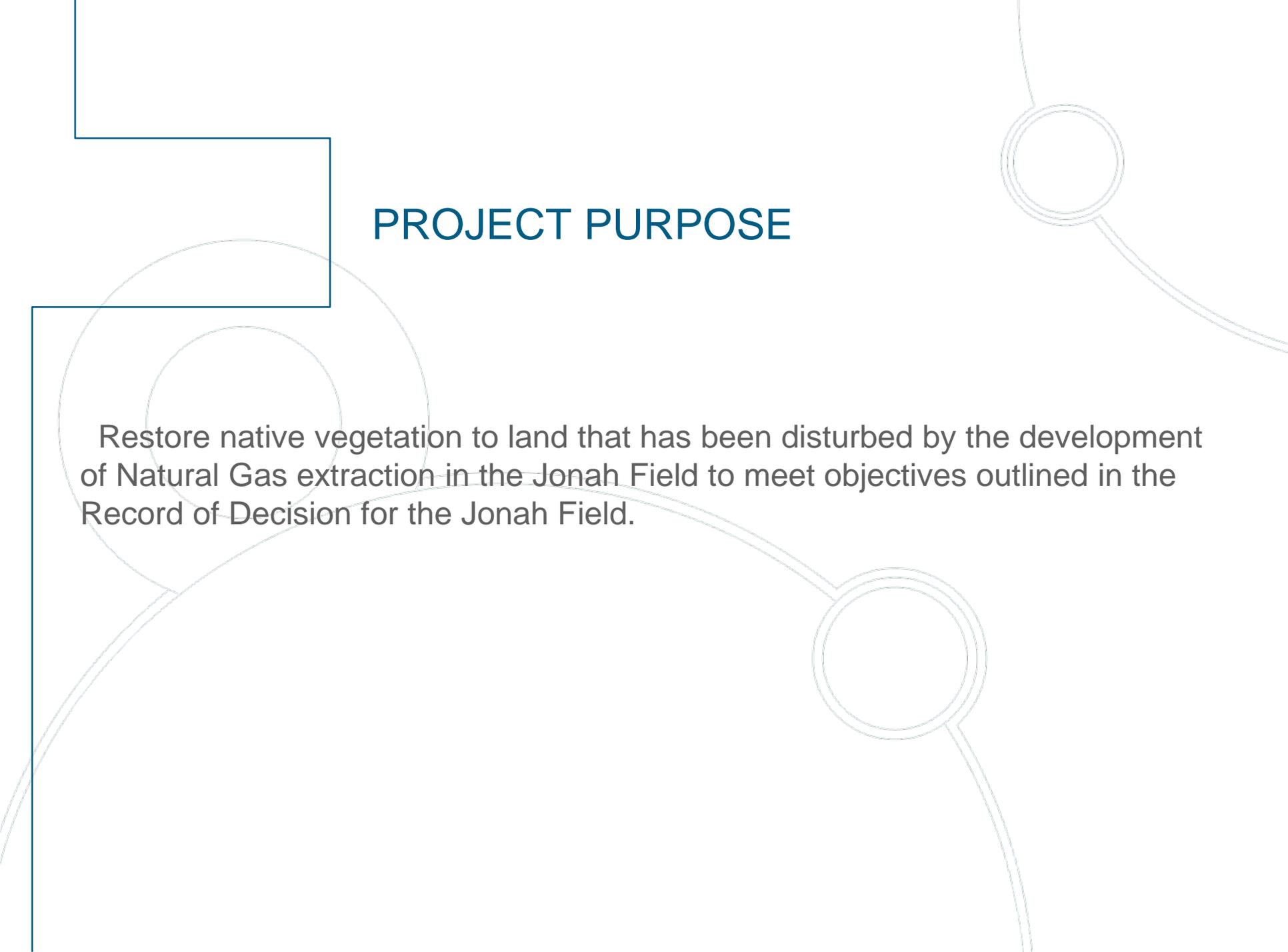


The background features a series of light blue decorative elements: a stepped line in the top left, a large circle on the left, a smaller circle in the top right, and a larger circle in the bottom right. A thick blue arc curves across the middle of the page.

Restoration of Sagebrush Landscapes Impacted by Energy Development Jonah Field

Josh Sorenson
Reclamation Supervisor
Jonah Energy LLC
Jonah Field

The background features a decorative design with blue lines and circles. On the left, there is a stepped line that descends from the top left and then turns right. Below this, there are several overlapping circles of varying sizes, some with double outlines. On the right side, there are two more circles, one above the other, also with double outlines, connected by curved lines that sweep across the page.

