

Incorporating Wildlife Habitat in Mine Reclamation Design

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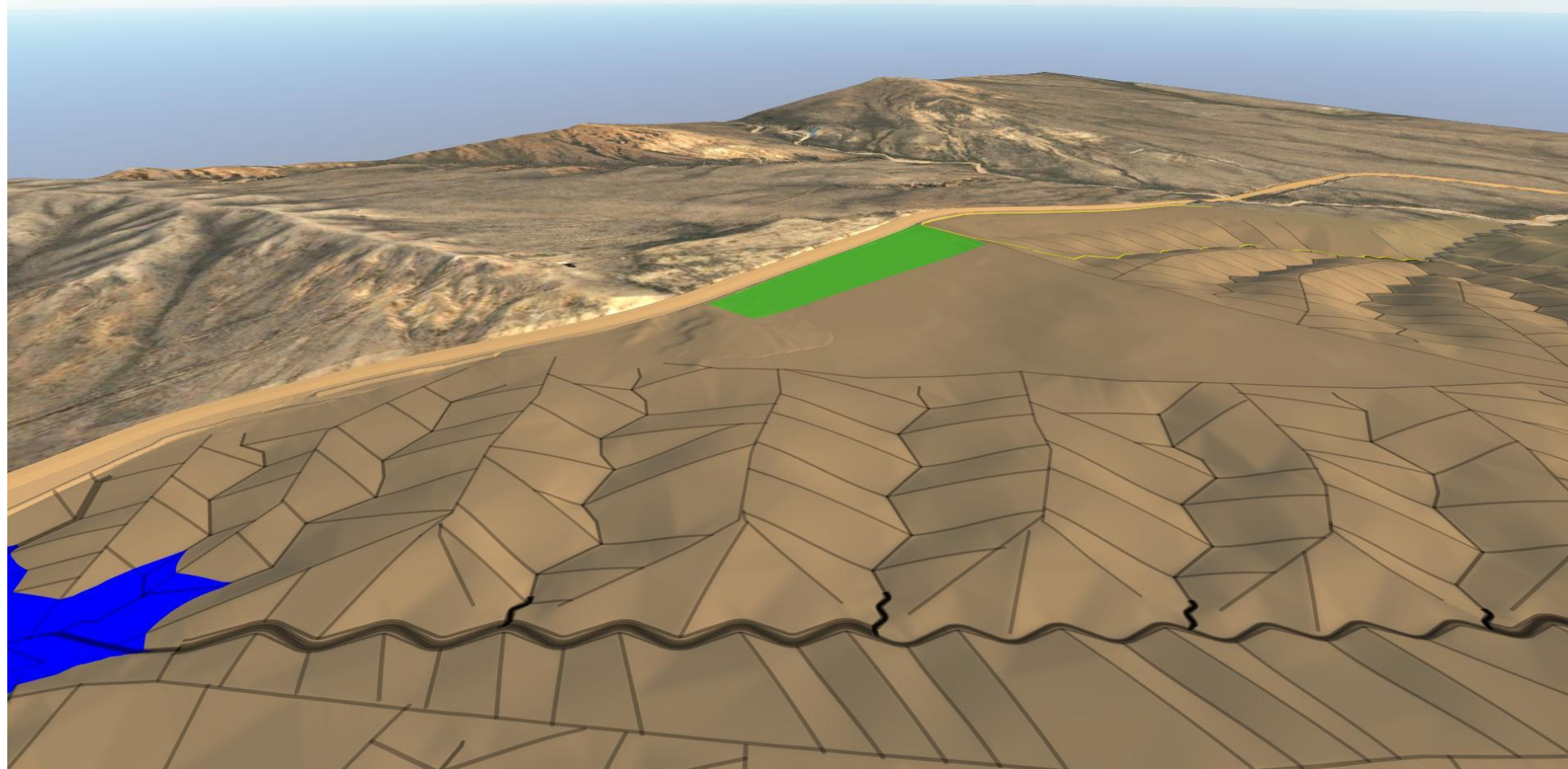


