



**BOLTON
& MENK**

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Engineer's Report for

Proposed Tile Improvements

Drainage District No. 14

Worth County, Iowa

2023

Submitted by:

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Certification

Engineer's Report

for

Proposed Tile Improvements

Drainage District No. 14
Worth County, Iowa
0A1.124363

2023



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, 2024.

By: Jacob Hagan
Jacob Hagan, P.E.
License No. 25738

Date: 8/21/2023

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I. INTRODUCTION

A. Scope of Work

In 2021, the Board of Supervisors requested an investigation and report of recommended tile improvements of the Drainage District No. 14 facilities and appointed Bolton & Menk, Inc. to complete the necessary survey, study, plan and report. This report addresses the request for improvements.

B. Location

The watershed of Drainage District No. 14 covers approximately 1,982 acres in Sections 28, 29, 33 and 34 of Northwood and Sections 3, 4, 9, 10, 15, and 16 of Kensett Township in Worth County, Iowa. The district is directly south of Northwood, east of Highway 65, originally draining into the Shell Rock River south of the new quarry. At present, most of the district either drains into Kuennen's Quarry or straight west along 450th Street into the Shell Rock River. Portions of the piece south of 450th Street drain into the quarry ponds and others continue to drain into what remains of the old main.

Drainage District No. 14 north of Keunnen's Quarry consists of a main tile totaling approximately 10,000 LF of tile ranging in size from 24" to 10", as well as five lateral tiles totaling approximately 15,000 LF ranging from 12" to 7". South of 450th Street it originally consisted of a main totalling approximately 8,000 LF of 24" and 22" tile and 4 laterals totalling approximately 6,800 LF of 10" and 8" tile.

Currently the existing Drainage District No. 14 facilities include the North Main, the lower 2,500 LF of the South Main, as well as laterals 4, 4A, 5, 5A, 5B, and 6.

C. History

Drainage District No. 14 has been studied several times since its construction. Below are listed items that have occurred since the establishment of the district.

1912-6-29 Original petition filed.

1912-8-1 Report of Engineer filed.

1913-3-7 Construction contract awarded for main drain, and Laterals 1, 3, 5, 5A, and 5B for a total of \$12,410.28.

1913-6-7 Classification Report filed.

1913-8-26 Construction contract awarded for additional Laterals 2, 4A, and 6.

1963-4-25 Agreement signed between Drainage District No. 14 and Welp & McCarten Inc. to allow mining limestone within the right-of-way of the DD 14 tile.

1976-11-18 Engineer's Report filed recommending installing a new 24" main on the south side of Section 4 of Kensett Township to take the upper watershed off the old main. Project completed in 1977.

1981-3-23 Petition for repairs in Section 33 of main. Drainage Engineer requested to investigate. No record of repairs.

1990-10-12 Petition for repairs in Section 4 of main. Drainage Engineer requested to investigate. No records of repairs.

- 1996-11-18 Petition for repairs for Lateral 5. Approval given for installing an 8" tile in area in need of repair.
- 1999-6-21 Petition for repairs for Lateral 6. Drainage Engineer requested to investigate. No record of repairs.
- 2008-11-7 Petition to cut off the main tile to outlet into the Worth County Conservation Pond. Petition failed.
- 2012-6-18 Board approved County Conservation request to move water out of the main running west and into the main running south.

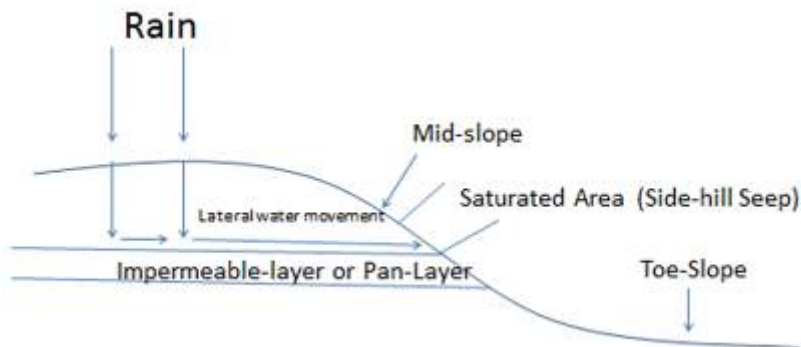
II. INVESTIGATION

Survey of the tile system was made in spring 2022. The records of the district were reviewed and the original plans located. A visual survey of the lands in the district showed several wet areas and lands not being row cropped. Looking at aerial photos, large areas of the watershed appear to suffer from excessive moisture. A 2019 aerial photo showed approximately 410 acres of cropland that was either not planted or drowned out. We have included this photo in our report.

In 1977, the district was effectively split into two watersheds, a north and south watershed via the construction of new 24" tile on the south side of Kensett Township Section 4. This provided relief to the downstream landowners as it removed approximately 1,341 acres from the main tile south of this point. However, this improvement provided little relief to the severely undersized tile upstream.

Approximately 550 acres of Drainage District No. 14 are within the corporate city limits of Northwood. The north main tile also drains part of the city of Northwood. Urban areas have more hard surface areas designed to drain the water off more quickly than agricultural lands. There is no city storm sewer in the area of Northwood which is served by Drainage District No. 14. The city has installed intakes to drain the water from the surface to the sand layer underneath.

This district's landscape has a sizable area of side-hill seep. The lands to the north have a layer of sand underneath and their water seeps out on the hillside directly south of them. An illustration of a side-hill seep provided by Iowa State is included below. The lands within Northwood or directly east of Northwood range from somewhat poorly drained to well-drained due to the sand beneath them, however, this sand allows the water to move laterally through the soil seeping out in the hillside below them. This has created a very poorly drained environment downstream.



When evaluating drainage tile capacity, we use what is referred to as the drainage coefficient. 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 ½" of water removed from the surface area of the watershed in 24 hours (½" Dc) has been in use since the mid-1950's. In other words, for an agricultural field to be deemed adequately drained, that field will drain ½" per acre per day (½" Dc).

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 1/12" per acre per day, which is 16% of the recommended modern design. This is one of the lowest drainage coefficients we have seen; typically a district tile of this age would have been designed to a ¼" per acre per day coefficient.

The coefficients and percent of modern capacity, as shown in the table below, 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 below. The highlighted areas are recommended to be replaced.

Existing DD 14 Tile Capacities					
Facility	Size & Grade (Diameter @ %)	Station Range	Acres Served	D _c * (Inches/Acre/Day)	% of ½" D _c (Modern Standard)
South Main	24" @ 0.08%	4+00-25+00	183	0.83	167%
1977 North Main	24" @ 0.07%	New 0+00- 26+00	1,245	0.11	23%
North Main	14" @ 0.08%	85+00- 126+00	1,200	0.03	6%
North Main	12" @ 0.08%	126+00- 145+00	423	0.06	11%
North Main	10" @ 0.15%	145+00- 160+11	329	0.06	12%
Lateral 2	8" @ 0.30%	7+00-21+50	76	0.21	42%
Lateral 3	10" @ 0.20%	0+00-10+69	17	1.38	275%
Lateral 3	8" @ 0.20%	10+69-14+73	13	0.99	198%
Lateral 4	12" @ 0.08%	0+00-40+00	400	0.06	12%
Lateral 4	10" @ 0.08%	40+00-88+62	221	0.07	13%
Lateral 4A	7" @ 0.10%	0+00-15+50	80	0.08	16%
Lateral 5	10" @ 0.08%	0+00-24+00	500	0.05	9%
Lateral 5	8" @ 0.10%	24+00-35+63	421	0.03	7%
Lateral 5A	8" @ 0.10%	0+00-2+03	47	0.19	39%
Lateral 5B	7" @ 0.10%	0+00-8+00	34	0.19	38%
Lateral 6	8" @ 0.40%	0+00-12+75	85	0.21	43%

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. We have received information that there are wetlands in this district.

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 state 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 Worth County. 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 “Waters 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 Sec 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 Sec 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 the revisions repealed on September 12, 2019, returning the USEPA jurisdiction to the pre-2015 guidance. A revised WOTUS rule took effect on March 20, 2023.

It is all but certain that if it were to be unleashed the WOTUS rule would 1) expand CWA Sec 404 jurisdiction to include all isolated farmed wetlands and even drained prairie potholes, 2) identify more jurisdictional wetland than has the USDA identified under the farm program and 3) demand 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 which requires proof of inability to avoid draining a wetland before it can be drained and mitigated.

On April 12, 2023 the federal district court of North Dakota stayed the revised WOTUS rule in several states including Iowa. We are reasonably confident that until the WOTUS rule stay is lifted there are no CWA Section 404 jurisdictional wetlands found in the benefited area and that only the farm program wetland rules are in play.

V. WATER QUALITY

The hydrologic impacts to tile drainage entail a complex interaction of processes dependent upon landscape, climatic, and human influences, watershed scale, soil permeability, and rainfall event size. There is a popular and often accepted idea that an increase in subsurface drainage facilities adds to an increase in both peak and total flow values, thereby increasing flooding. Recently published research from the University of Iowa’s IIHR – Hydroscience and Engineering Center refutes that perception. This University of Iowa report was the result of a water model study of the Clear Creek Watershed in Iowa and Johnson Counties and found that an increase in field tile and subsurface drainage decreases peak flows for most storm events. The field scale DRAINMOD model was used in the research in conjunction with a simplified routing equation to analyze the impact of tile drains in the Clear Creek Watershed.

However, additional steps are required to slow, impound, or infiltrate water to receive benefits in water quality. Water quality is a growing topic throughout the nation and more recently throughout

Iowa. The particle loads and nutrient levels within drainage water is a concern that is receiving increased scrutiny. Processes and reduction practices are being developed and incorporated on farms and into projects throughout Iowa which reduce nitrogen loss and improve water quality. Enhancement of water quality is possible through many different drainage applications that can see both immediate and long-term benefits.

We encourage the landowners of this District to consider multi-purpose drainage management, which incorporates Best Management Practices (BMPs) which utilize effective measures aimed at reducing sediment and nutrient loading and improving water quality. These BMPs are divided into three (3) areas: preventative measures, control measures, and treatment measures.

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

Control measures are practices aimed at improving water quality directly associated with the flow of water by reducing peak flows, providing in-stream storage, sedimentation, and nutrient uptake. Examples of control measures include alternative tile intakes, grassed waterways, two (2) stage ditches, water control structures, and controlled subsurface drainage. These practices are directly linked to the conveyance of subsurface tile water or open channel ditch flow.

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

These practices may be incorporated into either the public or private drainage systems. Funding options are available to landowners through the Environmental Quality Incentives Program (EQIP) and the Iowa Water Quality Initiative. EQIP is a voluntary program that provides financial assistance to individual landowners for various conservative practices as identified above. Also, the State of Iowa, through the Iowa Water Quality Initiative, provides cost share funds to participating landowners to voluntarily install nutrient reduction practices.

A unique opportunity may exist when a wetland is created within the district for the treatment of the tile and/or surface waters of the watershed. A properly sized and created wetland may be able to be utilized as a mitigation site for any farmed wetlands that are found within the drainage district. With the possibility of a large share of the created wetland being funded by the Iowa Water Quality Initiative program, any potential farmed wetlands could be mitigated at a much-reduced cost.

If there is landowner interest in any of these water quality features and funding options, further study and review would be required to select, site, and fund the water quality measures appropriate for the area.

VI. PROPOSED WORK

Tile Improvement

The investigation has confirmed the need for drainage relief within the district. Modern farming practices rely upon well drained soils to achieve maximum productivity. This standard applies to land with surface relief and little ponding. We recommend replacement

of the existing Drainage District No. 14 tile with a system designed according to modern standards.

The standard design for drainage tile in northern Iowa is the ½" drainage coefficient, or "Dc." This standard is adequate for the majority of drainage districts in Worth County and is a cost-effective design to maximize the productivity of today's farming practices. Paralleling the existing system is not recommended because the function of the system would rely upon a 110 year old tile. The ½" Dc would provide five times the drainage capacity of the existing DD 14 North Main Tile and Laterals, and would be a substantial improvement for the lands in Drainage District No. 14.

When determining which tiles we recommend to be replaced, we looked at three criteria: tile capacity, service of multiple landowners, and use as an outlet for additional tile. Several undersized laterals do not meet the full criteria and are recommended not to be replaced for reasons of cost-effectiveness. We also looked to "break up" the watershed by utilizing multiple outlets, serving to downsize and reduce new tile as possible. Resultingly, we recommend replacement of the Lower Main (Relief Line), Upper Main, Lateral 4, and Lateral 5, and construction of a new Drainage District No. 5 Lateral 8; all designed to modern standards.

The proposed tiles will generally follow similar routes as the existing tiles following the valleys of the district. Each proposed tile route is described below.

- The Lower Main would outlet into the Shell Rock River approximately 1,500 feet upstream of its current outlet. From there, it heads in an easterly direction crossing the railroad.
- The Upper Main would head north then northeast ending in the NE SE of Section 33.
- Lateral 4 would outlet into the North Main and go straight north before angling northeast to connect with the existing Lateral 4 in the NE NW of Section 4.
- The Lateral 5 tile connects into the North Main heading east and then turning northeast to parallel the existing upper end of the Lateral 5 tile.
- The Drainage District No. 5 Lateral 8 tile outlets into the DD 5 Open Ditch and heads northwest to remove lands from the Lateral 5 watershed.

The preliminary plans included in this report show the proposed tile routes in more detail.

The proposed tile 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 tiles 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 manufacturers 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.

We are proposing to construct the new Lower Main (Relief Line) north of the current Relief Line as a cost saving measure to allow for those 145 acres in the lower portion to continue to drain to the current Relief Line. With the lands upstream removed, the relief line constructed in the 1970's will achieve a ½" drainage coefficient for those lower lands.

The DD 5 Lateral 8 tile is proposed to remove 168 acres from the Lateral 5 tile watershed. The outlet area is privately patterned tile, however, the lands upstream surface flow into this low-lying area. The existing 10" private tile if laid at 0.1% grade is only sized to a drainage coefficient of 1/10th of an inch Dc. This is 20% of the recommended drainage coefficient. By constructing this 18" line, we are able to provide a ½" drainage coefficient and downsize the Lateral 5 tile for a cost savings. If DD 5 Lateral 8 is not constructed, we recommend upsizing the Lateral 5 tile and Lower Main Tile to be able to handle these additional acres drainage and thus all the lands benefitted by Lateral 8 should be assessed to help pay for the Lower Main Tile and Lateral 5.

The Upper North Main could be cut short to provide an outlet for the pattern tiling in the NW NE of Section 4 ending at Station 58+00 instead of extending to Station 85+66. There would be a significant cost savings to shorten the route, however, the drainage upstream of this point would be restricted to the existing 10" Main Tile operating at less than a tenth drainage coefficient.

The total improvement work for all the branches would cost about \$1,383,000. The table below shows the breakdown of only the estimated construction costs for each facility of the proposed improvements. Please be reminded that assessments are based upon benefits, and that following reclassification some highly benefitted parcels will likely bear 2 to 2½ times the average assessments. A complete opinion of probable total costs is included in Appendix C of this report.

Estimated Construction Costs Summary			
Facility	Estimated Construction Cost (\$)	Acres Served (ac)	Cost per Acre (\$/ac)
Improvement			
Lower North Main	\$299,000	1,174	\$254
Upper North Main	\$318,000	468	\$681
Lateral 4	\$163,000	246	\$663
Lateral 5	\$146,000	253	\$579
DD 5 Lateral 8	\$102,000	168	\$603

A. 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.

B. Road Crossing

One railroad and one state road crossing are required as part of the recommended improvement. It is assumed that the paved road will be bored and the railroad crossing will be open cut. The following table summarizes the road crossings which are part of the proposed tile improvement.

Tile Road Crossings					
Road	Control Agency	Type	Facility	Station	Diameter
Railroad	Union Pacific	Open Cut	North Main	29+15	36"
Highway 65	IA DOT	Bore	North Main	7+66	36"

Iowa Code Section 468 requires that all costs of primary and secondary road crossing are to be paid from funds available to the entity that controls the road or railroad. The total estimated cost to the Iowa Department of Transportation is \$100,000. The estimated cost to the Union Pacific railroad is \$162,000.

C. Work Limits

The district will need an area to install the tile. The extent of the work limits on the tile will be finalized when the final construction plans are developed, but it will typically be 50 to 100 feet from the tile centerline on whatever side(s) the work will be done. Landowners will also be entitled to compensation for damages in the work area. It is recommended that, 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 is normally determined at the project completion hearing.

VII. EXISTING SCHEDULE REVIEW

A. Benefited Lands Not Now Assessed

There are approximately 639 acres appear may benefit from Drainage District No. 14 facilities that have never been assessed for benefit . This area is shown on Benefitted Lands Map in Appendix B of this report.

Annexation should be studied further. This is expected to cost approximately \$5,000.

B. Existing Assessment Schedule Review

Drainage District No. 14 was last reclassified in 1913, and all facilities are included in this single assessment schedule. Appendix B contains a list of all lands that appear to be benefited by each of the proposed facilities. Appendix B also contains a map showing the existing benefited units assessed per acre and the classification for each parcel in the currently assessed area of DD 14.

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 tiles be divided into separate maintenance schedules to make the cost of future repairs more equitable.

We have included a pre-classification schedule, and it is similar to what the benefit commission would consider at the end of the project for the lower main. Pre-classification is an estimate only. The final approved classification would still be subject to review by the commission appointed by the Board, with any final changes made by the 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 of a facility that 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.

VIII. DISCUSSIONS & RECOMMENDATIONS

This report confirms the need to improve the drainage efficiency and capacity of the Drainage District No. 14 drainage system. The work described herein can accomplish that improvement.

Improvement Recommended. The improvements proposed will provide the drainage capacity needed for modern farming practices. The estimated assessable cost of the recommended ½" Dc improvement is \$1,383,000. We find that the proposed improvements are practicable, feasible, and beneficial to the public.

Annexation Recommended. Approximately 32% of the lands now served by Drainage District No. 14 (639 acres) may 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 would be necessary to bring them into the Drainage District No. 14 benefited area. An annexation report will need to be completed before annexation can take place.

Reclassification Recommended. The Worth County Board of Supervisors has appointed us to reclassify the district whether an improvement is completed or not. The existing assessment schedule is inequitable and should be reclassified, including 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 8% simple interest, the recommended improvement costs for all benefited lands would be about \$95 per acre per year. Please be reminded that assessments are based upon benefits, and that following reclassification some highly benefited parcels will likely bear two to two-and-a-half 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 payback 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.

The average price received by Iowa corn growers in the last 5 years when adjusted for inflation has been \$5.07/bushel. Assuming corn averages \$5.00/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 11 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 Board of Supervisors of Worth County, acting as trustees for Drainage District No. 14, 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 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 to Drainage District No. 14.
- Initiate reclassification procedures.

