

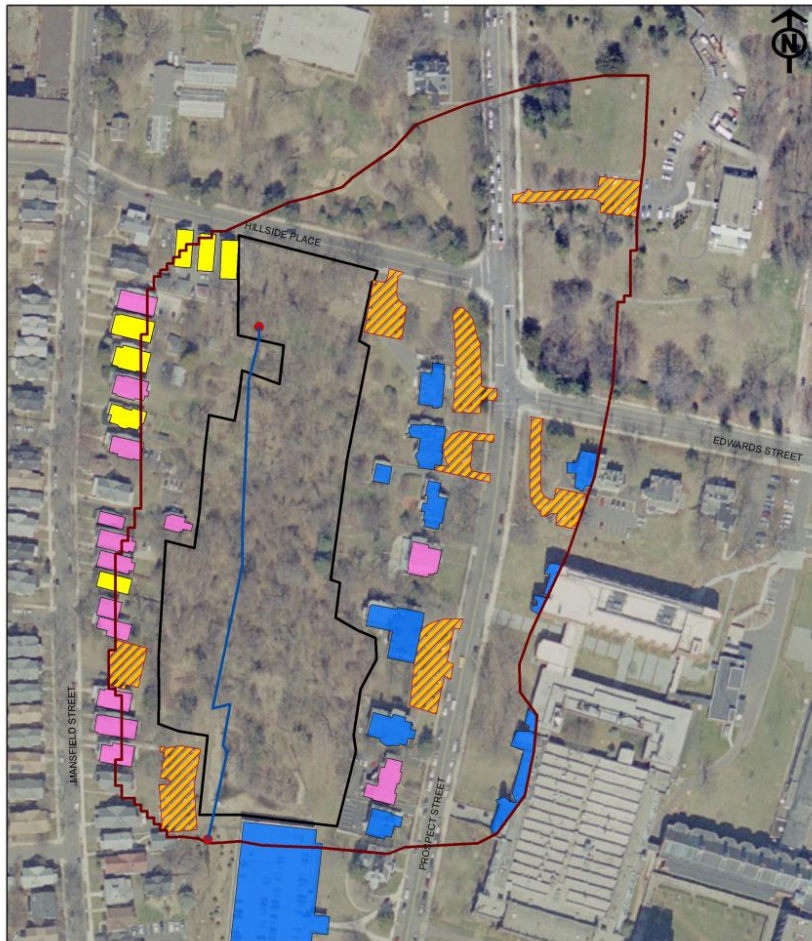
YALE SWALE PROJECT

Hixon Center for Urban Ecology
School of Forestry and Environmental Studies
Yale University

AGENDA

- Here is what there is!
- Here is what is possible!
- Here is the ways of developing!

Here is what we have!



Yale Swale: Study Area

- Groundtruthed Stream
- Academic Building
- Inlet and Outlet
- Leased Building
- Watershed
- Private Property
- Swale Study Area
- Parking lot

0 12.5 25 50 75 100
Meters



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Baseline Information On:

VEGETATION

BIRDS

SOIL

Bulk Density

Soil pH, Temperature

Water holding capacity, Moisture content,

Macro and micro nutrients, active microbial biomass

WATER

Watershed

Downspouts

Surface area draining into the Swale

Water table monitoring

Water flow/ depth

COARSE WOODY MATERIALS

CONTD...

- **Hixon Center for Urban Ecology**

- **Other Resources**

- URI
- Urban MODs
- Yale University Faculties/ Students
- FES faculties/ Students
- Relevant courses

