

Via Email:

August 17, 2018

Dominic F. Mauriello, AICP
PO Box 4777
2205 Eagle Ranch Road
Eagle, Colorado 81631

Re: Reserve at Hockett Gulch Site Visit Report
WJE No. 2018.5122

Dear Mr. Mauriello:

Wiss, Janney, Elstner Associates, Inc. (WJE) understands that the Reserve at Hockett Gulch residential development is being planned on an approximately 30-acre site located approximately 1,000 feet south of the intersection of Highway 6 and Sylvan Lake Road in Eagle County, Colorado (Figure 1). The site slopes gently to the northeast and contains steep, eroded slopes south of the proposed development. Hockett Gulch, a prominent drainage feature south of the site, exits the steeper terrain and has created an alluvial fan in the development area. In its preliminary geotechnical report dated September 20, 2015, Hepworth-Pawlak Geotech (HP Geotech), identified potential debris flow/debris flood hazards associated with Hockett Gulch. Consequently, WJE was tasked with assessing potential debris flow/debris flood hazards and recommending risk mitigation, if applicable. As the initial step in this assessment, Emma Bradford, EI, and Michael W. West, PhD, PE, PG, , performed a preliminary site reconnaissance on August 1, 2018, to assess debris flow/debris flood hazards and associated risks to the proposed project.

As currently envisioned, the development will contain 100 residential units and a 30,000 square foot commercial-use area to the west of Hockett Gulch, and thirteen 3-story buildings containing approximately 400 apartment units to the east of Hockett Gulch. The Planned Unit Development (PUD) Zoning Plan and Concept Plan for the site has been submitted to the Town of Eagle for review. It is WJE's understanding that the Colorado Geological Survey (CGS) has requested a site-specific debris flow/debris - flood hazard analysis and, if necessary, a mitigation and maintenance plan, to accompany the PUD. The following site visit report describes the geologic setting of Eagle, Colorado, site-specific geology, the site reconnaissance performed by WJE, and our initial conclusions and recommendations for additional work. Figures and photos are included at the end of the report.

REGIONAL GEOLOGY

The Town of Eagle is located within a sedimentary basin known as the Eagle Collapse Center. During the Pennsylvanian Period (310 million years before present), the Uncompahgre Uplift and the Front Range of the Ancestral Rocky Mountains created a landlocked marine depression, termed the Central Colorado Trough. Evaporite minerals, namely gypsum, were precipitated out of solution at the southeastern end of the trough, forming what is known today as the Eagle Valley Evaporite. (Mallory, 1971). The formation is estimated to be up to 2,000 meters in total thickness.

The Middle Pennsylvanian-age Eagle Valley Evaporite is a white to dark grey evaporitic sequence composed primarily of gypsum with interbedded shale and argillaceous limestone. Due to its tendency to

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dissolve in the presence of water, exposures of the Eagle Valley Evaporite exhibit an irregular, yet distinct topographic signature, marked by weathered, rounded slopes and locally-formed collapse features. The lower slopes below evaporite outcrops are commonly covered by a veneer of gypsum-rich, silty alluvium that assumes a popcorn-like appearance due to wetting and drying. The Eagle Valley Evaporite is known to produce collapsible soils and form dissolution sinkholes up to several meters deep. (Lidke, 2002).

SITE GEOLOGY

According to the Geologic Map of the Eagle Quadrangle (Lidke, 2002), the site is situated within Holocene to middle Pleistocene-age alluvium and colluvium described as “...*broad alluvial and colluvial aprons that overlap and cover terrace deposits along [the] Eagle River.*” In addition, a middle Pleistocene-age intermediate terrace alluvium deposit is mapped outside of the northeastern boundary of the site. Lidke (2002) indicates the alluvium was deposited by the Eagle River and consists of well-sorted, rounded and well-rounded, pebble and cobble gravel with sparse boulders. The steeper, mountainous terrain to the south of the site is mapped as the Eagle Valley Evaporite. Locally, the evaporite strikes N15°W on average and dips steeply to the east and northeast, ranging from 36° to 60°. Figure 2 shows the location of the site with respect to mapped geology (Lidke, 2002).

HP Geotech completed a drilling program in July 2015, consisting of eight boreholes. In seven out of eight boreholes, they logged variable thicknesses of silt and clay (ML-CL) to silty clay (CL) underlain by gravel and cobbles (GM). The eighth borehole log showed sand (SM) underlain by gravel and cobbles (GM).

