When Does Green Infrastructure Make Sense?
Comparing Conventional Systems and Green Infrastructure

Deciding whether, or where, to incorporate green infrastructure best management practices (BMPs) into a project plan can be informed by a comparison of the costs and values associated with these practices with those of more conventional piped systems. Whether you are contemplating including BMPs in a municipal or public works project or in a private development project, the following "value engineering" strategy may be useful in evaluating your options.

Value engineering

"Value engineering" is widely used in design and engineering projects to evaluate the relative benefits and costs of project components and to suggest where substitutions might be made that provide more value for less cost. Value can incorporate functional attributes, aesthetic attributes, or other elements that are perceived to be significant in achieving the overall goals of the project. This is not simply an exercise to identify the least expensive option. Rather, it is a framework for making decisions that incorporates value and benefits into the equation. In some cases, this analysis can help justify a higher-cost option if the value provided (including those that are not easily measured in terms of dollars) is significantly greater than other options.

The approach involves:

- Identifying elements of value or benefit, against which project components can be measured and compared. These may include the ability to convey design flows, the amount of land area required, the potential to reduce runoff, the amount of habitat created, or opportunities for adding recreational facilities.
- Developing a schematic of the project using a conventional storm drainage system, and estimating the value or benefit provided, along with capital and life cycle costs for each element.
- Developing an alternative schematic using green infrastructure practices, and estimating value and costs of each component.
- Comparing the two approaches, component by component, to identify which provides the best value.

Application of this approach can help decision makers "optimize" their storm drainage system to provide the most value for the dollars invested. Elements of the approach are discussed in more detail below.

Identifying components of value: "What is my project worth?"

Traditionally, design and engineering practice has focused on comparing the capital construction costs of alternative systems – for example, the costs of a shingle versus a green or eco-roof. In recent years, however, practice has moved beyond this relatively simplistic approach to examine not only initial construction but also life cycle costs. Life cycle costs are those associated with operations and maintenance, as well as capital repair or replacement. A system that costs less to construct may require more maintenance or need to be repaired or replaced more frequently than a system that is slightly more expensive to install. Looking at the total picture helps decision makers identify the approach that will be most beneficial in the long run.

When comparing green infrastructure to more conventional storm drainage approaches, a first task is to define the components of value that will be used in the comparison. These components (or factors) will vary based on the specific context and objectives of the project. Relevant variables may be identified by an examination of the following factors:

- Land area requirements for flood storage and water quality treatment – conventional systems may or may not require less land area, depending on whether a detention area is necessary.
- Allowable (or desired) runoff volume – many green infrastructure alternatives increase on-site infiltration, retention, or detention of stormwater and are likely to show a significant reduction in off-site runoff.
- On-site water use requirements - the "harvesting" of rainwater may reduce demands on potable water supplies for landscape irrigation and provide cost savings
- Groundwater recharge needs – practices that increase the amount of rainwater infiltrated on-site and those that direct runoff to groundwater recharge areas can replenish local water supplies
- Landscape amenity opportunities – practices such as rain gardens and bioinfiltration parking medians can provide amenities by enhancing the appearance (and potentially the property value) of the site
- Habitat created – rain gardens and natural areas can be designed to create habitat for birds, butterflies and mammals; on larger projects opportunities may exist to restore connectivity within the larger ecosystem
- Recreation opportunities – with larger projects in particular, green infrastructure projects can provide passive or active recreation opportunities

Estimate the value and cost of your project using only conventional storm drainage approaches

Once elements of value have been identified, a second step is to develop a schematic of your project using conventional storm drainage systems. This does not need to be a detailed design, but should be developed to a level where gross construction costs can be estimated for each element, such as inlets, piping, catch basins, appurtenances, curbs and gutters,.

Once these costs have been developed, a related task is to estimate operations and maintenance costs, which might include cleaning inlets and catch basins or flushing pipes, as well as capital repair and replacement costs. Don't forget to consider the frequency with which these operations will be required.

Finally, evaluate your project against each of the value indicators. In some cases you may be able to quantify its performance (as in land acres used or volume of runoff), and in other cases the evaluation may be more qualitative; for example, you might consider whether the element contributes a low or high level of landscape amenity.

Estimate the value and cost of your project with the inclusion of green infrastructure practices

Having considered a conventional approach, the next task is to develop the project substituting green infrastructure elements for conventional features. It is likely that you will not be able to fully substitute elements, but there may be other options to consider. Some examples to think about might include:

For streetscape and roadway projects:

- If there is room for a tree lawn, consider adding tree boxes or infiltration gardens to capture street runoff. This may allow you to use less pipe, or smaller size pipes. Good examples of this type of practice are found in the Seattle and Portland case studies.
- Design medians as infiltration areas.
- Use porous pavement for parking lanes.

For commercial areas with significant parking:

- Drain roofs to grass buffers in gardens, planters, or parking islands and medians.
- Use porous pavement in low-traffic areas, such as portions of parking lots and emergency or service access drives.
- Sheet drain parking to grass buffers and vegetated swales.
- Design parking and landscape areas to also accommodate flood detention, if feasible.

For small infill building sites or retrofits:

- Install an eco-roof for buildings and parking structures (like those described in the Chicago Case Study).
- Install porous pavement in plazas and courtyards.
- Drain roofs to grass buffers or swales.
- Install a rain garden in the landscape strip between the building site and the street.

For residential areas:

- Drain roofs to grass buffers, rain gardens and grass swales in gardens and yards (as shown in the Burnsville Case Study).
- Drain driveways, walks and patios to adjacent grass buffers or rain gardens either directly or through slot drains or porous pavement.
- Construct driveways and parking aprons using porous pavement.
- In appropriate neighborhoods with rural character, develop roadside grass swales with or without curbs. Allow swales to drain frequently to open space areas or storm sewers to maintain shallow swales.

Now, estimate the capital and life cycle costs of your project with the green infrastructure elements included, and also estimate the value associated with them. Identify elements that contribute significant value, or that yield significant cost savings.

Compare the two approaches to determine which is more beneficial, or to identify where green infrastructure might best be substituted for conventional approaches

Go through each value element and compare the conventional option to that with green infrastructure elements. This may prove to be an illuminating comparison – especially when the benefits of green infrastructure elements are factored in. Stormwater best management practices (or green infrastructure) often represent the best value option for a project. Unlike conventional storm drainage systems that fulfill a single function (conveying runoff off-site), green infrastructure elements can provide multiple benefits to a project.

Identify where additional benefits might accrue if code requirements were relaxed

As a final task, you might examine where you could gain additional benefits if code requirements were relaxed. If regulations were modified or relaxed – for example, to allow runoff from public roadways to be directed towards infiltration planters or tree boxes – additional water quality and aesthetic benefits could be realized. After consideration, you may choose to pursue opportunities to change or eliminate certain restrictions by consulting with local regulatory agencies and officials.

You may also be interested in:

BMPs from Start to Finish

Case studies cited above:

- Burnsville, MN
- Chicago, IL
- Portland, OR
- Seattle, WA