Lewis Mine Fire Mitigation

PKAA# 2024-0026

Colorado Department of Natural Resources

Division of Reclamation Mining & Safety

Inactive Mine Reclamation Program

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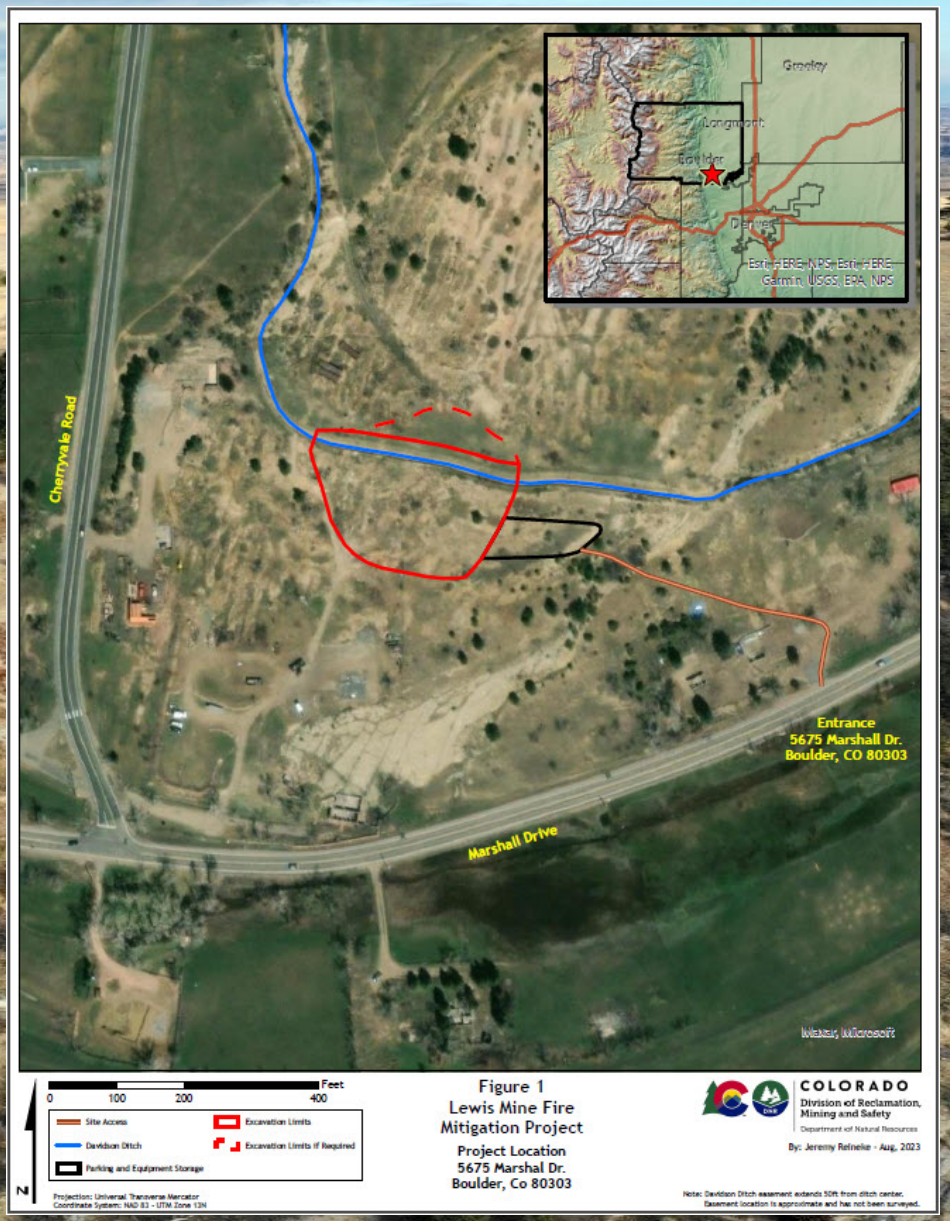
Site Location:

The Lewis Mine Fire is located on private property north east of the Marshall Drive – Cherryvale Road intersection in unincorporated Boulder County.



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Site Description:

The Lewis Coal Mine was a small production coal mine that operated between 1914 and 1946 [(1)]. The Davidson Ditch, a water supply ditch built in the late 1800s, crosses the Lewis Site [(2)].

Miners, Red Ash Mine - Louisville Public Library

Davidson Ditch

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Site Description:

Surface subsidence resulting from the shallow mine workings began almost immediately after mining at the Lewis Coal Mine was complete.

Lewis Mine (circa 1950?) – RB Cotton; US GS Denver

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Site Description:

Surface subsidence remains readily visible today as north-south trending linear depressions.

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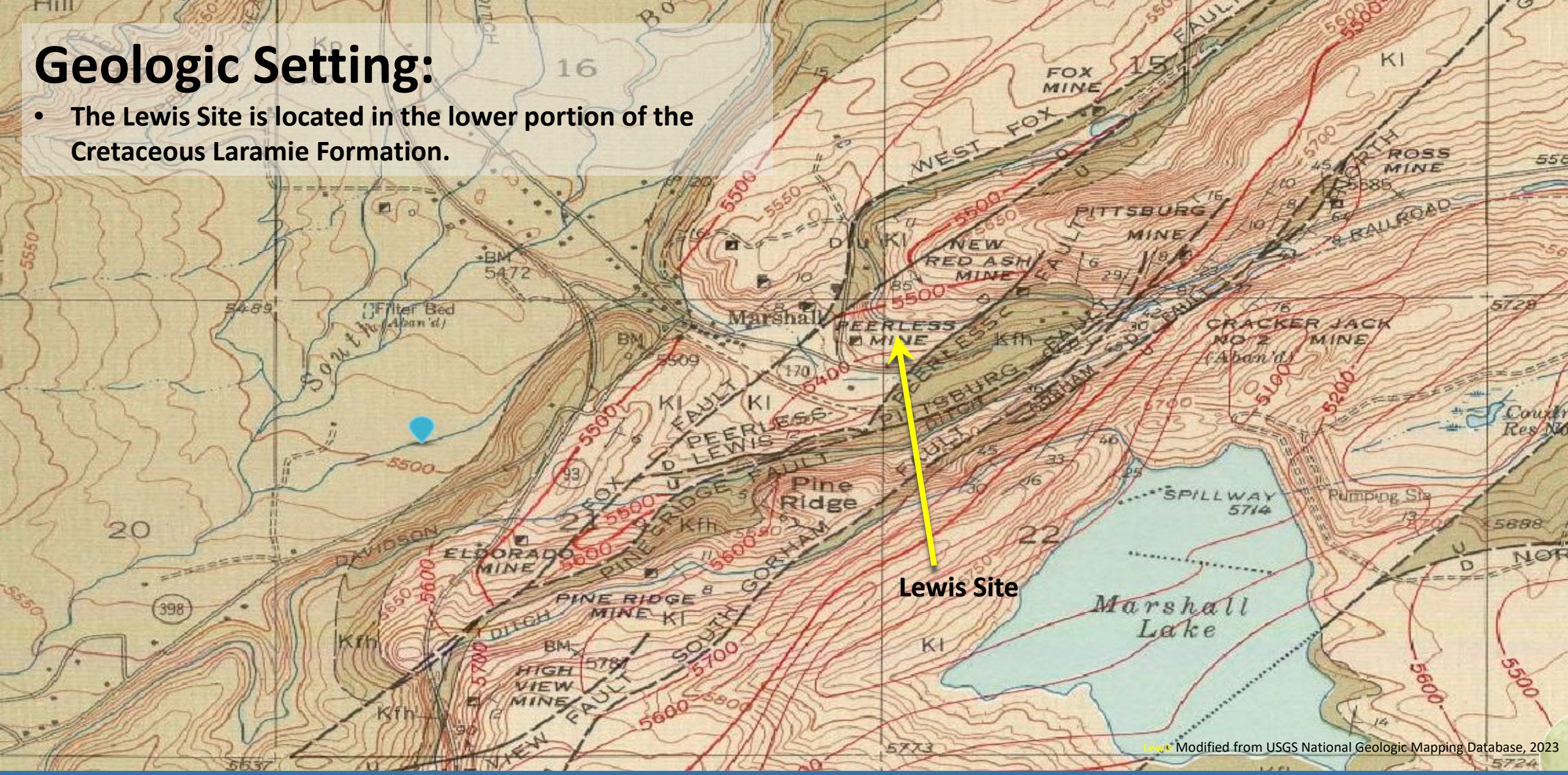
Geologic Setting:

- **The Lewis Site is located in the lower portion of the Cretaceous Laramie Formation.**



