More than just stormwater management:
A holistic approach to site design & development

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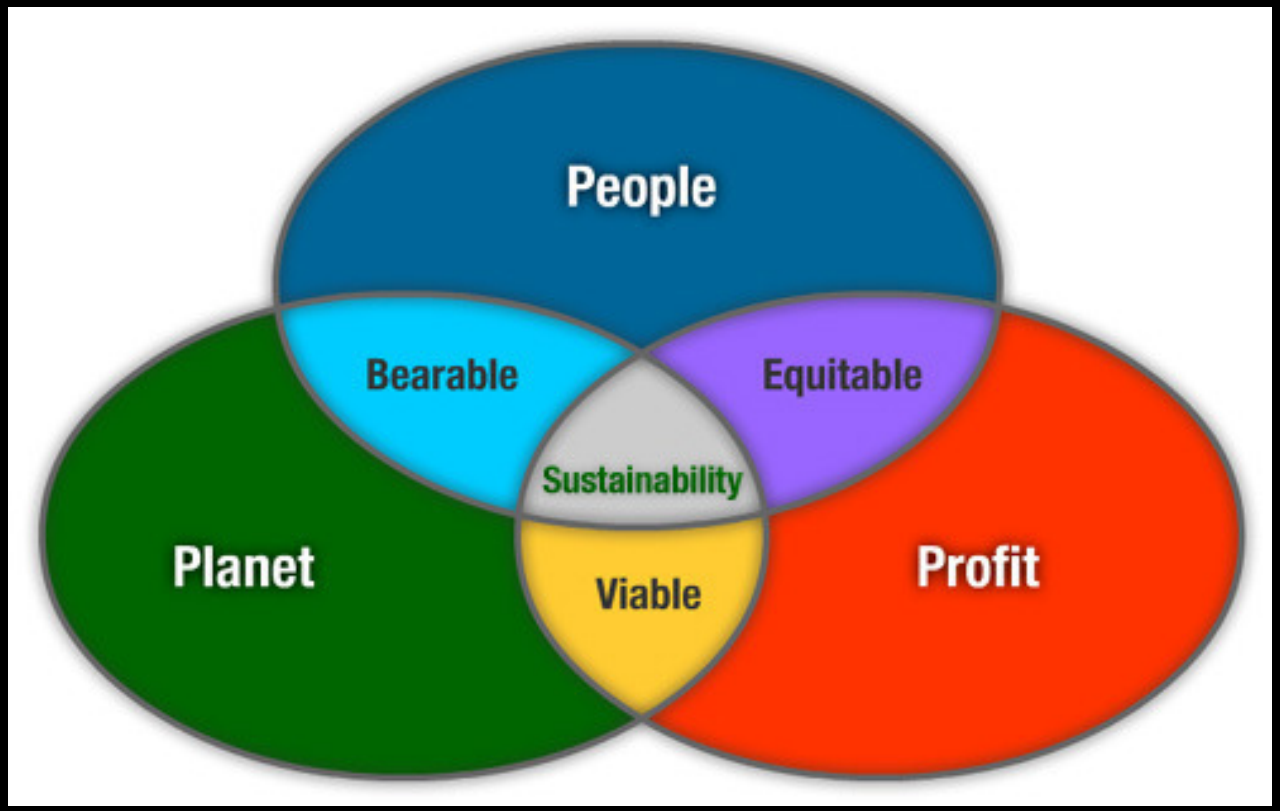
What is a sustainable landscape?

Triple Bottom Line for Sustainable Site Design

Solving Community
Problems



Opportunity to
repair and restore
site systems

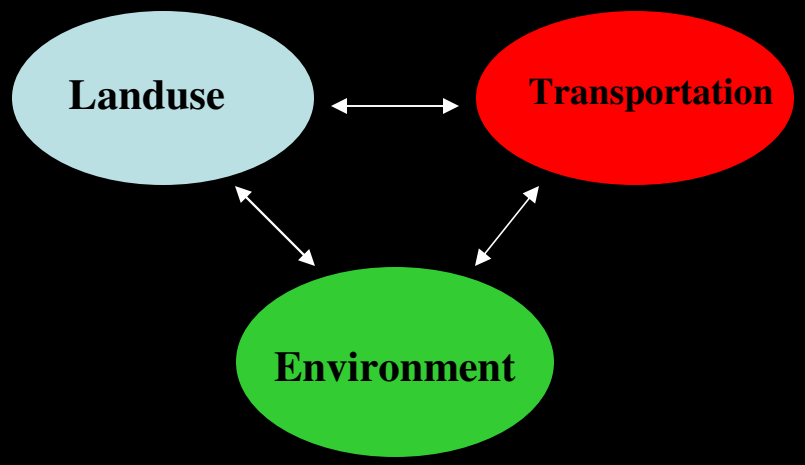
Cost Effectiveness
(when all costs
considered)

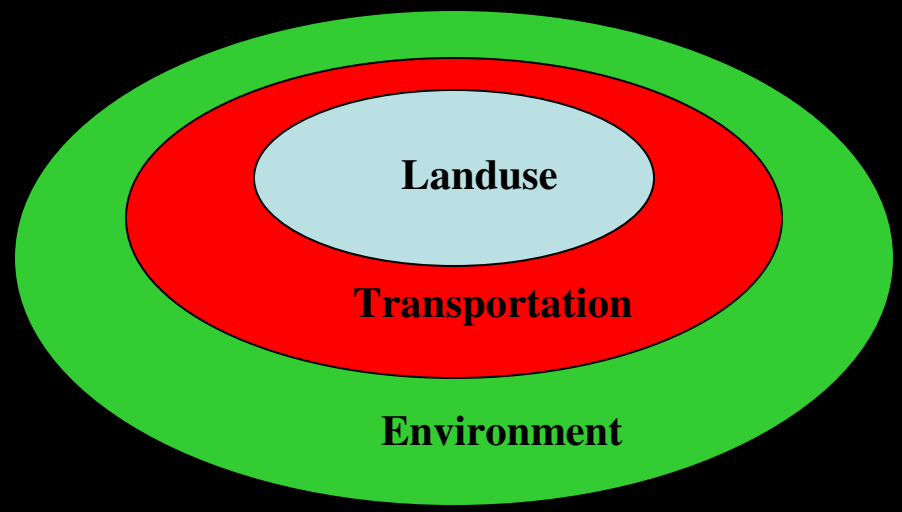
Holism *(a Greek word meaning all, entire, total) is the idea that all the properties of a given system (physical, biological, chemical, social, economic, etc.) cannot be determined or explained by its component parts alone. Instead, the system as a whole determines in an important way how the parts behave.*

Reductionism *is sometimes seen as the opposite of holism. Reductionism in science says that a complex system can be explained by reduction to its fundamental parts. For example, the processes of biology are reducible to chemistry and the laws of chemistry are explained by physics.*

From a holistic perspective, the universe exists in and forms integrated webs of wholeness, often beyond our direct perception

Planning/Design Challenge





Linked Silos → Systems Thinking

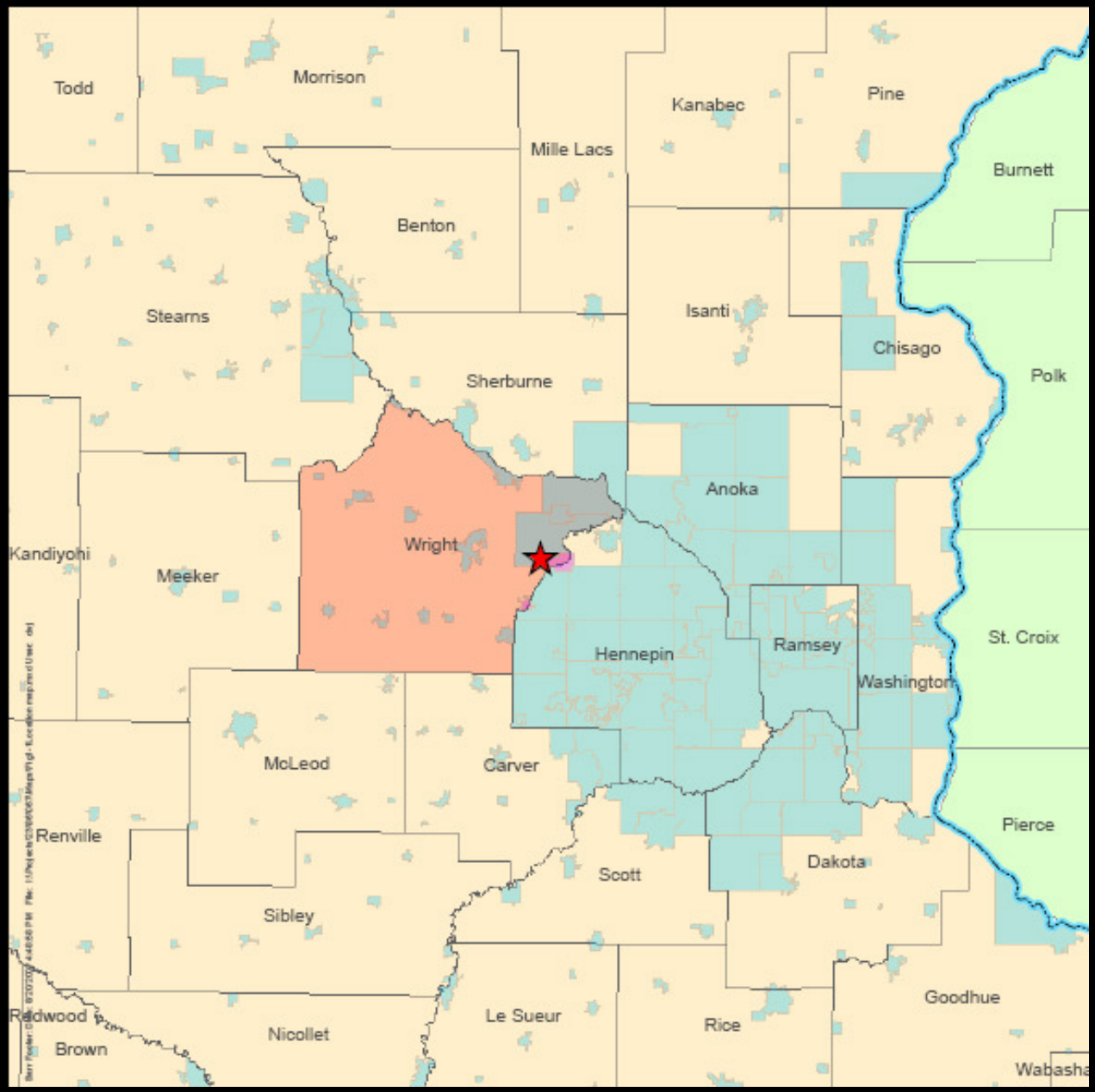
Sustainable Stormwater Design Principles

