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Report of

Annexation
Drainage District No. 46
Worth County, Iowa

2024

Submitted by:
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Report

of

Annexation

Drainage District No. 46
Worth County, Iowa
0T7.132489

2024

Annexation Report

Schedules

ANNEXATION REPORT
DRAINAGE DISTRICT NO. 46
WORTH COUNTY, IOWA
2024

Introduction

A. Scope of Work

The Board of Trustees, having examined the existing assessment schedule, had determined the assessment schedule was not equitable. The Drainage District No. 46 Trustees appointed Bolton & Menk, Inc. as engineer to investigate and recommend the annexation of benefited lands not now included in Drainage District No. 46. Jacob Hagan, a licensed Engineer in the State of Iowa with 8 years of experience working on drainage district annexations across the state, along with other licensed professional engineers within Bolton & Menk have prepared this report to follow Iowa Code 468.119 as stated below:

"To examine such additional lands, to make a survey and plat thereof showing their relation, elevation, and condition of drainage with reference to such established district, and to make and file with the auditor a report…said report to specify the character of benefit received".

Pursuant to our appointment we have examined every parcel within the district and each ¼-¼ section or smaller tract of land in the district. This report will be on file with the Worth County Auditor's Office and is available to the public. We encourage the landowners to read the report and enclosed appendices and schedules. We will answer any questions or concerns at the public hearing.

B. District Facilities

District No. 46 consists of an open ditch approximately 3.9 miles long that outlets into a ditch at the state line. The district also includes 82 lateral tiles totaling 116,905 LF. Construction of the open ditch was completed in 1920 with repairs done in 1948 and 1978. A table of all the district facilities is shown on the next page.

Existing DD 46 Facilities					
Main Open Ditch	Lateral 1	1A			
	Lateral 2	2A	2A1		
		2B			
	Lateral 3	3A	3A1		
		3B	3B1		
			3B2		
			3B3		
		3C			
	Lateral 4	4A			
	Lateral 5				
	Lateral 6	6A			
		6B			
		6C	6C1		
	Lateral 7				
	Lateral 8	8A			
	Old Lateral 9	9A			
		9B			
		9C	9C1		
			9C2		
	New Lateral 9	9D	9D1		
			9D2		
		9E			
		9F			
	Lateral 10				
	Lateral 11				
	Lateral 12				
	Lateral 13				
	Lateral 14	14A			
		14B			
		14C			
		14D			
		14E			
		14F	14F1		
			14F2		
			14F3		
			14F4	14F4A	
				14F4B	14F4B1
		14G	14G1		
		14H	14H1		
		14I	14I1	14I1A	
			14I2	14I2A	
				14I2B	

			14I3
		14J	14J1
		14K	14K1
		14L	
		14M	
		14N	14N1
		14O	
		14P	
	Lateral 15		
	Lateral 16	16A	
	Lateral 18	18A	

C. Landscape

The district's land is typical of Worth County, largely devoted to row crop corn and soybean production with a few tree-lined acreages and marsh, woodland, and CRP/grass. Interstate 35 crosses the district facilities.

Approximately 5,997 acres in Iowa, and approximately 309 acres in Minnesota flow into the Drainage District No. 46 open ditch. Drainage District No. 46 serves as the outlet for Silver Lake. Silver Lake is a 343-acre lake with a mean depth of 4.8 feet and reaching a maximum depth of 7.3 feet. The lake's volume is approximately 1,640 acre-ft. Upstream of the lake is approximately 1,729 acres that flow into the lake.

The primary soil complexes in the watershed are Okoboji-Harps and Webster-Nicollet-Clarion and Kilkenny soil. The Okoboji-Harps soil complex is very poorly drained, Webster soils are poorly drained, and Nicollet, Kilkenny and Clarion soils are less poorly drained.

D. Weather Patterns

According to a report by the EPA, the average annual precipitation in most of the midwest has increased by 5 to 10 percent over the last 50 years, and rainfall during the four wettest days of the year has increased by 35 percent. Regardless of what has caused this increase, our current climate is different than the climate of 1921 when this district was constructed.

There is a popular and often accepted idea that an increase in subsurface drainage facilities adds to an increase in flooding. 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 thereby lowering the risk of flooding. Most flooding is due to peak flows from surface runoff over land, not drainage tile.

E. History

The existing schedule was developed at the time of establishment in 1921. The existing schedule includes all the facilities in one schedule and was created with the land use at that time considered. The drainage district's land use has changed since 1921. Looking at the US Census of Agriculture in 1925, Worth County had approximately 43,000 acres of grain corn, 27,000 acres of corn silage and corn pasture, 63,000 acres of oats, 56,000 acres of pasture, and 34,000 acres of hay land. For comparison, in 2022 Worth County had 110,000 acres of grain corn and 86,000 acres of soybeans. This represents a nearly 4.6 times increase in row crop grain production in Worth

County over the last 100 years. The existing schedule is on file at the Worth County Auditor's office.

Modern Concept of Drainage

It's important to think of drainage within the time we are living in. The assessment schedule should reflect the needs and understanding of modern drainage and agriculture. When this district was established, their understanding of drainage of different than today and their assessment schedule reflects their time. Annexation considers that the lands may not have been considered to benefit at the time of establishment but do benefit today even though the facilities may not have changed, our understanding of the facilities benefit has changed.

The first drainage districts were founded in the 1900's after Iowa established its drainage laws in 1904. Much of the drainage district activity was constructed during World War I due the commodity price increases. Iowa now has 3,800 drainage districts. Most of the tiles installed at the time are still operating today.

In 1920, the US Census of Agriculture completed a census of each state's drainage systems. It found of the 255,360 acres in Worth County, 92,860 acres were operating in a drainage enterprise. This equates to 36% of the total county's farmland relying on agricultural drainage. The census also stated 7.3 million acres of Iowa was provided drainage and an additional 2 million acres needed drainage. Looking at the 2017 US Census of agriculture 15.8 million acres of Iowa relies on drainage. This is a 116% increase in the last 100 years and 6.5 million acres more than was estimated to be needed.

The standard drainage coefficient, which is the measure of how much excess water should be removed from the landscape via drainage tile, was between 0.12"- 0.25" in 1920, but was updated in the 1950's to 0.5" to reflect the understanding that Iowa's agriculture needs more drainage. A 1983 study by Iowa State University concluded that 95% of tile drainage district in the state are undersized.

An engineer in 1921 would have thought about drainage during their time; laying clay tile by hand; they wouldn't have imagined 1,000 horsepower tile plows laying 4" plastic tile every 60' through an entire farm.

Methodology

In accomplishing annexation, Iowa Code 468.119 does not explicitly state what is a benefit received by a drainage district, also referred to as a character of benefit or material benefit. Looking at the only two sections of Iowa Code 468 in which benefit is explicitly described, we can logically assume the benefit being referred to in Annexation would be the same benefit as described below:

Iowa Code 468.2 states the benefits of drainage districts:

*"The **drainage of surface waters from agricultural and all other lands**, including state-owned lakes and wetlands, or **the protection of such lands from overflow** shall be presumed to be a public benefit and conductive to the public health, convenience, and welfare."*

Iowa Code Iowa Code 468.40 lays out the Rules for Classification, estimating benefits received:

*"In estimating the benefits to the lands….. only the benefits which will be received by reason of the construction of the improvement in question **as it affords an outlet to the drainage of such lands** or **brings the outlet nearer to said lands or relieves the same from overflow and relieves and protects the same from damage by erosion**.*
When the land is a state-owned lake or state-owned wetland, the commissioners shall ascertain the

*benefits realized from **removing excess water** and shall not consider any benefit realized if the state-owned lake or state-owned wetland were drained or converted to another land use."*

In summary to recommend annexation, the engineer should examine the lands and determine if the drainage district aided the parcel by any of the following benefits: the drainage was improved, the parcel is less likely to pond, a drainage outlet was provided or brought closer, erosion was reduced, or the district removed excess water from the parcel.

Annexation requires the engineer to examine, survey and plat the additional lands showing the annexed parcels' relation, elevation, and condition of drainage. We will go through how each of those requirements are related to the benefits as outlined in 468.2 and 468.40.

1. Relation of Annexed Lands to Established Facilities

When determining the relationship of the proposed annexed lands to the established district facilities, the Iowa Drainage Code provides no specific means of establishing such a relationship leaving it to the discretion of the engineer. Typically, the relationship is described as how the annexed lands interact with the district facilities and how close they are to the district facilities. The benefit being described is how drainage district provided or brought an outlet closer to the parcel.

For this report, we mapped the flow of water for every 1-acre area of the proposed annexation. Using these flow paths, we were able to calculate the distance between each parcel and their waters entry point to the district facilities. We have included a map showing these flow paths.

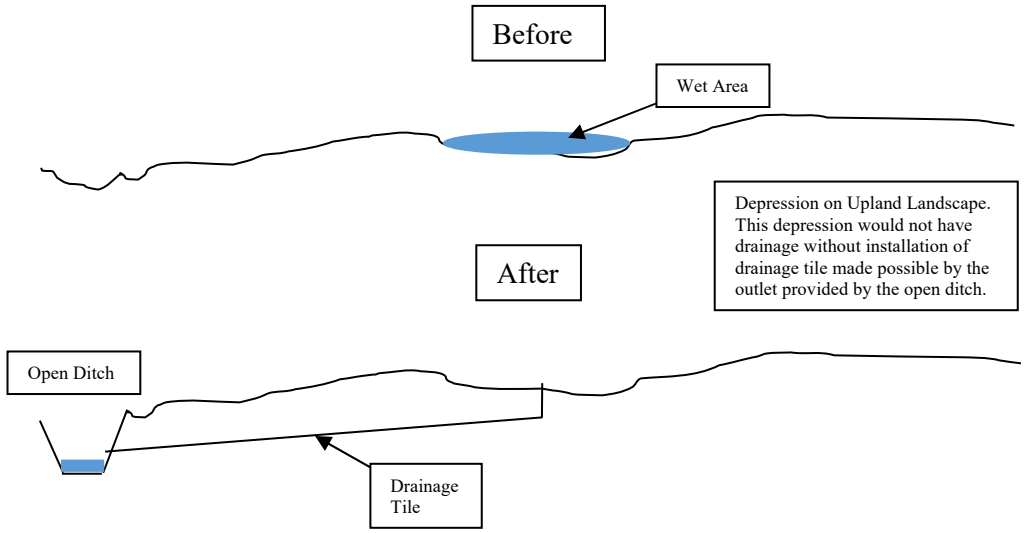
Drainage District No. 46 is an open ditch and tile drainage district. It does not provide a drainage tile directly to the annexed parcels; however, it does bring an open ditch and drainage tile closer to the parcels. Prior to the installation of Drainage District No. 46, the annexed parcels would have been needed to construct a private tile system to a natural creek limiting their outlet. The installation of drainage tile allows for the lands to connect private tiles into the drainage tile, thereby allowing those annexed lands to change the flow of their water both in the matter of how is transported and in quantity vs. the natural drainage that would be only surface water. Drainage Tile typically is 2-5' under the ground surface allowing for better grade and lowering the water table below the surface.

Silver Lake uses the Drainage District No. 46 Main Open Ditch as an outlet. This relationship allows the lake to maintain a normal lake level with a reliable outlet downstream to control overflow events.

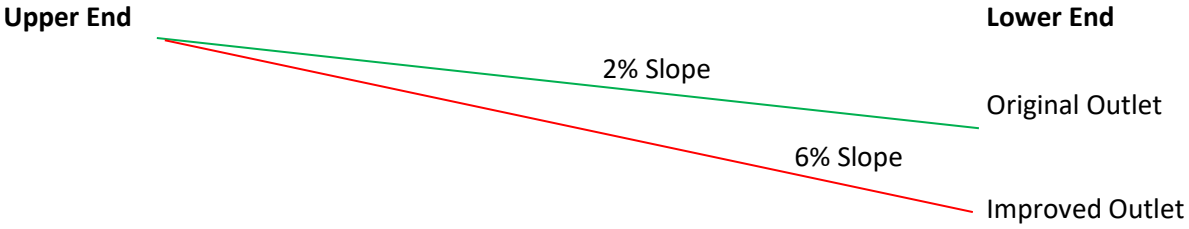
2. Elevation

We have studied contour maps and used LIDAR to determine the elevation of every acre of the proposed annexed area as shown on the enclosed map. Again, the Iowa Drainage Code provides no specific way in which the elevations should be used when preparing an annexation report, leaving it to the discretion of the engineer. It is well understood that water flows downstream, and all parcels both currently in any drainage district or being proposed for any annexation have elevations above the bottom of any open ditch or drainage tile that they drain. Considering that, it has been the understanding of drainage engineers in the state that lands being simply higher in elevation than the district facilities that they drain to are not exempt from annexation on those grounds alone.

