OGMCOAL DNR <ogmcoal@utah.gov>

Fwd: 015015 Emery 2 Mine. NRCS Sinkhole Geological Investigation Report

Priscilla Burton <priscillaburton@utah.gov> Mon, Jun 10, 2019 at 4:37 PM
To: OGMCOAL DNR <ogmcoal@utah.gov>

This NRCS report was undertaken at the request of the landowner, Bill Stansfield to evaluate surface and subsurface conditions leading to sink hole formation in T22S, R6E Section 31 S/2 SE1/4. The NRCS report is dated 2/22/2019.

---------- Forwarded message ---------
From: **Urie, Wayne - NRCS, Castle Dale, UT** <Wayne.Urie@ut.usda.gov>
Date: Thu, Mar 21, 2019 at 3:13 PM
Subject: Bill Stansfield Sinkhole Geological Investigation Report
To: Priscilla Burton <priscillaburton@utah.gov>, Kit Pappas <jpappas@broncoutah.com>
Cc: Sieber, Todd - NRCS, Salt Lake City, UT <Todd.Sieber@ut.usda.gov>, Gardner, Lowell - NRCS, Castle Dale, UT <lowell.gardner@ut.usda.gov>, Atkins, Alan - NRCS, Richfield, UT <alan.atkins@usda.gov>

Dear Priscilla & Kit,

I have attached the report that was compiled by our Utah Natural Resources Conservation Services (NRCS) Geologist, Todd Sieber, on the Sinkholes that have appeared on Bill Stansfield's farm just west of the Emery Deep mine.

After he almost lost a tractor while plowing a field, Bill called our office and asked for some help in determining what was happening/had happened to cause subsidence on his farm.

I organized a site visit with 2 of our state geologists and 2 soil scientists to start the process to determine what had happened to cause the subsidence.

Todd did a geological investigation on the area where Bill has found sinkholes on his farm.

Using field observations, hydrogeologic studies, geologic and topographical mapping, as well as satellite imagery; Todd has determined that the subsidence is most likely being caused by aquifer-system compaction.

If you have any questions regarding the report, please let me know.

Thanks,

Wayne

Wayne Urie

Watershed Coordinator

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Stansfield Sinkholes GI.pdf
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USDA

United States Department of Agriculture

SUBJECT:	Stansfield Ranch Sinkhole Geological Investigation	DATE:	02/22/2019
TO:	Wayne Urie	File Code:	011-02-2019

On December 19th, 2019 a geologic evaluation was performed near the town of Emery, UT, (Figure 1) to observe and collect data in response to the development of sinkholes on property owned by Bill Stansfiield. On site for the evaluation were: Todd Sieber, geologist; Cianna Wyshnytzky, geologist; Wayne Urie, Watershed Coordinator; Vic Parslow, Soil Scientist; Keith Crossland, Soil Scientist; and Bill Stansfield, Owner/Operator. The approximate location of the assessment was 38.8533, -111.2853.

