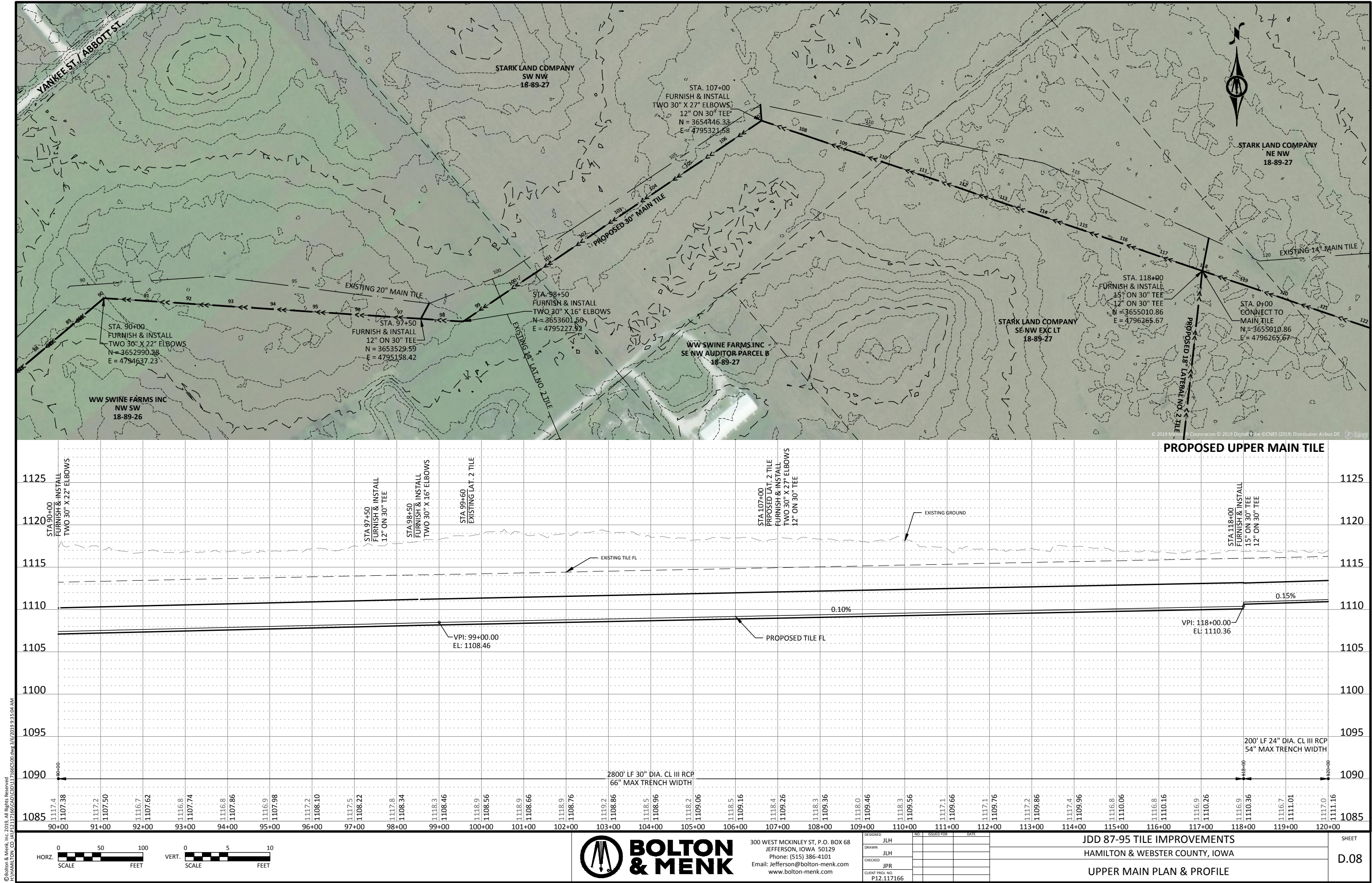
300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: [Jefferson@bolton-menk.com](mailto:Jefferson@bolton-menk.com)  
[www.bolton-menk.com](http://www.bolton-menk.com)

DESIGNED	NO.	ISSUED FOR	DATE
JLH			
DRAWN			
JLH			
CHECKED			
JPR			
CLIENT PROJ. NO.			
P12.117166			

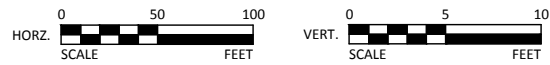
JDD 87-95 TILE IMPROVEMENTS  
HAMILTON & WEBSTER COUNTY, IOWA  
UPPER MAIN PLAN & PROFILE