Elevation alone doesn't dictate a parcel's need of drainage. Drainage districts exist to improve drainage on poorly drained lands. There are often poorly drained areas or areas in need of drainage higher on the landscape in localized depressions. The simple drawing below illustrates this point. Note the elevation of the depression is not the lowest land in the landscape but without the outlet provided by the open ditch, the depression won't be able to tile drain as needed to achieve maximum productivity.



Another example that elevation alone doesn't dictate a parcel's need of drainage is when the slope is insufficient to quickly remove excess water from the surface. Slope is the change of elevation over a distance. Drainage Districts allow for the slope to be steepened to remove excess water more quickly. Increasing the slope can be accomplished by lowering the outlet. For example, if you have a 2' of elevation change over 100', you have a slope of 2%. Now, if you lower the outlet by 4', you will have the opportunity to have 6' of elevation change over 100' resulting in a slope of 6%. See illustration below, the green line shows the slope before, and the red line shows the slope after. Water will flow faster down the red line than the green line.



This increase in slope availability allows landowners to install smaller tile at a steeper grade to achieve the same drainage capacity. This is a direct cost savings to the landowners as smaller tile is less expensive than larger tile. For example, laying a 15" drainage tile at 6% slope has more drainage capacity than an 18" drainage tile at 2% slope.

3. Condition of Drainage

The understanding of condition to drainage is describing how the land drains and water flows into the facility. Condition of drainage is directly related to the benefits of relieving the lands from overflow, protecting from erosion, and removing excess water. Has the lands outlet been improved, is the land able to flow as runoff or subsurface flow, is there natural barriers limiting the flow or has the landowner constructed a system to avoid using the district facility are examples of questions the engineer asks himself when studying the condition of drainage.

We have included a soil drainage class map with this report. The soil drainage classes show a parcel's need for drainage and their response to taking advantage of an outlet provided. In 1983, Iowa State University completed a study of drainage districts in Iowa. It estimated corn yields in very poorly and poorly drained soils to be zero without tile drainage. We have included the study as an appendix with this report.

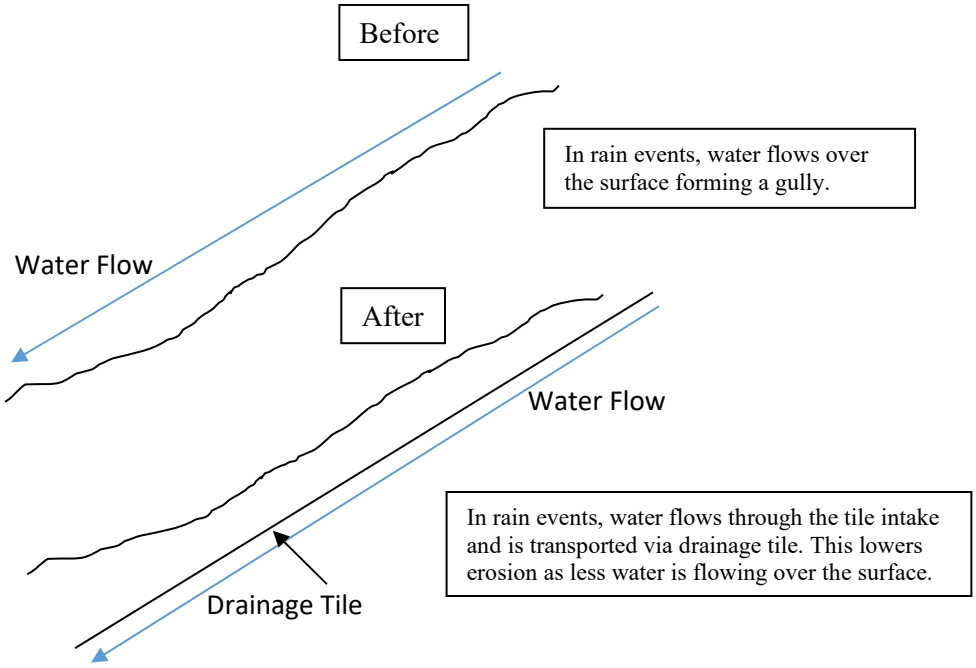
Land needing drainage is not alone a reason for annexation, the district must show a benefit was provided by the drainage district improvements. Did the drainage district improvements provide an opportunity for the lands to be better adapted for crop production or to convert the unusable marsh lands into farm or pastureland? To better understand this, we look at historical maps, soil maps, and historical photos to come up with a picture of the landscape before the drainage districts.

Another condition of drainage to consider is the opportunity provided by the district to change the condition of drainage from surface to subsurface (tile) drainage. Iowa Code Section 468.621 states:

"Owners of land may drain the land in the general course of natural drainage by constructing or reconstructing open or covered drains, discharging the drains in any natural watercourse or depression so the water will be carried into some other natural watercourse, and if the drainage is wholly upon the owner's land the owner is not liable in damages for the drainage unless it increases the quantity of water or changes the manner of discharge on the land of another."

According to 468.621, the upstream landowner may not increase the quantity of water or change the manner of discharge on the land of another. Therefore, without a drainage district tile or open ditch providing an outlet for a drainage tile, the upstream landowner would be unable to channel the natural surface flows into tile drainage without the consent of the downstream landowner. Being within a drainage district all landowners have the right to use the district facilities.

Iowa Code also mentions protecting lands from erosion as a benefit of a drainage district. Drainage Tile can be beneficial to the environment and protect the land from erosion. Did the district facilities change the condition of drainage to limit erosion and control the flow of water on the annexed lands. This benefit is more common on lands with steeper slopes that are in less need of drainage. The installation of drainage tile or open ditches with controlled points of entrance can reduce runoff erosion as the runoff is channeled into the drainage facilities. Below is a simple drawing of a drainage tile preventing erosion of a gully.



Benefits of Drainage

The primary benefit of drainage is increased agricultural productivity. We have included some of the agricultural benefits of Drainage District No. 46 as described by Ohio State Professor Mel Palmer. Below are listed the benefits as described by Professor Palmer.

- 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 extensive root development and a more favorable environment for beneficial soil micro-organisms and earthworms. When soil aeration is reduced, the severity of soil-borne root is increased.
- Better soil moisture conditions with good drainage permit more efficient operation of tillage, planting, and harvesting equipment.
- Better soil structure can be developed and maintained with good drainage by reducing compaction when working soil that is too wet.
- Soils warm up 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.
- 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.
- Longer growing seasons can be achieved with good drainage due to earlier possible planting dates. This also permits the use of higher-yielding crop varieties or extended grazing periods for livestock.
- 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.
- Winds are less liable to uproot plants growing in soils that have been properly drained since root systems are deeper.
- 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.
- Good drainage saves fuel that would be used in working around wet areas in fields 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.
- Good drainage reduces winter crop damage such as frost heaving of alfalfa and smothering of wheat and cover crops under patches of ice.
- 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.
- 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.
- Weed control is easier with good drainage since shallow-rooted weeds and undesirable grasses often thrive in wet soil moisture and nutrients.
- Well-drained grazing land supports more livestock with less compaction damage to vegetation and soil from animal traffic.

- 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.
- Valuable livestock water supplies can be obtained by draining hillside seeps and piping the water to stock water tanks.
- 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.
- Drainage is essential for salinity control in drier regions where irrigation is needed for permanent agricultural production.

Acreages and non-agricultural properties benefit from drainage district facilities. These properties rely on drainage district tiles and the outlets they provide to lower the water table and keep their basements drier. They are provided storm sewer relief, and their yards, gardens, and trees benefit from the increased soil productivity. Much like residents in town pay for storm sewers, the acreages should help pay for drainage districts providing the same benefit.

Roads can be assessed for benefits from a drainage district as outlined in Iowa Code 468.43. Iowa's early roads were muddy. The roads being drier makes maintenance easier. The roads also have higher runoff due to the hard surfaces. This runoff doesn't soak into the soil but instead quickly goes to the district tiles typically via intakes in the road ditches.

All landowners within the district benefit from the decrease in mosquitoes and the diseases associated with mosquitoes. Today, we don't think about how before drainage districts and other public health measures, malaria was a common disease in Iowa's wetlands. Iowa Code 468.2 even goes as far as stating one of the reasons to construct drainage districts as being conductive to public health, convenience, and welfare.

Overall, good drainage results in higher crop yields, improved public health, and higher land values. Most of these benefits may not be easily recognized as the system has been in place for 100 years now, and no one alive today remembers how this area drained prior to the district establishment. Therefore, when assessing benefits, we must review the historical information and use scientific and mathematical modeling to estimate the benefits.

Investigation

During the investigation the engineer surveyed and examined each parcel under consideration for the benefit received. Extensive drainage district records on file in the County Auditor's office, publicly available aerial photographs, land surface elevations and soils information were reviewed and utilized to determine the elevation and condition of drainage with relation to the several facilities of Drainage District No. 46.

To estimate the drainage prior to the installation of the Drainage District, we have complied maps from the USDA soil maps to estimate the landscape and drainage prior to any drainage in the area. This was compared to the aerial photos from the 1930's to present. We also analyzed the elevation maps to determine if any natural outlets or alternative drainage outside the drainage district facilities could have existed.

To calculate these factors and determine the benefits for each parcel, we employed a grid system using hexagons. Each hexagon covers an area of approximately one acre, which provides a comprehensive and precise assessment of the benefitted area. Within each hexagon, three key variables were documented: elevation, soil composition, and land usage. By establishing connectivity between these hexagons, the natural flow paths of water towards district facilities were outlined. The distance of the flow path from each hexagon to its associated district facility was then calculated. All this data was compiled and

compared with our estimation of how the land would have drained prior to the district establishment to determine a benefit for the annexed lands.

The annexation schedule assumes that all landowners take advantage of the drainage provided by the drainage district. Iowa Code does not have a method to assign benefits based on the number of private tiles each individual landowner has. It would also be difficult to administrate such a method; it would require landowners to inform the district of any work being done on their lands and every time someone completed any work, the district would need to be reclassified.

The lower 1400' of the Drainage District No. 46 open ditch is in poor condition. This stretch of the ditch was shown as a district facility on the original plat and profiles of the district. It does not appear to have cleaned out since and has become overgrown with trees and the ditch has meandered, appearing more like a creek than an open ditch. I found no record of this stretch being formally abandoned by the district. I do not recommend abandoning this stretch. Even if leaving it in its current condition is desired by the district's landowners, by remaining a district facility any future maintenance would be easier, and the district would have the right to make repairs and improvements in the future.

There are three areas of land recommended to be annexed.

There is a row of parcels along the Minnesota border that benefit from Lateral 2 eventually outletting into the Main Open Ditch just upstream of the Interstate. Drainage District No. 46 Lateral 2 tile provided a nearer outlet to the lands recommended to be annexed and provided them the opportunity for these lands to tile drain to the district facilities.

The lands within Drainage District No. 26 are also recommended to be annexed. These lands are in the upper area of Drainage District No. 26. When Drainage District No. 46 improved the natural creek that Drainage District No. 26 outletted into, Drainage District No. 46 provided a more reliable deeper outlet. The main open ditch, now being a district facility, ensures that the ditch will be maintained for drainage. If it was still a creek the creek would meander, silt in, become tree lined, and not be designed for drainage.

Silver Lake lies within the Drainage District No. 46 watershed and the Main Open Ditch serves as the outlet for the lake. A weir structure was installed to control the lake level. The lake can be assessed for removing excess water; however, it must be assessed differently than the agricultural and other lands in the district per Iowa Code 468.40. The benefit to the lake is the opportunity to control the lake level with a reliable well-maintained outlet that is designed to take the lake overflows. It also benefits from the opportunity to drain the lake if necessary. It is our understanding the lake has been drained before using the open ditch as the outlet. We have modelled the lake flows into the ditch and the lake level during storm events. We found the ditch helped control the lake level and contributed a significant amount of water to the ditch.

For the lands upstream of the lake, we do not recommend annexation currently. Their outlet is the lake; therefore, their benefit of the open ditch is small. This is not to rule out annexation in the future for these lands.