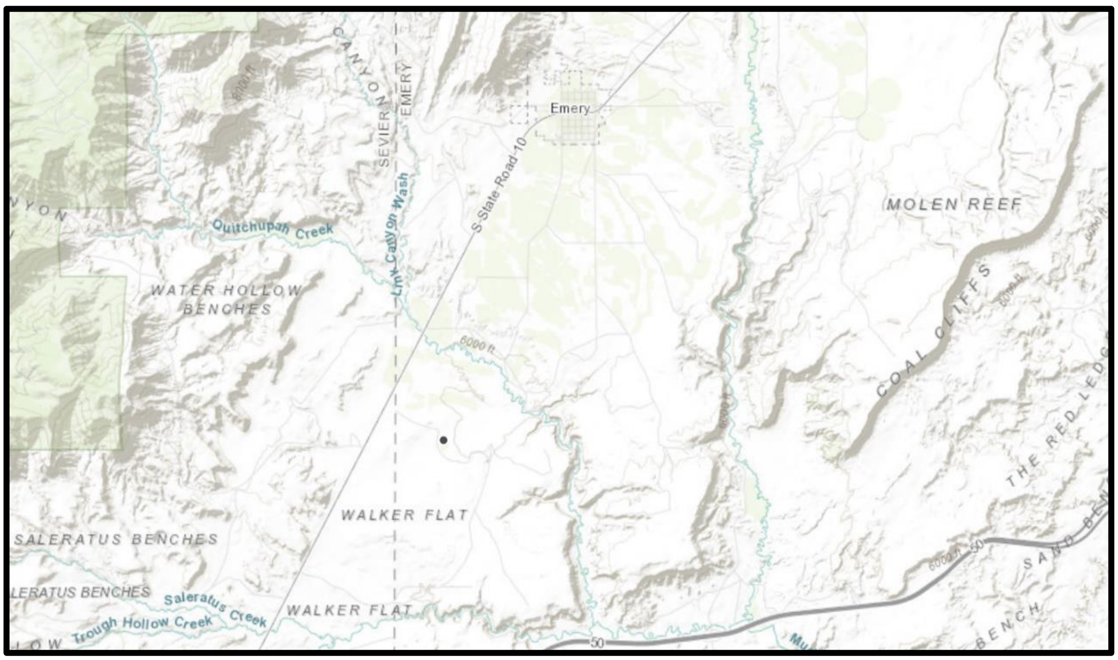

Figure 1. Topographic map of the project area (UGS website, 2019). Black circle shows approximate project site.

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GEOLOGY

Within the investigation area, there are five major units (Table 1, Figure 2), with cliffs, plateaus, and rises formed from the Emery and Ferron sandstone layers (both are members of the Mancos Shale). The valley floor and washes are comprised of alluvial deposits ranging in size and composition from sand, silt and clay to pebbles and cobbles. For this investigation, the alluvial deposits and the Ferron sandstone are the most important units.

The Ferron Sandstone Member of the Mancos Shale, the coal-bearing unit in the Emery Coal Field, is exposed in a series of prominent cliffs in the southern part of Castle Valley. The escarpment produced by the Ferron defines the eastern limit of Castle Valley. The Ferron cliffs attain their maximum development between the town of Moore and the southern end of Castle Valley. The thickness of the Ferron generally increases southward from about 300 feet near Moore to about 850 feet near the southern end of Castle Valley. The Ferron dips 2° to 10° to the northwest beneath the surface of Castle Valley (Ryer, 83).

In addition to the site visit and subsequent tests, the geologic map of the Salina 30’x60’ Quadrangle was analyzed to help determine depositional history and stratigraphy. The following unit descriptions and geologic map were produced by Doelling and others (2016) and are accessible from the Utah Geological Survey website (UGS, 2019)

Qa2	*Level-two alluvial deposits:* Sand, silt, granules, pebbles, and sparse cobbles forming large, incised, low-level alluvial terraces or broad benches; similar to older parts of Qa; mapped where deposits form large benches in protected areas near the margins of larger alluvial drainages; consists primarily of locally derived materials; locally includes lower level terrace deposits similar to Qat and other types of deposits that are not mapped separately; Qa2 deposits are typically more than 10 meters (33 ft) above active channels; generally 0 to 10 meters (0-33 ft) thick.
Qaf	*Alluvial Fan Deposits:* Mostly unconsolidated, poorly sorted silt, sand, gravel, and cobbles in a crudely bedded to nonstratified granule to clay matrix; angular to subrounded; carried from surrounding bedrock outcrops by torrential rainfall and are deposited where washes experience a reduction in gradient, forming fan-shaped deposits; cut-and-fill channel features locally present; deposited by debris flows near the base of steep slopes, cliffs, and ledges, and at the mouths of streams and washes; as mapped, they commonly contain minor alluvium and eolian deposits; as much as 15 meters (50 ft).
Kme	*Emery Sandstone Member of the Mancos Shale:* Yellow-gray, friable sandstone, fine- to medium-grained; forms cliffy ledges with minor slopes of sandy gray shale; Fouch and others (1983) showed that the Emery Sandstone is early Santonian; 120 to 245 meters (400-800 ft) thick, thickening southward.
Kmb	*Blue Gate Member of the Mancos Shale:* Pale blue-gray, marine shale, nodular and irregularly bedded mudstone, and siltstone with several yellow-gray sandy beds; weathers into

