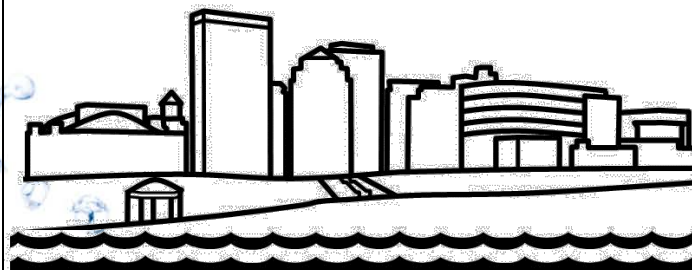


Stormwater BMPs for Buildings and Grounds

**Protect & Preserve
Your Water Resources**



CITY OF DAYTON

water

Environmental Management

937.333.3725

City of Dayton

National Pollutant Discharge Elimination System (NPDES) Phase I Stormwater Permit



“When it rains, Dayton drains”

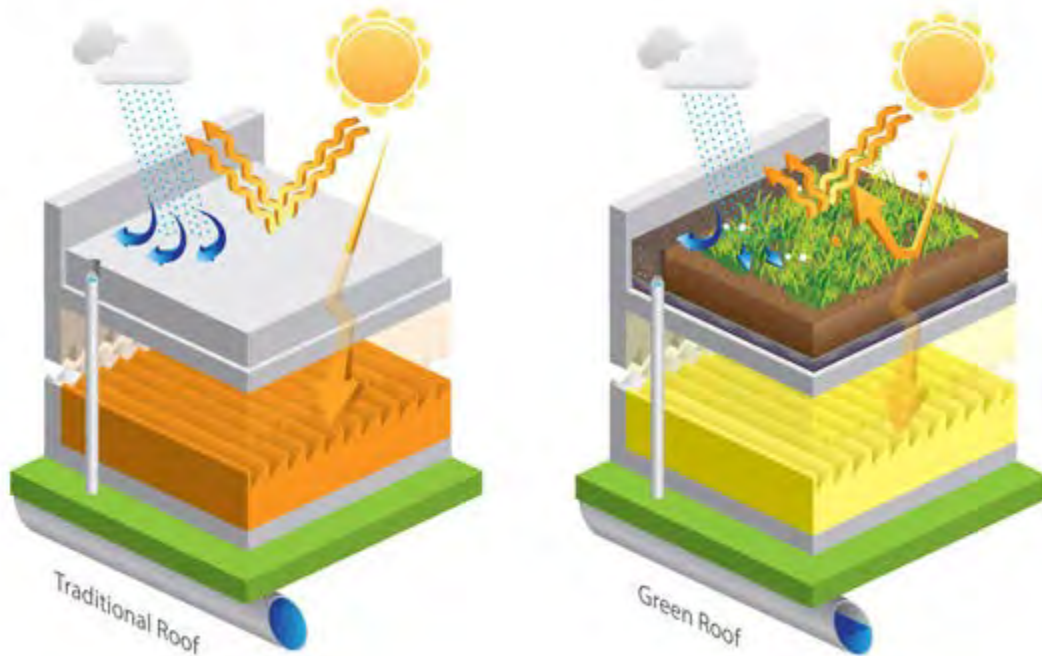


**Storm
Water
Flow**

