LOUISIANA STATE UNIVERSITY

COMPREHENSIVE & STRATEGIC CAMPUS MASTER PLAN

APPENDIX G - Stormwater Study Findings & Stormwater Solutions

LSU: MP Narrative
July 2017

3.5 Open Space

Existing Conditions

The LSU campus is situated in on the top of an historic bluff that rises approximately 20 feet above the surrounding floodplain. This natural bluff is located between two major watersheds that convey stormwater runoff flows via the Fountain Bayou and Duplanier Bayou. The flows from both of these bayous connect further downstream and eventually discharge into Lake Pontchartrain.

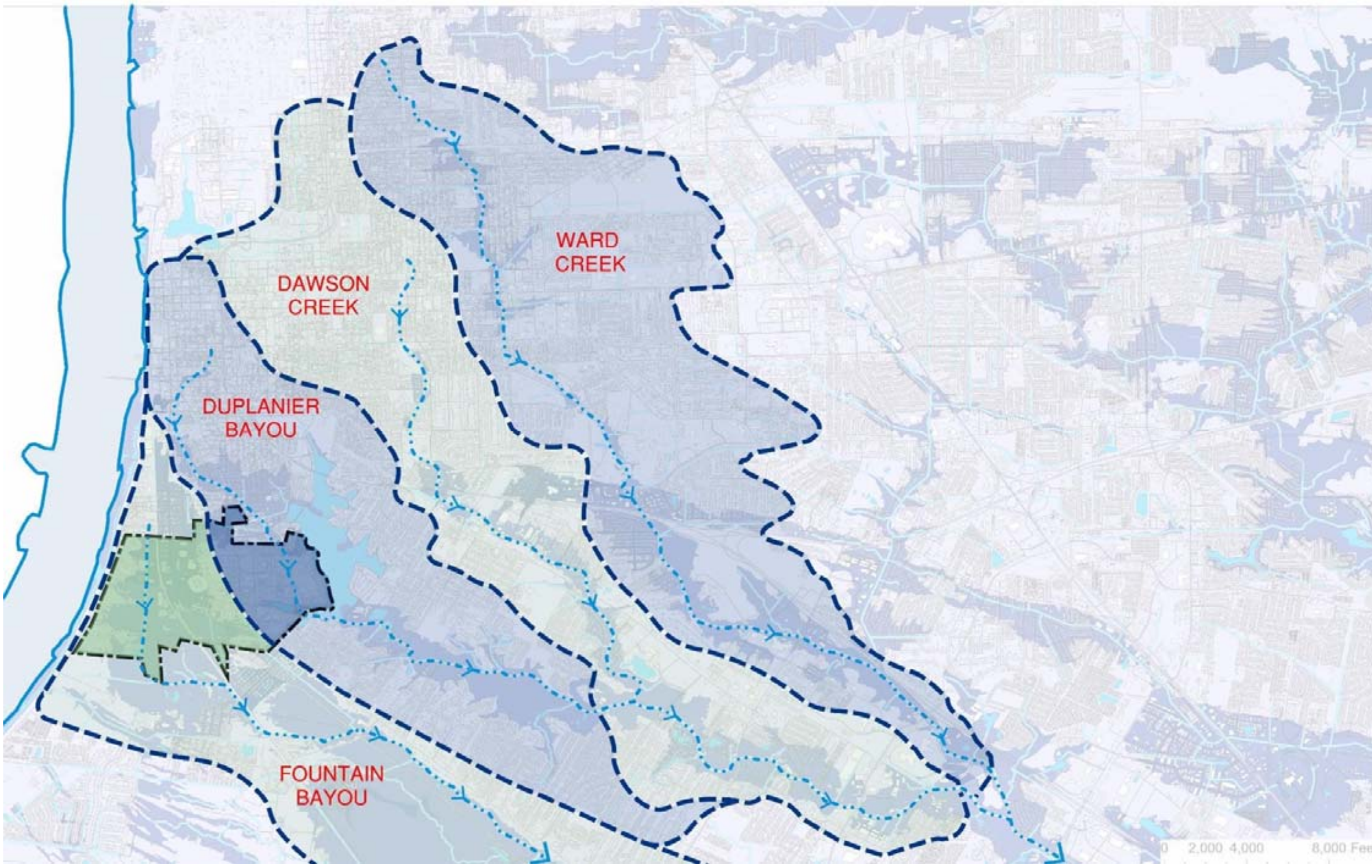


Figure 1 – Existing Conditions Watersheds

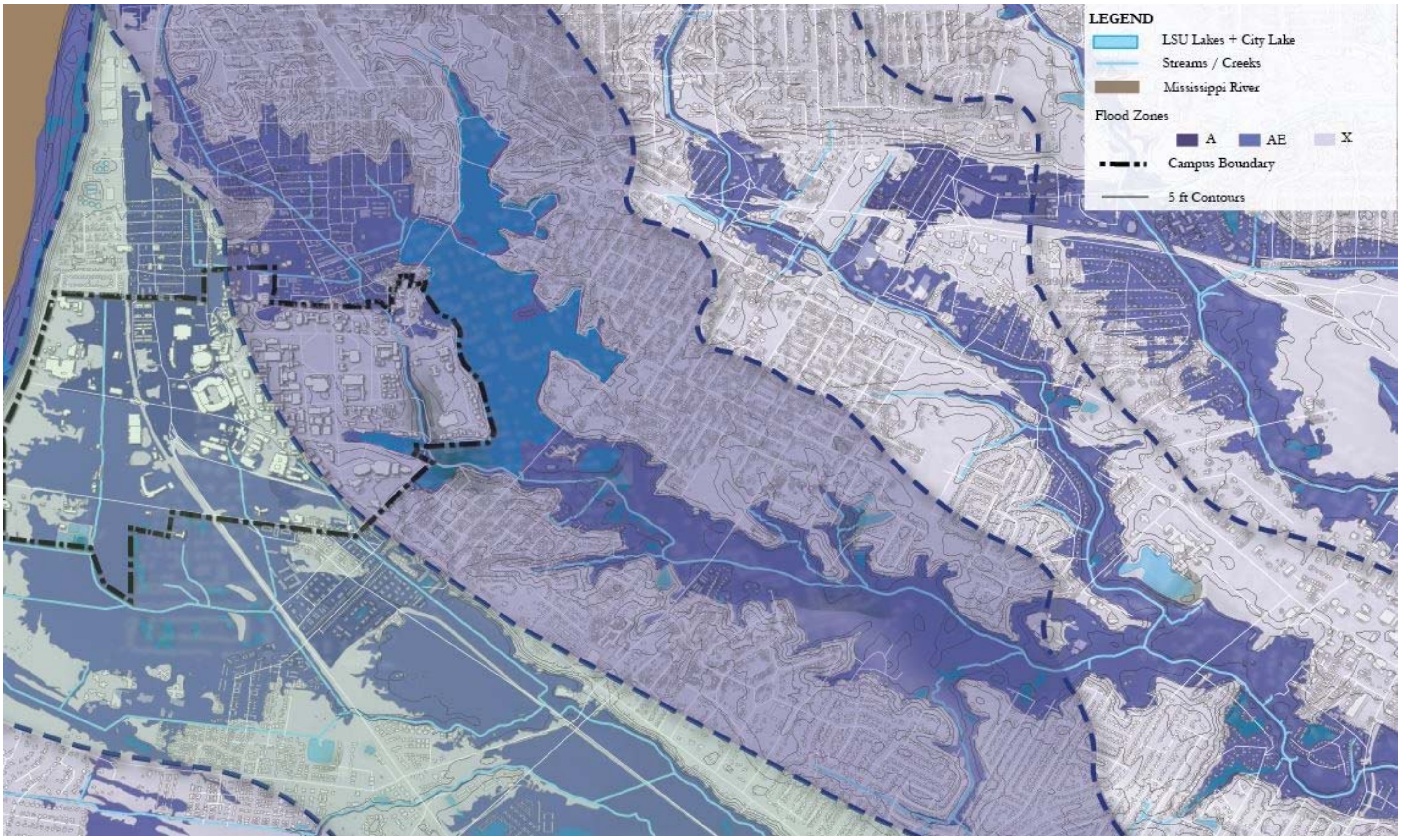


Figure 2 – Regional Watershed and Flood Zone Mapping

The campus itself contains two distinct zones that are divided by the natural ridge that runs northwest to southeast along the bluff; the upland and lowland zones. The upland zone is best defined as the zone located on top of the bluff above the floodplain where the majority of the campus development exists. This zone discharges to Duplanier Bayou. The lowland zones are those areas of the campus that are situated within the floodplain with less dense development and which are more prone to current and future flooding. This zone discharges to the Fountain Bayou.