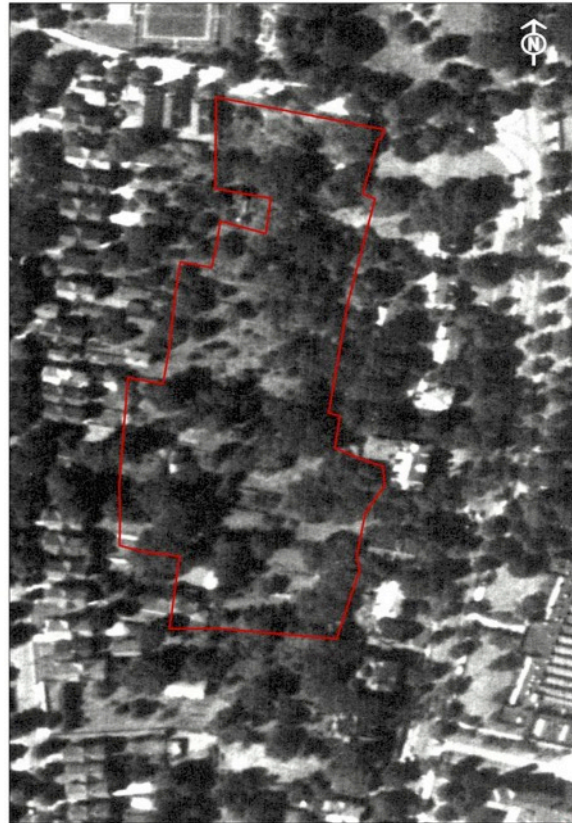
Land-use History



1934 Aerial View

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1951 Aerial View

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2008 Aerial View

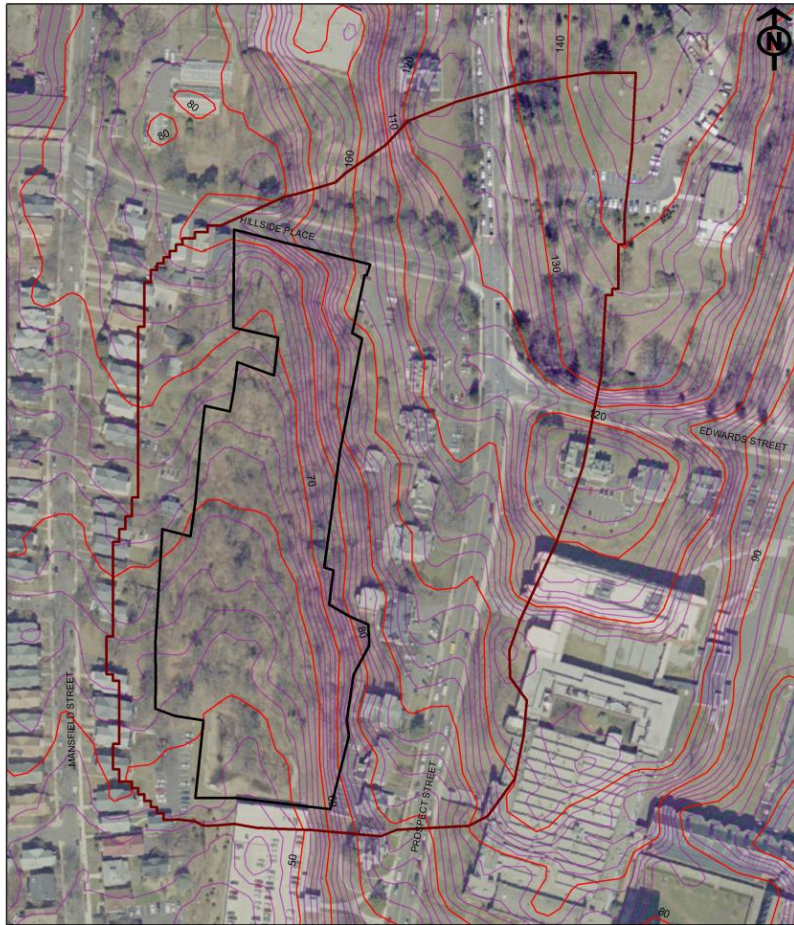
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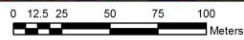
HYDROLOGY

YALE SWALE WATERSHED



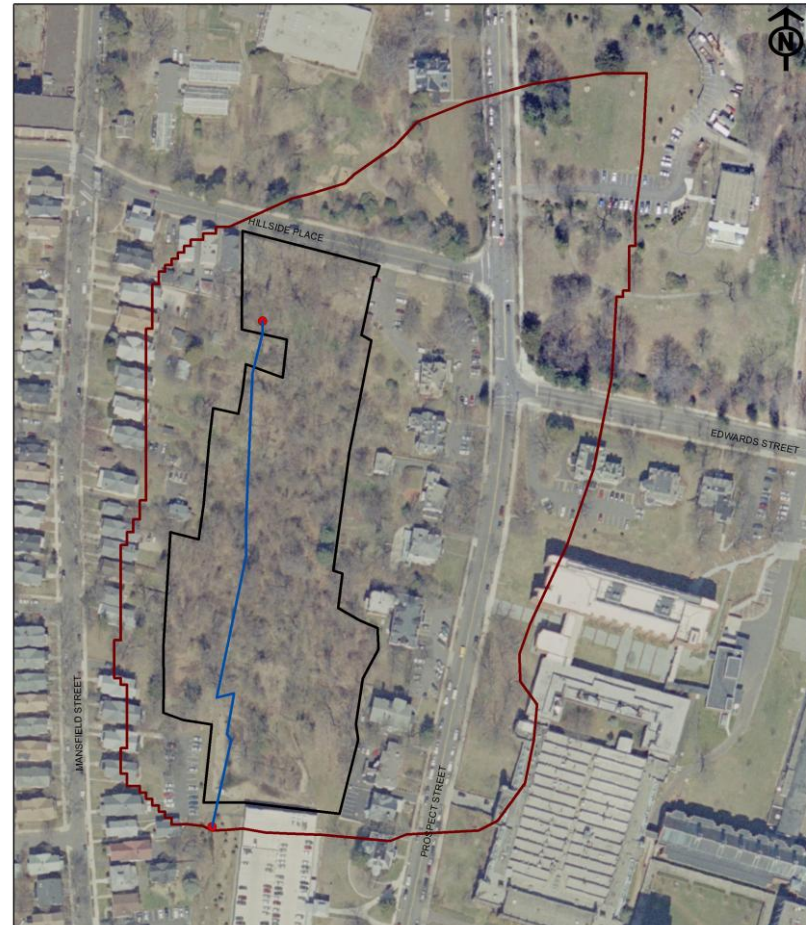
Yale Swale: Watershed from Contours

- 2 foot Contour
- 10 foot Contour
- ▭ Swale Study Area
- ▭ Watershed



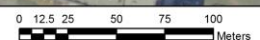
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Area of the watershed =
857,278 sq.ft
19.68 acres

