AgriVia

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Annexation Report

Joint Drainage District No. 4-263

Webster & Hamilton County, Iowa
2026

PROFESSIONAL ENGINEER JACOB L. HAGAN 25738 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. Jacob Hagan 7/28/26 Jacob L. Hagan, P.E. (date) License No. 25738 My license renewal date is December 31, 2026. Pages or sheets covered by this seal: All
PROFESSIONAL ENGINEER TYLER J. BUMAN 30759 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. Tyler Buman 7-28-26 Tyler J. Buman, P.E. (date) License No. 30759 My license renewal date is December 31, 2027. Pages or sheets covered by this seal: All

Project No. 2628-94

Executive Summary

Introduction

This report recommends the annexation of additional lands into Joint Drainage District No. 4-263. The objective is to align the district's legal boundaries with the full extent of the lands that materially benefit from its infrastructure, ensuring the system is effective and that maintenance costs are shared equitably among all beneficiaries.

Justification for Annexation

The basis for this annexation is the significant evolution in engineering and agricultural practices since the district's formation. The need of drainage and hydraulic load placed on the district's drainage facilities has increased substantially. This annexation is a necessary modernization to align the district's legal and financial structure with its current operational reality.

Material Benefits

Annexation requires tangible, material benefits such as increased property value and agricultural productivity. The primary economic benefit is a direct increase in crop yields, as the district's deep, maintained facilities provides a superior outlet that is essential for the effective function of private subsurface tile drainage. This leads to improved soil health and more timely fieldwork. Additional benefits include the protection of non-agricultural property through improved water management, which helps keep basements dry and prevents soil saturation on lawns and driveways. Furthermore, inclusion grants landowner's significant legal rights under Iowa Code, including the right to petition for repairs, the right to object to assessments, and the right of remonstrance to stop a proposed project.

Methodology for Determining Annexation

The parcels recommended for annexation were identified through an objective, data-driven engineering analysis. Every acre was evaluated against five key criteria to determine material benefit. A parcel was identified as benefited if the district provides an improved outlet where the natural slope is insufficient for effective drainage, or if the district provides significantly closer and more efficient access to a drainage outlet than what existed naturally. Additionally, official USDA soil data was used to identify lands with inherent limitations, such as a poor natural drainage class, low soil permeability, or a high-water table, that are overcome by the artificial drainage the district enables. This scientific process ensures that only lands receiving a true, material benefit are recommended for inclusion.

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Introduction

Overview

The Joint Webster and Hamilton County Board of Supervisors, serving as Trustees for Joint Drainage District No. 4-263 (JDD 4-263), has identified additional lands that appear to benefit from the district's drainage infrastructure but are not currently included within the district's boundaries. As authorized by Iowa Code §468.119, the Board appointed AgriVia to serve as the engineer for a potential annexation.

This report examines these additional lands to determine if they receive a material benefit from JDD 4-263. It has been prepared to provide a thorough, transparent, and legally sound basis for the Board and affected landowners to evaluate the proposed annexation. Our investigation includes a review of the lands' elevation, historical and current drainage conditions, and their relationship to the established district facilities.

Location

JDD 4-263 serves approximately 4,606 acres including the right-of-way of the open ditch. These lands are in Section 4 of Washington Township, Sections 13, 24, 25, 26, 34, 35, and 36 of Colfax Township in Webster County. Additional lands are in Sections 7, 8, 17, 18, 19, 20, 29, 30, and 31 of Fremont Township in Hamilton County, Iowa. A Map of the JDD 4-263 benefited area is included in Appendix A.

Material Benefits of Drainage

Crop Yield Response

A 1983 ISU study found that poor drainage can reduce yields by up to 32%, but installing tile in these areas often provides strong economic returns. A table showing yield increases from that study is provided below:

	Poor Drainage (Less than ¼" Drainage Coefficient)		High Drainage (1/2" Drainage Coefficient)		Percent Increase	
Soil Drainage Class	**Corn Yield (bu/acre)**	**Soybeans Yield (bu/acre)**	**Corn Yield (bu/acre)**	**Soybeans Yield (bu/acre)**	**Corn Yield**	**Soybeans Yield**
Very Poorly Drained	28	12	123	48	339%	300%
Poorly Drained	80	31	121	47	51%	52%
Somewhat Poorly Drained	90	34	124	48	38%	41%

According to Iowa State University Extension's Understanding the Economics of Tile Drainage (2023), tile drainage can increase corn yields by 10–20 bushels per acre and soybean yields by 4–8 bushels per acre, depending on soil and weather.

Using ISU's Excel-based calculator, we prepared a map of the drainage district showing estimated corn yield increases for tile drainage based on soil drainage class. This calculator is available at: extension.iastate.edu/agdm/wholefarm/xls/c2-90tilinganalysis.xlsx. The map is included in Appendix H.

Long-term research from Ohio State University found similar benefits. Their data showed that tiled fields produced 24–39% more corn and 12–45% more soybeans compared to untiled ground. Benefit-cost ratios ranged from 1.7:1 up to 4:1, meaning a return of $3–$4 for every $1 invested in tile.

For more detail, we have included a summary of drainage benefits from Ohio State in Appendix B.

Non-Crop Benefits

Drainage districts do not just serve farmland. Acreages, conservation areas, small towns, and other rural homes depend on district infrastructure to lower the water table, keep basements dry, and manage stormwater that would otherwise pool in yards and create muddy driveways for example. These properties benefit from better growing conditions for trees, lawns, and gardens, similar to how urban properties benefit from storm sewer systems.

Public roads, driveways, and paths are another example. Modern roadways, especially paved ones, shed water quickly. That runoff often enters the drainage system through roadside intakes. Drier roads and driveways are more durable, easier to maintain, and less prone to erosion or frost damage. Iowa Code 468.43 allows for assessing roads because they directly benefit from district facilities.

There are also public health benefits. In the early days, before drainage districts existed, wetlands across Iowa were breeding grounds for mosquitoes and disease. The law (Iowa Code 468.2) recognizes drainage as a tool to improve public health, safety, and overall welfare.

Existing Infrastructure

Lateral No. 7 Open Ditch

The district's open ditch begins just south of the Quarter-section corner between Sections 24 and 25 of Colfax Township, south of 200th St, two miles northeast of Duncombe. From there, it flows south through Sections 25 and 36, crossing 210th Street, then west through Section 35, crossing Xavier Avenue, before flowing into Lateral No. 1 of JDD 4-272.

Landscape Considerations

District Landscape

To better understand the watershed, we used publicly available LiDAR (Light Detection and Ranging) technology to map the district's surface topography. LiDAR uses laser pulses from aircraft to produce highly accurate elevation data, allowing us to identify natural drainage patterns and areas of water accumulation. An elevation map is included in Appendix D, and a water flow paths map is included in Appendix E.

Soils

The soils in this drainage district are primarily clay loams and silty clay loams. Common soil types include Canisteo, Clarion, Harps, Nicollet, Okoboji, and Webster, with most slopes in the 0% → 3% range. Drainage classes vary across the district as shown below:

Soil Drainage Class			
As Noted on Schedule	**Drain Class**	**Acres**	**Percentage of Watershed**
7	Very Poorly Drained	377	8%
6	Poorly Drained	2727	59%
5	Somewhat Poorly Drained	1008	22%
4	Moderately Well Drained	432	9%
3	Well Drained	24	1%
2	Somewhat Excessively Drained	0	0%
1	Excessively Drained	0	0%
0	Disturbed	38	1%

Private Drainage
The primary purpose of a drainage district is to provide a legal and reliable outlet for surface and subsurface drainage, allowing coordinated water management across multiple properties. While the district maintains shared infrastructure, such as main tile lines and open ditches, individual landowners are responsible for installing and maintaining private tile systems on their land to connect to and benefit from the district system.

Water Flow Behavior
Subsurface drainage systems collect excess water using perforated pipes or clay tiles installed below ground. As the soil becomes saturated, water moves through the soil's pores and enters the tile system through small openings. The water is then carried away to the district main. This process lowers the water table, improves soil aeration, and reduces surface runoff.

A key soil property in drainage design is saturated hydraulic conductivity (Ksat), which measures how quickly water moves through saturated soil. Sandy soils have high Ksat values and drain quickly, while clay soils, such as those common in the district, have lower Ksat values and drain more slowly. Most soils in the district are classified as loams and clay loams, with moderate to low Ksat values. These values are used to determine appropriate drainage coefficients and to guide decisions on tile spacing and depth for an effective and efficient drainage system.

Land Use
Landowners are free to manage their land as they choose, regardless of how much benefit they receive from the drainage system. The lands already included in the district since its establishment include some acres not being currently farmed. The current district includes wetlands, grassland, woods, and other non-cropped areas. The proposed annexed lands are mostly cropland.

Whether a property is currently tile drained has no bearing on its inclusion or benefit from a drainage district. District facilities are designed to provide an outlet to all lands within their watershed, regardless of private land use or drainage improvements. The Classification Commission determines relative benefit and assigns corresponding cost shares through its report, ensuring fair distribution. Every drainage district in Iowa includes acres that are not presently tile drained, including this one. Having private tile is not a prerequisite for materially benefiting from a district facility. The law presumes benefit for all included lands; it is up to each landowner to decide how and when to make use of that benefit. The district's role is to provide and maintain the outlet, not to monitor or influence individual property management decisions.

Land use may have changed in some areas in the time since the last classification schedule was made. However, the drainage district is focused on providing a drainage outlet, not on how or whether each parcel takes advantage of the outlet. That decision rests entirely with the landowner.

Legal Framework

Statutory Requirements
The annexation of land into a drainage district is governed by Iowa Code Chapter 468. Specifically, §468.119 requires an engineer's report that makes a "survey and plat thereof showing their **relation, elevation, and condition of drainage**" and must "specify the character of the benefits received". Iowa Code §468.120 further requires the Board of Supervisors to be satisfied that the lands are "materially benefited" by the district and that annexation is feasible, expedient, and for the public good before proceeding.

The "Material Benefit" Standard
Iowa courts have established a clear and strict standard for what constitutes a "material benefit." This report was prepared with these legal precedents at its core.

- **More Than Just an Outlet**: It is not enough for a drainage district to simply provide an outlet for surface water that would naturally drain off a property anyway. The Iowa Supreme Court has stated that a landowner "may freely avail himself of the topography of his land, and may discharge his surface waters wherever gravitation naturally carries them, without further concern (Thompson v. Bd. of Sup'rs, 1925).