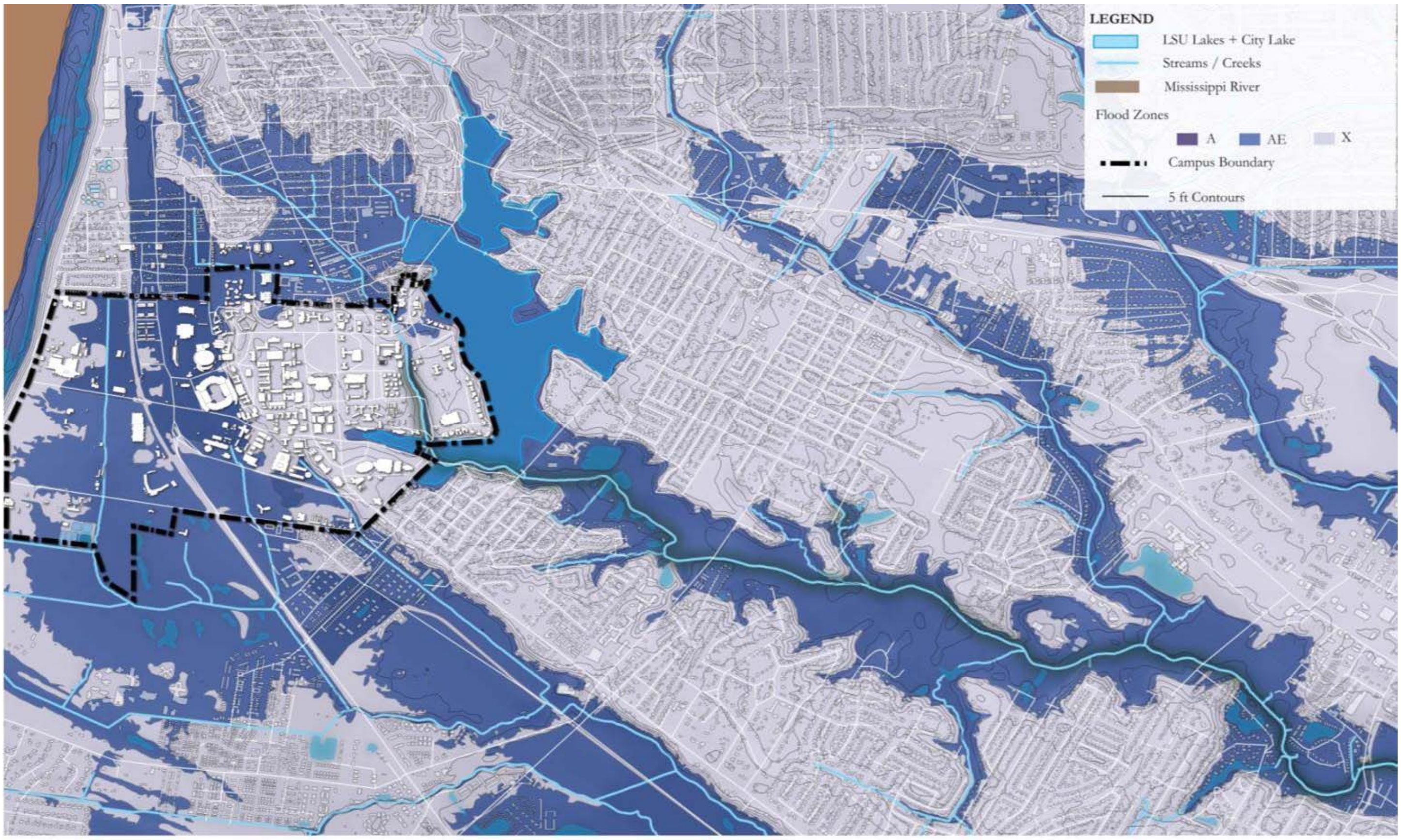


Figure 3 – Regional Floodplain

The existing stormwater infrastructure system on campus consists primarily of a curb and gutter drainage system which works to prevent the campus from localized flooding and conveys stormwater via pipes to adjacent drainage ways. One of the unique parts about LSU is that its campus contains four (4) open blueway systems that act as the major stormwater conveyance mechanisms for the campus and also add flood storage infrastructure during large storm events. These four (4) different blueways are the west side canal, the existing open channel that carries runoff through the existing parking lot, the open channel behind the E.J. Ourso College of Business and the Corporation Canal segment just west of the UREC building. Each of these drainage conveyance channels perform an important part to the conveyance and storage of stormwater associated with LSU and its surrounding properties. As storm intensities and frequencies increase considerations for stormwater conveyance and strategic flooding strategies are important to incorporate into future development plans. In addition and with any development, temporary management of sediment transport due to exposed soils is a