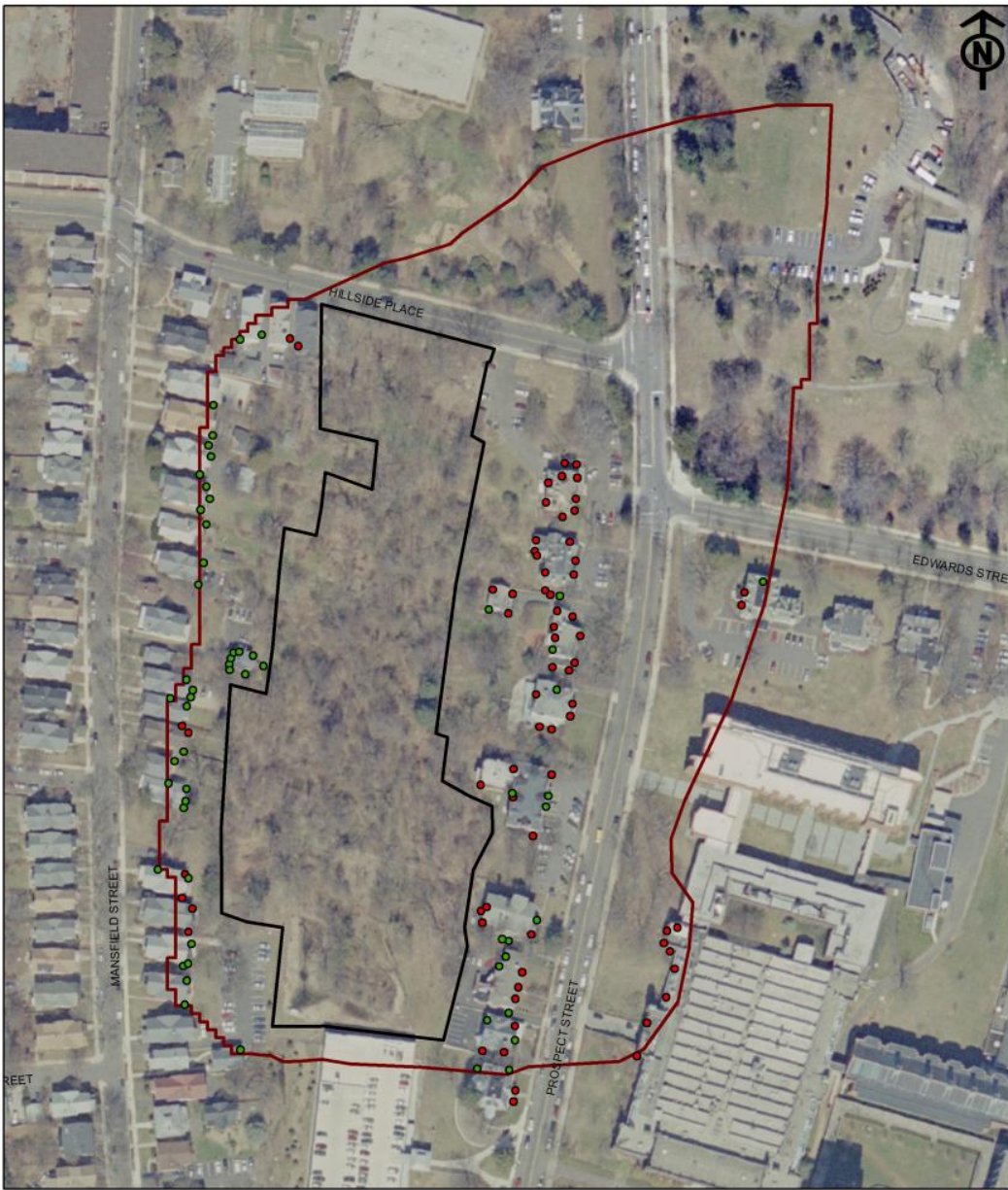


Yale Swale: Watershed

- Inlet and Outlet
- Groundtruthed Stream
- ▭ Swale Study Area
- ▭ Watershed



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Yale Swale: Downspouts

- Disconnected
- Connected
- ▭ Watershed
- ▭ Swale Study Area

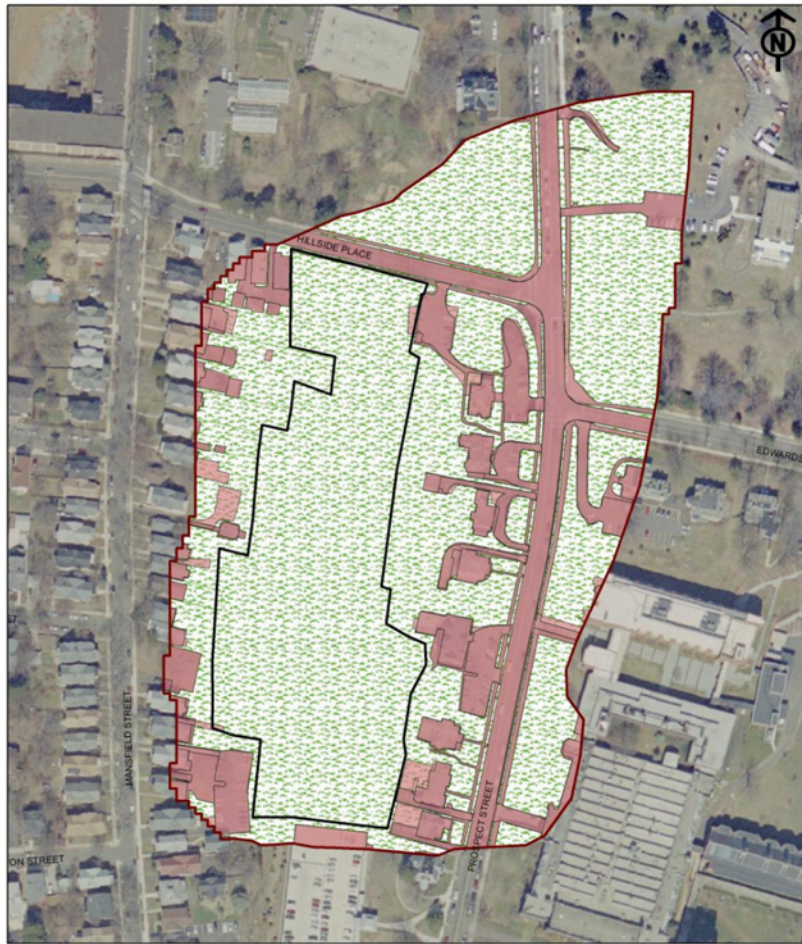


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DOWNSPOUTS

	Total	Connected	Disconnected
Number	129	69	60
Approximate roof area (sq.ft)	81,379	60,448	20,931
Volume of Stormwater (cu.ft)	354,384	263,235	91,150
Volume in gallons	2,650,793	1,968,994	681,799