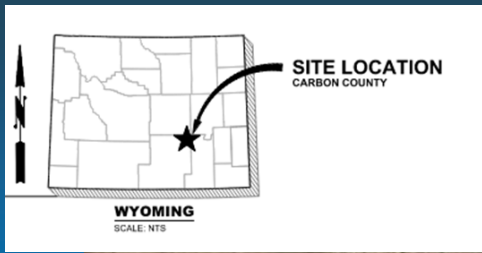
Greater sage grouse, Tom Koerner/USFWS, Public Domain,

The Objective: Grading habitat into the landform



- The Opportunity
- Design Criteria
- Methodology
- The Outcome



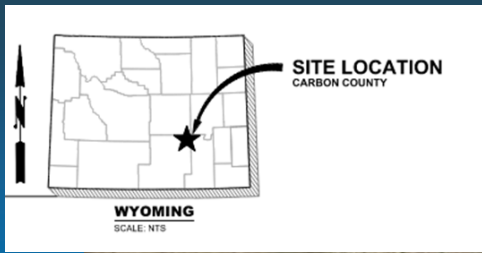


Shirley Basin Background



Pre-Disturbance Baseline Conditions

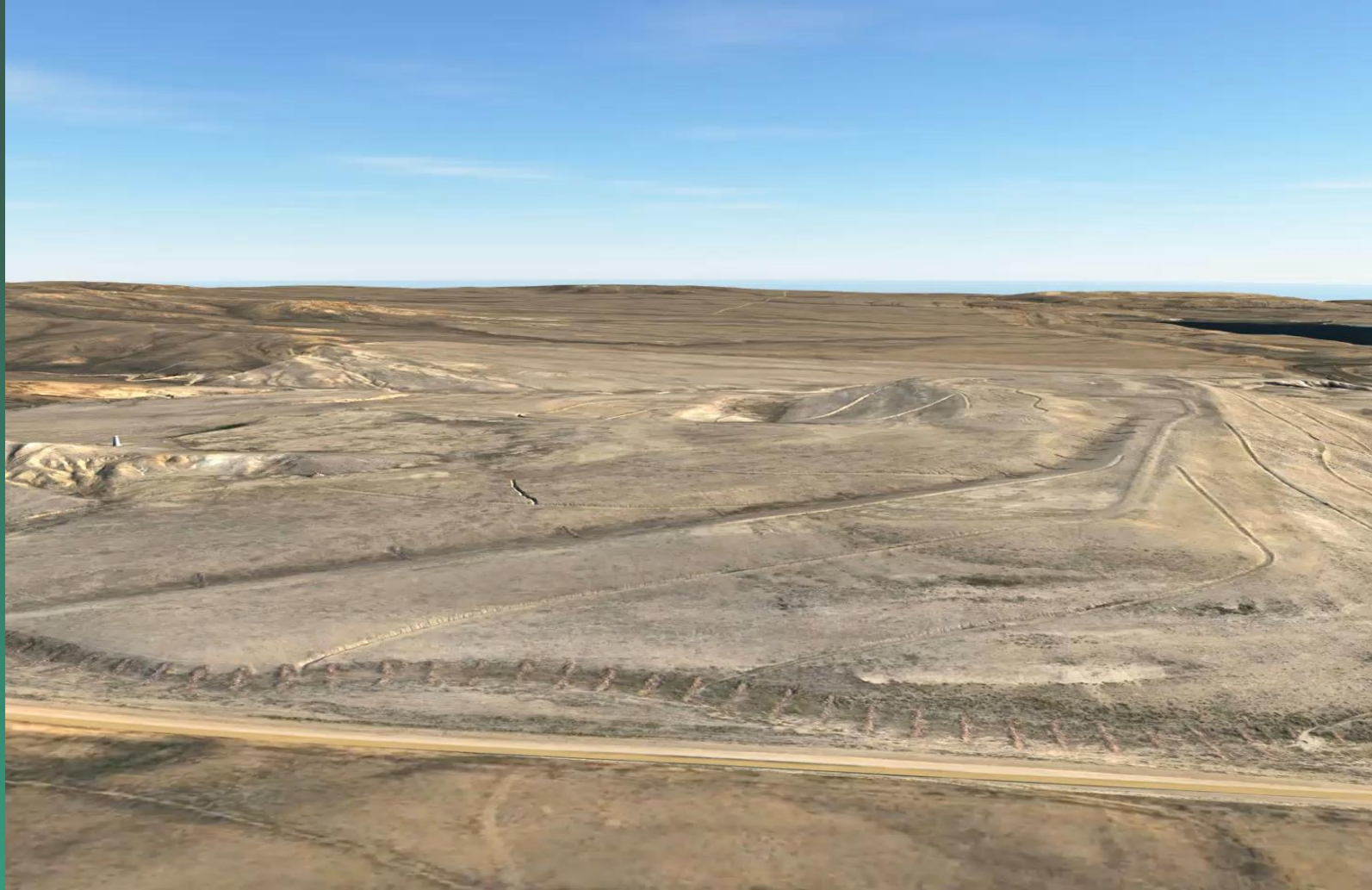
- **Climate:** Semi-arid, high-elevation prairie at ~7,100 ft; mean annual temperature ~41°F with ~12 inches of annual precipitation
- **Vegetation:** Sagebrush steppe dominated by Wyoming big sagebrush with native grasses and forbs
- **Wildlife:** Core greater sage-grouse habitat and important winter range for pronghorn; part of the Medicine Bow herd (~38,400 animals)