significant factor in water quality of downstream and on-site natural systems. A balance of thoughtfully placed vegetation, site grading, materials and stormwater controls are solutions to controlling future disruptions due to construction. All of these systems will play a role in potential sediment loss and erosion and are important factors to build into temporary and permanent design.

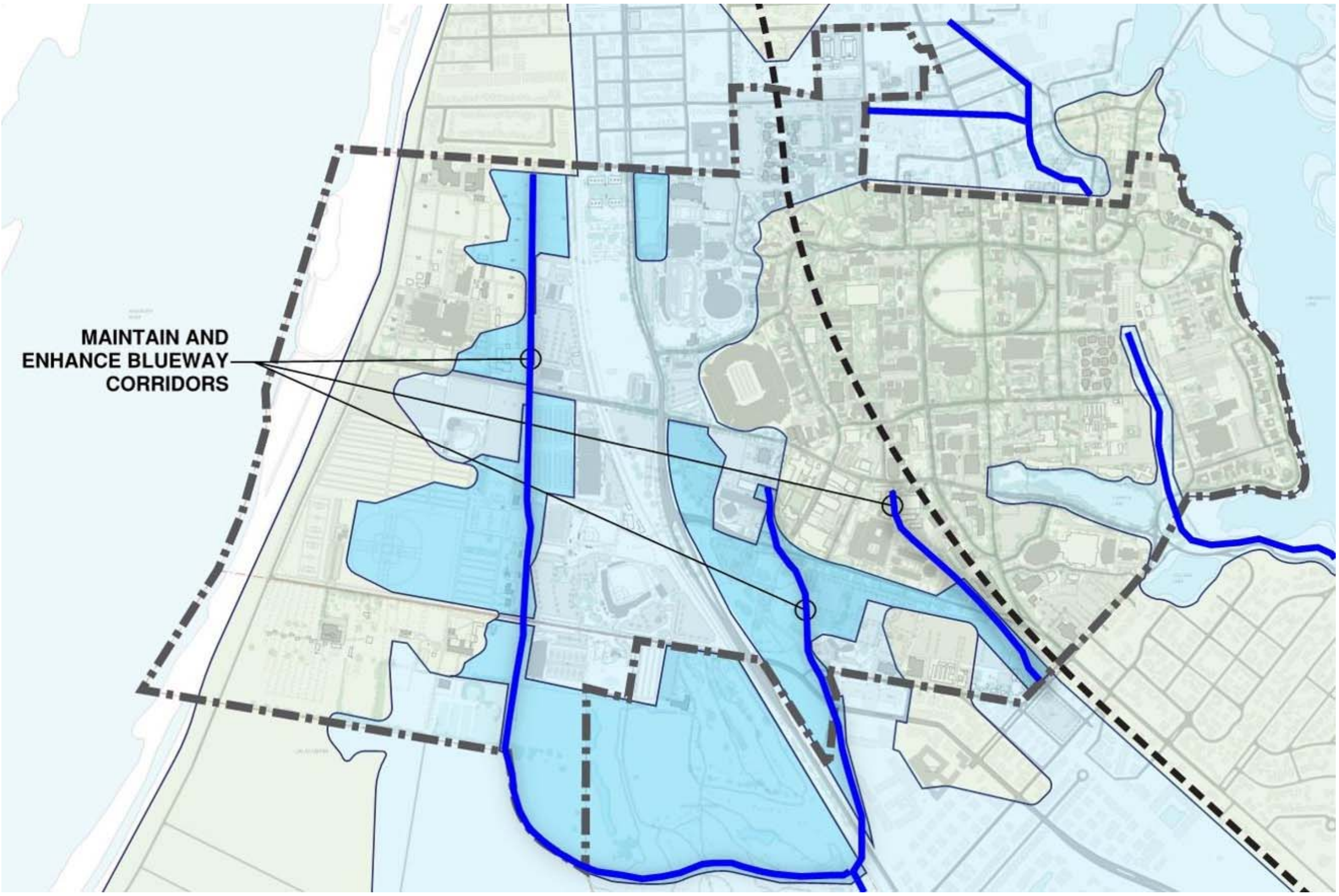


Figure 4 – Blueway Systems

4.5 Component Plan

Analysis and Design Approach

To understand LSU's campus further, the floodplain and watershed boundaries were mapped and analyzed to review natural patterns and identify ways in which blueways and greenway corridors could be better utilized and expanded to create more functional and aesthetic value to the campus. This helped to determine the larger stormwater strategy for the campus which is simply broken down into slowing, storing and draining. These three practices work together to create a more resilient approach to on-site stormwater; a. slowing water by re-directing away from pipe networks and into infiltration zones, b. storing water on-site in areas designed to flood in controlled ways and c. draining the campus after storm events via natural drainage corridors.