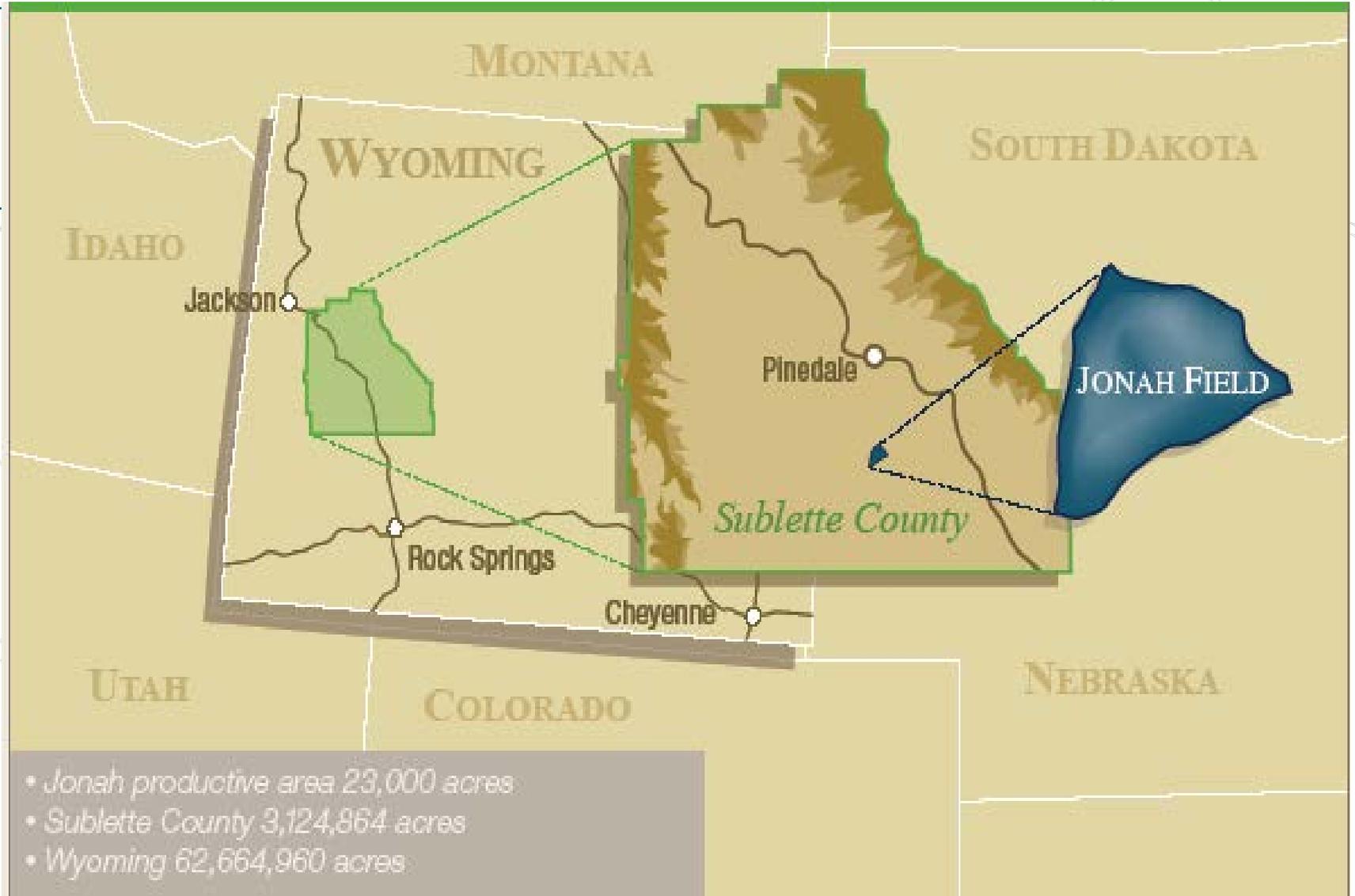
PROJECT PURPOSE

Restore native vegetation to land that has been disturbed by the development of Natural Gas extraction in the Jonah Field to meet objectives outlined in the Record of Decision for the Jonah Field.

Jonah Field Restoration Drivers

- The Jonah ROD
- A social license to operate
- Need for more understanding and science

Jonah Field Location



PHYSICAL CHARACTERISTICS

- Average annual precipitation 7-9 inches
- Land Cover type for the most part is Wyoming Sage/Rhizomatous wheat grass
- Soils are Loamy, Loamy Slightly Alkaline, and Sandy Clay Loam
- Two major Ecological Sites are Wind River Loamy 7-9, and Clayey 7-9
- High Desert - 34 frost free days