Respectfully submitted,


Jacob Hagan, PE

Appendix A: Existing Conditions

Highway 105- East side of Northwood
February 27th, 2023

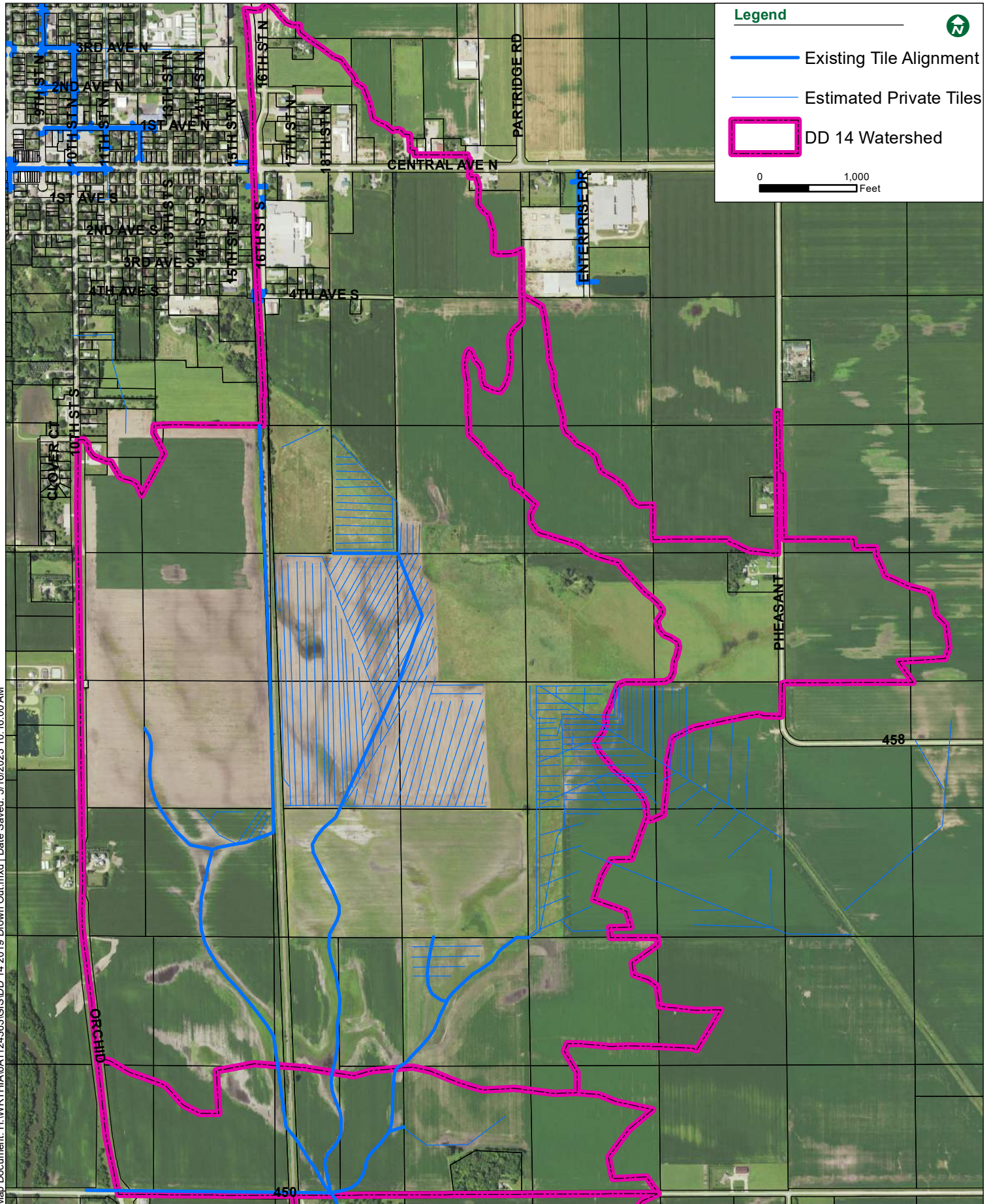


Highway 65- South of Northwood
February 27th, 2023

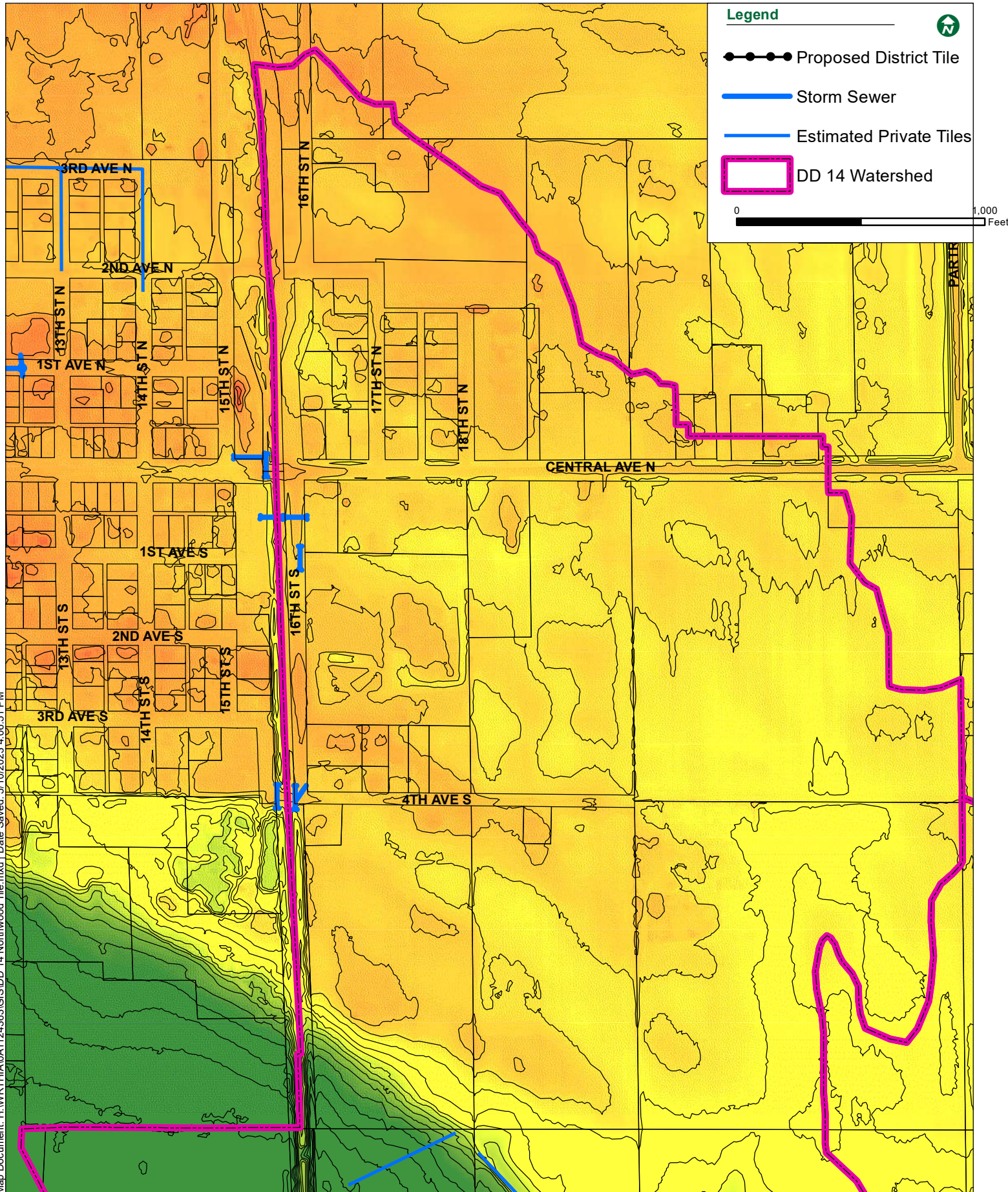


450th Street North of County Park
April 22nd, 2022





Map Document: H:\WORTH\IA\01124363\GIS\DD_14_2019_Drown_Out.mxd | Date Saved: 5/16/2023 10:16:00 AM



Map Document: H:\WORTH\IA\0A1124363\GIS\DD 14 Northwood Tile.mxd | Date Saved: 5/10/2023 4:06:51 PM

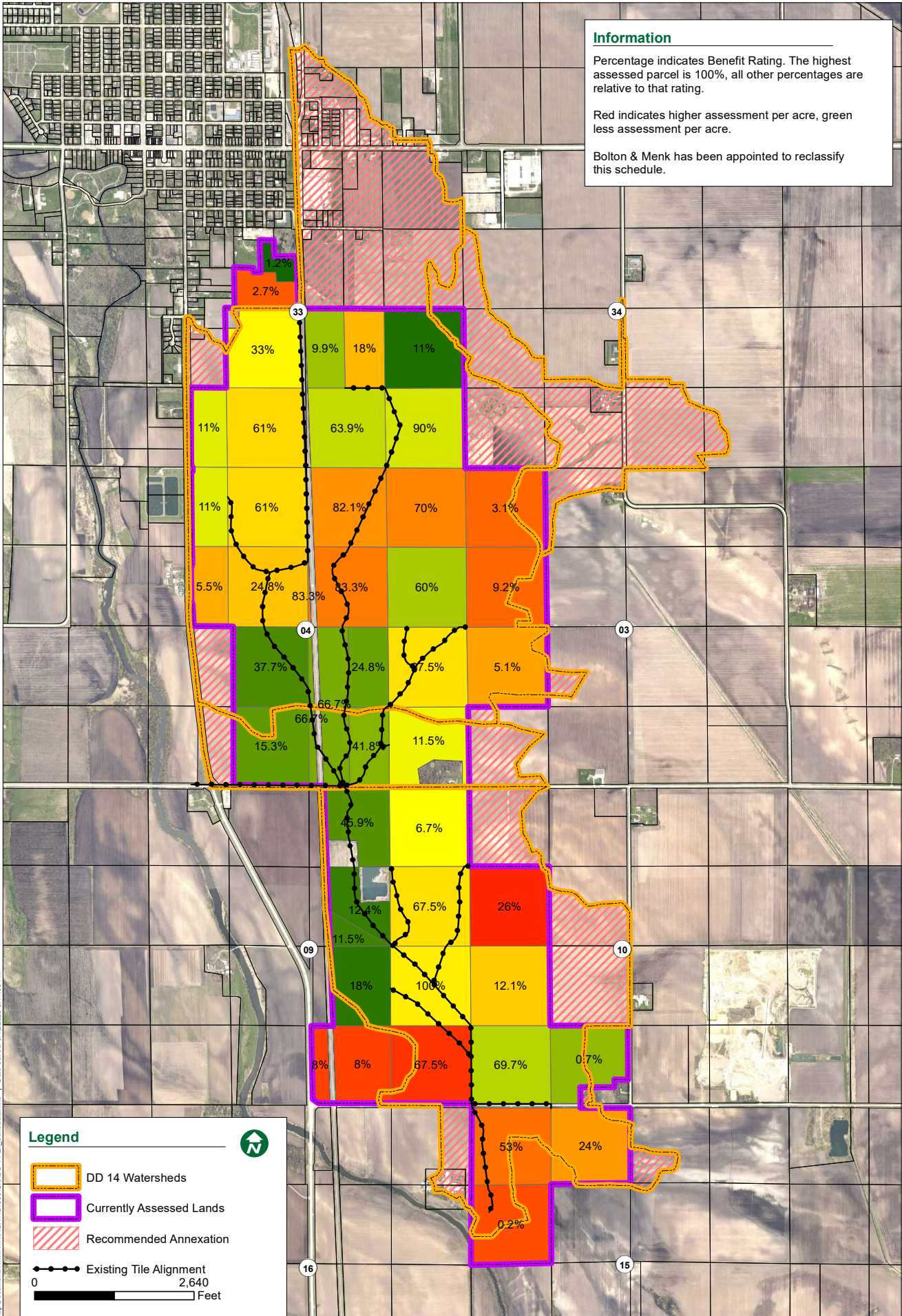
Appendix B: Existing Schedule Review

Information

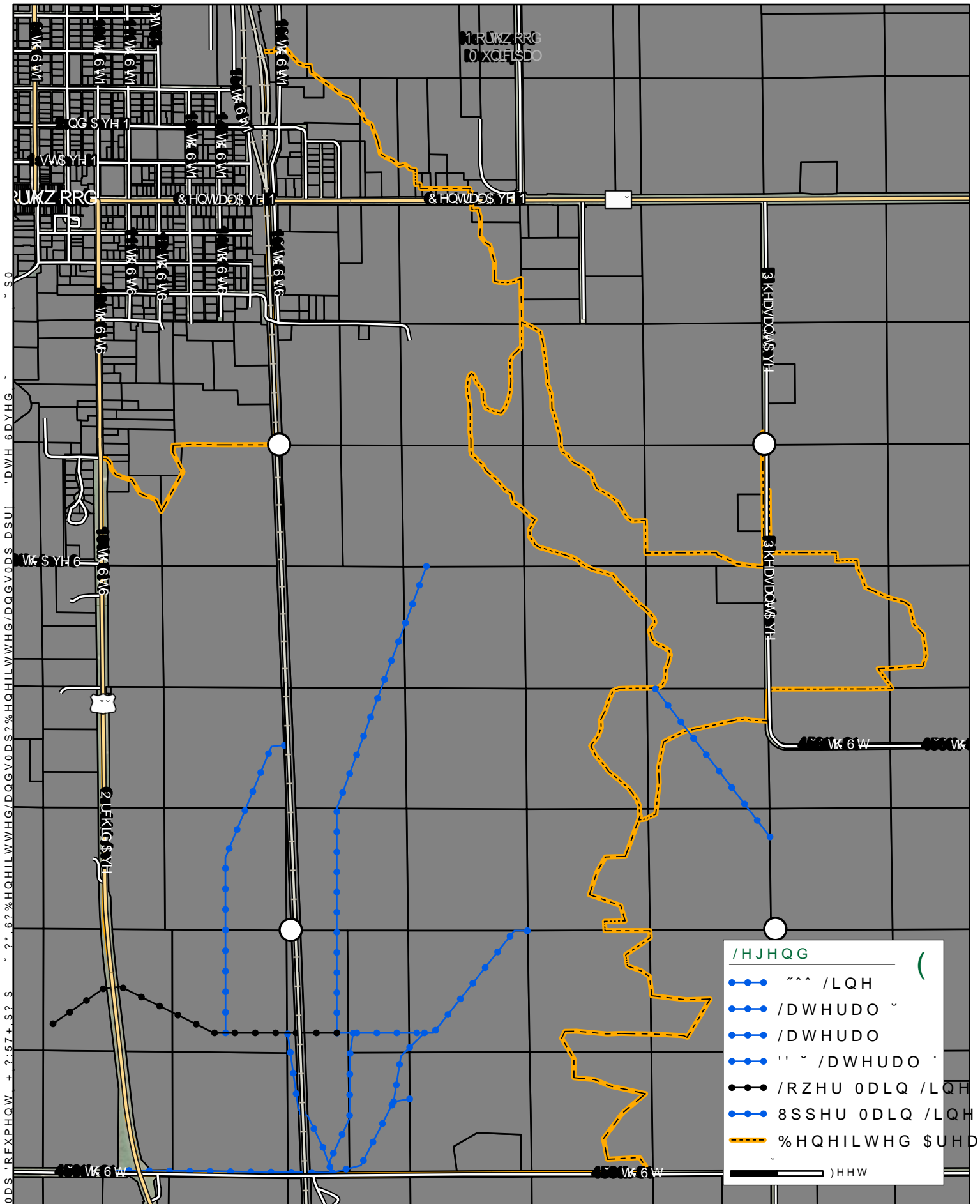
Percentage indicates Benefit Rating. The highest assessed parcel is 100%, all other percentages are relative to that rating.

Red indicates higher assessment per acre, green less assessment per acre.

Bolton & Menk has been appointed to reclassify this schedule.



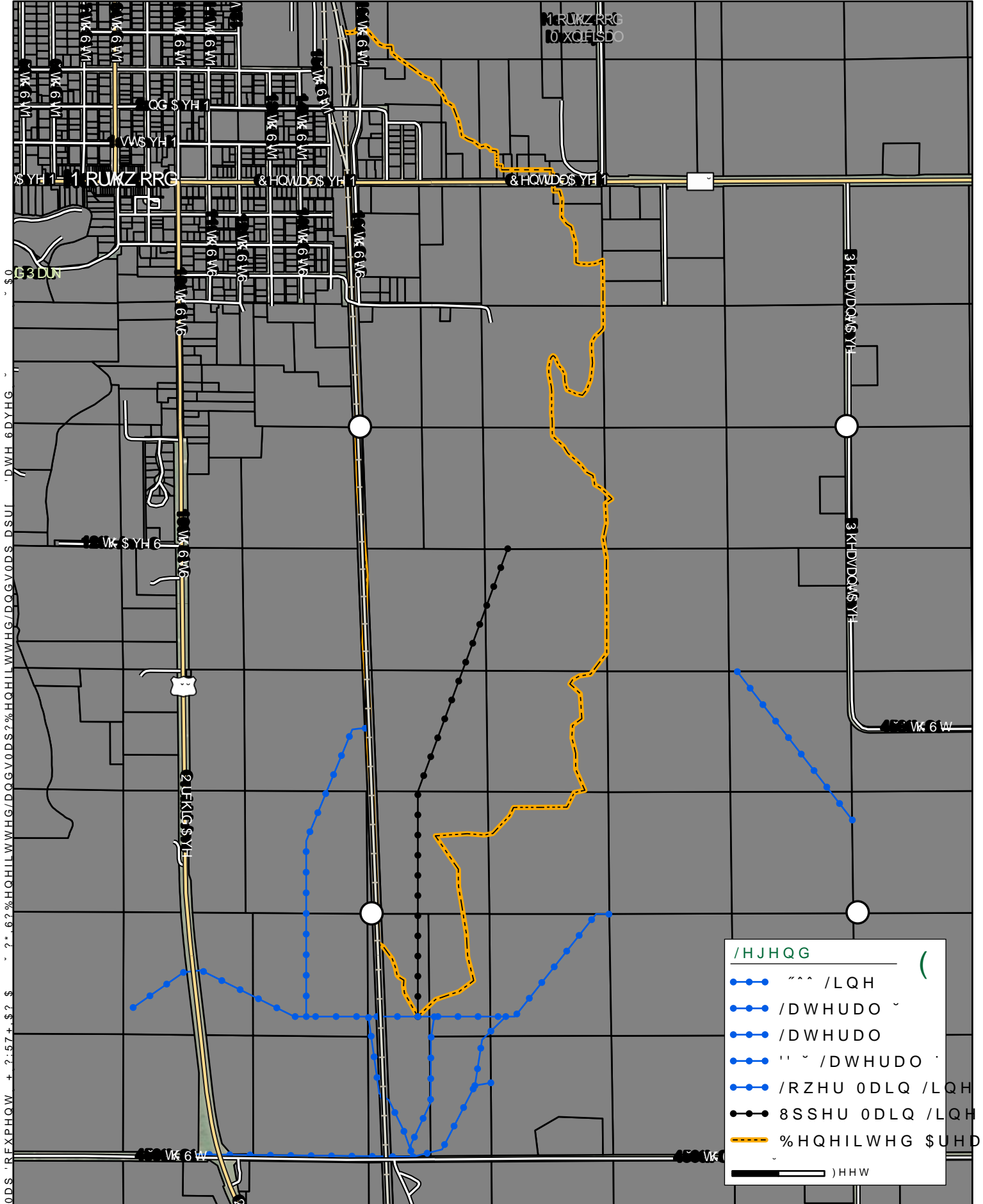
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/HJHQG

- /LQH
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**UPPER MAIN LINE BENEFITED AREA
DRAINAGE DISTRICT NO. 14
WORTH COUNTY, IA**