Modified from USGS National Geologic Mapping Database, 2023

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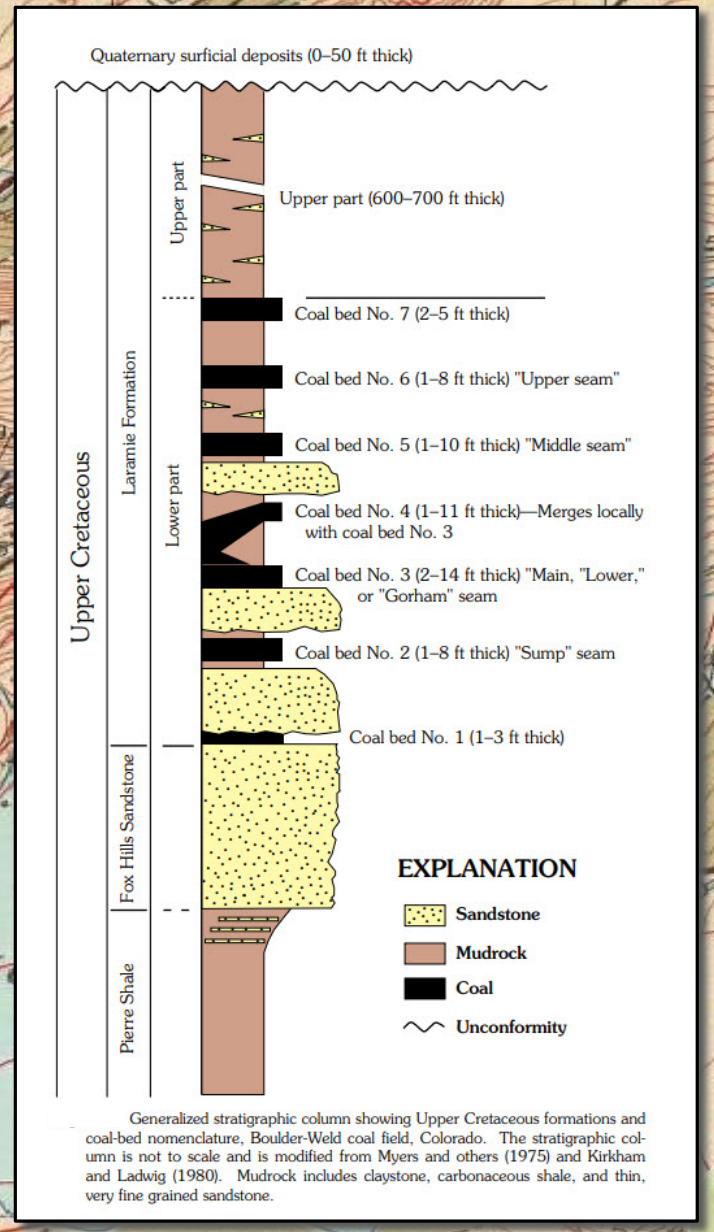
Geologic Setting:

- The lower portion of the Laramie Formation consists of sandstones interlayered with clays, shales and coal seams.
- Coal Seams in the area generally range from 2 feet to 14 feet in thickness[4,5].
- The Site is bounded by the Peerless fault on the East and the Fox Fault on the west[4].

Lewis Site



Generalized stratigraphic column showing Upper Cretaceous formations and coal-bed nomenclature, Boulder-Weld coal field, Colorado. The stratigraphic column is not to scale and is modified from Myers and others (1975) and Kirkham and Ladwig (1980). Mudrock includes claystone, carbonaceous shale, and thin, very fine grained sandstone.

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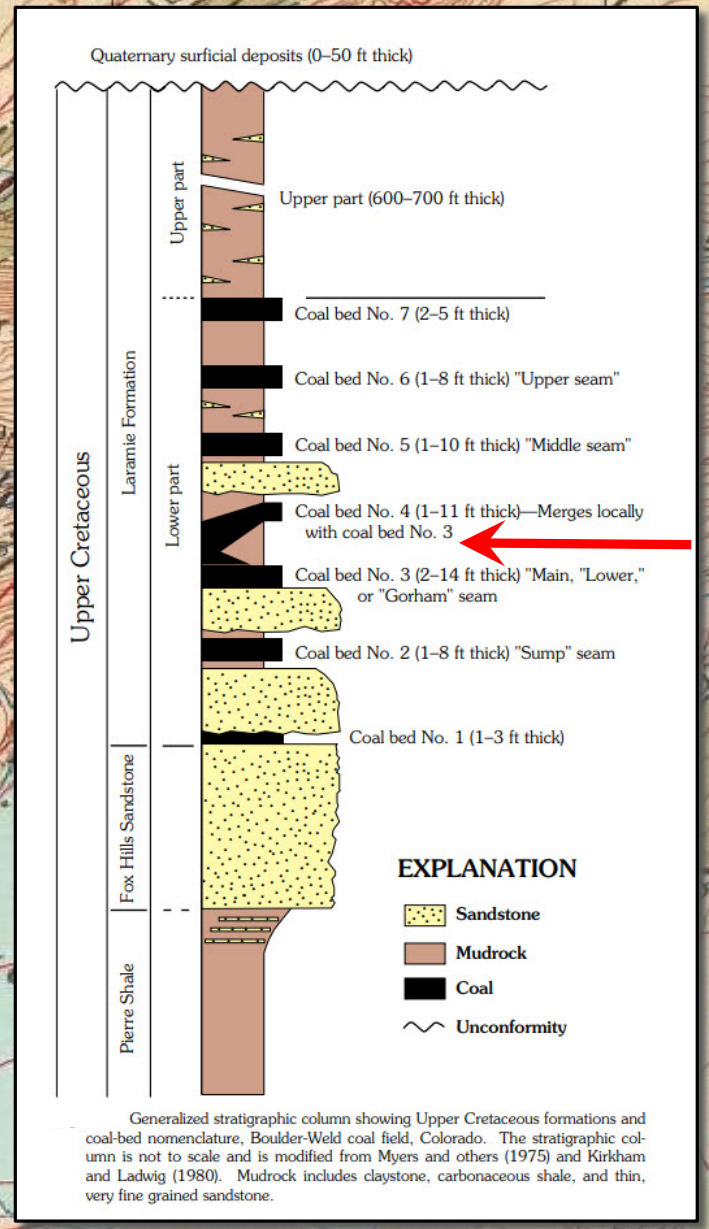
Geologic Setting:

The No. 3 coal seam which ranges from 3 feet to 14 feet thick was the most extensively Mined seam in the Marshall area[2,3].



Generalized stratigraphic column showing Upper Cretaceous formations and coal-bed nomenclature, Boulder-Weld coal field, Colorado. The stratigraphic column is not to scale and is modified from Myers and others (1975) and Kirkham and Ladwig (1980). Mudrock includes claystone, carbonaceous shale, and thin, very fine grained sandstone.

Lewis Site

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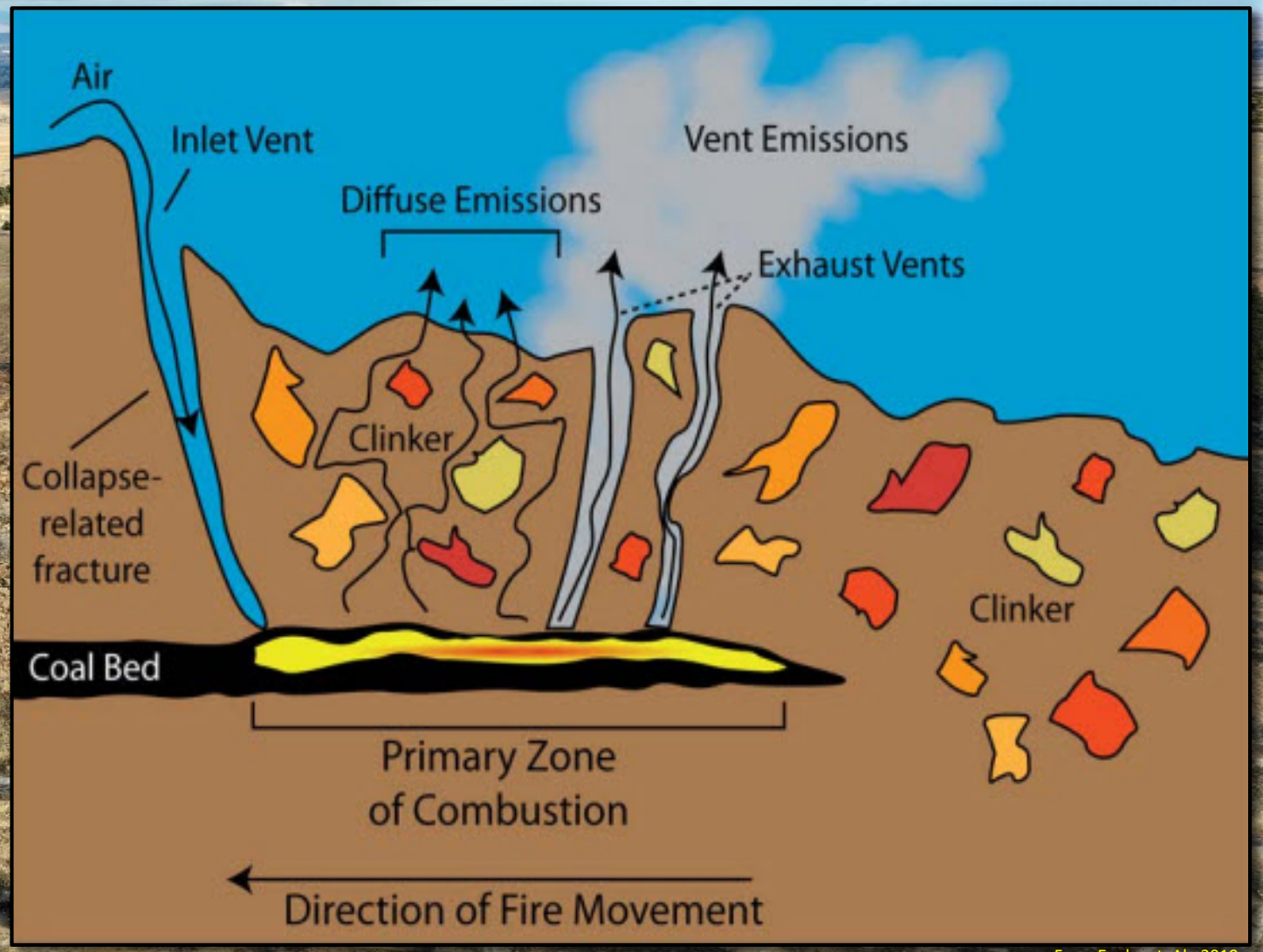
Mine Fire & Subsidence:

- The initial cause of the Lewis Mine Fire is unknown but likely resulted from spontaneous combustion.
- Observations from long time local residents indicate that the Lewis Mine Fire has been burning for more than 50 years.
- Subsidence related to the mine fire and shallow mine workings continues.



From Engle, et. Al., 2010

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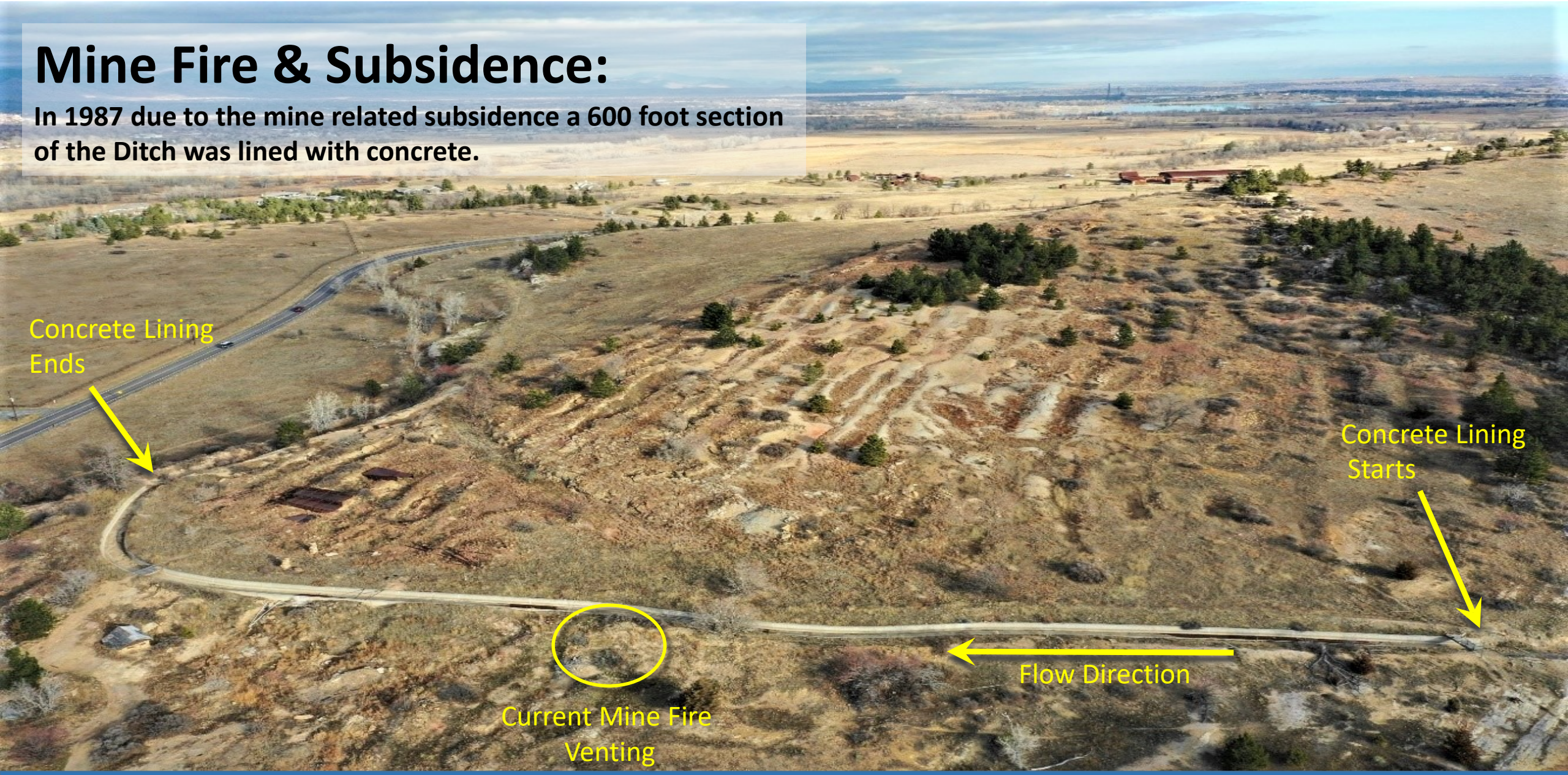
Mine Fire & Subsidence:

In 1987 due to the mine related subsidence a 600 foot section of the Ditch was lined with concrete.



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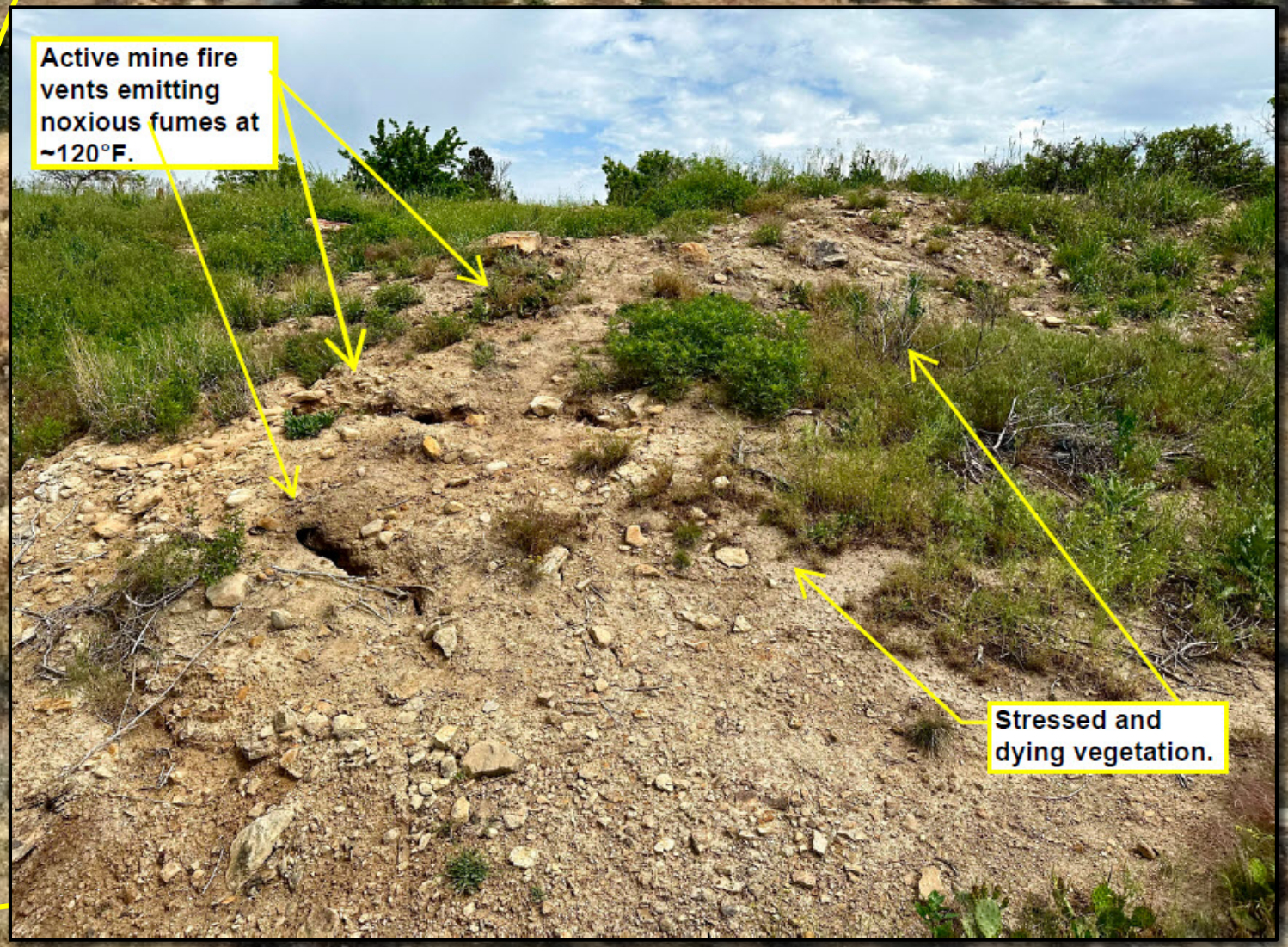
Mine Fire & Subsidence:

The Lewis Mine Fire continues to burn at a low intensity adjacent to the south edge of and possibly underneath a portion of the concrete lined section of the Davidson Ditch[2].