DAYTON

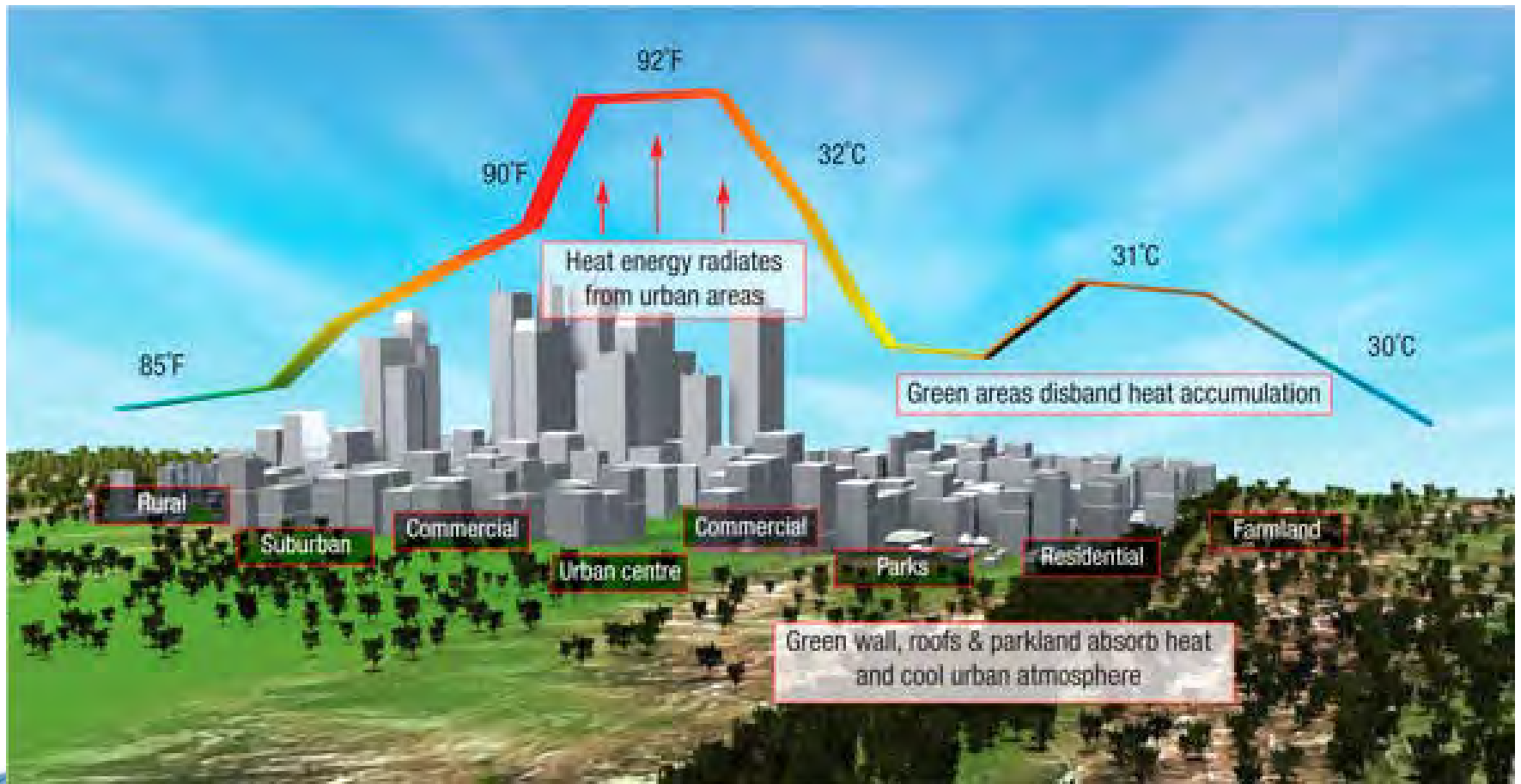
Why Green Roofs?

Green Roof Comparison



Benefits of Green Roofs

- Reduce and improve stormwater runoff
- Improve energy efficiency of building
- Increase lifespan of roof
- Aesthetic improvement
- Improve air quality
- Mitigate urban heat island effect

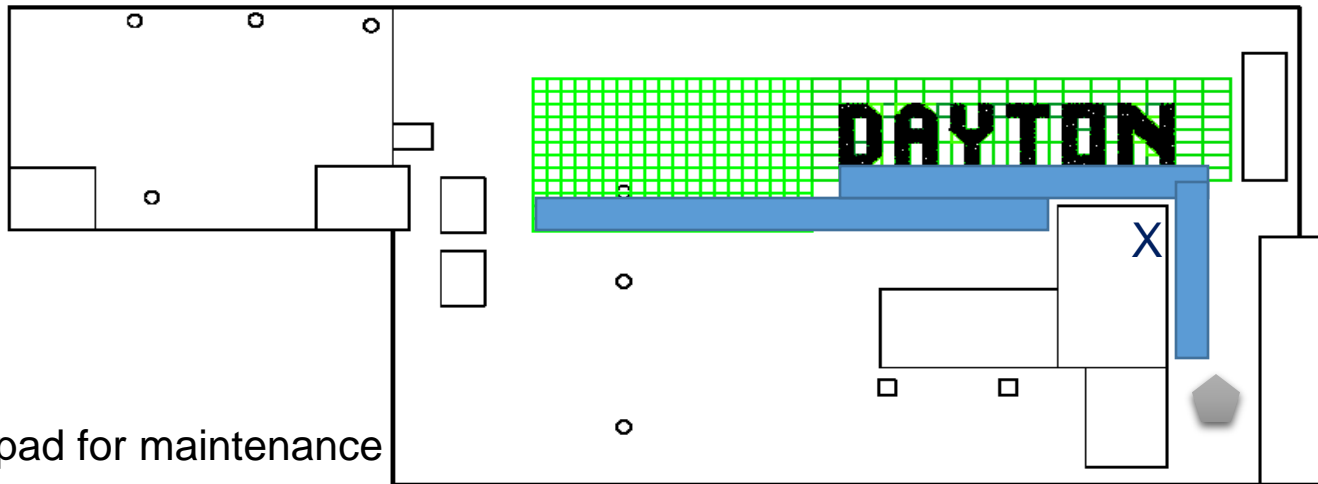


Schematic of Green Roof

Size: ~2,000 sq. ft.

