

Appendix E. Coordinating Erosion and Sediment Control With Low-Impact Development Planning

E.1 Introduction

It is essential to coordinate post-construction stormwater planning with the design and implementation of erosion and sediment control plans. This appendix provides general guidance on this coordination.

Before proceeding, it may be helpful to provide some simple definitions in order to distinguish what is meant by “erosion and sediment control” and “post-construction stormwater” in the context of this section:

EROSION AND SEDIMENT (E&S) CONTROL: The application of planning approaches and practices during the construction phase in accordance with the Stormwater Management and Sediment Reduction Act of 1991 and the *South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities*. These practices generally apply during the active construction phase of a land disturbing activity, including land clearing, filling, excavation, soil movement, construction, and other activities defined in the Act. It should be noted that construction phase plans and practices also must be coordinated with other applicable permits, such as the NPDES General Permit for Discharge from Construction Activities and, for MS4 communities, minimum measure #4.

POST-CONSTRUCTION STORMWATER: The term post-construction stormwater is used to distinguish stormwater practices used during the active construction phase (sometimes referred to as “construction stormwater”) from those that are used on a permanent basis to control runoff once construction is complete (“post-construction stormwater”). Post-construction stormwater includes site planning and structural and non-structural practices such as Low-Impact Development features that intercept, treat, and often reduce the volume of runoff from land development sites. Collectively, these practices are referred to as “post-construction BMPs (best management practices)”. As with construction, other permits may apply, such as MS4 minimum measure #5.

Recent trends in post-construction stormwater management make erosion and sediment control coordination all the more important. These include:

- ✧ **The use of low impact development and green infrastructure techniques to help satisfy post-construction stormwater requirements.** These approaches involve the use of open space, vegetated areas, impervious cover disconnection, and other site planning and design techniques. For an E&S control plan, this can mean more “do not disturb” zones and the need to avoid disturbing and compacting soils in dispersed areas around a development site.
- ✧ **The use of small-scale, distributed (low impact development) practices that treat runoff closer to its source.** Many of these practices rely on the underlying soil to infiltrate at least part of the runoff. Some may be on individual lots, within community open space, or within drainage easements. For the erosion and sediment control plan, this means a finer level of control for the limits of disturbance so that the performance of the ultimate post-construction practices is not compromised during the construction phase.

- ✧ **More elaborate design parameters for stormwater ponds and wetlands that may begin their lives as sediment basins.** Often, the post-construction configuration will involve pretreatment forebays, flowpath and geometry requirements, multi-stage riser structures, and other features that the designer must consider when designing the initial sediment basin. A detailed conversion plan is needed for the practice to successfully meet both E&S control and post-construction needs.

All of these trends make it essential for a higher level of coordination during site planning and implementation of erosion and sediment control in the field.

There are several key principles that apply to the coordination between E&S control and post-construction stormwater, as outlined below:

Principle #1: Limits on the Limits of Disturbance (LOD): The limits of disturbance on the E&S control plan must respect natural areas, open spaces, undisturbed vegetated areas, and the footprints of certain BMPs that are part of the post-construction stormwater plan. Limits of disturbance that make sense for the construction phase only can compromise the integrity of the post-construction approach. Also, LOD boundaries may need more careful fencing and signage during construction.