There is no means available to annex lands from Minnesota into an Iowa Drainage District. The lands may benefit, however at this time, we have no legal means to include them, so no study of these lands benefit was made. If it becomes legal to annex the lands in Minnesota, further study will need to be completed.

Drainage District Procedure on Report

A. Notice and Hearing

Upon filing this report, the Board of Trustees will schedule a public hearing inviting all landowners in the district by regular mail and publishing the Notice of Hearing in the local newspaper per Iowa Code Sections 468.14 and 468.15. Landowners are encouraged to attend. At this hearing, we will present this report and answer any questions or concerns from the landowners and the Board of Trustees. No decision can be made outside a public hearing with all landowners invited. The hearing will be recorded and any information shared at the public heairng shall become a part of this report. The report may be amended after the hearing to reflect any information shared.

Our office and the Auditor's office will only mail letters and notices to the landowners of record. They do not have any official knowledge of any tenants. It is the landowner's responsibiltiy to notify their tenants. Tenants have no official position, or the ability to file objections, or to file claims for damages.

B. Objections

Landowners have the right to object to annexation. The Board will consider these objections at the hearing. All objections should be in writing and filed prior to the close of the hearing.

Recommendations

It is this engineer's opinion that all the land areas shown in yellow hatching on the included map, totaling approximately 745.2 acres including 315.3 acres of Silver Lake, are materially benefited by the facilities of Drainage District No. 46.

The benefits derived are material in that the lands recommended to be annexed drainage was improved, the parcel is less likely to pond, a drainage outlet was provided or brought closer, erosion was reduced, or the district removed excess water from the parcel due to the construction and maintenance of the Drainage District No. 46 facilities.

Based on the information available to the engineer it is recommended that the board of supervisors pursue the annexation of the several benefiting parcels described herein following Iowa Code section 468.120. The Board shall consider this report and all other reports, plats, and profiles of the drainage district on file with the Auditor's Office.

Listed for each forty-acre or smaller parcel being recommended for annexation are the owner(s) of record, the legal description, elevation, relation, condition of drainage and the approximate number of benefited acres within the parcel. Actual benefited acres in each parcel will be established at the time the lands are classified. Benefiting county road rights-of-way which adjoin the annexed parcels, will also be made eligible for assessment by this action. A schedule of lands benefited by the existing DD 46 facilities and recommended for annexation is included with this report.

Annexation of the lands recommended herein is considered feasible, practicable and for the public good. It is therefore recommended that the Board of Supervisors take appropriate steps to accomplish the following:

1. Tentatively approve this report.
2. Subject to qualified legal guidance, schedule and give formal notice of and conduct the required public hearing or hearings as needed.
3. Annex to Drainage District No. 46 the lands ultimately determined to be benefited.

Respectfully submitted,

5/24/24

Jacob Hagan Date

Professional Engineer No. 25738

Background Information

Drainage District No. 46

Worth County, IA

Elevation Map

February 2024

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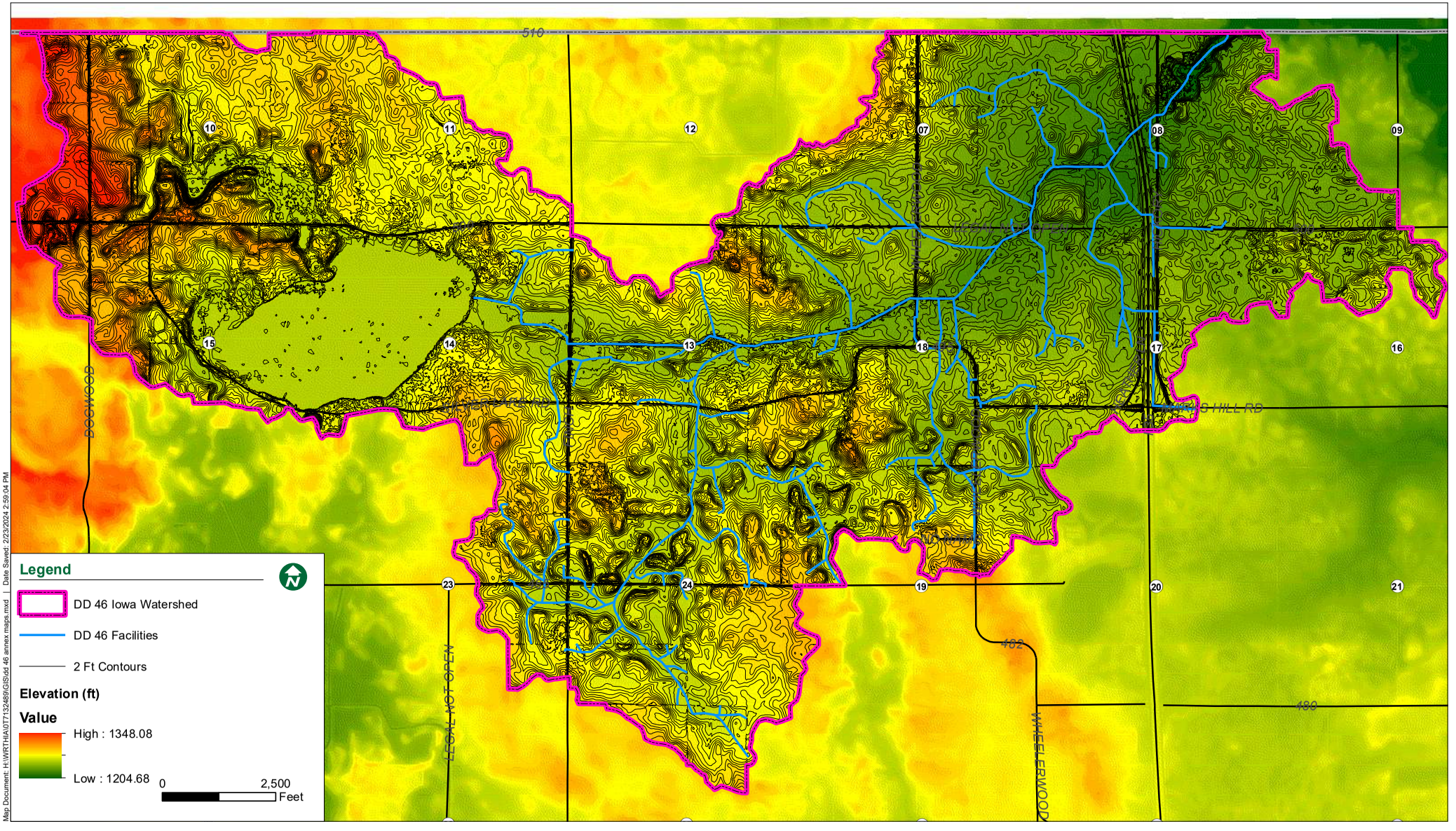

Drainage District No. 46

Worth County, IA

Flood Frequency Map

February 2024

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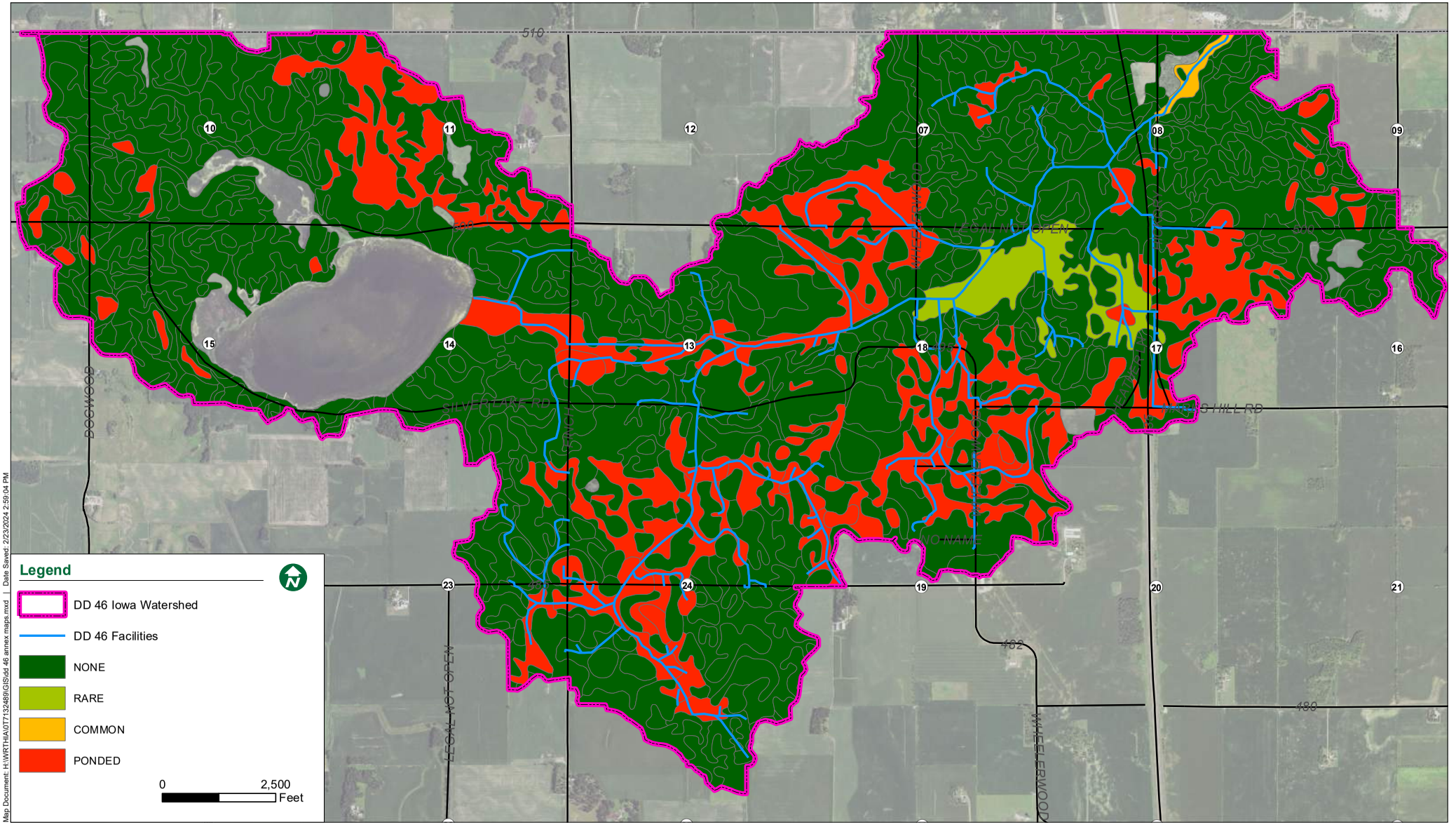