SHEET

D.07



© Bolton & Menk, Inc. 2019. All Rights Reserved.  
P:\1217166\1217166.dwg 3/6/2019 9:25:04 AM

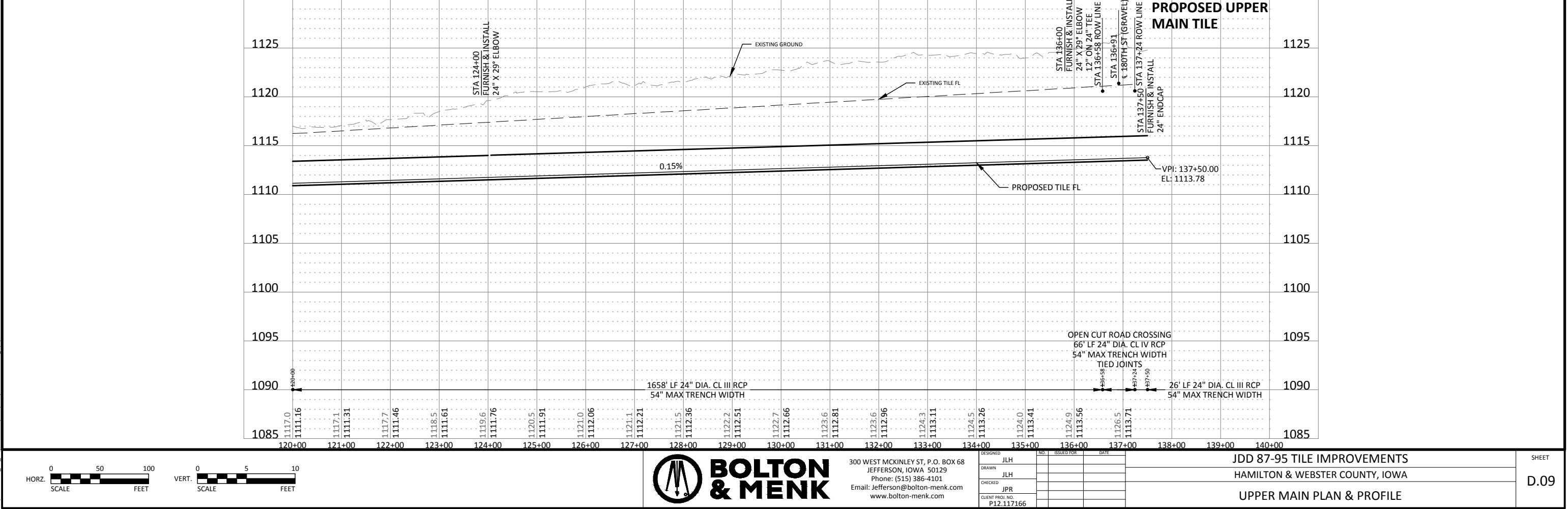
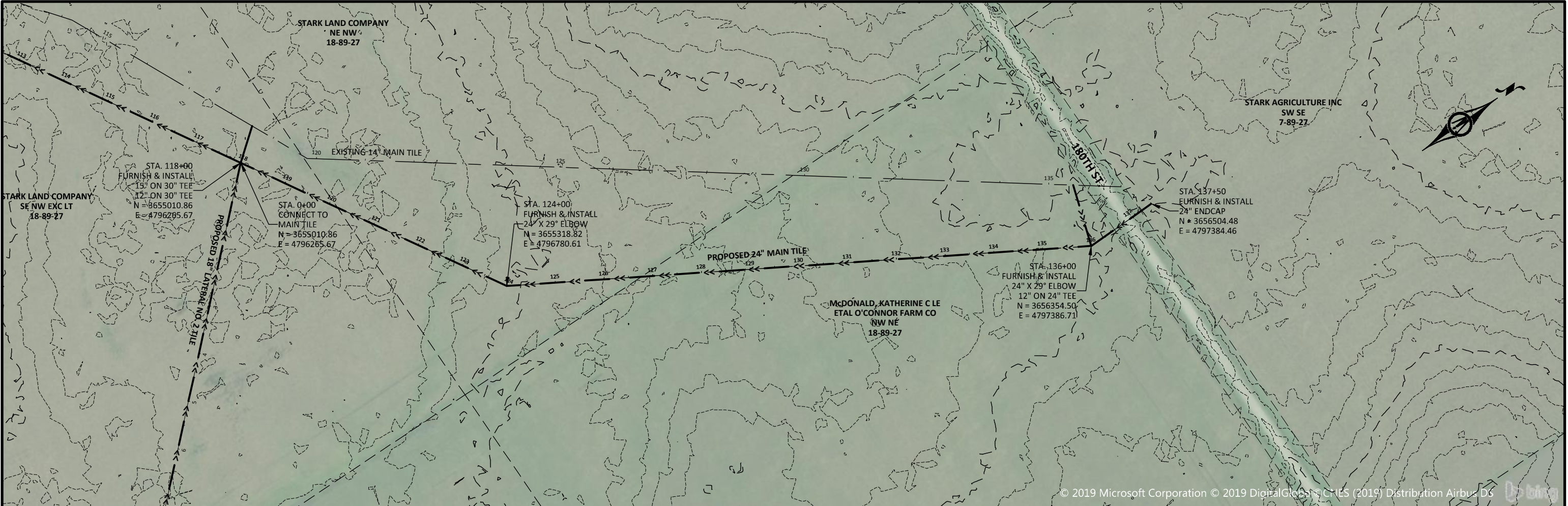