	low rolling hills and badlands; the Blue Gate Member is Campanian to Santonian in age (Molenaar and Cobban, 1991); 300 to 490 meters (1000-1600 ft) thick.
Kmf	*Ferron Sandstone Member of the Mancos Shale:* Alternating yellow-gray, light-brown, and white sandstone, sandy gray shale, gray and carbonaceous shale, and coal; sandstone is mostly fine to medium grained; calcareous; lenticular, thin to very thick beds; forms resistant cliff above Tununk Member; contains several mineable coal beds; Turonian in age (Molenaar and Cobban, 1991); 120 to 215 meters (400-700 ft) thick, thickening to the southwest

Table 1. Geologic unit descriptions for the project area, as shown in Figure 2 (UGS, 2019).

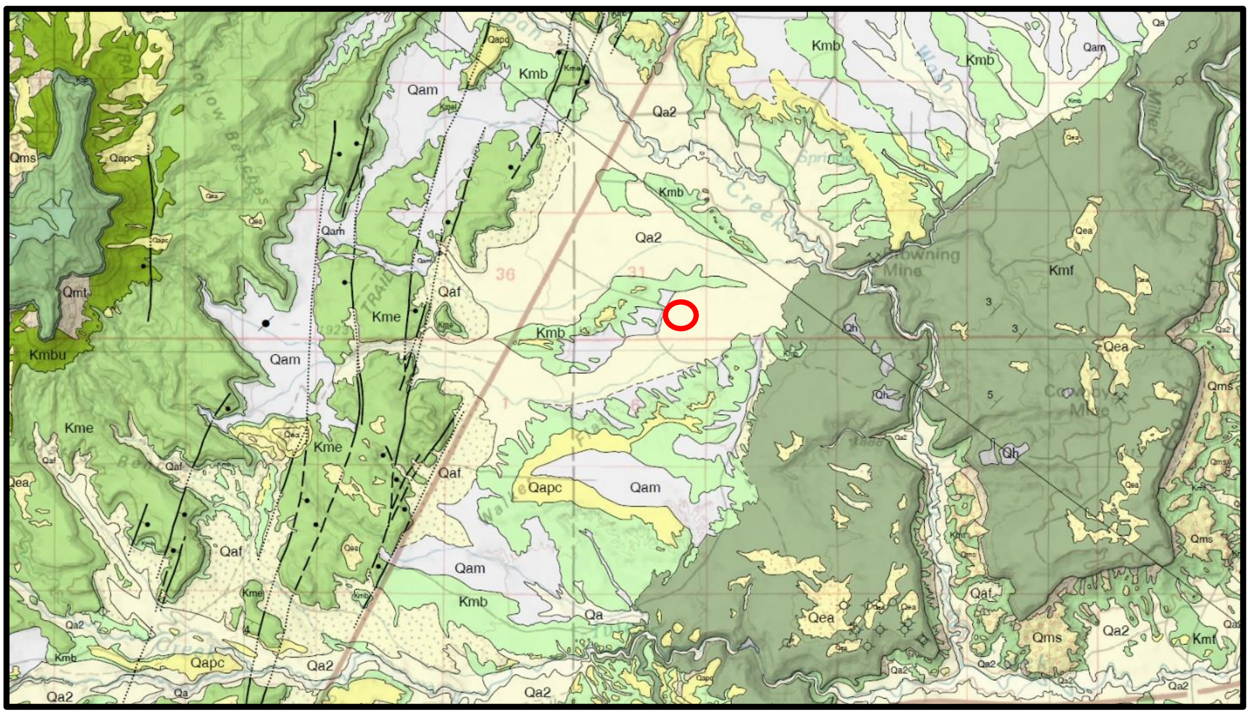

Figure 2. Geologic map of the project area (Hellmut and others, 2016; UGS website, 2019). Red circle shows approximate project site. Same extent as Figure 1.

