Understanding Nutrient & Sediment Loss at Soaring Eagle Dairy - 3

Equipment, Procedures and Sampling

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Water Quality Monitoring

- To fully assess annual nutrient and sediment losses, the UW-Discovery Farms Program conducts year-round monitoring.
- Partnership between producers, UW – Extension and United States Geological Survey (USGS).

Water Quality Monitoring

- Equipment was selected and procedures developed and implemented that provide high-quality, agricultural runoff and water quality data during the full range of weather conditions.

Water Quality Monitoring

- Personnel from the U.S. Geological Survey Wisconsin Water Science Center worked cooperatively with the Discovery Farms Program to collect hydrologic and water quality data from the small watershed site located on Soaring Eagle Dairy (SED) from December 2004 to October 2006.

Monitoring Equipment at Soaring Eagle Dairy

Monitoring Stations

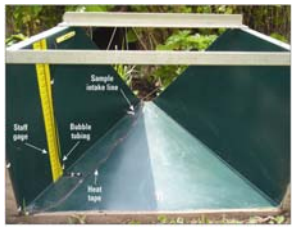
- An aluminum, clam-style enclosure was used to house equipment designed to measure flow (discharge), collect water samples and provide two-way communications that facilitated data collection and real-time programming.

Monitoring Stations

- A solar panel powered equipment and a digital camera was programmed to take one photograph each day to track field conditions.
- The aluminum enclosure was locked with a padlock to prevent unauthorized access.

Monitoring Stations

- A 2.5-foot pre-rated, fiberglass H-flume was selected to measure surface water runoff volume (discharge) based on this drainage area and the general terrain.



Monitoring Stations

- The flume was attached to a thick sheet (¾-inch) of treated plywood, installed perpendicular to the flow in the intermittent stream.
- The wing wall was designed to funnel all the surface water through the flume so the discharge could be measured.

Monitoring Stations

- A non-submersible pressure transducer, coupled with a nitrogen bubbler system, was used to monitor the water level in the flume.
- The system transmits nitrogen gas at a known rate and pressure through 3/8 inch black bubble tubing.

Monitoring Stations

- The end of the bubble tubing was attached to the floor of the flume.
- Water levels measured by the system were then recorded by a datalogger. Since the flume was pre-rated, discharge could be directly calculated from measurements of water level.

Monitoring Stations

- Heat tape was attached to the bottom of the H-flume to reduce or prevent ice from forming near the bubble tubing, sample-intake line tip and flume exit.
- Maximum peak water levels were also verified via a cork on a measuring tape in a standpipe.

Monitoring Stations

- An automated, refrigerated, 24-bottle ISCO® 3700R sampler was used to collect surface water runoff samples.

Monitoring Stations

- A Campbell Scientific CR10X datalogger with a custom USGS program was used to remotely read and store sensor data and control station equipment.

Sample collection

- A runoff event was defined as the time from the onset of rainfall- or snowmelt-induced surface water runoff to the time when runoff ceased.
- Sampling frequency during a runoff event was controlled and adjusted by the datalogger at each station.

Sample collection

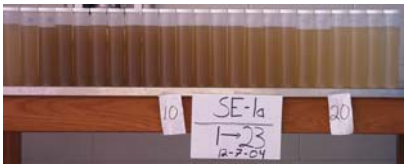
- With remote communication, the datalogger program was modified to adjust for changing weather and storm runoff characteristics to prevent filling the 24 sample bottles before the end of an event or not filling enough sample bottles to properly characterize water quality.

Sample collection

- Water samples were generally retrieved within 24 hours of the end of a runoff event.
- Upon collection, sample quantity and appearance was recorded, and equipment accuracy was checked and noted.

Sample collection

- Samples were labeled, placed in coolers with ice and transported to the UW-Stevens Point Water and Environmental Analysis Lab (WEAL) for analysis.



Sample collection

- Water samples were taken with a goal of achieving a good sample distribution during runoff events. Samples were recombined in the lab so that one representative sample could be analyzed for each event.

Sample collection

- The lab tested for the following parameters:
  - suspended sediment and total dissolved solids
  - nitrogen: nitrate/nitrite, ammonium and total kjeldahl nitrogen unfiltered
  - phosphorus: total P unfiltered and dissolved reactive P
  - chloride
  - conductivity
  - pH

Sample collection

- The equipment & methods proved to be reliable, flexible and versatile enough to collect accurate runoff data in a wide range of conditions and landscape positions.
- Use of the USGS NWIS database assured long-term storage and allows users to view and retrieve the collected data through the web interface.

Maintenance

- Maintenance was vital to accurately measure the annual quantity and quality of surface water runoff from the monitoring station.

Maintenance

- During spring, summer and fall, the station was periodically maintained by mowing around the gauge and along the wing wall.

Maintenance

- The flumes were surveyed with an autolevel at least twice per year to determine if adjustments to the water level-discharge relation were necessary.

Maintenance

- More maintenance was needed for monitoring during winter than for the rest of the year.
- During winter, snow and ice could fill the H-flume and downstream channel, causing backwater conditions if runoff occurred.

Maintenance

- Frequent maintenance visits were necessary to keep the flume free of ice and snow and to provide maintenance for other equipment.
- Snow and ice were removed from the H-flume prior to anticipated wintertime runoff events. In most cases, a trench was dug in the snow upstream and downstream of the H-flume.

Maintenance

- Freezing temperatures also required extra maintenance.
- Frequent visits were necessary to remove ice prior to the next surface water runoff event.

Additional Information

- *Additional information on problems with flume freezing and overtopping can be found in the Water Budget at Soaring Eagle Dairy – Part 4.*

Additional Information

- *For more detailed information on sampling materials and methods see:*

  Methods of Data Collection, Sample Processing, and Data Analysis for Edge-of-Field, Streamgaging, Subsurface-Tile, and Meteorological Stations at Discovery Farms and Pioneer Farm in Wisconsin, 2001–7.

  http://wi.water.usgs.gov/pubs/index.html.

Information Available

- There are six factsheets available on SED.
- There are six briefs available on SED (2 page summaries of the factsheets).
- There are six presentations available on SED.

http://www.uwdiscoveryfarms.org

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