300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: [Jefferson@bolton-menk.com](mailto:Jefferson@bolton-menk.com)  
[www.bolton-menk.com](http://www.bolton-menk.com)

DESIGNED	JLH	NO.	ISSUED FOR	DATE
DRAWN	JLH			
CHECKED	JPR			
CLIENT PROJ. NO.	P12.117166			

JDD 87-95 TILE IMPROVEMENTS  
HAMILTON & WEBSTER COUNTY, IOWA  
UPPER MAIN PLAN & PROFILE

SHEET  
D.08



© Bolton & Menk, Inc. 2019. All Rights Reserved. J:\117166\CAD\3D\117166C3D.dwg 3/6/2019 9:25:17 AM



**BOLTON & MENK**

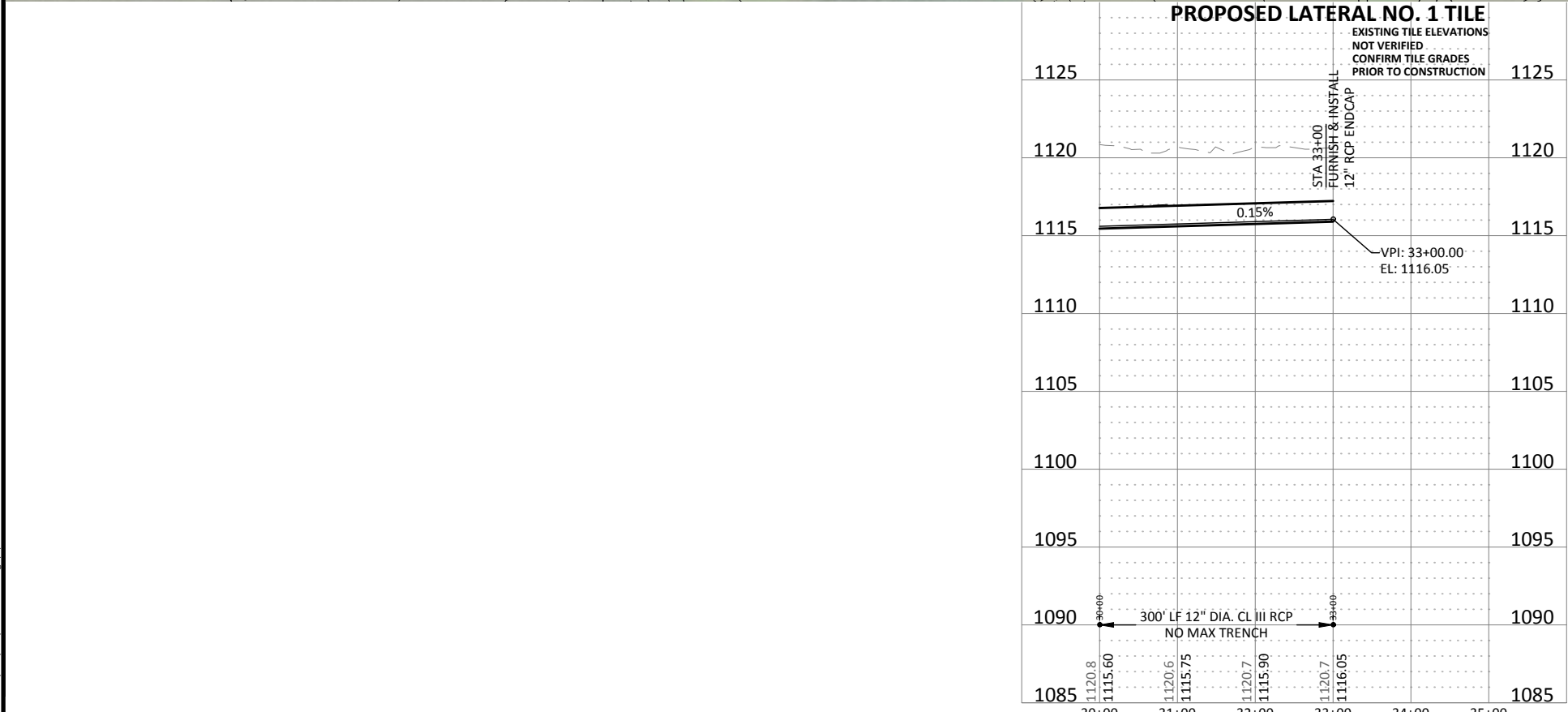
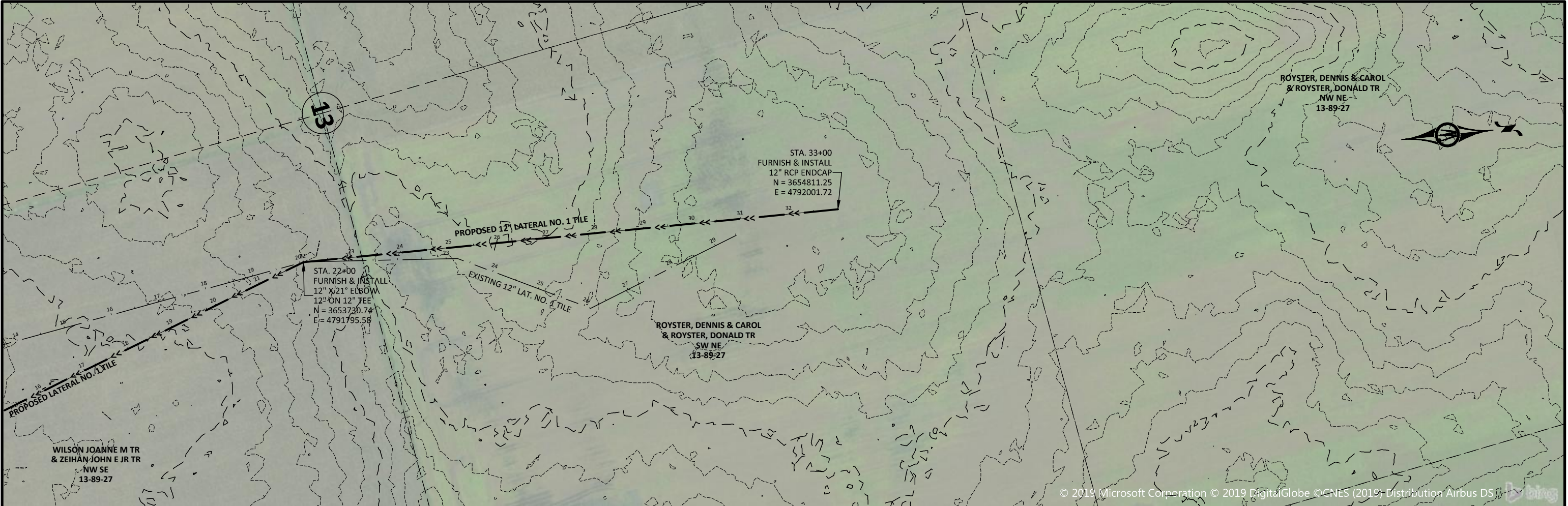
300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: Jefferson@bolton-menk.com  
www.bolton-menk.com