IMPERVIOUS AREA DRAINAGE PLAN

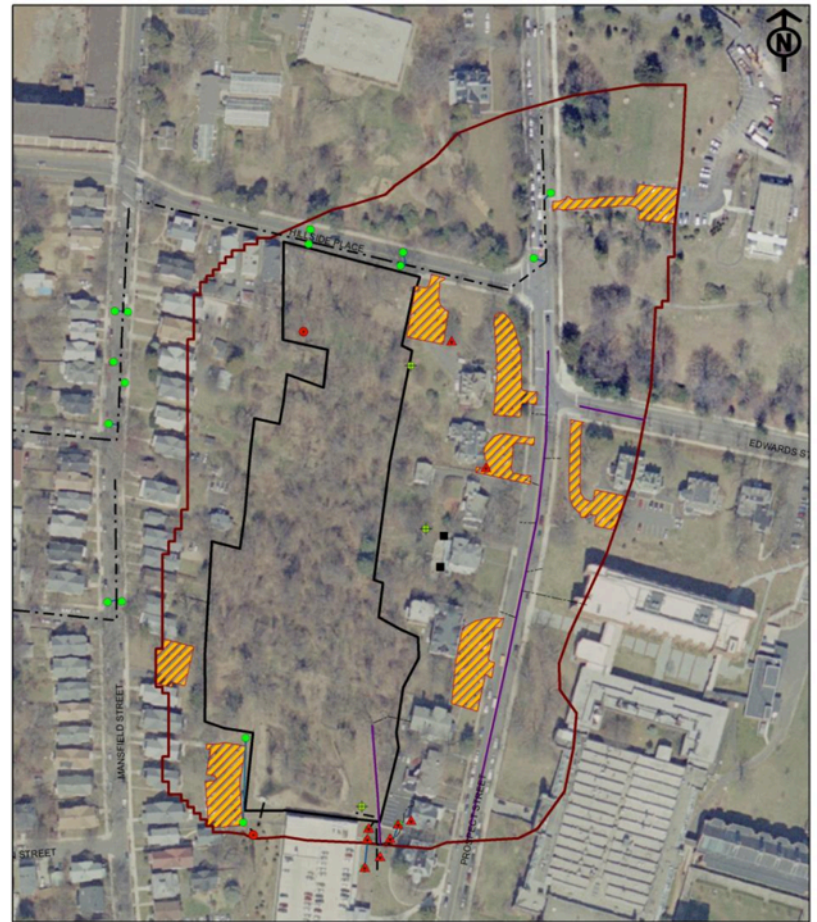


Yale Swale: Pervious and Impervious areas

- Pervious Area
- Impervious Area
- Swale Study Area
- Yale Swale Watershed

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Swale Watershed: Drainage Plan

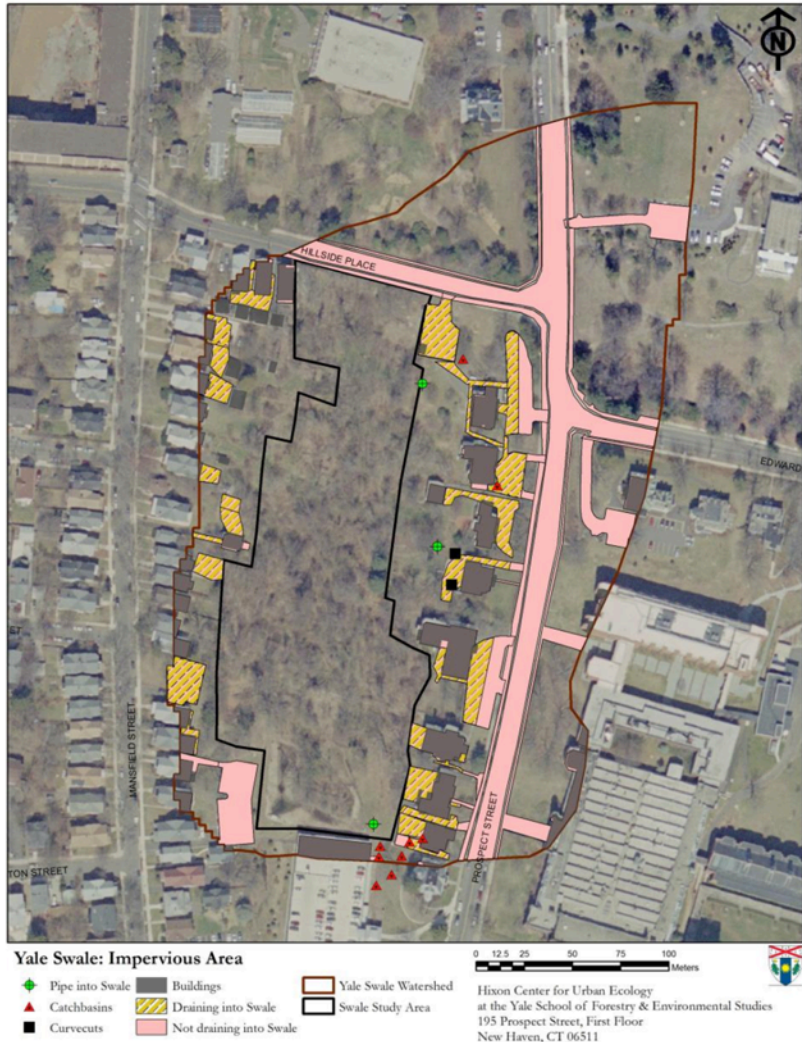
- Drainline
- Drainlateral
- Sewer main
- Sewer lateral
- Catchbasins
- Catchbasins into Swale
- Curbs
- Parking lot
- Swale Study Area
- Watershed

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CONTD.....

