Utah Geological Survey

Project: Review of geotechnical investigation, Rhodes Condominium building, Provo, Utah County, Utah			Requesting Agency: City of Provo
By: Richard E. Giraud	Date: 08-06-99	County: Utah	Job No: 99-16 (R-15)
USGS Quadrangle: Orem (1088)		Number of attachments: None	

INTRODUCTION

At the request of Dave Graves, Provo City Project Engineer, I reviewed a geotechnical report by RB&G Engineering, Inc. (RB&G, 1999) for the Rhodes Condominium building. The site is located at 5600 North Canyon Road in Provo, Utah, in the SW 1/4 SW1/4 section 7, T. 6 S., R. 3 E., Salt Lake Base Line and Meridian. I received the report on June 30, 1999. The purpose of this review is to evaluate if geologic hazards were adequately addressed. The scope of work for the review included a literature review and inspection of soil and geologic maps, Utah County natural-hazard overlay maps, and Provo City geologic-hazard maps. I visited the site on August 3, 1999 with Gary Christenson of the Utah Geological Survey. Recommendations pertaining to foundation design and site grading should be reviewed by a qualified geotechnical engineer.

RB&G (1999) addresses problem soils, shallow ground water, surface fault rupture, and slope stability. The report recommendations concerning these hazards are adequate. However as I interpret the site plan and slope profiles, to have enough space at the base of the slope for the building and parking lot, the final cut slope will need to be steeper than the evaluated slope. If this is the case, additional slope stability study may be necessary depending on final slope grade. In addition, debris-flow, alluvial-fan-flooding, and rock-fall hazards may exist at the site but were not addressed.

SURFACE FAULT RUPTURE

RB&G (1999) inspected a fault trench across the building's footprint that was excavated because a fault is shown on the Provo City geologic-hazard maps (International Engineering Company Inc. [IEC], 1984). No trench log was included, and RB&G states that, although no evidence of faulting was found, their study was not conclusive in discounting faulting at the site. Although IEC (1984) shows a fault at the site, the most recent mapping by Machette (1992) shows the nearest trace of the Wasatch fault approximately 4,500 feet east of the site, placing the site outside of the Utah County fault-rupture overlay zone (Robison, 1990). Based on this and the apparent lack of faulting in the trench, I do not believe further fault investigations are necessary.

SLOPE STABILITY

The site is within Utah County's landslide-hazard overlay zone (Robison, 1990) and a potential landslide area on the Provo City geologic-hazard maps (IEC, 1984). The RB&G (1999) investigation shows soils at the site to be thick unstratified gravel with no silt or clay beds. RB&G states that, based on their experience with gravel soils, a slope of 2.2H:1V will be stable under normal wetting conditions with a factor of safety greater than 1.5. I agree, and only add that allowance must also be made for raveling of the slope if it is not vegetated. However, to accommodate the proposed building and parking lot footprints shown on the site plan (figure 1), the final cut slope (figure 3) would need to be steeper than 2.2H:1V. I recommend showing the building and parking lot on the final cut slope drawing. If the final cut slope is steeper than 2.2H:1V, a slope-stability evaluation may be necessary depending on final grade of the gravel slope.

DEBRIS FLOWS AND ALLUVIAL-FAN FLOODING

The site is within the Utah County debris-flow hazard overlay zone (Robison, 1990). Machette (1992) maps young fan alluvium (Holocene to uppermost Pleistocene) upslope of the site, consisting of pebble and cobble gravel in a matrix of sand and minor clay. The fan alluvium is deposited by intermittent stream flow, debris floods, and debris flows. RB&G (1999) does not discuss the geologic origin of gravels at the site (for example, whether they are debris-flow/alluvial-fan deposits, hillslope colluvium, or Lake Bonneville deposits), so I do not know if recent sedimentation events have affected the site in the geologic past. Also, there is no discussion drainages east of the site and their potential to produce debris flows or flooding during rapid snowmelt or intense rainfall. If debris-flow/alluvial-fan deposits are present at the site, I recommend the debris-flow and alluvial-fan-flooding potential from drainages and slopes east of the site be evaluated and mitigation measures, if necessary, be incorporated into site drainage design. Site drainage design must consider runoff from the hillslope and drainages east of the site. Swenson and others (1972) indicate that site soils are erodible, so soil erosion by floodwaters particularly during site preparation and construction should also be addressed.

ROCK FALL

The site is within a rock-fall hazard overlay zone (Robison, 1990) and rock-fall clasts were observed east of the site, indicating a potential for rock fall from the slopes east of the site. No comments are made regarding the presence of rock-fall sources or clasts east of the site. I recommend that the rock-fall hazard be evaluated in terms of identifying potential rock-fall sources, travel paths, and runout areas.

SUMMARY AND RECOMMENDATIONS

RB&G's (1999) recommendations for problem soils, shallow ground water, and surface fault rupture are adequate; however, additional evaluation of slope stability may be necessary, and the

potential debris-flow, alluvial-fan-flooding, and rock-fall hazards must be addressed. I recommend the following:

- If final cut slope is steeper than 2.2H:1V, a slope stability evaluation may be necessary depending on final slope grade. Also, raveling of gravel slopes must also be considered if they are not vegetated.

- Define the origin of gravel deposits at the site and, if debris-flow/alluvial-fan deposits are present, assess the hazard by estimating the frequency and volume of flows, travel paths, and flow depths. These data must be incorporated into site drainage design or other hazard-reduction measures, where pertinent. The drainage design must consider runoff from the hillslope and drainages east of the site. Potential erosion from floodwaters, particularly during site preparation and construction, should also be addressed.

- Evaluate the rock-fall potential from slopes east of the site and provide recommendations for hazard-reduction measures, if necessary.

I recommend that setbacks, hazard areas, and protective structures, determined from the above hazard evaluations, be shown on the site map. Specific recommendations and restrictions pertaining to site design should be included in the report. All conclusions and recommendations must be supported with evidence. The hazard evaluations should be performed by a qualified engineering geologist, hydrologist, and/or geotechnical engineer, as appropriate. I also recommend that the RB&G (1999) report, this review, and any subsequent geologic-hazards reports and reviews for this site be disclosed to future condominium lot and/or home buyers.

REFERENCES

International Engineering Company Inc., 1984, Provo geological hazard study: San Francisco, California, unpublished consultant's geological hazard maps for Provo City, 24 p. pamphlet, scale 1:1,200.

Machette, M.N., 1992, Surficial geologic map of the Wasatch fault zone, eastern part of Utah Valley, Utah County and parts of Salt Lake and Juab Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-2095, 26 p. pamphlet, scale 1:50,000.

RB&G Engineering, 1999, Geotechnical investigation, Rhodes Condominium building, 5600 North Canyon Road, Provo, Utah County, Utah: Provo, Utah, unpublished consultant's report for Jack Rhodes, Real Properties, L.C., 9 p.

Robison, R.M., 1990, Utah County natural hazards overlay (NHO) zone, southern Utah County: unpublished Utah County Planning Department maps, scale 1:50,000.

Swenson, J.L., Jr., Archer, W.M., Donaldson, K.M., Shiozaki, J.J., Broderick, J.H., and Woodward, Lowell, 1972, Soil survey of Utah County, Utah, central part: U.S. Department of Agriculture Soil Conservation Service, 161 p.