Reuse of Stormwater for Irrigation of Municipal Ballfields in Centerville, Minnesota

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Key Resource to Protect: Centerville Lake
Downtown Redevelopment
RCWD Rules

Rate Control
• No increase from existing for 2-year and 100-year events

Water Quality and Volume Control
• Infiltrate 0.8 - 2.8 inch event, depending on site conditions
• Alternative sequencing if infiltration is infeasible
Options

• Stormwater ponding
Options

- Stormwater ponding
- Infiltration features
Options

- Stormwater ponding
- Infiltration features
- In-line treatment devices

Options

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- Underground storage
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- Infiltration features
- In-line treatment devices
- Underground storage
- Stormwater reuse
Selected Option: Stormwater Reuse for Irrigation of Laurie LaMotte Park Ballfields
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Advantages of Stormwater Reuse Option

• Saves space in downtown redevelopment area vs. stormwater ponds or infiltration features
• Provides needed irrigation system to ballfields with “free” water
• Reduces stress on aquifer from irrigation demands
• Keeps stormwater on the land – reduces runoff peaks and volumes
• Protects quality of Centerville Lake
Questions to be Answered

• Is the stormwater safe for use in a city park?
• Will the stormwater kill turf grass due to high salinity?
• Will the sprinkler system clog from sediment in the stormwater?
• What if the pond water for irrigation runs out?
• What permit requirements need to be met?
Is the stormwater safe for use in a city park?

- Water quality tests on pond water and sediment – fecal coliforms, heavy metals, PAHs, volatile organics, pH, chloride, Legionella
  - Results below MnDNR standards for swimmable waters
- Soil testing in ballfields to establish baselines – heavy metals, PAHs, volatile organics, pH, chloride
  - Results below Health Department guidelines
- Will continue to test periodically
Will the stormwater kill turf grass due to high salinity?

- Chloride levels in pond water did not indicate problem
- City will incorporate best management practices to reduce risk
  - Sprinkling protocols
  - Fertilizer formulas
Will the sprinkler system clog from sediment in the stormwater?

- Learned from practices in golf course industry
- Pond and intake designed to minimize sediment in irrigation system
- Sprinkler heads selected based on performance under these types of conditions
What if the pond water for irrigation runs out?

• Pond designed with capacity for three weeks of operation with no rain
• City’s potable water system can be used to refill pond – without direct interconnection between potable water system and irrigation system
What permit requirements need to be met?

- MnDNR Water Appropriations permit was needed
- Future permit requirements? TBD
- At the same time, the project helped meet (and exceed) RCWD requirements
System Design

• Components of system
  – Pond
  – Intake
  – Supply line
  – Pump and wet well
  – Controls
  – Irrigation system
System Design: Pond

• No immediate modifications to pond
• Future improvements to pond to increase storage capacity

• Floating dock section for use in inlet screen maintenance
System Design: Intake

- Important to keep inlet clean
- Designed for inlet velocities of less than 0.5 fps
- Well screen utilized to keep aquatic life out (frogs, etc.)
- Fabric/Rip Rap/Sump to keep sediment and vegetation out
System Design: Supply Line

- HDD used to avoid prairie plantings and deep cuts in County Regional park
- HDD used to avoid prairie plantings and deep cuts in regional park
- Flat grade used to avoid sediment build-up at low point in line
System Design: Pump and Wet Well

- City reused existing well control panel
- System utilizes city-owned well pump that was no longer being used
- Wet well was installed like a standard water supply well
System Design: Controls

- Keep it simple
- Pump is triggered by drop in pressure
- Sprinklers are opened by standard irrigation control system creating pressure drop
- System has ability to add moisture probe and wind gauge
System Design: Gun-Style Irrigation System

- Let’s see it work!
- 200’ spray radius
- 400 gpm @ 100 psi
- Just 7 irrigation heads cover 11 acres of ballfields

- 50% less capital cost vs. traditional
## Project Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pond, intake, supply line</td>
<td>$125,000</td>
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<tr>
<td>Pump, wet well, controls</td>
<td>$52,000</td>
</tr>
<tr>
<td>Irrigation system</td>
<td>$52,000</td>
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<tr>
<td>Design, administration</td>
<td>$40,000</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$269,000</strong></td>
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</tbody>
</table>

1. City reused existing pump and control panel
2. Funding sources: City of Centerville, Clean Water Legacy Fund, RCWD
System Maintenance

- A lot is yet to be determined
- Examine and clean (if necessary) inlet screen
- Treat well pump like any other well pump
- Treat irrigation system like any other irrigation system
Results and Conclusions

• System is fully operational and was successful throughout the summer
• At the very end of this year’s drought, the city did fill the pond with their water supply. However, the pond lasted longer than the estimated 3 weeks without rain.
• Volume used is to be monitored over a 3-year period for use in determining actual volume credits through RCWD
• Don’t be afraid to try something new
Questions?

