INNOVATION PARK AT THE UNIVERSITY OF TEXAS AT ARLINGTON

Research and Innovation in a Changing Climate

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ABSTRACT

The North Central Texas area expects to see rising temperatures and increased flooding as the result of climate change. The University of Texas at Arlington, located in the North Central Texas region, is preparing for these changes as it plans construction for changing student needs as well as increased enrollment. Innovation Park is the student-proposed research quad that transforms 17 acres of parking lots, draining directly into Trading House Creek, into a solution that allows for increased storm intensity as well as considers higher temperatures. This new development will create a strong visual identity to pedestrian corridors connecting two recently completed LID projects on the north and east sides of campus. Innovation Park will incorporate bioswales, living walls, and extensive living roofs to mitigate heat gain on vertical and horizontal surfaces. Plantings are selected to provide maximum carbon sequestration and pollution filtration with as little irrigation as possible. For a two inch storm event, runoff will be reduced from the current 817,931 untreated gallons to 283,630 gallons of bio-filtered water. The University, by incorporating careful use of LID techniques, is making a solid investment in the future of its students as well as setting an example for the region.

INTRODUCTION

Climate change in the North Central Texas region is projected to increase flooding and temperatures. This proposal relies heavily on several Low Impact Development (LID) techniques: living roofs and walls, permeable paving, and vegetated swales (bioswales) to reduce the impact of these projected changes. Living roofs and walls reduce the heat gain of building surfaces, which reduces energy used to cool interiors as well as the heat released from these surfaces at night. Vegetated swales use drought-and-flood resistant plants to slow and filter pollution from stormwater runoff.

PROJECT GOALS:

- Enhance the "placemaking" or identity of the campus by strengthening the visual identity of the pedestrian corridors between recent LID construction projects on the northern and eastern sides of campus.

Figure 1 Showing partial concrete reinforcement of channel.

- Meet the University's needs for new construction and parking while reducing heat load and runoff.
- Limit Urban Heat Island Effect by shading horizontal hardscape and roofs with vegetation (living roofs) and vertical surfaces with vegetation (mature trees and living walls).
- Sequester carbon through planting of trees and woody shrubs.
- Reduce need for maintenance inputs such as irrigation and mowing through the use of well adapted and native plantings
- Increase the quality of habitat for birds and pollinators through use of multi-seasonal flowering and fruiting species.
- Reduce volume of water runoff and increase quality of water by using bioswales along roadways and medians as well as permeable paving to clean particulates, nitrogen, and phosphates from water.
- Provide quality outdoor spaces for human comfort by careful use of prevailing winds and siting of outdoor seating and gathering spaces.

PROJECT CONTEXT

EXISTING CONDITIONS

Figure 2 Erosion visible at water's edge

The University of Texas at Arlington is located within the West Fork Trinity River watershed. This river flows southeast from the urban North Texas region, through central Texas and into lake reservoirs in Houston. During times of drought, much of the water in the Trinity is composed of treated wastewater from Dallas and Fort Worth. The region is considered to have a humid subtropical climate with average rainfall of 37 inches per year. Population for the region is predicted to increase to 15 million by 2050, and the associated changes in impervious surfaces will affect the rise in surface temperatures associated with the urban heat island.

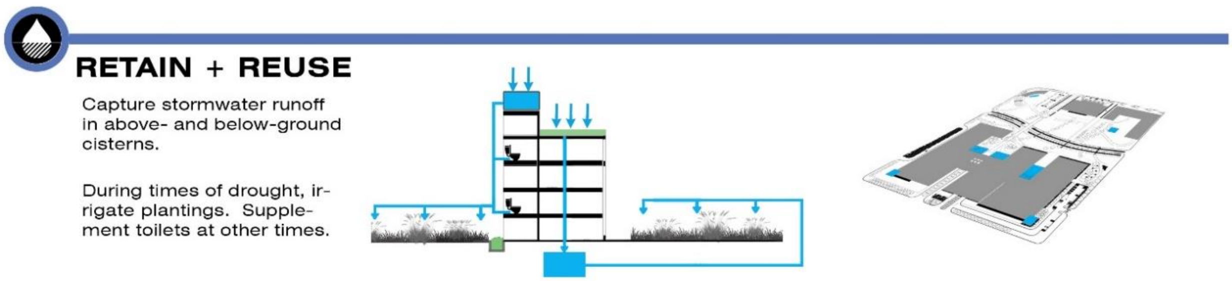
The site chosen for this competition is located on the south side of campus, and is currently composed mostly of asphalt parking lot built between 1963 and 1968. The site contributes to the urban heat island, as it is only about 5% shaded during the peak sunlight hours.

