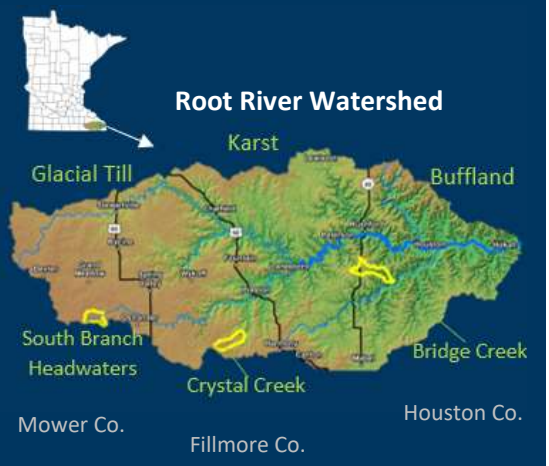
High Risk Runoff Areas



Field to Stream Partnership

The Root River Field to Stream Partnership is a multi-organizational effort to evaluate agricultural practices and water quality at multiple scales and landscape settings. The strategic selection of these study watersheds allows the findings to be applied to similar areas across southeastern Minnesota.

High Risk Areas

Small areas of a field or landscape can contribute a disproportionate amount of sediment and nutrient loss. Edge of field monitoring associated with the Root River Field to Stream Partnership provided a unique opportunity to measure soil and nutrient loss associated with this type of runoff and erosion.

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DEPARTMENT OF AGRICULTURE

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High Risk Runoff Areas (also called Critical Source Areas) are small areas of a field or landscape which contribute a disproportionate amount of contaminants in runoff. In some studies, it is suggested that 80% of the measured loss in a watershed can be associated with just 20% of the land area[1]. One example of a high runoff risk area is an ephemeral gulley.

Figure 1. Pictures of ephemeral gullies in early spring and late summer.

Ephemeral gullies are defined as small, visible channels eroded by concentrated flow that are filled by normal tillage, only to form again in the same location with additional runoff (Figure 1). Edge of field monitoring associated with the Root River Field to Stream Partnership provided a unique opportunity to measure soil and nutrient loss associated with this type of erosion.

Figure 2B shows the cumulative soil loss (delivery off the field) measured in surface runoff over a seven-year period (2011-2017) from four conventional tilled fields in southeast Minnesota. Fields 1, 2 and 3 had cumulative sediment loss rates between 4,000 lb/ac and 7,300 lb/ac. For perspective, typical rates of soil formation can range from 3,000 lb/ac to 7,000 lb/ac[2] every seven years and runoff monitoring conducted by MN/WI Discovery Farms have shown that no-till operations typically lose less than 1,500 lb/ac over a seven-year period. In contrast, Field 4 lost 23,000 lb/ac of soil which equates to three to seven times more than the estimated soil formation rate. Field 2 is a suitable comparison to Field 4 since it has similar soils, slope and cropping system (corn silage with manure). When compared to Field 2, Field 4 had three times more soil, two times more phosphorus and three times more nitrogen loss in surface runoff. Why did Field 4 have higher loss?

Figure 2A. June 2013 photo of ephemeral gully along the edge of an existing grassed waterway.

During the first three years, Field 4 had virtually no sediment loss. However, in 2013 the tables had turned. A series of rainfall events from April through June caused an ephemeral gully to form along the outside edge of an existing grassed waterway (Figure 2A). Once this gully had formed, it acted like a conveyer belt, which

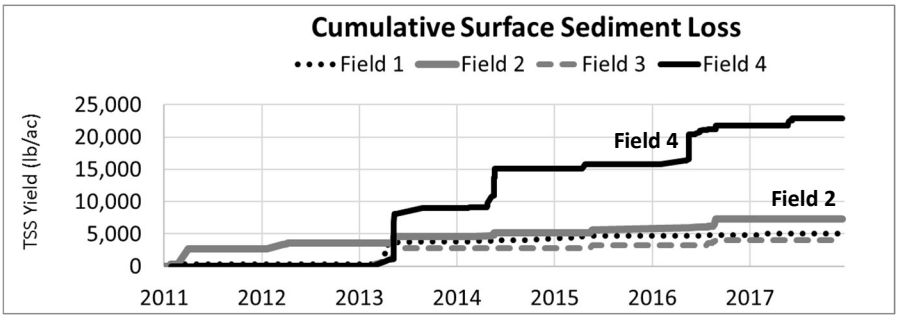


Figure 2B. Cumulative sediment loss over a seven-year period across four different fields. Field 4 had three times more sediment loss due to an ephemeral gully that developed in 2013 along an existing and poorly functioning grassed waterway.