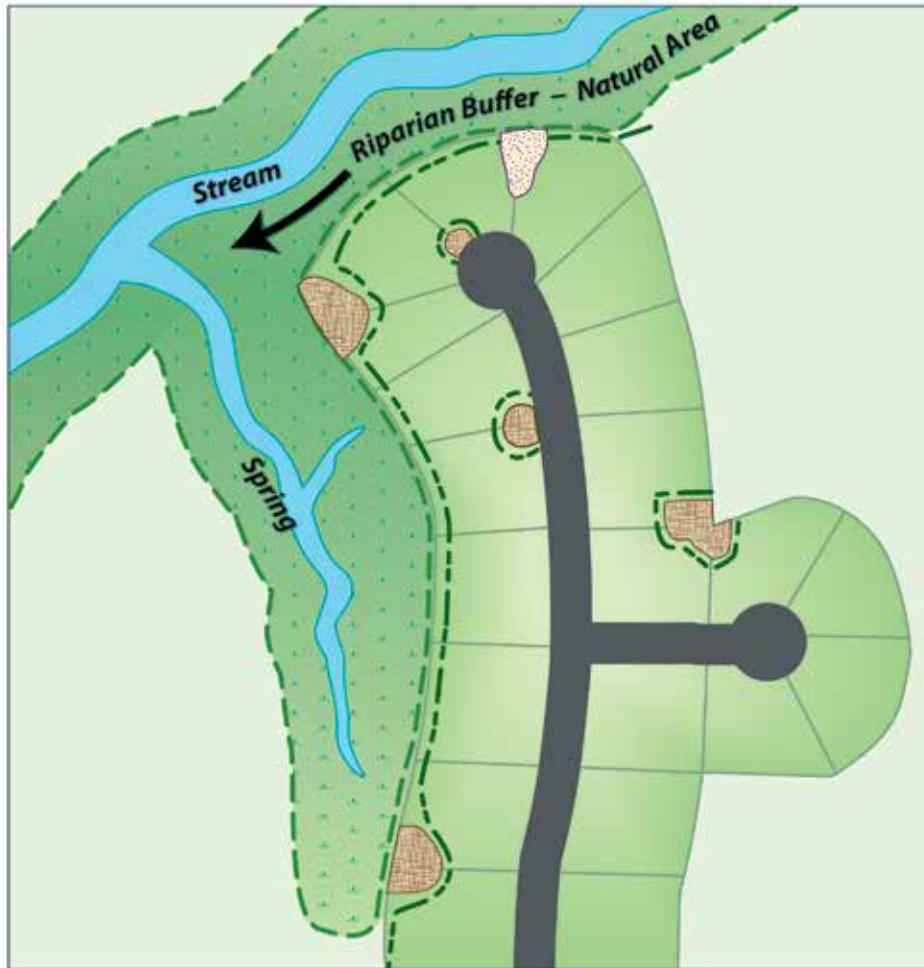
Principle #2: Soil Structure as a Post-Construction Stormwater Tool: Many post-construction practices rely on the underlying soil structure to allow the BMPs to function properly. This obviously is true for practices designed to infiltrate runoff, but also applies to post-construction BMPs that have an underdrain (e.g., some bioretention, dry swale, and porous pavement designs). Care must be taken during the construction phase not to compact soils in the vicinity of post-construction BMP installations.

Principle #3: Diversions: In many cases, construction runoff can seriously compromise post-construction BMPs, even before they are installed. Sediment-laden construction runoff can damage soils intended for infiltration or filtration and can clog rock and other materials intended for use in the post-construction BMP. As such, the E&S control plan should include diversions to prevent construction runoff from entering certain areas associated with post-construction BMP implementation.

Principle #4: Conversion Details: In many cases, E&S control practices and post-construction practices can be co-located. This has advantages in terms of the efficiency of the design, and also can help the post-construction BMP because the conversion cannot take place until the erosion control function is complete (thus avoiding premature installation of the post-construction features). However, given the increasingly sophisticated nature of post-construction BMP design, a detailed conversion plan is needed as part of the E&S control plan to make sure that post-construction volumes, BMP geometry, riser configuration, access, and other features adhere to the design. Also, the conversion plan should be very specific about the timing and sequencing of conversion activities with ongoing land disturbance and stabilization.

Principle #5: Communication & Coordination: In order to coordinate erosion and sediment control with post-construction stormwater, the local government authority should strive to integrate activities such as plan review, site inspections, administration of performance bonds, adoption of technical standards and policies, and training and communication for the regulated community.

Figure E.1-1 shows several typical points of coordination between E&S control and post-construction stormwater.







-  Riparian Buffer/Natural Area Boundary
-  Co-Located construction-phase sediment basin and post-construction BMP
-  Post-construction bioretention/infiltration area — Soil must be protected during construction. Do **not** use for construction-phase BMPs
-  Limits of Disturbance (LOD) for construction-phase SWPPP — Must protect Riparian Buffer and post-construction infiltration area. Fencing recommended.

Figure E.1-1. Typical coordination points between E&S control and post-construction stormwater management. (Source: CWP, 2008)

E.2 E&S Control Considerations when Using Post-Construction Practices

Tables E.2-1 and E.2-2 provide more specific guidance on E&S control considerations for practices and BMPs contained in *Low Impact Development in Coastal South Carolina: A Planning and Design Guide*. Table E.2-1 provides E&S control considerations for post-construction practices related to natural resources protection, low impact design, and other site planning practices.

