MINNESOTA LOW-IMPACT DEVELOPMENT STUDY

Fall 2006

EOR water ecology community

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PROJECT MADE POSSIBLE BY

Financial & In-kind contributions made by:

Minnesota Pollution Control Agency

Minnesota Department of Natural Resources

EOR water ecology community

Lakeville

Vermillion River Watershed JPO

RCWD

Minnehaha Creek Watershed District

Project design & administration:

EOR water ecology community

Friends of the Mississippi River

OBJECTIVE

A side by side comparison of traditional design and LID design comparing:

1. Stormwater performance
    a) quality
    b) quantity
2. Development
    a) yield
    b) cost
3. Maintenance cost
4. Quality of Life Benefits

DELIVERABLES

Development Scenarios	TRADITIONAL	BUILT	LID
Stormwater Treatment	ponding	ponding regional infiltration basin	integrated BMP's ponding regional infiltration basin

PROJECT SITE

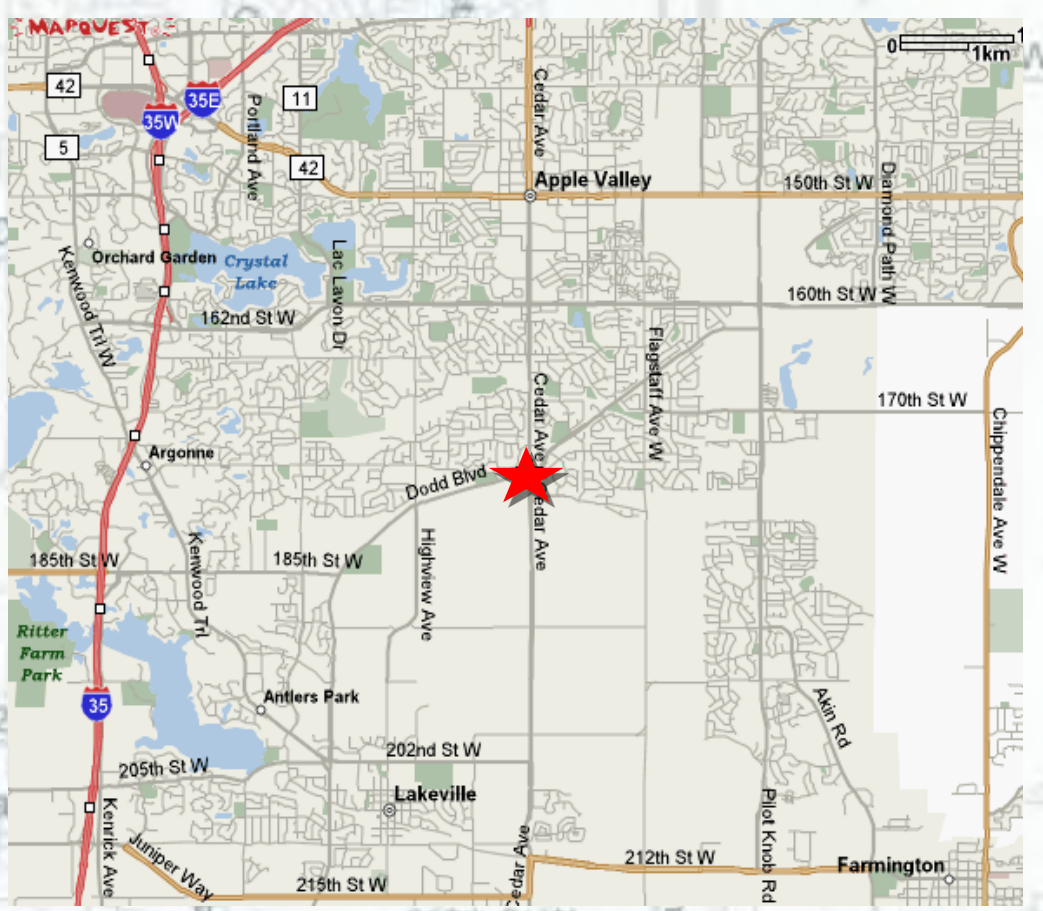
REAL WORLD SITE

Project Location

Lakeville, MN (Dakota County)