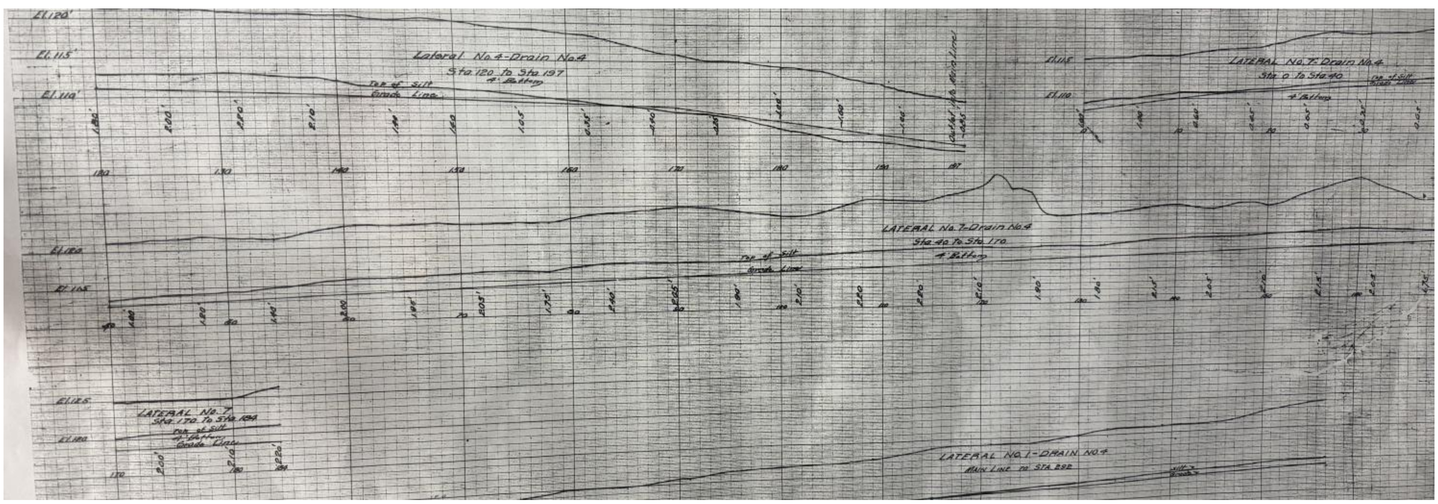
- **A Demonstrable Improvement**: To be “material,” benefit must increase the land’s value, “either by relieving it of some burden, or by making it adapted for a different purpose, or better adapted for the purpose for which it is used”.

- **Specific, Not Conclusory**: An engineer’s report cannot simply state that lands are benefited. The courts require a specific explanation of how they are benefited. For instance, Lindflott v. Drainage District No. 23 (2017), a material benefit was found because the district’s deep ditch enabled the landowner to deepen their own private ditch, an improvement that would have otherwise been impossible.

Methodology

Relation of Annexed Lands to District

We analyzed how the proposed annexed lands physically connect to the drainage facilities. Using GIS mapping, we traced the water flow paths from every acre of the subject properties to the district's infrastructure. Our analysis shows that the drainage system provides a deeper and more stable outlet than what existed in the natural landscape prior to its construction. The original engineer included the average cut for each station ranging from approximately seven to twelve feet deeper than the pre-existing ground. The original engineer’s profile for the open ditch is shown below. Note how much deeper the ditch is than the original ground elevation.

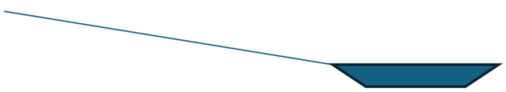
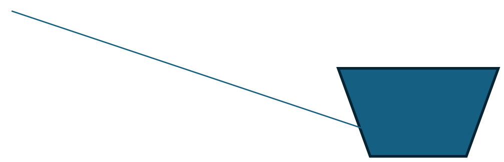


This artificial lowering of the drainage outlet is key; it creates the opportunity for landowners to install deeper, more effective private subsurface tile systems, a direct and demonstrable benefit that would not exist otherwise. An example is provided below showing how an improved ditch is not only deeper but can carry far more water providing a more reliable and deeper outlet.

Cross Section Before Improvement Example	Cross Section After Improvement Example
	

Elevation and Topography Analysis

Using LiDAR elevation data, we created a detailed topographic model. While it is obvious that water naturally flows from higher to lower elevations, this alone does not mean higher lands do not receive material benefit from a drainage district.

Slope Before Improvement Example	Slope After Improvement Example
	

As illustrated above; by deepening the outlet, a drainage district effectively increases the available "fall" or slope for a private tile system. This allows a landowner to drain otherwise flat or depressional areas and enables them to use smaller, less expensive tile to achieve the same drainage capacity, a direct economic benefit.

Condition of Drainage

We compared the landscape's historical condition, using the 1850's General Land office maps, 1875 Andres Atlas, soil maps, historical plats, and aerial photography with its current state.

The best available information of the condition of drainage prior to the district establishment is soil maps. The soil maps can tell us what the natural drainage of the soil is without artificial drainage, what landscape it sat in, and what formed the soils. For example, high organic matter would indicate the area was peat, and thus very poorly drained and unsuitable for agriculture before artificial drainage.

- Before JDD 4-263: Historically, some of the area proposed for annexation, particularly parcels with poorly drained soils, high water tables, and low Ksat values were limited in their agricultural use. These areas were often saturated, suitable for pasture or hay, and planting was frequently delayed.

- After JDD 4-263: The construction and maintenance of the drainage facilities provided an outlet nearer and deep enough to make comprehensive subsurface tiling feasible. This transformed the land's potential, allowing for its conversion into productive row crop agriculture. This change in the land's utility and productivity is a clear and direct material benefit resulting from the existence of JDD 4-263.

Specification of Benefits Received

Based on our analysis, the lands proposed for annexation receive the following material benefits, as required by Iowa Code and defined by case law:

- **Improved Agricultural Productivity**
  The largest economic benefit of the district is its direct increase in agricultural productivity. By providing an improved and reliable outlet for drainage, JDD 4-263 enables landowners to:

  - Lower the water table, which improves soil aeration and creates a healthier root environment.
  - Achieve more timely fieldwork, as soils warm up faster and support equipment sooner in the spring.
  - Increase crop yields. Research from the 1983 Iowa State University study shows that effective tile drainage can boost corn yields by over 50% on poorly drained soils, a substantial increase in value directly attributable to the drainage outlet.

- **Enabling Surface Drainage**
  The district facilities provide a direct conveyance for surface overflow waters to escape the district. Landowners can legally install tile surface intakes in upland depressions and construct surface drains along the ditch to remove large volumes of excess water that would otherwise remain trapped in those depressions. Without the facilities, the available grade for private tile lines designed to carry surface water would be significantly reduced or in some cases, nonexistent. Reduced grade requires larger tile sizes to maintain capacity, which substantially increases installation costs. This represents a clear and direct material benefit of the drainage district facility.

  In addition, there would be many cases where draining these areas would be legally impossible without a drainage district outlet. Iowa Code §468.621 prohibits a landowner from increasing the quantity or altering the manner of water discharge onto a downstream neighbor without that neighbor's consent. This means an upland landowner cannot install intakes or surface drains in their depressions and discharge that water onto their neighbor. The presence of a lawful drainage district facility provides a collectively maintained and authorized outlet for such discharges. This allows these depressional areas to be farmed and to achieve much higher crop yields, a direct and measurable material benefit that would not exist without the district facility.

- **Enabling Subsurface Drainage**
  The "Iowa Drainage Guide" published by Iowa State Extension states a subsurface (tile) drainage system will only function as well as its outlet. Without the JDD 4-263 facilities, landowners would be limited to the shallow, and in many cases ineffective, natural drainage paths that existed prior to the district's construction. In numerous areas, there would be no feasible subsurface drainage outlet at all. Without the district facilities, the available grade for private tile lines designed to carry subsurface water would be significantly reduced or in some cases, nonexistent. Reduced grade requires larger tile sizes to maintain capacity, which substantially increases installation costs. This represents a clear and direct material benefit of the drainage district facilities.

  Installing a private tile system without an established drainage district outlet could also create legal complications, as Iowa Code §468.621 prohibits a landowner from increasing the quantity or altering the manner of water discharged onto a downstream property without the downstream owner's consent. An upland landowner cannot legally pattern-tile their field and simply discharge water directly across the property line onto their lower neighbor. In addition, landowners are prohibited from tile draining their fields across watershed lines into another creek. The JDD 4-263 facilities provide a lawful, more effective, and collectively maintained outlet, granting all landowners within its benefited area the right to connect private drainage systems. This relieves them of both the legal exposure and physical limitations that would otherwise prevent adequate drainage.

- **Increased Land Value and Utility**

The ability to convert land from marginal pasture or wetland to productive cropland directly and materially increases its value. The historical and soil records show that the landscape has been altered for agricultural purposes because of the opportunities created by JDD 4-263. This is not merely an acceleration of natural flow; it is a fundamental change in the land's character and economic potential by making it better adapted for cropland and other uses.

The private landowner ultimately makes the decision of what to do with their land, for some they have chosen to create wildlife habitat, hunting areas, or construct homes. These landowners may argue they do not receive a benefit from the drainage district, because they do not see cropland yield increases, but they benefit from drier basements, improved access paths, upland plant and wildlife population, and less surface ponding. These are a tangible economic benefit, a home with a dry basement has less maintenance and more usable floor space than a home with a wet basement.

Land use can change at any time, and it is not within the district's purview to dictate or evaluate how individual landowners use their property. The district respects each landowner's right to choose their own land use, and those choices are irrelevant to their rights and obligations within the district. State law is clear that all landowners within a drainage district share equal rights to use and benefit from the drainage system.

A property currently in woodland, pasture, or other non-cropland use could be converted to row-crop production and pattern-tiled at any time. The district should not be required to fund additional annexation or reclassification proceedings each time such a change occurs. The system must remain stable and equitable for all members, regardless of individual land use decisions.

Having access to a functioning drainage facility provides landowners with flexibility to change how their land is used in the future. A parcel that currently serves as woodland or pasture retains the option to be converted to cropland because the necessary outlet already exists. This flexibility carries inherent value. Even if a current owner does not intend to change their land use, the ability to do so increases the property's market value. A prospective buyer who wishes to convert the land to cropland will recognize the benefit of an established drainage outlet and be willing to pay more for a property that can support such a transition. In this way, access to a drainage system not only enhances agricultural productivity but also strengthens long-term land value and marketability.

Most of Iowa's popular game animals, including deer, pheasants, quail, rabbits, turkeys, and coyotes, strongly favor upland habitats over consistently wet or swampy areas because uplands provide better cover, forage, nesting sites, and accessibility. Prolonged saturation reduces habitat quality, limits movement, and increases disease risk for both wildlife and native upland vegetation. Many common Iowa trees and plants such as maples, oaks, hickories, and prairie grasses cannot tolerate extended flooding, quickly dying from root suffocation or oxygen loss. By improving drainage, lands become better suited for upland wildlife, timber production, and recreation such as hunting and bird watching. Ultimately, the district's drainage facilities provide a tangible benefit by giving landowners the flexibility to maintain or enhance their property for the uses they value most.