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Drainage District No. 46

Worth County, IA

Water Flowpaths

February 2024

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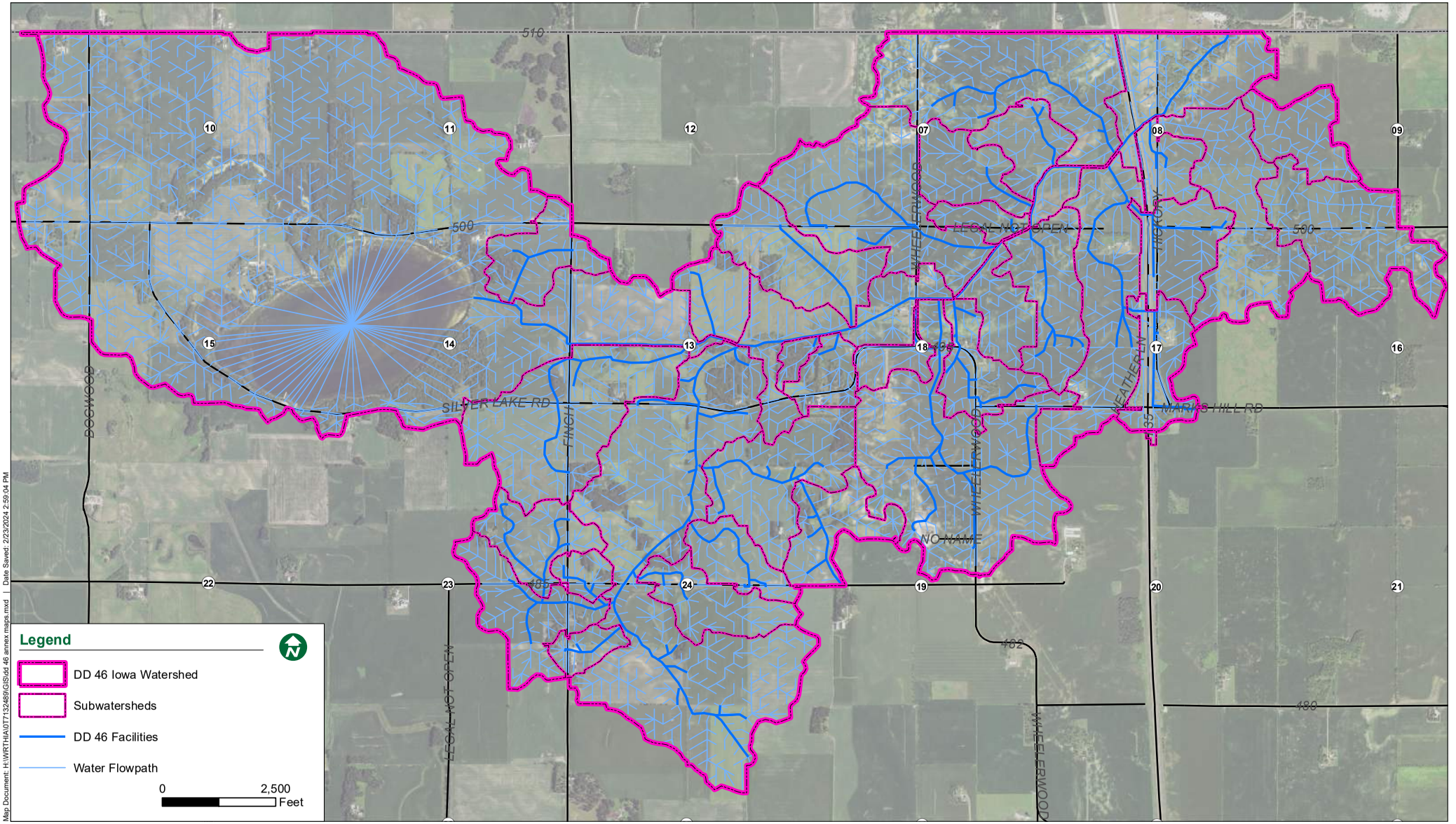

Drainage District No. 26
Worth County, IA

Susceptibility of a Soil to Sheet and Rill Erosion by Water
May 2024

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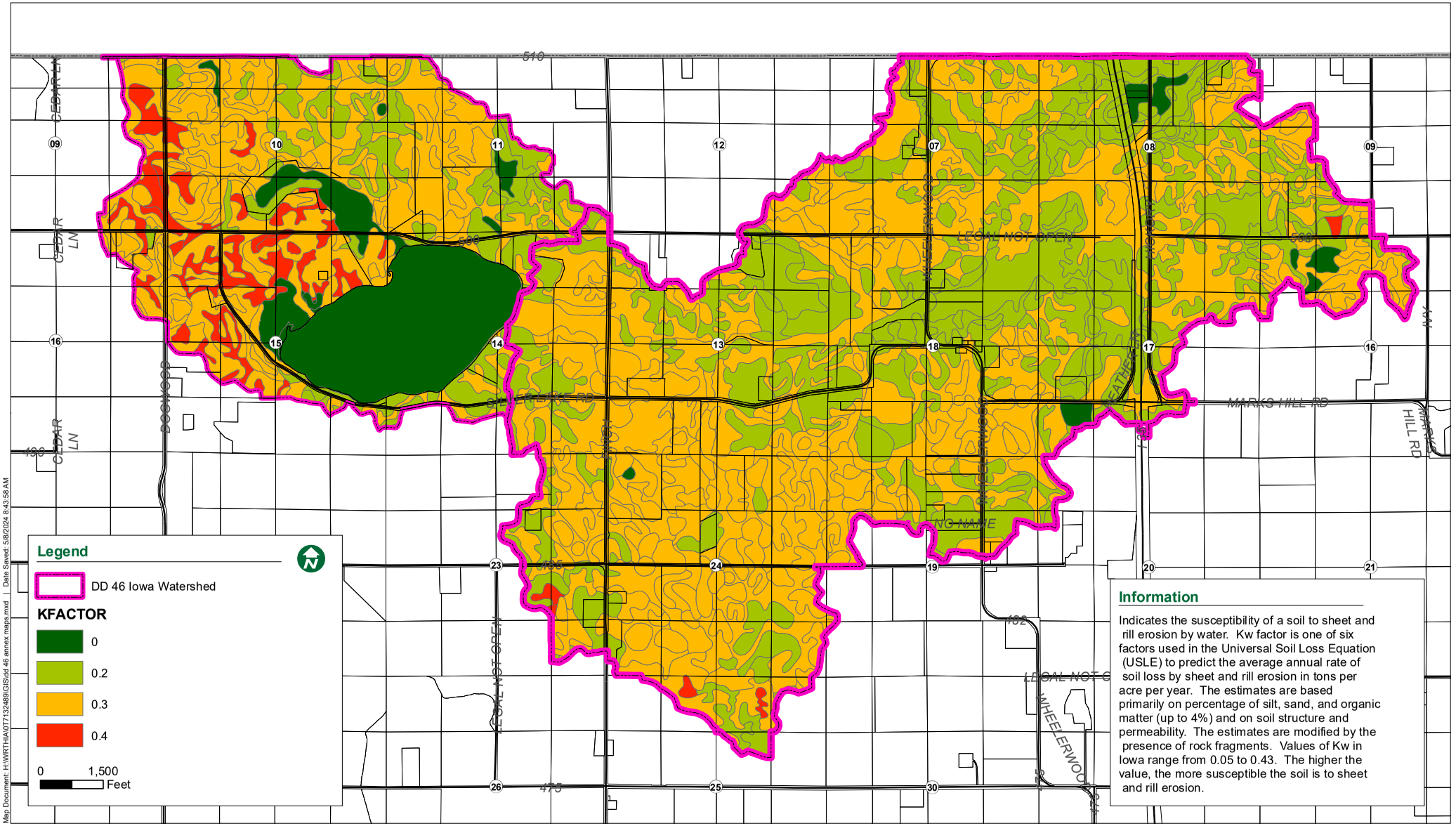

Drainage District No. 26

Worth County, IA

Soil Drainage Class

May 2024

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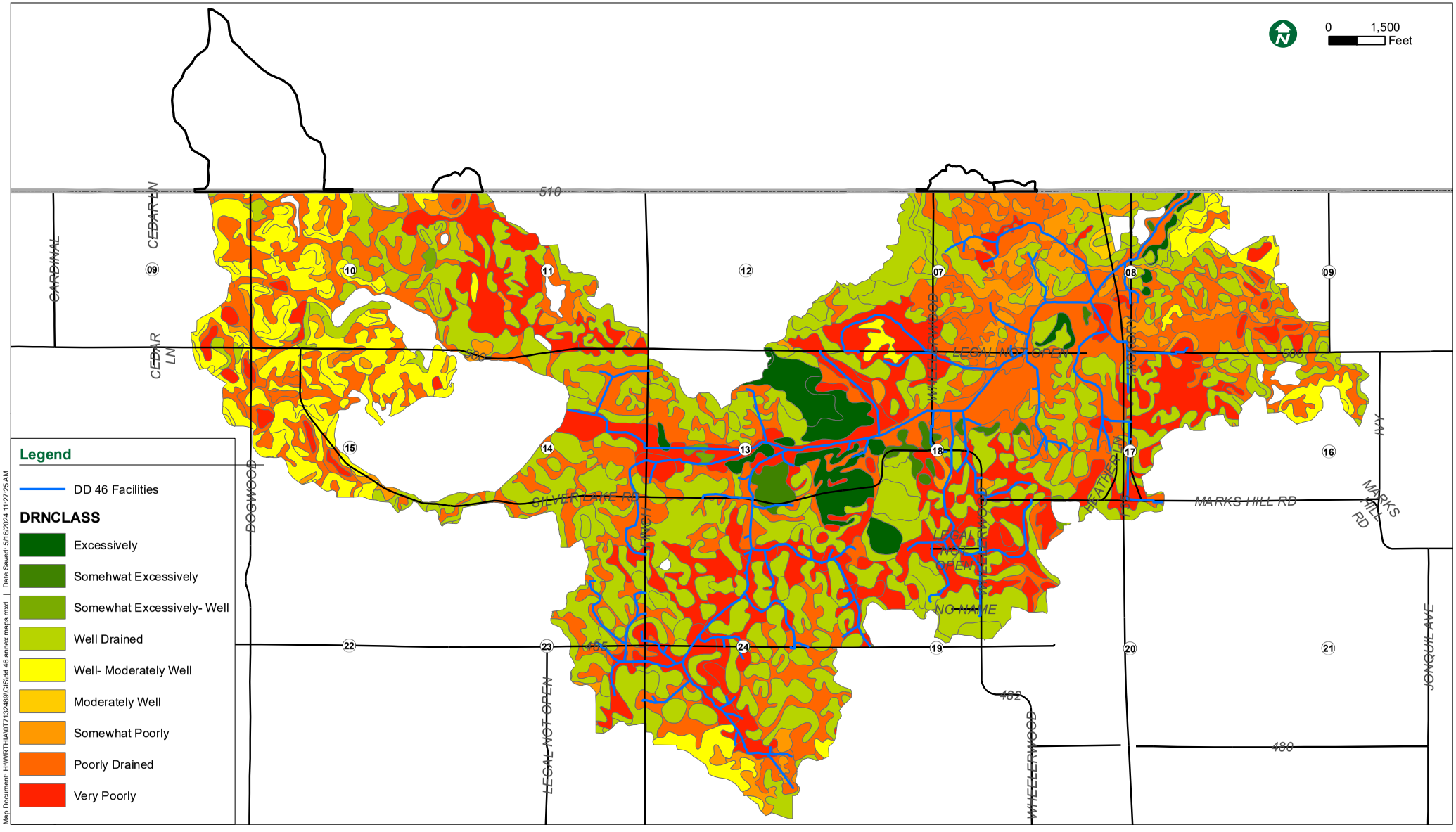

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Drainage District No. 46

Worth County, IA

1850's General Land Office Map

February 2024

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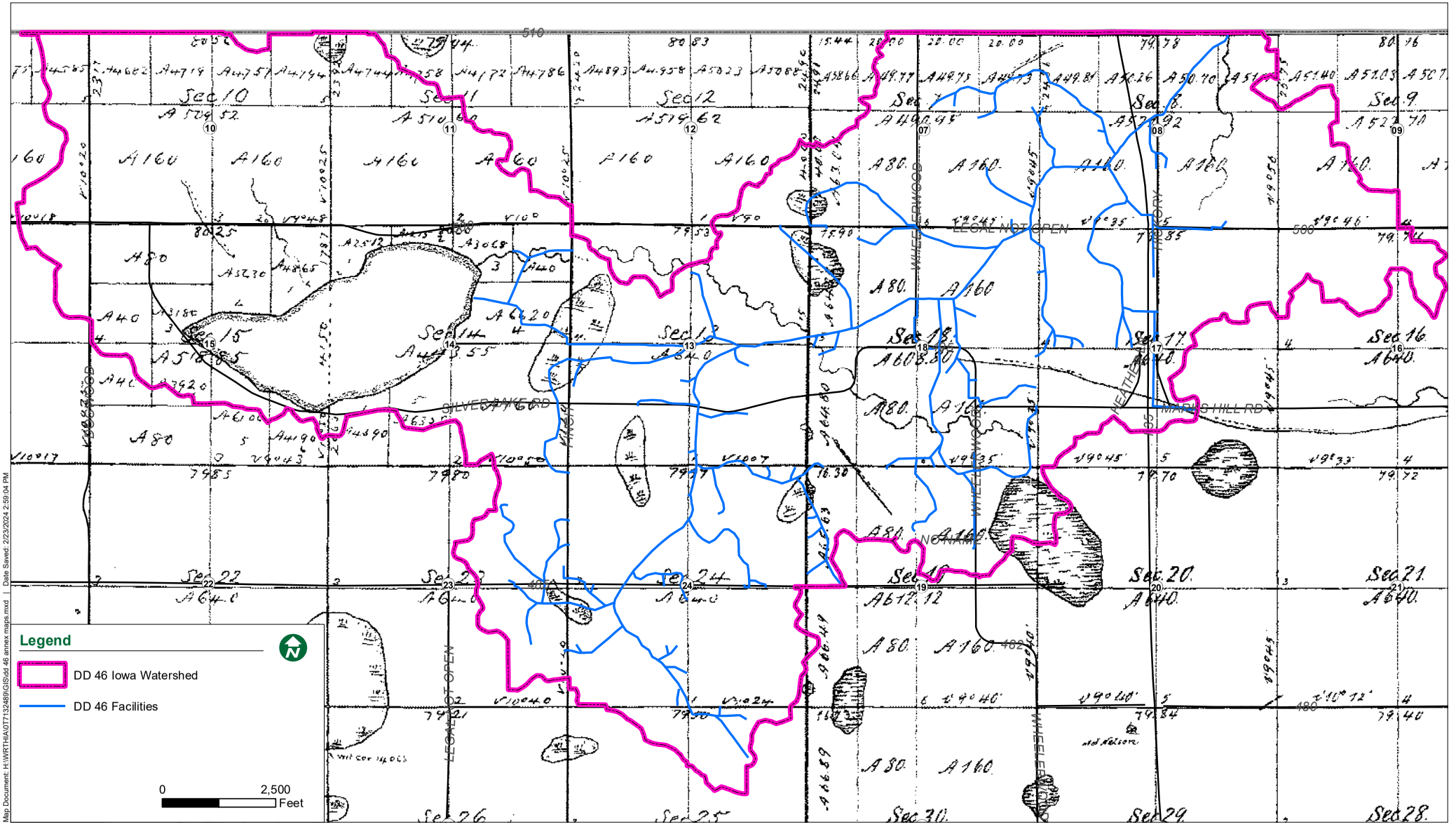