Colorado DRMS, 2023

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Mine Fire & Subsidence:

- Ground subsidence continues threatening the integrity of the Davidson Ditch.
- When installed in 1987 the ground surface on the south side of the Davidson Ditch matched the elevation on the north side.

Colorado DRMS, 2023

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Subsurface Investigation:

In the winter of 2023 Colorado DRMS initiated a subsurface investigation to further delineate the nature and extent of the Lewis Mine Fire.

Colorado DRMS, 2023

Colorado DRMS, 2023

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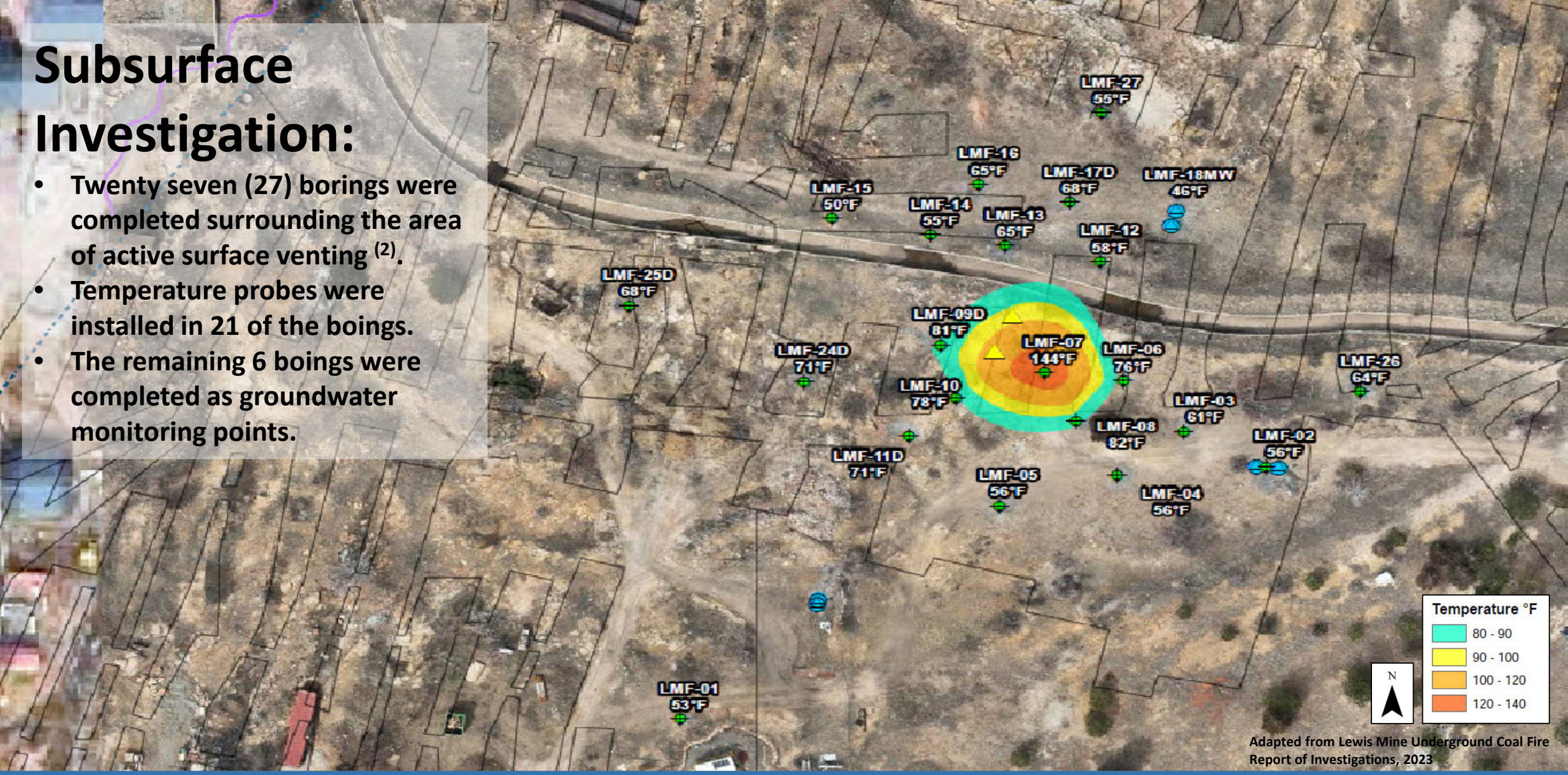
Subsurface Investigation:

- Twenty seven (27) borings were completed surrounding the area of active surface venting [2].
- Temperature probes were installed in 21 of the boings.
- The remaining 6 boings were completed as groundwater monitoring points.



Adapted from Lewis Mine Underground Coal Fire Report of Investigations, 2023

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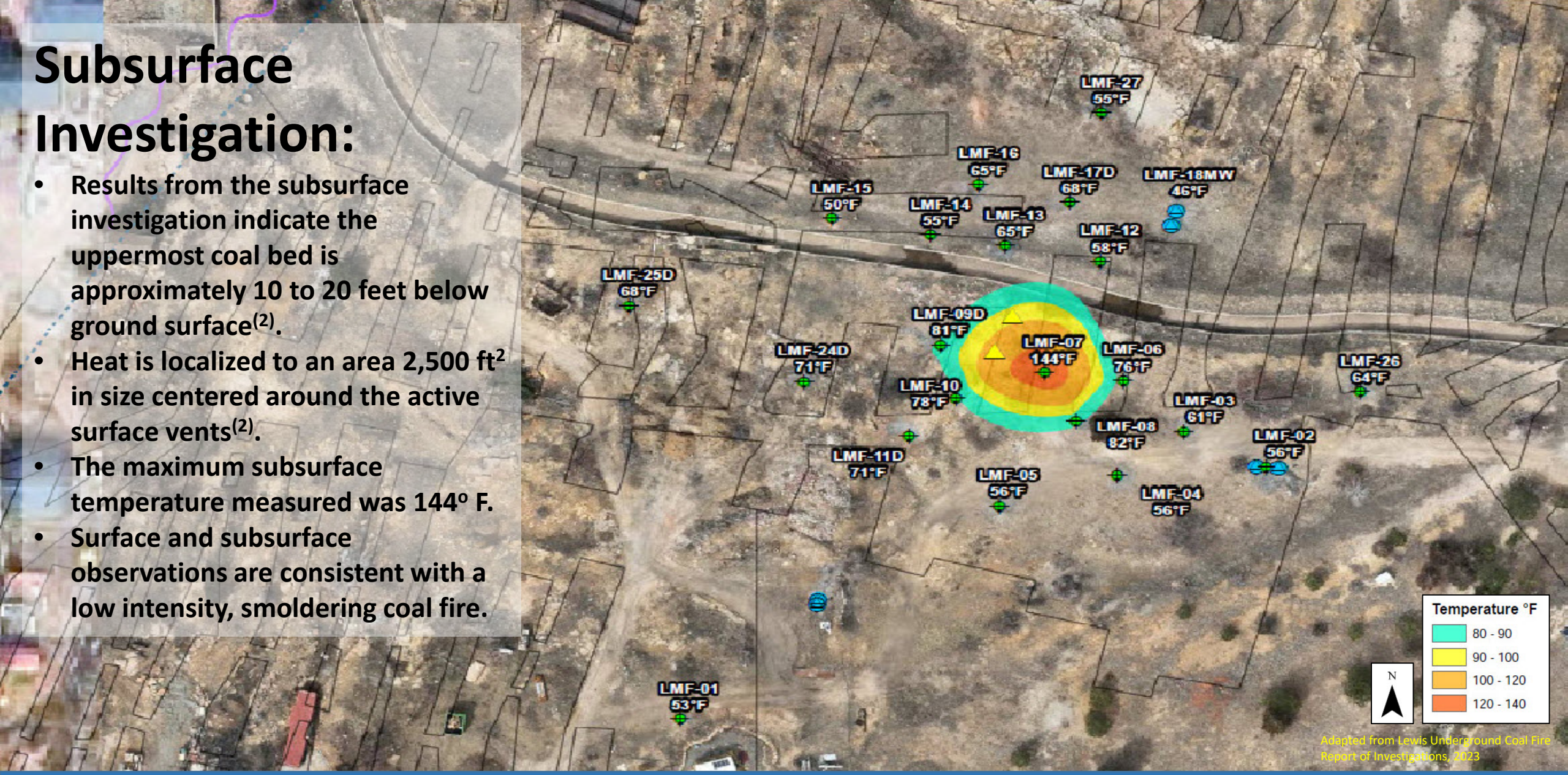
Subsurface Investigation:

- Results from the subsurface investigation indicate the uppermost coal bed is approximately 10 to 20 feet below ground surface[(2)].
- Heat is localized to an area 2,500 ft^2 in size centered around the active surface vents[(2)].
- The maximum subsurface temperature measured was 144° F.
- Surface and subsurface observations are consistent with a low intensity, smoldering coal fire.