- **Shared Rights and Benefits**
  Landowners included in a drainage district share important rights that ensure access, fairness, and control. They can use the district's drainage system, request repairs or improvements, and take part in public hearings and decisions that affect how the system is managed. Included landowners also have the right to object to unfair costs or oppose major projects they do not support. Together, these rights provide both access to the infrastructure and a voice in how it is maintained and improved, protections not available to landowners outside the district.

- **Right to Petition for Repairs §468.126**
  Iowa Code §468.126 grants landowners within a drainage district the right to petition for repairs or improvements to the district's facilities. This includes restoring the system to its original capacity or upgrading it to meet evolving drainage needs. These rights ensure that any landowner within the district, regardless of current land use, can initiate action to benefit their property. For woodland owners or those not presently utilizing the facility, inclusion preserves the legal right to request repairs or improvements if land use changes, drainage issues emerge, or neighboring development alters runoff patterns.

  Landowners outside the district do not have this right: they cannot petition for repairs, cannot compel trustee action, and may be left unprotected if the system deteriorates or access is denied when drainage becomes necessary. Inclusion under §468.126 guarantees agency, protection, and access.

- **Rights of Participation in Public Hearings §468.14–§468.22**
  Iowa Code §468.14–§468.22 establishes the procedural rights of landowners during the establishment or improvement of a drainage district, ensuring due process through notice, hearing, objection, and review. These provisions guarantee that every landowner within the district has a formal opportunity to be heard before any classification, assessment, or construction proceeds. Landowners receive written notice of proposed actions, may appear at public hearings to support or oppose the plans, and can contest benefit classifications or cost allocations. This framework safeguards against unilateral decisions and promotes transparency, fairness, and accountability in district governance.

  In contrast, landowners whose water drains toward the district but who are not formally included do not receive notice, cannot object, and lack standing to influence decisions, even when district actions may affect downstream conditions or future access. Inclusion ensures not only the right to use the facility, but also the right to participate in its planning and oversight.

- **Rights of Use §468.2 and Case Law**
  Iowa Code §468.2 establishes the foundational principle that all lands within a drainage district are presumed to be benefited and entitled to the use of the district's improvements. This includes the right to tile into a district facility, a critical benefit for landowners, even if their property is not currently tiled or under cultivation. Inclusion in the district automatically secures this right, without requiring a separate petition, or legal proceeding. Landowners may connect private tile systems to district mains, laterals, or outlets as needed.

  In contrast, landowners whose water drains toward the district but who are not formally included do not possess this automatic right. They must request permission, negotiate access, or face potential denial or special assessments. Inclusion ensures that drainage infrastructure is available when needed, without delay or uncertainty, and that landowners retain full legal standing to use, maintain, and benefit from the system. This right becomes especially valuable as land use changes, such as when woodland is converted to cropland, or when drainage needs evolve due to shifting soil, weather, or development conditions.

Procedure

Data Collection and Preparation

To establish a fair and measurable system for identifying lands that benefit from the drainage district facilities, a comprehensive analysis was conducted on the entire potential area. This process is designed to be objective, relying on established scientific data and engineering principles.

The entire area was divided into a grid of one-acre squares. For each square, we compiled data from trusted and publicly available sources. Elevation and slope data were derived from high-precision LiDAR (Light Detection and Ranging) datasets provided by Iowa State University. Soil characteristics, including drainage class, depth to the water table, and Saturated Hydraulic Conductivity (Ksat), were obtained from official USDA-NRCS (Natural Resources Conservation Service) soil surveys. Finally, we performed spatial measurements within GIS to define each acre's physical relationship to the existing drainage district infrastructure.

Evaluation Criteria

Each parcel was evaluated across three main categories: Elevation, Relation to District Facilities, and Natural Condition of Drainage. On the assessment schedule, values highlighted in red indicate that a specific criterion for benefit has been met. The five criteria are detailed below.

Elevation

- Slope: Effective subsurface drainage depends on having sufficient grade for pipe flow capacity. To quantify the improvement in grade provided by the district facility, the average ground slope from each acre to the district outlet was calculated by tracing the natural flow path. Using that slope, we then determined the drainage coefficient achievable with a standard 4-inch subsurface drain. The 1983 Iowa State University study found that increases in drainage coefficient up 1.0 inches per day resulted in meaningful corn and soybean yield increases. Where the natural slope was insufficient to achieve a drainage coefficient of at least 1.0 inches per day, the land is materially benefiting from the increased depth and outlet capacity provided by the district facility.

Relation to District Facilities

- Improved Outlet Access: The district facility provides a shorter and more direct path to a usable drainage outlet than existed under the previous natural conditions. To quantify this improvement, we calculated the reduction in flow distance from each parcel to its nearest viable outlet. Any parcel for which the district facility reduced that distance (thereby bringing a usable outlet closer) has been materially benefited by the facility. For example, under pre-district conditions, a parcel's nearest outlet of sufficient depth for subsurface drainage may have been 5,000 feet away. Following construction of the district facility, that outlet distance may now be only 1,000 feet. This reduction in length needed and subsequent cost of tile is a clear, direct, and material benefit to the landowner.

Natural Condition of Drainage

- Drainage Class: Using USDA soil classifications, we identified the drainage condition of each 1-acre square within every parcel. Based on guidance from the Ag Decision Maker of Iowa State University Extension, soils classified as very poorly drained, poorly drained, somewhat poorly drained, or moderately well drained show a notable crop yield increase when artificially drained. Therefore, any parcel containing these soils will receive a material benefit from artificial drainage.

- Saturated Hydraulic Conductivity (Ksat): Ksat (saturated hydraulic conductivity) measures how quickly water moves through saturated soil. Ksat values (less than approximately 115 inches per day) indicate soils with poor permeability and a strong need for artificial drainage. In such soils, effective drainage generally requires tile spacings of about 120 feet using standard 4-inch diameter tile installed at a depth of four feet. This configuration is designed to lower the water table to at least two feet below the surface, assuming a restrictive layer at 8 feet and a drainage coefficient of 0.5 inches per day. A spacing of 120 feet represents the practical upper limit for most private pattern-tile systems. Areas identified as suitable for or requiring pattern tile drainage require a legal and functional outlet such as the one provided by the drainage district facility.

- Water Table Depth: For optimal crop production, Iowa State University research recommends maintaining a water table depth of at least twenty-four inches during the growing season. Any acre with a naturally occurring average water table depth of less than 24 benefits from artificial drainage, as its natural condition is not ideal for modern agricultural yields.

Conclusion for Annexation

A parcel does not need to meet all five criteria to be considered for annexation, as the benefits vary from one property to another. Every parcel proposed for annexation meets all five criteria. Two of them are already assessed for benefits in Webster-Hamilton JDD 95-87, a tile district which discharges into the Lateral No. 7 Open Ditch.

This data-driven system ensures that the determination of benefit is both repeatable, scientific, and equitable. For a detailed assessment of the benefit allocated to each individual parcel (both existing and newly annexed), please consult the official Reclassification Report filed with this Annexation Report.

Landowner Considerations

Public Hearing on Report

A public hearing will be scheduled to review this annexation report. Per Iowa Code § 468.14, all affected landowners will be notified by mail, and notice will also be published in a local newspaper. At the hearing, we will present our findings, proposed annexation, and will be available to answer questions and address concerns. The Board of Trustees will conduct the hearing and may continue it to a later date if more discussion or information is needed. No decision can be made until the hearing is held and all landowner input is considered. This report may be amended as needed in response to feedback received during the hearing.

Objections

Landowners who have concerns about the proposed annexation are encouraged to submit written objections either before or during the public hearing. These written objections will be included in the official record and are necessary to preserve the right to appeal the Board's final decision.

Landowners who wish to object to their assessment are strongly encouraged to provide any relevant information, such as tile maps, permanent wetland easements, or other documentation not available to us, that could assist in refining the schedule if necessary.

Engineer's Report & Reclassification Report

An Engineer's Report was filed in 2026 recommending a full clean out of the open ditch. The report is on file at the Auditor's Office. The Engineer's Report including all plats and profiles shall be considered by the Board as part of the proceedings of this annexation.

A Reclassification Report was filed with this Annexation Report. The Reclassification Report provides a specific parcel by parcel comparison of benefit received by each parcel, including parcels already included in the district. The information contained can help provide more context to the proposed annexed lands and should be considered by the Board as part of the proceeding of this annexation. We recommend the public hearings on annexation and reclassification be held on the same date for that reason.

Recommendations

Annexation Schedule

We find that the parcels included in the Annexation Schedule are materially benefited by the facilities of Joint Drainage District No. 4-263. The benefits derived, specifically the provision of a sufficiently deep and legal outlet enabling the conversion of land to more productive agricultural use, and supporting modern subsurface drainage systems, are substantial and extend far beyond the mere conveyance of natural surface flow. Historical data demonstrates that the landscape within the district has been fundamentally improved and transformed into a significantly more economically productive area.

Our parcel-level analyses confirm that each tract possesses measurable potential to benefit from the district facilities, regardless of the current land use decisions of individual owners. We have provided our five criteria for determining material benefit from the district facility. These were based on physical and soil factors including improved available slope, closer proximity to outlets, and natural condition of drainage (soil drainage class, saturated hydraulic conductivity (Ksat), and water table depth). Together, these criteria quantify each parcel's improved capacity for effective drainage and demonstrate how the district facility provides that improvement and material benefit.

Recommendations

We recommend that the Board accept the filing of this report and schedule a public hearing to formally present the findings and proposed annexation schedule to all affected landowners. At the closing of the hearing, we further recommend that the Board proceed with adopting the annexation as presented.

