- Following construction, these areas shall be restored to preconstruction condition or better to prevent future erosion.
- Perform street cleaning at the end of each day or more often if necessary.

BMP C120E: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

- Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for > 30 days. See Element #5: Stabilize Soils for specific timelines for stabilizing exposed soils.
- The optimum permanent seeding window for eastern Washington is October 1 through November 15.
- The acceptable permanent seeding window for eastern Washington is September 1 through April 30.
- Seeding permanent species is not recommended for eastern Washington from May 1 through August 31, unless irrigation is conducted.
- Review all disturbed areas in late August to early September and complete all seeing by the end of April. Otherwise, vegetation will not establish itself well enough to provide more than average protection.
- Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121E: Mulching for specifications.
- Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions or geotextiles) which will prevent erosion. See BMP F6.61: Amending Construction Site Soils.

Design and Installation Specifications

General

- Install channels intended for vegetation before starting major earthwork and hydroseed with a bonded fiber matrix (BFM). For vegetated channels that will have high flows, install erosion control blankets over hydroseed. Before allowing water to flow in vegetated channels, establish a 50% vegetation cover of all seeded areas after 3 months of active growth following germination during the growing season. If vegetated channels cannot be established by seed before water flow, install sod or prevegetated mats in the channel bottom over hydromulch

and blankets.

- Confirm the installation of all required stormwater control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre (lb/acre) of mulch with 3% tackifier.
- Mulch is always required for seeding. Apply mulch on top of the seed or simultaneously by hydroseeding. See BMP C121E: Mulching for specifications.
- Areas that will have seeding only and not landscaping may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Reinstall native topsoil on the disturbed soil surface before application. See BMP F6.61: Amending Construction Site Soils in Chapter 6 - Flow Control BMP Design.
- When installing seed via hydroseeding operations, only about one-third of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. One way to overcome this is to increase seed quantities by up to 50%.
- Vegetation establishment can be enhanced by one of the following two approaches:
    - Approach 1: Enhance vegetation establishment by dividing the hydromulch operation into two phases:
        - Phase 1 – Install all seed and fertilizer with 25% to 30% mulch and tackifier onto the soil in the first lift.
        - Phase 2 – Install the remaining mulch and tackifier over the first lift.
    - Approach 2: Vegetation can also be enhanced by:
        - Installing the mulch, seed, fertilizer, and tackifier in one lift;
        - Spreading or blowing straw over the top of the hydromulch at a rate of about 800 to 1,000 lb/acre; or
        - Holding straw in place with a standard tackifier.
    - Both of these approaches (Approach 1 and Approach 2) will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:
        - Irrigation,
        - Reapplication of mulch, and
        - Repair of failed slope surfaces.

      Either of these approaches can use standard hydromulch (1,500 lb/acre minimum) and BFM/mechanically bonded fiber matrix (MBFM) (3,000 lb/acre minimum).
- Seed may be installed by hand if it is:

- Temporary and covered by straw, mulch, or topsoil; or
- Permanent in small areas (usually < 1 acre) and covered with mulch, topsoil, or erosion blankets.

- The seed mixes listed in Table 7.3: Temporary Seeding through Table 7.12: Permanent Seed Mixes: Stabilization of Ski Slopes and Subalpine Areas include recommended mixes for both temporary and permanent seeding. Alternative seed mixes approved by the local jurisdiction may be used.
- Because it is difficult to generalize soil and climate conditions in eastern Washington, the project proponent is directed to check with the local suppliers or the local conservation district for appropriate seed mixes and application rates for their site based on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic.
- In addition to meeting erosion control functions and not hindering maintenance operations, selection of long-lived, successional growth native vegetation that can compete against or exclude weeds and grow with minimal maintenance after plant establishment is preferred. Provide diversity to the greatest extent possible and plan for a succession of flowering times to improve pollinator habitat.

Table 7.3: Temporary Seeding shows seeding rates for four different seed mixes (A, B, C, and D) for the temporary stabilization of disturbed areas until permanent vegetation or other long-term erosion control measures can be established. These annual plants will generally not survive more than one growing season.

