BMPs Start to Finish

Developing projects with a focus on sustainable stormwater management is a challenging and exciting prospect. The process outlined here represents a generic planning and development project that you can modify and adapt to meet the requirements of your own project. While this process may be most appropriate for larger projects, it can help those who are working on a smaller scale. Smaller projects may involve the same steps but they may be condensed, or shortened due to financial or staffing limitations.

Development as an Iterative Process

The project development process is presented in a linear fashion but keep in mind that you may need to revisit earlier steps as new information is collected or unexpected challenges are encountered. This continual adjustment results in an iterative development process where each successive iteration should bring you closer to your goal.

During each phase, take the time to assess where you are and prioritize next steps. Check to make sure that you have addressed relevant concerns of your stakeholder groups and that there are no unresolved issues to address (at least none that will prevent you from moving forward with relative confidence). If a new issue is identified, take the time to resolve it before moving forward. Issue resolution may require you to revisit an earlier stage or step but will clarify your goals and may prevent costly delays and mistakes later in development.

Phases of development can be broken down into four general stages:

- Conceptual Phase
- Planning and Design Phase
- Build/Installation Phase
- Operations and Maintenance Phase

Each one of these phases is discussed in detail below. As you begin to develop your own project remember: there is no one way to incorporate green design concepts and sustainable stormwater practices. Each project should be approached as a unique opportunity to improve on what has come before and to set standards for future attempts.

Conceptual Phase

This initial phase of project development is a time to

- collect ideas for potential projects (to create a new or revisit existing installations)
- assess the value of each idea and its current relevancy and feasibility given available resources
- develop general strategies or ideas for on-site water management.

Depending on your role in the process, you may or may not be involved with the conceptual phase of development. Often, this phase is conducted before the project team is assembled. For those involved in

this aspect of project development, however, it may be worth seeking the opinions and feedback from a variety of stakeholders and collaborators, especially if new practices or development processes are planned.

If you first encounter a project after this initial development phase, or, if new collaborators are brought into the process after this phase, consider having a debriefing session to bring everyone up to speed on the motivations and ideas developed during this phase.

Planning Phase

In the planning phase you will take the project idea(s) identified during the conceptual phase and clarify the circumstances, goals, and requirements of the final installation. It is a collaborative process in which you will establish an initial project definition, identify and solicit the assistance of stakeholder groups, define your immediate and extended project team, gather information about the physical, regulatory and cultural situation in which you will operate, refine your project definition, and create and initial installation design.

During this phase you will determine:

- Where are we now?
- Where do we want to go?
- How do we get there?

Once you have established answers for all three questions you can move on to the subsequent phases. Whenever you hit a snag in your planning process, come back to these three questions to realign your focus. Also, notice that the questions above use the word “we” – it is essential to include multiple perspectives during this phase of your project. Without open communication and collaboration, it is possible to overlook critical elements and increase the likelihood of later development problems.

Where are you now?

Before you can effectively plan the project you must first establish a clear understanding of the circumstances in which the project will be designed and implemented. Part of this step will involve collecting information, identifying information gaps, and finding ways to fill those gaps. Remember: the more you know about the project and its context in the early planning stages, the easier it will be to anticipate problems, suggest cost-saving options, and plan for the inclusion of best management practices.

The four steps presented here: define the project, identify stakeholders, build your project team, and characterize the site, do not necessarily need to be completed in the order listed. Some components of the different steps may be carried out concurrently or in a different order.

Define the project

The solutions you develop to address project requirements and client expectations can only be successful if you first understand the nature of the project are considering. To define your project, consider the following questions:

- Who is the client?
- Is this a retrofit or a new installation?
- Where will the project be located?

- What restrictions must be accommodated?
- What laws/regulations/permit requirements must be met (or modified)?
- Is this project part of a community development initiative or will it be developed as a stand alone project?
- What aspects of water quality, quantity and amenity should be considered?
- How can sustainable stormwater practices be incorporated into this project?

