Analysis of Nonpoint Source Pollution in the Galien River Watershed

Galien River Steering Committee Meeting

December 6, 2004
Galien River Watershed

- **Nonpoint Source (NPS) Pollutants of Concern**
  - *E. coli*
  - Sediment
  - Nutrients
  - Obstructions and debris
  - Altered hydrology
  - Chemicals
  - Increased temperatures
  - Invasive species
  - Urban storm water runoff
Definition of Sediment Pollution

- Sediment pollution is an excessive amount of organic and inorganic particles entering the stream system.
- Sedimentation is the act or process of depositing sediment.
Why Sediment is a Problem

- Decreases sunlight penetration impacting plant growth
- Absorbs heat, warming up the water body
- Reduces dissolved oxygen
- Covers fish spawning grounds, decreasing fish production
- Covers insect habitat decreasing food source
Sources of Sediment

- Known Sources
  - Agricultural runoff
  - Construction sites
  - Gully erosion
  - Road/stream crossings
Causes of the Sources of Sediment

- Known Causes
  - Conventional tillage practices and livestock/vehicle access
  - Lack of proper soil erosion and sedimentation control (SESC) practices
  - Lack of filter strips and stabilized outlets
  - Lack of maintenance and improperly managed stormwater
Unrestricted Livestock Access
Lack of Stabilized Outlets
### Sediment Loadings and Reductions

#### Agricultural Runoff

<table>
<thead>
<tr>
<th>Contributing area (Agricultural land within watershed)</th>
<th>Soil loss before treatment (RUSLE - using 10% cover)</th>
<th>Area of conservation tillage (Soils with erosion rate above “T”)</th>
<th>Soil loss after treatment (RUSLE - using 30% cover)</th>
<th>Tillage sediment reduction [\left(\text{Soil loss before - soil loss after}\right) \times \text{delivery ratio}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>35,217 acres</td>
<td>86,918 tons/year</td>
<td>11,576 acres</td>
<td>69,588 tons/year</td>
<td>8,665 tons/year</td>
</tr>
</tbody>
</table>
## Sediment Loadings and Reductions

**All NPS Sites**

<table>
<thead>
<tr>
<th>Total soil loss before treatment&lt;br&gt;(Existing soil loss before best management practices (BMPs) implemented)</th>
<th>Total soil loss after treatment&lt;br&gt;(Soil loss after BMPs implemented)</th>
<th>Total sediment reduction&lt;br&gt;(Reduction in sediment loading as a result of BMPs implemented)</th>
</tr>
</thead>
<tbody>
<tr>
<td>87,242 tons/year</td>
<td>69,588 tons/year</td>
<td>8,989 tons/year</td>
</tr>
</tbody>
</table>
What Actions Need to be Taken

• Goal
  • Prevent soil erosion and reduce sedimentation in river and streams

• Objectives
  • Encourage cover crops
  • Promote no-till farming
  • Review SESC inspection and enforcement
  • Increase use and quality of filter strips and windbreaks
  • Improve degraded habitats
  • Stabilize tile outlets and road crossings
What Actions Need to be Taken

• Structural and Vegetative BMPs
  • Conservation tillage practices
  • Livestock exclusion fencing and stabilized crossings
  • Stream buffers/filter strips
  • Streambank stabilization (bioengineering)
  • Culvert and bridge improvements
  • Stabilized tile outlets (berm and tube)
  • Debris/obstruction management
What Actions Need to be Taken

- Managerial BMPs
  - Turf management
  - Ordinance development and enforcement
- Community Outreach Program Implementation
Definition of Nutrient Pollution

Although nutrients, like nitrogen and phosphorus, are essential to aquatic plant life, an excess of these nutrients can be harmful. This is called "nutrient pollution."
The Nitrogen Cycle

- Gaseous Loss to Atmosphere (N₂, N₂O, NO)
- Precipitation
- Fossil Fuel Combustion
- Organic Residues
- Livestock & Sewage Waste
- Fertilizer
- Plant Uptake Organic N (R-NH₂)
- Mineralization
- Natural Fixation
- Denitrification
- Nitrates (NO₃⁻)
- Nitrites (NO₂⁻)
- Nitrification
- Leaching

- Ammonium (NH₄⁺)
Why Excessive Nutrients are a Problem

- Excess amounts of nutrients cause algal blooms
- Blooms reduce the amount of available sunlight
- The loss of sunlight can kill the bloom
- Decay of the bloom depletes dissolved oxygen
- Fish and other species will die unless they move to other areas of suitable habitat
- Excessive nitrates leaching to groundwater can be harmful to humans and livestock
Sources of Excessive Nutrients

- Known Sources
  - Fertilizer applications
  - Human and animal wastes
  - Yard waste
Fertilizer Runoff
Yard Wastes
Causes of the Sources of Excessive Nutrients

- Known Causes:
  - Improper and excessive fertilizer application
  - Failing septic systems
  - Leaking manure storage areas
  - Improper disposal of yard wastes
  - Lack of buffer strips
# Nutrient Loadings and Reductions

## Agricultural Runoff

<table>
<thead>
<tr>
<th>Contributing area (Agricultural land within watershed)</th>
<th>Phosphorus and nitrogen content before treatment (RUSLE - using 10% cover)</th>
<th>Area of conservation tillage (Soils with erosion rate above “T”)</th>
<th>Phosphorus and nitrogen content after treatment (RUSLE - using 30% cover)</th>
<th>Phosphorus and nitrogen reduction (Before Content - After Content)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35,217 acres</td>
<td>55,445 lbs P/year 110,891 lbs N/year</td>
<td>11,576 acres</td>
<td>46,694 P lbs/year 93,388 N lbs/year</td>
<td>8,751 lbs P/year 17,502 lbs N/ year</td>
</tr>
</tbody>
</table>
## Nutrient Loadings and Reductions

### All NPS Sites

<table>
<thead>
<tr>
<th>Before phosphorus and nitrogen content (Existing nutrient content before best management practices (BMPs) implemented)</th>
<th>After phosphorus and nitrogen content (Content reduction after BMPs implemented)</th>
<th>Phosphorus and nitrogen reduction (Reduction in loading as a result of BMPs implemented)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55,721 lbs P/year 111,442 lbs N/year</td>
<td>46,694 lbs P/year 93,388 lbs N/year</td>
<td>9,027 lbs P/year 18,053 lbs N/year</td>
</tr>
</tbody>
</table>
What Actions Need to be Taken

• Goal
  • Reduce nutrient (primarily phosphorus) loading

• Objectives
  • Increase use of filter strips and cattle exclusion fencing
  • Use integrated crop management
  • Practice better manure utilization
  • Address residential septic systems
  • Provide educational brochures
What Actions Need to be Taken

• Structural and Vegetative BMPs
  • Cover crops
  • Livestock exclusion fencing
  • Drop structures, weirs, and stone spillways
  • Geotextile vegetated chutes
  • Stabilized tile outlets (berm and tube)
  • Stream buffers/filter strips
  • Debris/obstruction management
What Actions Need to be Taken

• Managerial BMPs
  • Wetland restoration
  • Turf management
  • Ordinance development and enforcement

• Community Outreach Program Implementation
  • Volunteer cleanups
Next Steps

- Evaluate pollution loading and reduction calculations
- Set goals for pollution reductions
- Assess recommended BMPs
- Restate goals and recommendations for watershed
- Develop monitoring plan for long-term evaluation of watershed
The Galien River Watershed