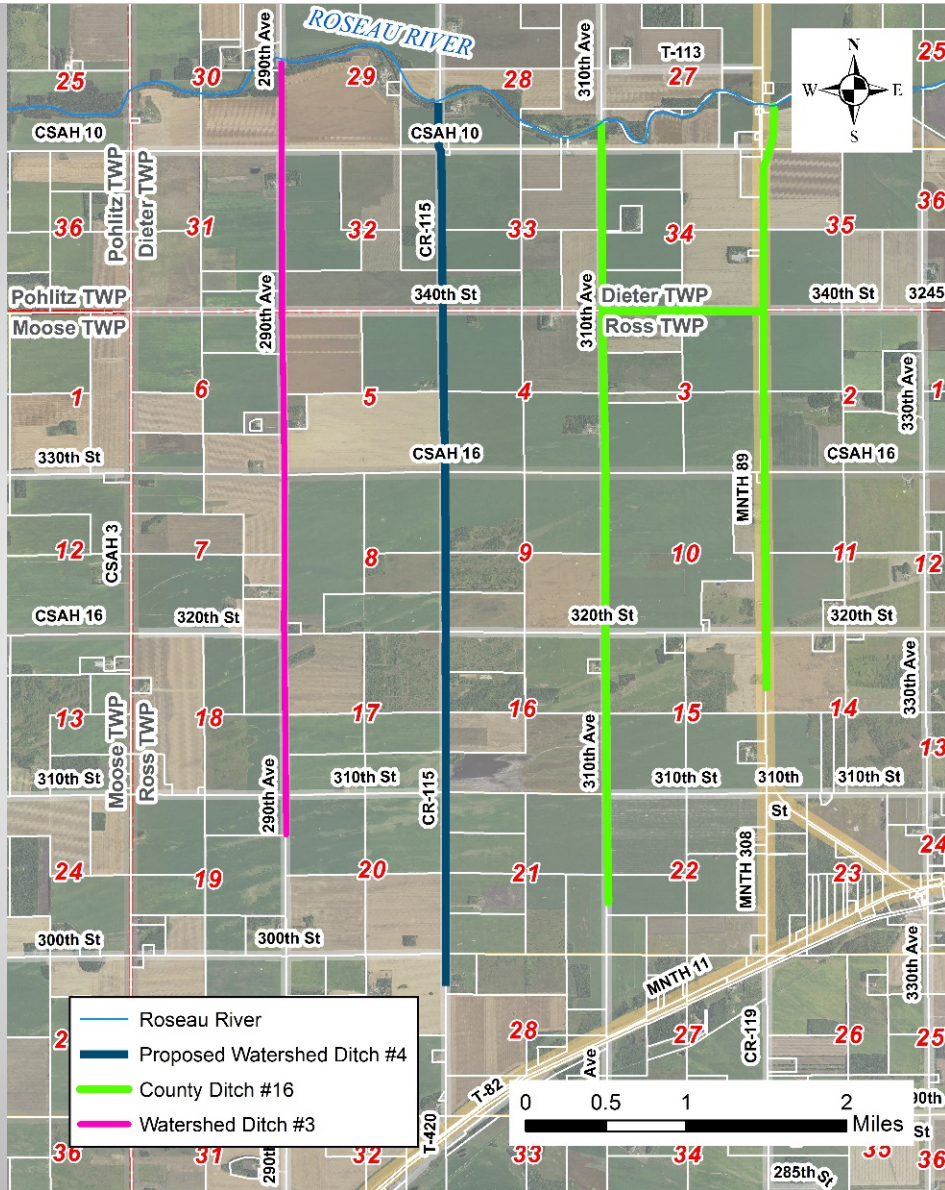
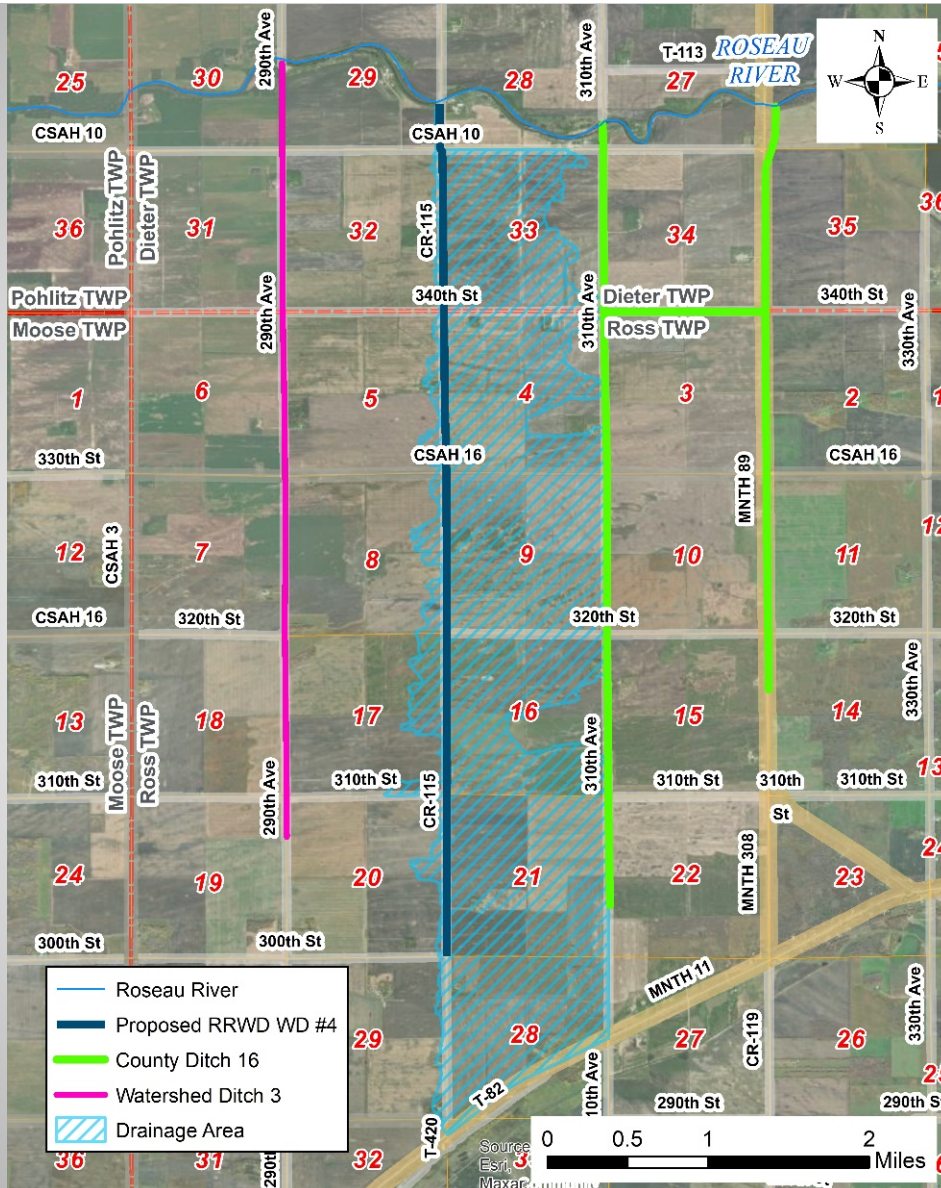