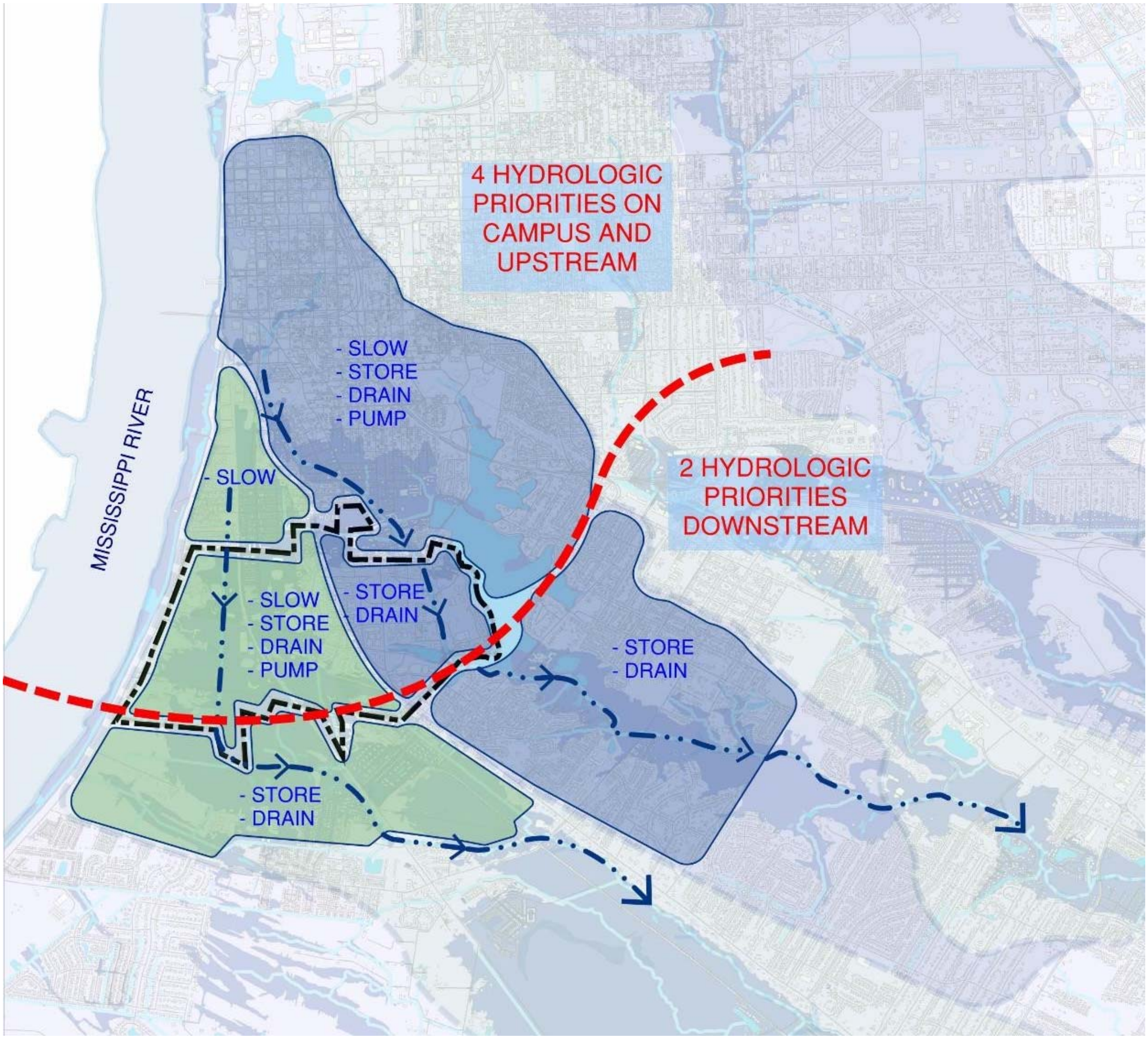


Figure 5 – Stormwater Design Approach

The majority of the campus's runoff is created by the interception of rainfall over impervious development surfaces (pavement and rooftops) and lifting sediments and contaminants as it flows. These contaminants are then concentrated by drainage conveyance systems and result in the degradation of natural watercourses and water bodies. It will be essential to address this challenge by the design of the landscape and associated drainage collection/conveyance system. The softscape zones throughout the campus will be designed with soil media that will filter stormwater runoff prior to collection and conveyance. This bioretention soil media paired with native plantings will help to filter out sediment, reduce runoff, remove pollutants and use plants for nitrogen uptake. The resulting discharge from these planted areas will be cleaner water for recharging back into the aquifer. Keeping these systems upstream of the natural corridors will allow for higher water quality for both infiltration and discharge to the larger stormwater management system / watershed.

As the masterplan schemes were developed the key strategies that emerged were a strong focus on maintaining existing drainage patterns, improving existing blueway systems and developing larger greenway corridors that better define the campus and provide a more structured approach to managing stormwater on campus. This approach will aim to minimize impacts to existing drainage networks and improve the overall conditions of the watershed and associated floodplain. The strategies evolve around above ground conveyances , stormwater storage and water quality nodes located along natural greenway/blueway zones and transportation / landscape (vehicular and pedestrian) corridors.