HYDROGEOLOGY – FERRON AQUIFER (Lines and Morrissey, 1983)

Extent and Thickness

The Ferron aquifer consists of the whole thickness of the Ferron Sandstone Member. The thickness of the Ferron varies considerably throughout Castle Valley. Along the outcrop, the Ferron thickness varies from about 80 feet in the northern part of Castle Valley near Mounds to 850 feet in the southern part along Last Chance Creek. The Ferron also generally thickens in the subsurface downdip from the outcrop area. Records from wells and test holes indicate that a short distance from the outcrop area, the complete thick-ness of the Ferron is usually saturated with water. In the investigation area, the saturated thickness of the Ferron is about 450 feet. In the outcrop area, not all the of Ferron is saturated with water; and at the higher altitudes along the outcrop, much of it is unsaturated.

Conductivity[1] *and Transmissivity*[2]

Tests in the Emery area indicate that transmissivity of the Ferron sandstone aquifer ranges from about 200 to 700 feet squared per day where the Ferron is fully saturated. Aquifer transmissivity is greatest near the Paradise Valley-Joes Valley fault system where permeability has been increased by fracturing. Data indicates a large variation in the porosity and hydraulic conductivity of the sandstone. This may be due to differences in cementation and compaction between samples. Unconsolidated sand, similar in size and sorting, would have a porosity of about 40 percent as compared to the average of 16 percent for the sandstone in the Ferron. The average hydraulic conductivity of delta-front sandstone samples was $1.0x\ 10^{-1}$ ft/d in the horizontal direction and $9.1x10^{-2}$ ft/d in the vertical. Similarly, hydraulic conductivity of the fluviatile sandstone samples averaged $1.5x10^{-1}$ ft/d in the horizontal direction and $9.9x10^{-2}$ ft/d in the vertical.

[1]The hydraulic conductivity of a water-bearing material is the volume of water that will move through a unit cross section of the material in unit time under a unit hydraulic gradient. The units for hydraulic conductivity are cubic feet per day per square foot [$(ft^3/d)/ft^2$]. which reduces to ft/d.

[2]Transmissivity is the rate at which water is transmitted through a unit width of the aquifer under a unit hydraulic gradient The units for transmissivity are cubic feet per day per foot [$(ft^3/d)/ft$, which reduces to ft^2/d.

Storage

Water in the Ferron sandstone aquifer is confined, except for possibly a few areas in the outcrop and in the upper part of the aquifer near the Emery Mine. The water is confined under pressure between shale and siltstone beds within the aquifer and between the enclosing shales in the Blue Gate and Tununk Members of the Mancos Shale. Where a well taps the confined aquifer, water is released from storage mainly by compression of the sandstone and less permeable confining beds as pressure in the aquifer declines. The quantity of water that can be released from storage from the Ferron sandstone aquifer is dependent upon the storage coefficient[3], which ranges from about 10^{-6} to 10^{-3} where the Ferron sandstone aquifer is confined and probably averages 5×10^{-2} where it is unconfined.

[3]The storage coefficient of an aquifer is the volume of water it releases from or takes into storage per unit surface area of the aquifer per unit change in head. Storage coefficient is a dimensionless number Under confined conditions, the storage coefficient is typically small, generally between 10^{-5} and 10^{-3} Under unconfined conditions, it is much larger, typically between $5x10^{-2}$ and $3x10^{-1}$

Movement

Water moves laterally through the Ferron sandstone aquifer downgradient at approximately right angles to the potentiometric contours shown in figures 8 and 9. On a regional scale, the strike and dip of beds in the aquifer have little effect on the movement of water. Movement of water is governed instead by the location and altitude of sources of recharge and discharge. In the Emery area, water moves through the aquifer from areas of subsurface recharge in the west and northwest toward areas of manmade discharge and toward areas of natural discharge along the Ferron outcrop. The rate at which water moves laterally through the aquifer can be estimated from the following equation:

$$V = KI/\emptyset$$

where

V = velocity, in feet per day,
K = hydraulic conductivity, in feet per day,
I = hydraulic gradient, a decimal fraction, and
Ø = effective porosity, a decimal fraction.

Assuming a hydraulic conductivity of 1 ft/d, a hydraulic gradient of 50 ft/mi or 0.0095, an effective porosity of 5 percent, then

V = (1 ft/d)(0.0095)/0.05

V = 0.2 ft/d (rounded)

It should be stressed that 0.2 ft/d would be the average fluid velocity through the aquifer at the assumed conditions. It does not necessarily equal the actual velocity between any two points in the aquifer, which would depend on the flow path followed. Water moving along an open fracture would move much faster than water moving through pore spaces between sand grains.