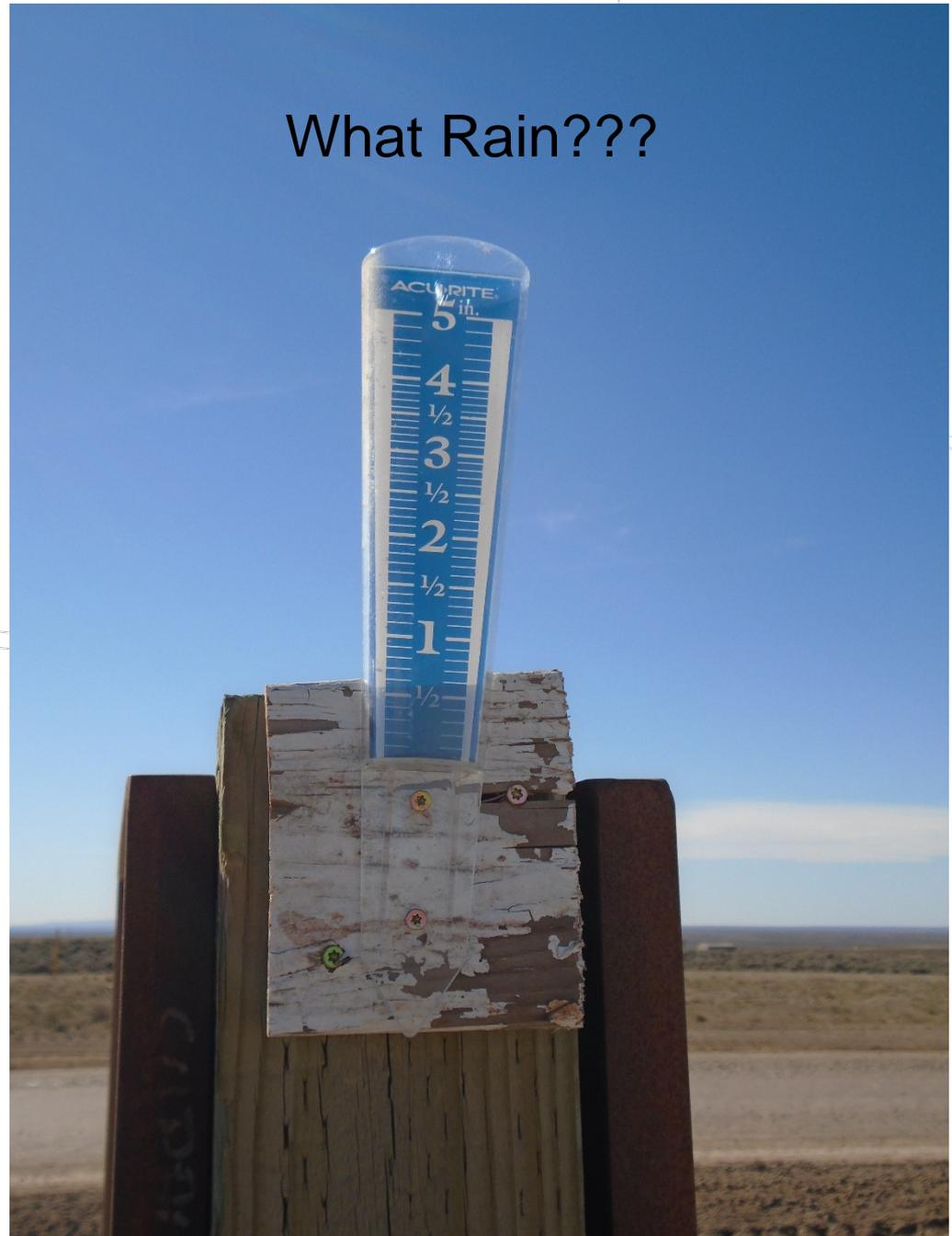
It Blows!!!!!!!!!!



Sec. 17 - .92"

Sec. 26 - 1.17"

What Rain???



JONAH FIELD

- Total Field is approximately 30,000 Ac
- Jonah Energy LLC lease approximately 17,400 Ac
- Total disturbance allowed all operators 20,000 Ac
- Never to exceed 14,000 Ac – at one time
- Current Disturbance 5026 Ac
- Current Reclamation 4001 Ac
- Average annual Disturbance 200 Ac

The background features a white page with decorative blue elements. On the left, there is a blue stepped line graphic. A large, faint blue circle is positioned on the left side, partially overlapping the stepped line. A blue arc curves across the bottom of the page. On the right side, there are two blue circles of different sizes, one above the other, connected by thin blue lines to the right edge of the page.