Shirley Basin Background

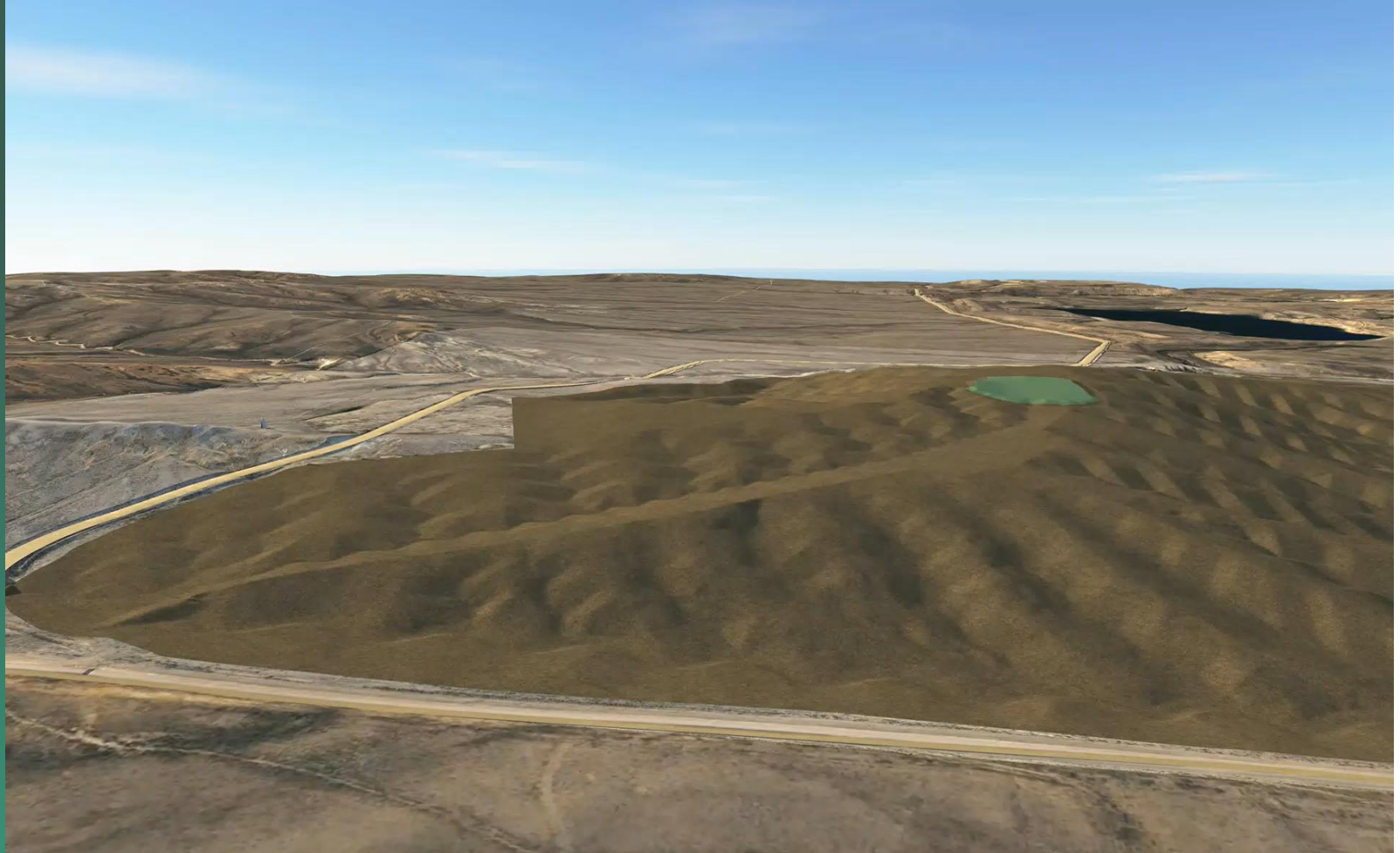


A



The 500 Pile Current Conditions

The 500 Pile Proposed Design



1

Identify

GIS slope zone analysis to map target areas on the grading surface for habitat potential

2

Design

Sage grouse habitat criteria applied to guide grading — nesting bowls, brood-rearing swales, connectivity corridors

3

Iterate

Feedback loop between habitat targets and geomorphic stability to refine the final landform



Summary of Approach

Habitat Design Considerations

1 Nesting Habitat

Mid-slope benches and bowls at 0–12° slopes. Sagebrush canopy cover of 15–30%, plant heights >40 cm for concealment.

2 Brood-Rearing

Bowls and swales create mesic microsites. Small depressions capture moisture supporting forbs and insects critical for chick survival.

3 Habitat Connectivity

Well-vegetated pathways connect drier nesting uplands to wetter brood-rearing areas. No isolated patches separated by steep ground.

4 Constructed Lek

Relatively open on low slope terrain with adequate site lines and they also seem to prefer an area that allows an acoustic effect.

