The Foundation for Successful Reclamation

Topsoil Preservation and Water Retention Techniques

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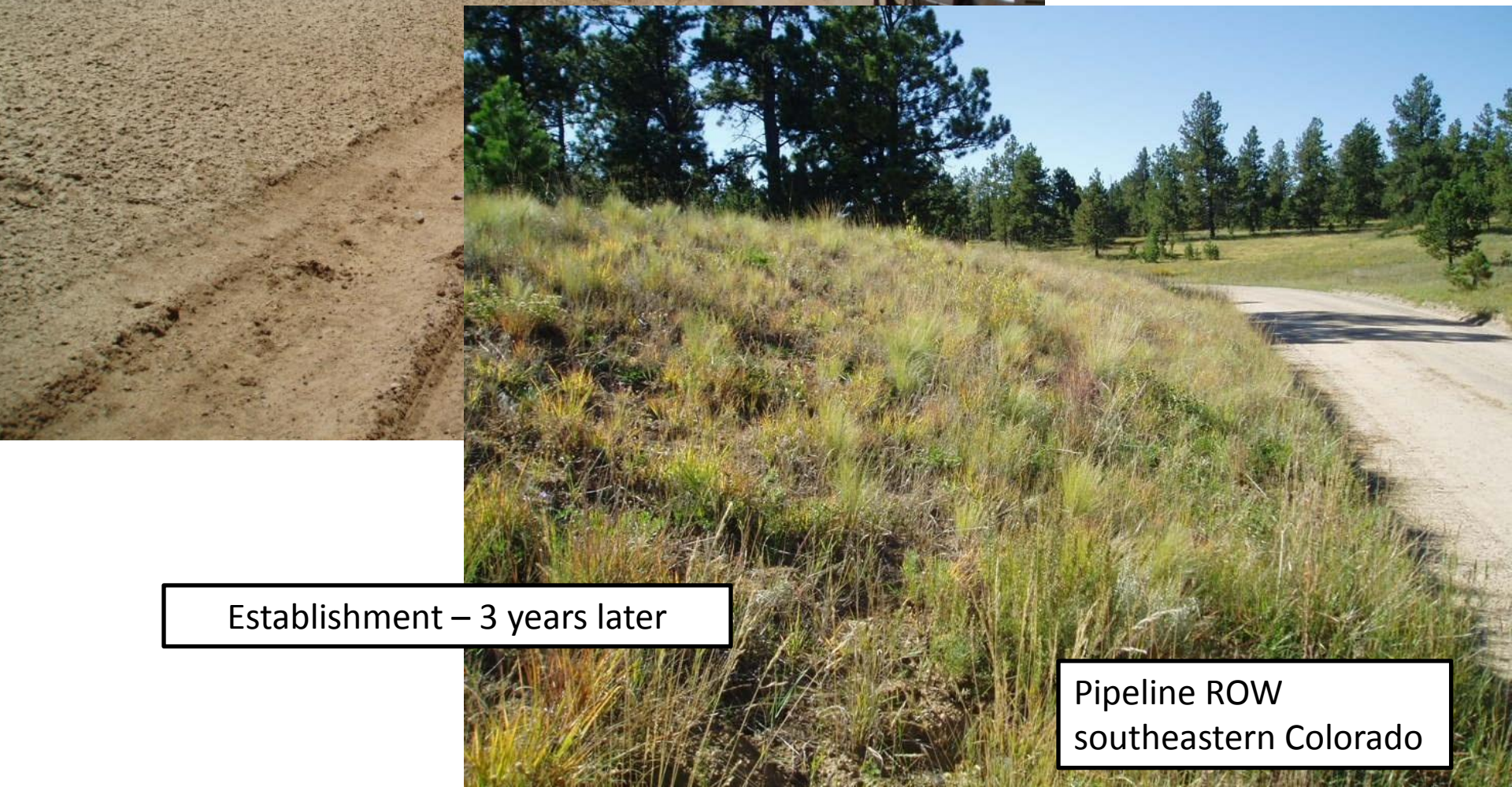
Reclamation Goals

- Compliance with federal and state regulations
- Private landowner satisfaction
- Establish a long term self-sustaining vegetative cover that meets agency and/or landowner's standards

Pipeline ROW construction



Establishment – 3 years later

Pipeline ROW southeastern Colorado

Successful Reclamation

- Returning the site to near pre-disturbance conditions
- Obtaining adequate vegetative cover to increase moisture retention and prevent sediment loss

Key Factors for Successful Reclamation

1. Preconstruction Site Analysis and Inventory
2. Identify Areas for Potential Topsoil Salvage
3. Site Grading to Reduce Sediment Runoff
4. Apply Soil Amendments When Necessary
5. Proper Seed Selection and Application
6. Water Retention and Erosion Control

1. Preconstruction Site Analysis and Inventory

- Locate Facilities and Access Roads to Minimize Slope and Storm Water Runoff
- Soil Inventory
- Vegetation Species Inventory
- Drainage Basin or Watershed Information
- Noxious Weed Inventory
- Analysis of Inventoried Information

Site Soil Samples

Planning - Soils Rating Table

Table No. C-1: Criteria to establish suitability of topsoil (or topsoil substitutes).				
Parameter	Suitable			Unsuitable
	Good	Fair	Poor	
pH	6.0 - 8.4	5.5 - 6.0 8.4 - 8.8	5.0 - 5.5 8.8 - 9.0	< 5.0 >9.0
EC (Conductivity) mmhos/cm	0 - 4	4 - 8	8 - 16 > 8 may prove difficult to revegetate	> 16
Saturation Percentage	25 - 80		> 80 < 25	
Texture 1/	sl, l, sil, scl, vfsl, fsl	cl, sicl, sc, ls, lfs	c, sic, s	
SAR	< 6	6 - 10	10 - 15 10 - 12 2/	>15 >12 2/
Selenium	< 2.0 ppm			> 2.0 ppm
Boron	< 5.0 ppm			> 5.0 ppm
Calcium Carbonate	0 - 15%	15 - 30%	over 30%	
Coarse Frag 3 - 10 in. (% vol) > 10 in.	0 - 15 0 - 3	15 - 25 3 - 7	25 - 35 7 - 10	> 35 > 10
Soil Organic Matter (%) 3/	2.0 - 2.5	1.0 - 1.9	< 1.0	
Cation Exchange Capacity (CEC)	> 30	5 - 30	< 5	

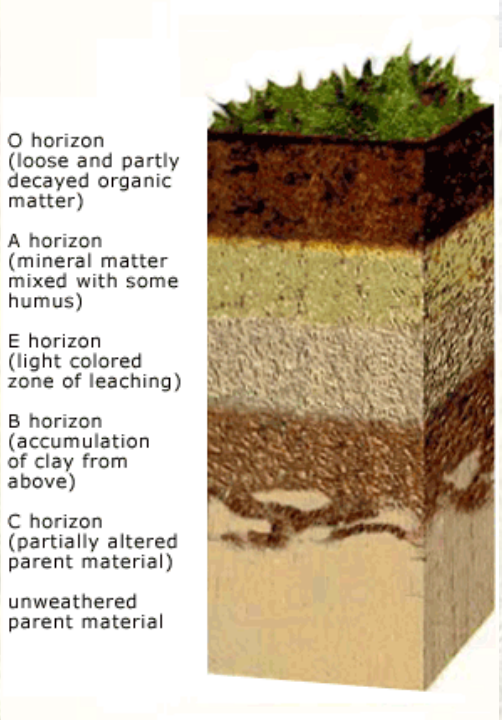
2. Identify Areas for Potential Topsoil Salvage

Key Factors to Identify

Soil Horizon Depths

Physical and Chemical Analysis

Salvage Feasibility



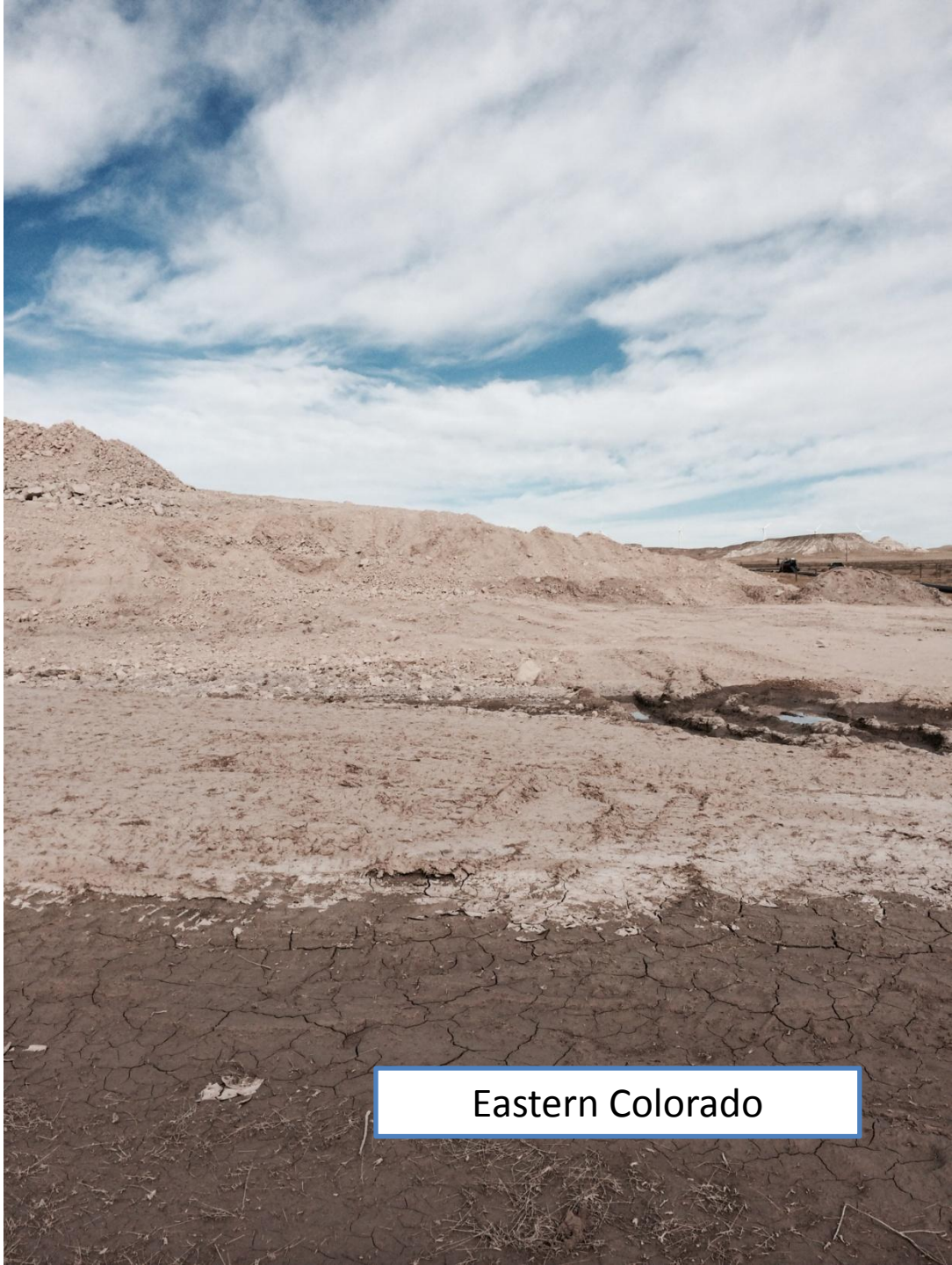
Topsoil Stockpile with Temporary Vegetative Cover

3. Site Preparation - Earthwork

- Grade Locations to Lessen Slopes
- Install Terraces, Berms, Benches, etc.
- Reduce Erosion During Construction

Eastern Colorado Soil Stockpile

Extreme Rill Erosion
Steep Slopes
Sandy Soil



Earthwork to reduce slopes
Eastern Colorado


Slope Reduced to 4:1 or less.
Drill Seeding Eastern Colorado

4. Soil Amendments

- Topsoil Substitute
- Organic Matter
- Increase water holding capacity


Amendment Application
Canada


Manual Amendment
Application


Amendment Application

5. Seed Selection and Application

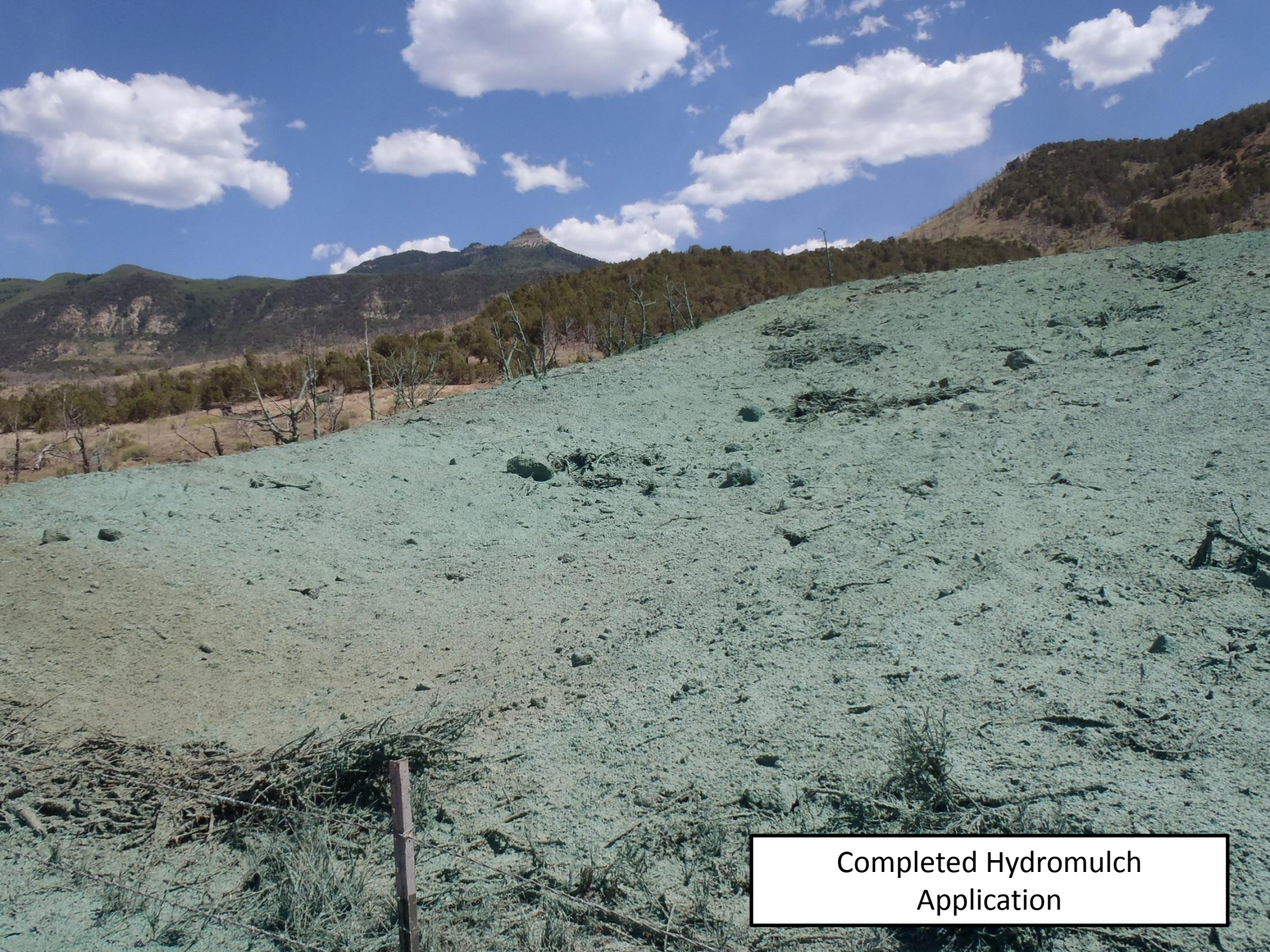
- Native Seed Mix Selection
  - Based on Native Plant Inventory on Site
  - Balanced Seed Mix (grasses, shrubs, forbs)
  - Requirements for Permit
- Planting Techniques
  - Drill
  - Broadcast (need to double seed rate)
  - Hydro (need to double seed rate)

Vernal , Utah
Drill Seeder


Hydro Seeding
Remote Access

6. Water Retention/Temporary Erosion Control

- Mulch Applications
- Pocketing
- Organic Matter
- Soil Cover



Completed Hydromulch Application


Hand Pocketing for Moisture Retention

Machine Pocketing With Hydro Application for Moisture Retention

Multi Directional Spraying to Maximize Coverage and Limit Bare Spots

Aerial Mulch Application
Los Angeles, CA


Soil Cover
Erosion Control Blanket
N. Salt Lake, Utah

Six Steps to Reclamation Success

1. Preconstruction Site Analysis and Inventory
2. Identify Areas for Potential Topsoil Salvage
3. Site Grading to Reduce Sediment Runoff
4. Apply Soil Amendments When Necessary
5. Proper Seed Selection and Application
6. Water Retention and Erosion Control

Successful Reclamation

- “The better you prepare, the more success you have.”

- Always remember your goals

Reclamation Plan Sample

Site/Project Name:	UTM Projection:
Ownership: EnCana_____BLM_____Other Private_____	Photo: Y ☐ N ☐
Date:	Prepared By:
Well Pad #:	Checked By:

Soil Preparation Method

Slopes 2:5:1 or Less ☐	Disk: ☐	Chisel Plow: ☐	Harrow: ☐	
Slopes Greater than 2:5:1 ☐	Hand Pit: ☐	Dozer Tracking: ☐		Rock Picking: ☐
	Pit with Excavator: ☐			

Soil Amendments

Sustane 3-7-2 w/Humates & Mycorrhizae:	1000 lbs/acre: ☐	2000 lbs/acre: ☐
Other: ☐	3000 lbs/acre: ☐	4000 lbs/acre: ☐

Additional Amendments based on notes from Soil Scientist:

Seed Mixture

Low Elevation Salt-Desert/Basin Big Sagebrush:	☐
Pinyon-Juniper Woodland and/or Mountain/Wyoming Big Sagebrush Shrubland:	☐
Mixed Mountain Shrubland, Including Oakbrush:	☐
Spruce-Fir Forest, Including Mountain Meadows:	☐
Other:	☐

Seeding Methods

Hydroseed 2x Rate: ☐	Hand Broadcast Seed 2x Rate: ☐
Drill Seed: ☐	Machine Braodcast Seed 2x Rate: ☐

Special Seeding Instructions:

Describe areas receiving different treatments:

Mulching

ons/Acre	Area:	Flat to 3:1
g	Area:	Flat to 3:1
bs/Acre	Area:	Rocky Conditions or Steeper than 3:1
Matrix	Area:	Steeper than 3:1
00 lbs/Acre	Area:	Steeper than 3:1
Blanket with 0 lbs/Acre	Area:	Spill Ways or Culverts

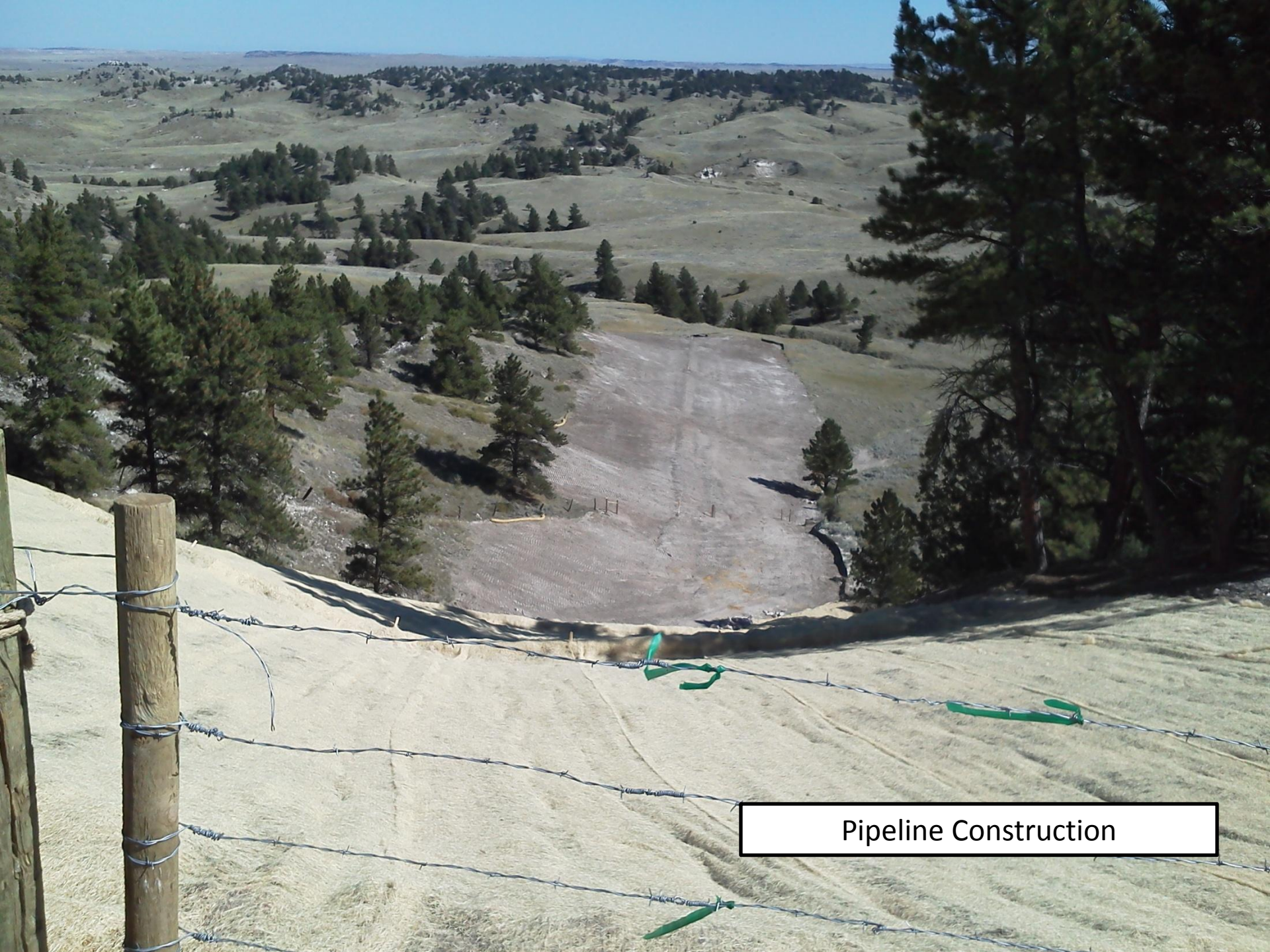
Areas of Noxious Weeds (Treatment)

_____ Inches of Soil	Use Mechanical Weed Control:
e Stripped w/	Bush Hog Mower: ☐
	Weed Eater: ☐
	Hand Pull & Bag/Dispose of Off Site: ☐

BMPs

attles:	Site Perimeter ☐	Exit Point for Water ☐
Dams:	☐ Barrow Ditch	
	☐ Culverts (Inflow & Outflow)	
	☐ Drainage Ditches Off Pad	
g:	☐	
itch:	☐	

Additional Comments/Notes:


Pipeline Construction


Pipeline Reclamation

Questions?

Thank You

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