Adapted from Lewis Underground Coal Fire Report of Investigations, 2023

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Mitigation:

- Colorado DRMS will mitigate the Lewis Mine Fire by excavating the burning coal and blending this material with the cold overburden.
- Additionally the subsidence under the Davidson Ditch to the west will also be addressed.

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Mitigation:

- A 300 foot section of the Davidson Ditch will be removed.
- The area will be excavated to just below the Lewis Mine workings, approximately 25 feet to 30 feet below ground surface.

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Mitigation:

- Any material exceeding 100° F will be blended with cold overburden (rock & soil) at a ratio of 5 parts cold material to 1 part hot material.
- This process breaks up any hot or smoldering material and disperses it within the cold soil and rock.

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Mitigation:

- The blended material will then be monitored until the temperature is less that 100° F.
- Once cooled, the blended material will be backfilled into the excavation.

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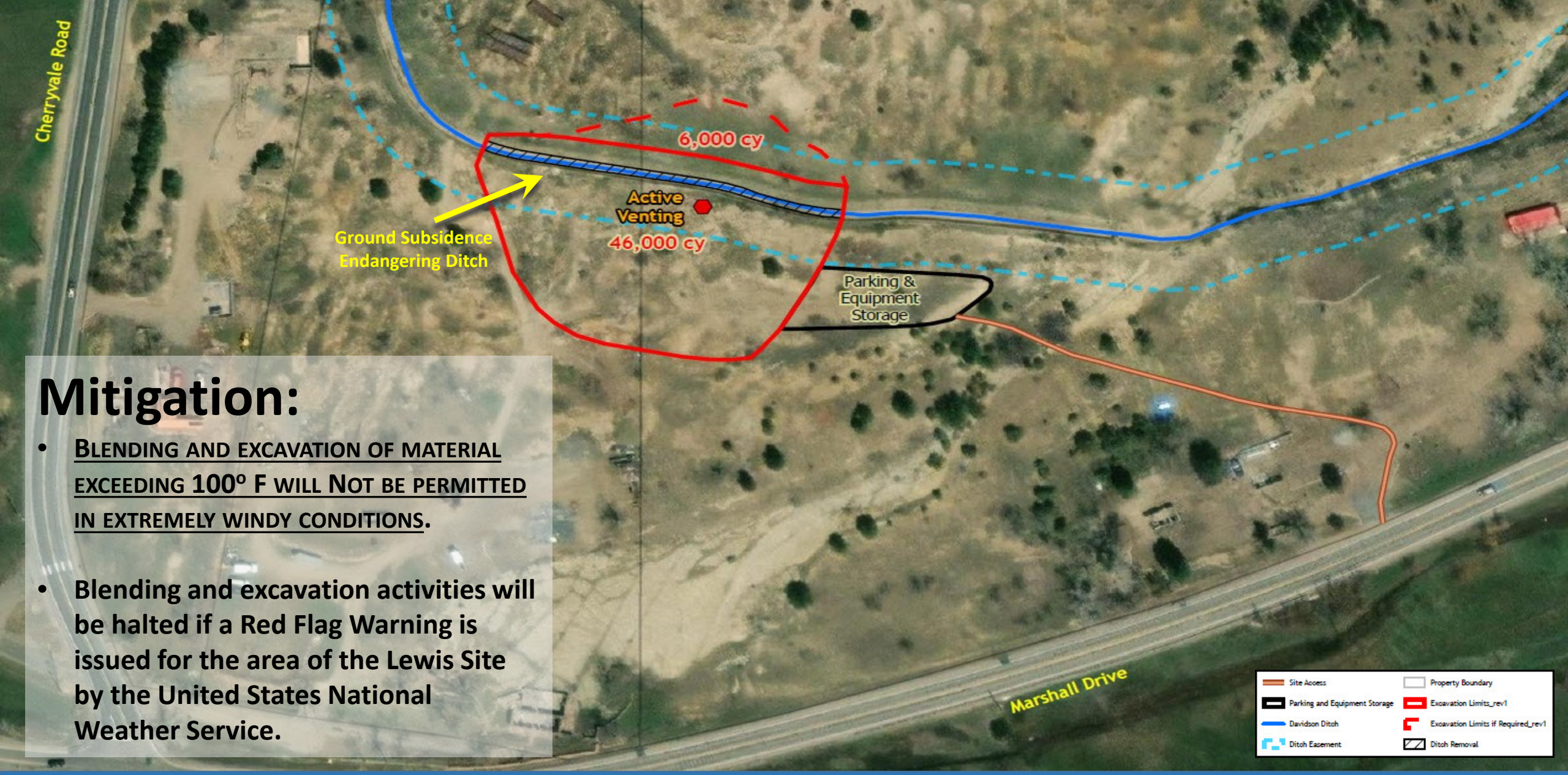

Mitigation:

- <u>Blending and excavation of material exceeding 100° F will Not be permitted in extremely windy conditions</u>.

- Blending and excavation activities will be halted if a Red Flag Warning is issued for the area of the Lewis Site by the United States National Weather Service.

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Mitigation:

- In the event that blending operations are halted for high winds any material exceeding 100° F shall be immediately covered with a minimum of two feet (2 ft) of cold overburden.

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Mitigation:

- The excavated area beneath the Davidson Ditch will be backfilled with clean, non-carbonaceous (non-coal) compacted fill.
- Depending on Site conditions clean fill material may need to be imported to the Site.
- A 24-inch compacted clay liner will be installed in the reconstructed section of the Davidson Ditch.

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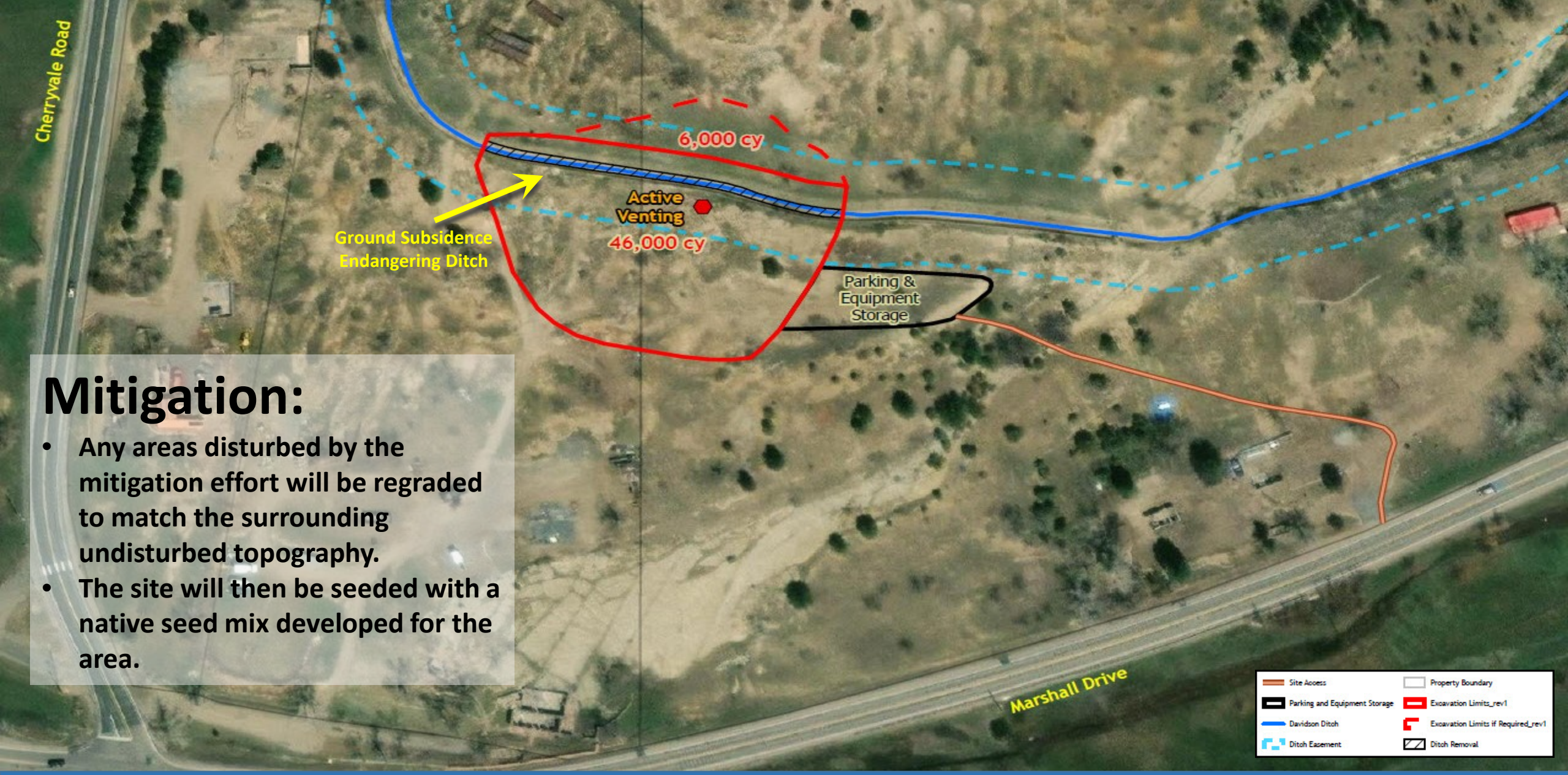

Mitigation:

- Any areas disturbed by the mitigation effort will be regraded to match the surrounding undisturbed topography.
- The site will then be seeded with a native seed mix developed for the area.