CURRENT RESTORATION EFFORTS

965 CONVENTIONAL EARTH LOCATIONS

106 MAT LOCATIONS

ECOLOGICAL GOALS

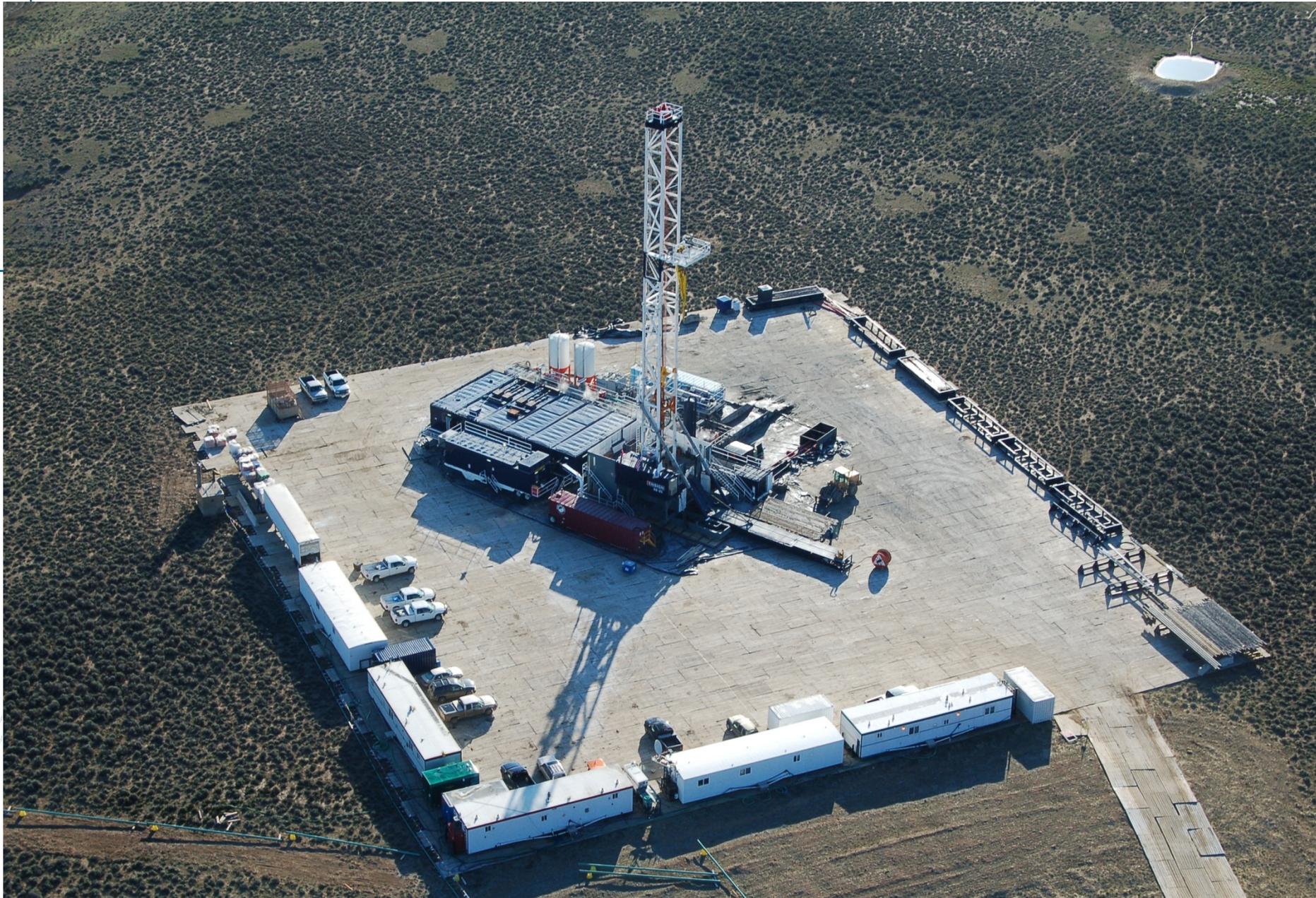
Restoration of Disturbance to Sage Brush Steppe Landscapes to meet Roll Over Criteria established by Jonah Interagency Office

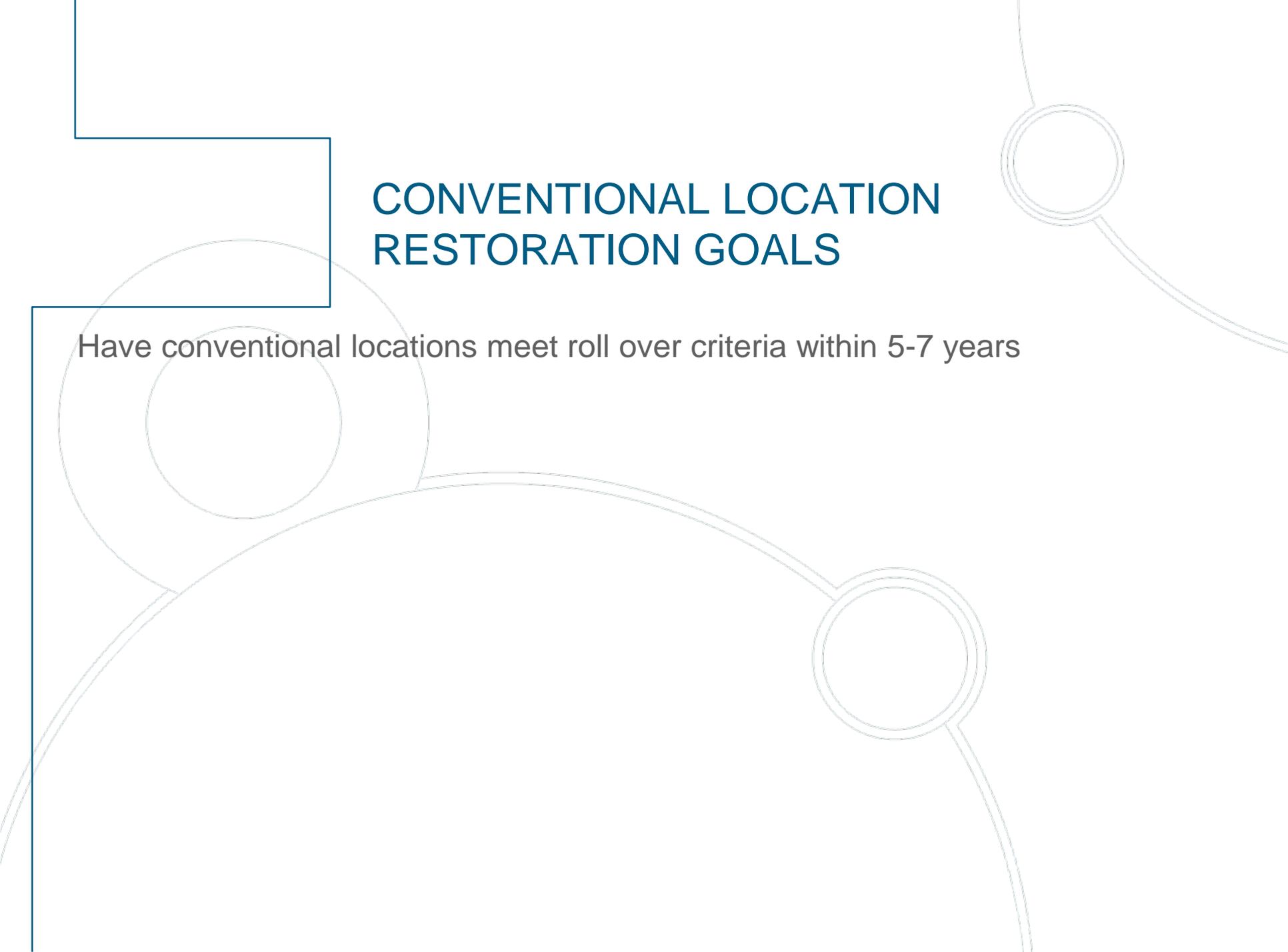
- Bare Ground equal to or less than reference
- Stable Soil
- Established 5-6 species of forbs
- Shrubs have become established
- Grass three species two bunch grasses
- Forbs, Shrubs and Grasses in a reproductive state

