

ENGINEER'S REPORT FOR:

TILE IMPROVEMENTS

DRAINAGE DISTRICT NO. 26
OSCEOLA COUNTY, IOWA

DECEMBER, 2015
Project No. 14-17364



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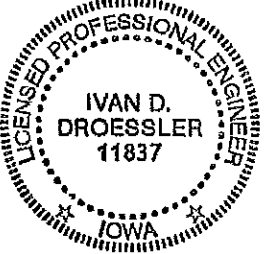
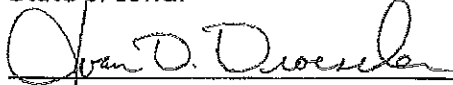
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	<p>I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.</p> <p> <u>12-8-2015</u> Ivan D. Droessler, P.E. Date</p> <p>License No.: 11837</p> <p>My License Renewal Date is December 31, 2015</p>
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1725 NORTH LAKE AVENUE
STORM LAKE, IOWA 50588

**ENGINEER'S REPORT
FOR
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DRAINAGE DISTRICT NO. 26
OSCEOLA, IOWA
DECEMBER, 2015**

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**ENGINEER'S REPORT
FOR
TILE IMPROVEMENTS
DRAINAGE DISTRICT NO. 26
OSCEOLA COUNTIES, IOWA
NOVEMBER, 2015**

1.0 INTRODUCTION

1.1 Scope of Work

The following report is presented to provide information relative to a tile improvement project for Drainage District No. 26, Osceola County, Iowa.

In the fall of 2014, the Osceola County Board of Supervisors, acting as the Trustee for Drainage District No. 26 (DD26), received a petition (Appendix A) from District landowners, Brett Young and Duane Dake. The petition requests the District tile be studied for possible improvements. In November of 2014, the Board of Supervisors directed I+S Group, Inc. (ISG) to conduct a preliminary investigation and report our findings. A Preliminary Report was filed on March 24, 2015 with an informational meeting held with the landowners on April 9th to discuss our findings. At this meeting, LG Farms LLC, Ron Bosma & Linda De Boer expressed concern about the condition of the tile main; particularly the possibility that the tile main is partially blocked on their property in Section 24 of Horton Township. The Board directed ISG to coordinate the investigation of the tile main on LG Farms and authorized ISG to perform a profile survey with downs to verify the gradeline of the existing tile and existing ground cover. The additional findings were reviewed with Board in August with the Board directing ISG to continue with final report and to proceed to public hearing.

Our investigation included researching the history of the District's records and the use of existing District plats, aerial photography, soils and topographical maps.

1.2 Location & Description

The watershed of DD26 consists of approximately 2,939 acres (4.6 square miles) located within parts of Sections 13, 23, 24, 25, 26, 27, 34, and 35 of Horton Township, and Sections 18, 19, and 30 of Fairview Township. The facilities of DD26 consists of 23,700 feet of tile main serving as an outlet to 31 branch tile lines consisting of an additional 33,230 linear feet of subsurface tile. The tile main discharges to an unnamed tributary of Osterman Creek in the NE1/4 of NW1/4 of Section 34, Horton Township. The record shows that the channel was improved for a distance of 300 feet below the headwall. The tile then traverses in a northeasterly direction for 16,400 LF across Section 27, 26, 25 and 24 of Horton before bearing north for 1,900 LF in Section 19 of Fairview Twp. The tile main then turns back to the northeast traversing across the NE1/4 of Section 24 of Horton and then crosses into Section 13 ending at Station 240+00 in the SE1/4 of SW1/4 of Section 13, Horton Township.

The lands in the lower 45% of the watershed have surface drainage relief available to them while the lands in the upper plus 50% of the watershed rely on the tile main to serve as their outlet for both surface and subsurface water. Refer to Sheet A.02 of the preliminary plans for a plat of DD26.

1.3 History Summary

A petition for establishment of DD26 was filed on August 12, 1915. An Engineer's Report dated February 1, 1916 was filed recommending the installation of various tile lines. On April 4, 1916, a resolution to establish DD26 was approved. On May 1, 1917, the Board directed the Engineer to make a survey for the proposed tile lines. A Report filed September 10, 1917 outlined the construction of 300 linear feet of open ditch and the installation of 23,700 LF of tile main and 31 branch tile lines for a total of 57,230 linear feet of tile installation, contract for the tile work was signed on July 16, 1918. Contractor, Crowley was dismissed on September 17, 1918, with work rebid on May 12,

1921. All bids were rejected with new bids received on October 27, 1921, bid from Herman Larson of Sioux Rapids, Iowa was accepted. Work was completed with final acceptance on February 20, 1923.

A Notice of Assessments was published on June 3, 1918. After completion of the project, a notice of additional assessments was published on April 6, 1925. The record reflects that additional repairs and assessments continued through 1925.

In 1985, the Board appointed Siouxland Engineering Associates, P.C. to prepare a preliminary report for drainage relief to DD26. Siouxland Engineering Associates, P.C. filed their report on April 30, 1985 recommending a formal investigation and report be prepared for drainage relief of the tile system. The Board of Supervisors chose to not move forward with a full report concerned about wetland mitigation.

2.0 INVESTIGATION

2.1 Preliminary Investigation of Existing Facilities

There was no tile profile of record that reflected the design elevations of the tile main. Therefore, we have prepared a profile of the existing ground surface over the tile main alignment from survey data gathered in early summer of 2015. Then we plotted the existing main profile based on slope and depth of cover data found in the District Records. Our evaluation of original capacity and possible relief options are based on this profile as reported in our Preliminary Report filed on March 24, 2015.

