



COST-BENEFIT ANALYSIS OF MS4 BMPs & INSPECTIONS



NOAH CZECH


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COST-BENEFIT ANALYSIS OF MS4 BMPs & INSPECTIONS


- Review City's MS4
- Installation Cost Analysis
- Inspection & Maintenance Cost Analysis
- Conclusions

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Municipal Separate Storm Sewer System (MS4) Permit

- Stormwater Pollution Prevention Program (SWPPP)
- Minimum Control Measures (MCM's)
 - 1) Public Education/Outreach
 - 2) Public Involvement/Participation
 - 3) Illicit Discharge Detection/Elimination
 - 4) Construction Site Runoff Control
 - 5) Post Construction Runoff Control
 - 6) Municipal Good Housekeeping



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POST CONSTRUCTION STORMWATER MANAGEMENT REQUIREMENTS

Land Development Code Requirements:

- ½" Volume Reduction Over New Impervious
- ¼" Volume Reduction Over Redeveloped Impervious
- Right of Way Areas Exempt



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ST. CLOUD'S STORMWATER UTILITY

General Information

- > 40 Square Miles
- > 139 City Maintained Ponds
- > 190 Miles of Stormdrain Pipe
- > 215 Outfalls
- > 7,600 Catch Basins

Other City Treatment Practices:

- > 1 Green Roof
- > 5 Pre-Fabricated Systems
- > 8 Bioretention Basins
- > 13 Infiltration Trenches
- > 40 Pervious Sections
- > 44 Rain Gardens
- > 48 Sumps
- > 106 Tree Planters



INSTALLATION COST ANALYSIS

- 1) Capital Improvement Projects
- 2) Stormwater Retrofits


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UNDERGROUND SYSTEMS




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INFILTRATION TRENCHES




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SURFACE BIORETENTION




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SURFACE BIORETENTION



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TREE PLANTERS

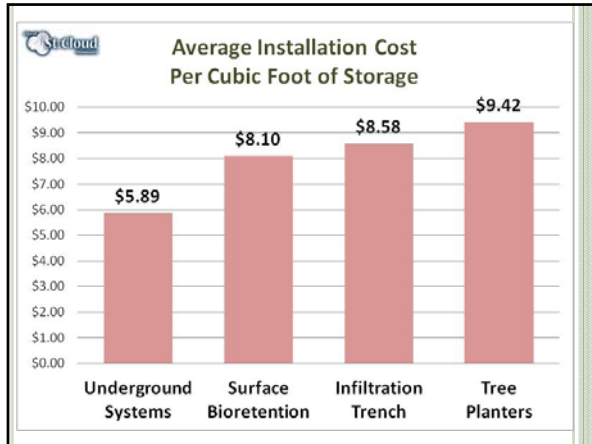


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**INSTALLATION COST ANALYSIS
CAPITAL IMPROVEMENT PROJECTS**

BMP Type	Total BMPs	Storage Volume (CF)	Average Storage (CF)	Installation Cost	Cost Per CF Storage
Underground Systems	5	71,240	14,248	\$419,574	\$5.89
Infiltration Trenches	13	4,128	318	\$35,435	\$8.58
Surface Bioretention	46	4,118	90	\$33,368	\$8.10
Tree Planters	22	3,354	152	\$31,579	\$9.42

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INSTALLATION COST ANALYSIS

- 1) Capital Improvement Projects
- 2) **Stormwater Retrofits**
 - Simple
 - Moderately Complex
 - Highly Complex

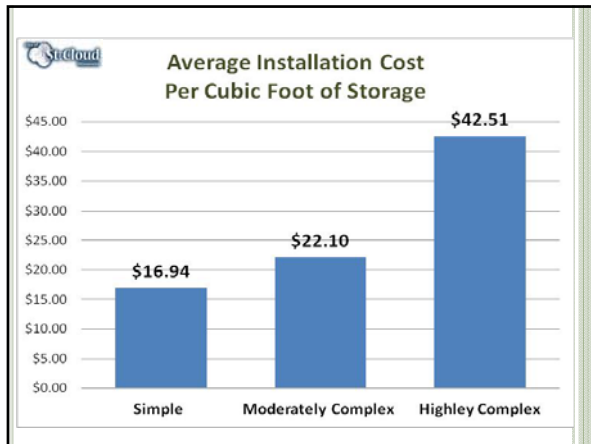
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INSTALLATION COST ANALYSIS STORMWATER RETROFIT PROJECTS

BMP Type	Total BMPs	Storage Volume (CF)	Average Storage (CF)	Installation Cost	Cost Per CF Storage
Retrofit Rain Gardens Simple	15	2,845	190	\$48,200	\$16.94
Retrofit Rain Gardens Moderately Complex	9	1,212	135	\$26,775	\$22.09
Retrofit Rain Gardens Highly Complex	6	1,469	245	\$62,450	\$42.51

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INSPECTION & MAINTENANCE COSTS

- Staff Time**
 - Intern \$15/hr
 - Public Works \$40/hr
 - Public Utilities \$45/hr
- Equipment**
 - Vector Truck \$175/hr
- Materials**
- Contract Services**

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INSPECTION & MAINTENANCE COSTS CAPITAL IMPROVEMENT PROJECTS

BMP Type	Cost Per CF Storage	Hours Spent Per BMP	Cost Per BMP
Underground Systems	\$0.07	6.80	\$1,024.50
Tree Planters	\$2.58	3.35	\$393.14
Infiltration Trenches	\$1.17	3.04	\$372.88
Surface Bioretention	\$0.96	2.38	\$85.97

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INSPECTION & MAINTENANCE COSTS STORMWATER RETROFIT PROJECTS

BMP Type	Cost Per CF Storage	Hours Spent Per BMP	Cost Per BMP
Retrofit Rain Gardens Simple	\$0.44	2.47	\$83.67
Retrofit Rain Gardens Moderately Complex	\$0.82	2.78	\$95.00
Retrofit Rain Gardens Highly Complex	\$0.63	3.78	\$118.35


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2013 PROJECTED INSPECTION & MAINTENANCE STAFF HOURS


Category	Public Works (Hrs)	Utilities (Hrs)
Rain Gardens	N/A	131
Tree Planters	N/A	141
Infiltration Wells	18	9
Sumps	126	47
Underground	18	4
Outfalls	75	58
Ponds	50	45
Stockpiles	12	6
Other	5	25
TOTAL (hrs)	304	466

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- ### CONCLUSIONS
- 1) Regional BMPs best bang for buck
 - 2) Optimizing small treatment practices
 - 3) Analyze annual volume reduction
 - 4) Pretreatment, Pretreatment, Pretreatment!
 - 5) 2013 City Projects
 - a) More regional
 - b) Maximization of smaller BMPs
 - 6) Budgeting
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 **CONCLUSIONS**

BMP Type	Total BMPs	Average Storage (CF)	Installation Cost Per CF Storage	Insp/Maint Cost Per CF Storage	Hours Spent Per BMP	Cost Per BMP
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 **QUESTIONS**



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