Detailed Survey Report
RRWD Watershed Ditch #4





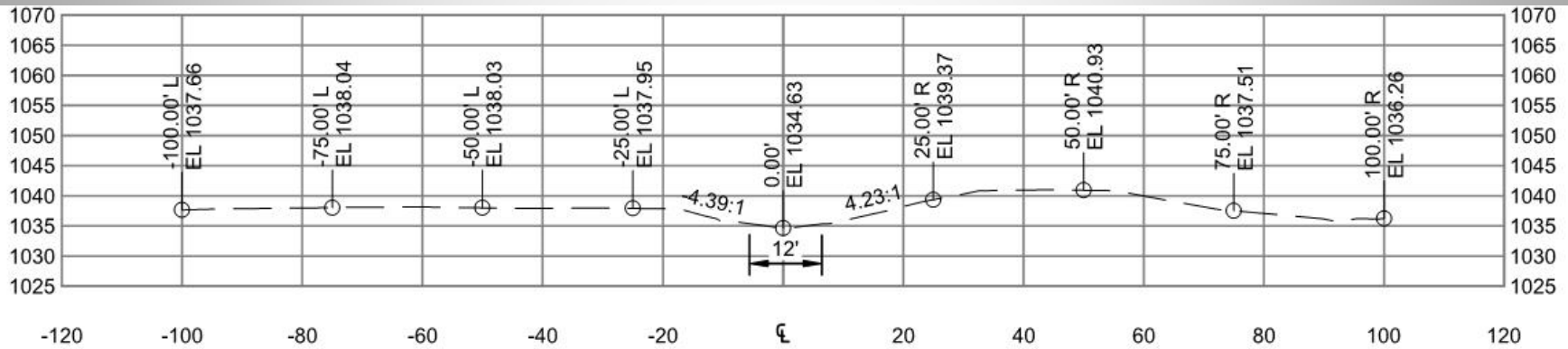


- Roseau River
- Proposed RRWD #4
- County Ditch 16
- Watershed Ditch 3
- Drainage Area

