COLORADO GEOLOGICAL SURVEY AT THE COLORADO SCHOOL OF MINES

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May, 14, 2018

Ms. Kari Parsons
El Paso County Community Development
2880 International Circle, Suite 110
Colorado Springs, CO 80910
Re: Windingwalk Filings #1 and #2, PUD and Preliminary Plan, CGS EP-18-0037_2

Dear Ms. Parsons:

Thank you for the above referenced referral. CGS previously reviewed the application on February 13, 2018. The application is for approval of a PUD and preliminary plan for approximately 405 single-family homes on 139 acres.

The previous review outlined several constraints that may impact the performance of homes, pavements, and utilities. These included uncontrolled fill, expansive and collapsible soil, and shallow groundwater. The letter also noted that the application did not contain the required geologic hazard report.

The resubmittal includes a revised geotechnical report and a geologic hazard report. Based upon review of the new and revised materials, CGS offers the following comments and concerns for your consideration. None of site constraints and geologic hazards listed below will prevent development of the site for the intended use; however, carefully designed and constructed mitigation is needed. Without it, homes, roads, pavements and utilities may be damaged and not function as designed.

Uncontrolled Fill

As noted in the previous CGS letter and in the geotechnical report, the southern, western, and northern sections of Filing 1 (Lots 24-55; 152-159; 162-163; and Fairway Glen Circle) are underlain by fill. Per the Entech report, the fill is reported to be properly placed and compacted. However, the report also states that Entech has not been given the required documentation to show the fill was properly placed and compacted as engineered fill.

Improperly placed fill may be subject to excessive settlement, and instability, during construction of foundations, roads, and utilities. Without such documentation, it would be prudent for the county to require the fill to be removed and replaced as engineered fill. This will need to be done as part of the public improvements.

Collapsible Soil

As noted in the Entech geotechnical and geologic hazard report, parts of Filing 1 are underlain by loose, unconsolidated sand. Few swell/consolidation tests were performed on the sand; however, standard penetration tests show the fine, silty sand is generally loose to medium dense. Such sand is generally prone to excessive settlement when wetted and/or loaded. Though the sand layers are not thick or generally located at or below home foundation depths, they are located below roads, pavements, storm sewer and other utilities. These structures may be damaged if constructed on such deposits.

The sand layers are generally located in the western section of Filing 1 near or below areas where fill has been placed (Lots 24-55; 152-159; 162-163; and Fairway Glen Circle). Since it's likely that the fill will need to be removed and replaced as engineered fill, CGS also recommends that any unconsolidated sand below the fill be mitigated to reduce collapse potential.

Expansive Soil

The Entech report indicates that site is underlain by expansive soils (clayey sand, clay, very clayey sandstone, claystone, and clayey siltstone) that have a low to high swell potential. The report outlines prudent mitigation recommendations for the design of residential foundations and floor systems. The recommendations are preliminary and a site-specific soils foundation investigation will need to be completed prior to issuance of building permits for each lot.

However, the report does not include any mitigation recommendations for roads, pavements, storm sewer, and other utilities. In the western part of Filing 1, again near or below the area where fill has been placed, shallow claystone is present. No swell/consolidation testing was done on the claystone but it may also have a high swell potential. It would be prudent to require mitigation measures for roads, pavements, storm sewer, and other utilities that will be constructed within five feet of

claystone or other expansive materials. This type of expansive soil mitigation should be done as part of the public improvements.

Shallow Groundwater

As previously noted by CGS and by Entech, the site is underlain by shallow groundwater. Almost all of Filing 1 and the western section of Filing 2 show groundwater levels within five feet of foundation levels. The geotechnical report does not contain any sustained groundwater monitoring. It appears that water levels were measured shortly after drilling. The dates of monitoring are not included in the report. It is not known if any measurements were taken when water levels are seasonally high.

In addition, comparing groundwater levels with cut/fill estimates provided by Entech; it appears that some proposed cuts are within five feet of groundwater levels. During periods of seasonally high groundwater levels, groundwater may flow from utility excavations potentially impacting slope stability. If grading plans change, the county may wish to ensure that no permanent cuts are made in areas with shallow groundwater without adequate mitigation.

A natural drainage bisects Filing 2 and shallow groundwater is present near the drainage. The drainage should not be filled without an adequate drain system, and a daylighted outlet, placed at the base of the fill. Groundwater build up in such fill can cause fill instability. The drain will need to be maintained and caution should be taken when considering placing structures (see Lot 7 Filing #2 and Quietwalk Dr.) on top of the fill and drain. An easement should be placed on the drain and outlet.

The Entech report states that construction of an area-wide underdrain system should be considered for long-term groundwater mitigation. Though a preliminary utility plan was provided, I was unable to find a legend but assume the plan only shows main lines and stubouts for water and sewer. A properly designed, constructed, and maintained area-wide underdrain system will also improve the long-term performance of homes, sanitary sewer, roads and other utilities.

The system would need to be installed as part of the public improvements and provisions for service line connection stubouts to each lot should be provided. In addition, all segments of the subsurface groundwater collection pipe and the gravel

bedding should have positive drainage. This includes segments dammed by manhole bases. Cleanouts will need to be placed at bends or junctions in the main collection lines and along the main collection lines. The cleanouts will be of sufficient size to allow for proper maintenance.

If the county does not have standards for area-wide underdrain systems, you may wish to review adopted standards for the City of Colorado Springs or Jefferson County. In the absence of an area-wide underdrain, CGS recommends one of the following options:

- No basements should be allowed in Filing 1 and the area west of the natural drainage in Filing 2 (west of Quietwalk Drive).
- Groundwater levels across both filings should be monitored monthly for at least one year (complete spring-summer-fall cycle). Basements should only be allowed in areas where there is at least a 3-ft. separation between seasonally high groundwater levels and the lowermost floor and crawl space elevations.

In summary, there are no constraints that will prevent development of the site; however, there are significant constraints that require careful mitigation. These include verification or removal of fill; mitigation of collapsible and expansive soil; mitigation of shallow groundwater by installation of an area-wide underdrain system with connections to each lot or prohibiting/restricting the construction of basements.

Please contact me if you have any additional questions or concerns. My phone number is 303.384.2640.

Sincerely yours,

Karen A. Berry, PG, AICP