Saint Paul’s CHS Field

- Public-private partnership
- Brownfield redevelopment
- Sustainability focused
- *Rainwater harvesting across properties*
Partnership

Agencies
• Capitol Region WD
• Metropolitan Council
• Metro Transit

Project Team
• St. Paul Saints
• City of Saint Paul Parks and Rec.
• Ryan Companies
  • Schadegg Mechanical
  • Solution Blue, Inc.
  • Rainwater Management Solutions
Ballpark Impact

- 180 events each year
  - 50+ Saints games
  - College partnership
  - Amateur baseball
  - Concerts
  - Community space
  - Rentable conference
  - Reception space
  - Movie nights

- 400,000 annual visitors

- 7,000 seats
Stormwater “Double Play”
Design Charrette

- Facilitated by outside reuse expert (Stark Rainwater / RMS)
- Develop possible alternatives
- Schematic design and prelim cost estimates

MEP contractor not on project team yet
Pricing and Options
LOWERTOWN BALLPARK
STORMWATER MANAGEMENT PLAN

STORMWATER MANAGEMENT FEATURES
1. PLAYING FIELD
   - Irrigate Field
2. COLLECTION AREA
3. COLLECTION BASIN
4. TREE TRENCH
5. FIELD STORAGE
6. PROGRAM 4 LOOPS
7. FILTERATION AREA
8. STORMWATER MANAGEMENT PLANTERS
9. RAIN GARDENS

RAIN HARVESTING OPTION B
BALLFIELD IRRIGATION FROM 3/6 THE OMF ROOF

LEGEND
- STORMWATER OMF LOCATION
- COLLECTION BASIN
- COLLECTION PIPE
- NORTH TREE TRENCH
- SOUTH TREE TRENCH
- OMF ROOF
- 32,000 SF
- (2) 27,000 gal tanks (service level)

Pricing and Options
Pricing and Options

LOWERTOWN BALLPARK
STORMWATER MANAGEMENT PLAN

STORMWATER MANAGEMENT FEATURES
1. PLANTING FIELD
   - Stormwater management features that incorporate native vegetation and soil improvements.
2. ELEVATION AREA
   - Collection of stormwater runoff and sediment control measures.
3. RAIN GARDEN W/ STORMWATER PLANTERS
   - Vegetation and soil amendments to manage stormwater.
4. SWALE
   - A low, narrow channel for stormwater runoff.

RAIN HARVESTING OPTION C
BALLFIELD IRRIGATION AND TOILET FLUSHING
FROM 1/6 THE OMF ROOF

Restrooms flushed with harvested rain water

Irrigate Field

Collection piping

(2) 27,000 gal tanks (service level)

32,000 SF

OMF ROOF

STORMWATER MANAGEMENT PLAN

SHEET SIZE: 24" x 36"
Rainwater use – toilet flushing & ballfield irrigation

- 27,000 gallon tank
- 10% of toilet fixtures; 15-20% of field demand (450,000 gall est.)

Preferred Alternative – Option C
Met Transit “OMF”

- Operation & Maintenance Facility
- 4-acre facility for storing light rail trains
- Roof drained away from CHS Field site
- Active train electrical grid near rain leaders
Enhanced Water Sustainability

- Total Ballpark cost ........................................$ 63,000,000
- Total cost*..................................................$ 487,000
  - Rainwater harvesting system ............$ 300,000
  - Enhanced stormwater items ..............$ 68,000
  - Design and Admin/Fees .....................$ 75,000
  - Contingency ........................................$ 44,000

- Total grants ..............................................$425,000

*Does not include cost to re-route OMF rain leaders
Rainwater Harvesting
## Rainwater Harvesting

<table>
<thead>
<tr>
<th>Cistern size</th>
<th>27,000 gallons</th>
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<tbody>
<tr>
<td>Roof area captured</td>
<td>33,770 ft² (about ¾ acre)</td>
</tr>
<tr>
<td>Maximum rainfall captured by cistern</td>
<td>1.3 inches</td>
</tr>
<tr>
<td>Primary uses</td>
<td>Irrigation and toilets</td>
</tr>
<tr>
<td>Treatment provided</td>
<td>Vortex filter (pre-treatment), bag filters, UV disinfection</td>
</tr>
<tr>
<td>Annual potable water reduction</td>
<td>An estimated 450,000 gallons</td>
</tr>
<tr>
<td>Annual savings</td>
<td>&gt;$1,600</td>
</tr>
</tbody>
</table>
Rainwater Harvesting
# Water Quality Goals

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Intended End-Use Quality Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Coli</td>
<td>&lt;2.2 MPN/100 mL</td>
</tr>
<tr>
<td>Turbidity</td>
<td>Less than 1 NTU</td>
</tr>
<tr>
<td>Odor</td>
<td>Non-offensive</td>
</tr>
</tbody>
</table>

*TO CONSERVE WATER THIS BUILDING USES RAINWATER TO FLUSH TOILETS. WATER FROM THESE FIXTURES IS NOT SAFE TO DRINK*
Performance Results

