

# Reclamation in Southeastern Wyoming: Beauty is in the Eye of the Beholder

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**31<sup>st</sup> National Meeting American Society of Mining and Reclamation**  
**Exploring New Frontiers in Reclamation**  
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# Outline

- Industrial characteristics
  - Extent of oil and gas disturbance in SE WY
  - Extent of uranium mining in SE WY
  - Other disturbances
- Factors in SE WY
  - Geology: Sandstone Formations
  - Climate
  - Ecological Site Descriptions
    - Sandy
    - Limy
    - Rock Hills
- Reclamation in Sandy Soils Lessons Learned
  - WDEQ-LQD
  - Leonardite Mine
  - Glenrock Coal Mine
  - Guernsey National Guard Facility
  - WYDOT

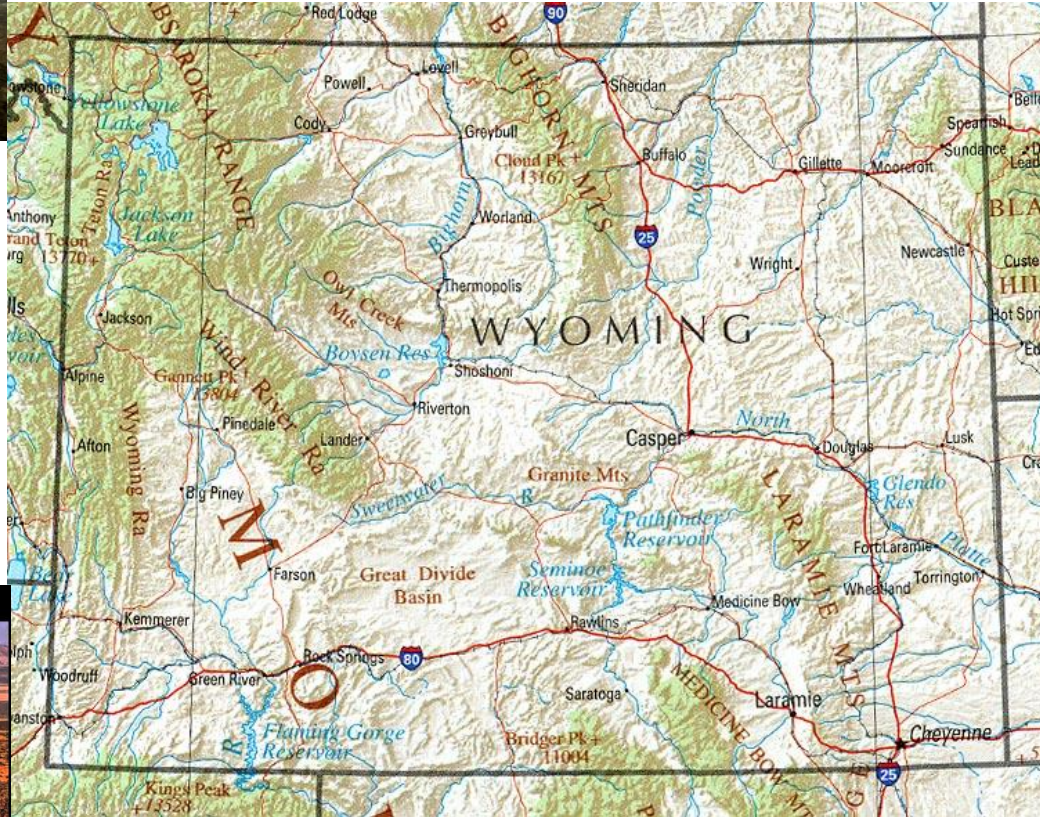
# Wyoming in tourist catalogues?



Wyoming...the reality.