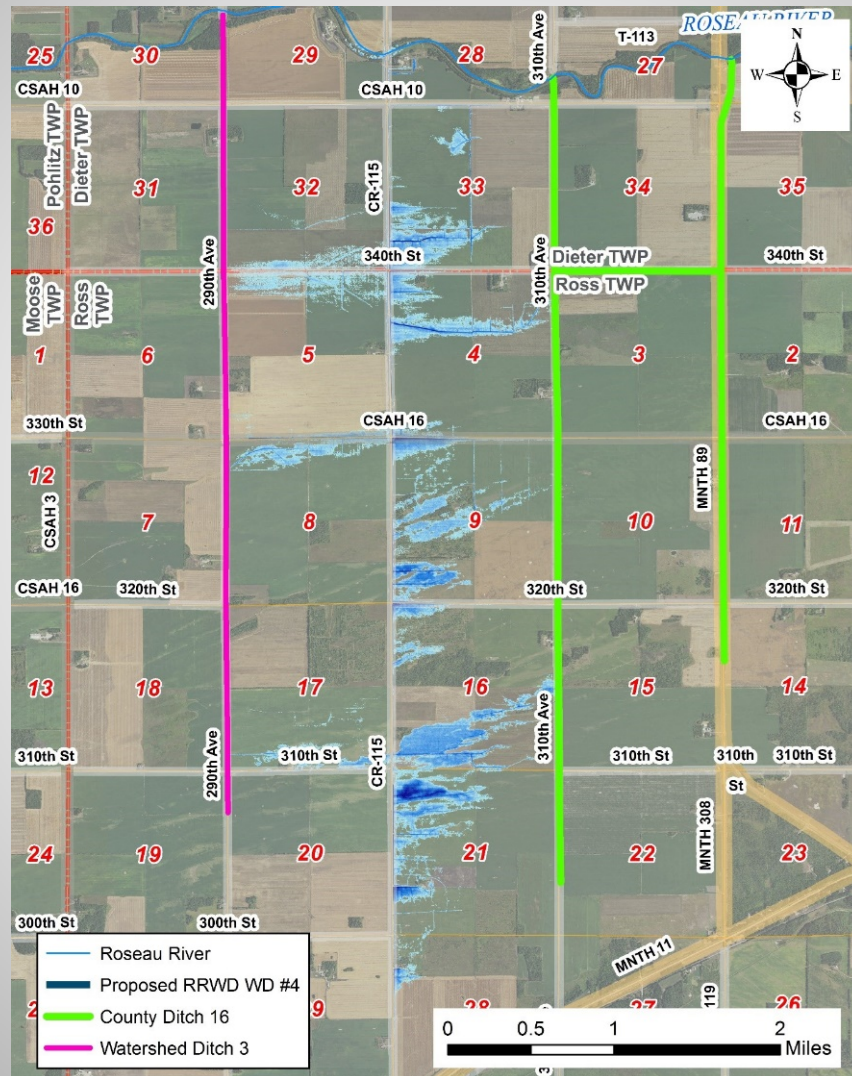


Source: Esri, Maxar Community

EXISTING CR 115 EAST DITCH GEOMETRY



EXISTING 10-YEAR 24-HOUR (3.3") INUNDATION MAP



WD 4 DESIGN GOALS / CRITERIA

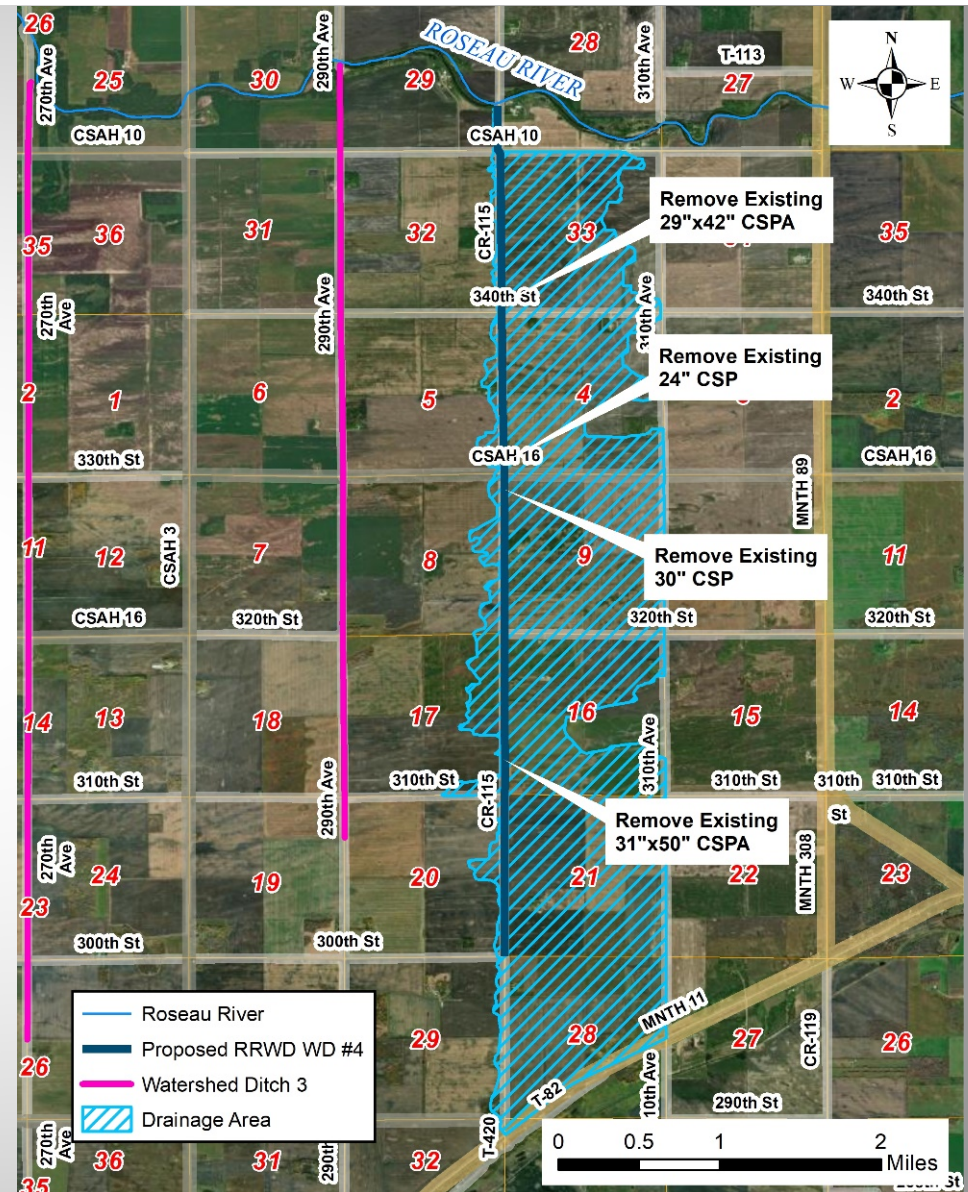
- Red River of the North Basin TSAC Briefing Paper #3:
 - Channel capacity for a 10-year 24-hour (~3.3" Rainfall) design event
 - Head loss at culverts of 0.5' – 1.0' for the design event
 - Water surface elevations below the adjacent natural ground (or protected by berm)
 - Flows greater than design event access the floodplain near road crossings

ALTERNATIVES

1. Initial design in Preliminary Survey Report meeting all Project goals
2. Revise culvert design. Maintain 10-year capacity and ditch extents
3. Shorten ditch extents but maintain 10-year capacity
4. Reduce ditch capacity to 5-year

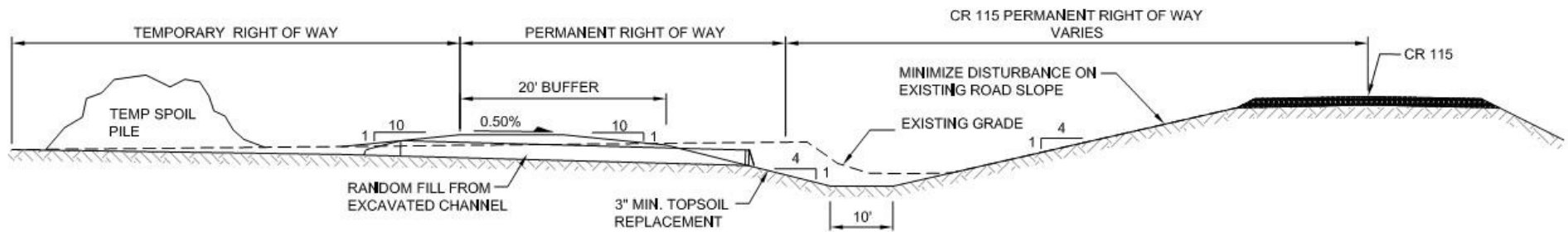
DESIGN CONSIDERATIONS

- Remove / combine crossings
- Crossing size (Ag vs. Hunting Access)
- Adjust culvert sizes while maintaining 10YR capacity
- Remove / Install smaller high flow centerline pipes through CR 115