- Operated August - October
- Water quality standards met
- Toilet reuse: 22,500 gallons
- Irrigation reuse: 118,500+ gallons

141,000 gal total (or 18,850 ft³) reused/conserved
Water Quality Testing
Water Quality Testing
Testing/Operations Diagram

Flowchart:

1. Testing Start Up
2. Step 10-01.1
3. Step 20, W51-051
4. Result:
   - Operator Accepted
   - Operator Rejected
5. Notify CSS, Parks
6. Unmonitored Number
7. Step 735-051
8. Operate
9. Operate
10. Notify CSS, Parks
11. Operator Accepted
12. Notify CSS, Parks
13. Operator Rejected
14. Unmonitored Number
15. Notify CSS, Parks
16. Step 501
17. Step 502
18. Notify CSS, Parks
19. Notify CSS, Parks
20. Operate
21. Operate
22. Unmonitored Number
23. Notify CSS, Parks
24. Step 105
25. Step 106
26. Notify CSS, Parks
27. Notify CSS, Parks
28. Operate
29. Operate
30. Unmonitored Number
31. Notify CSS, Parks
32. Notify CSS, Parks
33. Operate
34. Operate
35. Loop

Legend:
- Normal
- Alarm
- Emergency
- Exception
Visibility/Education
Visibility/Education
• It is possible to meet standards
• Operation and maintenance
  – Tank capacity design vs. as-built
  – System pressure
  – Monitoring
    • Buy a meter device
    • LGU/Owner interface

• Alternatives analysis
  – Pumps
  – Tank location/space
• Water economics don’t work
• Public awareness is key
Questions
Stormwater Reuse/Irrigation Projects and Lessons Learned

Sharon Doucette
Environmental Resources Coordinator

Jennifer Levitt, City of Cottage Grove
Bryan Bear, City of Hugo
Joey Abramson, WSB and City of Richfield
Why?

- Stormwater Requirements
  - NPDES
  - Watershed District rules
  - City ordinances
- Wellhead Protection Areas restrictions
- North and East Metro Groundwater Management Area
- Education
Major System Components

- Catchment
- Storage
- Filtration/Treatment
- Pumping system
- Controls
- Irrigation lines
Projects

Eagle Valley and Prestwick Golf Courses, Windwood Passage Park and Bielenberg Gardens

City Hall

Waters Edge and Clearwater Cove

Veterans Memorial and Taft Parks
- 9 acre impervious surface increase
- Stormwater requirements
- Reduce phosphorous inputs by 30 lbs/yr to Colby Lake (north half of project)
- Reduce phosphorus to Bailey Lake (south half of project)
- SWWD received grant funding from the Clean Water Fund
- $700,000 for both systems
Eagle Valley Subwatershed

Colby Lake

Runoff from hatched area treated by reuse system (430 acres)
Eagle Valley Golf Course

- Irrigate 60 of 70 acres using well
- Pumped 30 million gallons annually
- Can pump approximately 22.5 million gallons from stormwater pond annually (modeled)
- Provide supplementary water from existing well
- Route water through babbling brook feature
Prestwick Subwatershed

Runoff from hatched area treated by reuse system (130 acres)
• Irrigate 75 acres
• Previously pumped 35 million gallons of water annually from well
• System pumps approximately 17.5 million gallons from pond annually (modeled)
• Supplement with 17.5 million gallons of water from well
• Refill interior amenity ponds if needed with stormwater
Windwood Passage Park

- Carver Lake drainage area
- Lake classified as “vulnerable” – delisted in 2014 for nutrient impairment
- Stormwater retrofit with 2012 roadway rehabilitation program
- Cost share funding from RWMWD
- $95,000
Windwood Subwatershed

Runoff from hatched area treated by reuse system (300 acres)
Windwood Passage Park

- Park did not have irrigation
- 6.5 acres of park irrigated
- Modeled 7.5 million gallons used annually
- Park is not irrigated when water is not available
Bielenberg Gardens

- Private project
- Meeting stormwater requirements
  - Infiltration restricted by future well sites
  - Maximizing development area
Bielenberg Gardens Subwatershed

Runoff from hatched area treated by reuse system (124 acres)
Bielenberg Gardens

- 685,000 gallons of water available
- Future conditions modify drainage
- City owned pond (outlot) w/ recorded O&M plan and license agreement for maintenance of pump equipment and fountain
Bielenberg Gardens Reuse System

- System provides irrigation to all green space on site, ROW and landscaped medians
- Irrigation lines added as pads are developed
Cottage Grove City Hall

- New City Hall constructed in 2012
- Irrigate planting beds on 7 acre site
- Received funding from SWWD
- $240,000
City Hall “Subwatershed”

SWC Bulletin photo
Cottage Grove City Hall

- Reduce conventional irrigation by 80% on site
- 570,000 gallons of water used annually from system
- Modeled stormwater volume reduction of 1.8 acre-feet
- Education site
- System has UV and microfiltration treatment
City Hall Reuse System
City of Hugo projects