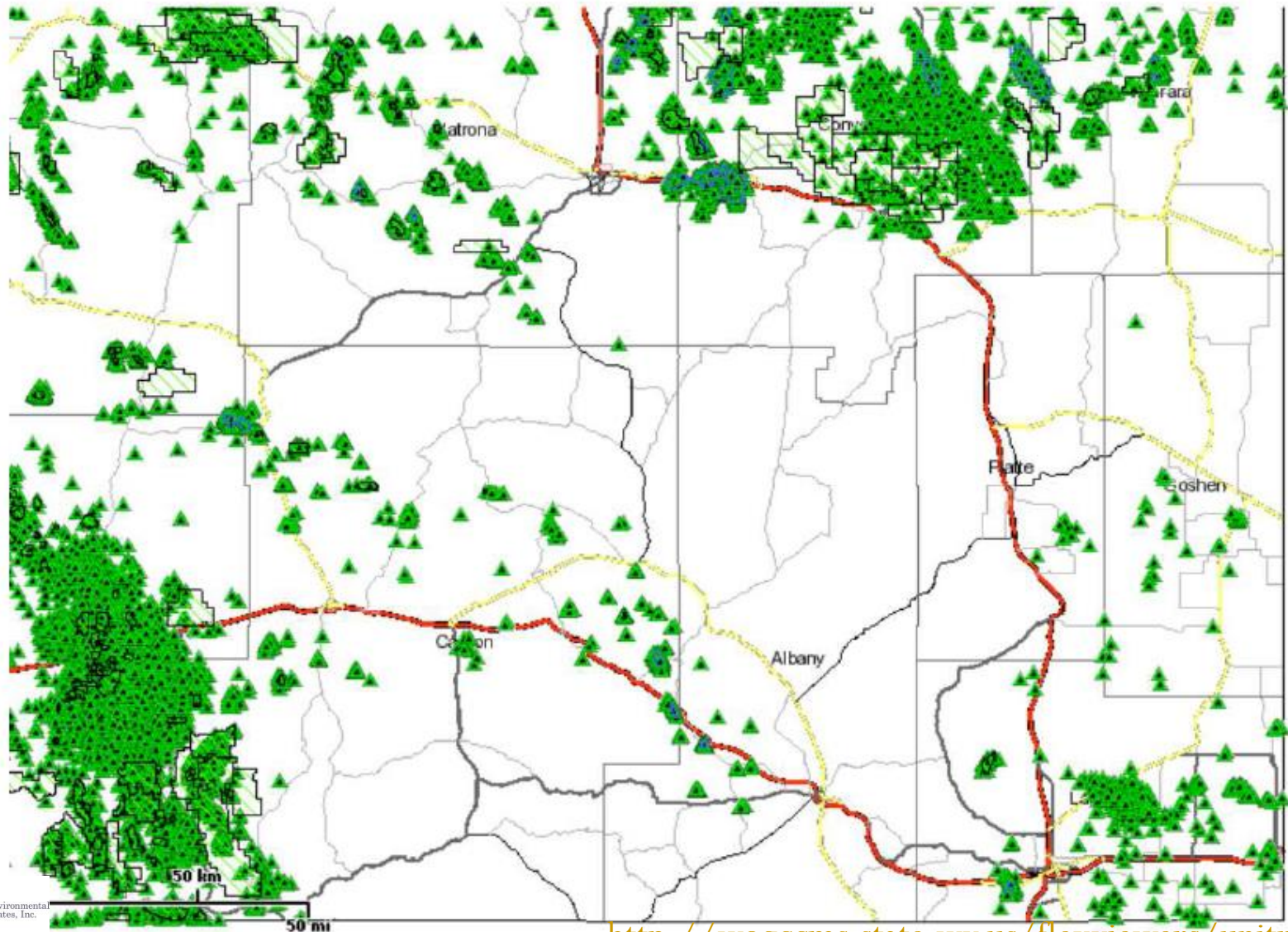


# How different the four corners are.

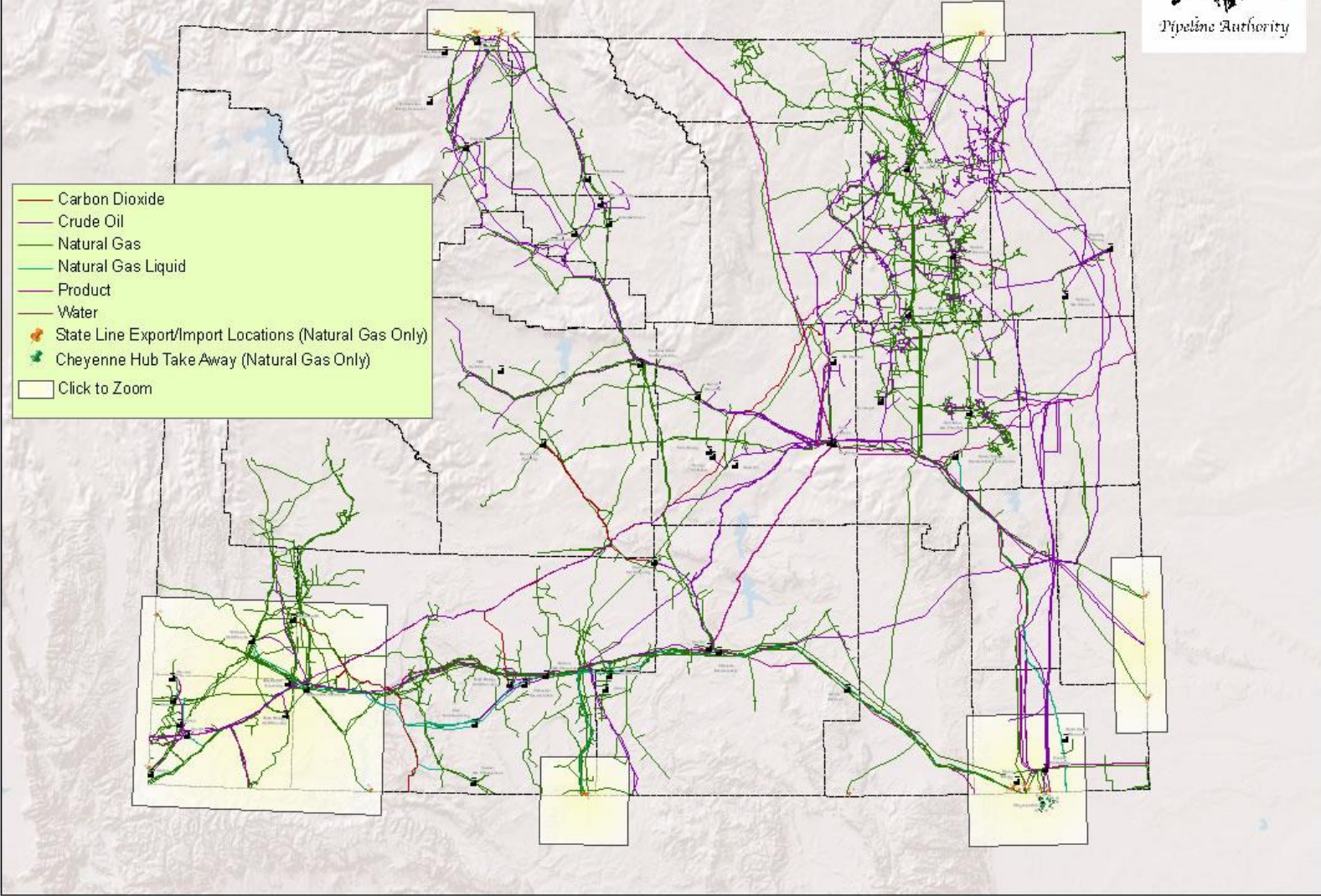


# Oil & Gas Disturbance in SE Wyoming

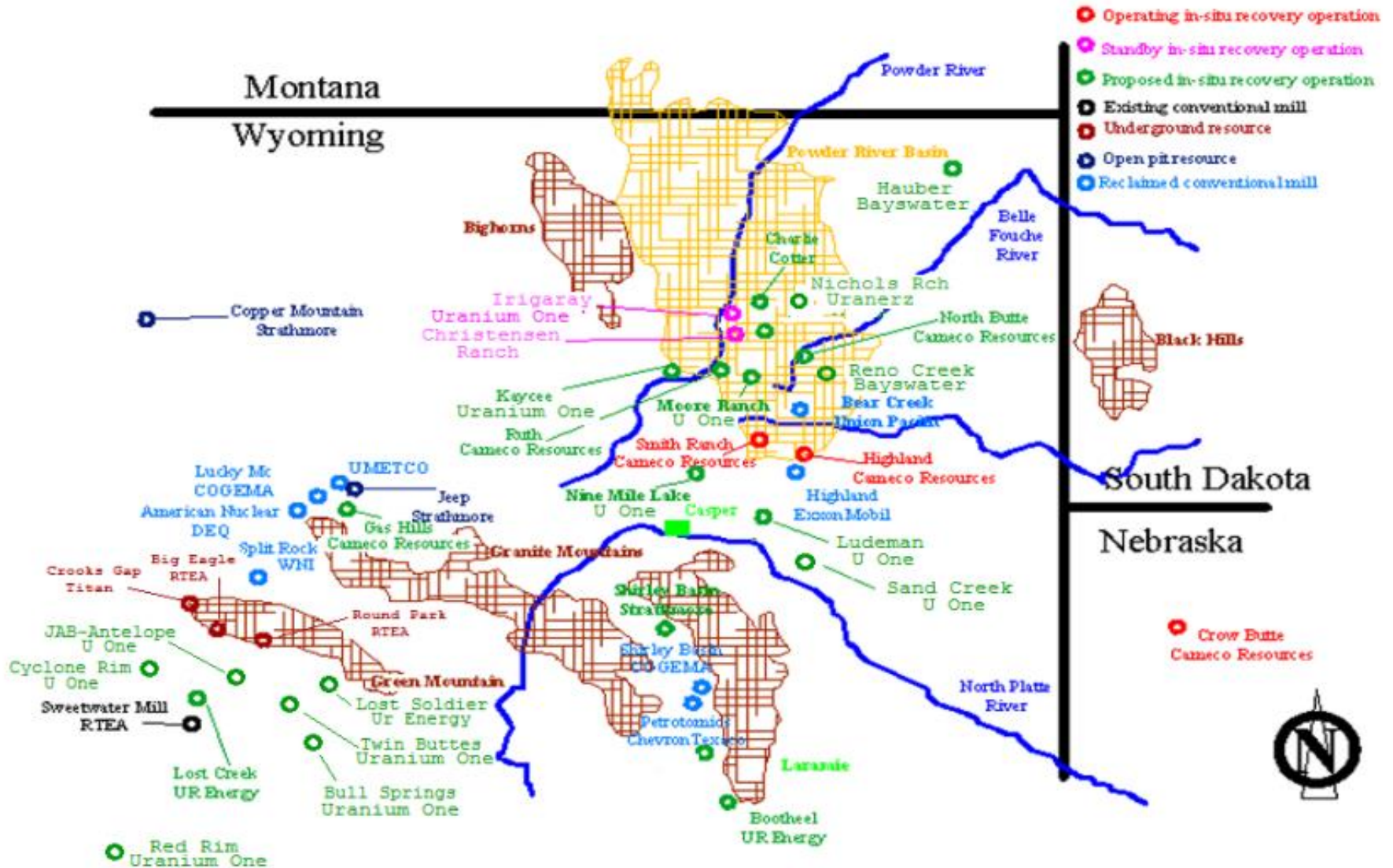
Information obtained from WOGC – Note only the SE portion of WY is displayed here



# Wyoming Pipeline Infrastructure



# URANIUM PROJECTS IN WYOMING





# Wyoming Wind Projects on State Trust Lands

## Wind Project Status

- Application (14)
- Inquiry (5)
- Lease (Initial Phase) (18)
- Lease (Operational Phase) (4)

Project locations are approximate.



