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**ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED**

Job No. 179012

July 30, 2021

Landhuis Company
212 N. Wahsatch Ave. Ste 301
Colorado Springs, CO

Re: Underdrain Evaluation
Paint Brush Hills, Filing No. 14
El Paso County, Colorado

Dear Landhuis Company:

RMG – Rocky Mountain Group has reviewed various geotechnical reports pertaining to the Paint Brush Hills subdivision, Filing No. 13E, as well as the adjacent Filings 13C and 14. The purpose of this review was to evaluate and address the need (or lack thereof) for an "underdrain" system located within the roadways (below the storm sewer and other utilities) to mitigate potential groundwater conditions. The reports reviewed in preparation of this evaluation are listed below:

1. *Soil, Geology, and Geologic Hazard Study, Paint Brush Hills, Phase 2, El Paso County, Colorado*, prepared by Entech Engineering, Inc., Job No. 11274, last dated March 5, 2004.
2. *Subsurface Soil Investigation, Lots 1-3, 18-44, 77-90, 105-118, 134-135, Paint Brush Hills, Filing No. 13C, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 161307, last dated March 15, 2018.
3. *Subsurface Soil Investigation, Lots 4-11, 59, 69-76 and 91-98, Paint Brush Hills, Filing No. 13C, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 161896, last dated December 4, 2018.
4. *Subsurface Soil Investigation, Lots 58-120, 130-132, and 145-148, Paint Brush Hills, Filing No. 13E, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 171983, last dated October 3, 2019.
5. *Subsurface Soil Investigation, Lots 2-4, 11-15, 121-129, 133-144, and 149-158, Paint Brush Hills, Filing No. 13E, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 173629, last dated January 22, 2020.
6. *Subsurface Soil Investigation, Lots 24-25, 34-35, and 57, Paint Brush Hills, Filing No. 13E, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 173692, last dated March 24, 2020.
7. *Subsurface Soil Investigation, Lots 16, 19-22, 27, 28, 30-32, 42, 44-49, 53, and 56, Paint Brush Hills, Filing No. 13E, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 180347, last dated March 30, 2021.
8. *Soils and Geology Study, Lots 1-224, Paint Brush Hills, Filing No. 14, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 179012, last dated October 16, 2020.
9. *Field Activity Reports*, prepared by RMG – Rocky Mountain Group, Job No. 156158, dated March 22, 2017 through May 25, 2018.

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Central Office:
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Evans, CO 80620
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Fort Collins: 970.616.4364
Monument: 719.488.2145
Woodland Park: 719.687.6077

10. *Field Activity Reports*, prepared by RMG – Rocky Mountain Group, Job No. 165451, dated July 11, 2018 through July 6, 2020.

The findings, conclusions and recommendations contained in these reports were considered during the preparation of this evaluation.

The *Soil, Geology, and Geologic Hazard Study* report by Entech Engineering, Inc. indicates areas of seasonal high groundwater and potentially seasonal high groundwater across Phase 2 of Paint Brush Hills. However, they also note that the majority of these areas are within defined drainages or areas that did not indicate the yearly presence of shallow groundwater but that could experience high groundwater during high moisture periods or years. Furthermore, they state that groundwater was not encountered in any of the test borings drilled by Entech as part of their investigation, and that only 1 test boring drilled by Earth Engineering Consultants, Inc. for a prior investigation contained groundwater (at 4 feet below grade), but that this test boring was located within a defined drainageway on the site. They conclude that areas of groundwater seepage, if encountered, may require drainage systems in order to dewater the area. Entech did not recommend, nor did they provide any detailing for, the installation of subsurface drainage systems (typically referred to as "underdrains") within the roadways.

Regarding the areas of seasonal shallow groundwater and the potential for shallow groundwater mapped by Entech Engineering, Inc. in their *Soil, Geology and Geologic Hazard Study* referenced above, RMG disagrees with Entech's identification of this hazard. Entech's stated reasons for identifying these areas as "*Seasonal High Groundwater Area*" or "*Potentially seasonal High Groundwater Area*" are the presence of defined drainages and "*topography and site conditions*". However, defined drainages and/or surficial topography are not reliable indicators of subsurface water conditions.