Watershed

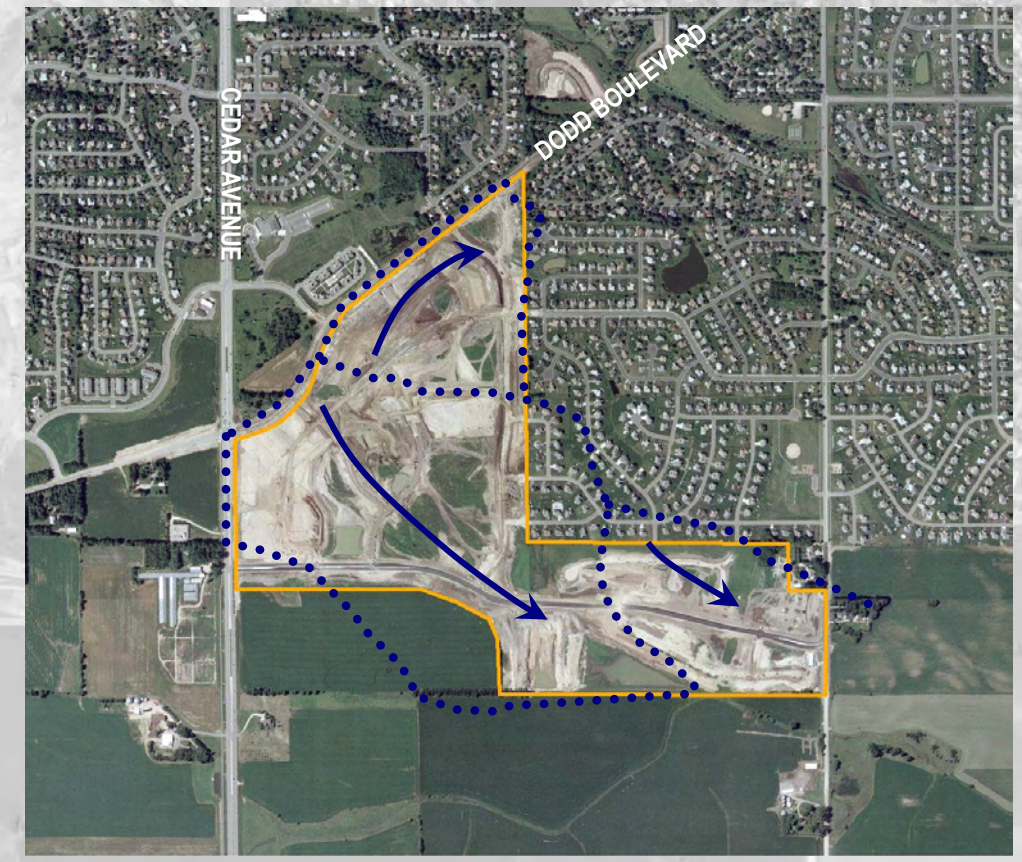
Vermillion River



REAL WORLD SITE

Parcel Description

SE of Cedar Ave and Dodd Blvd
217.10 acres
Soils – B's, C's and Isolated D's
Discharges to Vermillion Trib.



REAL WORLD SITE

Development

Residential – unattached
Residential – attached
Senior Housing
Institutional
Commercial

LID Design

APPROACH

PLANNING

- Hydrology as the integrating framework
- Control stormwater at the source
- Multifunctional landscape and infrastructure
- Reduce impervious surfaces
- Creating a system of continuous stormwater polishing
- Disconnect impervious surfaces