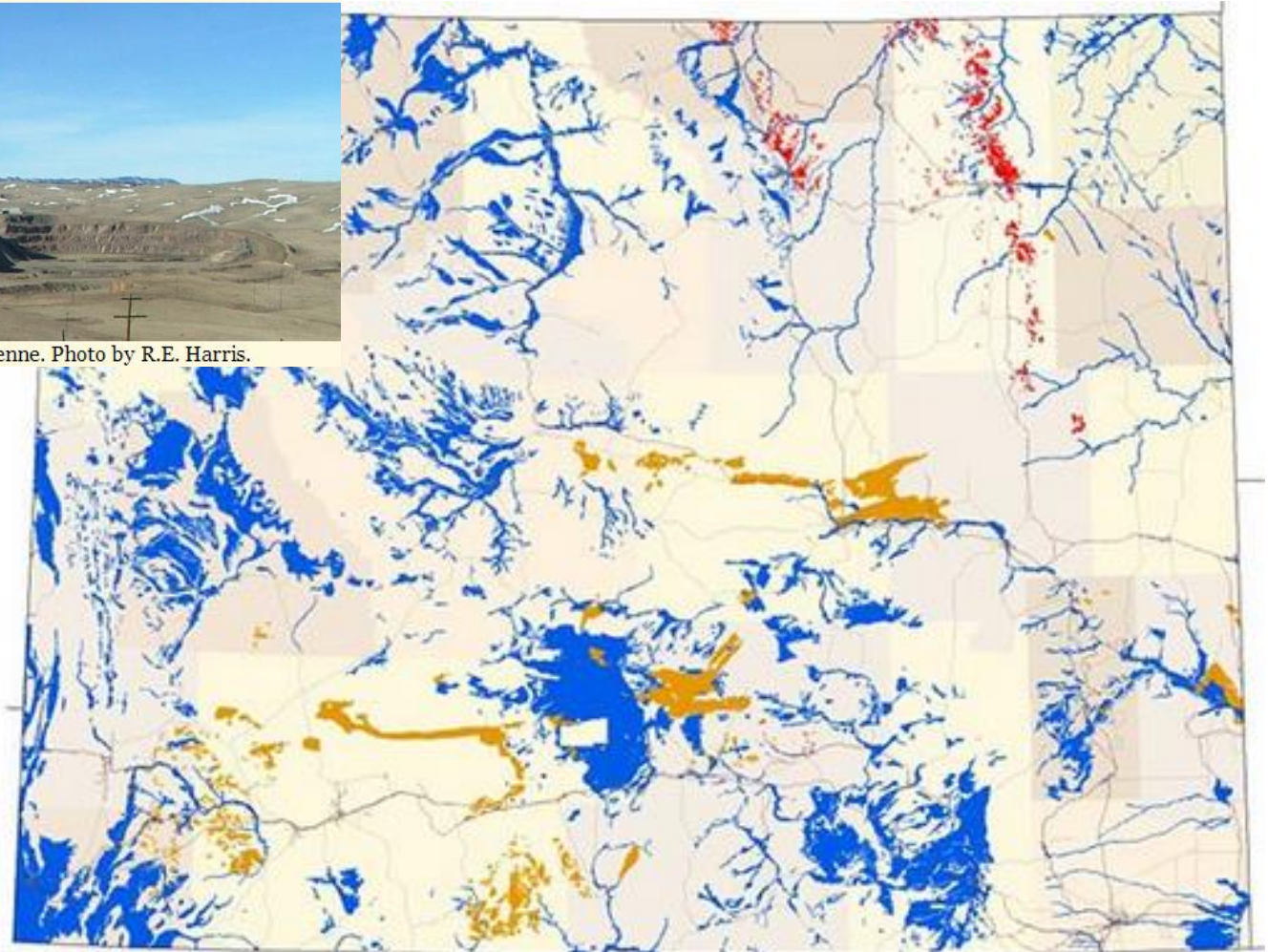
0 15 30 60 Miles



# Gravel Quarries





Martin-Marietta quarry west of Cheyenne. Photo by R.E. Harris.



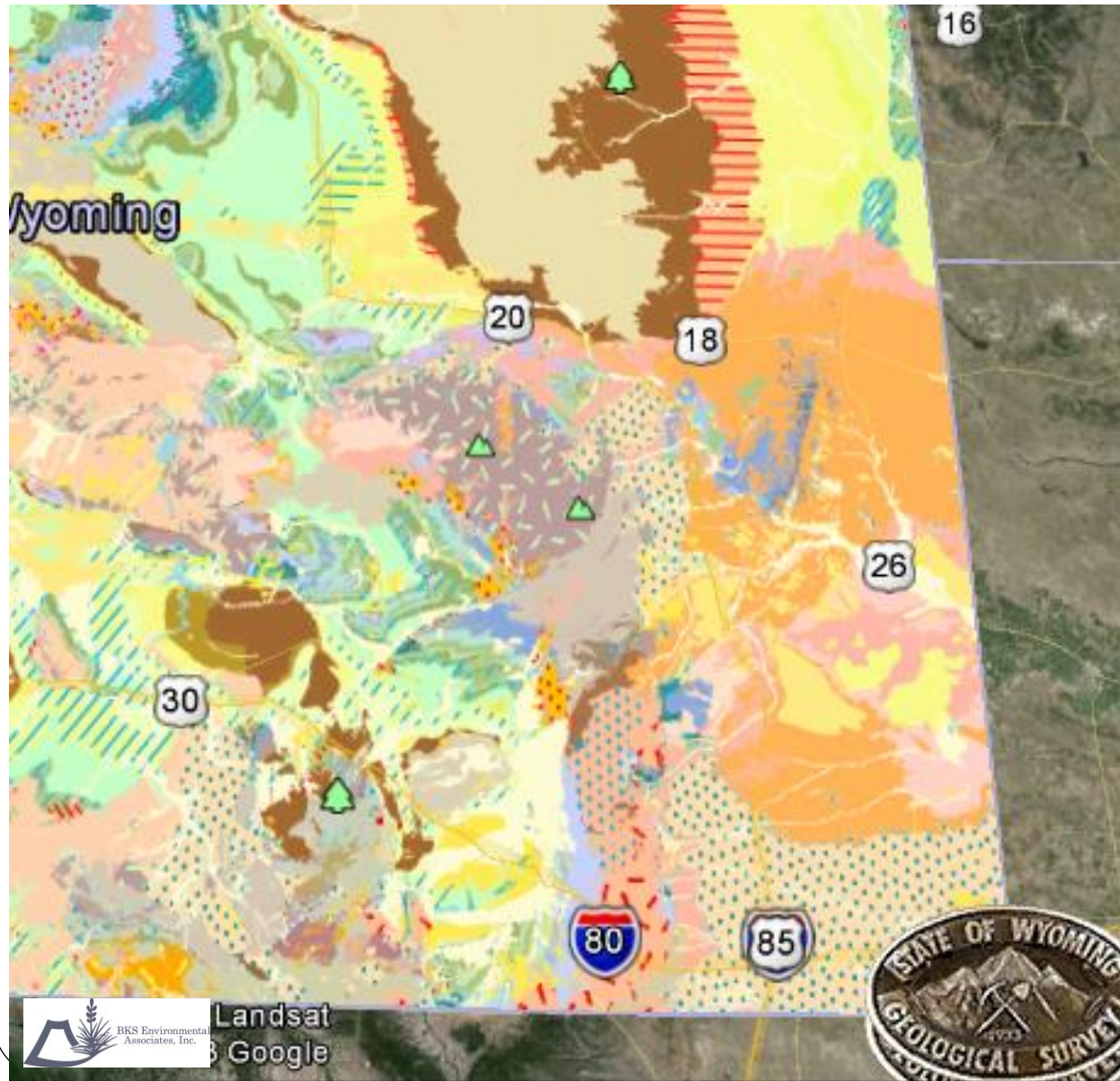
## POTENTIAL SOURCES FOR AGGREGATE IN WYOMING

 Alluvial sand & gravel

 Windblown sand

 Baked & fused rocks

# Geological Map- SE Wyoming



Orange, purple, and yellow all have sandstone components.

