

CHAPTER 7

CONSTRUCTION

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Erosion and sediment control measures are required on construction sites because construction activities impact natural systems that are deemed worthy of protection. Inspection of erosion and sediment control measures is necessary to ensure their effectiveness. Unless the measures are properly installed and maintained, there is a strong chance of failure during the construction period.

7.1 Erosion and Sediment Control Manager

The contractor shall designate and supply a representative, experienced in all aspects of construction and experienced and qualified to design and inspect erosion control plans and facilities, as the Erosion and Sediment Control Manager (ESCM). At a minimum the ESCM should have attended a class on erosion control that covered all the items included in this manual. The ESCM shall be responsible for assuring the implementation of the ESCP and have the authority to immediately mobilize necessary personnel to correct and modify erosion prevention and sediment controls if required.

Duties of the EPCM include:

- Manage and insure proper implementation of the ESCP.
- During periods of active construction maintain the ESCP at the project site, available for review upon request.
- Accompanying the Agency in a field review of the ESCP prior to the beginning of work.
- Monitor rainfall on the project site.
- Inspecting erosion and sediment controls on active construction sites weekly.
- Inspecting erosion and sediment controls on inactive sites at least biweekly.
- Inspecting erosion and sediment controls on both inactive and active sites at least daily during rainy periods where a minimum ½ inch of rain has fallen in a 24 hour period.
- Mobilizing crews to make immediate repairs to the controls or install controls during working and non-working hours.
- Recording measures taken to clean up significant amounts of sediment.
- Completing erosion control monitoring forms (Appendix E) after each inspection, erosion control facility modification, or maintenance action. Submit forms to the Agency weekly for active sites and bi-weekly for inactive sites.
- Maintain an up-to-date ESCP.

- Prepare a contingency plan in preparation for emergencies and the rainy season.
- Accompany the Agency on inspections and, if requested, on inspections made by other regulating agencies.

7.1.1 Ineffective Controls

The ESCM shall record measures taken to clean up significant amounts of sediment. Should a control measure not function effectively, one for more of the following tasks should be performed:

- Immediately repair the control.
- Replace the control.
- Provide additional controls.

7.1.2 Rainfall Monitoring

The ESCM shall furnish and install a rain gauge at the project site. Rainfall should be monitored and the Agency will be notified if .6 in. (minimum) rainfall occurs within 24 hours. The entire project should be inspected to evaluate the condition of the control measures as soon as is practicable, but no later than 24 hours, including weekends and holidays.

7.2 Pre-Construction Meeting

The contractor and inspector should carefully review the ESCP prior to the pre-construction meeting to understand what is required. Implementing the ESCP and assuring its performance may involve significant expense. The following pre-construction activities should be required:

- Prior to the pre-construction meeting, review and comment on the contractor-modified ESCP or contractor proposed ESCP modifications.
- During the pre-construction meeting, review the comments and finalize the ESCP implementation schedule with the contractor.
- Prohibit clearing and grading operations prior to ESCP approval and implementation.
- Tentatively locate construction accesses.
- Delineate clearing limits, drainage courses, easements, setbacks, wetlands and other sensitive areas and their buffers.

The pre-construction meeting provides an opportunity for the contractor to discuss the plan with the inspector and learn which elements of the ESCP deserve the most attention. Adjustments to

improve performance or make installation easier and maintenance more reliable may also be discussed.