SITE RECONNAISSANCE

On August 1, 2018, WJE observed the following conditions:

- The relatively flat site area is covered in greyish-tan silty soils deposited in an alluvial fan issuing from Hockett Gulch (Photo 1).
 - Evidence of erodible soils was observed (Photo 2).
- The steep slopes that flank Hockett Gulch and associated side ravines to the south side of the development site are underlain by weathered Eagle Valley Evaporite (Photos 3, 4, and 5).
 - Some exposures of Eagle Valley Evaporite are covered with a thin silty alluvium that exhibited a popcorn-like texture (Photo 6).
 - Blocks of evaporite removed by excavation were observed in Hockett Gulch a short distance away from the site (Photo 7).
- The terrain to the south of the site contained contorted bedding as a result of dissolution and collapse (Photo 8).
- Multiple fan deposits of varying sizes composed of silt-dominated soils have been deposited from small ravines in steeper terrain along the south side of the development area, east of Hockett Gulch. These fan deposits interfinger with and overlie the larger fans associated with Hockett Gulch (Photo 9).
 - No boulders, cobbles, or significant amount of gravels were observed within or surrounding these fans at the surface.
 - Fans were vegetated with native grasses and sage brush.
- Various cultural features were observed including metal pipe remnants, a culvert, man-made earthen berms, etc. (Photos 10 and 11).
- An active, west-east-oriented, high pressure gas pipeline runs through the development site.

INITIAL CONCLUSIONS

Surficial site geology published by Lidke (2002) was confirmed via visual observation in the field.

Based on published geologic mapping, HP Geotech's borelogs, and our site reconnaissance, there have not been any significant debris flow events involving material greater in size than small gravel-sized clasts in the recent past. WJE saw no evidence that surface flows from Hockett Gulch, or from smaller fans associated with north-south trending ravines to the south of the site, contained cobbles, boulders, or large debris (brush, trees). The gravel and cobble unit logged by HP Geotech contains "*primarily rounded to subrounded*" clasts supported in a coarse granular alluvium. We interpret this unit to be a stream terrace deposited by the Eagle River, not a debris flow deposit associated with Hockett Gulch.

The silty soils across the site are likely collapsible and will settle in the presence of wetting associated with development. We did not observe any collapse features associated with the Eagle Valley Evaporite within the proposed development area.

RECOMMENDATIONS FOR FUTURE WORK

We recommend WJE personnel return to the site to map it, and appropriate surrounding areas, in detail prior to submitting the Development Permit by the Town of Eagle. Specifically, nearby potential source areas will be evaluated for the potential to produce a debris flow. Evidence of collapsible and erodible soils will be identified and evaluated for impact on future development. In addition, we will identify significant anthropogenic features at the site that can be visually observed. WJE plans to coordinate future work with the Colorado Geological Survey to reasonably assure that government planning requirements are satisfied.

WJE recommends site-specific analyses prior to subdivision or development permit approvals. In our judgement, the PUD Zoning Plan and Concept Plan appear to adequately address debris flow hazard/risk and provide for potential mitigation that may be required. The Concept Plan shows a large drainage path that appears to adequately accommodate flows from Hockett Gulch, including potential oversizing should it be necessary. Defining maintenance requirements at this stage of investigation, design, and zoning is premature.

Thank you for the opportunity to work with you on this project. If you have any questions or comments, please do not hesitate to contact us at your convenience.

Sincerely,

WISS, JANNEY, ELSTNER ASSOCIATES, INC.



