Adaptive Design: Field Reconnaissance

Chris Reed, StoSS landscape urbanism

REPORT

SITE

The site for the field tests is a hillside at the back of Somerville City Hall along School Street. It was selected on the basis on a number of physical and logistical criteria:

- availability of stormwater runoff
- size (approximately one-half acre)
- its underutilized condition
- existing volunteer vegetation that could serve as a control
- ownership / control (by the City of Somerville)
- adjacencies (as a public installation, its position next to civic buildings—City Hall and Somerville High School—and a residential neighborhood was important in terms of visibility and access)

LANDFORM STRATEGY

To initiate plant establishment and succession, two landforms are constructed to intercept stormwater and to provide slightly protected areas for initial plant propagation. The stormwater that is collected provides a low-tech irrigation system for the installation and is anticipated to reduce the overall stormwater runoff burdening the city's stormwater infrastructure.

The upper landform, the generator, will be planted with adaptive meadow grass and wildflower plugs. Its elevated position relative to the site and to the neighborhood will help catalyze plant succession, especially for plants that rely upon wind-dispersed seed mechanisms.

The lower landform, the interceptor, is formed to intercept the seed that would be blown or carried by stormwater across the site. The crease on the up-hill side of the landform allows for the establishment of a moist and protected environment for successional processes to begin.

Together, the landforms also establish a new civic and ecological marker for the city and for the neighborhood, a self-sustaining testing grounds for learning and experimentation with urban landscape strategies.

PLANT STRATEGY

The plant strategy utilizes a combination of meadow grasses and wildflowers that depend on a variety of spreading and dispersal mechanisms to move across the site: rhizomes, wind, and animals. It is anticipated that plants with wind-dispersed seed mechanism will be most successful, as they are most mobile and can potentially colonize a greater portion of the site.

Plants have also been choreographed to establish vivid and constantly changing bloom and foliage displays, in order to attract the attention of visitors and passers-by and to re-establish connections to ecological cycles often lost in the city.

Selected plants include:

- Veronica glauca / ironweed
- Rudbeckia hirta / black-eyed susan
- Heliopsis helianthoides / false sunflower
- Penstemen digitalis / foxglove
- Andropogon gerardii / big bluestem
- Panicum vigatum / panic grass
- Echinacea purpurea / purple coneflower

The attached plant chart provides a full detailing of these plants' performance characteristics.

Plant selection is being re-considered prior to spring 2005 in response to the quantity of stormwater runoff being captured (see below). Plant growth and succession will be monitored for a number of years by a combination of students from Somerville High School and the Department of Landscape Architecture at the Harvard Design School.

PROJECT STATUS

Landform construction commenced and was completed in the fall of 2004; slopes are stabilized and the site is secured for winter. Initial planting will occur in early spring 2005, followed by ongoing monitoring throughout 2005, 2006, and beyond to evaluate the plants' full growth cycle, including the impacts of the plants' seeding mechanisms on the longer-term viability of the system. Full plant inventories will be conducted each season to help evaluate both the performance of the plants introduced to the system and the resilience of the system to adapt to other inputs through the year, including potential flood or drought, plant succession, disturbance, etc.

INTERIM FINDINGS

The upper landform is already collecting considerable amounts of stormwater runoff, as evidenced by a standing pool of water; this is an encouraging development. However, it is currently unknown whether hydrologic and soil conditions will allow the standing pool to persist; it is possible that an unusually wet November combined with saturated soil at time of construction has resulted in the pool. This condition, as well as the relative wetness of the up-slope crease in the lower landform, will continue to be monitored through the spring.

Should the standing water persist through winter and into early spring, one of two strategies will be pursued:

- reconsider the plant communities and species to be installed in the upper landforms, focusing on plants that can withstand periodic inundation and alternating dry spells (likely)
- adjust grading on the inside eastern edge to allow for an overflow channel to drain a portion of the planting area (less likely)

Careful adjustments will be made, though, as it is anticipated that the pool will disappear during the dry season.