In addition to lateral flow through the Ferron sandstone aquifer, potentiometric-surface data also indicate that significant vertical components of flow exist. Along the outcrop of the Ferron, where a small amount of recharge from precipitation occurs, water moves downward through the aquifer and some water leaks into the underlying Tununk Member. In most areas downdip from the outcrop, head in the aquifer increases with depth, and water moves upward into the Blue Gate Member.

Recharge

The largest source of recharge to the Ferron sandstone aquifer in the Emery area is subsurface flow, probably from the Wasatch Plateau. Most of the water in the aquifer in the Emery area probably originates as precipitation on the plateau, and most, if not all, is transmitted into the area along the highly permeable zone along the Paradise Valley-Joes Valley fault system. Carbon-14 dating indicates that movement of water from the original recharge areas to the Emery area probably takes thousands of years.

Annual precipitation on the 100 mi^2 outcrop of the Ferron Sandstone Member in Castle Valley averages about 8 inches. Precipitation occurs about equally as rain from thunderstorms and as snow. Thunderstorms contribute little recharge because the slopes on the Ferron outcrop are usually steep, there is little or no soil cover in most of the area, and runoff is rapid. Most of what little recharge occurs on the outcrop area probably takes place during the spring when snow melts slowly.

NATURAL AND GEOLOGIC HAZARDS

☐ Karst Terrain

Topography where carbonate rocks (limestone and dolomite) underlie the surface and the area is characterized by closed depressions (sinkholes), disrupted drainage (disappearing streams), caves, and underground drainage systems (enhanced solution openings along joints and faults) is widely known as karst. Potential hazards posed by karst terrain include hydrologic modification, seepage, subsidence, and collapse. The project area **is not** located in karst terrain.

☐ Mass Movement

Mass movement (gravity movement or landside) is defined as the downslope movement of earth material by gravity. Areas of high relief, steep slopes, and irregular topography are especially susceptible. Geologic factors include depth to bedrock, weathering, degree of sediment consolidation, presence and spacing of fractures (faults, joints, and cleavage) and dipping beds. Fluctuations of the water table, subsurface erosion and solution, and the quantity, velocity, and direction of groundwater movement are also factors. The site **is not** located in an area of known landslides and/or with landslide potential. However, over saturation of subsurface materials could lead to increased erosion potential.

☐ Dispersive Clays

Dispersive clays are highly erodible because they contain a higher percentage of dissolved sodium in their pore water than do ordinary clays. These clays, typically fine-grained lean clays (CL), fats clays (CH), silt (ML) and elastic silt (MH), are found in loess material and marine shale formations. Soils derived from metamorphic rocks, igneous rocks, and limestones are rarely dispersive. Dispersive clays are usually cohesive and particles act as a mass because of the attraction between particles. Engineering problems associated with dispersive clays are erosion of external slopes, embankments and channel slopes and internal erosion of fill material through cracks.
The parent rock and/or soil type **are not** favorable for yielding dispersive clay.

☒ Collapsible Material

Collapsible soils are generally associated with an open structure formed by sharp grains, low initial density, low natural water content, low plasticity, relatively high stiffness and strength in the dry state, and often by particle size in the silt to fine sand range.
The parent rock and/or soil type are **somewhat** favorable for collapsible material.

☒ Seismic Activity (minor)

Geologic hazards from earthquakes include ground shaking, land subsidence, landslides and liquefaction. Other hazards exist because of poorly designed and/or constructed structures, including collapsed walls, bridges, towers, etc. and failure of dams. The area may have future impacts from the Joes Valley fault zone approximately 2 miles to the northwest (slip rate of <.2mm/yr).

SITE RECONNAISSANCE

The objective of the geologic reconnaissance is to assess the need for a more detailed investigation and whether additional technical expertise is needed. The reason for this reconnaissance was to ascertain the extent and possible cause of multiple sink holes developing on Mr. Stansfield's property. While on location, existing geologic and topographic conditions were observed and recorded.