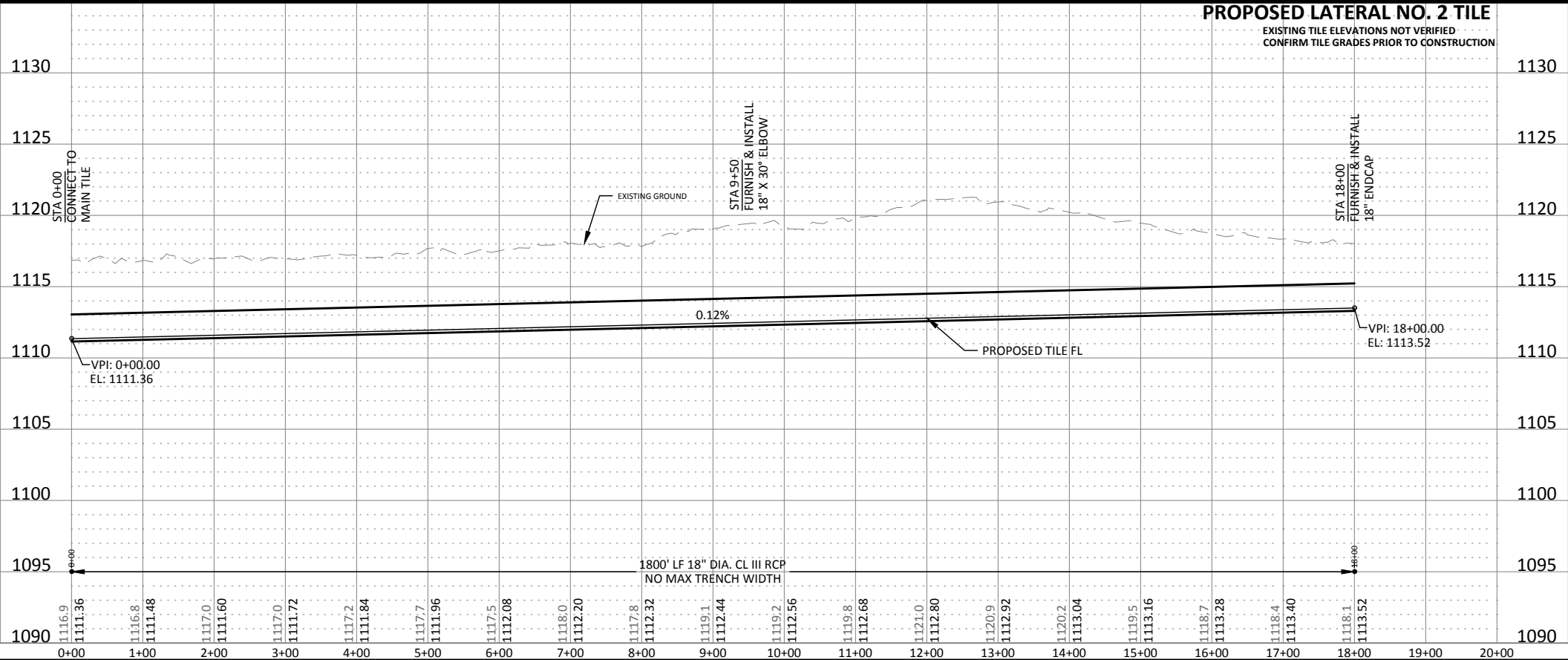
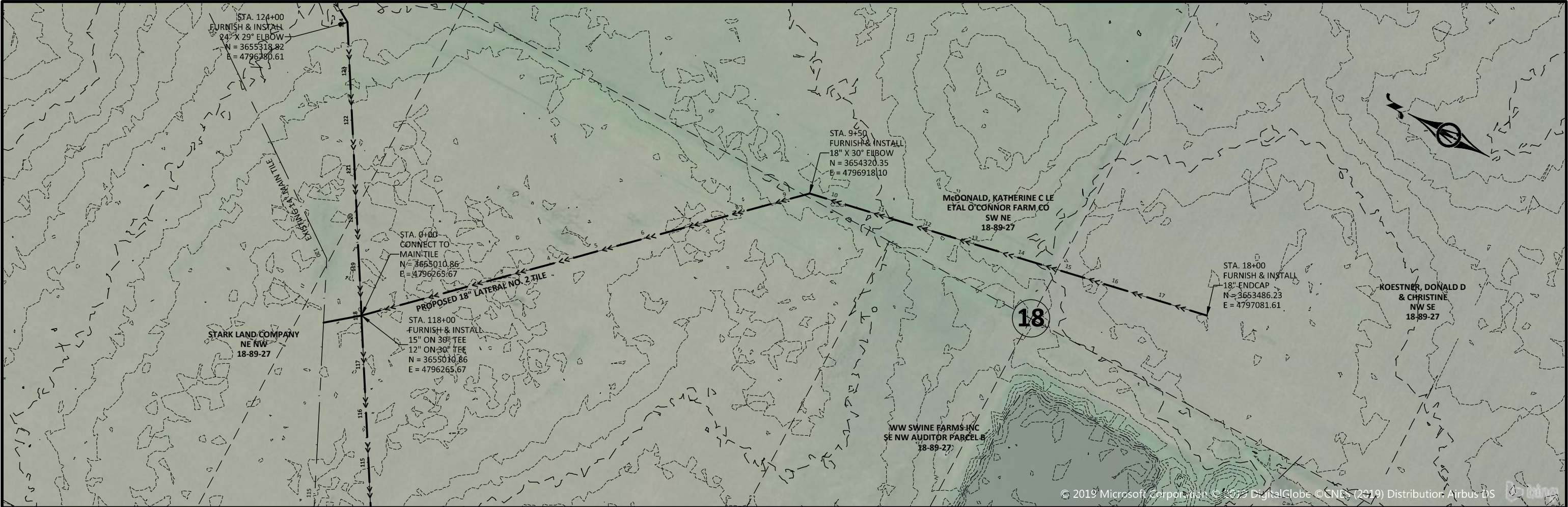
DESIGNED	NO.	ISSUED FOR	DATE
JLH			
DRAWN			
JLH			
CHECKED			
JPR			
CLIENT PROJ. NO.			
P12.117166			