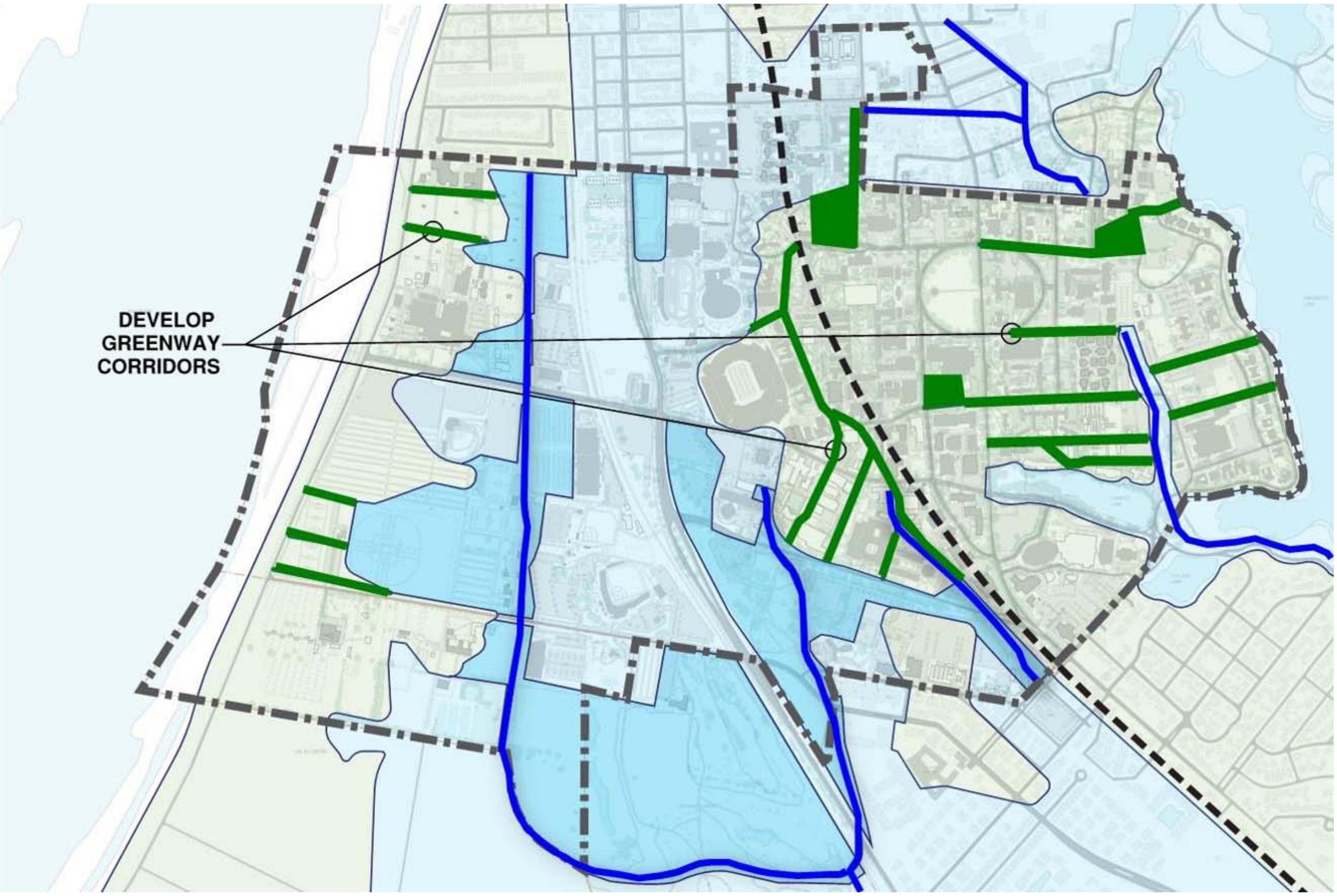


Figure 6 – Greenway Systems

By finding these alignments, stormwater infrastructure is reduced, water quality of the stormwater runoff is improved, user experience is enhanced and natural habitat corridors are extended. In order to move towards a more resilient approach to future development and stormwater management a toolkit of techniques have been established based on location and type of development. Below is a list of runoff types and the ideal approach to capture, conveyance and treatment.

<u>Hardscape Runoff</u>

Stormwater runoff from vehicular and non-vehicular hardscape surfaces will be conveyed to water quality collection nodes; typically rain gardens, bioswales and roadside bioswales. Sized to handle the first inch of runoff these areas will promote infiltration and provide increased water quality and conveyance during larger storm events. Additionally, these softscape stormwater measures will convey stormwater flows to the closest blueway network for release to the downstream network. The future goal for this type of runoff is to provide interventions that would work in conjunction with the existing systems in place (i.e. providing curb cuts to bioswales to provide additional storage/water quality and promote infiltration but excess flows would still connect into existing infrastructure).