The reconnaissance area is in an existing agrarian field located just east of Highway 10 (Figure 3). The terrain is mostly flat, with a slight dip to the northeast. The field appeared to have been developed through land leveling efforts due to the surrounding topography, and the observable drainage areas to the southwest and northeast. Quitchumpah Creek runs on a southeastwardly path to the east of the field and is the destination of most drainages in the vicinity.

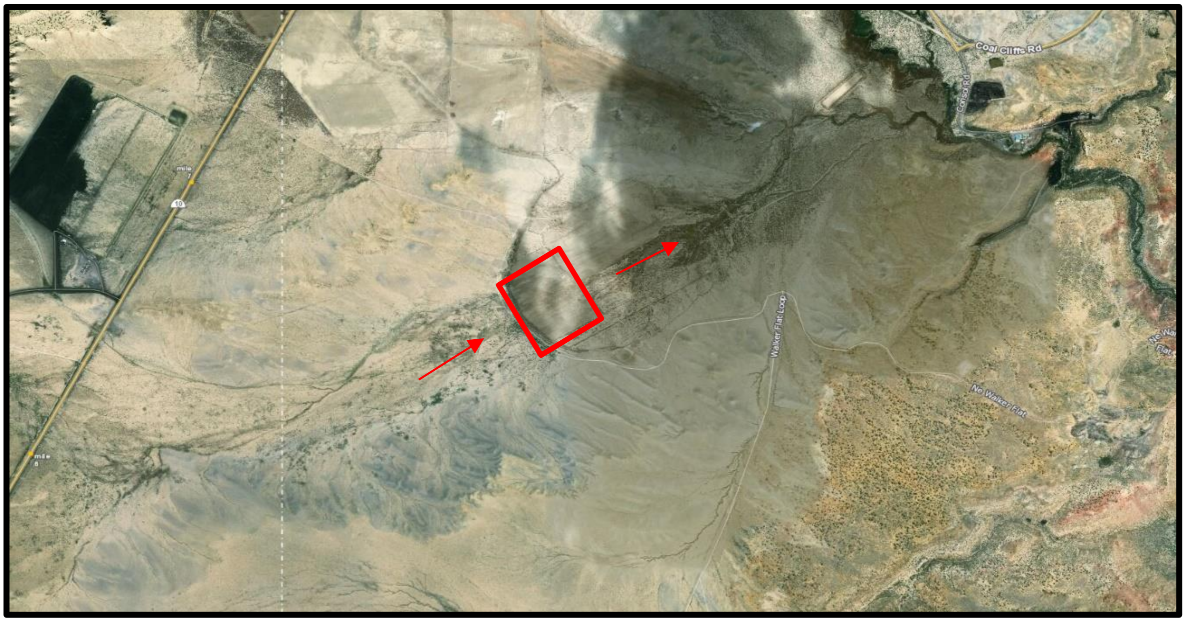

Figure 3. Satellite Image of reconnaissance area. Red rectangle is Mr. Stansfield's field. Red arrows show drainage paths and direction.

While on location at lease six sinkholes were observed in a linear pattern running parallel to the existing drainage features. On closer inspection it was noticed that the sink holes appeared to be connected via subsurface channeling across the field (Figure 4). By following the trace of the sinkholes, a definite depression ran the length of the field from the southwest to the northeast (Figure 5). At the southwest edge of the field it was observed that drainage water entered the field and was immediately absorbed into the ground.

Figure 4. Left Photo shows one of the larger sink holes and the subsurface channel. Right picture shows water draining into the field from the southwest

Figure 5. Photograph of a sinkhole and the depression running to the southwest.

DISCUSSION

Hydrogeological Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. Subsidence is a global problem and, in the United States, more than 17,000 square miles in 45 States, an area roughly the size of New Hampshire and Vermont combined, have been directly affected by subsidence. The prinicipal causes are aquifer-system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost (National Research Council, 1991). More than 80 percent of the identified subsidence in the Nation is a consequence of our exploitation of underground water, and the increasing development of land and water resources threatens to exacerbate existing land subsidence problems and initiate new ones. In many areas of the arid Southwest, and in more humid areas underlain by soluble rocks such as limestone, gypsum, or salt, land subsidence is an often- overlooked environmental consequence of our land- and water- use practices (Galloway and others, 1999).