There may be other questions relevant to your particular project. Having a project team with representatives from multiple disciplines, as well as a close connection with relevant regulatory bodies will bring a wide range of questions to the table. This is the time to start thinking about how BMPs can be incorporated into the project and which BMPs will be used. Initial selections should be evaluated and verified by the project team and revised as necessary to find the most appropriate stormwater management solutions.

Identify stakeholders

Once you have an initial understanding of what the project will entail, identify your project stakeholders. These are people who have an interest in, or who may be affected by, the installation. Stakeholders can be members of associated professions such as engineers, designers, landscape architects, stormwater utility managers, and community planners; members of local, state, or federal regulatory agencies; and the general public. Local colleges and universities may also be valuable partners for your development team. They can be a good source of local data and may have done research that is applicable to your installation site or project type.

Build your project team

The composition of your project team will be unique to the situation and to the procedures established by your own organization. As you move forward look for ways to expand your typical project team (either formally or informally) by including additional stakeholder groups in your development process. Use the list of stakeholders you identified in the previous phase and determine how each group may contribute to the overall project.

Take time at the beginning of the project to establish some basic guidelines for your project team:

- Define roles and responsibilities, communication pathways and decision making hierarchies
- Establish regular meeting schedules to ensure timely updates and a consistent flow of information

The success of your project may depend on the effectiveness of communication between members of your project team. Treat all members with respect and check in continuously to maintain open lines of communication.

Characterize the site

No project exists in a vacuum. During the site characterization phase of planning, you will gather available data related to the context within which the project will be developed. Data gaps will be identified where further information is needed. Later, all data will be analyzed to develop final project specifications and requirements.

Physical site

Your development plan should consider all aspects of the physical environment in which the installation will be located. Some aspects of site characterization to consider are listed below. The list is meant to provide some elements to consider and to encourage a broad survey of the physical area in which you will build. The requirements of your project will help you decide which are most appropriate for your own evaluation.

You may also find a need to collect additional site information during later phases of development. Consider this the start of your data collection and be prepared to accommodate new information as it becomes available to you.

The list below gives a comprehensive look at some other factors you may want to consider when defining the physical setting of your project:

Watershed Boundaries

Local Hydrology
- *Climate/Precipitation*
- *Surface Water Resources*
- *Groundwater Resources*
- *Flood Plains*
- *Navigation Channels, Ports and Harbors*
- *Dams*
- *Vernal pools*
- *Topography/Elevation*
- *Geology and Soils*
- *Vegetation*
- *Exotic/Invasive Species (If there are endangered species in your area, work with NMFS and FWS to identify potential areas of critical habitat)*

Demographic Characteristics
- *Population*
- *Economics*
- *Languages*

Watershed Conditions
- *Water Quality Standards*
  - *Designated and Desired Uses*
- *Wildlife*
- *Protected Species*
- *Sensitive Areas*
- *Cultural Resources*

Land Use and Land Cover
- *Detailed topography*
- *Open Space*
- *Scenic vistas*
- *Wetlands*
- *Forested Areas*
- *Agricultural Lands*
- *Mining*
- *Fisheries*
- *Recreation*
- *Developed Areas*
- *Transportation*
- *Political Boundaries*
  - *Federal Lands*
  - *State Lands*
  - *Numeric and Narrative Criteria*
  - *Antidegradation Policies*

Available Monitoring/ Resource Data
- *Water Quality Data*
- *Impaired Uses and/or Water Quality Threats*
- *Tribal Lands*
- *Local Lands*
- *Relevant Authorities*
- *Future Land Use Considerations*
- *Locations of community facilities (schools, government buildings, community centers)*
- *Utility lines (can be obtained from utility companies or aerial photographs)*
- *Parcels*
- *Local zoning*
- *Historic resources/sites*

- *Flow Data*
- *Biological Data*
- *Benthic Macroinvertebrates*
- *Fish*
- *Aquatic Nuisance Species*
- *Migratory Patterns*
- *Stream Survey Data*

Regulatory Environment

Layered over the physical characteristics of a site is a regulatory framework made up of local, state, and federal requirements and practices. These must be identified and their potential impacts on the project should be considered.

