unsigned copy

STATE OF COLORADO

COLORADO GEOLOGICAL SURVEY
Division of Minerals and Geology

Department of Natural Resources
1313 Sherman Street, Room 715
Denver, Colorado 80203
Phone (303) 866-2611
FAX (303) 866-2461

DEPARTMENT OF NATURAL RESOURCES

EP-96-0059

May 27, 1996

Mr. James R. Mayerl
City of Colorado Springs
Development Services and Comprehensive Planning Division
P.O. Box 1575, Mail Code 310
Colorado Springs, CO 80901-1575

RE: **Broadmoor Glen South Subdivision Geologic Hazard Review.**

Dear James;

At your request this office has reviewed the development that is currently being proposed south of Farthing Drive in the Greater Broadmoor Development area east of Cheyenne Mountain. The geologic history of the area is complex due the proximity of the Ute Pass Fault that marks the Front Range upthrust. The site is underlain by weathered Pierre Shale bedrock. This formation has been buried by alluvial pediment deposits of sandy to gravel material that was eroded and shed out from the Front Range during the last glacial age. Subsequent geologic processes have dissected the alluvial pediment with gullies, swales, and drainageways. In the recent geologic past large gravity deposits of huge boulders from Cheyenne Mountain were deposited in the southern portion of this site. Landslides have occurred on both sides of the main ridgeline of the property that has been, just recently, extensively regraded for the Broadmoor Bluff Drive alignment. Steeper slopes generally exist in the western portion of the property that moderate toward the east. The proposed development is quite large with 118 residential lots proposed on a 163-acre parcel.

For this review we have examined the materials submitted with this proposal, specifically the *Engineering Geology and Preliminary Geotechnical Engineering Study, Proposed Broadmoor Glen Development, Colorado Springs, Colorado* by Kumar & Associates, Inc. In addition, as they were referenced in Kumar's report, we have also reviewed Huntingdon Engineering & Environmental, Inc.'s two reports: *Preliminary Geotechnical Engineering Study, Broadmoor Bluffs Drive, Broadmoor Glen South Subdivision* dated May 12, 1994, and the *Geologic Hazard Study, Broadmoor Glen Development,* dated August 22, 1994. The comments and observations in this

review cover the area delineated in Kumar & Associates, Inc. report, lot configurations in the N.E.S. Inc. development plan last revised December 11, 1995, and a preliminary grading plan dated April 29, 1994. The CGS did not receive or review a Drainage Plan. A site inspection was conducted by this office on May 14 and 17, 1996.

This office is in general concurrence with the final geotechnical report by Kumar & Associates, Inc. They have done an admirable job in the correct identification of the geologic hazards of the site. The Survey is in complete agreement with their Figure 11, Development Constraints Map. In addition, we offer the following observations.

→The grade of Broadmoor Bluff Drive has resulted in substantial excavations along its alignment. Expansive Pierre Shale claystone bedrock is exposed, at road level and in embankment cuts sloping towards the road. All of lots 19-26 and portions of lots 27 - 34 as proposed lie on exposed surface Pierre Shale mostly on the embankment cuts sloping towards Broadmoor Bluff Drive and Alpglen Court. Perched ground water conditions will develop in any soil material (fills, base courses, top soils, etc.) placed on the relatively impermeable weathered claystone. A certain amount of heave in the expansive bedrock can be expected by rebounding effects from the removal of ≤70 feet of overburden and moisture introduction into the now burden-relieved fractures in the bedrock. Such heave will damage pavement and concrete gutters and sidewalks. Moisture introduction into the bedrock may cause sloughing or small earth failures on the ≥30% grade slopes of the embankment. Irrigated lawns and roof storm runoff from downspouts to the soil will worsen the situation. Positive drainage away from roadway subgrade is critical.

15° dip in Kp

→The embankment grade of Broadmoor Bluff Drive adversely affects the lot configurations to the north. Extensive overlot grading and excavation will be required above and on the embankment grade to insure that the building envelopes do not encroach onto the mapped landslide boundary.

→To minimize cut slopes and avoid landslide areas the developer needs to consider deleting Throughglen Circle Road, or redesign access to the potentially developable land in the northern portion of the development. Possible alternatives could be a road access from Broadmoor Bluff Drive that follows the slope contour above the mapped landslide or from below along the intermediate ridge from Kettleglen Drive.

→No drainage study was submitted so, if not done so already, it is advised that basin peak discharge rates be calculated and storm runoff conveyances under Kettleglen Drive and an unnamed access tract be designed so that the building envelopes of lots 81-88 and 77 are not threatened by flash floods or mudflows.

→We reiterate that site specific geotechnical investigations are an absolute must in this development. Unless piles or drilled piers and grade beams are used for foundations we do not recommend that home's foundations bear on laterally differing strata, such as manmade

fill to claystone, or claystone to Verdos Alluvium. More than one investigative boring maybe needed in spread footing foundation design areas for those home footprints on native nonexpansive, granular soils to insure that the soils do not thin or pinch out within the building footprint. The bearing substrate should be inspected by the consultant before foundation construction.

In closing, there are many concerns and unacceptable hazards with the Broadmoor Glen South subdivision as currently proposed. Most of these concerns have been appropriately identified in the latest geotechnical investigation by Kumar & Associates, Inc. Many present lot configurations and roadway designs do not conform with the consultant's recommendations. In known geologic hazard areas a design process that incorporates the geotechnical study is preferable. **The Survey believes that discussing approval of the entire development is entirely premature because of the amount of further study, analysis, and redesign required in the identified problematic areas**. We agree with Kumar & Associates, Inc. that the areas to the east that have been mapped in their Development Constraints Map do have low to very low potential for slope instability. Provided the developer complies with all recommendations of the consultant and heeds the Survey's concerns and addresses them, we believe that development for that eastern area can proceed. Our recommendations is that no home footprint be placed within a mapped landslide area. The developer needs to consider carefully whether to build within the mapped development constraints area. If they do, the commission of additional studies in these problematic areas and re-submittal of a revised development plan is required. A re-submittal for our later review requires:

Redesigned for later date.

1. A design that addresses recommendations, considerations, and suggestions made by the geotechnical consultant and this office. Such redesign must include additional geotechnical study. As stated in the Kumar & Associates, Inc. report, "it is possible some of the areas outside of the identified landslides could include older landslides which are less discernable", and "large changes in the slope geometry created by overlot grading could reactivate slope movements in such a case";

2. A final drainage plan;

3. A revised development plan that includes, in the development constraints areas, precise home site footprint including setbacks for each proposed lot, a current grading plan that includes driveway accesses for all lots, and definitive language to minimize over lot grading, require xeriscape landscaping where ground is to be disturbed, minimize road and individual lot cuts and fills, generally require home design to conform to existing landforms, and provide full, complete disclosure to potential lot and home buyers of the potential geologic hazards specific to the immediate area and the knowledge that ordinary home owners insurance does not include protection from earth creep or landslides.

The City of Colorado Springs should not allow any infrastructure such as roads, gutters, and

sidewalks in this development to be dedicated to the City for a suitably sufficient period of time to insure that damage by heave, swelling soils, or earth movement will not occur. The Survey believes the 18 months stated in the general notes is not adequate time, without guarantees from the developer. If there are any questions or the Survey can be of additional assistance please call this office at (303) 866-2645.

Sincerely,

_____

Jonathan L. White
Engineering Geologist

cc: Robin Kidder, Stormwater and Subdivision Section