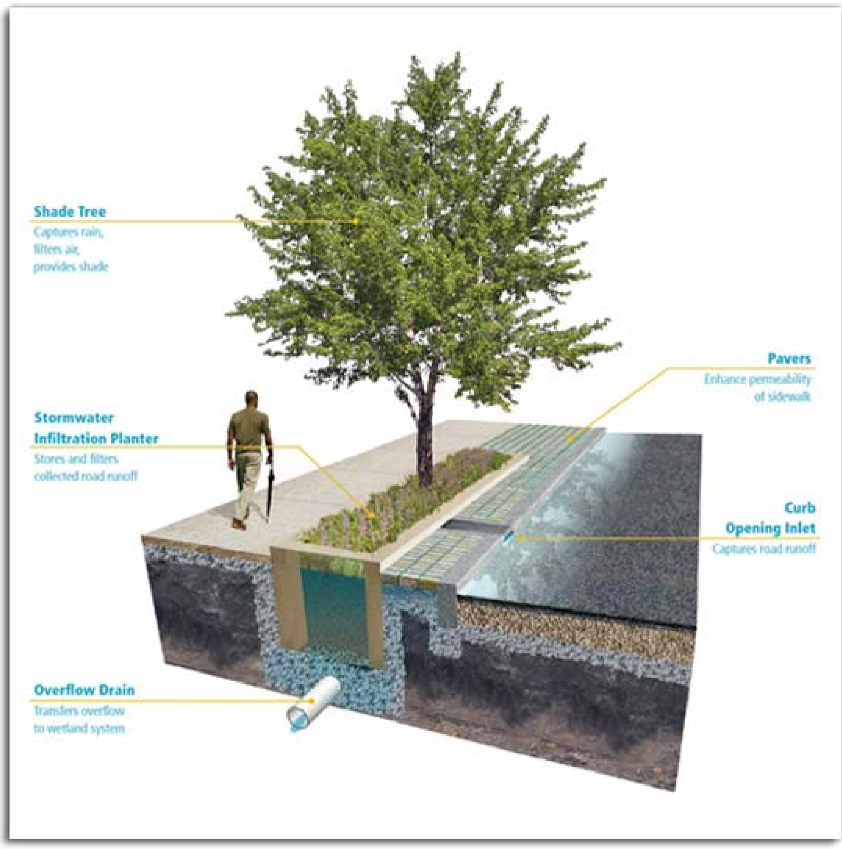


Figure 7 – Hardscape Runoff Opportunities

<u>Roof Runoff</u>

Stormwater runoff from existing and proposed buildings shall be disconnected, where feasible, from direct pipe connections and conveyed into strategic surface rain gardens and blended with site landscape elements. This will help to slow runoff, promote infiltration and improve water quality of the runoff. Where applicable, the opportunity of re-directing roof downspouts into at grade or below grade cisterns should be considered. By using stored stormwater runoff and improving a landscape with a more native plant palette could help to reduce or even eliminate the potable water demands for irrigation on a per building lot scale. This approach stretched across the entire campus could create a significant water footprint reduction.

Figure 8 – Roof Runoff Opportunities

Parking Lot Runoff

Parking areas used for event space and which are located within the floodplain shall be designed to handle flooding and reduce runoff by using a combination of grass pavers and permeable pavement. The type of final cover will depend upon the use, but switching away from conventional paved parking lots can have an important impact on water quality/quantity, aesthetic and downstream effects. The additional benefit to traditional pavement is reduction of heat island effect, maintenance and the opportunity to more easily dual use the space.

Figure 9 – Parking Runoff Opportunities

HMGP Projects

During the masterplan process the Baton Rouge area, including LSU's campus experienced a significant storm event which began on August 11th 2016. The event flooded many homes and roadways throughout the Baton Rouge area and caused millions of dollars in damages. The area was declared a Presidential major disaster area which thus enables FEMA to provide Hazard Mitigation Grant Funding (HMGP) toward projects that will help communities reduce or eliminate long term risk to people and property. From Sherwood's experience with this funding stream, we worked with the LSU staff and the master planning team to identify three (3) projects that could integrate into the Masterplan which could also help to benefit the communities north and south of the campus. Below is a list of the projects identified that build upon the masterplan work;

Project 1: West Side Improvements

The west side of the LSU campus is less populated by educational buildings/facilities and rather hosts campus outdoor sports activities, the Louisiana Animal Disease Laboratory, the LSU Agriculture Center and LSU golf course and sports fields. An existing canal carrying runoff from the campus property and neighborhood to the north splits the west campus in half and offers an opportunity to create floodable/dual functioning spaces that could create on and off-site benefits.

Strategies to be employed include excavating and berming in the selected areas and deepening and/or widening specific ponds on the golf course to increase storage for a predetermined amount of time before controlled release into the downstream Bayou Fountain. Also, upgrading the existing canal by removing current constrictions will provide for better conveyance efficiency during all storms.

Project 2: Corporation Canal Improvements

Project 2 consists of improvements to the Corporation Canal on the east side of campus as well as Campus Lake. In addition to providing improved stormwater management on campus, better management of the flow through Corporation Canal will benefit areas north and south of campus by diverting flow north of campus and storing water from campus so areas south can drain before receiving runoff from LSU.

Strategies to be employed include installing a lift station in Corporation Canal to remove heavy flows from the canal north of campus, widening the section of canal on campus to provide for greater storage, and deepening Campus Lake to provide for increased storage.

The lift station proposed would be located at the East Chimes Street bridge crossing and pump water across campus property for discharge directly into University Lake. On campus Corporation Canal and Campus Lake will be reconfigured to provide for increased storage for a predetermined amount of time before controlled release into the downstream Bayou Duplanier.

Project 3: University Lake Outfall Improvements

The improvements proposed during the University Lake Masterplan process made limited adjustments to flood storage within the lake and rather focused on connectivity and edge conditions. To build upon this thinking the opportunity to improve the lakes storage capacity was evaluated. By lowering the outfall weir elevation of University Lake the storage capacity will be greatly enhanced. Over an area of 284 acres, one additional inch of capacity will provide for approximately 7.5 million gallons of storage and thereby increasing pipe capacity upstream.

Figure 10 – LSU HMGP Project Locations

STORMWATER SOLUTIONS
KIT OF PARTS

SHERWOOD
DESIGN ENGINEERS

Content

Stormwater BMPs included:

- Roadside Bioswale
- Gravel Diaphragm
- Rain Garden
- Vegetated Swale
- Grass Pavers
- Permeable Pavement
- Floodplain Naturalization

STORMWATER BMPs

ROADSIDE BIOSWALE

Bioswales adjacent to roadways and parking lots capture and treat runoff, removing pollutants from the road surface including debris, silt, heavy metals and hydrocarbons.