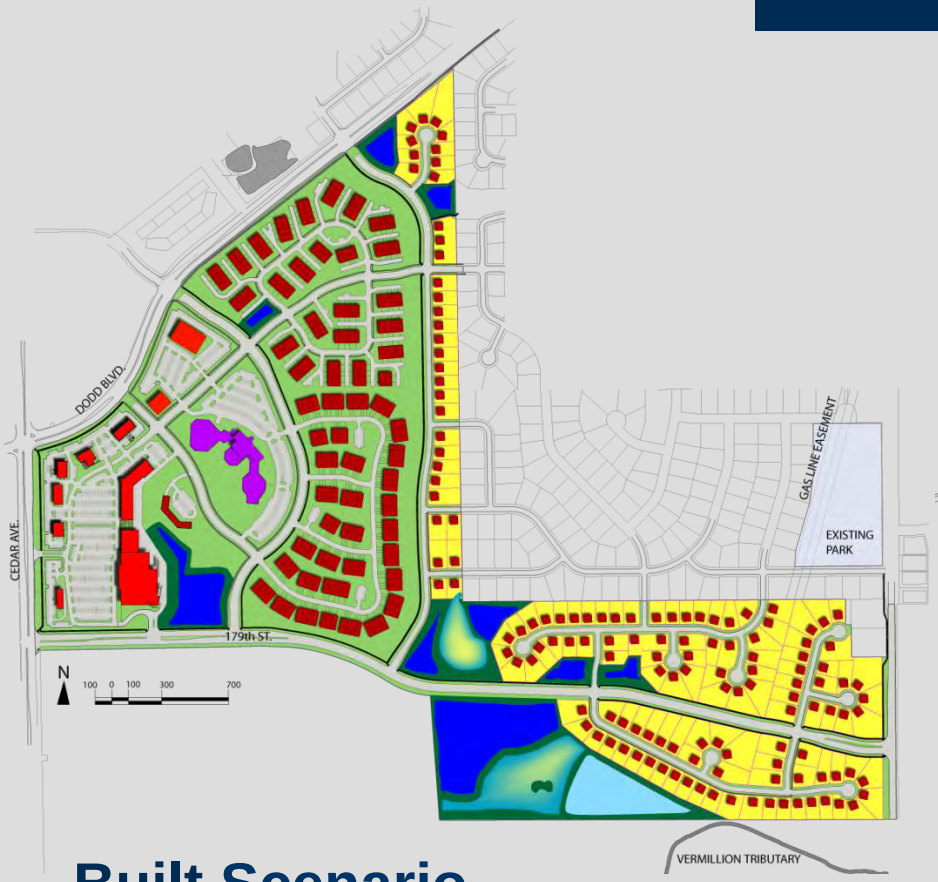
UTILIZED

- Bioretenion & vegetated swales
- Regional infiltration basin

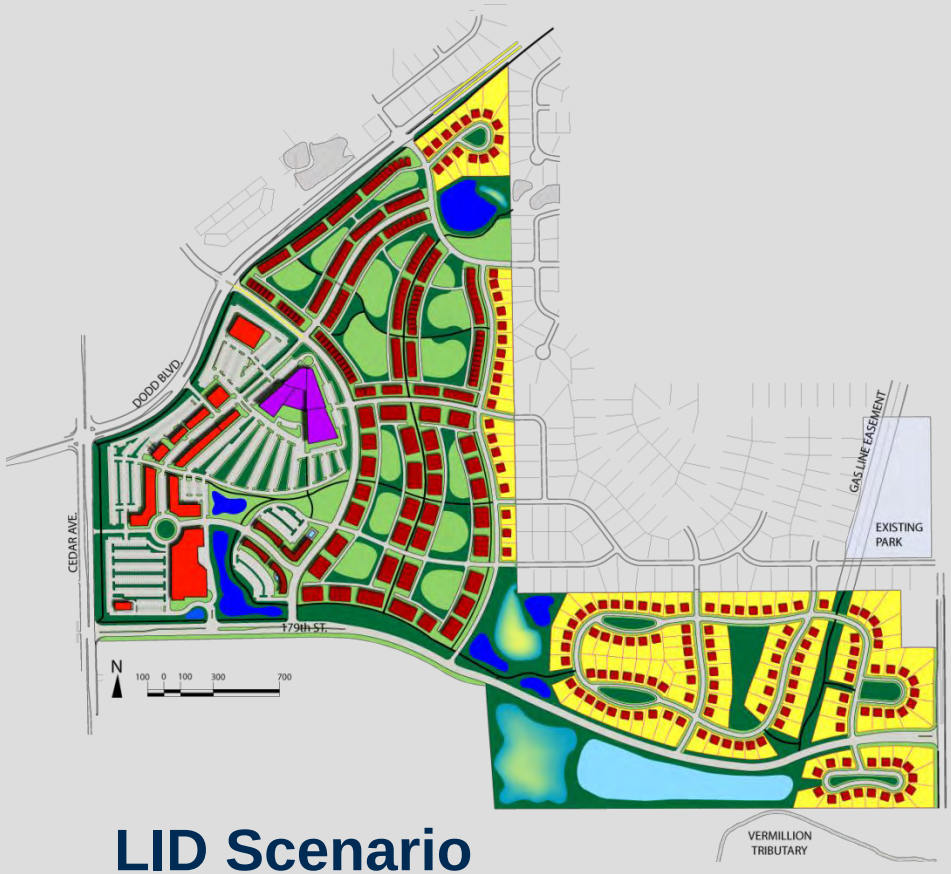
NOT UTILIZED

- Narrower Street Widths
- Smaller Lot Sizes
- Porous or Pervious Pavements
- Green Roofs
- Underground Proprietary Devices