Table 7.3: Temporary Seeding

Common Name	Seeding Rate for Four Seed Mixes (lb/acre)			
	A	B	C	D
Winter or spring wheat (I)	80			
Spring barley (I)		80		
Regreen (I)[a] or triticale (I)			50	
Annual ryegrass (I)				15

[a]Sterile wheat x wheatgrass hybrid

I = introduced, nonnative plant species

Table 7.4: Permanent Seed Mixes: Upland Areas with Less than 12 Inches Precipitation shows three different erosion control seed mixes (A, B, and C) for upland areas that receive less than 12 inches effective precipitation. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.4: Permanent Seed Mixes: Upland Areas with Less than 12 Inches Precipitation

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]		
	A	B	C
Crested or Siberian wheatgrass* (droughty, coarse soils) (I)	7		
Bluebunch wheatgrass (N)		7	
Indian ricegrass (sandy soil)(N)	2		
Thickspike wheatgrass (N)			8
Sheep fescue (I)		1	1
Big bluegrass (N) or needle and thread grass (N)	1	1	
TOTAL	10	9	9
Seeds/sq ft/mixture	63	56	64

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

sf = square feet

Table 7.5: Permanent Seed Mixes: Upland Areas That Receive 12 to 15 Inches Precipitation shows three different erosion control seed mixes (A, B, and C) for upland areas that receive 12 to 15 inches effective precipitation. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.5: Permanent Seed Mixes: Upland Areas That Receive 12 to 15 Inches Precipitation

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]		
	A	B	C
Bluebunch or beardless wheatgrass (N)		8	
Pubescent wheatgrass (I)			7
Indian ricegrass (sandy or sandy loam soils) (N)	2		
Thickspike wheatgrass (N)	7		2
Sheep fescue (I)		1	2
Basin wildrye (N)		1	
TOTAL	9	10	11
Seeds/sf/mixture	53	63	49

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

sf = square feet

Table 7.6: Permanent Seed Mixes: Upland Areas With 15 to 18 Inches Precipitation shows two different erosion control seed mixes (A and B) for upland areas that receive 15 to 18 inches effective precipitation. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.6: Permanent Seed Mixes: Upland Areas With 15 to 18 Inches Precipitation

Common Name	Seeding Rate for Two Seed Mixes (lb/acre)[a]	
	A	B
Bluebunch wheatgrass (N) or beardless wheatgrass (N)	8	
Pubescent wheatgrass (I) or intermediate wheatgrass (I) or thickspike wheatgrass (N)		8
Hard fescue (I) or sheep fescue (I)	2	2
Big bluegrass (N)	1	1
Native legume (N)	2	2
TOTAL	9	10
Seeds/sf/mixture	70	72

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

sf = square feet

Table 7.7: Permanent Seed Mixes: Upland Areas With 18 to 24 Inches Precipitation shows three different erosion control seed mixes (A, B, and C) for upland areas that receive 18 to 24 inches effective precipitation. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.7: Permanent Seed Mixes: Upland Areas With 18 to 24 Inches Precipitation

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]		
	A	B	C
Slender wheatgrass (N) or sodar streambank wheatgrass	7		
Blue wildrye (N)		8	
Mountain brome (N)	1		8
Hard fescue (I)	2	2	2
White clover (I) or red clover (I)			2

Table 7.7: Permanent Seed Mixes: Upland Areas With 18 to 24 Inches Precipitation (continued)

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]		
	A	B	C
Native lupine (N) or northern sweetvetch (N)		2	
Native clover spp. (N) or milkvetch spp. (N)	2		
TOTAL	12	12	12
Seeds/sf/mixture	64	62	76

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

sf = square feet

Table 7.8: Permanent Seed Mixes: Upland Areas With More Than 24 Inches Precipitation shows two different erosion control seed mixes (A and B) for upland areas that receive > 24 inches effective precipitation. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.8: Permanent Seed Mixes: Upland Areas With More Than 24 Inches Precipitation

Common Name	Seeding Rate for Two Seed Mixes (lb/acre)[a]	
	A	B
Hard fescue (I)		2
Blue wildrye (N)	6	
Red fescue (I)	1	
Mountain brome (N)	2	4
Slender wheatgrass (N)		4
White clover (I)	2	
Native legume (N)		2
TOTAL	11	12