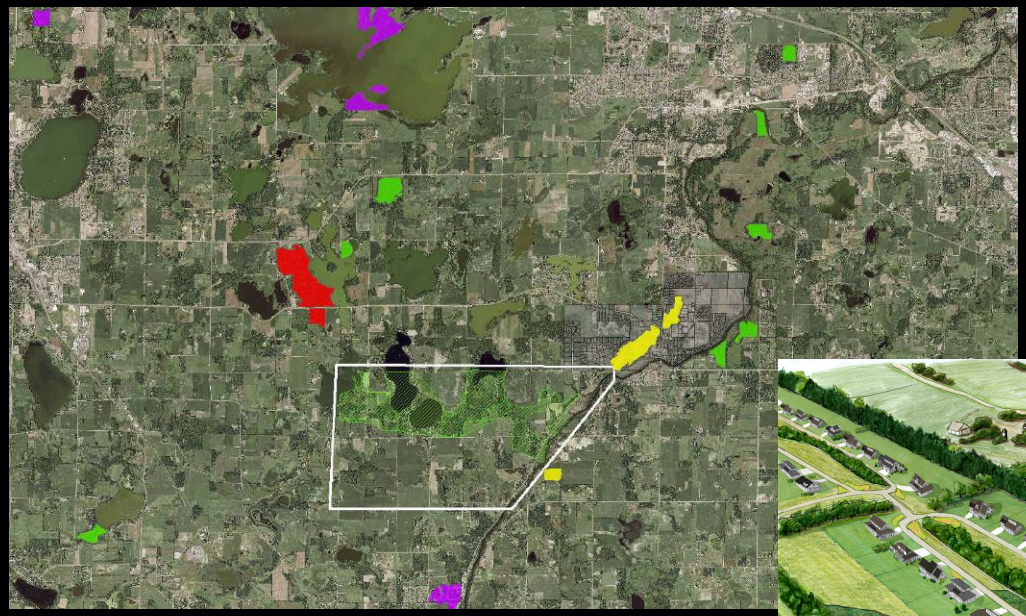
1. Manage Stormwater at the source
2. Use plants & soil to absorb, slow, filter, and cleanse runoff.
3. Integrate consideration of all project goals/potential impacts into site and SW system design.
4. Design facilities that are simple, cost-effective, enhance aesthetics and support other design goals.
5. Stack Functions (multi-functionality)

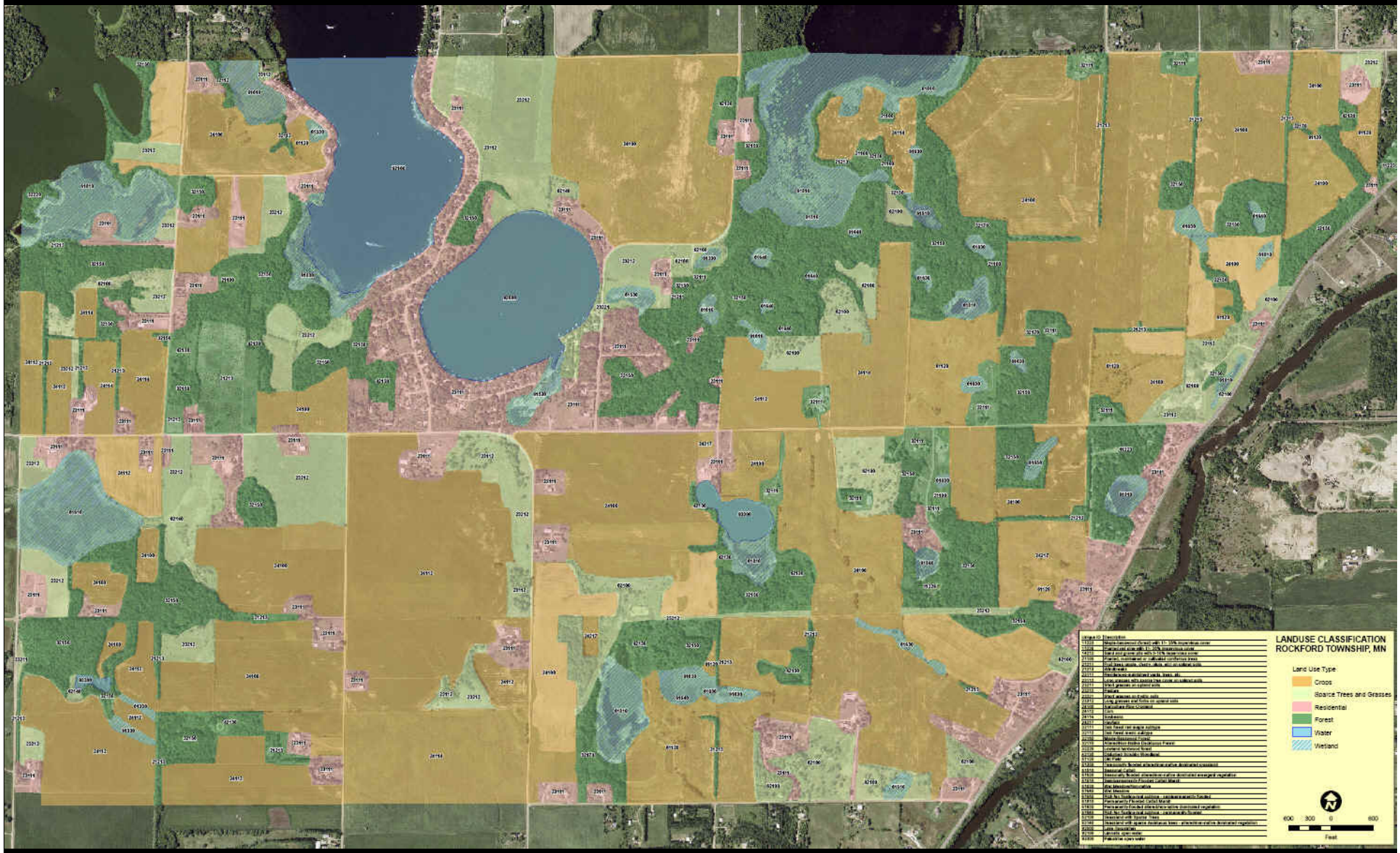
“Sustainable” Benefits of Holistic Approach to SW Management & Site Design

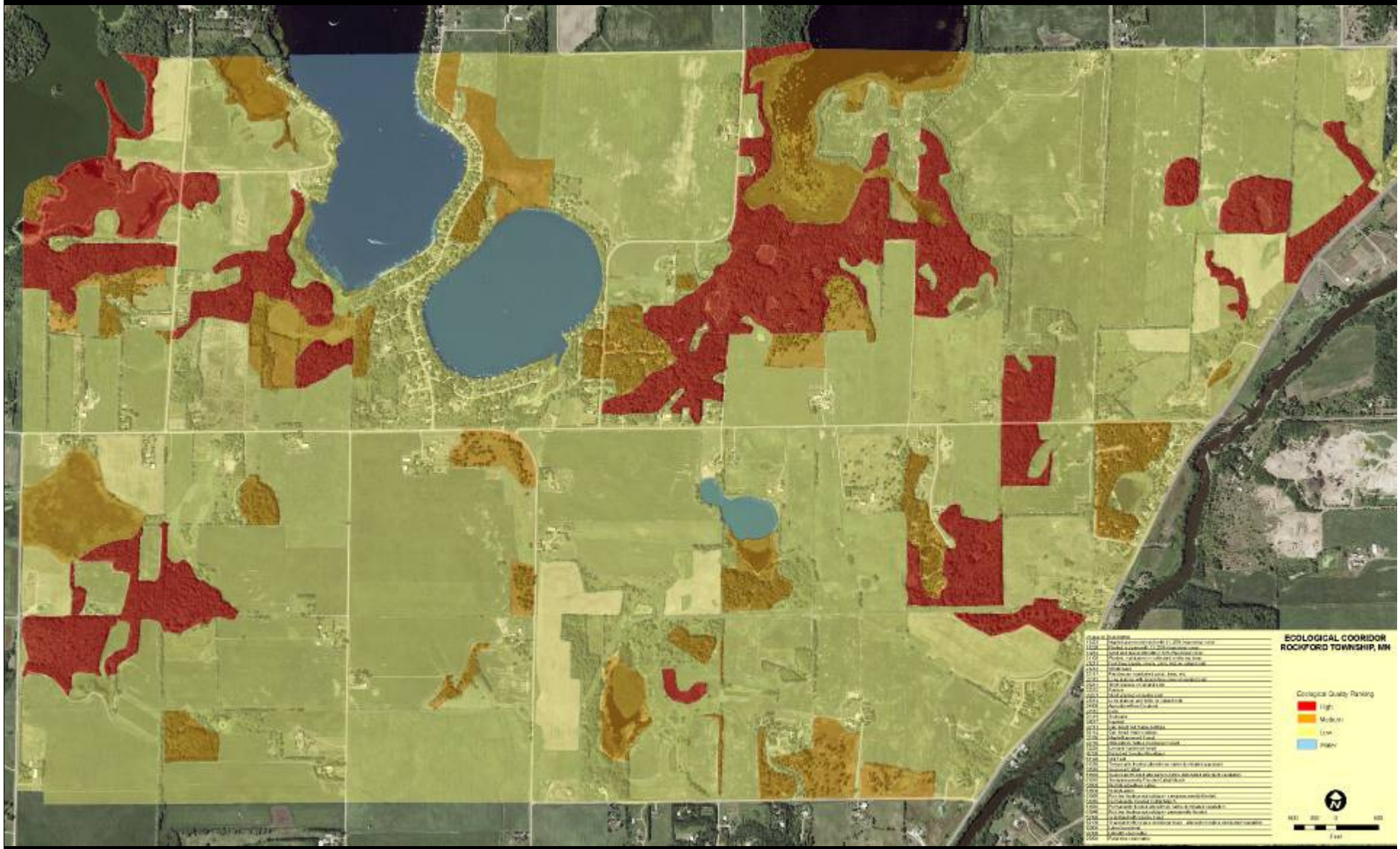
- Improved Water quality
- Reduced Energy Use/GHG Emissions
  - Urban Heat Island
  - Building Shading
  - Carbon Sequestration
  - Urban Forests
- Multi-modal transportation
  - Complete Green Streets