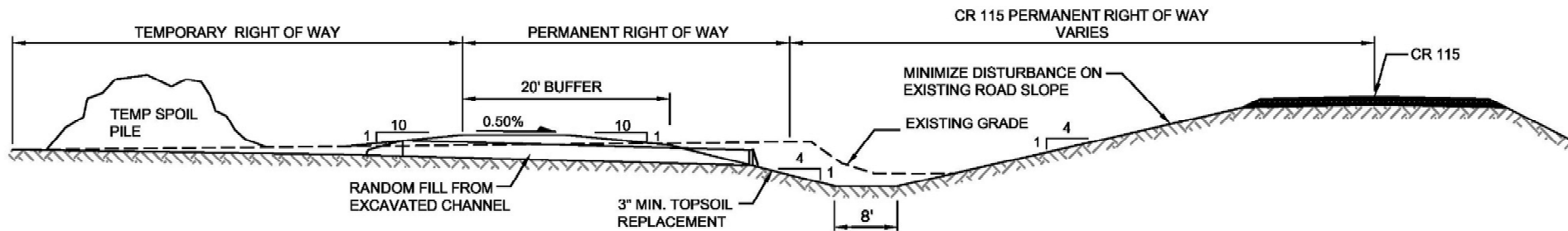


PROPOSED WD 4 GEOMETRY

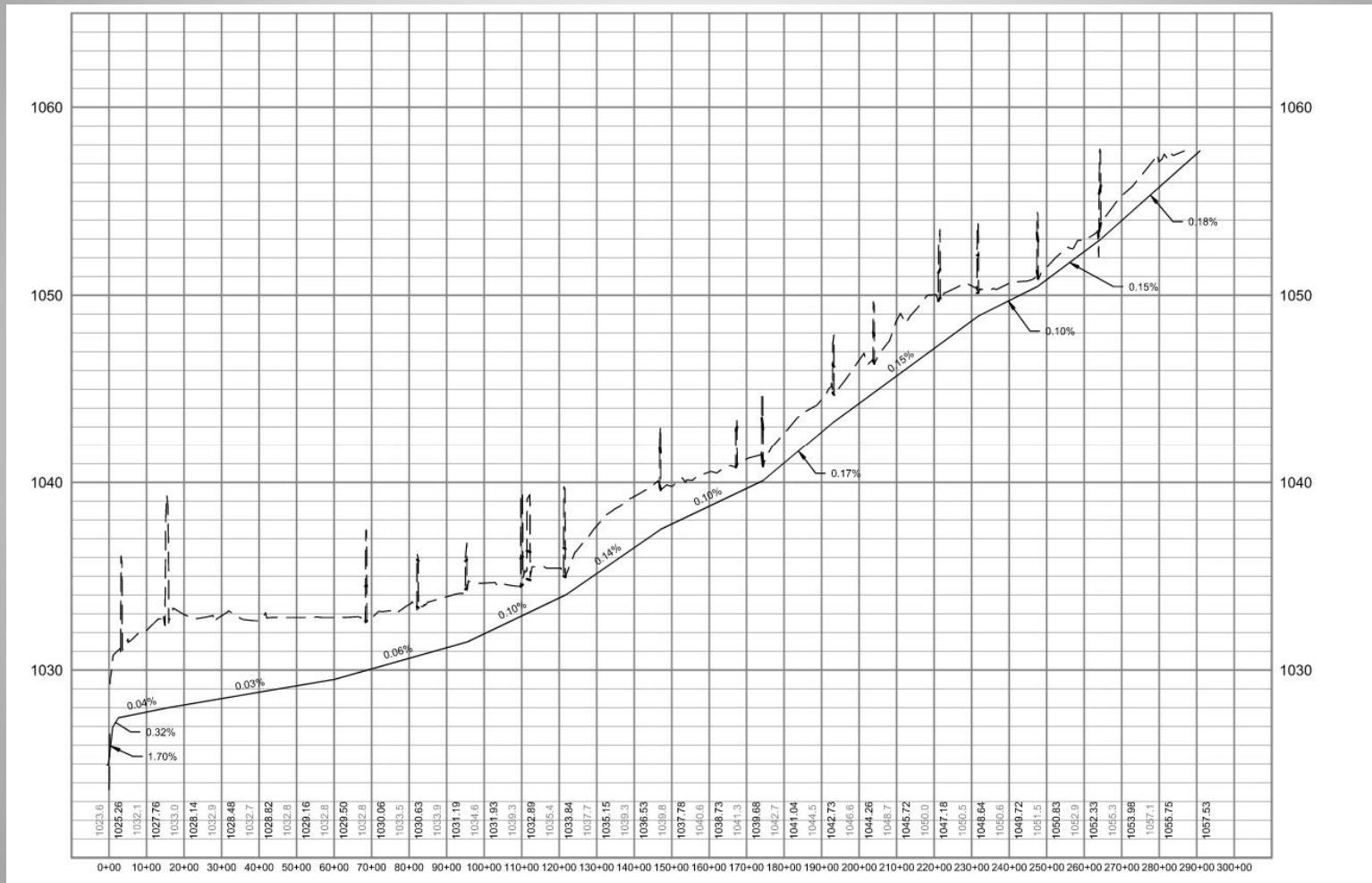
CSAH 10 TO UPSTREAM EXTENTS



ROSEAU RIVER TO CSAH 10



EXISTING VS PROPOSED DITCH GRADE



EXISTING VS PROPOSED STRUCTURES

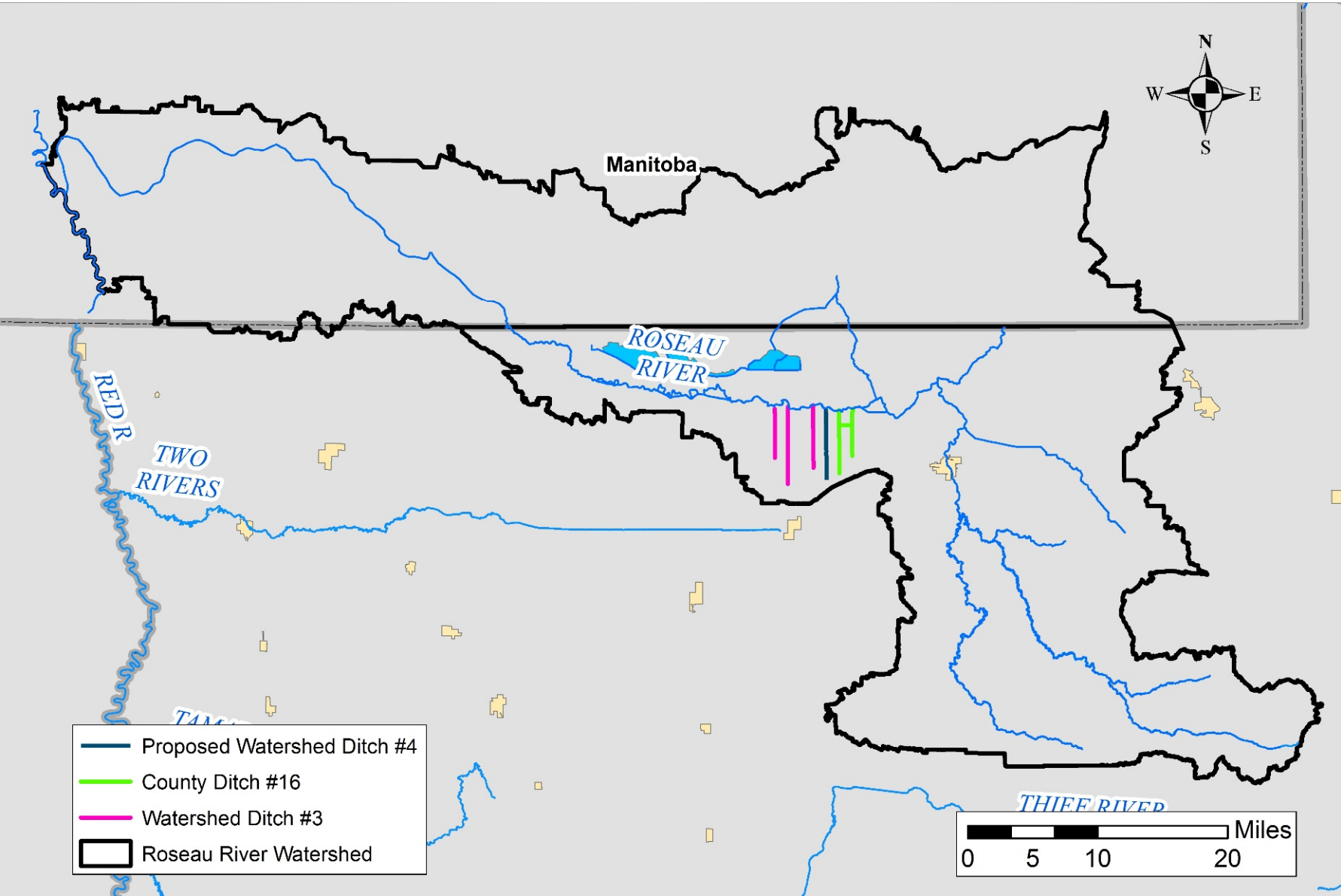
Description	Station	Existing Culvert	Proposed Shape	Proposed Size	Proposed Length (ft)	Proposed Material
Field Crossing	3+00	18" CSP	Round	60" CSP	103	Corrugated Steel
CR 10	15+50	30" RCP	Round	60" RCP	148	Reinforced Concrete
Field Crossing	41+85	30" CSP	Round	60" CSP	92	Corrugated Steel
340 th St.	68+50	24" X 35" CSP Arch	Round	60" CSP	60	Corrugated Steel
Field Crossing	82+32	30" CSP	-	-	-	-
Field Crossing	95+20	18" CSP	Round	60" CSP	81	Corrugated Steel
Field Crossing	110+00	18" CSP	-	-	-	-
Field Crossing	111+86	18" CSP	Round	60" CSP	84	Corrugated Steel