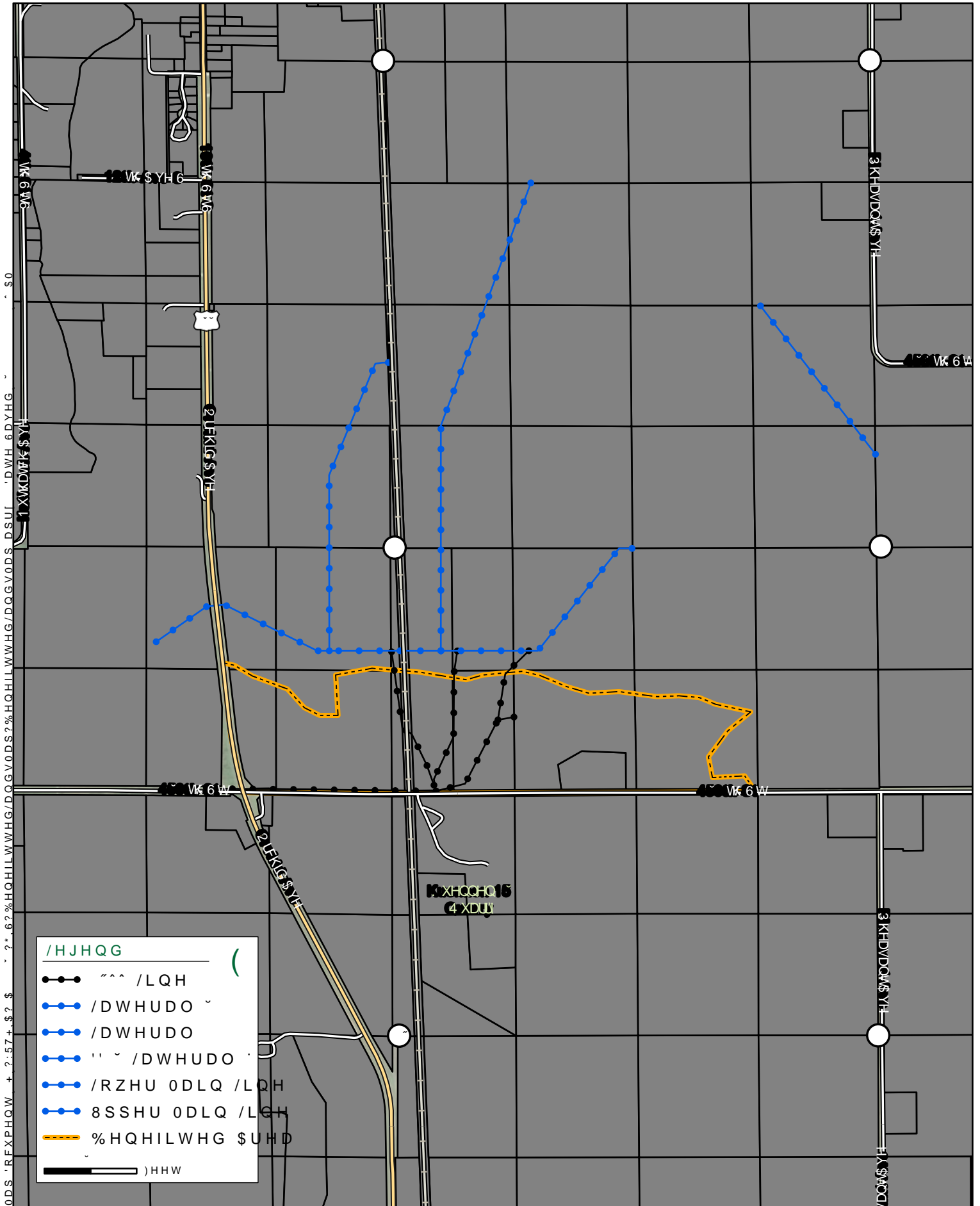
Deedholder(s)	Parcel Number	S-T-R	Legal Description	Benefited Area (ac)
A.D.A. ENTERPRISES, INC.	0334101005	33-100-20	NORTHWOOD VIKING INDUSTRIALPARK, LOT 5 & S 10' LOT	0.01
AGRI-SALES & BUILDING SUPPLY, INC.	0333201019	33-100-20	NORTHWOOD SECTION 33 LOT IN SW NW NE EX PAR	0.86
ANDERSON, ERBIN & ANITA SUZANNE	0333201015	33-100-20	NORTHWOOD PAR. NW NE 33 100 20(80X297)	0.50
ANDERSON, ERBIN & ANITA SUZANNE	0333201018	33-100-20	NORTHWOOD PAR 106X130 IN NW NE 33 100 20	0.25
ANDERSON, ERBIN & ANITA SUZANNE	0333201020	33-100-20	NORTHWOOD E 106' OF LOT IN SW NW NE 33 100 20	0.41
BACHTLE, TROY D & DAWN M	0328452012	28-100-20	NORTHWOOD SECTION 28 TOWNSHIP:100 RANGE:20 PAR I	0.80
BEHNE, LESLIE H. & JOANNE M.	0328454002	28-100-20	NORTHWOOD PAR. IN SW SE28- 100-20	3.86
BEHNE, LESLIE H. & JOANNE M.	0328454003	28-100-20	NORTHWOOD W 3/8 SE SW SE28- 100-20	3.01
BEHNE, LESLIE H. & JOANNE M.	0328454004	28-100-20	NORTHWOOD PAR. IN E 1/2 SW SE28-100-20	0.76
BEHNE, LESLIE H. & JOANNE M.	0328454005	28-100-20	NORTHWOOD PAR. IN SW SE28- 100-20	1.32
BERG, DELANO R.	0333276001	33-100-20	NORTHWOOD SE NE 33-100-20	31.81
BERG, DELANO R.	0333400003	33-100-20	NORTHWOOD NE SE 33-100-20	34.60
BERG, DELANO R.	0333400005	33-100-20	NORTHWOOD SW SE 33-100-20E. OF RR	38.13
BERG, DELANO R.	0333400006	33-100-20	NORTHWOOD SE SE 33-100-20	39.54
BERG, DELANO R.	0334300001	34-100-20	NORTHWOOD NW SW 34-100-20	0.13
BERG, DELANO R.	0704200001	4-99-20	4-99-20 FRL. NW NE, E. OF RR	36.88
BERG, DELANO R.	0704200002	4-99-20	4-99-20 FRL. NE NE	29.53
BRUNSVOLD, BRADLEY J	0328476003	28-100-20	NORTHWOOD SECTION 28 PAR IN SE SE	0.19
CAPRANOS, THOMAS C.	0328453013	28-100-20	NORTHWOOD MC KERCHER LOT 5,BLK. 1	0.20
CAPRANOS, THOMAS L.	0328453005	28-100-20	NORTHWOOD MC KERCHER LOT 14,BLK. 1	0.20
CITY OF NORTHWOOD	0328452001	28-100-20	PART OF SE 1/428-100-20	0.45

CITY OF NORTHWOOD	0333201002	33-100-20	NORTHWOOD PARCEL IN NW NE33-100-20	3.71
DAHLBY, ROGER & JANET	0704200003	4-99-20	4 99 20 SW NE EX. RR	28.78
DAHLBY, ROGER & JANET	0704200004	4-99-20	4 99 20 SE NE	4.62
DAUGHERTY, ERNEST D	0328452011	28-100-20	NORTHWOOD SECTION 28 TOWNSHIP:100 RANGE:20 PAR I	0.65
DAUGHERTY, ERNEST D.	0328453002	28-100-20	NORTHWOOD MC KERCHER LOT 11,BLK. 1	0.20
DAVIS, CLIFTON B & TONYA M	0328476002	28-100-20	NORTHWOOD SECTION 28 S 317' OF E 150'OF W 1/4 SE	0.22
DIERENFELD, MICHAEL E & JOAN A	0328452005	28-100-20	NORTHWOOD PAR. IN SW SE28 100 20	0.30
DOTY, DUSTIN J & CHELSEA E	0333201016	33-100-20	NORTHWOOD SECTION 33 PT NW NE EX PAR	0.52
EILERTSON, EUGENE D. & KATHLEEN S.	0333226002	33-100-20	NORTHWOOD PAR. 216.5'X520' INNE NE 33-100-20	0.28
EKSTROM, SHIRLEY A. (HOADLEY)	0328453010	28-100-20	NORTHWOOD MC KERCHER LOT 2 EX.S 6', BLK. 1	0.18
ELLIOTT, DAVID C. & PAMELA S.	0333201001	33-100-20	NORTHWOOD PT. NW NE 33-100- 20	0.90
EVERHART, MARVIN L & SHIRLEY A L/E	0328476017	28-100-20	NORTHWOOD SECTION 28 PAR "D" IN SE SE	0.50
FARMERS FEED & GRAIN COMPANY, INC.	0328476018	28-100-20	NORTHWOOD SECTION 28 PAR "E" IN SE SE	0.05
FEDERAL FOAM TECHNOLOGIES, INC	0333201003	33-100-20	NORTHWOOD SECTION 33 PARS IN W 1/2 NW NE	10.51
FELLAND, THOMAS A	0328451001	28-100-20	NORTHWOOD SECTION 28 PAR IN SW SE, E OF RR & PAR	1.61
GROSLAND, THOMAS R	0333201009	33-100-20	NORTHWOOD SECTION 33 LOT IN NW NE	1.00
HEEREN, JOSEPH P. & MINDY S.	0328453012	28-100-20	NORTHWOOD MC KERCHER LOT 4 & S12' LOT 3, BLK. 1	0.24
HELGELAND, KEITH L/E, HELGELAND, SARAH 1/2 INT, HELGELAND, KIRSTEN 1/4 INT, MORTON, KIRSTEN 1/4 INT	0704400006	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 E 20 A NW SE KENSETT	8.53
HICKLE, CODY & JOLENE K.	0328453006	28-100-20	NORTHWOOD MC KERCHER LOTS 15& 16, BLK. 1	0.40
HOGEN, PAUL R.	0328453017	28-100-20	NORTHWOOD MC KERCHER SUB. LOTS8, 9 & S 1/2 LOT 7,	0.50

JASPERS, DONALD TRUST	0328401002	28-100-20	NORTHWOOD SECTION 28 W 51.16 A OF E 70.10 A OF N	0.20
JOHNSON, STEVE D	0328453009	28-100-20	NORTHWOOD MC KERCHERS ADD / SUB BLOCK:1 LOT:1	0.20
KATCHER, JACOB C	0328453001	28-100-20	NORTHWOOD MC KERCHERS ADD / SUB BLOCK:1 LOT:10	0.20
KENISON CONSTRUCTION, INC.	0328453008	28-100-20	NORTHWOOD MCKERCHER'S LOTS 17& 18 BLK 1	0.40
KENISON, CONSTANCE J	0328454008	28-100-20	NORTHWOOD SECTION 28 LOT:PART OF PAR "H"	2.48
LINK, LINDA J. & ROBERT L.	0328453003	28-100-20	NORTHWOOD MC KERCHER LOT 12,BLK. 1	0.20
LOW, LONNIE D	0333226003	33-100-20	NORTHWOOD SECTION 33 NE NE EX PAR	31.76
MIKKELSON, TED C.	0333201017	33-100-20	NORTHWOOD PAR IN SW NW NEEX E 106' 33 100 20	0.53
NORTHWOOD YARD, LLC	0334101009	33-100-20	NORTHWOOD VIKING INDUSTRIALPARK, LOT 4 EX. S 10',	0.01
ODEGAARD CONSTRUCTION LLC	0328452002	28-100-20	NORTHWOOD SECTION 28 RANGE:20 PAR IN S 1/2	0.93
ODEGAARD CONSTRUCTION LLC	0328452003	28-100-20	NORTHWOOD SECTION 28 RANGE:20 PAR IN SW SE	0.14
OLSON, SCOTT LEON	0328453004	28-100-20	NORTHWOOD MC KERCHERS ADD / SUB BLOCK:1 LOT:13	0.20
PROGRESSIVE AG COOPERATIVE	0328379001	28-100-20	NORTHWOOD PAR. IN S 1/228-100- 20 (E. SIDE) (DRY FE	0.72
PROGRESSIVE AG COOPERATIVE	0328401001	28-100-20	NORTHWOOD PAR. IN W 1/2 SE,28 100 20	2.16
RAMIREZ, MANUEL & SHAWNA	0328453016	28-100-20	NORTHWOOD MC KERCHERS ADD / SUB BLOCK:1 LOT:6 & N	0.30
REEDER, KEVIN	0333251002	33-100-20	NORTHWOOD SECTION 33 W 1/2 SW NE EX PAR	19.10
REEDER, KEVIN	0333400001	33-100-20	NORTHWOOD SECTION 33 W 1/2 NW SE EX RR	19.12
REUVERS, DEBRA A L/E, STEINKAMP, KRISTINE A 1/2 INT, BJORK, TERESA 1/2 INT	0334300004	34-100-20	34-100-20 SW SW	0.05

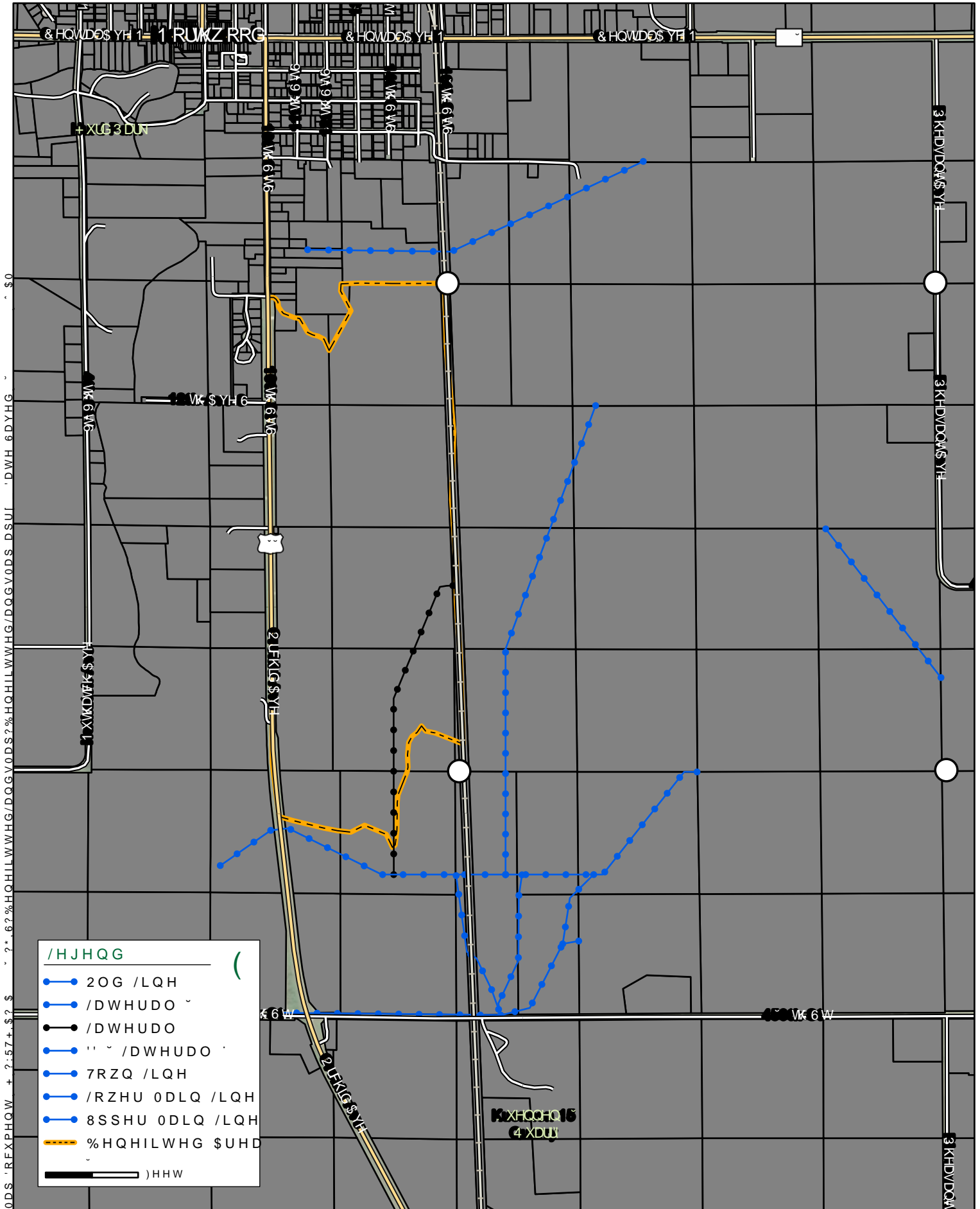
REYERSON, GREGORY J. & SUZANNE R.	0328453011	28-100-20	NORTHWOOD MC KERCHER S 6' LOT 2& N 54' LOT 3, BLK.	0.18
RUSTAD, ROGER	0328476014	28-100-20	NORTHWOOD PARCEL IN E1/2 W1/2SE SE 28-100-20	0.13
SCRIBBINS, ELAINE J REVOCABLE TRUST	0333251004	33-100-20	NORTHWOOD SECTION:33 TOWNSHIP:100 RANGE:20 E 1/2 SW NE EXC PAR GROVE	19.34
SCRIBBINS, ELAINE J REVOCABLE TRUST	0333400002	33-100-20	NORTHWOOD SECTION:33 TOWNSHIP:100 RANGE:20 E 1/2 NW SE GROVE	19.98
SEATER, CONNIE ELAINE	0333201012	33-100-20	NORTHWOOD E 1/2 NW NE EX. PARS.33-100-20	15.58
SERVERSON PROPERTIES LLC	0333251001	33-100-20	NORTHWOOD SECTION 33 PAR IN W 1/2 SW NE	0.57
SMITH SERVICES LLC	0328476015	28-100-20	NORTHWOOD SECTION 28 PAR130'X317' S517'OF W200'	0.29
SPILED GRAIN, LLC	0328452010	28-100-20	NORTHWOOD SECTION 28 PAR "G" IN SW SE	0.36
STEVENS, MICHAEL & JUDY JT	0328454007	28-100-20	NORTHWOOD SECTION 28 LOT:LOT 1 OF PAR "H"	6.49
STEVE'S SON LLC	0328452009	28-100-20	NORTHWOOD SECTION 28 PAR "F" IN SW SE	0.44
THOFSON, TIMOTHY H. & MELISSA A.	0328476001	28-100-20	NORTHWOOD W 1/4 SE SE & PAR.28-100-20	1.37
UNION PACIFIC RAILROAD	0328501002	28-100-20	SECTION:28 TOWNSHIP:100 RANGE:20 RR IN W 1/2 SE GR	2.55
UNION PACIFIC RAILROAD	0333501001	33-100-20	SECTION:33 TOWNSHIP:100 RANGE:20 PAR IN NE1/4 GROVE	2.81
UNION PACIFIC RAILROAD	0333501002	33-100-20	SECTION:33 TOWNSHIP:100 RANGE:20 PAR IN SW 1/4 GROVE	1.07
UNION PACIFIC RAILROAD	0333501003	33-100-20	SECTION:33 TOWNSHIP:100 RANGE:20 PAR IN SE 1/4 GROVE	1.95

UNION PACIFIC RAILROAD	0704501002	4-99-20	SECTION:4 TOWNSHIP:99 RANGE:20 RR IN NE 1/4 KENSETT	3.19
UNION PACIFIC RAILROAD	0704501003	4-99-20	SECTION:4 TOWNSHIP:99 RANGE:20 RR IN SE1/4 KENSETT	0.40
WEINER, STEVEN J & JILL A	0333201011	33-100-20	NORTHWOOD SECTION:33 TOWNSHIP:100 RANGE:20 PAR 25	3.79
WILKINS, ANGELA K 1/2 INT, HELGELAND, SARAH 1/8 INT & KEITH L/E, HELGELAND, KEITH 1/2, HELGELAND, KIRSTEN 1/8 INT & KEITH L/E	0704400005	4-99-20	04 99 20 W 1/2 SE EX. E 40 A.(NW SE 16.97 & SW SE 16.97 LESS RD)	9.22
ZIPSE, NALDA J.	0333251003	33-100-20	NORTHWOOD SECTION 33 PAR IN E 1/2 SW NE	0.35
Worth County Secondary Roads				21.45
			Total	455.89



