This presentation premiered at WaterSmart Innovations

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Implementing Sustainable Stormwater Management: Lessons Learned from Ten Years of Collaboration

WaterSmart Innovations Conference & Expo, Las Vegas, Nevada
Session: T-1006 9:30am - 10:00am Thursday, October 8, 2009

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OLIN

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Nitsch Engineering

OUTLINE

I. Introduction

II. Challenges and Opportunities in Implementing Sustainable Stormwater Management in Building Projects

III. Stormwater System Design & Implementation throughout the Project Lifecycle

IV. Post-Construction and Evaluation

V. Case Studies

VI. Lessons Learned

Q & A

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“There is no place for the attitude “stormwater management should be left to engineers, or wetland design should be left to landscape architects. History has clearly shown that employing a single-disciplined approach to design more often than not leads to failure of the design.”

Wong, T., & Eadie, M. **Water Sensitive Urban Design - A Paradigm Shift in Urban Design**. Proceedings of the Xth World Water Congress, 12-16 March 2000.

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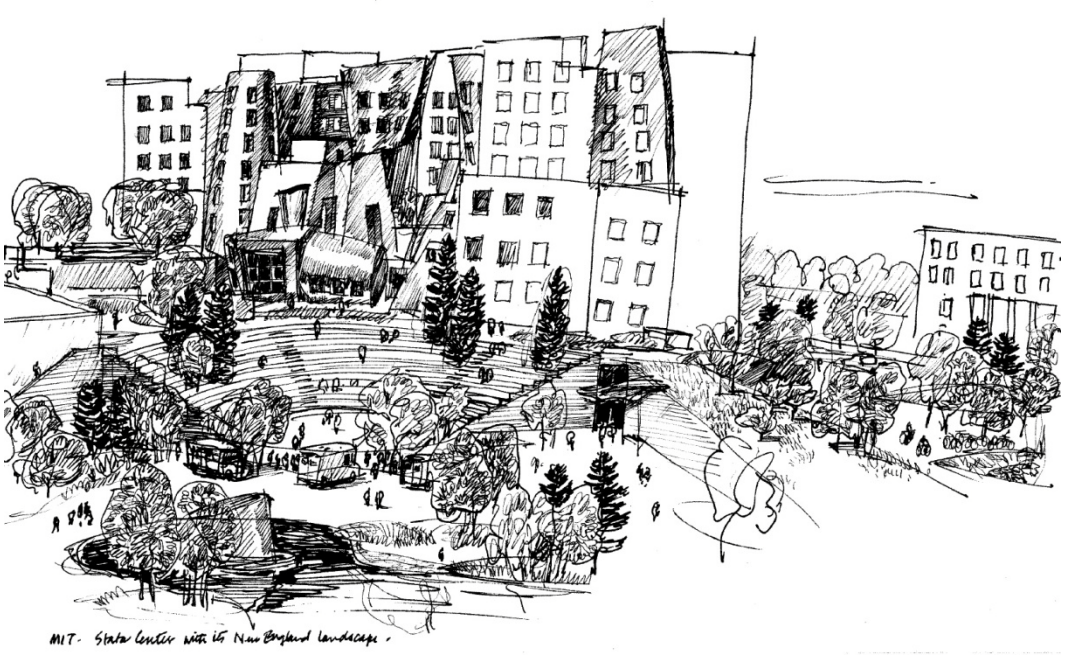
COLLABORATION

How Our Offices Met

- MIT - Ray and Maria Stata Center for Computer, Information, and Intelligence Sciences

Work We've Done Together

- 20 Projects in 10 years



MIT Landscape Framework Plan

MIT Stata Center

Fountain Square

Bethel Woods

UVA Carr's Hill Arts Precinct Master Plan

UVA Observatory Hill Residence Cluster

Yale Science Hill Master Plan

Yale Science Hill Garage

Yale Kroon Hall (FES)

Yale Sachems Wood

Yale Biology Building

Yale SCL/KCL

Mill River Park

The Point Master Plan

Temple University Development Plan

Brooklyn Atlantic Yards Master Plan

New York Botanical Garden

Taiwan National Palace Museum

Worcester Polytechnic Institute Master Plan

Harvard Allston Master Plan

Duke Nicholas Center

Canal Park

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HOW WE WORK TOGETHER

- With knowledge and respect
- Communication – looking out for each other's scope
- Being collaborative – no fine lines that each firm can't cross
- With a strategy for working with the Architect and overall design vision
- Creating drawing and details together in an iterative process.
- Identifying gaps/overlaps together to develop a comprehensive solution.

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WHY IT'S SUCCESSFULL

- Civil Engineer cares about the visual / cultural / social implications and Landscape Architect understands the functional / technical implications
- Early interaction and collaboration between firms
- No "turf" wars – Nitsch ventures into landscape architecture issues and OLIN ventures into drainage/utility issues
- Civil Engineer appreciates value the Landscape Architect brings and vice versa

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STORMWATER BEST MANAGEMENT PRACTICES

A suite of planning processes, development methodologies, and specific "structural" techniques designed to be used in combination to:

- Prevent disturbances to natural systems and hydrologic functions
- Minimize the impacts of disturbances where they do occur

Source: Pennsylvania DEP Stormwater BMP Manual

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STORMWATER BMP TYPES

Volume/Peak Rate Reduction by Infiltration

- Pervious pavement
- Infiltration Basin
- Dry well/seepage pit
- Vegetated swale
- Rain Garden/bioretention

Volume Peak Rate Reduction

- Vegetated Roof

Runoff Quality/Peak Rate

- Constructed wetland
- Wet pond/retention basin
- Dry extended detention basin
- Water quality filters & hydrodynamic devices

Restoration

- Riparian buffer restoration
- Landscape restoration
- Soil amendment and restoration

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CHALLENGES & OPPORTUNITIES

National Regulatory Environment

National Pollutant Discharge Elimination System (NPDES) established in 1972 under the Clean Water Act

1990, Phase I of the NPDES Stormwater program

1999, Phase II of the NPDES Stormwater program

1. Public education and outreach on stormwater impacts
2. Public involvement/participation
3. Illicit discharge detection and elimination
4. Construction site stormwater runoff control
5. Post-construction stormwater management in new development and redevelopment
6. Pollution prevention/good housekeeping for municipal operations

Regulatory Challenges

- "The regulations require this instead of that…"
- Local codes and "green" incentives lagging behind the leading BMP trends and technical possibilities
- Consideration of stormwater as a waste product rather than a resource

Regulatory Opportunities

- Overcoming the Status Quo
- Conservation and Reuse BMPs can help in meeting regulatory requirements
- Project can assist municipality in meeting larger, regional goals
- Encouraging the visible display of sustainable stormwater practices

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Technical Challenges

- Dealing with existing conditions:
  Site restrictions, buildings, infrastructure, topography, soils, plants

- Integrating innovative methods with traditional building & utility components

Technical Opportunities

- Pursuing LEED-NC and LEED-ND certification

- Creating a cost benefit from reduction of energy and utility usage

- Utilizing a variety of BMP options for specific site conditions

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GREEN INCENTIVES FOR STORMWATER BMPS

LEED New Construction
2009 - Active

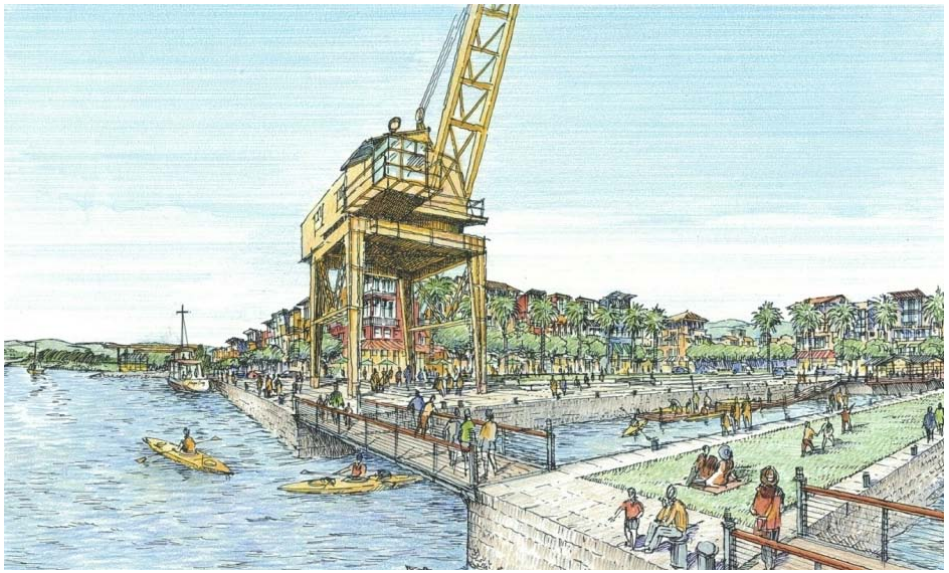
0 Prerequisites
6 Credits (direct or indirect)