APPROACH



Built Scenario

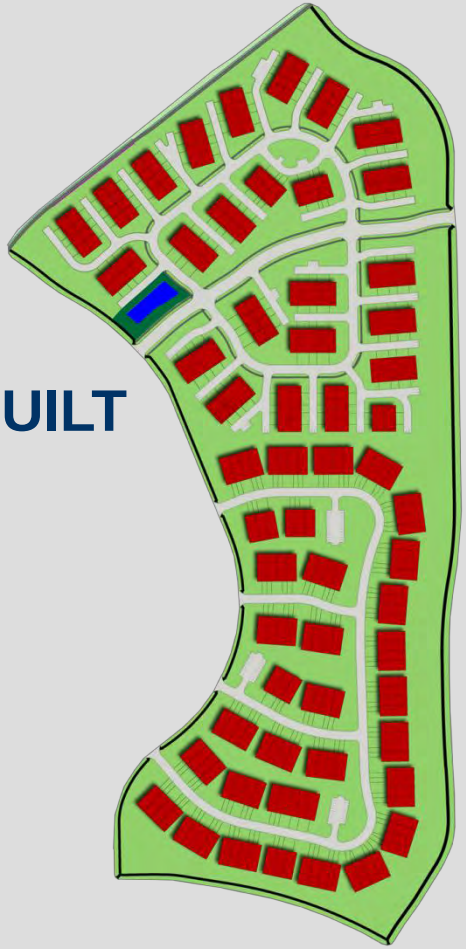


LID Scenario

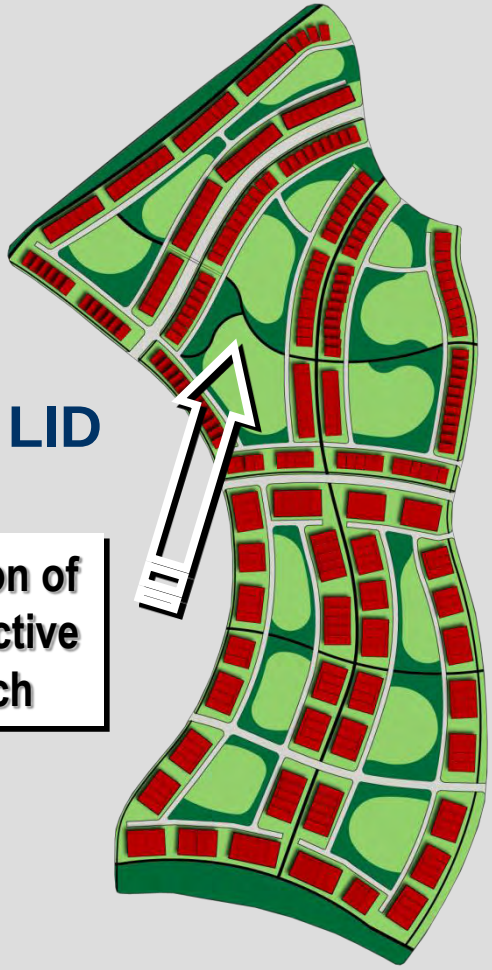
Landuse Comparison

MULTI-FAMILY

BUILT



LID



Direction of Perspective Sketch

Landuse Comparison

MULTI-FAMILY

YIELD

Incentives
YIELD

BUILDING TYPE	DEVELOPMENT SCENARIO		
	CONVENTIONAL	*BUILT*	*LID*
RESIDENTIAL			
Unattached Units (REU=1.0)	130	140	149
Attached Units (REU=0.80)	317	317	348
	447	457	497
SENIOR HOUSING			
Units (REU=0.5)	140	140	280
INSTITUTIONAL			
Square Feet (REU=2500 sf)	83,575	83,575	83,575
COMMERCIAL			
Square Feet (REU=2500 sf)	182,836	182,836	219,581
TOTAL RESIDENTIAL EQUIVALENT UNITS (REU) :	**664**	**682**	**808**

More potential developable area:

- ✓ Reduced ponding requirements
- ✓ More efficient site planning (lot platting)
- ✓ Multifunctional landscape

