City of Madison – Public Information Meeting

Enhanced Phosphorus Removal from Stormwater –East Branch Starkweather Cr. Project

July 21, 2016

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Topics

- Project Background & Setting
- Project Purpose and Goals
- Project Specifics – Feasibility Study
  - Background Analysis
  - Project Components
  - Next Steps
- Discussion & Questions

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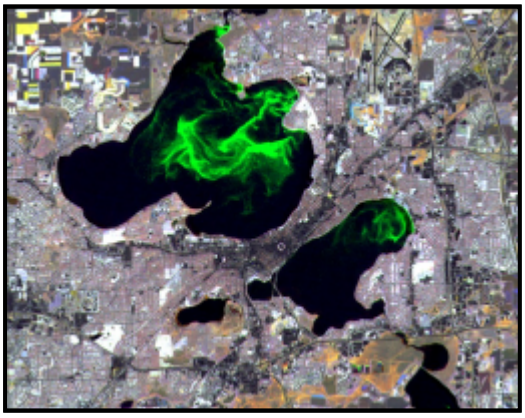
Project Background, Setting & Goals

Greg Fries; City of Madison

Starkweather Creek Phosphorus Treatment System

Project Background



Despite decades of pollution management – lakes still become hyper-eutrophic

Project Background

Rock River Basin TMDL:

- Completed in 2011

Madison Stormwater Requirements:

- Phosphorus Reduction of ~ 14,000 lbs./yr.
- = 55 % City-wide Reduction from Stormwater

Background – Why Propose Coagulant Treatment for Stormwater?

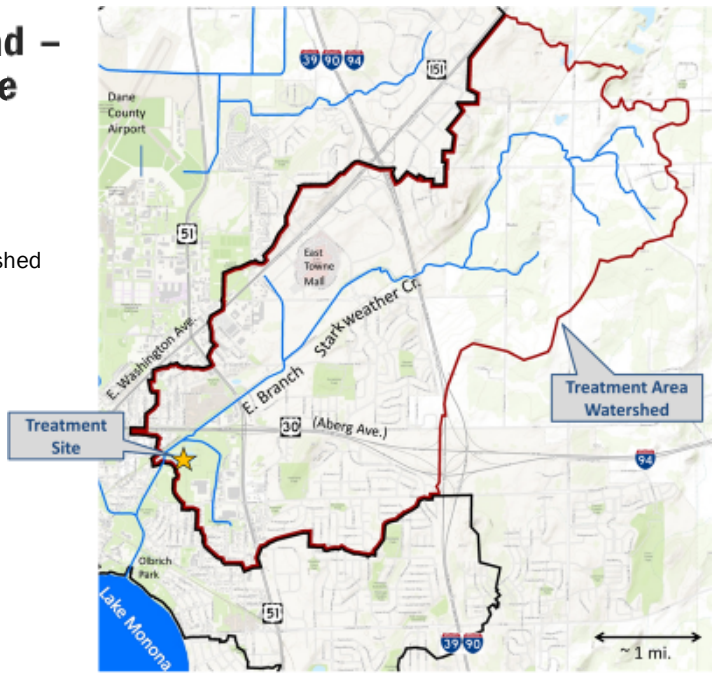
- Ponds are expensive. Example: $1.2 million for recent pond
  - Removes ~ 225 lbs. of phosphorus / year
  - ~ $300/lbs./year (does not include land or maintenance)
  - Modest phosphorus removal (~ 40% - 50%)
  - Land opportunities are limited for large ponds
- City is partnered with Madison Met. Sewerage District in Yahara WINS, however …
- Many tools will be needed to address the phosphorus reduction needs – this is an important "piece of the puzzle"