All water from these parking lots empty directly into Trading House Creek without treatment. Pollution from these lots may include polycyclic aromatic hydrocarbons, which are toxic to aquatic animals and are human carcinogens, heavy metals such as cadmium, and particulates.

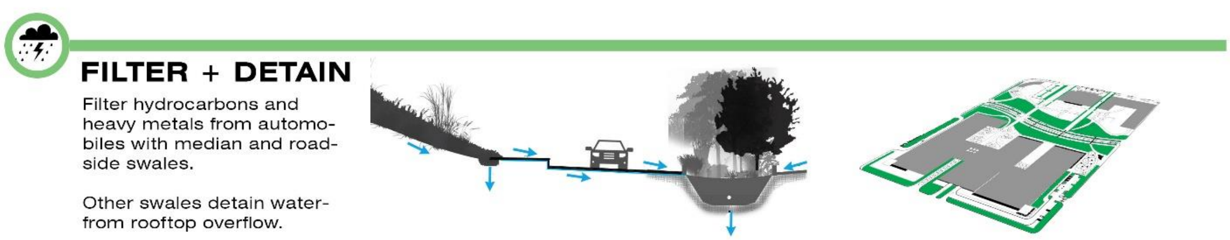
CAMPUS MASTER PLAN

The University's published Master Plan, from 2005, specifically addresses the transformation of surface parking lots into a different use, and uses the term "grey to green" to describe this goal. This "2060 Plan" also includes the proposal for increased numbers and connectivity of trails around the campus and the region. Uses for buildings listed on this plan include health services, nursing instruction, "Science Education and Innovation Research" and a small hotel and conference center.

DESIGN APPROACH: This proposal specifically addresses two factors of climate change: heat increase and flooding. Other factors, important for campus design, include a sense of visual identity for pedestrian corridors, comfortable multi-use spaces which take advantage of southerly breezes on warm days, and recreational trails. This design also incorporates economic benefits to the campus by placing the hotel and conference center on a highly visible roadway.



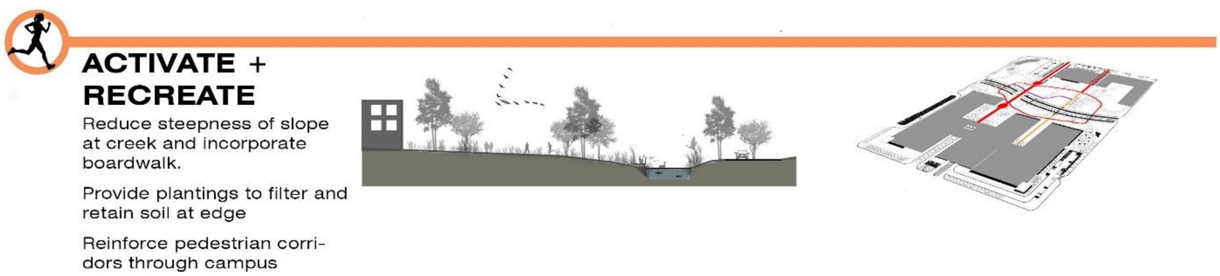
This proposed design replaces much of the 17 acres of asphalt parking lot with another impervious surface: rooftops. However, the water not detained by the plants and growing media on the roof would be stored for later use. Above- and below-ground cisterns, located throughout the site, store stormwater runoff and allow it to be used as needed for indoor sanitary use as well as outdoor irrigation during times of low rainfall. Above-ground cisterns will require energy inputs to pump water into storage, but the below-ground cisterns will require pumping only when water is needed. Underground cisterns are used at other locations on the UT Arlington campus.



