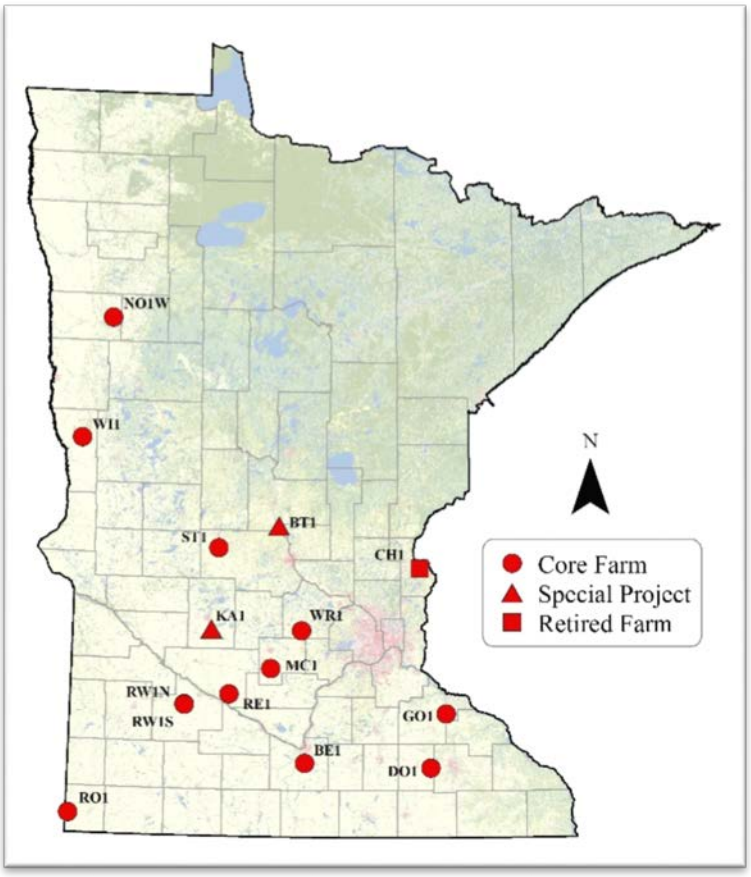
DISCOVERY FARMS MINNESOTA

# 2016 Year in Review

Discovery Farms Minnesota (DFM) is a farmer led water quality research and educational program. The mission of the program is to collect water quality information under real-world conditions to provide credible and practical information that supports better farm management decisions.

This factsheet summarizes data collected at core farms in water year 2016 (Oct 2015 through Sept 2016) to give a range of precipitation and runoff losses observed throughout the DFM monitoring network. In 2016, there were 10 core farm projects in Minnesota. Annual data is displayed in box plots which display the range of the data collected. The middle line in the box plots represents the median, a number at which half of the values are above and half of the values are below.

The data presented in this factsheet are generated from edge-of-field monitoring sites. Water quality monitoring results from edge-of-field monitoring sites are different than stream monitoring data and standards. Therefore, direct comparisons of the two types of data should not be made. The information presented is only from one year of data collection. Past Discovery Farms research has shown that runoff losses can vary greatly from year to year due to weather conditions, landscape characteristics and farm management practices. Final conclusions should not be made from this information, but rather these data should be used as a point of context for information gained in future years.