CONVENTIONAL EARTH PAD – SHB 44-11(multi-well)



MAT PAD DRILLING LOCATION



The background features a light blue decorative design consisting of several overlapping circles and curved lines. A prominent blue stepped line starts from the top left and extends towards the center. Another blue stepped line starts from the left side and extends towards the center. A large, faint blue circle is positioned on the left side, partially overlapping the stepped lines. A smaller blue circle is located in the upper right quadrant, connected to a curved line that extends towards the right edge. A larger blue circle is positioned in the lower right quadrant, also connected to a curved line that extends towards the bottom right edge.

CONVENTIONAL LOCATION RESTORATION GOALS

Have conventional locations meet roll over criteria within 5-7 years

The background features a light blue decorative design consisting of several overlapping circles and lines. On the left side, there are two concentric circles. A blue stepped line starts from the top left, goes right, then down, then right again, and finally down. On the right side, there are two more concentric circles, one near the top and one near the bottom, connected by a curved line that arcs across the bottom of the page.

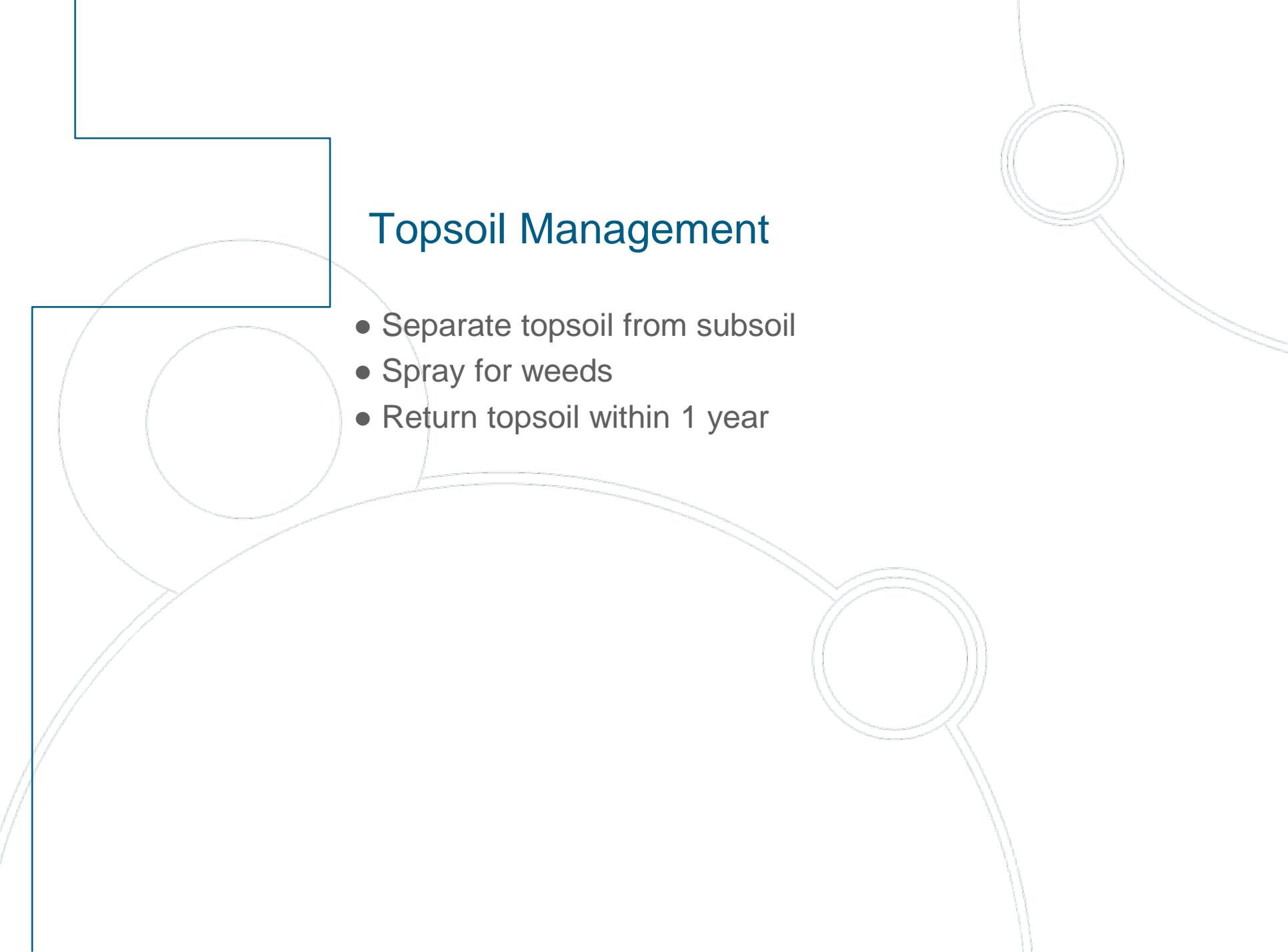
How do we get there?