The pre-construction meeting is also an opportunity to discuss the inspection schedule and procedures. Additional key points to consider in the pre-construction meeting are:

- Pollution Control Plan for contractor operations.
- Qualifications of individual designated as the ESCM.
- Method to be used to document the up-to-date ESCP.
- Adjacent areas that need special protection from sedimentation, particularly environmentally sensitive areas such as wetlands, stream crossings, channel, and water disposal outlets.
- Location of erosion and sediment control practices and their implementation.
- Sequence of installation with respect to the construction schedule.
- Surface stabilization plans, temporary and permanent seeding.
- Construction schedule and any anticipated shutdown periods.
- Maintenance plans and the contractor's procedure for monitoring performance.
- Location of all borrow and disposal areas.
- Emergency or contingency plans.
- Any special requirements identified in permits.
- Monitoring Form submittal requirements, provide a copy of the monitoring form to the contractor.
- Biological Opinion – this is furnished by ODOT and covers special needs and concerns for threatened and endangered species on the project. The contractor should be made aware of its contents.

7.2.1 Contractor-Modified ESCP

Most projects will include an ESCP prepared by designers. This plan is only a guide and is unlikely to have addressed all erosion problems for the project adequately. The ESCP included in the plan set should not be followed blindly. It is the contractor's responsibility to propose modifications to the plan. The modifications can be marked on the ESCP included in the plan set and submitted to the Agency. The Project Manager or Agency reviews and comments on the contractor-modified ESCP.

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In order to assess the adequacy of the ESCP, the reviewer should ask the questions listed below. The plan should include a brief narrative describing any unique site characteristics or special considerations. Sufficient detail should be provided to implement the plan properly and control erosion and sedimentation during each phase of site development.

1. Is the information site specific? Any information provided by the contractor for the ESCP must be site and project specific rather than generic.
2. Does the ESCP fulfill the following minimum requirements (when applicable)?
 - Show protection and buffers for sensitive areas, streams, lakes, and wetlands?
 - Protect adjacent properties and protect downstream properties and waterways from erosion by control velocity and volume of runoff as it leaves the site?
 - Prevent upslope runoff from flowing over disturbed areas?
 - Provide measures which trap sediment onsite?
 - Route dewatering devices through a sediment-trapping device before leaving site?
 - Protect inlets and the storm drain system?
 - Provide perimeter protection downslope and along the full length of disturbed areas?
 - Provide erosion prevention for steep slopes?
 - Provide protection at cut and fill slope transitions?

7.2.2 Up-to-Date ESCP

Effective erosion control is closely tied to a contractor's staging, operation methods, and construction timing. When ODOT develops the erosion control plan, the contractor's staging and operation methods are unknown. Therefore, ODOT expects the contractor to propose changes to the ESCP and update the plan as needed throughout the life of the project.

Changes to the ESCP are the responsibility of the ESCM. Changes to the ESCP shall be submitted to the Agency for approval. The modified ESCP will be documented using procedures approved by the Agency. Generally, changes to the ESCP can be made by hand on the plan itself, which will become a master up-to-date ESCP. An example of an updated up-to-date ESCP is provided in Appendix C. Notes on the up-to-date ESCP should indicate the location, date, and status of each BMP (I=installed, M=maintained, R=removed).

7.2.3 Construction Schedule Review

Refer to Sections 00290.30(c), 00180.41 and 00280 for specific requirements. The implementation schedule should include the following:

- Timing of activities to limit seasonal and weather impacts.
- Timing of wet season work and temporary work shutdown.
- Timing of activities to meet “in-water” work restrictions.
- Erosion prevention and sediment controls shown on the plans should be installed before ground-disturbing activities begin.
- Permanent facilities, such as sediment traps and basins, which will be used during construction as temporary measures should be installed.
- Retention of temporary perimeter controls until all upstream areas are finally stabilized.
- Timing of seeding operations.

7.2.4 Monitoring Form

All inspections are to be recorded on the ODOT Erosion Control Monitoring form, which is included in Appendix E. Also included in Appendix E is a sample form showing proper descriptions of the performance of various BMP’s on a hypothetical project. The effectiveness of each BMP at every location on site should be documented on the form, and general observations on site conditions should also be recorded. Information provided on the form is useful for tracking repairs and demonstrating permit compliance. It is noteworthy that in the event of permit violations or subsequent enforcement actions, the information recorded on the form, along with photographs and videos, may be used to evaluate the responsibility of involved parties.