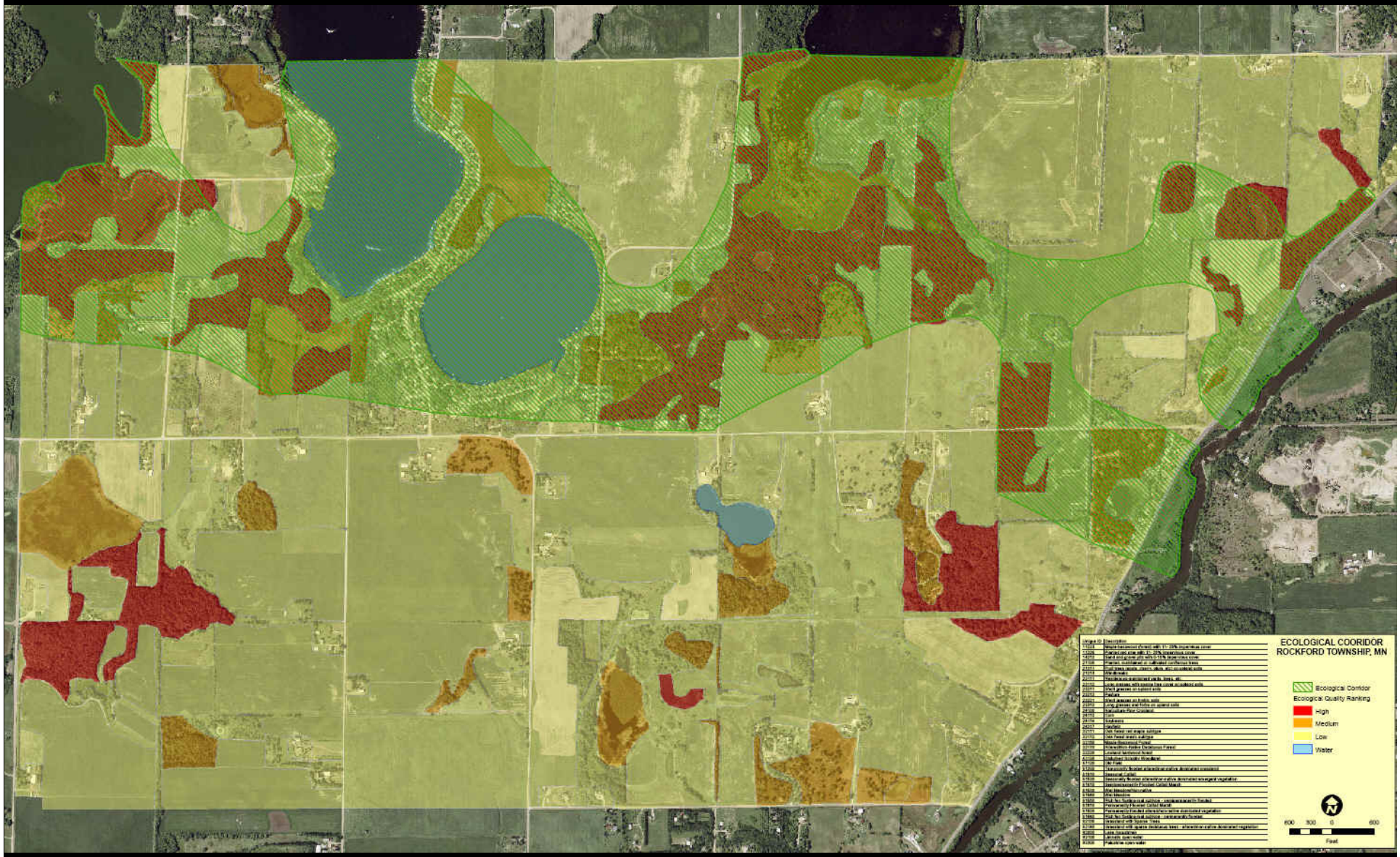
Holistic Residential Design in Hanover, MN






LANDUSE CLASSIFICATION
ROCKFORD TOWNSHIP, MN
Land Use Type
Crops
Sparce Trees and Grasses
Residential
Forest
Water
Wetland
600 300 0 600
Feet