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

Sincerely,

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Appendix A – Benefited Area

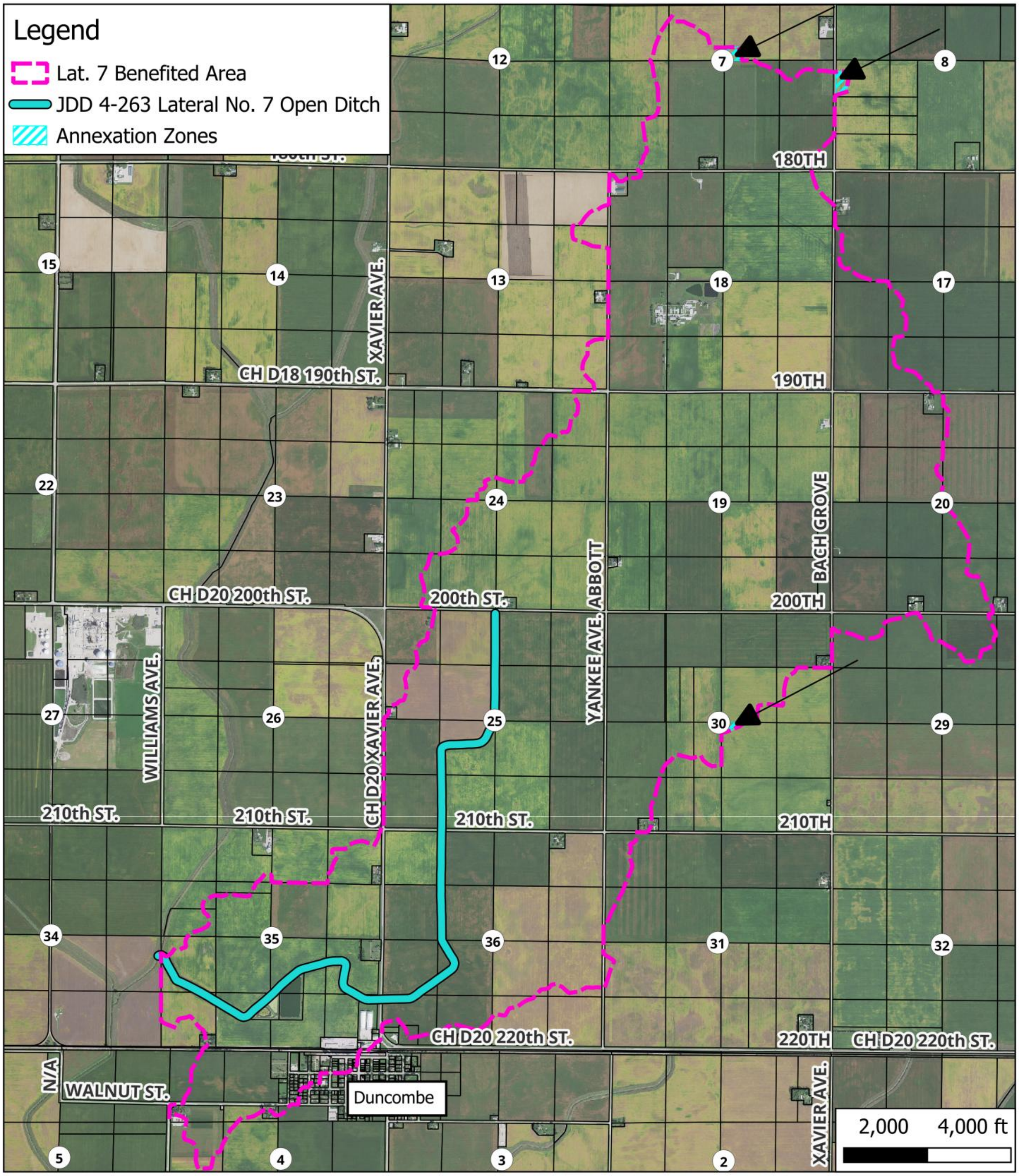
AgriVia

Joint Drainage District No. 4-263 Lateral 7

Benefited Area

Webster - Hamilton County

July 2026



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Columbus, Ohio 43210

SOIL AND WATER NO. 31 JULY 1982

TWENTY BENEFITS OF DRAINAGE

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

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

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

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

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

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

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

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

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

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

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

(over)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Melville L. Palmer

Melville L. Palmer
Extension Agricultural Engineer

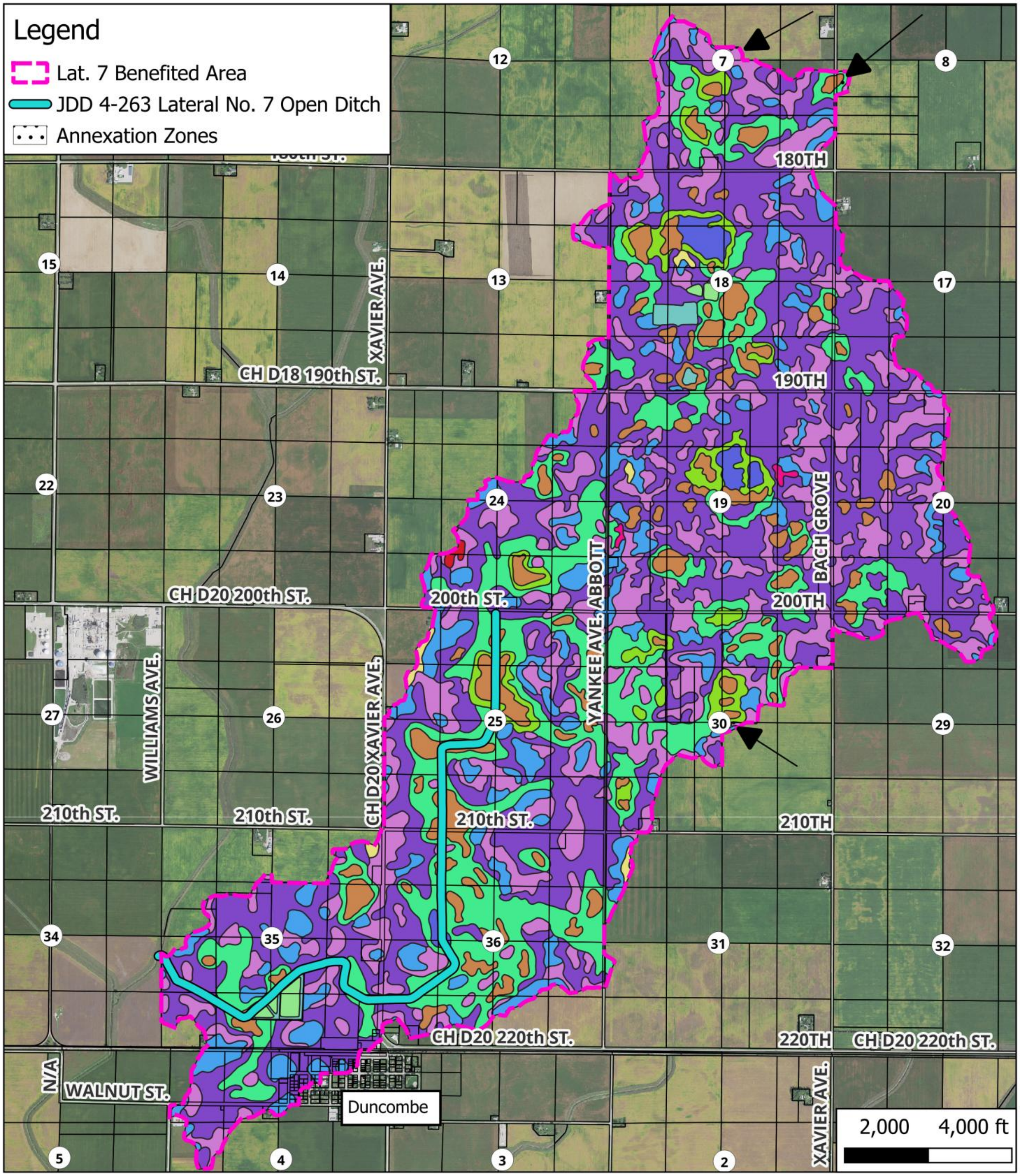
Appendix C – Soil Map

Joint Drainage District No. 4-263 Lateral No. 7

Webster - Hamilton County

Soil Types

July 2026



Legend

Soil Types

- Canisteo clay loam, 0 to 2 percent slopes
- Clarion loam, 2 to 6 percent slopes
- Clarion loam, 6 to 10 percent slopes
- Clarion loam, 6 to 10 percent slopes, moderately eroded
- Clarion-Storden complex, 6 to 10 percent slopes, moderately eroded
- Harps clay loam, 0 to 2 percent slopes
- Nicollet clay loam, 1 to 3 percent slopes
- Okoboji silty clay loam, 0 to 1 percent slopes
- Orthents, loamy
- Sewage lagoon
- Wacousta silty clay loam, 0 to 1 percent slopes
- Webster clay loam, 0 to 2 percent slopes