We analyzed the capacity of the tile based on six (6) sub-drainage areas and computed the existing capacity based on assuming the tile to be on line and in original condition. Standards for good agricultural drainage recommend a tile facility to be sized to drain 1/2 inch of runoff from the lands in the watershed in a 24 hour period when the lands in the watershed do not have sufficient surface drainage. For lands with surface drainage, the tile system is recommended to be sized

based on a 3/8 inch drainage coefficient. For our investigation we have broken the watershed down into 6 major sub-watersheds based on surface and non-surface drainage. Our investigation concluded the lands in the upper portion of the watershed, above Station 104+00, do not have adequate surface drainage. Therefore, the recommended design capacity of this tile system was calculated using a 1/2 inch drainage coefficient for 1,553 acres of land in the upper portion of the District and 3/8 inch drainage coefficient for the lower 1,386 acres. The results of this evaluation are summarized within Table 1 of this report.

Table 1 - Drainage District 26 - Original Design Tile Capacities

Station	Size (in)	Slope (ft/ft)	A (ft ²)	P (ft)	R (ft/ft)	n	DA		Original Q (cfs)	Original Q/Recom. Q (%)
							Ac. 1/2"	Ac. 3/8"		
Main 3+00	30	0.002	4.909	7.854	0.625	0.0108	1553	32.61	22.08	40.6%
							1386	21.66		
Main 57+00	28	0.0015	4.276	7.330	0.583	0.0108	1553	32.61	15.91	35.3%
							788	12.41		
Main 104+00	24	0.0015	3.142	6.283	0.500	0.0108	1553	32.61	10.55	32.3%
Main 116+00	22	0.0015	2.640	5.760	0.458	0.0108	925	19.43	8.36	43.1%
Main 150+00	20	0.0012	2.182	5.236	0.417	0.0108	592	12.43	5.80	46.7%
Main 183+00	16	0.0015	1.396	4.189	0.333	0.0108	365	7.67	4.03	46.7%

2.2 Capacity Findings

As indicated by the table, the most restrictive segment of the main is between Stations 57+00 to 104+00. Therefore, the available capacity to the majority of the land is only 32% of that recommended making the tile system severely under sized for the lands above Tyler Avenue that do not have surface drainage relief.

The petition filed is for drainage relief due to this lack of capacity of the tile outlet system. From our preliminary study we have found the existing main to be undersized for current cropping practices and the

acres served. The District would benefit from an improvement project that would increase the capacity of the tile system.

2.3 Preliminary Improvement Options Comparison

The Board of Supervisors acting as Trustees of the District are responsible to see to the maintenance of the District facilities. If the facilities are found to be in a poor state of repair and not providing the original design capacity, repairs to the system are required by Iowa Drainage Law. In the case of DD26, we do not know of any failures of the tile system, however, as part of any evaluation of improvement options, ISG also provides a cost of replacing the existing tile system to provide the landowners a means of evaluating the true additional cost of the improvements.

In regard to drainage relief, we have evaluated two (2) improvement options for increasing the drainage capacity of the tile main to the recommend levels for good agricultural drainage; one being the complete replacement of the tile main with a new large tile system. The second improvement option would be using a parallel relief tile system in conjunction with the existing tile main. Included as Appendix C, are preliminary estimates of probable construction costs for the Repair/Replacement, Improvement Replacement and Improvement Relief options. A summary comparison of the option and cost is provided below:

Repair/Replacement – The current construction cost to replace the existing tile main with the same size tile at same grade is estimated at a subtotal cost of \$882,510.00.

Improvement Replacement Tile Option – This proposes increasing the capacity of the tile system by replacing the existing tile main with a larger tile. Using the same 1/2 inch drainage coefficient standard described previously, the proposed Main Tile would be increased from 30 inch diameter to 42 inch at its outlet to Station 104+00 followed by 36 inch tile to Station 116+00. 30 inch tile will be used between Stations

116+00 and 150+00, and the last 5,700 linear feet is planned for 24 inch, although when moving upstream from Station 183+00, the tile size may be analyzed in smaller watersheds resulting in smaller tile sizes when deciding final plans. The estimated construction cost subtotal would be \$1,676,800.00. The capacities are summarized below in Table 2.

Table 2 - Drainage District 26 - Improvement Replacement Tile Option

Station	Recom. Size (in)	Recom. Slope (ft/ft)	Recom. A (ft ²)	Recom. P (ft)	Recom. R (ft/ft)	Recom. n	DA Ac. 1/2" Ac. 3/8"	Rec. Q Ac. 1/2" Ac. 3/8"	Total Recom. Q (cfs)	Proposed Q (cfs)
Main 3+00	42	0.002	9.62	11.00	0.88	0.0108	1553 1386	32.61 21.83	54.44	54.16
Main 57+00	42	0.0015	9.62	11.00	0.88	0.0108	1553 788	32.61 12.41	45.02	46.90
Main 104+00	36	0.0015	7.07	9.43	0.75	0.0108	1553	32.61	32.61	31.09
Main 116+00	30	0.0015	4.91	7.85	0.63	0.0108	925	19.43	19.43	19.12
Main 150+00	30	0.0012	4.91	7.85	0.63	0.0108	592	12.43	12.43	17.10
Main 183+00	24	0.0015	3.14	6.28	0.50	0.0108	365	7.67	7.67	10.55

Improvement Relief Tile Option - The capacity of the outlet tile is improved by adding a parallel relief tile line. This was a recommendation of Siouxland Engineering Associates P.C. in their 1985 preliminary report. Using the same 1/2 inch drainage coefficient standard described above, the proposed parallel relief tile would be sized to 36 inch diameter at its outlet to Station 104+00. 24 inch tile will be used between 104+00 and 150+00 and the final 4,140 feet will be 18 inch tile. The estimated construction cost subtotal would be \$1,301,717.00. Refer to Table 3 for a summary of the drainage capacity associated with this relief option.

