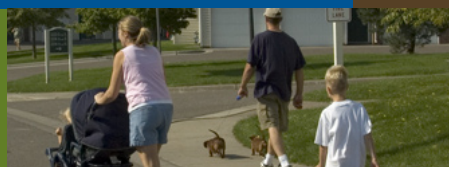
A case study comparison of costs, water quality and quantity benefits, and quality of life.

MINNESOTA LOW IMPACT DEVELOPMENT A COMPARISON

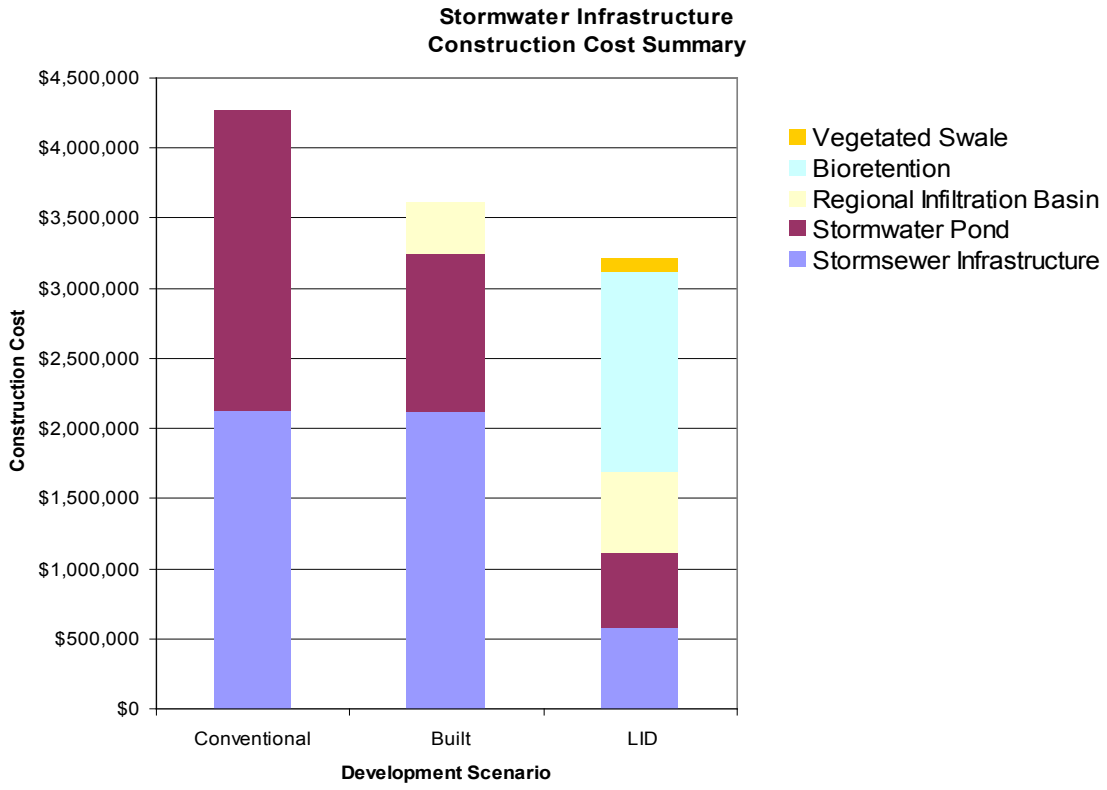
COST COMPARISON



CONSTRUCTION COST

For this project, the cost of the stormwater management infrastructure was estimated, along with the additional site development cost for the Conventional, Built and LID scenarios. Since the focus of this project was on the comparison of stormwater management cost these cost have been estimated in more detail. The other site development cost were provided by the City of Lakeville for the Built scenario and estimated for the LID scenario. These costs are estimates and are used for comparison purposes only.

Costs are very site specific. Each project will be unique based on the site's soil conditions, topography, existing vegetation, land availability etc. Here, fairly exact cost estimates are given for some of the individual techniques. Keep in mind, however, that the actual costs will vary greatly based on the character of the individual site and the creativity of the designer.