ECOLOGICAL COORIDOR
ROCKFORD TOWNSHIP, MN
Ecological Quality Ranking
High
Medium
Low
Water
Feet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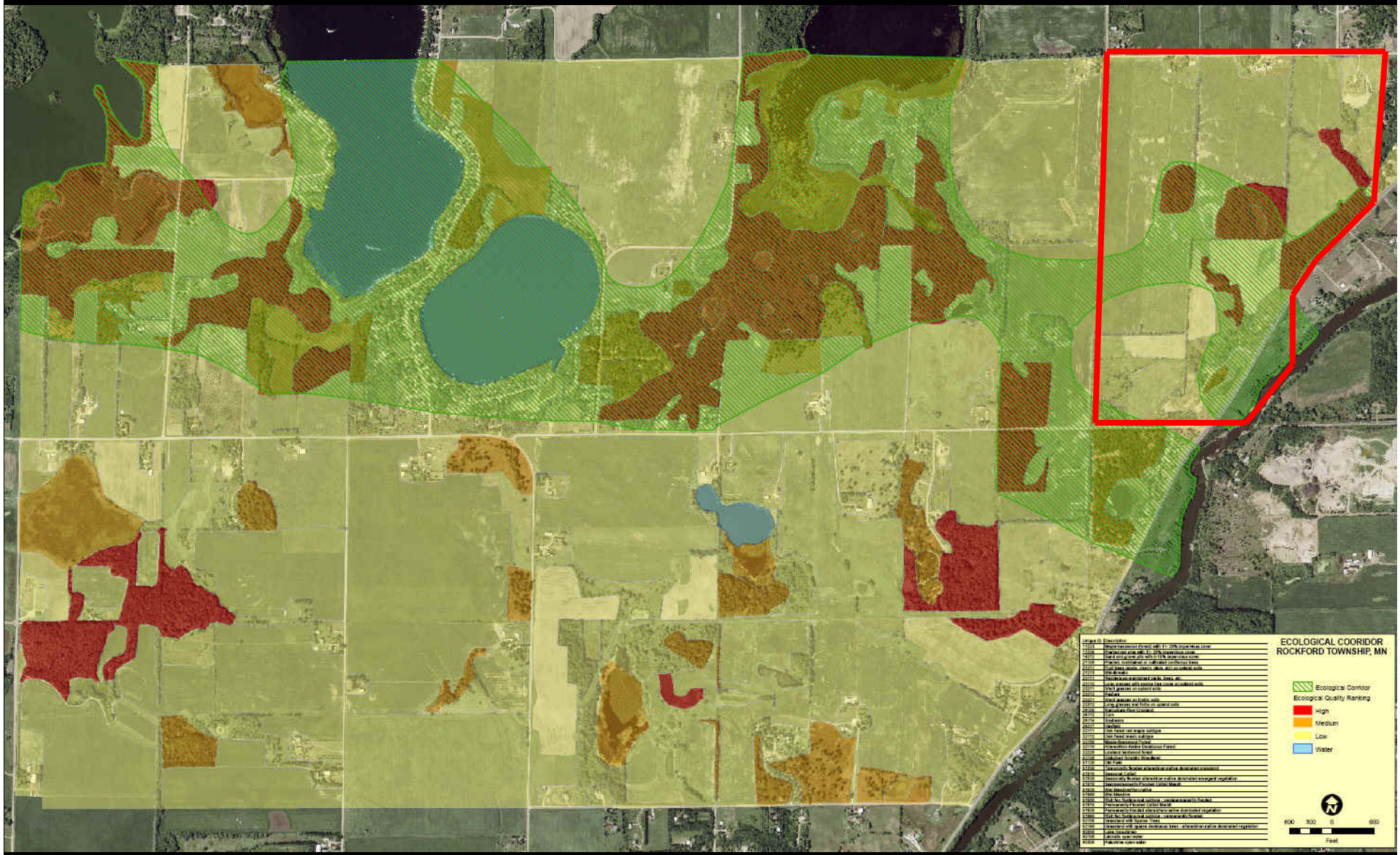
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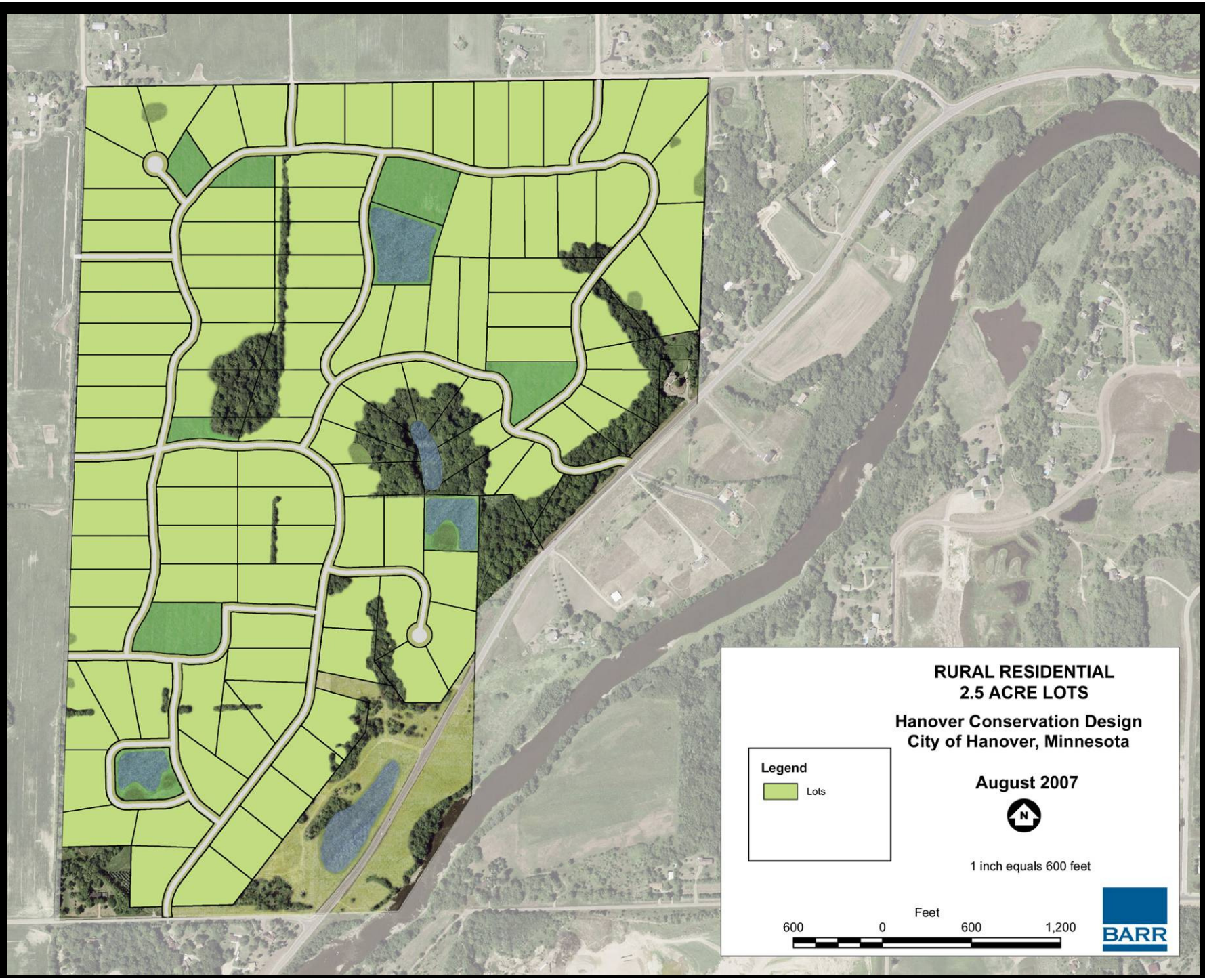
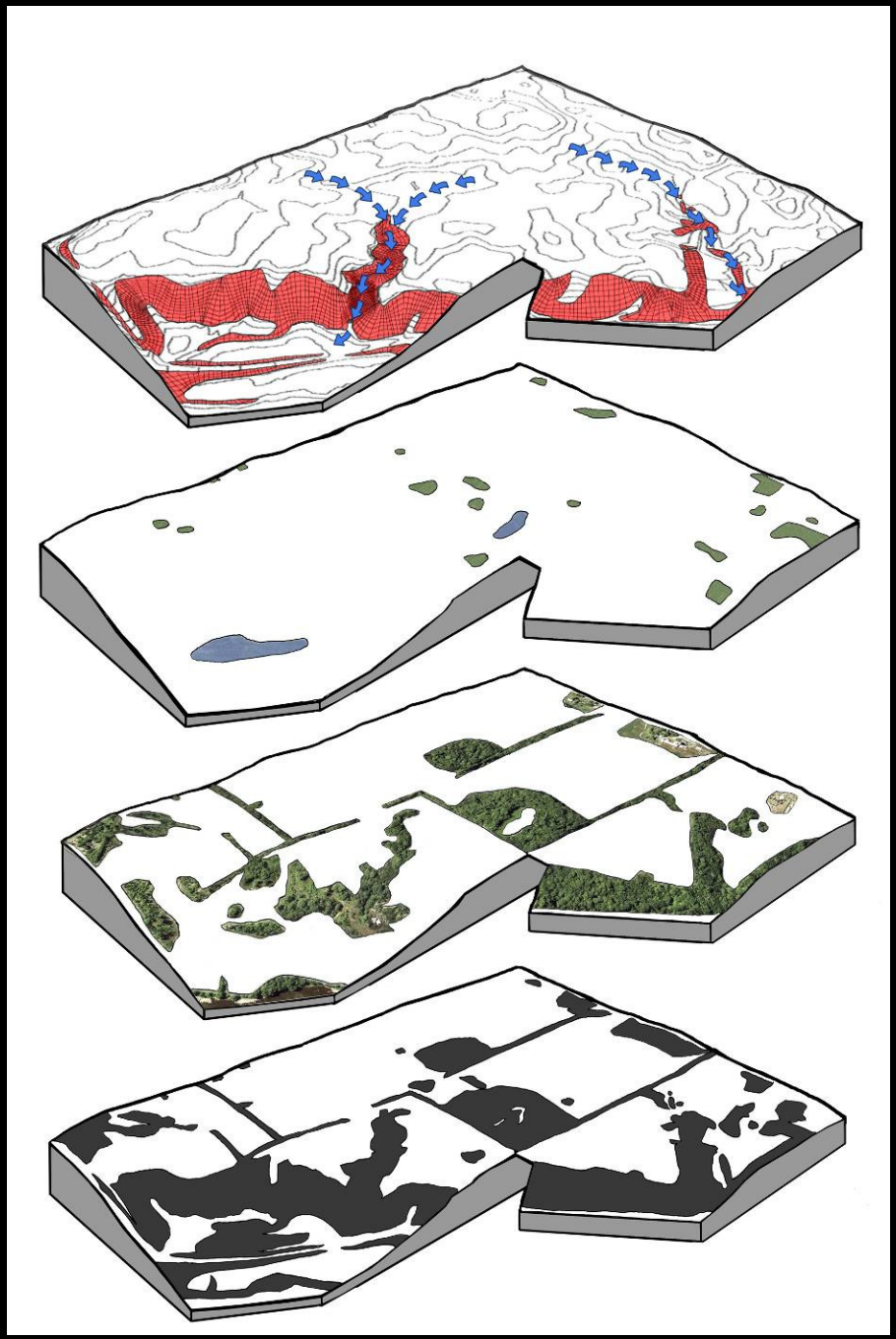

RURAL RESIDENTIAL
2.5 ACRE LOTS
Hanover Conservation Design
City of Hanover, Minnesota
August 2007
Legend
Lots
N
1 inch equals 600 feet
Feet
600
0
600
1,200
BARR