Table 3 – Drainage District 26 – Improvement Parallel Relief Tile Option

Station	Size (in)	Recom. (ft/ft)	Slope (ft ²)	DA Ac. 1/2" Ac. 3/8"	Rec. Q Ac. 1/2" Ac. 3/8"	Total Recom Q (cfs)	Orig. Q (cfs)	Relief Q (cfs)	Total Orig. & Relief (cfs)	Proposed Q /Recom. Q (%)
Main 3+00	30	36	0.002	1553 1386	32.61 21.83	54.443	22.08	35.90	57.98	106.5%
Main 57+00	28	36	0.0015	1553 788	32.61 12.41	45.024	15.91	31.09	47.00	104.4%
Main 104+00	24	36	0.0015	1553	32.61	32.613	10.55	31.09	41.64	127.7%
Main 116+00	22	24	0.0015	925	19.43	19.425	8.36	10.55	18.91	97.3%
Main 150+00	20	24	0.0012	592	12.43	12.432	6.49	9.43	15.92	128.0%
Main 183+00	16	18	0.0027	365	7.67	7.665	3.58	4.90	8.47	110.6%

3.0 RECOMMENDED RELIEF TILE SYSTEM

3.1 Relief Tile Design

At the informal meeting on April 9, 2015, concern about the condition of the tile main; particularly the possibility that the tile main is partially blocked on their property in Section 24 of Horton Township was expressed by LG Farms LLC, Ron Bosma & Linda De Boer. Rocky Marco, Contractor investigated this tile in April and found the tile to be in good condition with no blockage. Based on this and the fact there few repairs of record for this tile main, we would expect the majority of this tile to be in good condition. Therefore, it is apparent from our investigation that inadequate drainage is due to lack of tile size and capacity, not failing or blocked tile.

Therefore, we would recommend the lack of capacity be addressed by the use of the relief tile option. This involves installing a new tile line adjacent to the existing tile and using both lines in combination to provide the necessary coefficient of drainage. This option has the lowest upfront cost but does rely upon a portion of its capacity coming from the nearly 100 year tile line that is in good condition.

Using field survey data where intakes provided opportunities for downs we have made adjustments to the profile and expanded our evaluation of the tile system so a final relief tile could be properly sized and designed. The corrected gradeline of the original tile along with the proposed alignment and gradeline of the proposed relief tile system is shown on the half plan/profile Sheets D.01 through D.10. Refer to Table 4 for a summary of the proposed relief tile system.

Table 4 – Drainage District 26 –Recommended Relief Tile Option

Station	Size (in)	Recom. (ft/ft)	Orig Slope (ft ²)	Relief Slope (ft ²)	DA Ac. 1/2" Ac. 3/8"	Total Recom Q (cfs)	Orig. Q (cfs)	Relief Q (cfs)	Total Orig. & Relief (cfs)	Proposed Q /Recom. Q (%)
Main 3+00	30	36	0.0025	.0015	1553 1386	54.443	26.59	31.09	57.68	106.3%%
13+00	26	36	.0029	.0017	1553 1309	53.23	18.15	33.10	51.26	96.3%
20+00	30	36	.0019	.0017	1553 1276	53.71	21.52	33.10	54.62	103.6%
42+00	28	36	.0015	.0017	1553 827	45.64	15.91	33.10	49.01	107.4%
57+00	28	36	.0015	.0017	1553 788	45.02	15.91	33.10	49.01	108.9%
72+00	26	36	.0013	.0017	1553 685	41.67	12.15	33.10	45.26	104.3%
84+00	24	36	.0017	.0017	1553 573	45.02	11.23	33.10	44.33	106.4%
104+00	24	32	.0017	.0017	1553	32.61	11.23	24.18	35.41	108.6%
107+00	22	32	.0014	.0017	1527	32.07	8.08	24.18	32.26	100.6%
116+00	22	30	.0014	.0015	925	19.43	8.08	19.12	27.20	140%
133+00	20	30	0.0015	.0015	817	17.16	6.49	19.12	25.61	149.3%

Station	Size (in)	Recom. (ft/ft)	Orig Slope (ft ²)	Relief Slope (ft ²)	DA Ac. 1/2" Ac. 3/8"	Total Recom Q (cfs)	Orig. Q (cfs)	Relief Q (cfs)	Total Orig. & Relief (cfs)	Proposed Q /Recom. Q (%)
150+00	20	24	0.0015	.0015	592	12.43	6.49	10.55	10.55	137.0%
164+00	18	24	0.0014	.0015	541	11.36	4.73	10.55	15.28	134.5%
183+00	16	18	0.0019	.001	365	7.66	4.03	4.00	8.02	104.7%
200+00	14	18	.0007	.001	241	5.06	1.71	4.00	5.71	112.8%
214+00	12	18	.0014	.001	181	3.80	1.60	4.00	5.60	147.4%
230+00	10	*	.0023		86	1.81	2.06			70.0%
235+00	8		.0077		48	1.01	1.28			126.6%

Notes: * The existing 10 inch tile between Station 230+00 and 235+00 is to be replaced with 12 inch tile.

Our opinion of final construction cost for a parallel relief tile system is \$1,694,070 with total project cost of \$2,220,500. This cost averaged over the watershed acres of 2,939 acres is approximately \$830/acre with the average per acre per year for 20 years being \$41.52. Please see Appendix C for our full itemized opinion of cost.

3.2 Road Crossings

The proposed relief tile will cross seven (7) county secondary gravel roads. Iowa Law (code section 468.108) requires that the costs of crossing county and state roadways with drainage District facilities be paid from the appropriate road funds. It will be the County Engineer's decision as to the method of installation for these crossing, open cut or jack and bore. The crossings involve the following roads and tile sizes:

140 th Street -	36" RC Pipe
Tanager Avenue -	36" RC Pipe
Tyler Avenue -	32" RC Pipe
130 th Street -	30" RC Pipe

Van Buren Avenue -	24" RC Pipe
Van Buren Avenue -	18" RC Pipe
120 th Street -	18" RC Pipe

The Osceola County Engineer may choose to separately contract the crossing work. If the work is to be included with the District project under one construction contract, the District will be reimbursed for the cost of construction by the County Secondary Roads Department when the work is completed.

3.3 Other Crossings

There are no railroad or entrance crossings associated with the proposed open ditch alignment.

3.4 Utilities

The contractor will be responsible to determine locations and notify utility companies and to cooperate in locating, marking and protecting their facilities for the tile installation, including those utilities within the County's secondary road right-of-way.