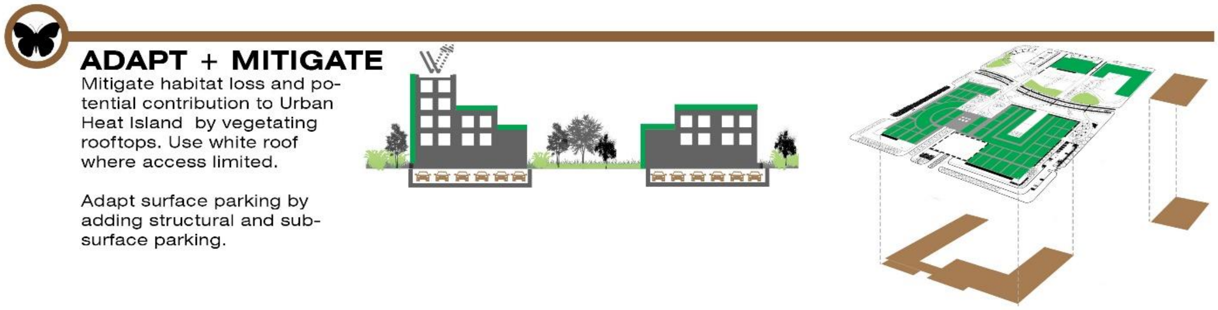
Much of the stormwater runoff from rooftops, which carry few pollutants, will be stored for later use, but runoff from roadways, if not treated, has the potential to carry pollutants into the creek. Roadways in this project are designed with median and roadside bioswales to slow, filter and cool water. Overflow from rooftop storage cisterns is also directed into swales to allow the water to infiltrate into the soil. Vegetated buffers along the sides of the creek would also help to prevent erosion of soil into the waterway.

Rainfall in north Texas in 2015 has been record-breaking, yet many areas saw almost no rainfall during the summer months. These conditions make irrigation necessary for most plants commonly used across the landscape on campus, as well as newly installed plants proposed in this design. Even after establishment, plants used in these swales and buffers must be able to withstand water inundation as well as drought. Many of the plants used have a wetlands designation of “FAC” for facultative wetland. Some of these species are:

Berchemia scandens Alabama Supplejack	*Ilex decidua* Possumhaw Holly	*Muhlenbergia reverchonii* Seep Muhly
Panicum virgatum Switch Grass	*Phyla nodiflora* Frogfruit	*Physostegia virginiana* Fall Obedient Plant
Quercus muehlenbergii Chinquapin oak	*Quercus shumardii* Shumard Red Oak	*Senna marilandica* Maryland Senna