Ludlow St.

Third St.



■ – Walk pad for maintenance

X – Doorway to roof area

■ – Roof drain to Storm Sewer

ROOF PLAN
1/16" = 1'-0"

- ▲ GreenGrid(R) 2'x2'x4" TRIANGLE MODULE (10) – ECOBALLAST
- GreenGrid(R) 2'x2'x4" MODULE (58) – ECOBALLAST
- ▲ GreenGrid(R) 2'x2'x4" TRIANGLE MODULE (10)
- GreenGrid(R) 2'x2'x2.5" MODULE (240)
- GreenGrid(R) 2'x2'x4" MODULE (10)
- GreenGrid(R) 2'x4'x4" MODULE (81)

Not Open to Public

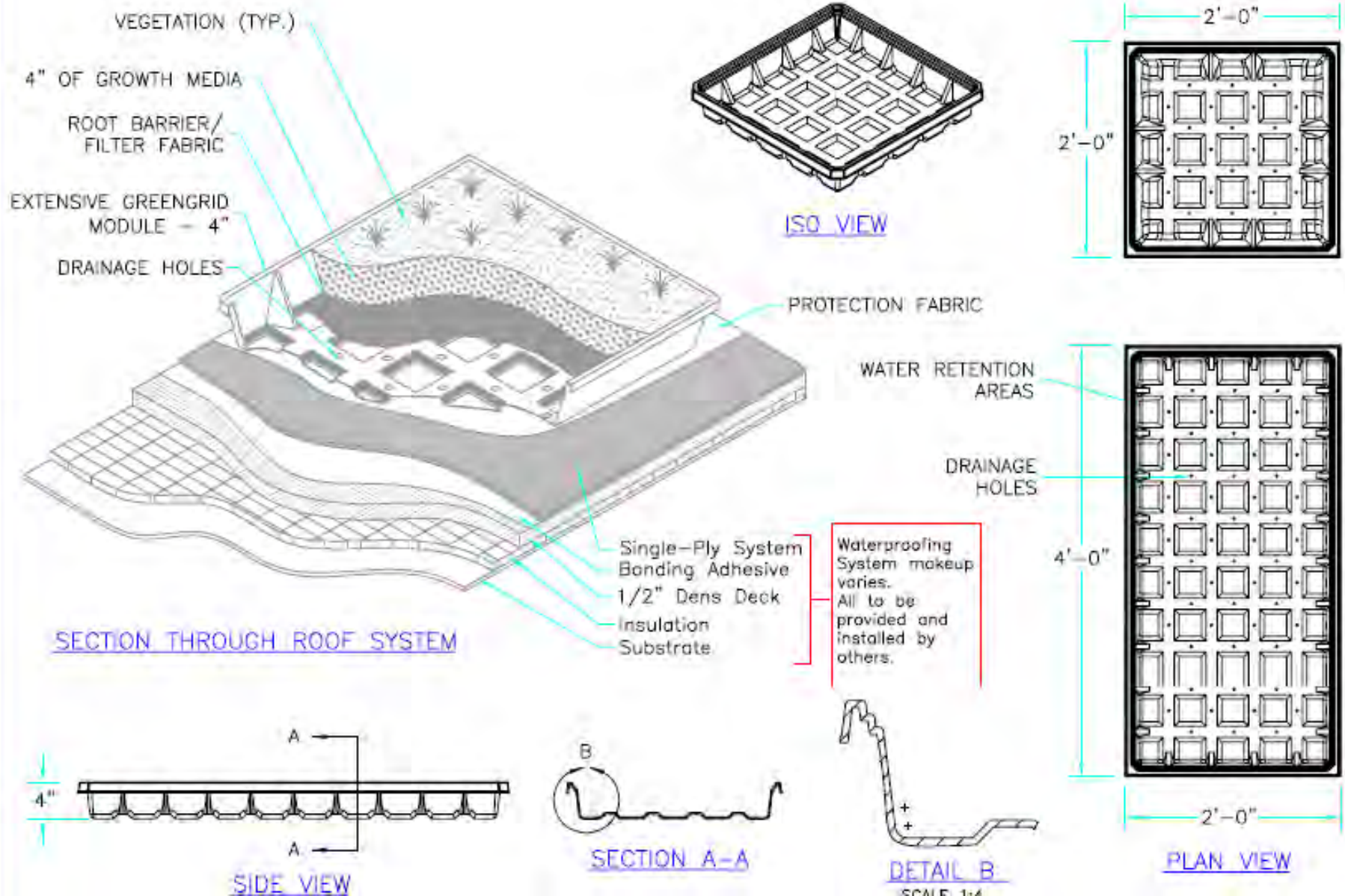


148 Eastern Boulevard
Glastonbury, CT
06033

GREENGRID(R) CONCEPTUAL DESIGN
CITY HALL
Dayton, Ohio

FIGURE 1

Schematic of Green Grid Units



Pre and Post Installation Storm Water Quality Sampling



Sample runoff for:

- Volatile Organic Compounds (VOCs)
- General Chemistry – Phosphate, Nitrate
- Total Metals





City Hall Green Roof

Installed
June 13, 2009



Partnerships

Planning

- Design Firm and Existing Roof Warranty
- Political Figures