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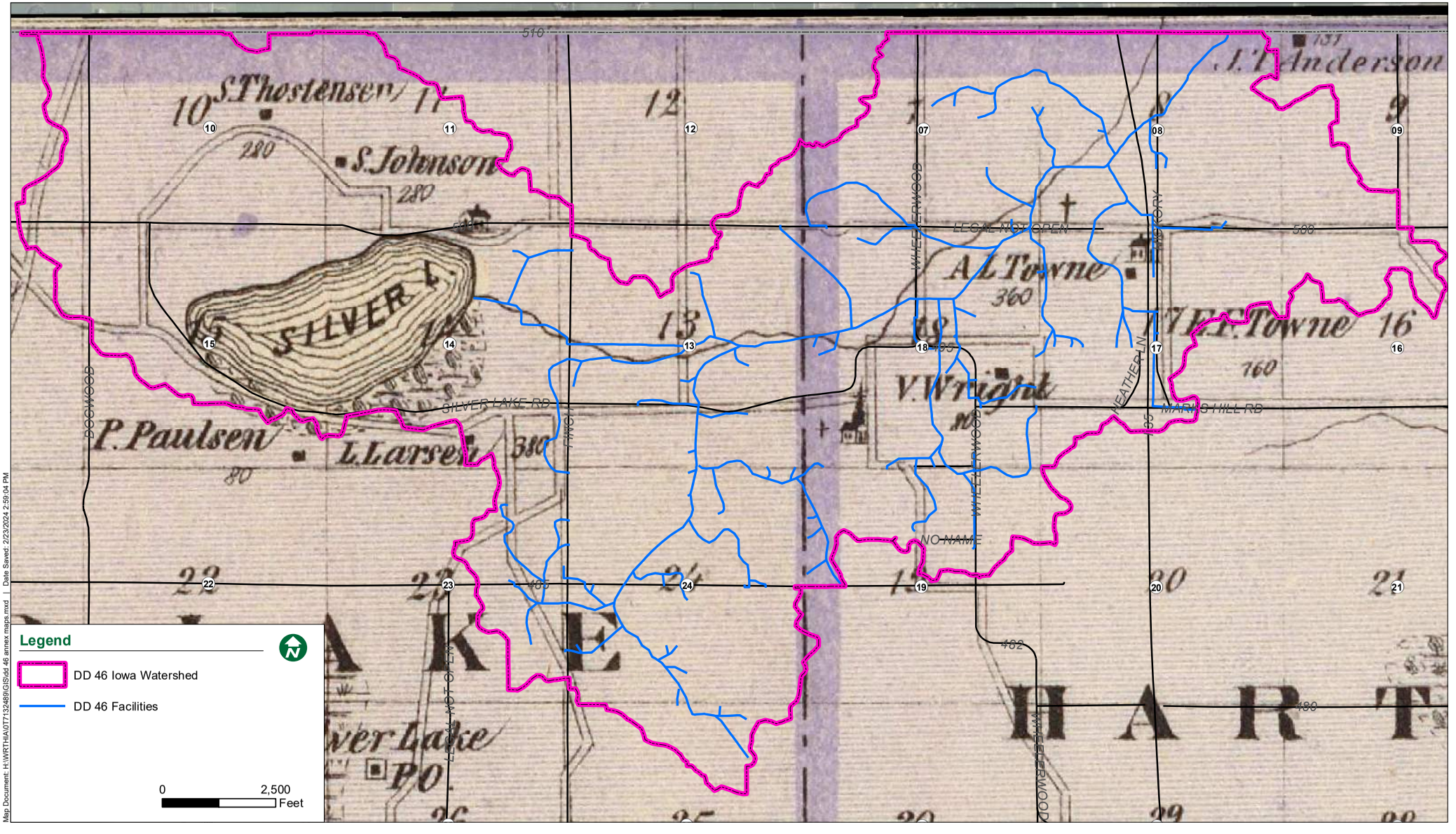

Drainage District No. 46

Worth County, IA

1930's Aerial Photo

February 2024

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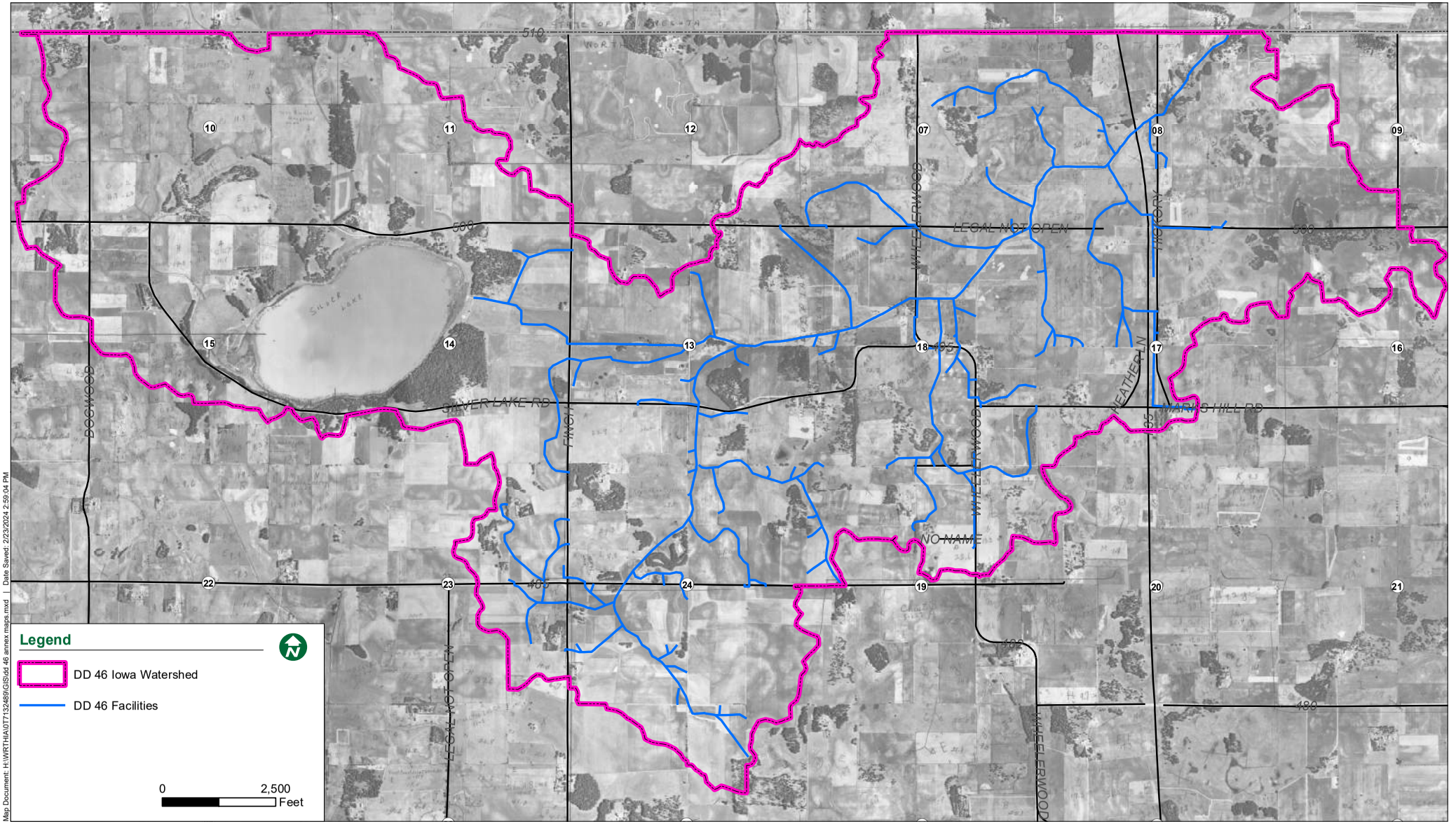
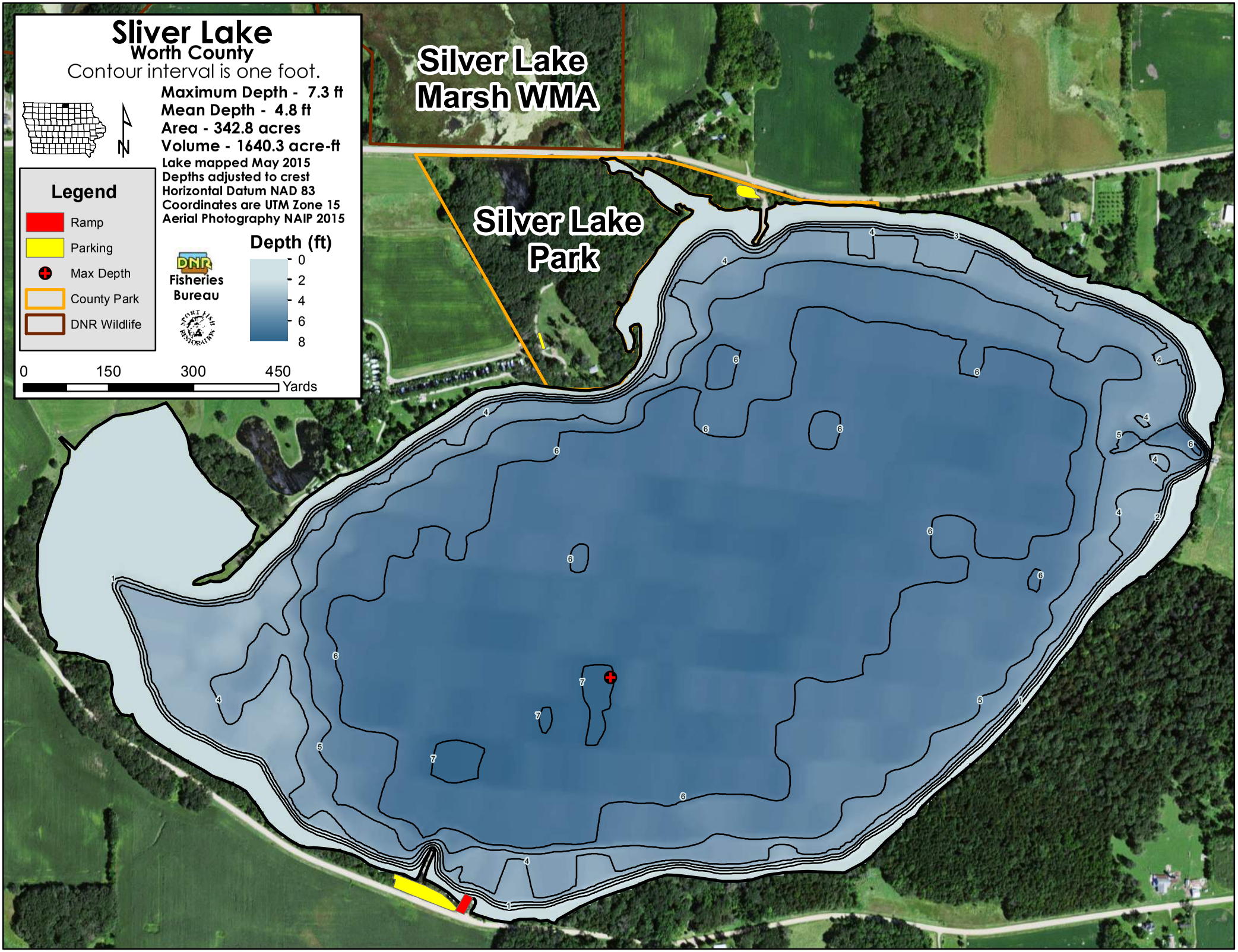