7.3 Materials

The following sections present information on erosion and sediment control products and materials approved for use on ODOT projects. Information necessary to verify proper Quality Control /Quality Assurance in accordance with the specifications is also provided.

7.3.1 ODOT Qualified Products List (QPL)

The ODOT Qualified Products List (QPL) is for products that have been reviewed and found to be suitable for use in a specific category. Erosion control products are found in Section 00280.10 of the QPL. Job control testing may still be necessary.

- Approved List – commercially available products having a low consequence of failure, products may be used for appropriate applications only.
- Rejected List – products that should not be used for that specific category.
- Conditional List (unpublished): conditionally approved products that require specific approval for each application.

Specific questions regarding products on the Conditional List can be answered by calling the New Products Coordinator, Construction Section, ODOT materials Laboratory.

The QPL is accessible on the Internet at:

<http://www.odot.state.or.us/techserv/construction/products/prodsearch/search2.cfm>

7.3.2 Seed Tags

Seed furnished for a project must meet or exceed the requirements of the Standard Specifications. The most important requirement is meeting state and federal seed law which, among other things, spells out exact seed labeling requirements. (See Oregon Revised Statute 633.520 for the exact requirements). The following are typical requirements:

- The kind and variety of the seed or each seed constituting 5% percent or more in a mixture – ensure that seed mix labels bear the word “mixture” or words “mixed seed”.
- The country or state where the seed is grown
- The lot number or other lot identification
- The total percentage, by weight, of other crop seed
- The total percentage, by weight, of weed seed
- The total percentage, by weight, of inert matter
- Statement of “No Noxious (weed) Found”
- For each named seed:
 - (a) Percentage of germination
 - (b) Percentage of hard seed, if more than 1%
- Month and year of (seed) test
- Name and address of seed labeler or seller
- If seed inoculant is used, the claimed date that inoculant effectiveness ends

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- For treated seed (if any present):
 - (a) Statement that the seeds have been treated
 - (b) Name of any chemical used in the treatment
 - (c) Descriptive statement of any process used in the treatment
 - (d) Warning statement for any residual chemicals used
- Net weight of each container

The label must be correct and the purity, germination and other information on the tag must be backed by a seed lab analysis report. High quality seed germinates well, has a high purity percentage, and is free of noxious weeds or unintended species. The identity, purity and uniformity of the seed must be maintained at all times by continuing to monitor seed delivered to the project for proper labeling.

See Section 01030 for special labeling requirements for Certified Seed. Native seed may also have unique labeling requirements that will be shown in 01030 and the project Special Provisions.

The identity, purity and uniformity of the seed must be maintained at all times. All seed must be tested and meet the minimum seed viability standards. Lots containing weed seeds as listed by State or Federal law are not allowed. Seed must meet minimum viability standards. If there is reason to be suspicious of the quality of the seed, it is advisable to have samples of the seed tested at the state seed laboratory. Wet, moldy, or otherwise damaged seed should not be accepted. If a specified seed variety is not available, the contractor needs to consult with the Agency and receive approval of any proposed substitutions prior to any substitutions. Seed should be used soon after purchase and should be stored for any length of time in a cool and dry space. Seed should not be subject to extreme heat or cold temperatures prior to application.

7.3.3 Pure Live Seed Calculation

This is a method of calculating an amount of seed to be planted which takes into account the variation of seed germination and purity of the seed source.

$$\text{Pure Live Seed (PLS)} = \% \text{ Germination} \times \% \text{ Purity}$$

Example:

A recommended seed mixture requires that 26 lb (PLS) of intermediate wheatgrass be planted.

Intermediate wheatgrass germination = 80%

Intermediate wheatgrass purity = 90%

$$80\% \times 90\% = 0.72 \text{ or } 72\% \text{ PLS}$$

26 lb (PLS) to be planted = Approximately 37 lb of bagged seed should be

0.72 (PLS factor) used so that 26 lb of PLS will be planted.

