**Tom Connelly**

| | |
|---|---|
| **From:** | Sandin Phillipson <sedphil24@comcast.net> |
| **Sent:** | Thursday, August 15, 2019 1:44 PM |
| **To:** | Tom Connelly |
| **Cc:** | Wendy Scatterday |
| **Subject:** | GC&P Development-Planning Commission Invited Comments |
| **Attachments:** | Planning Commission Cover Letter.doc; Slope Stability of the Ridge.doc; Mine Subsidence.doc |

Dear Mr. Connelly,

In response to your invitation to the public to submit concerns via e-mail regarding GC&P Development, LLC's proposal to construct a mixed use village adjacent to Woodsdale, with attendant zoning change and change of the current land designation in the Wheeling Comprehensive Plan, I offer the following three attached documents. The summary of concerns may be found in the Word Document "Planning Commission Cover Letter" with additional supporting discussion of slope stability and previous mining beneath the footprint of the proposed project found in the associated documents. I also copy Wendy Scatterday, the Woodsdale 4th Ward representative, also a member of the Planning Commission.

Please contact me if you have questions regarding the attached. I may provide additional information prior to September 9 if the geotechnical analyses discussed at the Planning Commission meeting on August 12 become available. I have not as yet seen that such information has been posted in the SAP folder.

Sincerely,

Sandin Phillipson
24 Shady Street
Wheeling, WV 26003
304-218-9975

# SANDIN E. PHILLIPSON, PH.D.

24 Shady Street
Wheeling, WV 26003
304-218-9975


August 16, 2019

**Mr. Tom Connelly**
Planning Commission
1500 Chapline Street, Suite 305
Wheeling, WV 26003
304-234-3701

Dear Mr. Connelly,

After attending the August 12, 2019, meeting of the Planning Commission and reviewing the available material relevant to the proposal from GC&P Development, LLC (Applicant) regarding revision to Wheeling's Comprehensive Plan and consideration of zone change to facilitate their construction of a mixed use village adjacent to Woodsdale, I, as a resident of Woodsdale, have several concerns that I believe should be considered by the Commission. Given the state of the Applicant's submittal, I believe the current Comprehensive Plan designation for Parcel W26-90, W26-90.2, and W32-99.2 is appropriate and should not be changed. The Applicant's submittal package fails to address several important considerations, as described below.

The Applicant does not address the potential for slope instability on the south side of the ridge, which lies adjacent to Woodsdale. Further discussion of the potential for slope instability is included in the attached document entitled "Slope Stability of the Ridge Bounded by Woodsdale, Waddles Run, and SR88." The Applicant has not clarified what safety precautions will be implemented to protect adjacent property owners on the south side of the ridge from mountain top removal and related excavation, which could place downslope homes at risk of damage from soil movement, runoff, and dislodged rock. It should be noted that residents along Edgwood Street have experienced major flash flooding runoff events in recent years, as documented on local news coverage, which bears a temporal and perhaps causative relationship with denudation of the ridge top and cutting of new access roads into the top of the southern slope.

The Applicant does not address the potential for mine subsidence. Further discussion of this issue is included in the attached document entitled "Previous Mining and Mine Subsidence Potential." The entire ridge, including the portion proposed for future development, is underlain by old mine workings in the Pittsburgh Seam. This is particularly important in that the point of the proposed project is the construction of numerous buildings, but if those buildings are at risk of structural damage, all that goes before it will have been wasted effort while possibly already having inflicted irreparable harm on adjacent properties and municipal infrastructure.

The Applicant has not clarified whether the highwall will terminate at the boundary line with adjacent property owners, or will be set back to avoid disturbance of adjacent property through gradual erosion and sloughing of unstable rock. It will be noted that the highwall approaching a height of 200 feet will constitute a potential danger, could lead to erosion and loss of adjacent property, and may therefore infringe on adjacent property owners' expectations to enjoy use of their own property. The Applicant has not provided a geotechnical assessment to justify the stability of the highwall design. Although the Applicant referenced the acquisition of core sample testing, the results of which have not yet been made available, the information available for core samples does not constitute a highwall stability assessment. The Applicant's animation video portrayed a nearly vertical, smooth highwall, which is at variance with existing practices in which the overall highwall angle is based on an assessment of rock strength, RQD, joint and bedding orientation, and shear strength of existing fractures. Improperly designed highwalls are at risk of failure, with numerous illustrative examples available from open pit mines. Further, highwalls incorporate benches to improve overall stability and catch spalling material. No such features were apparent on the Applicant's video presentation or design maps.

