

DATE: April 7, 2022

TO: Troy Jensen

FROM: Mark Origer, PE - ISG

SUBJECT: Troy Jensen Tile Outlet Review

TROY JENSEN PETITION FOR OUTLET REVIEW

In response to a petition for outlet from Martin County JD 314 to JD 414 ISG has reviewed the proposed private tile plans for the Jensen Property that lines within the Martin/Faribault Judicial Ditch 414 and 314 systems (JD 414 and JD 313). The plan includes installing 15- and 18-inch private tile from 50th Street in the NW ¼ of the NE ¼ of Section 13 of East Chain Township to 40th Street in the SE ¼ of the SW ¼ of Section 13 of East Chain Township. At the end of the tile, a pump will transfer flow into the main open ditch of JD 414. After reviewing the tile and pump plan from the landowner, drainage calculations show the following for the proposed drainage plan. The proposed private tile will drain approximately 220 acres from the JD 314 watershed and transfer it to JD 414 open ditch. The following is a review of the proposed project and potential impacts on both systems.

AFFECTS ON DOWNSTREAM CROSSINGS

The capacity of agricultural drainage conveyance infrastructure (ditch or tile) is expressed as a drainage coefficient in inches per day (in/day); the depth of water over the entire area of the upstream watershed that a ditch, tile, or culvert can drain in 24-hours. The proposed tile and pump capacities are shown below in Table 1.

Table 1. Proposed Tile Capacities

Area	Size (in)	Slope (%)	Proposed Drainage Area (Acres)	Proposed Drainage Coefficient (in/day)
Pump*	-	-	215.0	0.49
South	18	0.10%	215.0	0.37
Middle	15	0.10%	154.0	0.32
North	15	0.10%	78.0	0.63

*2,000 gal/min pump

Due to the proposed private tile draining land from one watershed to another, the downstream crossings at 40th Street and 310th Ave were analyzed to compare the pre- and post-conditions in order to verify no reductions in system capacity would occur. Currently there are portions of the 220-acre sub watershed that drain downstream into the JD 414 main open ditch. The tile system will move the outlet of these acres upstream in the JD 414 main open ditch to the location of the pump/tile outlet. The existing mainline crossings are both 84-inch Reinforced Concrete Pipe culverts that reside at a 0.06% grade (40th Street) and a 0.45% grade (310th Ave), the crossings are currently in good condition and were recently repaired in 2018. It was observed that a slight reduction in capacity at the two crossings would occur due to the increased watershed size draining to the crossings. Table 2 below outlines the capacity of the crossings for the existing and proposed conditions.

Table 2. Crossing Capacities

Crossing # on Map	Roadway	Existing Type	Existing Material	Existing Size (in)	Existing Slope (%)	Existing Drainage Area (Acres)	Proposed Drainage Area (Acres)	Existing Drainage Coefficient (in/day)	Proposed Drainage Coefficient (in/day)
1	40th St	ROUND CULVERT	RCP	84	0.06%	5606	5822	0.67	0.64
2	310th Ave	ROUND CULVERT	RCP	84	0.45%	5837	6053	1.75	1.69

The proposed private tile would cause a 4% capacity decrease on the 40th Street crossing and a reduction of 3% at the 310th Ave crossing. However, the capacity analysis is assuming the peak flows throughout the drainage area all reach the crossing at the same time. In reality the

timing within the system varies greatly due to potential storage and isolated basins within the watershed. The proposed private tile peak flow will arrive at the crossing before any the culvert is at full capacity, therefore the private tile project will not affect the existing culverts. When analyzing culvert capacities for open ditch systems, a $\frac{1}{2}$ inch to 1 inch per day drainage coefficient is recommended. Both the existing and proposed capacities of 40th street are within this range, but are slightly in the lower end of the capacity,

AFFECTS ON EXISTING PUBLIC TILE

The tile within the JD 314 system was also analyzed to compare the drainage capacity of the system for the pre- and post-construction conditions. Currently, the northern portion of the private tile watershed drains into Branch N21 and Branch N24 of JD 314. Branch N21 ranges in size from 8-inch to 12-inch tile while Branch N24 is a 6-inch tile. The proposed private tile will reduce the Branch N21 sub watershed by approximately 25.4 acres while the Branch N24 sub watershed will be completely taken by the private tile system. Table 3 outlines the capacities of the JD 314 system for the existing and proposed conditions.