**1977 RELIEF LINE BENEFITED AREA
DRAINAGE DISTRICT NO. 14
WORTH COUNTY, IA**

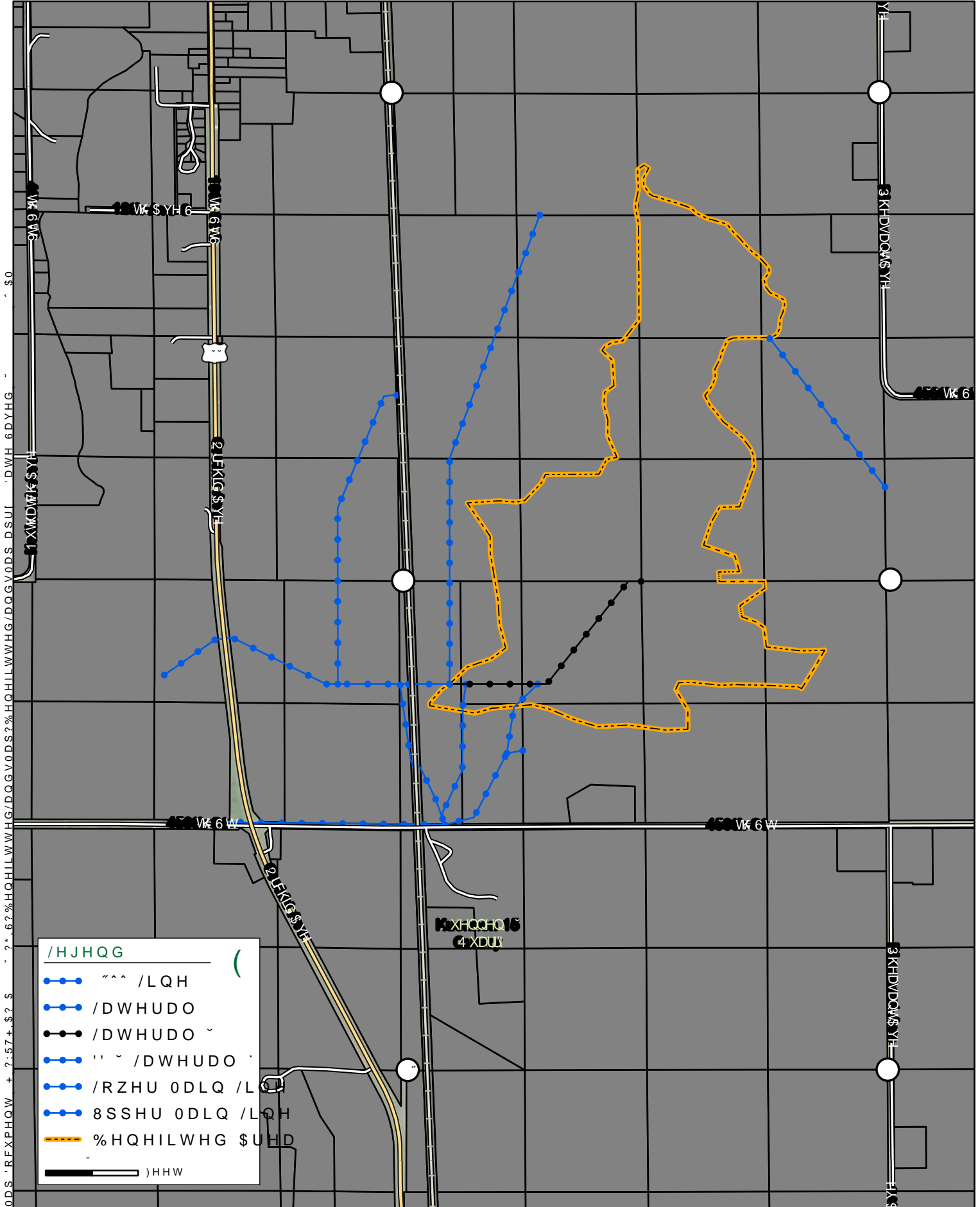
Deedholder(s)	Parcel Number	S-T-R	Legal Description	Benefited Area (ac)
HELGELAND, SARAH 1/4 INT & KEITH L/E, WILKINS, ANGELA K 1/2 INT, MORTON, KIRSTEN 1/8 INT & HELGELAND, KEITH L/E	0704300005	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 NW SW EXC PAR & PAR IN NE SW KENSETT	0.10
HELGELAND, SARAH 1/42 INT, HELGELAND, KIRSTEN 1/4 INT, MORTON, KIRSTEN 1/4 INT	0704400007	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 E 20 A SW SE KENSETT	18.80
HELGELAND, SARAH 1/8 INT & KEITH L/E, HELGELAND, KEITH 1/2, HELGELAND, KIRSTEN 1/8 INT & KEITH L/E	0704400005	4-99-20	04 99 20 W 1/2 SE EX. E 40 A.(NW SE 16.97 & SW SE 16.97 LESS RD)	16.60
Luedtke, Deanna L Revocable Trust	0704400009	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 PAR "A" IN SE SE KENSETT	6.40
MORTON, KIRSTEN 1/8 INT & HELGELAND, KEITH L/E, HELGELAND, KEITH 1/2, HELGELAND, SARAH 1/8 INT & KEITH L/E	0704300008	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 SE SW EXC PAR KENSETT	31.50
MORTON, KIRSTEN 1/8 INT & HELGELAND, KEITH L/E, HELGELAND, SARAH 1/4 INT & KEITH L/E, WILKINS, ANGELA K 1/2 INT	0704300007	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 SW SW EXC PAR & PAR IN SE SW KENSETT	11.80
MORTON, KIRSTEN 1/8 INT & HELGELAND, KEITH L/E, HELGELAND, SARAH 1/8 INT & KEITH L/E, HELGELAND, KEITH 1/2	0704300006	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 NE SW EXC PAR KENSETT	0.10
TRENHAILE, ERIC, TRENHAILE, WAYNE	0703300003	3-99-20	3 99 20 SW SW	22.40
UNION PACIFIC RAILROAD	0704501003	4-99-20	SECTION:4 TOWNSHIP:99 RANGE:20 RR IN SE1/4 KENSETT	3.10
WEIR, DORTHY A REVOCABLE TRUST	0704400008	4-99-20	4-99-20 SE SE EXC PARCEL "A"	27.80
IOWA DOT				2.30
WORTH COUNTY SECONDARY ROADS				4.20
Total				145.10



**LATERAL NO. 4 BENEFITED AREA
DRAINAGE DISTRICT NO. 14
WORTH COUNTY, IA**

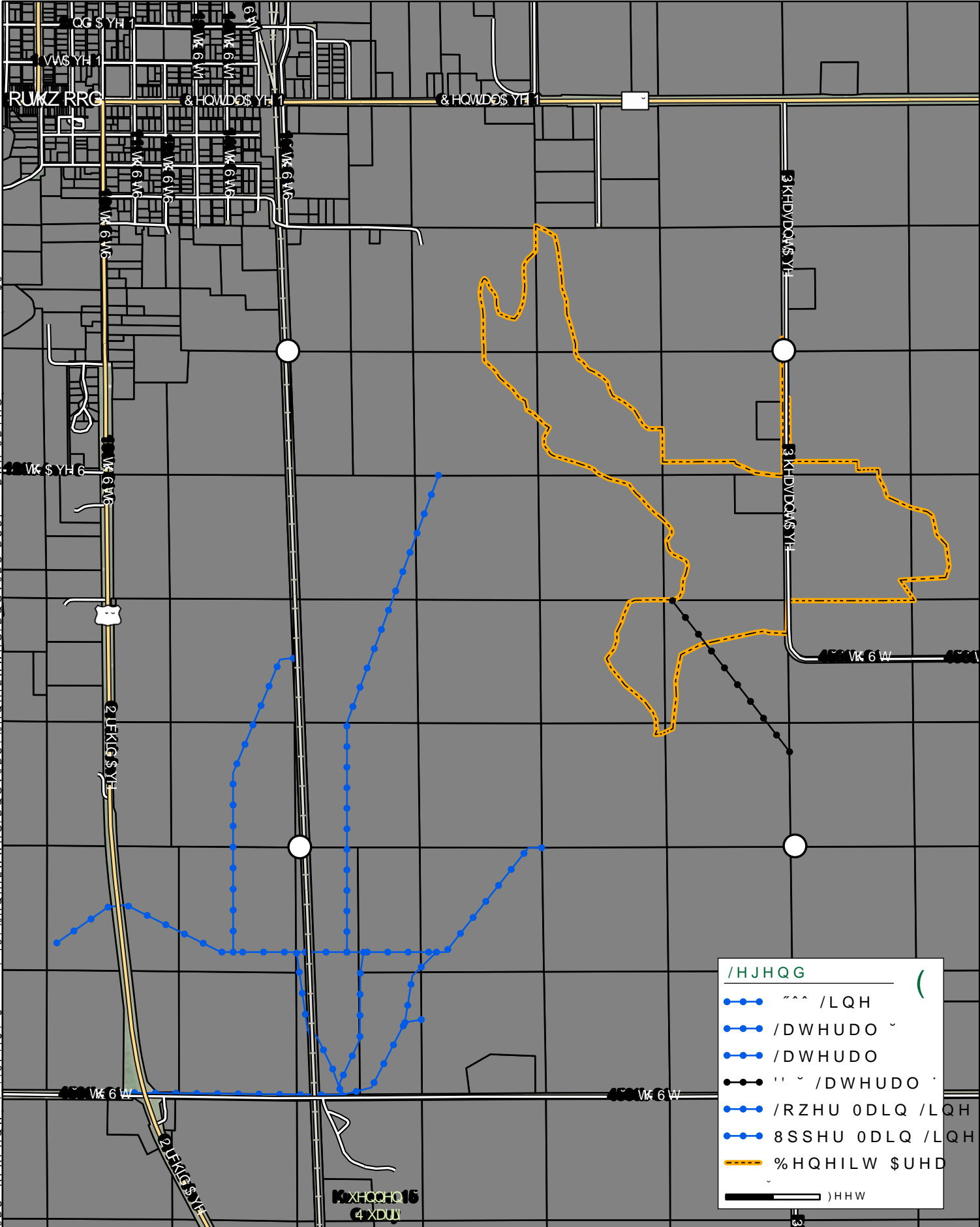
Deedholder(s)	Parcel Number	S-T-R	Legal Description	Benefited Area (ac)
DAHLBY, ROGER & JANET	0704100008	4-99-20	4 99 20 E 1/2 SW NW EX.	18.21
DAHLBY, ROGER & JANET	0704100009	4-99-20	4 99 20 SE NW	35.51
DAHLBY, ROGER & JANET	0704200003	4-99-20	4 99 20 SW NE EX. RR	0.59
GORDON, DEAN R REVOCABLE TRUST	0333303004	33-100-20	NORTHWOOD SECTION 33 E 1/2 NW SW EX 3 PARS	10.61
GORDON, DEAN R REVOCABLE TRUST	0333326001	33-100-20	NORTHWOOD SECTION 33 NE SW EX RR	34.90
GORDON, DEAN R REVOCABLE TRUST	0333352001	33-100-20	NORTHWOOD SECTION 33 E 1/2 SW SW EX PARS	17.97
GORDON, DEAN R REVOCABLE TRUST	0333376001	33-100-20	NORTHWOOD SECTION 33 SE SW	38.36
GORDON, DEAN R REVOCABLE TRUST	0704100005	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 E 1/2 NW FRL NW EX PAR KENSETT	17.94
GORDON, DEAN R REVOCABLE TRUST	0704100006	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 FRL NE NW KENSETT	39.35
HELGELAND, KIRSTEN 1/8 INT & KEITH L/E, HELGELAND, SARAH 1/4 INT & KEITH L/E, WILKINS, ANGELA K 1/2 INT, MORTON, KIRSTEN 1/8 INT & HELGELAND, KEITH L/E	0704300005	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 NW SW EXC PAR & PAR IN NE SW KENSETT	8.50
NORTHERN NATURAL GAS COMPANY	0704100004	4-99-20	4-99-20 PARCEL IN NW CORNER	0.09
PIXLEY, GRACE, METZGER, DAVID & INEZ TRUST, METZGER, DAVID D & INEZ N, MEDLANG, JAMES JR	0333177006	33-100-20	NORTHWOOD SECTION 33 PAR IN SE NW	0.01
UNION PACIFIC RAILROAD	0333501001	33-100-20	SECTION:33 TOWNSHIP:100 RANGE:20 PAR IN NE1/4 GROVE	0.01
UNION PACIFIC RAILROAD	0333501002	33-100-20	SECTION:33 TOWNSHIP:100 RANGE:20 PAR IN SW 1/4 GROVE	2.77

UNION PACIFIC RAILROAD	0333501003	33-100-20	SECTION:33 TOWNSHIP:100 RANGE:20 PAR IN SE 1/4 GROVE	0.27
UNION PACIFIC RAILROAD	0704501001	4-99-20	SECTION:4 TOWNSHIP:99 RANGE:20 RR IN NW1/4 KENSETT	0.33
UNION PACIFIC RAILROAD	0704501002	4-99-20	SECTION:4 TOWNSHIP:99 RANGE:20 RR IN NE 1/4 KENSETT	2.20
WILKINS, ANGELA K 1/2 INT, MORTON, KIRSTEN 1/8 INT & HELGELAND, KEITH L/E, HELGELAND, SARAH 1/8 INT & KEITH L/E, HELGELAND, KEITH 1/2 ZIMMERMAN, DEAN	0704300006	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 NE SW EXC PAR KENSETT	9.68
	0333303003	33-100-20	NORTHWOOD PAR IN E 1/2 NW SW33 100 20	1.08
IOWA DOT				9.40
			Total	247.78



**LATERAL NO. 5 BENEFITED AREA
DRAINAGE DISTRICT NO. 14
WORTH COUNTY, IA**

Deedholder(s)	Parcel Number	S-T-R	Legal Description	Benefited Area (ac)
ANDERSON, MILLARD N & CYNTHIA A 1/2 INT, ROBERTS, VELMA J TRUST, ROBERTS, DONALD L TRUST	0703100001	3-99-20	SECTION:03 TOWNSHIP:99 RANGE:20 NW NW KENSSETT	27.42
ANDERSON, MILLARD N & CYNTHIA A 1/2 INT, ROBERTS, VELMA J TRUST, ROBERTS, DONALD L TRUST	0703100003	3-99-20	SECTION:03 TOWNSHIP:99 RANGE:20 SW NW KENSSETT	29.27
BERG, DELANO R.	0333400003	33-100-20	NORTHWOOD NE SE 33-100-20	0.09
BERG, DELANO R.	0333400006	33-100-20	NORTHWOOD SE SE 33-100-20	0.39
BERG, DELANO R.	0334300001	34-100-20	NORTHWOOD NW SW 34-100-20	2.85
BERG, DELANO R.	0704200002	4-99-20	4-99-20 FRL. NE NE	9.88
BERGE, TIMOTHY	0703300002	3-99-20	3 99 20 NE SW	4.85
DAHLBY, ROGER & JANET	0704200003	4-99-20	4 99 20 SW NE EX. RR	7.46
DAHLBY, ROGER & JANET	0704200004	4-99-20	4 99 20 SE NE	34.99
HELGELAND, KEITH L/E, HELGELAND, SARAH 1/42 INT, HELGELAND, KIRSTEN 1/4 INT, MORTON, KIRSTEN 1/4 INT	0704400006	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 E 20 A NW SE KENSSETT	11.59
HELGELAND, KEITH L/E, HELGELAND, SARAH 1/42 INT, HELGELAND, KIRSTEN 1/4 INT, MORTON, KIRSTEN 1/4 INT	0704400007	4-99-20	SECTION:04 TOWNSHIP:99 RANGE:20 E 20 A SW SE KENSSETT	0.84
REUVERS, DEBRA A L/E, STEINKAMP, KRISTINE A 1/2 INT, BJORK, TERESA 1/2 INT	0334300004	34-100-20	34-100-20 SW SW	37.42
REUVERS, DEBRA A L/E, STEINKAMP, KRISTINE A 1/2 INT, BJORK, TERESA 1/2 INT	0334300007	34-100-20	34-100-20 SE SW EX PAR	2.78
WEIR, DOROTHY A. REVOC TRUST	0704400008	4-99-20	4-99-20 SE SE EXC PARCEL "A"	4.87
WILKINS, ANGELA K 1/2 INT, HELGELAND, SARAH 1/8 INT & KEITH L/E, HELGELAND, KEITH 1/2, HELGELAND, KIRSTEN 1/8 INT & KEITH L/E	0704400005	4-99-20	04 99 20 W 1/2 SE EX. E 40 A.(NW SE 16.97 & SW SE 16.97 LESS RD)	1.79
Total				176.49



0DS -RFXPHQW + 2+.57+. \$2 \$ - 2*+.62%HQHILW\$UHD/DQGV0DS2%HQHILW\$UHD/DQGV0DS.DSUJ .DWH 6DYHG . \$0

KXHQHQ16
4XDUI

**DD NO. 5 LATERAL NO. 8
DRAINAGE DISTRICT NO. 14
WORTH COUNTY, IA**

Deedholder(s)	Parcel Number	S-T-R	Legal Description	Benefited Area (ac)
A.D.A. ENTERPRISES, INC.	0334101005	34-100-24	OD VIKING INDUSTRIALPARK, LOT 5	0.01
ANDERSON, MILLARD N & CYNTHIA A 1	0703100001	03-99-20	SECTION:03 TOWNSHIP:99 RANGE:20 NW NW KENSETT	12.3
ANDERSON, MILLARD N & CYNTHIA A 1	0703100002	03-99-20	SECTION:03 TOWNSHIP:99 RANGE:20 NE NW KENSETT	14.8
ANDERSON, MILLARD N & CYNTHIA A 1	0703100003	03-99-16	SECTION:03 TOWNSHIP:99 RANGE:20 SW NW KENSETT	0.3
ANDERSON, MILLARD N & CYNTHIA A 1	0703100004	03-99-17	SECTION:03 TOWNSHIP:99 RANGE:20 SE NW KENSETT	0.1
ANDERSON, MILLARD N & CYNTHIA A 1	0703200001	03-99-19	TOWNSHIP:99 RANGE:20 FRL NW N	0.3
ANDERSON, MILLARD N & CYNTHIA A 1	0703200002	03-99-18	3 TOWNSHIP:99 RANGE:20 FRL NE N	0.01
BERG, DELANO R.	0333276001	33-100-20	NORTHWOOD SE NE 33-100-20	8.2
BERG, DELANO R.	0333400003	33-100-20	NORTHWOOD NE SE 33-100-20	5.1
BERG, DELANO R.	0334151001	34-100-24	NORTHWOOD SW NW 34-100-20	8.9
BERG, DELANO R.	0334300001	34-100-24	NORTHWOOD NW SW 34-100-20	26.9
OLSON, KEITH A. & FRAN J.	0334300006	34-100-22	34 100 20 PAR IN SE SW	4.8
REUVERS, DEBRA A L/E	0334300004	34-100-20	34-100-20 SW SW	2.9
REUVERS, DEBRA A L/E	0334300007	34-100-21	34-100-20 SE SW EX PAR	31.7
REUVERS, DEBRA A L/E	0334400003	34-100-23	34-100-20 SW SE	37.3
REUVERS, DEBRA A L/E	0334400004	34-100-24	34-100-20 SE SE	5.4
WALSER, CHAD 1/2 INT & TRACIE 1/2 IN	0334300010	34-100-24	SECTION:0034 TOWNSHIP:100 RANGE:20 GROVE NE SW EX	2.9
WALSER, CHAD 1/2 INT & TRACIE 1/2 IN	0334400001	34-100-24	SECTION:0034 TOWNSHIP:100 RANGE:20 NW SE GROVE	2.6
Worth County Secondary Roads				4.0
Total				168.3

Appendix C: Engineer's Opinion of Probable Cost

Drainage District No. 14
Proposed Drainage Improvements
Worth County, Iowa
OPINION OF PROBABLE COSTS
Thursday, August 3, 2023



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Construction Division 1--Lower Main (Relief Line)

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
101	Class IV R.C.P., 36" Dia.	LF	175	\$91	\$15,925
102	Class III R.C.P., 36" Dia.	LF	2,951	\$85	\$250,835
103	18" on 36" Dia. R.C.P. Tee, Fabrication Only	EA	1	\$1,150	\$1,150
104	12" on 36" Dia. R.C.P. Tee, Fabrication Only	EA	1	\$1,150	\$1,150
105	36" Dia., R.C.P. Elbow Section, Fabrication Only	EA	4	\$800	\$3,200
106	12" Dia., R.C.P. Endcap	EA	1	\$125	\$125
107	Old to New Main Drains, All Sizes, Installation Only	EA	1	\$500	\$500
108	Lateral Tile Connections, 10" Dia. or Smaller	EA	7	\$400	\$2,800
109	Lateral Tile Connections, 12" Dia. or Larger	EA	1	\$500	\$500
110	HDPE Beehive Intake, 24" Dia.	EA	2	\$2,000	\$4,000
111	Tile Trench Stabilization and Cradling Rock	TN	88	\$35	\$3,080
113	Administration of Erosion Management Plan	LS	1	\$500	\$500
114	Silt Fence Install and Remove	LF	100	\$3	\$300
115	Spot Tile Exploration	HR	2	\$200	\$400
116	Mobilization	LS	1	\$14,200	\$14,200

Estimated Division 1 Subtotal \$299,000
Average Dollars Per Acre \$291

Drainage District No. 14
Proposed Drainage Improvements
Worth County, Iowa
OPINION OF PROBABLE COSTS
Thursday, August 3, 2023



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Construction Division 2--Upper Main

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
201	Class III R.C.P., 24" Dia.	LF	5,240	\$54	\$282,960
202	24" on 36" Dia. R.C.P. Tee, Fabrication Only	EA	1	\$1,150	\$1,150
203	15" on 24" Dia. R.C.P. Tee, Fabrication Only	EA	3	\$730	\$2,190
204	30" Dia., R.C.P. Elbow Section, Fabrication Only	EA	1	\$600	\$600
205	24" Dia., R.C.P. Endcap	EA	1	\$250	\$250
206	15" Dia., R.C.P. Endcap	EA	3	\$145	\$435
207	Old to New Main Drains, All Sizes, Installation Only	EA	3	\$500	\$1,500
208	Lateral Tile Connections, 10" Dia. or Smaller	EA	12	\$400	\$4,800
209	Lateral Tile Connections, 12" Dia. or Larger	EA	1	\$500	\$500
210	Hickenbottom Intake, 12" Dia.	EA	3	\$1,000	\$3,000
211	Tile Trench Stabilization and Cradling Rock	TN	130	\$35	\$4,550
212	Administration of Erosion Management Plan	LS	1	\$500	\$500
213	Silt Fence Install and Remove	LF	100	\$3	\$300
214	Spot Tile Exploration	HR	2	\$200	\$400
215	Mobilization	LS	1	\$15,200	\$15,200