- Regulators
- Community-Public
- Environmental Groups
- City Staff
- Contractors

Installation

- Design Firm
- Installation Contractor
- Existing Roof Warranty
- Publicity
- City Staff

Maintenance

- Design Firm – short term maintenance
- Community collaboration – long term maintenance
- City Staff

Community Involvement



Lessons Learned

- Review building structural assessment
- Collaboration between existing roof warranty contractor, designer and installer
- Involve City Departments early in the planning process...i.e. inspectors etc.

Green Roof Resources

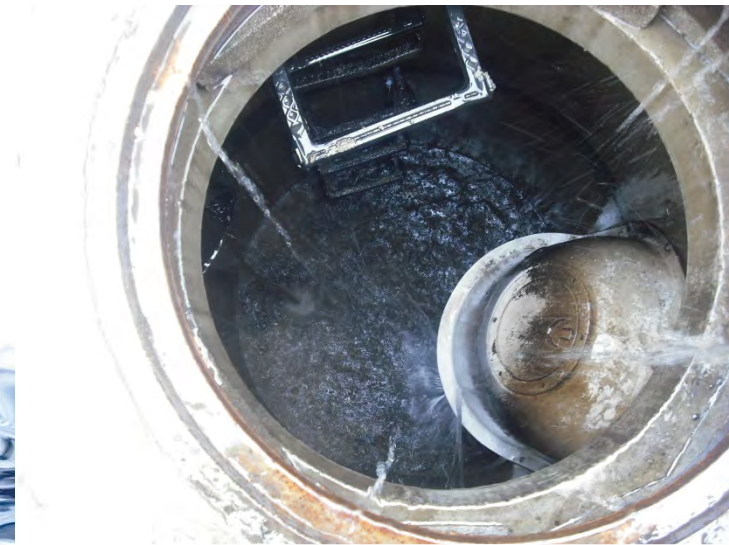
- Green Roofs for Healthy Cities
- GSA Green Roof Report
- City of Dayton Engineering Design Standards
- EPA Soak Up the Rain: Green Roofs
- Other green roofs in the area
 - UD Kennedy Union
 - Montgomery County Environmental Services
 - Dayton Metro Library Downtown
 - SD1 Public Service Park in Northern Kentucky