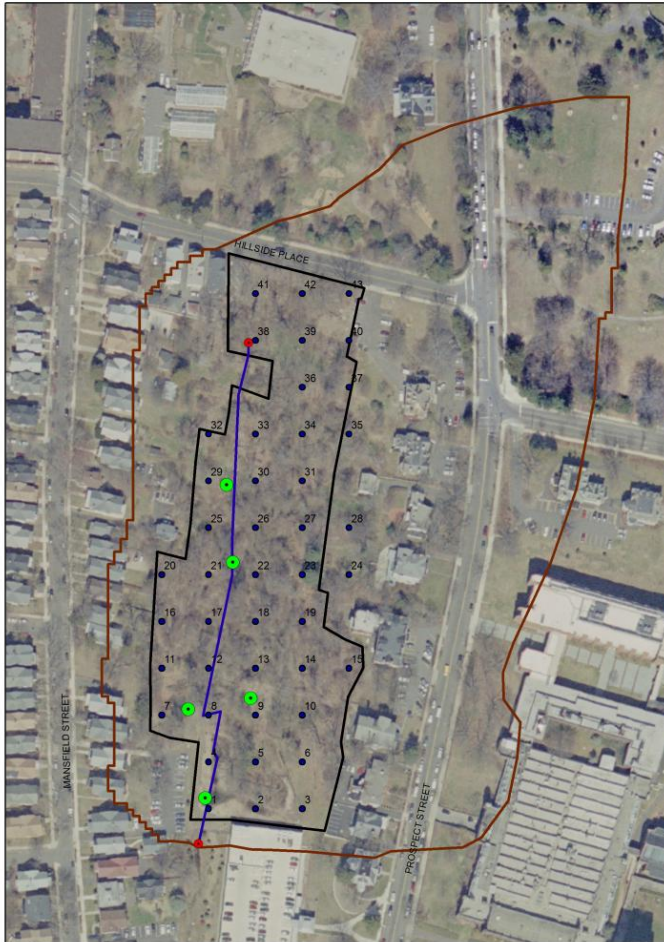


	Total Area (sq ft)	Vol of Precip	Percentage
Area of natural watershed	857,278	3,733,446	100.00
Pervious Area	636,783	2,773,190	74.28
Impervious Area	220,495	960,256	25.72

	Total Area (sq ft)	Vol of Precip	Percentage
Area in the watershed whose surface runoff drains into stormwater drainage	464,072	2,021,035	54.13
Area in the watershed whose surface runoff does not drain into stormwater drainage	393,206	1,712,411	45.87
Total Area of natural watershed	857,278	3,733,446	100.00

Impervious Area	Total Area	Vol of Precip	Percentage
Roof Area	81,379	354,406	36.9
Parking Lot	49,796	216,862	22.6
Others (Pavements, driveways,)	89,320	388,989	40.5
Total	220,495	960,256	100

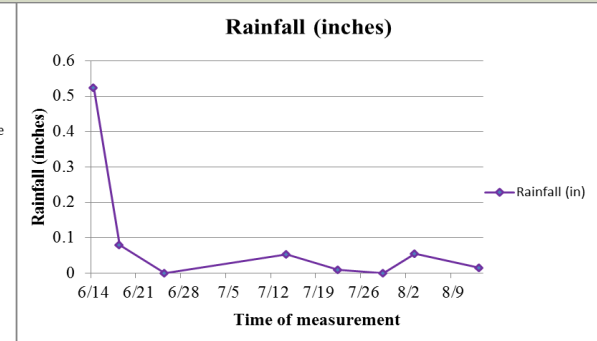
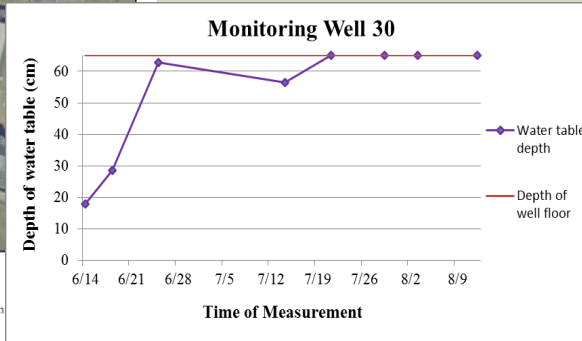
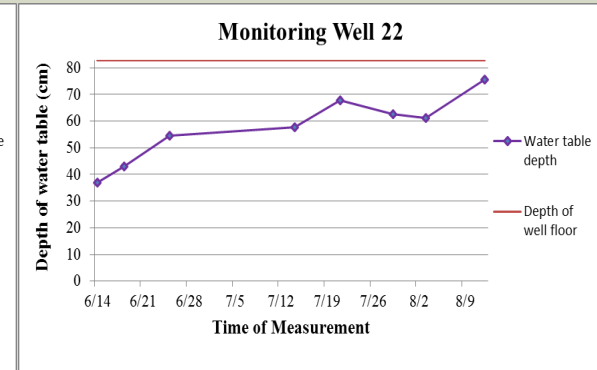
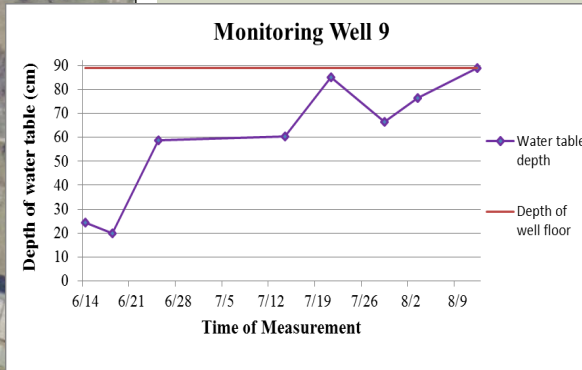
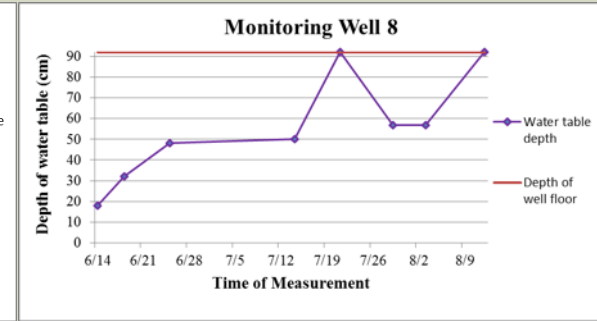
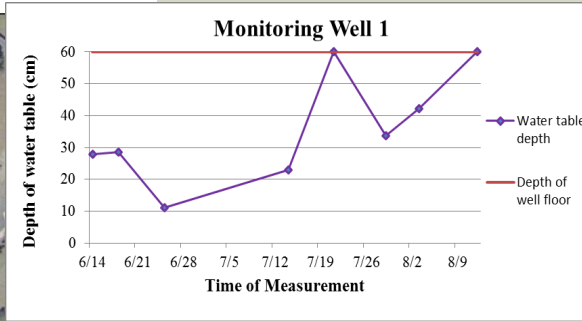
GROUND WATER LEVEL



