CLASIC

CASE STUDY

Community Life-Cycle Analysis for Stormwater Infrastructure Costs

Downtown Dubuque
Iowa

CLASIC Case Studies showcase the variety of ways that the online tool can assist communities with stormwater project planning and decision-making.

CASE STUDY HIGHLIGHTS

- Lowest cost options for a municipality that may be cash-strapped
- Rain gardens and permeable pavement are technologies that fit into a highly developed urban landscape
- Small, dispersed stormwater infrastructure can be effective to combat hydrologic and water quality impacts of predicted climate change

Background and Project Purpose

Dubuque is Iowa's oldest city and is among the oldest settlements west of the Mississippi River.

The Challenge

Dubuque, Iowa has suffered at least six severe flooding events since 1999. The Bee Branch Watershed includes the city's most developed areas where over 50% of Dubuque residents either live or work. In 2001, the drainage basin master plan found that 1,155 homes and businesses in the Bee Branch Watershed were especially vulnerable to severe flooding.

The developed downtown core does not offer large amounts of open space to implement detention basins or other typical stormwater solutions. What are the effective stormwater management technologies that will fit the downtown area and provide protection against predicted increases in rain events over the next 20 to 30 years.

KEY INPUTS

Climate

Changes were made to the climate baseline to reflect predicted climate changes. Also see Appendix A.

- **Precipitation**: Average 11% increase.
  - » 13-17% increase in February, March, May
  - » 12-14% reduction in July-September
  - » 33% increase in December
- **Evaporation**: Change varies
  - » 27% and 24% reduction in January and February, respectively
  - » 10% increase monthly from March – August
  - » 5% decrease in September
  - » 22% and 26% increase in October and November, respectively

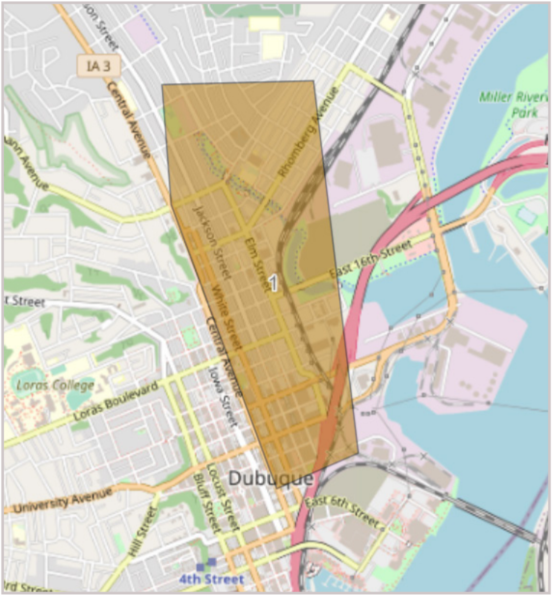


Figure 1 Downtown Dubuque study area

On average, the increase in runoff from estimated climate change is 1.5%; infiltration increases 1.6%.

Scenarios

Baseline

- Includes the climate change inputs, and no change in the current stormwater infrastructure.

Scenario 1 Technologies

- Medium Rain Gardens (1,000 ft^2) that capture 10% of the runoff from impervious surfaces. Fifty-six are simulated in the study area, catching 1 inch of rainwater each.
- Large infiltration trenches (2,000 ft^2) are simulated, catching 1 inch of rainwater and 10% of the runoff from impervious surfaces.