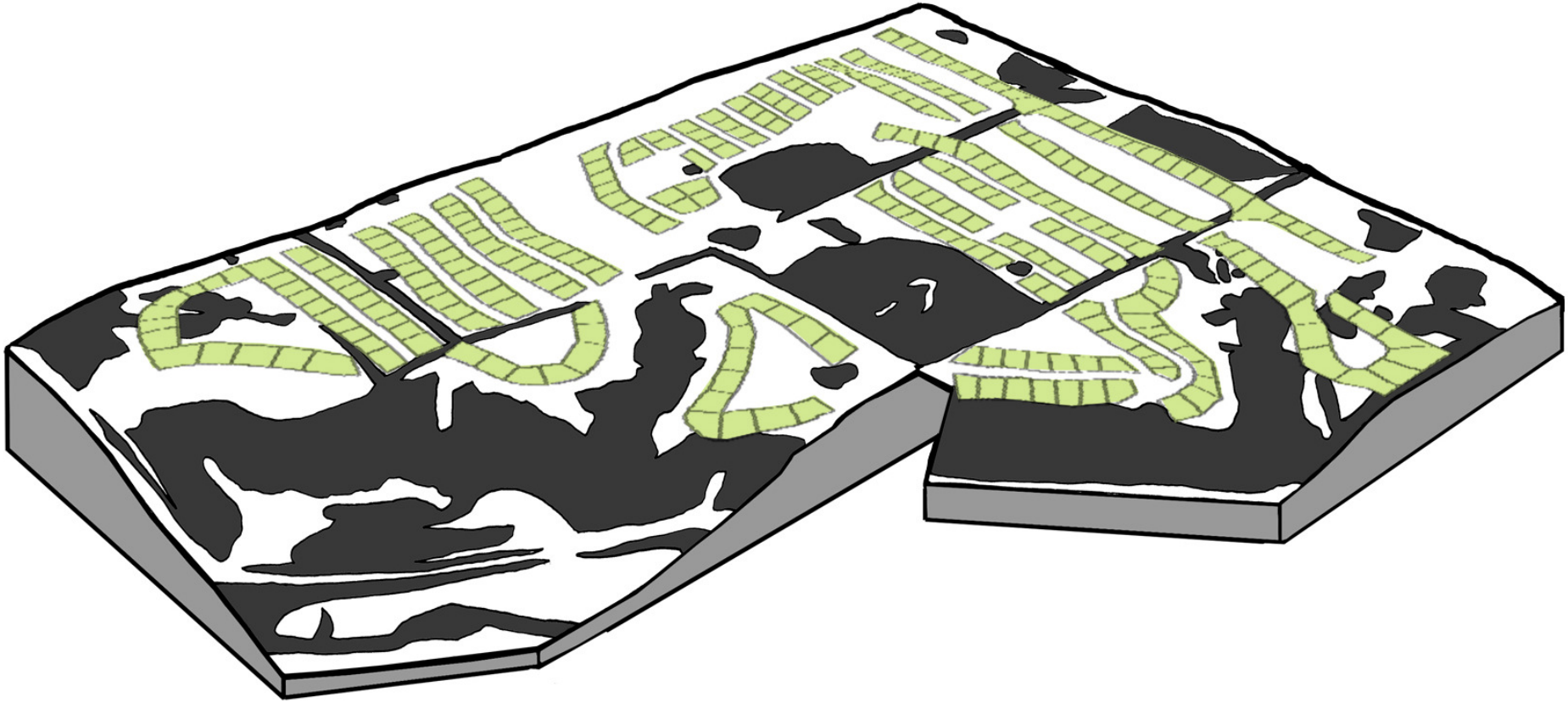


Steep Slopes & Waterways

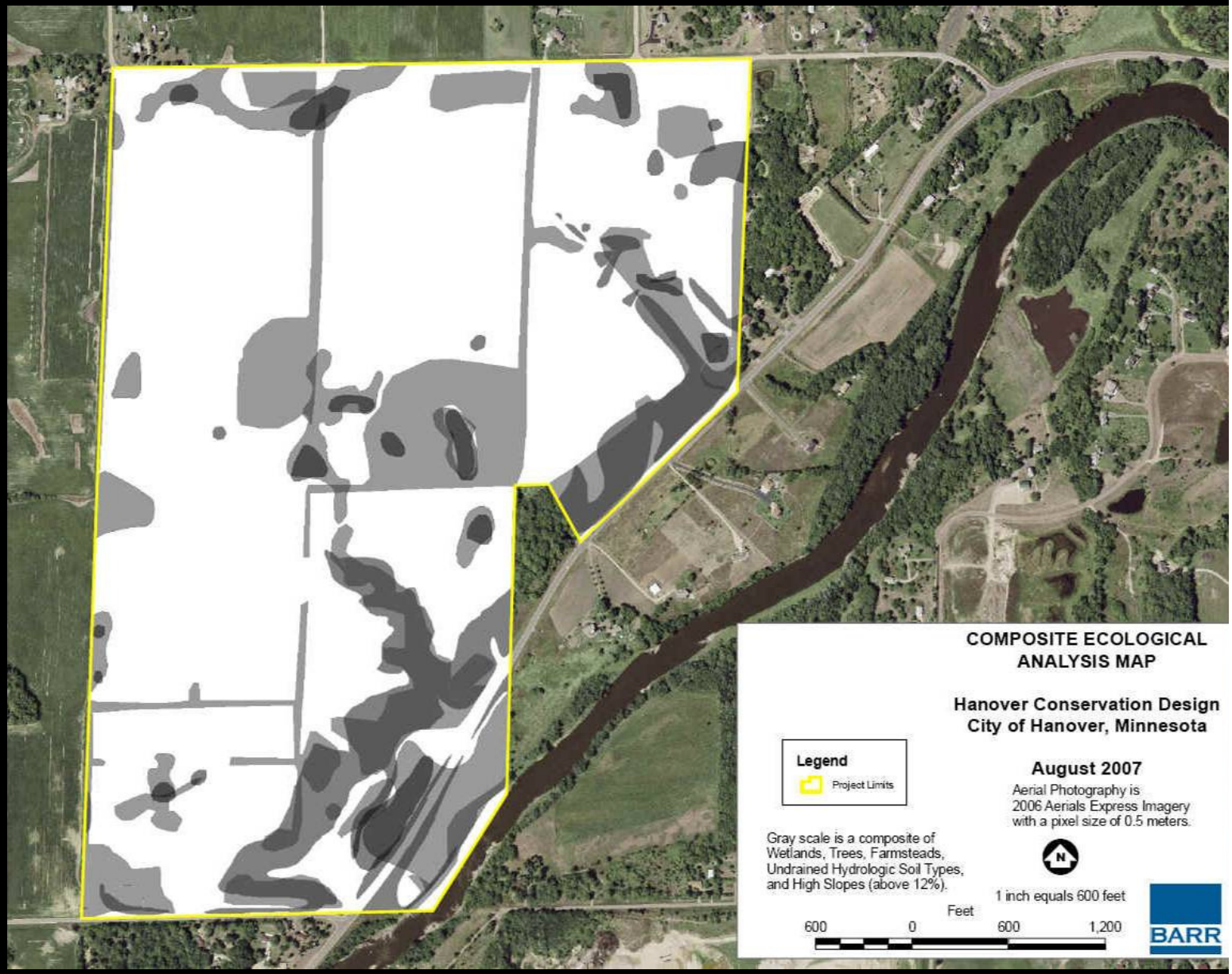
Wetlands

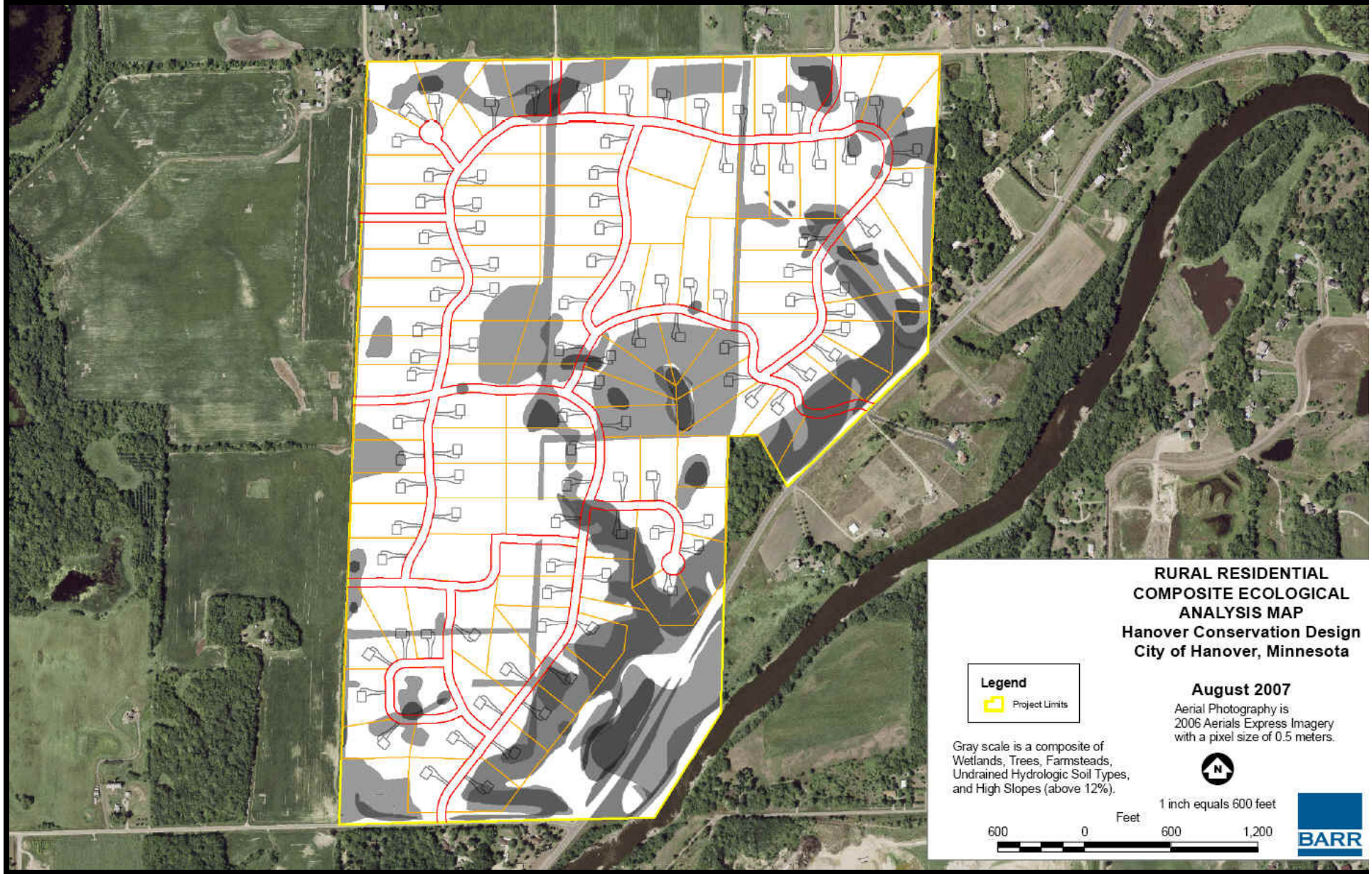
Vegetation & Farmsteads

COMPOSITE



In Conservation Design **less than 50%** of the developable land (white space) is developed.