Yale Swale: Monitoring Wells

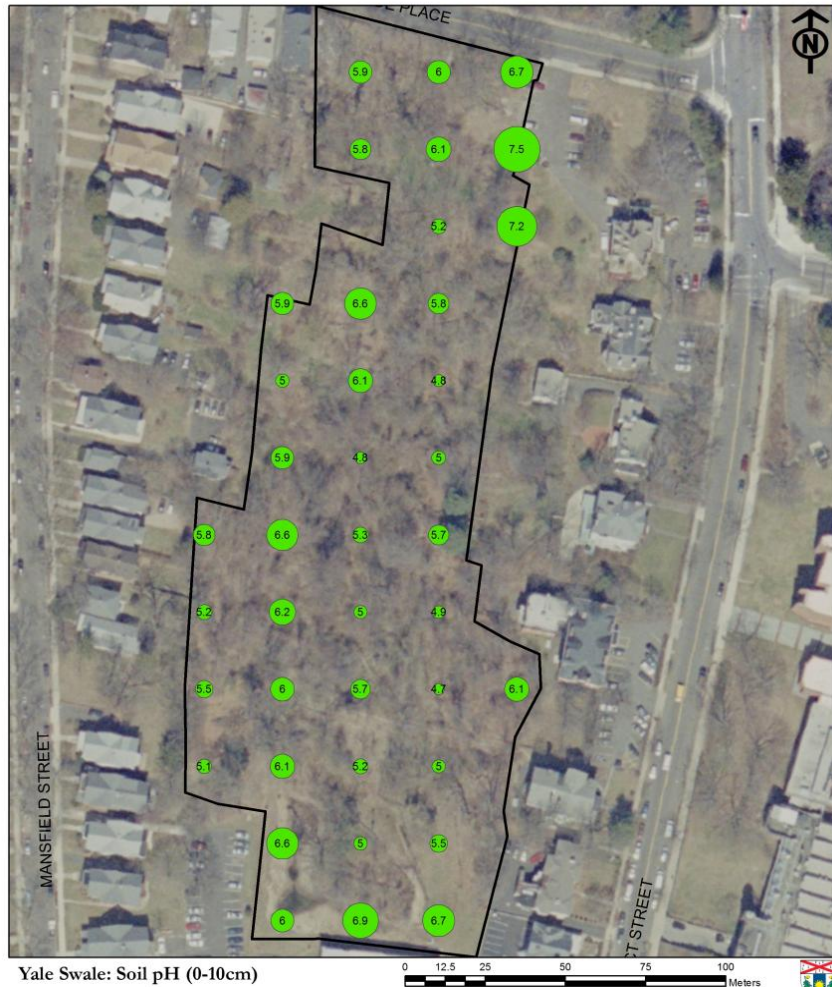
- Monitoring Well
- Sampling points
- Stream
- Yale Swale Watershed
- Inlet and Outlet
- Swale Study Area

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SOIL ANALYSIS

SOIL PH AND WATER HOLDING CAPACITY



Soil pH
Swale Study Area

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Swale Study Area
Water holding capacity

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SOIL SIR AND CALCIUM



Yale Swale: SIR (0-10cm)

Soil SIR
Swale Study Area

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Yale Swale: Soil Calcium (0-10cm)

Soil Calcium
Swale Study Area

0 12.5 25 50 75 100 Meters

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SOIL POTASSIUM AND PHOSPHORUS