Estimated Division 1 Subtotal \$318,000
Average Dollars Per Acre \$681

Construction Division 3--Lateral 4

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
301	Class III R.C.P., 18" Dia.	LF	3,354	\$42	\$140,868
302	12" on 24" Dia. R.C.P. Tee, Fabrication Only	EA	2	\$730	\$1,460
303	18" Dia., R.C.P. Elbow Section, Fabrication Only	EA	3	\$430	\$1,290
304	Old to New Main Drains, All Sizes, Installation Only	EA	3	\$500	\$1,500
305	Lateral Tile Connections, 10" Dia. or Smaller	EA	8	\$400	\$3,200
306	Lateral Tile Connections, 12" Dia. or Larger	EA	1	\$500	\$500
307	Hickenbottom Intake, 12" Dia.	EA	3	\$1,000	\$3,000
308	Tile Trench Stabilization and Cradling Rock	TN	67	\$35	\$2,345
309	Administration of Erosion Management Plan	LS	1	\$500	\$500
310	Silt Fence Install and Remove	LF	100	\$3	\$300
311	Spot Tile Exploration	HR	3	\$200	\$600
312	Mobilization	LS	1	\$7,800	\$7,800

Estimated Division 2 Subtotal \$163,000
Average Dollars Per Acre \$663

Drainage District No. 14
Proposed Drainage Improvements
Worth County, Iowa
OPINION OF PROBABLE COSTS
Thursday, August 3, 2023



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Construction Division 4--Lateral 5

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
401	Class III R.C.P., 24" Dia.	LF	1,600	\$54	\$86,400
402	Class III R.C.P., 18" Dia.	LF	1,009	\$42	\$42,378
403	15" on 24" Dia. R.C.P. Tee, Fabrication Only	EA	1	\$730	\$730
404	12" on 24" Dia. R.C.P. Tee, Fabrication Only	EA	1	\$730	\$730
405	24" Dia., R.C.P. Elbow Section, Fabrication Only	EA	2	\$500	\$1,000
406	18" Dia., R.C.P. Elbow Section, Fabrication Only	EA	2	\$430	\$860
407	36" to 24" Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	\$2,320	\$2,320
408	24" to 18" Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	\$1,425	\$1,425
409	15" Dia., R.C.P. Endcap	EA	1	\$145	\$145
410	12" Dia., R.C.P. Endcap	EA	3	\$125	\$375
411	Old to New Main Drains, All Sizes, Installation Only	EA	2	\$500	\$1,000
412	Lateral Tile Connections, 10" Dia. or Smaller	EA	2	\$400	\$800
413	Lateral Tile Connections, 12" Dia. or Larger	EA	1	\$500	\$500
414	Hickenbottom Intake, 12" Dia.	EA	3	\$1,000	\$3,000
415	Tile Trench Stabilization and Cradling Rock	TN	20	\$35	\$700
416	Administration of Erosion Management Plan	LS	1	\$500	\$500
417	Silt Fence Install and Remove	LF	100	\$3	\$300
418	Spot Tile Exploration	HR	2	\$200	\$400
419	Mobilization	LS	1	\$2,900	\$2,900

Estimated Division 3 Subtotal \$146,000
Average Dollars Per Acre \$579

Drainage District No. 14
Proposed Drainage Improvements
Worth County, Iowa
OPINION OF PROBABLE COSTS
Thursday, August 3, 2023



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Construction Division 5--DD 5 Lateral 8

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
501	Class III R.C.P., 18" Dia.	LF	2,025	\$42	\$85,050
502	18" Dia., R.C.P. Endcap	EA	1	\$180	\$180
503	Lateral Tile Connections, 10" Dia. or Smaller	EA	5	\$400	\$2,000
504	Lateral Tile Connections, 12" Dia. or Larger	EA	1	\$500	\$500
505	Hickenbottom Intake, 12" Dia.	EA	1	\$1,000	\$1,000
506	Tile Trench Stabilization and Cradling Rock	TN	66	\$35	\$2,310
507	Administration of Erosion Management Plan	LS	1	\$500	\$500
508	Silt Fence Install and Remove	LF	100	\$3	\$300
509	Spot Tile Exploration	HR	2	\$200	\$400
510	Mobilization	LS	1	\$9,300	\$9,300
Estimated Division 4 Subtotal					\$102,000
Average Dollars Per Acre					\$603

Construction Division 6--Iowa DOT

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
601	Drain Tile, Trenchless, Steel, 5/16" Wall, 36" Dia.	LF	80	\$1,100	\$88,000
602	Hickenbottom Intake, 12" Dia.	EA	2	\$1,000	\$2,000
603	Tile Trench Stabilization and Cradling Rock	TN	40	\$35	\$1,400
604	Seeding and Fertilizing (Rural)	LS	1	\$1,000	\$1,000
605	Traffic Control	LS	1	\$2,000	\$2,000
606	Silt Fence-Install and Remove	LF	200	\$3	\$600
607	Exploratory Excavation	HR	2	\$200	\$400
608	Mobilization	LS	1	\$4,800	\$4,800
Estimated Division 6 Subtotal					\$100,000

Drainage District No. 14
Proposed Drainage Improvements
Worth County, Iowa
OPINION OF PROBABLE COSTS
Thursday, August 3, 2023



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Construction Division 7--Union Pacific Railroad

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
701	Drain Tile, Trenchless, Steel, 5/16" Wall, 36" Dia.	LF	120	\$1,000	\$120,000
702	Tile Trench Stabilization and Cradling Rock	TN	200	\$35	\$7,000
703	Seeding and Fertilizing (Rural)	LS	1	\$1,000	\$1,000
704	Railroad Insurance and Permitting	LS	1	\$25,000	\$25,000
705	Silt Fence-Install and Remove	LF	200	\$3	\$600
706	Exploratory Excavation	HR	2	\$200	\$400
707	Mobilization	LS	1	\$7,700	\$7,700

Estimated Division 7 Subtotal \$162,000

Subtotal of Construction Divisions 1 - 6 \$1,290,000

Construction Contingency \$65,000

Total Estimated Construction Cost \$1,355,000

Less Estimated Road Construction Costs Paid by Others \$262,000

Total Estimated Assessable Construction Cost \$1,093,000

Work Area Rental (42.0 ac) \$42,000

Other Damages \$34,000

Basic Engineering Services

Survey, Study & Report, Meetings & Hearing \$75,000

Construction Plans, Specifications, & Bid Letting \$15,000

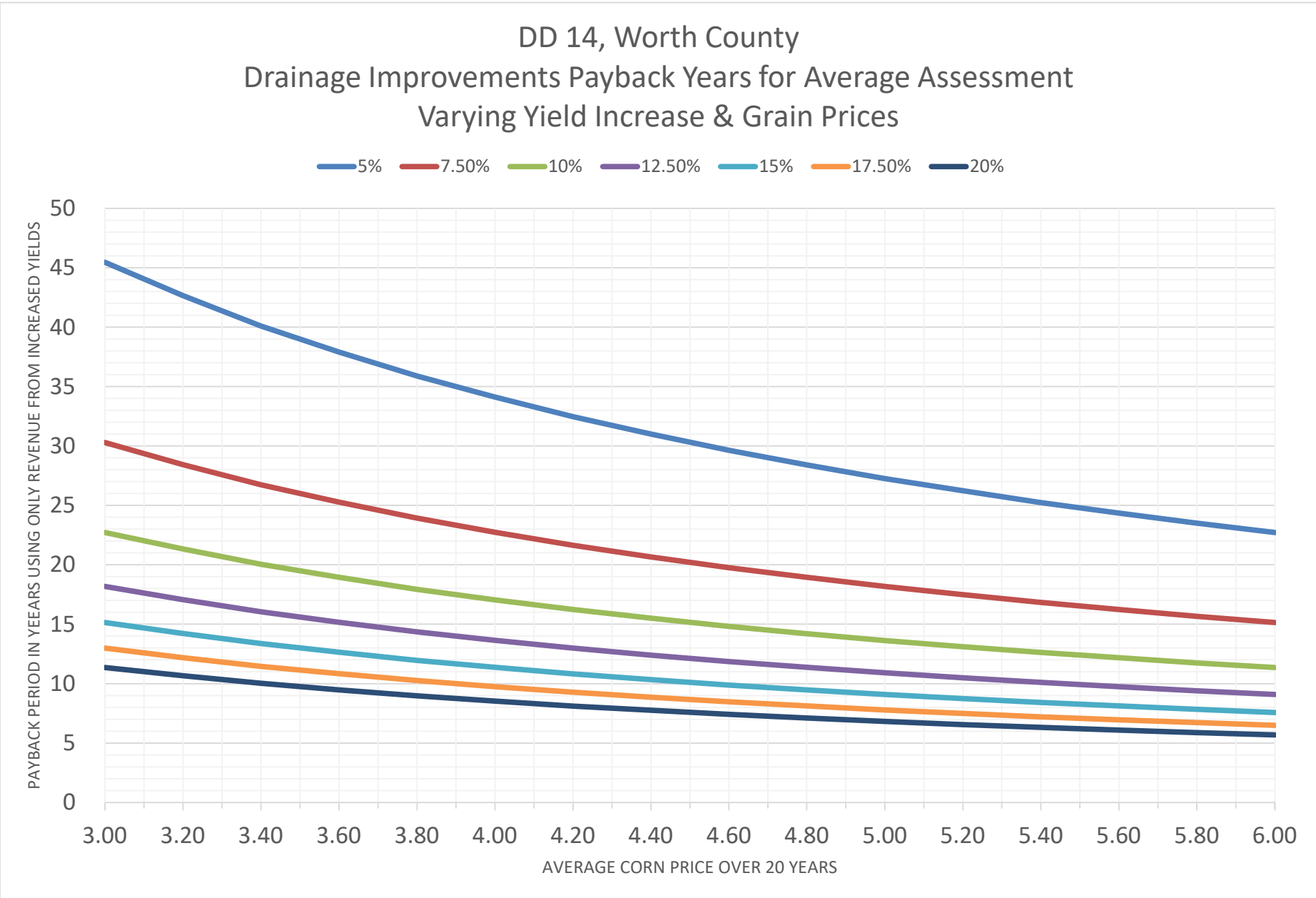
Construction Engineering Services \$50,000

Legal Services, Publications, Mailings, Etc. \$13,000

Finance, Interest & Contingency \$66,000

Total Estimated Assessable Project Cost \$1,388,000

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: **DD14**

ACRES IN DD	Enter>	1,028	ac
% Corn Acreage	Enter>	63	%
% Soybeans Acreage	Enter>	33	%
% Other (Roads, Etc)		3	%
Base Corn Yield	Enter>	193	bu/a
Base Soybeans Yield	Enter>	55	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	\$ 5.87
Avg Price of Soybeans Next 20 Years	\$ 14.08

From Corn	
From Soybean	
Total	
Increased Revenue/acre	
Based Revenue/acre over the anticipated life of the facility (100 years)	

Average Yield Improvement Due to Better Drainage Outlet, %							
2.5	5	7.5	10	12.5	15	17.5	20
3,125	6,250	9,375	12,499	15,624	18,749	21,874	24,999
466	933	1,399	1,866	2,332	2,799	3,265	3,732

<< 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							
\$ 18,343	\$ 36,686	\$ 55,029	\$ 73,372	\$ 91,715	\$ 110,058	\$ 128,401	\$ 146,744
\$ 6,568	\$ 13,135	\$ 19,703	\$ 26,271	\$ 32,838	\$ 39,406	\$ 45,974	\$ 52,541
\$ 24,911	\$ 49,821	\$ 74,732	\$ 99,643	\$ 124,553	\$ 149,464	\$ 174,374	\$ 199,285
\$ 24	\$ 48	\$ 73	\$ 97	\$ 121	\$ 145	\$ 170	\$ 194
\$ 2,423	\$ 4,846	\$ 7,270	\$ 9,693	\$ 12,116	\$ 14,539	\$ 16,962	\$ 19,386

Very High Assessment		
\$3,375	per ac	250% of Avg
High Assessment		
\$2,700	per ac	200% of Avg
Above Average Assessment		
\$2,025	per ac	150% of Avg
Average Assessment		
\$1,350	per ac	100% of Avg
Low Assessment		
\$675	per ac	50% of Avg
Very Low Assessment		
\$338	per ac	25% of Avg

Payback Period For Revenues From Only Yield Increase (Years)							
139.3	69.6	46.4	34.8	27.9	23.2	19.9	17.4
111.4	55.7	37.1	27.9	22.3	18.6	15.9	13.9
83.6	41.8	27.9	20.9	16.7	13.9	11.9	10.4
55.7	27.9	18.6	13.9	11.1	9.3	8.0	7.0
27.9	13.9	9.3	7.0	5.6	4.6	4.0	3.5
13.9	7.0	4.6	3.5	2.8	2.3	2.0	1.7
2.5	5	7.5	10	12.5	15	17.5	20
Average Yield Improvement Due to Better Drainage Outlet, %							

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 \$5 and soybeans at \$12

A very high cost assessment (250% of average) would be paid off in	23.2	years on a 15% average yield increase.
A high cost assessment (200% of average) would be paid off in	22.3	years on a 12.5% average yield increase.
An above avg cost assessment (150% of average) would be paid off in	20.9	years on a 10% average yield increase.
An average cost assessment (100% of average) would be paid off in	18.6	years on a 7.5% average yield increase.
A low cost assessment (50% of average) would be paid off in	13.9	years on a 5% average yield increase.
A very low cost assessment (25% of average) would be paid off in	13.9	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	\$5.00	
Soybeans	\$12.00	
Price Adj. for Yield Change		
Average Annual Yield Change	CORN 20-Year Avg. Price	SOYBEANS 20-Year Avg Price
0.0%	\$5.00	\$12.00
0.5%	\$5.26	\$12.63
1.0%	\$5.55	\$13.32
1.5%	\$5.87	\$14.08
2.0%	\$6.21	\$14.92
2.5%	\$6.60	\$15.83
3.0%	\$7.02	\$16.84
3.5%	\$7.47	\$17.94

Existing Farm Yield vs. Potential Farm Yield

		Current Average Corn Yield over Entire Field bu/ac					
		90	110	130	150	170	190
Average Field Yield with Improvement bu/ac	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 Drainage District No. 14

Assumptions

Long-term Soybean/Corn price ratio is 2.6

Average assessment of \$1,350/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

Price Used Over Payback Period		Average Yield Response Due to Drainage Improvements						
		Corn	Soybeans	5%	7.50%	10%	12.50%	15%
3.00	7.80	45.46	30.30	22.73	18.18	15.15	12.99	11.36
3.20	8.32	42.65	28.44	21.33	17.06	14.22	12.19	10.66
3.40	8.84	40.10	26.74	20.05	16.04	13.37	11.46	10.03
3.60	9.36	37.91	25.27	18.95	15.16	12.64	10.83	9.48
3.80	9.88	35.88	23.92	17.94	14.35	11.96	10.25	8.97
4.00	10.40	34.11	22.74	17.05	13.64	11.37	9.75	8.53
4.20	10.92	32.46	21.64	16.23	12.98	10.82	9.27	8.11
4.40	11.44	31.00	20.67	15.50	12.40	10.33	8.86	7.75
4.60	11.96	29.63	19.76	14.82	11.85	9.88	8.47	7.41
4.80	12.48	28.42	18.94	14.21	11.37	9.47	8.12	7.10
5.00	13.00	27.26	18.17	13.63	10.90	9.09	7.79	6.82
5.20	13.52	26.23	17.49	13.11	10.49	8.74	7.49	6.56
5.40	14.04	25.24	16.83	12.62	10.10	8.41	7.21	6.31
5.60	14.56	24.35	16.23	12.17	9.74	8.12	6.96	6.09
5.80	15.08	23.50	15.66	11.75	9.40	7.83	6.71	5.87
6.00	15.60	22.72	15.15	11.36	9.09	7.57	6.49	5.68

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

Appendix D: Estimated Classification of Benefit



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300 W McKinley Street
PO Box 68
Jefferson, IA 50129

Ph: (515) 386-4101
Bolton-Menk.com

RE: Approximate Assessment Distributions
Proposed Tile Improvements
Drainage District No. 14

Dear Board Members:

As per your direction we have prepared a preliminary classification showing the approximate distribution of project costs estimated for each of the proposed tile drain improvements that are recommended in the engineer's report for Drainage District No. 14.

We wish to emphasize that this work has been done for the landowners to use as a tool for planning purposes only. We offer the following disclaimer statement and ask that it accompany all distributions and displays of the approximate assessments.

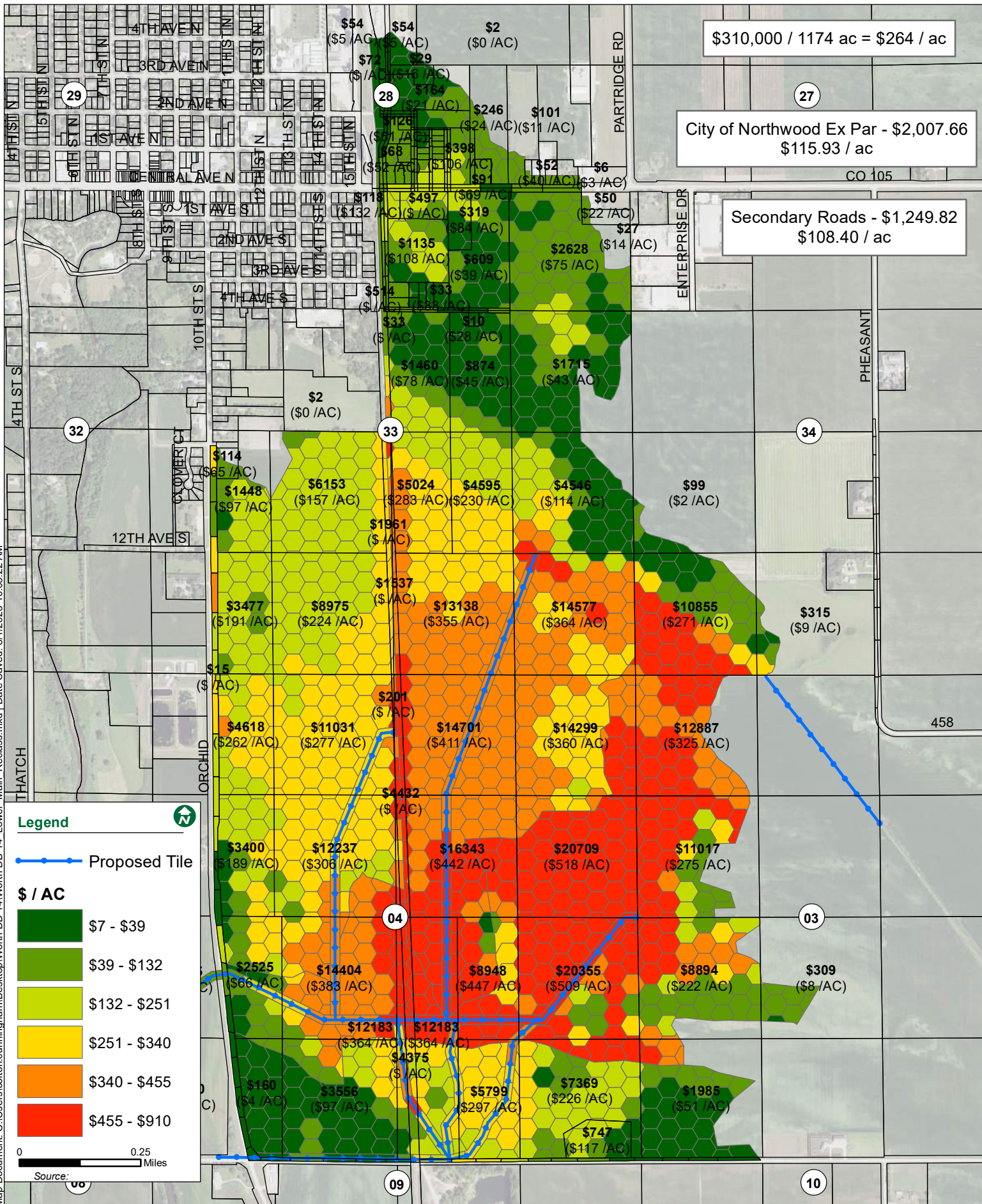
DISCLAIMER

Many variables are involved in the calculation of a drainage district benefit classification. The approximate assessments presented are estimates of how an experienced benefit commission would spread the engineer's estimated construction cost of the designated proposed facility to the benefited lands. This is not the product of a duly appointed benefit commission. This is not a part of the engineer's report. This should not be relied upon to be accurate for any individual parcel or farm. The intended purpose is to show the approximate general relative distribution of benefits for planning purposes of the landowners. No guarantee is intended, made or implied by the preparers of these approximate assessment maps

