



**Kumar & Associates, Inc.**  
Geotechnical and Materials Engineers  
and Environmental Scientists



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November 28, 2006  
Revised January 9, 2009

Mr. Martin List  
c/o First Properties, Inc.  
Attn: Mr. Rich Walker  
PO Box 696  
Colorado Springs, CO 80901

Subject: Revised Geologic Hazard Study, **The Westgate at Powers**, Vicinity of  
Troy Hill Road and Airport Road, Colorado Springs, Colorado

Project No. 062-213.1

Dear Mr. List:

This report presents the results of a revised geologic hazard study for the proposed approximately 68.41-acre development, parcel numbers 6413000093, 6413000094, 6413000105, 6413000118, 6413300022, 6413300024 and 6413300025, located north of the Airport Road and west of Troy Hill Road, Colorado Springs, Colorado. The purpose of the study was to identify potential geologic hazards that could affect the proposed development and to provide conceptual recommendations for the mitigation of potential geologic hazards. This revision is in response to changes in the development plan. Some of our conclusions and mapping are based on our previous Geologic Hazard Study, dated February 24, 2005, for parcel 6413000105. The scope of the study included conducting a geologic field reconnaissance of the site and performing a review of published geologic maps and literature. The project site is shown on the Vicinity Map, Fig. 1.

Proposed Development: We understand the proposed development will occur in several phases and will ultimately consist of constructing approximately a dozen commercial buildings with associated drive and parking areas on the eastern half of the site. We also understand construction on the western half of the site will consist of approximately eight industrial or warehouse buildings and associated drive and parking areas. Additionally, we understand that it is planned to realign Airport Road through the southeastern portion of the site. The proposed development will also include the realignment of the center tributary of Sand Creek into an engineered channel slightly north and west of its current alignment. We understand that JPS Engineering is designing the new channel of the center

**CPC DP 09-00007**

**PLANNER: SCHULTZ**

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tributary of Sand Creek and is addressing erosion and flooding hazards related to the creek. The provided grading plan suggests moderate amounts of cut and fill will be necessary to construct the proposed development. The grading plan also suggests the proposed banks of the center tributary of Sand Creek will slope at approximately 3:1 (horizontal to vertical), and grading elsewhere will range from nearly level to moderately sloping to the southwest.

Regional Geologic Setting: The project site is situated in a portion of the southern half of Section 13, Township 14 South, Range 66 West of the Sixth Principal Meridian, El Paso County, Colorado. The property is located near the western edge of the Colorado Piedmont within the Great Plains Physiographic Province. Structurally this region is located east of the Rocky Mountain Front Range and the Rampart Range reverse fault. This area of Colorado Springs is located near the southern edge of the Denver Basin, a structural depression centered to the north. Sedimentary rocks in this portion of the Denver Basin generally dip gently to the northeast. According to Madole and Thorson (2002), the regional geology in this area of Colorado Springs consists of a paleo-valley which has been buried by alluvium from aggrading streams of upper Pleistocene to Holocene age and Holocene-age eolian (windblown) deposits.

Site Conditions: Airport Road and Troy Hill Road bound portions of the southern and eastern edges of the site, respectively. Vacant land bounds a portion of the northern and western edges of the site. Single-family homes bound a portion of the northern and western edge of the site. A mobile home park is located along a portion of the development's southern and western boundaries. The braided channel of the ephemeral center tributary of Sand Creek enters the northeastern portion of the site just west of a concrete box culvert which carries the creek under Troy Hill Road. This creek meanders to the southwest and exits the southern edge of the property through a sloping culvert below Airport Road. The braided channel of the ephemeral Sand Creek occupies the northwest corner of the subject property.

During our visit to the site on January 6, 2009, we observed the subject site to be relatively unchanged since our previous visit on July 31, 2006. In general, the subject site consisted of vacant land. A large area of man-placed fill was observed west of the creek and east of Troy Hill Road. Smaller areas of man-placed fill were observed on other portions of the property. The materials observed in the larger area of fill consisted of silty to clayey sand with cobble- to boulder-sized clasts of sandstone, granite, concrete and asphalt debris. Much of the other fill identified on the site consisted of smaller piles of concrete, asphalt, wood, plastic, metal and automotive debris.