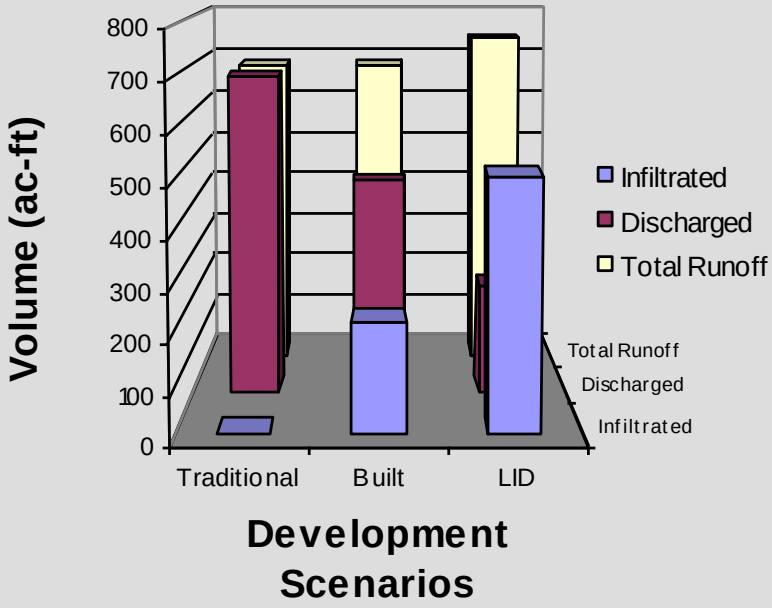
STORMWATER PERFORMANCE

Performance
WATER QUANTITY

LID Performance

- ✓ Increased total runoff generated
- ✓ Reduced peak discharge (Zero Discharge for 2-yr 24-hr event)
- ✓ Reduced total discharge volume from site
- ✓ Increased infiltration volume – groundwater recharge

Annual Stormwater Volume During a normal rainfall year (26.6 inches)

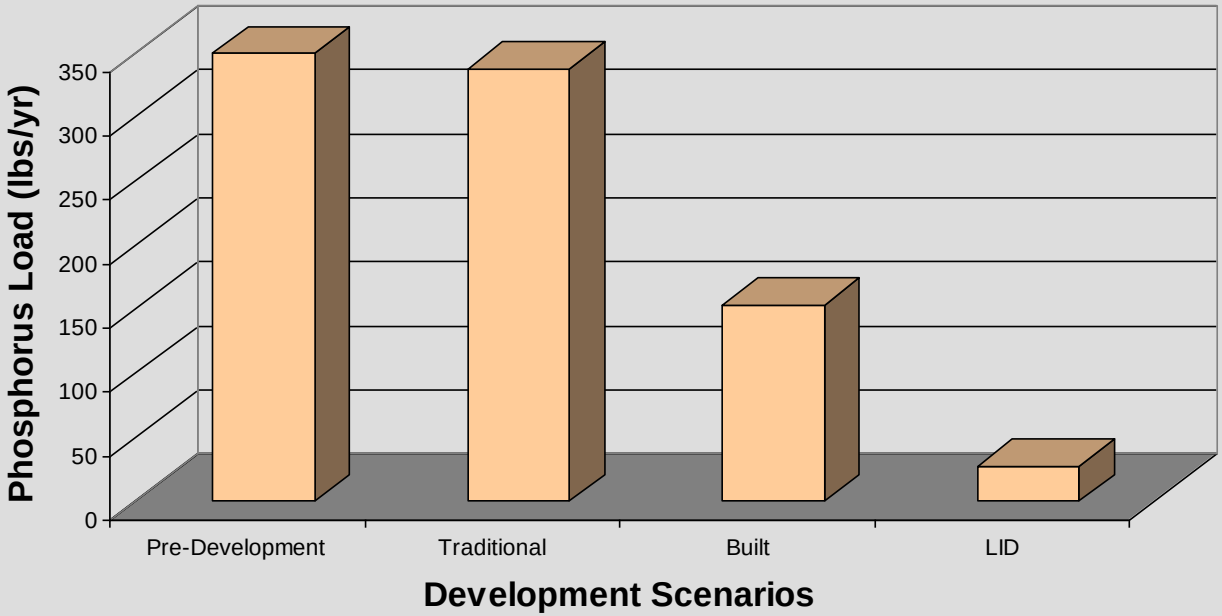


Performance

WATER QUANTITY

Annual Phosphorus Loading

During a normal rainfall year (26.6 inches)



Performance
WATER QUANTITY

Thermal pollution reduction via:

- ✓ **Disconnection of impervious surfaces**
- ✓ **Reduced total runoff volume**
- ✓ **Runoff filtered through the bioretention facilities and cooled**
  - one study observed a temperature drop of 12°C between influent and effluent water
- ✓ **Less stormwater ponding surface area**

CONSTRUCTION & MAINTENANCE COST

Incentives

DEVELOPMENT COSTS

Important Consideration when evaluating cost

Stormwater features like bioretention often replace area that would likely be landscaped anyway.