3.5 Fence Cuts

Where the propose relief tile line will cross fences, the Contractor will be responsible for perform a fence cut and repairing these fences as part of his contract.

3.6 District Right-of-Way

Tile District easement is discussed in Iowa Drainage Code Section 468.27, "Following its establishment, the drainage District is deemed to have acquired by permanent easement all right-of-way for drainage District ditches, tile lines, settling basins and other improvement,... The permanent easement includes the right of ingress and egress across adjoining land and the right of access for maintenance, repair, im-

provement, and inspection. The owner or lessee shall be reimbursed for any crop damages incurred in the maintenance, repair, improvement, and inspection except within the right-of-way of the drainage District.”

Because the proposed relief tile will follow a new alignment, damages will be paid according to the claim process to the landowners for construction of the new improvements. It is planned that the contractor will be required to segregate and separately stockpile 12 inches of topsoil from over the tile trench. This topsoil shall be spread over the top of the finished tile trench to reduce fertility issues from the construction. Therefore, damages are typically limited to crop and property damage from the construction and landowners are required to file claims at the time of the completion hearing.

4.0 PROPOSED WORK

The analysis of the tile systems confirms additional capacity is required in order to provide the watershed with good agricultural drainage. Also, the tile investigation confirmed the existing tile main facility is in good condition, therefore; we propose the installation of a relief tile line.

4.1 Open Ditch Cleanout

The tile main discharges to an unnamed tributary of Osterman Creek in the NE1/4 of NW1/4 of Section 34, Horton Township. The record shows that the channel was improved for a distance of 300 feet below the headwall. We would recommend this channel be cleaned of sediment to ensure a free flowing outlet for the improved tile system.

4.2 Proposed Relief Tile Alignment

The proposed relief tile line in combination with the existing main tile facility of DD26 will provide for an outlet that has the recommended drainage coefficient needed for good agricultural drainage. The relief

tile line will then traverse northeasterly, offset from the existing tile. The alignment and grade is shown on the half plan and profile sheets D.01 through D.10

4.3 Proposed Tile Sizes and Connections

The proposed relief tile line will include a total of 22,170 linear feet comprised of the following linear feet of each size of RCP tile: 9,934'-36"; 1,100'-32"; 3,334'-30"; 3,234'-24" and 4568'-18". These lengths do not include the required tile across Secondary Roads. In addition, from Station 230+00 to 235+00 the existing 10" tile will be replaced with new 12" tile for the 10 inch is inadequate in capacity. The relief line will be crossed tied to the existing main tile line at approximate Stations 28+00, 48+00, 72+00, 90+00, 106+00, 121+00, 132+00, 146+00, 166+00, 182+00, 198+00, and 214+00, by field fabricated tees on the existing and manufacture tees on the relief line with cross connecting 12 inch reinforced concrete pipe. At Station 230+00, the top end of the relief line, a junction structure will be used to bring the two tile lines together; junctioning with the upstream tile line that is being replaced from Station 230+00 to 235+00.

We are recommending the use of reinforced concrete pipe because of its +100 year design life, suppliers are competitively pricing the pipe, the pipe strength tolerates deviations from expected trench and envelope conditions and because the installation method does not demand as high a level of observation as do the installation methods of other products. Please review Appendix B for further cost details.

5.0 ANNEXATION & RECLASSIFICATION REVIEW

5.1 Annexation/Reclassification Evaluation

As part of our field investigation, we have mapped the watershed boundary of the entire District using LiDAR data and aerial photography to determine the lands that drain by surface or subsurface into the District. From this review, (Please refer to Sheet A.03 of the draw-

ings) it became apparent that there are approximately 290 acres of land draining to facilities of DD26 that are not included in the original assessment boundary of the overall District. In addition, approximately 71 acres of land contained in eleven parcel splits were discovered to have been dropped from assessment schedule. This appears to have occurred by mistake when a property sell necessitated a split of a full quarter-quarter parcel. The original assessment should have been split between the parcel splits weighted in acres. Therefore, the Auditor's Record should be corrected and these landowners treated as being in the District.

It should also be noted that when this District was originally established, all of the facilities of the District were paid for under one assessment schedule. The District has not been reclassified since its original assessment schedule was adopted in 1918. Therefore, when work is done on any branch of the District facilities, all landowners in the District pay for this work even if they receive no benefit. Section 468.131 of the Iowa Code states, "When an assessment for improvements as provided in Section 468.126, exceeds twenty-five percent of the original assessment and the original or subsequent assessment or report of the benefit commission as confirmed did not designate separately the amount each tract should pay for the main ditch and tile lateral drains then the board shall order a reclassification in accordance with the principles and rules set forth in Section 468.41."

Therefore, even if the improvement project does not proceed we would recommend the additional lands benefitting from the facilities of the District be annexed and the District reclassified to designate separately the amount each tract should pay for the upkeep and maintenance of the Branch tile systems and to redistribute the benefits to all lands in the District with the incorporation of the annexed lands and the dropped parcel splits.

6.0 DISCUSSION & RECOMMENDATIONS

6.1 General

Based on the evaluation of the existing tile system it is apparent that there is a need to improve the capacity of the existing facilities in order to provide drainage relief to the agricultural lands of DD26. This is more apparent in the upper portion of the watershed where the lands do not have any surface drainage relief. The installation of the proposed relief tile line working combination with the existing tile main would provide the necessary outlet capacity for good agricultural drainage for all of the lands in the watershed.

6.2 Jurisdictional Wetlands

The USDA Farm Program has long included wetland conservation compliance "swampbuster" provisions administered by the Natural Resources Conservation Service (NRCS). These rules and policies require that the lost functions, values and area of each converted (better drained) farmed wetland be replaced (mitigated). Under Part 12 of Title 7 of the Federal Regulations, "activities of a Water Resource District, Drainage District, or similar entity will be attributed to all persons within the jurisdiction of the District or other entity who are assessed for the activities of the District or entity. Accordingly, where a person's wetland is converted due to the actions of the District or entity, the person shall be considered to have caused or permitted the drainage." However, Drainage Districts in Iowa have the right to maintain the existing drainage capacity of their facilities. Therefore, under a repair option the only wetlands that could be affected would be wetlands or farmed wetlands located adjacent to the open ditch that may have spoil placed in them during the excavation of the open ditch. This situation can be avoided.