Table 3. JD 314 Tile Capacities

Area	ACSIC Size (in)	ACSIC Slope (%)	Existing Drainage Area (Acres)	Proposed Drainage Area (Acres)	ACSIC Drainage Coefficient (in/day)	Proposed Drainage Coefficient (in/day)
Branch N21	12	0.10%	148.3	122.9	0.18	0.22
	12	0.90%	129.6	104.2	0.62	0.77
	12	0.10%	112.3	86.9	0.24	0.31
	12	1.00%	69.9	44.5	1.22	1.91
	12	0.10%	69.9	44.5	0.38	0.60
	12	0.20%	50.4	25.0	0.75	1.52
	10	0.20%	35.1	9.7	0.67	2.42
Branch N24	6	0.30%	9.0	0.0	0.81	-
Branch N (JD 314 Outlet)	22	0.10%	2824.0	2798.6	0.05	0.05

The proposed private tile would reduce the drainage area to the existing JD 314 branches, resulting in an increase in capacity along Branch N21. However, there is no significant capacity increase at the outlet of JD 314 due to the relatively small watershed that is removed compared to the entire JD 314 system. Furthermore, the overall outlet capacity of JD 314 is 0.05 in/day in both the existing and proposed conditions, which is significantly undersized for today's drainage demands.

PROPOSED ROAD CROSSING

Agricultural drainage tile that resides under road crossings are subjected to heavier loads that pose a risk to pipe integrity. Traditional single wall private tile has been shown to collapse when exposed to heavier loads, like the road crossing at 40th Street. It is the engineer's recommendation that the tile under 40th Street be either dual-wall high density polyethylene (HDPE) or reinforced concrete pipe, in order to increase the lifespan of the system and prevent any future road maintenance due to tile failure under the road surface. Please see the attached specifications for agricultural drain tile and road crossings. Rip rap should also be place at the tile outlet into the open ditch to prevent erosion of the ditch banks. The rip rap should be sized to handle the velocity existing the pipe and prevent scour into the JD 414 open ditch.

Based on the information provided with the private tile outlet from JD 314 into JD 414, there will be insignificant impacts on the overall drainage to JD 414. While the culvert capacity under 40th street may be slightly undersized, rerouting the tile from JD 314 as shown will not burden the crossing to a capacity under the minimum recommended capacities. Therefore, the proposed tile reroute design as shown is acceptable from a drainage capacity standpoint.

Please feel free to contact me with and questions or comments.