Legend

- DD 46 Iowa Watershed
- DD 46 Facilities

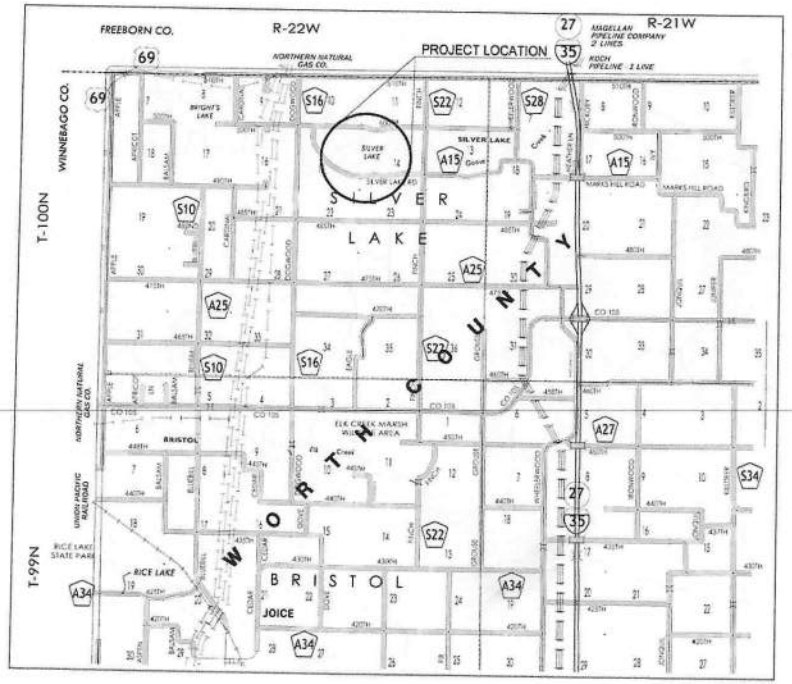
0 2,500 Feet

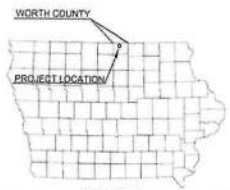
Map Document: H:\WRT\HIA\07713248\GIS\dd 46 annex maps.mxd | Date Saved: 2/23/2024 2:59:04 PM


Sliver Lake
Worth County
Contour interval is one foot.
Maximum Depth - 7.3 ft
Mean Depth - 4.8 ft
Area - 342.8 acres
Volume - 1640.3 acre-ft
Lake mapped May 2015
Depths adjusted to crest
Horizontal Datum NAD 83
Coordinates are UTM Zone 15
Aerial Photography NAIP 2015
Legend
Ramp
Parking
Max Depth
County Park
DNR Wildlife
Fisheries Bureau
Depth (ft)
0
2
4
6
8
0
150
300
450
Yards
Silver Lake Marsh WMA
Silver Lake Park

SILVER LAKE WCS AND FISH BARRIER IMPROVEMENTS

SECTION 14 & 15, TOWNSHIP 100N, RANGE 22W
WORTH COUNTY, IOWA
IOWA DEPARTMENT OF NATURAL RESOURCES
2011





INDEX OF PLAN SHEETS		
SHEET NO.	DRAWING NO.	
1	GN-01	COVER SHEET
2	GN-02	CONSTRUCTION SEQUENCE & QUANTITIES
3	GN-03	PROJECT SITE PLAN
4	PP-01	PLAN & PROFILE
5	GR-01	WCS & EMERGENCY SPILLWAY SITE PLAN
6	ST-01	FARM CROSSING DETAILS
7	ST-02	CMP CULVERT DETAILS
8	DE-01	WCS W/FISH BARRIER DETAILS
9	DE-02	DETAILS
10	DE-03	SAND/GRAVEL FILTER DETAILS
11	DE-04	CATWALK, FENCE DETAILS
12	DE-05	S.S. PROTECTIVE SCREEN DETAILS

IOWA ONE CALL
800/292-8989

THE CONTRACTOR SHALL NOTIFY IOWA ONE CALL NO LESS THAN 48 HRS. IN ADVANCE OF ANY DIGGING OR EXCAVATION.

WHERE PUBLIC UTILITY FIXTURES ARE SHOWN AS EXISTING ON THE PLANS OR ENCOUNTERED WITHIN THE CONSTRUCTION AREA, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE OWNERS OF THOSE UTILITIES PRIOR TO THE BEGINNING OF ANY CONSTRUCTION. THE CONTRACTOR SHALL AFFORD ACCESS TO THESE FACILITIES FOR NECESSARY MODIFICATION OF SERVICES. UNDERGROUND FACILITIES, STRUCTURES AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS, AND THEREFORE THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. IT IS POSSIBLE THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN OR SHOWN. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THEIR EXISTENCE AND EXACT LOCATION AND TO AVOID DAMAGE THERETO. NO CLAIMS FOR ADDITIONAL COMPENSATION WILL BE ALLOWED TO THE CONTRACTOR FOR ANY INTERFERENCE OR DELAY CAUSED BY SUCH WORK.

Construction Sequence (order of construction)
1.Drain lake in increments to avoid large discharge flows. Remove a 6ft wide by 1.5ft depth of spillway and let the lake drain until depth of water is only 0.2ft flowing over spillway, then remove remaining spillway.
2. After existing spillway removal, begin lake channel excavation as conditions allow.
3. When lake channel is completed, begin construction of water control structure, emergency spillway and 10' x 5' farm crossing.

WATER CONTROL STRUCTURE HYDROLOGIC AND HYDRAULIC DESIGN DATA

HYDROLOGIC DATA
Drainage Area: 2,108 Acres
CN: 78
Tc: 4.3 HRS
% Imperious: 18

DATA FOR TECH BULLETIN NO. 16:
Emergency Spillway Elev. 1263.18 Principal Spillway Elev. 1261.75
Channel Elev. Below Spillway Elev. 1255.0
Low Hazard Dam not Major Structure Criteria:
(Dam Ht.) 8.5 ft. x (total storage) 2,100 Ac. Ft. = 17,850 < 30,000

Freeboard Design Flood:
Rainfall = P100 + 0.12 (PMP-P100)
= 6.3 in. + 0.12 (31 in. - 6.3 in.)
= 9.26 in. 24 hr. duration

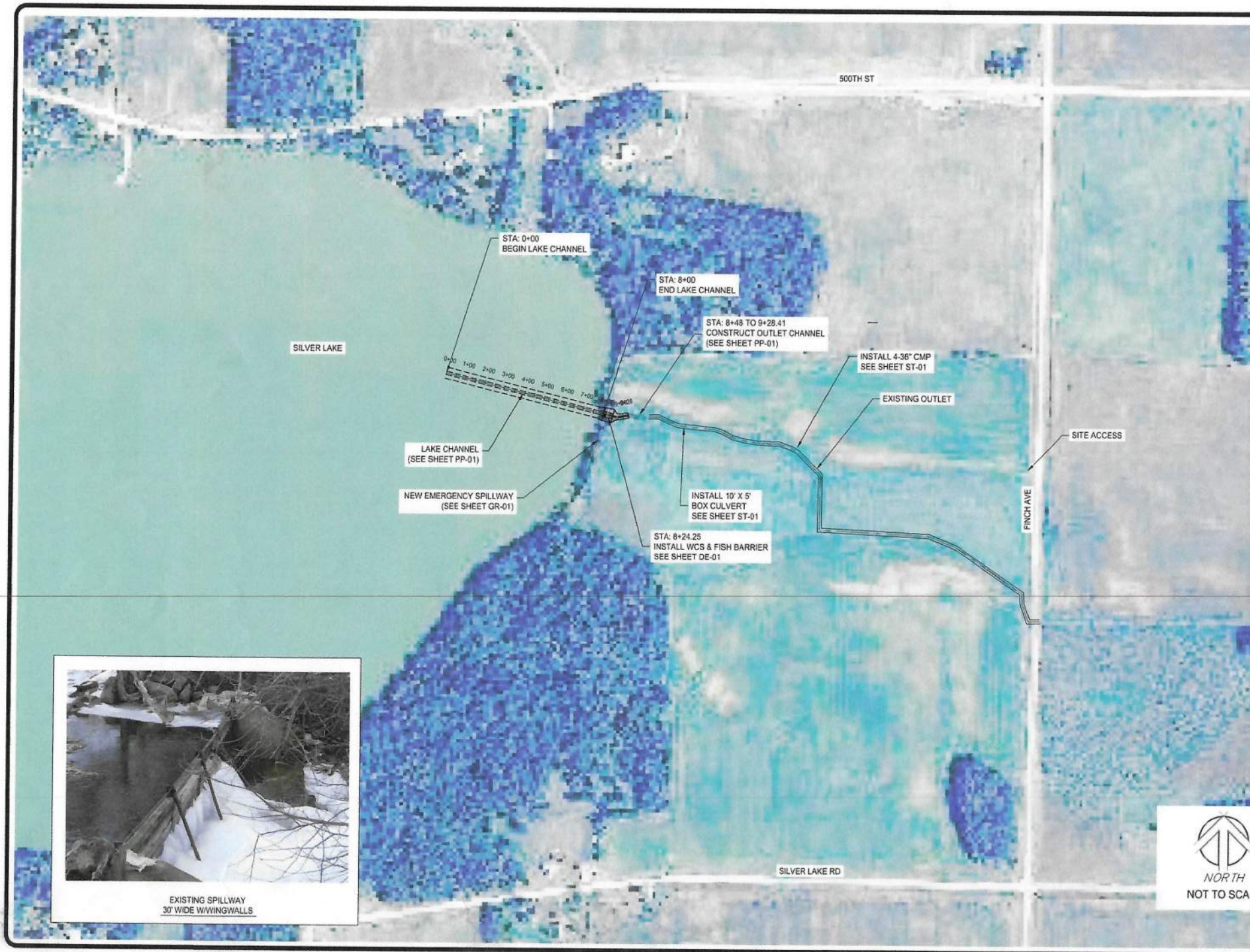
DESIGN CREST ELEVATION: Elev. 1264.60'
Q100 = 1316 CFS 24hr. duration HWL100 1263.52
Spillway Peak Flow: 220 CFS
Time to evacuate 80% volume for Q25 is 5 days < 10 day criteria

OTHER HYDRAULIC DATA:
Time to remove 25 yr. - 24 hr. storm (5.1 inches) at spillway
Elev. 1258.75 (3 ft. below normal pool) is 8.6 days to Elev. 1258.85
Q25 Spillway: 131 CFS