LEED Neighborhood Development
2009 - Pilot program

2 Prerequisites
7 Credits (direct or indirect)

Sustainable Sites Initiative
2009 - Under development
2012 - Pilot program

3 Prerequisites
8 Credits (direct or indirect)



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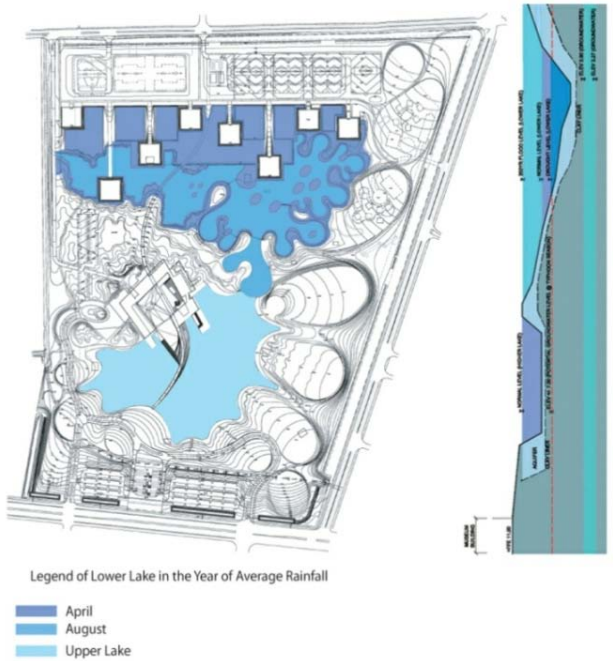
Project Team Challenges

- Forced marriage of consultants
- Overcoming inertia: “We’ve always done it this way”
- Lack of respect of other consultant’s expertise
- Don’t want to make the investment in BMP’s

Project Team Opportunities

- Utilize expertise on team in project-wide sustainable collaboration
- Collaboration of client and entire team on green solutions means greater advocacy
- Desire to push the sustainable envelope and learn



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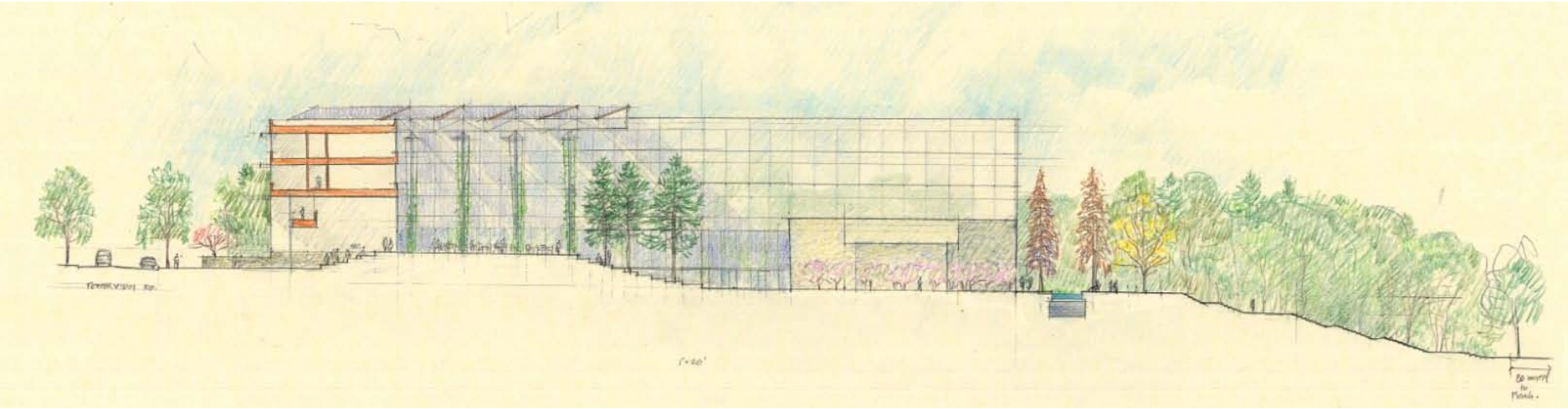
STORMWATER SYSTEM DESIGN

Pre-Design

- Having a seat at the table
- Understanding the owner's goals
- Understanding the regulatory environment and potential LEED credits
- Overcoming resistance to change and energizing the owner and the team to support the design and implementation of BMPs
- Ensuring critical BMP issues are addressed early



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Design

- Supporting the project design intent through collaboration
- Anticipating challenges to initial assumptions and remaining flexible
- Educating team members on technical issues
- Facilitating consultant communication and their ability to learn each discipline's "language"
- Maintaining the all-important

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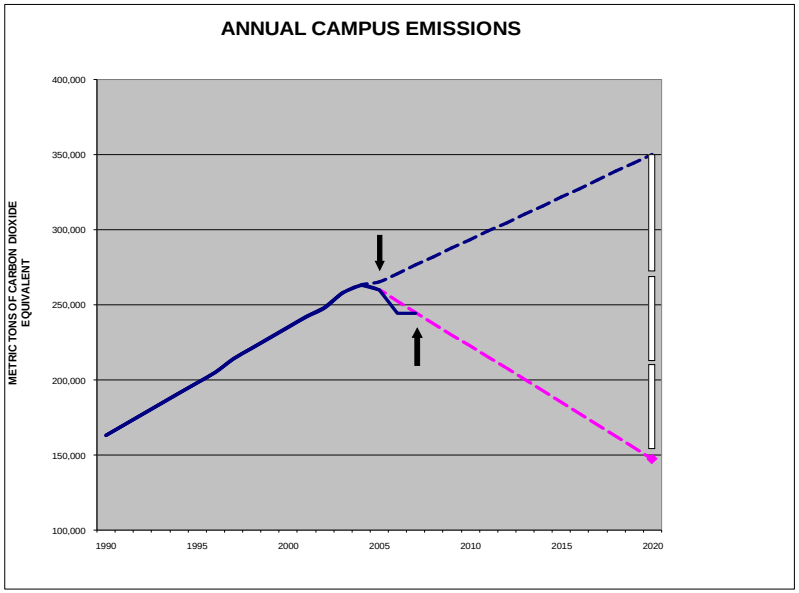
Construction

- Educating site subcontractors
- Anticipating problems and overseeing installation during construction administration

Post-Construction

- Laying the groundwork so regular maintenance will be carried out on BMPs
- Evaluating system performance and cost benefit data



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POST CONSTRUCTION AND EVALUATION

Maintenance

- Maintenance, Maintenance, Maintenance
- Understand that different BMPs have different maintenance schedules
- Overcome lack of knowledge/lack of interest in learning by the maintenance staff
- Realize that failure due to lack of maintenance impacts future ability to implement Stormwater BMPs

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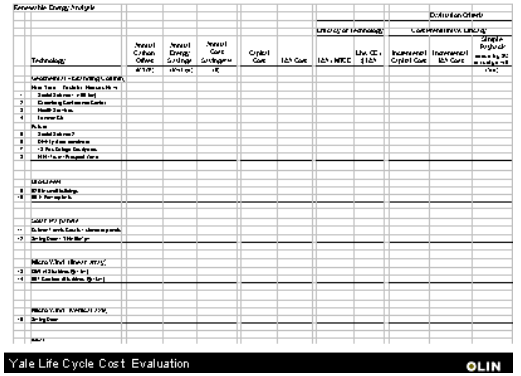
Performance And Cost Benefits

ALL on the Client's team need to understand WHY this system was included

- Saves operating expenses – calculated ROI
- Provides environmental benefits
- Qualifies for LEED credit(s)
- Provides marketing / public relations value



Yale Life Cycle Cost Evaluation OLIN

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Civil Engineering
Land Surveying
Transportation Engineering
Planning
GIS Services

Building better communities with you

Yale University, Kroon Hall: Aquatic plants in the pond cleanse stormwater, which will be used for landscape irrigation and toilet flushing. Architect: Hopkins Architects, London; Landscape Architect: Olin Partnership, Philadelphia; Civil Engineer: Nitsch Engineering, Boston

Building Green at Yale University ... It "Saves"

Rainwater harvesting at Yale University's Kroon Hall will pay for itself in about 10 years. This innovative system is expected to save 500,000 gallons of potable water annually and helps satisfy six LEED credits towards the project's LEED Platinum goal. You can learn how and why in the recent article featured in *Environment: YALE*, the Journal of the School of Forestry and Environmental Studies, at http://www.nitscheng.com/highlights/news.html.

If you have any questions about this project or on how a rainwater harvesting system can be implemented on your next project, please contact Nicole Holmes, PE, LEED AP, or Gary Pease, PE, LEED AP, from Nitsch Engineering's sustainable sites group, at 617-338-0063, or by email at nholmes@nitscheng.com or gpease@nitscheng.com.

Nitsch Engineering has developed a trademarked software, RainUSE™, to analyze and optimize rainwater harvesting systems to help clients save money and reduce waste.

