

CVEN 489/689  
“SUSTAINABLE SYSTEMS IN CIVIL ENGINEERING”

**Exercise 1: Natural Capital and Stormwater Engineering**

The point of this exercise is to demonstrate quantitatively the value of preserving natural capital in an engineered project using the example of stormwater effects of land development. You have read in McCuen’s article several concepts of how hydrology can influence what McCuen calls “smart growth.” Although he does not explicitly say so, McCuen’s concepts are various aspects of preserving the natural capital of the hydrologic cycle that yields the natural resources of flood control and water quality. Traditional land development practices often liquidate this natural capital (loss of infiltration capacity, shortened flow paths, etc.) for conversion to short-term economic profit. Of course, traditional stormwater engineering is focused on then building manmade capital that attempts to re-create the lost benefits.

You will be given a map for a typical undisturbed parcel of land to be developed. The map includes information on topography, soils, vegetation, and a grid for calculating lengths and areas. With your group you will draft 2 development plans. The first plan will be a “traditional” one that is focused on short-term (i.e., 1 to 5 years) profitability, ease of building, conformity with traditional patterns, and full use of the parcel’s area. The second plan will focus on preservation of natural hydrologic capital and a corresponding minimization of manmade capital necessary to regain lost flood control and water quality benefits. Both plans must include the same quantity of marketable real estate units (i.e., house sites, apartments, or retail square footage). For guidance on issues such as parking space requirements, setback requirements, etc., refer to the Bryan/College Station Unified Development Ordinance Article 7 ([http://www.cstx.gov/docs/161372842006article\\_7.pdf](http://www.cstx.gov/docs/161372842006article_7.pdf)).

*Your tasks:*

- Form 6 groups.
- Groups 1 & 2: Draft development plans for single-family housing on separate lots. Include 35 house lots in your plan along with necessary streets, utility easements, drainage structures, and detention structures.
- Groups 3 & 4: Draft development plans for multi-family (apartment) housing. Include 80 units in your plan along with necessary streets, parking areas, utility easements, drainage structures, and detention structures.
- Groups 5 & 6: Draft development plans for retail development. Include 100,000 ft<sup>2</sup> of retail space in your plan along with necessary streets, parking areas, loading areas, utility easements, drainage structures, and detention structures.
- All Groups: Discuss the costs and benefits of preserving natural capital in your land development plans. How are these costs and benefits affected by the time-horizon for analysis? How are they affected by the perspective of who quantifies them (i.e., how are they different for the developer versus the owner versus the tenant versus the neighbors versus the local government, etc.)? Does it make sense for engineers to consider natural capital in design? ... to encourage it? ... to be required to preserve it?