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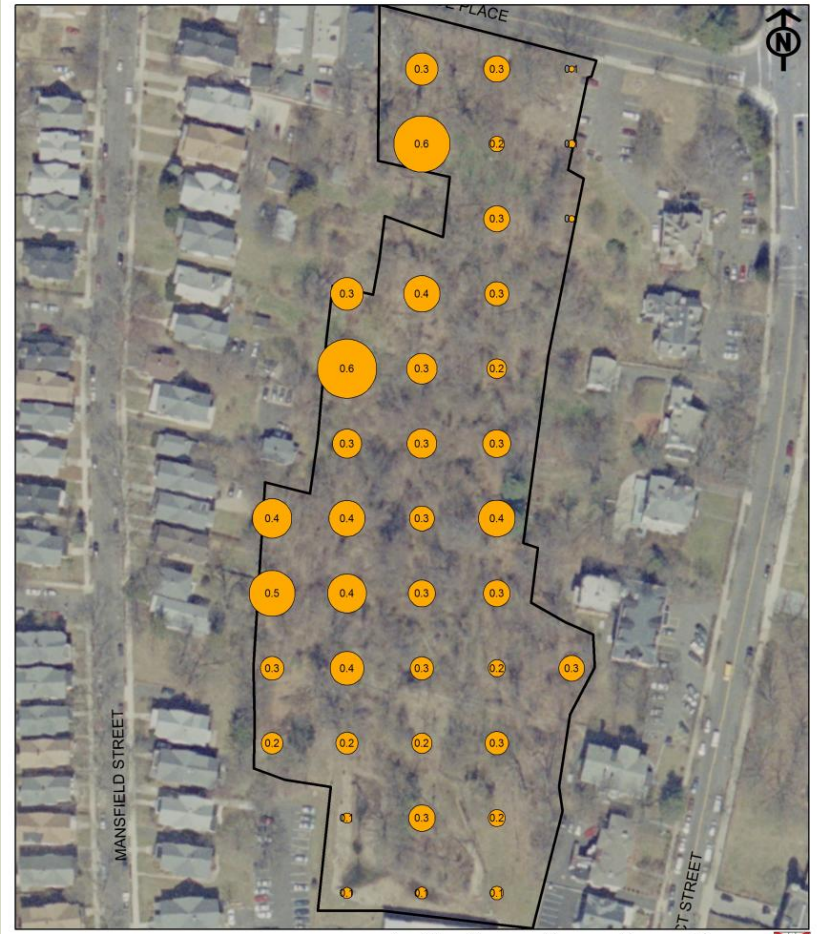
SOIL CARBON AND NITROGEN



Yale Swale: Percent Carbon (0-10cm)

- Soil Total Carbon
- Swale Study Area

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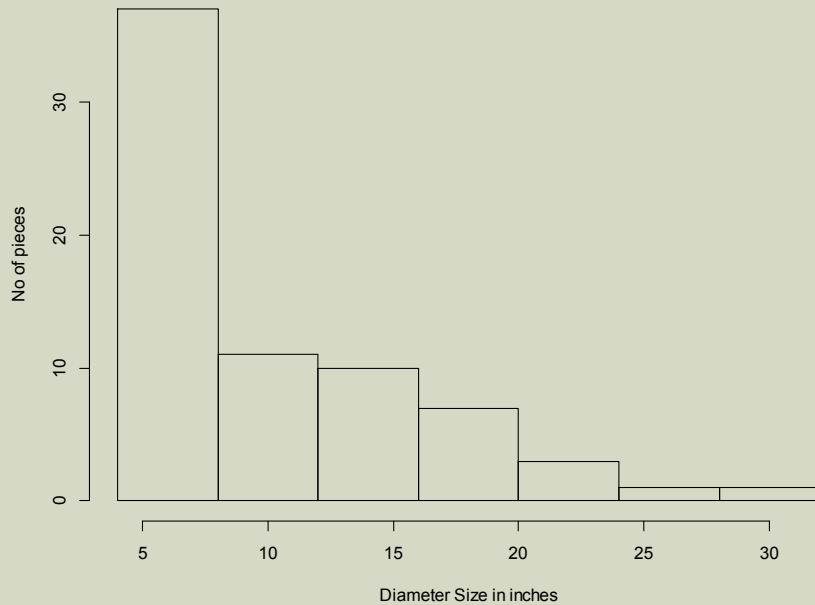
Yale Swale: Percent Nitrogen (0-10cm)

- Soil Total Nitrogen
- Swale Study Area

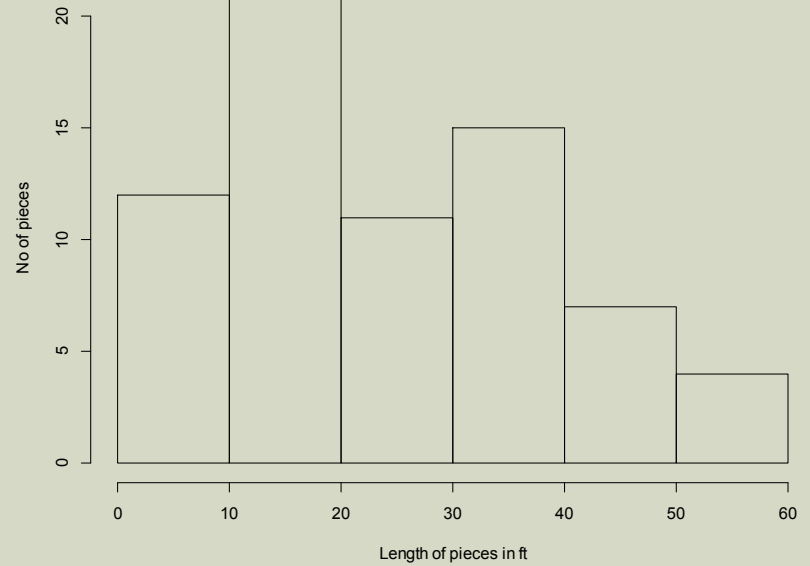
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COARSE WOODY DEBRIS