- What local, state and federal requirements govern project design, installation and long-term maintenance?
- Has a regulatory framework been established for projects that employ stormwater best management practices? If not, how can you help establish one or encourage the development of one? Alternatively, how can you make this project work without a supporting regulatory framework?
    - One possibility is to start with projects that only have small BMP installations. Successful implementation of small-scale projects can ease the way for development of larger-scale projects in the future.

As you characterize the local regulatory environment, consider any additional regulations or restrictions you may encounter with the addition of stormwater BMPs. Or, as you consider which BMPs to incorporate, consider the regulatory implications of their inclusion.

Involve appropriate regulatory agencies early in project development, especially if you plan to propose something that might be different than what plan reviewers are used to seeing. Both communities and designers/engineers should ensure that "green" design issues get discussed early on in the development approval process to identify and address site constraints or regulatory limitations (e.g., geotechnical issues, public health concerns) that could affect the design.

Community values and aesthetic

The third component of site characterization involves a close look at the local community and the values and aesthetics embraced by local residents. This is your opportunity to discover:

- What aspects of the project are of interest/concern to the local community?
- Are there safety issues related to open water or accessibility concerns?
- Does the community have a 'green aesthetic'? Do they want to see more environmentally- or user-friendly development?
- Is there an inherent distrust of change within the community? What can you bring to them to help overcome their resistance?

Listen to all concerns from the community and use their input to guide the development of your project. You may want to do (or find an existing) visual preference survey to help identify what community members have identified as important or appropriate for a particular area.

As you move forward, be sure to stay in touch with this group to verify that you have adequately addressed the concerns and desires of this important stakeholder group (or provided good reasons for not meeting expectations).

Where do you want to go?

Now that you have established your project team and have developed a better understanding of the physical site, regulatory environment and community values associated with the installation, revisit your project definition. Did you learn anything new from your site characterization? Can you clarify the scope and definition of the project?

With a clear understanding of project requirements and context, it is possible to establish targets for development.

Set goals for the project

Once you are comfortable with the scope and definition of the project, ask yourself what problems you are trying to solve with your installation and begin to set project goals. These may fall into several categories:

Water Quantity
- Capture the first inch of stormwater runoff on site
- Flood control

Water Quality
- Maintain or improve water quality
- Reduce erosion and stream bank scour
- Meet TMDL or NPDES permit requirements
- Attain designated uses

Community Improvement
- Preserve open space
- Create recreational areas
- Increase tourism value of the community
- Provide additional parking
- Establish a relationship with the local community

Environmental
- Mimic the natural hydrological cycle
- Maintain interconnected surface stormwater control areas

Regulatory
- Meet permitting requirements
- Submit a design that is not rejected
- Reduce impervious surfaces
- Improve site drainage

Budget or Resources
- Save money
- Reduce infrastructure costs

Health and Safety
- Eliminate or reduce possibilities for insect breeding areas
- Meet safety concerns of local citizens

Maintenance
- Develop a site that is easy to maintain

Evaluation
- Monitor all BMPs to evaluate their use for future projects

How do you get there?

With a firm grasp of where the project needs to go, it is possible to develop a roadmap for the remaining development phases. The products from this step may include a formal, written definition of your project, a plan for the development phase, drawings of your installation, a maintenance plan, and an evaluation plan that includes the metrics and processes used to monitor and evaluate the project during installation and after initial implementation. All of the information gathered in previous phases should be used to develop these products but be aware that changes may occur during subsequent stages. If you have problems or encounter unexpected snags during this phase, talk to your stakeholders to work towards a mutually agreeable solution.