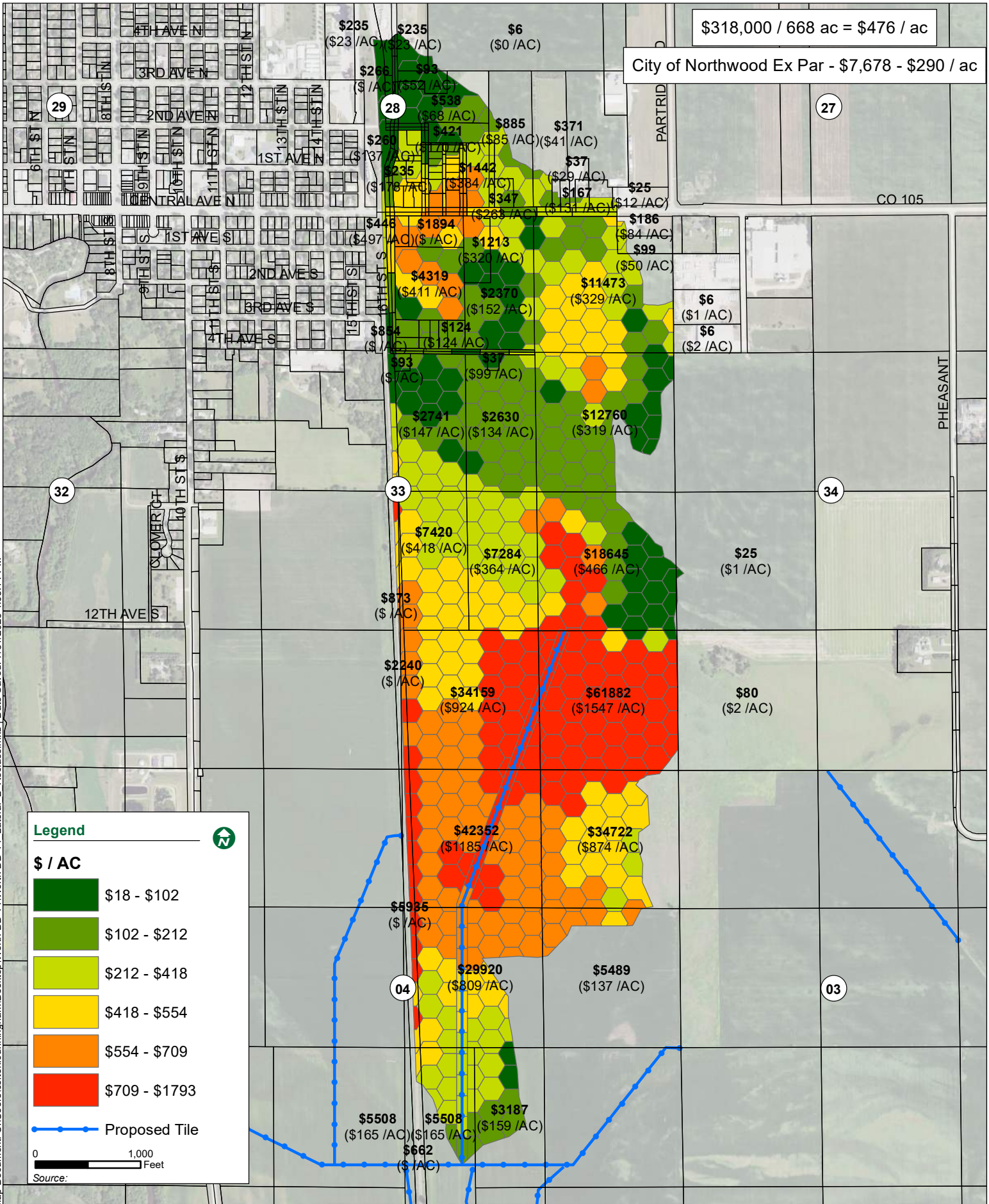
Sincerely,

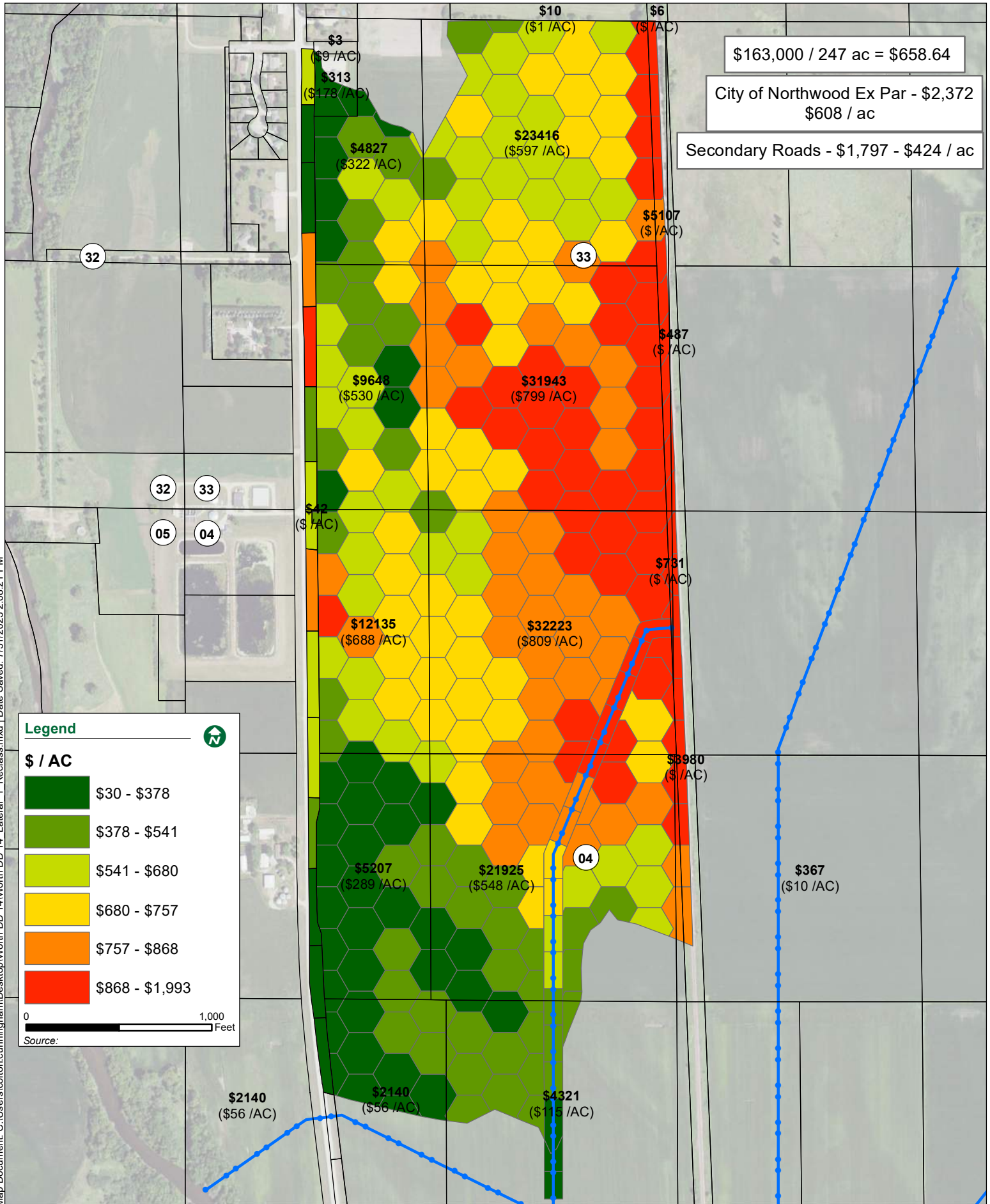
Bolton & Menk, Inc.

Jacob Hagan, P.E.
Project Engineer

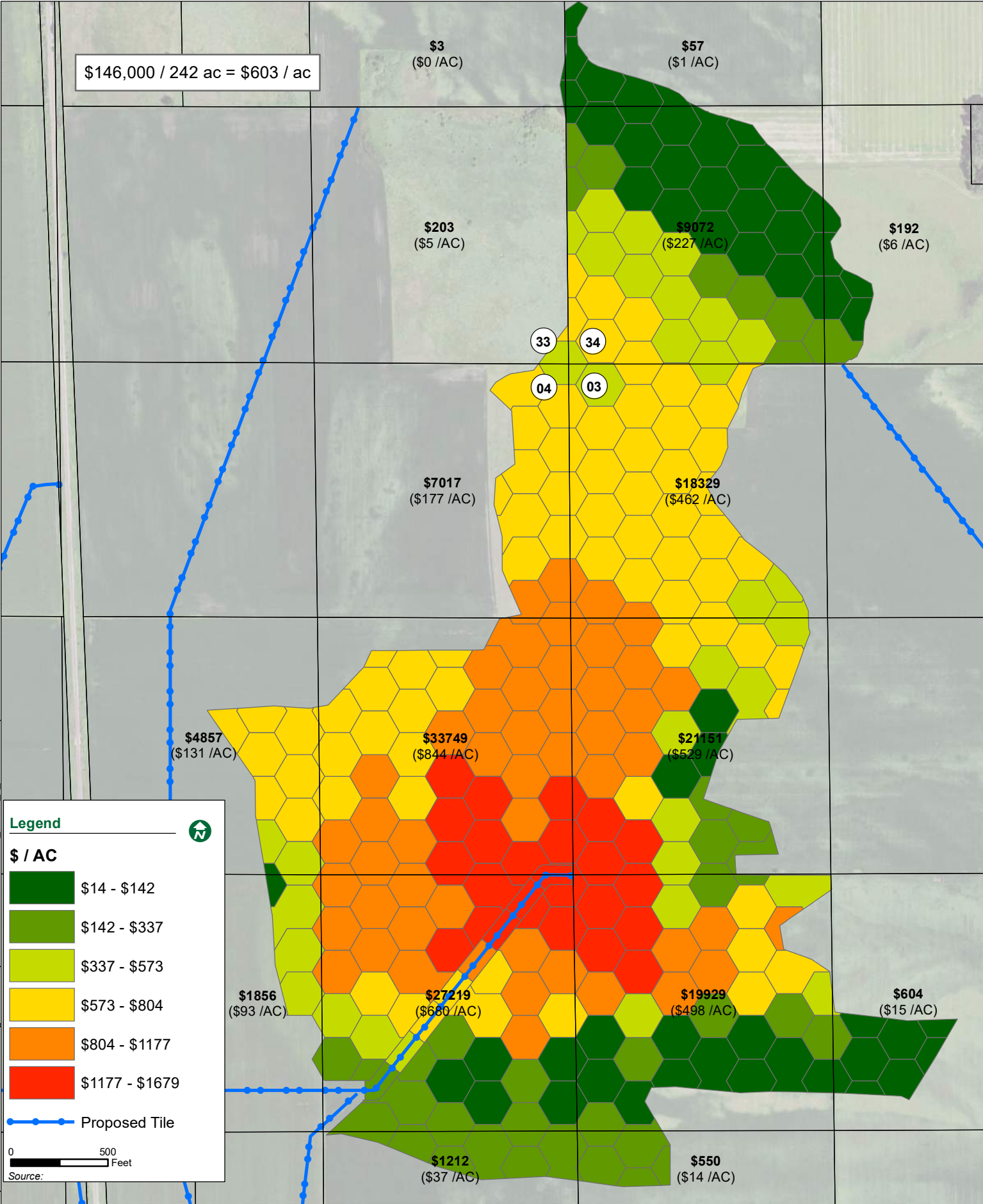


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\$146,000 / 242 ac = \$603 / ac



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Legend

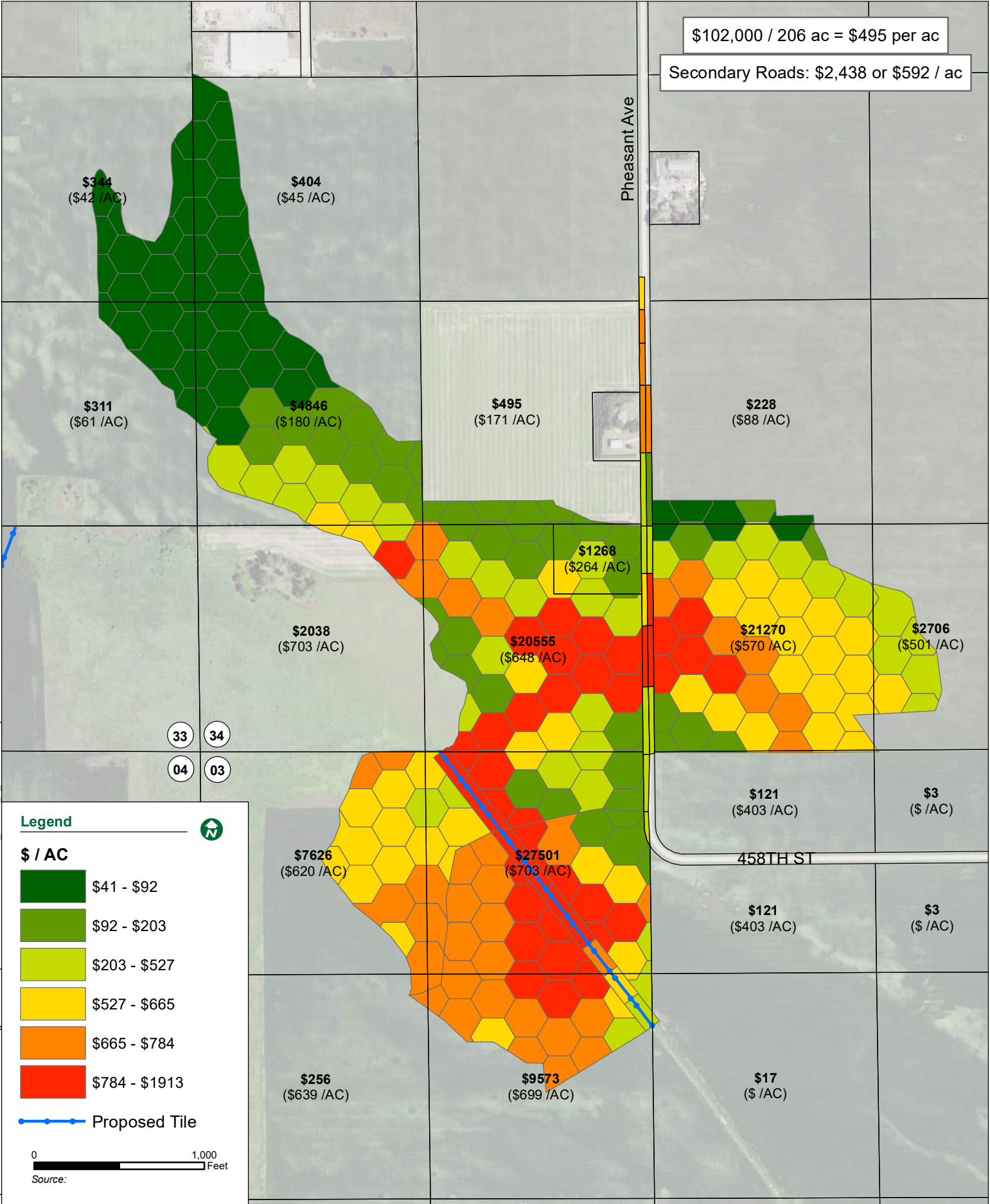
\$ / AC

- \$14 - \$142
- \$142 - \$337
- \$337 - \$573
- \$573 - \$804
- \$804 - \$1177
- \$1177 - \$1679

Proposed Tile

0 500 Feet

Source:



\$344
(\$42 /AC)

\$404
(\$45 /AC)

\$311
(\$61 /AC)

\$4846
(\$180 /AC)

\$495
(\$171 /AC)

\$228
(\$88 /AC)

\$1268
(\$264 /AC)

\$2038
(\$703 /AC)

\$20555
(\$648 /AC)

\$21270
(\$570 /AC)

\$2706
(\$501 /AC)

33 34

04 03

\$7626
(\$620 /AC)

\$27501
(\$703 /AC)

\$121
(\$403 /AC)

\$3
(\$ /AC)

458TH ST

\$121
(\$403 /AC)

\$3
(\$ /AC)

\$256
(\$639 /AC)

\$9573
(\$699 /AC)

\$17
(\$ /AC)

Pheasant Ave

Proposed Plans

PRELIMINARY PLANS FOR

DRAINAGE DISTRICT NO. 14

DRAINAGE REPAIRS & IMPROVEMENTS

WORTH COUNTY, IOWA

2023

SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
A.01	TITLE SHEET
A.02	LANDOWNER PLAT
M.01 - M.03	PLAN & PROFILE - DD No. 14 - PROPOSED MAIN
M.04 - M.05	PLAN & PROFILE - DD No. 14 - PROPOSED LATERAL 4
M.06	PLAN & PROFILE - DD No. 14 - PROPOSED LATERAL 5
M.07 - M.08	PLAN & PROFILE - DD No. 14 - PROPOSED NORTHWOOD TILE
M.09	PLAN & PROFILE - DD No. 14 - DD No. 5 PROPOSED LATERAL 8

GOVERNING SPECIFICATIONS

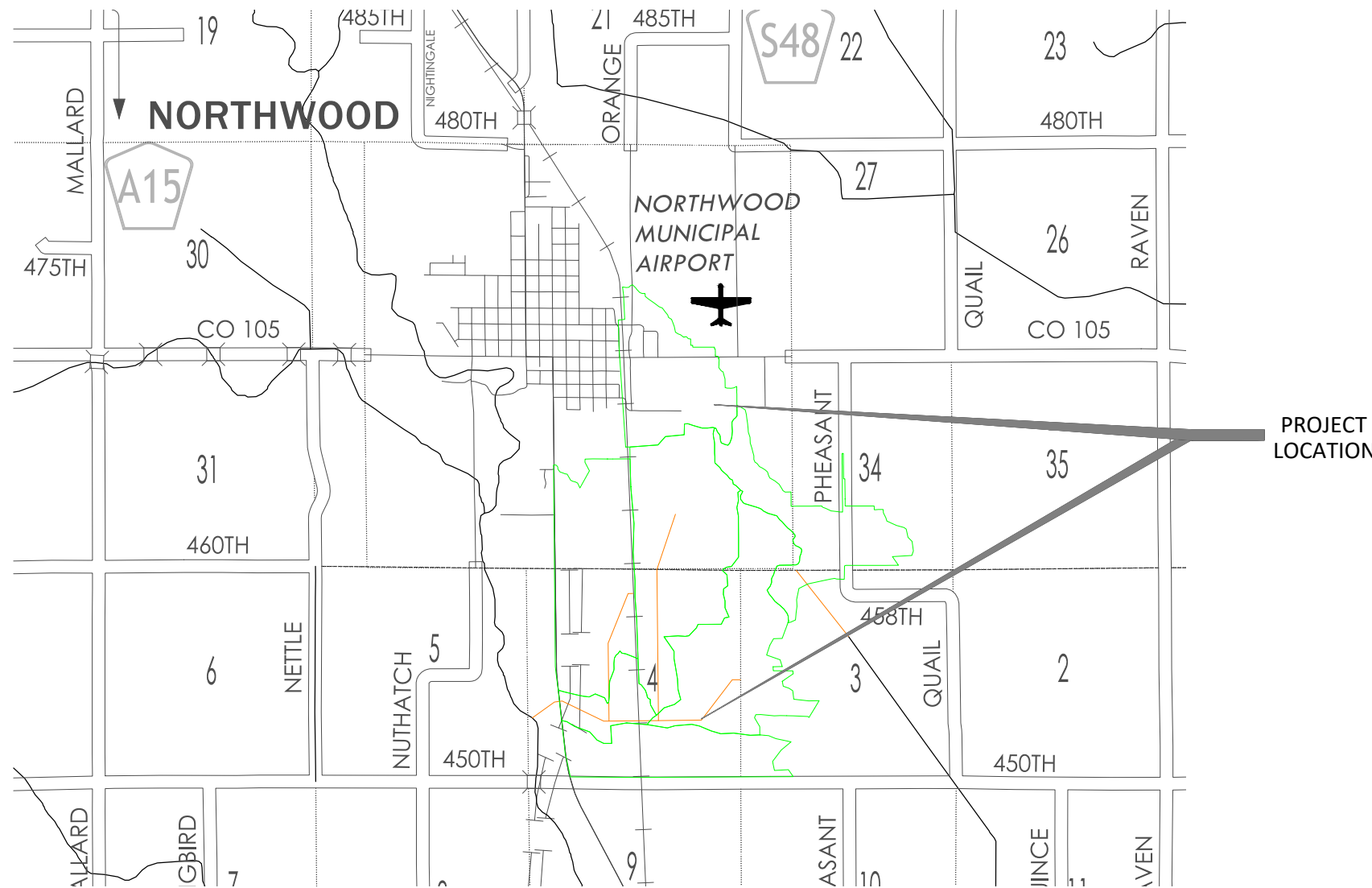
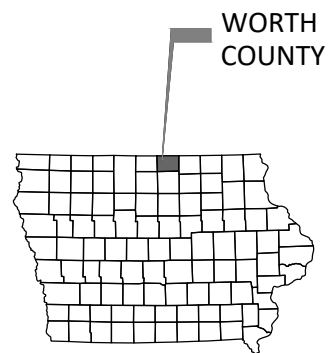
THE 2023 EDITION OF THE "IOWA STATEWIDE URBAN STANDARD SPECIFICATIONS FOR PUBLIC IMPROVEMENTS" SHALL GOVERN.