INTERIM CONCLUSIONS

Intercepting stormwater runoff on hillsides can be accomplished through the careful insertion of landforms: disturbance yields response. The responses in this case were primarily hydrologic (the altering of flows) but also social (more concentrated pathways through the site, curiosity and comment by the public), and political (a concerted effort by the City to begin an outreach effort, which has already resulted in the project's publication in the Boston Sunday Globe).

These are short-term, almost immediate responses (construction was completed in mid-November 2004). Long-term responses, most notably vegetative successional strategies, have yet to be put in play.

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ADDENDA 01–03

01. StoSS. Plant Chart showing plant characteristics, spread and growth mechanisms, and blooming cycles. 2004.
02. Patrick Gerard Healy. "The Mounds Have Come to Flower Among Us: Two Additions Near City Hall Meant to Teach." *The Boston Sunday Globe*. City Weekly Section / Somerville. 12 December 2004.
03. StoSS. "City of Somerville Eco-Demonstration Project." Media Overview. November 2004.

BOSTON SUNDAY GLOBE DECEMBER 12, 2004

Somerville

The mounds have come to flower among us

Two additions near City Hall meant to teach

By Patrick Gerard Healy
GLOBE CORRESPONDENT

The fuzzy pair of yellow sculpted forms on a hill behind City Hall represent a different kind of art form for Somerville: the fine art of keeping the city's sewer system from overflowing.

The official name for the two mounds is the Eco-Demonstration Project, and the forms are positioned off School Street to absorb storm-water overflow, sprouting patches of lush vegetation as a bonus.

The project is the brainchild of Chris Reed, principal of the StoSS urban landscape architecture firm in Boston, who says the goal of the project is not only to limit the amount of water going into drains causing sewage overflow, but also to "choreograph flowering displays."

The Eco-Demonstration Project itself comes from a flowering of partnerships between the City of Somerville, Somerville High School, the Center for Technology and Environment at Harvard, and StoSS, with funding from the Boston Society of Architects' Design Research Grant program and the Boston Foundation for Architecture. Reed says the total cost will be between $20,000 and $25,000 plus donated materials.

GLOBE STAFF PHOTO/PAT GREENHOUSE

Two striking mounds have landed on the hill behind City Hall as part of an ecological experiment to lessen the amount of storm water that ends up in the sewers.

Last year Reed contacted Sherri Geldersma, director of urban design and park development for the city, and the two began looking for the ideal site in the city for the project, until they realized that it was in their own backyard, literally.

"It seemed like it would be a really good use of a piece of land that's really underutilized," says Geldersma.

"There is a fair amount of land back there and being on a slope there was a great potential to catch rainwater runoff," she continues. "It had the proper physical characteristics and proximity to the high school, and plus it was city-owned."

Rainwater sits atop one of the mounds. The amount of water feeding the site should cause a dramatic flowering next spring.

The eye-catching mounds landed early last month in their places on the hill. The next phase will begin in the spring when program participants, who will include Somerville High School students, will plant seeds on the upper mound and study how the wind spreads the seeds to the lower mound.

"We wanted to see what happens if you dump some dirt on a hillside to intercept water," says Reed. "What will grow? So we will plant the top landform in the spring with very vivid meadow grasses and flowers, and the seeds will be dispersed through the wind."

Reed says the amount of water feeding the soil could cause more flowers to grow than in an ordinary garden, and getting people to notice is a primary goal of the project.

"The flowers, like the forms themselves, are intended to be dramatic," says Reed. "We want these to be things people can't miss."

Geldersma says that when people notice the flowers, they may also start to think about the benefits of such ecological projects, which include reducing the cost and strain on the water supply for irrigation systems and combined sewer overflow systems, from excess runoff from vegetated urban sites.