[1] Pionke et al. 1997, 2000. [2] Alexander, 1988.

easily transported excessive amounts of soil and attached nutrients during subsequent rainfall events. With each tillage pass in the spring and fall, the gully was filled in, only to be exposed during the next runoff event.

NEW practices at Field 4

The farm operator at Field 4 recently rehabilitated this particular grassed waterway along with 17,000 additional feet of targeted grassed waterways on his farm. The waterway channels were reshaped with a bulldozer and re-seeded with sod-forming, cool season grasses. To further reduce soil movement and loss, the farmer installed a contour hay strip and upgraded his manure injection equipment to a low soil disturbance system and is trying cover crops. Monitoring will continue on this field to measure the increased performance of these conservation practices.

Figure 3. Before 2020 at Field 4- manure injection using high soil disturbance equipment. After 2020- low soil disturbance manure injection system.

Options for High Runoff Risk Areas

Grassed Waterways (412)

Prairie Strips (CP43), Filter Strip (CP21), Field Border (386), Conservation Cover (327), Contour Grass Strip (332)

No Till (329) and Cover Crops (340)

Water and Sediment Control Basins (638)

Contact your local SWCD/NRCS office for more information

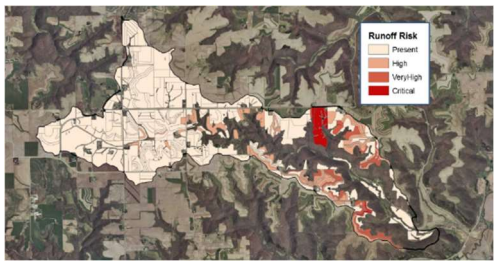
CLEAN WATER LAND & LEGACY AMENDMENT

Root River Field to Stream Partnership

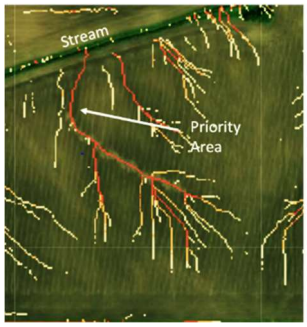
Minnesota Department of Agriculture
Minnesota Agricultural Water Resource Center
The Nature Conservancy
Mower SWCD
Fillmore SWCD
Root River SWCD

Top Tools to Address High Risk Runoff Areas

Runoff Risk- this tool uses detailed elevation information to help identify which fields have the highest runoff risk. Fields with the highest runoff risk have steep slopes and are in close proximity to a stream. In this example, one field with *Critical* runoff risk was identified in the Bridge Creek Watershed. As a result of this map and different conservation options, the landowner enrolled this 70-acre field into the Conservation Reserve Program. Additional grassed waterways and sediment control basins were also installed to protect the field when it transitions back to row crops.



The **Stream Power Index (SPI)** is a measure of the erosive power of flowing water. Think of high SPI values like conveyer belts that can easily transport soil and water contaminates (nitrogen, phosphorus, manure, or pesticides) off farm fields during snowmelt or rainfall events. Installing grassed waterways, prairie strips, or other conservation practices in areas with high SPI values can help reduce this risk. It may not be practical to address all SPI areas, so prioritize based on color (darker orange areas) and fields that have very high and critical runoff risk.



Now that you know which sites to target, wouldn't it be nice to predict when runoff is most likely to occur? The Minnesota **Runoff Forecast** tool is designed to help farmers and commercial applicators determine the best time to apply manure and fertilizers. This model accounts for current soil moisture, temperatures, forecast precipitation and snowmelt to predict the likelihood of runoff and runoff risk. Users can select different layers in the map to view the chances for runoff to occur in the next 24 hours or three days.