Other Stormwater BMPs



Sediment captured by the Flex-Storm Filter

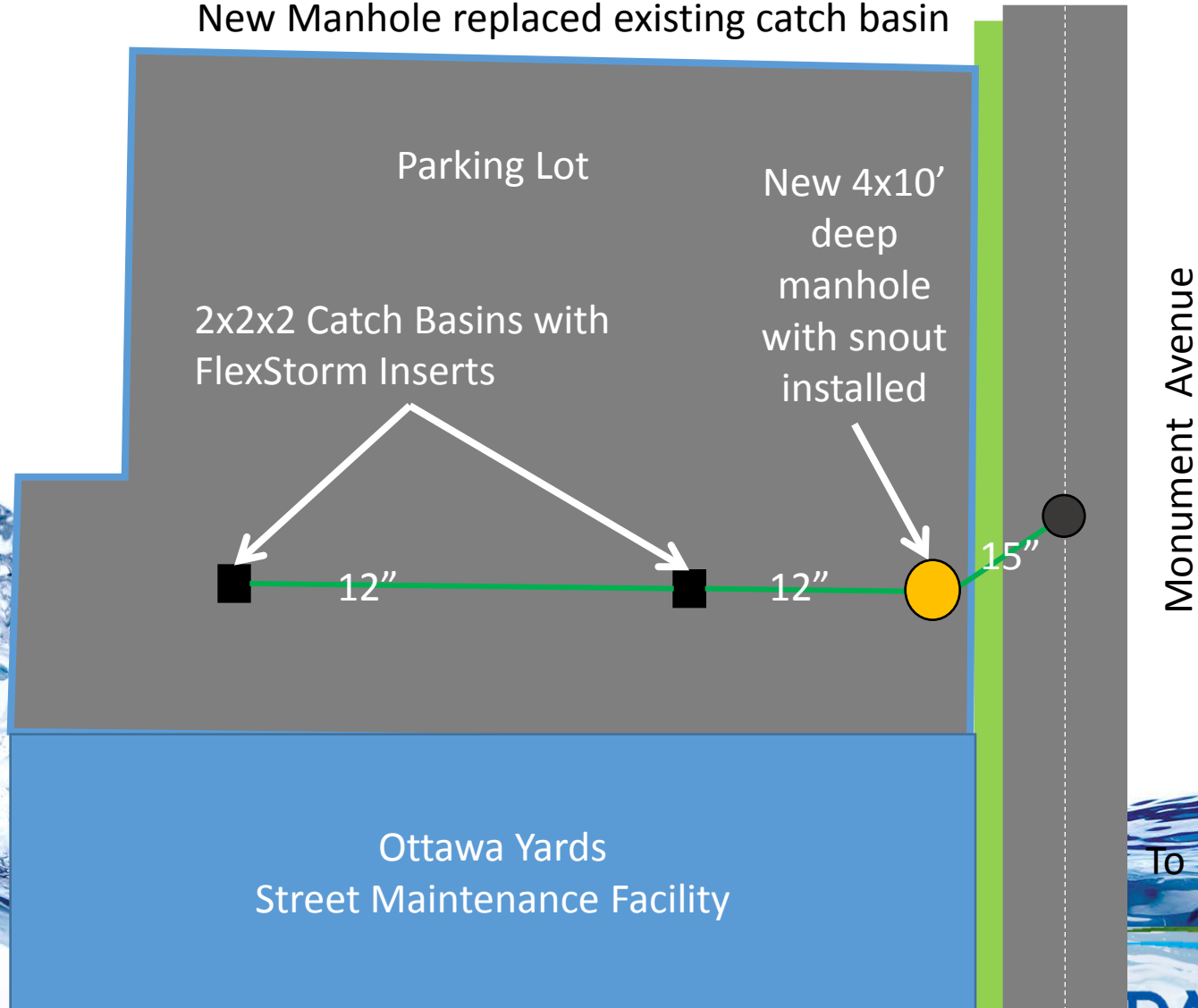


Cleaned manhole showing "Snout" over outlet

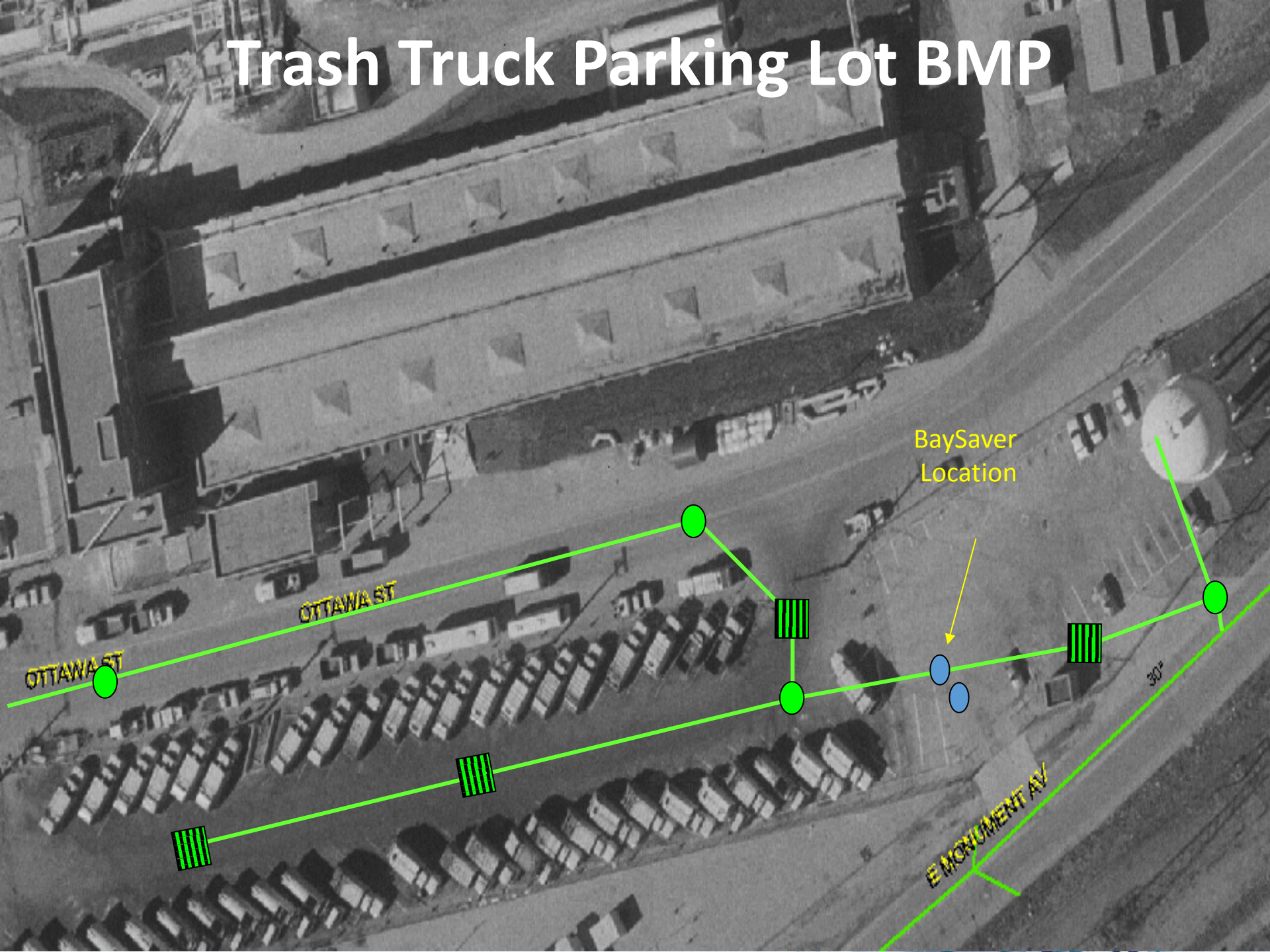
Street Maintenance Parking Lot

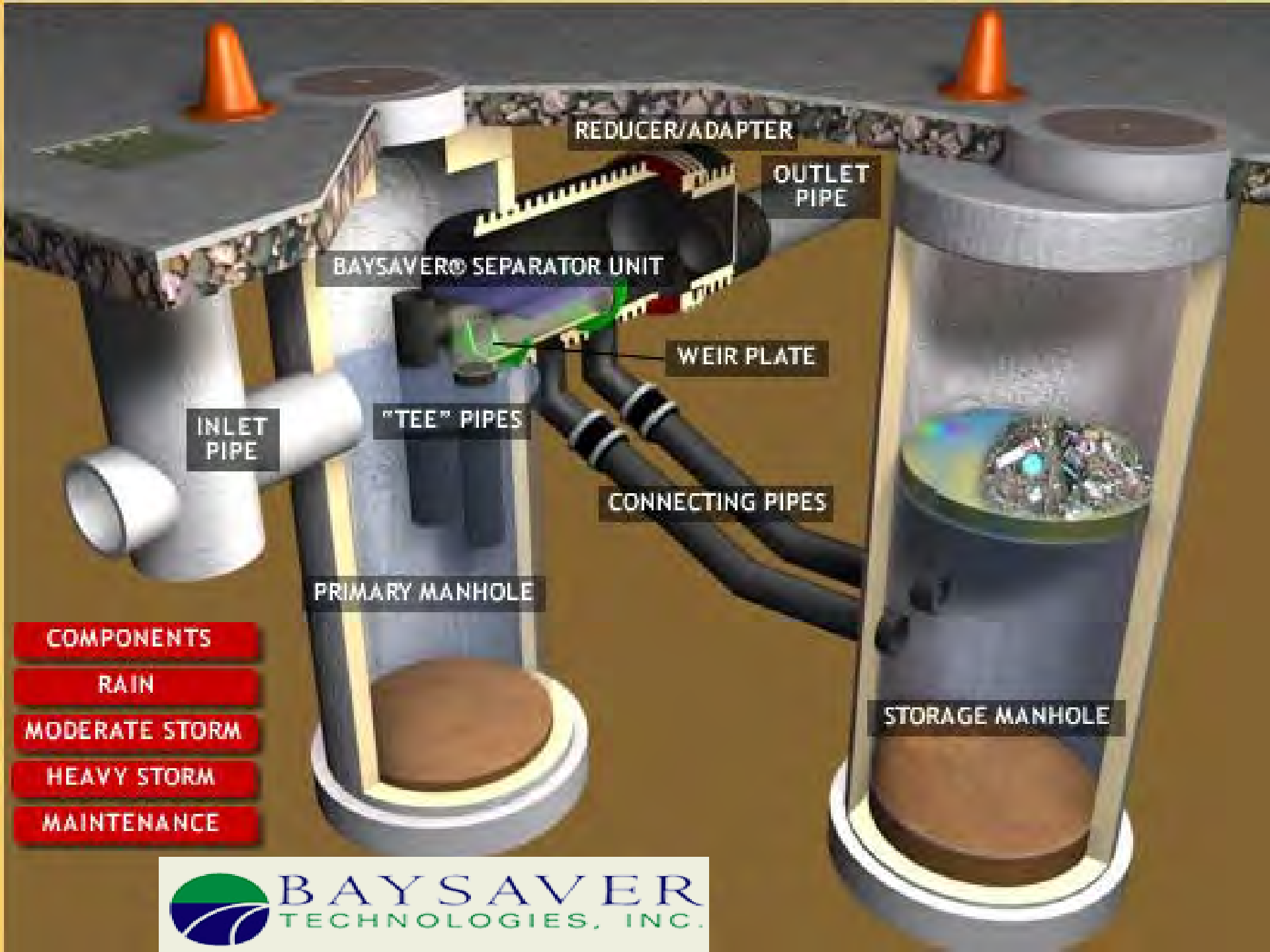
Street Maintenance Heavy Equipment Parking Lot Drain Upgrade Project

New Manhole replaced existing catch basin



Trash Truck Parking Lot BMP





REDUCER/ADAPTER

OUTLET
PIPE

BAYSAVER® SEPARATOR UNIT

WEIR PLATE

"TEE" PIPES

CONNECTING PIPES

INLET
PIPE

PRIMARY MANHOLE

STORAGE MANHOLE

COMPONENTS

RAIN

MODERATE STORM

HEAVY STORM

MAINTENANCE

Baysaver Performance

The unit is effective at capturing both solids and oil from the storm water run-off of the “Packer Lot”.



Primary manhole sample



Storage manhole sample

Employee Parking Lot – Pervious Concrete



Community Gardens as BMPs