Background – Project Site

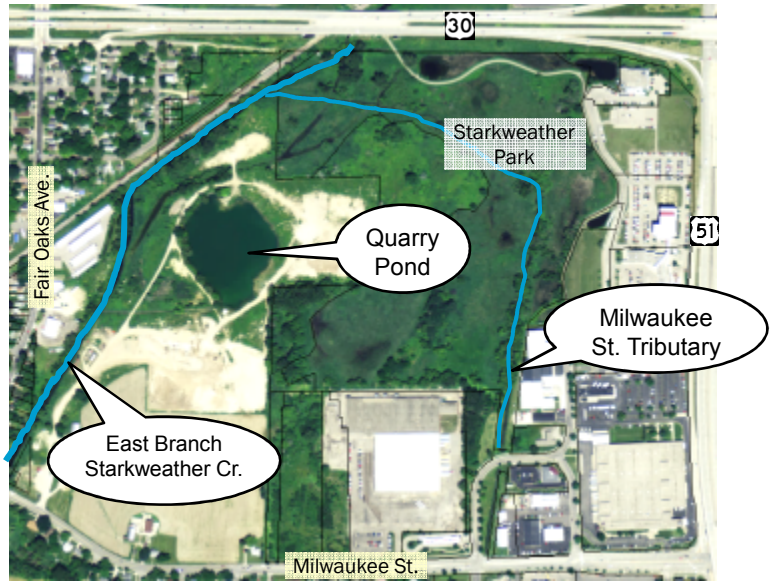
- City investigated many locations for treatment system
- Ideal site:
  - Unused, open space
  - Near an urban creek with large watershed
  - Does not impact parks or other adjacent lands
  - Provides potential for other Public Works' needs and public benefits

Background – Project Site Watershed

5,500 acre watershed
- 67% urban
- 33% rural



Background – Project Site



Background – Project Site

Existing Quarry Pond – from north end looking southeast

Quarry Pond – outlet channel to East Branch Starkweather Cr.

Background – Project Site

R.R. Spur Culverts: East Branch Starkweather Cr. - downstream

Background – Project Site

R.R. Spur Culverts: East Branch Starkweather Cr. - upstream

Project Goals

- Maximize phosphorus reduction to Lake Monona
- Visibly improve Starkweather Creek water quality
- Improve aesthetics and public use of Starkweather corridor.

Feasibility Study

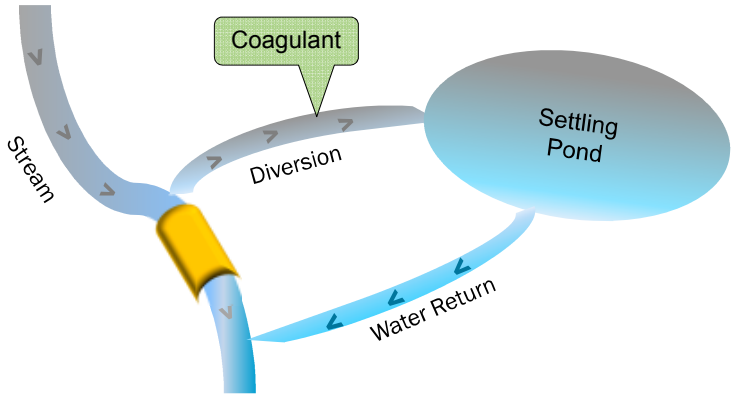
Jim Bachhuber; Brown and Caldwell

Starkweather Creek Phosphorus Treatment System

Feasibility Study - Project Aspects

- Conducted January 2015 – March 2016
- Water Quality & Coagulant Testing
- Watershed Runoff Modeling
- Conceptual Design
- DNR Discussions

Project – Basic Concept



Coagulant Testing

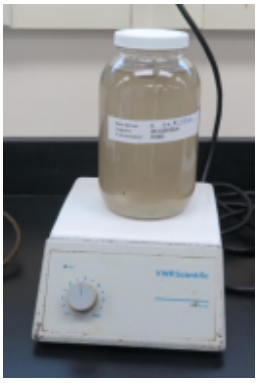
Field Sampling:

- 6 Runoff Events in Starkweather Cr.
- Capture spring, summer, and fall conditions
- Test different coagulants for performance

Coagulant Testing

Lab Procedure

- Split raw samples
- Analyze raw water samples
- Add coagulants & rapid mix
- Analyze jars at start and 24 hrs.