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CASE STUDIES

Massachusetts Institute of Technology
Ray and Maria Stata Center for Computer, Information, and Intelligence Sciences
Cambridge, MA (Built)

Yale University
Science Hill Landscape and Open Space Plan
School of Forestry and Environmental Studies
New Haven, CT (Under Construction)

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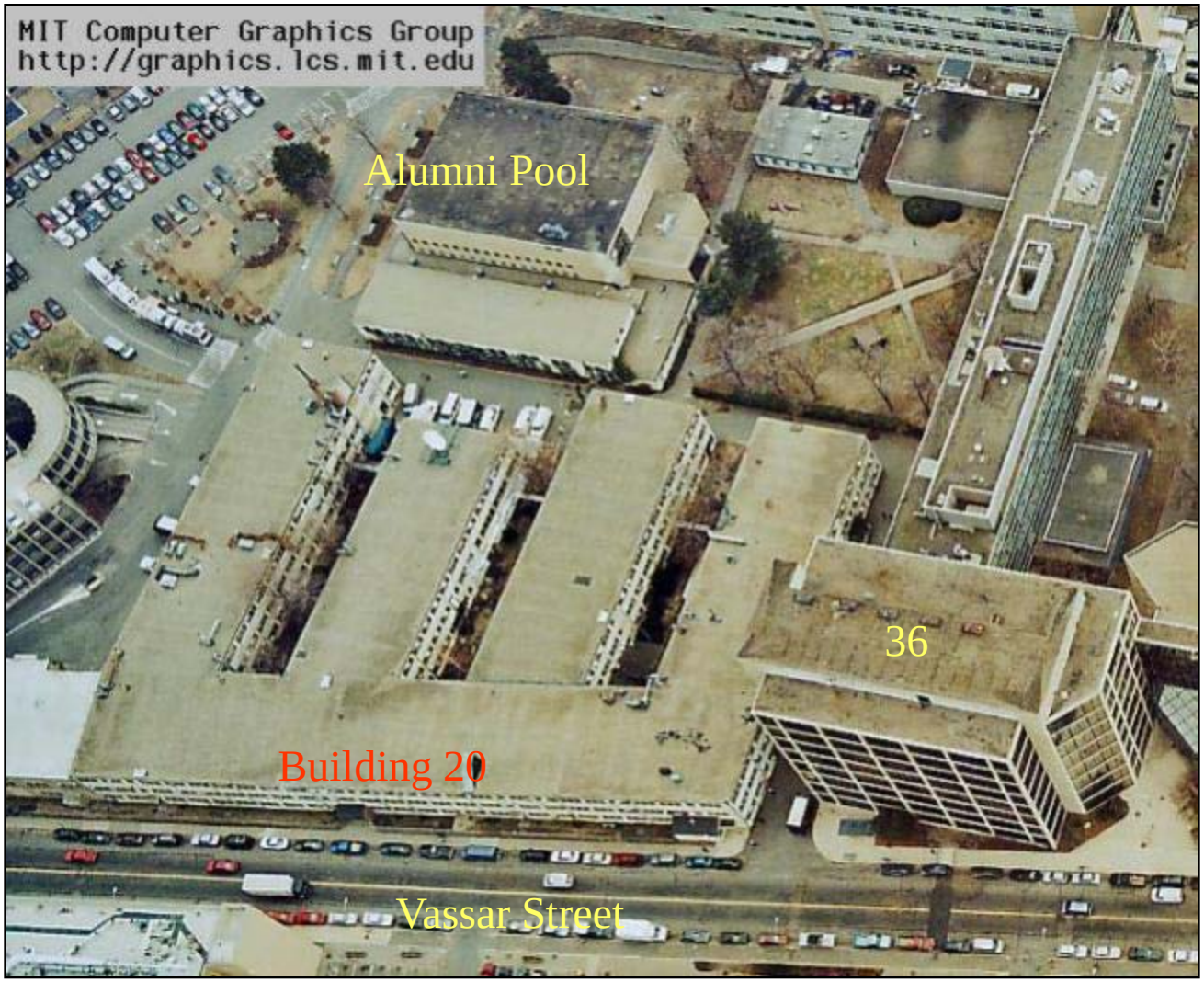

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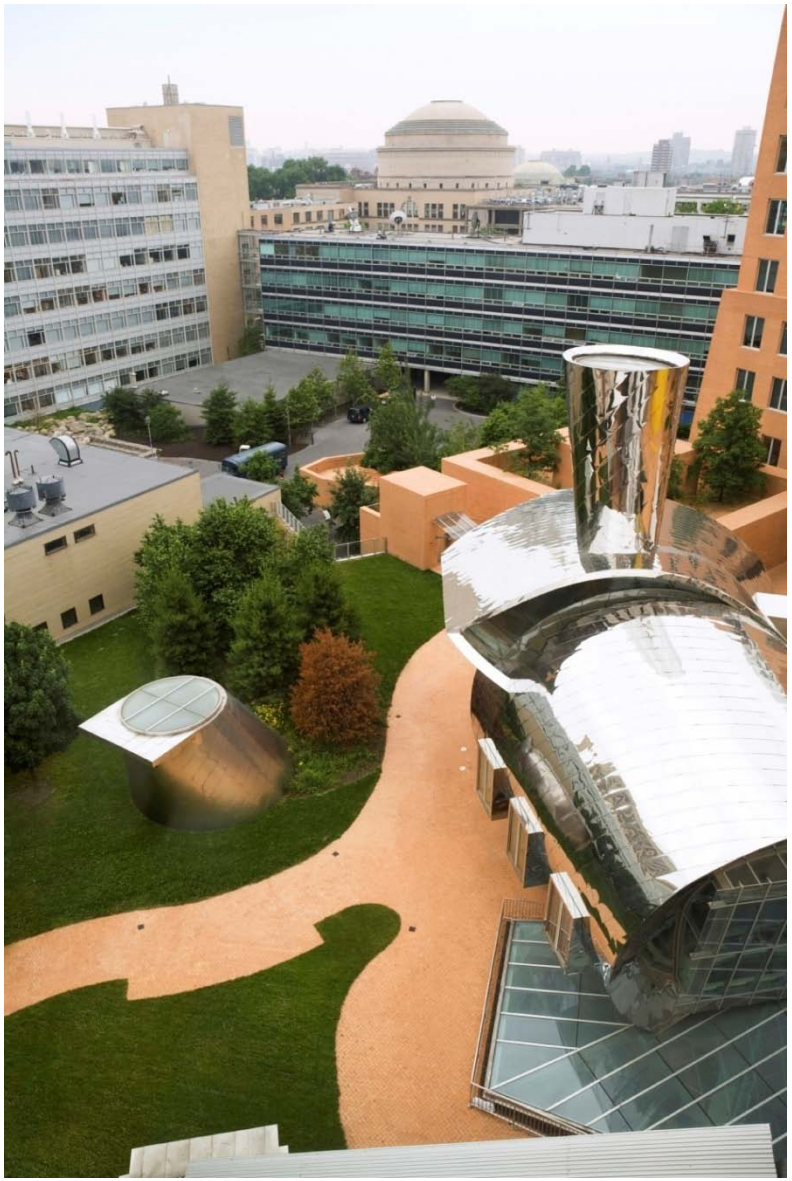