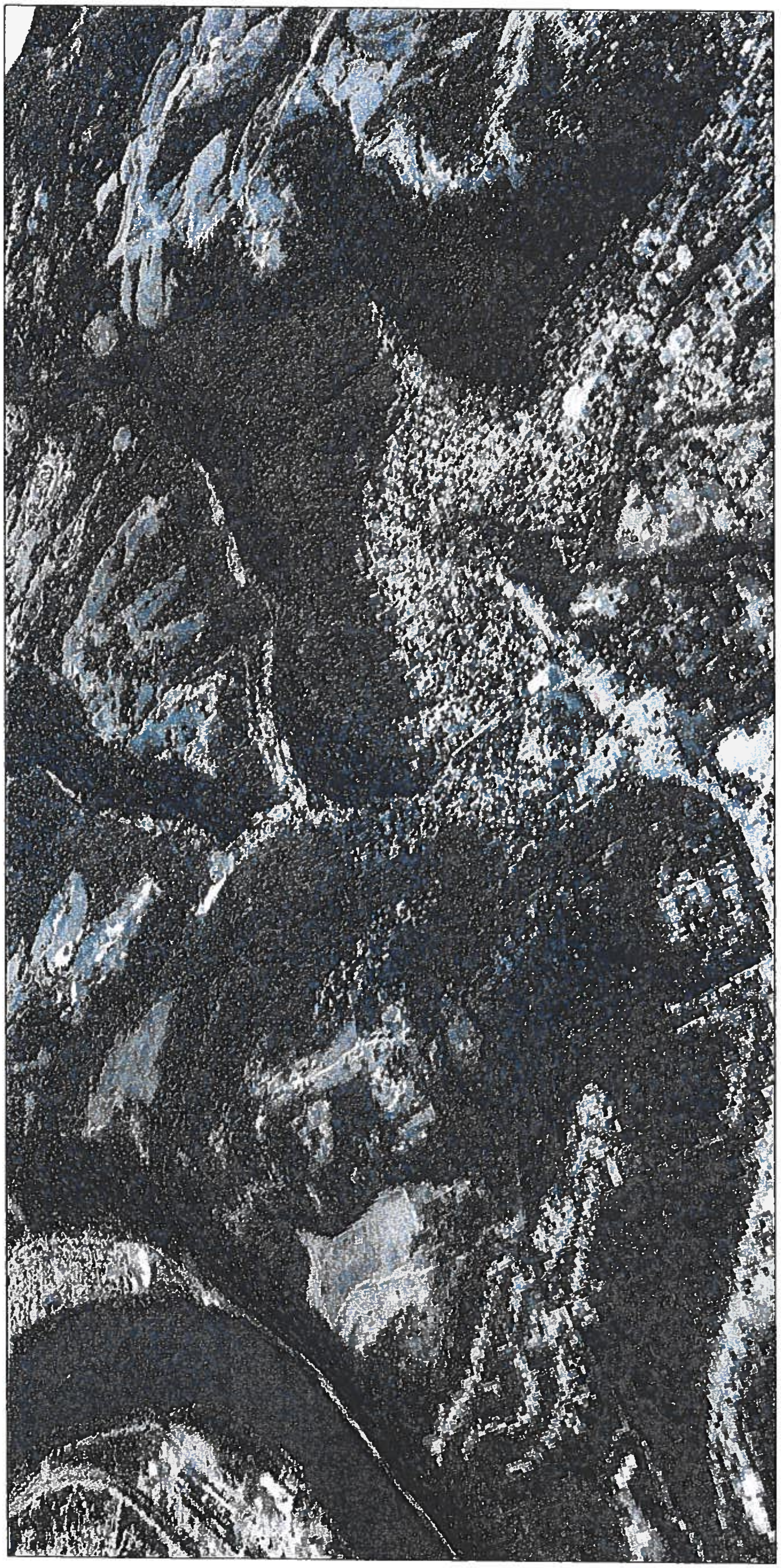
Finally, the Applicant states that the project will require the removal of 9,000,000 cubic yards of overburden, but it does not appear that the implications for such activity have been thoroughly considered. The sheer magnitude of this activity is difficult to envision, but essentially represents that akin to an open-pit mine. Consider that a standard dump truck rated for highway use has a capacity up to 15 cubic yards, though may be unable to carry that much weight on public roads in accordance with Department of Transportation regulations, depending on density of hauled material. To move 9,000,000 cubic yards off the property would require 600,000 dump truck loads. In actuality, incorporating a conservative bulking factor of 25%, reflecting the expansion of in-place material when excavated, a more realistic estimate would be that 750,000 dump truck loads would be required to move the 11,250,000 cubic yards resulting from excavation. In other words, State Route 88 would be subjected to 1,500,000 dump truck trips over and above existing traffic flow, representing the outbound and return trips to and from the property. Stated another way, assuming the Applicant has sufficient capacity to allow one loaded dump truck to leave the property every 5 minutes, 24 hours per day, 7 days per week, it would require 5.7 years of round-the-clock mining to remove the given volume of overburden. The use of the term "mining" with its implications of massive equipment and large-scale excavations is intentional and appropriate to describe the proposed activity. Thus, the required activity has implications for noise, dust, and heavy truck traffic within city limits on a scale that is unlikely to have been considered or even conceptualized, and that may be inappropriate given the adjacent residences and existing transportation infrastructure.