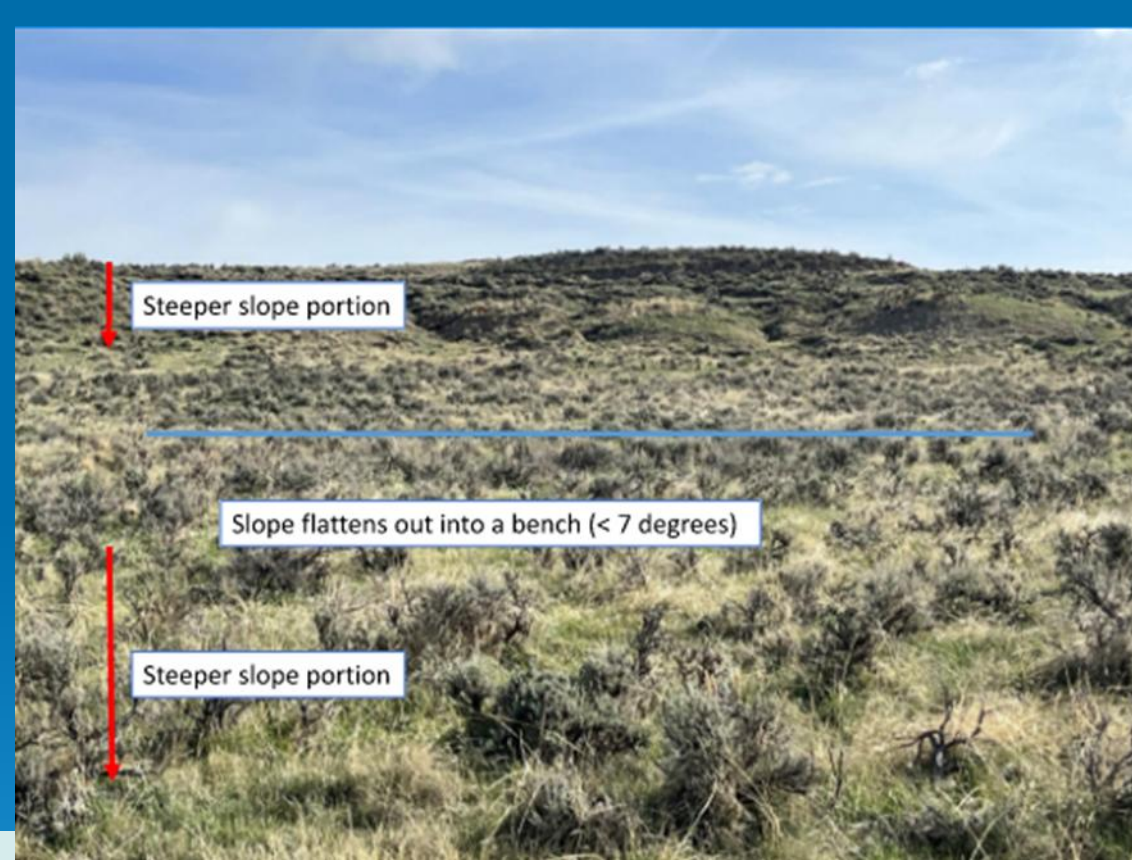
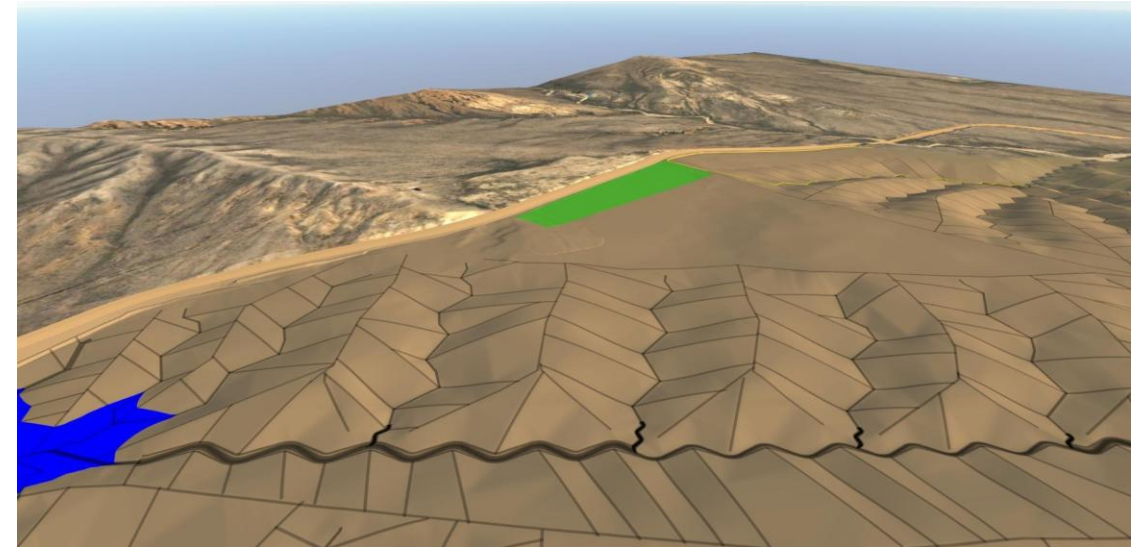
