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Minnesota Low Impact Development Comparison Study

HAVING OUR CAKE & EATING IT TOO!

PROJECT MADE POSSIBLE BY

Financial & In-kind contributions made by:

Minnesota Pollution Control Agency

Minnesota Department of Natural Resources

EOR Emmons & Olivier Resources

Lakeville

Vermillion River Watershed JPO

RCWD

Minnehaha Creek Watershed District

Project design & administration completed by:

EOR Emmons & Olivier Resources

Friends of the Mississippi River

WHAT IS LID?

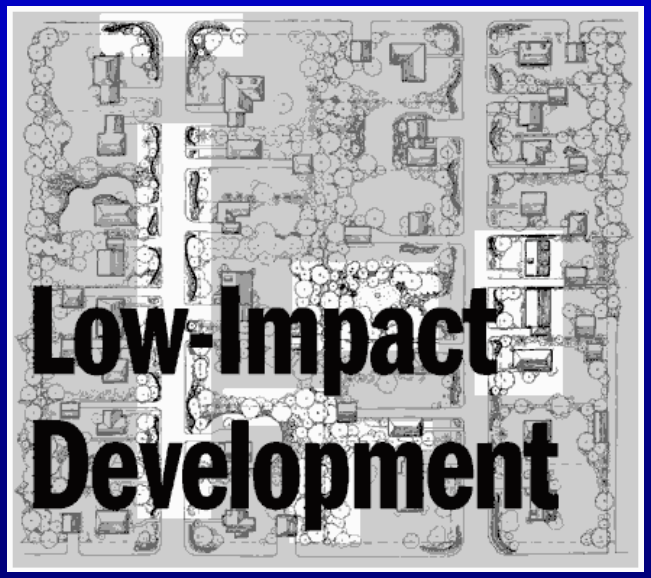
Low Impact Development (LID)

WHAT

An innovative, ecosystem-based approach to land development and stormwater management

WHY

Greater protection for water and other natural resources while accommodating growth



WHAT IS LID?

How

Looking at stormwater as a starting point in the design process and viewing stormwater as an amenity

Design each development site to protect, or restore, the natural hydrology of the site so that the overall integrity of the watershed is protected. This is done by creating a “hydrologically” functional landscape.

WHAT IS LID?

Designing for the TRIPLE Bottom Line

- **Environmental** – conservation & stewardship
- **Quality of Life** – healthy and livable communities
- **Economic** – economically viable development

CAN WE REALLY HAVE OUR CAKE & EAT IT TOO?

Protecting water and other natural resources while accommodating growth

but……..

It's too costly to construct!

*Maintenance will bankrupt the city!?#**

It won't work on my soils!!

It can't work in higher density development?

What about flood control?

OUR CHARGE

Begin to answer these questions thru:

An Apples to Apples Comparison of,

Three Development Scenarios,

For the Same Real-World Site

"We cannot solve the problems that we have created with the same thinking that created them"

–Albert Einstein

DELIVERABLES

Presentation Topics

1) Development Scenarios
2) Site Selection
3) Design
4) Results – Comparison Analysis
   - Stormwater performance
   - Development yield and cost
   - Maintenance cost

DEVELOPMENT SCENARIOS

Scenarios Compared

CONVENTIONAL

Pipe & Pond

BUILT

Pipe & Pond w/
Regional Infiltration Pond

LID

Integrated &
Multifunctional

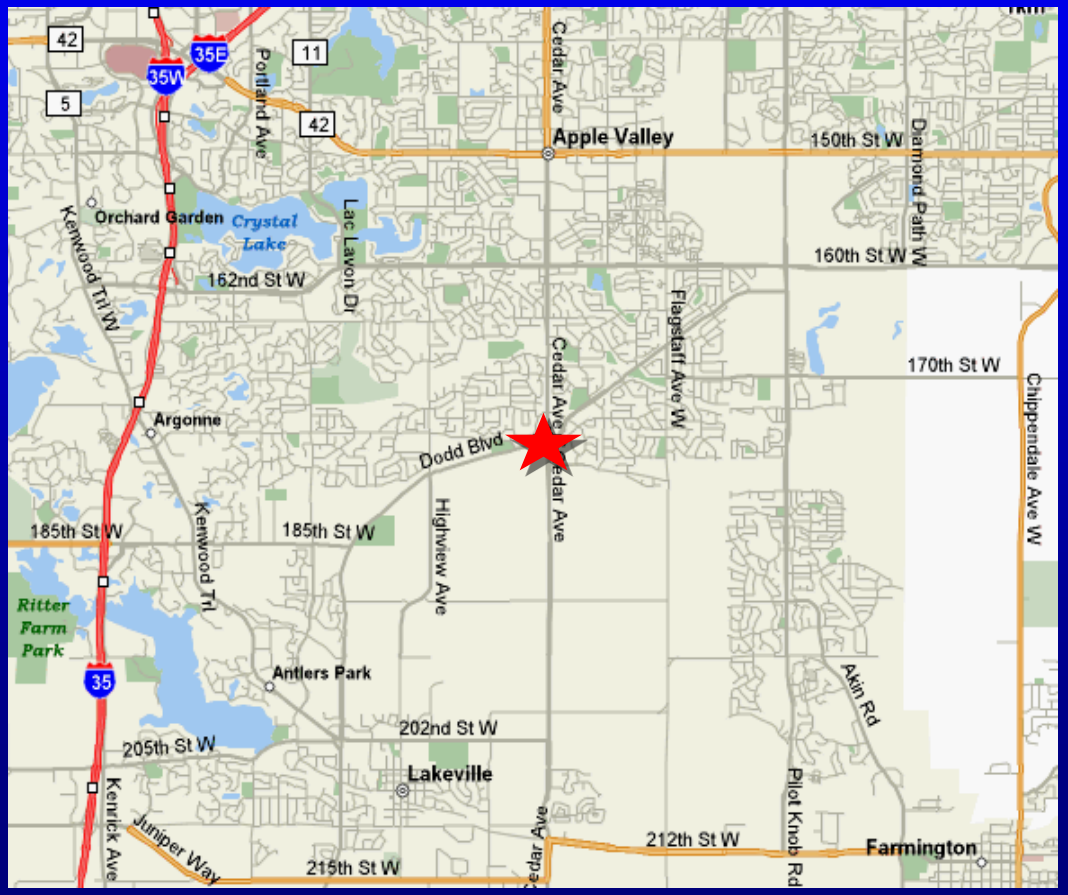
Project Site

Having your cake & eating it too!

REAL-WORLD PROJECT SITE

Project Location

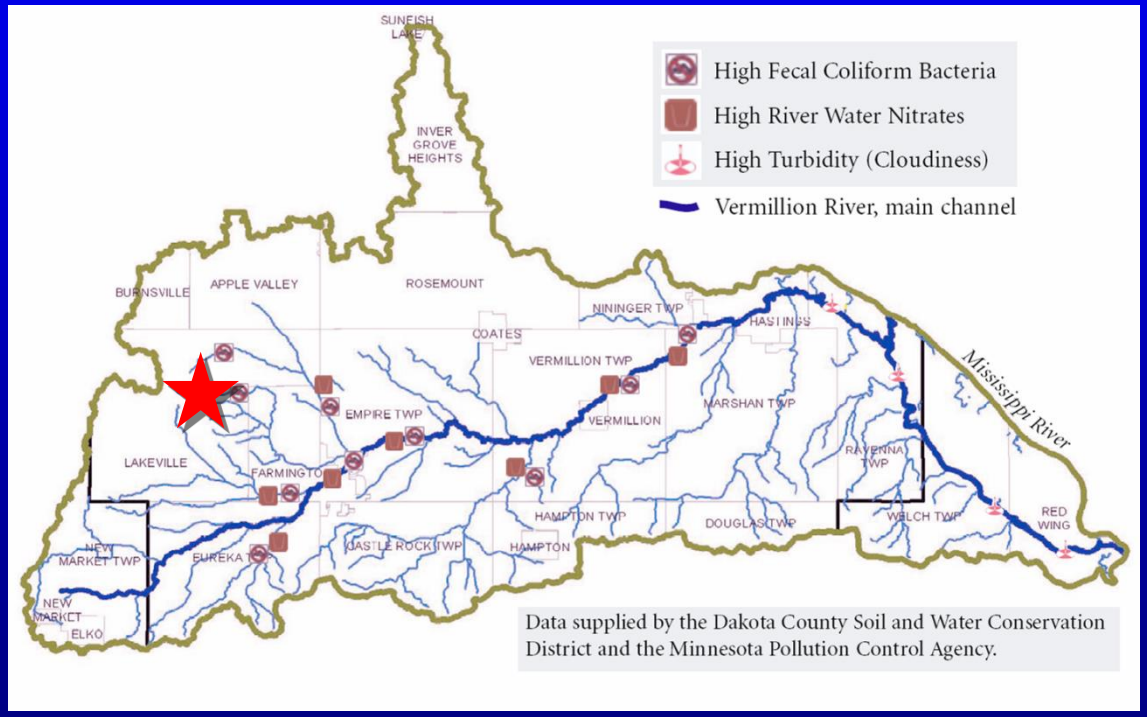
Lakeville, MN (Dakota County)