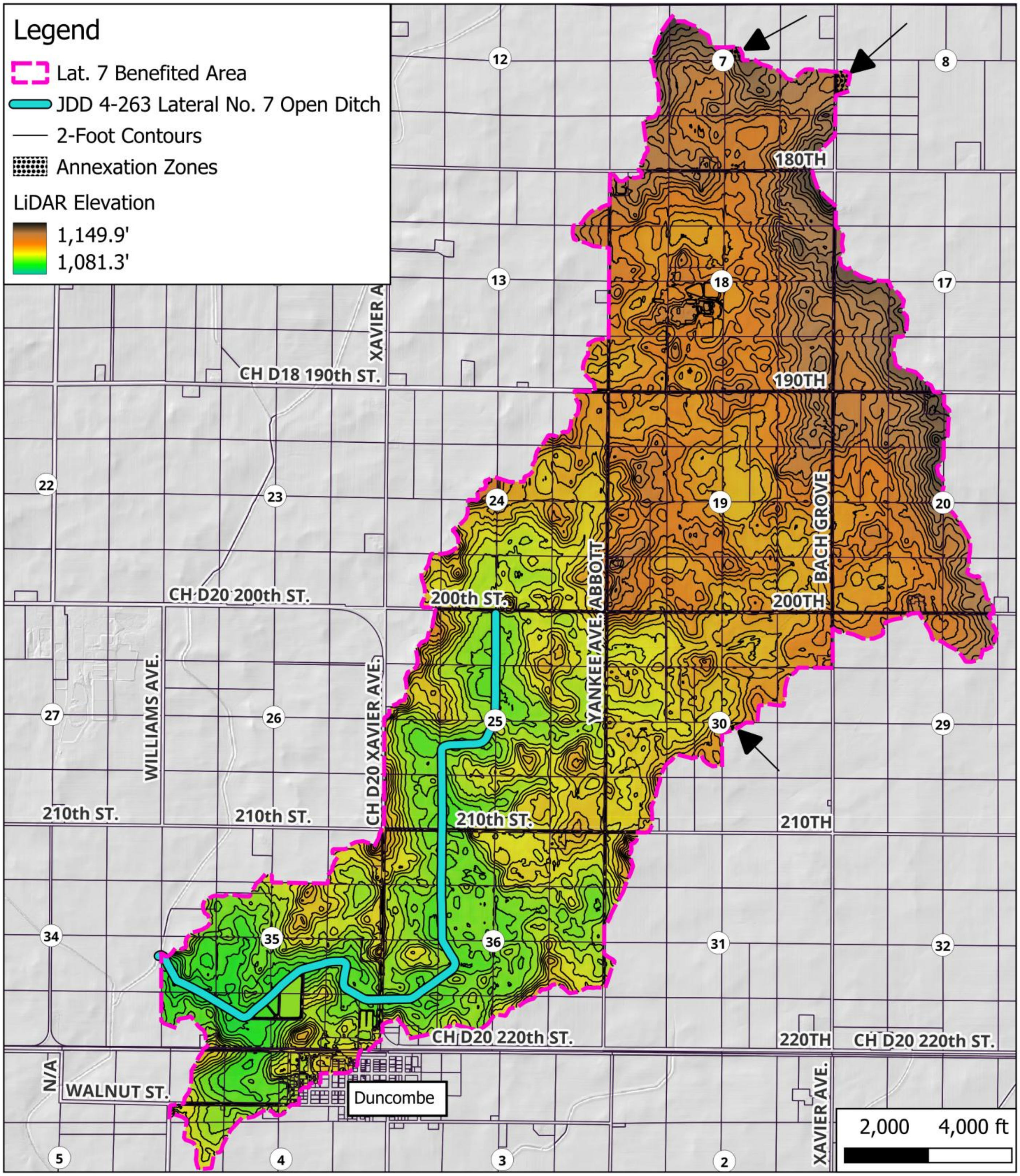
Appendix D – Elevation Map

Joint Drainage District No. 4-263 Lateral No. 7

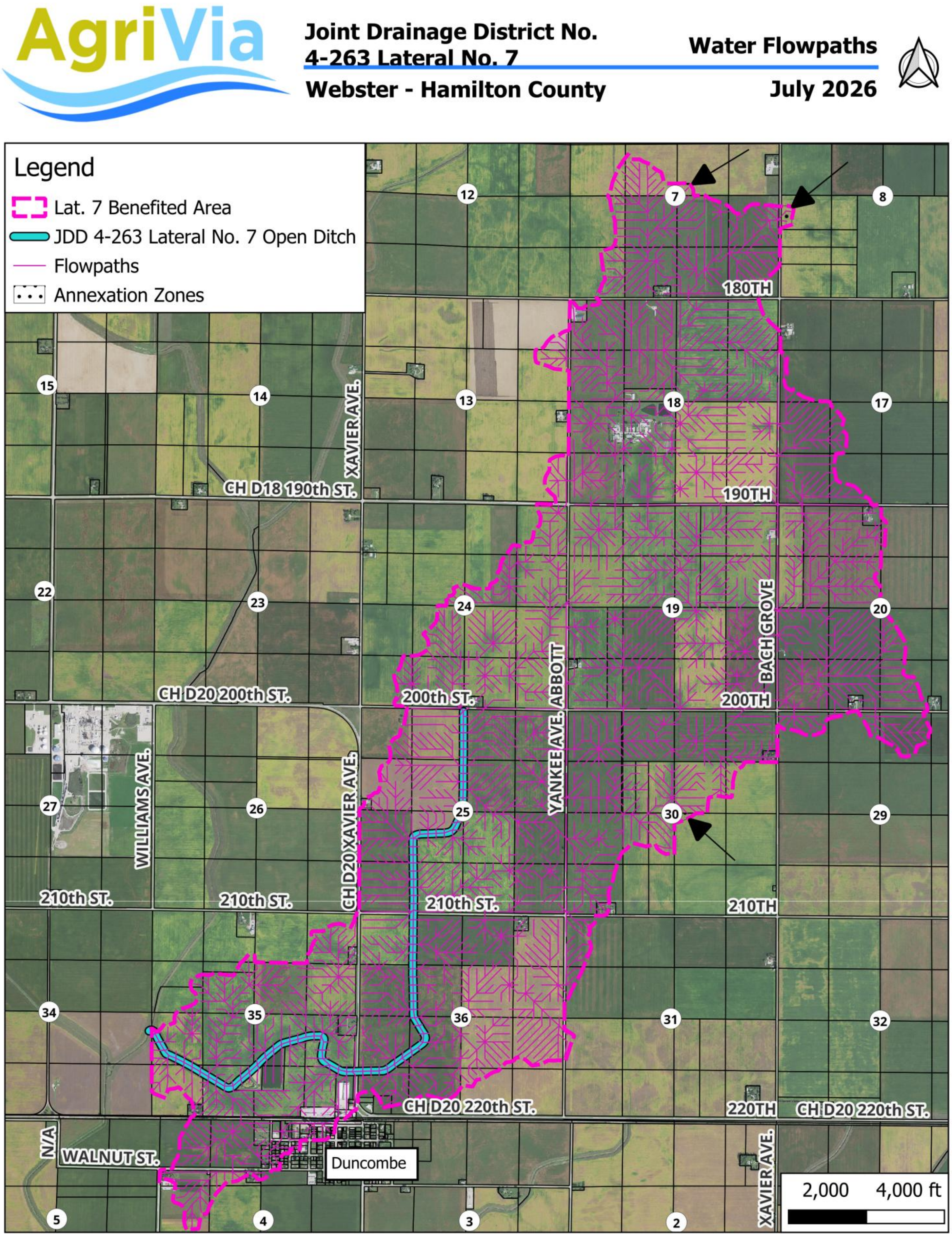
Webster - Hamilton County

Elevation

July 2026



Appendix E - Water Flow Paths Map

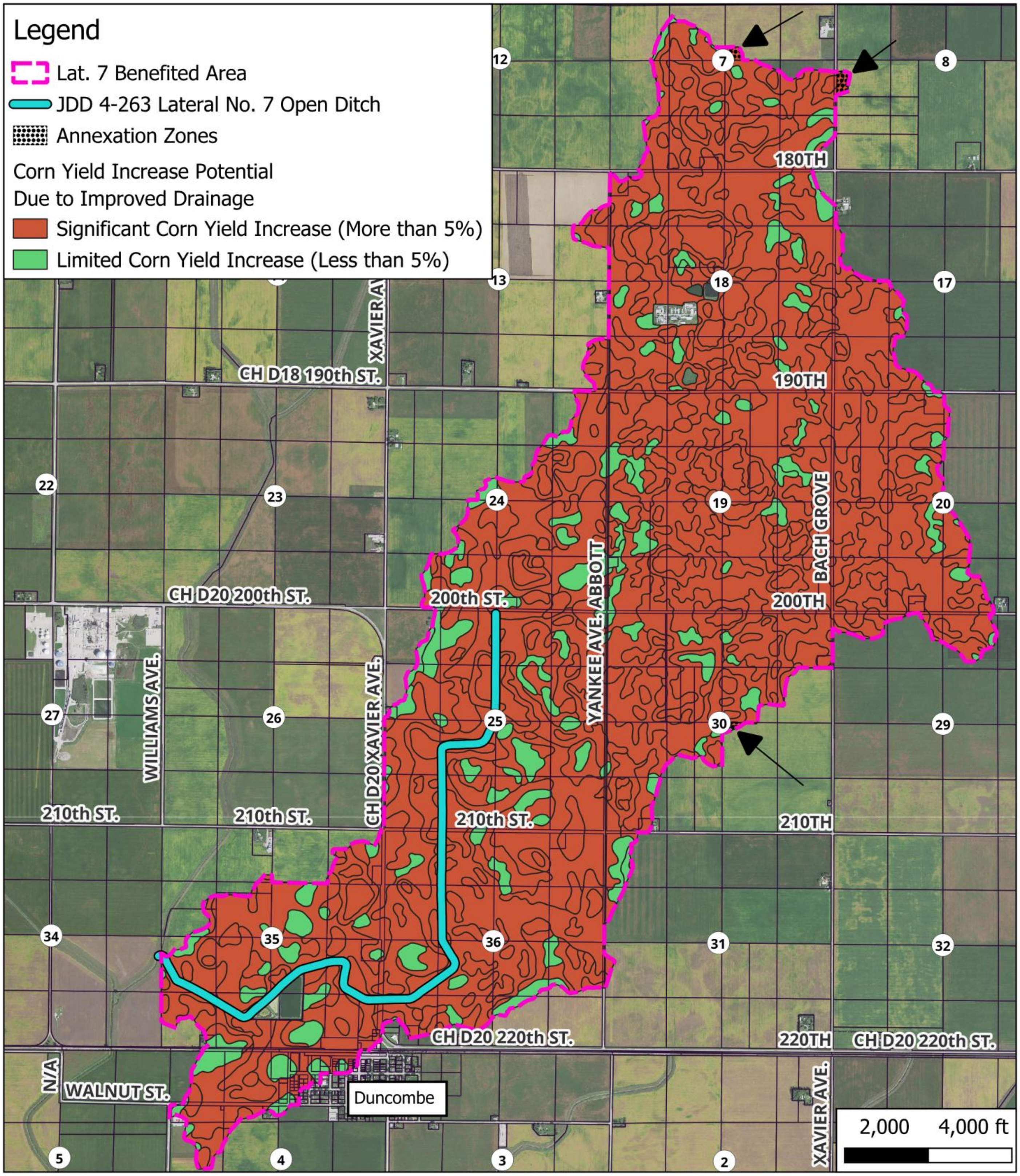


Appendix H - Iowa State Extension- Corn Yield Increase Map

AgriVia

Joint Drainage District No. 4-263 Lateral No. 7
Webster - Hamilton County

Corn Yield Increase Potential
July 2026



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Technical Appendix

Joint Drainage District No. 4-263 Annexation Report

Webster & Hamilton County, Iowa
2026

Project No. 2628-94

Table of Contents

Introduction

Overview
This appendix summarizes the legal and technical basis for annexing the proposed lands into the drainage district. It draws on Iowa drainage law, a watershed-scale engineering survey, and current agricultural conditions to support one conclusion: every parcel within the watershed boundary receives a direct, material benefit from the drainage district's drainage facilities, and the assessment schedule filed with this report reflects that benefit fairly across upland and lowland ground.

Summary of the Legal and Technical Case for Annexation
Iowa courts have interpreted "material benefit" for more than a century, and the case law is consistent on one point: a better outlet counts as a real, assessable benefit, even where the improvement doesn't touch a parcel directly and even for land that already drains. The drainage district's facilities give every tributary parcel, uplands included, the legal right and the physical capacity to drain more effectively than the natural watercourse ever allowed. That right doesn't exist without the drainage district, and Iowa courts have repeatedly held that providing it is itself a material benefit.

The engineering analysis behind this report combines publicly available data, and water resources engineering equation. That combination moves the benefit determination past the "all lands in the watershed benefit" assertions Iowa courts have rejected before, and shows instead, parcel by parcel, why the annexed land depends on the drainage district's outlet.

The underlying argument is straightforward: drainage in 1920 is not drainage now. Annexation isn't correcting a mistake the original engineers made. It's bringing the drainage district's boundary into line with a hydraulic and economic reality that has moved a long way past 1920.

Legal Case for Annexation

What Iowa Courts Mean by "Material Benefit"
For land to be included in a drainage district, whether at formation or by later annexation, Iowa courts require that it receive a material or special benefit from the improvement: something more than a speculative or trivial advantage. The benefit has to be tangible: it must raise the land's value, make it better suited to its use, or relieve it of a burden such as inadequate drainage. Courts have been clear for over a century that mere location within a watershed isn't enough on its own. A landowner is entitled to let surface water leave the property naturally and owes nothing for its trip downstream after that. What the law requires is something more direct: a better outlet than nature provides, improved soil quality from better drainage, or the practical ability to drain the land more effectively than before.

The case summaries below work through the Iowa decisions that govern establishment and annexation of drainage districts, and explain how each one bears on the findings in this report.

