

**To: Mr. Michael Johnson
Director of Community and Economic Development
City of Cottonwood Heights**

**Mr. Adam Ginsberg
Staff Engineer
Public Works, City of Cottonwood Heights**



From: Daniel J. Brown, P.E., Senior Geotechnical Engineer

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Date: April 8, 2021

Subject: Review of Report Geotechnical Study and Slope Stability Analysis Proposed Wasatch Rock Development, 6695 South Wasatch Boulevard Cottonwood Heights, Utah (Gordon Geotechnical, May 13, 2020, Job No. 528-005-20) (June 17, 2020)

Review of Response Letter, Review of Geotechnical Study and Slope Stability Analysis, Proposed Wasatch Rock Development, 6695 South Wasatch Boulevard, Cottonwood Heights, Utah (Gordon Geotechnical, July 9, 2020, Job No. 528-005-20) (November 3, 2020)

Review of Report Final Slope Stability Analysis, Proposed Wasatch Rock Development 6695 South Wasatch Boulevard, Cottonwood Heights, Utah (Gordon Geotechnical, October 7, 2020, Job No. 528-006-20) (November 3, 2020)

Review of Response Letter 3-rev1, Review of Geotechnical Study and Slope Stability Analysis, Proposed Wasatch Rock Development, 6695 South Wasatch Boulevard, Cottonwood Heights, Utah (Gordon Geotechnical, December 16, 2020, Job No. 528-006-20) (January 20, 2021)

Response Letter No. 4, Review of Geotechnical Study and Slope Stability Analysis, Proposed Wasatch Rock Development, 6695 South Wasatch Boulevard, Cottonwood Heights, Utah (Gordon Geotechnical, March 18, 2021, Job No. 528-006-20)

Introduction

At the request of Mr. Michael Johnson, GeoStrata reviewed the most recent Gordon Geotechnical Engineering, Inc. (Gordon Geotechnical) (G²) review response dated March 18, 2021 which was prepared for the Proposed Wasatch Rock Development located at 6695 South Wasatch Boulevard in Cottonwood Heights, Utah. Our review of the above referenced consultant's documents was conducted on behalf of Cottonwood Heights City to assist the city in protecting public health, safety, and welfare, and to reduce risks to future property owners and to assess whether or not the report adequately addresses the geotechnical and slope stability concerns associated with the project consistent with reasonable standards of practice and in accordance with Cottonwood Heights City's Sensitive Lands Evaluation &

Development Standards (SLEDS) (Title 19 Chapter 19.72 of the Cottonwood Heights City Municipal code).

Review Discussion

The March 18, 2021 G² Response Letter No. 4 states:

“As presented in the January 20, 2021 review letter from GeoStrata, comments 4 and 6 - 12 are considered addressed or required no action by G². The general geotechnical and slope stability parameters and recommendations. for the development have been addressed and accepted. Comments 1 - 3 and 5 will be addressed through the required SLEDS compliant, design-level geotechnical and geologic hazard studies as finalized building details and site grading plans are completed for each phase of the project.”

It is our understanding that the Western Geologic & Environmental geologic hazards reports and the G² geotechnical engineering reports provided by the applicant to Cottonwood Heights City as of March 18, 2021, were submitted to the city for review as part of a request for rezoning of the subject property and to obtain approval of the planned development which is currently being considered for rezoning and initial master development plan. G² states that design-level geologic hazard studies and geotechnical engineering studies will be conducted as finalized building details and site grading plans are completed for each phase of the project. G² intends to address some review comments made by GeoStrata during our review of the consultant reports submitted to the city prior to the March 18, 2021 G² Response Letter No. 4 in the subsequent design-level geologic hazard studies and geotechnical engineering studies.

Title 19 Chapter 19.72, Section 19.72.110 Review of geologic hazard reports of the Cottonwood Heights City Municipal code, subsection B. states “Prior to consideration of any request for rezoning, preliminary plat approval, conditional use approval and/or site plan approval of property, the required geologic hazard reports shall be submitted to the city for review.”