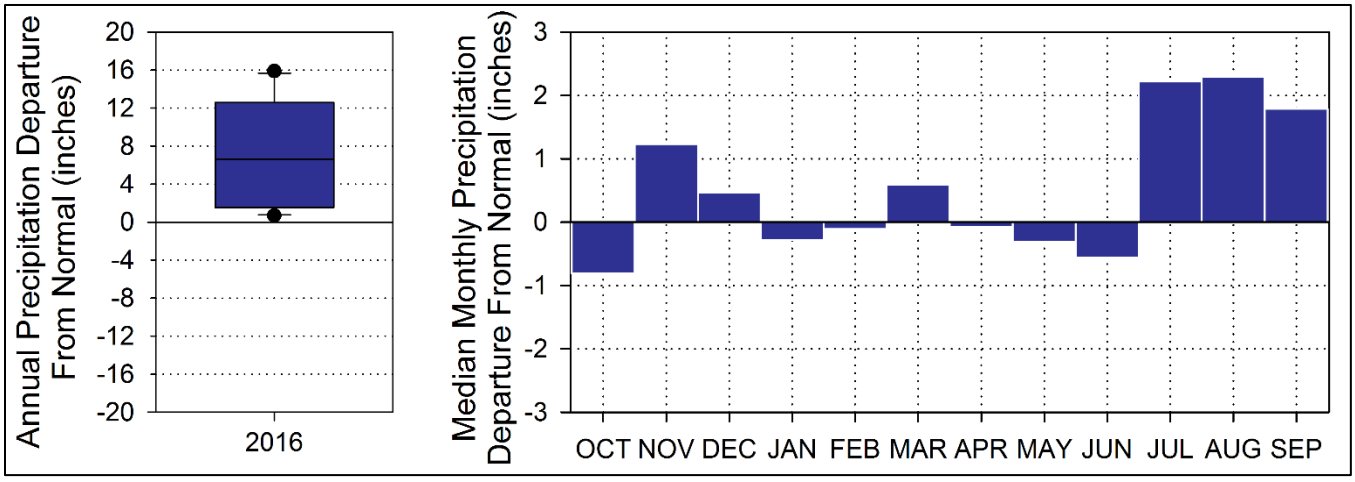

**DFM locations**

**Description of DFM core farm projects**

| Field ID | Farm Enterprise | Start of Project | Monitoring Setup | Soil Texture | Average Slope | 2016 Crop | Tillage | Manure History |
|---|---|---|---|---|---|---|---|---|
| GO1 | Swine farrow to wean and beef (corn-alfalfa) | Sep-10 | Surface runoff (6.3 acres) | Silt loam (well drained) | 6.7 % | corn | Fall chisel, spring field cultivator | Yes |
| ST1 | Dairy (corn-alfalfa) | Mar-11 | Surface runoff (28.2 acres) and tile drainage (24.2 acres) | Loam (poorly drained) | 4.1 % | alfalfa | Fall chisel, spring field cultivator | Yes |
| CH1 | Grain (corn-soybean) | Mar-11 | Surface runoff (6.1 acres) | Loam (well drained) | 3.4 % | soybean | No primary tillage | No |
| BE1 | Swine finishing and grain (corn-soybean) | Jun-11 | Surface runoff (14.3) and tile drainage (26.2 acres) | Silty clay loam (poorly drained) | 1.4 % | soybean | Fall chisel, spring field cultivator | Yes |
| WR1 | Dairy (corn-alfalfa) | Dec-11 | Surface runoff and tile drainage (23.9 acres) | Loam (poorly drained) | 4.7 % | alfalfa | Fall chisel, spring field cultivator | Yes |
| RE1 | Grain (corn-soybean/sweet corn-peas) | Dec-11 | Tile drainage (81 acres) | Clay loam (poorly drained) | 2.0 % | soybean | Fall plow or chisel, spring field cultivator | No |
| DO1 | Swine finishing and grain (corn-soybean) | Oct-12 | Surface runoff and tile drainage (13.9 acres) | Silt loam (poorly drained) | 2.9 % | soybean | Fall chisel, spring field cultivator | Yes |
| WI1 | Grain (corn-soybean) | Oct-12 | Tile drainage (160 acres) | Very fine sandy loam (poorly drained) | 1.1 % | wheat | Fall chisel, spring field cultivator | No |
| NO1W | Grain (sugar beet-corn-dry bean-soybean-wheat) | Oct-12 | Tile drainage (570.8 acres) | Fine sandy loam (poorly drained) | 1.0 % | corn | Fall chisel, spring field cultivator | No |
| RO1 | Beef and grain (corn, soybean, and alfalfa) | Oct-13 | Surface runoff (25.5 acres) | Silt loam (well drained) | 4.7 % | corn | Fall disk rip, spring field cultivator | Yes |

## PRECIPITATION

Median annual precipitation for DFM sites in 2016 was 6.63 inches above normal, with a range of 0.69 inches above normal to 15.88 inches above normal. Every farm had above normal annual precipitation. Precipitation in 2016 can be characterized by a slightly above normal fall heading into winter, slightly above normal snowfall, a dry April through June, and a wet July through September.