Emma Bradford, EI
Associate II



Reviewed by: Michael W. West, PhD, PE, PG
Principal Geological Engineer

REFERENCES

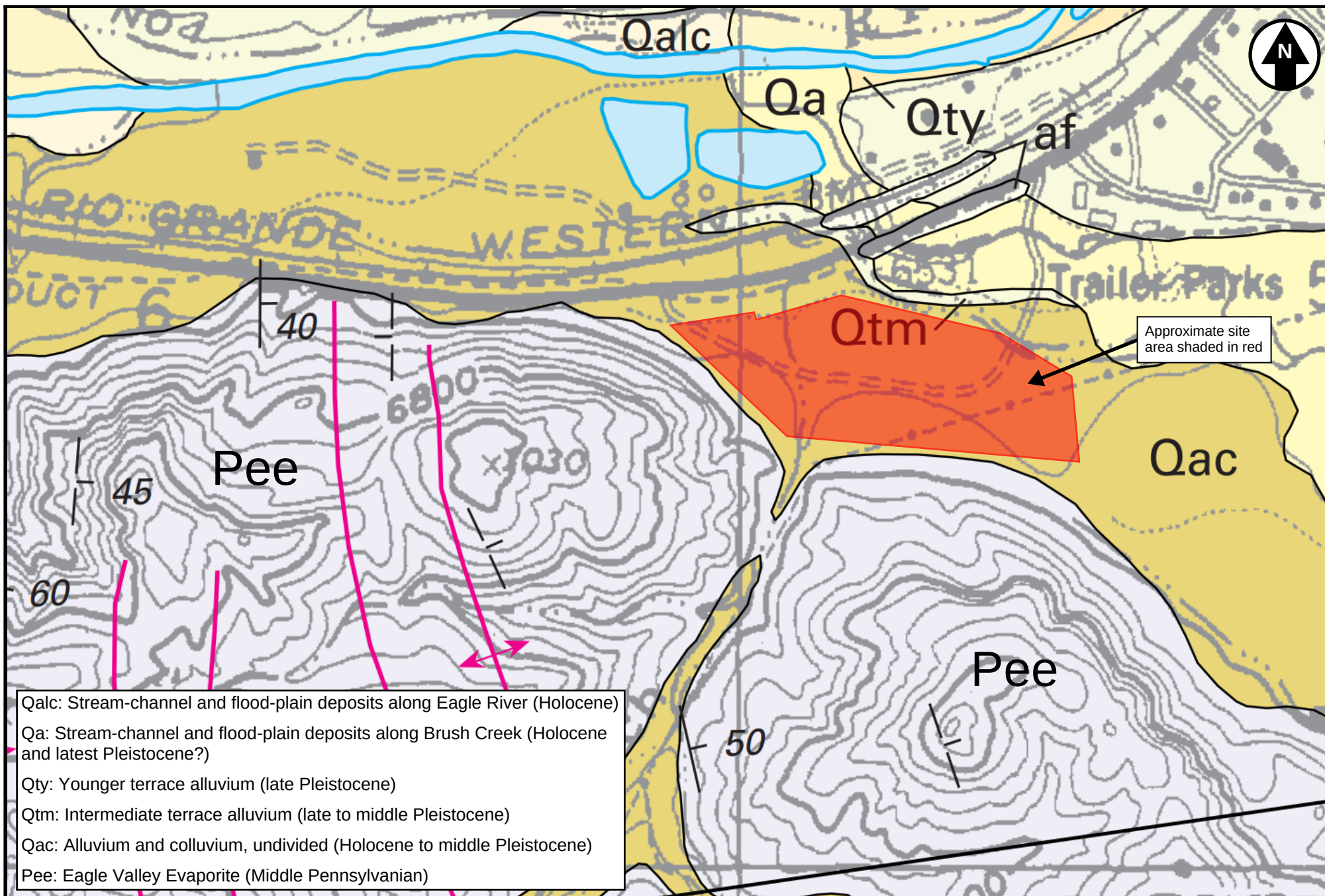
Lidke, D. J. (2002). "Geologic map of the Eagle quadrangle, Eagle County, Colorado." The United States Geological Survey, Miscellaneous Field Studies Map MF-2361, scale 1:24000.

Mallory, W. W. (1971). "The Eagle Valley Evaporite, Northwest Colorado - A Regional Synthesis." *Geological Survey Bulletin*, 1311-E, E1-35.

FIGURES



Figure No.	Proj. No.	Project	Reserve at Hockett Gulch Eagle, Colorado	WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS Wlss, Janney, Elstner Associates, Inc. 3609 South Wadsworth Boulevard, Suite 400 Lakewood, Colorado 80235 303.914.4300 tel 303.914.3000 fax www.wje.com
	Date			
	Drawn	Sheet Title	Site Location Map	
	Checked			
	Scale			



PHOTOS



Photo 1. Silty soils covering site area on the Hockett Gulch alluvial fan.



Photo 2. Evidence of erodible silty soils.



Photo 3. Highly weathered Eagle Valley Evaporite exposure along service road leading to Hockett Gulch.



Photo 4. Highly weathered Eagle Valley Evaporite exposure along service road leading to Hockett Gulch.



Photo 5. Small cobble-sized clast of Eagle Valley Evaporite found in Hockett Gulch.



Photo 6. Popcorn-like texture of residual Eagle Valley Evaporite soils.



Photo 7. Cobble- to boulder-sized Eagle Valley Evaporite clasts, removed by excavation, south of the site in Hockett Gulch.



Photo 8. Irregular topography within the Eagle Valley Evaporite.



Photo 9. View of relatively smaller fan deposits, issuing from higher terrain along the south side of the development site.



Photo 10. Abandoned pipeline parts.



Photo 11. Culvert full of dried silty material exhibiting desiccation cracks.



Photo 12. High pressure gas pipeline route indicated by yellow flags.