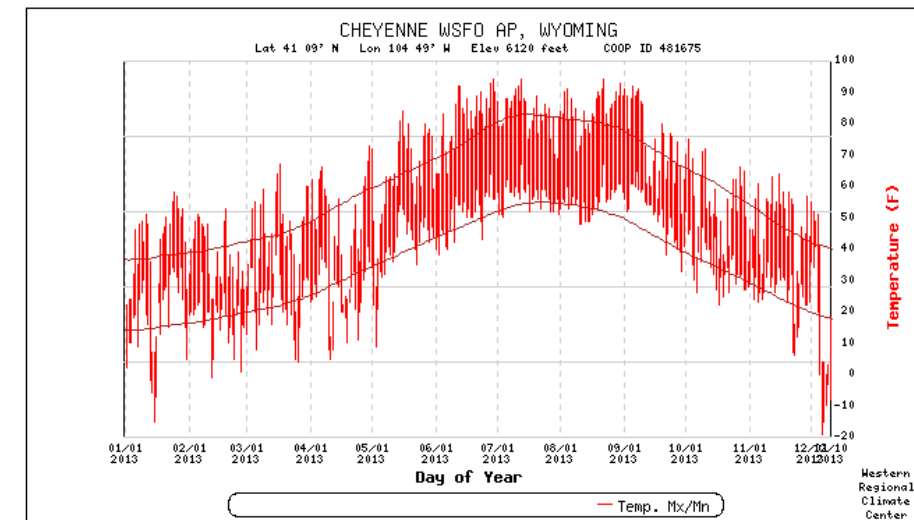
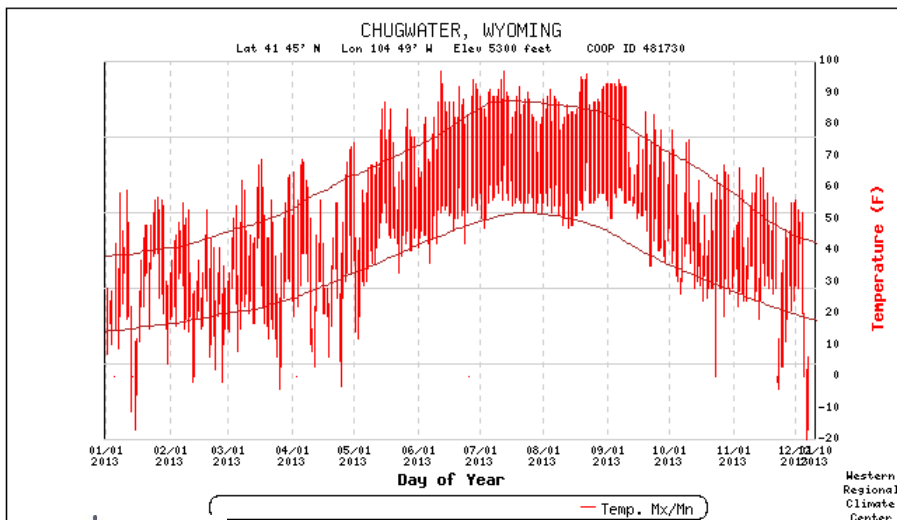
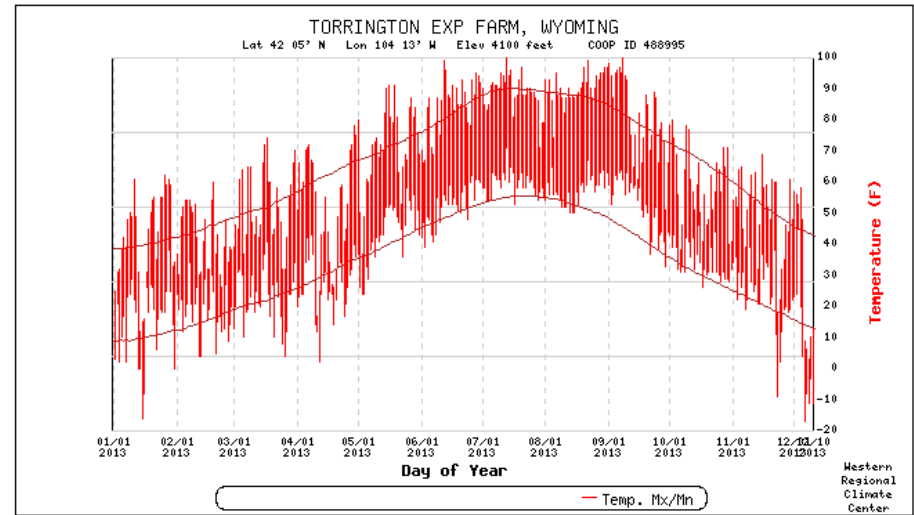
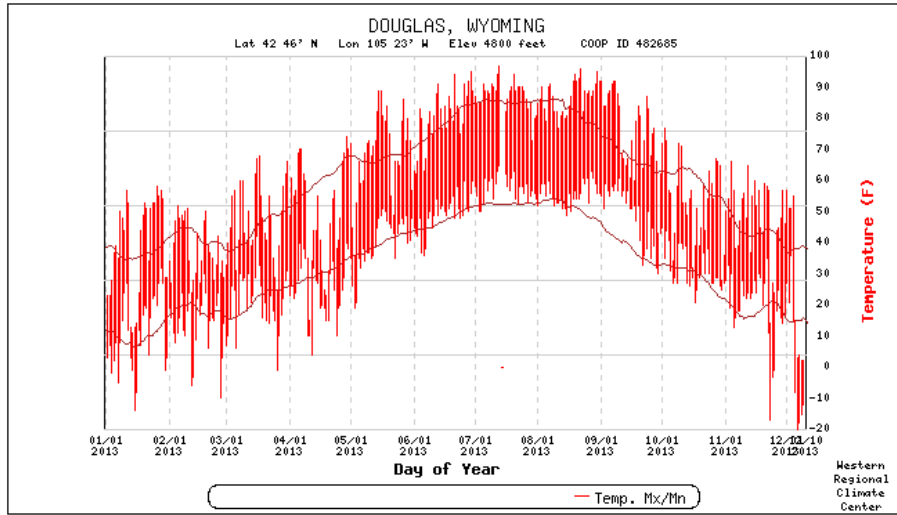
Purple has limestone as well as sandstone present.

Beige has variegated red to gray, brown, and gray mudstone and sandstone; conglomeratic lenses

Beige with blue dots has locally radioactive sandstone, claystone, and conglomerate.