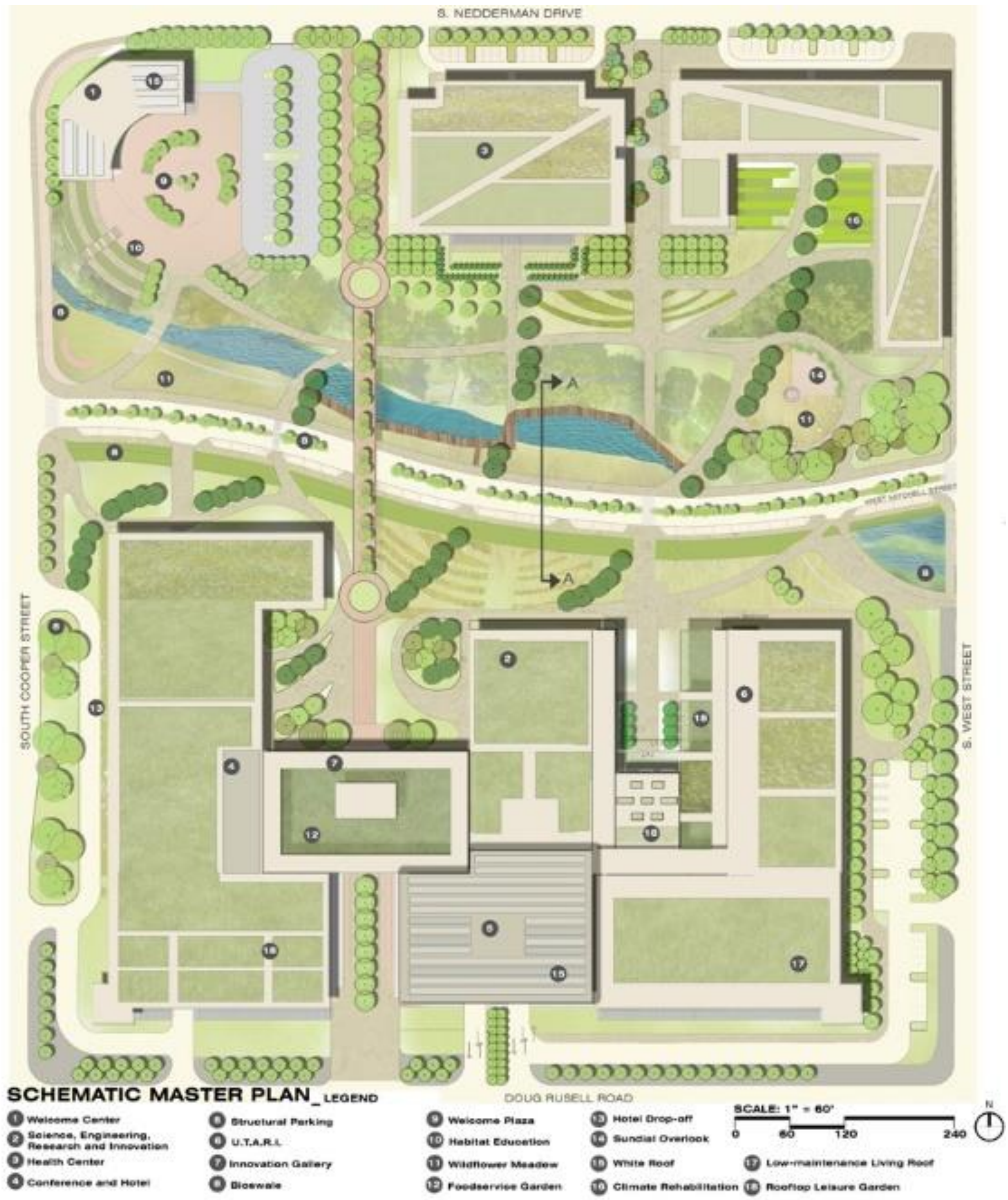


As shown in Figure 2, steep sides and thin vegetation contribute to erosion of the creek banks. Reducing the steepness of the slope and adding denser vegetation help to reduce the potential for erosion while also creating a more user-friendly space for people. Incorporating a boardwalk and a short loop trail also encourage users to walk or jog around the vegetated area. Finally, improving the pedestrian bridge over Mitchell Street and the creek allow for a stronger visual identity through the campus. This bridge would form part of the primary north-south pedestrian axis through the campus to link the new Innovation Park with the Central Library quad and the Engineering Research Building.



The approximately 17 acres of asphalt parking lot currently on the site add to the urban heat island effect by absorbing energy during the day and releasing it at night. Much of this area will be replaced with rooftops, but these roofs will mitigate heat storage with the use of living and white roofs. Living roofs can be low- or high- maintenance, depending on the type of vegetation planted. This proposal includes several types of living roofs: a vegetable garden requiring high levels of water, soil, and weeding; rooftop gardens, also requiring weeding and occasional irrigation; and low maintenance roof, consisting of xeric adapted native plants. Size of high-input gardens will be minimized, and the majority of roof cover will be low maintenance.

Parking spaces taken over for Innovation Park will be gained through semi-underground spaces located under the buildings as well as structural parking on a nearby surface lot. The structural parking will allow more students to park closer to campus than before.