Please do not hesitate to contact me if you or members of the Planning Commission require additional information or clarification regarding these concerns.

Sincerely,

Sandin E. Phillipson, Ph.D.

Slope Stability of the Ridge
Bounded by
Woodsdale, Waddles Run, and SR88



**Background**

The ridge bounded by the Woodsdale neighborhood, Waddles Run, and State Route 88 is dominated by land parcels W26-90 and W32-99.2 (Figure 1). The ridge has a maximum width of 245 feet over a length of 900 feet, representing a relatively flat 7 acres along the spine before transitioning to precipitous grades in all directions. The steep slopes are likely to have inhibited previous development.

Steep slopes represent a difficult construction terrane for reasons other than the physical operating demands of equipment. As highlighted in the National news by the complete destruction of the community of Oso, Washington, steep slopes represent an inherently unstable environment. This inherent instability was recognized by the West Virginia Geological and Economic Survey (WVGES), which conducted a state-wide study of slope stability in 1976 in order to provide West Virginia homeowners and the State Government with information to guide purchasing and remediation decisions (Lessing et al., 1976). Figure 2 represents an excerpt from landslide mapping performed on the Wheeling 7½-minute quadrangle that characterizes the ridge bounded by Woodsdale, Waddles Run, and SR88 as a "slide-prone area" that was judged to be unstable due to the previous occurrence of landslides, the presence of incompetent rock and soil, and a steep slope. The 1976 study identified landslides that had already occurred on the north and south slopes of the ridge. As will be discussed subsequently, the map presciently and accurately predicted the potential for landslides.