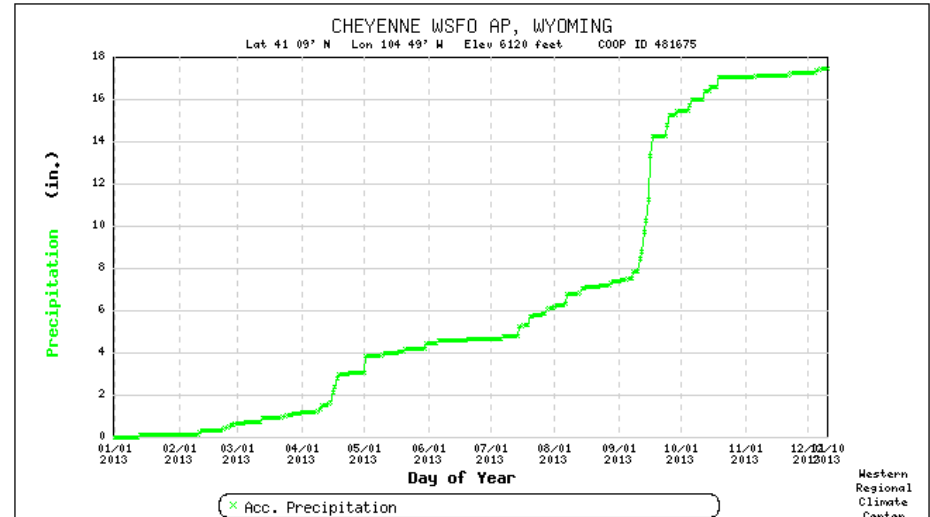
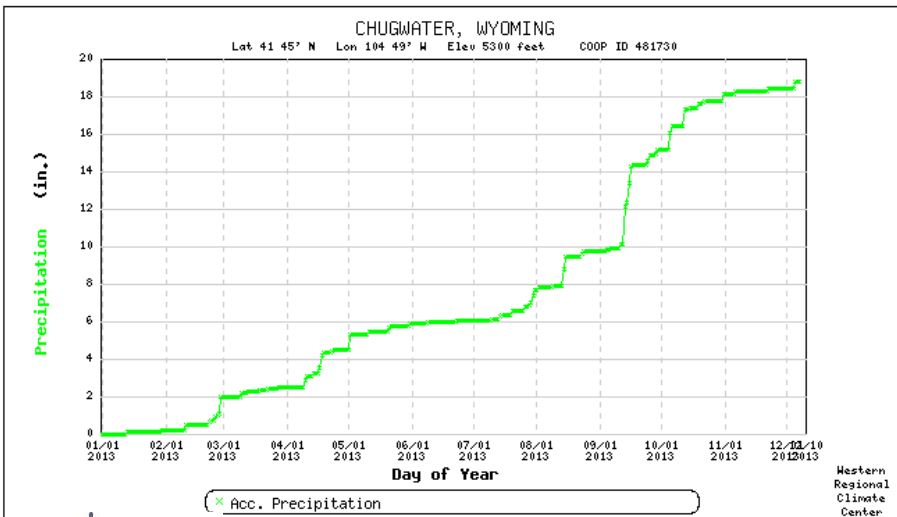
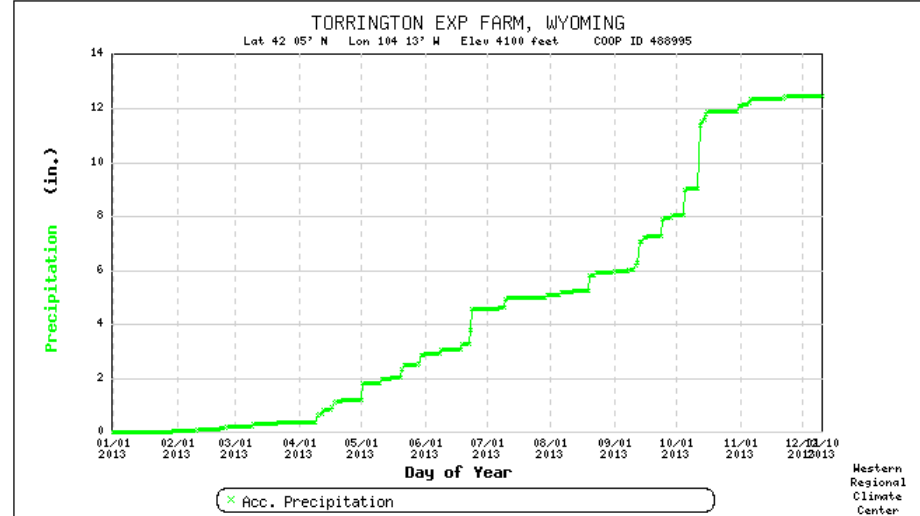
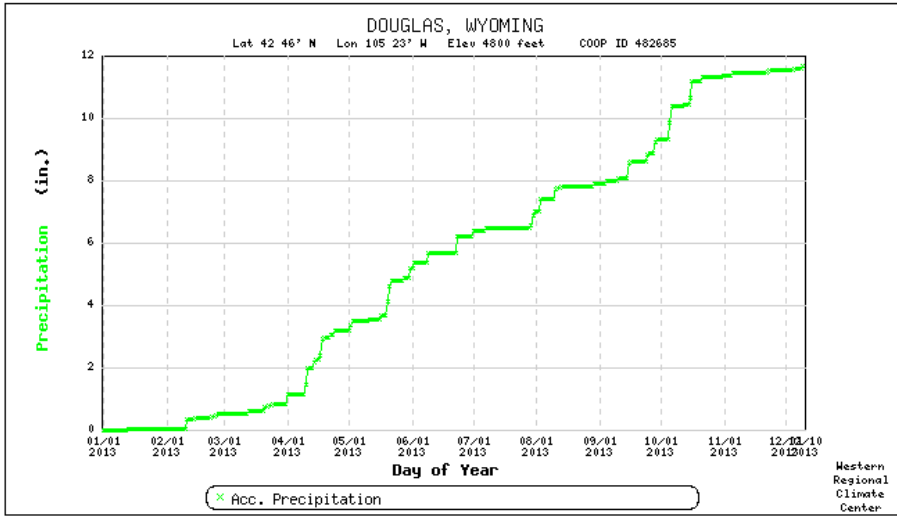
# Climate - 2013 Temperatures High and Lows

