



Construction Sequence

Description An appropriately scheduled construction sequence will reduce erosion and sediment potential on a construction sites. Construction sequencing should be noted in the Stormwater Pollution Prevention Plan. At a minimum, construction sequencing schedules should consider the following:

- Principal development activities
- Which measures should be installed before other activities are started
- Compatibility with the general contract construction schedule

More details in the use of a construction schedule sequence as a BMP are described in Table 1.

Table 1. Scheduling considerations for construction activities

Construction Activity	Schedule Consideration
Construction access, entrance to site, construction routes, areas designated for equipment parking	This is the first land-disturbing activity. As soon as construction begins, stabilize any bare areas with gravel and temporary vegetation.
Sediment traps and barriers, basin traps, sediment fences, outlet protection	After the construction site is accessed, install principal basins. Add more traps and barriers as needed during grading.
Runoff control diversions, perimeter dikes, water bars, outlet protection	Install key practices after installing principal sediment traps and before land grading. Install additional runoff control measures during grading.
Runoff conveyance system, stabilize stream banks, storm drains, channels, inlet and outlet protection, slope drains	If necessary, stabilize stream banks as soon as possible, and install a principal runoff conveyance system with runoff control measures. Install the remainder of the systems after grading.
Land clearing and grading, site preparation (cutting, filling, and grading, sediment traps, barriers, diversions, drains, surface roughening)	Implement major clearing and grading after installing principal sediment and key runoff-control measures, and install additional control measures as grading continues. Clear borrow and disposal areas as needed, and mark trees and buffer areas for preservation.

Table 1 (continued).

Construction Activity	Schedule Consideration
Surface stabilization, temporary and permanent seeding, mulching, sodding, riprap	Apply temporary or permanent stabilizing measures immediately to any disturbed areas where work has been either completed or delayed.
Building construction, buildings, utilities, paving	During construction, install any erosion and sedimentation control measures that are needed.
Landscaping and final stabilization, topsoiling, trees and shrubs, permanent seeding, mulching, sodding, riprap	This is the last construction phase. Stabilize all open areas, including borrow and spoil areas, and remove and stabilize all temporary control measures.

Design Considerations

The nature of construction work is such that many activities are subject to delays from weather, delivery of materials, project funding, equipment availability, work by subcontractors, remedial construction repairs, or simply that difficult tasks can be hard to estimate.

Erosion and Sediment Controls

The following erosion control activities provide a detailed outline that applies to the initial phase of most site developments:

1. Install a stabilized construction entrance and exit.
2. Flag and mark the project boundaries. Flag the construction buffer zones, sediment traps or basins, construction storage areas, and equipment travel lanes.
3. Clear a path for the installation of perimeter erosion and sediment controls.
4. Install perimeter erosion and sediment controls. Evaluate effectiveness and adjust as needed.
5. Excavate any temporary sediment traps or sediment basins. For most small project sites, the proposed detention basin will also function as a temporary sediment basin with slight modifications.
6. Install outlet structures and channel stabilization measures for temporary sediment traps or sediment basins. Install slope stabilization measures such as grass sod or turf reinforcement mats.
7. Proceed with site grading and construction work. Establish either temporary or permanent vegetation on all disturbed areas within 14 days of completion of grading at the disturbed area. Provide temporary seeding on temporary soil stockpiles.
8. A system of routine inspections for erosion and sediment control throughout the construction phase should be planned. The local Stormwater authority will also respond to complaints of erosion or sediment. In addition, TDEC may investigate complaints of erosion or sediment anywhere within the Program Area.

Other Erosion and Sediment Control Considerations

- Minimize or eliminate construction areas adjacent to streams, wetlands, and storm drainage features. This should be consistent with stream buffer requirements.
- Monitor weather forecast for rainfall. Inform field supervisors and inspectors to inspect site conditions. When rainfall is predicted, verify that erosion and sediment control devices are effective for disturbed areas prior to onset of rain.

During dry periods, erosion may be caused by winds and vehicle tracking. Keep the site stabilized year-round and maintain effective sediment-trapping devices.

Other Considerations

Plan construction project to incorporate a schedule and flow chart to layout the project. There are many types of scheduling software that are inexpensive and commonly available, or spreadsheets may be used to generate a timeline.

Work out the sequencing and timetable for the start and completion of each item such as site clearing, grading, excavation, trenching, pouring foundations, installing utilities, etc. This should be shown by specific construction areas.

Schedule work to minimize the active construction area during predicted times of rainfall. Minimize land-disturbing activities during the rainy season. Schedule major grading operations for times other than winter or spring when practical.

Incorporate placement and maintenance of erosion control items and soil stabilization items into the construction schedule, including seeding and planting. Stabilize nonactive areas as soon as practical within 14 days of grading activities. Sequence trenching so the length of open cuts is minimized.

Common Types of Schedules

Planning Evaluation and Review Technique (PERT):

1. List all individual tasks and events. Arrange and interconnect the tasks and events in order so that no task may be started until all of the preceding events have been completed.
2. Estimate the time required to complete each task. Compute the critical path by taking the longest possible time to go from start to finish, accomplishing all necessary tasks along the way.
3. Analyze ways to improve the schedule or to troubleshoot possible delays. Slack time for any task is defined as the amount of time that the task can be delayed without becoming part of the critical path. Resource leveling is defined as shifting resources from a non-critical path into the critical path.

Milestone Chart:

1. List all individual tasks and events in the order in which they occur. Identify which tasks cannot be started until a previous task or event has been finished.
2. Estimate the time and manpower required to complete each task.

Monitor time and manpower closely. Update chart regularly and report progress. If there are more appropriate units to measure work (such as miles of roadway or pallets of bricks), then these units may be used to measure the work accomplished.

References

USEPA, Office of Wastewater Management (OWM). April 09, 2007. "National Menu of Stormwater Best Management Practices". See link below.

<http://cfpub1.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=50>

Knoxville (City of). October 2007. Knoxville Stormwater Engineering Division. City of Knoxville BMP Manual. http://www.ci.knoxville.tn.us/engineering/bmp_manual/