Overdrafting of aquifers is the major cause of subsidence in the southwestern United States, and as ground-water pumping increases, land subsidence also will increase. In many aquifers, ground water is pumped from pore spaces between grains of sand and gravel. If an aquifer has beds of clay or silt within or next to it, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure is a loss of support for the clay and silt beds. Because these beds are compressible, they compact (become thinner), and the effects are seen as a lowering of the land surface. The lowering of land surface elevation from this process is permanent. For example, if lowered ground-water levels caused land subsidence, recharging the aquifer until ground water returned to the original levels would not result in an appreciable recovery of the land-surface elevation.

In areas where climate change results in less precipitation and reduced surface-water supplies, communities will pump more ground water. In the southern part of the United States from states on the Gulf Coast and westward including states of New Mexico, Colorado, Arizona, Utah, Nevada and California, major aquifers include compressible clay and silt that can compact when ground-water is pumped. Also, increased population in the Southwest will increase demands on ground-water supplies, causing more land subsidence in areas already subsiding and new subsidence in areas where subsidence has not yet occurred. In the past, major subsidence areas have been in agricultural settings where ground-water has been pumped for irrigation. In the future, however, increasing population may result in subsidence problems in metropolitan areas where damage from subsidence will be great (Leake, 2013).

In many areas of the arid Southwest, earth fissures are associated with land subsidence. Earth fissures can be more than 100 feet deep and several hundred feet in length. One extraordinary fissure in central Arizona is 10 miles long. These features start out as narrow cracks, an inch or less in width. They intercept surface drainage and can erode to widths of tens of feet at the surface (Figure 6).

Figure 6. Left photo is an earth fissure near Picacho, Arizona; Right photo is Benson Arizona. Both are suspected to have been caused by subsidence (Leake, USGS, 2013).

In figures 4 and 5, we can see the beginning of fissuring starting to take place in the reconnaissance area. Furthermore, when looking at satellite imagery, we can trace out the path of subsidence from the southwest to the northeast (Figure 7). The channel connecting the sink holes appears linear and was measured between 8 to 30 feet deep. Since the initial field investigation, additional sink holes have been developing on location.

Figure 7. Satellite imagery of the Stansfield property. Visible drainage patterns across the field are in line with both the sinkholes, and the channel of lower relief in the middle of the field running from the southwest to the northeast.

Erosion

Erosion is the geological process in which earthen materials are worn away and transported by natural forces such as wind or water. Most erosion is performed by liquid water, wind, or ice (usually in the form of a glacier).

Physical erosion describes the process of rocks changing their physical properties without changing their basic chemical composition. Physical erosion often causes rocks to get smaller or smoother. Rocks eroded through physical erosion often form clastic sediments. Clastic sediments are composed of fragments of older rocks that have been transported from their place of origin.

Rainfall produces four types of soil erosion: splash erosion, sheet erosion, rill erosion, and gully erosion.
- Splash erosion – Soil displacement by the impact of a falling rain drop;
- Sheet erosion - Removal of soil in thin layers by the forces of rain and stream flow;
- Rill erosion – Process of soil removal by water running through little streamlets, or headcuts;
- Gully erosion – Removal of soil along drainage lines by surface water runoff.

Wind is also powerful agent of erosion. Aeolian (wind-driven) processes constantly transport dust, sand, and ash from one place to another. In dry areas, windblown sand can blast against a rock with tremendous force, slowly wearing away the soft rock. It polishes rocks and cliffs until they are smooth. Wind can also erode material until little remains at all. Ventifacts are rocks that have been sculpted by wind erosion.

Some of the natural factors impacting erosion in a landscape include climate, topography, vegetation, and tectonic activity. Climate is perhaps the most influential force impacting the effect of erosion on a landscape. Climate includes precipitation and wind. Climate also includes seasonal variability, which influences the likelihood of weathered sediments being transported during a weather event such as a snowmelt, breeze, or hurricane.