Zinser v. Bd. of Sup'rs of Buena Vista County, 114 N.W. 51 (Iowa 1907)
Zinser is the foundational case on this question, and it's worth engaging directly, because this report's recommendation, annexing an entire watershed, is the same recommendation the Iowa Supreme Court rejected there. The distinction is in the reasoning behind it. The engineer in Zinser included every parcel in the watershed because he felt unqualified to judge which parcels would actually benefit; his report offered no analysis beyond the watershed line itself. The court held that inclusion requires evidence a parcel will "in all reasonable probability derive some special benefit from the improvement": something that increases its value by relieving a burden or making it better suited to its use.

This report reaches the same watershed boundary, but by a different route. The watershed in question funnels to a single natural outlet that creates an insufficient hydraulic gradient across the entire area: a shared, specific burden affecting every parcel that drains to it, not an assumption based on geography alone. The pre-district hydraulic grade line for the basin was set by that outlet's elevation, and it suppressed drainage potential everywhere upstream of it. By cutting through that bottleneck and establishing a lower control elevation, the drainage district's facilities lowered the tailwater elevation for the whole system and steepened the drainage gradient available to every tributary parcel: deeper, more effective tile, faster surface removal, basin-wide. That is the specific benefit the Zinser engineer never identified, and it happens to track the watershed boundary precisely, because the watershed boundary is the physical extent of the area constrained by that one natural bottleneck.

Thompson v. Bd. of Sup'rs of Buena Vista County, 206 N.W. 624 (Iowa 1925)
Here, the court rejected annexing roughly 102,000 acres of upstream land that already belonged to other, functioning drainage districts with adequate outlets of their own; the Board's only argument was that the water eventually reached the creek being improved. The court held that a landowner has no ongoing obligation to answer for surface water once it has left the property.

That principle protects land that doesn't need the downstream improvement to drain. It doesn't describe the parcels proposed for annexation here, which have no other adequate outlet; the drainage district's facility is their outlet, not a remote downstream convenience. The controlling elevation for the entire annexation area is the elevation the drainage district created. This isn't a case of assessing land for water that has already left it; it's a case of the drainage district having built the only outlet that lets the water leave in the first place.

Lindflott v. Drainage District No. 23, No. 16-1579, 2017 WL 5185430 (Iowa Ct. App. Nov. 8, 2017)
Lindflott supports the core premise of this report: that benefit means opportunity, not a finished improvement. The drainage district's downstream excavation let a landowner deepen the channel on his own property, an improvement the court called impossible without the drainage district, and it held that the benefit existed the moment the ditch was dug, regardless of whether the landowner ever acted on it.

Two points follow directly. First, giving a landowner the ability to improve their own drainage is itself a material benefit, the premise behind annexing land where the opportunity to install effective tile didn't exist before. Second, current land use doesn't determine current benefit: a parcel isn't exempt just because nobody is farming it yet, because the benefit is the opportunity to convert it to a higher use, available the moment the outlet exists. The engineering behind Lindflott is the same engineering at work here: a downstream excavation lowers the hydraulic control point, which increases the gradient available to every upstream property in the watershed, which is what makes deeper, more effective private drainage possible on the annexed parcels.

Hatcher v. Bd. of Sup'rs of Greene County, 145 N.W. 12 (Iowa 1914)
Hatcher affirmed an assessment against land containing an 80- to 90-acre pond that the new drainage system converted to productive ground, on the theory that reclaiming swampy land for agriculture is a valid public purpose. It also held that a district isn't required to provide complete drainage to every parcel on its own; private drains and laterals will often have to supplement the system for the best result.

That second point matters here: several of the annexed parcels have depressional areas of their own, on a smaller scale than Hatcher's pond, that currently hold water for lack of a natural outlet. The drainage district's deep outlet gives those areas somewhere to drain to; whether an individual landowner installs the tile to take advantage of it is a separate question from whether the benefit exists. A landowner who chooses not to connect a private drain to the drainage district's system doesn't get to argue, on that basis, that the drainage district provides no benefit.

Prichard v. Bd. of Sup'rs of Woodbury County, 129 N.W. 970 (Iowa 1911)
Prichard addressed unequal benefit directly: the court held that some parcels benefiting more than others, in proportion, is not grounds to exclude the lesser-benefited land from the district; that kind of difference gets sorted

out later, in classification and cost assessment, not at the inclusion stage. An argument that an upland parcel benefits less than a low-lying one is accordingly not a basis for excluding it from annexation, so long as it receives some special benefit: here, the new opportunity for effective drainage. The cost of realizing that benefit, and how quickly it pays off, will vary parcel to parcel; that variation doesn't undercut the engineering basis for including the land in the first place.

Monson v. Bd. of Sup'rs of Boone and Story Counties, 149 N.W. 624 (Iowa 1914)
Monson held it proper to weigh a parcel's pre-existing drainage condition when assessing benefit: land with some natural drainage already gets a reduced assessment relative to land with none. The court also addressed a shallower main drain that didn't fully serve the lowest lands, and held that even an imperfect outlet confers a "lessened benefit" that remains properly assessable.

Run that logic in reverse and it supports a higher degree of benefit for land with no meaningful natural drainage to begin with, which describes much of the annexation area. And it forecloses an objection this report anticipates: that because the drainage district doesn't solve every water problem on every parcel, it provides no benefit at all. Monson says otherwise: an outlet doesn't have to be perfect to be assessable, only real.

Kelley v. Drainage District No. 60 in Greene County, 158 Iowa 735, 138 N.W. 841 (1912)
Kelley affirmed a new district built over an existing one that had proven inadequate, holding that a "better outlet" or "additional outlet" is a legitimate purpose, and that providing one "was of some benefit to all the lands tributary thereto." The court went on to hold that an improved outlet benefits all tributary land regardless of proximity to the new work itself:

> *"The new drains did relieve the main drain in the system as previously constructed by furnishing an additional outlet, and in this respect was of some benefit to all the lands tributary thereto, even though not as near to some of them as the existing main. Nor was the circumstance that it did not touch such lands a valid objection to the assessments."*

The land in question here doesn't need to be an unimproved swamp for this to apply. If the drainage district provides a deeper, more efficient outlet than the natural watercourse did, and the engineering data in this report shows that it does, that is a benefit to every parcel tributary to it, proximity notwithstanding.

Ray W. Ohrtman Revocable Trust v. Palo Alto County Bd. of Sup'rs, No. 07-1921, 2008 WL 5234359 (Iowa Ct. App. Dec. 17, 2008)
Ohrtman is the case objectors are most likely to raise, and it's worth distinguishing carefully. There, the Court of Appeals reversed an annexation because the land already drained into Cylinder Creek, a natural watercourse that functioned as an adequate outlet in its own right; the drainage district's work was downstream of the landowners' actual controlling feature.

That fact pattern doesn't match this annexation. Here, the drainage district's facility is not downstream of some other adequate outlet. It is the outlet. It was built by cutting through the watershed's own high-elevation natural bottleneck, the same kind of feature that controlled the Ohrtman parcels, except here the drainage district eliminated it rather than leaving it in place upstream of the improvement. Every acre proposed for annexation sits upstream of a control point the drainage district physically lowered. That is a direct benefit, not the remote, speculative one Ohrtman found insufficient.

Blue Verbrugge Family Farms, LLC v. Hamilton County Bd. of Supervisors, No. 22-1797 (Iowa Ct. App. Mar. 27, 2024)
Blue Verbrugge is the most recent case on this issue. The Court of Appeals didn't reject the annexation on the natural-drainage point alone; it rejected the engineer's report for being conclusory. The annexation report recommended including the entire 43,000-acre watershed and stated, in essence, that the upland parcels were materially benefited without tying that conclusion to any parcel-specific finding. The court held that wasn't

enough: Iowa Code section 468.119(1) requires the annexation report to specify the character of the benefit received, and a general statement that land is upland of an old lakebed and drains through the district's facilities doesn't meet that bar. The court also reaffirmed, citing Lindflott, that where the topography of a parcel would let surface water drain off naturally on its own, the landowner needs to show a benefit beyond simply having an outlet.

On the natural-drainage question: the watershed here does not drain naturally and efficiently on its own; the soil survey and LiDAR analysis demonstrate a shared topographic bottleneck that keeps water tables high and surface water moving slowly across the entire basin. On the specificity question, this report doesn't stop at a watershed-wide conclusion. The soil drainage classification, saturated hydraulic conductivity, and depth-to-water-table data are tabulated by parcel in the schedule filed with this report, and each shows the same limitation: slow permeability, a seasonal high-water table within one to three feet of the surface, and a soil series the USDA lists as responsive to artificial drainage. That is the parcel-by-parcel showing Blue Verbrugge found missing, applied here to every tract in the annexation area.

Roewe v. Pavik, 70 N.W.2d 845 (Iowa 1955)
Roewe affirmed the annexation of land that had been considered, and excluded, when the district was first formed. The landowners argued res judicata; the court held that the annexation statute contemplates correcting errors and omissions in the original district boundary, and that an earlier omission doesn't permanently bar later annexation.

This confirms the Board's ongoing authority to bring in land that is materially benefited by the drainage district, whether or not that land was considered and passed over decades ago. Drainage science and agricultural practice have both moved on since the original formation; ground that didn't look wet enough to include in the 1920s can be meaningfully burdened by a high-water table today, and Roewe is the case that lets the Board act on that.

Statutory and Technical Methodology of Engineering Required

Purpose
This section explains the statutory authority for the engineering survey behind this report and the methodology used to evaluate benefit across the annexation area. It is included to address, directly, the argument that a "survey" under drainage law requires a physical, parcel-by-parcel topographic survey on the ground. It doesn't, and a data survey of the kind used here is both legally sufficient and, at this point, the more accurate way to do the work.

"Survey" Means an Engineering Investigation, not a Land Survey
Iowa Code section 468.11 directs the appointed engineer to examine the lands and "survey and locate such drains . . . as may be necessary for the drainage of the lands." Read against Iowa Code chapter 542B, which governs professional licensure, that is a description of an engineering survey, a broad investigation and analysis, not a land survey concerned with property boundaries. Chapter 542B defines the practice of engineering as work requiring engineering education and training applied to consultation, investigation, evaluation, and planning for public or private works. It defines land surveying separately, as the determination and description of areas for conveyancing and the establishment of boundaries. Evaluating drainage needs, watershed hydrology, drain locations, and benefit determinations falls under the first definition, not the second. The "survey" Chapter 468 requires is an engineering investigation, and it can properly use whatever tools and methods the work calls for.
Section 468.11 also requires the appointment of a "disinterested and competent engineer," a safeguard built into the statute because landowners on both sides of an annexation have a direct financial stake in the outcome. The engineer's role is to bring an objective, professional judgment to the hydrology, the benefit determination, and the cost allocation, independent of any party's financial interest, and to give the Board a technical recommendation it can rely on for that reason.

The Engineering Survey Behind This Report
Treating a 1904-era method as the only lawful way to interpret a 1904-era statute ignores what has changed in the intervening century. This survey combines four kinds of data, integrated to produce a single benefit determination.