Sincerely,



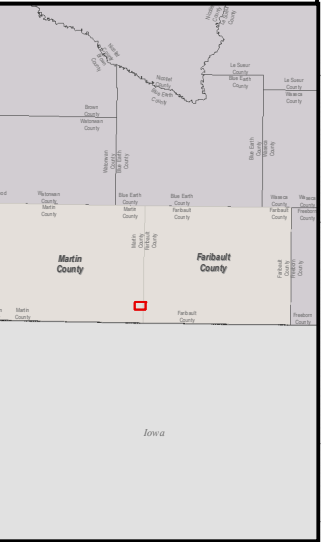
Mark Origer, PE
Civil Engineer

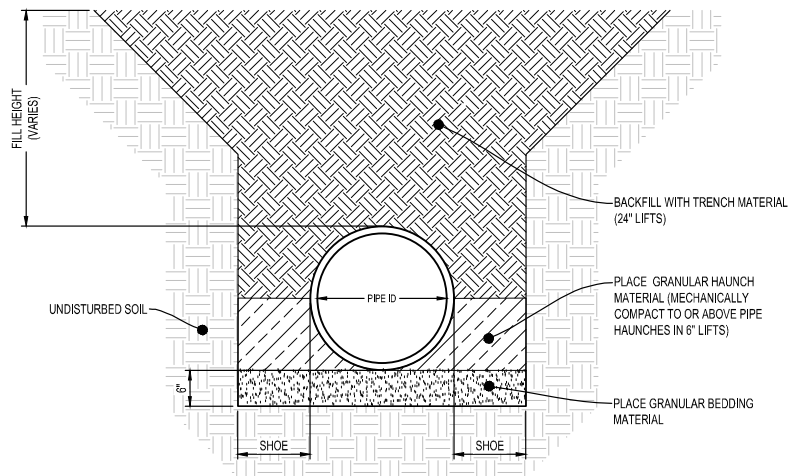


Martin County,
Minnesota
Wednesday, April 6, 2022

-  Proposed Private Tile
-  Existing Tile
-  Existing Open Ditch
-  Private Tile Watershed
-  Watersheds
-  Parcels

0 200 400 800 Feet

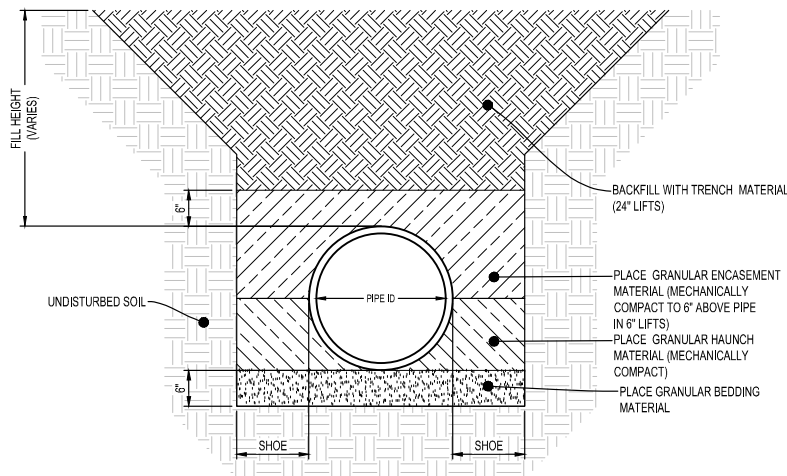




NOTES:

GRANULAR BEDDING, GRANULAR ENCASEMENT, AND BACKFILL SHALL BE INCIDENTAL TO CONSTRUCTION.
ALL PIPE WITH A FILL HEIGHT GREATER THAN 15-FEET SHALL BE FULLY ENCASED IN ASTM CLASS I MATERIAL.
THE SHOE WIDTH SHALL BE THE SAME AS THE COMPACTING MECHANISMS WIDTH OR THE PIPE MANUFACTURER SPECIFICATIONS, WHICHEVER IS GREATER.
THE CLASS OF RCP REQUIRED SHALL BE BASED ON THE PIPE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE SPECIFIED.

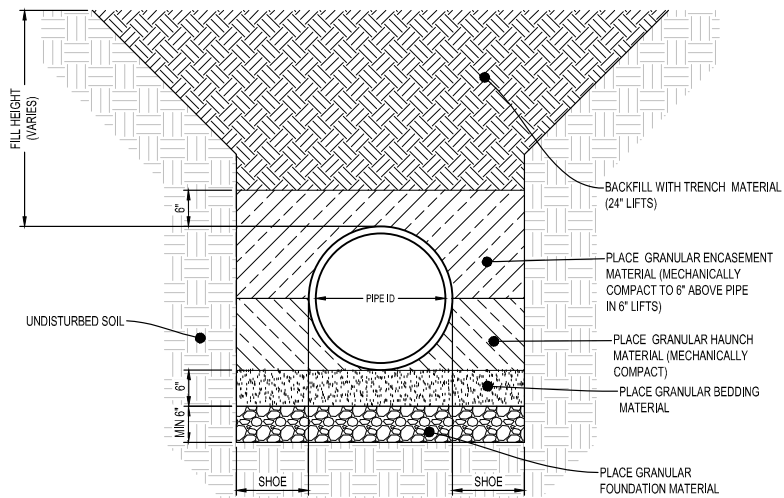
RCP FLAT BOTTOM TRENCH
NTS



NOTE:

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ALL PIPE WITH A FILL HEIGHT GREATER THAN 15-FEET SHALL BE FULLY ENCASED IN ASTM CLASS I MATERIAL.
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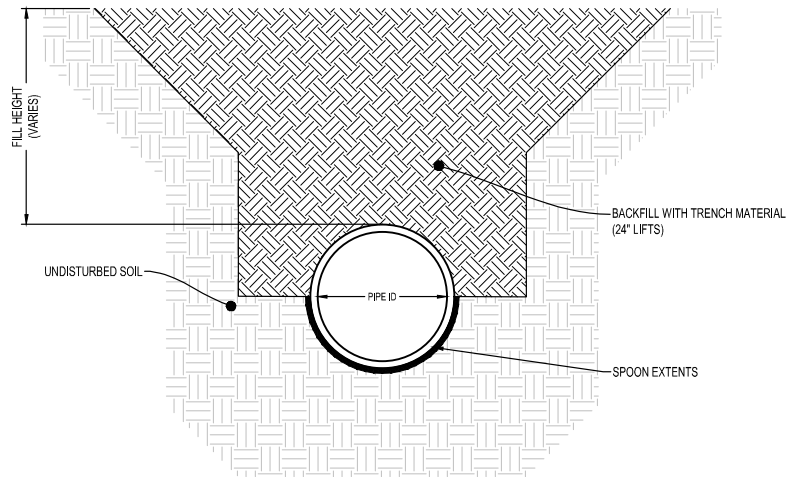
HDPE FLAT BOTTOM TRENCH
NTS



NOTES:

GRANULAR BEDDING, GRANULAR ENCASEMENT, AND BACKFILL SHALL BE INCIDENTAL TO CONSTRUCTION.
GRANULAR FOUNDATION BELOW THE PIPE SHALL BE PAID FOR BY THE CUBIC YARD, ONLY WHERE APPROVED BY THE FIELD ENGINEER.
ALL PIPE WITH A FILL HEIGHT GREATER THAN 15-FEET SHALL BE FULLY ENCASED IN ASTM CLASS I MATERIAL.
THE SHOE WIDTH SHALL BE THE SAME AS THE COMPACTING MECHANISMS WIDTH OR THE PIPE MANUFACTURER'S SPECIFICATIONS, WHICHEVER IS GREATER.

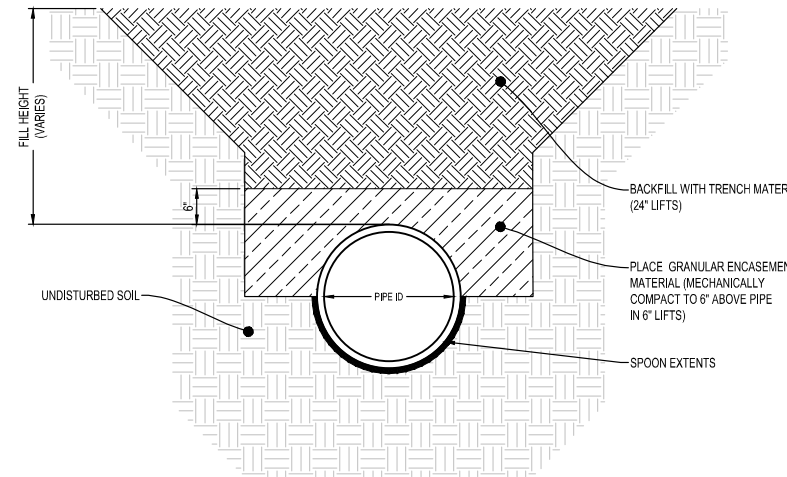
HDPE FLAT BOTTOM TRENCH
WITH GRANULAR FOUNDATION
NTS