Street Tree Farms as BMPs



Future BMPs

Lakeside and
Pineview
Neighborhood

Lake cleanup and
inlet protection
BMPs

(Under consideration)





CITY OF DAYTON
water
one source
Regional • Reliable • Renewable

Division of Environmental Management
937-333-3725

The following slides are
supplementary information



Sampling Results

Parameter	Unit	Date							
		8/5/2008	9/12/2008	7/23/2009	6/3/2010	10/26/2010	6/20/2011	12/5/2011	7/26/2012
VOC's	microgram/L	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
sVOC's	microgram/L	bdl	bdl	bdl	bdl	bdl			
Ammonia (undis N)	mg/L	na	0.114	na	0.17	0.13	<0.05	<0.05	0.085
Nitrate/Nitrite (N)	mg/L	0.832	1.59	5.6	0.94	1.2	0.8	0.0617	0.899
Phosphate (PO4)	mg/L	0.584	<0.310	0.27	0.07	0.31	<0.1	<0.1	<0.1
Total Metals									
Antimony	mg/L	0.000809	0.00132	na	na	na	<0.001	<0.001	<0.001
Arsenic	mg/L	<0.002	<0.004	<0.015	<0.003	<0.003	<0.01	<0.01	<0.01
Barium	mg/L	na	na	0.0276	0.0196	0.0241	0.0113	0.00985	0.0216
Beryllium	mg/L	<0.4	<0.4	na	na	na	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.0008	0.00102	<0.01	<0.01	<0.01	<0.001	<0.001	<0.001
Chromium	mg/L	0.002	0.00715	<0.01	<0.01	0.0032	<0.01	<0.01	<0.01
Copper	mg/L	0.0228	0.0397	na	na	na	<0.005	<0.005	0.00708
Lead	mg/L	0.145	0.285	0.041	0.105	0.0835	0.0169	0.0384	0.0214
Mercury	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	mg/L	0.00242	0.00423	na	na	na	<0.005	<0.005	<0.005
Selenium	mg/L	<0.004	<0.004	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01
Silver	mg/L	<0.0002	0.000221	<0.01	<0.01	<0.01	<0.0005	<0.0005	<0.0005
Thallium	mg/L	<0.0004	<0.0004	na	na	na	<0.001	<0.001	<0.001
Zinc	mg/L	0.401	0.666	na	na	na	0.0532	0.0917	0.149
Comments						Replanted some seedlings and added media. It was also one of the first good rains in awhile.			first rain in a while