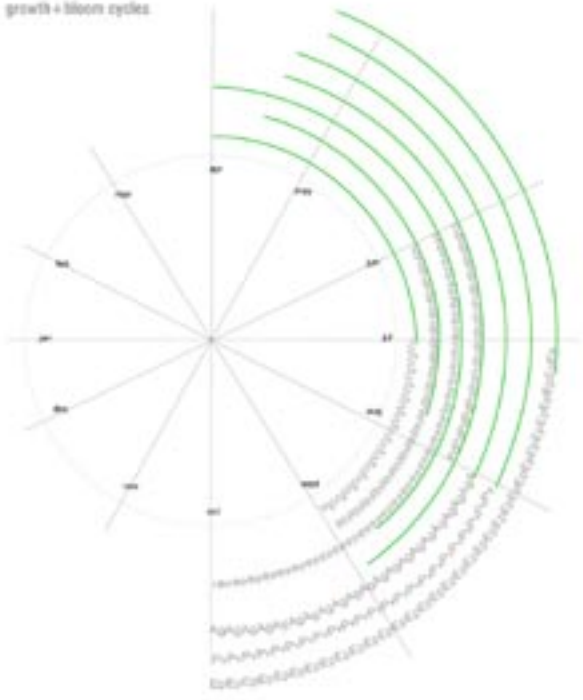
"People talk about sustainable landscapes all the time, and having a place specifically constructed to test some of these theories is a really plausible way for everyone to learn about ecology and things like urban forests," she says, "not just high school kids but professionals as well."

As for the involvement of the high school students, Robert Siggins, science coordinator for the city, says he is involving students in a media class to document the project, students studying ecology to assist in the planning, and special education students to assist in watering and maintaining the site.

"It's really like a science fair project, because we don't know how it's going to turn out," he says. "It's truly an inquiry-based activity."

	Veronica glauca	***Rudbeckia hirta***	***Heliopsis helianthoides***	***Penstemon digitalis***
	ironweed	black eyed susan	false sunflower	foxglove
				
MORPHOLOGY/PHYSIOLOGY				
Active Growth Period	spring/summer	spring/summer	spring + summer	spring + summer
Growth Form	single crown	rhizomatic	single stem	rhizomatic
Growth Rate	moderate	rapid	moderate	moderate
Height, Mature	6'	3'	4'	4'
REPRODUCTION	sexual	sexual	asexual	sexual
Fruit/Seed Abundance	low	low	medium	medium
Seed per Pound	378000	1710000	116,410	400,000
Seedling Vigor	low	medium	low	medium
Seed Spread Rate	slow	slow	slow	slow
Vegetative Spread Rate	none	none	moderate	moderate
seed persistance	no	no	yes	no
GROWTH				
Root Depth, Minimum	8"	5"	10"	8"
Shade Tolerance	intolerant	intolerant	intermediate	tolerant
Color	JUL AUG	JUN JUL AUG	JUN JUL AUG SEPT	JUN JUL
DISPERSAL MECHANISM				
Primary	wind (appendages)	rhizomes	rhizomes (mats growth)	barochory
Secondary			wildlife	wildlife