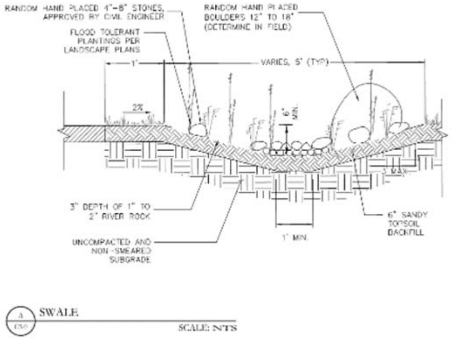

VEGETATED SWALE

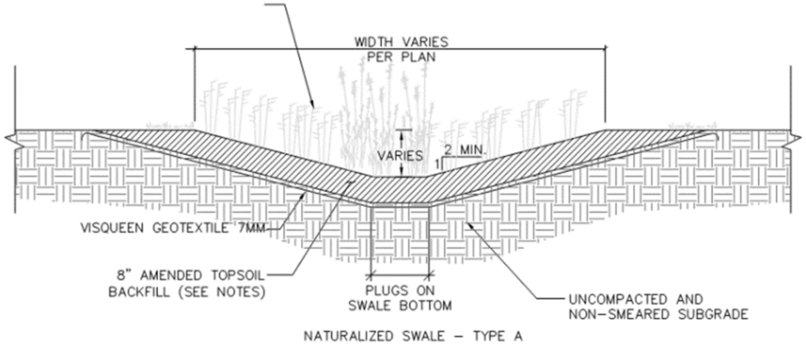
A vegetated swale is designed to capture and convey stormwater surface runoff downstream in place of typical pipe networks. Vegetated swales help to create a more functional landscape, promote infiltration and act as habitat and ecological corridors throughout the project site. The benefits of vegetated swales to typical pipe networks are improved aesthetic, decrease in construction cost, increase in water quality and decrease in water quantity / downstream erosion.





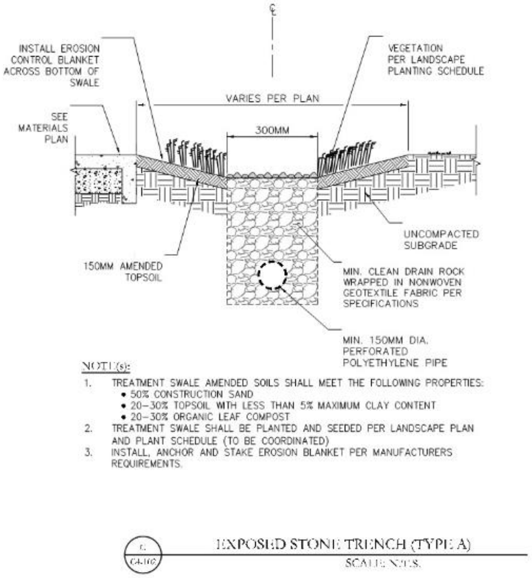


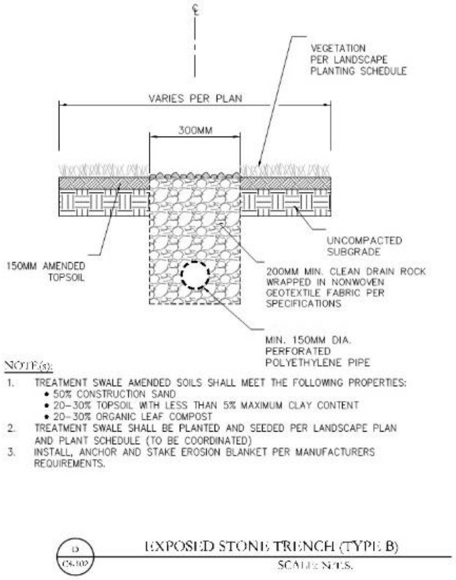




GRAVEL DIAPHRAGM

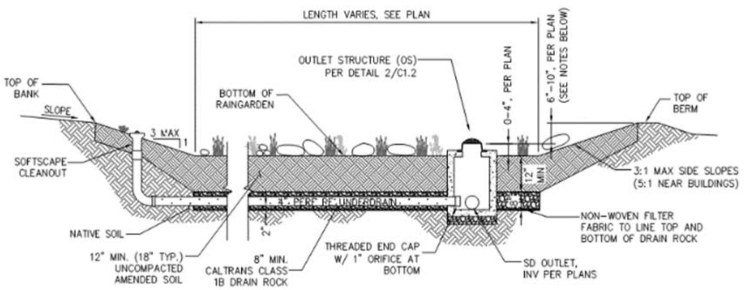
A gravel diaphragm is an exposed stone trench containing a perforated pipe, bordered by vegetation on either side. Stormwater is filtered through vegetated edges prior to reaching the exposed gravel diaphragm where runoff is forced to either infiltrate or collected and carried downstream via a perforated pipe. This practice helps to promote infiltration, slow flows and provide an improved aesthetic to typical curb and gutter.

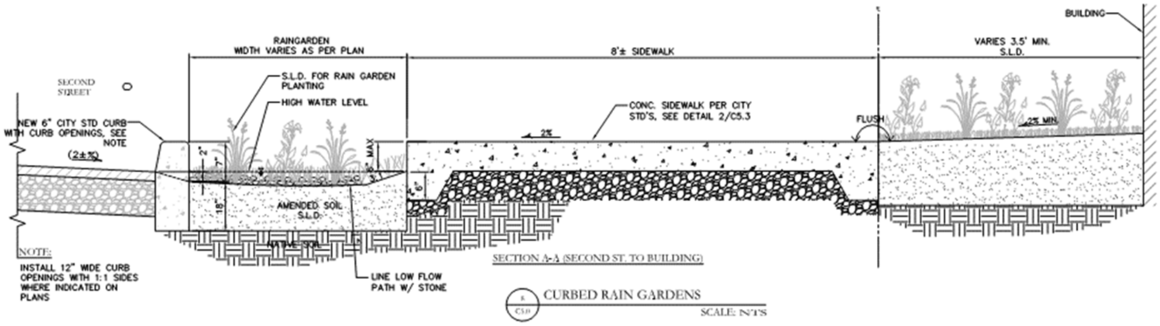




RAIN GARDENS

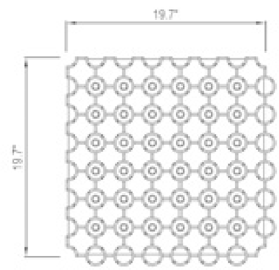
Rain gardens provide capacity to capture and treat stormwater. Rain gardens can be integrated next to sidewalks, buildings, and roadways, as well as within landscaped areas. Rain gardens improve water quality and can provide aesthetic and biophilic benefits.