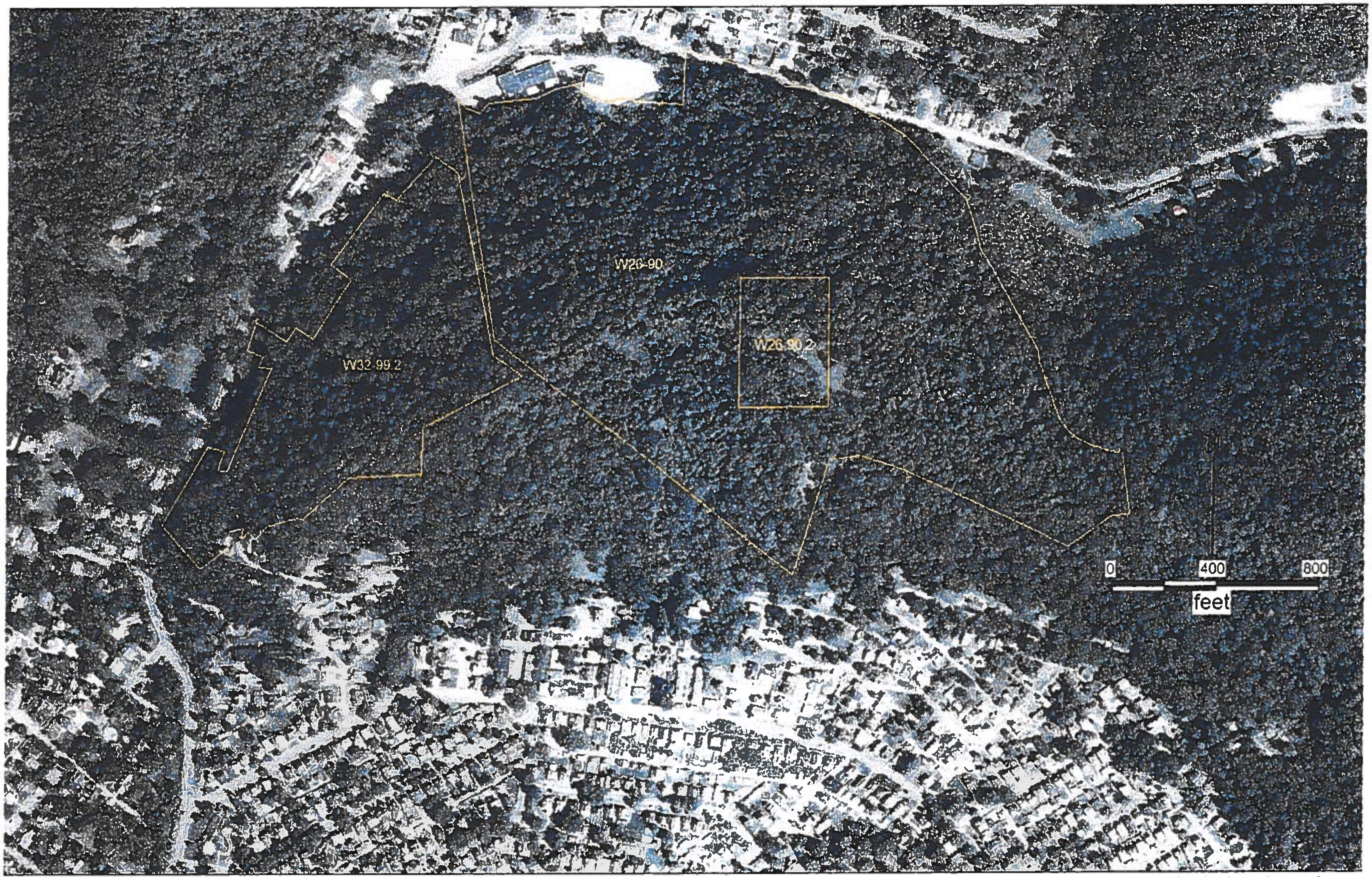



Figure 1. Parcel outlines are shown in relation to the ridge bounded by Woodsdale, Waddles Run, and SR88. Parcel W26-90 includes the spine of the ridge and a significant portion of the slope facing Woodsdale, and comes within 100 feet of Orchard Lane where the slope is 30°. The edge of parcel W32-99.2 coincides with the spine of the ridge.