CR 16	121+50	18" CSP	Round	65" x 40" RCPA	48	Reinforced Concrete
Field Crossing	146+92	24" CSP	Round	54" CSP	82	Corrugated Steel
Field Crossing	167+28	24" CSP	-	-	-	-
320 th St.	174+20	24" CSP	Round	57" x 38" CSPA	40	Corrugated Steel
Driveway	193+09	18" CSP	Round	48" CSP	40	Corrugated Steel
Field Crossing	203+86	18" CSP	Round	42" CSP	74	Corrugated Steel
Field Crossing	221+34	18" CSP	Round	42" CSP	90	Corrugated Steel
Field Crossing	231+60	24" CSP	Round	-	-	-
Field Crossing	247+55	24" CSP	Round	49" x 33" CSPA	74	Corrugated Steel
Driveway	264+21	24" CSP	Round	36" CSP	44	Corrugated Steel
Driveway	290+80	18" CSP	Round	36" CSP	40	Corrugated Steel

EXISTING CR 115 RIGHT-OF-WAY

Station	Permanent R.O.W.
0+00 to 55+30	65'
55+30 to 82+00	60'
82+00 to 109+95	65'
109+95 to 110+85	55'
110+85 to 111+75	33'
111+75 to 121+50	55'
121+50 to 280+00	50'