Development Cost

IMPORTANT CONSIDERATIONS WHEN EVALUATING THE ESTIMATED DEVELOPMENT COST

- Stormwater features like bioretention, often replace area that would likely be landscaped anyway. Thus, the true stormwater construction cost for the LID scenario would be less than the construction cost reported.
- The LID scenario has a higher density than the BUILT example. Since additional infrastructure was necessary to service these additional units, *cost per unit* is a more appropriate cost comparison than total cost.

ITEM	UNITS	UNIT COST	CONVENTIONAL		BUILT		LID	
			QTO	Total Cost	QTO	Total Cost	QTO	Total Cost
Storm Sewer Infrastructure								
4" PVC Draintile	L.F.	$18.00	5274	$94,932	5274	$94,932	0	$0
6" PVC Draintile w/Sock	L.F.	$25.00	613	$15,325	613	$15,325	0	$0
12" RCP, CL V	L.F.	$24.00	9034	$216,816	9034	$216,816	8863	$212,712
15" RCP, CL V	L.F.	$26.00	3503	$91,078	3503	$91,078	0	$0
18" RCP, CL V	L.F.	$30.00	4144	$124,320	4144	$124,320	500	$15,000
21" RCP, CL III	L.F.	$32.00	2744	$87,808	2744	$87,808	0	$0
24" RCP, CL III	L.F.	$33.00	3032	$100,056	3032	$100,056	715	$23,595
27" RCP, CL III	L.F.	$41.00	2996	$122,836	2996	$122,836	150	$6,150
30" RCP, CL III	L.F.	$50.00	1721	$86,050	1721	$86,050	370	$18,500
36" RCP, CL III	L.F.	$63.00	3833	$241,479	3833	$241,479	150	$9,450
42" RCP, CL III	L.F.	$100.00	845	$84,500	845	$84,500	0	$0
48" RCP, CL III	L.F.	$105.00	705	$74,025	705	$74,025	0	$0
54" RCP, CL III	L.F.	$136.00	142	$19,312	142	$19,312	0	$0
36" x 58" RC Arch Pipe	L.F.	$155.00	461	$71,455	461	$71,455	0	$0
40" x 65" RC Arch Pipe	L.F.	$190.00	57	$10,830	57	$10,830	0	$0
4" PVC Cleanout	Each	$200.00	6	$1,200	6	$1,200	0	$0
6" PVC Cleanout	Each	$250.00	4	$1,000	4	$1,000	0	$0
RCP Manhole/Catchbasin less than 8 feet	Each	$1,700.00	260	$442,000	260	$442,000	140	$238,000
RCP Manhole/Catchbasin greater than 8 feet	Each	$3,500.00	49	$171,500	49	$171,500	0	$0
Outlet Structure	Each	$6,000.00	8	$48,000	8	$48,000	6	$36,000
Stormceptor	Each	$15,000.00	1	$15,000	1	$15,000	0	$0
Flared End Section	Each	$300.00	26	$7,800	26	$7,800	37	$11,100
		SUBTOTAL:		**$2,127,322**		**$2,127,322**		**$570,507**
Stormwater BMP's								
Stormwater Pond	C.F.	$0.56 [1]	3815856	$2,136,879	1998533	$1,119,178	982713	$550,319
Regional Infiltration Basin	C.F.	$1.11 [2]	0	$0	353707	$392,615	540144	$599,560
Bioretention (w/ underdrain & amended soils)	C.F.	$6.40 [3]	0	$0	0	$0	138078	$883,699
Bioretention (w/o underdrain & amended soils)	C.F.	$3.30 [3]	0	$0	0	$0	165960	$547,668
Vegetated Swale	S.F.	$0.56 [2]	0	$0	0	$0	177000	$99,120
		SUBTOTAL:		**$2,136,879**		**$1,511,793**		**$2,680,366**
STORMWATER TREATMENT COST				**$4,264,201**		**$3,639,115**		**$3,250,873**

Development Cost

ESTIMATED STORMWATER FACILITIES CONSTRUCTION COST

References:

[1]Adapted from

Brown, W. and T. Schueler. 1997b. *The Economics of Storm Water BMPs in the Mid-AtlanticRegion*. Center for Watershed Protection. Ellicott City, MD.

EPA. (August 1999). Preliminary data summary of urban storm water best management practices (epa-821-r-99-012):Environmental Protection Agency, Office of Water.

[2]Adapted from

Southeastern Wisconsin Regional Planning Commission (SWRPC). 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Waukesha, WI.