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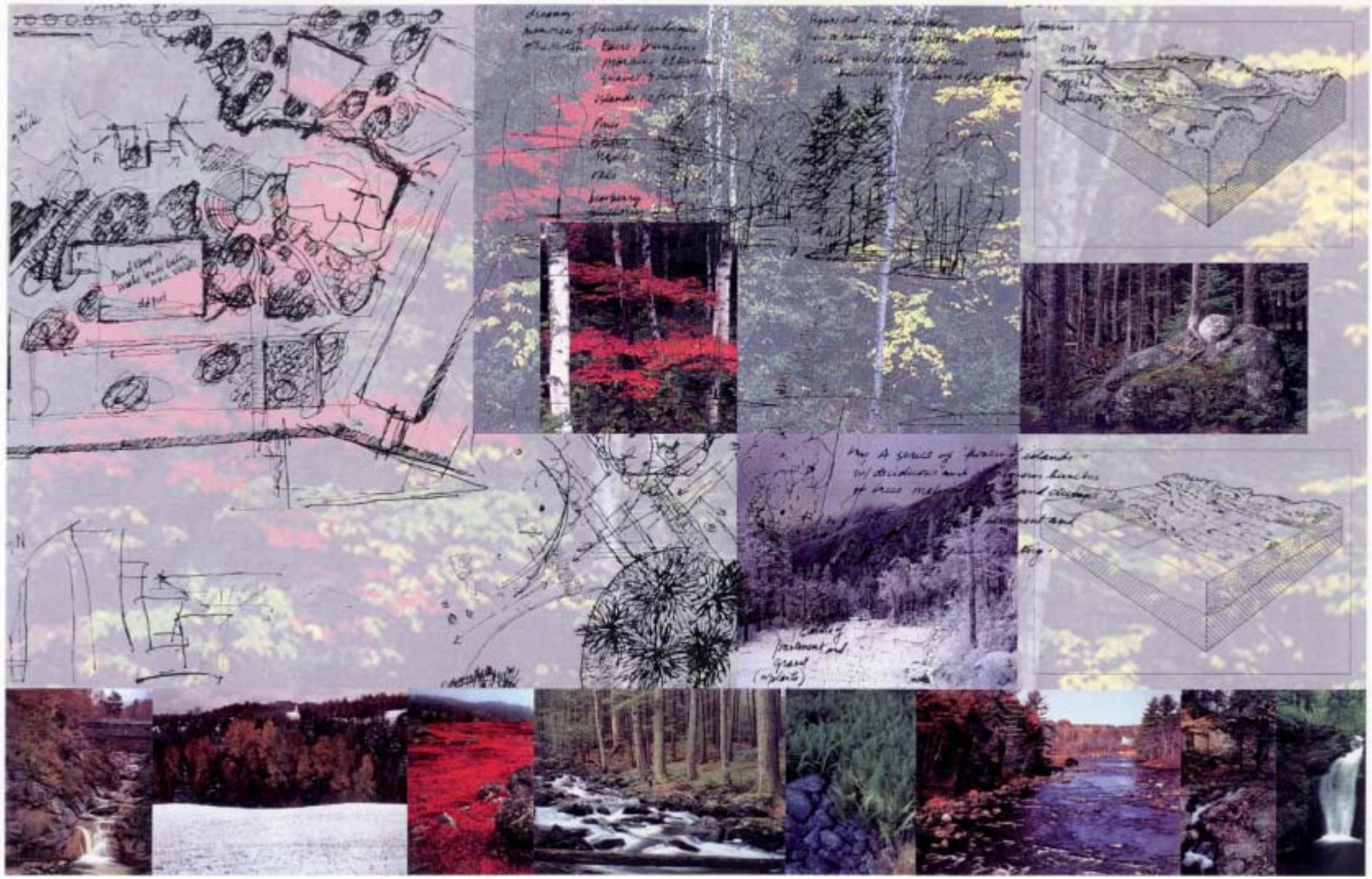

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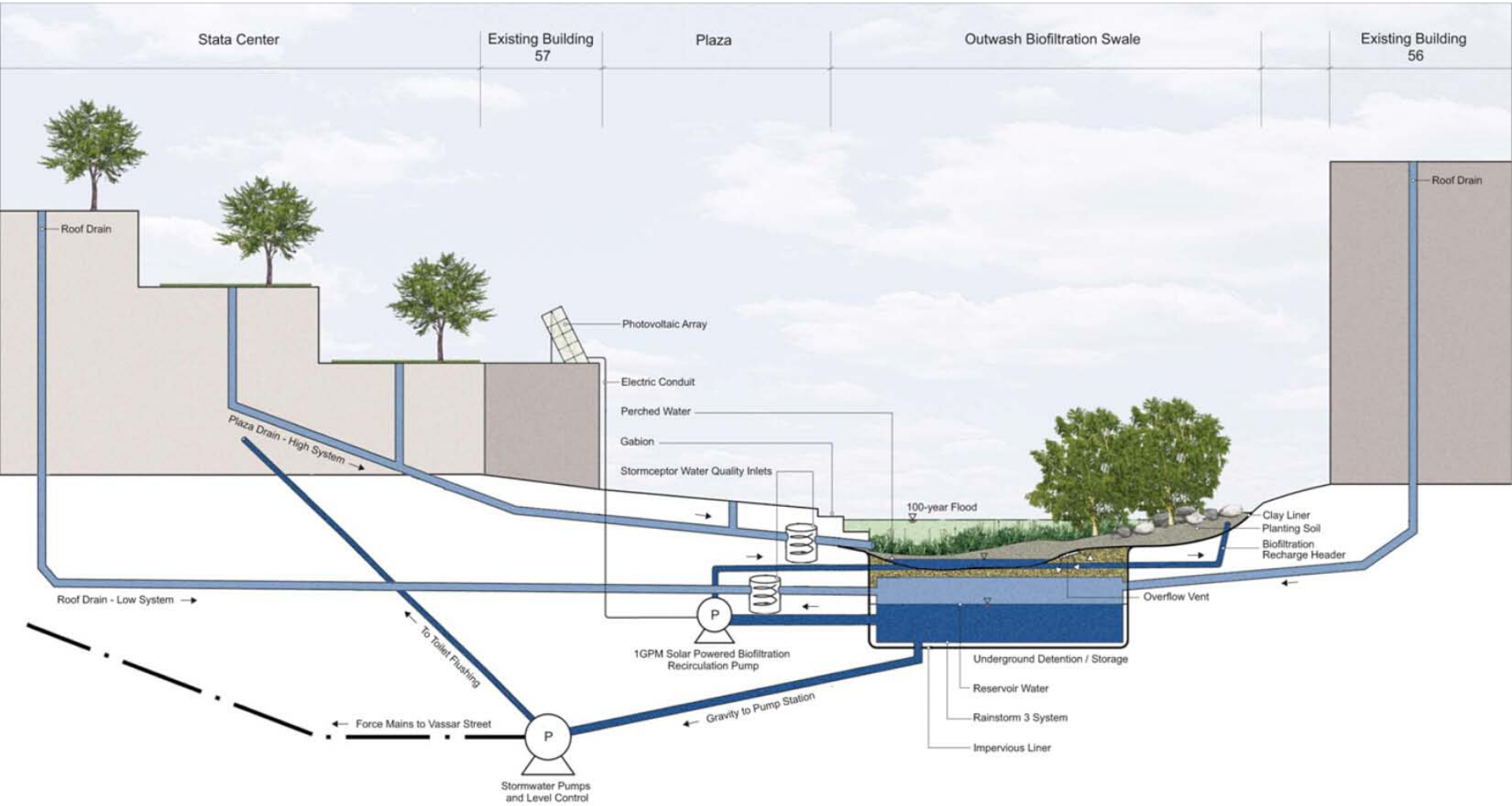

Stata Center Stormwater Schematic Cross-Section

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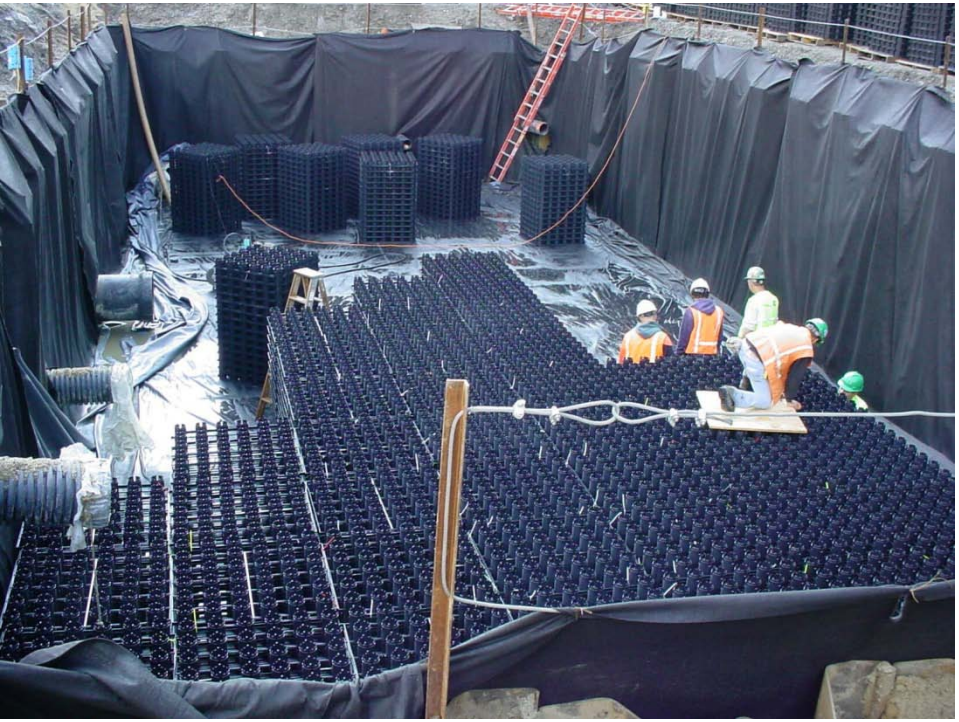