- USDA-NRCS soil survey data. Soil type is a direct physical record of a parcel's long-term drainage characteristics. This report uses that data to identify, acre by acre, which soils carry the kind of limitation that indicates a genuine need for drainage. Because it predates the drainage district and reflects conditions independent of anyone's opinion, it serves as an objective baseline for the benefit determination.
- LiDAR elevation data. High-resolution, aircraft-collected elevation data, accurate to a few inches vertically, gives a continuous digital elevation model of the entire annexation area. It was used to delineate the watershed and sub-watershed boundaries precisely, trace surface flow paths, identify the depressions and ridges that control water movement, and calculate the acreage tributary to specific points in the drainage system. Together with the soil data, it shows how every parcel connects hydrologically to the rest of the watershed.
- District Records. The drainage district records provide plats, profiles, and engineering reports that discuss the drainage of the lands in the district. This provides a valuable measure comparing the annexed lands to the lands that were already included in the district.
- Visual survey and aerial photography. A ground-level visual survey confirmed that current land use and infrastructure match the data, and both modern and historical aerial imagery were reviewed for the visual signatures of poor drainage (cropping patterns, ponding, vegetation stress) that corroborate the soil and elevation findings.

None of this required physical entry onto every individual parcel to produce a complete, defensible picture of the watershed. The plats, and schedules filed with this report are the product of that combined analysis.

Relationship to the Existing Public Record
This report doesn't stand alone. Preparing it included a review of the drainage district's full public record: the original engineer's report, subsequent repair reports, prior reclassification reports, and the minutes of official proceedings, all on file with the County Auditor and available for public inspection. That history informs the findings here, and as with any engineering report, I reserve the right to amend or supplement this one if new, material information comes to light before the Board takes final action.

Conclusion
The benefit determination in this report is the product of a survey that complies with both the letter of Iowa Code chapter 468 and the professional standards of chapter 542B. The claim that a lawful survey requires individual property entry and traditional field measurement doesn't hold up, legally or technically; the multi-layered approach used here gives a more complete and more objective picture of the annexed lands than the older method ever could. What follows is not an opinion; it is the output of a data-driven process, conducted by a disinterested, licensed engineer, that identifies which lands contribute to this system and which lands benefit from the stable, efficient outlet it provides.

Historical Drainage of the Landscape

Purpose
This section explains why USDA-NRCS soil survey data is the primary basis for reconstructing historical drainage conditions on the land proposed for annexation, rather than the general land office surveys, county atlases, or early aerial photography. Records from that era are limited and often anecdotal, which is why a method grounded in stable, physical evidence is the more defensible approach. Historical maps and photographs provide useful context, but each has real limits in scope, purpose, and accuracy for mapping historical wetlands and

drainage patterns. Soil survey data doesn't share those limits: it is a direct physical record of long-term hydrological conditions that predates artificial drainage and remains legible on the ground today.

Soil as a Historical Record

Soil develops over centuries in response to its environment, and its physical and chemical properties record the conditions, particularly the relationship with water, under which it formed. Soils that stay saturated or ponded for extended periods during the growing season develop hydric soil indicators: the prolonged absence of oxygen drives chemical reduction of iron and manganese compounds, producing visible, persistent features in the soil profile. Consistently saturated soils turn gray, blue, or green as iron is stripped out: gleying, a clear sign of long-term waterlogging. Soils with a fluctuating water table show mottling instead: iron reduced and moved, then re-oxidized into red or orange patches when the water table drops, marking a seasonally high-water table.

These features take centuries to form, and critically, they don't disappear once a field is tiled or ditched. The hydrology changes; the soil profile doesn't. It remains a record of the pre-drainage condition. A tiled field that still shows hydric soil indicators is about as close to direct proof as this kind of analysis gets that the ground was historically wetland or poorly drained upland. The USDA-NRCS Soil Survey, built from soil pits, auger borings, and laboratory analysis and published as the SSURGO database, is the most detailed and defensible record available of what this land looked like hydrologically before the drainage district existed.

Why the Alternatives Fall Short

Historical maps and photographs were made for other purposes, and that limits how much weight they can carry here. The 1850s General Land Office surveys were the first systematic documentation of the region, but their purpose was legal: establishing the Public Land Survey System for the sale and transfer of land, not ecological. Surveyors marked what intersected their section lines and didn't map the interior of sections in any detail, so a wetland complex sitting entirely within a section could go unrecorded.

The 1875 Andreas Atlas and later county plat atlases are useful for property and genealogical research, but they are commercial products, not scientific surveys; landowners often paid to have their land shown, and the focus was ownership, roads, and other cultural features. Natural features like wetlands were secondary, often stylized or copied from older GLO data without new field verification, and coverage could depend on which landowners paid for inclusion.

Aerial photography has a more fundamental problem: the earliest comprehensive coverage of this region dates to the 1930s, which is after the drainage district was built and operating. Those photos show the result of artificial drainage, not the condition before it. Land that had already been successfully drained by 1930 would simply appear as productive cropland. And a photograph is a single moment in time, shaped by season and recent rainfall; it can't distinguish a temporarily wet field from one that was persistently saturated for a century before the camera arrived.

Data Source	Primary Purpose	Relevant Strengths	Critical Limitations for Early Drainage Analysis
USDA Soil Survey	Scientific inventory of soil resources	Direct physical evidence of long-term hydrology; unaffected by post-drainage conditions; high scientific rigor and standardization	None, it is the most reliable baseline available
1850s GLO Maps	Legal survey for land sale	First systematic documentation; notes major features along section lines	Legal rather than ecological purpose; qualitative, non-specific terminology; incomplete mapping between section lines
1875+ County Atlases	Document land ownership	Shows property lines and cultural features	Commercial rather than scientific purpose; natural features are secondary and generalized; accuracy not independently verifiable
1930s+ Aerial Photos	Landscape documentation	Visual snapshot of the land	Postdates artificial drainage by years or decades; cannot represent pre-drainage conditions; depicts transient, not historical, wetness

Conclusion
Historical maps and photographs add context, but none of them were built to answer the specific question this analysis requires. Their purposes were different, their data is qualitative, and in the case of aerial photography, the timing is simply wrong. Soil survey data doesn't have those problems. It is physical evidence, formed over centuries and legible in the ground regardless of what has been built on top of it since. It is the most accurate and legally defensible basis available for identifying which of these lands were historically poorly drained, and would have benefited from the drainage district's formation in the first place.

The Evolving Standard of Benefit and Modern Reality

Annexation as Modernization
This report isn't arguing that the original engineers made a mistake. They designed a system that fit the agriculture, technology, and economics of their time. The problem is treating their assessment as the final word on what counts as drainage benefit, a century later. Objectors have pointed to Zinser (1907) and Thompson (1925) as controlling; those are foundational cases, but they are also products of a specific technical and economic moment, and applying them today without accounting for what has changed since is a mistake. Annexation isn't correcting the past. It is bringing the drainage district's legal and financial structure into line with the hydraulic and economic reality of the drainage district as it actually exists now.

How Much Agriculture Has Changed
The scale of change over the last century is not incremental.

- Yield: in 1925, average Iowa corn yield was around 40 bushels per acre, and land that couldn't reliably produce that was left in pasture. In 2025, the state average is over 200 bushels per acre, roughly a 400 percent increase, or five times the 1925 figure, driven by genetics bred for high performance in optimized soil conditions and correspondingly vulnerable to the anaerobic stress that poor drainage causes.

- Equipment weight: a fully loaded tractor and implement in 1925 weighed three to four tons, and soil compaction was a minor concern. Today a loaded combine can weigh over thirty tons and a grain cart over fifty; that weight needs firm, well-drained soil to avoid deep compaction that costs yield for years afterward. Drainage benefit today isn't only about crop health; it's about whether equipment can get into the field at all.
- Economics: at 1920s input costs and yields, a wet spot in a field was a nuisance. At today's prices, an acre lost to ponding at 220 bushels and five dollars a bushel is an $1,100 loss, every year it happens.

A Wetter, More Intense Climate

The rainfall these systems have to manage has also changed. Statewide annual precipitation in Iowa has increased on the order of 5 to 10 percent over the last several decades, by most published estimates, which raises the total volume any drainage system has to move. More significant is the change in intensity: multiple sources tracking Iowa and Midwest precipitation, including NOAA and Iowa DNR data, show a substantial increase, on the order of 30 to 40 percent over the last several decades, in the frequency of heavy rainfall events. A system designed for slow, multi-day snowmelt and gentle spring rain is now regularly asked to move storms that drop several inches in a day, which is a different engineering problem than the one the original design solved.

A Century of Engineering Progress

Manning's equation (1889), Bernoulli's principle (1738), and Darcy's law (1856) aren't new; what has changed is the ability to apply them. Land-grant research after World War II, much of it at Iowa State, produced the modern discipline of agricultural drainage: drainage coefficient standards, the Hooghoudt and Kirkham equations for subsurface flow, and design references like the Iowa Drainage Guide that are now standard practice.

The practical difference shows up in the drainage coefficient, the rate at which a system is designed to remove water from the soil profile, measured in inches per 24 hours. Early-1900s systems were designed around basic reclamation: draining potholes and swamp enough to make land tillable, with tile, where it existed at all, targeting only the wettest spots, at a coefficient around one-tenth to one-fourth of an inch. The modern standard is agronomic optimization: farming every acre intensively, with tightly spaced pattern tile designed to a coefficient of a half inch or more. That is a significant increase in designed capacity, achieved with tools like LiDAR elevation models accurate to inches and GIS-based hydrologic simulation, which let an engineer model how water moves across the entire watershed under a range of storm conditions, rather than interpolating between a few dozen elevation shots taken by hand. That is the scale of the shift this report is accounting for, and it is larger than the standard the original system was built to.

The Cost of Not Annexing

Without annexation, the drainage district is left with a lopsided arrangement: existing members pay the full cost of maintaining a system that unassessed acreage also uses and benefits from. When the system eventually needs upgrading, the existing members would be the ones paying for capacity made necessary by land that was never assessed for it. Annexation fixes that by matching financial responsibility to hydraulic reality, so that everyone drawing on the system's capacity also contributes to keeping it working.

Conclusion

Holding a system built to serve 1904 agriculture to a 1904 legal and technical standard, when the agricultural purpose, the physical load, the economics, the climate, and the engineering analysis available have all changed this much, isn't a defensible position. The lands proposed for annexation are benefiting under any modern, quantifiable standard for what drainage benefit means. Declining to annex them doesn't preserve the original intent of the drainage district; it just leaves the drainage district operating under a framework the last century of agricultural and engineering practice has made obsolete.