EPA. (August 1999). *Preliminary data summary of urban storm water best management practices.* (epa-821-r-99-012):Environmental Protection Agency, Office of Water.

[3]Adapted from

Brown, W. and T. Schueler. 1997b. *The Economics of Storm Water BMPs in the Mid-AtlanticRegion*. Center for Watershed Protection. Ellicott City, MD.

EPA. (September 1999). *Stormwater technology fact sheet bioretention.* (832-f-99-012):Environmental Protection Agency, Office of Water

Development Cost

ESTIMATED DEVELOPMENT COST

ACTIVITY	BUILT COST	LID Cost	LID Est. % Difference	EXPLANATION OF DIFFERENCE
SUMMARY OF CONSTRUCTION COST				
Grading	$2,500,000	$2,250,000	90% +/-	*LID scenario has reduced volume and transport distance due to greater utilization of existing drainage & holding to the contour*
Erosion Control	$336,388	$706,415	210% +/-	*LID developments are more sensitive to construction disturbance and sedimentation; therefore this type of development often warrants greater temporary and permanent erosion control*
Sanitary Sewer	$706,857	$735,131	104% +/-	*Due to greater yield, the LID scenario has more sanitary hookups*
Watermain	$882,448	$900,097	102% +/-	*Due to greater yield, the LID scenario has more water hookups*
Streets	$3,301,111	$3,235,089	98% +/-	*Due to efficiency of site planning the LID scenario has less overall road length*
Storm Sewer Infrastructure	$2,127,322	$570,507	27% +/-	*LID scenario has significantly less stormsewer infrastructure;* ***See Stormwater Treatment Cost Estimate Comparison for more information***
Storm Water BMP's	$1,490,571	$2,647,958	179% +/-	*LID scenario relies heavily on stormwater BMP's;* ***See Stormwater Treatment Cost Estimate Comparison for more information***
Dodd Blvd Reconstruction	$3,665,728	$3,665,728	=	
	$15,010,425	$14,710,924		
OTHER COST				
Developers Design	$566,104	$634,037	112% +/-	*Due to the greater upfront effort ,the design cost associated with LID are often higher than conventional design*
Developers Const Survey	$235,876	$235,876	=	
City Legal Expense	$47,175	$47,175	=	
City Const Observation	$660,455	$660,455	=	
Developer's Record Drawing	$47,175	$47,175	=	
Landscaping (Block 1)	$70,000	$70,000	=	
Landscaping (Buffer Berms & Outlots)	$70,000	$70,000	=	
Lot Corners	$6,400	$7,360	115% +/-	*Due to greater yield, the LID scenario has greater number of potential lots*
One Year Real Estate Taxes	$13,000	$15,340	118% +/-	*Due to greater yield, the LID scenario has greater potential real estate tax value*
Wetland Mitigation	$200,000	$200,000	=	
Tree Preservation	$5,000	$5,000	=	
Street Lighting	$39,000	$39,000	=	
	$1,960,185	$2,031,418		

Development Cost

ACTIVITY	BUILT COST	LID Cost	LID Est. % Difference	EXPLANATION OF DIFFERENCE
SUMMARY OF CASH FEES				
Sanitary Sewer Area Charge	$53,550	$53,550	=	
Storm Sewer Area Charge	$499,890	$499,890	=	
Park Dedication Fee	$200,270	$100,135	50% +/-	*The LID scenario affords 14.8 acres (5.5 landscaped) of "useable" public open space (non pond, wetland and associated shoreline); Built provides 0 acres.*
Street Signs	$15,545	$15,545	=	
Street Lights Operating Fee	$4,500	$4,500	=	
Surface Water Management Utility Fee	$1,850	$1,887	102% +/-	*Fee is based on impervious surface area; Greater yield in LID scenario resulted in an additional 2 acres of impervious surface*
Base Map Upgrading	$2,336	$2,336	=	
City Admin Fee	$283,050	$283,050	=	
Escrow for Cedar/179th and Dodd/Glacier Signals	$575,000	$575,000	=	
Assessment 89-1, Outlot I	$19,700	$19,700	=	
Landowner education	$0	$20,200	N/A	*Costs to educate the homeowners on use and maintenance of LID BMPs are estimated at $25/household initially. These costs include preparation and distribution of outreach materials and limited training/education at homeowner meetings.*
	$1,655,691	$1,575,793		
SUMMARY OF CASH CREDITS				
Sanitary sewer truck credit	$136,798	$136,798	=	
North Creek sanitary sewer credit	$50,000	$50,000	=	
Watermain truck credit	$101,758	$101,758	=	
Residential storm sewer trunk credit	$111,422	$111,422	=	
Commercial storm sewer trunk credit	$48,293	$48,293	=	
Purchase of outlots for Wetlands/Stormwater	$94,215	$94,215	=	
	$542,486	$542,486		
SITE DEVELOPMENT COST	**$18,083,815**	**$17,775,649**		
SITE DEVELOPMENT COST PER RESIDENTIAL	**$26,509**	**$22,003**		