7.3.4 Weed Free Straw/Straw Bales

Grass seed crops in Oregon become certified through the Oregon State University Extension Service. This program was created to ensure that the seed that is produced will be the correct species and variety and have genetic purity. The certification program includes an inspection of the field by OSU Extension where they look at whether the field has a buffer distance to prevent cross pollination from other plant varieties, is noxious weed free, and meets other criteria related to seed purity. ODOT relies upon the OSU Extension seed certification program when specifying straw and grass seed for temporary erosion control in an effort to control the spread of noxious and other invasive weeds.

Straw is not certified in Oregon at this time, and therefore, straw bales will not have a tag indicating certification. The field from which the straw originates should be certified by the OSU Extension. Because straw bales are often left on the project site after the work is completed, ODOT must insure that the straw bale does not harbor weed species that can be invasive to agricultural fields and wildlife habitat. Documentation must be obtained from the supplier that demonstrates the source of the straw was a certified field or a field which was tested for weed seed content and met the same requirements for a certified field.

Straw can originate from cereal grain as well, however, the grain crop must be from a certified field. The OSU Extension Service keeps track of fields around the state that are certified. The OSU Extension Service has a presence in every county in Oregon and can be called if anyone needs assistance in finding a source for weed-free straw and certified grass seed.

7.4 Installation

Proper installation of erosion and sediment controls is absolutely essential. Performance of control measures is directly determined by how they are installed in the field, and often times the measures themselves can cause more damage when improperly installed than if they are not used at all. Installation of all base measures should be inspected and any deficiencies corrected prior to the start of land disturbing activities. Subsequent inspections of any additional installations should also be made throughout the life of the project as needed.

The inspector should be familiar with installation details for each BMP used on the project. Details for the installation of all specified BMP's are provided in the ESCP. Installation details for BMP's are also provided in Chapter 3 of this manual, and in Section 00280 (Appendix A).

The application of mulch and seed is normally based on the rate described in the specifications. To assure the appropriate rate is applied, mark off an area of known dimensions and apply the specified amount of material over the area. This will provide a visual baseline for inspecting the rate of application over areas of similar area preparation and material specifications.

7.5 Measures During Construction

The approved ESCP should be viewed as an open-ended document, subject to approved adjustments and modifications, if necessary. Contingencies such as changes in the construction schedule or unexpectedly severe weather frequently call for changes or adjustments to the plan.

In addition the contractor is expected to monitor the performance of all erosion and sediment control practices and make minor adjustments as needed on a day-to-day basis. Major modifications, on the other hand, must be approved by the Agency before they are implemented.

The contractor's responsibility does not end with installation and maintenance of designated measures, the plan must also work effectively. Excessive erosion on the site or off-site damage from sediment is not acceptable. If performance of the ESCP is not adequate the plan must be revised, approved and implemented. Major revisions may be made in the field if they are well documented and work effectively. Major revisions or minor revisions that are ineffective must be discussed with the engineer of record. All graded areas and the supporting erosion and sediment control measures should be checked periodically, especially after heavy rain events. All sediment from diversions and other water-disposal practices should be promptly removed. If washouts or breaks occur, they should be repaired immediately. Prompt maintenance of small-eroded areas before they become significant gullies is an essential part of an effective ESCP.

Inspections, changes, problems, and solutions should be documented on the Updated ESCP as described in Section 7.2.2. Meetings to review and update the ESCP before winter work and

before temporary work shutdown should be conducted. Submittals for materials and alternative measures should be reviewed and approved.