IOWA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION", SERIES 2023 AND ALL CURRENT GENERAL SUPPLEMENTAL SPECIFICATIONS AND MATERIALS INSTRUCTIONAL MEMORANDUM SHALL GOVERN AS REFERENCED.

ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND ORDINANCES WILL BE COMPLIED WITH IN THE CONSTRUCTION OF THIS PROJECT.



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



DATUM EQUATION 1912 DATUM + = NAVD 88	PROJECT DATUM: STATE PLANE HORIZONTAL: IOWA NORTH VERTICAL: NAD 1988
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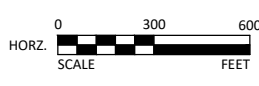
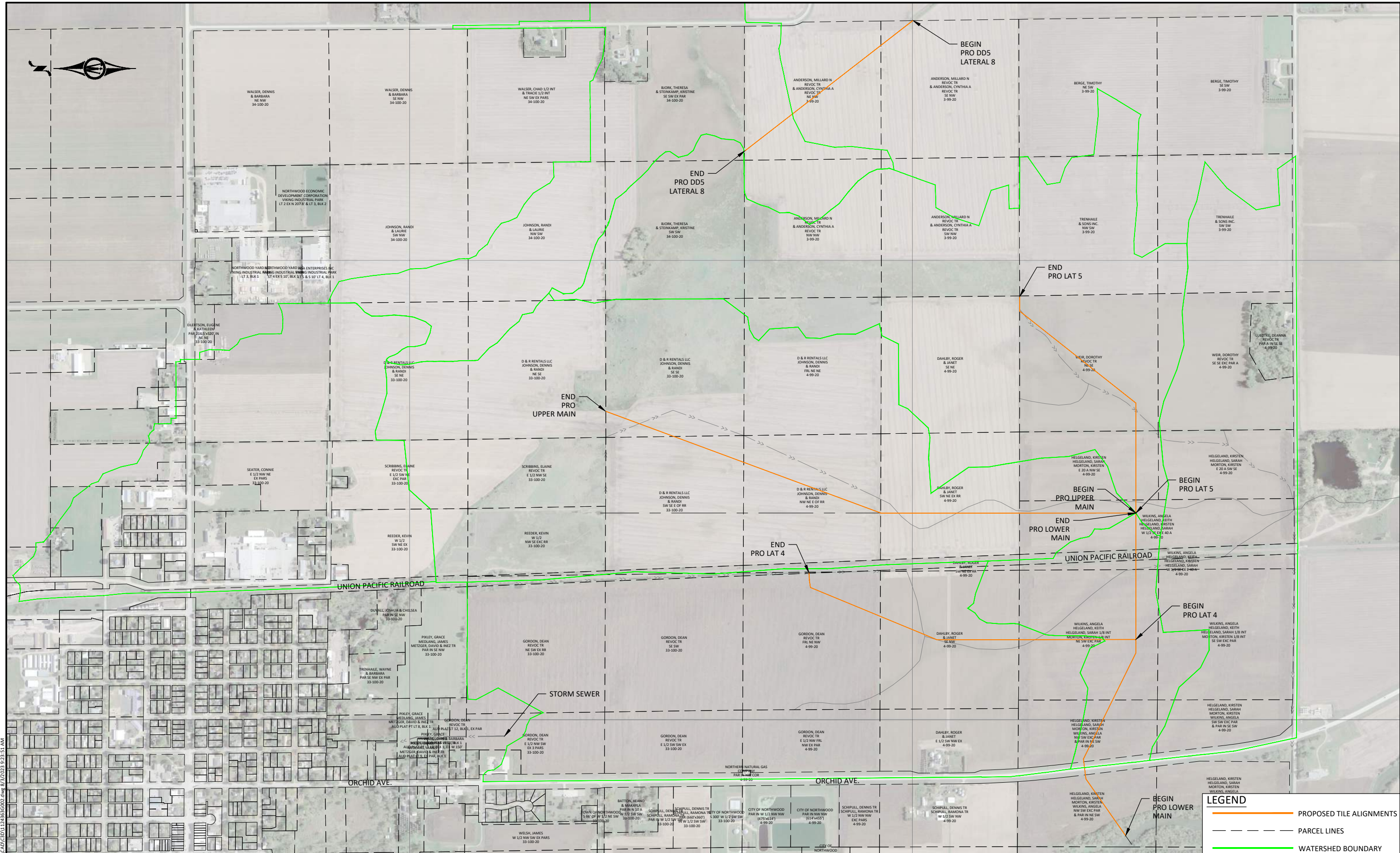


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 TITLE SHEET

SHEET
A.01



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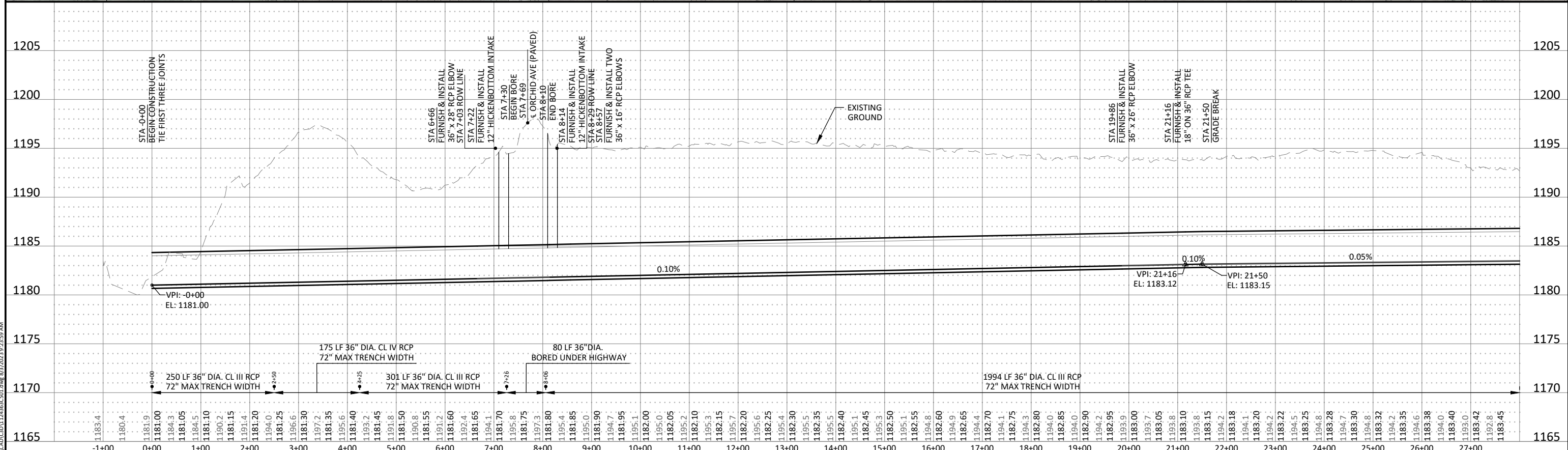
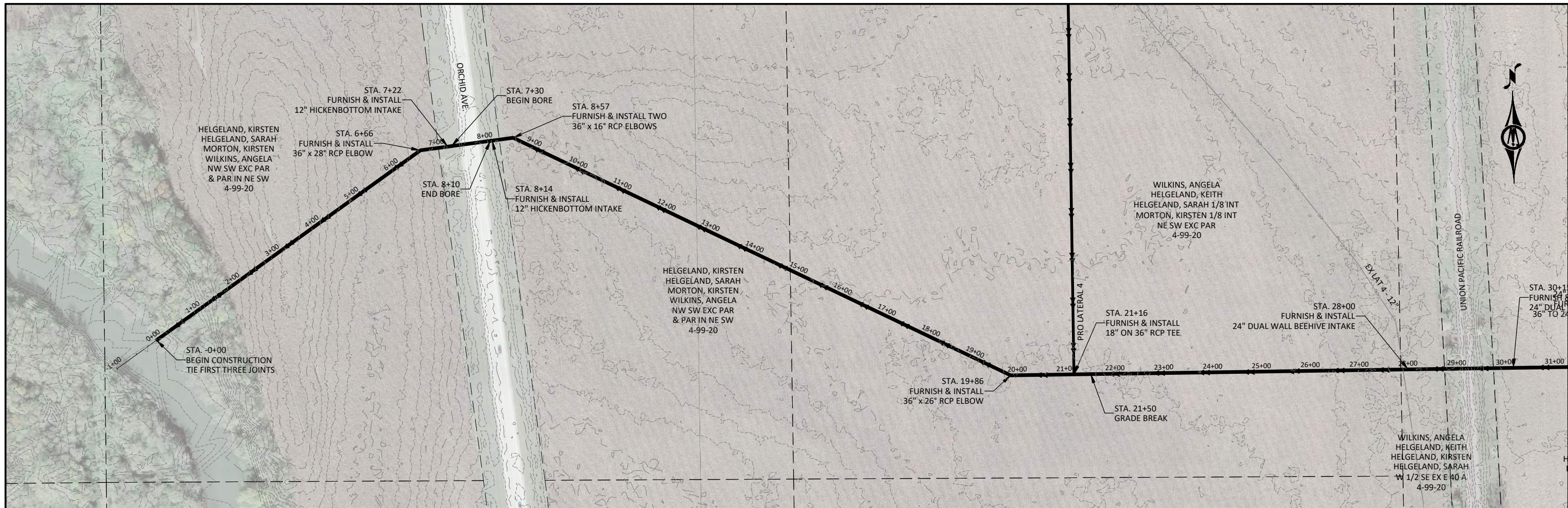
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LANDOWNER PLAT

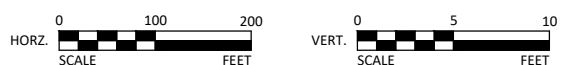
LEGEND	
	PROPOSED TILE ALIGNMENTS
	PARCEL LINES
	WATERSHED BOUNDARY

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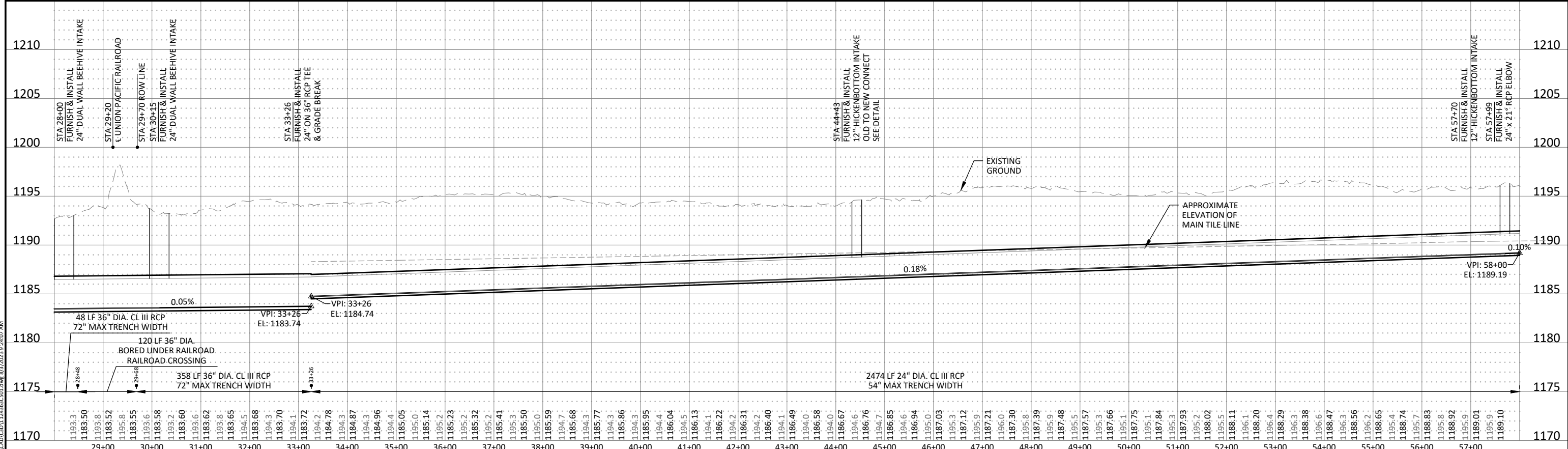


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SHEET
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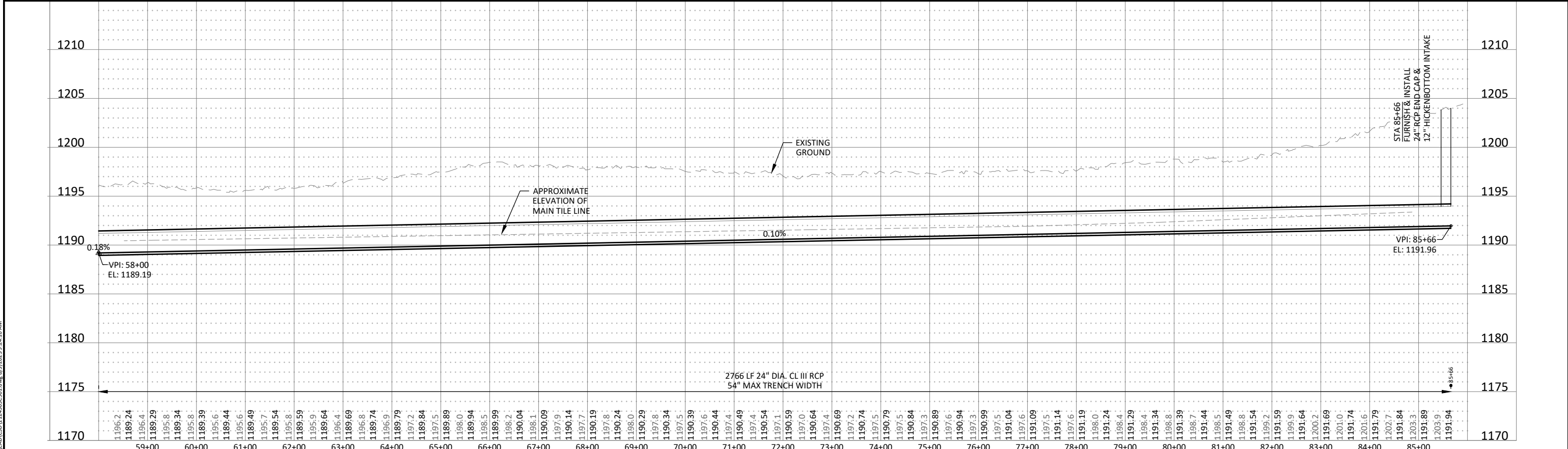
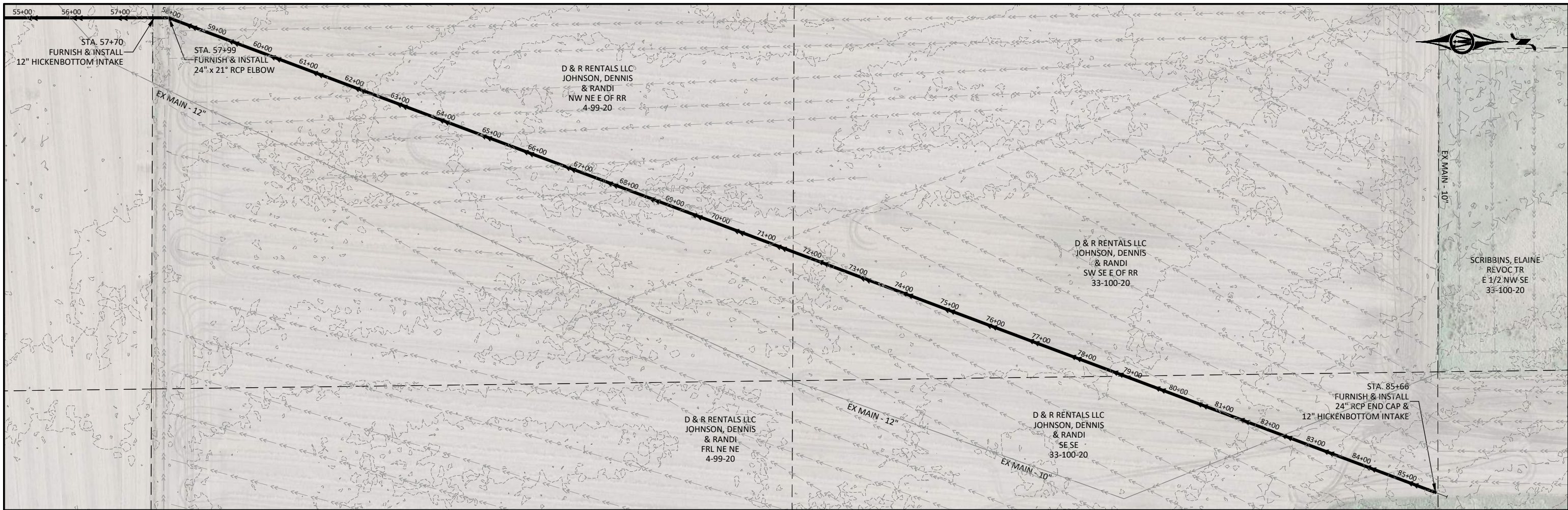
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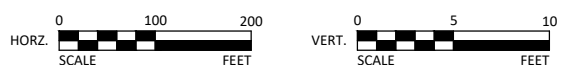
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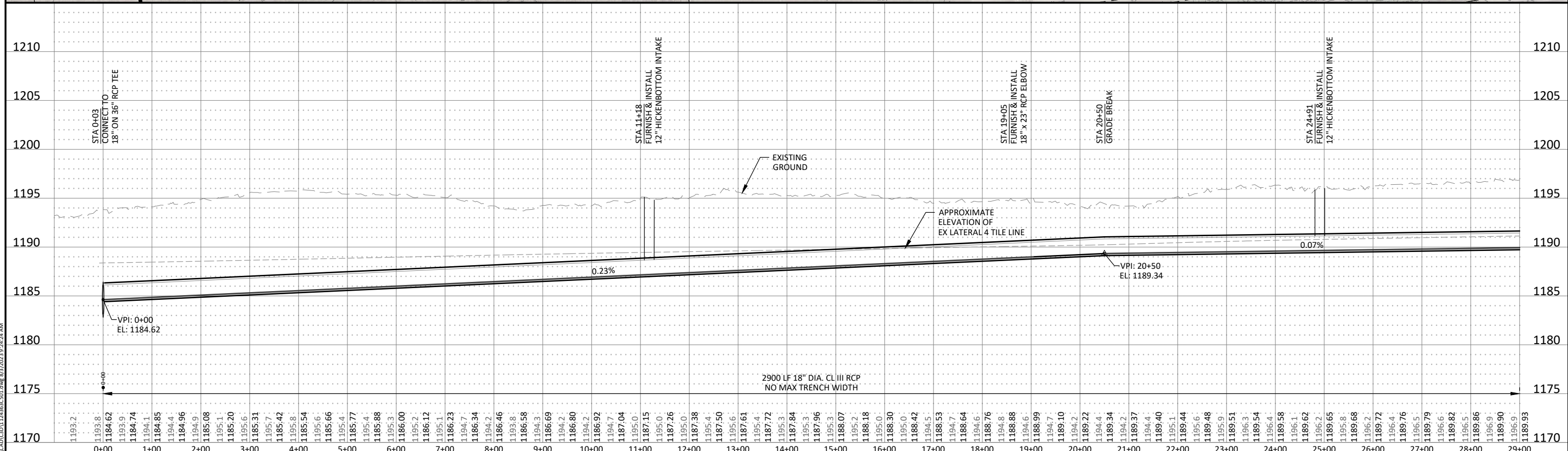
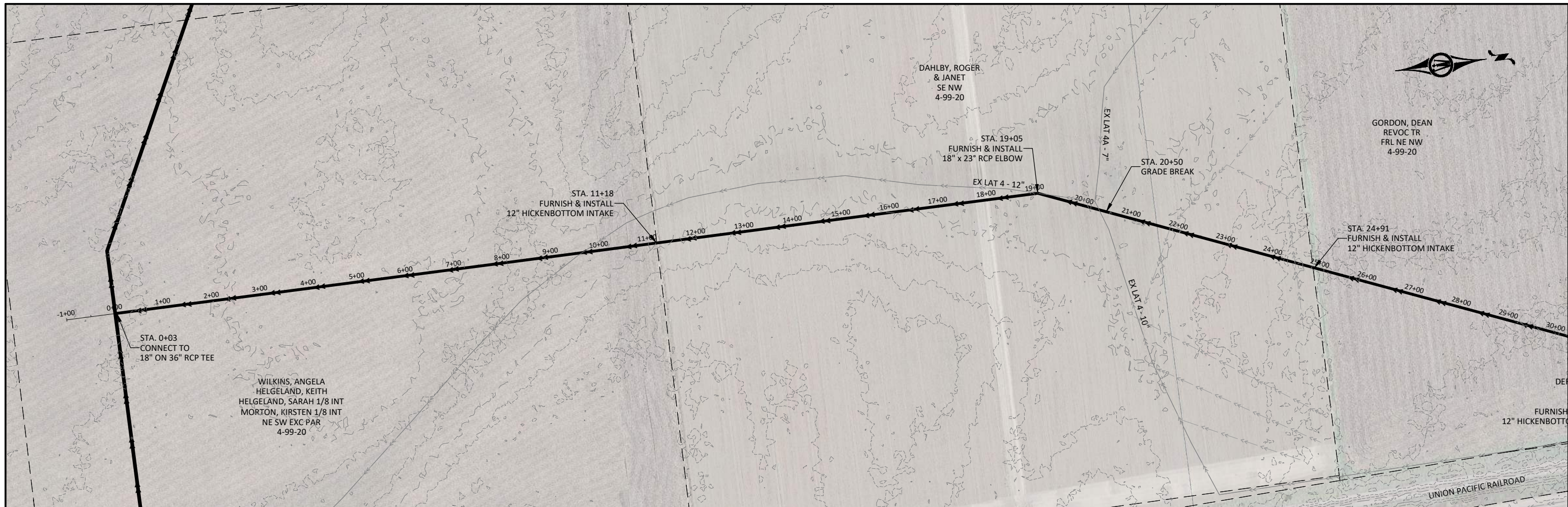