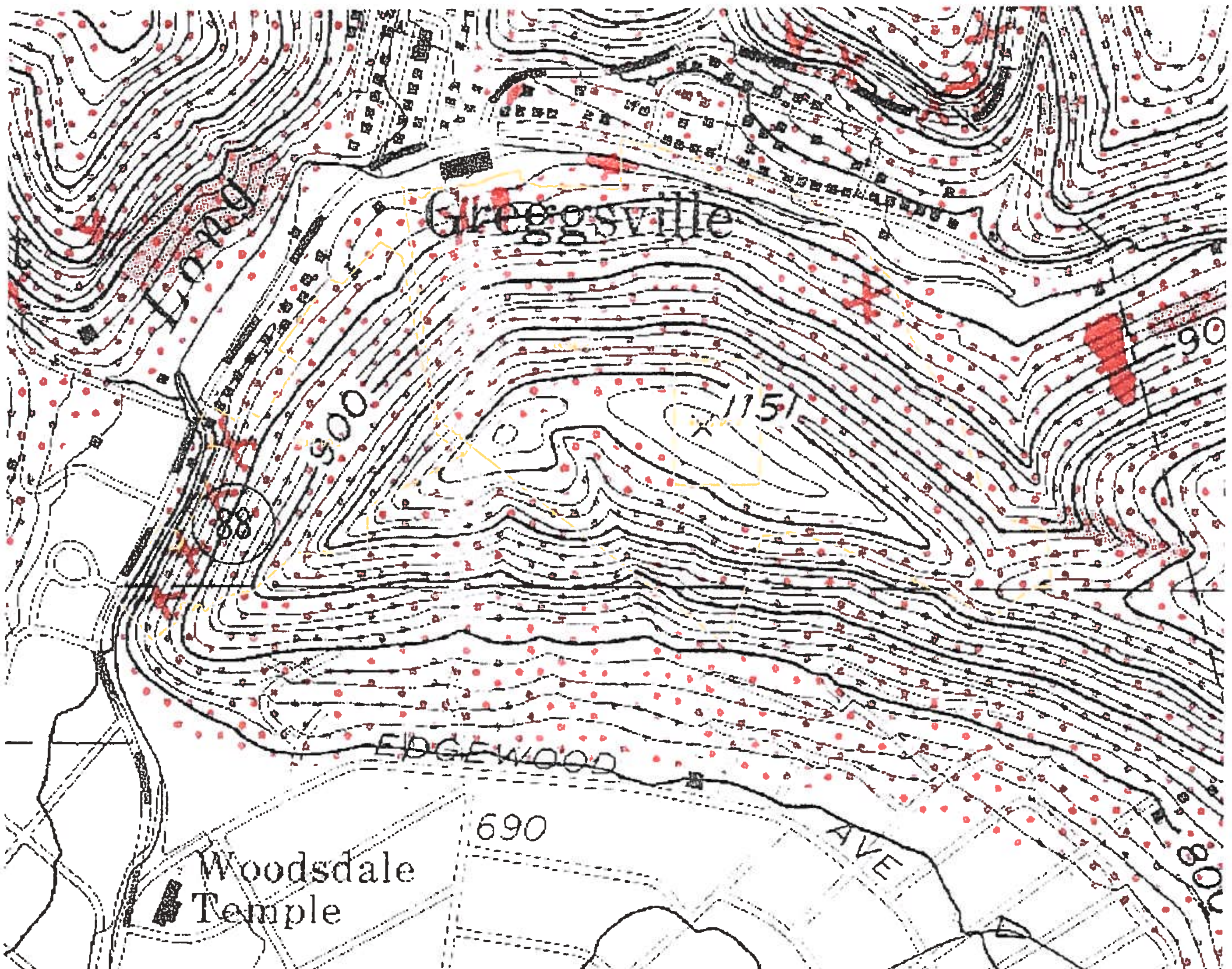



Figure 2. The north, south, and west slopes of the ridge were classified as slide-prone and judged to be unstable by Lessing et al. (1976) as represented by stippled pattern. Pink areas represent older landslides; large red X's represent rock falls; red areas represent recent landslides as of 1976. Parcel outlines are shown for comparison.