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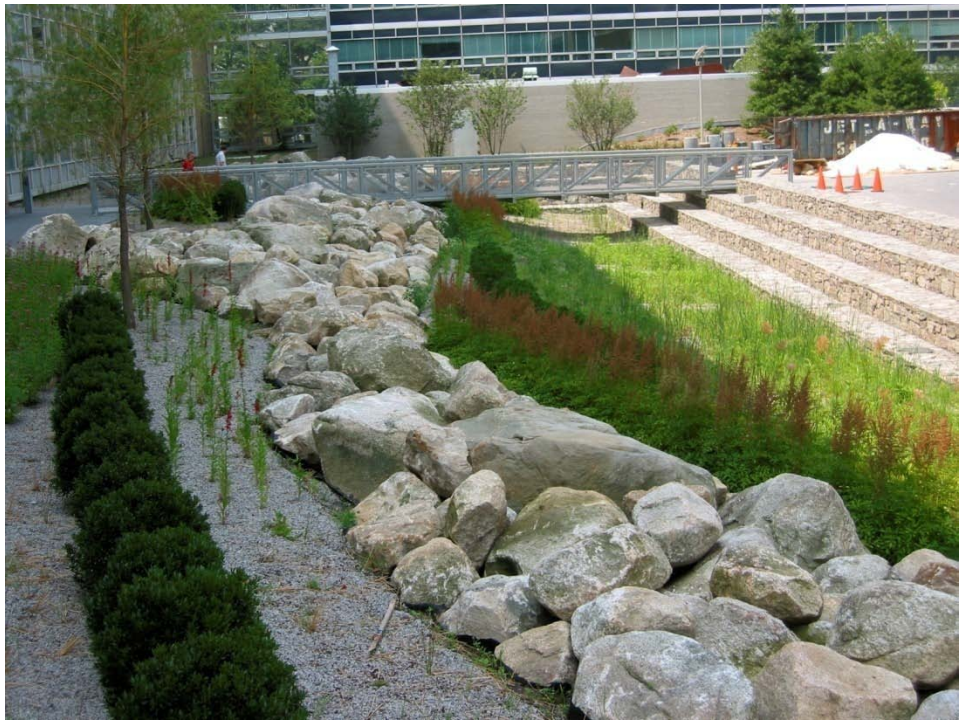

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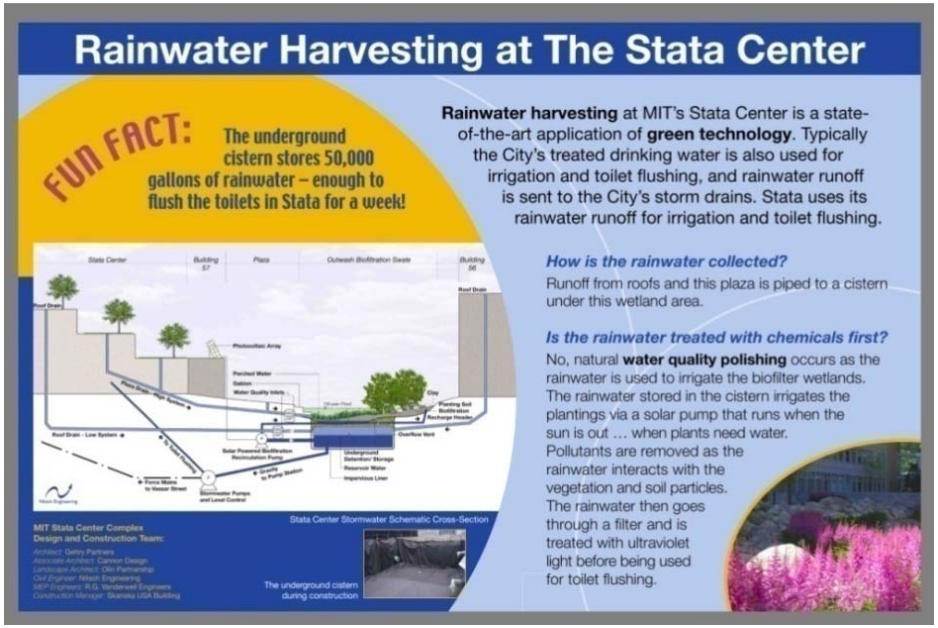
- Create opportunities for a stormwater management “win-win” situation for client and municipality
- Develop building and site as an integrated system to retain BMPs and other sustainable components during value engineering
- Design stormwater system to be flexible and adaptable to unforeseen conditions
- Describe BMP system and benefits through signage and promotional materials to credit client and team.



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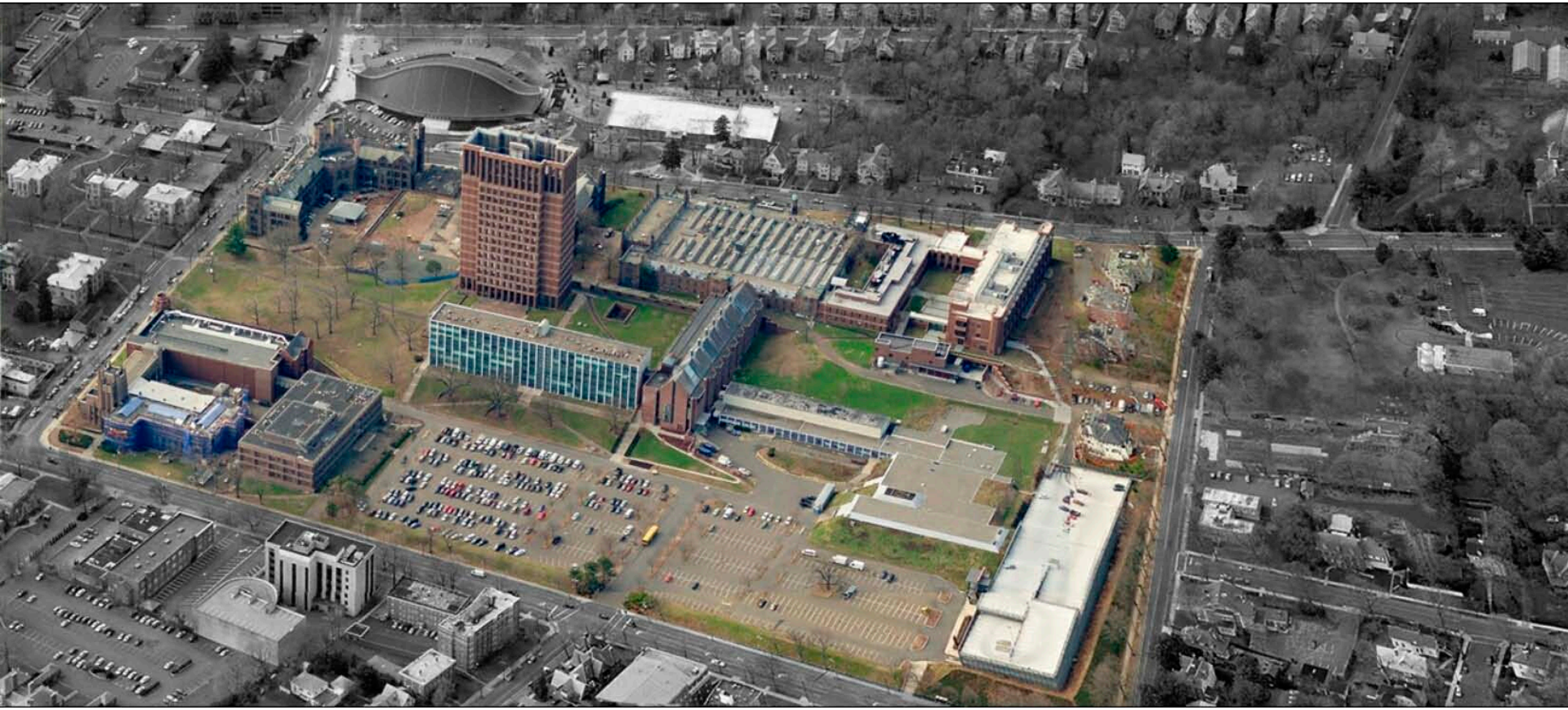
YALE SCIENCE HILL



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YALE SCIENCE HILL

Goals

Develop Watershed-based Solutions

- West (Wetlands Area)
- Prospect Street (Forestry and Environmental Studies Building)
- Whitney Avenue (Yale Biology Building)