Intermittent (or "seasonal") drainages such as those identified on the site are typically incised by surficial runoff during periods of high precipitation or snowmelt, not by subsurface groundwater conditions (whether a permanent water table, or a localized "perched" water condition). The pathway that these surface water conditions follow (and thus, the drainage channels that they incise) are based on surface topography, not on subsurface groundwater conditions. Surficial drainage channels such as the ones identified on this site can and do occur in areas with no subsurface groundwater conditions. Likewise, areas containing high groundwater conditions (either permanent or "perched") can and do occur in areas with no incised drainages on the ground surface. The two conditions, while both relating to the presence or movement of water, can and do occur independently of each other and the presence of one is not a reliable indication of the presence of the other.

Regarding this specific site, 228 test borings have been performed across Paint Brush Hills, Phase 2 and Paint Brush Hills, Filings 13C, 13E, and 14 during the course of the Entech Engineering and the RMG investigations referenced above. Groundwater was encountered in 4 of these borings, and only one had groundwater less than 15 feet below the ground surface (at approximately 11.75 feet). It's unclear at this time whether this was a highly localized "perched" groundwater reading or a result of a caved test boring and limited amount (several inches) of water collecting on top of the cave-in due to surface runoff. However, there were no indications of subsurface groundwater in any of the test borings on the surrounding lots. Furthermore, RMG performed several hundred site visits during the land-development phases of Filings 13C and 13E, as indicated in the field activity reports referenced above. There were no reports of subsurface groundwater collecting within the utility trenches during any of those site visits.

RMG disagrees with the use of surficial drainage conditions as an indicator of "high" subsurface groundwater conditions. We also disagree that the presence shallow, surficial drainageways is sufficient justification to require the installation of an "underdrain" system within the roadways, particularly when there are no indications of subsurface groundwater conditions in any of the test borings performed within this filing. It is our opinion that shallow groundwater, particularly pervasive and persistent shallow groundwater requiring mitigation, does not exist below Paint Brush Hills, Filing No. 14. As such, there is not sufficient reason to require the installation of a subsurface "underdrain" drainage system within the roadways.

Should you have questions, please do not hesitate to call.

Cordially,

RMG – Rocky Mountain Group

Tony Munger, P.E.
Geotechnical Project Manager



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**ROCKY MOUNTAIN GROUP
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Job No. 179012

July 30, 2021

Landhuis Company
212 N. Wahsatch Ave. Ste 301
Colorado Springs, CO

Re: Perimeter Drain Evaluation
Paint Brush Hills, Filing No. 14
Devoncove Dr
El Paso County, Colorado

Dear Landhuis Company:

RMG – Rocky Mountain Group has reviewed various geotechnical reports pertaining to the Paint Brush Hills subdivision, Filing No. 13E, as well as the adjacent Filings 13C and 14. The purpose of this review was to evaluate and address the need for foundation perimeter drains and recommendations for the discharge of water collected by the foundation perimeter drains. The reports reviewed in preparation of this evaluation are listed below:

1. *Soil, Geology, and Geologic Hazard Study, Paint Brush Hills, Phase 2, El Paso County, Colorado*, prepared by Entech Engineering, Inc., Job No. 11274, last dated March 5, 2004.
2. *Subsurface Soil Investigation, Lots 1-3, 18-44, 77-90, 105-118, 134-135, Paint Brush Hills, Filing No. 13C, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 161307, last dated March 15, 2018.
3. *Subsurface Soil Investigation, Lots 4-11, 59, 69-76 and 91-98, Paint Brush Hills, Filing No. 13C, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 161896, last dated December 4, 2018.
4. *Subsurface Soil Investigation, Lots 58-120, 130-132, and 145-148, Paint Brush Hills, Filing No. 13E, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 171983, last dated October 3, 2019.
5. *Subsurface Soil Investigation, Lots 2-4, 11-15, 121-129, 133-144, and 149-158, Paint Brush Hills, Filing No. 13E, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 173629, last dated January 22, 2020.
6. *Subsurface Soil Investigation, Lots 24-25, 34-35, and 57, Paint Brush Hills, Filing No. 13E, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 173692, last dated March 24, 2020.
7. *Subsurface Soil Investigation, Lots 16, 19-22, 27, 28, 30-32, 42, 44-49, 53, and 56, Paint Brush Hills, Filing No. 13E, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 180347, last dated March 30, 2021.
8. *Soils and Geology Study, Lots 1-224, Paint Brush Hills, Filing No. 14, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 179012, last dated October 16, 2020.

