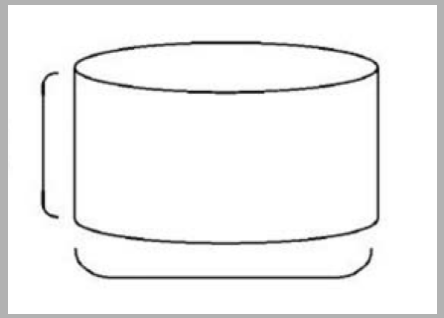
STORMWATER BMP PERFORMANCE ASSESSMENT

Milwaukee County- Environmental Services:
Jack Sudar and Michael Brill

OUTLINE

Procedure

Discovery



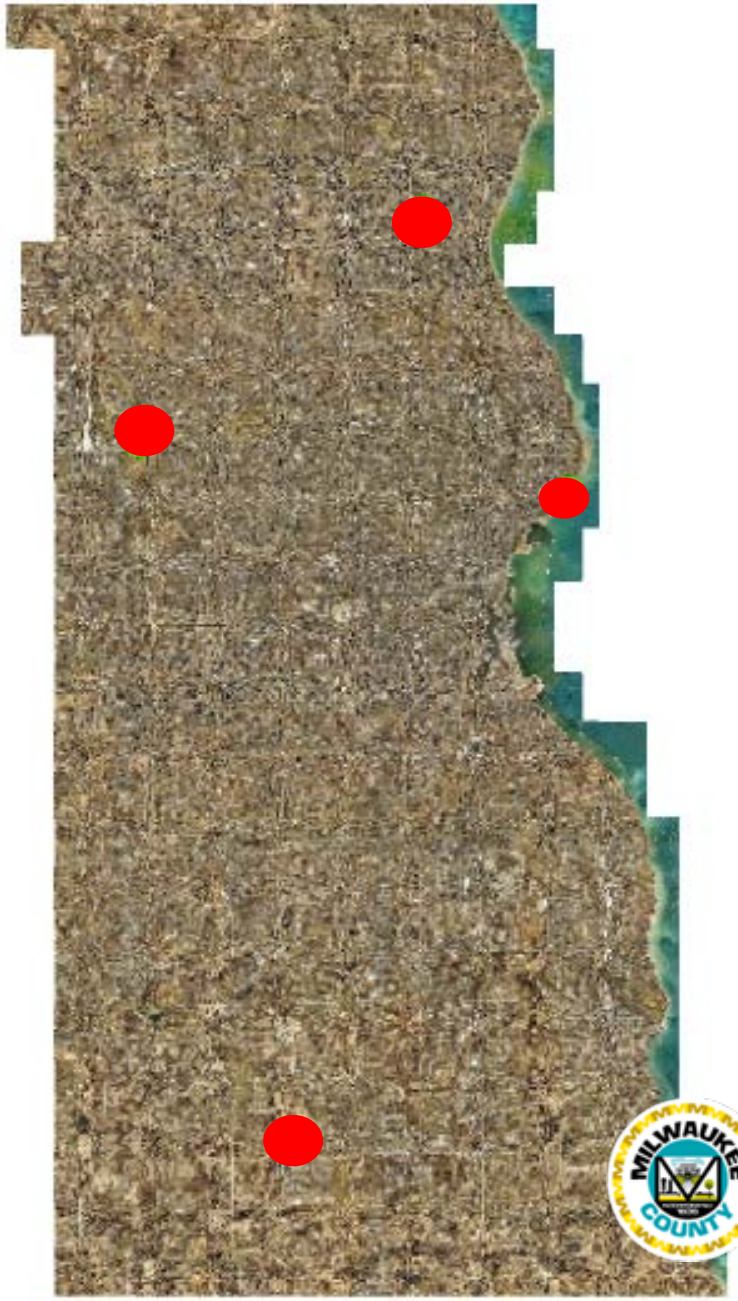
Future Design

Assessment Procedures

- Visual Assessment
- Rain Gauges
- Infiltration Assessment
- TSS and TP Sampling
- O&M Plan Comparison
- Check Performance

Site Selection

- Milwaukee County Sports Complex Pervious Paver Lot
- Milwaukee River Parkway Bioinfiltration Swale #3
- Menomonee River Parkway Bioinfiltration Swale #4
- Bradford Beach Parking Lot Bionfiltration Swale
- Bradford Beach Bioinilftration Basin #3



Visual Assessment: Wet Events

Visual Inspection:

- Ponding, Underdrains, Inlets, Outlets, Emergency Overflows
- Sedimentation, Erosion, Trash, Weeds, Trees, Oil, Pollutants
- Slumping, Seeping, Animals holes.
- Clogging, Tampering, Structural integrity