The US Army Corps of Engineer (USACE) in conjunction with the US Environmental Protection Agency (USEPA) also have jurisdiction to wetlands under the Federal Clean Water Act Section 404. However,

for the wetlands to be jurisdictional they have to be connected to waters of the United States and not isolated wetlands. To be connected, the wetlands would need to be adjacent and the surface connected to the current open ditch outlet.

Therefore, if an improvement option is approved that increases the capacity of the outlet system, impacts to wetlands will need to be considered both under the Farm Bill and Clean Water Act. To determine if wetlands will be impacted, the NRCS requires that all lands in the watershed must have a wetland determination completed prior to any construction by the District. The landowners or their tenants are the only individuals that can request these determinations. If a landowner does not request a certified wetland determination and the District proceeds with an improvement project, the landowner may be found to be in violation of the farm program rules and not eligible for program benefits. In addition, the USDA could file claim for refund of farm program payments. Therefore, if the proposed relief tile improvement is approved, we will encourage all landowners within the watershed boundary to request a certified wetland determination from the NRCS. Please note the NRCS will only provide determinations on agricultural lands producing a commodity crop. For other lands, a consultant will need to be hired to make the wetland determination. Additionally, if a landowner refuses to sign up for a determination, we will recommend the Board approve hiring a consultant to make the wetland determination assessment for review by the NRCS. The cost of these determinations will be paid by the District and are estimated to be \$4,500.

If farmed wetlands in this watershed are affected by the proposed relief tile the cost of mitigation is estimated at \$20,000 per acre. If verified to be impacted wetland, we would recommend the cost of mitigation be shared between the landowner and the District. This is because all landowners in the District will benefit from the improvement in capacity, and therefore it has become typical that the District participates along with the landowner in the cost of mitigation.

6.3 Conservation and Nutrient Reduction Measures

We encourage the landowners of this District to consider multi-purpose drainage management, which incorporates Best Management Practices (BMPs) which utilize effective measures aimed at reducing sediment and nutrient loading, and improving water quality. These BMPs are divided into three areas: preventative measures, control measures, and treatment measures. Preventative measures that can be applied throughout the watershed include crop rotation, cover crops, residue management, and nutrient management. These measures are aimed at controlling sediment, minimizing erosion and nutrient loss, and sustaining the soils health, all without dramatically changing the current land use of the landscape.

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

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

Funding options are available to land owners through the Environmental Quality Incentives Program (EQIP) and the Iowa Water Quality Initiative. EQIP is a voluntary program that provides financial assistance to individual land owners for various conservative practices as identified above. Also, the State of Iowa through the Iowa Water Quality Initiative provides cost share funds to participating landowners to volun-

tary install nutrient reduction practices. For information on these programs and to receive free planning assistance contact your local Soil and Water Conservation District.

6.4 Recommendations

A relief tile system would provide the needed additional capacity to provide the necessary outlet capacity for good agricultural drainage for all of the lands in the watershed. Therefore, we recommend the Joint Board of Supervisors, acting as Trustees for the District hold a public hearing on this report to consider the input of the District's landowners.

Annexation & Reclassification. As Section 5.1 explains, annexation of the lands receiving benefit that are currently not assessed by the District is recommended. Also, reclassification of DD26 is considered necessary for an equitable distribution of benefits even if the improvement project does not proceed.

Installment Payments. Iowa Drainage District Law Code Section 468.57 provides that large assessments may be paid in not less than ten (10) or more than twenty (20) annual installments at the discretion of the Board of Supervisors acting as Trustees for the District. Based on the estimated cost of this project, we recommend twenty (20) installments be considered by the Board.

It is recommended that the Board of Supervisors of Osceola County, acting as Trustees for Drainage District No.26, take appropriate action, with legal guidance, to accomplish the following:

- 1) Tentatively accept this Engineer's Report as filed.
- 2) Hold a public hearing and consider the input of the District landowners.
- 3) Adopt the proposed improvement option and modify as deemed appropriate, to satisfy the desires of the District.

- 4) Initiate wetland determination proceedings along with impact assessments.
- 5) Direct the Engineer to prepare the necessary plans and specifications, obtain the necessary permits, and to proceed toward a bid letting.
- 6) Adopt a resolution of necessity for the annexation of additional lands, if that is the desire of the District.
- 7) Initiate reclassification procedures.

APPENDIX A
Drainage Petition

Brett Young

DRAINAGE PETITION

TO THE BOARD OF SUPERVISORS OF Oscawola COUNTY, IOWA
The undersigned ask that a drainage Improvement / Study
commencing at 5 1/2 of Section 13 Horton twp DD #26

and running thence S & W

and terminating at Section 34 Horton twp

be
Your petitioners further state that the lands situated in DD #26

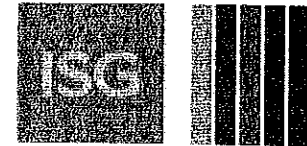
are subject to overflow (or are too wet for cultivation or subject to erosion or flood danger), and the public benefit, utility, health, convenience and welfare will be promoted by the above mentioned project.

