<u>Dissertation Summary</u>

Premise: There are many post-construction Best Management Practices (BMPs) that are effective.

Question: How do you identify the **best** management practice for a given application?

A decision needs to be made.

There are two types of tools that can be used for analyzing the options of a decision:
Procedural tools focus on specific procedures to guide the way to reach a decision.
Analytical tools provide information about the consequences of a choice.

"For a tool to be effective, it should have a strong element of learning, or understanding more about the problem, the objectives, and one's own preferences. When complex decisions are reduced to simple mechanistic process, the decision maker may lack confidence in the outcome (SWARD, 2002). The assumptions used to create the mechanistic process are often hidden. The human element is removed making the decision less holistic. If the tool is not flexible, the decision outcome it generates will likely not be considered valid. More robust decision making processes yield higher quality outcomes." (pg. 17)
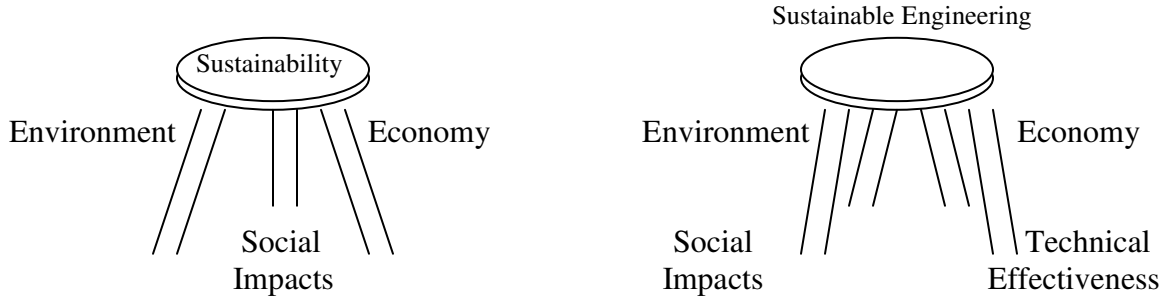
"As the decision maker's understanding of the issues increases he/she will be able to make better, more informed, decisions and may begin to take ownership of those decisions. An increased understanding of the issues surrounding a decision can also lead to innovation. Rather than relying upon the already existing options, better alternatives can be developed that combine the decision maker's preferences more efficiently, attaining the desired outcome with fewer compromises." (pg. 18)

"Methods such as flow charts or decision trees are often used for simple decision processes. However, the data is hidden in an ambiguous process that leads the decision maker to a conclusion, often with no flexibility. The benefit of the format used for the selection tool is that the data is available for side-by-side comparison and evaluation leaving room for flexibility and professional judgment when site conditions are unique or complex." (pg. 19)

"A tool that does not appear to be quick and easy to use will not be employed. Because the data remains visible for the purpose of explanation and no assumptions are hidden in the process, if, over time, new evidence is presented that changes the results of the decision criteria, the selection tool can be easily modified without having to completely reassess the process." (pg. 19)

SWARD, 2002. Ashley, R., Butler, D., Jowitt, P., Pearson, P.J.G., et al., 2002. *The SWARD Guidebook: A Guide to Incorporating Sustainability Criteria into Decision Making for Water Service Providers and Their Stakeholders*, Imperial College, University of Bradford, Heriot-Watt University, University of Abertay, Dundee.

What to consider.

Sustainability

Sustainable Engineering

Environment Economy

Environment Economy

Social Impacts

Social Impacts Technical Effectiveness

No single factor is more important than another if a sustainable solution is desired.

How the tool was made.

BMPs selected: Taken exactly from the USEPA Menu of BMPs for Post Construction (structural).
(http://cfpub1.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5)

Data Sources: USEPA Menu of BMPs,
CASQA Post Construction BMP Handbook,
Stormwater Manager's Resource Center

BMP costs made equivalent: All BMPs were sized to treat on acre-foot of water (43,560 ft^3)

Hard Gates: Since there is no sense in considering BMPs that are not suitable for site conditions, I compiled the design parameter data and grouped them by ability to reduce volume. This draws attention to the importance of volume reduction and makes it easier to read. The Hard Gates act as a 'first cut' and eliminate BMPs that just won't work because of site conditions.

* Note: I already plan to modify the Hard Gates so that the color blocks are more intuitive.

Soft Gates: The soft gates consider the factors in the 4 legged "Sustainable Engineering" stool shown above so that the Best Management Practice can be selected. The data is present so that the decision process is informed and transparent.

Technical Effectiveness: The pollutant load reduction data is stated in the form of % removal as taken from the literature sources stated above. A color code system was used to make the data easy to compare at a glance. (6 colors were used so each color represents a 15% interval)

Economy: There are three aspects of BMP costs to consider: the initial construction cost, the annual maintenance costs, and other economic impacts caused by or associated with the BMP. The additional costs are listed below the soft gates and described in more detail in Table 2 (pg. 25). After costs were made equivalent, a color code system was used to make the costs easy to compare at a glance. Each color represents a $50,000 interval for construction and annual maintenance costs. For the additional economic impacts, the color code system was assigned based on number of benefits vs. number of impacts, most favorable to least favorable.

Environment: Environmental impacts are listed below the soft gates and in more detail in Table 3 (pg. 27). A color code system was used to make the initial impact comparison easy. Because there is no measure for the severity of the impact or benefit in this tool, the actual impacts should be reviewed for each BMP considered. The color code system was merely assigned based on number of benefits vs. number of impacts to avoid the use of personal judgment which could make the tool contentious.

Social Impacts: Social impacts are listed below the soft gates and in more detail in Table 4 (pg. 33). A color code system was used to make the initial impact comparison easy. Because there is no measure for the severity of the impact or benefit in this tool, the actual impacts should be reviewed for each BMP considered. The color code system was merely assigned based on number of benefits vs. number of impacts to avoid the use of personal judgment which could make the tool contentious.

How the tool is used.

The selection tool is Figure 8 (pg. 34).

Step 1: The concept is that infeasible BMPs are eliminated here and that creativity is encouraged through the use of combinations of BMPs.

Step 2: Before looking at the soft gates the user should consider land use (industrial, residential, commercial) in order to anticipate what the pollutants of concern will be and prioritize the pollutant load reduction accordingly. This step should narrow the BMP options to the few preferred options.

Step 3: The last step of the selection process is to apply local knowledge such as local climate, how much rain falls in this area, is it arid, semi-arid? What sorts of plants can survive in that climate? What types of materials locally available?

* The Selection Tool was meant to fit on one page. It is currently formatted for A3 paper size. If it were to be posted on our web page for public use, it would need to include instructions for use.