Table 7.8: Permanent Seed Mixes: Upland Areas With More Than 24 Inches Precipitation (continued)

Common Name	Seeding Rate for Two Seed Mixes (lb/acre)[a]	
	A	B
Seeds/sf/mixture	72	61

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

sf = square feet

Table 7.9: Permanent Seed Mixes: Grassed Waterways With Fewer Than 15 Inches Precipitation shows three different erosion control seed mixes (A, B, and C) for stabilizing grassed waterways in areas that receive fewer than 15 inches effective precipitation. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.9: Permanent Seed Mixes: Grassed Waterways With Fewer Than 15 Inches Precipitation

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]		
	A	B	C
Pubescent wheatgrass (I)		10	
Streambank wheatgrass (N)			7
Thickspike wheatgrass (N)	7		
Sheep fescue (I)		2	2
Big bluegrass (N)	2		
TOTAL	9	12	9
Seeds/sf/mixture	66	48	56

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

sf = square feet

Table 7.10: Permanent Seed Mixes: Grassed Waterways With 15 to 18 Inches Precipitation shows three different erosion control seed mixes (A, B, and C) for stabilizing grassed waterways in areas that receive 15 to 18 inches effective precipitation. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.10: Permanent Seed Mixes: Grassed Waterways With 15 to 18 Inches Precipitation

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]		
	A	B	C
Tall wheatgrass (I)	10		
Pubescent wheatgrass (I), streambank wheatgrass (N), or intermediate wheatgrass (I)		10	
Hard fescue (I) or sheep fescue (I)	2	2	2
Thickspike wheatgrass (N)			8
TOTAL	12	12	10
Seeds/sf/mixture	46	48	57

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

sf = square feet

Table 7.11: Permanent Seed Mixes: Grassed Waterways With More Than 18 Inches Precipitation shows three different erosion control seed mixes (A, B, and C) for stabilizing grassed waterways in areas that receive more than 18 inches effective precipitation. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.11: Permanent Seed Mixes: Grassed Waterways With More Than 18 Inches Precipitation

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]		
	A	B	C
Intermediate wheatgrass (I)	10		
Mountain brome (N) or meadow brome		10	
Annual ryegrass (I) or perennial ryegrass (I)	4		
Hard fescue (I)		2	
Tall wheatgrass (I)			10
TOTAL	14	12	10
Seeds/sf/mixture	40	46	38

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

sf = square feet

Table 7.12: Permanent Seed Mixes: Stabilization of Ski Slopes and Subalpine Areas shows two different erosion control seed mixes (A and B) for stabilizing ski slopes and subalpine areas in eastern Washington. For each, drilled seeding rates are given (in lb/acre); double seed rates if broadcast or hydroseeded. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.

Table 7.12: Permanent Seed Mixes: Stabilization of Ski Slopes and Subalpine Areas

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]	
	A	B
Blue wildrye (N) or Idaho fescue (N)	10	
Pubescent wheatgrass (I) or red fescue (I)		8
Hard fescue (I)		5
Sheep fescue (I)	2	2
White clover (I) or bentgrasses (I)		2
Lupine (N)	2	

Table 7.12: Permanent Seed Mixes: Stabilization of Ski Slopes and Subalpine Areas (continued)

Common Name	Seeding Rate for Three Seed Mixes (lb/acre)[a]	
	A	B
TOTAL	14	17

[a]Expressed as pure live seed

I = introduced, nonnative plant species

N = native plant species

Roughening and Rototilling

- The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Back-blading or smoothing of slopes > 4H:1V is not allowed if they are to be seeded.
- Restoration-based landscape practices require deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas shall receive soil amendments to achieve organic matter and permeability performance defined in amended soil/landscape systems. For systems that are deeper than 8 inches, complete the rototilling process in multiple lifts, or prepare the soil amendments to achieve the specified depth.