NAMES	NAMES
<i>Quary Ray Duke</i>	
<i>Joe Starnick</i>	
<i>Adrian by Brett Young Manager</i>	

Repair only

APPENDIX B
PRELIMINARY COMPARISON CONSTRUCTION COSTS

DRAINAGE DISTRICT 26 OSCEOLA COUNTY
 PRELIMINARY ENGINEER'S ESTIMATE OF PROBABLE COSTS



PROJECT NUMBER: 17364

REPAIR/REPLACEMENT

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	TOTAL
1.	Mobilization	1	JOB	42,025.00	\$42,025.00
2.	Open Ditch Excavation	8.00	HRS	165.00	\$1,320.00
3.	Spoil Bank Leveling (Two Sided)	3.0	STA	70.00	\$210.00
4.	Non-Reinforced Concrete Pipe, 8" Dia.	500	LF	15.00	\$7,500.00
5.	Non-Reinforced Concrete Pipe, 10" Dia.	500	LF	15.00	\$7,500.00
6.	1500D Reinforced Concrete Pipe, 12" Dia.	1,600	LF	17.00	\$27,200.00
7.	1500D Reinforced Concrete Pipe, 14" Dia.	1,400	LF	18.00	\$25,200.00
8.	1500D Reinforced Concrete Pipe, 16" Dia.	1,700	LF	21.00	\$35,700.00
9.	1500D Reinforced Concrete Pipe, 18" Dia.	1,900	LF	24.00	\$45,600.00
10.	1500D Reinforced Concrete Pipe, 20" Dia.	3,100	LF	27.00	\$83,700.00
11.	1500D Reinforced Concrete Pipe, 22" Dia.	2,600	LF	30.00	\$78,000.00
12.	1500D Reinforced Concrete Pipe, 24" Dia.	2,300	LF	34.00	\$78,200.00
13.	1500D Reinforced Concrete Pipe, 26" Dia.	1,900	LF	38.00	\$72,200.00
14.	1500D Reinforced Concrete Pipe, 28" Dia.	3,000	LF	48.00	\$144,000.00
15.	1500D Reinforced Concrete Pipe, 30" Dia.	3,200	LF	48.00	\$153,600.00
16.	Alignment Turns				
	a. 12" Dia. R.C.P. Elbow Section, Fabrication Only	1	EA	275.00	\$275.00
	b. 16" Dia. R.C.P. Elbow Section, Fabrication Only	1	EA	325.00	\$325.00
	c. 18" Dia. R.C.P. Elbow Section, Fabrication Only	2	EA	325.00	\$650.00
	d. 20" Dia. R.C.P. Elbow Section, Fabrication Only	1	EA	425.00	\$425.00
	e. 22" Dia. R.C.P. Elbow Section, Fabrication Only	1	EA	425.00	\$425.00
	f. 24" Dia. R.C.P. Elbow Section, Fabrication Only	1	EA	425.00	\$425.00
	g. 28" Dia. R.C.P. Elbow Section, Fabrication Only	1	EA	580.00	\$580.00
	h. 30" Dia. R.C.P. Elbow Section, Fabrication Only	5	EA	580.00	\$2,900.00
17.	Lateral Tile Connections	22	EA	300.00	\$6,600.00
18.	Misc. Drain Tile Repairs & Connections	38	EA	300.00	\$11,400.00
19.	Topsoil Strip, Stockpile, Respread	11,000	CY	2.25	\$24,750.00
20.	Tile Trench Stabilization and Cradling Rock	396	TN	25.00	\$9,900.00
21.	Spot Tile Exploration	66	HR	165.00	\$10,890.00
22.	Open Ditch Fertilizing & Seeding	3.0	STA	65.00	\$6,760.00
23.	Fence Cuts	17	EA	250.00	\$4,250.00

CONSTRUCTION COST SUBTOTAL

\$882,510.00

Average Cost per Watershed Acre (2,939 AC)

\$300.28

Average Cost per Watershed Acre for 10 years

\$30.03

NON-DISTRICT COSTS

Secondary Roads: Jack and Bore

Furnish & Install 30" 3000D RCP, Tanager Ave.	100	LF	657.00	\$65,700.00
Furnish & Install 24" 3000D RCP, Tyler Ave.	100	LF	525.00	\$52,500.00

Secondary Roads: Open Trench

Furnish & Install 30" 3000D RCP, 140th St.	66	LF	69.00	\$4,554.00
Furnish & Install 24" 3000D RCP, 130th St.	66	LF	53.00	\$3,498.00
Furnish & Install 24" 3000D RCP, Van Buren Ave.	66	LF	53.00	\$3,498.00
Furnish & Install 18" 3000D RCP, Van Buren Ave.	66	LF	42.00	\$2,772.00
Furnish & Install 18" 3000D RCP, 120th St.	66	LF	42.00	\$2,772.00

TOTAL ESTIMATED NON-DISTRICT COSTS

\$135,294.00

**DRAINAGE DISTRICT 26 OSCEOLA COUNTY
PRELIMINARY ENGINEER'S ESTIMATE OF PROBABLE COSTS**



PROJECT NUMBER: 17364

IMPROVEMENT REPLACEMENT OPTION

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	TOTAL
1.	Mobilization	1	JOB	84,000.00	\$84,000.00
2.	Open Ditch Excavation	8.00	HRS	165.00	\$1,320.00
3.	Spoil Bank Leveling (Two Sided)	3.0	STA	70.00	\$210.00
4.	1500D Reinforced Concrete Pipe, 24" Dia.	5,700	LF	34.00	\$193,800.00
5.	1500D Reinforced Concrete Pipe, 30" Dia.	6,700	LF	48.00	\$321,600.00
6.	1500D Reinforced Concrete Pipe, 36" Dia.	1,200	LF	68.00	\$81,600.00
7.	1500D Reinforced Concrete Pipe, 42" Dia.	10,100	LF	90.00	\$909,000.00
8.	Alignment Turns				
	a. 24" Dia. R.C.P. Elbow Section, Fabrication Only	2	EA	425.00	\$850.00
	b. 30" Dia. R.C.P. Elbow Section, Fabrication Only	4	EA	580.00	\$2,320.00
	c. 42" Dia. R.C.P. Elbow Section, Fabrication Only	6	EA	700.00	\$4,200.00
9.	Lateral Tile Connections	22	EA	300.00	\$6,600.00
10.	Misc. Drain Tile Repairs & Connections	38	EA	300.00	\$11,400.00
11.	Topsoil Strip, Stockpile, Respread	12,000	CY	2.25	\$27,000.00
12.	Tile Trench Stabilization and Cradling Rock	440	TN	25.00	\$11,000.00
13.	Spot Tile Exploration	66	HR	165.00	\$10,890.00
14.	Open Ditch Fertilizing & Seeding	3.0	STA	65.00	\$6,760.00
15.	Fence Cuts	17	EA	250.00	\$4,250.00