- Soil Management
- Deep Ripping
- Monitoring
- Patience
- Flexibility/Tools/BMP's







The background features a white page with decorative blue elements. On the left, there is a blue stepped line that descends and then turns right. A large, faint blue circle is partially visible behind the text. On the right side, there are two smaller blue circles, one near the top and one near the bottom, connected by a thin blue line that curves across the page.

Topsoil Management

- Separate topsoil from subsoil
- Spray for weeds
- Return topsoil within 1 year



Deep ripping of subsoil prior to topsoiling







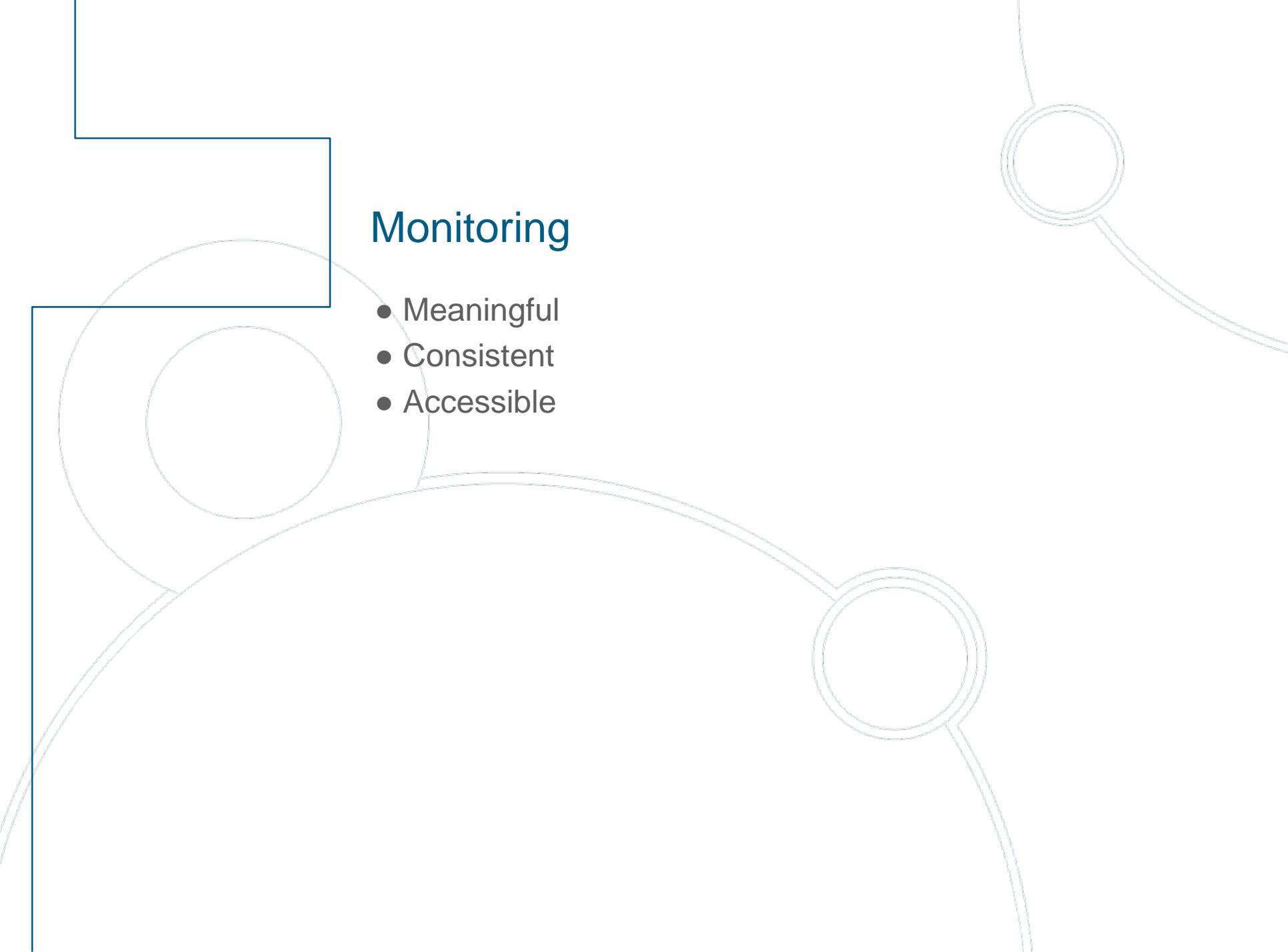
TRUAX RANGELAND DRILL WITH 12 INCH ROW SPACING



How do we know how we are doing?