S. NEDDERMAN DRIVE
SOUTH COOPER STREET
S. WEST STREET
DOUG RUSELL ROAD
SCHEMATIC MASTER PLAN_LEGEND
1 Welcome Center
2 Science, Engineering, Research and Innovation
3 Health Center
4 Conference and Hotel
5 Structural Parking
6 U.T.A.R.I.
7 Innovation Gallery
8 Bioswale
9 Welcome Plaza
10 Habitat Education
11 Wildflower Meadow
12 Foodservice Garden
13 Hotel Drop-off
14 Sundial Overlook
15 White Roof
16 Climate Rehabilitation
17 Low-maintenance Living Roof
18 Rooftop Leisure Garden
SCALE: 1" = 60'
0 60 120 240
N

ESTIMATED SIZE OF STORMWATER BIOSWALES

With this design, approximately 1.39 acres of bioswales would be needed to treat water runoff for a two-inch storm event, as calculated using the Natural Resources and Conservation Service Curve Number Method. Approximately 1.43 acres (68,806 ft^2) are designed into the master plan to accommodate stormwater. These calculations are shown below:

ROOFTOPS		
For rooftops and a 2 inch storm:		
CN = 92		
S =	0.8696	
Ia=	0.0174	
P=2 inch storm		
Q=	1.38	inches
Total area of runoff=	415,539.99	ft^2
runoff volume in gallons=	356,778.67	gallons
for 15" deep swale		
surface area=	38,158.15	ft^2
43560 ft^2 per acre=	0.88	acres
Green roof CN=92		

PERMEABLE PAVEMENT		
For permeable pavement and a 2 inch storm:		
CN = 79		
S =	2.6582	
Ia=	0.0532	
P=2 inch storm		
Q=	0.82	inches
Total area of runoff=	99561	ft^2
runoff volume in gallons=	51,050.52	gallons
for 15" deep swale		
surface area=	5,459.95	ft^2
43560 ft^2 per acre=	0.13	acres
CN can vary 45 to 89		

BIOSWALES		
For bioswales and a 2 inch storm:		
CN = 69		
S =	4.4928	
Ia=	0.0899	
P=2 inch storm		
Q=	0.57	inches
Total area of runoff=	63806	ft^2
runoff volume in gallons=	22,651.95	gallons
for 15" deep swale		
surface area=	2,422.67	ft^2
43560 ft^2 per acre=	0.06	acres

PLANTINGS		
For plantings and a 2 inch storm:		
CN = 55		
S =	8.1818	
Ia=	0.1636	
P=2 inch storm		
Q=	0.34	inches
Total area of runoff=	515670	ft^2
runoff volume in gallons=	108,140.50	gallons
for 15" deep swale		
surface area=	11,565.83	ft^2
43560 ft^2 per acre=	0.27	acres

IMPERVIOUS		
For impervious and a 2 inch storm:		
CN = 98		
S =	0.2041	
Ia=	0.0041	
P=2 inch storm		
Q=	1.81	inches
Total area of runoff=	25387	ft^2
runoff volume in gallons=	28,639.29	gallons
for 15" deep swale		
surface area=	3,063.03	ft^2
43560 ft^2 per acre=	0.07	acres

Bioswales are useful in cleaning the first flush of rainfall; if water is to be stored for irrigation and other uses, cisterns will store that water.

PLANT AND POLLINATOR DIVERSITY

Figure 3 A late season Queen butterfly caterpillar feeds on Milkweed growing wild at College Park Green in December.

Pollinators supported by an improved habitat include: ants, bees, beetles, birds, butterflies, flies, moths, wasps, and true bugs (Hemiptera). Each of these pollinators favor a certain type of bloom, which vary by shapes, colors, sizes, and scents. Different pollinators seek different fuel sources from flowers; some feed on nectar, others consume pollen, and still others chew flower petals. Including larval hosts for insects also encourages diversity.