| Table E.2-1. E&S Control Considerations for Natural Resource Protection and Site Planning Practices | |
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| Practice | E&S Control Considerations |
| <i>Natural Area Conservation:</i> Protect floodplains, slopes, porous/erodible soils, aquatic resources, groundwater recharge zones. | <ul style="list-style-type: none"> ◆ Clearly identify all natural resources area boundaries on E&S control plans as being outside of the limits of disturbance (LOD). ◆ Specify use of temporary construction fencing at LOD. ◆ Diversions or other measures may be needed to divert construction runoff away from the area. ◆ Install temporary fencing and signage at the beginning of land disturbing activities. ◆ Monitor construction activities to ensure that heavy equipment does not enter natural resource areas. |
| <i>Stream/Riparian Buffers:</i> Protect or restore vegetated area adjacent to streams and aquatic resources. | <ul style="list-style-type: none"> ◆ Clearly identify all stream buffer boundaries on E&S control plans as being outside of the LOD. ◆ See above for other guidelines under “Natural Area Conservation.” |
| <i>Disconnection of Post-Construction Impervious Surface:</i> Direct impervious cover to down-gradient pervious areas as sheet flow or overland flow filter paths. | <ul style="list-style-type: none"> ◆ Identify on E&S plans all pervious areas that will receive runoff from upgradient impervious or developed areas. ◆ Avoid compaction of pervious areas with heavy equipment during construction; use temporary fencing as necessary. ◆ Diversions or other measures may be needed to divert construction runoff away from the pervious areas. ◆ Make sure that all subcontractors know about the areas. ◆ It may not be practical to prevent disturbance or compaction of ALL of these pervious receiving areas on a site (e.g., small areas on individual lots). Pervious receiving areas that ARE compacted during construction should be restored by tilling and adding compost, as per the Impervious Surface Disconnection section in this manual or similar guidance. |
| <i>Grass/Vegetated Channels:</i> Direct runoff from developed areas to vegetated channels instead of storm sewer systems. | <ul style="list-style-type: none"> ◆ Similar to Impervious Surface Disconnection, vegetated/grass channels and drainageways should be identified on E&S control plans and marked in the field to avoid disturbance and compaction as much as possible. ◆ Roadside channels will be disturbed during construction; soil restoration should follow post-construction plans. |
| <i>Other LID Practices:</i> Reduce limits of clearing, reduce impervious cover, more compact development design. | <ul style="list-style-type: none"> ◆ Ensure that reduced development footprint translates to E&S control plan by matching limits of disturbance with post-construction design and layout. ◆ Clearly mark limits of disturbance; use temporary construction fencing as necessary. |

Table E.2-2 lists similar considerations for structural post-construction BMPs, such as bioretention, porous pavement, vegetated swales, infiltration trenches, and stormwater ponds and wetlands.

| Table E.2-2. E&S Control Considerations for Structural Post-Construction BMPs | |
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| Post-Construction BMP | E&S Control Considerations |
| <p>Bioretention, Infiltration, Permeable Pavement <u>WITHOUT</u> an underdrain system (designed for infiltration into underlying soils)</p> | <ul style="list-style-type: none"> ◆ Clearly show post-construction practice footprints on E&S control plan. Usually, these areas should be outside of the limits of disturbance (with the exception of permeable pavement), unless they are used as small, temporary sediment traps. ◆ Mark practice footprint areas in the field with temporary fencing and signage. ◆ Monitor construction activities to ensure that heavy equipment does not enter practice footprint areas. ◆ All contributing drainage areas (CDAs) to the practice MUST be fully stabilized and vegetated prior to installation of post-construction BMP. ◆ In addition, runoff from the CDA can be diverted around the post-construction BMP footprint and supplemental E&S control measures (e.g., silt fence/barriers around the perimeter of the practice) can be used to prevent erosion into the practice from the CDA or practice side slopes as they are being graded. |
| <p>Bioretention, Dry Swale, Permeable Pavement <u>WITH</u> an underdrain system (designed for underdrain to discharge to storm sewer)</p> | <ul style="list-style-type: none"> ◆ Clearly show post-construction practice footprints on E&S control plan. Usually, these areas should be outside of the limits of disturbance (with the exception of permeable pavement), unless they are used as small, temporary sediment traps. ◆ If outside of the LOD, mark practice footprint areas in the field with temporary fencing and signage. ◆ Monitor construction activities to ensure that heavy equipment does not enter practice footprint areas. ◆ Similar to practices without underdrains, the CDA must be stabilized and supplemental E&S control measures (e.g., silt fence/barriers around the perimeter of the practice) can be used to prevent sediment from entering the post-construction BMP. |
| <p>Conversions from temporary E&S practice to post-construction BMP</p> | <ul style="list-style-type: none"> ◆ For post-construction stormwater designs that include stormwater ponds or wetlands, it is likely that the practice will be installed initially as a temporary E&S basin. ◆ E&S control plans should incorporate the design considerations outlined in the following section on co-locating and converting E&S practices to post-construction BMPs. ◆ The timing of conversion from temporary to permanent practices depends on exposed areas and continued land disturbance in the CDA. The E&S control plan should have a detailed phasing plan that clearly explains this sequence. |