All downslope movements, regardless of rate, are referred to by the term "mass wasting," while the popular term "landslide" is used in a loose way to refer to any style of rapid downslope movement. Three factors are involved in defining a particular kind of mass movement: the rate of movement, whether the mass moves as a coherent body or is disturbed during movement, and the amount of water in the mass. "Creep" is the slowest form of mass wasting, and represents the slow downhill movement of regolith (that is, the unconsolidated material above bedrock, which may be different than soil) by continuous rearrangement of particles with only minor amounts of water. An "earthflow" is a sluggish, erratic flow of clayey or silty regolith down relatively gentle slopes, with water present but not to the point of saturation. Earthflows can sometimes by recognized by a curved scarp that develops at the breakaway line on the slope and by the crescent-shaped bulges at the convex toe of the flow. Earthflows or mudflows result when the water content in the slope material permits it to flow as a plastic or viscous material, and commonly result where the weathering of shale has defined clay-rich soil that is poorly drained. Failures characterized by slump blocks at the head may also be characterized by earthflows at the foot. A "slump" is a form of slide motion in which a mass of regolith slips along a concave surface while at the same time rotating backward. As a result, the upper surface of the slump block may be tilted back into the slope. Slumps occur along discrete slips or shear surfaces, and the bulk of material is detached as an individual block or series of blocks bounded by a series of parallel normal faults that bend into an underlying failure plane (Figure 3). Surface cracks usually delineate the head and sides of the slump. Due to downslope movement, the head of the slump is characterized by a depression while the foot is characterized by a zone of uplift. "Sheet flow" represents a style of mass wasting in which a thin sheet of flowing water forms on slopes when rain falls faster than the soil can absorb it, or when the ground is already saturated. The sheet picks up and transports small particles. Slopes on which the vegetation cover has been removed by construction practices are highly susceptible to sheet flow erosion. Sheet flow does not continue indefinitely and eventually forms rills and gullies.

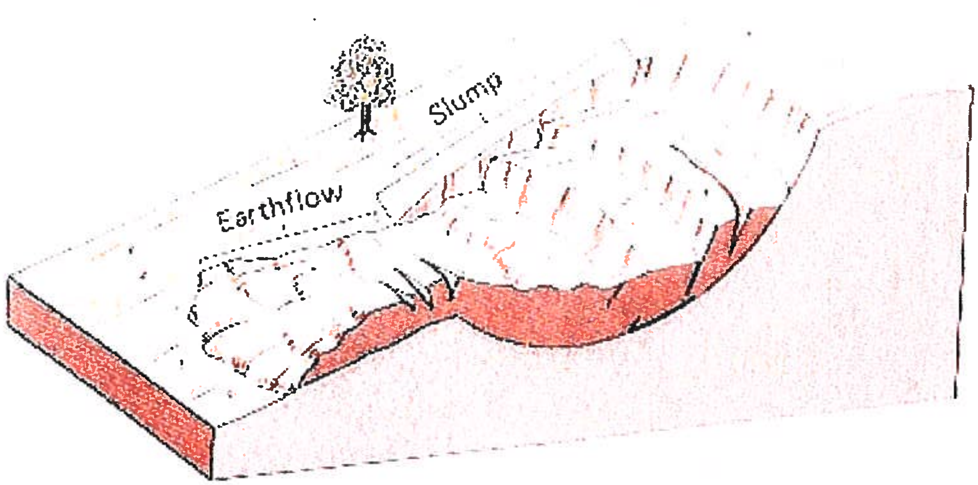


Figure 3. Diagram of a typical slump, showing rotation down-slope and formation of an earthflow at the toe.

Although downhill movement is ultimately induced by gravity, the steepness, component of earth materials, water content, and nature of vegetation on the slope not only influence the susceptibility of an area to mass wasting, but also influences the speed and frequency of such movements. Some kinds of rocks and even certain unconsolidated material are inherently better able to stay in position on a slope. For example, clay becomes plastic and weak when it absorbs water, thereby adding weight and acting as a lubricant. The degree of uniformity of grain size and the presence of root networks affect the ability of coarse materials to keep their position on a slope. Water increases the possibility for mass wasting by adding weight, contributing to buoyancy, and decreasing the cohesion of clay minerals. Plants are able to protect soil and regolith against erosion and contribute to the stability of slopes by binding soil together within root systems. In areas where plant cover is sparse, mass wasting may be enhanced, particularly if slopes are steep and water is readily available.