Noting:

- Weather, Temperature
- Runoff Present, Rain Gauge Levels
- Take Photos
- Collect Influent and Effluent Samples

Rain Garden & Infiltration Basin Semi Annual Inspection

Storm Water Facility Inspections

Location: Bradford Beach Parking Lot Bio Retention
Inspected By: Jack Sudar
Date: 6/13/2018

Basin	
Condition	**Status**
Sedimentation	No
Erosion	No
Ponding	No
Trash	No
Weeds / Trees	Yes
Hydrocarbon	No

Embankments	
Condition	**Status**
Slumping	No
Seepage	No
Animal Holes	No
Weeds / Trees	Yes
Erosion	No

Outlet Strucure and Pipe	
Condition	**Status**
Clogging	No
Erosion	No
Tampering	No
Stuctural Integrity	Excellent

Additional Comments
There were some invasive plants in the garden. There was significant growth throughout the garden, though most plants were under 3'. Plugs were properly installed. Trash was not significant.

BMP Performance Assessment Form

Location: Bradford Beach Infiltration Swale

Inspected By: Jack Sudar

Date & Time: 9/5/18 2:00 PM

Stormwater Flowing?

Inlet	Yes	No
Outlet	Yes	No
Other	Yes	No

TSS & P Samples Collected?

Inlet Sample	Yes	No
Outlet Sample	Yes	No
Other	Yes	No

Weather Condtions

Currently Raining	Yes	No
Recently Rained	Yes	No
Clear	Yes	No
Overcast	Yes	No
Temperature	78°F	

Rain Gauge Measurement

Rain Gauge #1	2.3"
Rain Gauge #2	2.8"

Photos

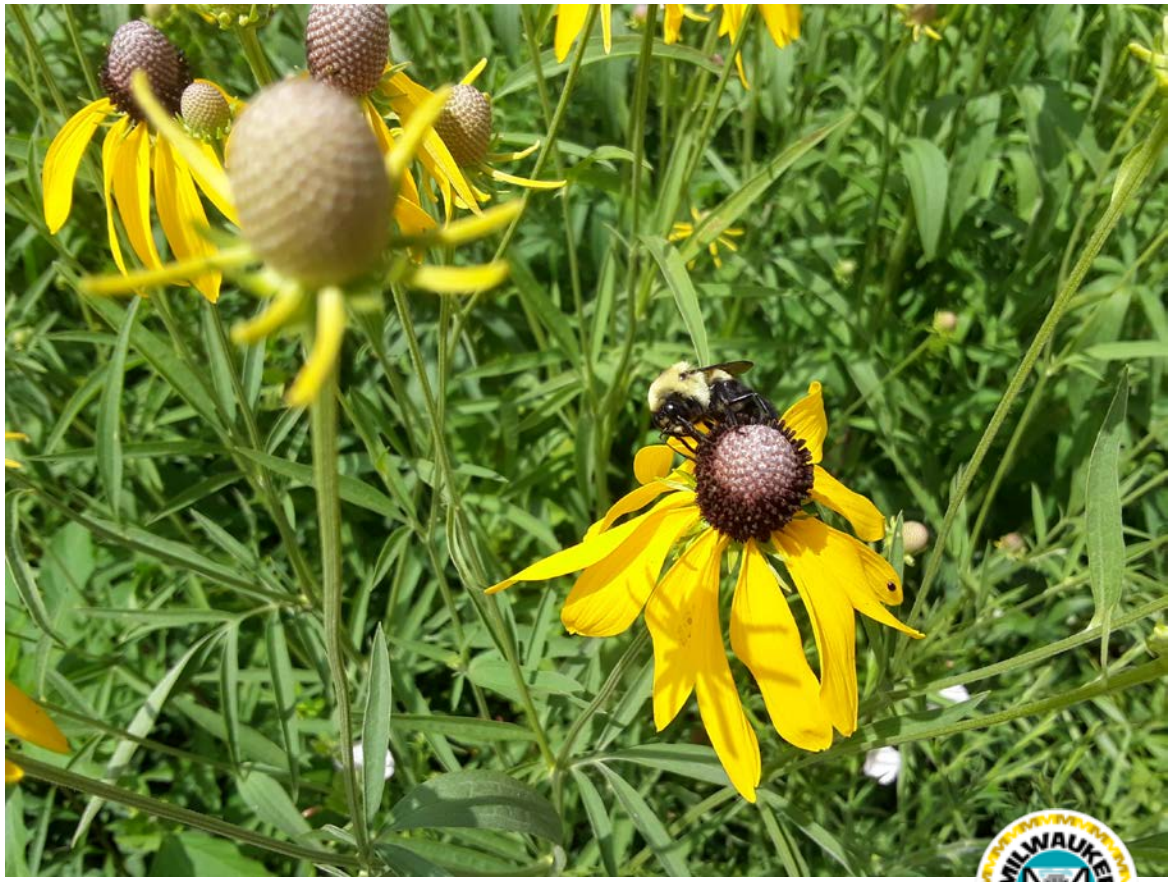
Photos Taken	Yes	No

Comments

Raining and water flowing in and out of the swale. Structures and vegetation all in good order