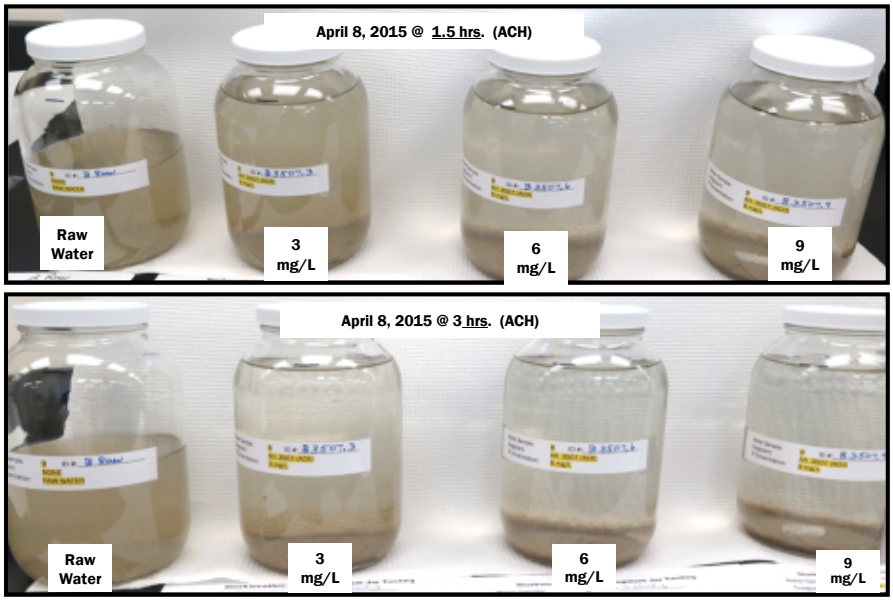
Coagulant Testing

Tested 5 Coagulants:

- Aluminum Sulphate (Alum)
- Polyaluminum Chloride (PAC) (3 types)
- Aluminum Chlorohydrate (ACH)

- Tested at Various Doses
  - 3 mg/L - 9 mg/L of Aluminum

ACH Coagulant Performance Example



Coagulant Testing - Results

Recommend Aluminum Chlorohydrate (ACH)

- Target ACH concentration: 4.0 – 5.0 mg/L Al
- Phosphorus reduction: 78% - 95% (avg. 85%)
- Post treatment dissolved Al ≤ raw water Al
- No sulfates
- No pH impacts
- ACH has lower freezing temperature (19 F)
- Requires less bulk storage volume

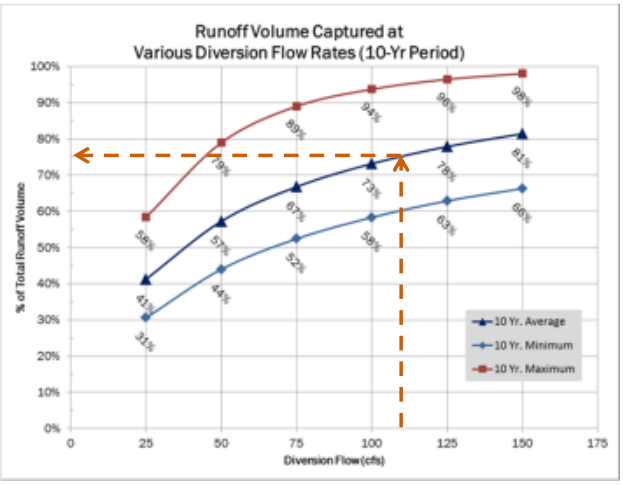
Watershed Runoff Modeling

- Continuous simulation modeling
- Selected 2002 – 2011 rain data.