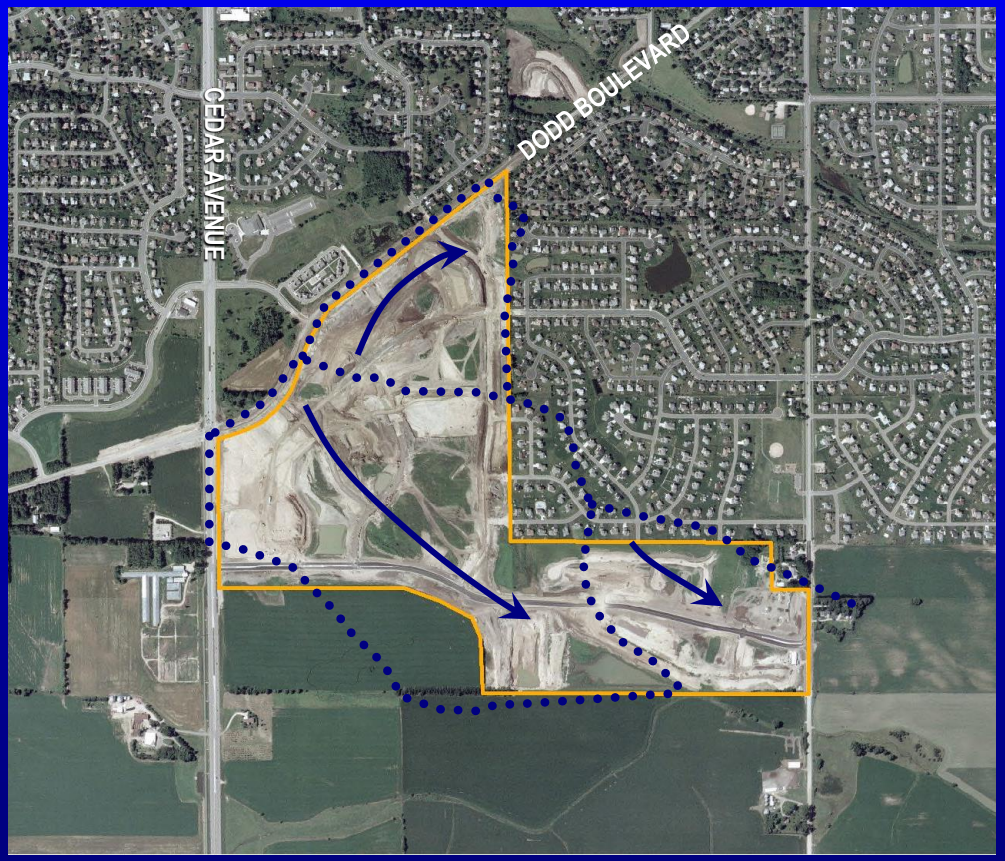
REAL-WORLD PROJECT SITE

Watershed

Vermillion River Watershed



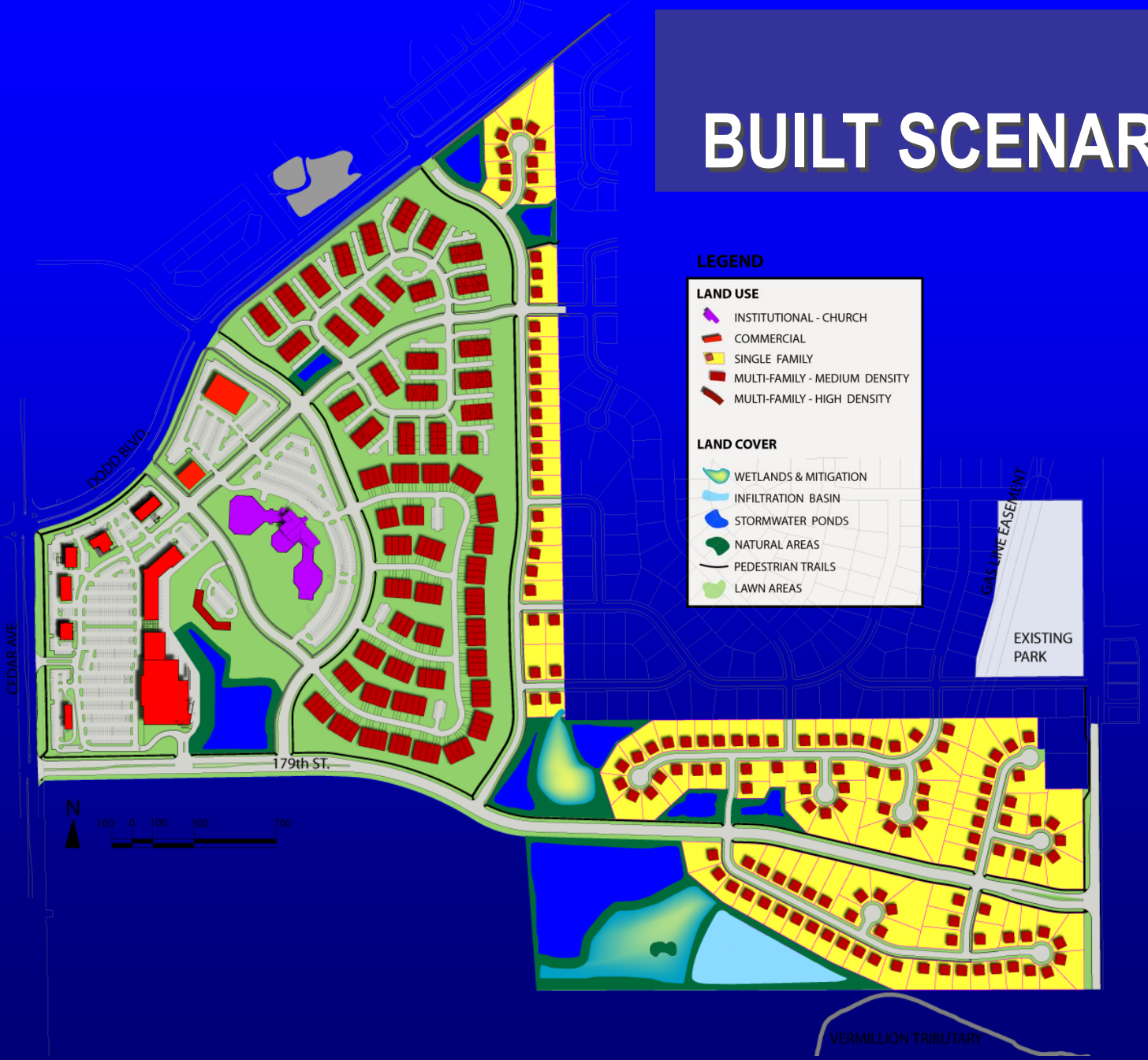
REAL-WORLD PROJECT SITE



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.

BUILT SCENARIO



LID - Design

Having your cake & eating it too!

LID APPROACH

SITE PLANNING

- Using hydrology as the integrating framework
- Controlling stormwater at the source
- Creating a multifunctional landscape and infrastructure
- Reducing impervious surfaces
- Creating a system of continuous stormwater polishing
- Disconnecting impervious surfaces

LID APPROACH

Utilized most “accepted” BMP’s & Avoided the easy solutions
(such as narrowing street widths)

COULD IMPROVE DESIGN, BUT NOT UTILIZED
- Narrower Street Widths
- Smaller Lot Sizes
- Porous or Pervious Pavements
- Green Roofs
- Underground Proprietary Devices

UTILIZED
- Bioretention Devices
- Vegetated Swales
- Infiltration Basins

OUR APPROACH

Built Scenario

LID Scenario

LID SCENARIO

Economics – Property Values

- Proximity to Parks & Trails
- Proximity to Open Space
- Water Quality & Clarity
- Connectivity and Sense of Community
- Safety of Neighborhood

Economics – Development & Maintenance Costs

LID SCENARIO

Natural Resources

- Connectivity
- Large tracts of natural areas
- Small habitat niches throughout
- Healthier landscapes
- Healthier downstream waters