7.5.1 Work Restrictions

All ODOT construction projects are required to restrict certain types of work, which may contribute to sediment laden water leaving the project boundaries or entering waterways. The following work restricts may apply:

3. **Flag Clearing Limits:** Construction site clearing limits will be clearly flagged in accordance with the approved plans by the contractor. No ground disturbance is permitted beyond the flagged boundary. Flagging should be maintained for the duration of construction.
4. **Perimeter Controls Before Grubbing:** All appropriate perimeter controls should be installed prior to any major site grubbing operation. Perimeter controls include interceptor ditches, berms in fill areas, and sediment fences or straw bales along the banks of existing streams and toes of slopes.
5. **Wet Season Plan and Schedule:** Prior to wet season construction work and before temporary work suspension for winter, the contractor should meet with the Agency to review and update the ESCP and to develop a schedule to assure that appropriate controls are implemented and maintained during the wet season work and suspended periods.
6. **Limit Disturbed Areas:** If soil erosion and sediment resulting from construction activities is not effectively controlled, the Agency will limit the amount of disturbed areas that can be effectively controlled.
7. **Install BMP's Early:** Erosion and sediment control features should be incorporated into the project at the earliest practicable time. All erosion and sediment control measures should be installed according to the approved implementation schedule and with these specifications.
8. **Stop Work:** Failure to control erosion and or pollution shall be cause for the Agency to stop all construction work until measures have been taken to bring all construction into compliance with these specifications.

7.5.2 Stabilization Requirements

This is the definition of stabilization from the 1200-CA Permit:

Stabilization The completion of all soil disturbance activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as riprap, gabions, geotextiles, or bioengineering methods) that will prevent erosion.

All soils that are exposed and disturbed by construction-related activities should be stabilized according to the following time frames:

- Statewide (Entire Year) – Stabilize within 7 days of exposure all areas within 30 meters of waterways, wetlands or other sensitive areas.
- West of the Cascades (Entire Year) – Stabilize all other areas within 14 days of exposure.
- East of the Cascades (October 1 through May 1) – Stabilize all other areas within 14 days of exposure.
- East of the Cascades (May 1 through October 1) – Stabilize slope and embankment construction in stages based on site conditions, weather, and as determined by the Agency's Representative.

7.5.3 Erosion Control Emergency Items

The contractor is required to have materials on hand as a contingency in the event of a failure or when required to shore up BMP's installed as part of the ESCP. An example of when to use these items would be in the event of a heavy rainfall that creates runoff beyond the capabilities of the existing erosion control facilities of the project site. At a minimum, the following materials should be kept on the project site for use in emergencies:

- 100 ft. of unsupported sediment fence
- 280sq ft of 6 ml plastic sheeting (when soil stock piles are anticipated).
- 50 bags for sand bags (these are only empty bags, so they do not take up much space)
- 5 straw bales w/10 stakes
- 10 biobags w/20 stakes

It is prerogative of the designer to specify additional or alternate material types and quantities depending on the scope of the project.

The emergency items may also be used at the discretion of the project inspector to strengthen the erosion control measures as needed during construction project. A discussion should take place between the inspector and the ESCM when making the decision when to employ these contingency erosion control items. An example would be when the contractor creates a stockpile of soil at the project site that was not anticipated during development of the ESCP. The plastic sheeting could be employed to cover the stockpile and the rope and sandbags would be used to secure the plastic from blowing around in the wind. Contingency materials on-hand which are not installed are paid for in the Lump Sum Bid Item under Section 00280 – Erosion Control. If the contingency erosion control items are not used during the life of the construction project, the contractor may re-use these items at another site.

7.6 Maintenance

Erosion and sediment controls must be maintained in good working order at all times in order to function as intended. These controls must be maintained and retained in place until the Agency issue notification of acceptance of permanent stabilization. All maintenance and repairs are included in the bid price submitted by the contractor and are therefore at the contractor's expense.

Typical maintenance activities, guidelines, and failure modes for BMP's are discussed in Chapter 3 of this manual, and in Section 00280 (Appendix A). The inspector should be familiar with maintenance requirements for each BMP used on the project. It is noteworthy that maintenance activities and frequencies vary among the different BMP's, and will depend largely on weather and other site conditions. In general, the more effective erosion prevention measures are, the less maintenance will be required for sediment controls.

