Introduction

On average about 50% of the rain and snow on Long Island infiltrates the ground and becomes groundwater. The other 50% is lost to the atmosphere by evaporation and transpiration by plants. During the summer more precipitation is lost to evaporation and transpiration, and during the winter more water infiltrates the ground because less water is lost to evaporation and transpiration.

In developed areas, such as the campus at Stony Brook University, a large part of the ground is covered by impervious surfaces. Impervious surfaces are structures through which water cannot infiltrate. Types of impervious structures that can be found on campus include sidewalks, streets, parking lots and buildings. Large areas covered with impervious surfaces are more susceptible to flooding because of decreased infiltration and increased surface water runoff.

To prevent flooding in developed areas, engineers design storm water runoff systems so that water will not collect on the surface and cause flooding. When designing a storm water runoff system engineers must consider that topography plays a major role in runoff. Gravity is the driving force. Water move from areas of high elevation to areas of low elevation. Engineers use the landscape to collect runoff and transport it to recharge basins.

The campus has an intricate network of open bottom catch basins that drain surface water runoff directly into the ground, or overflow into the storm water drainage system that ends at recharge basins. There are several different drainage systems and recharge basins on campus.

The two largest storm water drainage systems collect water from the East and West sides of the campus. The East side also includes most of the runoff from the Health Sciences and University Hospital area. The topography of the campus separates the two storm water drainage systems.

This walk will follow the path of rainwater on campus as it falls on impervious surfaces, enters catch basins, passes through the storm water drainage system and enters a recharge basin. We will see how the landscape guides the water to the catch basins and how gravity is the driving force for the entire storm water drainage system.

1) Divide Between the East and West Drainage System

This is the Western most catch basin that enters the East storm water drainage system. Locate yourself on the map in Figure 1. Notice where the divide between the east and the west drainage system is. What is the elevation doing as you walk toward the east from were you are standing?

The water collected here moves through an underground tunnel of catch basins connected to pipes that finally end up in the recharge basin. Gravity is the only force driving the water through the drainage system and into the recharge basin. Is the elevation of the catch basins increasing or decreasing, as we get closer to the recharge basin?

Standing water recharge basin

Catch Basin

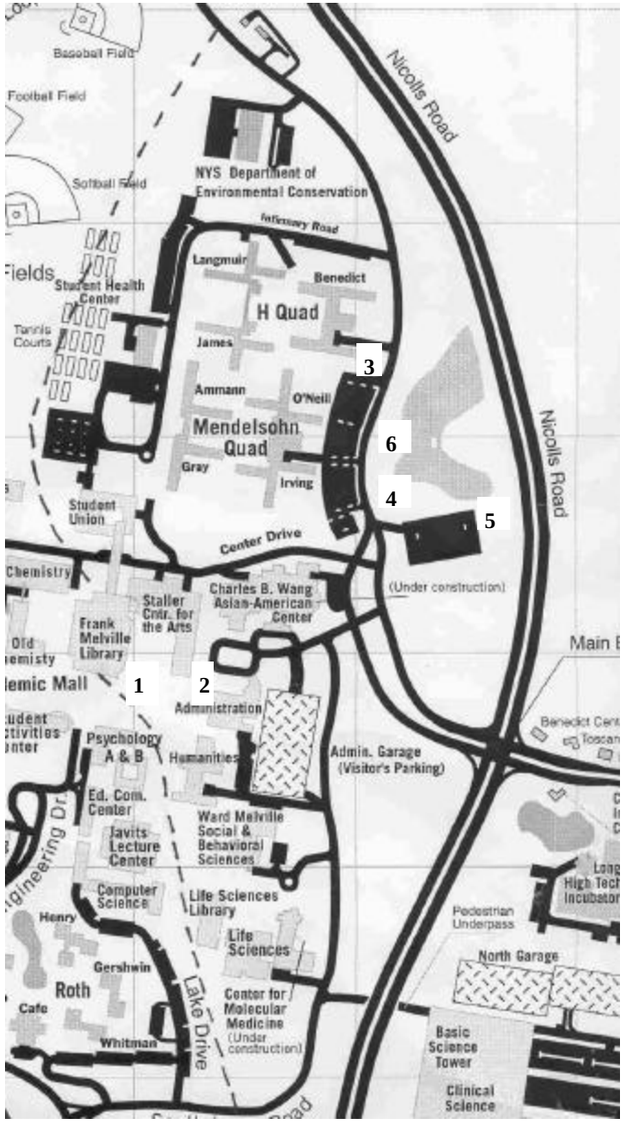

Fig. 1
The dashed line indicates the divide between the east and west drainage systems.
The numbers indicate the stops we will be making.