It is our opinion, based on our reviews of the Western Geologic & Environmental geologic hazards reports and the G² geotechnical engineering reports submitted to Cottonwood Heights City for review as of the March 18, 2021 G² Response Letter No. 4, that these geologic hazards reports and geotechnical engineering reports are sufficient to represent the required geologic hazard reports for the city’s consideration of the requested rezone and initial master development plan. Based on our understanding of the current entitlement phase of this project, the SLEDS requirements concerning completion of all studies prior to city approval have been satisfied.

The following comments have been provided to clarify outstanding review items that need to be addressed by G² in future design-level geologic hazard studies and geotechnical engineering studies and to also present current G² recommendations that we recommend that Cottonwood Heights City require the applicant to comply with.

GeoStrata Review Comment 1 (November 3, 2020)

An update to portions of the geologic hazards study has been completed with the October 7, 2020 Gordon Geotechnical report. GeoStrata is currently completing a separate review of the updated geologic hazards study. Any deficiencies with the geologic hazards’ evaluation (if present) will be noted in our current

geologic hazards review letter. Any comments pertaining the updated geologic hazards evaluation must be addressed prior to approving final buildable areas for the proposed development.

GeoStrata Review Comment 1 (January 20, 2021)

The GeoStrata November 3, 2020 Review Comment 1 was not addressed by Gordon Geotechnical in their December 16, 2020 review response. GeoStrata recommends that Cottonwood Heights City request that the consultant provide a response to this review comment.

GeoStrata Review Comment 2 (November 3, 2020)

GeoStrata recommends that the City require that a detailed geotechnical assessment be provided for each proposed building with recommendations tailored to the structural loads when foundation plans or loading details become available.

GeoStrata Review Comment 2 (January 20, 2021)

The GeoStrata November 3, 2020 Review Comment 2 was not addressed by Gordon Geotechnical in their December 16, 2020 review response. GeoStrata recommends that Cottonwood Heights City request that the consultant provide a response to this review comment.

GeoStrata Review Comment 3 (November 3, 2020)

Section 6, Conclusions, of the October 7, 2020 Gordon Geotechnical report states:

“The slope at Section C-C’ is the steepest with an average grade of approximately 53 percent. The stability analysis indicates that compacted bank-run sand and gravel fill material will be required for slopes that exceed 50 percent or 2:1 (H:V).”

Cottonwood Height Code of Ordinances, Title 19, Chapter 19.72, Section 19.72.40, Development Standards and Controls, Subsection F, Cut and Fill Slopes states:

Cut and fill slopes shall comply with the following unless otherwise recommended in an approved soils and geology report:

- 1) Cut and fill slopes shall not exceed 12 feet.
- 2) Cut and fill slopes shall not exceed a slope ratio of 2:1 except as follows:
 - a) No slopes shall be cut steeper than the bedding plane, fracture, fault or joint in any formation where the cut slope will lie on the dip of the strike line of the fracture, bedding plane, fault or joint.
 - b) No slopes shall be cut in an existing landslide, mud flow or other form of naturally unstable slope.
 - c) If the material of a slope is of such composition and character as to be unstable under the anticipated maximum moisture conditions, the slope angle shall be reduced to a stable value or increased through retention using a method approved by the city engineer and certified as to its stability by a professional soils engineer.
- 3) Fill slopes shall not be constructed on natural slopes steeper than 2:1.
- 4) Roadway cut and fill slopes located outside the dedicated public right-of-way shall be within recorded easements providing for slope protection and preservation. The easements shall be in a form acceptable to the city.

GeoStrata recommends that Cottonwood Heights City request that the project geotechnical engineer review final site grading plans to assess whether the final grading plan conforms to the final accepted

slope stability analysis and recommendations or whether additional slope stability analysis is needed for the subject development.