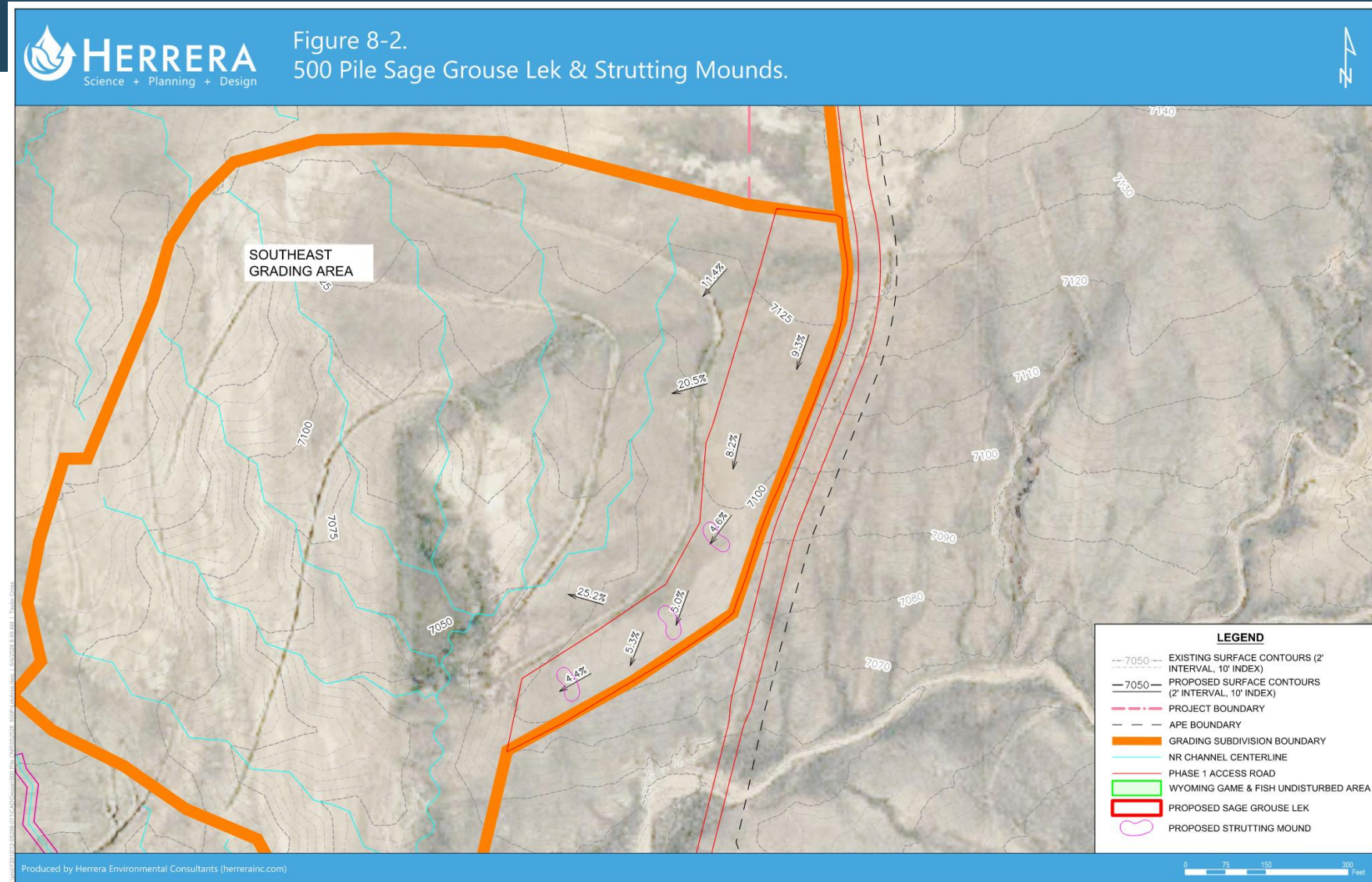