LID SCENARIO

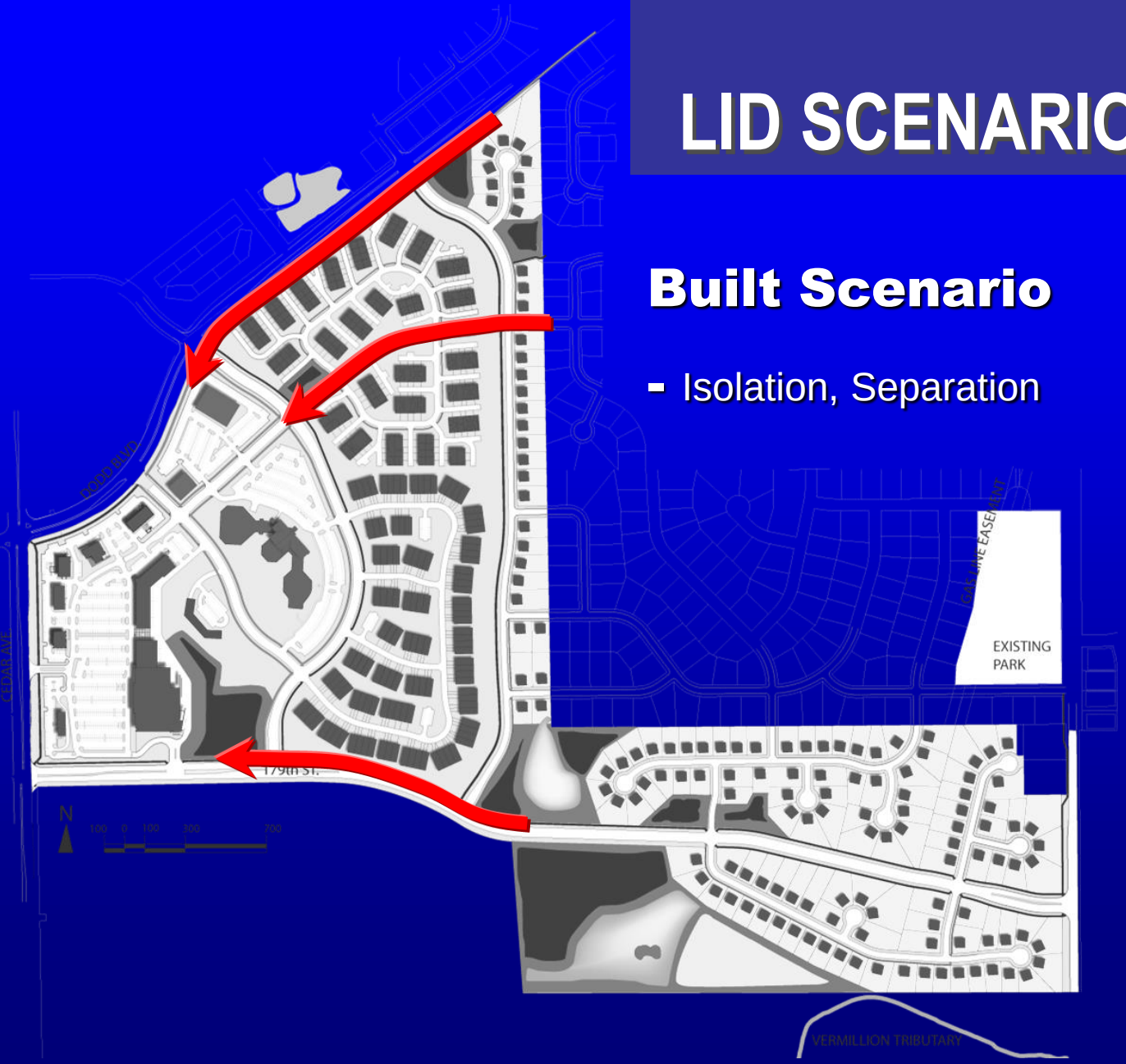
Quality of Life
- Community Focused

- Recreation
- Connectivity to neighbors, stores & public transportation
- Reduced traffic
- Safety