Promote Sustainable, Green Design

Enable 2 Million GSF of Science Development

Reduce or Eliminate Pedestrian / Vehicular Service Conflicts

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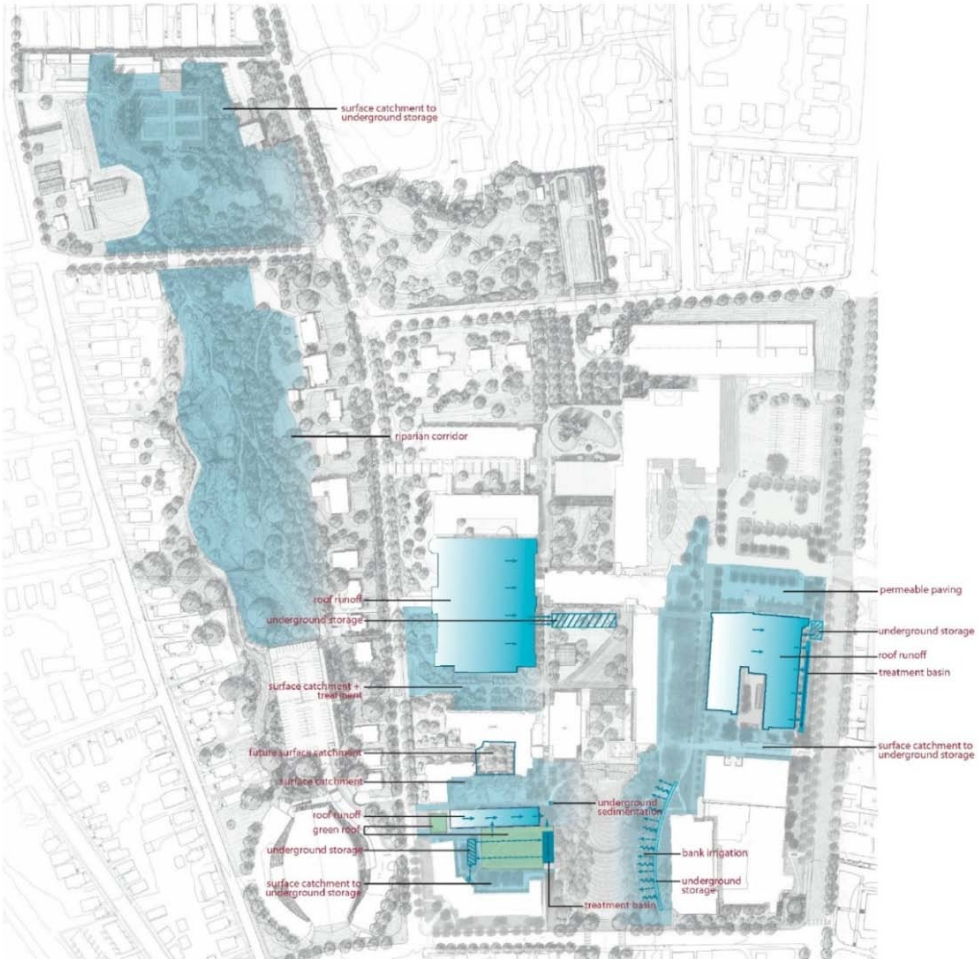
YALE SCIENCE HILL



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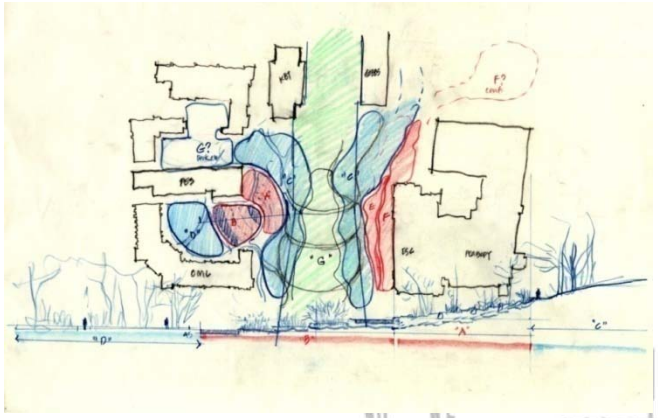
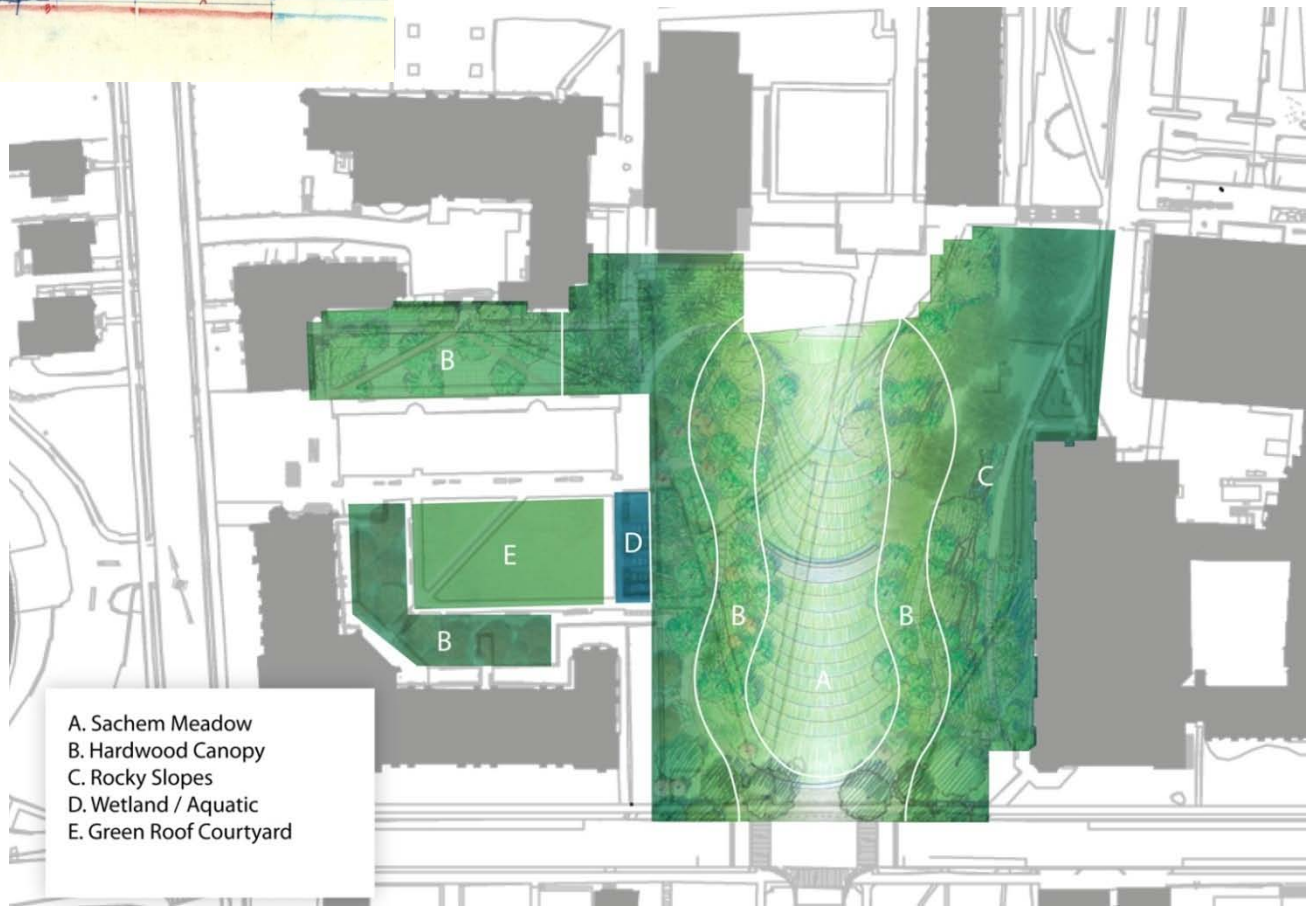
FORESTRY AND ENVIRONMENTAL STUDIES (FES)





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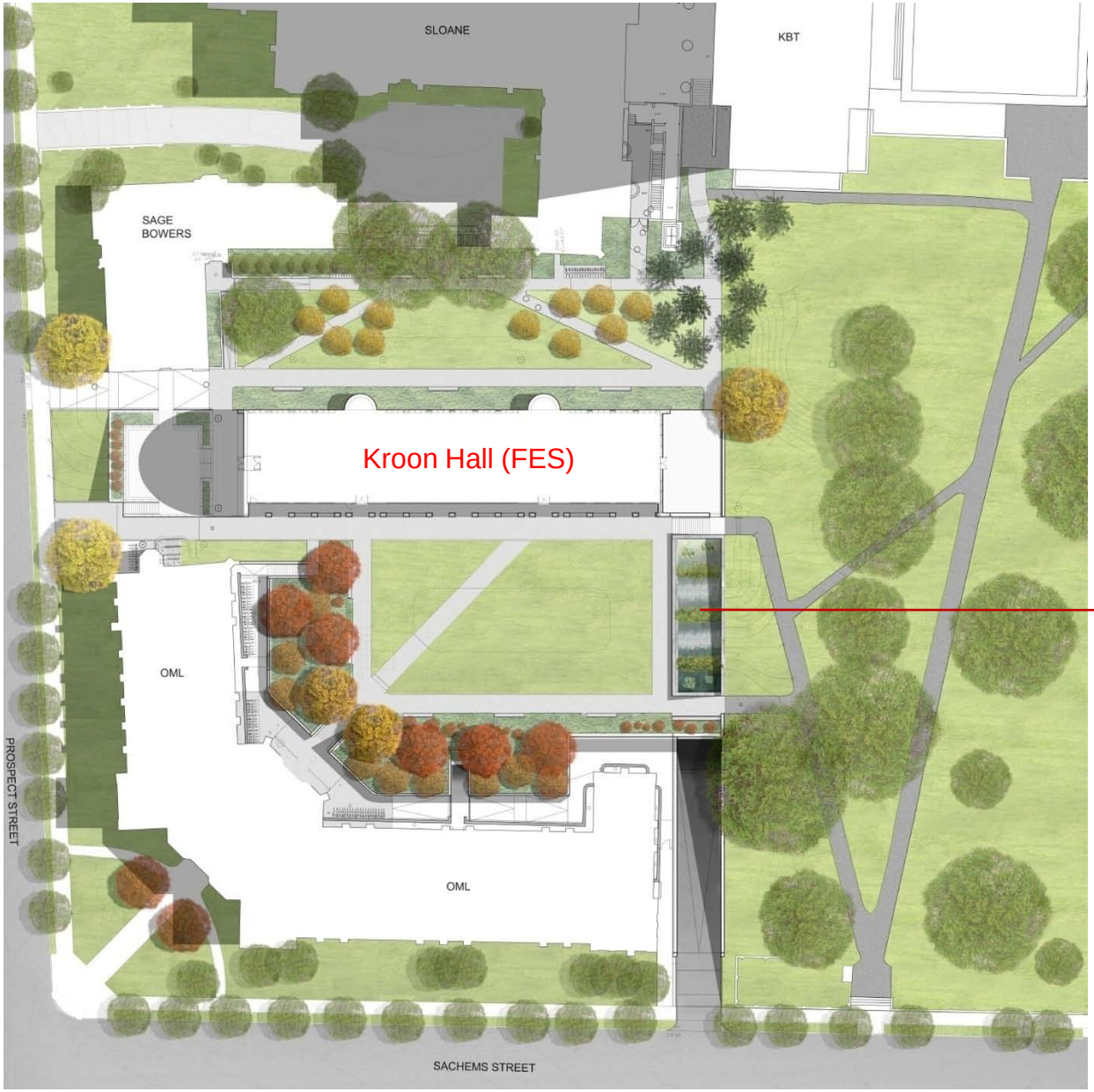

