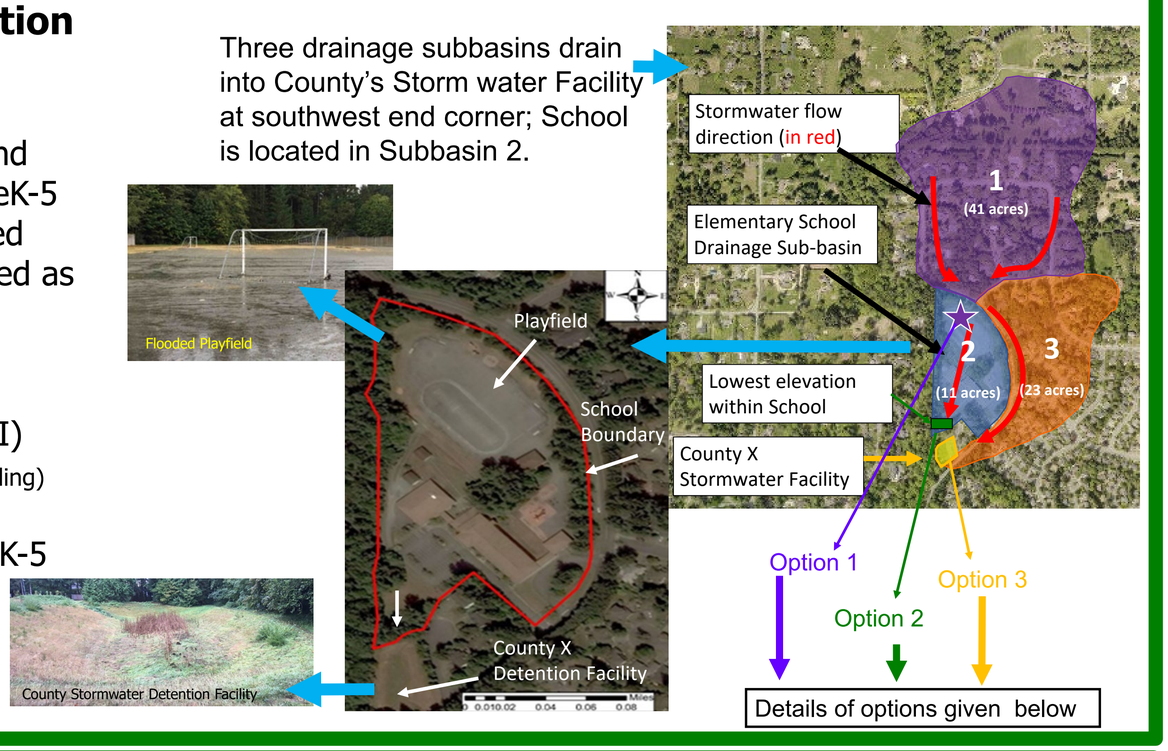
Introducing Engineering to Elementary School Students through Flood Mitigation in School Property

Background and Site Information

County X identified an opportunity to modernize stormwater infrastructure, address periodic flooding complaints, and strengthen community relations at a PreK-5 elementary school. The county partnered with our university, and this was assigned as a civil engineering capstone project.
The county requested that solutions incorporate,

- Green stormwater infrastructure (GSI) techniques (ie. natural systems to control flooding)
- Educational opportunities that would introduce science/engineering to PreK-5 students.
- Building good-will with surrounding community



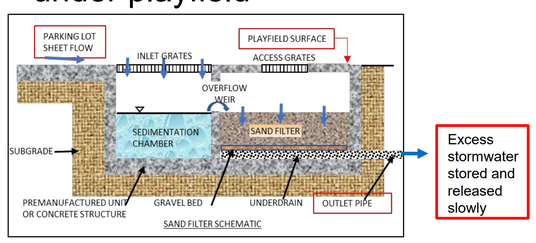
Faculty, Licensed Engineers and Allied Professional Collaboration

- A faculty member served as advisor to the team and another taught the capstone course (both PEs).
- Two PEs from County X guided the team to successful completion of project.
- Team presented project to the department advisory board (all PEs), county stormwater professionals (several PEs) and a local engineering society (several PEs).
- Individual from County X with K-12 education background served as link between school, county and team.
- Science teacher from school assisted the team in developing learning modules.
- Facilities Management personnel at school reviewed the design plans periodically.

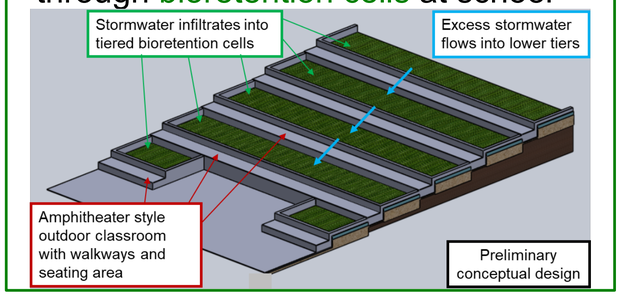
Design Approach

1. Developed three options to 10% design

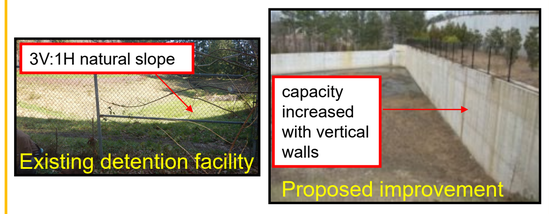
★ Option 1: Divert Subbasin 1 stormwater to sand filter/wet vault under playfield



Option 2: Treat Subbasin 2 stormwater through bioretention cells at school



Option 3: Increase county stormwater facility capacity to handle flows from Subbasins 1-3