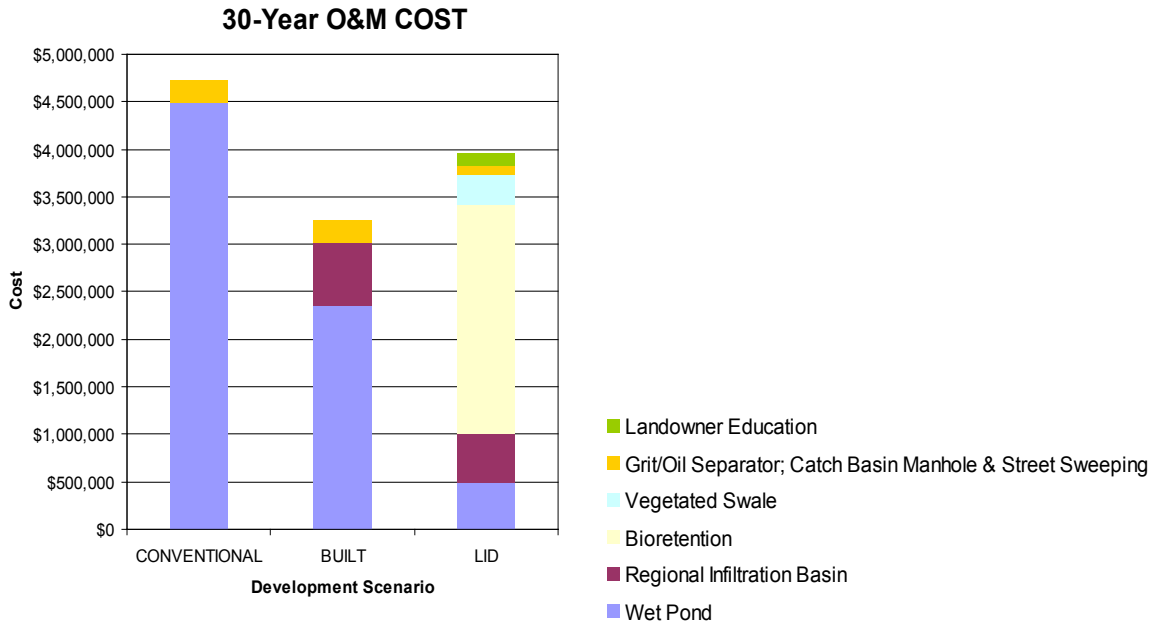
Maintenance Cost

MAINTENANCE COST

This report considers maintenance costs only to the stormwater management practices. Therefore maintenance of other components of the development, such as road pavement are not included.

Maintenance of stormwater management practices can be broken down into two primary categories: aesthetic/ nuisance maintenance and functional maintenance. Functional maintenance is important for performance and safety reasons, while aesthetic maintenance is important primarily for public acceptance of BMPs, and because it may also reduce needed functional maintenance. Aesthetic maintenance is obviously more important for BMPs that are very visible, such as ponds and bioretention facilities. In most studies, operation and maintenance (O&M) costs have been estimated as a percentage of base construction costs. While some BMPs require infrequent, costly maintenance, others need more frequent but less costly maintenance. Accordingly, selection of appropriate structural BMPs must factor in maintenance cost (and a responsible party to carry out maintenance) to ensure the necessary long-term performance.

Of concern to developers, designers, and engineers is the national trend toward storm water utility fees, or taxes, for storm water that exits a property. Fees are typically calculated on the impervious area of a lot, such as roofs, roads, and driveways. LID will reduce or eliminate storm water utility fees by reducing impervious surfaces or mitigating their impact, promoting infiltration, and dispersing flows. LID site design lowers the volume of runoff leaving a site. This should be considered as an additional cost savings beyond reduced maintenance costs.