GeoStrata Review Comment 3 (January 20, 2021)

The GeoStrata November 3, 2020 Review Comment 3 was not addressed by Gordon Geotechnical in their December 16, 2020 review response. GeoStrata recommends that Cottonwood Heights City request that the consultant provide a response to this review comment.

Gordon Geotechnical Response to Review Comment 4 (December 16, 2020)

G² Response to Current Review Comment 4

Our slope stability analysis indicates that a shoring system will be required to maintain excavation sidewall stability and global stability of the large cuts associated with the condominium structure. There is most likely not sufficient space on the site to open cut this excavation. We recommend that the structural element requirement be considered as part of the shoring or footing design since it would likely be installed by drilling/shoring contractors.

Based on our understanding of the subsurface conditions and experience with deep below grade construction, a top-down cut with a shoring system such as soldier pile and lagging, tieback, or soil nail walls are feasible for this project. G² works with several shoring contractors in Salt Lake City with extensive experience installing permanent and temporary showing walls.

Temporary or permanent shoring systems are typically designed by the contractor performing the work. The shoring system design requires a significant amount of engineering and therefore is typically not performed until the building construction plans have been finalized. Minor changes to the building layout or footing elevations would require a complete re-design of the shoring/deep foundation system.

G² must review the shoring design to ensure that it conforms to the recommendations in our geotechnical study and slope stability analysis.

GeoStrata Review Comment 4 (January 20, 2021)

We concur with the recommendations provided by Gordon Geotechnical in their December 16, 2020 response to review comment 4 and we recommend that Cottonwood Heights City require the applicant to comply with these Gordon Geotechnical recommendations.

GeoStrata Review Comment 5 (November 3, 2020)

Section 5.1.2, Geometry, of the October 7, 2020 Gordon Geotechnical report states:

“The geometry for the slope stability models was developed from the geologic cross-sections provided with the concurrent Geologic Hazards Evaluation report. Topography was obtained from 2013 lidar data with 0.5-meter resolution. Four cross-sections (A-A’, B-B’, C-C’, and D-D’) for slope stability analysis were selected based on the locations of the proposed developments and the most adverse topographic and geologic conditions.”

Based on our review of the slope stability results presented in Appendix D of the October 7, 2020 report and review of the Western Geologic prepared geologic cross sections presented in Appendix A of the October 7, 2020 report, the updated slope stability cross sections closely match the updated Western Geologic cross sections. If any changes to the geologic cross sections are made based on comments from our review of the Western Geologic geologic hazards study, any updated information, or otherwise, GeoStrata recommends that Cottonwood Heights City request that slope stability cross sections likewise be updated.

GeoStrata Review Comment 5 (January 20, 2021)

The GeoStrata November 3, 2020 Review Comment 5 was not addressed by Gordon Geotechnical in their December 16, 2020 review response. GeoStrata recommends that Cottonwood Heights City request that the consultant provide a response to this review comment.

Gordon Geotechnical Response to Review Comment 6 (December 16, 2020)

G² Response to Current Review Comment 6

The concrete washout material was found to be relatively competent and intact during G²'s field investigation and testing. Our updated slope stability analysis with reduced strength parameters indicated that the concrete washout material can be left in place and maintain global stability of proposed fill slopes. However, some loose blocks and raveling material was observed in the current gravel pit cut slope face near the location of Cross-Section B-B' and is anticipated to be encountered during site grading. The competency of this material will be assessed during initial earthwork site preparation for mass grading. Any loose or raveling material encountered on the slope face during preparation for placement of site grading fill slopes will be considered unsuitable and must be completely removed. G² can observe the site preparation and assess the competency of these materials as needed.

GeoStrata Review Comment 6 (January 20, 2021)

We concur with the recommendations provided by Gordon Geotechnical in their December 16, 2020 response to review comment 6 and we recommend that Cottonwood Heights City require the applicant to comply with these Gordon Geotechnical recommendations.