AVERAGE ADDITIONAL RIGHT-OF-WAY

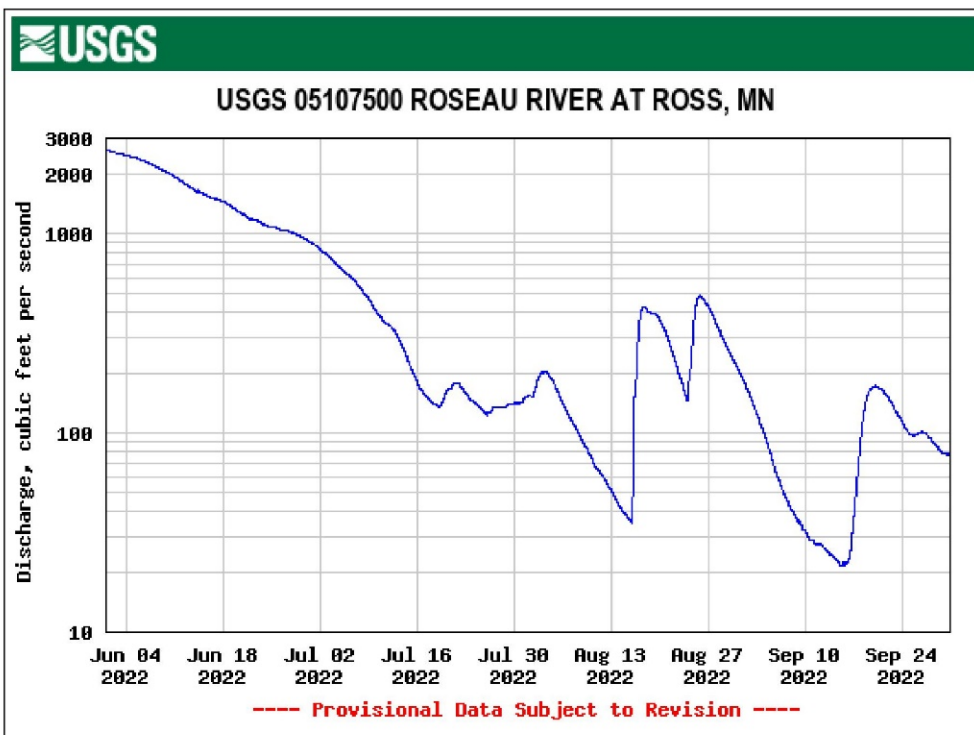
Station	Permanent R.O.W. Required
0+00 to 55+30	45'
55+30 to 82+00	35'
82+00 to 109+50	32'
109+50 to 110+85	45'
110+85 to 111+75	66'
111+75 to 121+50	40'
121+50 to 280+00	30'