JDD 87-95 TILE IMPROVEMENTS  
HAMILTON & WEBSTER COUNTY, IOWA  
UPPER MAIN PLAN & PROFILE

SHEET  
D.09







300 WEST MCKINLEY ST, P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: [Jefferson@bolton-menk.com](mailto:Jefferson@bolton-menk.com)  
[www.bolton-menk.com](http://www.bolton-menk.com)

DESIGNED	JLH	NO.	ISSUED FOR	DATE
DRAWN	JLH			
CHECKED	JPR			
CLIENT PROJ. NO.	P12.117166			

JDD 87-95 TILE IMPROVEMENTS  
HAMILTON & WEBSTER COUNTY, IOWA  
LATERAL NO. 2 PLAN & PROFILE

SHEET

D.12

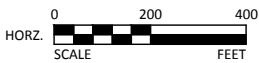
© Bolton & Menk, Inc. 2019. All Rights Reserved.  
J:\Hamilton CO\JDD 87-95\JDD 87-95.dwg 3/6/2019 9:36:17 AM

LATERAL NO. 1 ALIGNMENT GEOMETRY						
No.	Type	Length	Start Station	End Station	Start E-N	End E-N
1	Line	500.00'	0+00'	5+00'	(4791533.08',3651785.69',0.00')	(4791905.10',3652119.77',0.00')
2	Line	1300.00'	5+00'	18+00'	(4791905.10',3652119.77',0.00')	(4792014.23',3653415.18',0.00')

MAIN TILE ALIGNMENT GEOMETRY						
No.	Type	Length	Start Station	End Station	Start E-N	End E-N
1	Line	3900.00'	0+00'	39+00'	(4787022.40',3651182.69',0.00')	(4790922.11',3651135.35',0.00')
2	Line	177.57'	39+00'	40+77.57'	(4790922.11',3651135.35',0.00')	(4790922.24',3651312.92',0.00')
3	Line	772.43'	40+77.57'	48+50'	(4790922.24',3651312.92',0.00')	(4791533.08',3651785.69',0.00')
4	Line	1350.00'	48+50'	62+00'	(4791533.08',3651785.69',0.00')	(4792838.29',3651440.83',0.00')
5	Line	1300.00'	62+00'	75+00'	(4792838.29',3651440.83',0.00')	(4794091.58',3651786.22',0.00')
6	Line	100.00'	75+00'	76+00'	(4794091.58',3651786.22',0.00')	(4794191.56',3651788.21',0.00')
7	Line	600.00'	76+00'	82+00'	(4794191.56',3651788.21',0.00')	(4794636.91',3652190.28',0.00')
8	Line	800.00'	82+00'	90+00'	(4794636.91',3652190.28',0.00')	(4794637.23',3652990.28',0.00')
9	Line	850.00'	90+00'	98+50'	(4794637.23',3652990.28',0.00')	(4795227.92',3653601.50',0.00')
10	Line	850.00'	98+50'	107+00'	(4795227.92',3653601.50',0.00')	(4795321.58',3654446.33',0.00')
11	Line	1700.00'	107+00'	124+00'	(4795321.58',3654446.33',0.00')	(4796780.61',3655318.82',0.00')
12	Line	1200.00'	124+00'	136+00'	(4796780.61',3655318.82',0.00')	(4797386.71',3656354.50',0.00')
13	Line	150.00'	136+00'	137+50'	(4797386.71',3656354.50',0.00')	(4797384.46',3656504.48',0.00')