LID SCENARIO

Built Scenario

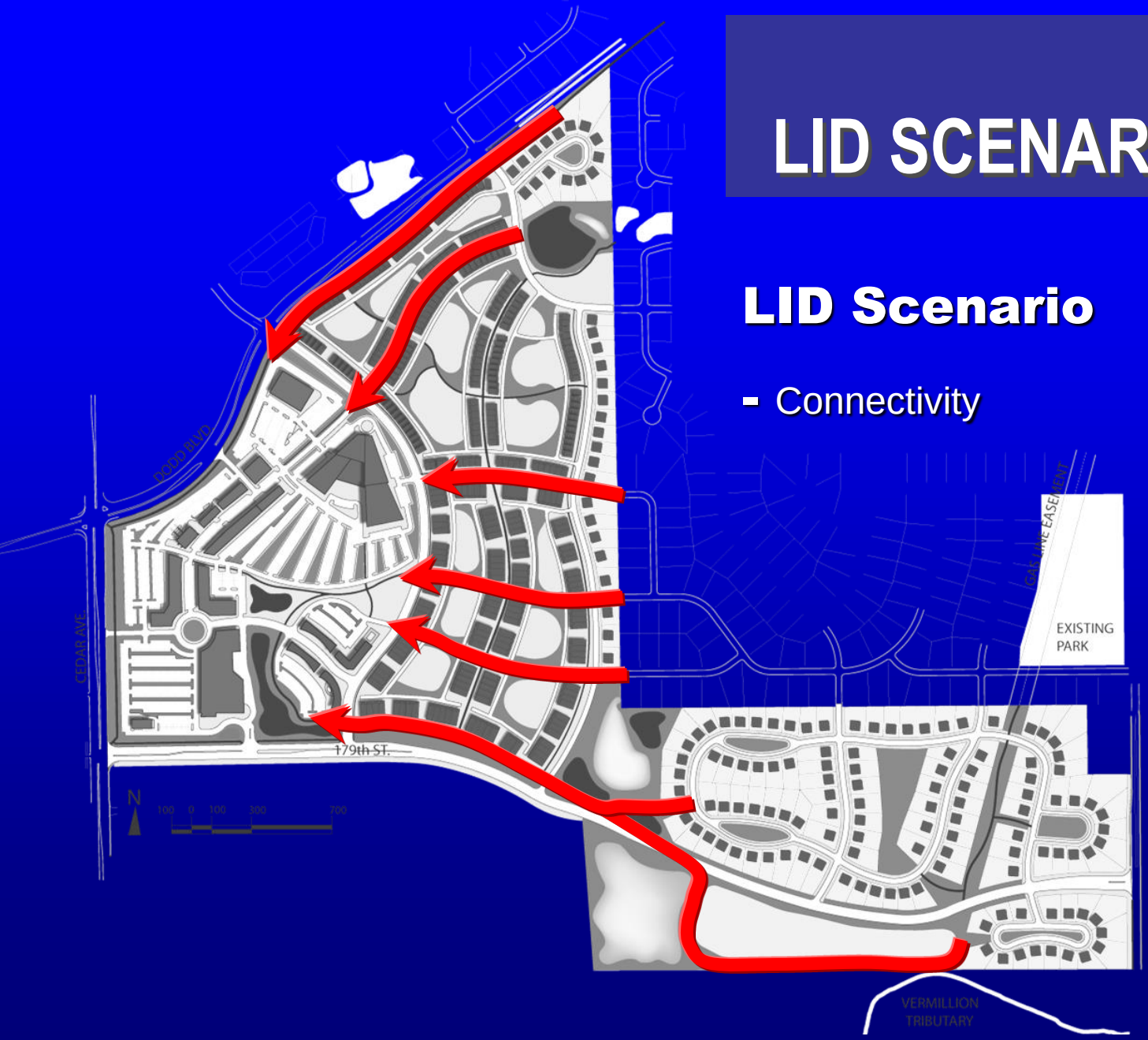
- Isolation, Separation



LID SCENARIO

LID Scenario

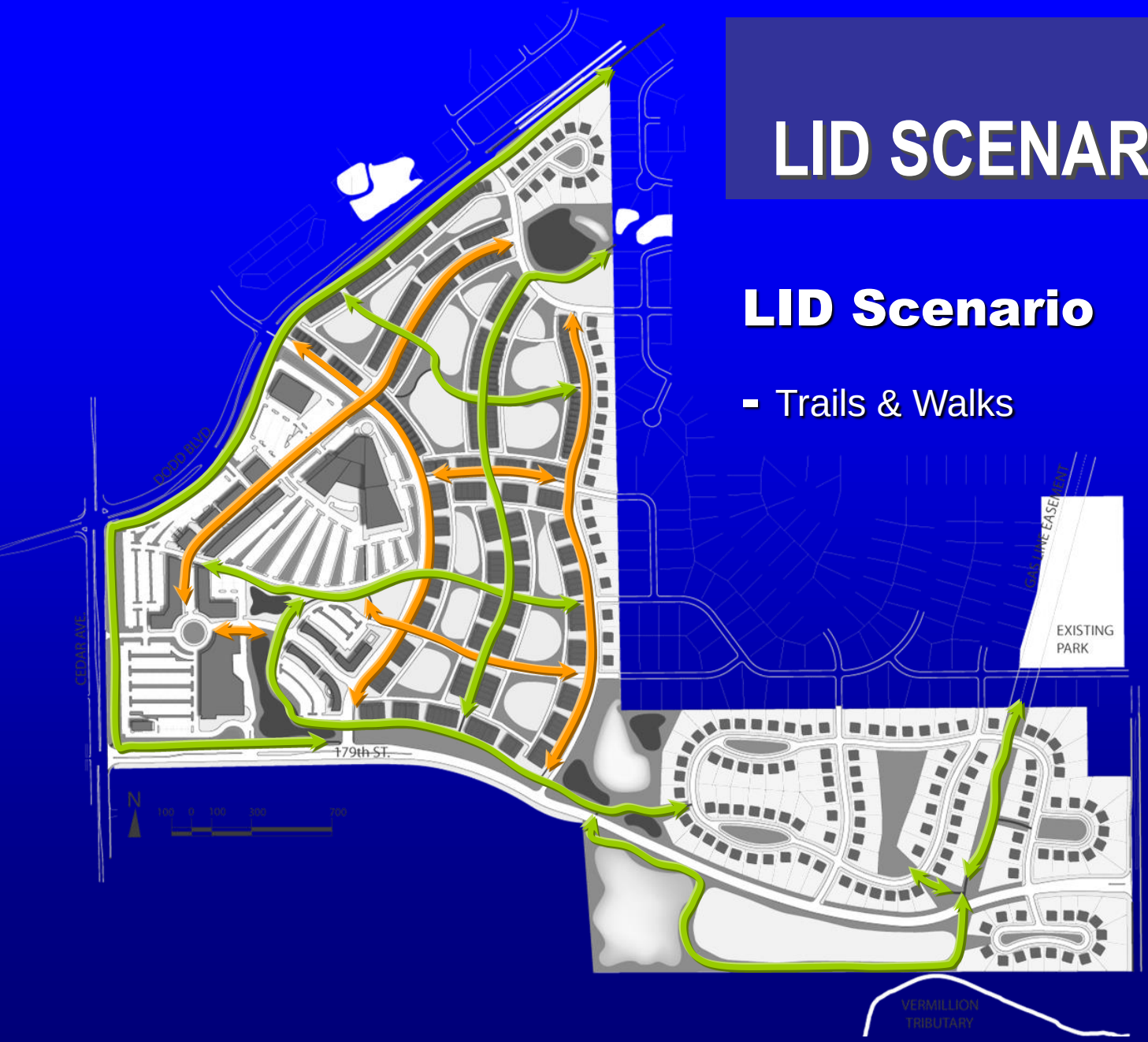
- Connectivity



LID SCENARIO

LID Scenario

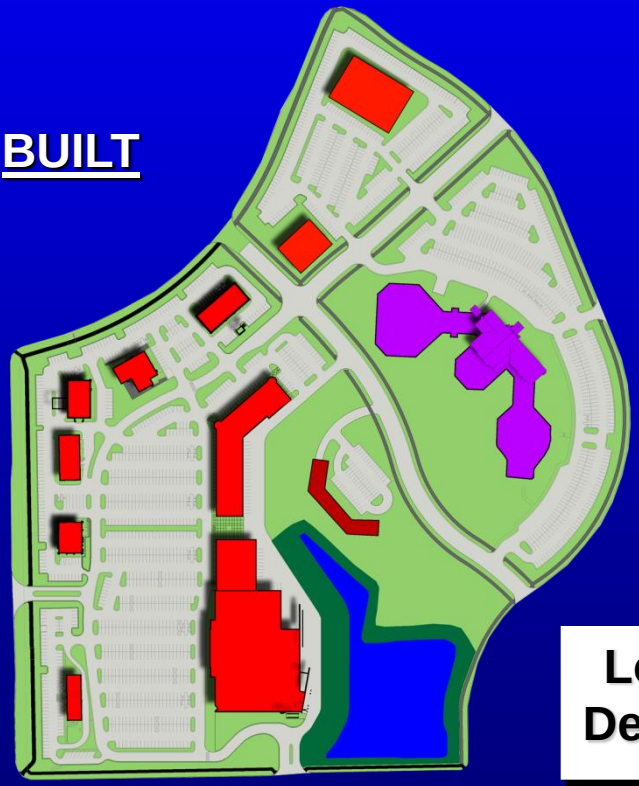
- Trails & Walks



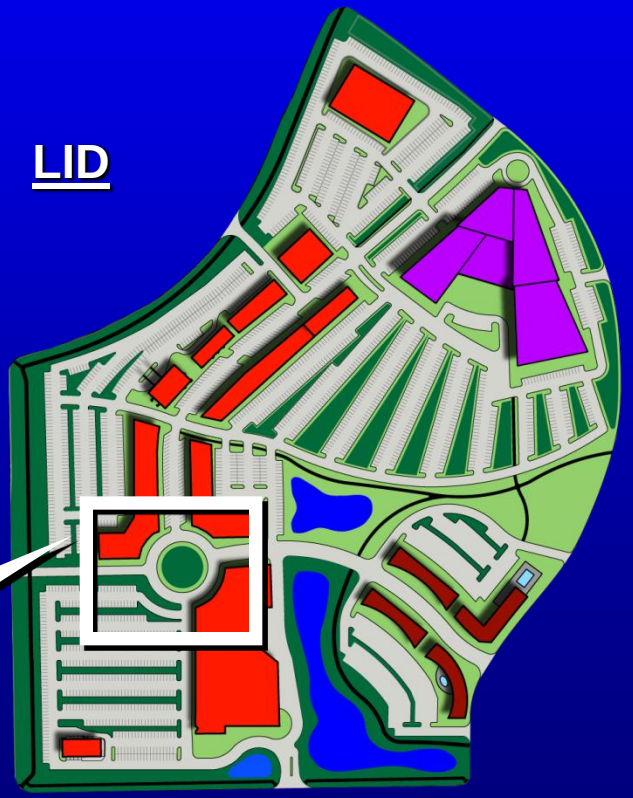
Landuse Comparison

COMMERCIAL

BUILT



LID



Location of Detailed Plan

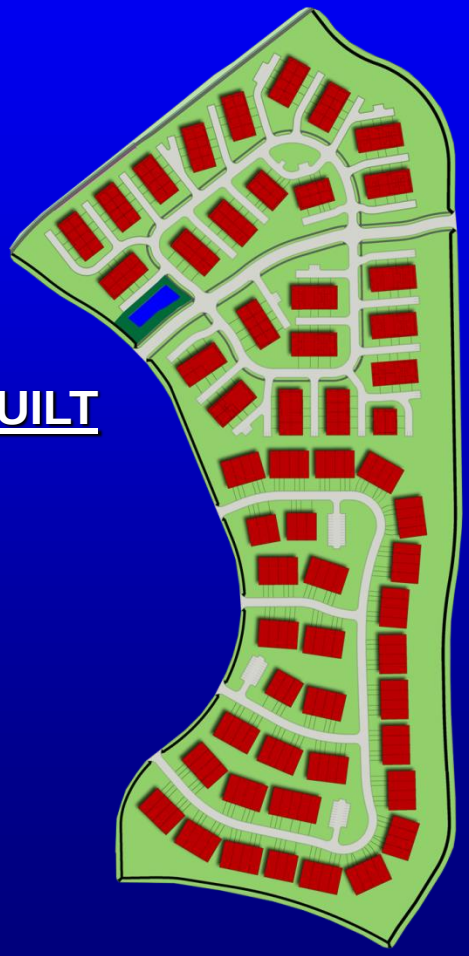
Landuse Comparison

COMMERCIAL

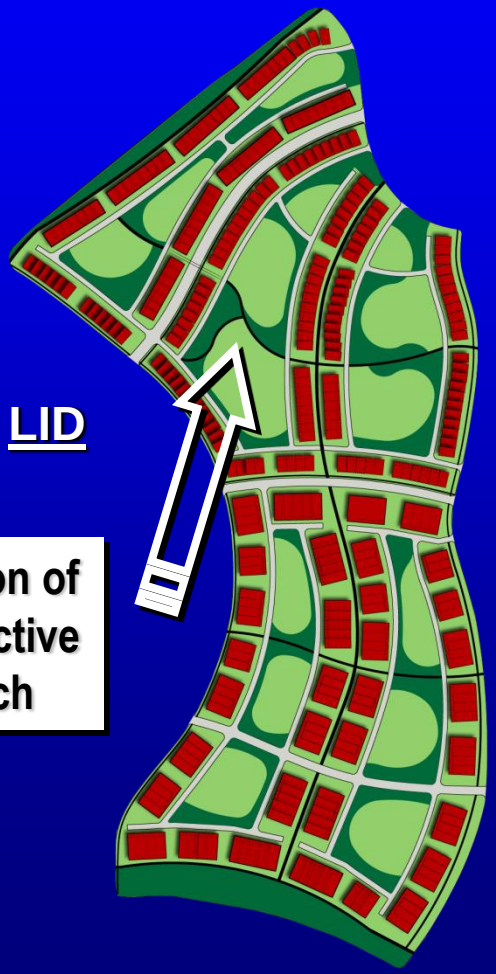
Landuse Comparison

MULTI-FAMILY

BUILT



LID



Direction of Perspective Sketch

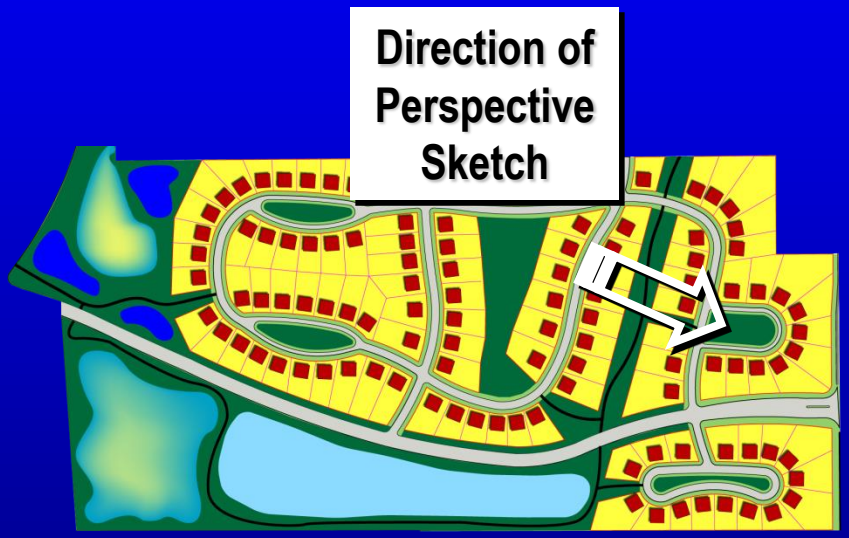
Landuse Comparison

MULTI-FAMILY

Landuse Comparison

SINGLE FAMILY

BUILT



LID

Landuse Comparison

SINGLE FAMILY

Results

Having your cake & eating it too!

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:

- Reduction in pond size
- More efficient site planning & lot platting
- Multifunctional landscape

Stormwater Performance

Having your cake & eating it too!