Topography on the eastern half of the site is undulating due to the man-placed fill and the center tributary of Sand Creek; however, in general, ground surfaces slope gently to moderately to the west and southwest. Topography on the western half of the site slopes gently to strongly to the southwest. Within the area of proposed development, the west bank of Sand Creek is moderately steep and is

approximately 4 feet high. Northwest of the development the banks of Sand Creek range from approximately 2 to 16 feet in height and are moderately steep to near vertical. The east banks of Sand Creek are approximately 2 to 10 feet in height and are steep to near vertical. In this area, there are at least two terraces east of Sand Creek at approximate elevations of 12 and 16 feet above Sand Creek's modern channel. The banks of the center tributary of Sand Creek range from approximately 1 to 14 feet high and are very steep to vertical and are occasionally undercut. Some banks appear to be native soils and others appear to be man-placed fill. Many toppled blocks of soil embankment were observed in the channel of the center tributary of Sand Creek.

Where present, vegetation consisted of grasses, weeds, yucca, cactus and deciduous trees. Parts of the man-placed fill observed on the southern portion of the site were barren. Marshy vegetation at the northwest corner of the site, observed between the active channel of Sand Creek and its eastern bank, consisted of dense grasses, weeds, cattails, willows bushes and deciduous trees. Several areas of standing water were observed near the eastern bank of Sand Creek. No evidence of seepage or bedrock outcrops was observed in the area of proposed development.

Site Geology: The attached Surficial Geologic Map, Fig. 1, depicts the surficial geology at the site. The map is based on a review of published geologic maps, literature and the results of our field reconnaissance.

Scott and Wobus (1973), Robinson (1977), and Trimble and Machette (1979) map the majority of the site as the Piney Creek and Post Piney Creek Alluvium (Upper Holocene). Robinson (1977) identified physiographic floodplain alluvium deposits within and along the channels of Sand Creek and the center tributary of Sand Creek. The Post Piney Creek and Piney Creek Alluvium (Upper Holocene) are composed of gravel, sand, silt, and clay. Recent mapping by Madole and Thorson (2002) shows small amounts of artificial fill related to the channelized streambeds of the Center Channel of Sand Creek near Toy Hill Road and Airport Road. Madole and Thorson (2002) also map three alluvial units of varying age, including Young Alluvium 1 and 2 (late and middle Holocene) and the Middle Alluvium (late Pleistocene), all of which consist of poorly-sorted sand, silty sand, and gravels. Scott and Wobus (1973), Robinson (1977), Trimble and Machette (1979) and Madole and Thorson (2002) map the southeastern edge of the site as bedrock of the Pierre Shale. The Pierre Shale (Upper Cretaceous) consists of marine shale with occasional interbedded sandstone and thin layers of bentonite. Strike and dip measurements mapped by Madole and Thorson and (2002) indicate that bedrock in the vicinity of the subject site dips gently to the northeast.

Our field reconnaissance indicates silty to clayey sand fill with fragments of sandstone, claystone, concrete, asphalt, and other debris are present on portions of the property and are more widespread on the eastern half of the property. Much of the remainder of the site appears to consist of native alluvium consisting of poorly-

graded sand with gravel, silty sand and occasional layers to lenses of sandy clay. We observed an increased amount of fines in the upper 1 to 4 feet of the soils exposed in the majority of the creek banks suggesting that a portion of the near surface soils may be eolian (windblown) in depositional nature. We did not observe claystone bedrock at the ground surface along the southeastern edge of the site as mapped by others. The silty to clayey sand and sandy silt to clay soils observed in the southeastern portion of the site are likely interbedded colluvium, derived from the claystone bedrock and eolian deposits.

Potential Geologic Hazards:

*Flooding:* According to the Federal Emergency Management Agency (1997) "Flood Insurance Rate Map", map number 08041C0753F, portions of the subject site along Sand Creek and the center tributary of Sand Creek are in Zone AE, a special flood hazard area inundated by the 100-year flood. Other flood areas present on the subject site include Zone X (shaded), areas of the 500-year flood, areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from the 100-year flood; and Zone X (unshaded), areas determined to be outside the 500-year floodplain. Additional flood-prone areas not mapped by FEMA exist where we observed flood debris and in areas where the channel of the center tributary of Sand Creek has migrated from its course mapped during the creation of the FEMA map. Areas where we observed flood deposits and debris are shown on Fig. 2 as physiographic floodplain. A hydrologic study should be performed to determine the actual floodplain. The FEMA floodplain boundaries are approximately overlain on the base map as shown on Fig. 3.