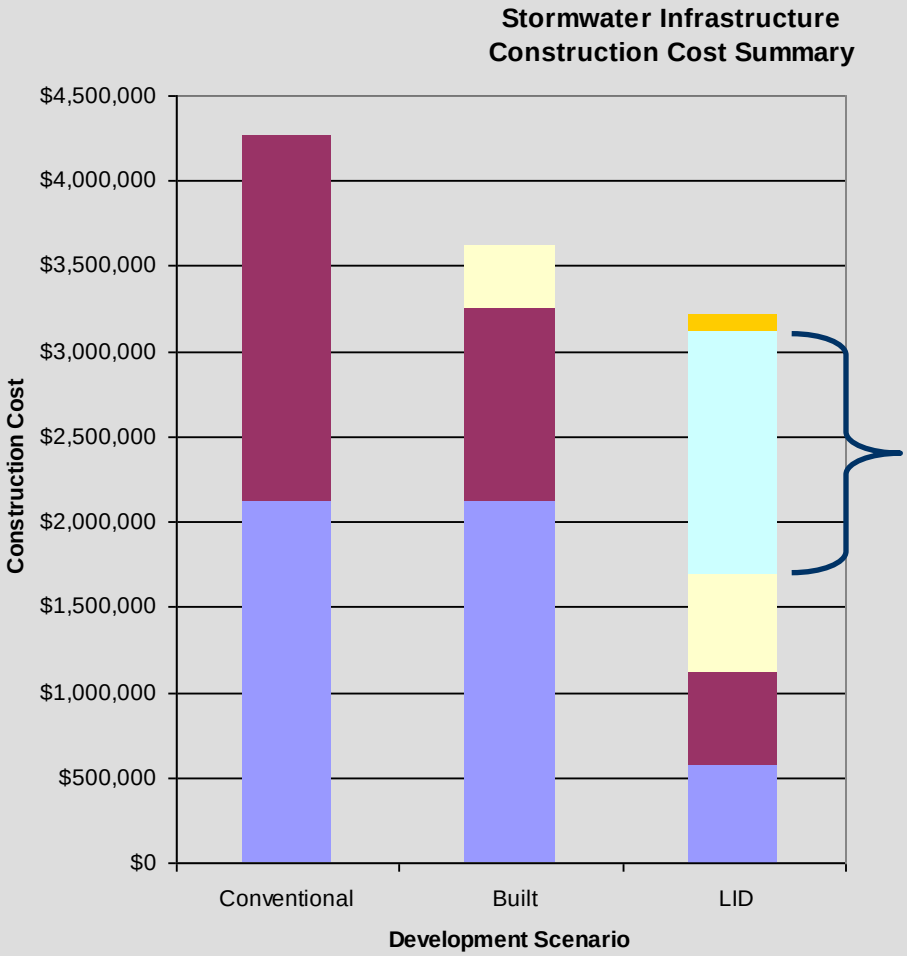
- ✓ Thus, the true stormwater construction cost for the LID scenario would be less than the construction cost reported

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

Incentives

DEVELOPMENT COSTS



Stormwater Development Cost

Note:
Includes "landscaping" installation cost for many areas that would likely be landscaped in each development

- Vegetated Swale
- Bioretention
- Regional Infiltration Basin
- Stormwater Pond
- Stormsewer Infrastructure

Incentives

DEVELOPMENT COSTS

SUMMARY OF DEVELOPMENT COST

ACTIVITY	COST DIFFERENCE FOR LID
SUMMARY OF CONSTRUCTION COST	
Grading	-
Erosion Control	+
Sanitary Sewer	+
Watermain	+
Streets	-
Storm Sewer Infrastructure	-
Storm Water BMP's	+
OTHER COST	
Developers Design	+
Lot Corners	+
One Year Real Estate Taxes	+
SUMMARY OF CASH FEES	
Park Dedication	-
Surface Water Management Utility	+
Landowner education	+