E.3 Co-Locating & Converting E&S Practices to Post-Construction BMPs

Previous sections discussed the prospect of co-locating E&S control and post-construction practices. While this cannot be done in all cases, it is an acceptable approach as long as certain guidelines are followed to ensure the integrity of the post-construction BMP. In addition, there are some notable advantages to co-locating practices, the chief one being that the post-construction conversion cannot take place until the construction-phase E&S control function is complete. This is important because one of the chief causes of failure for post-construction BMPs is premature installation and the introduction of construction sediments into the practice. There are many bioretention, infiltration, and other practices where this has been a serious concern (see Figure E.3-1). The other advantage for co-location is that it is straight-forward, can be implemented easily by the contractor, and may lead to cost savings.

Despite these advantages to co-location, there are circumstances where it should not be done, including:

- ✧ Post-construction BMPs that have too small of a drainage area and/or are in a location that is not conducive for an E&S control trap.
- ✧ Post-construction BMPs where the local plan reviewer deems that construction activity will compact and damage underlying soils to an extent that performance of the post-construction BMP will be compromised.
- ✧ Post-construction BMPs where timing and sequencing of construction phases will not allow the conversion to take place in the proper sequence so that the practice cannot fulfill its post-construction treatment objectives.
- ✧ Other situations where the local authority, plan reviewer, designer, and/or contractor believes that co-location will compromise the E&S control and/or post-construction plan implementation.

Where co-location is a viable option, there are generally two types of practices where conversion from E&S control to post-construction can take place:

1. Smaller-scale sediment traps (generally with drainage areas less than 3 acres) that can be converted to bioretention, dry swales, or surface sand filter BMPs. See Table E.3-1 for specific conversion guidance.
2. Larger-scale sediment basins with larger drainage areas that can be converted to post-construction stormwater ponds or wetlands. See Table E.3-2.

In addition, Figure E.3-1 shows examples of E&S control practice conversions to post-construction BMPs, as well as some of the pitfalls of the conversion process.

| Table E.3-1. Conversion of Smaller-Scale Sediment Traps to Bioretention, Dry Swales, or Surface Sand Filter BMPs (generally with drainage areas less than 3 acres). | |
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| Topic | Conversion Guidance |
| Drainage Areas | Drainage areas should be limited by the appropriate post-construction BMP design specifications, even if construction phase drainage areas could be larger. This means that sites may have to be divided into smaller drainage areas with use of multiple sediment traps and other E&S control measures. |
| Grading to Blend into Topography | Some temporary E&S practices are installed on slopes, have steep embankments or side slopes, and otherwise don't blend into the surrounding topography. These types of practices are not good candidates to convert to post-construction BMPs, unless re-grading is part of the conversion plan. A sounder approach is to design the temporary E&S control practice so that this type of re-grading is not necessary, which may include changing the footprint, grading, slopes, and other features of the E&S practice. |
| Stabilizing the Drainage Area | Make sure the contributing drainage area (CDA) is stabilized prior to conversion. This is a good thing about using sediment traps, since they cannot be taken out until their erosion control function is complete. Therefore, the tendency to prematurely install post-construction practices is lessened. The conversion can proceed when site inspectors indicate that the CDA is properly stabilized. In addition to CDA stabilization, other supplemental E&S control measures may be warranted, such as diverting flow around the practice during the conversion process and using silt fence or matting/sod on side slopes of the practice. |
| Remove Construction Sediments | All construction sediments should be removed as the first step in the conversion process. This may also involve de-watering the practice with an approved de-watering and sediment capture method (e.g., dirt bags, sediment traps). |
| Excavate Below the E&S Practice Bottom Elevation | The bottom of the post-construction practice should be at least one foot lower than the temporary ES&PC bottom elevation. This is so that the bottom of the post-construction BMP will be in undisturbed soils that are not impacted by construction activities. During excavation to the post-construction design elevation, scarify or rip the underlying soil to promote infiltration. |
| Installing Underdrains | If the post-construction practice design has an underdrain, decide when to install the underdrain. Usually this will be done as part of the conversion (at end of the construction phase). However, if the underdrain goes through an impounding structure or berm that will stay in place with the post-construction BMP, it may be best to install the underdrain with the initial E&S practice, cover it with heavy gage plastic, and then fill on top to reach the desired bottom elevation of the E&S practice. This will prevent having to breach the impounding structure or berm to install an underdrain system during the conversion process. At the time of conversion, the overlying soil and plastic can be removed, exposing the underdrain system, at which point the desired soil or filter layers can be placed on top of the underdrain. |
| Proceed to Install Post-Construction BMP | Install the practice as per the approved post-construction plans. Some minor grading or adjustments to the footprint may be needed to meet the post-construction design. |
| Be Aware of Easement & Post-Construction Practice Location | If the post-construction BMP is supposed to be located within a drainage easement or in another specific location (e.g., common area in a subdivision), it is very important to make sure that the final practice is within the specified area in order to avoid costly relocation of the practice. |