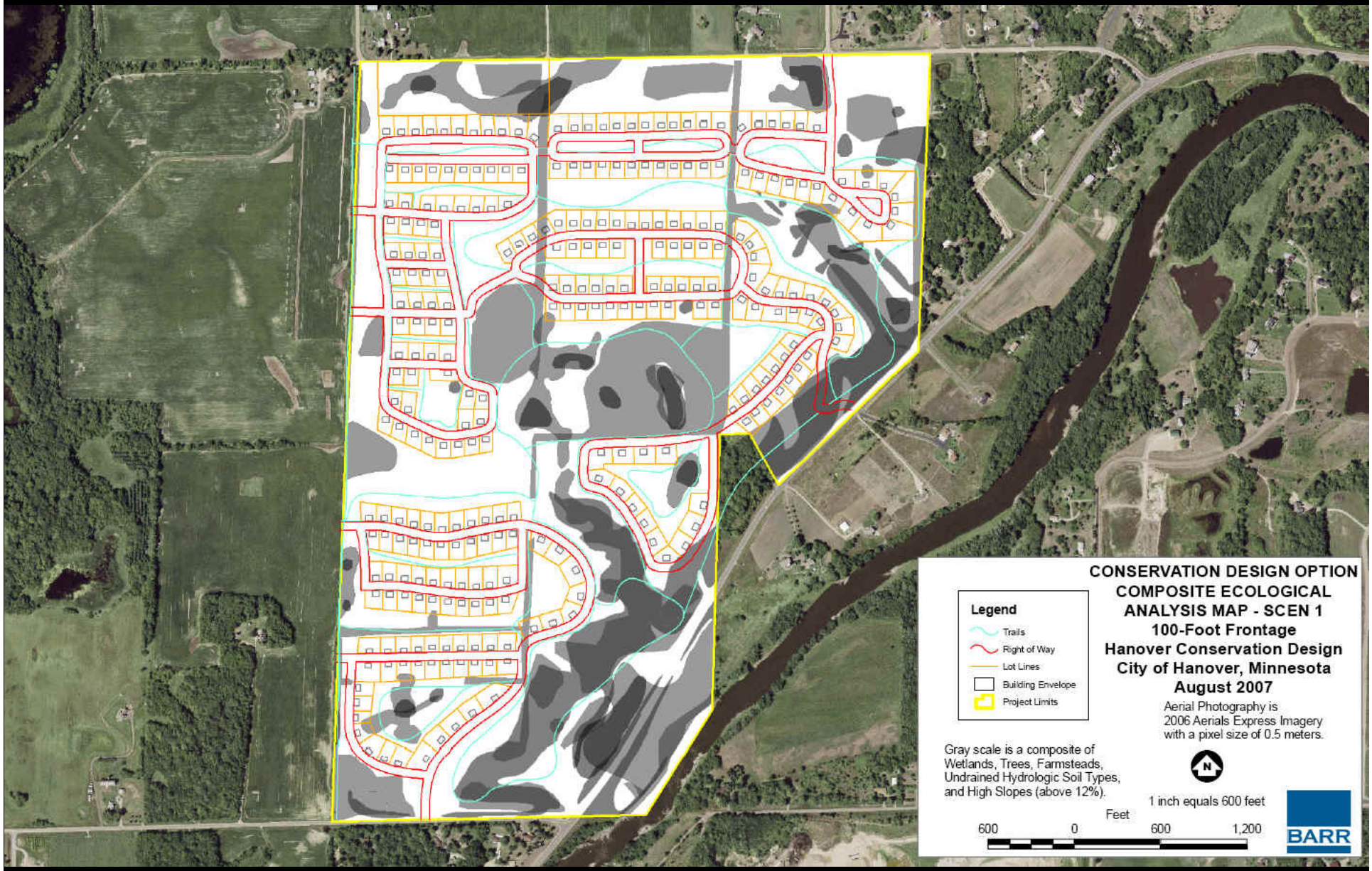




RURAL RESIDENTIAL COMPOSITE ECOLOGICAL ANALYSIS MAP
Hanover Conservation Design
City of Hanover, Minnesota

August 2007

Aerial Photography is 2006 Aerials Express Imagery with a pixel size of 0.5 meters.


CONSERVATION DESIGN OPTION
COMPOSITE ECOLOGICAL
ANALYSIS MAP - SCEN 1
100-Foot Frontage
Hanover Conservation Design
City of Hanover, Minnesota
August 2007
Legend
Trails
Right of Way
Lot Lines
Building Envelope
Project Limits
Aerial Photography is
2006 Aerials Express Imagery
with a pixel size of 0.5 meters.
Gray scale is a composite of
Wetlands, Trees, Farmsteads,
Undrained Hydrologic Soil Types,
and High Slopes (above 12%).
N
1 inch equals 600 feet
Feet
600
0
600
1,200
BARR

Cost Comparison of Rural Residential and Conservation Design Scenario 1, 100-Foot Frontage

	Rural Residential	Conservation Design, Scenario 1
Roads	$1,275,918	$1,357,824
Sanitary	$1,103,310	$1,566,720
Water	$858,130	$1,218,560
Storm Sewer	$108,150	$85,050
Walking/Biking Trails	$32,525	$436,762
Total	**$3,378,033**	**$4,664,916**
Cost Per Lot	$32,796	$16,142

Holistic Corporate Campus Design

3

10

PARKING
LOT #6
1
3
4
19
19
5

16

PARKING
LOT #7
5
16
15
PARKING
LOT #1
1
12
19
6

Fruit, Vegetable, and Nut Production

Lockheed Martin Corporation - Edina, MN Campus Master Plan

SWMM Modeling Results: Existing vs. Proposed Conditions

Site Runoff - Excluding Roof Area*

	24-Hour Rainfall		Existing Condistions	Proposed Conditions	Percent Reduction
1 Inch	1.0 inch	**Max Flow (cfs)**	15.2	1.1	93%
		Volume (ac-ft)	1.3	0.1	93%
1 Year	2.3 Inches	**Max Flow (cfs)**	63.5	10.1	84%
		Volume (ac-ft)	4.1	0.7	84%
2 Year	2.75 Inches	**Max Flow (cfs)**	78.4	19.2	76%
		Volume (ac-ft)	5.2	1.5	71%
5 Year	3.6 inches	**Max Flow (cfs)**	99.8	43.5	56%
		Volume (ac-ft)	7.3	3.1	57%
10 Year	4.2 Inches	**Max Flow (cfs)**	112.8	55.9	50%
		Volume (ac-ft)	8.6	4.2	51%
100 Year	6.0 Inches	**Max Flow (cfs)**	141.5	68.1	52%
		Volume (ac-ft)	12.5	7.0	44%

*Roof area excluded from results in both existing and proposed conditions.
The results reflect areas where treatment is possible.

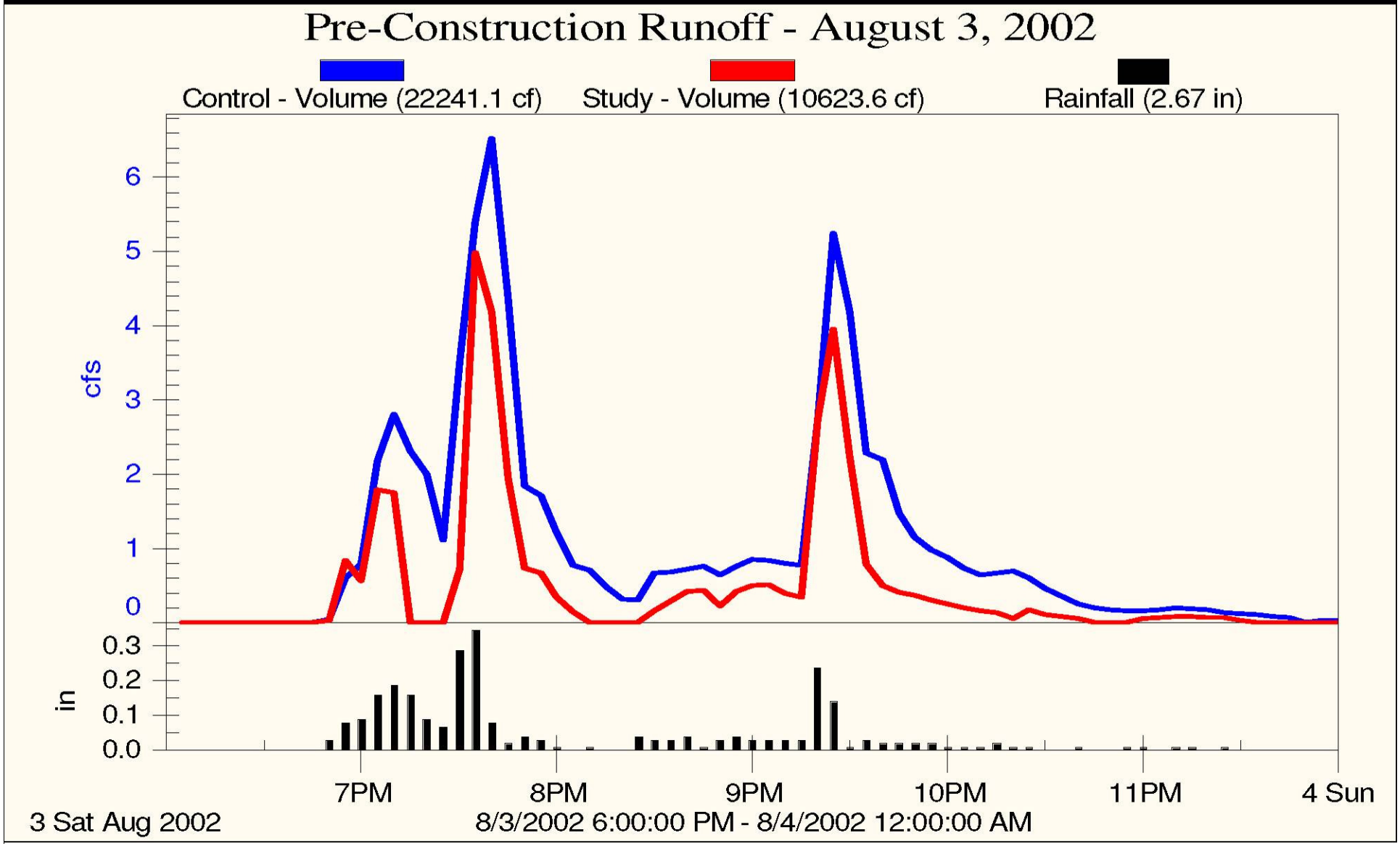
Improved Water Quality

Burnsville, MN Rainwater Gardens

- -17 of 25 homes retrofitted with rainwater gardens
- -Average cost of $7,500 per garden
- -5.3 acre subwatershed
- -Gardens infiltration 0.9” from impervious surfaces