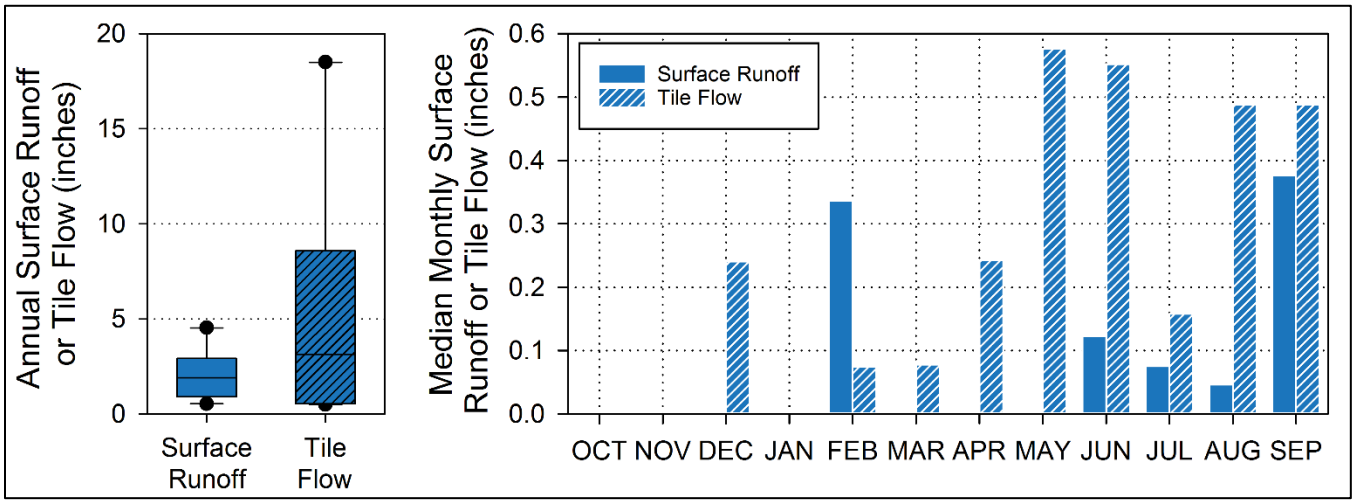



**Annual and monthly precipitation departure from normal**

## RUNOFF

Surface runoff and tile flow were higher in 2016 compared to past years. Median surface runoff in 2016 was 1.90 inches with a range from 0.53 to 4.53 inches. Across the DFM network, only 25% of the annual surface runoff occurred during frozen soil conditions, which is lower than in past years of DFM monitoring. There was little snowpack at most sites reducing the amount of frozen soil runoff. Most of the surface runoff occurred in February and September. Median tile flow was 3.14 inches with a range from 0.49 to 18.50 inches. Only 5% of the tile flow was observed during frozen soil conditions with most of the tile flow occurring from May through June and August through September.

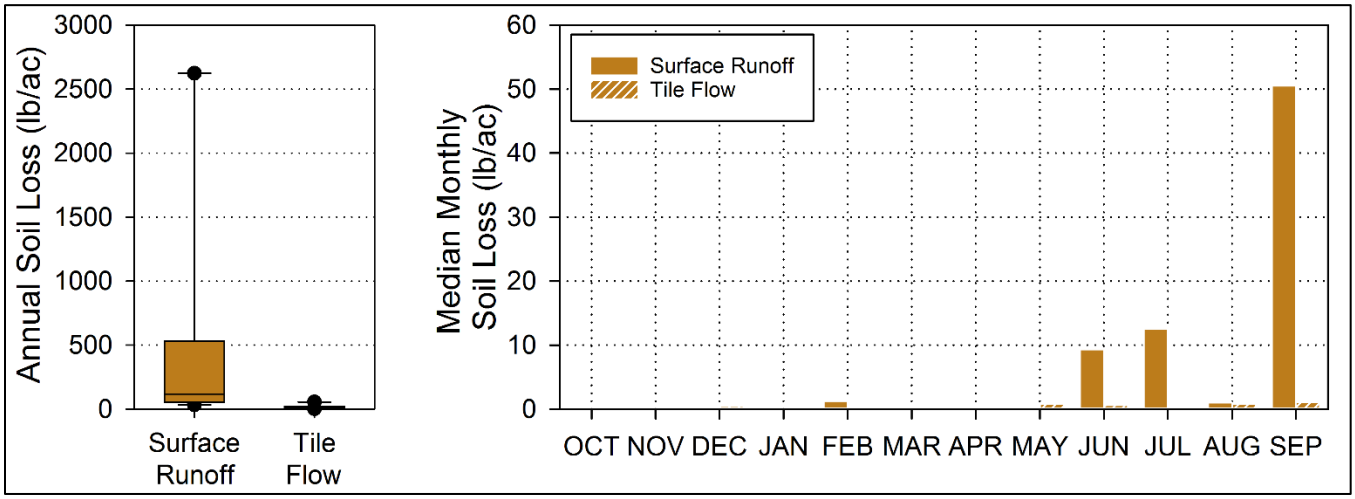
The median of 4% and 8% of the annual precipitation left the monitored fields as surface runoff and tile flow, respectively. Surface runoff was variable throughout the year with a median of 3 cumulative days of flow. Tile flow was more constant with a median of 183 cumulative days of flow.