Class Size of Coarse Woody Materials

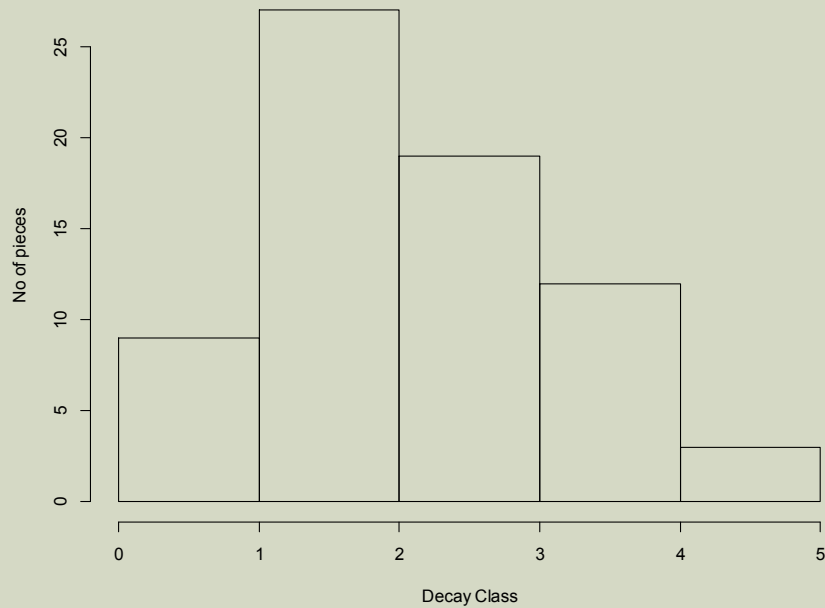


Length Class of Coarse Woody Debris



CONTD....

Decay Class of Coarse Woody Debris

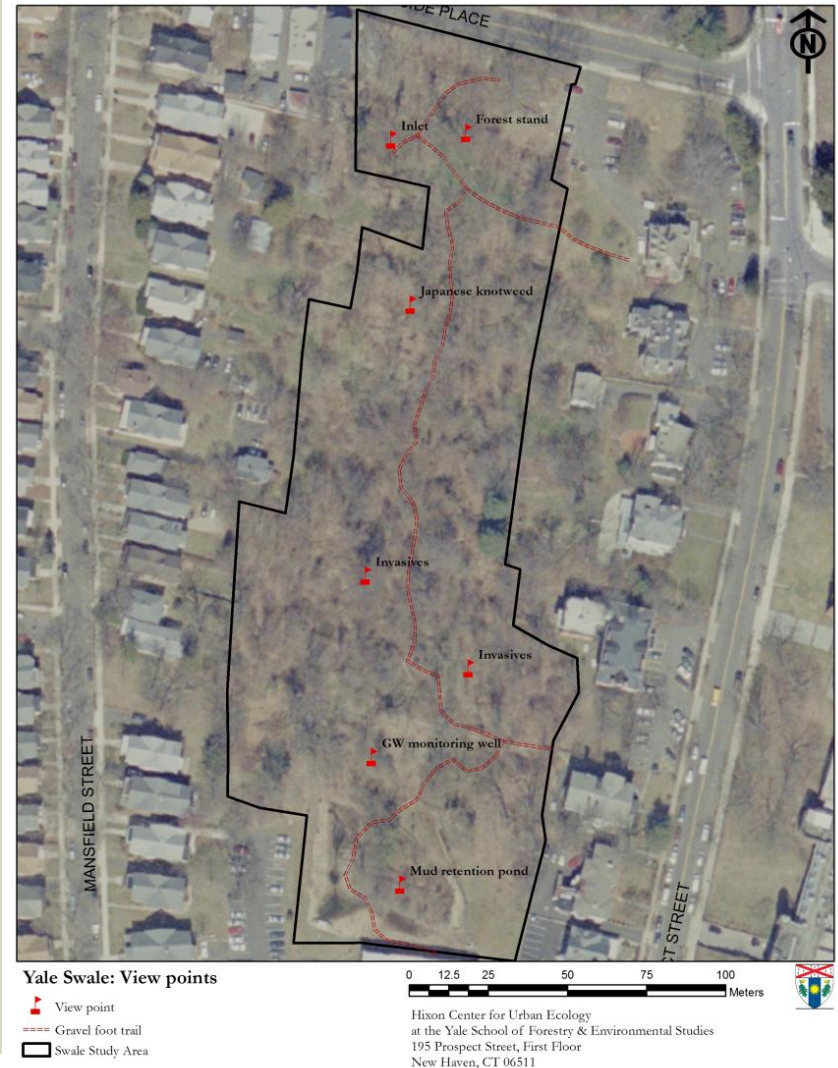


	No of Pieces	Volume (cft)	Projection Area (%)
Average	465	5665	3.2
95% Confidence interval lower limit	269	1856	1.4
95% Confidence interval upper limit	661	9474	5.0

HERE IS WHAT'S POSSIBLE

Education

- Demonstration site
- Trail with sighting spots/
Information signage/
Smartphone application
- Information booklet/ brochure
- Urban MODs Curriculum
- Community Involvement



CONTD....

Research

- Water quality monitoring/
Texture analysis of soil
- Long-term monitoring of
sampling plots as part of FES
course such as:
 - Soil science
 - Forest Dynamics
 - Water quality
 - Urban Ecology
- Involve interested Students/
Interns in these researches
- Collect 20-30 years worth of
data for archiving and
publication

Teaching

- University teaching culture
 - Soil science
 - Forest dynamics
 - Water quality
 - Urban ecology
 - Invasive species
 - Taxonomy of trees
 - Sustainability of Field Course
 - Urban Ecology
 - Stormwater/ water quality

WAYS OF DEVELOPING

Hixon Center

- Summer Interns
- One or two work study programs for maintenance of swale foot trail
- Urban MODs curriculum
- Restoration Plan
- Coordination with other agencies

Faculties

- Research
- Long-term study/ monitoring
- Involving students in research, education, and teaching
- Data archiving
- Publication
- Research Laboratory

WAYS OF DEVELOPING

Facilities/ Sustainability

- Removal of internal fences
- Construct gravel foot trail
- Control invasive plants by planting native species
- Demonstration site
- Include swale in the campus-wide stormwater management plan



SWALE FOR DUMPING



SWALE WATERWAY



SWALE DRAINAGE