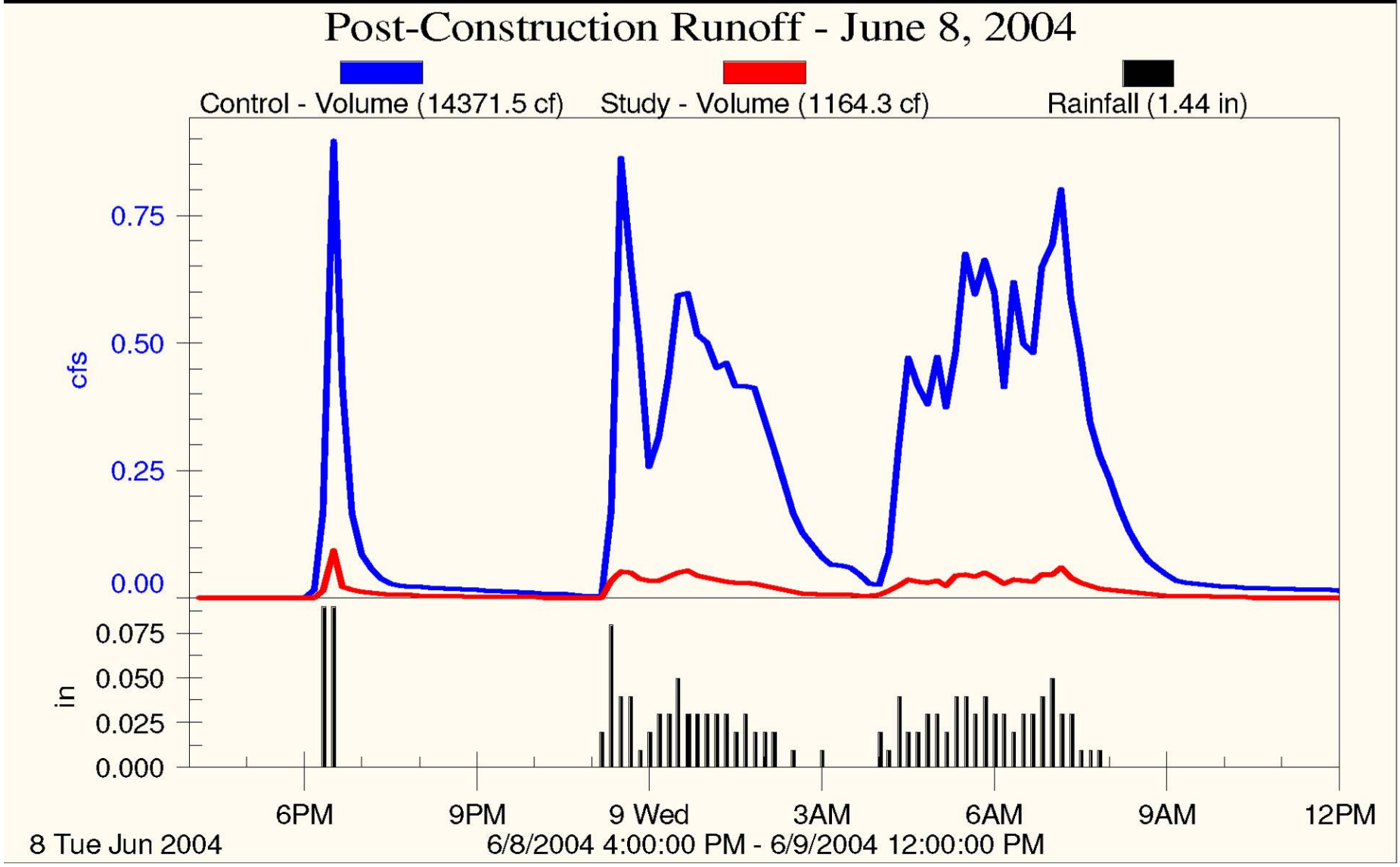
Pre-Construction Runoff (2002 – 2003)

2.67 inches in 4 Hours



Post-Construction Runoff (2004–2005)

1.44 inches in 9 hours



Improved Water Quality

Reduced Energy Use/GHG Reduction

Reduced Energy Use/GHG Reduction

Reduced Energy Use/GHG Reduction

Reduced Energy Use/GHG Reduction

Reduced Energy Use/GHG Reduction

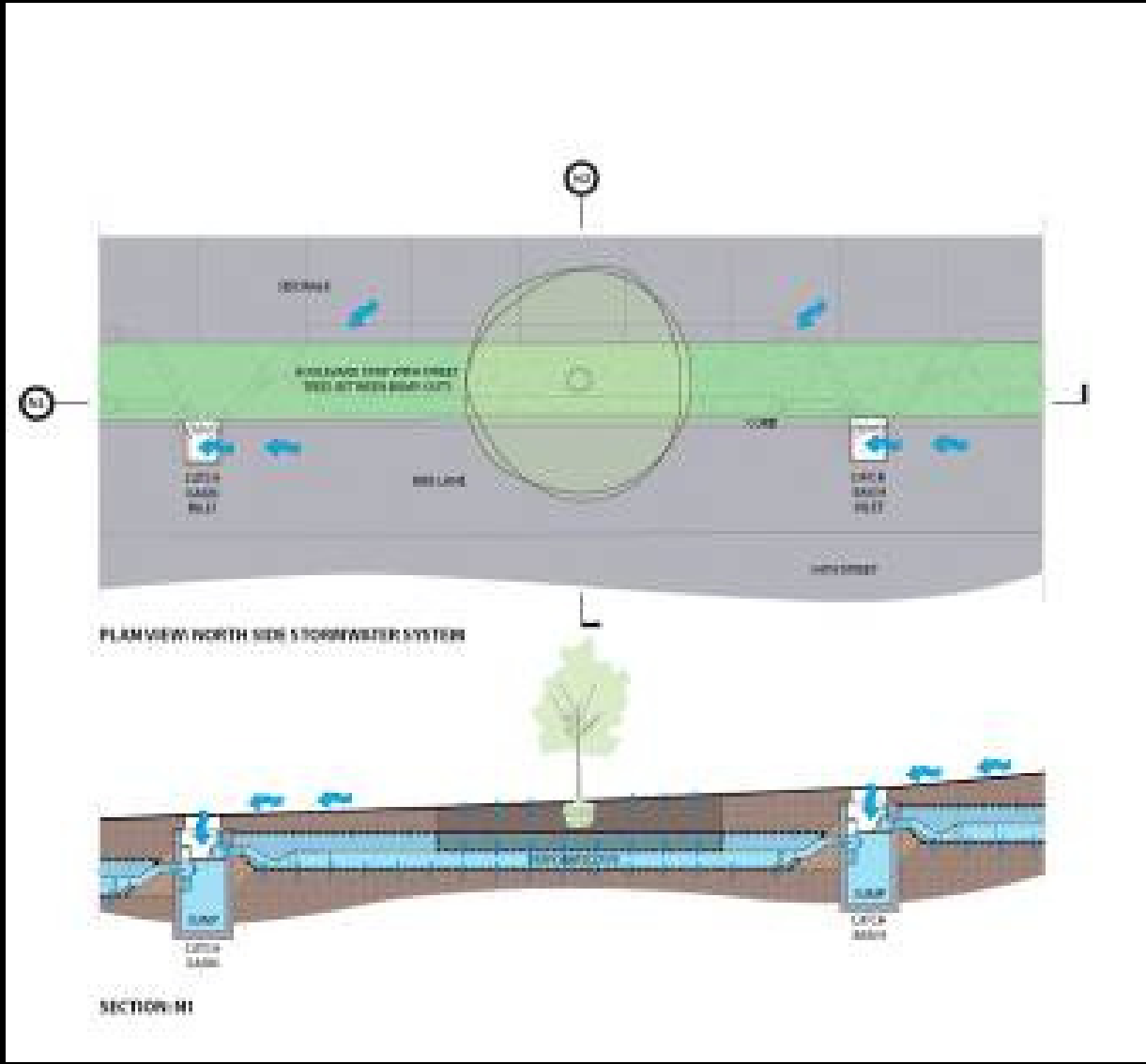
Shades of Sustainable SW Development

1. **Green Streets**: Maximize landscape area and minimize impervious areas.

2. **Greener Streets**: Landscape SW systems used to manage runoff from streets, sidewalks, and driveways.