NOTES:

BACKFILL SHALL BE INCIDENTAL TO CONSTRUCTION.
SPOON DIMENSIONS SHALL COMPLY WITH PIPE MANUFACTURER'S SPECIFICATIONS.
ALL PIPE WITH A FILL HEIGHT GREATER THAN 15-FEET SHALL BE FULLY ENCASED IN ASTM CLASS I MATERIAL.
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RCP SPOON TRENCH
NTS



NOTES:

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HDPE SPOON TRENCH
NTS

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SUPERVISION AND THAT I AM A DULY LICENSED
PROFESSIONAL ENGINEER UNDER THE LAWS OF THE
STATE OF MINNESOTA.
CHARLES J. BRANDEL

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PROJECT

REVISION SCHEDULE		
DATE	DESCRIPTION	BY

PROJECT NO. _____
FILE NAME _____
DRAWN BY _____
DESIGNED BY _____
REVIEWED BY _____
ORIGINAL ISSUE DATE --/--
CLIENT PROJECT NO. --

TITLE

SHEET

DATE: April 11, 2022

TO: Troy Jensen, Martin-Faribault Joint Drainage Authority

FROM: Mark Origer, PE - ISG

SUBJECT: Troy Jensen Tile Outlet Review-Amendment 1

CULVERT CAPACITY AMENDMENT-40TH STREET

After reviewing various conflicting as-built and culvert repair documents, ISG re-surveyed the 40th Street culvert crossing which is immediately downstream of the proposed 0.50 inch/day pump on the Jensen property.

AFFECTS ON DOWNSTREAM CROSSINGS

The capacity of agricultural drainage conveyance infrastructure (ditch or tile) is expressed as a drainage coefficient in inches per day (in/day); the depth of water over the entire area of the upstream watershed that a ditch, tile, or culvert can drain in 24-hours. For tile drainage, a 0.50 inch/day drainage coefficient is recommended while a 1.0 inch/day drainage coefficient is recommended for an open ditch.

The downstream crossings at 40th Street and 310th Ave were analyzed to compare the pre- and post-conditions in order to verify no reductions in system capacity would occur. Currently there are portions of the 220-acre sub watershed that drain downstream into the JD 414 main open ditch. The tile/pump system will move the outlet of these acres upstream in the JD 414 main open ditch to the location of the pump/tile outlet. The existing mainline crossings are both 84-inch Reinforced Concrete Pipe culverts that reside at a 0.26% grade (40th Street) and a 0.45% grade (310th Ave), the crossings are currently in good condition and were recently repaired in 2018. It was observed that a slight reduction in capacity at the two crossings would occur due to the increased watershed size draining to the crossings. Table 1 below outlines the capacity of the crossings for the existing and proposed conditions.

Table 1. Crossing Capacities

Crossing # on Map	Roadway	Existing Type	Existing Material	Existing Size (in)	Existing Slope (%)	Existing Drainage Area (Acres)	Proposed Drainage Area (Acres)	Existing Drainage Coefficient (in/day)	Proposed Drainage Coefficient (in/day)
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2	310th Ave	ROUND CULVERT	RCP	84	0.45%	5837	6053	1.75	1.69

The proposed private tile/pump would cause a 4% capacity decrease on the 40th Street crossing and a reduction of 3% at the 310th Ave crossing. After the increase in flow to the JD 414 open ditch, the proposed drainage capacities for 40th Street and 310th Avenue are both well above the 1.0 inch/day drainage coefficient which is recommended for open ditch capacity.

SUMMARY

Based on the information provided with the private tile outlet from JD 314 into JD 414, and additional survey data on 40th Street; there will be insignificant impacts on the overall drainage to JD 414. Therefore, the proposed tile reroute design as shown is acceptable from a drainage capacity standpoint.

Please feel free to contact me with and questions or comments.

Sincerely,



Mark Origer, PE
Civil Engineer