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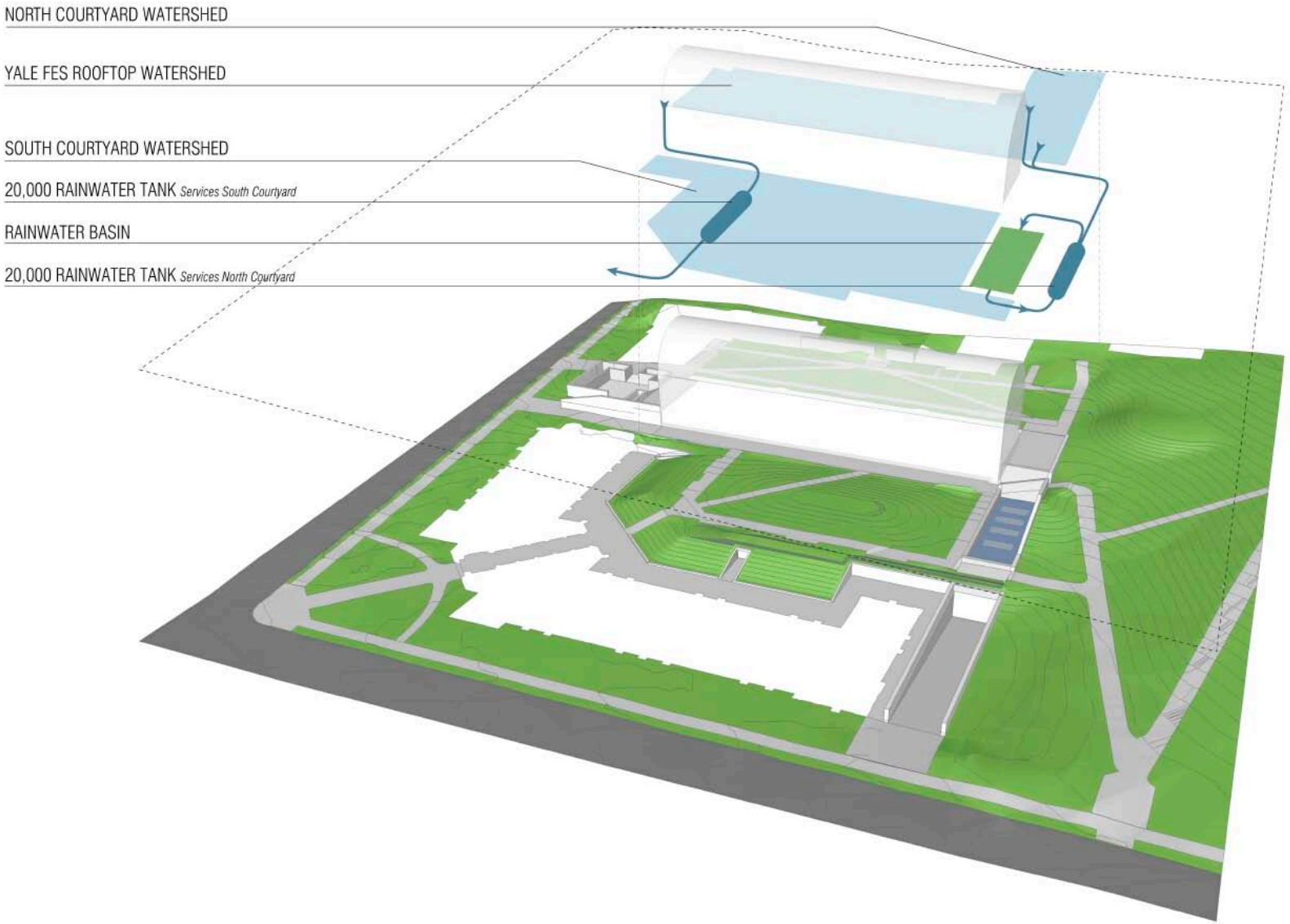

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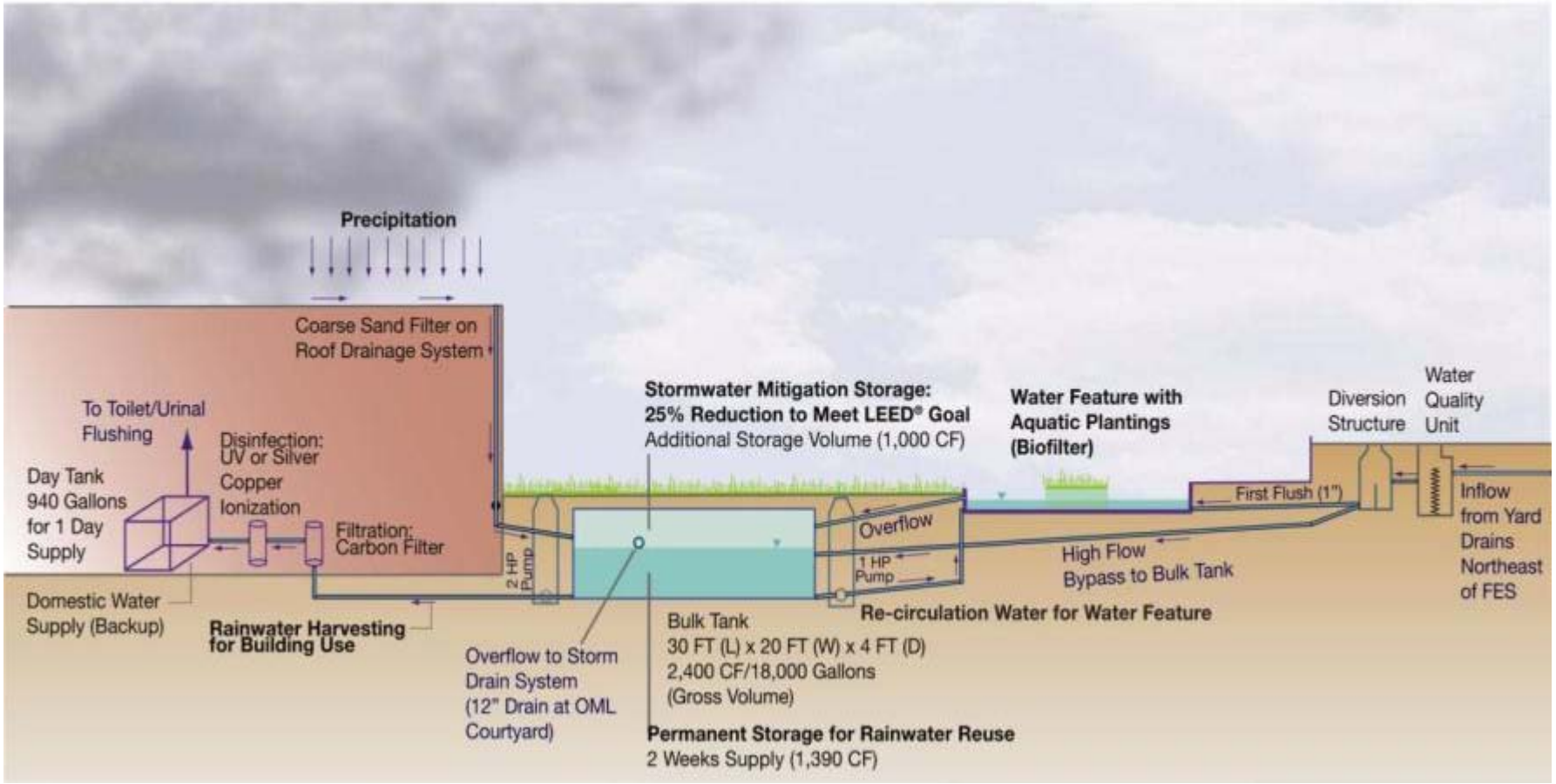

