Right of Way Development and Control

01030.00

Seeding

ODOT MATERIALS & INSPECTION

Section 01030.00 –
Seeding

01030.13 (c) Pure Live Seed

This section provides a formula and an example calculation of how to obtain the correct amount of seed per acre. Using the example formula provided in this Section works well if one seed type is specified or if the contractor is going to mix individual seed bags in the field. However, it is common that the contractor is going to provide pre-mixed seed blend.

Let's take a look at the Standard Specifications.

ODOT MATERIALS & INSPECTION

Calculation of Amount of Seed (lbs / ac)

Specified Seeding Rate = _10_ PLS / Ac_

Actual Seeding Rate = $\dfrac{\textbf{10 PLS / AC}}{\text{Seed Purity } \textbf{80\%} \text{ x Germination } \textbf{90\%}}$

(0.80 x 0.90 = **0.72**)

Actual Seeding Rate = $\dfrac{\textbf{10}}{\textbf{0.72}}$

Actual Seeding Rate = **13.88** pounds per acre

ODOT MATERIALS & INSPECTION

01030.13 (c) Pure Live Seed for seed mixes

- The last sentence in Specification 01030.13 (c) states, *"For a seed mix, make this calculation for every seed to obtain the **total** amount to be applied."*
- **The word *"total"* leads to a common misconception**; "When you run through the Pure Live Seed (PLS) calculations for every seed, why wouldn't you just add them all up to obtain the "Amount (lb/acre)"?
- There is an **additional step** that needs to be calculated, in order to obtain the specified amount (lb/acre) of all seeds.

01030.13 (c) Pure Live Seed for seed mixes

- Example #1 will use a real project that I was inspecting and how I was taught by the RE/PM on the project using:
  - Specified rate from the Special Provisions
  - The seed tag from that project
  - The clarifying email from the RE/PM
- Example #2 will use the Spec Note I created with the POR (Bob Marshall) to clarify the extra step.

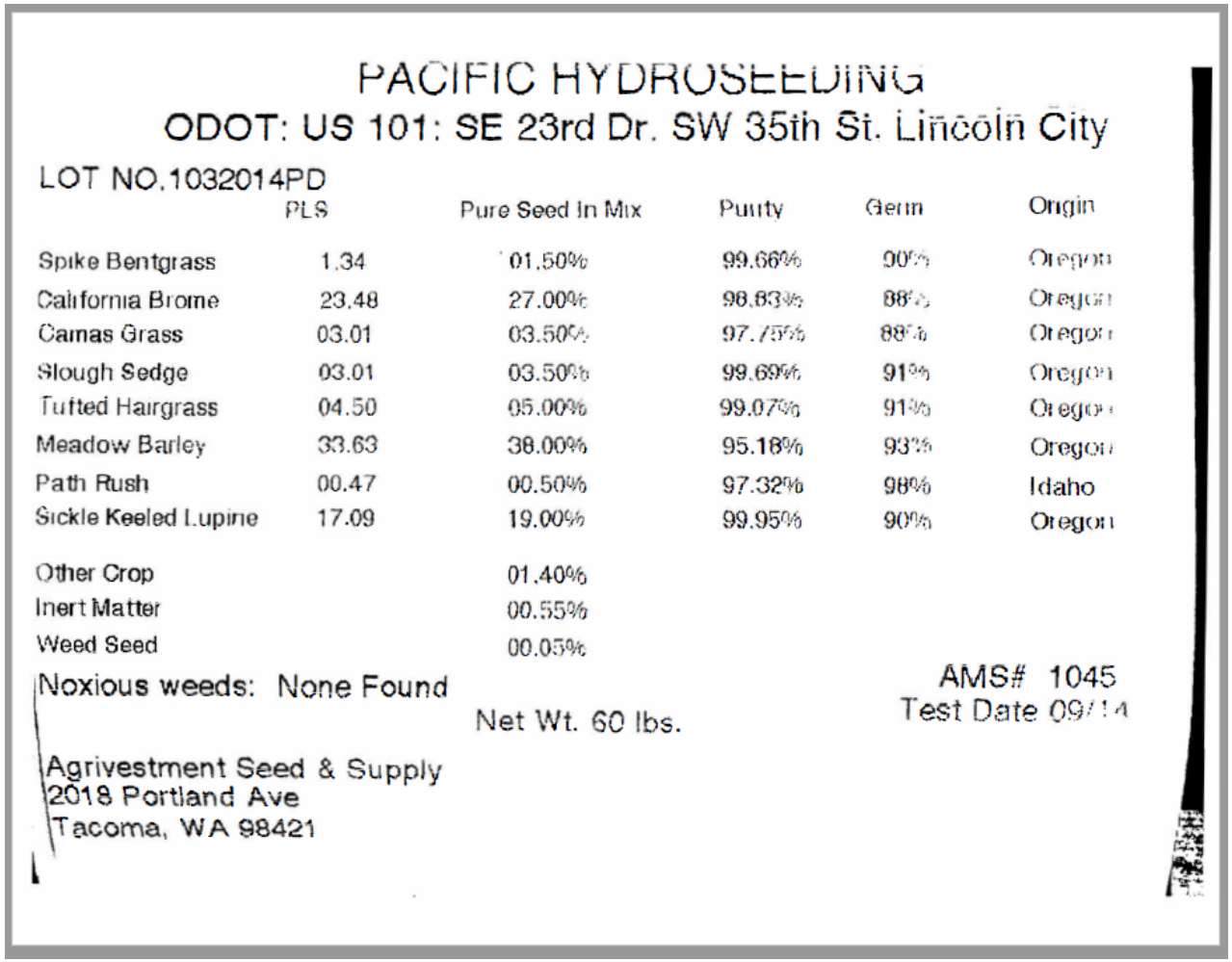
01030.13 (f) Pure Live Seed for seed mixes Example #1