*Potentially Unstable Slopes:* We observed evidence of recent erosion, undercutting and regression of the banks of both Sand Creek and the center tributary of Sand Creek. We believe that the banks of Sand Creek and especially those of the center tributary of Sand Creek will be prone to erosion and regression during storm events. The near vertical, vertical and undercut banks have a potential to topple due to a coarse blocky structure within the soils. A previous attempt to stabilize the channel the Sand Creek near Airport Road appears to have failed due to the erosion of its east bank. The channel of the center tributary of Sand Creek appears to have shifted as much as 100 feet to the east at the southern edge of the subject site. Stabilization of the banks of the center tributary of Sand Creek near Troy Hill Road appears to have been successful.

The active channel of Sand Creek occupies approximately the western half of its floodplain and is entrenched below the terraces observed on the western portion of the subject site. Future migration of Sand Creek may bring its channel in contact with the terrace slopes on the east side of the creek, thus posing a greater risk of destabilizing these slopes than it currently does.

*Man-placed Fill:* Areas of man-placed fill, located approximately as shown on Figs. 1 and 2, were observed on the site during our field reconnaissance on July 31,

2006 and confirmed on January 6, 2009. The exact vertical and lateral extent of the fill was not determined on the subject site. The condition and method of placement of the fill is unknown. Structures placed on uncontrolled fill may experience differential settlement causing structural distress.

*Moisture Sensitive Soils and Bedrock:* According to Hart (1974), the site is within an area mapped predominately as soils having a low swell potential. This area generally corresponds to the alluvial deposits observed on the site. Hart (1974) also maps an area of soils and/or bedrock with a moderate swell potential on the southeastern portion of the site. This area generally corresponds to the area mapped as Pierre Shale bedrock by Scott and Wobus (1973), Robinson (1977), Trimble and Machette (1979), and Madole and Thorson (2002). Although not encountered during our field reconnaissance, we anticipate that potentially expansive claystone bedrock of the Pierre Shale may be present at relatively shallow depths on the southeast portion of the site. It has been our experience that eolian soils, such as those identified during our field mapping, may be prone to hydrocompaction or collapse when wetted under load. Foundations and floor slabs may experience distress if they are placed on or near the moisture sensitive soil or bedrock.

*Mine Subsidence:* Amuedo and Ivey (1981), and Turney and Murray-Williams (1983), do not indicate the presence of surface or subsurface mining on or adjacent to the subject site. The nearest mining related hazard, the Hall Slope, is mapped approximately 1.25 miles north of the site.

*Shallow Perched Ground Water:* Hillier and Hutchinson (1980) indicate the subject site is within an area of unconsolidated sediments and that the depth to the seasonal water table generally ranges from 10 feet to greater than 20 feet. Standing surface water was observed near the east bank of Sand Creek. Iron staining was observed in some of the banks of the center tributary of Sand Creek. This suggests shallow perched ground water may be present on the subject site.

*Seismic Hazards:* The Rampart-Range Fault, a high-angle generally north-south trending reverse fault, and the Ute Pass Fault, generally characterized by several northwest-southeast trending reverse faults, are mapped approximately 7.2 miles west and southwest, respectively, of the site. According to the "Preliminary Quaternary Fault and Fold Map and Database of Colorado" by Widmann, Kirkham and Rogers (1998), there is evidence that the Rampart Range Fault may have moved between 600,000 and 30,000 years ago, and the Ute Pass Fault may have ruptured during the last 750,000 years. According to the Colorado Geological Survey (Kirkham and Rogers, 1981), Colorado Springs, should be considered as Zone 2 in the Uniform Building Code (UBC) scheme of seismic zonation.

*Radon Gas:* According to the Environmental Protection Agency (EPA) and the El Paso County Department of Health, elevated levels of radon gas (4 pCi/L or more) have been found in buildings in El Paso County. Radon is a radioactive gas that

forms from the natural breakdown of uranium in soil, rock and water. Radon tends to accumulate in poorly ventilated areas below ground level; however, radon may accumulate inside any above- or below-grade construction. According to the EPA, elevated radon levels in buildings can be reduced by several methods, including pressurization of the building using a heating, ventilating and air conditioning system, sealing of cracks in foundation walls and floor slabs which may allow entry of radon, and using active soil depressurization (ASD) systems.