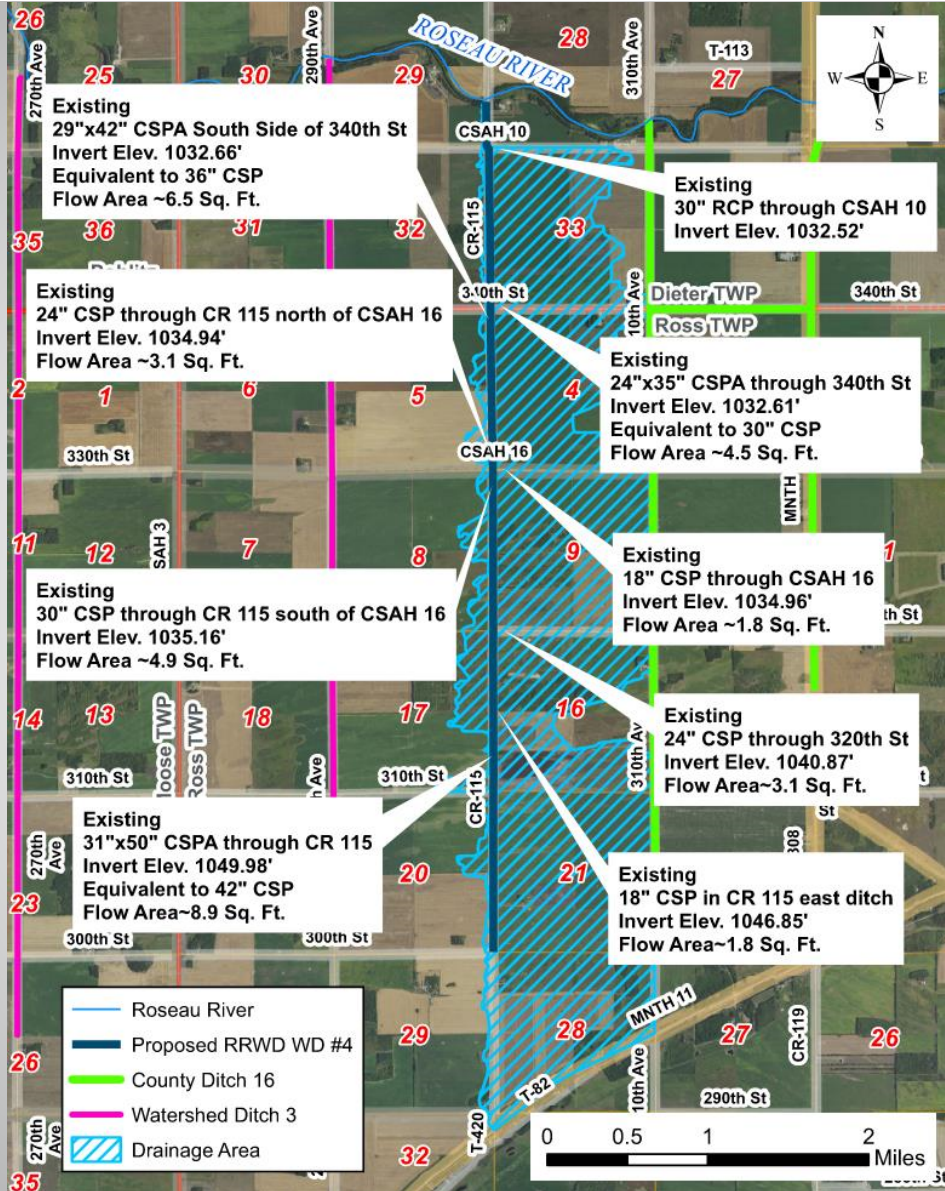
OUTLET CONSIDERATIONS

ROSEAU RIVER @ ROSS

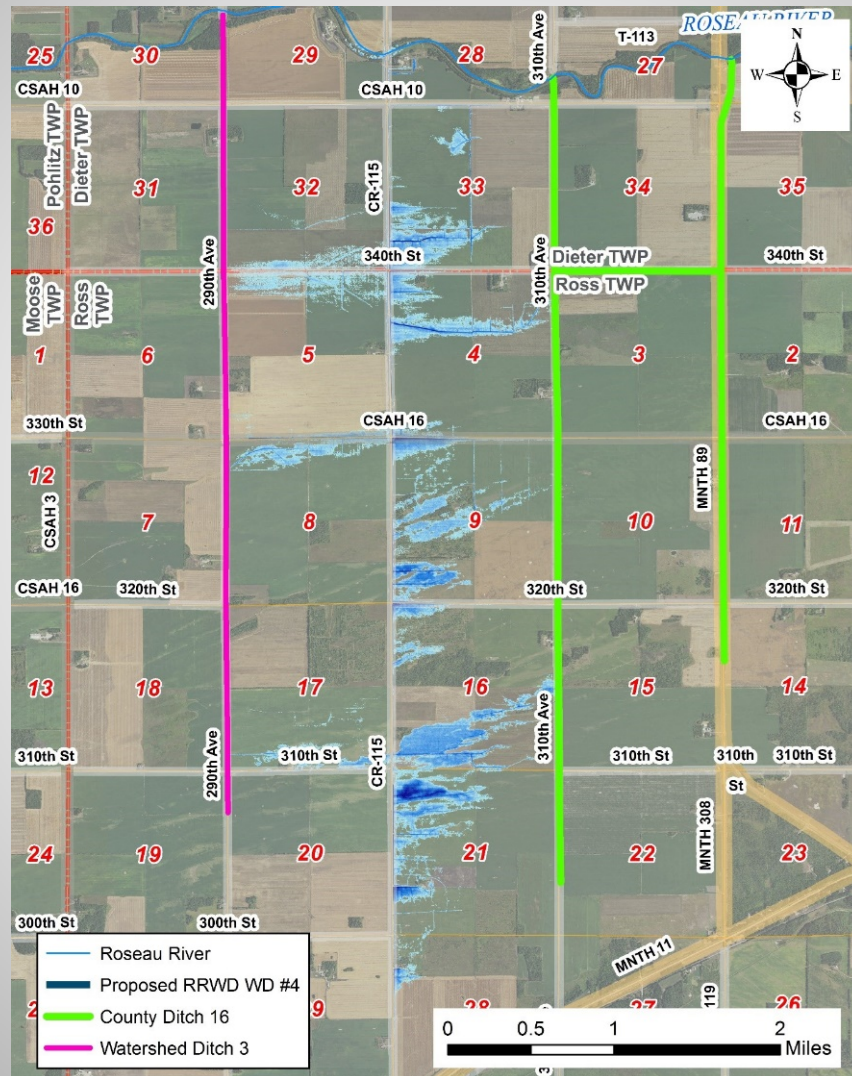
- 1 Year Event on River ~ 300 cfs
- 2 Year Event on River ~1,990 cfs / 1033' Elev.
- Bankfull capacity ~2,000 cfs / 1,033.9' Elev.



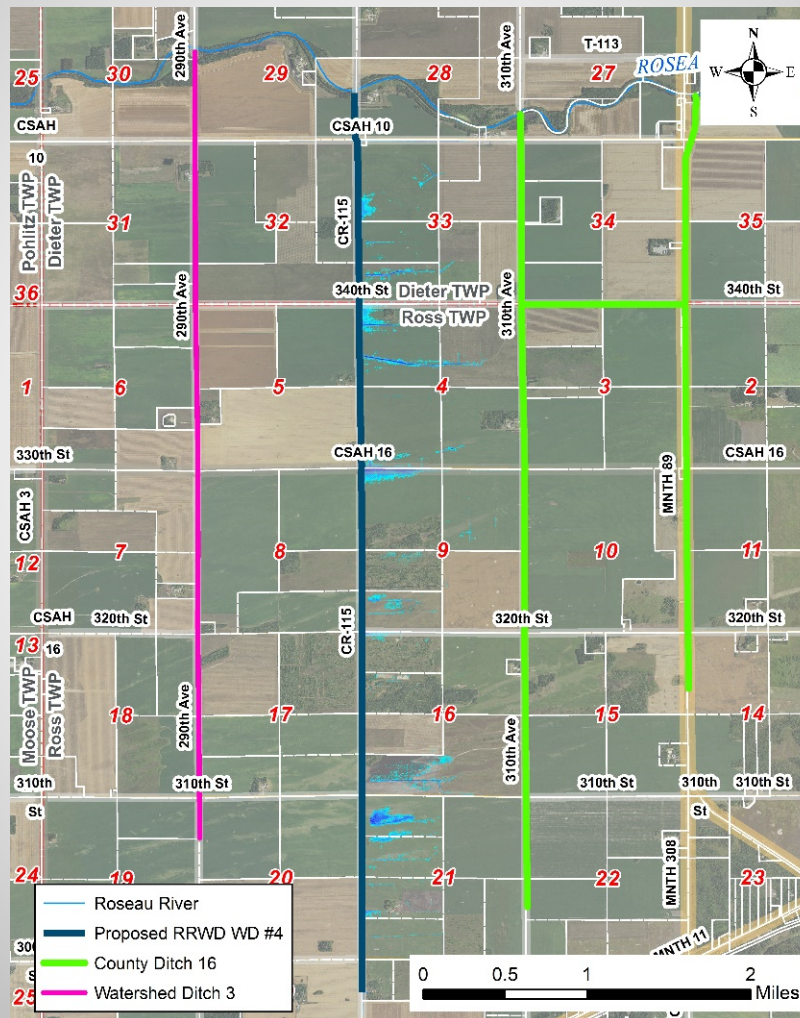
- Proposed 10 Year 24 Hour (3.3" Rainfall) Flow @ Outlet ~84 cfs
- Proposed 50 Year 24 Hour (4.9" Rainfall) Flow @ Outlet ~110 cfs