• Integrated Water Management
• Council directive – Reduce, Reuse, Replenish
• One of 13 cities facing potential connection to Mississippi River for water
• Water conservation is the focus
Waters Edge

- 1100 homes
- Homeowners association
- Annual water use of 45,000,000 gallons
- $120,000 water bill
- Surface water supply is available
Water’s Edge

• Retrofit of 1/3 of development complete (townhomes)

• System design for entire development (possible 2016 construction)

• City-owned surface water supply system will pay for itself
  – Sell stormwater instead of drinking water at a cheaper rate
Clearwater Cove

- 89 lot single family development
- PUD flexibility
  - Lot size, lot width, setbacks
- Zoned system
- Sprinkler controls in garages
- No need to conserve stormwater
- Infiltration credits
- $250,000
Taft & Veterans Memorial Parks
City of Richfield
• No irrigation component to this project, only infiltration

• Similarities – pumps required, water is “land” applied
Taft & Veterans Memorial Parks

1. 1500 acres of Richfield and MAC property
2. Reuse systems draw surface water for infiltration
3. Water pumped from Legion Lake (at Veterans Memorial Park) and Taft Lake to subsurface infiltration trenches located within each park
4. 4,500 linear feet of 3’ wide trenches were constructed in upland areas
5. Completed in 2015
6. Expected infiltration of 8.75 million gallons of stormwater per year
7. $950,000
Lessons Learned

• Ownership of underlying property (regardless of D and U easements) matters
• Aesthetics are important on a golf course!
• Infiltration - Pond may need impervious liner
• Accidents happen
• Find the right designer/installer – hire an expert
Lessons Learned

• Meet with irrigation contractors – understand issues and hazards
• Reuse projects can work on any project type
• More guidance on interconnections
• Regulatory framework is confusing
  – Department of Labor and Industry (plumbing code)
  – Department of Health
  – Department of Natural Resources
  – Watershed districts
• Chapter 17 Nonpotable Rainwater Catchment Systems
  – “Irrigation. Rainwater catchment systems used for lawn irrigation are not covered under this chapter.”
  – Provides direction on design, installation, inspection, maintenance, testing including water quality requirements for restrooms, industrial processes, vehicle washing facilities, cooling towers (interior water reuse)
Lessons Learned

• Screening and location of intake is important to minimize future maintenance

• Stormwater does have contaminants
  – System or management plan should be designed to avoid human exposure (irrigation at night or early morning)
  – Chlorides may damage turf
  – Treatment may be required
Began monitoring for chlorides in 2013

2014 Monitoring

<table>
<thead>
<tr>
<th>Chloride</th>
<th>Sodium</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>Potassium</td>
</tr>
<tr>
<td>Carbonates and bicarbonates</td>
<td>Magnesium</td>
</tr>
<tr>
<td>Electrical conductivity</td>
<td>Calcium</td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>Fecal coliform*</td>
</tr>
<tr>
<td>Nitrate</td>
<td>Phosphorus</td>
</tr>
</tbody>
</table>

*(e. coli analysis not available)*

2016 Additional Monitoring

<table>
<thead>
<tr>
<th>Turbidity</th>
<th>Total coliform</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS</td>
<td>E. coli</td>
</tr>
<tr>
<td>Copper</td>
<td>Zinc</td>
</tr>
</tbody>
</table>
Chloride (mg/L)
Lessons Learned

• Surface water is not as certain as other sources (another reason for supplemental water source)
• Consider increasing storage capacity (area and depth of pond)
• Aesthetics of fluctuating water elevation
• You can use natural wetlands
• Proximity to surface water source can make or break a project (think about elevation changes too)
Irrigation systems that are designed to meet stormwater management requirements must meet the following requirements:

- Designed by a certified irrigation contractor
- The system, including pumps, controllers, connections and irrigation line placement must be submitted for review and approval
- The system must include a connection to municipal water as a back-up irrigation source – this connection must include an air gap or other backflow prevention practice
- Municipal water cannot be pumped into a pond to be later pumped into the irrigation system
- Private irrigation wells as a back-up irrigation source are not allowed (Section 27-93 of City Code)
Summary

• The range of reuse project options is large
• Project intent and budget are key to a successful project
• Systems vary from basic to complex
• Large price range due to system requirements or specific design
• Cost/benefit (from a pure water use standpoint) doesn’t usually work – municipal water is too cheap
Other reuse/irrigation projects

• Bielenberg Sports Center, Summit Pointe Park, Views at City Walk, St. Therese, Woodbury Flats (2016), ISD 833/city park project being planned for 2016 - Woodbury
• Target Field
• City Hall and Central Park - St Anthony Village
• Laurie LaMotte Memorial Park - Centerville
• Evergreen Park - Roseville
• Brook Peterson Community Park - Waconia
• Edison High School – Minneapolis
• 5 projects in Carver County
• Minnesota National Guard Facility - Arden Hills
• Oneka Ridge Golf Course, Beaver Ponds Park, CSAH 8 - Hugo