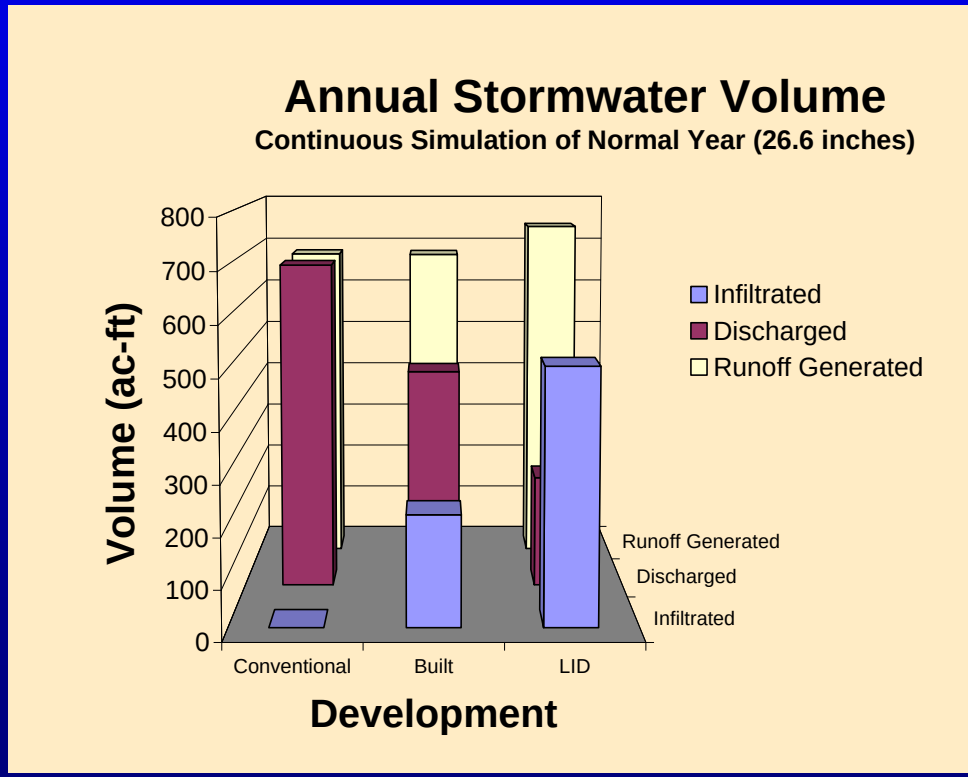
Performance

WATER QUANTITY

Despite an increase in runoff generated (due to yield increase)

The LID Scenario:

- **Reduced peak discharge (Zero Discharge for 2-yr 24-hr event)**
- **Reduced total discharge volume from site**
- **Increased infiltration volume**

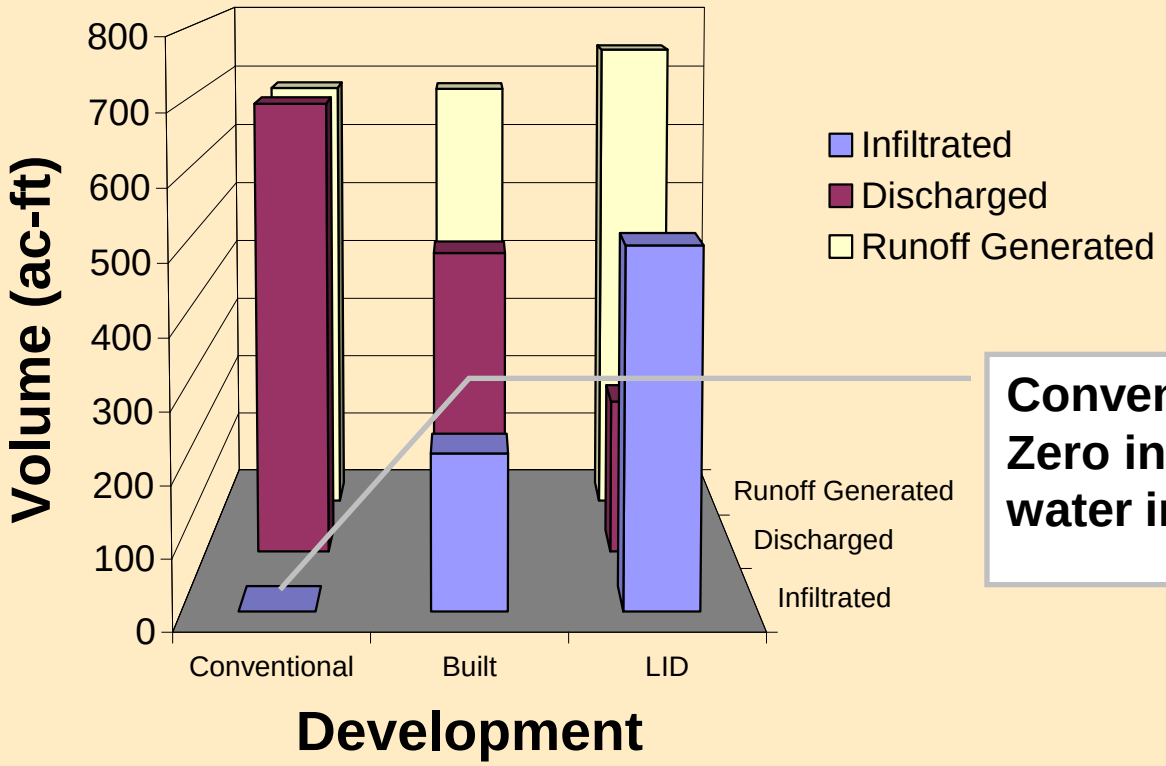


Performance

WATER QUANTITY

Annual Stormwater Volume

Continuous Simulation of Normal Year (26.6 inches)



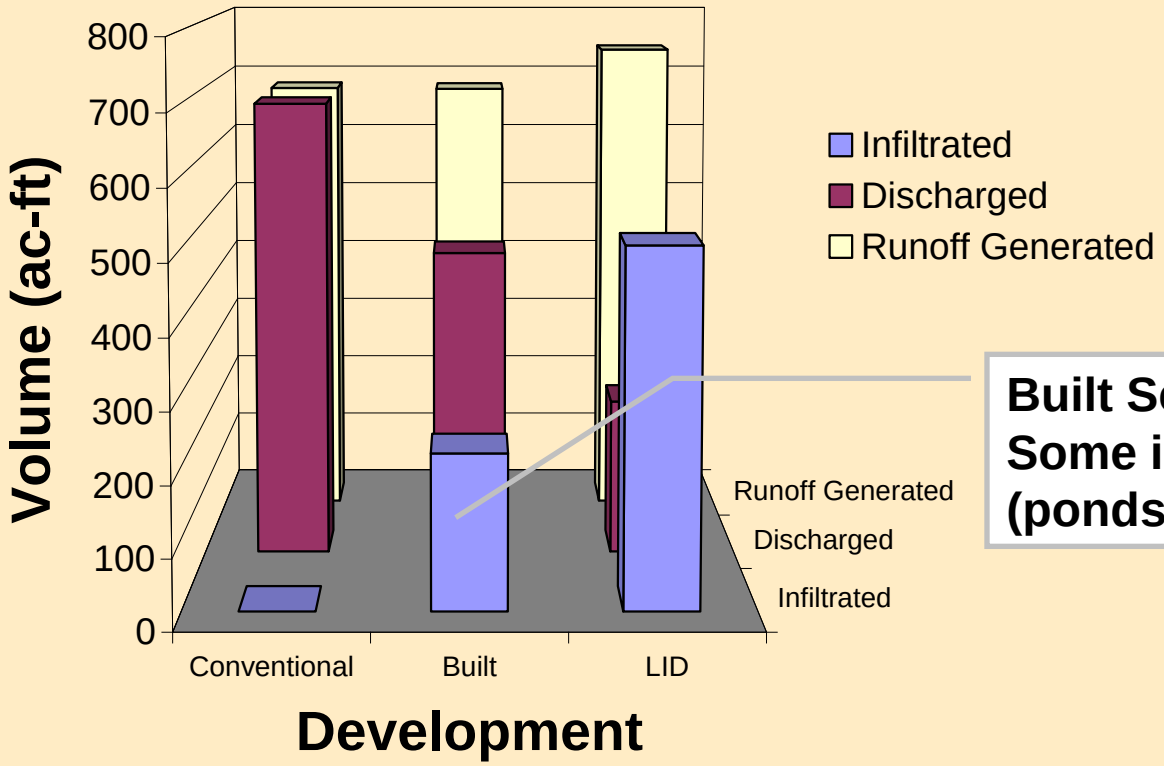
Conventional Scenario: Zero infiltration (ponds: water in = water out)

Performance

WATER QUANTITY

Annual Stormwater Volume

Continuous Simulation of Normal Year (26.6 inches)



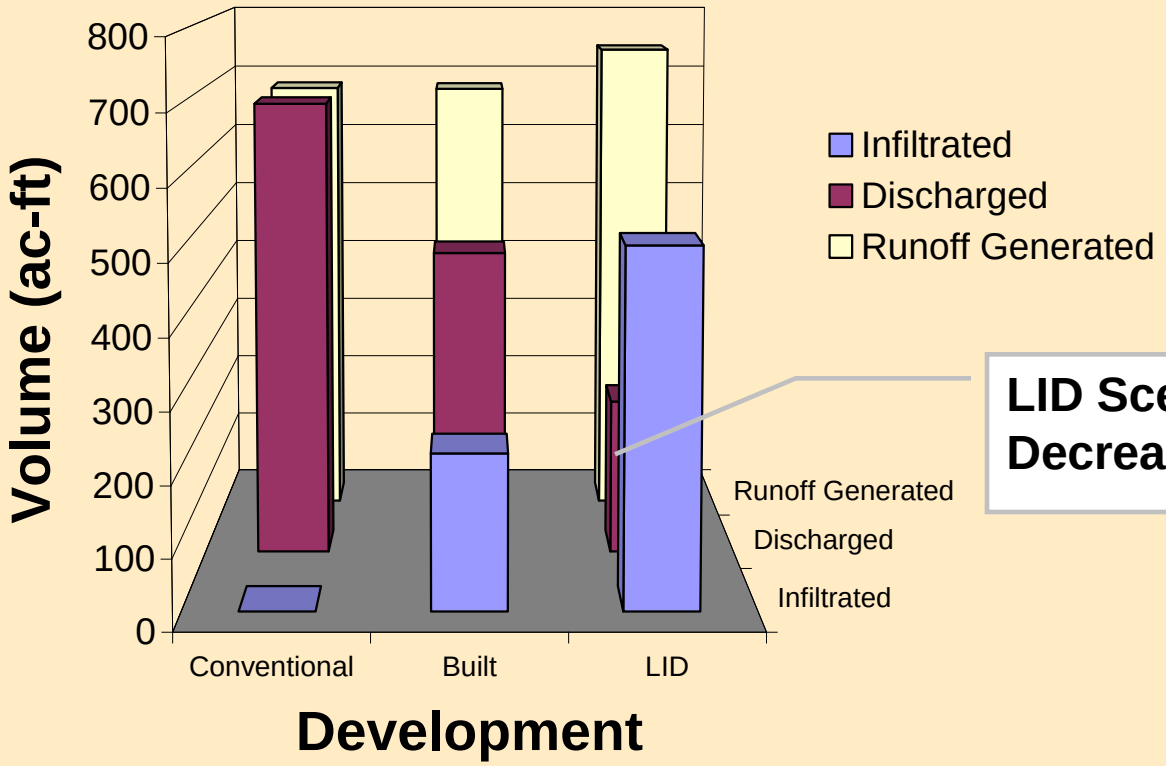
Built Scenario:
Some infiltration
(ponds & infiltration basin)