Maintenance Cost

IMPORTANT CONSIDERATIONS WHEN EVALUATING THE ESTIMATED O&M COST

- BMP's, such as bioretention, are strategically placed in areas that would otherwise be landscaped.
- The estimated O&M cost for the LID scenario included the "landscaping" cost for these areas, which total over 11 acres.
- The estimated O&M cost for the BUILT scenario do not reflect the O&M cost for these areas that would otherwise be landscaped.
- Operation and maintenance costs for a bioretention facility are comparable to those of typical landscaping

STORMWATER BMP	ANNUAL MAINTENANCE COST (% of Construction Cost)	MAINTENANCE CYCLE	CONVENTIONAL		BUILT		LID	
			Const. Cost	Maint. Cost	Const. Cost	Maint. Cost	Const. Cost	Maint. Cost
Routine & Non-Routine Maintenance Measured by % of Construction Cost								
Wet Pond w/ limited pretreatment	7%	30 Years	$2,136,879	$4,487,447	$1,119,178	$2,350,275	$0	$0
Wet Pond w/ pretreatment	3%	30 Years	$0	$0	$0	$0	$550,319	$495,287
Regional Infiltration Basin w/ primary pretreatment	6%	30 Years	$0	$0	$371,392	$668,506	$0	$0
Regional Infiltration Basin w/ significant pretreatment	3% [1]	30 Years	$0	$0	$0	$0	$567,151	$510,436
Bioretention (w/ underdrain & amended soils)	6%	30 Years	$0	$0	$0	$0	$883,699	$1,590,659
Bioretention (w/o underdrain & amended soils)	5%	30 Years	$0	$0	$0	$0	$547,668	$821,502
Vegetated Swale	6%	30 Years	$0	$0	$0	$0	$177,000	$318,600
				$4,487,447		$3,018,781		$3,736,484

STORMWATER BMP	FREQUENCY (over 30-years)	UNIT	COST PER ACTIVITY	TRADITIONAL		BUILT		LID	
				Quantity	Maint. Cost	Quantity	Maint. Cost	Quantity	Maint. Cost
Non-Routine Maintenance Measured by Cost Per Activity									
Grit/Oil Separator	75 [2]	Each	$885.00 [2]	1.00	$66,375	1.00	$66,375	0.00	$0
Catch Basin/Manhole	10 [3]	Each	$50.00 [3]	309.00	$154,500	309.00	$154,500	140.00	$70,000
Street Sweeping	90	Mile	$21.00 [4]	11.20	$21,168	11.20	$21,168	11.20	$21,168
Landowner Education	30	REU	$5.00	0.00	$0	0.00	$0	808.00	$121,200
					$242,043		$242,043		$212,368
30 Year Maintenance Cost					**$4,729,490**		**$3,260,824**		**$3,948,852**
Maintenance Cost Per Residential Equivalent Unit (REU) Per Year					**$237**		**$159**		**$163**

Maintenance Cost

STORMWATER FACILITIES O&M COST FOR A 30-YEAR PERIOD
ESTIMATED BY PERCENTAGE OF CONSTRUCTION COST

References:

[1]Adapted from:

Center for Watershed Protection (CWP). 1998. *Costs and Benefits of Stormwater BMP's: Final Report 9/14/98.* Center for Watershed Protection, Ellicott City, MD.

[2]Adpated from:

Canada Mortgage and Housing Corporation. *Oil and Grit Separators.* [www.cmhc-schl.gc.ca/en/inpr/su/waco/alstmaprrepr/alstmaprrepr_009.cfm]. Accessed December 19, 2006

[3]Adpated from:

Rouge River National Wet Weather Demonstration Project. 2001. *Planning and Cost Estimating Criteria for Best Management Practices.* [www.rougeriver.com/pdfs/stormwater/sr25.pdf]. Accessed December 19, 2006.

[4]Adpated from:

Finley, S. 1996. "Sweeping Works." *Pavement Maintenance and Reconstruction*. October/November, pp. 16-17.

Southeastern Wisconsin Regional Planning Commission (SWRPC). 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Waukesha, WI.

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