Topography, the shape of surface features of an area, can contribute to how erosion impacts that area. The earthen floodplains of river valleys are much more prone to erosion than rocky flood channels, which may take centuries to erode. Soft rock like chalk will erode more quickly than hard rocks like granite.

Vegetation can slow the impact of erosion. Plant roots adhere to soil and rock particles, preventing their transport during rainfall or wind events. Trees, shrubs, and other plants can even limit the impact of mass wasting events such as landslides and other natural hazards such as hurricanes. Deserts, which generally lack thick vegetation, are often the most eroded landscapes on the planet.

In the reconnaissance area, erosion is clearly apparent. To the west is the Wasatch Plateau, which is responsible for much of the surface water that drains into Quitchupah creek. During rain storms many of the washes and channels become choked with sediment, as water rushes to lower topographical areas. Additionally, the San Rafael desert is known for its windy conditions during the winter and spring months. Both wind and water have contributed to the removal of fines in the reconnaissance area, which in turn has decreased the saturation potential of the soil.

Mining

To the southeast of the reconnaissance area is the currently operating Emery Deep Coal mine. The Emery Deep mine was acquired in 2015 by Bronco Utah Operations, LLC. The mine is located in Emery County at the confluence of Quitchupah Creek and Christiansen Wash, approximately four miles south of the town of Emery. Emery Mine previously produced 700,000 tons and is planned to increase production to 1,700,000 tons per year.

Since there is not a current hydrological report, a previous Hydrogeological study entitled, *Hydrology of the Ferron Sandstone Aquifer and Effects of Proposed Surface-Coal Mining in Castle Valley, Utah*, by Lines and Morrisey is included by reference.

Of note in the study was the predicted drawdown of the potentiometric surface within a 2-mile radius of the mine due to dewatering. However, the model was based on conditions that existed in 1979 and focused on surface mining. Nonetheless, a consistent drawdown of the water table, over an extended period of time, could produce hydrogeological subsidence due to reduced pore space pressure in the Ferron Sandstone aquifer.

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Conclusions

The purpose of this investigation is to gather as much information as possible to try and understand what is causing land subsidence on the Stanfield property. Using field observations, hydrogeologic studies, geologic and topographical mapping, as well as satellite imagery; it is determined that the subsidence is most likely being caused by aquifer-system compaction.

Evidence pointing to this is as follows: 1) There are only minor carbonate or evaporitic formations underlying the area, and there is no gypsum present in the soil. This excludes subsidence being created through dissolution of material. 2) The amount of precipitation in the region is not significant enough to cause hydrocompation. 3) The soil matrix is not considered organic, so is not impacted due to drainage. 4) The subsidence does not seem to be directly impacted from underground mining, tunneling or blasting. By removing the other major factors of subsidence, aquifer-system compaction becomes the most probable cause.

Furthermore, studies that analyze the Ferron sandstone aquifer (FSA) point out details that further substantiate this conclusion. First, storage, transmissivity, conductivity, and recharge data suggest that the water present in the FSA could be 15,000 to 24,000 years old. Meaning water removed from the system could take thousands of years to recharge. Second, it is predicted that water removed from the system through a variety anthropomorphic of means (pumping for irrigation and livestock, dewatering of mines, wells for domestic use) will lower the potentiometric-surface of the FSA. Lowering of the potentiometric surface reduces the hydrostatic pressure within the aquifers pore space and causes permanent compaction. Finally, the layering of shale and porous sandstone layers that define the Mancos Shale (the parent unit of the Ferron Sandstone) are highly conducive to aquifer-system compaction.

In addition to the hydrogeological studies, surface and topographical observations also point to aquifer-system compaction. The area observed was a field which had been land leveled to support cropland. Unfortunately, satellite imagery suggests the field was created overlying a drainage system of small gullies and rills. Moreover, the field has been out of use for quite a while (with no vegetation); which has led to erosional forces removing a portion of the plastic constituents of the soil. Because of these factors, surface drainage has connected to subsurface subsidence and has created an area subject to fissuring. The sink holes are sympathetic to the fissuring, and if not treated will continue to grow in size and extent.

Prepared by:

ANTHONY TODD SIEBER
NRCS State Geologist, Utah

United States Department of Agriculture

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