CONSTRUCTION COST SUBTOTAL

\$1,676,800.00

Average Cost per Watershed Acre (2,939 AC)

\$570.53

Average Cost per Watershed Acre for 10 years

\$57.05

NON-DISTRICT COSTS

Secondary Roads: Jack and Bore

Furnish & Install 42" 3000D RCP, Tanager Ave.	100	LF	866.00	\$86,600.00
Furnish & Install 42" 3000D RCP, Tyler Ave.	100	LF	866.00	\$86,600.00

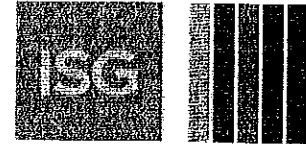
Secondary Roads: Open Trench

Furnish & Install 42" 3000D RCP, 140th St.	66	LF	150.00	\$9,900.00
Furnish & Install 30" 3000D RCP, 130th St.	66	LF	69.00	\$4,554.00
Furnish & Install 30" 3000D RCP, Van Buren Ave.	66	LF	69.00	\$4,554.00
Furnish & Install 30" 3000D RCP, Van Buren Ave.	66	LF	69.00	\$4,554.00
Furnish & Install 24" 3000D RCP, 120th St.	66	LF	53.00	\$3,498.00

TOTAL ESTIMATED NON-DISTRICT COSTS

\$200,260.00

DRAINAGE DISTRICT 26 OSCEOLA COUNTY
 PRELIMINARY ENGINEER'S ESTIMATE OF PROBABLE COSTS



PROJECT NUMBER: 17364

IMPROVEMENT RELIEF OPTION

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	TOTAL
1.	Mobilization	1	JOB	65,000.00	\$65,000.00
2.	Open Ditch Excavation	8.00	HRS	165.00	\$1,320.00
3.	Spoil Bank Leveling (Two Sided)	3.0	STA	70.00	\$210.00
4.	Parallel Relief Tile				
	1500D Reinforced Concrete Pipe, 18" Dia.	4,140	LF	24.00	\$99,360.00
	1500D Reinforced Concrete Pipe, 24" Dia.	7,575	LF	34.00	\$257,550.00
	1500D Reinforced Concrete Pipe, 36" Dia.	11,590	LF	68.00	\$788,120.00
5.	Alignment Turns				
	a. 18" Dia. R.C.P. Elbow Section, Fabrication Only	3	EA	325.00	\$975.00
	b. 24" Dia. R.C.P. Elbow Section, Fabrication Only	10	EA	425.00	\$4,250.00
	c. 36" Dia. R.C.P. Elbow Section, Fabrication Only	8	EA	650.00	\$5,200.00
6.	Junction Structures	3	EA	5,000.00	\$15,000.00
7.	Tile End Caps				
	a. 6" Dia., Fabrication Only	2	EA	70.00	\$140.00
	b. 7" Dia., Fabrication Only	3	EA	70.00	\$210.00
	c. 8" Dia., Fabrication Only	2	EA	70.00	\$140.00
	d. 10" Dia., Fabrication Only	3	EA	70.00	\$210.00
	e. IDOT DR-142 RCP, 12" Dia.	1	EA	70.00	\$70.00
	f. IDOT DR-142 RCP, 15" Dia.	1	EA	77.00	\$77.00
8.	Lateral Tile Connections	12	EA	300.00	\$3,600.00
9.	Misc. Drain Tile Repairs & Connections	37	EA	300.00	\$11,100.00
10.	Topsoil Strip, Stockpile, Respread	10,000	CY	2.25	\$22,500.00
11.	Tile Trench Stabilization and Cradling Rock	330	TN	25.00	\$8,250.00
12.	Spot Tile Exploration	45	HR	165.00	\$7,425.00
13.	Open Ditch Fertilizing & Seeding	3.0	STA	65.00	\$6,760.00
14.	Fence Cuts	17	EA	250.00	\$4,250.00

CONSTRUCTION COST SUBTOTAL

\$1,301,717.00

Average Cost per Watershed Acre (2,939 AC)
 Average Cost per Watershed Acre for 10 years

\$442.91
 \$44.29

NON-DISTRICT COSTS

Secondary Roads: Jack and Bore

Furnish & Install 36" 3000D RCP, Tanager Ave.	100	LF	660.00	\$66,000.00
Furnish & Install 36" 3000D RCP, Tyler Ave.	100	LF	660.00	\$66,000.00

Secondary Roads: Open Trench

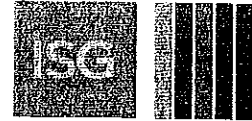
Furnish & Install 36" 3000D RCP, 140th St.	66	LF	86.00	\$5,676.00
Furnish & Install 24" 3000D RCP, 130th St.	66	LF	53.00	\$3,498.00
Furnish & Install 24" 3000D RCP, Van Buren Ave.	66	LF	53.00	\$3,498.00
Furnish & Install 24" 3000D RCP, Van Buren Ave.	66	LF	53.00	\$3,498.00
Furnish & Install 18" 3000D RCP, 120th St.	66	LF	42.00	\$2,772.00