OF3

OF3



Sports Complex Permeable Paver Lot
Menomonee River Parkway Rain Gardens #7 and #8
Milwaukee Parkway Infiltration Swales #2 and #3
Bradford Beach Infiltration Basins #3 and #4

Site	Date	Cumulative Amount Recorded at Milwaukee County Gauges Between Inspections (inches)	Daily Amount Recorded at MMSD Gauges at Time of Inspection (inches)
Sports Complex	7/26/18	0, 0	0
Sports Complex	8/17/2018	0.3, N/A	0.17
Sports Complex	8/30/2018	2.3, 1.1	0
Bradford Beach	7/26/18	0, 0	0
Bradford Beach	8/9/2018	0.5, 0.5	0
Bradford Beach	8/17/2018	0.2, 0.5	1.23
Bradford Beach	8/30/2018	3.2, 4.1	0
Bradford Beach	9/5/2018	2.3,2.8	0.92
Bradford Beach	10/5/2018	0.5, 2.0	0.30
Menomonee River Parkway	7/26/18	0, 0	0
Menomonee River Parkway	8/3/2018	0.3, 0.3	0
Menomonee River Parkway	8/17/2018	1.2, 1.0	0.05
Menomonee River Parkway	8/30/2018	3.6, 3.9	0
Milwaukee River Parkway	7/26/18	0, 0	0
Milwaukee River Parkway	8/3/2018	0, 0	0
Milwaukee River Parkway	8/17/2018	3.0, 1.8	3.04
Milwaukee River Parkway	8/30/2018	2.1, 3.2	0
Milwaukee River Parkway	9/5/2018	1.3, 1.6	1.30
Milwaukee River Parkway	10/5/2018	2.4, 2.2	0.21

TSS and P Results

- Four BMPs were chosen to sample total suspended solids (TSS) and phosphorous (P).
  - Milwaukee County Sports Complex Pervious Paver Lot
  - Milwaukee River Parkway Bioinfiltration Swale #3
  - Bradford Beach Parking Lot Bionfiltration Swale
  - Bradford Beach Bioinilftration Basin #3
- Selection criteria included the ability to obtain a sample from the inlet and outlet
- If the inlet or outlet structures were flowing during an inspection, grab samples were taken with the appropriate vessel for analysis.

Equipment used to collect and transport samples

Underdrains flowing at Milwaukee River Parkway

TSS and P Results

Site	Sample	Date	TSS (mg/L)	P (mg/L)
Bradford Beach	Infiltration Swale Inlet	8/17/18	161	0.14
Bradford Beach	Infiltration Swale Outlet*	8/17/18	194	1.04
Bradford Beach	Infiltration Swale Inlet	9/5/18	100	0.35
Bradford Beach	Infiltration Swale Outlet	9/5/18	60	0.47
Bradford Beach	Outfall 3 Inlet	8/17/18	23	0.07
Bradford Beach	Outfall 3 Inlet	9/5/18	30	0.1
Milwaukee River Parkway	Inlet	8/17/18	113	0.03
Milwaukee River Parkway	Outlet	8/17/18	8	0.09
Milwaukee River Parkway	Outlet	8/30/18	<2	0.02
Milwaukee River Parkway	Inlet	9/5/18	130	0.05
Milwaukee River Parkway	Outlet	9/5/18	24	0.15
Sports Complex	Outlet	8/17/18	<2	N/A
Sports Complex	Outlet	8/30/18	<2	0.01
Sports Complex	Outlet	10/5/18	<2	N/A

Follow Up Assessment

Flow Monitor

Infiltration Assessment

ASTM Designation C1781/C1781M-13 : Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems.

- Prepare a 12.0 ± 0.5 inch diameter cylindrical ring open on both ends
- Seal to pervious surface with plumber's putty at the base of the cylinder
- Conduct a "prewet" test of eight pounds of water by pouring into cylinder at a constant head of 0.4 and 0.6 inches above the bottom of the cylinder until water fully infiltrated
- Record the prewet test time and based on infiltration rate adjust the final test water volume
- Conduct final initiation test at a constant head of 0.4 to 0.6 inches and record the final time
- Determine infiltration rate of surface via ASTM standard equations

A minimum of three locations were tested for infiltration rates per site.