Rainwater Harvesting and Reuse Concept

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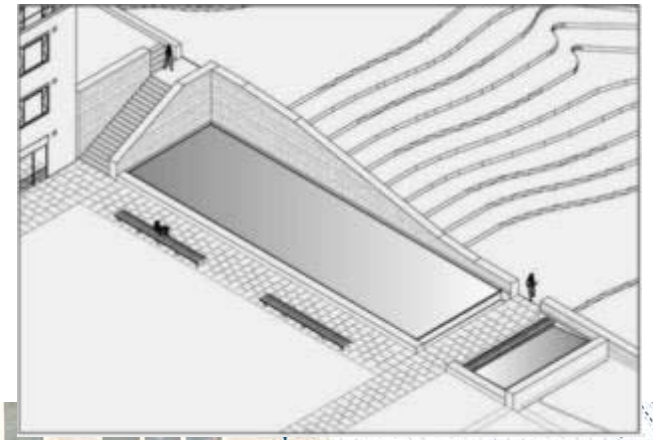
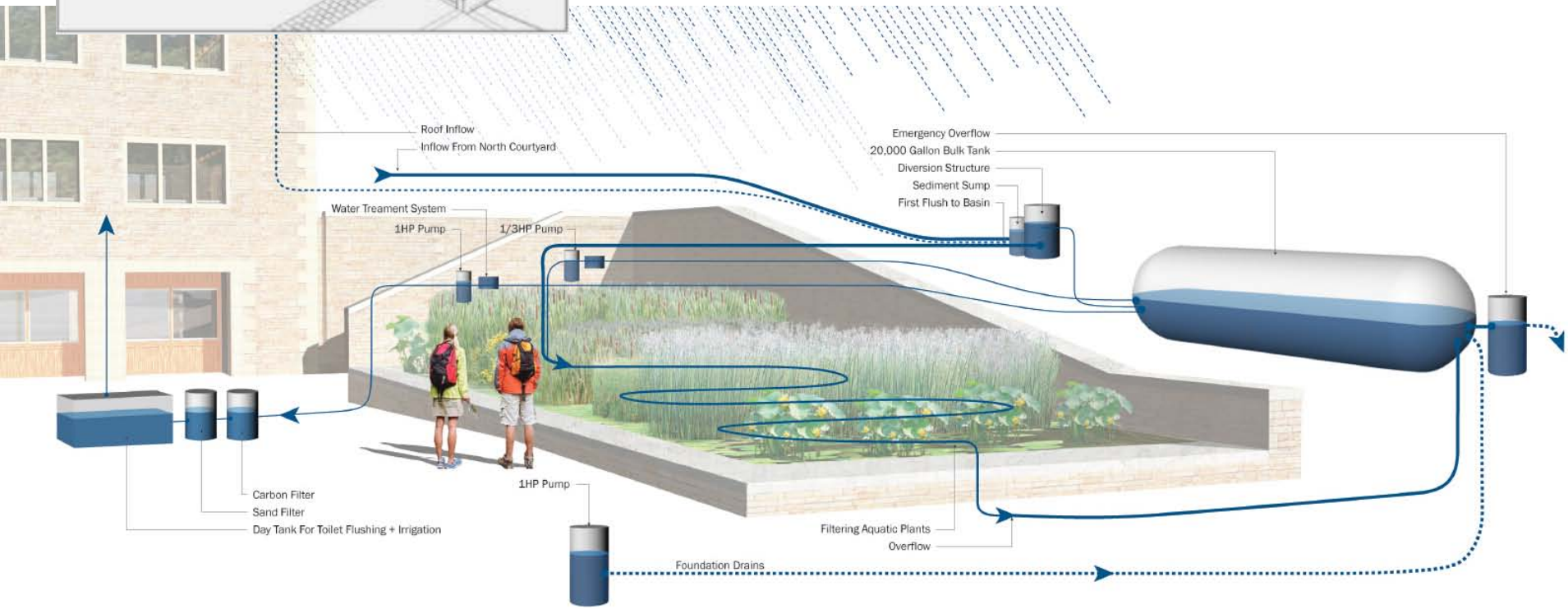


Biofiltration Water Feature

- Treats the first 1” flush
- Provides water quality polishing



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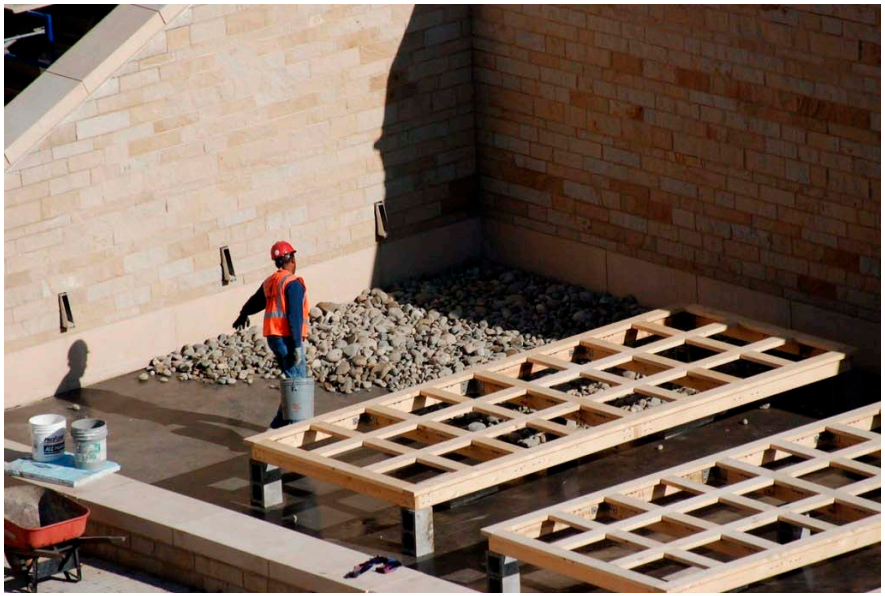

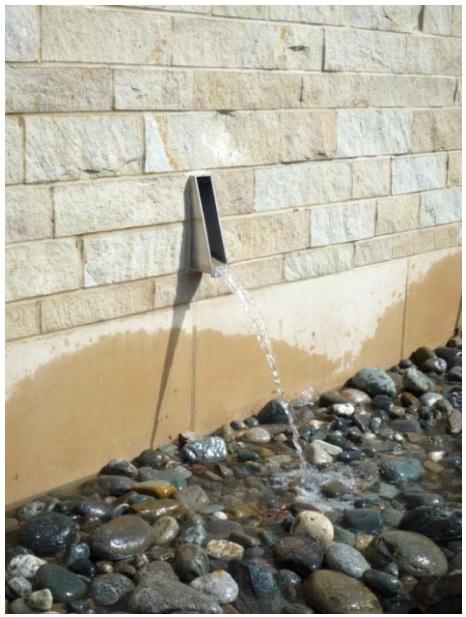

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FORESTRY AND ENVIRONMENTAL STUDIES (FES)

- Subdivide watershed to respond to site conditions and for specific interaction with new and existing buildings
- Develop BMP as an architectural expression of natural processes in restricted sites or over structure
- Integrate BMP with building systems early in the design process by describing energy savings and ROI
- Develop stormwater BMPs to the highest technical and aesthetic standards to create viable social spaces and ensure long-term performance and maintenance

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LESSONS LEARNED – PROJECT SPECIFIC

- Start thinking about stormwater solutions at very beginning
- Discuss technical aspects with Landscape Architect and Civil to understand their approach and areas of flexibility
- Educate team members – site visits to good built examples create buy-in after seeing them in operation
- Tie stormwater strategy to LEED, architectural form, municipal requests, etc. to ensure stormwater BMP is retained (or too critical to remove)
- Stress importance of maintenance early on and often. BMPs require attention on a regular basis. Design with maintenance in mind. Create maintenance specification

LESSONS LEARNED – TEAM SPECIFIC

- Communicate design intent to the entire project team
- Be sure the team is kept informed of other disciplines' issues so problems can be avoided
- Have frequent interactions, especially in early project phases
- Communicate!
- Architect, Landscape Architect , and Civil must be advocates for each others' work.
- Don't be passive, be a proactive collaborator

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“A technical creation can only be perfect if it is perfect from the point of view of aesthetics.”

Ettore Bugatti (1881-1947)

1938 Bugatti Type 57SC Altlantic Coupe © Michael Furman, courtesy of the Museum of Fine Arts

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