

Monitoring Presque Isle Bay: Design and Construction of a Sediment Collection Device

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Polluted runoff, typically consisting of bacteria, nutrients, sediment, toxin, and debris, is one of the main water quality problems in the United States. Pennsylvania (PA) Sea Grant is interested in capturing suspended sediment from streams or other tributaries during storm events to assess the level of nutrients and toxins entering Presque Isle Bay. Freshman engineering students in the fall of 2010 at Gannon University, recipients of a scholarship funded by a National Science Foundation S-STEM award, partnered with PA Sea Grant to design and build a sediment collection device that would monitor Cascade Creek which flows into Presque Isle Bay. The students underwent a two-year design sequence (2010-2012). The first year of the project consisted of researching different environmental studies on sediment collection and different types of collection techniques with minimal focus on design. The freshman class with the help of the senior class mentors completed the research necessary to start designing in the fall of 2011. The second year of the project consisted of designing, building, and testing two prototypes. The two prototypes both accomplished the goals in testing. Since only funds for one device were available, both designs were combined to create a more efficient and effective device. The spring of 2012 consisted of the building stage. After the design was finalized, research into necessary, environmentally friendly materials was completed, which were then purchased. The sediment collection device was then slowly built over the course of the rest of the semester by the sophomore class. The deployment of the device was postponed until the fall of 2012, in order to not interfere with the heavy fishing of the area in the late spring and summer.

The device consists of a galvanized steel frame with a lockable, hinged lid, and two removable Lexan boxes located inside of the frame. The frame contains ledges on the side, in order to apply weights to anchor the frame in place. The inside of the frame also contains pieces of angle iron to hold the boxes in place. The base of the frame is 2.5 feet wide by 4 feet long, while the height is 13 inches. Concrete blocks are attached to ledges in order to anchor the device to the streambed. The boxes are 12 inches tall, 12 inches wide, and 18 inches long and can be opened through the use of lockable, hinged lids. The first box has an 8 inch by 5 inch opening at the entrance and exit, while the second box has only an 8 inch by 5 inch opening at the entrance. The first box contains four removable steel baffles, while the second box contains only three baffles, but also a three inch PVC elbow joint at the exit. The purpose of the baffles is to slow the water down, allowing sediment to collect at the bottom of the boxes for removal. Different grades of screens were placed at the openings of each box, the exit of the first box and the entrance to the elbow joint. A screen with large pore openings was placed in the entrance of the first box to filter out large debris, which could have potentially damaged the device. The exit to the first box and the entrance of the second box used the same sized screen, which was of a finer pore size than that of the first screen to filter additional sediment. The screen on the elbow joint was the finest screen used, in order to ensure that all of the sediment collected remained in the device while only the water exited.

Pennsylvania Sea Grant will use the sediment collection device to monitor the water quality of the streams and creeks that flow into Presque Isle Bay. The device was placed in Cascade Creek on Friday, September 28, 2012. The sediment collection device has since been removed after a short trial run, which showed promising results for the future. At this time, the device is not currently deployed due to the weather and access to Cascade Creek, but will be redeployed. This poster will provide details of the design, characteristics, and construction of the sediment collection device.