Scale: -20 to 100°F

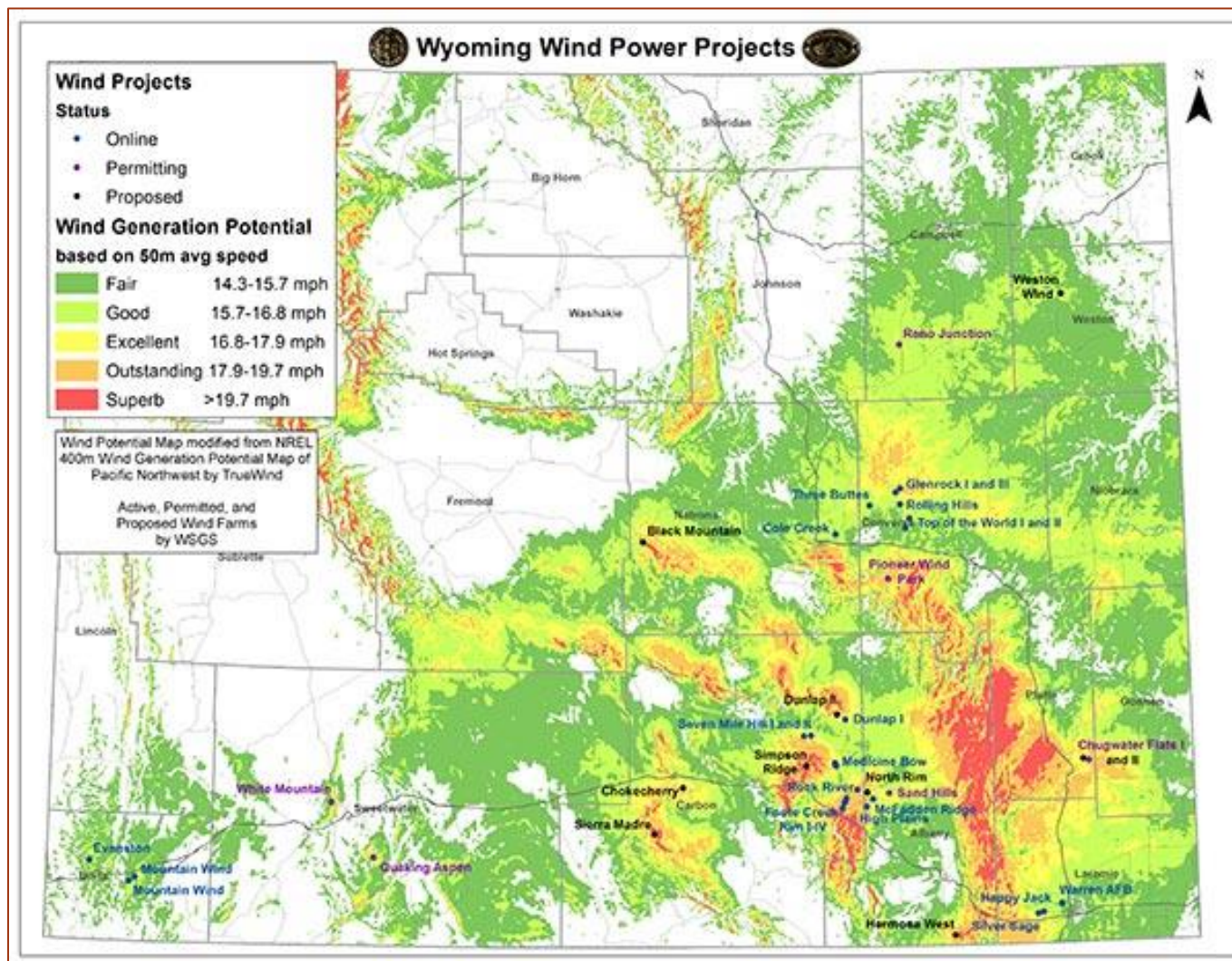


# Climate – 2013 Precipitation Distribution

## Accumulated Precipitation

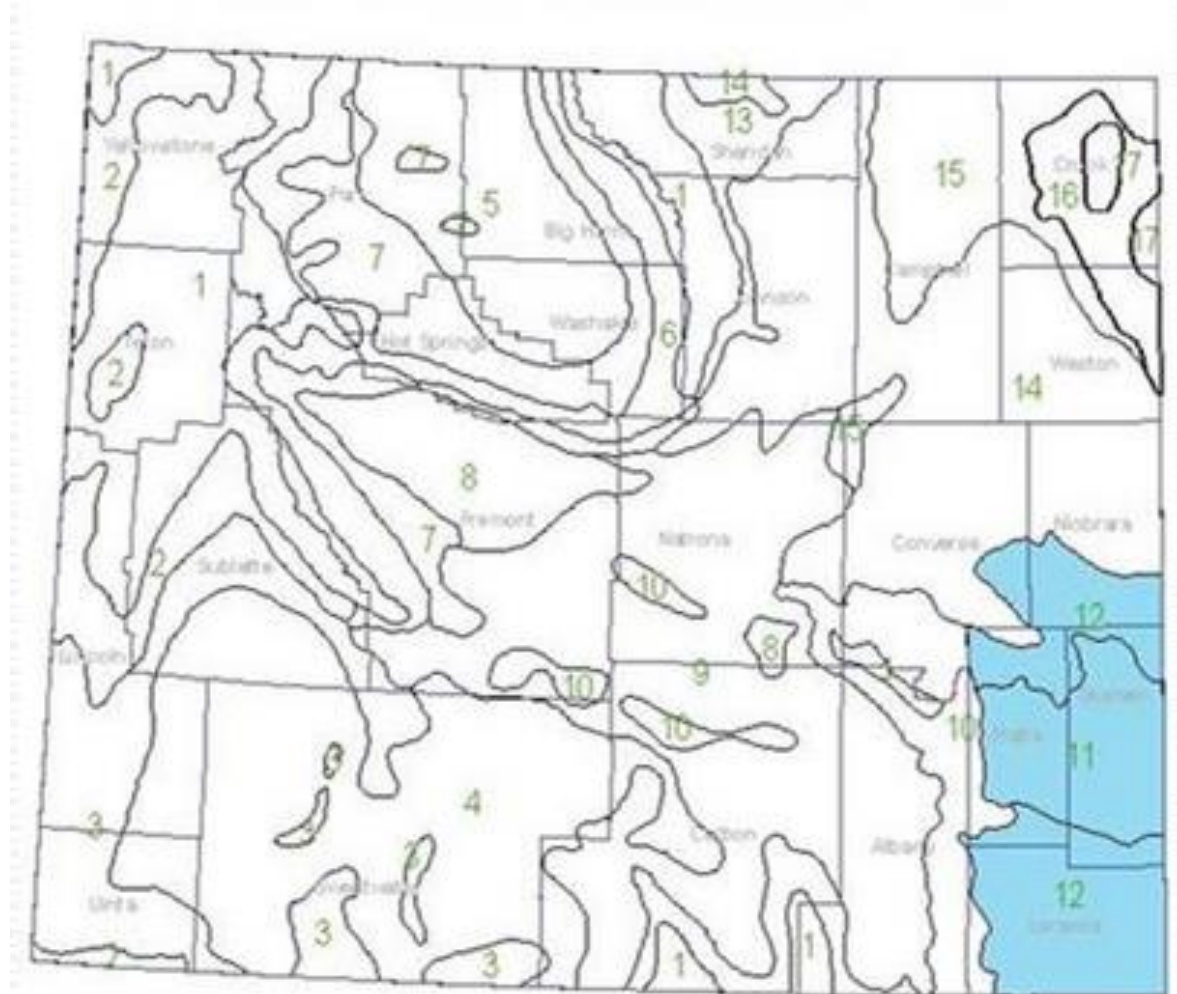


# Wind Speeds in SE WY



# MLRA: 067A- Central High Plains Northern Part

- Elevation: 4,000-6,500'
- Annual Precipitation: 12-17 inches
- Wind Speed: 7 -10 mph, gusts more than 75 mph
- Growth of native cool season plants: April 1 – July 1
- Growth of warm season plants: May 15- August 15
- Air Temperature: 31 – 59.3 (average min/max)





# Sandy (Sy)

## Ecological Site Description

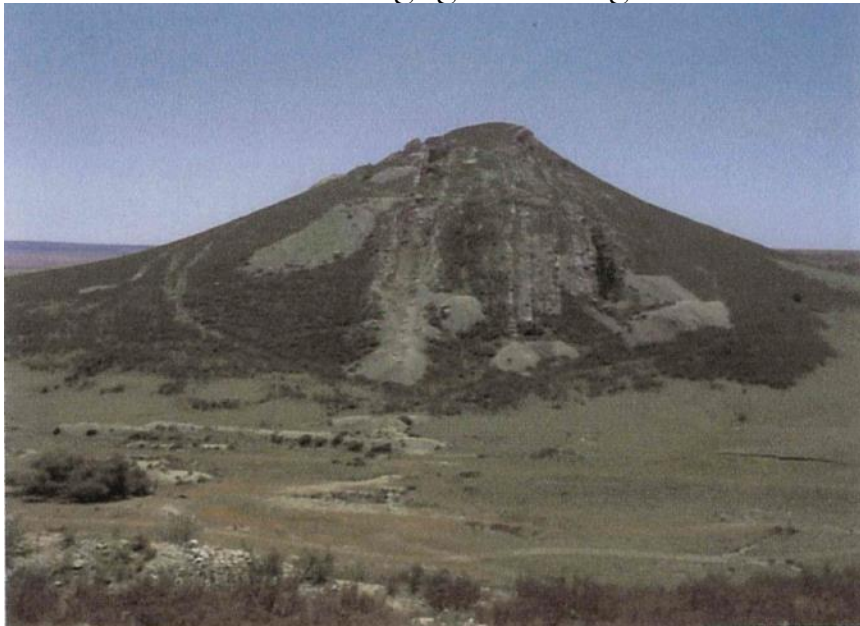
- Site Type: Rangeland
- MLRA: 067A- Central High Plains, Northern Part
- Landforms: Hill, alluvial fan, stream terrace
- Slope: 0-30%
- Runoff class: Very low – medium
- Major Soil Series correlated to this site include: Alice, Bayard, Manter, Jayem, Phiferon, Moskee, Vetal, Otero, Keeline, Turnercrest, Altvan, Glendive, Parshall, Busher, Dailey, Dunday, Sarben, Anselmo, Satanta, Valent, Ashollow, Scoville, Tripp, Vebar, Chappell
- Surface texture:(1) Sandy loam(2) Loam
- Subsurface texture group: Sandy
- Depth: 20-60 inches
- EC: 0-4 mmhos/cm
- SAR: 0-5
- Available water capacity: 2.0- 7.8 inches in the upper most 60”



# Limy Upland (LiU)

## Ecological Site Description

- Site Type: Rangeland
- MLRA: 067A- Central High Plains, Northern Part
- Landforms: Hill, ridge
- Slope: 3 - 20%
- Runoff class: Negligible – High



- Major Soil Series: Colby, Keota, Mitchell, Buffinton, Sulco
- Soils are deep and well drained to somewhat excessively drained
- Surface texture: Loam, Sandy loam, Very fine sandy loam
- Subsurface texture group: Loamy
- Depth: 40-60 inches
- EC: 0-4 mmhos/cm
- SAR: 0-5
- Available water capacity: 3.0- 6.3 inches in the upper most 60”

# Rocky Hills (RH)

## Ecological Site Description

- Site Type: Rangeland
- MLRA: 067A- Central High Plains, Northern Part
- Landforms: Hill, alluvial fan
- Slope: 1 -50%
- Runoff class: Low – High
- Major Soil Series: Tyzak, Rentsac, Stormitt, Sunup, Trimad, Pinelli, Redthayne
- Soils are shallow to very deep and well drained
- Surface texture: Cobbly Loam, Very channery Clay Loam
- Subsurface texture group: Loamy
- Depth: 20-60 inches
- EC: 0-2 mmhos/cm
- SAR: 0-3
- Available water capacity: 0.70 – 1.00 inches in the upper most 60”