Conclusions: The potential geologic hazards that may impact the site are those related to the presence of the flooding, potentially unstable slopes, man-placed fill, moisture sensitive soils and bedrock, and shallow perched ground water. The results of this study did not identify other potential geologic hazards that could adversely impact the development.

*Flooding and Potentially Unstable Slopes:* We understand that the center tributary of Sand Creek is to be realigned and will be designed by JPS Engineering. At the time of this report, we have not reviewed the hydrologic study or discussed the channel mitigation proposed by JPS Engineering. We recommend the new channel of the center tributary of Sand Creek be designed based on an adequate hydrologic analysis to safely allow the transmittance of flow through the development. We also recommend that the design include erosion control measures such as riprap armoring, gabions or channel paving. All proposed development should be either raised above the floodplain, protected from flooding by levees, or the new channel should be designed to contain the 100-year flood. Based on our review of the site plan, we anticipate that the potentially unstable banks of the center tributary of Sand Creek will be regraded during the realignment of the creek, the construction of the roadways, and during grading for the development.

Areas within the physiographic floodplain of Sand Creek (at the northwestern corner of the site) are at risk of flooding and erosion. Development within this area should not occur unless the grade is raised above the floodplain and proper channel erosion control measures, such as those listed above, are provided. The channel erosion control measures should also be utilized if development outside the physiographic floodplain is planned near the edge of the channel of Sand Creek.

If measures such as channel armoring are taken to prevent scour of the banks of Sand Creek and the center tributary of Sand Creek, adequate building setbacks, determined based on the bank height and slope, should be provided. If measures to prevent bank erosion are not taken, the required setbacks should be determined by the hydrologic study.

Construction within the floodplains will require a Floodplain Development Permit.

*Man-placed Fill:* The on-site fill appears to have been dumped on the site and should be assumed unsuitable for the support of foundations or floor slabs. Removal of the existing fill and replacement with new structural fill may be used to

mitigate the affects of uncontrolled fill. With the exception of the debris and rock fragments, some of the silty to clayey sand fill identified on the eastern half of the site may be suitable for use as structural fill depending on the materials gradation and swell characteristics which were not tested during this study. Man-placed fill placed on slopes steeper than 4:1 should be benched into the slope.

*Moisture Sensitive Soils and Bedrock:* Potentially expansive soils and bedrock are mapped on the subject site. We also anticipate that soils prone to hydrocompaction may be present on the site. In areas of low to moderately swelling or hydrocompactive soils, these hazards can be mitigated by standard foundation design and construction practices such as overexcavation and replacement with nonexpansive structural fill. If expansive bedrock is encountered at or near the foundation or floor-slab bearing level, standard foundation design and construction methods may be used to mitigate the hazard of expansive bedrock. These methods include the use of straight-shaft drilled piers and structural floors.

*Shallow Perched Ground Water:* If encountered, shallow perched ground water can be mitigated by raising the proposed construction with the placement of fill or by the use of a properly designed subsurface drainage system. All below-grade spaces, such as crawl spaces and basements, should be protected by a perimeter drain.

A completed application form for this geologic hazard report is attached.

Please call us if you have any questions or require additional information.

Sincerely,  
KUMAR & ASSOCIATES, INC.

By   
\_\_\_\_\_  
Christopher A. Jones, E.I., P.G.  
Engineering Geologist

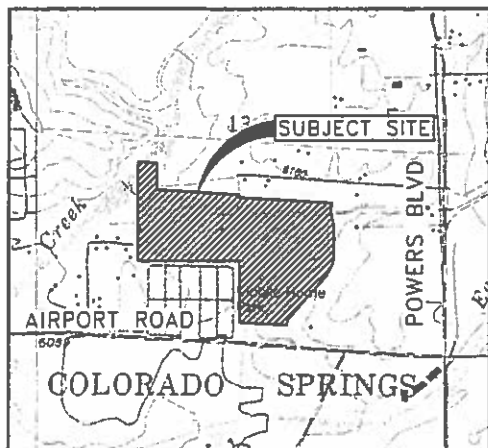
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Attachments

xc: LDC-Inc.; Attn: Mr. Jim Byers

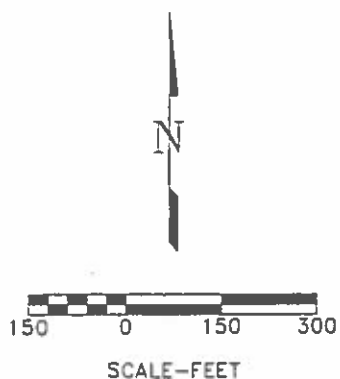
## REFERENCES

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18. White, J.L. and Wait, T.C., 2003, Potential Areas of Landslide Susceptibility in Colorado Springs, El Paso County, Colorado: Colorado Geological Survey, Plate 1 of 3.
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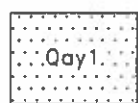