Water Year (Oct.-Sept.)	Annual Rain Depth (in.) *	+ / - from Avg. (%)	
1994-1995	29.85	15.25%	
1995-1996	34.5	2.05%	
1996-1997	30.33	13.89%	
1997-1998	38.23	-8.54%	
1998-1999	34.42	2.27%	
1999-2000	39.22	-11.35%	
2000-2001	37.18	-5.56%	
2001-2002	27.75	21.21%	Selected H&H Modeling Period
2002-2003	24.43	30.64%	
2003-2004	44.3	-25.78%	
2004-2005	25.76	26.86%	
2005-2006	35.37	-0.42%	
2006-2007	43.51	-23.53%	
2007-2008	44.48	-26.29%	
2008-2009	36.98	-4.99%	
2009-2010	41.3	-17.26%	
2010-2011	28.49	19.11%	
2011-2012	25.23	28.37%	
2012-2013	47.73	-35.52%	
2013-2014	35.36	-0.39%	
1994 - 2013 Avg:	**35.22**		
Modeled Period Avg.:	**35.24**	**-0.05%**	

Watershed Runoff Modeling

Estimated Diversion Volume



- Design Diversion Rate:
  = 110 cubic ft./sec.
- Average Annual Treatment Volume:
  ~ 3,500 acre-feet

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Conceptual Design Overview

Treatment System Performance

- Raw Water Phosphorus Conc. = 0.205 mg/L
- Annual Treatment Volume ~ 3,500 ac-ft
- Coagulant Effectiveness = 85%
- Estimated Annual Phos. Removal = **1,660 lbs/year**

- City of Madison TMDL Phos. reduction goal: ~14,000 lbs. /yr.
- **~ 12% of TMDL Goal**

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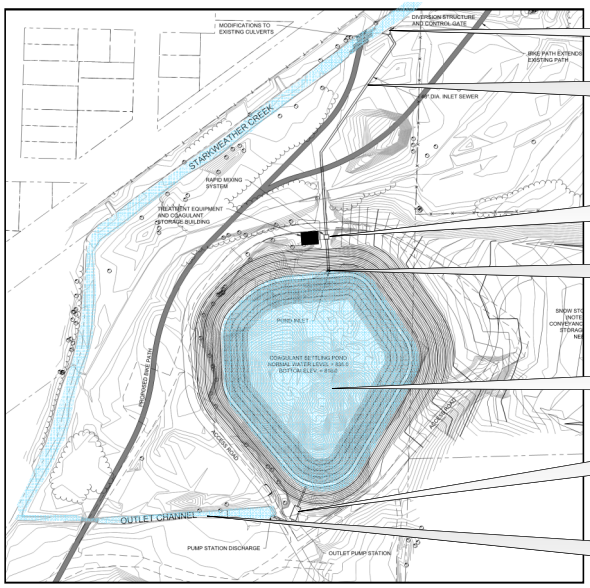
Conceptual Design Components



Diversion Gate

48" diameter pipe (buried)

Coagulant Mixing Chamber (buried)

Treated Water Discharge to Pond

Coagulant Settling Pond

Outlet Structure / Pump Station

Treated Water Return to Creek

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Conceptual Design – Costs

Preliminary Cost Estimates from Feasibility Study:

- Construction / Capital Costs: $5,567,000
  (does not include land costs)
- Annual O&M Costs: $351,000
- 20 year life cycle $/lb. P removed: $380/lb. of P.

- Conventional Treatment:
  - Ponds: ~ $300/lb. P removal.
    (not including maintenance or land cost)
  - Catch Basin Treatment: ~ $500 / lb. P removal
    (includes capital and maintenance cost)

Next Steps

- Continued Public Outreach (ongoing)
- Land Acquisition (2016 – 2017)
- Additional Site Investigations (2016 – 2017)
  - Groundwater modeling
  - Wetland delineation
  - Environmental Testing
- Continued DNR / Agency Coordination
- Permitting
- Final Design (2017 – 2018)
- Construction (2018 – 2019)

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Discussions / Questions