# Main Challenges of Sandy Soil Reclamation in SE WY

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- Right seed mix
  - Climate
  - Soils
- Physical challenges of the soil
  - Droughty
  - Abrasive
  - Move
  - Firm seedbed

# WDEQ – Land Quality Division, Gravel Quarries/Large and Small Mines

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## Lessons Learned

Information from:

Lowell K. Spackman, District I Soil Scientist

WYDEQ/Land Quality Division and

Robin Jones, District I

# Recommended Seedmix

Eastern WY, Sandy Soil (non-coal), 8-14 inch precipitation zone

<u>Species</u>	<u>lbs. P.L.S./acre</u>
Western wheatgrass ( <i>Agropyron smithii</i> )	1 to 3 (2 to 5 Broadcast Rates)
Bluebunch or Beardless Bluebunch wheatgrass ( <i>Agropyron spicatum</i> or <i>A. inerme</i> )	2 to 3
Indian ricegrass ( <i>Oryzopsis hymenoides</i> )	3 to 5
Prairie sandreed ( <i>Calamovilfa longifolia</i> )	2 to 4
Sand Bluestem ( <i>Andropogon hallii</i> )* <sup>a</sup>	3 to 5
* <sup>b</sup> (one or more species from list below)	Recommended Rates
* <sup>c</sup> (Minimum three from list below)	Recommended Rates
* <sup>a</sup> Little bluestem ( <i>Schizachyrium scoparium</i> )	3 to 5 (substitute species for <i>A. hallii</i> )
* <sup>b</sup> Buffalo grass ( <i>Buchloe dactyloides</i> )	2 to 4
Blue grama ( <i>Bouteloua gracilis</i> )	1 to 2
Prairie junegrass ( <i>Koeleria cristata/macrantha</i> )	1 to 4
Sideoats grama ( <i>Bouteloua curtipendula</i> )	3 to 5
Sheep fescue ( <i>Festuca ovina</i> )	2 to 4
Sandberg bluegrass ( <i>Poa sandbergii</i> )	2 to 4
Sand dropseed ( <i>Sporobolus cryptandrus</i> )	1 to 2.5



**Include a minimum of 3 of the following species (drill seed rates)**

* <sup>c</sup> Western yarrow ( <i>Achillea millefolium</i> or <i>lanulosa</i> )	0.75 to 1.5
Pacific aster ( <i>Aster chilensis</i> )	0.5 to 1
Lance-leaved coreopsis ( <i>Coreopsis lanceolata</i> )	1 to 2
Purple coneflower ( <i>Echinacea purpurea</i> )	1 to 3
Sulfur flower buckwheat ( <i>Eriogonum umbellatum</i> )	1 to 2
Blacksamson ( <i>Echinacea angustifolia</i> )	1 to 3
Blanket flower ( <i>Gaillardia aristata</i> )	1 to 2
Blue flax ( <i>Linum lewisii</i> )	0.5 to 1
Wild lupine ( <i>Lupinus perennis</i> ) or Silky lupine ( <i>Lupinus sericeus</i> )	1 to 3
White eveningprimrose ( <i>Oenothera pallida</i> )	1 to 2
Rocky Mountain penstemon ( <i>Penstemon strictus</i> )	0.75 to 1
White prairieclover ( <i>Dalea candida</i> or <i>Petalostemon candidus</i> )	1 to 3 or
Purple prairieclover ( <i>Dalea purpurea</i> or <i>P. purpureus</i> , <b>use inoculated seed</b> )	0.75 to 2
Scarlet or Munro globemallow ( <i>Sphaeralcea coccinea</i> or <i>S. munroana</i> )	0.75 to 2
Purple verbena ( <i>Verbena stricta</i> )	0.5 to 1
Mexican hat ( <i>Ratibida columnifera</i> forma <i>pucherrima</i> )	0.5 to 1.5
American vetch ( <i>Vicia americana</i> )	1.5 to 4
Fourwing saltbush ( <i>Atriplex canescens</i> )	0.5 to 1
Rubber Rabbitbrush ( <i>Chrysothamnus nauseosus</i> )	1 to 4

**Double the recommended seed rates for broadcast seeding Species from lists b and c.**

# Species that grow well on Sandy Soils

## Tall Grass Prairie

- Little bluestem
- Canada wildrye
- Sideoats
- Prairie dropseed
- Indian ricegrass
- Needleandthread
- Salina wildrye
- Rusty lupine
- Sandhill muhly
- Scurfpea
- Blowout grass
- Wildrye

## Mixed Grass (Elements)

- Western wheatgrass
- Threadleaf sedge
- Sheep fescue (similar to threadleaf sedge)
- Blue grama
- Sandberg bluegrass
- Little bluestem
- Sideoats
- Indian ricegrass
- Sand dropseed
- Yucca (often has good regrowth)
- Prairie sandreed

# AML- Abandoned Mine Lands

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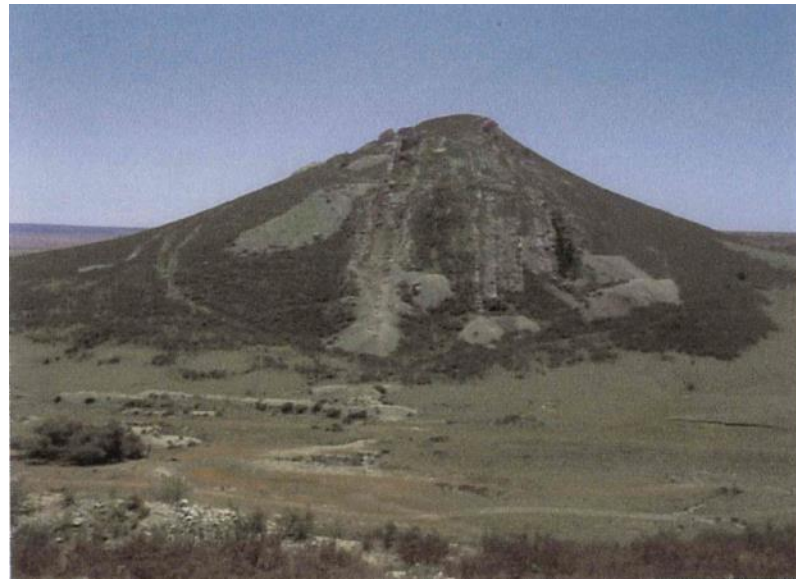
## Lessons Learned

Photographs and Information from:  
Marcia Murdock  
AML NEPA Coordinator/ AML Database  
Manager/ AML Project Manager  
Abandoned Mine Land Division, Department of  
Environmental Quality



# Main AML projects in SE WY

- Limestone, e.g., Sunrise Mine north of Guernsey
- Other hard rock mines





# Grass Creek Fire Reclamation



# Gas Hills Reclamation





AML: Pitting is used in  
coarse textured soils

# Leonardite Mining

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## Lessons Learned

Information from Bruce Lawson with Black Hills Bentonite

<http://www.bhbentonite.com/lignite.html>

# Sandy Soils Reclamation

## Lessons Learned- Leonardite Mining

- Location: Near Glenrock, WY
- Soil Type: Sandy
- Seeding Method:
  - Re-spread topsoil in the Spring
  - Seed sterilized cover crop (green mulch) like Quickguard, in the Spring after re-spreading topsoil
  - Use a No-Till Drill in the fall to seed in the permanent seed mix
- Results: Has had good results with this method of seeding on sandy soils.