Specifications

ELEMENT DESCRIPTION

Module sizes (nominal)

2 ft x 2 ft x 4 in
2 ft x 4 ft x 4 in

Depth of modules (three depths)

2.5 in, 4 in, and 8 in

Weight of planted modules (when wet)

2.5-in depth – Approx. 11-13 lb/ ft²
4-in depth – Approx. 18-22 lb/ ft²

Module material

100% post-industrial recycled High Molecular Weight Polyethylene.
Protected with UV inhibitors and stabilizers. – 150 mil (2.5 and 4 in)

Module drainage clearance above roof

0.5 in

Drainage/root resistance medium

3-oz spunbonded polypropylene geotextile

Slip sheet protection fabric

6-oz non-woven geotextile slip sheet.

GreenGrid® Green Roof Extensive Plant Species (4" depth modules) – Dayton City Hall



Botanic Name	Common Name	Mature Height (in)	Mature Width (in)	Flower Color	Foliage Color	Months in Bloom
<i>Sedum floriferum</i>	Weihenstephaner Gold	3-6	12-18	Yellow	Green	June-Aug
<i>Sedum kamtschaticum</i>	Kamtschaticum Stonecrop	6-8	8-10	Yellow	Green	June-July
<i>Sedum reflexum</i>	Reflexum Stonecrop	4-6	12-18	Yellow	Blue	July
<i>Sedum sexangulare</i>	Sexangulare Stonecrop	6-8	6-8	Yellow	Green	June-July
<i>Sedum spurium</i> 'Fuldaglut'	Fuldaglut Stonecrop	3-6	12	Ruby red	Red-Green	July
<i>Sedum spurium</i> 'John Creech'	John Creech Stonecrop	2-3	12-18	Pink	Green	July-Aug

Sedum album 'Murale'

Sedum sexangulare

Sedum floriferum
'Weihenstephaner Gold'

Sedum album
'Coral Carpet'



Sedum kamtschaticum



INSTALLATION

- Modules arrive pre-planted, palletized, and shrink-wrapped for stability.
- Palletized modules hoisted to the roof (crane).
- Delivery of Materials by a 53-foot Tractor Trailer
- Crane set up along on Ludlow (east end of building)

GreenGrid® Green Roof Logistics

- Coordinated in advance to minimize disruptions (Saturday installation)
- Installation ~8 hours

Equipment Requirements:

40-ton Crane (minimum)

✓ Safety Equipment (flags, cones, caution tape, etc)

Hose for irrigation

Labor Requirements:

1 Foreman/Safety Monitor

1 Crane Operator

1 Rigger

1 Crane Signaler

4 Laborers to offload/install modules

Street Maintenance Heavy Equipment Parking Lot Drain Upgrade Project

The City of Dayton upgraded a three (3) catch basin storm sewer which captures run-off from a one (1) acre heavy equipment parking lot associated with our Street Maintenance Department. The purpose of the upgrade is to reduce or prevent oils and debris from flowing to the MS4 which discharges to the Mad River and subsequently to the Great Miami River. This was accomplished by adding filter inserts to the catch basins and replacing the last catch basin with a new outlet structure to act as a sediment/oil trap.

The upgrade included placing custom made Flexstorm® inlet filters in all three catch basins and enlarging the outlet catch basin with a manhole structure to create a sump for the capture of sediments. A Nyloplast® Snout® Structure has been installed on the discharge pipe to prevent oils and other floatables from discharging to the MS4.

As part of the structures performance evaluation, the catch basins and manhole were cleaned and the sediments and the amount of water recovered were measured. A total of 7500 lbs. of water and debris were removed from the separator, including ~1 cubic yard of sandy sediment and 800 gallons of water.

Diagrams depicting the two options are as follows: