The Foundation for Successful Reclamation

Topsoil Preservation and Water Retention Techniques

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&
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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
Establishment – 3 years later

Pipeline ROW construction

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
## Planning - Soils Rating Table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Unsuitable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pH</strong></td>
<td>6.0 - 8.4</td>
<td>8.4 - 8.8</td>
<td>8.8 - 9.0</td>
<td>&lt; 5.0</td>
</tr>
<tr>
<td><strong>EC (Conductivity)</strong> mmhos/cm</td>
<td>0 - 4</td>
<td>4 - 8</td>
<td>8 - 16</td>
<td>&gt; 8 may prove difficult to revegetate</td>
</tr>
<tr>
<td><strong>Saturation Percentage</strong></td>
<td>25 - 80</td>
<td>&gt; 80</td>
<td>&lt; 25</td>
<td></td>
</tr>
<tr>
<td><strong>Texture</strong></td>
<td>sl, l, sil, scl, vsf, fsl</td>
<td>cl, sicl, sc, ls, lfs</td>
<td>c, sic, s</td>
<td>&gt; 15</td>
</tr>
<tr>
<td><strong>SAR</strong></td>
<td>&lt; 6</td>
<td>6 - 10</td>
<td>10 - 15</td>
<td>&gt; 12 2/</td>
</tr>
<tr>
<td><strong>Selenium</strong></td>
<td>&lt; 2.0 ppm</td>
<td>10 - 12 2/</td>
<td>&gt; 2.0 ppm</td>
<td></td>
</tr>
<tr>
<td><strong>Boron</strong></td>
<td>&lt; 5.0 ppm</td>
<td>&gt; 5.0 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Calcium Carbonate</strong></td>
<td>0 - 15%</td>
<td>15 - 30%</td>
<td>over 30%</td>
<td></td>
</tr>
<tr>
<td><strong>Coarse Frag 3 - 10 in. (% vol)</strong></td>
<td>0 - 15</td>
<td>15 - 25</td>
<td>25 - 35</td>
<td>&gt; 35</td>
</tr>
<tr>
<td><strong>Soil Organic Matter (%)</strong></td>
<td>2.0 - 2.5</td>
<td>1.0 - 1.9</td>
<td>&lt; 1.0</td>
<td></td>
</tr>
<tr>
<td><strong>Cation Exchange Capacity (CEC)</strong></td>
<td>&gt; 30</td>
<td>5 - 30</td>
<td>&lt; 5</td>
<td></td>
</tr>
</tbody>
</table>
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
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
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
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

<table>
<thead>
<tr>
<th>Site/Project Name:</th>
<th>UTM Projection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership: EnCana</td>
<td>BL M Other Private</td>
</tr>
<tr>
<td>Date: Prepared By:</td>
<td>Checked By:</td>
</tr>
<tr>
<td>Well Pad #:</td>
<td></td>
</tr>
</tbody>
</table>

### Soil Preparation Method

- **Slopes 2:5:1 or Less**
  - Disk: []
  - Chisel Plow: []
  - Harrow: []
- **Slopes Greater than 2:5:1**
  - Hand Plow: []
  - Dozer Tracking: []
  - 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:

### Mulching

<table>
<thead>
<tr>
<th>Variations/Acre</th>
<th>Area:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 lbs/Acre</td>
<td>Flat to 3:1</td>
</tr>
<tr>
<td>2000 lbs/Acre</td>
<td>Rocky Conditions or Steeper than 3:1</td>
</tr>
<tr>
<td>3000 lbs/Acre</td>
<td>Steeper than 3:1</td>
</tr>
<tr>
<td>4000 lbs/Acre</td>
<td>Spill Ways or Culverts</td>
</tr>
</tbody>
</table>

### Areas of Noxious Weeds (Treatment)


### 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 Broadcast Seed 2x Rate: []

Special Seeding Instructions:

Describe areas receiving different treatments:

### BMPs

- Site Perimeter: [] Exit Point for Water: []
- Barrow Ditch: [] Culverts (Inflow & Outflow): []
- Drainage Ditches Off Pad: []

### Additional Comments/Notes:
Questions?

Thank You

Jim A Jones
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