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9. *Field Activity Reports*, prepared by RMG – Rocky Mountain Group, Job No. 156158, dated March 22, 2017 through May 25, 2018.
10. *Field Activity Reports*, prepared by RMG – Rocky Mountain Group, Job No. 165451, dated July 11, 2018 through July 6, 2020.
11. *Underdrain Evaluation*, prepared by RMG – Rocky Mountain Group, Job No. 165451, last dated June 18, 2021.

The findings, conclusions and recommendations contained in these reports were considered during the preparation of this evaluation.

Regarding foundation perimeter drains, the need for them is to be determined on a lot-by-lot basis at the time of the lot-specific subsurface soil investigations. However, in general, we do recommend a subsurface perimeter drain be placed around all below-grade habitable or storage spaces, including around crawlspaces. Where foundation perimeter drains are installed, we generally recommend that they extend beyond the foundation backfill zones and discharge to a location that is graded to direct discharge water away from the structure.

As noted in the *Underdrain Evaluation* report referenced above, it is our opinion that shallow groundwater, particularly pervasive and persistent shallow groundwater requiring mitigation, does not exist below Paint Brush Hills, Filing No. 14. The perimeter foundation drains (if required) would not be intended for use in de-watering the site, and thus are only anticipated to convey typical amounts of discharge water common to residential foundation perimeter drains throughout the El Paso County region. This volume would be expected to only amount to a relatively small percentage of the volume of water discharged by roof gutter downspouts during a rainstorm. Thus, as long as the discharge pipe discharges into the on-site drainage features as described above and not directly into the public right of way (ROW), the discharge water should not impact the public ROW.

As noted by the county, the majority of the lots in the proposed Filing No. 14 are anticipated to drain to the front. Generally speaking, these lots are already designed to accommodate the anticipated volume of surface runoff without discharging onto the public ROW. This accounts for the anticipated quantities of both rainwater and irrigation water, which should be mitigated via a combination of absorption into the soil and evaporation. Again, as noted above, the water anticipated to be conveyed by the foundation perimeter drain is a result of only those two sources. There is not a persistent shallow groundwater condition present in these areas of Paint Brush Hills, and the perimeter foundation drains are not intended for use in dewatering the site. As such, the foundation perimeter drain is only anticipated to convey water that is already accounted for in the design of the lot's surface drainage features. Provided that the site drainage has been properly designed and implemented, the water discharged from the foundation perimeter drain should not exceed the capacity of the site and overflow into the ROW. Based on this, it is our opinion that the foundation perimeter drains do not pose a significant risk of generating flow that will encroach on the public ROW.

Water collected and conveyed by foundation perimeter drains should be discharged into defined surface drainage features (drainage swales, retention/detention areas, etc.) or to other portions of the site that are graded to direct discharge water away from the structure(s) and into the surface runoff pathways delineated by the drainage plan or drainage report prepared for the development.

Should you have questions, please do not hesitate to call.

Cordially,

RMG – Rocky Mountain Group

Tony Munger, P.E.
Geotechnical Project Manager



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ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

Job No. 179012

December 31, 2020

Landhuis Company
212 N. Wahsatch Ave. Ste 301
Colorado Springs, CO

Re: Response to CGS Comments,
Paint Brush Hills, Filing No. 14
Lots 1-224, Paint Brush Hills, Filing No. 14
El Paso County, Colorado

Dear Jeff Mark:

RMG – Rocky Mountain Group (RMG) prepared the *Soils and Geology Study* (RMG Job No. 179012, last dated October 16, 2020) for the proposed development comprising 224 single-family residential lots located approximately 1 mile west of the intersection of Meridian Road and Londonderry. The report was reportedly reviewed by personnel of the Colorado Geological Survey (CGS). The CGS comments (dated November 18, 2020) were provided to us by personnel of Matrix Design on November 19, 2020.