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Taft Lake Watershed Regional Stormwater Treatment Partnership

A cooperative venture between the Minnehaha Creek Watershed District and the City of Richfield
Partnership Financial Features

Minnehaha Creek WSD commitment
• $2.7 million funds for capital improvement

City of Richfield commitment
• $3.0 million of 20-year O&M
• City willing to bond for project to spread MCWD costs over time
Area Treated by Water Quality Improvement Project

1,600 acres treated

Fully developed

$2.7 million
What is a Regional Approach?

Centralized treatment (not site by site) using the full spectrum of treatment options:

Active:
- Irrigation
- Flocculation*
- Infiltration pipes

Passive
- Buffers
- Sumps
- Ponds

* Flocculation, in the field of chemistry, is a process wherein colloids come out of suspension in the form of floc or flakes by the addition of a clarifying agent.
Regional vs. Site by Site Approach

Regional (centralized)
• Public (long-term)
• Immediate results
• Entire area treated
• Public maintenance

Site by site (piecemeal)
• Private (mostly)
• Delayed results
• Fragmented treatment
• Private (no?) maintenance
Regional vs. Site by Site Approach (continued)

**Regional (centralized)**
- Measurable results
- Wellheads protected
- Economy of scale
- Compatible land use
- Long-term planning

**Site by site (piecemeal)**
- Fragmented measurement
- Little control of wellheads
- Small-scale inefficiency
- Maybe incompatible land use
- Defies planning
Richfield – 1950s: *Wells and Septic Systems*
Richfield Urbanization: *Centralized Infrastructure*

- Met the post-WWII housing need
- Not viable long-term water and septic solution
- 1950s – built centralized sewer system
- 1960s – built centralized water system
- 1970s – built all residential streets
- 1980s – retrofitted 100-year flood protection
- 2013 – build centralized surface water treatment
High or very high Vulnerability Drinking Water Supply Management Areas

Richfield
Project Elements

- Water reuse irrigation system
- Water reuse infiltration system
- Habitat enhancement – shoreline buffers
- Grit chambers
- Flocculation treatment
Stormwater Reuse Irrigation

- Install irrigation systems in Veterans Park/Taft Lake Park
- Operate systems for up to 30 weeks
- Systems can annually reduce:
  - Runoff volumes by 14-40 acre-ft
  - Total phosphorus loadings by 17-50 lb
Stormwater Reuse Infiltration

• Install infiltration/drain tile systems in Veterans Park/
  Taft Lake Park
• Operate system for up to 180 days
• Systems can annually reduce:
  – Runoff volumes up to 240 acre-ft
  – Total phosphorus loadings up to 216 lb
Native Wetland Buffer Plantings

- Reduce phosphorus loadings by 2-8 lb
- Enhance habitat for wide range of benefits
Construct Grit Chambers

- Will remove sediment prior to discharge into Legion Lake
- Reduce coarse phosphorus load by 10-30 lb
Flocculation Treatment System

• Construct/install intake and outfall pipes, pumps, storage tanks, metering systems, controls
• Treats water to an extremely high quality standard
• Removes soluble phosphorus
• Reduces total phosphorus loading by 40-160 lb/year
• Treats water from 1,600 acres
• Less than one acre of land used
# Potential Annual Load Reduction for Proposed Improvements

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Annual Reduction (pounds)</th>
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<tbody>
<tr>
<td>Water Reuse Irrigation System</td>
<td>17 to 50</td>
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<tr>
<td>Water Reuse Infiltration System</td>
<td>108 to 216</td>
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<tr>
<td>Habitat Enhancement</td>
<td>2 to 8</td>
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<tr>
<td>Construct Grit Chambers</td>
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<tr>
<td>Reduction of Impervious Surface</td>
<td>1</td>
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<tr>
<td>Flocculation Treatment</td>
<td>40 to 160</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>167 to 413</strong></td>
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Taft/Legion Regional Partnership: Creativity & Leadership

• Technical
  – Active and passive treatment methods
  – Treating the lake itself, but not in-lake treatment

• Bureaucratic
  – Regional concept
  – Multi-agency: MAC, MnDOT, Hennepin County, MPCA, DNR

• Financial
  – City sells bond, MCWD makes payments
  – Spread costs over the life of the project