Identify solutions to meet established goals and requirements

As specific needs are addressed, look to stormwater best management practices first to see if they can provide all, or part, of the solution. Sustainable stormwater practices can provide benefits to water quality, water quantity, site amenity – or a combination of the three. They will not necessarily resolve all problems a stormwater management plan must address. These practices can be used in isolation or in combination with other, more traditional, practices to fully address the particular needs of a location. Adding an ecoroof or rain garden to your project, for example, may reduce the quantity of runoff from a site. Creating a green space that also provides some stormwater management benefit may make the community more pleasant to live in (amenity), increasing public support for a project or bolstering property values in a given area.

Design the project

Before you launch into your design, do a little scouting around to see what has been done before to address goals that are similar to yours. Build off of the work done by other groups and ask for advice whenever appropriate. Stormwater BMPs have been developed for many years and there is a growing body of knowledge available that you may be able to draw on with a few hours of research and a couple of well-directed phone calls.

Keep your goals and objectives in mind as you design the project. Check to make sure the design addresses the goals and requirements and incorporates the identified solutions (including maintenance and evaluation). The final design should be a marriage of both technical and aesthetic elements.

Develop a Maintenance Plan

Maintenance is a key part of every stormwater installation plan. Some sustainable practices, especially those involving vegetation, have specific maintenance requirements. Addressing these issues at this stage of development will ensure that adequate resources are directed towards this important component of design. Comprehensive and effectively designed maintenance plans can make or break a project as this will determine the enduring aesthetic of the installation. Projects may be implemented with no problems but if maintenance plans are not established, disrepair and neglect may create negative feedback from the local community. This may make future development more difficult. Proper site maintenance will also preserve the function of the installation, increasing the likelihood that you will meet water quality and quantity goals and requirements.

Develop a set of evaluation metrics and measurements for installation and maintenance

Part of project design should include methods for measuring progress towards attaining goals – during installation and also during implementation and operation. A monitoring and evaluation plan allows you to determine whether (or when) you meet establish project goals – during both the installation and implementation phases.

Keep regulatory requirements in mind when developing your monitoring and evaluation plan. There may be prescribed metrics to address to satisfy one or more regulatory bodies.

Get feedback

With a clear picture of what the installation will look like and how it will function, check in with all stakeholders to ensure that no issues were overlooked and that no new information has become available that may impact project design or requirements. This is a good way to maintain contact with your extended project team and increases the likelihood that your final installation will be supported by the community.

Revise and finalize

Take the comments and feedback from all parties and revise your plan as necessary. Perhaps some ideas are not feasible at this time. Have supporting documentation to backup any decisions you make. Return to the client with suggestions for change if appropriate. Your design is done when all parties have reached some sort of agreement.

Final review and approval

This is the time to get final sign off and approval on your designs and implementation plans. Keep those stakeholders close, new suggestions should be considered as they arise and their feasibility assessed continuously as you go along.

Now you are ready to build!

Build/Installation Phase

Now that you've done all of your planning and have an approved project plan and design you're home free, right? Not exactly. The build and installation phase is a critical time. During this phase, you will:

- Implement construction best management practices as specified in the development plan
- Perform evaluation as specified in the monitoring and evaluation plan (as necessary)
- Perform maintenance tasks as specified in the maintenance plan (as necessary)

Check in with your stakeholders

It is important to remain in contact with all members of your project team and the community and to identify and accommodate unexpected developments. Keep the lines of communication open during installation. Your extended project team can help with technical issues, planning questions and should be kept informed of your progress.

Follow through with any problems that arise during construction

No matter how good your project plan is, you should always be prepared for the unexpected. Draw on the knowledge and combined resources of you project team and keep the lines of communication open as you work through whatever issues you encounter. Be ready to adapt your design but keep the ultimate goals in mind as you work to find an acceptable solution.

Operations and Maintenance Phase

The end of the installation phase marks the beginning of the operations and maintenance phase. During this stage, you will:

- Implement programmatic and operational components of the development plan
- Initiate post-construction phase of the maintenance plan
- Initiate post-construction phase of the evaluation plan

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