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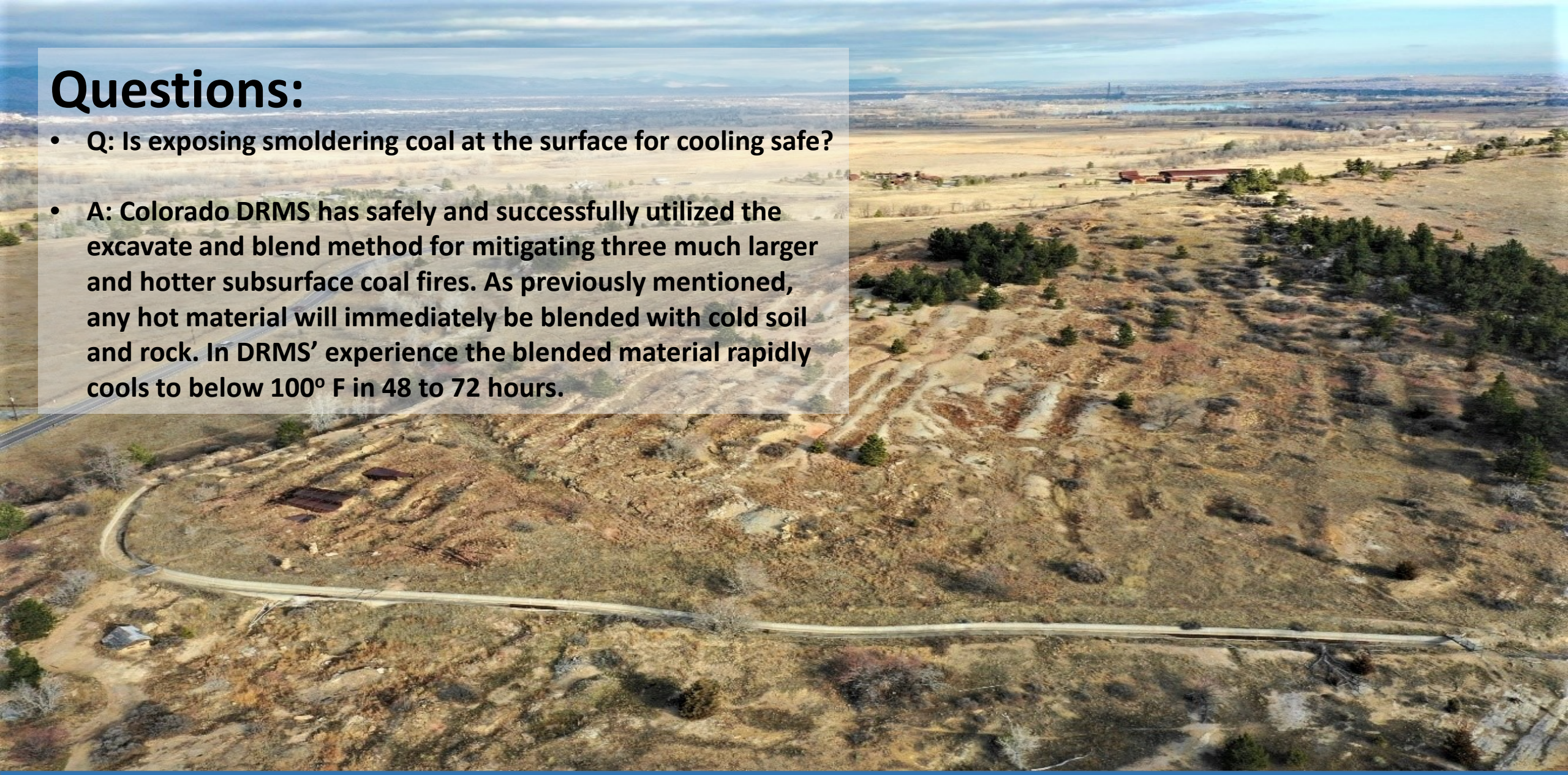
Questions:

- Q: Is exposing smoldering coal at the surface for cooling safe?

- A: Colorado DRMS has safely and successfully utilized the excavate and blend method for mitigating three much larger and hotter subsurface coal fires. As previously mentioned, any hot material will immediately be blended with cold soil and rock. In DRMS' experience the blended material rapidly cools to below 100° F in 48 to 72 hours.



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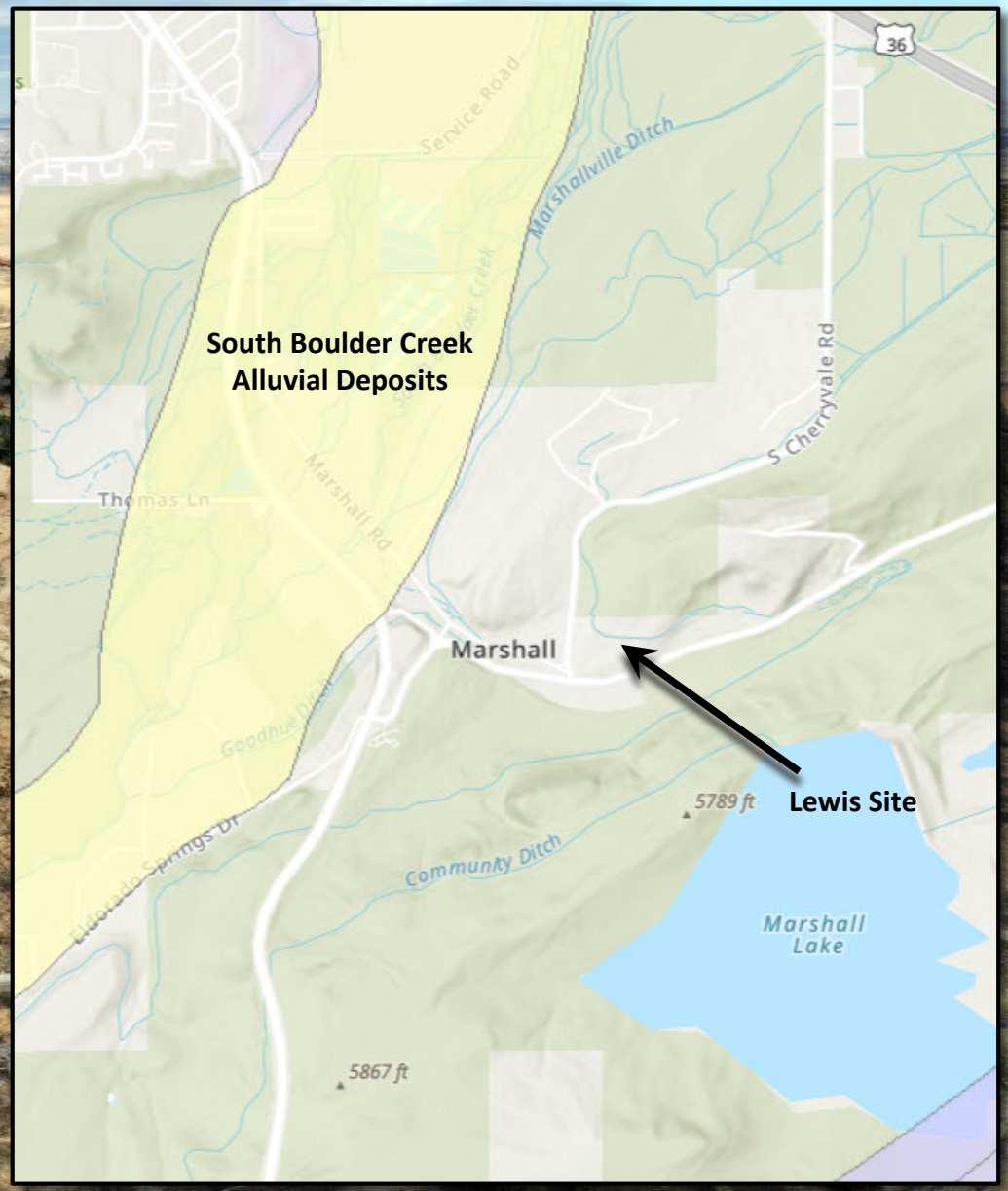
Questions:

- Q: Will hydrological changes occur due to the mitigation of the historical mine workings?