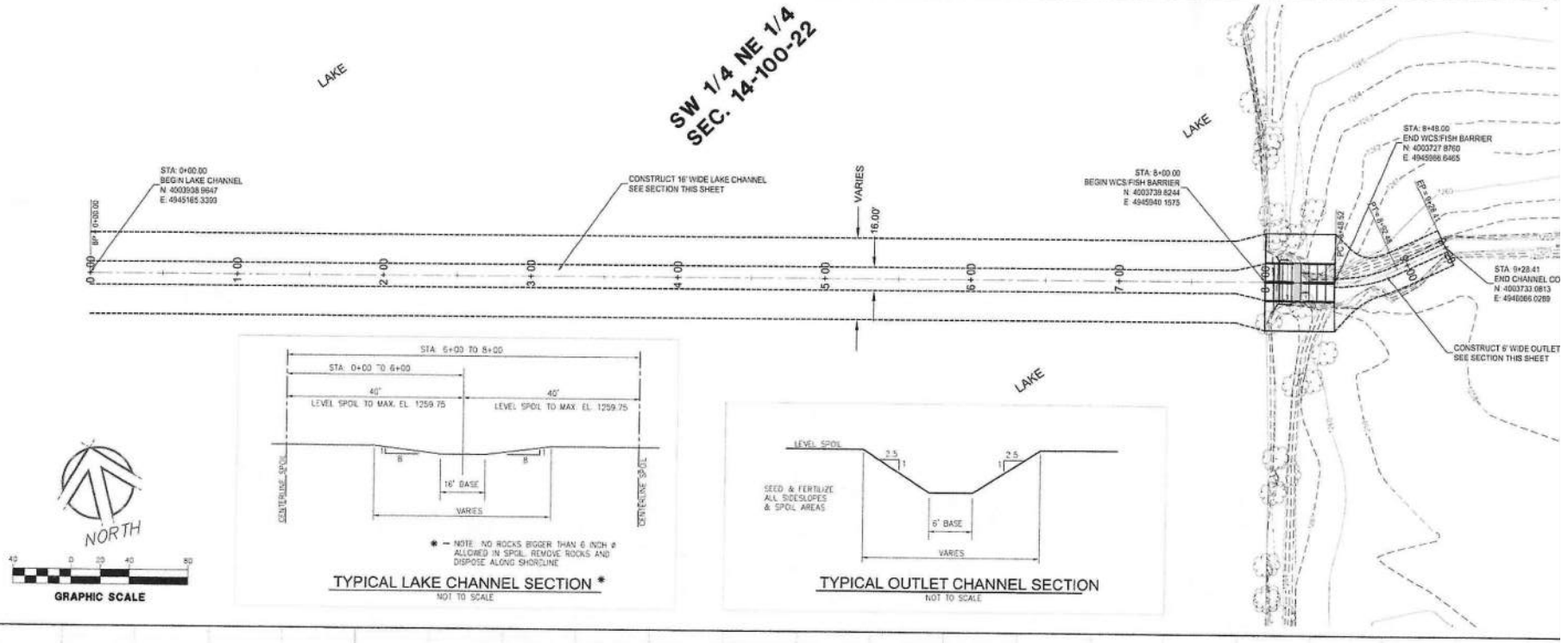
SURVEY CONTROL POINTS			
No	Easting	Northing	Elevation
300	4945946.0760'	4003722.1590'	1262.534'
200	4946402.8070'	4003686.8930'	1261.981'
201	4947027.0100'	4003221.0510'	1257.642'
202	4948064.3880'	4002822.4530'	1259.357'
203	4948060.6110'	4002133.7720'	1260.555'
204	4948075.7140'	4003000.1010'	1260.367'

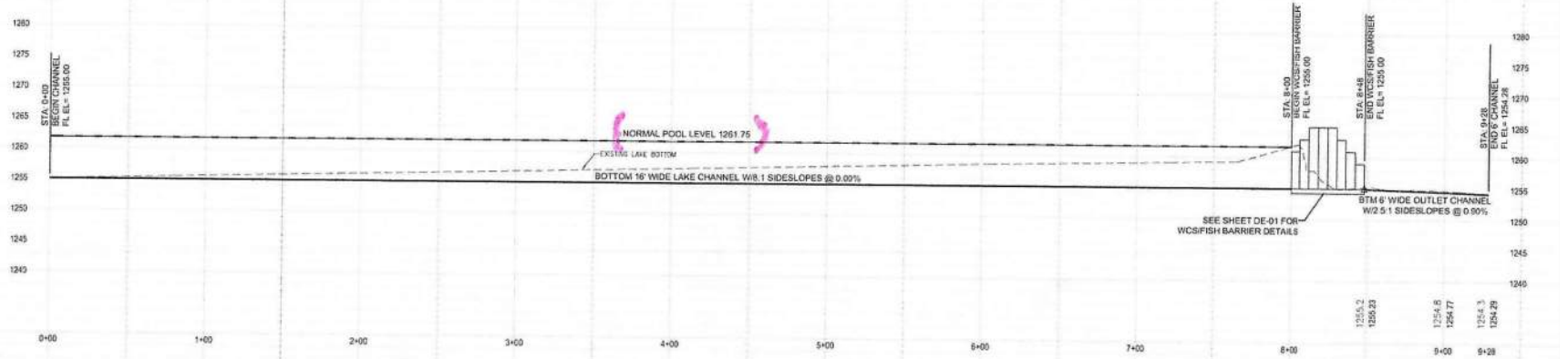
QUANTITIES

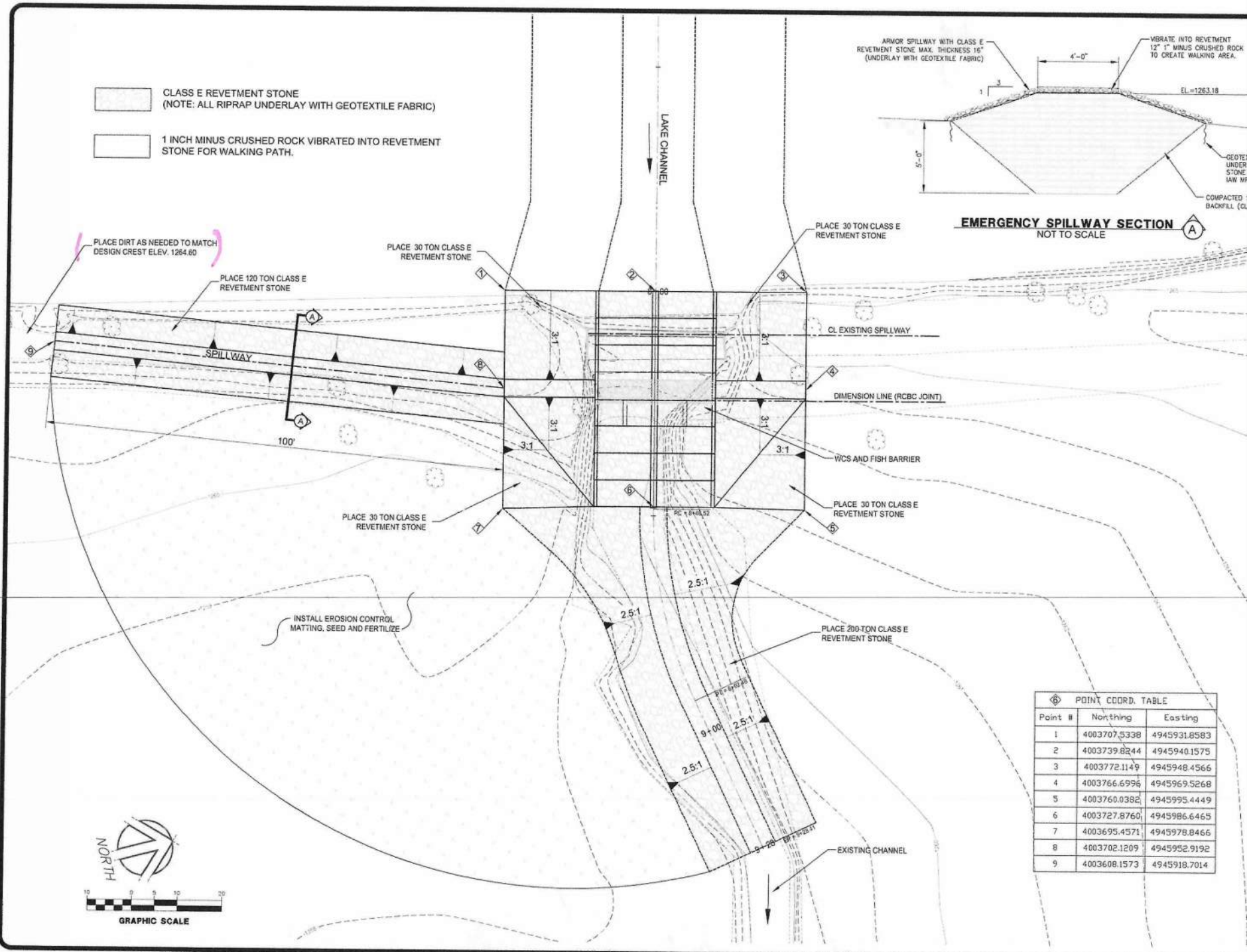
item	description	quantity	units	Comment
1.	Mobilization	1	Lump Sum	See Sec. 02000 (Specifications)
2.	Clearing and Grubbing	1	Lump Sum	See Sec. 02222
3.	Discharge Channel Excavation & level spoil(6ft. Base , 2.5:1 s.s.)	500	cy	See Sec. 02222
4.	Existing concrete spillway removal (approx. 20 cy)	1	Lump Sum	See Sec. 02222
5.	Lake channel excavation 900 ft.(16ft. Base, 15:1 ss)	4200	cy	See Sec. 02222
	Precast RCBC Fish Barrier Water Control Structure			
6.	Class 10 Excavation	500	cy	See Sec. 02222
7.	12ft x 4ft. Precast RCBC	12	lf	See Sec. 02730
8.	12ft.x 6ft. Precast RCBC	24	lf	See Sec. 02730
9.	12ft.x 8ft. Precast RCBC	24	lf	See Sec. 02730
10.	12ft.x 10ft. Precast RCBC	36	lf	See Sec. 02730
11.	Cutoff walls	65.4	lf	See Sec. 02730
12.	Granular filter Diaphragm	50	tn	See Sec. 02222
13.	Aluminum Fish Barriers	665	lbs	See Sec. 05500
14.	Aluminum Fish Barrier Rake	1	ea	See Sec. 05500
15.	Concrete Weir Buttress Wall	12	lf	See Sec. 03100, 03200 & 03300
16.	StopLog Weir Guides	575	lbs	See Sec. 05500
17.	StopLogs Aluminum	1300	lbs	See Sec. 05500
18.	Fish Barrier Portable Hoist Assembly	1	ea	See Sec. 05500
19.	Steel Catwalk 48in Wide	2100	lbs	See Sec. 05500
20.	Steel Catwalk 36in Wide	1930	lbs	See Sec. 05500
21.	Stainless Steel Protective Screens	150	lbs	
22.	8ft. Ht. chainlink fence and gates	96	lf	See Sec. 2831
23.	Imported compacted fill	800	cy	IDNR to Approve Material. Contractor to Furnish Borro
24.	Class E revetment	375	tn	See Sec. 02270
25.	Geotextile	1000	sy	See Sec. 02270
26.	Geogrid	360	sy	See Sec. 02270
27.	1/2in. crushed road stone	100	tn	See Sec. 02511
	Emergency Spillway			
28.	a. Class 10 Excavation	300	cy	See Sec. 02222
29.	b. Imported Compacted Fill	400	cy	IDNR to Approve Material. Contractor to Furnish Borro
30.	c. Class E revetment	120	tn	See Sec. 02270
31.	d. Geotextile	200	sy	See Sec. 02270
32.	e. Erosion Control Matting	100	sq	See Sec. 02270
33.	Seeding, Fertilizing and Mulching (Total Project)	1	ac	See Sec. 2731
	Field access culvert (N. of WCS)			
34.	10'x5' Precast RCBC	24	lf	See Sec. 02730
35.	10'x5' Precast End Sections	2	ea	See Sec. 02730
36.	Class E revetment	40	tn	See Sec. 02270
37.	Geotextile	32	sy	See Sec. 02270
38.	1/2in. crushed road stone	50	tn	See Sec. 02511
	Access Road Crossing			
39.	36in C.M.P. 14 ga.	96	lf	See Sec. 02730
40.	36in C.M.P. End Sections	8	ea	See Sec. 02730
41.	Geotextile	110	sy	See Sec. 02270
42.	1/2in Crushed Road Stone	50	tn	See Sec. 02511



EXISTING SPILLWAY
30' WIDE W/WINGWALLS


SW 1/4 NE 1/4
SEC. 14-100-22
LAKE
LAKE
LAKE
STA: 0+00.00
BEGIN LAKE CHANNEL
N: 4003938.9647
E: 4945165.3393
CONSTRUCT 16' WIDE LAKE CHANNEL
SEE SECTION THIS SHEET
VARIES
16.00'
STA: 8+00.00
BEGIN WCS/FISH BARRIER
N: 4003739.8244
E: 4945940.1575
STA: 8+48.00
END WCS/FISH BARRIER
N: 4003727.8760
E: 4945988.6465
STA: 9+28.41
END CHANNEL CO
N: 4003733.0813
E: 4946066.0269
CONSTRUCT 6' WIDE OUTLET
SEE SECTION THIS SHEET
NORTH
GRAPHIC SCALE
STA: 0+00 TO 6+00
STA: 6+00 TO 8+00
40'
LEVEL SPOIL TO MAX. EL. 1259.75
40'
LEVEL SPOIL TO MAX. EL. 1259.75
16' BASE
VARIES
CENTERLINE SPOIL
CENTERLINE SPOIL
* - NOTE: NO ROCKS BIGGER THAN 6 INCH ø ALLOWED IN SPOIL. REMOVE ROCKS AND DISPOSE ALONG SHORELINE
TYPICAL LAKE CHANNEL SECTION *
NOT TO SCALE
LEVEL SPOIL
SEED & FERTILIZE ALL SIDESLOPES & SPOIL AREAS
6' BASE
VARIES
TYPICAL OUTLET CHANNEL SECTION
NOT TO SCALE