GeoStrata Review Comment 7 (January 20, 2021)

Section 6, Conclusions, of the October 7, 2020 Gordon Geotechnical report lists the following recommendations for site grading:

“1) The condominium structure at Section A-A' incorporates a deep cut for below-grade parking. A structural element must extend a minimum of 5 feet below the bottom of footings on the cut side to assure an adequate factor of safety. This may consist of deep foundations, soil improvement, or a permanent shoring solution such as soil nails. A depth of 5 feet is shallower than previously recommended in the May 13, 2020 report. This is due to the lack of groundwater encountered to depths of 81 feet at boring locations B-9 and B-10. The projected groundwater is deeper in the updated slope stability models resulting in more favorable slope stability conditions.

Section B-B' indicates that concrete washout material may remain in place provided that any loose or raveling material is removed and the concrete washout is competent.

2) The slope at Section C-C' is the steepest with an average grade of approximately 53 percent. The stability analysis indicates that compacted bank-run sand and gravel fill material will be required for slopes that exceed 50 percent or 2:1 (H:V).

3) Compacted washout fines may be utilized for slopes that do not exceed 50 percent or 2:1 (H:V).

4) It is recommended that all fill slopes on the northern and eastern portions of the site incorporate subdrains near the toe of the existing slopes to intercept potential seepage from up-gradient runoff.

5) Fill slopes must be benched into the existing slope as fill placement progresses to avoid a planar interface at the base of the fill. Individual benches may be on the order of five feet in height.

6) Site grading fill comprising slopes must be compacted to a minimum of 90 percent of the Modified Proctor dry density.”

In GeoStrata’s November 3, 2020 Review Comment 7, we recommended that Cottonwood Heights City request that the applicant include these recommendations and detail drawings for benching of fill slopes into the existing slope with the final grading plan.

Gordon Geotechnical Response to Review Comment 9 (July 9, 2020)

“G2 recommends that the Cottonwood Heights City requirements for City roads be followed. City roads must be established upon structural site grading fill extending to suitable natural soils. The recommendations provided for flexible pavement site preparation in our May 13, 2020 report are still valid for all private parking and roadway areas.”

We concur with the recommendations provided by Gordon Geotechnical in their July 9, 2020 response to review comment 9 and we recommend that Cottonwood Heights City require the applicant to comply with these Gordon Geotechnical recommendations.

Gordon Geotechnical Response to Review Comment 10 (July 9, 2020)

“G² can provide a detailed geotechnical assessment for each proposed building, including the condominium structure, when final foundation loading details become available.”

GeoStrata Review Comment 10 (November 3, 2020)

As part of final design of the proposed structures and as recommended in Review Comment 2, GeoStrata recommends that Cottonwood Heights City request that a design level geotechnical assessment be performed for each of the proposed buildings, which incorporates detailed structural loads. As part of preparation of these reports, a review of planned building foundations and foundation loads should be completed by the geotechnical engineer.

Closure

This review letter is issued in response to the consultant’s assessment of the above referenced site. Comments and recommendations in this review letter are based on data presented by the Consultant. GeoStrata has not performed an independent site assessment. GeoStrata has relied on the Consultant's reports in performing its services. Consequently, it does not represent or warrant that the Consultant's reports contain accurate data or proper recommendations. Recommendations and Comments presented in this review letter are provided to Cottonwood Heights City to assist the city in reducing risks from geologic hazards. GeoStrata makes no warranty; either expressed or implied and shall not be liable for any direct, special, incidental, or consequential damages with respect to claims by users of this review.

All services performed by GeoStrata for this review were provided for the exclusive use and benefit of Cottonwood Heights City. No other person or entity is entitled to rely on GeoStrata’s services or use the information contained in this letter without the express written consent of GeoStrata.

If there are any questions concerning the contents of this review, please feel free to contact our office at (801) 501-0583.