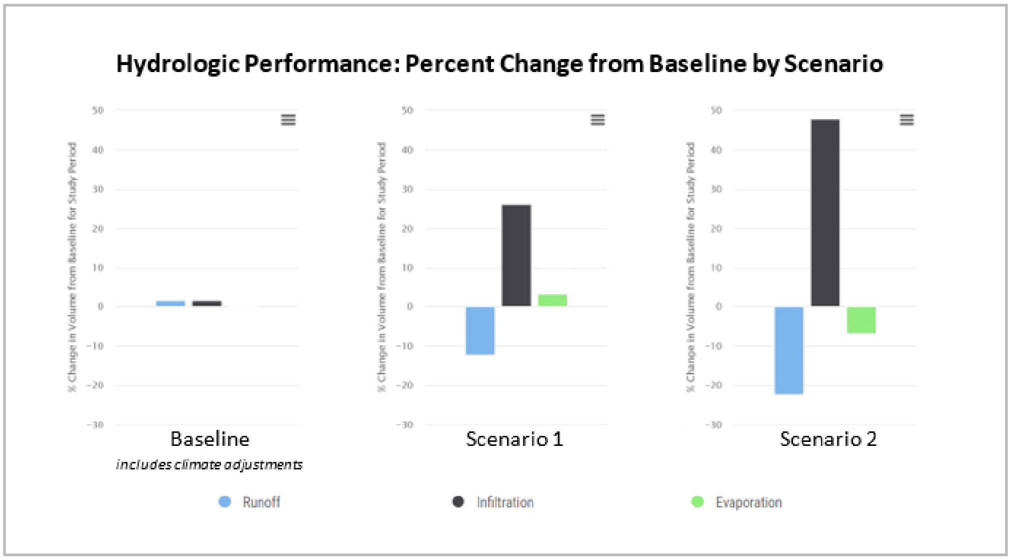
Scenario 2 Technologies

- Medium Rain Gardens (1,000 ft^2) that capture 10% of the runoff from impervious surfaces. Fifty-six are simulated in the study area, catching 1 inch of rainwater each.
- Large infiltration trenches (2,000 ft^2) are simulated, catching 1 inch of rainwater and 10% of the runoff from impervious surfaces.
- Permeable Pavement that captures 10% of runoff from impervious surface and has storage depth of 8 inches. Run-on ratio of 0:1.

CLASIC OUTPUTS

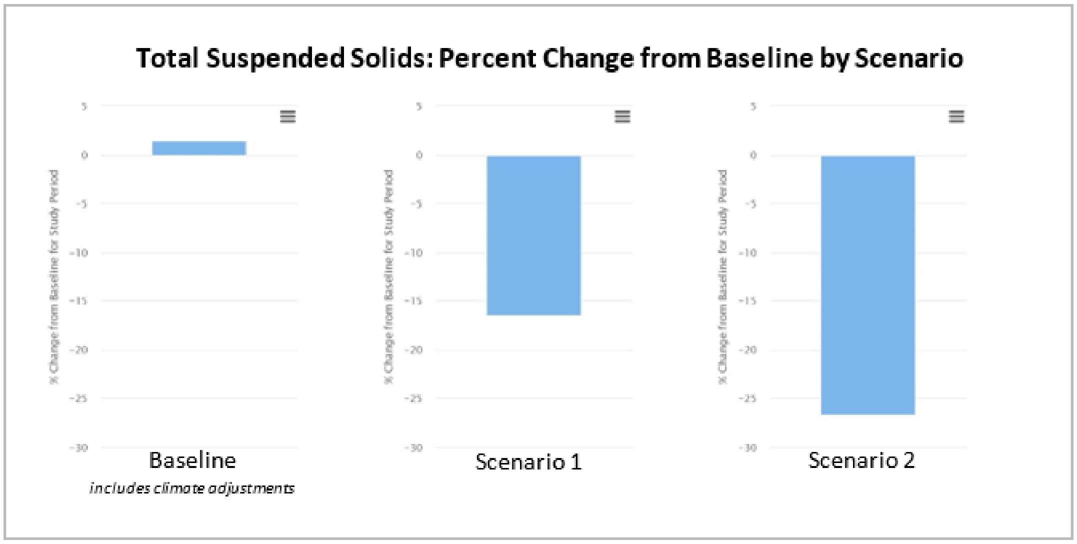
Hydrology

The Baseline Scenario shows slight increases in the runoff and infiltration due to climate change inputs. Scenario 1 reduces runoff 12.2%, increases infiltration 26.2% and increases evaporation by 3.3%. Scenario 2 predicts even greater hydrology results – 22.3% runoff reduction, 47.8% infiltration increase and 6.7% evaporation increase.



Water Quality

The Baseline Scenario with the climate change inputs increases total suspended solids (TSS) load by 1.5%. Scenario 1 reduces TSS by 16.5%. Scenario 2 reduces TSS by 26.6%.