STA: 0+00
BEGIN CHANNEL
FL EL= 1255.00
NORMAL POOL LEVEL 1261.75
EXISTING LAKE BOTTOM
BOTTOM 16' WIDE LAKE CHANNEL W/8:1 SIDESLOPES @ 0.00%
STA: 8+00
BEGIN WCS/FISH BARRIER
FL EL= 1256.00
STA: 8+48
END WCS/FISH BARRIER
FL EL= 1255.00
STA: 9+28
END 6' CHANNEL
FL EL= 1254.28
BTM 6' WIDE OUTLET CHANNEL
W/2.5:1 SIDESLOPES @ 0.00%
SEE SHEET DE-01 FOR
WCS/FISH BARRIER DETAILS
1255.2
1255.23
1254.8
1254.77
1254.3
1254.29
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
9+28



⑥ POINT COORD. TABLE		
Point #	Northing	Easting
1	4003707.5338	4945931.8583
2	4003739.8244	4945940.1575
3	4003772.1149	4945948.4566
4	4003766.6996	4945969.5268
5	4003760.0382	4945995.4449
6	4003727.8760	4945986.6465
7	4003695.4571	4945978.8466
8	4003702.1209	4945952.9192
9	4003608.1573	4945918.7014

Annexation Schedule

Drainage District No. 46
Worth County, IA

Lands Recommended for Annexation
May 2024

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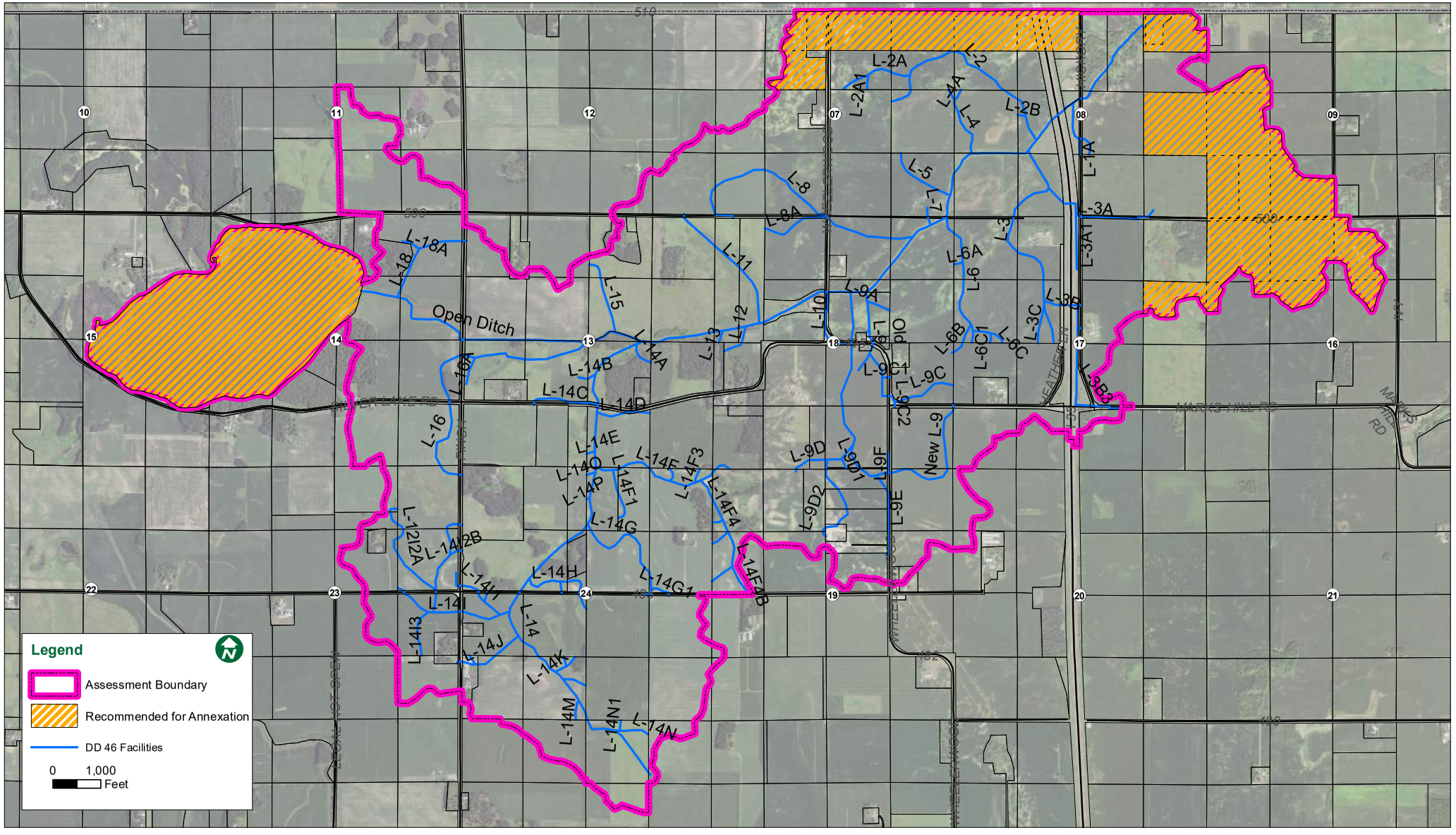

ANNEXATION SCHEDULE
DRAINAGE DISTRICT NO. 46
WORTH COUNTY, IOWA

Deedholder(s)	Parcel Number	Sec-Twp-Rng	Legal Description	Benefited Acres	Elevation (ft)	Relation (Percent of Outlet Provided)	Condition of Drainage	Drain Class (% Poorly Drained)	Surface Grade to Open Ditch	K Factor
ARNESON, DOUGLAS & DONICA	0216200003	16-100-21	SW NE	6.1	1263	21%	Surface and Subsurface Flows	37%	0.4%	0.3
KVAM, LEE & DARLENE	0207100003	07-100-21	NE NW FRL. EX. PAR.	6.6	1277	37%	Surface and Subsurface Flows	2%	0.8%	0.3
KVAM, LEE & DARLENE	0207100004	07-100-21	PAR. IN NE NW FRL.	7.1	1277	38%	Surface and Subsurface Flows	51%	0.8%	0.3
KVAM, LEE & DARLENE	0207100006	07-100-21	SE NW FRL. EX. PAR.	16	1277	40%	Surface and Subsurface Flows	0%	0.9%	0.3
KVAM, LEE & DARLENE	0207200001	07-100-21	NW NE FRL.	21.7	1246	49%	Surface and Subsurface Flows	69%	0.5%	0.3
KVAM, LEE & DARLENE	0207200002	07-100-21	NE NE FRL.	23.2	1242	59%	Surface and Subsurface Flows	100%	0.6%	0.3
LARSON, JOSHUA J & KLUVER, BOBBIE J	0208200008	8-100-21	PAR "A" NE NE	0.3	1252	13%	Surface and Subsurface Flows	0%	2.4%	0.3
LOKEN, RONALD M REVOCABLE TRUST	0216100001	16-100-21	NW NW	36.8	1250	34%	Surface and Subsurface Flows	39%	0.5%	0.3
LOKEN, RONALD M REVOCABLE TRUST	0216100003	16-100-21	SW NW	6	1253	26%	Surface and Subsurface Flows	52%	0.4%	0.3
LOKEN, RONALD M REVOCABLE TRUST	0216100004	16-100-21	SE NW	11.4	1253	22%	Surface and Subsurface Flows	39%	0.3%	0.3
MITTAG, LYDIA J	0209300003	09-100-21	W 1/2 SW SW	19.8	1243	38%	Surface and Subsurface Flows	77%	0.5%	0.3
MITTAG, LYDIA J	0216200001	16-100-21	NW NE	20.6	1254	25%	Surface and Subsurface Flows	39%	0.4%	0.3

ANNEXATION SCHEDULE
DRAINAGE DISTRICT NO. 46
WORTH COUNTY, IOWA

Deedholder(s)	Parcel Number	Sec-Twp-Rng	Legal Description	Benefited Acres	Elevation (ft)	Relation (Percent of Outlet Provided)	Condition of Drainage	Drain Class (% Poorly Drained)	Surface Grade to Open Ditch	K Factor
NELSON, DONNA	0208100002	08-100-21	NW NW EX. PAR.	22.9	1242	64%	Surface and Subsurface Flows	88%	0.7%	0.3
NELSON, DONNA	0208100003	08-100-21	NE NW EX. PAR.	17.3	1237	67%	Surface and Subsurface Flows	33%	1.0%	0.2
NELSON, KEVIN R	0209300002	9-100-21	NE SW	3.1	1245	35%	Surface and Subsurface Flows	65%	0.5%	0.4
OSMUNDSON, TIMOTHY J	0208200005	8-100-21	PAR. IN NE NE FRL	5.9	1214	100%	Surface and Subsurface Flows	23%		0.3
REYERSON, DENNIS L	0217200004	17-100-21	SE NE	16.2	1249	29%	Surface and Subsurface Flows	57%	0.4%	0.3
RUGLAND, ARLOW A C TRUST	0208200007	08-100-21	NE NE FRL EX PAR & PAR "A"	16.1	1216	100%	Surface and Subsurface Flows	22%		0.3
RUGLAND, ARLOW A C TRUST	0208400002	08-100-21	NE SE	39.8	1238	64%	Surface and Subsurface Flows	52%	1.0%	0.3
RUGLAND, ARLOW A C TRUST	0209100005	9-100-21	SW NW FRL.	8.7	1247	43%	Surface and Subsurface Flows	36%	0.7%	0.4
RUGLAND, ARLOW A C TRUST	0209300001	9-100-21	NW SW	38.3	1244	47%	Surface and Subsurface Flows	53%	0.7%	0.4
SANDERSON, DEREK	0209300004	09-100-21	E1/2 SW SW	19.7	1244	38%	Surface and Subsurface Flows	86%	0.5%	0.3
WALLIN, LINDA F TRUST	0209300005	09-100-21	SE SW	29.3	1245	35%	Surface and Subsurface Flows	59%	0.5%	0.4
WALLIN, LINDA F TRUST	0216100002	16-100-21	NE NW	36.9	1250	29%	Surface and Subsurface Flows	31%	0.4%	0.4

ANNEXATION SCHEDULE
DRAINAGE DISTRICT NO. 46
WORTH COUNTY, IOWA

Deedholder(s)	Parcel Number	Sec-Twp-Rng	Legal Description	Benefited Acres	Elevation (ft)	Relation (Percent of Outlet Provided)	Condition of Drainage	Drain Class (% Poorly Drained)	Surface Grade to Open Ditch	K Factor
WILLIAMS PIPELINE COMPANY, A DELAWARE COPR	0208100001	08-100-21	NW NW (50' X 50')	0.1	1247	54%	Surface and Subsurface Flows	100%	0.6%	0.3
STATE OF IOWA	SILVER LAKE	14/15-100-22		315.3	1261.75	100%	Lake Level Stabilized			
			Total	**745.2**						

Elevation- The lowest elevation on the annexed parcel per Contour maps.

Percent of Outlet Provided- Calculated by taking the length of the improved district facilities divided by the total length from the parcel to the outlet (The distance required if a drainage district didn't construct an outlet)

Condition of Drainage- How the drainage was changed via the construction of the drainage district facility. In this case, drainage tile could now be installed where only surface drainage naturally existed.

Drain Class- The percent of the annexed area that is very poorly drained, poorly drained, or somewhat poorly drained. Thee areas see the largest crop yield increase, however the entire area benefits from increased crop yields.

Surface Grade to District- The grade from the lowest elevaiton of the annexed parcel to the surface at the open ditch.

K Factor- Indicates the susceptibility of a soil to sheet and rill erosion by water. K Factor values range from 0.05 to 0.43 in Iowa. The higher the value, the higher the susceptibility.