| Table E.3-2. Conversion of Larger Sediment Basins to Post-Construction Stormwater Ponds & Wetlands | |
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| Topic | Conversion Guidance |
| Timing/ Sequencing | Generally, E&S basins cannot be converted to a post-construction configuration until the contributing drainage area (CDA) is fully developed and stabilized. However, phasing plans can incorporate additional upgradient E&S control practices if certain portions of the CDA will be disturbed subsequent to the conversion. This is likely the case with multi-phase development projects, commercial subdivisions, etc. |
| Sediment Removal | Construction sediment will have to be removed from the basin before conversion to a post-construction BMP. Once de-watered, the sediment can be used as fill on the site. Additional grading may be needed to meet the design standards for the post-construction configuration. |
| Volume & Design Elevations | Sizing rules are different for E&S basins and post-construction BMPs. The E&S basin may be larger or smaller than the post-construction practice, so additional grading is likely needed for the conversion. A common problem with conversions is that not all of the construction sediment is removed so that the post-construction elevations are incorrect. Contractors should always check design elevations for the post-construction BMP. |
| Pond Geometry | Compared to an E&S control basin, a post-construction practice may have a longer flow path, multiple cells, larger surface area, shallower side slopes (e.g., 3:1), deeper or shallower pool depths, safety benches around permanent pools, and other design features. The E&S basin should at least consider the overall footprint and general depth of the post-construction pond so that major grading can be avoided in the conversion process. |
| Pre- Treatment | Most post-construction ponds will incorporate one or more forebays for pretreatment. The forebays can be constructed as part of the E&S basin, but it may be preferable to install them as part of the conversion to avoid the cost of cleaning them out, repairing or replacing rock spillways, etc. In either case, the footprint of the forebay should be incorporated into the E&S basin footprint. |
| Risers & Spillways | The post-construction practice design will adhere to certain safety features and riser designs (likely multi-stage risers to address water quality, channel protection, and flood protection). The designer should consider constructing the post-construction design as part of the E&S basin, and then modifying it for the construction phase. For instance, risers can be perforated during construction, and then the perforations plugged as part of the conversion. Certain orifices will likely need to be temporarily plugged during construction. In addition, the spillway and freeboard requirements may be different for the post-construction pond, and relevant design elevations should be used for the temporary E&S basin, unless this is specifically addressed otherwise in the conversion plan. |
| De-watering Drains | Certain post-construction pond or wetland designs may call for de-watering drains so that pools can be drained to remove sediment or for maintenance. With regard to constructability, it may be best to install drains in the original E&S basin, and make sure they do not get clogged during construction. |
| Rock Weirs, Spillways, Outlet Protection | Rock features may be part of the E&S and/or post-construction practice. However, it is likely that they will get filled with sediment during construction, so they will have to be replaced or rebuilt as part of the conversion. |
| Maintenance Access | While temporary E&S basins only need to be accessed during the construction phase, post-construction ponds require permanent maintenance access. Plan for this access during construction. |
| Landscaping | Most post-construction ponds will have a landscaping plan. The landscaping should be installed during the conversion, and not during the active construction phase. |



Figure E.3-1. Examples of E&S control practice conversions to post-construction BMPs (Photos: Center for Watershed Protection)

E.4 Conclusion

Increasingly, it is important to coordinate E&S control planning and implementation with post-construction stormwater plans. A coordinated plan will help both phases (construction and post-construction) to proceed in a logical, well thought-out way that avoids costly redesigns and work delays.

The principles of adjusting the limits of disturbance, protecting soil structure associated with post-construction BMPs, diverting construction runoff around important post-construction areas, developing detailed conversion plans for E&S to post-construction BMPs, and coordination and communication among plan reviewers, design professionals, inspectors, and contractors will help achieve this integration of E&S control and post-construction stormwater.

E.5 Coordinating Erosion and Sediment Control with LID Planning References

1. CWP. 2008. *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program*. Center for Watershed Protection, Ellicott City, MD. EPA Publication No.: 833-R-08-001.