- A: According to the Colorado Geological Survey the project area is not within a significant alluvial aquifer or area of significant ground water recharge. The excavation work being done as part of the mitigation effort will not extend below the local groundwater table and should have little to no impact on the local water table.



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Questions:

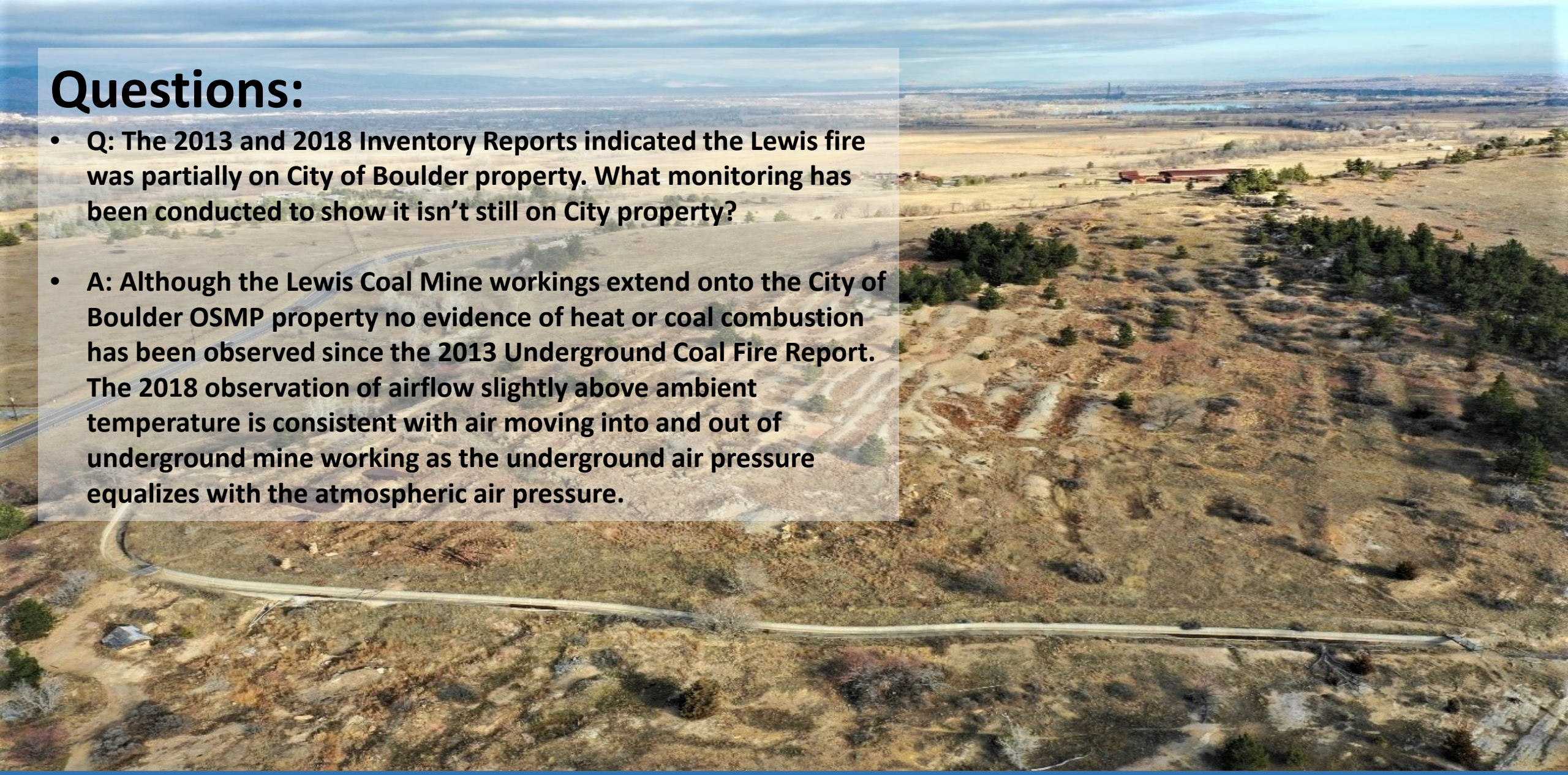
- **Q: The Davidson Ditch failed in this general location during the 2013 floods. Will the rebuilding of the ditch in this location address this risk?**

- **A: The portion of the Davidson Ditch that was overtopped during the 2013 flood event is not within the Lewis Mine Fire Mitigation project area. The portion of the Davidson Ditch that will be replaced after the completion of the mitigation effort is designed to contain flows greater than the existing upstream Ditch segments.**

Questions:

- Q: The 2013 and 2018 Inventory Reports indicated the Lewis fire was partially on City of Boulder property. What monitoring has been conducted to show it isn't still on City property?

- A: Although the Lewis Coal Mine workings extend onto the City of Boulder OSMP property no evidence of heat or coal combustion has been observed since the 2013 Underground Coal Fire Report. The 2018 observation of airflow slightly above ambient temperature is consistent with air moving into and out of underground mine working as the underground air pressure equalizes with the atmospheric air pressure.



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Questions:

- **Q: A citizen reported smoke rising from the ground on Dec 30, 2021 approximately 1000 feet northwest of the Lewis site. Has the State evaluated this location?**

- **A: The area was scanned thermally in the days following the Marshall Wildfire and no heat or snowmelt was observed at the location in question. Additionally the area was again thermally scanned on August 18, 2023 and visited by DRMS personnel on August 24, 2023. No heat or evidence of coal combustion was observed in this area.**

Thermal imagery form the area of reported smoke January 14, 2022. No areas of heat significantly above background were detected. Note the bright white heat signatures from structures in the upper left.

By Tetra Tech, Inc for Colorado DRMS, Jan. 2022

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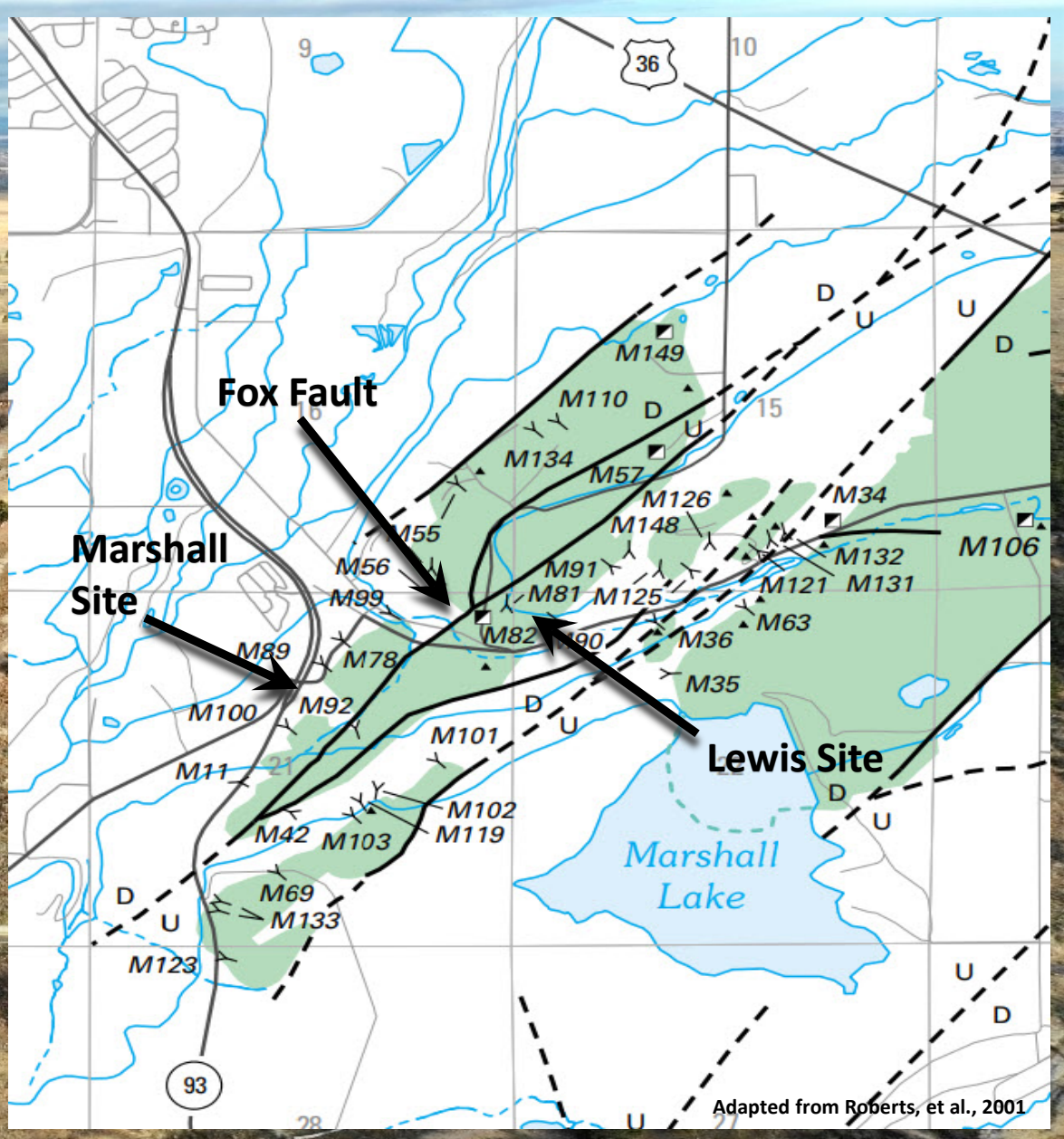
Questions:

- Q: Are the Lewis and Marshall Mine networks are connected?