2. Developed decision matrix, selected preferred option with county input[1]

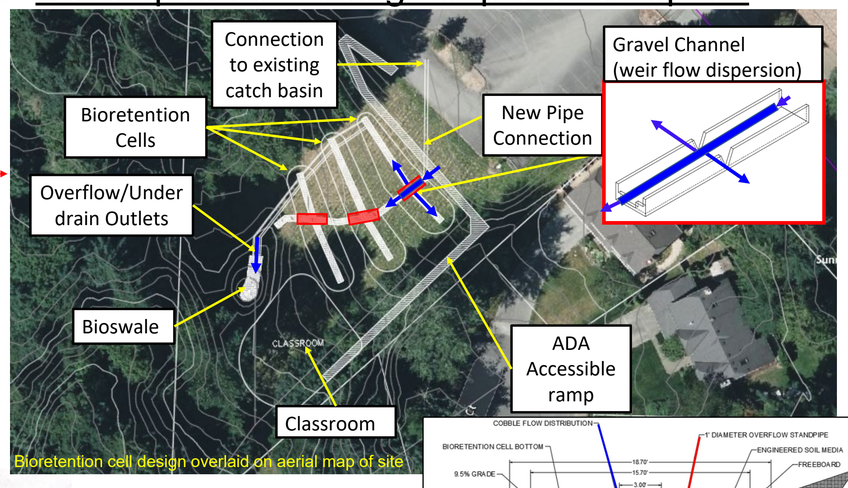
(3 = most desirable; 1 = least desirable)

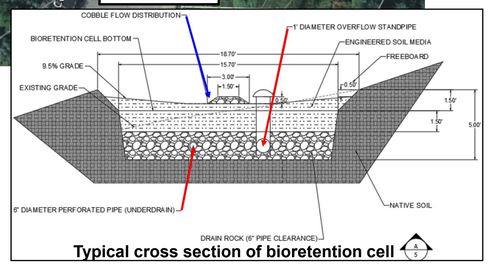
	Stormwater Mitigation[2]	Environmental Impact[3]	Environmental Benefit[4]	Cost[5]	Educational Benefit[6]
Option 1	3	1	3	1	2
Option 2	1	2	2	2	3
Option 3	2	3	1	3	1

Preferred option

[1] in decision matrix all three options sum to 10; the team and county had an in-depth discussion on qualitative benefits of each option in selecting the preferred alternative
[2] flow rate reduction (through hydraulic modeling)
[3] environmental lifecycle assessment for climate change and eutrophication impacts
[4] copper, zinc and total suspended solid removal
[5] sum of capital cost and operation & maintenance
[6] educational opportunities for PreK-5 students

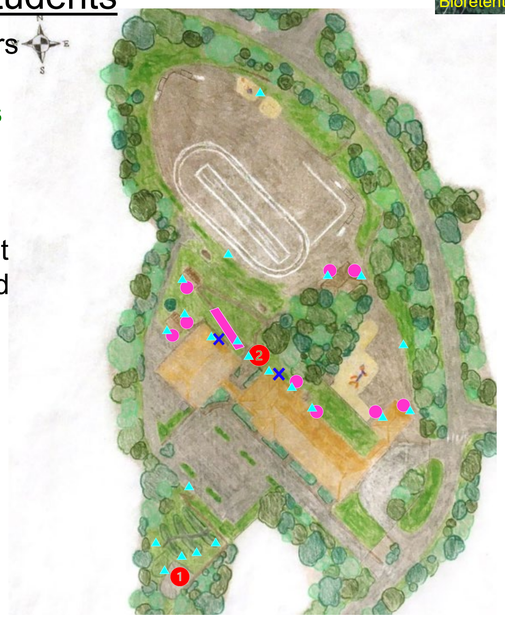
3. Developed 30% design of preferred option

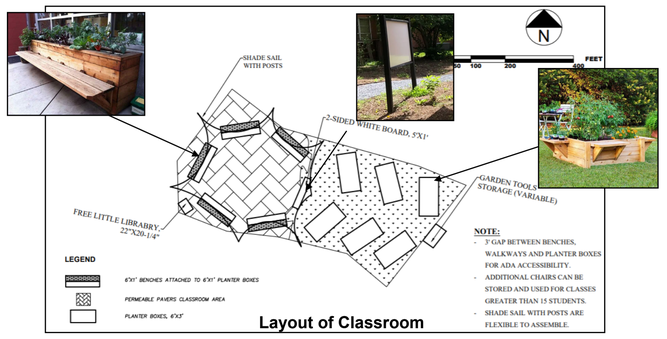




4. Developed hands-on educational activities for PreK-5 students

- Sample stormwater as it enters and leaves bioretention cells
  - Learn water quality issues
- Collect stormwater in cisterns
  - Learn water reuse
  - Measure rainfall
- Plant different drought tolerant plants in bioretention cells and planters
  - Learn plant ecology and environment





Preliminary cost estimate $940,000

Health, Safety & Welfare Issues

- Safety and welfare of PreK-5 students was of paramount importance
  - Heights of bioretention cells and retaining walls that are safe
  - ADA compliant ramp provides universal access
  - Construction during summer when students not present
- Students benefit learning about ecology and environment early in life

Knowledge and Skills Gained

Technical

- Used a wide array of design manuals, guidelines and relevant literature
- Extensive use hydraulic modeling software and AutoCAD for engineering drawings
- Used Geographic Information system (GIS) extensively
- Engineering outreach to PreK-5 students

Communication

- Written – proposal, final report, surveys to collect data from stakeholders
- Oral – presentations to peers, faculty, county personnel, local practitioners
- Worked efficiently in remote work environment
- Interacted with broad range of stakeholders

Project Management

- Teamwork, scheduling, time management, running meeting, community outreach