LATERAL NO. 2 ALIGNMENT GEOMETRY						
No.	Type	Length	Start Station	End Station	Start E-N	End E-N
1	Line	950.00'	0+00'	9+50'	(4796265.66',3655010.88',0.00')	(4796918.10',3654320.35',0.00')
2	Line	850.00'	9+50'	18+00'	(4796918.10',3654320.35',0.00')	(4797081.61',3653486.23',0.00')

ALTERNATIVE MAIN TILE ALIGNMENT GEOMETRY						
No.	Type	Length	Start Station	End Station	Start E-N	End E-N
1	Line	58.76'	0+00'	0+58.76'	(4791456.81',3645827.24',0.00')	(4791478.82',3645881.72',0.00')
2	Line	684.00'	0+58.76'	7+42.76'	(4791478.82',3645881.72',0.00')	(4791485.74',3646565.69',0.00')
3	Line	1000.00'	7+42.76'	17+42.76'	(4791485.74',3646565.69',0.00')	(4792459.96',3646791.29',0.00')
4	Line	1300.00'	17+42.76'	30+42.76'	(4792459.96',3646791.29',0.00')	(4793551.77',3647496.93',0.00')
5	Line	3600.00'	30+42.76'	66+42.76'	(4793551.77',3647496.93',0.00')	(4793874.35',3651082.45',0.00')
6	Line	648.51'	66+42.76'	72+91.27'	(4793874.35',3651082.45',0.00')	(4793890.35',3651730.76',0.00')
7	Line	208.73'	72+91.27'	75+00'	(4793890.35',3651730.76',0.00')	(4794091.58',3651786.22',0.00')
8	Line	100.00'	75+00'	76+00'	(4794091.58',3651786.22',0.00')	(4794191.56',3651788.21',0.00')
9	Line	600.00'	76+00'	82+00'	(4794191.56',3651788.21',0.00')	(4794636.91',3652190.28',0.00')
10	Line	800.00'	82+00'	90+00'	(4794636.91',3652190.28',0.00')	(4794637.23',3652990.28',0.00')
11	Line	850.00'	90+00'	98+50'	(4794637.23',3652990.28',0.00')	(4795227.92',3653601.50',0.00')
12	Line	850.00'	98+50'	107+00'	(4795227.92',3653601.50',0.00')	(4795321.58',3654446.33',0.00')
13	Line	1700.00'	107+00'	124+00'	(4795321.58',3654446.33',0.00')	(4796780.61',3655318.82',0.00')
14	Line	1200.00'	124+00'	136+00'	(4796780.61',3655318.82',0.00')	(4797386.71',3656354.50',0.00')
15	Line	150.00'	136+00'	137+50'	(4797386.71',3656354.50',0.00')	(4797384.46',3656504.48',0.00')



**BOLTON  
& MENK**

300 WEST MCKINLEY ST., P.O. BOX 68  
JEFFERSON, IOWA 50129  
Phone: (515) 386-4101  
Email: [Jefferson@bolton-menk.com](mailto:Jefferson@bolton-menk.com)  
[www.bolton-menk.com](http://www.bolton-menk.com)

DESIGNED	NO.	ISSUED FOR	DATE
JLH			
DRAWN			
JLH			
CHECKED			
JPR			
CLIENT PROJ. NO.			
P12.117166			

© 2019 Microsoft Corporation © 2019 DigitalGlobe © CNES (2019) Distribution Airbus DS

**JDD 87-95 TILE IMPROVEMENTS**  
**HAMILTON & WEBSTER COUNTY, IOWA**

**ALIGNMENT GEOMETRY**

SHEET

**G.01**