Photo Credit (Chris Kirol).

Brood-Rearing Habitat and Connectivity



Sage Grouse Lek



Methodology: Target Area Identification



Slope Zone Analysis (ArcGIS)

1. Applied slope zone analysis tool to differentiate terrain geometry by color
2. Defined slope zones: 0–7°, 7–10°, and 10°+
3. Bounded 0–7° slope areas and flagged as habitat expansion targets

Slope Degree Categories

0–7°



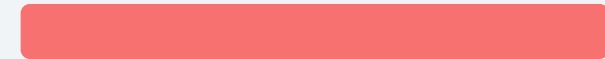
Target habitat zone

7–10°



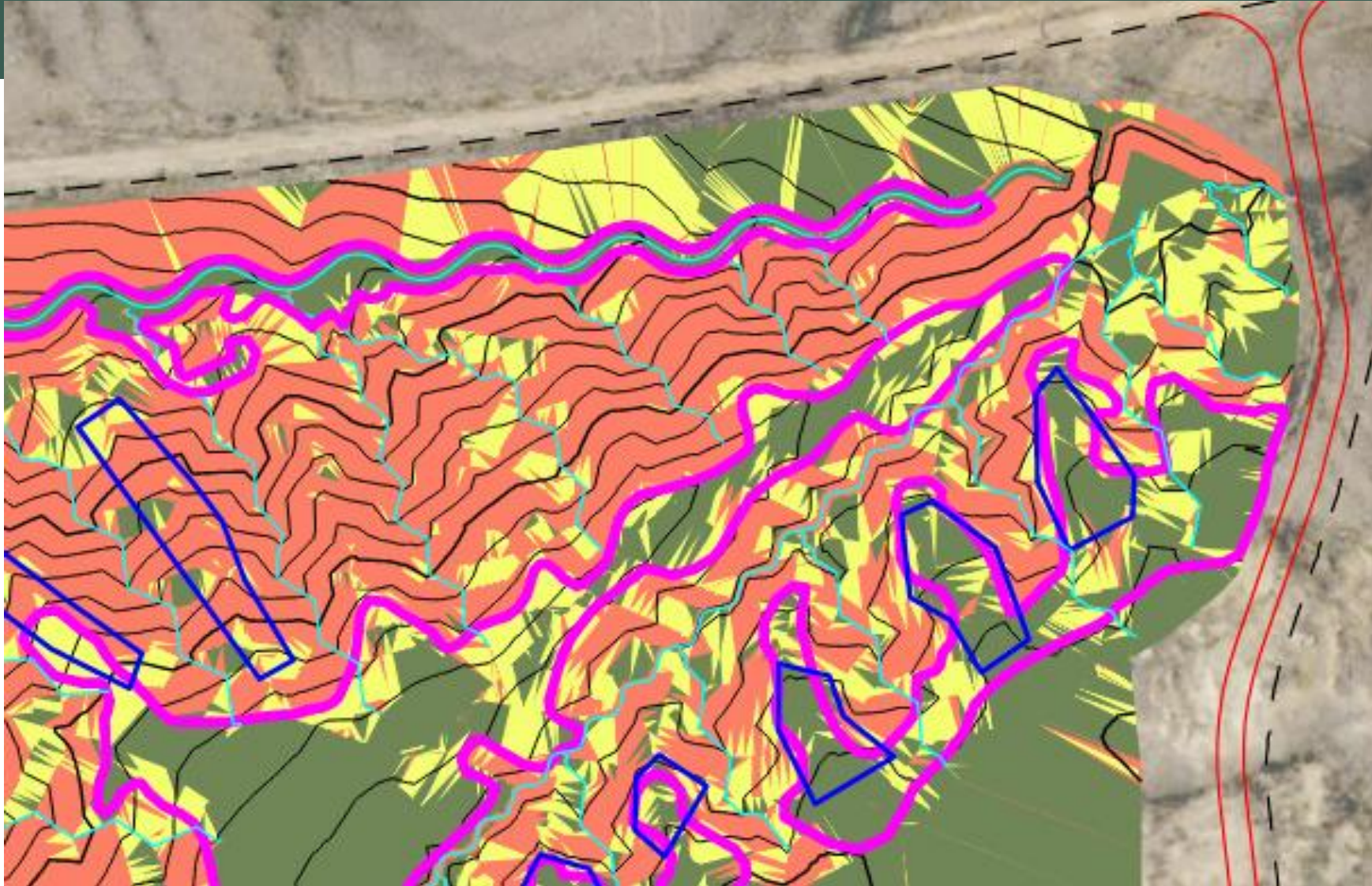
Transitional zone

10°+



Steep / constrained

Methodology: Target Area Identification



Slope Degree Categories

0–7°



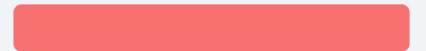
Target habitat zone

7–10°