Performance

WATER QUANTITY

Annual Stormwater Volume

Continuous Simulation of Normal Year (26.6 inches)



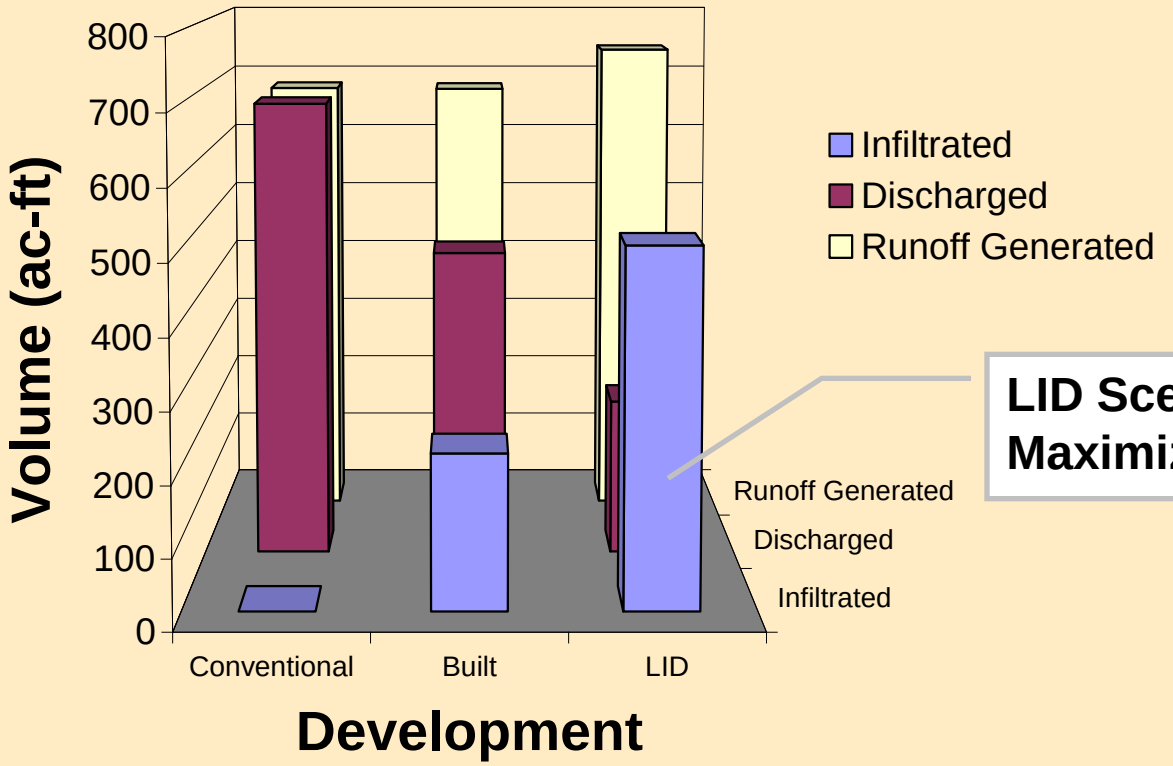
LID Scenario:
Decreased site discharge

Performance

WATER QUANTITY

Annual Stormwater Volume

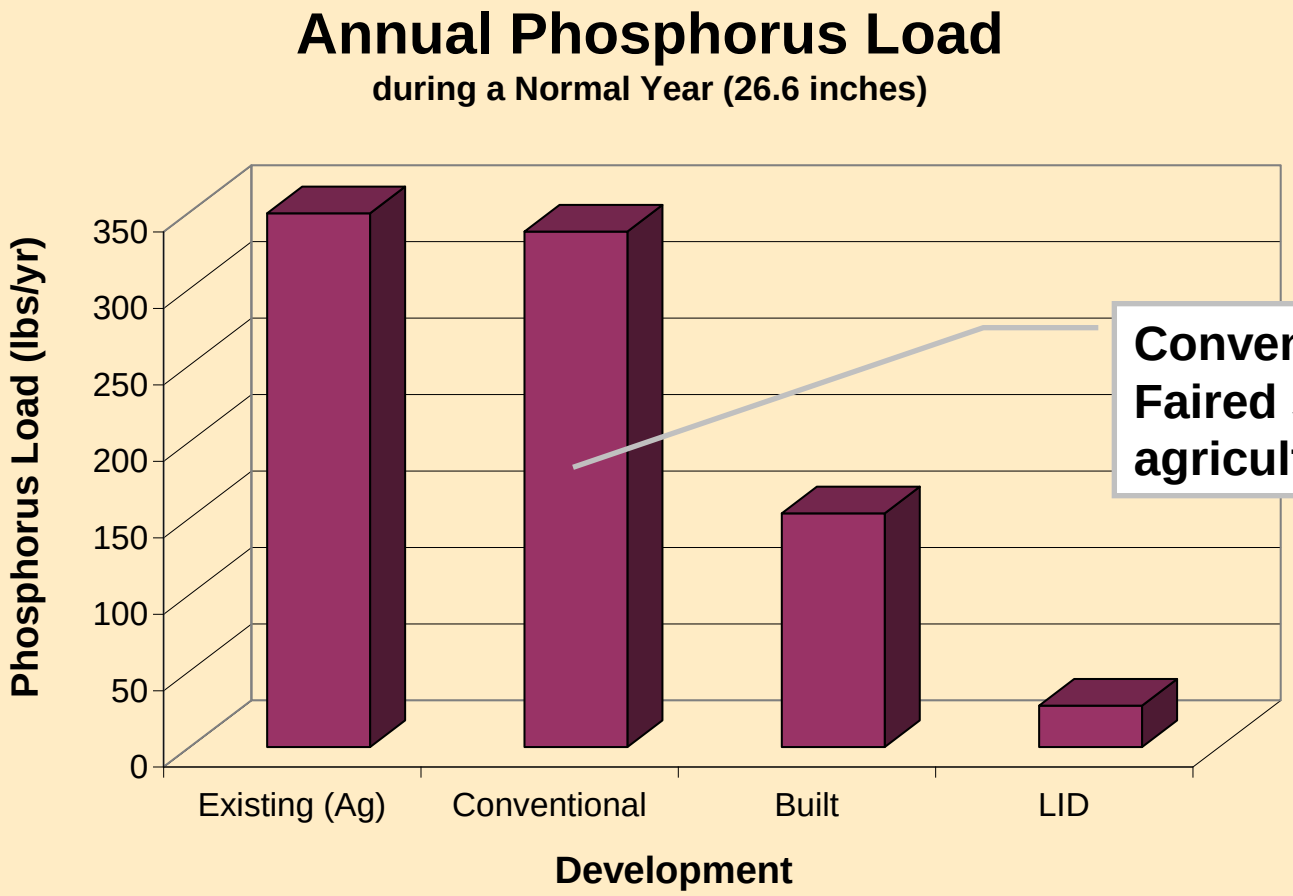
Continuous Simulation of Normal Year (26.6 inches)