- A: The Mines at the Lewis Site and the mining at the Marshall Mesa Trailhead Site are not connected. They are separated by the Fox Fault which cuts through and vertically separates the coal layers. Additionally they lie on opposite sides of Marshall Creek which is a perineal gaining stream representing the intersection of the top of the groundwater table and the land surface. Any mine workings extending under Marshall Creek lie beneath the groundwater table and are flooded.



Adapted from Roberts, et al., 2001

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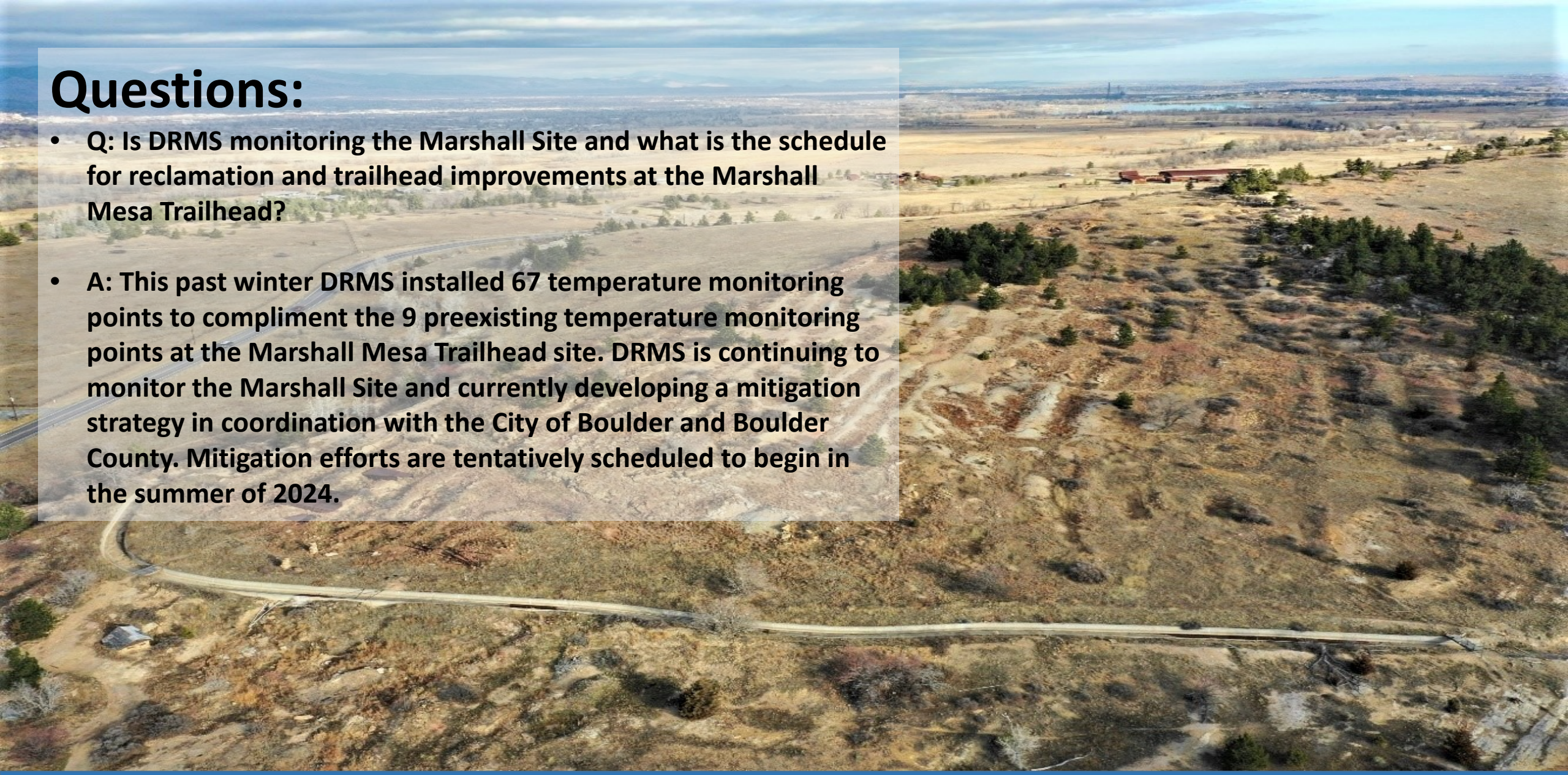

Questions:

- **Q: Is DRMS monitoring the Marshall Site and what is the schedule for reclamation and trailhead improvements at the Marshall Mesa Trailhead?**

- **A: This past winter DRMS installed 67 temperature monitoring points to compliment the 9 preexisting temperature monitoring points at the Marshall Mesa Trailhead site. DRMS is continuing to monitor the Marshall Site and currently developing a mitigation strategy in coordination with the City of Boulder and Boulder County. Mitigation efforts are tentatively scheduled to begin in the summer of 2024.**

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Questions:

- **Q: What long term monitoring will be conducted?**

- **A: Several of the temperature monitoring points installed during the 2023 subsurface investigation will remain in place at the Lewis Site once mitigation efforts are complete. The Lewis Site will continue to be monitored periodically to determine the effectiveness of the mitigation effort.**

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Questions:

- **Q: Is there a point of contact with the State for the community to reach out to with questions?**

- **A: Questions regarding the Lewis Mine Fire Mitigation project may be directed to: dnr_lewismine@state.co.us.**

  A web page dedicated to project progress and updates will be available starting October 1st and accessible through the Colorado DRMS website: https://drms.colorado.gov/

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Works Cited:

1) Roberts, S.B., Hynes, J.L., and Woodward, C.L., 2001, Maps showing extent of mining, locations of mine shafts, adits, air shafts, and bedrock faults, and thickness of overburden above abandoned coal mines in the Boulder-Weld coal field, Boulder, Weld and Adams Counties, Colorado: U.S. Geological Survey Geologic Investigations Map I–2735, scale 1:48,000.

2) Colorado Div. of Reclamation, Mining and Safety, 2023, Lewis Mine Underground Coal Fire Report of Investigations.

3) USGS National Geologic Map Database, MapView (beta) – NGMDB, accessed online 2023-08-26, https://ngmdb.usgs.gov/mapview/?center=-105.226,39.955&zoom=15

4) Roberts, S.B., 2007, Coal in the front range urban corridor—An overview of coal geology, coal production, and coal-bed methane potential in selected areas of the Denver Basin, Colorado, and the potential effects of historical coal mining on development and land-use planning, in Higley, D.K., compiler, Petroleum systems and assessment of undiscovered oil and gas in the Denver Basin Province, Colorado, Kansas, Nebraska, South Dakota, and Wyoming—USGS Province 39: U.S. Geological Survey Digital Data Series DDS–69–P, ch. 3, 45 p.

5) Spencer, Frank D., 1961, Bedrock Geology of the Louisville Quadrangle, Colorado; USGS Geologic Quadrangle Map CQ-151.

6) Roberts, S.B., and Fishman, N.S., 2001, Coalbed methane potential of the Laramie Formation, Greater Wattenberg Area, Denver Basin, Colorado, in Wray, L.L., and Koenig, N.V., eds., The coalbed methane potential in the Upper Cre- taceous to early Tertiary Laramie and Denver Formations, Denver Basin, Colorado: Colorado Geological Survey Open-File Report 01–17, p. 72–73.

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8) Colorado Div. of Reclamation, Mining and Safety, 2013, Summary of Underground Coal Fires in Colorado, https://drive.google.com/file/d/18t34wO9UDfMGQ91JiHQdx21QB84WLgwh/view

9) Colorado Div. of Reclamation, Mining and Safety, 2019, Colorado Underground Coal Mine Fires – 2018 Inventory Report, https://drive.google.com/file/d/1nKr1hwI10AMieikgg8t4x4ts1ROsGEzg/view

10) Barkmann, Peter E., Lauren D. Broes, Martin J. Palkovic, John C. Hopkins, Kenneth Swift Bird, Lesley A. Sebol, and F. Scot Fitzgerald. “ON-010 Colorado Groundwater Atlas.” Geohydrology. Colorado Geological Survey, Golden, CO. ON-010 Colorado Groundwater Atlas, 08 January 2020. https://coloradogeologicalsurvey.org/water/colorado-groundwater-atlas/

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Thank You

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https://drms.colorado.gov/

Email: dnr_lewismine@state.co.us

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