Fertilizers

- Conducting soil tests to determine the exact type and quantity of fertilizer needed is recommended. This will prevent the overapplication of fertilizer.
- Organic matter is the most appropriate form of fertilizer because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form. A natural system typically releases 20% to 10% of its nutrients annually. Chemical fertilizers have been formulated to simulate what organic matter does naturally.
- Always use slow-release fertilizers because they are more efficient and have fewer environmental impacts. Do not add fertilizer to the hydromulch machine, or agitate, more than 20 minutes before use. Too much agitation destroys the slow release coating.

There are numerous products available to take the place of chemical fertilizers, including several with seaweed extracts that are beneficial to soil microbes and organisms. If 100% cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal provides a good source of long-term, slow-release, available nitrogen.

Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix

- On steep slopes, use BFM or MBFM products. Apply BFM/MBFM products at a minimum rate of 3,000 lb per acre of mulch with approximately 10% tackifier. Achieve a minimum of 95% soil coverage during application. Numerous products are available commercially. Install products per manufacturer's instructions. Most products require 24 to 36 hours to cure before a rainfall and cannot be installed on wet or saturated soils. Generally, products come in 40- to 50-pound bags and include all necessary ingredients except for seed and fertilizer.
- BFMs and MBFMs provide good alternatives to blankets in most areas requiring vegetation establishment. Advantages over blankets include the following:
    - BFM and MBFMs do not require surface preparation.
    - Helicopters can assist in installing BFM and MBFMs in remote areas.
    - On slopes steeper than 2.5H:1V, blanket installers may require ropes and harnesses for safety.
    - Installing BFM and MBFMs can save at least $1,000 per acre compared to blankets.
- In most cases, the shear strength of blankets is not a factor when used on slopes, only when used in channels.
    - Areas to be permanently landscaped shall provide a healthy topsoil or amend the existing soil to reduce the need for fertilizers, improve overall topsoil quality, provide for better plant health and vitality, improve hydrologic characteristics, and reduce the need for irrigation.
    - Areas that already have good topsoil, such as undisturbed areas, do not require soil amendments.

Maintenance Standards

- Reseed any seeded areas that fail to establish ≥ 50% cover (100% cover for areas that receive sheet or concentrated flows) of all seeded areas after 3 months of active growth following germination during the growing season. If reseeding is ineffective, use an alternative method, such as sodding, mulching, or nets/blankets. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.
- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. If the erosion problem is drainage related, the problem shall be fixed and the eroded area reseeded and protected by mulch.
- Seeded areas shall be supplied with adequate moisture, but not watered to the extent that causes runoff.

Approved as Equivalent

The Washington State Department of Ecology (Ecology) has approved products as able to meet the requirements of BMP C120E: Temporary and Permanent Seeding. The products did not pass through the Technology Assessment Protocol–Ecology (TAPE) process. Local jurisdictions may choose not to accept this product approved as equivalent or may require additional testing prior to

consideration for local use. The products are available for review on Ecology's Emerging Stormwater Treatment Technologies (TAPE) web page at the following address:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C121E: Mulching

Purpose

The purpose of mulching soils is to provide immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture; holding fertilizer, seed, and topsoil in place; and moderating soil temperatures. There are a variety of mulches are available for use. Only the most common types are discussed in this section.

Conditions of Use

- As a temporary cover measure, mulch should be used:
    - For < 30 days on disturbed areas that require cover;
    - At all times for seeded areas, especially during the wet season and during the hot summer months; and
    - During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.
- Mulch may be applied at any time of the year and must be refreshed periodically.
- For seeded areas, mulch may consist of 100% of the following:
    - Cottonseed meal
    - Fibers made of wood, recycled cellulose, hemp, or kenaf
    - Compost
    - A blend of these three materials
- Tackifier shall be plant-based, such as guar or *Alpha plantago*, or chemical-based such as polyacrylamide (PAM) or polymers. Any mulch or tackifier product used shall be installed per manufacturer's instructions. Generally, mulches come in 40- to 50-pound bags. Seed and fertilizer are added at time of application.

Design and Installation Specifications

For mulch materials, application rates, and specifications see Table 7.13: Mulch Standards and Guidelines. Always use a minimum mulch thickness of 2 inches; increase the thickness until the ground is 95% covered (i.e., not visible under the mulch layer).

Note: Thicknesses may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.