LID Scenario:
Maximized infiltration

Performance

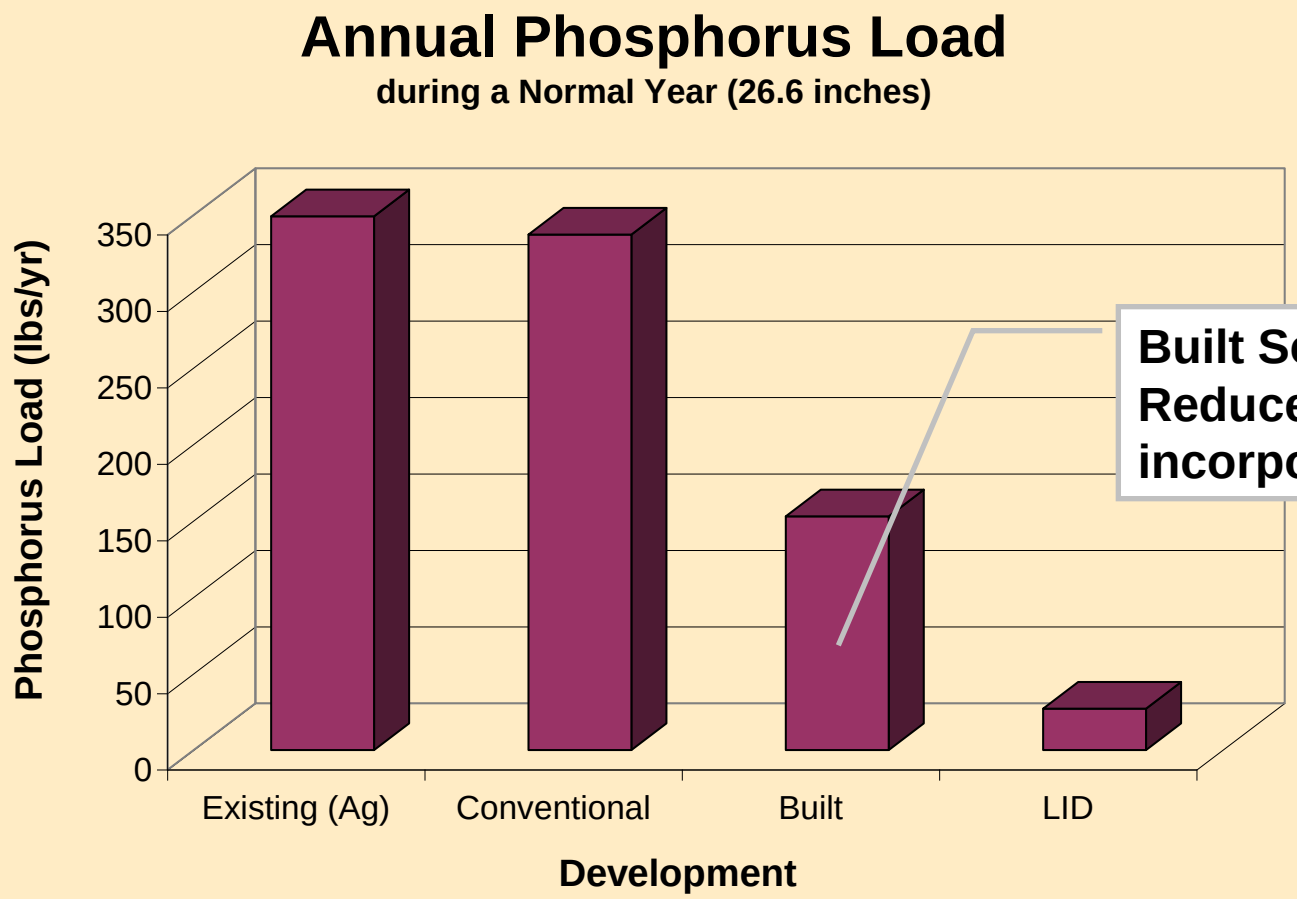
WATER QUALITY



Conventional Scenario: Faired slightly better than agriculture conditions

Performance

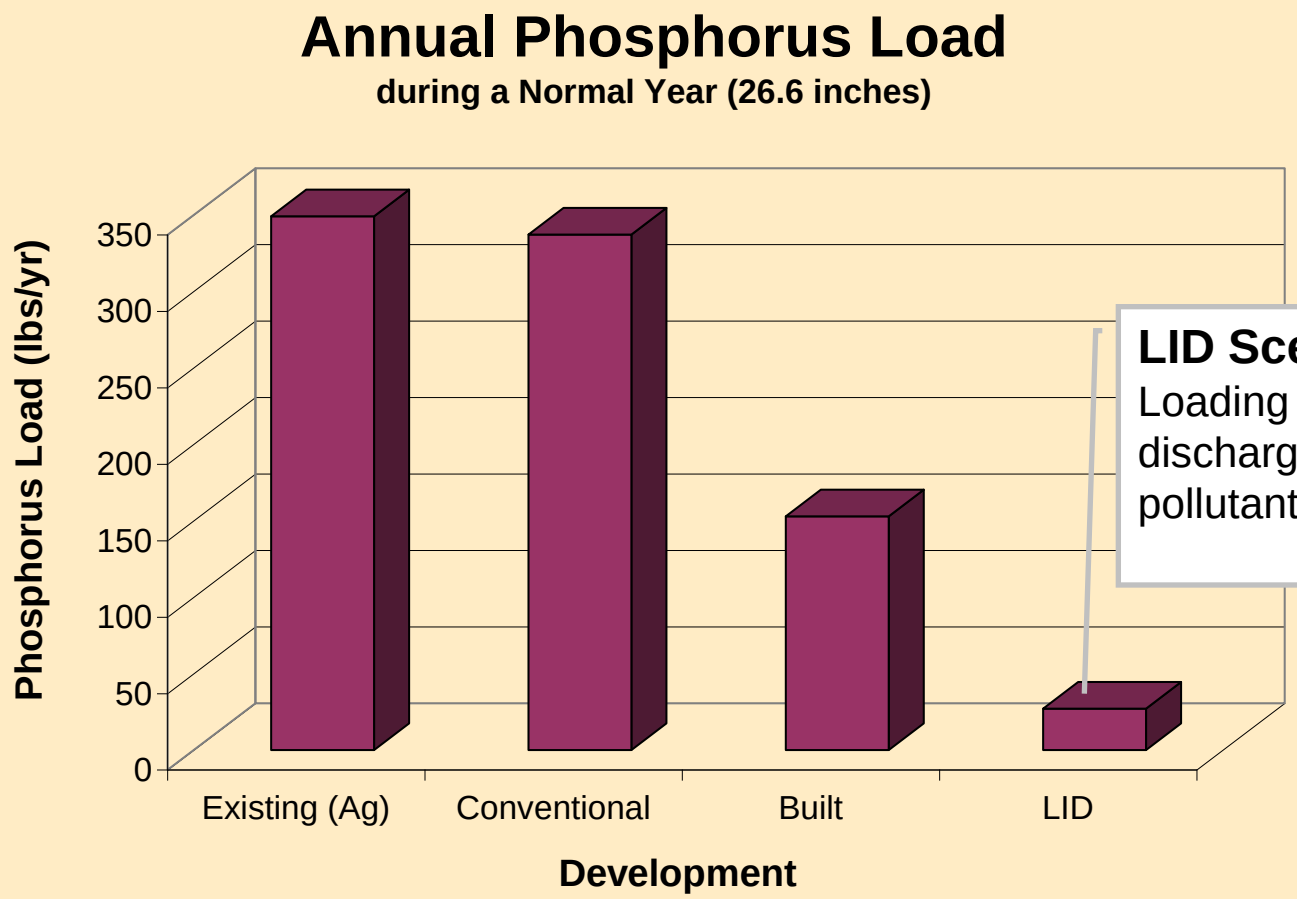
WATER QUALITY



Built Scenario:
Reduced loading through incorporation of infiltration

Performance

WATER QUALITY



LID Scenario:
Loading minimized – Reduced discharged volume & improved pollutant removal efficiency

Performance

WATER QUALITY

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

Having your cake & eating it too!