The purpose of this letter is to provide RMG's response to the CGS comments. For clarity and ease of review we have included the CGS comments below, each followed by our response to that comment.

CGS Comment:

Areas of seasonal shallow groundwater and the potential for shallow groundwater have been mapped and Entech has recommended that basements not be allowed in these areas and/or site grading raise the areas impacted. In addition, RMG states that an existing drainage has been infilled without records indicating if drain recommendations were followed. As infilled drainages can become conduits for groundwater CGS recommends that the lots in the area of the infilled drainage (map unit valley infill "Vi") also exclude basements or below grade areas.

The following is a list of lots potentially impacted by shallow groundwater as determined from RMG's Figure 14 that includes both Entech's mapping and RMG's valley infill area. CGS recommends basement feasibility for at least the following lots be determined by analysis of site grading and a seasonal groundwater monitoring program. Lots 6, 7, 8, 9, 10, 11, 12, 13, 26, 54, 55, 56, 91, 92, 93, 99, 100, 101, 102, 103, 104, 105, 108, 109, 110, 118, 119, 121, 122, 123, 124, 126, 127, 128, 156, 157, 158, 159, 160, 165, 166, 167, 168, 171, 172, 173, 174, 175, 176, 177, 178, 179, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 195, 196, 197, 198, 199, 200, 201, 206, 207, 208, 215, 216, 224.

RMG Response:

Regarding the areas of seasonal shallow groundwater and the potential for shallow groundwater mapped by Entech Engineering, Inc. in their *Soil, Geology and Geologic Hazard Study* noted in the RMG report referenced above, RMG disagrees with Entech's identification of this hazard. Entech's stated reasons for identifying these areas as "*Seasonal High Groundwater Area*" or "*Potentially seasonal High Groundwater Area*" are the presence of defined drainages and "*topography and site conditions*". However, defined drainages and/or surficial topography are not reliable indicators of subsurface water conditions.

Intermittent (or "seasonal") drainages such as those identified on the site are typically incised by surficial runoff during periods of high precipitation or snowmelt, not by subsurface groundwater conditions (whether a permanent water table, or a localized "perched" water condition). The pathway that these surface water conditions follow (and thus, the drainage channels that they incise) are based on surface topography, not on subsurface groundwater conditions. Surficial drainage channels such as the ones identified on this site can and do occur in areas with no subsurface groundwater conditions. Likewise, areas containing high groundwater conditions (either permanent or "perched") can and do occur in areas with no incised drainages on the ground surface. The two conditions, while both relating to the presence or movement of water, can and do occur independently of each other and the presence of one is not a reliable indication of the presence of the other.

Regarding this specific site, over 30 test borings have been performed across this site during the course of the Entech Engineering and the RMG investigations noted herein, with no indications of subsurface groundwater in any of them. RMG disagrees with the use of surface drainage conditions as an indicator of "high" subsurface groundwater conditions, and strongly disagrees that the presence shallow, surficial drainageways is sufficient justification to limit basement construction or to require costly and time-consuming groundwater monitoring studies, particularly when there are no indications of subsurface groundwater conditions in any of the test borings completed in the performance of these two investigations (not even in the test borings performed within these identified drainage areas). It is our opinion that there is insufficient reason to limit basement construction on this site, and that the performance of a groundwater monitoring study should not be required.