7.6.1 Sediment Removal

Sediment shall be removed and the controls upgraded or repaired as needed or as soon as practicable, but no later than 2 days after the surrounding exposed ground has dried sufficiently to prevent further damage from equipment needed for repair operations. In the event of continuous rainfall over a 24-hour period, or other circumstances that preclude equipment operation in that area, additional sediment controls shall be hand-carried and installed in accordance with best management practices and as approved by the Agency. Catch basins shall be maintained so that no more than 6 in. sediment depth accumulates within traps or sumps. Sediment shall be removed from controls such as sediment fences, sediment barriers, check dams, inlet protection, and sediment traps once the sediment buildup has reached 1/3 the exposed height of the control or storage depth. Rock filters and filter berm material shall be replaced with new aggregate material when sediment substantially reduces the effective filtering capacity by 50 percent.

7.6.2 Construction Entrances and Paved Areas

Aggregate or other material specified shall be added or removed as needed to maintain proper function of the entrance areas. All paved areas shall be kept clean for the duration of the project.

7.6.3 Sediment Disposal

Removed sediment shall be regraded into slopes or removed and disposed of off-site in accordance with all federal, state and local laws and ordinances. Sediment-laden water shall not be flushed into the storm drain system or waterways of any type.

7.7 Finishing and Cleanup

Within 30 days of the notification of acceptance of permanent stabilization, temporary erosion and sediment control materials should be removed from the area. Areas affected by the removal process should be permanently stabilized. All materials associated with temporary erosion and sediment control that are not incorporated into the permanent work become the property of the contractor.

Removed sediment should be regraded into slopes or removed and disposed of off site. Sediment-laden water can be settled, treated or reused on site. It should not be discharged directly to any water body, either treated or untreated.

7.8 Inspector's Tools

The following sections provide additional resources for the inspector to verify that adequate erosion and sediment control planning and measures are implemented. These checklists and guidelines are also useful for the ESCM as they outline ODOT's expectations for proper erosion and sediment control management.

7.8.1 Inspector Checklist

The Inspector Checklist included in Appendix E should be used by Agency representatives when inspecting erosion and sediment controls on a project site. The checklist is intended to summarize the key elements of a successful erosion and sediment control program. Topics on the checklist include:

- Schedule Review
- Erosion and Sediment Control Plan
- Erosion and Pollution Control Manager
- Sensitive Areas

- Contingency Plans
- Materials On-Hand
- Maintenance
- Monitoring Forms
- Slope Protection and Stabilization
- Plan Revisions and Modifications
- BMP Evaluation
- Technical Resources
- Additional Items

7.8.2 Winterization

The wet season in Oregon is approximately October 1 through April 30. Prior to wet season work and before temporary work suspension for winter, the contractor shall meet with the Agency to review and update the ESCP and to develop a schedule to assure that appropriate controls are implemented and maintained during wet season and work suspension periods.

Winter preparations should begin in August. Winterization planning should address the items listed above, and in the “Inspector Checklist” and “Buttoning Up Contraction for the Rainy Season” list in Appendix E.

7.8.3 Rules of Thumb

Several Rules of Thumb worksheets are provided in Appendix D to aid designers and inspectors in determining and verifying the quality and quantity of various erosion control items. These are especially useful when verifying the application rates of various mulch and hydraulically applied products. Appendix D includes the following:

- Example Seed Tags
- Slope Inclination Conversions
- Sediment Trap Sizing Spreadsheet
- I-D-R Curve Zone Map
- Straw Mulch Application Worksheet
- Hydraulic Application Equations
- Wood Fiber Mulch Hydraulic Application Worksheet

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- Seed / Fertilizer Hydraulic Application Worksheet
- Hydraulic Application Example Problems