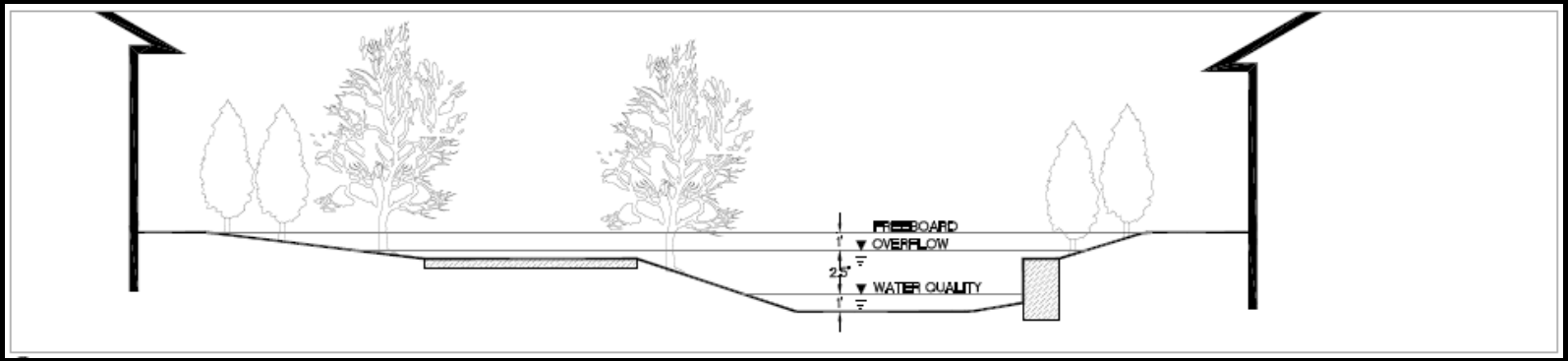
3. **Complete Green Streets:** Alternate modes of transportation including transit, biking and walking.

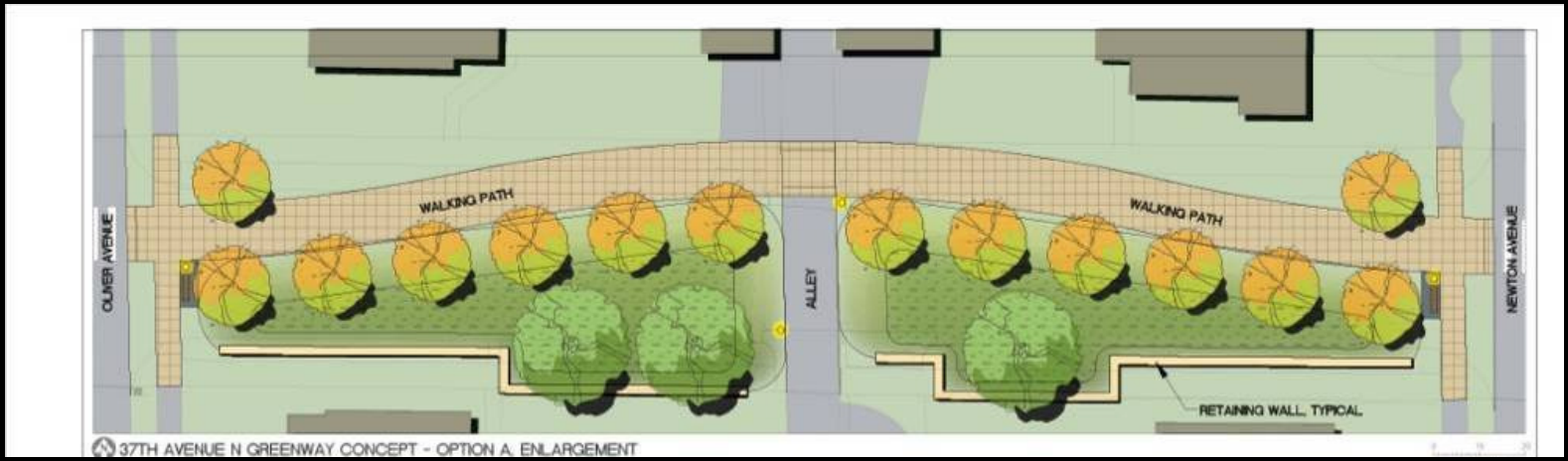
Under the Street

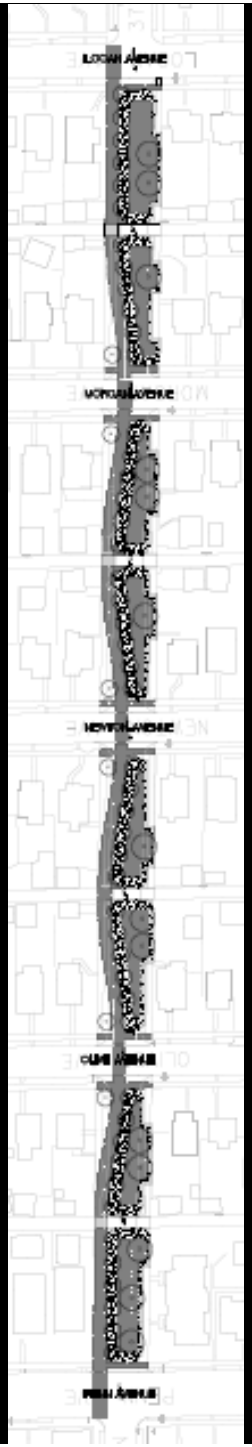


Under the Street

Removing the Street







Regulatory Tools to Implement a Holistic Approach to SW Design

Removing Obstacles

Creating Incentives

Enacting Better Standards

Change Regulatory Mindset

Removing Obstacles

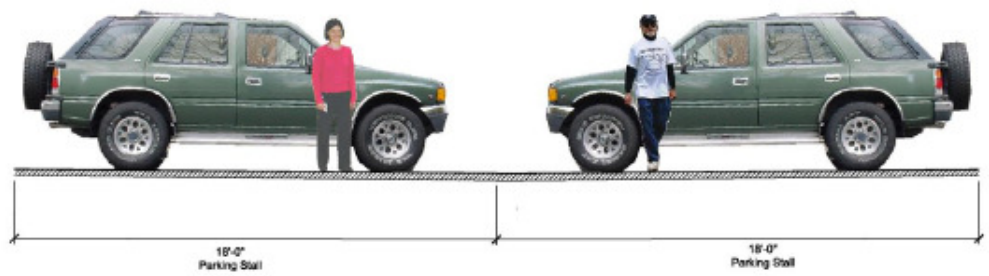
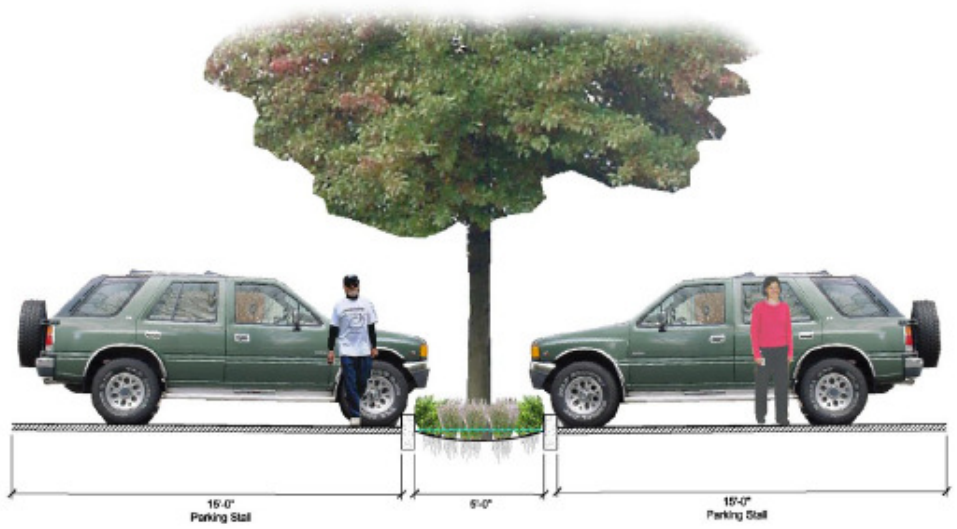


Figure 2-16: This typical cross section illustrates a conventional parking lot condition with 18 feet long parking stalls.



Parking Requirements:

Numbers

Dimensional Standards

Source: San Mateo Countywide Water Pollution Prevention Program/Nevue Ngan Associates & Sherwood Design Engineers.

Removing Obstacles

Vegetation standards

Removing Obstacles

Street Width

Setbacks

Vertical Curbs

Removing Obstacles

Landscaping Berms

Raised Parking Lot Islands

Creating Incentives

Offer:

- Density/height bonuses
- Reduced permit fees
- Accelerated review
- Points/credits

for:

- BMPs (green roofs, RW gardens, etc.)
- Low-energy/maintenance landscapes
- Preserving existing trees, planting new.

Enact Better Standards

Require street trees between sidewalk and street

Tree protection (not rationalized tree destruction)

Enact Better Standards

Trees in parking lots

Require wetland buffers (easements)

Enact Better Standards

Limit amount of turf
(Commercial)

Soils Compaction during development

Enact Better Standards

Require Decompaction of soils with redevelopment

Change Regulatory Mindset

- ❑ Adopt Performance standards to allow design creativity.
- ❑ Reduce number of prescriptive requirements
- ❑ Allow administrative variances for flexibility in standards review outside of normal variance process.
- ❑ Integrate staff review of development projects
- ❑Collaborative approach to project development and review.

Regulatory Mindset:

A set of beliefs, and way of doing business that determines organizational behavior, outlook and attitude.