



Other Resources

- PADEP MS4 Resources Page
<http://www.dep.pa.gov/Business/Water/Point/and/NonPoint/Stormwater/Nonpoint/Stormwater/MS4/MS4Resources.aspx?V=60070000>
- Maps, Modeling Tools
- Materials Related to MCMs
- Draft MS4 Water Quality Requirements
- Other DEP, EPA and Philadelphia Reference material

Stormwater Management Retrofits

Michael E. Lower, PE
Environmental/Chemical Engineer

Sample Projects: BMP Retrofit- Catfish Creek, Washington, PA




BEFORE

AFTER



BEFORE

AFTER

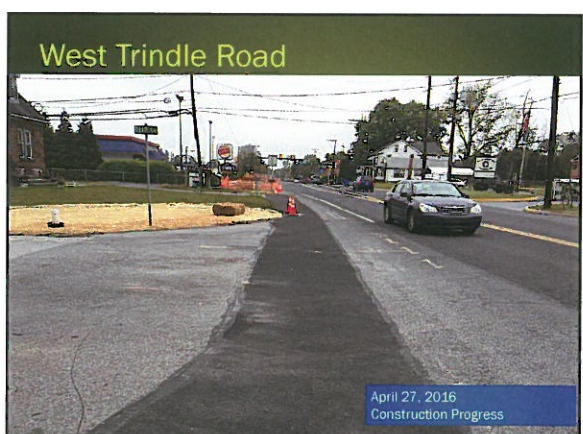
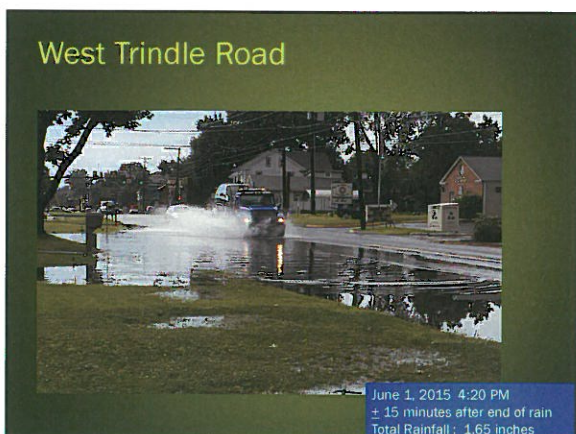
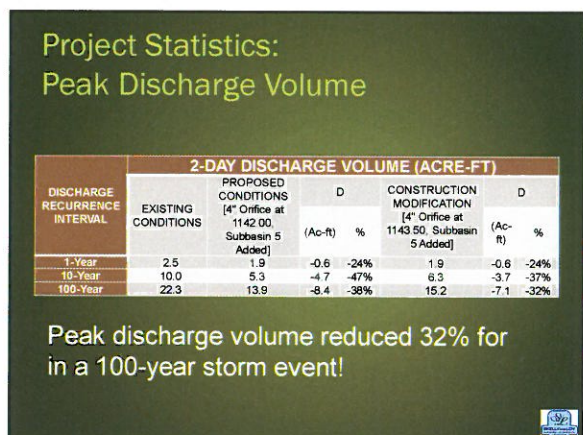
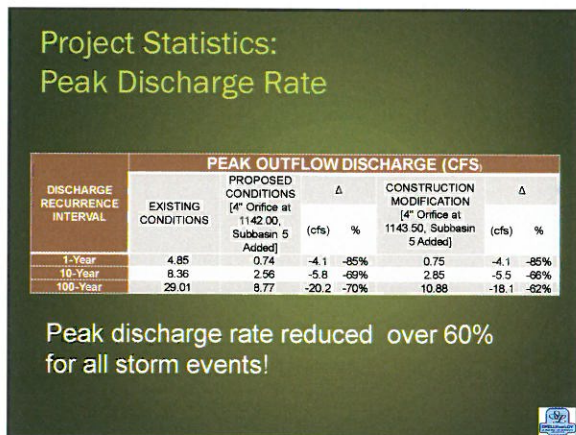
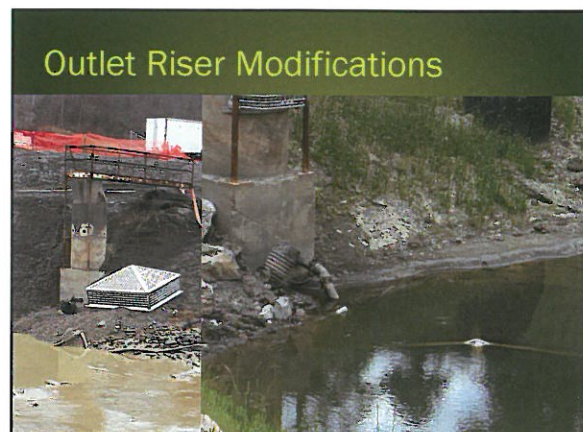
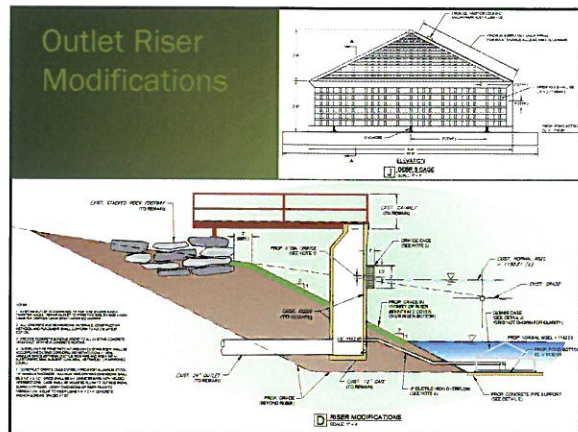