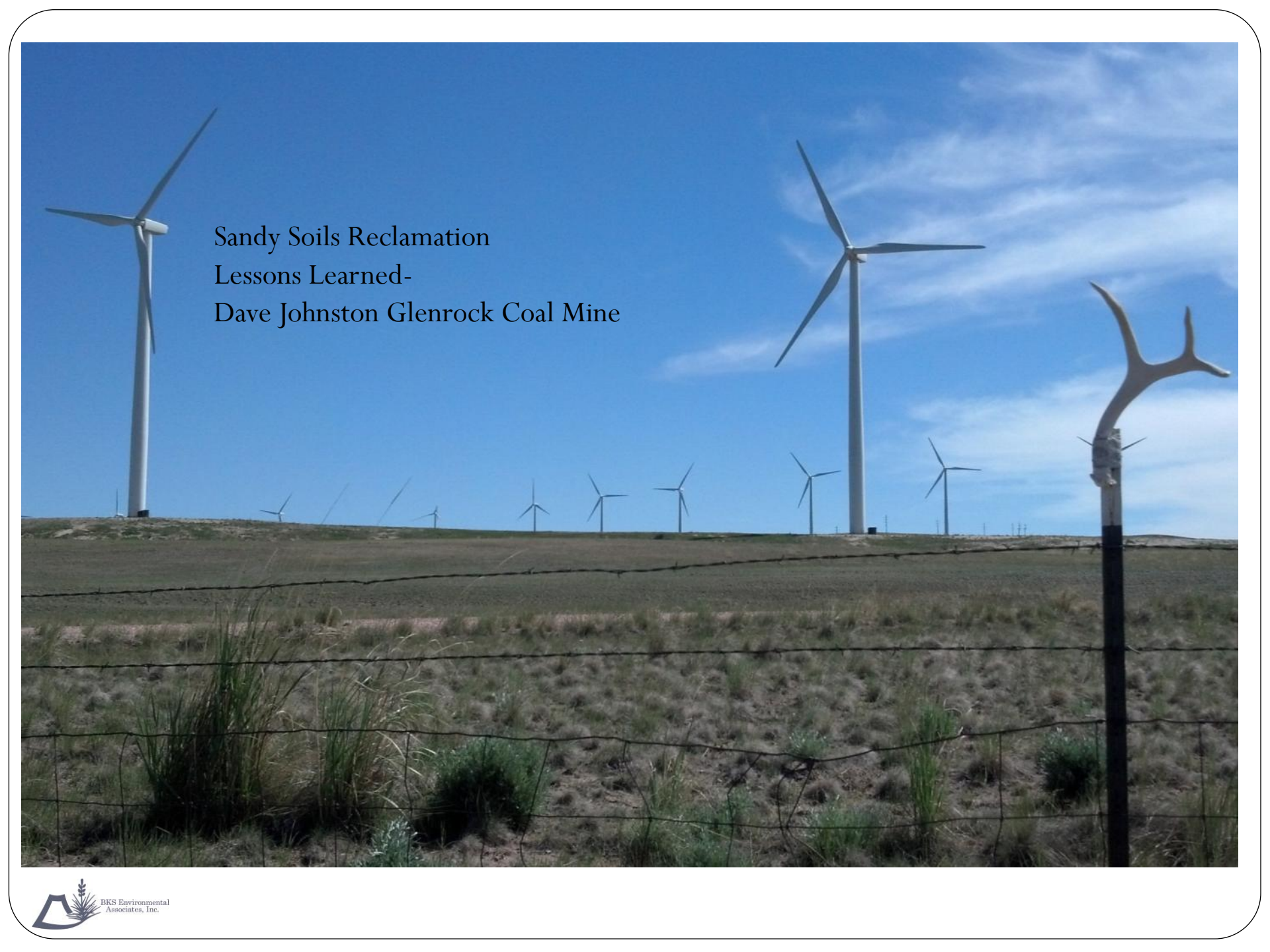
# Reclaimed Coal Mine/Wind Farm

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## Lessons Learned

Information and Photographs from Chet Skilbred,  
Interwest Mining Company- Glenrock Coal Company





Sandy Soils Reclamation  
Lessons Learned-  
Dave Johnston Glenrock Coal Mine

# Sandy Soils Reclamation and Low Precipitation

- Biggest concern when planting into sandy soils is the Wind!
- Seedbed preparation is similar to high intensity farming
- May need to work the Area up to 5 times before it is actually planted
  - 1<sup>st</sup> pass: deep rip spoil material to relieve compaction
  - 2<sup>nd</sup> pass: after the topsoil is placed, deep rip or chisel plow 12-16 inches
  - 3<sup>rd</sup> pass: roller-harrow to break up the soil after deep rip and prepare a firm seedbed
  - 4<sup>th</sup> pass: based on soil conditions, roller-harrow again if necessary
  - 5<sup>th</sup> pass: seed with drill

# Seedbed Preparation



# Seedmix

- All seeding will be done on a Pure Live Seed (PLS) bases and utilize a drill with ½” depth bands on the seed openers.
- The drill will be calibrated to seed at a bulk rate that equates to the required (PLS) seeding rate.
- All individual seeds used in the seed mixture will have seed certifications.
- The seed mixture will be pre-blended by (seed source/vendor) to the yield the designated seed mixture and per acre seeding rate.
- Site seeding will occur from **November 1 through March 31**.

## Approved seedmix for ROW

Thickspike wheatgrass  
Streambank wheatgrass  
Western wheatgrass  
Beardless bluebunch  
Prairie sandreed  
Sheep fescue  
Sandberg bluegrass  
Indian ricegrass  
Green needlegrass  
Blue flax  
Fourwing saltbush  
No substitutions of Species

**Seed when it is not  
convenient for you!**

# Russian Thistle Usefulness Example

**Usually NOT a Problem and It is Not Removed If Grass Seedlings are Sufficient Underneath**

- Leave Russian Thistle in Place to Provide Increased Snowcatch and to Act as Mulch During the Next Growing Season
- Prevents Antelope From Grazing the Shrubs



- Seed across (perpendicular to) the general prevailing winds

This may bury the seed some and help prevent seeds from blowing away



- Double normal seeding rates
  - It is inherent that you will lose seed due to the winds
- Expect that you may need to interseed (with drill seeder) into a few areas the next year due to blowouts

# Guernsey National Guard Facility

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## Lessons Learned

Information provided by  
Dustin J. Kafka, ITAM Coordinator  
Camp Guernsey Training Center

# Lessons Learned at Guernsey National Guard Facility

- Sandy soils common in the southern portion of facility
- Firm seed bed by using roller packer
- Seeding occurs throughout the year and they have seen some good results from July seeding
- Utilize grain cover crops such as wheat, oats, and barley (time planting/grazing before they head out)
- Fire is common





# Lessons Learned at Guernsey National Guard Facility

- Plant native and non-native (ecological bridge) species
  - Native species:
    - Buffalo grass
    - Blue grama
    - Western wheatgrass
    - First strike slender wheatgrass
  - Non-native (Ecological Bridge) species:
    - Vavilov II Siberian Wheatgrass (*A. fragilis*)
    - Bozoiisky II Russian Wildrye
    - These two species planted together have been keeping the cheatgrass out. There are several studies underway to see why this occurs.

# Ability to harvest their own seed using a seed stripper



# WYDOT

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## Lessons Learned

Information and Photographs from John Samson, WYDOT

# Lessons Learned from WYDOT

- Sandy or sand soils are well drained
  - Readily uptake brief summer showers
- Use of grass drill placement is better than hydroseeding
- Like everything in reclamation, it boils down to species selection.
  - Some species really like sandy soils but there are many that “refuse to grow there”.
- Standardized seed mixes that work for ROW projects in both salty clays and sandy soil types are very unlikely to meet state or federal regulation requirements.



- WYDOT I-25 reclamation
- Near Wheatland, WY



# Keys to Reclamation Success in Sandy Soils

- Create a firm seedbed
  - May also need to stabilize the area upwind of the disturbance
- Choose the right seed mix
  - Select a seedmix with species that grow well in sandy soils
  - Double the PLS lbs./acre of seed
    - Some seeds will blow away
  - Seed generally in the Fall/Winter; cover crop possible depending on timing of seeding
  - Seed right before its wet
    - It is useful to have your own equipment so this is possible
    - May need to seed when its not convenient to you
- Be aware of the primary wind direction
  - Seed perpendicular to the prevailing winds
  - Minimize wind impact
- After seeding complete, limit grazing for first two growing seasons or time it in dormant season

# Summary

- This area may get more precipitation than other areas in WY and is often lower elevation
- Distribution of precipitation and sandy soils often select for warm season grass species
- Select your seed mix carefully to be adapted to such conditions
- Be aware of the need for a firm seedbed in sandy soils
- Be aware of the detrimental effects of wind and sandy soils on newly seeded ground

??Questions??

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