TOTAL ESTIMATED NON-DISTRICT COSTS

\$150,942.00

APPENDIX C
RELIEF TILE SYSTEM PROJECT COST ESTIMATE

DRAINAGE DISTRICT 16 OSCEOLA COUNTY
 PRELIMINARY ENGINEER'S ESTIMATE OF PROBABLE COSTS



PROJECT NUMBER: 17364

IMPROVEMENT RELIEF OPTION

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	TOTAL
1.	Mobilization	1	JOB	80,700.00	\$80,700.00
2.	Open Ditch Excavation	8.00	HRS	165.00	\$1,320.00
3.	Spoil Bank Leveling (Two Sided)	3.0	STA	110.00	\$330.00
4.	Parallel Relief Tile				
	1500D Reinforced Concrete Pipe, 18" Dia.	3,292	LF	25.00	\$82,300.00
	1500D Reinforced Concrete Pipe, 24" Dia.	2,834	LF	36.00	\$102,024.00
	1500D Reinforced Concrete Pipe, 30" Dia.	354	LF	53.00	\$18,762.00
	1500D Reinforced Concrete Pipe, 32" Dia.	1,100	LF	60.00	\$66,000.00
	2000D Reinforced Concrete Pipe, 18" Dia.	1,276	LF	33.00	\$42,108.00
	2000D Reinforced Concrete Pipe, 24" Dia.	400	LF	45.00	\$18,000.00
	2000D Reinforced Concrete Pipe, 30" Dia.	2,980	LF	65.00	\$193,700.00
	2000D Reinforced Concrete Pipe, 36" Dia.	9,934	LF	93.00	\$923,862.00
5.	Main Line Tile				
	1500D Reinforced Concrete Pipe, 12" Dia.	500	LF	18.00	\$9,000.00
6.	Alignment Turns				
a.	18" Dia. R.C.P. Elbow Section, Fabrication Only	8	EA	325.00	\$2,600.00
b.	24" Dia. R.C.P. Elbow Section, Fabrication Only	4	EA	425.00	\$1,700.00
c.	30" Dia. R.C.P. Elbow Section, Fabrication Only	4	EA	580.00	\$2,320.00
d.	32" Dia. R.C.P. Elbow Section, Fabrication Only	4	EA	600.00	\$2,400.00
e.	36" Dia. R.C.P. Elbow Section, Fabrication Only	11	EA	650.00	\$7,150.00
7.	Cross Connections				
a.	12" On 18"	1	EA	1,500.00	\$1,500.00
b.	16" On 18"	1	EA	1,500.00	\$1,500.00
c.	18" On 24"	2	EA	1,500.00	\$3,000.00
d.	20" On 30"	1	EA	1,500.00	\$1,500.00
e.	22" On 30"	2	EA	1,700.00	\$3,400.00
f.	24" On 32"	1	EA	1,900.00	\$1,900.00
g.	24" On 36"	1	EA	1,900.00	\$1,900.00
h.	26" On 36"	1	EA	2,100.00	\$2,100.00
i.	28" On 36"	1	EA	2,300.00	\$2,300.00
j.	30" On 36"	1	EA	2,500.00	\$2,500.00
8.	Junction Structures	1	EA	5,000.00	\$6,500.00
9.	Tile End Caps				
a.	7" Dia., Fabrication Only	3	EA	70.00	\$210.00
b.	8" Dia., Fabrication Only	3	EA	70.00	\$210.00
c.	10" Dia., Fabrication Only	2	EA	70.00	\$140.00
d.	IDOT DR-142 RCP, 12" Dia.	1	EA	75.00	\$75.00
e.	IDOT DR-142 RCP, 15" Dia.	1	EA	80.00	\$80.00
10.	Lateral Tile Connections	10	EA	500.00	\$5,000.00
11.	Misc. Drain Tile Repairs & Connections	57	EA	300.00	\$17,100.00
12.	Topsoil Strip, Stockpile, Respread	28,030	CY	2.25	\$63,068.00
13.	Tile Trench Stabilization and Cradling Rock	325	TN	25.00	\$8,125.00
14.	Crush & Bury Existing Tile	500	LF	5.00	\$2,500.00
15.	Spot Tile Exploration	45	HR	165.00	\$7,425.00
16.	Open Ditch Fertilizing & Seeding	3.0	STA	65.00	\$6,760.00
17.	Fence Cuts	4	EA	250.00	\$1,000.00

CONSTRUCTION COST SUBTOTAL \$1,694,070.00

Engineering Services:	
Survey	\$10,170.00
Engineer Administration & Design Services	\$135,530.00
Research/Study/Engineering Report	\$67,770.00
Final Plans & Specs	\$50,830.00
Construction Admin/Staking/Observation	\$50,830.00
Legal & Auditor Services, Publication, Misc.	\$4,000.00
Damages (54 AC @ \$700/AC)	\$37,800.00
Contingencies	\$169,500.00

REPLACEMENT PROJECT COST SUBTOTAL \$2,220,500.00

Other Potential District Costs:	
Annexation	\$4,000.00
Reclassification (2,939 AC)	\$36,000.00
Project Warrant Interest	\$179,900.00

TOTAL ESTIMATED PROJECT COST \$2,440,400.00

Average Cost per Watershed Acre (2,939 AC)	\$830.35
Average Cost per Watershed Acre for 20 years	\$41.52

POTENTIAL WETLAND MITIGATION (19.5 AC @ \$20,000/AC) \$390,000.00

NON-DISTRICT COSTS

Secondary Roads: Jack and Bore					
	Furnish & Install 36" 3000D RCP, Tanager Ave.	100	LF	750.00	\$75,000.00
	Furnish & Install 32" 3000D RCP, Tyler Ave.	100	LF	700.00	\$70,000.00
Secondary Roads: Open Trench					
	Furnish & Install 36" 3000D RCP, 140th St.	66	LF	100.00	\$6,600.00
	Furnish & Install 30" 3000D RCP, 130th St.	66	LF	85.00	\$5,610.00
	Furnish & Install 24" 3000D RCP, Van Buren Ave.	66	LF	75.00	\$4,950.00
	Furnish & Install 18" 3000D RCP, Van Buren Ave.	66	LF	50.00	\$3,300.00
	Furnish & Install 18" 3000D RCP, 120th St.	66	LF	50.00	\$3,300.00

TOTAL ESTIMATED NON-DISTRICT COSTS \$168,760.00

Preliminary Plans