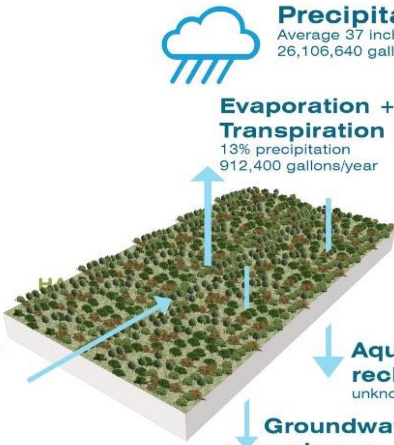
Post Oak, *Quercus stellata*, is a slow growing, but long-lived tree found in the narrow band of Cross Timbers ecoregion, of which this site is a part. These trees are rarely allowed to grow from seed in urban areas; allowing some unmowed areas of planting would help to provide a nursery for these trees. They are also better adapted to the poor soils and low water conditions in this area. They are able to fix carbon at higher temperatures and with less water than other commonly planted trees.

SITE DEVELOPMENT
HABITAT + TREE COVER
HYDROLOGY + WATER USE

PRE-DEVELOPMENT

Canopy cover 88-96% (depending on fire)
26.7 acres of Blackjack and Post Oak forest or savanna
Dense understory of Greenbriar, Roughleaf Dogwood, Poison Ivy, Redbud, and Coralberry. Many grasses in savannas.

Broad diversity of wildlife
Bison, blackfooted ferrets, prairie dogs, burrowing owls, mountain lions, black bears, coyotes, bobcats, foxes, wild turkeys, and white-tailed deer. Many songbirds, waterfowl, and birds of prey migrate through the area or stop to spend their breeding or winter season.



EXISTING

Canopy cover 14%
17 acres of parking lot

Post Oak, Live Oak, Bald Cypress, Red Oak, and Crape Myrtle. Groundcover of Asian Jasmine, St. Augustine, and Bermuda grasses.

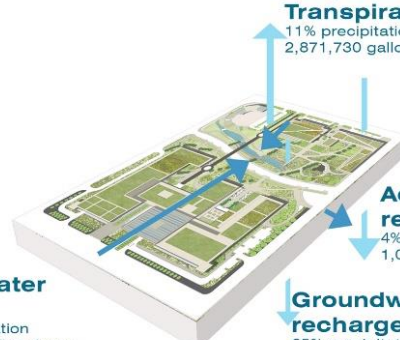
Impervious surfaces
Channelized stormwater drainage to handle impervious surfaces, some erosion in intense rainfall. Untreated water carries pollutants to Trinity waterway. Urban wildlife such as feral cats. Few hosts for pollinator species.

PROPOSED

Canopy cover 20%
+ 8.5 acres of living roofs

Various living roof types: Foodservice, leisure, habitat, and low-maintenance. New trees sited to shade hardscape and building surfaces. Planting chosed to encourage pollinator consumption.

Pervious surfaces increased
Bioswales cool, clean, and slow water runoff from rooftops and sidewalk before reaching creek.



EXPECTED OUTCOMES: SOCIAL

Outdoor multi-use spaces such as the Sundial Overlook and the Welcome Plaza allow for informal gatherings as well as structured social events. Parking for buses at the Welcome Plaza allows a first stop for visiting groups from area schools. This corner location also provides a resting place and retail opportunity for parents visiting with prospective students. The trails and enhanced walkways would bring more foot and bike traffic through the area, and daily use of the spaces would be around 3,000 people per day during weekdays.

EXPECTED OUTCOMES: ECONOMIC

A small hotel and conference center, administered through a public-private partnership, would attract hospitality support, such as coffee shops and cafes, to the Cooper Street corridor. These would provide a modest number of jobs to students. The university might also provide a new training program in the hotel, which could take advantage of federal Work Study programs to benefit students needing on-campus jobs. With new research facilities, the University would be inn a good position to attract research grants, which provide a large boost to the economic status of UT Arlington.

SUMMARY

Innovation Park strives to combine a modern treatment of stormwater runoff with sensitive use of hardscape in a university setting. It reduces the University’s contribution to the urban heat island while providing high quality research, instruction, recreation, and conference space to its users. Vegetated bioswales and roofs contribute to the overall mental, physical, and environmental health of the University of Texas at Arlington.

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