Operator	Location Name	Germinated Comment	Undesirable	Site Stable	Noxious	Other Und	Good Repr	Reclamation	Location R	Sage Grow	BMP Com	Geometry	ProcessFl	Reg ID	Reclaimed	Jonah Loc
Encana	SAG 17-30	Seeded Late Fall < 1 yr	No Undesi	Site Stable	No Noxiou	No Other U	Grass/For	Perennial	3	Seedling <	Wattle	GPS, Map	<Null>	<Null>	<Null>	CDP
Encana	SAG 73-20	Seeded Late Fall < 1 yr	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass/For	Perennial	3	Seedling <	Not Applic	GPS, Map	<Null>	<Null>	<Null>	CDP
Encana	SAG 48-19	Seeded 2+ yrs, No Ger	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass - O	No Perenn	1	Not Applic	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	SAG 34-19	Not Applicable	No Undesi	Site Stable	No Noxiou	Mostly Tur	Good Repr	Perennial	4	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	CDP
Encana	SAG 35-19	Seeded 2+ yrs, No Ger	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass - O	No Perenn	2	Not Applic	No BMP	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	SAG 36-19	Seeded 2+ yrs, No Ger	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass - O	No Perenn	2	Not Applic	No BMP	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 11-19	Not Applicable	No Undesi	Site Stable	No Noxiou	No Other U	Not Applic	Perennial	3.5	Seedling 2	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Well with E
Encana	SAG 5-17	Not Applicable	No Undesi	Site Stable	No Noxiou	Mostly Tur	Good Repr	Perennial	4.5	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	CDP
Encana	CAB 69-19	Not Applicable	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass Goc	Perennial	3.5	Seedling 2	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Well with E
Encana	CAB 12-19	Seeded 2+ yrs, No Ger	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass - O	No Perenn	1	Not Applic	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Well with E
Encana	CAB 72-19	Grass on <25% of Loc	No Undesi	Site Stable	No Noxiou	Mostly Hal	Grass - T	No Perenn	2	Not Applic	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 13-19	Not Applicable	No Undesi	Site Stable	No Noxiou	Mostly Hal	Not Applic	Perennial	3.5	Seedling >	Not Applic	GPS, Map	<Null>	<Null>	<Null>	CDP
Encana	CAB 75-19V	Not Applicable	No Undesi	Site Stable	No Noxiou	No Other U	Good Repr	Perennial	4	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 17-25	Not Applicable	No Undesi	Site Stable	No Noxiou	No Other U	Good Repr	Perennial	4.5	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 1-25	Not Applicable	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass Goc	Perennial	3	Not Applic	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Well with E
Encana	CAB 31-25	Grass on <25% of Loc	No Undesi	Site Stable	No Noxiou	Mostly Hal	Grass - T	Perennial	2	Seedling 2	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 32-25	Good Germination	No Undesi	Site Stable	No Noxiou	Mostly Hal	Grass Goc	Perennial	3.5	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 33-25	Good Germination	No Undesi	Site Stable	No Noxiou	No Other U	Grass Goc	Perennial	3.5	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 8-25	Not Applicable	No Undesi	Site Stable	No Noxiou	Mostly Hal	Grass Goc	Perennial	3	Seedling <	Not Applic	GPS, Map	<Null>	<Null>	<Null>	CDP
Encana	CAB 34-25	Not Applicable	No Undesi	Site Stable	No Noxiou	No Other U	Grass Goc	Perennial	4	Seedling >	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 47-25	Not Applicable	No Undesi	Site Stable	No Noxiou	No Other U	Grass Goc	Perennial	3.5	Seedling >	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 12-30	Good Germination	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass Goc	Perennial	3	Seedling <	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Well with E
Encana	CAB 57-30	Good Germination	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass Goc	Perennial	3	Seedling <	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 58-30	Other	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass Goc	Perennial	2	Seedling 2	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 11-30	Not Applicable	No Undesi	Site Stable	No Noxiou	Mostly Hal	Good Repr	Perennial	4	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Well with E
Encana	CAB 53-30	Good Germination	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass Goc	Perennial	3	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 60-30	Not Applicable	No Undesi	Site Stable	No Noxiou	Mostly Tur	Grass Goc	Perennial	3.5	Good Sage	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We
Encana	CAB 70-30OH	Good Germination	No Undesi	Site Stable	No Noxiou	Mostly Tur	Good Repr	Perennial	3	Seedling 2	Not Applic	GPS, Map	<Null>	<Null>	<Null>	Single We

MONITOR

The background features a light blue color with decorative elements. On the left, there are blue lines forming a stepped shape and a large circle. On the right, there are two smaller circles connected by a curved line. The overall design is clean and modern.