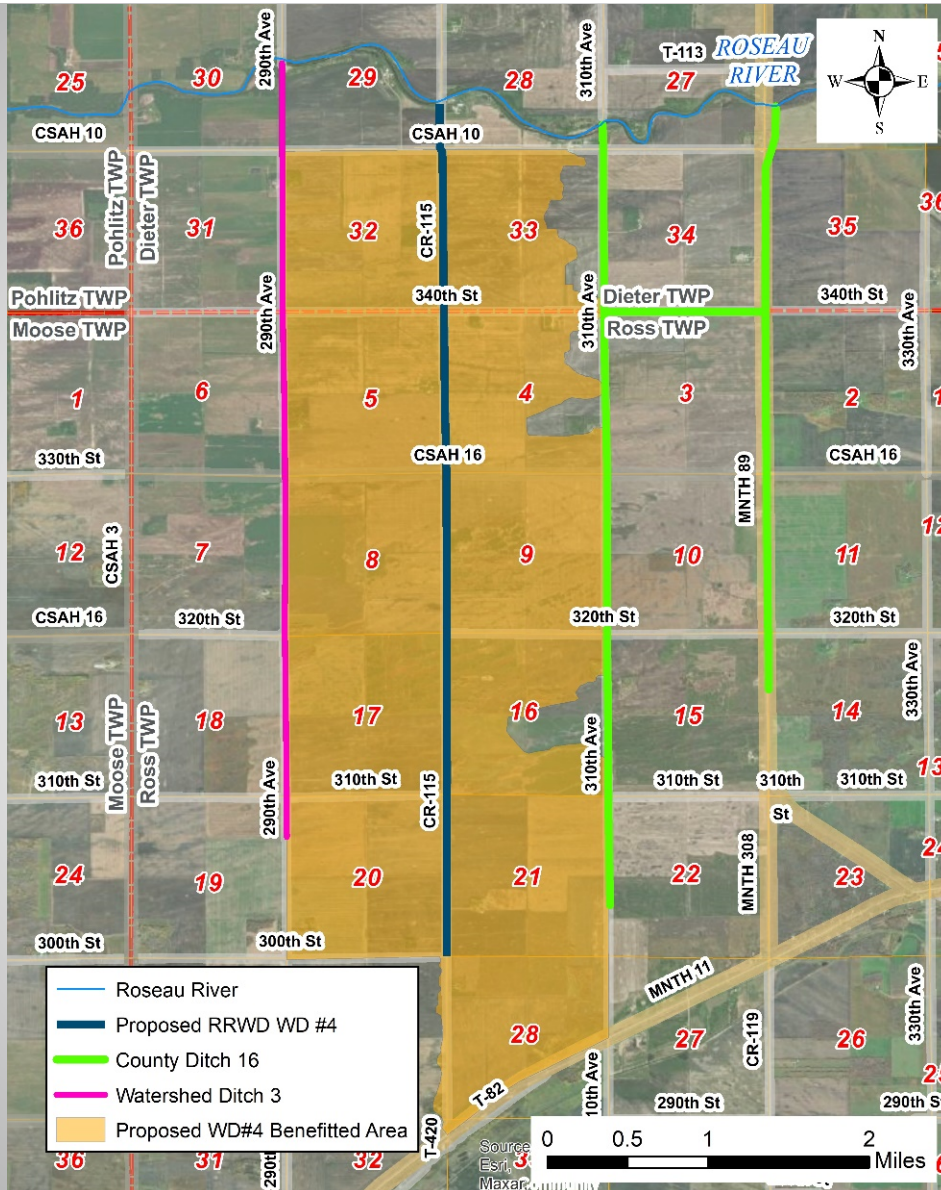


EXISTING 10-YEAR 24-HOUR (3.3") INUNDATION MAP



PROPOSED 10-YEAR 24-HOUR INUNDATION MAP 24 HOURS AFTER RAINFALL ENDS





ADDITIONAL CONSIDERATIONS

Permitting

- Impacts to wetlands adjacent to ditch will be addressed through permitting and mitigated
- Water quality is addressed through implementation of side water inlet pipes and buffer
- Project is not designed to improve fish and wildlife resources in the area and will not have a negative impact
- Project will not impact groundwater in the area

Construction

- Riprap aprons at culverts for permanent erosion control
- SWPPP will be implemented during construction
- Seed mix must be considered due to adjacent landuse and ag practices

ENGINEER'S ESTIMATE OF PROBABLE COST

Construction	Engineering & Admin	Utility Relocation	Right-of-Way	Temp. Right-of-Way	Total w/ Contingency
\$868,899	\$200,000	\$15,000	\$23,100	\$4,800	\$1,237,399

*Does not include BWSR Grant of \$160K

RECOMMENDATION

Proposed ditch is necessary and a public utility

Total benefits exceed the estimated costs

Benefits include:

- Flood Damage Reduction
- Roadway protection
- Increased agricultural production
- Increased land values
- Erosion control and water quality improvement by implementation of side water inlets and grass buffer

PROJECT PROCESS / NEXT STEPS

- ✓ Landowner Petition 5/5/2020
- ✓ Preliminary Survey Report 1/6/2021
- ✓ Preliminary Hearing 2/3/2021
- ✓ Landowner Meeting 2/9/2022
- ✓ Roseau County Highway Department Meeting 2/28/2022
- ✓ Viewing and Determination of Benefited Area 9/7/2022
- ✓ Detailed Survey Report 9/7/2022
- Final Hearing 10/25/2022
- Plans & Specifications
- Permits
- Construction
- Completion Hearing