CITY OF CLAYTON

OAKHURST GEOLOGIC HAZARD ABATEMENT DISTRICT

NEWSLETTER

MARCH 21, 2001

As you may recall, last May you received an updated GHAD newsletter with the invoice for your Fiscal Year 1999-2000 assessment, a copy of that newsletter is attached. The City's commitment to keeping GHAD residents abreast of recent developments in (and underneath) the Oakhurst subdivisions merits the release of another newsletter at this time.

Background

As we mentioned in our previous newsletters, the storms of February 1998 affected several areas of the Oakhurst development. The "El Niño" rains saturated our hillsides, causing landslides above Obsidian Court and the 16th Hole of the Oakhurst Country Club as well as movement in the hillside above Antelope and Tuyshtak Courts. Since 1998, rainfall and landscape irrigation have contributed to hillside movement. We performed several surveys in the Eagle Peak subdivisions, documenting both horizontal and vertical movement of survey points as well as visual evidence of movement, such as pavement separating from the curb and gutter, sidewalk panels popping, and driveways heaving or separating from garage slabs or sidewalks. There was also evidence of soil movement in other areas of the development, including the Windmill Canyon and Falcon Ridge subdivisions.

Between March and May 2000, the Engineering Department and Berlogar Geotechnical Consultants, a soils expert retained by the City, performed a baseline survey and inspections for visible signs of soil movement throughout many areas of Oakhurst in order to track any future movement. The GHAD Board of Directors also authorized the installation of eight inclinometers in strategic locations in the Eagle Peak subdivision area and along Keller Ridge Drive to monitor underground movement. Finally, we informed you in our May 2000 newsletter that the City of Clayton intended to file a lawsuit against Presley Homes and other potentially responsible parties seeking damages to repair *City* property. This lawsuit was filed on June 20, 2000, and is currently in the preliminary stage as of this writing.

Recent Developments

The baseline survey was completed during the first week of April 2000. These results were compared with past surveys and indicated a range of movements of one to five inches horizontally and one to two inches vertically over a period of approximately two years. We have now added more survey monitoring points in order to broaden the database for future surveys.

In June 2000, the aforementioned inclinometers were successfully installed at various depths between 126½' and 151½' beneath the surface. In order to allow the slope indicator casings to "settle in" and to increase the accuracy of future readings, the soils engineers waited until July 25, 2000 (roughly one month after installation), to take baseline readings from the inclinometers. The first set of inclinometer readings was obtained on October 25, 2000.

Soils engineers again performed visual inspections of the development in November 2000 and compared the results with those of the inspections completed the previous March. There was little or no indication of on-going movement in the Eagle Peak and Falcon Ridge subdivisions; however, significant indications of on-going movement *were* observed in the Windmill Canyon, Units 2 and 3, subdivisions. These indicators included the reopening and/or extension of sealed cracks in the streets, development of new cracks, and bulging of the asphalt pavement where the street meets the curb and gutter.

Last December, after review of the data obtained from the slope indicator readings and visual inspections, we resurveyed surface monuments in the areas where visual indications of movement were observed and compared the results with April's baseline survey. Finally, a second set of inclinometer readings was taken on January 25, 2001.

Results of the Data Collected

Unfortunately, the data and observations collected thus far *are* cause for concern for Oakhurst residents. Currently, we are still unable to accurately determine the geographic limits of the earth movement. Therefore, it is impossible to single out certain areas as "stable" or "unstable" at this time. However, comparison of the survey data recorded in December 2000 with the April 2000 baseline data specifically indicates incremental horizontal movements typically ranging between ½" and 1", and vertical movements typically ranging between ¾" and 1¼".

The slope indicator data is inconclusive at this time but it does appear that there has been movement beneath the surface in at least three of the eight locations at varying depths.

The horizontal and vertical movements defined by the survey data are the clearest evidence of ground movement in the area. While the visible indications of movement observed in the field are a more subjective form of evidence, these observations of apparent movement are consistent with the data collected from the surveys and inclinometers.

In the opinion of our soils engineers, the movements indicated by our monitoring are tending to be on the "high side" when compared to similar hillside developments.

The Next Step

More data from future surveys and slope indicator readings should provide a better understanding of the cause(s) and extent of the ongoing movement. However, the amount of movement documented in the past year forces us to consider possible remedies *now*, before the effects of unabated movement become more severe. These ground movements, if not addressed, may have the potential to cause extensive damage to both houses and the public infrastructure.

Please be aware that there *are* ways to deal with ground movement to one degree or another. The three basic approaches recommended by soils engineers to address ground movements are earthwork, structural (steel and concrete), and dewatering, with each option having its own benefits and drawbacks.

It is unlikely that an earthwork solution will be viable in our situation because the data collected thus far suggests movement throughout the developed area, including cut areas (areas in which earth was *removed* during the initial grading phase in the late 1980's), fill areas (in which earth was *added* during initial grading), and, presumably, the intervening natural ground as well. Furthermore, there does not appear to be enough unimproved area, free of infrastructure and housing, to allow an earthwork approach.

A structural solution, utilizing conventional concrete and steel reinforcement, could possibly remedy the situation, but would be extremely expensive due to the scale of the movement area.

In the opinion of our soils engineers, the only viable alternative that may reduce future movement is dewatering, a technique that would most likely involve the installation of water wells and horizontal drains (called hydroaugers) to extract ground water. Horizontal drains consist of upwardly-inclined drill holes (into upslope areas) approximately three inches in diameter used for the installation of ±1½"-diameter slotted pipe to provide drainage relief. Because they utilize the force of gravity, horizontal drains do not require pumping. Vertical wells, on the other hand, consist of vertically drilled holes several hundred feet in depth in which a well casing containing a submersible pump is installed to extract water. While the dewatering process is not expected to yield large quantities of water, it should provide some relief of the build-up of ground water pressure. Similar programs have been employed in the Blackhawk GHAD and the Canyon Lakes GHAD since 1986, with good results.

The cost for this alternative has been estimated at $1,000,000 for installation and $50,000 annually for operation and maintenance. While the actual effectiveness of dewatering is uncertain at this time, the cost required to exercise this option, when compared to the expense of earthwork or structural solutions and the potential damage to structures and property values, makes this alternative worth considering. However, the currently approved homeowner assessments provide an income of approximately $25,000 per year

to the GHAD. Obviously, the GHAD does not have adequate funds to implement this action at this time.

Under the best of circumstances, even if dewatering stabilizes the area under normal conditions, there would likely still be some risk of permanent ground deformations in the case of a major earthquake. Currently there is insufficient data to estimate the effects of a seismic event but a detailed investigation may be performed at some point in the future, if adequate funding becomes available.

The dewatering measures recommended above are still very much in a conceptual phase and are subject to revision and refinement in the near future. In the interim, the GHAD will continue to perform routine maintenance duties and will carefully monitor the entire development for future movement by performing regular field inspections, surface monument surveys, and slope indicator readings. These steps should help us to better define the areas affected by ground movement and the rate of movement; perhaps most importantly, continued monitoring will help our engineers to evaluate whether or not more aggressive measures must be taken either locally or throughout the development.

As more information develops, we will try to keep you informed.