Provide the following seed mix formula:

- **Permanent Seeding, Mix No. 1:**

Botanical Name (Common Name)	PLS (lb/acre)	÷	(% Purity (minimum)	x	% Germination) (minimum)	=	Amount (lb/acre)
Agrostis exrata (Spike bentgrass)	0.5						
Bromus carinatus (California brome)	24.5						
Camassia quamach (Common camas)	3.5						
Carex obnupta (Slough sedge)	3.5						
Deschampsia cespitosa (Tufted hair grass)	1.75						
Hordeum brachyantherum (Meadow barley)	37.0						
Juncus tenuis (Slender path rush)	0.1						
Lupinus albicaulis (Sickle keeled lupine)	17.5						

01030.13 (c) Pure Live Seed for seed mixes Example #1



PACIFIC HYDROSEEDING

ODOT: US 101: SE 23rd Dr. SW 35th St. Lincoln City

LOT NO.1032014PD

	PLS	Pure Seed In Mix	Purity	Germ	Origin
Spike Bentgrass	1.34	01.50%	99.66%	90%	Oregon
California Brome	23.48	27.00%	98.63%	86%	Oregon
Camas Grass	03.01	03.50%	97.75%	88%	Oregon
Slough Sedge	03.01	03.50%	99.69%	91%	Oregon
Tufted Hairgrass	04.50	05.00%	99.07%	91%	Oregon
Meadow Barley	33.63	38.00%	95.18%	93%	Oregon
Path Rush	00.47	00.50%	97.32%	98%	Idaho
Sickle Keeled Lupine	17.09	19.00%	99.95%	90%	Oregon
Other Crop		01.40%			
Inert Matter		00.55%			
Weed Seed		00.05%			

Noxious weeds: None Found

Net Wt. 60 lbs.

AMS# 1045

Test Date 09/14

Agrivestment Seed & Supply
2018 Portland Ave
Tacoma, WA 98421

ODOT MATERIALS & INSPECTION

01030.13 (f) Pure Live Seed for seed mixes Example #1

Provide the following seed mix formula:

- **Permanent Seeding, Mix No. 1:**

Botanical Name (Common Name)	PLS (lb/acre)	÷ (% Purity	x % Germination)	= Amount (lb/acre)
Agrostis exrata (Spike bentgrass)	0.5	99.66%	90.00%	0.6
Bromus carinatus (California brome)	24.5	98.83%	88.00%	28.2
Camassia quamach (Common camas)	3.5	97.75%	88.00%	4.1
Carex obnupta (Slough sedge)	3.5	99.69%	91.00%	3.9
Deschampsia cespitosa (Tufted hair grass)	1.75	99.07%	91.00%	1.9
Hordeum brachyantherum (Meadow barley)	37.0	95.18%	93.00%	41.8
Juncus tenuis (Slender path rush)	0.1	97.32%	98.00%	0.1
Lupinus albicaulis (Sickle keeled lupine)	17.5	99.95%	90.00%	19.5

ODOT MATERIALS & INSPECTION

01030.13 (c) Pure Live Seed for seed mixes Example #1

NUNEZ Arthur

From: [redacted]
Sent: Thursday, October 9, 2014 7:25 PM
To: [redacted]
Cc: [redacted]; NUNEZ Arthur; [redacted]
Subject: RE: US101: Lincoln City - Seeding

[redacted]

It looks like the seed mix is a little off. I calculate that if the mix was perfect, they would need 99.95 pounds per acre. However, since the mix isn't perfect, some seed is heavy and some too light. If you take 99.95 * (% of pure seed in mix)*(Purity)*(Germ) you get their calculated PLS.

I calculate that they need to put down 116.4 pounds(just under 2 bags) per acre to reach the minimum seed per acre for every variety, which is limited by the Camassia quamach. They would have 116.4-99.95 = 16.45 extra pounds of seed per acre on the ground of everything but Camassia quamach.

I left some calculations on your desk and can go through them with you tomorrow. It's confusing.

[redacted] P.E.
PROJECT MANAGER | [redacted]
OREGON DEPARTMENT OF TRANSPORTATION

01030.13 (c) Pure Live Seed for seed mixes Example #2

ODOT MATERIALS & INSPECTION

Spec Notes
& Best Practices

August 2018 Number 5

01030.13(c) Pure Live Seed

This section provides a formula and an example calculation to obtain the correct amount of seed per acre. Using the example formula provided in this Section works well if one seed type is specified, or if the Contractor plans to mix individual seed bags in the field. However, it is common that the Contractor will provide a premixed seed blend.

The last sentence in Specification 01030.13(c) states, *"For a seed mix, make this calculation for **every seed** to obtain the total amount to be applied."* The intent of this specification is to ensure that the application of a seed mix meets the minimum pounds per acre (lbs/acre) for **each** type of specified seed. The calculation example in 01030.13(d) assists in achieving this requirment. An additional example is on page 2 of this SpecNote.

Specification 01030.13(e) states, *"Furnish seed mixes that meet the labeling, quality and inspection requirements stated above."* This Specification reiterates that every seed must meet the above inspection requirements.

Specification 01030.13(f) states, *"Seed mixes, quantities, standards, seeding rates, and other information will be included in the Special Provisions for each type of seed mix."*

Questions & Answers: Applying premixed seed blend

Q – When you run through the Pure Live Seed (PLS) calculations for every seed, why wouldn't you just add them all up to obtain the Amount (lb/acre)?

A – That would only work if that specific seed mix (lot or batch #) had the exact mix percentage and germination/purity rates of 100%. Seeds are perishable living things and variability is to be expected. Adding all the seeds together is a common misconception and would likely not be applying some or all seed species at the specified application rate. The example on page 2 helps demonstate why this does not meet the Specificaiton. If you total the Amount (lb/acre), you will get a total of 9.1 lb/acre. By running the extra caluclation, you will find that the pre-blended seed mix needs to be applied at 15.1 lb/acre to satisfy the Spec requirement for California brome, and is the controlling factor for this specific seed mix/lot #. If the seed is applied at 9.1 lb/acre, then the California Brome would be out of specification by 6 lb/acre.

Q – Some seed mixes have a large variety of individual seed types with different percentages for each of them. Is there an easier way to calculate this?

A – Yes, ODOT has a new form called "Premixed Seed Blends, Adjusted Rates of Application" (form 734-5180) that will calculate the amount of seed mix to apply. The required inputs for the form are the specified application rate for each seed type, purity, germination, and percent of seed for that lot #. After you pre-measure the acreage (**always pre-measure, don't go off the plan measurement!**) then you can enter that to see how many pounds you will need for that seed mix lot/batch number. If there are changes to batch/lot number and/or seed mix, you will need to fill out a new form.

Note:
The PLS calculations were formulated when ODOT used only grass seeds on roadsides. Now native seeds and wildflower seeds are often included. Some of these seeds are by nature "dirty" or they germinate the second year (which would not be identified in testing). If a seed has very low purity and germination rates that skew the calculations beyond what is reasonable, contact the POR to discuss providing that one seed at a weight independent of the PLS calculations. The POR's approval will be needed.

Seeding Example

Use the Directions, Permanent Seeding (as you would find in section 01030.13(f)) and the Permanent Seed Tag (Lot# 28167840) below to calculate the actual application rate where the shorted seed type is applied at the specified rate, so that all seeds meet or exceed the specified amount per acre.

Directions:

1. Using the permanent seed tag for the pre-blended mix,Lot# 28167840, fill in the "Purity" and "Germination" blanks. Then, calculate the "Amount" respectively.
2. Using the seed tag, determine the weight of each seed species in the 25 lb. bag.
   Example: Sheep Fescue is 6.5% x 25 lb. = 1.625 lb. of Sheep Fescue in this 25 lb. bag
3. Use this information to find out how much Sheep Fescue is in 1 lb. for this pre-blended mix.
   1.625 lb. Sheep Fescue ÷ 25 lb. bag = 0.065 lb. of Sheep Fescue per 1 lb. of the pre-blended mix.
   Note: You can bypass the logical sequence in steps 2 & 3, by moving the decimal two spaces to the left.
   Example: Canada Wildrye 52.9% per 25 lb. bag = 0.529lb of Canada Wildrye per 1 lb. of this 25 lb. bag.
4. To determine how much of the pre-blended seed mix is needed to provide the specified weight of Sheep Fescue, divide the "Amount" of Sheep Fescue by the weight of Sheep Fescue in 1 lb. of the pre-blended mix.
   Example: 0.6 ÷ 0.065 lb. = 9.2 lb. per acre
5. Do this for each seed in this pre-blended mix. Determine the highest rate and apply this seed mix at this rate.

Permanent Seeding

Name (Common Name)	PLS (lb/acre)	÷ (% Purity (minimum)	x % Germination) (minimum)	= Amount (lb/acre)
Festuca ovina (Sheep Fescue)	0.5	.88	.90	0.6 / 0.065 = 9.2
Elymus canadensis (Canada Wildrye)	2	.90	.90	2.5 / 0.529 = 4.7
Bromus marginatus (California Brome)	5	.85	.98	6.0 / 0.397 = 15.1

Permanent Seed Tag

Lot# XX-YY-ZZ

Contains	Pure Seed	Purity	Germ	Origin
Sheep Fescue	6.5%	88%	90%	OR
Canada Wildrye	52.98%	90%	90%	OR
California Brome	39.77%	85%	98%	OR
Other Crop Seeds	0.25%			
Inert Matter	0.25%			
Weed Seeds	0.25%			Net Wt.: 25 lb.

Technical Contacts

Bob Marshall
S/W Roadside Development/Botany Coordinator
503.986.3512
robert.r.marshall@odot.state.or.us

Art Nuñez
Construction Quality Assurance Specialist
503.986.6630
arthur.nunez@odot.state.or.us

Spec Notes are prepared for inspectors by the Construction Quality Assurance Unit to provide background information around design elements and specifications. For additional Spec Notes, visit us at https://www.oregon.gov/ODOT/Construction/Pages/QA.aspx.