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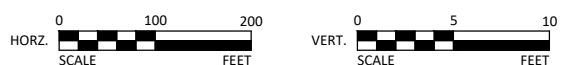
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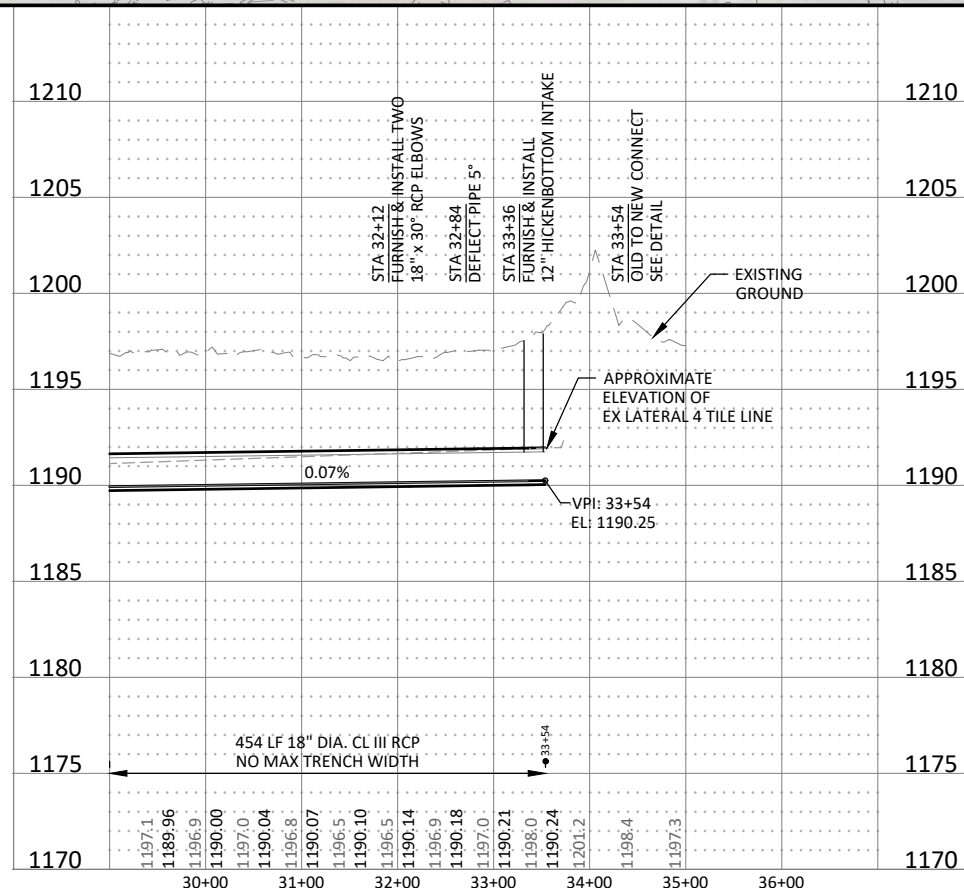
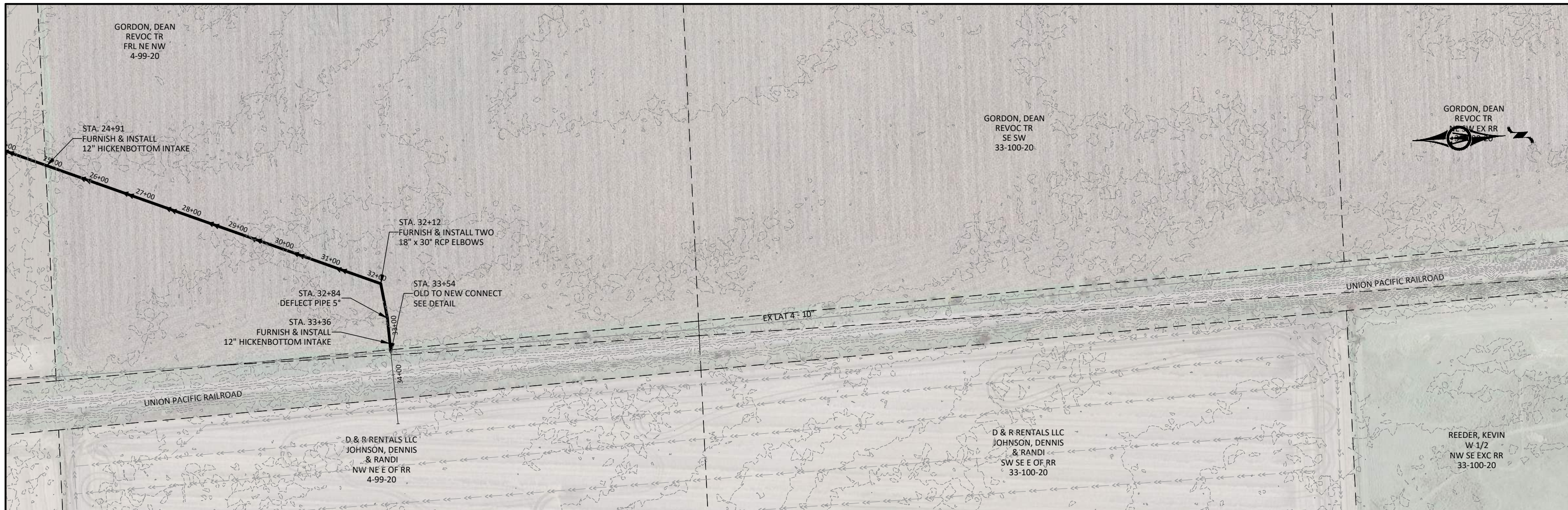


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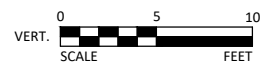
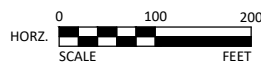
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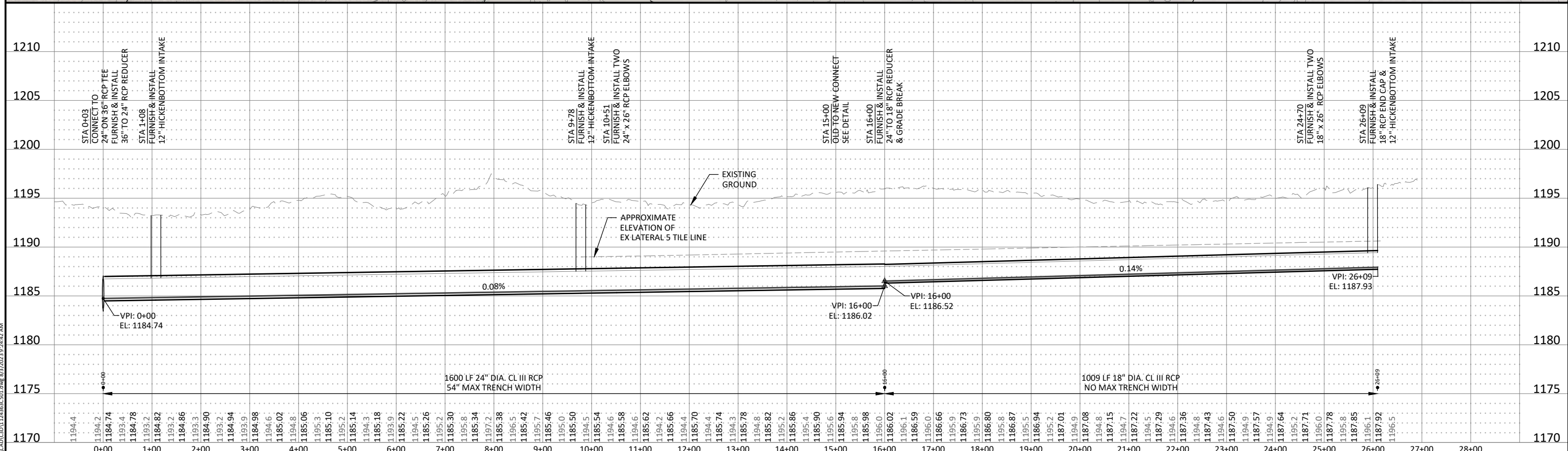
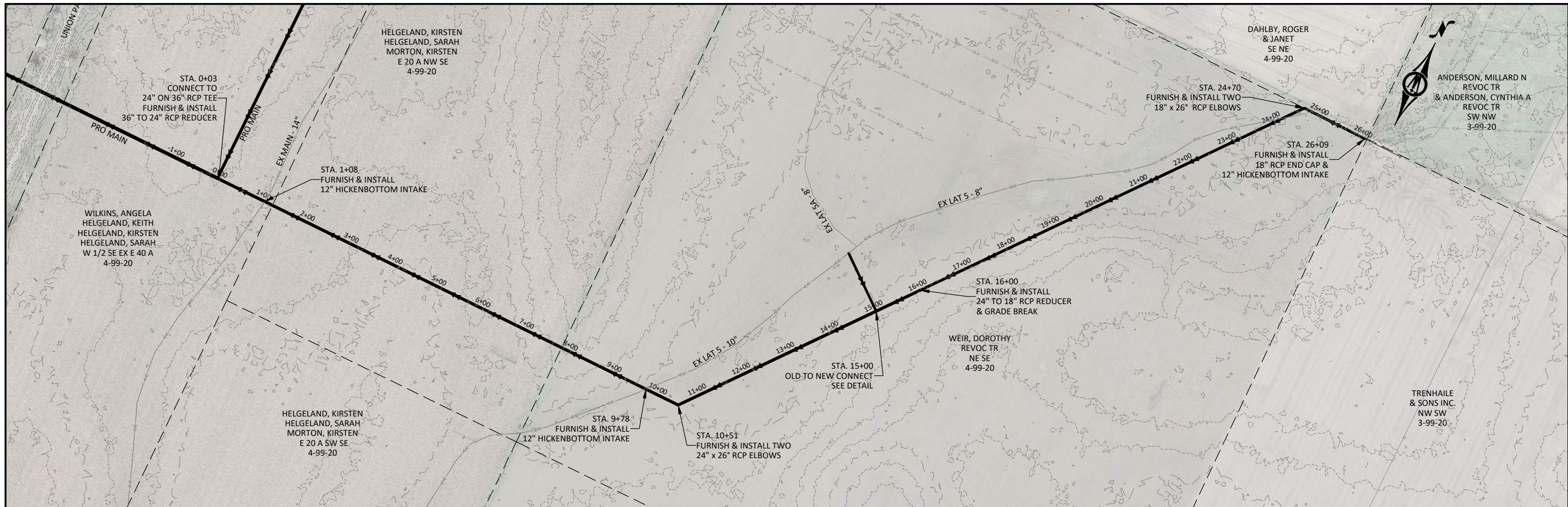


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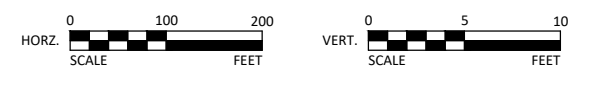
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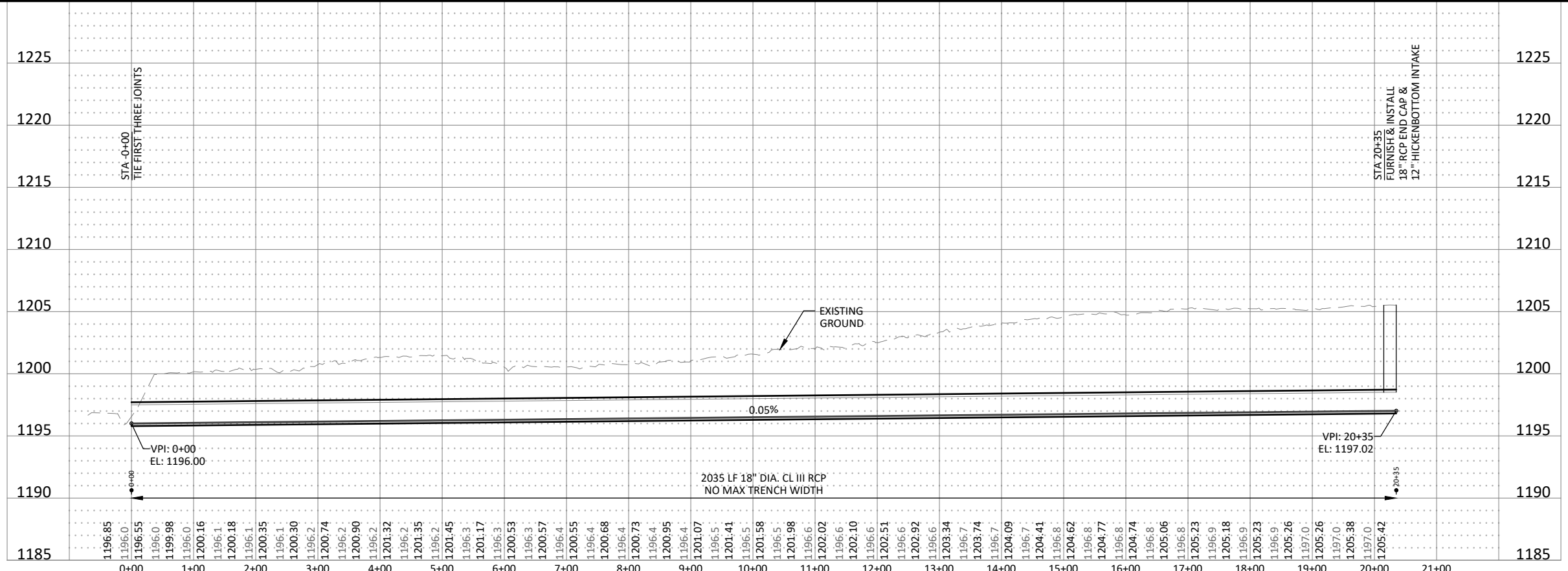
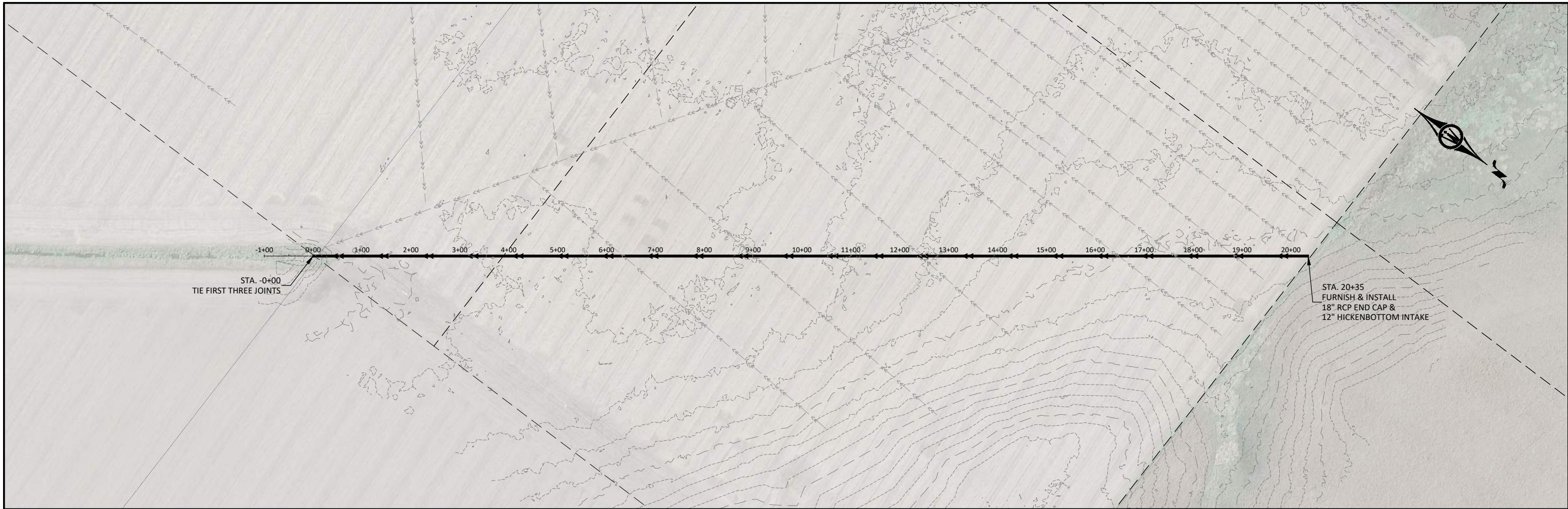
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