Science Walk
Hydrology of the East Campus
Written by
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April 12, 2003

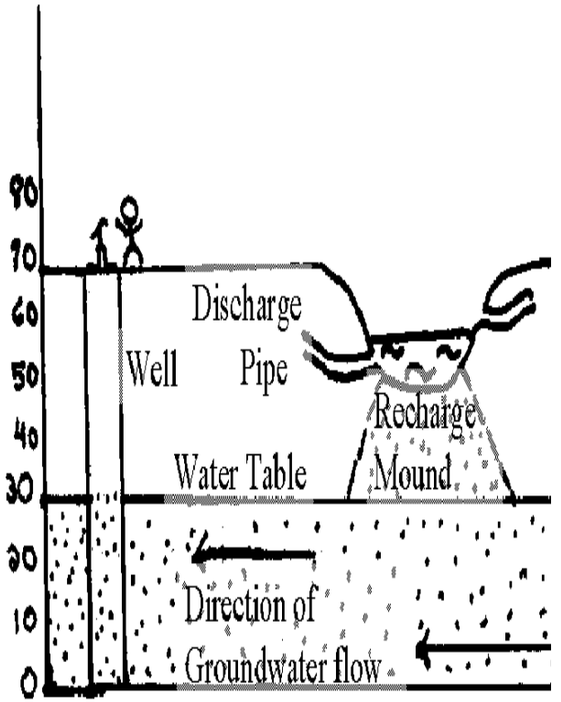

Fig. 2 The flow of water through the recharge basin.

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2) Storm Water System

These manholes and catch basins are connected to a complex storm water system, which drains the Eastern side of the main campus. The water in this system is driven by gravity, so the water must be flowing through the catch basins and pipes down slope to the recharge basin.

Anything that is applied to the grassy areas or the sidewalk can infiltrate the ground and be transported into the water table. The water table is the surface below which all the pore space of sediments is saturated with water. On Long Island, the water that is pumped from the ground is used for our drinking water. Fertilizers and animal waste is high in nitrogen. Drinking water with a high concentration of a form of nitrogen, called nitrate, can cause young babies to suffocate because there is an insufficient transport of oxygen from the lungs to the rest of the body. This is known as the "blue baby syndrome."

Pollutants such as pesticides and chemical leaks contain carcinogens. Carcinogens cause cancer if high enough concentrations of these chemicals occur in drinking water. During snow and ice storms Stony Brook University spreads salt onto the streets and sidewalks to prevent accidents. The salt can also enter the groundwater, but it is not yet known if this is affecting the concentrations of sodium in our drinking water.

The water transported in the storm water drainage system empties into a recharge basin and eventually ends up in the groundwater. Figure 2 on the front cover shows the flow of water leaving the recharge basin. Would you expect pollutants in the storm water drainage system to end up in the groundwater? What happens to toxic substances such as motor oil or antifreeze when they are dumped into or are transported by water to a catch basin?

3) Planning the Location of Catch Basins and Manholes

The purpose of designing a storm water drainage system is to ensure that an area that has been developed does not flood during a storm event. Engineers must consider the landscape of an area and design a system that is both efficient and effective. We are standing at a catch basin at the bottom of a hill. Locate yourself on the map labeled figure 3. If you drive North on this stretch of roadway you will not come across another catch basin until you reach the sports fields, approximately ¾ miles away. Surprisingly there is not a problem with flooding along this road. That is because the slope of the roadway

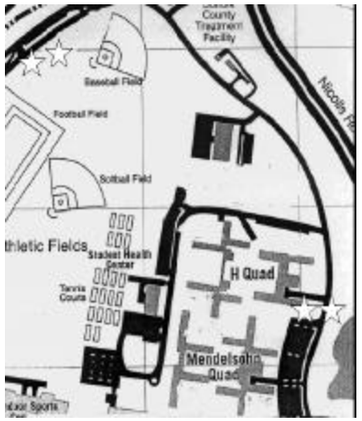


Fig. 3 Stars locate catch basins.