If you have an idea for a Spec Notes topic, please email us at ODOTConstructionTraining@odot.state.or.us or contact us at 503.986.4336.

01030.13 (c) Pure Live Seed for seed mixes Example #2

- The common error is that the “Amount” calculations are added up and that amount is used.

Name (Common Name)	PLS (lb/acre)	÷ (% Purity (minimum)	x % Germination) (minimum)	= Amount (lb/acre)
Festuca ovina (Sheep Fescue)	0.5	.88	.90	0.6
Elymus canadensis (Canada Wildrye)	2	.90	.90	2.5
Bromus marginatus (California Brome)	5	.85	.98	6.0
				9.1

ODOT MATERIALS & INSPECTION

01030.13 (c) Pure Live Seed for seed mixes Example #2

- Tying in the “additional step” and “common mistake”.
- 2. Using the seed tag, determine the weight of each seed species in the 25 Lb. bag.
  - Example: Sheep Fescue is 6.5% x 25 Lb. = 1.625 Lb. of Sheep Fescue in this 25 Lb. bag

Permanent Seed Tag
Lot# XX-YY-ZZ

Contains	PURE SEED	PURITY	GERM	ORIGIN
Sheep Fescue	6.5%	88%	90%	OR
Canada Wildrye	52.98%	90%	90%	OR
California Brome	39.77%	85%	98%	OR
Other Crop Seeds	0.25%			
Inert Matter	0.25%			
Weed Seeds	0.25%			

Net Wt.: 25 Lb.

ODOT MATERIALS & INSPECTION

01030.13 (c) Pure Live Seed for seed mixes Example #2

- 3. Use this information to find out how much Sheep Fescue is in 1 Lb. for this pre-blended mix.
  - 1.625 Lb. Sheep Fescue ÷ 25 Lb. bag = 0.065 Lb. of Sheep Fescue per 1 Lb. of the pre-blended mix.

  - **Note: you can bypass the logical sequence in steps 2. & 3., by moving the decimal two spaces to the left.**
  - **Example; Sheep Fescue 6.5% per 25Lb bag = 0.065Lb of Sheep Fescue per 1 Lb of this 25Lb bag.**

ODOT MATERIALS & INSPECTION

01030.13 (c) Pure Live Seed for seed mixes Example #2

- 4. To determine how much of the pre-blended seed mix is needed to provide the specified weight of sheep fescue , divide the “Amount” of Sheep Fescue by the weight of sheep fescue in 1 Lb. of the pre-blended mix.
  - Example: 0.6 ÷ 0.065 Lb. = 9.2 Lb. per acre

Name (Common Name)	PLS (lb/acre)	÷ (% Purity (minimum)	x % Germination) (minimum)	= Amount (lb/acre)
Festuca ovina (Sheep Fescue)	0.5	.88	.90	0.6 / 0.065 = 9.2
Elymus canadensis (Canada Wildrye)	2	.90	.90	2.5
Bromus marginatus (California Brome)	5	.85	.98	6.0

ODOT MATERIALS & INSPECTION

01030.13 (c) Pure Live Seed for seed mixes Example #2

- 5. Do this for each seed in this pre-blended mix.
  - Determine the highest rate and apply this seed mix at this rate.