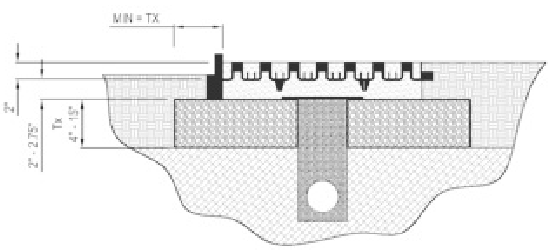


GRASS PAVERS

Grass pavers are an alternative to impermeable surfaces such as asphalt and concrete. Grass pavers provide support for vehicular circulation while allowing water to infiltrate through the surface, reducing runoff and flooding.



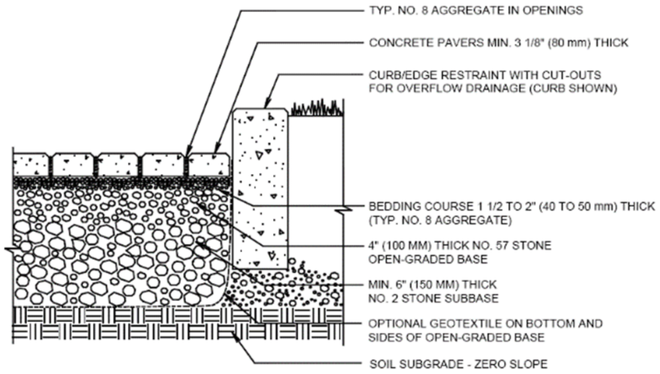
BODPAVE™ 85 : GRASSED SURFACE PAVING GRID



BODPAVE™ 85 : GRASSED SURFACE : TYPICAL CONSTRUCTION PROFILE

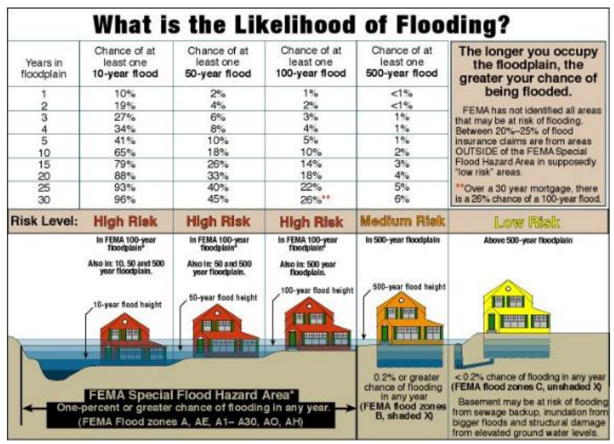
PERMEABLE PAVEMENT

Permeable pavement is an alternative to impermeable surfaces such as asphalt and concrete. Permeable pavement provides support for vehicular circulation while allowing water to infiltrate through the surface, reducing runoff and flooding.



FLOODPLAIN NATURALIZATION

Floodplains serve important functions of providing space for water when rains are heavy. Floodplains are typically low lying plains that either infiltrate water or hold water until it runs off. Naturalizing floodplains is a BMP strategy to optimize the performance of floodplains. Giving water the space it needs while protecting development from flooding is part of an approach to design with nature.



What is the Likelihood of Flooding?

Years in floodplain	Chance of at least one **10-year flood**	Chance of at least one **50-year flood**	Chance of at least one **100-year flood**	Chance of at least one **500-year flood**
1	10%	2%	1%	<1%
2	19%	4%	2%	<1%
3	27%	6%	3%	1%
4	34%	8%	4%	1%
5	41%	10%	5%	1%
10	65%	18%	10%	2%
15	79%	26%	14%	3%
20	88%	33%	18%	4%
25	93%	40%	22%	5%
30	96%	45%	26%**	6%

The longer you occupy the floodplain, the greater your chance of being flooded.

FEMA has not identified all areas that may be at risk of flooding. Between 20%–25% of flood insurance claims are from areas OUTSIDE of the FEMA Special Flood Hazard Area in supposedly "low risk" areas.

**Over a 30 year mortgage, there is a 26% chance of a 100-year flood.

Risk Level:	High Risk	High Risk	High Risk	Medium Risk	Low Risk
	In FEMA 100-year floodplain* Also in: 10, 50 and 500 year floodplain.	In FEMA 100-year floodplain* Also in: 50 and 500 year floodplain.	In FEMA 100-year floodplain* Also in: 500 year floodplain.	In 500-year floodplain	Above 500-year floodplain

ADDITIONAL INFO

Benefits of Stormwater BMPs

This Stormwater Kit of Parts provides information about various stormwater design elements as they apply to the LSU Master Plan.

There are many **benefits** of adding vegetation to a storm water system:

- **Planting slows down** the **water** and helps the soil stay healthy, the roots create better infiltration and treatment opportunities, and decomposing plant parts increase the organic matter in the soil.
- The **plants absorb water** - the larger the plant, the more water it transpires a day.
- The **foliage** picks up a lot of the rain and **delays or prevents rain from becoming runoff** on the ground.
- **Vegetation** also **picks up nutrients and pollutants** from the water.
- On top of all the technical benefits, vegetated stormwater solutions make the project more **aesthetically pleasing** compared with traditional mechanisms for treatment and quantity reduction.