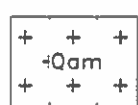






VICINITY MAP  
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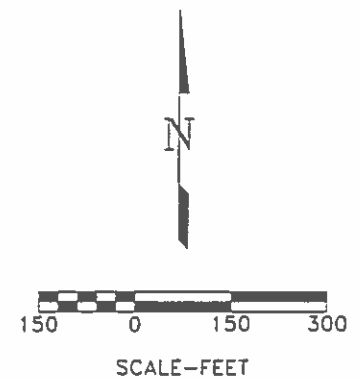


**LEGEND**





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 MAN-PLACED FILL CONSISTING OF SILTY TO CLAYEY SAND AND SANDSTONE, GRANITE, CONCRETE, ASPHALT, WOOD, METAL, AUTOMOTIVE, AND PLASTIC DEBRIS. DEPOSITS OVERLAY THE NATIVE ALLUVIAL AND COLLUVIAL DEPOSITS MAPPED ON THE SITE.
- 
 YOUNG ALLUVIUM 1 (RECENT LATE HOLOCENE) CONSISTING OF POORLY-SORTED SAND, SILTY SAND AND GRAVEL WITH OCCASIONAL COBBLES OR BOULDERS.
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 YOUNG ALLUVIUM 2 (LATE AND MIDDLE HOLOCENE) CONSISTING OF POORLY-SORTED SAND, SILTY SAND AND GRAVEL.
- 
 MIDDLE ALLUVIUM (LATE PLEISTOCENE) CONSISTING OF POORLY-SORTED SAND AND GRAVEL. UPPER PORTION CONSISTS OF SILTY SAND AND IS LIKELY PARTIALLY EOLIAN (WINDBLOWN) DERIVED. CONTAINS MANY SMALL AREAS OF MAN-PLACED FILL.
- 
 INTERBEDDED COLLUVIUM, DERIVED FROM THE PIERRE SHALE BEDROCK AND EOLIAN (WINDBLOWN) DEPOSITS. CONSISTS OF SILTY TO CLAYEY SAND AND SANDY SILT TO CLAY.
- 
 AREA OF STANDING WATER.

**NOTES**

1. BASE MAP PROVIDED BY LDC, INC.
2. SURFICIAL GEOLOGY MAP BASED ON OUR FIELD OBSERVATIONS AND PREVIOUS MAPPING BY MADOLE AND THORSON (2002), AND OUR PREVIOUS STUDY DATED FEBRUARY 24, 2005.
3. ALL BOUNDARIES ARE APPROXIMATE.



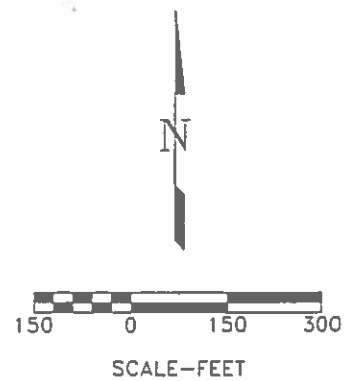
**LEGEND**

-  MAN-PLACED FILL.
-  AREA OF POTENTIALLY SHALLOW CLAYSTONE BEDROCK AND SOIL, AND BEDROCK WITH MODERATE SWELL POTENTIAL.
-  UNSTABLE BANKS. STEEP, VERTICAL AND UNDERCUT BANKS THAT ARE PRONE TO TOPPLING FAILURE.
-  PHYSIOGRAPHIC FLOODPLAIN. INCLUDES THE CHANNEL OF CREEKS, AREAS WITH OBSERVED OVERBANK DEPOSITS, AND MARSHY AREAS.