Name (Common Name)	PLS (lb/acre)	÷ (% Purity (minimum)	x % Germination) (minimum)	= Amount (lb/acre)
Festuca ovina (Sheep Fescue)	0.5	.88	.90	0.6 / 0.065 = 9.2
Elymus canadensis (Canada Wildrye)	2	.90	.90	2.5 / 0.529 = 4.7
Bromus marginatus (California Brome)	5	.85	.98	6.0 / 0.397 = 15.1

ODOT MATERIALS & INSPECTION

01030.13 (c) Pure Live Seed for seed mixes Example #2

- Incorrect Method

Name (Common Name)	PLS (lb/acre)	÷ (% Purity (minimum)	x % Germination) (minimum)	= Amount (lb/acre)
Festuca ovina (Sheep Fescue)	0.5	.88	.90	0.6
Elymus canadensis (Canada Wildrye)	2	.90	.90	2.5
Bromus marginatus (California Brome)	5	.85	.98	6.0
				9.1

- Correct Method

Name (Common Name)	PLS (lb/acre)	÷ (% Purity (minimum)	x % Germination) (minimum)	= Amount (lb/acre)
Festuca ovina (Sheep Fescue)	0.5	.88	.90	0.6 / 0.065 = 9.2
Elymus canadensis (Canada Wildrye)	2	.90	.90	2.5 / 0.529 = 4.7
Bromus marginatus (California Brome)	5	.85	.98	6.0 / 0.397 = 15.1

ODOT MATERIALS & INSPECTION

Questions?

ODOT MATERIALS & INSPECTION

01030.13 (c) Pure Live Seed for seed mixes ODOT FORM

- Question – Is there an easier way to calculate this? Some seed mixes have a large variety of individual seed types with different percentages for each of them.

01030.13 (c) Pure Live Seed for seed mixes ODOT FORM

- Question – Is there an easier way to calculate this? Some seed mixes have a large variety of individual seed types with different percentages for each of them.
- A – Yes, ODOT is coming out with a new form called “Premixed Seed Blends, Adjusted Rates of Application” (form #734-5180) that will auto-calculate after you enter the specified, purity, germination, and percent of seed, of that lot #. After you pre-measure the acreage (always pre-measure, don’t go off the plan measurement) then you can enter that to see how many pounds you will need for that seed mix lot/batch number. If there are changes to batch/lot# and/or seed mix, you will need to fill out a new form.

ODOT MATERIALS & INSPECTION

Premixed Seed Blends
Adjusted Rates of Application

Form Example	C######
Project Name (Section)	Contract No.

Enter Contractor or Subcontractor Name	Permanent Seeding	L03/SL1
(Sub)Contractor	Seed Mix Type	Lot/Batch No.

	COLUMN							
	I	II	III	IV	V	VI	VII	VIII
	Seed	Specified (lb./acre)	Purity %	Germ. %	Adjusted PLS (lb. per acre)	% of Seed (this lot#/mix)	lb. of Seed per 1 lb (this lot#/mix)	lb. of this Seed Blend Needed per Acre (this lot#/mix)
	Spike Bentgrass	0.5	99.66%	90.00%	0.6	1.50%	0.015	40.0
	California Brome	24.5	98.83%	88.00%	28.2	27.00%	0.270	104.4
	Camas Grass	3.5	97.75%	88.00%	4.1	3.50%	0.035	117.1
	Slough Sledge	3.5	99.69%	91.00%	3.9	3.50%	0.035	111.4
	Tufted Hairgrass	1.8	99.07%	91.00%	1.9	5.00%	0.050	38.0
	Meadow Barley	37.0	95.18%	93.00%	41.8	38.00%	0.380	110.0
	Path Rush	0.1	97.32%	98.00%	0.1	0.50%	0.005	20.0
	Sickle Keeled Lupine	17.5	99.95%	90.00%	19.5	19.00%	0.190	102.6

RESULTS	
Greatest Amount Calc. (from column VIII) =	117.1
Premeasured Acre =	1.9
Greatest Amount Calc. x Premeasured Acre =	**222.6**

Seed %	98.00%
Other Crop Seed %	1.40%
Weed Seed %	0.55%
Inert Material %	0.05%
Total %*	100.00%

*should be close to 100%

01030.13 (c) Pure Live Seed for seed mixes Note for “non-conforming seed”:

- The PLS calculations were formulated when ODOT used only grass seeds on roadsides. Now native seeds and wildflower seeds are often included. Some of these seeds are by nature “dirty” or they germinate the second year (which would not be identified in testing). If a seed has very low purity and germination rates that skew the calculations beyond what is reasonable, contact the POR. A possible solution is providing that one seed at a weight independent of the PLS calculations or a substitution.
- Contact the POR/Designer to discuss a solution to the non-conforming seed(s).