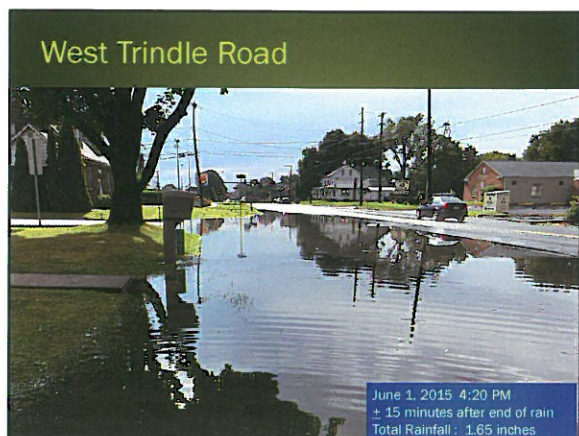
BEFORE

AFTER

Pre-Dredging Water Surface Elevation









West Trindle Road- Pollutant Removal

WEST TRINDLE ROAD, LEBANON, TN
2015-2016 CONSTRUCTION COSTS

PROJECT ID	LOCATION	ASSESSED BMP	TREATED VOLUME (acre-inches)		POLLUTANT LOAD REDUCTIONS (pounds/year)		ESTIMATED CONSTRUCTION COST (\$)		ANNUALIZED COST (\$/year)		Comments
			Assessed	Treated	Nitrogen	Phosphorus	Estimated	Annualized	Nitrogen	Phosphorus	
Upper Storm Drain	1. Between Burger King and Greystone Road (South Side)	1. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	2. Between Burger King and Greystone Road (South Side)	2. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	3. Between Burger King and Greystone Road (South Side)	3. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	4. Between Burger King and Greystone Road (South Side)	4. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	5. Between Burger King and Greystone Road (South Side)	5. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	6. Between Burger King and Greystone Road (South Side)	6. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	7. Between Burger King and Greystone Road (South Side)	7. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	8. Between Burger King and Greystone Road (South Side)	8. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	9. Between Burger King and Greystone Road (South Side)	9. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	10. Between Burger King and Greystone Road (South Side)	10. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
Lower Storm Drain	1. Between Burger King and Greystone Road (South Side)	1. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	2. Between Burger King and Greystone Road (South Side)	2. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	3. Between Burger King and Greystone Road (South Side)	3. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	4. Between Burger King and Greystone Road (South Side)	4. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	5. Between Burger King and Greystone Road (South Side)	5. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	6. Between Burger King and Greystone Road (South Side)	6. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	7. Between Burger King and Greystone Road (South Side)	7. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	8. Between Burger King and Greystone Road (South Side)	8. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	9. Between Burger King and Greystone Road (South Side)	9. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	10. Between Burger King and Greystone Road (South Side)	10. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	

West Trindle Road- Pollutant Removal

WEST TRINDLE ROAD, LEBANON, TN
2015-2016 CONSTRUCTION COSTS

PROJECT ID	LOCATION	ASSESSED BMP	TREATED VOLUME (acre-inches)		POLLUTANT LOAD REDUCTIONS (pounds/year)		ESTIMATED CONSTRUCTION COST (\$)		ANNUALIZED COST (\$/year)		Comments
			Assessed	Treated	Nitrogen	Phosphorus	Estimated	Annualized	Nitrogen	Phosphorus	
Upper Storm Drain	1. Between Burger King and Greystone Road (South Side)	1. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	2. Between Burger King and Greystone Road (South Side)	2. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	3. Between Burger King and Greystone Road (South Side)	3. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	4. Between Burger King and Greystone Road (South Side)	4. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	5. Between Burger King and Greystone Road (South Side)	5. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	6. Between Burger King and Greystone Road (South Side)	6. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	7. Between Burger King and Greystone Road (South Side)	7. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	8. Between Burger King and Greystone Road (South Side)	8. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	9. Between Burger King and Greystone Road (South Side)	9. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	10. Between Burger King and Greystone Road (South Side)	10. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
Lower Storm Drain	1. Between Burger King and Greystone Road (South Side)	1. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	2. Between Burger King and Greystone Road (South Side)	2. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	3. Between Burger King and Greystone Road (South Side)	3. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	4. Between Burger King and Greystone Road (South Side)	4. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	5. Between Burger King and Greystone Road (South Side)	5. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	6. Between Burger King and Greystone Road (South Side)	6. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	7. Between Burger King and Greystone Road (South Side)	7. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	8. Between Burger King and Greystone Road (South Side)	8. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	9. Between Burger King and Greystone Road (South Side)	9. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	
	10. Between Burger King and Greystone Road (South Side)	10. Bio-retention Rain Garden	0.05	1.2	0.1	10.0	\$10,000	\$10,000	\$1,000	\$1,000	

West Trindle Road- Pollutant Removal

PROJECT ID	LOCATION	ASSESSED BMP	TREATED VOLUME (acre-inches)	POLLUTANT LOAD REDUCTIONS (pounds/year)			Comments
				Nitrogen	Phosphorus	Sediment	
West Trindle Road	Between Burger King and Greystone Road (South Side)	• Bio-retention Rain Gardens • Bio-retention Rain Gardens	2.30	29.5	0.8	1,513	

ESTIMATED CONSTRUCTION COST	ANNUALIZED COST (20-Year Basis)	OPERATION AND MAINTENANCE (Assume 10% Annually)	TOTAL ANNUAL COST	ANNUAL POLLUTANT LOAD REDUCTION COST (\$/pound/year)			Comments
				Nitrogen	Phosphorus	Sediment	
\$352,500	\$17,025	\$1,763	\$19,388	\$657	\$24,234	\$13.00	
\$598,000	\$29,900	\$2,990	\$32,890	\$1,115	\$41,113	\$22.00	