**Annual and monthly surface runoff and tile flow**

## SOIL LOSS

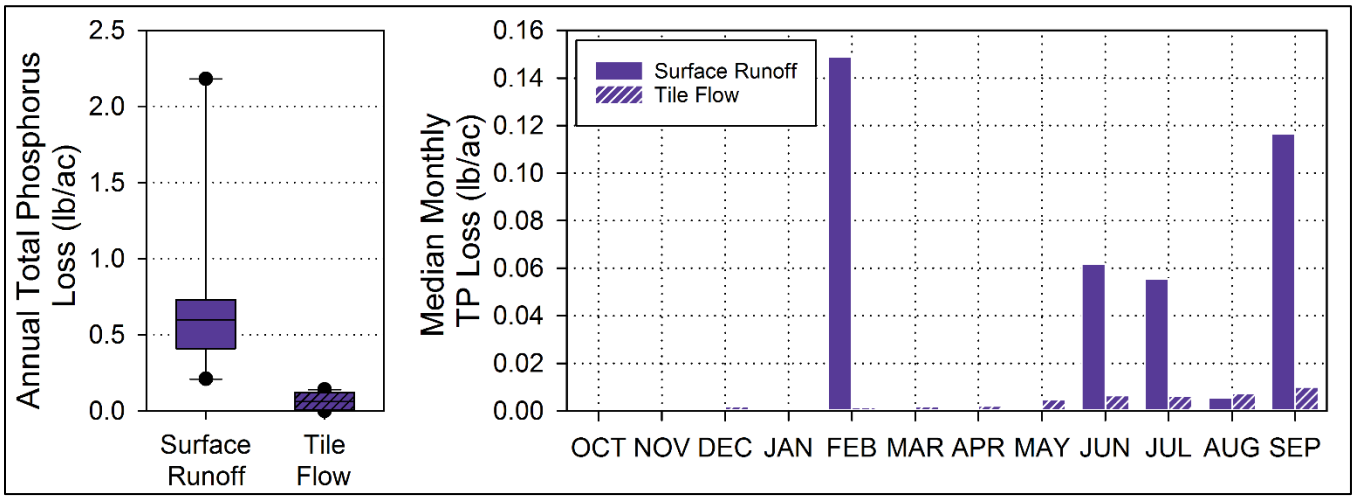
Soil loss is measured by total suspended solids (TSS), which are mineral and organic solids in water that can be trapped by a filter. Soil loss is driven by surface runoff during non-frozen soil periods. In 2016, soil losses were similar to past years even with above normal surface runoff. However, soil loss timing was different compared to past years. Usually, the time after planting until the crop canopy is established the most critical time for soil loss. Almost all the soil loss in 2016 was observed in September. Median soil loss from surface runoff in 2016 was 116 lb/ac with a range from 32 to 2623 lb/ac. Median soil loss from tile flow was 10 lb/ac with a range from 1 to 55 lb/ac.




**Annual and monthly soil loss**

## PHOSPHORUS LOSS

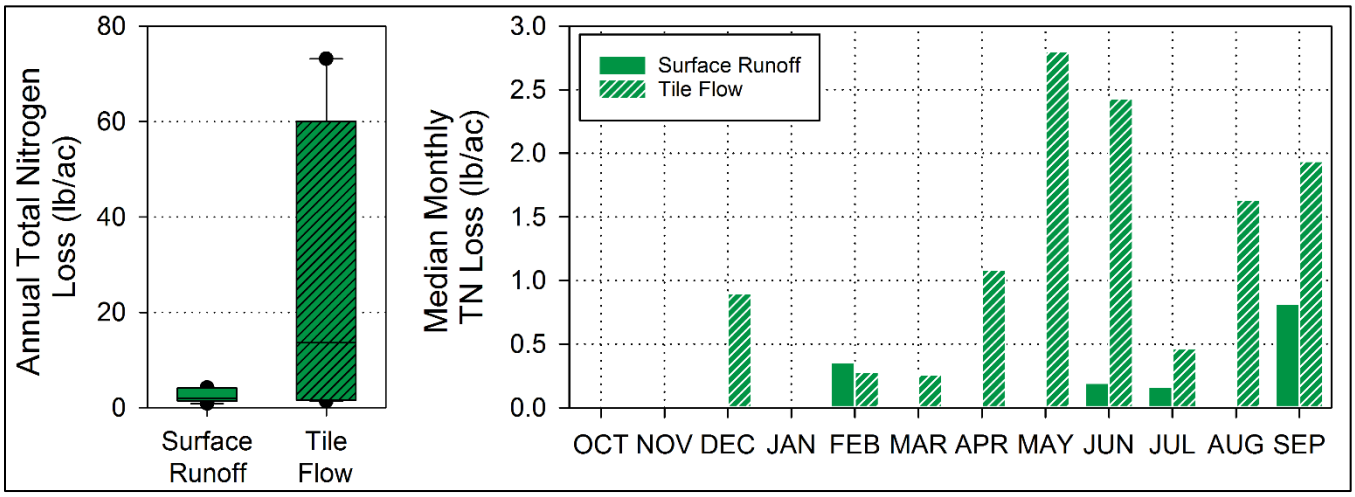
Total phosphorus (TP) refers to the combined total of particulate phosphorus, which is attached to soil particles, and dissolved phosphorus, which is not attached to soil particles. Surface runoff primarily drives phosphorus loss. Results from 2016 were similar to past years of DFM research, with total losses slightly above normal. Median TP loss from surface runoff in 2016 was 0.60 lb/ac with a range from 0.21 to 2.18 lb/ac. Fifty-seven percent of the surface runoff TP was in the dissolved form with 43% in the particulate form. Median TP loss from tile flow was 0.06 lb/ac with a range from <0.01 to 0.14 lb/ac.




**Annual and monthly total phosphorus loss**

## NITROGENLOSS

Total nitrogen (TN) refers to the combined total of nitrate nitrogen, ammonia nitrogen, and organic nitrogen. Tile flow primarily drives nitrogen loss. Median TN loss from surface runoff in 2016 was 2.02 lb/ac with a range from 0.86 to 4.20 lb/ac. Surface runoff losses were 76% organic N, 14% nitrate-N, and 10% ammonia. Median TN loss from tile flow was 13.58 lb/ac with a range from 1.34 to 73.15 lb/ac. Almost all the tile flow TN loss was in the nitrate-N form. Tile runoff losses were 7% organic N, 92% nitrate-N, and 1% ammonia. The timing of tile flow paralleled the timing of TN loss, with May through June and August through September being the most active. Total nitrogen concentrations in 2016 were lower compared to past years of DFM research; however, TN losses from 2016 were higher than past years because of increased amount of tile flow. Historically, the months of May and June have the most activity for total N loss.




**Annual and monthly total nitrogen loss**

## CONCLUSION

The data collected by the Discovery Farms program is building an understanding of actual surface runoff, tile flow, sediment loss and nutrient loss at the edge of field on representative farms across the state. While there are opportunities to improve soil and nutrient losses throughout the DFM network, many of the locations are doing an excellent job protecting water resources. Soil and phosphorus losses, which are surface runoff concerns, and nitrogen losses, which are a tile flow concern, are relatively low throughout the DFM monitoring network except for a few locations. The program will work to implement management practices to reduce soil, phosphorus, and nitrogen losses at those locations. The DFM program will continue to document the good practices that protect water quality while also helping identify areas for potential improvement.

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