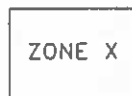
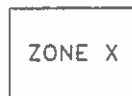
**NOTES**

1. BASE MAP PROVIDED BY LDC, INC.
2. GEOLOGIC HAZARD MAP BASED ON OUR FIELD OBSERVATIONS, PREVIOUS MAPPING BY HART (1974), ROBINSON (1977) AND MADOLE AND THROSON (2002), AND OUR PREVIOUS STUDY DATED FEBRUARY 24, 2005.
3. ALL BANKS ARE SUBJECT TO EROSION AND REGRESSION DURING FLOW IN THE CREEKS.
4. ALL BOUNDARIES ARE APPROXIMATE.
5. SHALLOW GROUND WATER MAY BE PRESENT ON SITE ESPECIALLY EAST OF THE SAND CREEK CENTER TRIBUTARY.

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**LEGEND**

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**ZONE AE** SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD WITH BASE FLOOD ELEVATIONS DETERMINED.
- 
**ZONE X** AREAS OF 500-YEAR FLOOD. AREAS OF 100-YEAR FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE, AND AREAS PROTECTED BY LEVEES FROM 100-YEAR FLOOD.
- 
**ZONE X** AREAS OUTSIDE 500-YEAR FLOODPLAIN.

- NOTES**
1. BASE MAP PROVIDED BY LDC, INC.
  2. FLOODPLAIN BOUNDARIES (ZONE AE AND X) ARE APPROXIMATE AND ARE BASED ON THE FEMA FLOOD INSURANCE RATE MAP #08041C0753F, DATED MARCH 17, 1997.

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LAND USE REVIEW DIVISION  
 PLANNING & COMMUNITY DEVELOPMENT DEPARTMENT



CITY OF COLORADO SPRINGS

APPLICATION FORM FOR GEOLOGIC HAZARD REPORT

Applicant: Kumar & Associates, Inc. Telephone 719-632-7009 Fax 719-632-1049

Address: 6735 Kumar Heights, Colorado Springs, CO Zip Code 80918 e-mail cjones@kumarusa.com

Premises Involved: Development Plan/Subdivision Plat Name: The Westgate at Powers

Tax Schedule No(s). 6 4 1 3 0 - 0 0 - 0 9 3, 6 4 1 3 0 - 0 0 - 0 9 4  
6 4 1 3 0 - 0 0 - 1 0 5, 6 4 1 3 0 - 0 0 - 1 1 8, 6 4 1 3 3 - 0 0 - 0 2 2,  
6 4 1 3 3 - 0 0 - 0 2 4, 6 4 1 3 3 - 0 0 - 0 2 5

(This can be obtained from the El Paso County Tax Assessor located at 27 E. Vermijo Avenue on the 2<sup>nd</sup> Floor; phone: 520-6600 or at their web site <http://www.co.el-paso.co.us/assessor>)

**GEOLOGIC HAZARD REPORT REQUIRED: (FIVE (5) PRELIMINARY COPIES)**

An application review fee will be required to accompany these applications (make checks payable to City of Colorado Springs). The fee schedule is as follows:

<b>Review of Geologic Hazard Reports</b>	<u>City Planning Fee:</u> \$300 plus any Colorado Geological Survey Review Cost Over \$300
	<u>City Engineering Fee:</u> \$252

The following documents have been included and considered as part of this report (checked off by individual(s) preparing the geologic report):

Development Plan:  X

Landscape Plan (if applicable): \_\_\_\_\_

Grading Plan:  X

Drainage Report (necessary if debris and/or mud flow hazard is present): \_\_\_\_\_

**ENGINEERS STATEMENT**

I hereby attest that I am qualified to prepare a Geologic Hazard Study in accordance with the provisions of Section 504 of the Geologic Hazards Ordinance of Colorado Springs. I am qualified as:

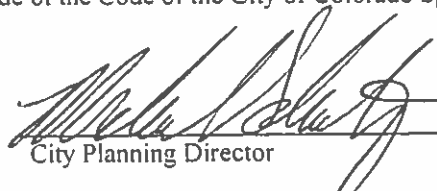
X  Professional Geologist as defined by CRS 34-1-201(3); or,

\_\_\_\_\_ Professional Engineer as defined by Board Policy Statement 50.2 - "Engineering in Natural Hazard Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. Board authority as defined by CRS 12-25-107(1).

Submitted by: Kumar & Associates, Inc.  Date: January 9, 2009

This Geologic Hazard Study is filed in accordance with the Zoning Code of the Code of the City of Colorado Springs, 2001, as amended.

  
 City Engineer 12/8/09  
 Date

  
 City Planning Director 12/3/09  
 Date