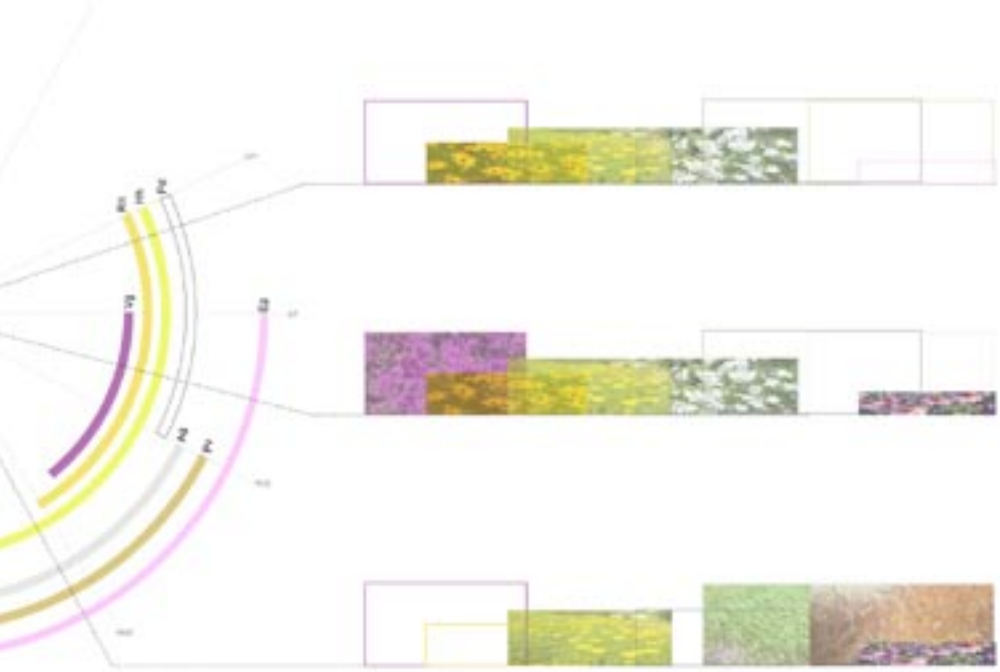
growth + bloom cycles



color sequences

Source: http://plants.usda.gov/

Andropogon gerardii	***Panicum vigatum***	***Echinacea purpurea***
big bluestem	panic grass	purple coneflower
		
summer	summer	spring / summer
bunch	rhizomatic	single stem
moderate	rapid	moderate
6'	6'	1.2'
sexual / asexual	sexual / asexual	sexual / asexual
low	high	medium
144,240	259,000	115,000
low	high	medium
slow	slow	moderate
slow	moderate	moderate
no	no	no
20'	12'	24'
intolerant	intolerant	intolerant
AUG SEPT	AUG SEPT	JUL AUG SPET
wind	wind	wildlife (birds, insects)
rhizomes (slow)	rhizomes	barochory



city of somerville

eco-demonstration project

a partnership between
The City of Somerville
StoSS landscape urbanism, Boston
The Center for Technology + Environment at the Harvard Design School

funded by
The Boston Society of Architects Design Research Program
The Boston Foundation for Architecture
The City of Somerville

with additional assistance, services, and materials from
StoSS landscape urbanism
Landscape Collaborative of New England
North Creek Nurseries
Department of Landscape Architecture students, Harvard Design School

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The site behind Somerville City Hall and the Somerville High School is being developed as the city's *Eco-Demonstration Project*, an outdoor laboratory for the testing and demonstration of landscape technologies and environmental science; it is part of a longer-term planning initiative, just in its formative stages, for a High School Eco-Lab on the hillside and in the courtyards behind the high school. The project is a unique partnership between the City (via its Office of Strategic Planning and the high school), the Center for Technology and Environment at Harvard, and StoSS landscape urbanism in Boston. Initial funding for the project was provided by the Boston Society of Architects' Design Research Grant program, with supplemental grant funding provided by the Boston Foundation for Architecture and the City of Somerville. In addition, we have secured discounted and donated materials and services from local and national businesses, including a meadow plant nursery in Pennsylvania, as well as hours of volunteer services from landscape architecture students at the Harvard Design School and staff from my office. (for reference and elaboration, i have attached a copy of the initial grant application.)

Currently, the project has completed phase 1 construction, included grading and site stabilization; stage two construction will occur in spring of 2005, though monitoring of the site and the changing hydrologic and vegetal conditions is already underway.