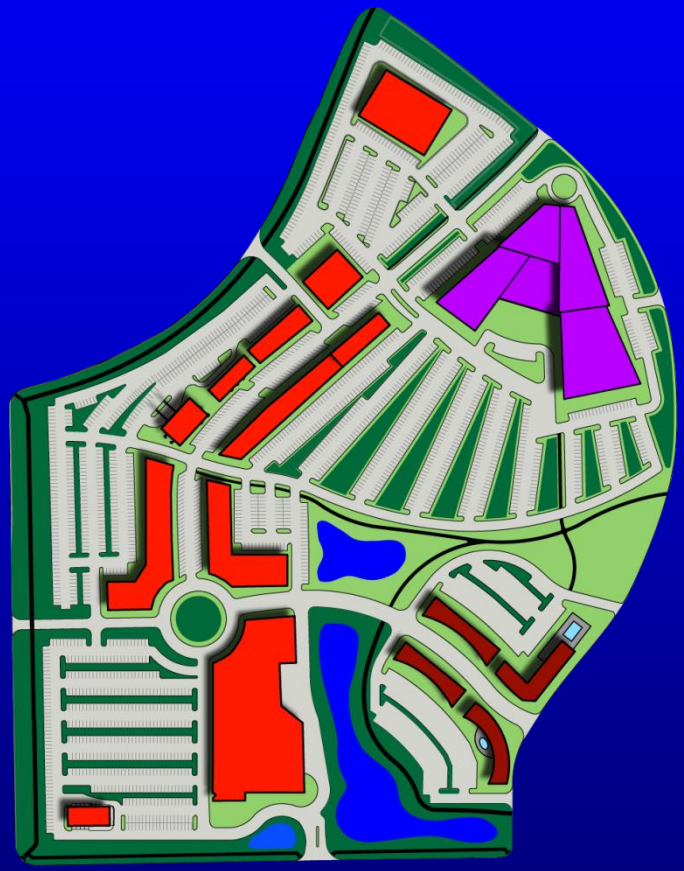
Incentives

DEVELOPMENT COSTS

Important Considerations when evaluating cost

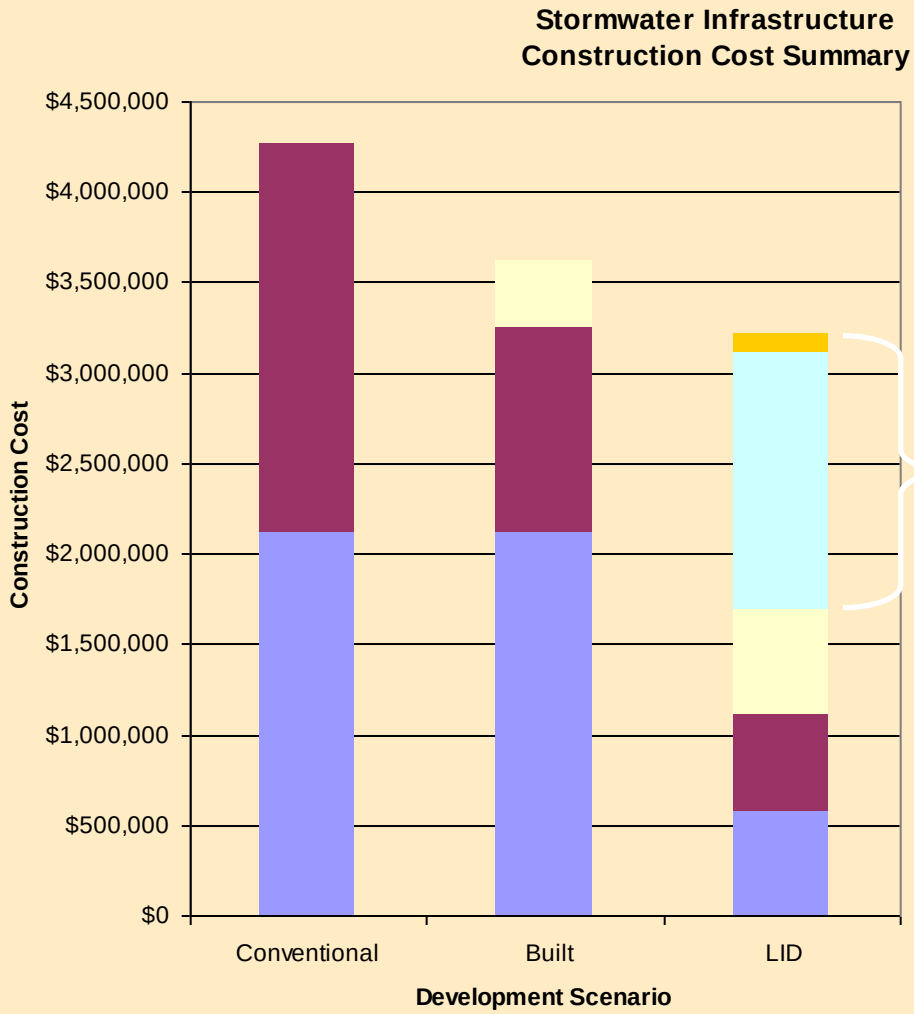
Stormwater features like bioretention often replace area that would likely be landscaped anyway. Thus, the true stormwater construction cost for the LID scenario would be less than the construction cost reported

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

Incentives

DEVELOPMENT COSTS

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	+

SUMMARY OF DEVELOPMENT COST

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

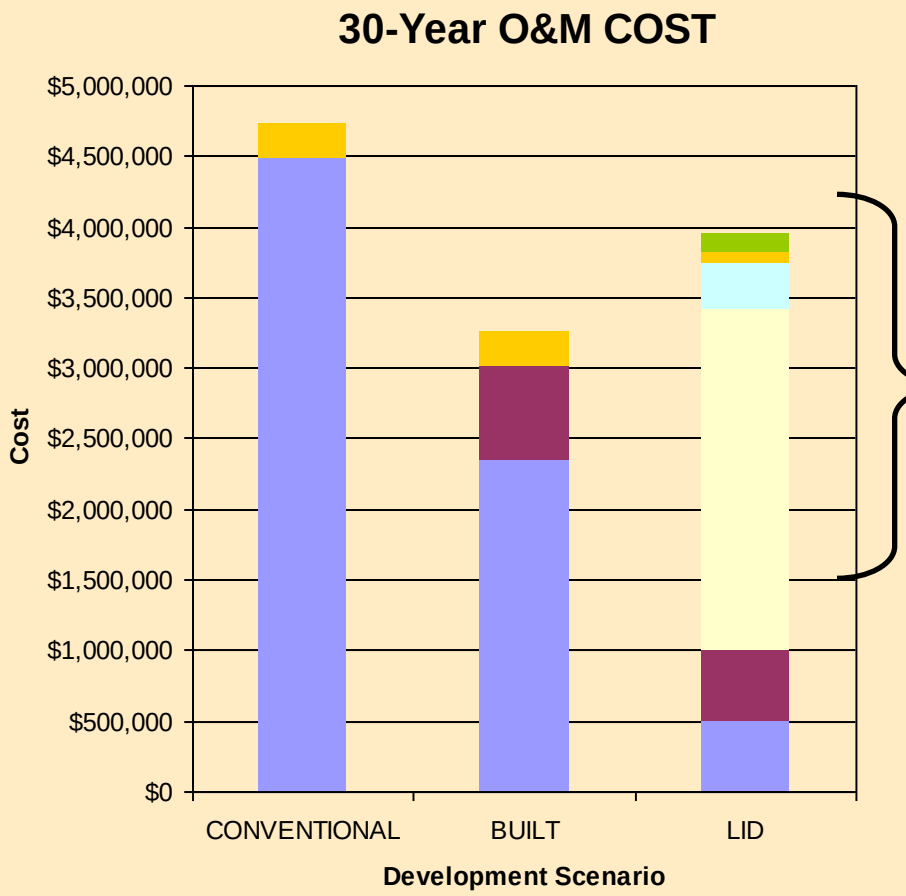
MAINTENANCE COSTS

O&M 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

RECAP

Environmental:

- Superior water quality performance
- Superior water quantity performance
- Higher quality natural areas
- Increase in yield (reduction in regional land consumption)

RECAP

Environmental:

- Superior water quality performance
- Superior water quantity performance
- Higher quality natural areas
- Increase in yield (reduction in regional land consumption)

Quality of life

- Numerous qualitative and quantitative benefits

RECAP

Environmental:

- Superior water quality performance
- Superior water quantity performance
- Higher quality natural areas
- Increase in yield (reduction in regional land consumption)

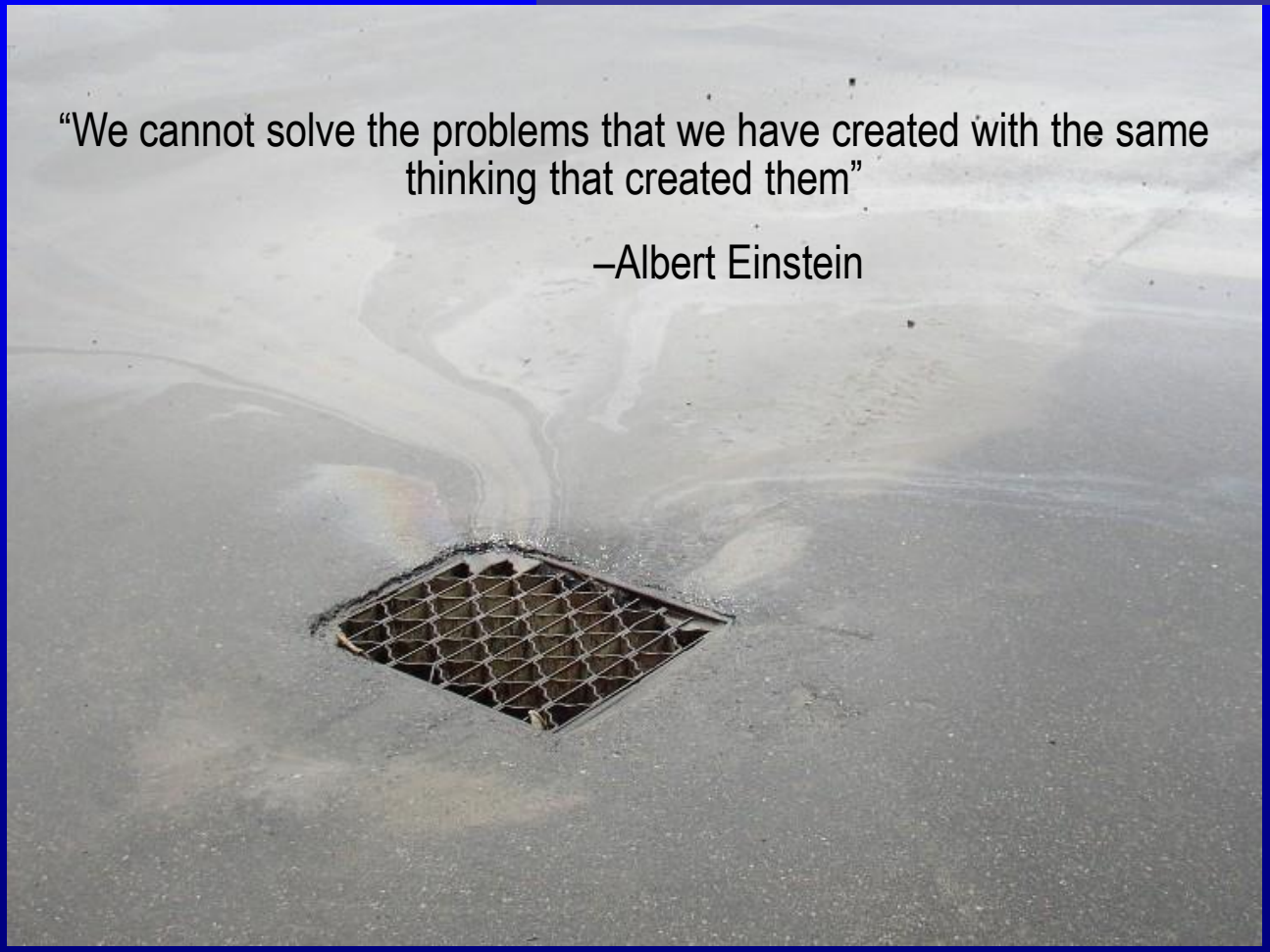
Quality of life

- Numerous qualitative and quantitative benefits

Economic:

- Increase lot yield
- Less development cost
- Less maintenance cost
- Higher lot value
- Enhanced marketability

RECAP


"We cannot solve the problems that we have created with the same thinking that created them"
–Albert Einstein

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