Regarding the presence of the identified areas of infilled drainages identified in the RMG report, surface topography, our site observations, and our test borings indicate that the drainages present on the site (both those that still exist, and the infilled drainages identified in our previous report) are approximately 4 feet or less in depth. At that depth, if significant amounts of water were to collect within or migrate through these drainages, it would be near enough to the surface to impact all types of foundation construction, not just basement construction. However, there are no indications of significant amounts of long-term water migration through these drainageways even prior to backfilling (when the drainages were exposed to air, which water can move through much more readily than the soil that has since been used to backfill them), we do not anticipate that these drainageways will become a conduit for more than limited amounts of intermittent water. These limited amounts of intermittent water are traditionally mitigated through the use of foundation drainage systems such as those recommended in the RMG report referenced above.

Furthermore, the construction of the proposed residences (particularly those containing basement foundations) would be anticipated to extend below, and thus interrupt, any drain placed within the bottom of the infilled drainages. Likewise, these foundations will also interrupt the flow of water within the drainage. Thus, the construction of basement foundations within these drainageways will serve to mitigate their potential to act as a continuous "path of least resistance" conduit through the site, and substantially limit the amount of water experienced by any one basement foundation. As such, the presence of these drainages is not anticipated to significantly impact (and should not be used as a reason to limit) construction of basement foundations on these lots.

CGS Comment:

Both RMG and Entech evaluated groundwater conditions in seasons where groundwater levels are typically at their lowest (September and January respectively). The shallow, unconfined aquifer beneath the site will typically have higher water levels in the spring and summer months and in years of above average rain and snow. The lot-specific soil investigations recommended by RMG do not typically perform groundwater monitoring as is required by the Engineering Criteria Manual in areas with potential for shallow groundwater. Impacts from shallow groundwater on feasibility of basement or below grade development is indeterminate without groundwater monitoring over seasonal variations.

First, there is no evidence from any of the of the test borings performed on the site by Entech or RMG that a shallow, unconfined aquifer exists beneath the site. Nor is there any indications in any of the test borings to indicate the presence of shallow groundwater which would invoke any requirements for additional investigations or monitoring within the El Paso County Engineering Criteria Manual. Second, as groundwater conditions have not been encountered within 20 feet of the ground surface, the potential "higher" water levels in wetter conditions is still anticipated to be sufficiently deep that it won't impact the feasibility of basement construction. Again, it is our opinion that "high" or "shallow" groundwater is not present at this site and that there is no basis for the requirement of groundwater monitoring.

CGS Comment:

CGS recommends:

- If basement or below grade areas are desired for the impacted lots, groundwater monitoring that follows the guidance El Paso Counties Engineering Criteria manual be conducted in the seasonally wet (map unit "sw"), potentially seasonally wet (map unit "psw"), or valley infill (map unit "Vi") through at least the high groundwater seasons (spring and summer) and discussions about impacts from seasonal groundwater be added to an updated soils and geology study. Site grading plans indicate up to 6 feet of fill in some areas potentially impacted by shallow groundwater which will help determine feasibility of basements along with groundwater monitoring;
- The soils and geology study be updated prior to final development plan and plat to include discussions of all the identified geologic hazards and results of seasonal groundwater monitoring should basement or below grade areas be desired in the identified lots potentially impacted by shallow groundwater;
- Additional subsurface investigation is conducted for the updated study to further characterize the potential for groundwater seepage and perched groundwater including locations of sandstone lenses that can be conduits for groundwater; and,

- A note is added to the Preliminary Plan stating that no basement construction is allowed without groundwater monitoring for lots impacted or potentially impacted by shallow groundwater (map units "sw", "psw", and "Vi").

RMG Response:

It is our opinion there is a lack of evidence to support these recommendations, and that the imposition of a costly and time-consuming seasonal groundwater monitoring program and/or the limitation of basements on this site is not justified. Our previous report (referenced above) provides recommendations for subsurface foundation drainage systems that are commonly utilized to mitigate water conditions such as those identified/encountered on the site and it is our opinion these recommendations are appropriate and adequate, and that no further requirements or limitations should be imposed.

I hope this provides the information you have requested. Should you have questions, please feel free to contact our office.

Cordially,

RMG – Rocky Mountain Group



Kelli Zigler
Project Geologist



Tony Munger, P.E.
Geotechnical Project Manager