Costs

Baseline

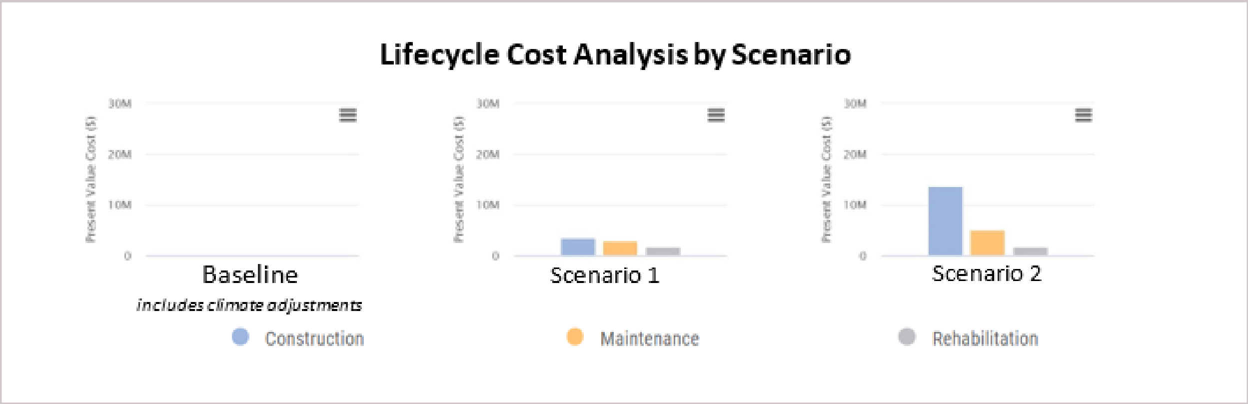
- No costs incurred

Scenario 1

- Capital costs: $3,580,360
- Main: $2,859,864
- Rehabilitation: $1,764,616

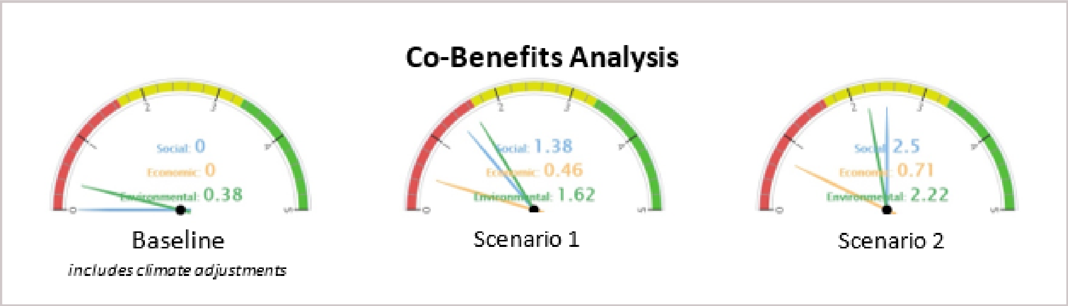
Scenario 2

- Capital costs: $13,806,405
- Main: $5,121,879
- Rehabilitation: $1,764,616



CO-BENEFITS

Social co-benefits increase likely comes from an increase in vegetation from rain gardens that is shown to be beneficial for mental health. Environmental co-benefits increase also likely due to the increase in vegetation that holds and filters stormwater so that the runoff does not collect pollutants. Economic co-benefits are low, which, as a general trend, happens when costs are low. There is a basic tradeoff between spending and co-benefits.



This case study is based on a hypothetical project in a real-world location. The project and results do not represent any actual construction or spending in the city listed.

Appendix A

	Precipitation	Runoff
Baseline – No Climate Change	6,672,091,154 cf	3,956,545,850 cf
Baseline – Medium Climate Change	6,768,187,410 cf	4,016,236,974 cf
SWM – No Pavers	6,768,187,410 cf	3,473,521,041 cf
SWM – With Pavers	6,768,187,410 cf	3,072,666,896 cf

Appendix B

Process for getting raw precipitation and runoff totals:

1. Run scenarios.
2. On the Run Scenarios page, download the data from the left-hand panel.
3. Open the file, click Extract All, and save to an appropriate location.
4. Go to www.jsonformatter.org, click Upload Data, and upload the "response.json" file. Only the final file "response.json" is needed.
5. Scroll past all of the data for individual years. Towards the bottom, there is an overall "total" that is in green lettering. Copy and paste this data into a Word document. Likely the "totalPrecip" and "runoff" numbers will be most useful.