Upland and Lowland Benefit

Differential Benefit

This section sets out the basis for assessing every parcel in the annexation area, including the higher-elevation ground (uplands) and the depressions and former wetlands (lowlands), under the established principle of differential benefit: all land tributary to a common outlet benefits from its improvement, but the nature and degree of that benefit varies with topography, soil, and distance from the main channel. The upland benefit is different in kind from the direct dewatering the lowlands receive, but it is substantial, measurable, and just as legally assessable. Framing this as the lowlands benefiting at the uplands' expense misreads both the hydrology of the watershed and the law governing it. The drainage district furnishes a stable, efficient, legally protected outlet that every landowner in it can use to improve their own ground.

The Right to an Outlet

Under Iowa common law, an upland (dominant) estate has a natural easement to drain surface water onto the lowland (servient) estate, but that easement is limited: an upland owner can't materially increase the volume or velocity of that water, or concentrate and discharge it in a way that departs from natural drainage, without becoming liable for the resulting damage.

That limit is exactly why upland landowners benefit so directly from the drainage district. Without it, an upland owner installing a comprehensive tile system risk overburdening the natural drainage course and damaging downstream neighbors, and is legally exposed for doing so. The drainage district removes that constraint. It gives every landowner within its boundary, upland and lowland alike, the right to use a common engineered outlet, which lets an upland owner drain more aggressively than the common law would otherwise permit. That legal right, on its own, is a significant and assessable benefit, consistent with how the Iowa Supreme Court read the same question in Kelley: an improved outlet benefits all tributary land, not just the parcels nearest to it.

The Soil Data on the Uplands

The USDA-NRCS soil survey data for the upland parcels in the annexation area doesn't support the assumption that upland ground is naturally well-drained. Soil drainage class for these parcels indicates seasonal waterlogging capable of restricting root development and delaying field work. Saturated hydraulic conductivity values are frequently low enough to slow percolation meaningfully, which during wet periods keeps the root zone saturated longer than the crop can tolerate. Depth to the seasonal high-water table on many of these soils runs one to three feet below the surface, close enough to interfere directly with production. And critically, the USDA lists these same soil series as suitable for, and responsive to, artificial drainage. Both halves of the benefit argument follow from that: the land needs drainage to reach its productive potential, and it is capable of using the outlet the drainage district provides.

The Drainage District Outlet Compared to the Natural One

The clearest way to see the upland benefit is to compare the pre-drainage district outlet with the engineered one that replaced it.

Before the drainage district's improvements, upland water drained to the adjacent lowland, a high-resistance system by any measure. Shallow depth, and meandering flow paths created significant friction and slowed the water down. Because the water level in the lowland sits at or near the surface by definition, any upland tile outletting into it would frequently sit submerged (a drowned outlet, unable to drain the soil profile above it), and the lowland's own capacity to convey water was small and swung wildly with rainfall, offering no dependable outlet for upland drainage in the first place.

The drainage district's facility replaces that with a low-resistance engineered system. Its invert sits well below the natural lowland, creating a materially steeper hydraulic gradient, the primary driver of flow. That gradient lets water exit upland tile freely and quickly, dropping the water table in the upland soil profile in hours rather than days after a rain event. Less time with a saturated root zone translates directly into yield and land value, which is the tangible agronomic benefit at the core of the upland assessment.

Conclusion

There is no real conflict between upland and lowland interests here; drainage in a watershed is one interconnected system, and the assessment schedule filed with this report reflects that. Lowland tracts get a high-percentage benefit through direct water removal and a lower water table, turning previously unproductive ground into farmland. Upland tracts get a different benefit that is no less real: a legally protected, hydrologically efficient outlet that lets them install or improve their own drainage in a way the common law wouldn't otherwise permit. Neither assessment is a subsidy to the other. Both reflect what each type of land actually gets from a shared, system-wide improvement, at rates that track the difference in benefit rather than erasing it.

Addressing the "Higher Elevation" Argument

Where the Argument Goes Wrong

The objection here is that land at a higher elevation can't benefit from a drainage facility. That is an oversimplification that isolates a single variable from a more complete physical picture, and it doesn't hold up. Open-channel flow is governed by the conversion of potential energy to kinetic energy under gravity. The potential energy of a mass of water is PE = mgh, where h is elevation head, and flow between two points requires that h_1 exceed h_2. The objection is self-defeating: the same elevation difference required for drainage to occur at all is being cited as proof that it provides no benefit. The relevant engineering question isn't whether the annexed land sits higher than the drainage district facility. It's how much the facility improves the rate and efficiency of the drainage that elevation difference already makes possible.

The Full Energy Equation

Water movement in a drainage system is governed by the energy equation, an extension of Bernoulli's principle. For a point on a parcel in the watershed (point 1) and a point in the drainage district facility (point 2):

$$p_1/\gamma + z_1 + \alpha_1 V_1^2/2g = p_2/\gamma + z_2 + \alpha_2 V_2^2/2g + h_L$$

p/γ = pressure head z = elevation head $\alpha V^2/2g$ = velocity head   hL = head loss to friction between points 1 and 2

The elevation-only objection considers just z_1 versus z_2 and stops there. The actual driving force for drainage is the difference in total energy head between the two points, and the drainage district's function is to manipulate the right side of that equation in the annexed land's favor: keeping the downstream water surface elevation as low as possible, and keeping channel friction and obstructions to a minimum. Minimizing both terms maximizes the total energy gradient across the system, which is the force pulling water off the higher parcels faster than degraded, natural conditions would allow.

The Backwater Effect

One concrete way the annexed land benefits is through the drainage district's effect on backwater. That is not a theoretical concern; it is governed by the standard equation for gradually varied flow:

$$dy/dx = (S_0 - S_f) / (1 - Fr^2), \quad \text{where } Fr = V / \sqrt{(gy)}$$

dy/dx = change in water depth along the channel   S0 = channel bottom slope   Sf = friction slope   Fr = Froude number

When a drainage facility loses conveyance (sediment, vegetation, a maintenance backlog), it behaves mathematically like a dam at the downstream end. That forces subcritical flow (Fr < 1) and produces what's called an M1 backwater curve, where water depth increases moving upstream even where the channel bottom itself is dropping. In practice, a downstream restriction raises the water surface for a measurable distance upstream, drowning private tile outlets and tributary swales along the way, including ones originating on higher ground.

Keeping the drainage district's facility clear and properly maintained is what prevents that condition from developing, which is what keeps the outlet free-flowing for the entire watershed, uplands included.

What Happens to the Tile Gradient

Subsurface tile performance on any parcel, at any elevation, follows the physics of flow through porous media, approximated by the Hooghoudt or Kirkham equations, or in simplified form, Darcy's law:

$$Q = -KA(\Delta h/L)$$

Q = flow rate into the tile K = hydraulic conductivity of the soil A = cross-sectional flow area $\Delta h/L$ = hydraulic gradient

where $\Delta h/L$ is the difference between the water table in the field and the water level at the tile, divided by distance. When the drainage district facility is functioning properly, the tile has a free outlet, the water level at the drain stays low, and the gradient stays steep, which means good flow. When backwater from a poorly maintained facility submerges that outlet instead, the water level at the drain rises, the gradient flattens toward zero, and flow into the tile slows to nothing, leading to saturated soil and crop loss on ground that, by elevation alone, would otherwise be assumed to be fine. That is the mechanism, not a theoretical one, by which the higher-elevation parcels depend on the drainage district's outlet functioning correctly.

Conclusion

Land at higher elevation not benefiting from a drainage system isn't a position the physics supports. The energy equation, the backwater effect, and the mechanics of subsurface flow all point the same direction: every parcel in this watershed is part of one interconnected hydraulic system, and the condition of the drainage district's outlet affects all of it, regardless of elevation.

The Watershed as Drainage District Boundary

Why the Watershed Is the Right Unit

A watershed is the area of land where all surface and subsurface water drains to a single common outlet, a physical boundary set by topography and gravity, not a line drawn for convenience. For a closed, engineered agricultural drainage system, the watershed boundary is the most defensible boundary for the district itself, because every parcel inside it contributes runoff and hydraulic load to the same infrastructure, whether or not that parcel is currently assessed.

What the "Watershed Fallacy" Cases Actually Held

Objectors sometimes cite a line of cases for the proposition that using a watershed as a district boundary is categorically improper. That is a misreading of what those cases actually decided. They didn't hold that a watershed boundary is legally improper; they held that the engineers in those specific cases failed to prove benefit within it.

Those cases share features that don't apply here. Several involved large, multi-county watersheds built around natural rivers, where the "improvement" was limited to channel work on a small stretch of an already-existing waterway; it's not hard to see why a farm fifty miles upstream in a thousand-square-mile river basin wouldn't be materially benefited by work that far downstream. Others involved improving an existing creek that already provided real natural drainage, which made the marginal benefit of the improvement genuinely weak, unlike a district that built an artificial ditch and tile system where nothing but a marshy slough existed before. And in nearly all of them, the engineer's failure was the same one Zinser identified: drawing the watershed line and asserting benefit without doing the parcel-by-parcel work to show it.

That is the actual holding: not that a watershed boundary is wrong, but that asserting benefit within one isn't a substitute for proving it. This report uses the watershed as the correct unit of study, and then does the parcel-specific analysis those other cases lacked.

The Watershed Boundary in Practice

In my own experience across more than fifty Iowa drainage district annexations, establishments, and reclassifications, I have recommended the watershed boundary as the district boundary in all but two of them. That is not a coincidence; it follows from how these systems actually function. Once a district builds a main ditch or tile, that facility becomes the only outlet for everything upstream of it within the watershed; every acre that isn't lost to evaporation or deep seepage has nowhere else to go. Every acre contributes runoff and adds to the maintenance load. Every private tile system depends on the district's main for a free-flowing outlet. Drawing the district line somewhere inside the watershed, rather than at its edge, ignores that reality and leaves some landowners paying to maintain an outlet that others use and burden without contributing to it, which is the inequity this annexation is meant to correct.

Conclusion

The “watershed fallacy” doesn't describe this annexation. It describes a narrow set of cases involving large natural river basins and engineers who never did the parcel-level work. This report provides the specific, parcel-by-parcel evidence those other cases lacked, and on that evidence, the watershed boundary is both the physically correct and the legally defensible line for this drainage district.

PIN	Deedholder	S-T-R	Legal Description	Area (Acres)	Elevation		Relation to Facility		Condition of Drainage		
					Elevation (ft)	Slope (%)	Outlet Closer (%)	Proximity (ft)	Drain Class	Ksat (in/day)	Water Table Depth (in)
40892607200003	SNELL, GARY & DRAPER, JANICE, SNELL, ARLINE L.	07-89-26	SW NE	2.9	1138.0	0.14	46.7	20764	6	9.6	8.9
40892608300001	VANDIEST FAMILY LLC	08-89-26	NW SW N 880'	3.4	1132.1	0.12	47.4	20190	7	4.1	0.0
40892630400001	NEDVED, CATHERINE M	30-89-26	NW SE	2	1117.3	0.18	68.8	7323	6	13.1	3.1
			Total Acres	**8.3**							