Monitoring

- Meaningful
- Consistent
- Accessible

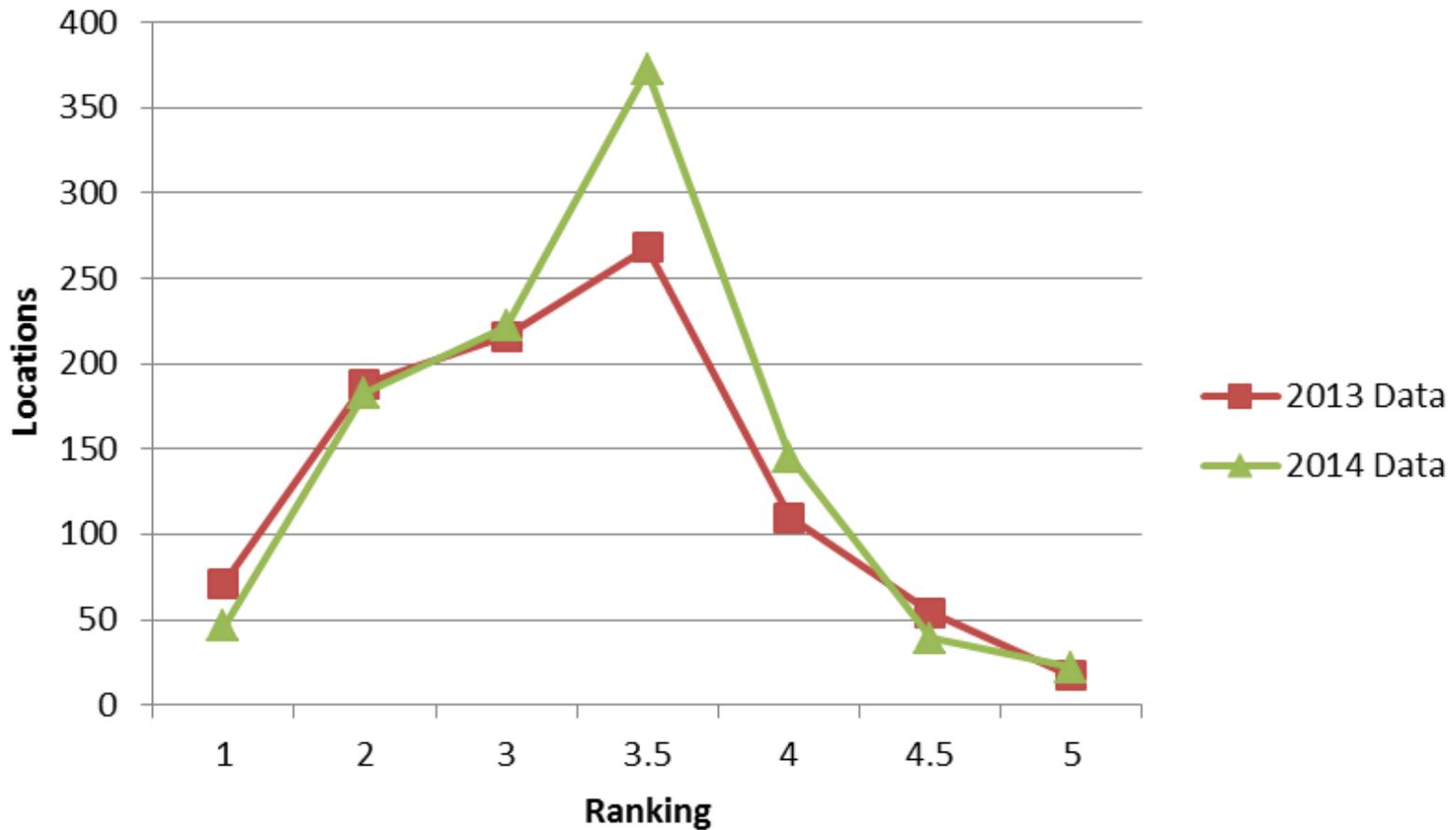
Qualitative Ranking Criteria

1. Majority of location lacks a minimum of two species of grass and needs remediation seeding.
2. Location has some cover on over 50% of location with 3 grass species and a least some perennial forbs but needs watching for additional seeding work
3. Location is stable throughout has three or more grass species has forbs and shrubs scatted over location but lacks sagebrush seedlings.
- 3.5. Location is stable throughout and has three or more grass species, has forbs and shrubs scatted over location and has some sagebrush seedlings.
4. Location is stable throughout and has three or more grass species, has a variety forbs and shrubs scatted over location and has good population of sagebrush seedlings.
5. Meets roll over criteria



Location Rating Distribution

Location Rating Distribution



Patience



SHB 69-15



SHB 75-15



SHB 73-15



SHB 70-34 – planted fall 2012



SHB 32-10 – granted rollover 2013





TIMING





Flexibility/Tools/Use of Tools

- **Erosion Mats**
- **Mulch**
- **Irrigation**
- **Interseeding**
- **Weed Control**

SHB 66-26 Reclaimed Fall 2014



SHB 84-36X Reclaimed Fall 2014



JF 22-5 Mulched and reclaimed Fall 2014







Stabilize Drainages



Irrigation



Interseeding







Summary

- Proper Management of topsoil
- Deep Ripping/Seedbed preparation
- Monitor
- Be Patient
- 40 locations have been rolled over
consisting of 91 acres



Josh Sorenson
Reclamation Supervisor
Jonah Energy LLC
307-537-6119