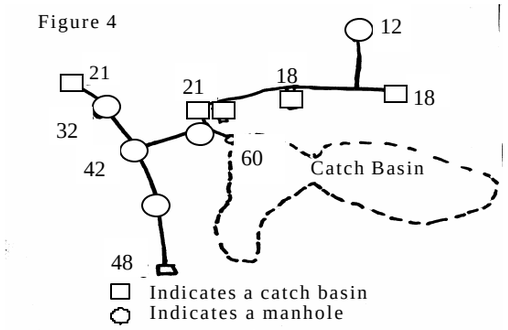
guides the water down to the catch basins below. The crown shape of the road keeps the water flowing on the sides next to the sidewalk in order to concentrate the flow of water away from the middle of the road. It is unnecessary to run a series of catch basins and pipes along the entire roadway because the topography of the area guides the water almost entirely to the recharge basin.

Look down into the catch basin and observe what is inside. If the catch basin is full of leaves and fine sediment, will the water infiltrate the ground or will most of it end up in the recharge basin?

4) Drainage From The Main Campus

The water from the storm water drainage system on the East side of the main campus drains into the recharge basin here. Look at the map below. The numbers next to the catch basins and manholes are the size of the pipes. Why are the pipes getting larger as they get closer to the catch basin? Is the pipe leading into the recharge basin going to be at the highest or lowest elevation or in the system. Why?

Figure 4



5) Drainage From The University Hospital

This pipe drains water from the grounds of the Health Science Center and the University Hospital on the East side of Nichols Road. The storm water drainage systems at Stony Brook University also carries leaking water from the heating and cooling systems. Water is constantly being added to the recharge basin.

Storm water runoff is carried the same way as it is carried on the main campus through a series of catch basins and pipes. At the University Hospital, the storm water runs through the catch basins and pipes to a small standing water recharge basin on the East side of Nichols Road. When the small recharge basin fills, the water runs through a pipe under Nichols road and into this recharge basin. Would you expect the elevation of the small recharge basin to be higher or lower than the elevation of the large recharge basin?

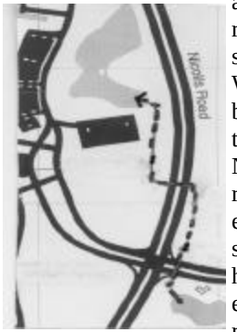


Figure 5
The dashed line shows the path of the drainage system under Nicolls Road

6) **The Standing Water Recharge Basin**

The storm water drainage system from the East part of the main campus and from the Health Science Center and University Hospital empties into this standing water recharge basin. The east side of the campus at Stony Brook University is a watershed for this recharge basin in that most of land area contributes to an artificial stream system that empties into this basin. Recharge basins were initially designed with the sole purpose of removing water from impervious surfaces to prevent flooding. It is now known that recharge basins play an important role in allowing more precipitation to enter the water table.

The majority of the water enters the basin from two pipes on the south side of the concrete dam. There is only one small pipe under the water on the North side coming from one catch basin near Nichols Road. Which way would you expect the water to flow over the small dam?

This is a standing water recharge basin because it always holds water. The fine sediment and organic material on the bottom of the basin do not allow the water to infiltrate the ground quickly. The water seeps into the ground slowly and eventually reaches the water table. Water from this basin may become someone's drinking water. Figure 6 is a contour map showing the elevation above sea level of the water table on Long Island. Locate us on the map. Groundwater like surface water flows down gradient. In which direction would you expect groundwater from this recharge basin to flow?

Many recharge basins are dry recharge basins. A dry recharge basin does not hold water, the water is able to infiltrate into the ground very quickly. What type of sediment would you expect on the bottom of a dry recharge basin?

Drinking water from a standing water recharge basin may be cleaner than drinking water from a dry recharge basin. Studies have shown that standing water recharge basins are effective in removing nitrates from water. The biological activity that occurs in this basin may be responsible for converting some of the nitrate in the water to other forms of nitrogen such as nitrogen gas or ammonium. Water that enters the groundwater from the recharge basin has a lower nitrate concentration than the water that enters the standing water recharge basin. Most engineers prefer dry recharge basins that have rapid infiltration to prevent flooding. Should we more recharge basins have standing water?

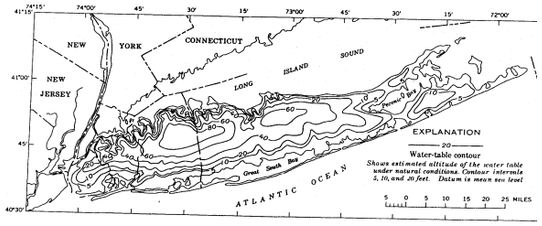


Fig. 6 Contours on Long Island's water table.