Transitional zone

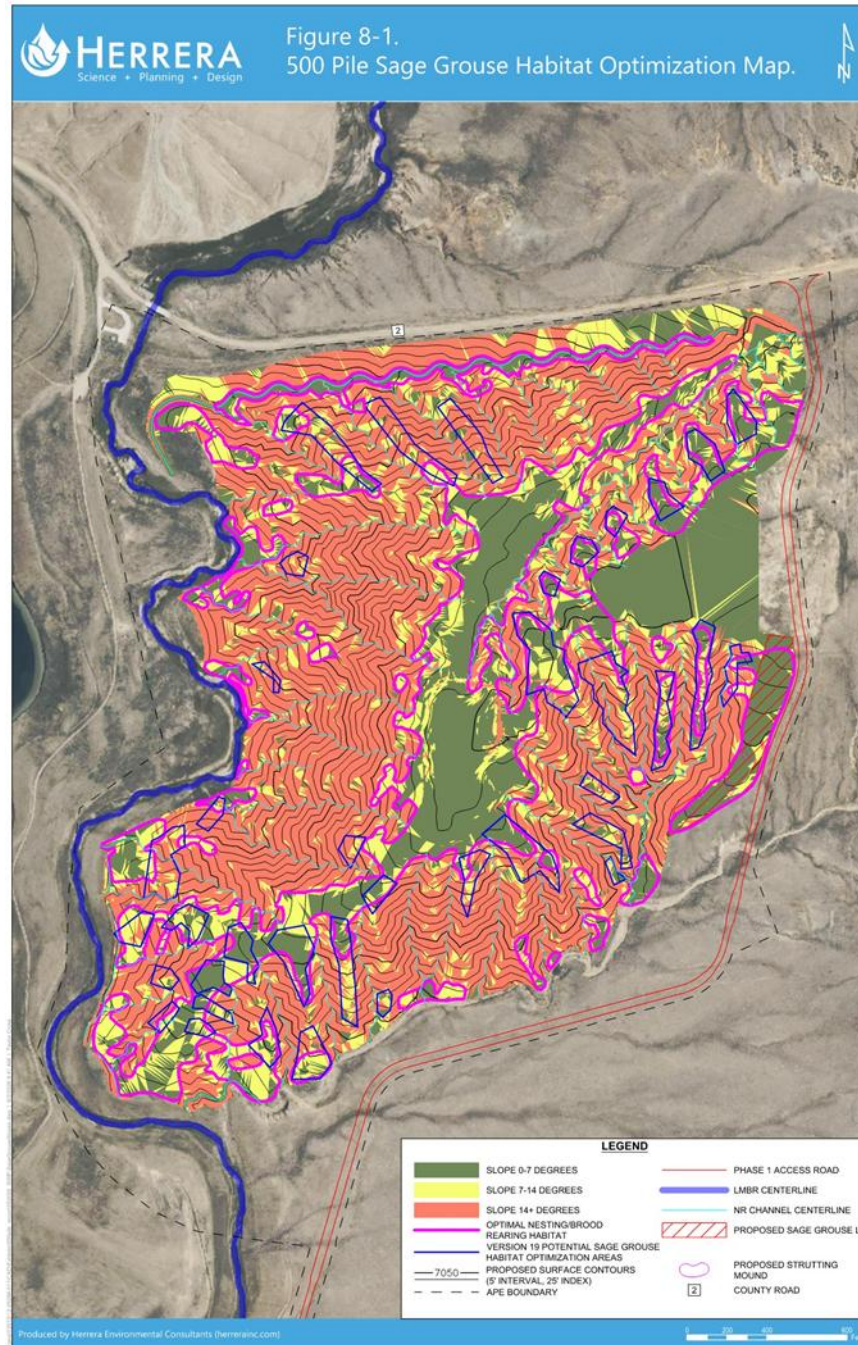
10°+



Steep / constrained

Habitat Integration Results

- **Minimal slope redistribution by design** — No significant change in overall slope class distribution; revisions were intentionally limited to preserve geomorphic stability
- **Expanded bench and bowl features** — Habitat functionality improved beyond what slope metrics alone capture
- **Enhanced mesic microsites** — Improved moisture retention in bowls and swales supports forb and insect production critical for chick survival
- **Connected habitat network** — Nesting, brood-rearing areas, and reconstructed lek are within ~0.5 mi of each other with well-vegetated corridors



~0.5 mi
lek-to-nesting connectivity

+0.4%
increase in 0–7° slopes

≈8,400
sq ft additional habitat

Questions?



References

Kirol, C. P. Slope, slope position and aspect of greater sage-grouse nest sites in the Powder River Basin. KAER LLC.

Kirol, C. P. Field Photographs of Greater Sage-grouse Nest and Brood-rearing Sites, Wyoming. KAER LLC.

Trihydro Corporation. (2021, February 3). Lek site, vegetation, and soil sampling protocol: AML Project No. 6A-V, AML 6A-V sage-grouse habitat implementation plan, Gas Hills and Shirley Basin mining districts, Wyoming (Project No. 084-016-001). In association with Operational Conservation, LLC.

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