Prewet Test Results

Location	Pervious Type	Date	Test	Time (s)
Milwaukee County Sports Complex	Pervious Pavement	7/26/2018	Prewet #1	60.1
Milwaukee County Sports Complex	Pervious Pavement	7/26/2018	Prewet #2	17.8
Milwaukee County Sports Complex	Pervious Pavement	7/26/2018	Prewet #3	37.4
Milwaukee County Sports Complex	Pervious Pavement	7/26/2018	Prewet #4	30.5
Milwaukee County Sports Complex	Pervious Pavement	7/26/2018	Prewet #5	356.8
Dineen Park	Pervious Concrete	7/26/2018	Prewet #1	>767.5
Dineen Park	Pervious Concrete	7/26/2018	Prewet #2	70.5
Dineen Park	Pervious Concrete	7/26/2018	Prewet #3	125.8
Milwaukee County Zoo 1A	Pervious Pavement	9/14/2018	Prewet #1	42
Milwaukee County Zoo 1A	Pervious Pavement	9/14/2018	Prewet #2	101.6
Milwaukee County Zoo 1A	Pervious Pavement	9/14/2018	Prewet #3	112.5
Milwaukee County Zoo 5	Pervious Pavement	9/14/2018	Prewet #1	226.4
Milwaukee County Zoo 5	Pervious Pavement	9/14/2018	Prewet #2	>767.5
Milwaukee County Zoo 5	Pervious Pavement	9/14/2018	Prewet #3	>767.5
Milwaukee County Zoo 6	Pervious Pavement	9/14/2018	Prewet #1	180
Milwaukee County Zoo 6	Pervious Pavement	9/14/2018	Prewet #2	93.5
Milwaukee County Zoo 6	Pervious Pavement	9/14/2018	Prewet #3	15

Infiltration Rates

Location	Pervious Type	Date	Test	Volume (lbs)*	Time (s)	Infiltration rate (in/hr)
Sports Complex	Pervious Pavement	7/26/2018	Test #1	8	74.5	103.0
Sports Complex	Pervious Pavement	7/26/2018	Test #2	40	89.8	427.3
Sports Complex	Pervious Pavement	7/26/2018	Test #3	8	51.1	150.2
Sports Complex	Pervious Pavement	7/26/2018	Test #4	8	33.7	227.7
Sports Complex	Pervious Pavement	7/26/2018	Test #5	8	1952.8	3.9
Dineen Park	Pervious Concrete	7/26/2018	Test #1	8	>767.5**	<10.0**
Dineen Park	Pervious Concrete	7/26/2018	Test #2	8	204.5	37.5
Dineen Park	Pervious Concrete	7/26/2018	Test #3	8	218.1	35.2
Milwaukee County Zoo 1A	Pervious Pavement	9/14/2018	Test #1	8	49.6	154.7
Milwaukee County Zoo 1A	Pervious Pavement	9/14/2018	Test #2	8	132.1	58.1
Milwaukee County Zoo 1A	Pervious Pavement	9/14/2018	Test #3	8	300.5	25.5
Milwaukee County Zoo 5	Pervious Pavement	9/14/2018	Test #1	8	539.5	14.2
Milwaukee County Zoo 5	Pervious Pavement	9/14/2018	Test #2	8	>767.5**	<10.0**
Milwaukee County Zoo 5	Pervious Pavement	9/14/2018	Test #3	8	>767.5**	<10.0**
Milwaukee County Zoo 6	Pervious Pavement	9/14/2018	Test #1	8	450.6	17.0
Milwaukee County Zoo 6	Pervious Pavement	9/14/2018	Test #2	8	66.8	114.9
Milwaukee County Zoo 6	Pervious Pavement	9/14/2018	Test #3	40	59.1	649.3

Green > 100 in/hr: meets initial design criteria

Yellow = 10 -100 in/hr: needs maintenance soon

Red <10 in/hr: immediate maintenance

* Based on prewet test

** excess of 10 minutes

Future Design

Curb cuts vs. Level Spreader (Milwaukee Parkway)

Field Verify As-builts after Construction

Accessibility to O&M

Amount of Plant Species

- More Species
  - More likely to survive
  - Diversity throughout growing months
  - Harder to identify weeds

- Less species
  - Low diversity / higher failure risk
  - Bald spots
  - Easier to identify weeds and maintain

Thank You

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