Incentives

DEVELOPMENT COSTS

SUMMARY OF DEVELOPMENT COST

DEVELOPMENT COST	BUILT	LID
SUMMARY OF CONSTRUCTION COST	$15,031,647	$14,743,333
OTHER COST	$1,960,185	$2,031,418
SUMMARY OF CASH FEES & CREDITS	$1,113,205	$1,032,807
SITE DEVELOPMENT COST	**$18,105,037**	**$17,807,558**
SITE DEVELOPMENT COST PER RESIDENTIAL EQUIVALENT UNIT (REU)	**$26,540.58**	**$22,042.81**

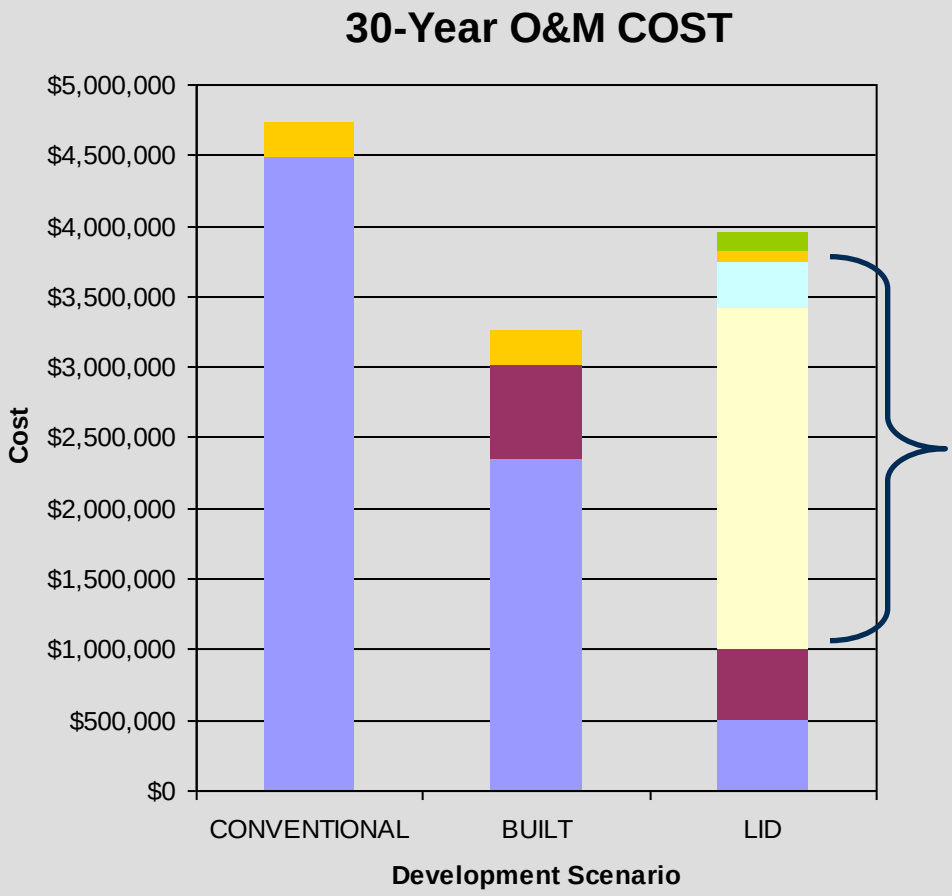
Incentives
MAINTENANCE COSTS

Maintenance Cost Considerations

- ✓ BMP's, such as bioretention, are strategically placed in areas that would otherwise be landscaped.
- ✓ The O&M cost for the LID scenario reflect the landscaping cost for these areas - over 11 acres!
- ✓ Operation and maintenance costs for a bioretention facility are comparable to those of typical landscaping

Incentives

MAINTENANCE COSTS



30-year Stormwater Maintenance Cost

Note:
Includes "landscaping" maintenance cost for many areas that would likely be landscaped in each development scenario

- Landowner Education
- Grit/Oil Separator; Catch Basin Manhole & Street Sweeping
- Vegetated Swale
- Bioretention
- Regional Infiltration Basin
- Wet Pond

Incentives

MAINTENANCE COSTS

Stormwater Maintenance Cost Summary

	CONVENTIONAL	BUILT	LID
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

Note:
Includes “landscaping” maintenance cost for many areas that would likely be landscaped in each development scenario

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