01030.13 (c) Special Provision Boiler Plate

SECTION 01030 - SEEDING

Comply with Section 01030 of the Standard Specifications modified as follows:
01030.13(c) Pure Live Seed - Replace this subsection, except subsection number and title, with the following subsection:

Use the PLS specified rate listed in 01030.13(f) for determining PLS application rates. Ensure the PLS application rate meets the PLS specified rate. Apply pre blended seed mixes, with multiple species, at a PLS application rate ensuring all species meet or exceed the PLS specified rate for each species in the seed mix.

PLS application rate for an individual seed species is determined as follows:

- PLS specified rate is listed in 01030.13(f)
- PLS factor is obtained by multiplying the seed label germination percentage times the seed label purity percentage. Use the purity and germination percentages from the label on actual bags of seed to be used on the Project.
- PLS application rate is obtained by dividing the PLS specified rate by the PLS factor.

For a seed mix, make this calculation for each seed species in the mix and then adjust as follows:

- Using the seed tag, determine the weight of each seed species in the bag and use this information to find the percentage, by weight, of each seed species is in 1 pound for the pre-blended mix.
- Divide the percentage by weight of each seed species, per pound, for the pre-blended mix, by the PLS application rate for that specific seed species.

Determine the highest application rate in the seed mix and apply the seed mix at that application rate.

01030.13(f) Types of Seed Mixes - Add the following to the end of this subsection:

Provide the following seed mix formulas:

- **Permanent Seeding:**

Botanical Name (Common Name)	PLS Specified Rate (lb/acre)
Elymus elymoides (Squirreltail)	10
Achillea millefolium (Common yarrow)	0.9
Eriophyllum lanatum (Oregon sunshine)	1.2
Linum lewisii (Blue flax)	8
Poa secunda (Bluebunch wheatgrass)	2.7

ODOT MATERIALS & INSPECTION

01030.13 Seed – Special Provision (page 277/321)

- Use the PLS specified rate listed in 01030.13(f) for determining PLS application rates. Ensure the PLS application rate meets the PLS specified rate. Apply pre blended seed mixes, with multiple species, at a PLS application rate ensuring **all species meet or exceed the PLS specified rate** for each species in the seed mix.

01030.13 Seed – Special Provision (page 277/321)

- PLS application rate for an individual seed species is determined as follows:
  - PLS specified rate is listed in **01030.13(f)**
  - PLS factor is obtained by multiplying the seed label germination percentage times the seed label purity percentage. Use the purity and germination percentages from the label on actual bags of seed to be used on the Project.
  - PLS application rate is obtained by dividing the PLS specified rate by the PLS factor.

01030.13 Seed – Special Provision (page 277/321)

- For a seed mix, make this calculation for each seed species in the mix and then adjust as follows:
  - Using the seed tag, determine the weight of each seed species in the bag and use this information to find the percentage, by weight, of each seed species is in 1 pound for the pre-blended mix.
  - Divide the percentage by weight of each seed species, per pound, for the pre-blended mix, by the PLS application rate for that specific seed species.

Determine the highest application rate in the seed mix and apply the seed mix at that application rate.

ODOT MATERIALS & INSPECTION

01030.00 Specification Owner

Robert (Bob) Marshall

Roadside Development and Erosion and Sediment Control Program Leader

Oregon Department of Transportation

(503) 986-3512 (office)

(503) 504-6979 (mobile)

ODOT MATERIALS & INSPECTION

Seeding Form Contact

Art Nuñez

ODOT Region Assurance Specialist

Arthur.nunez@odot.Oregon.gov

503-986-6630

ODOT MATERIALS & INSPECTION

Questions?

ODOT MATERIALS & INSPECTION