As an outdoor laboratory, the garden has been designed to test water flow dynamics and the spreading patterns and rates of plants, such as meadow grasses and meadow flowers. It has been our expressed purpose to alter water flow on the site, in order to allow for a self-sustaining plant community to colonize and adapt on the hillside. The benefits of such an effort, on the broader scale, include reducing the cost and strain on water supply for irrigation systems, and reducing the burden on utility systems, specifically stormwater systems and combined sewer overflow systems, from excess runoff from vegetated urban sites. We are encouraged that, even in its partially constructed state, the upper landform is already retaining stormwater, which ordinarily would have run off over the adjacent sidewalk and into the city's drainage system. To what degree the landforms collect water and alter water flow on the site are two important areas of study and monitoring over the next two years, but especially this winter. Our observations of water collection and flow over the coming months will allow us to finalize the selection of plants to be installed in early spring; if large amounts of water are collected, we will install a selection of plants that can both drink lots of water when inundated (eliminating standing pools of water) and withstand drier periods. Such is the case, for instance, with tree species such as the red maple, a now proven urban street tree whose native habitat is the river floodplain, where it can be alternately dry and very wet (inundated) throughout the course of the year.

The project is simple: two landforms were constructed on the hillside to redirect the flow of water and allow for the establishment of a new plant community. The upper landform, the generator, has a generally level top which will be planted with wind-dispersed meadow grasses and flowers. As these seeds blow across the site, some may be caught by the second lower landform, the interceptor. It is anticipated that the best establishment of this new plant community will occur on the uphill slope of this landform, where it is collecting the most water. However, we will also be testing how

far and at what rates introduced vs. existing vs. volunteer plants colonize the hillside and nearby sites.

From an educational standpoint, we are working with Robert Siggens at Somerville High School to develop a new in-field research curriculum that uses this initial stage of the Eco-Demonstration Project and other future projects as outdoor learning laboratories, where students can study ecological processes on site. The students will be working with students from the Harvard Design School in the finishing stages of site installation, including planting of the meadow grass plugs. They will also monitor the characteristics of plant colonization and succession (spread, rates, etc.) over a period of years.

The project does have a number of public outreach components yet to come. The first is a sign, in the design and review stage, that explains to residents and neighbors the purpose and nature of the installation. Second is planned media exposure and coverage on the project, specifically to the local newspaper, in order to tell all of Somerville's residents about the project. We have also discussed other forums and venues for public outreach, including neighborhood briefings and workshops with high school students.

We have been very encouraged by the interest expressed by a number of residents and neighbors who have inquired about the project; many such inquiries came while we were on site with a group of student volunteers assisting with some of the final grading, slope stabilization, and site finishing efforts. The site is already well-used by dog walkers and nature enthusiasts, some of whom seek out native wildlife, like hawks, who have made the hillside their home. We have received very positive feedback that this project will complement and even reinforce some of the sites existing uses.

Finally, it seems like the altered dynamics of water flow and collection that have been manifest as a result of the landform construction are already a case in point about how this project will differ from other less experimental open space installations. We are encouraged that the project is starting to collect water and will monitor throughout the winter the quantities of water collected and their duration in time. This is, in fact, the intended nature of the garden. However, it is also important to understand one issue at play: during construction, soil becomes saturated and takes a long time to dry out; the soil is still retaining water from the last couple weeks' rain storms, which is a normal occurrence. This could be, in part, cause for the small puddle currently being retained on the upper landform. If it is, the gradual drying out of the soil over the next few weeks will result in a reduction of standing water; if it is not, we will be able to install more water-loving plants in the spring, when the stage two construction commences. The advantage we have, though, in this kind of garden installation is that we can monitor site conditions, especially water flow and collection, and respond with planting solutions first, engineering solutions second; hence, both the research and sustainable components of the project. It will take some time, education, and outreach to explain to residents and visitors how exactly this project, an eco-demonstration garden, differs from a conventional public open space, including the fact that we will have the opportunity for ongoing monitoring and work. Such efforts will be continued through ongoing efforts now being coordinated by the City, High School, Center for Technology and Environment, and StoSS.

project credits

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Center for Technology + Environment at the Harvard Design School
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The City of Somerville
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ADDENDUM 04

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