Conditions favoring mass wasting may exist for a long time without occurring, until triggered by some mechanism such as excavation at the toe, overloading, reduction of friction, or vibrations. The base of a slope acts as a buttress for overlying materials, and its removal during construction can trigger failure. Overloading refers to placing added weight in the form of excavated material or even buildings onto meta-stable slopes. Rainwater seepage also adds weight while reducing friction and shear strength. The presence of vegetation, such as trees, is one of the most common, widespread examples of how meta-stable slopes can be stabilized naturally because the roots bind soil particles together, physically impeding their progress down-slope, and remove excess moisture from the soil by transpiration. Trees on a hillside promote slope stability through deep and extensive roof systems, which tend to prevent landslides (Lessing et al., 1976). The removal of water by vegetation also lowers weight and excessive water pressure, thereby aiding cohesion. Where vegetation is removed by logging or other activities, slides are often initiated after periods of heavy rainfall.

**Observations**

The average slope for various segments of the ridge bounded by the Woodsdale neighborhood, Waddles Run, and State Route 88 can be determined by inspection of a topographic map and noting the change in elevation contours over a specified linear distance. The north side of the ridge, that facing Waddles Run and Greggsville, is characterized by a slope of 24° (44% grade) as measured from the edge of the "flat" top to the Waddles Run flood plain. The west side of the ridge, adjacent to SR88, is characterized by a slope of 25° (46% grade). The south side of the ridge, that which bounds the neighborhood of Woodsdale, is characterized by a slope of 30° (58% grade). For comparison, the steepest slope upon which homes in the Woodsdale neighborhood were built, which appears to represent the only historical precedent for building on steep hillsides in this area, is 16° (28% grade).

The southern and western slopes are perhaps the most critical because approximately three-dozen homes lie along the base of the ridge, with the rest of the neighborhood of Woodsdale spread out in the valley below to the south in close proximity. The "angle of repose" of sand, gravel, and wet earth, representing a proxy for natural materials already found on the hillsides, is 20-30°. That is, these natural earth materials cannot be piled higher than at an angle of 20-30° before they flow under the force of gravity to define a stable pile with a lower aspect ratio. The ridge bounded by the Woodsdale neighborhood and Waddles Run can therefore already be considered as meta-stable, as it is characterized by slopes of 24-30°. That is, the slopes would exhibit a tendency toward failure except that abundant vegetation binds unconsolidated material together, and intervening layers of sandstone shelter weaker layers of shale from advanced erosion. Although intermittent layers of sandstone are strong enough to strengthen the overall ridge, the slopes themselves are subject to constant mechanical erosion as unconsolidated material is pulled down slope under the force of gravity. This process is evidenced by areas of creep and old earthflows at the base of the ridge, where large volumes of clay-rich soil derived from the weathering of shale were allowed to collect after historical clear-cutting allowed uncontrolled surface erosion.

Although the northern and western slopes could not be directly accessed because of respect for private property, they can be viewed from ridge tops on the opposite side of Waddles Run to gain a broad, panoramic perspective. Several large failures, which appear to represent earthflows, are present on the north slope of the ridge, and may have occurred after rains associated with Hurricane Ivan in 2004 (Figure 4). The largest such earthflow is estimated as 800 feet in width, extending for virtually the entire height of the slope (Figure 5). The earthflow truncated the former access road to the top of the ridge, and also truncated at least 5 former logging roads arrayed along horizontal terraces on the side of the ridge (Figure 6). It should be noted that in the summer of 2014, the truncated former logging road was re-established by earthmoving equipment, thereby undercutting the toe of the large earthflow. Because of extensive tree removal conducted on the northern slope during the summer of 2013, the approximate top 60 feet of elevation has been virtually denuded, and the toe of a small earthflow appears to have truncated the highest former terrace (Figure 7). Figure 8 represents what appears to be a debris flow, composed of jumbled rock and mud on the slope above the current C-3 Church in an area of extensive tree removal. This feature may, however, represent bulldozer activity from 2013.

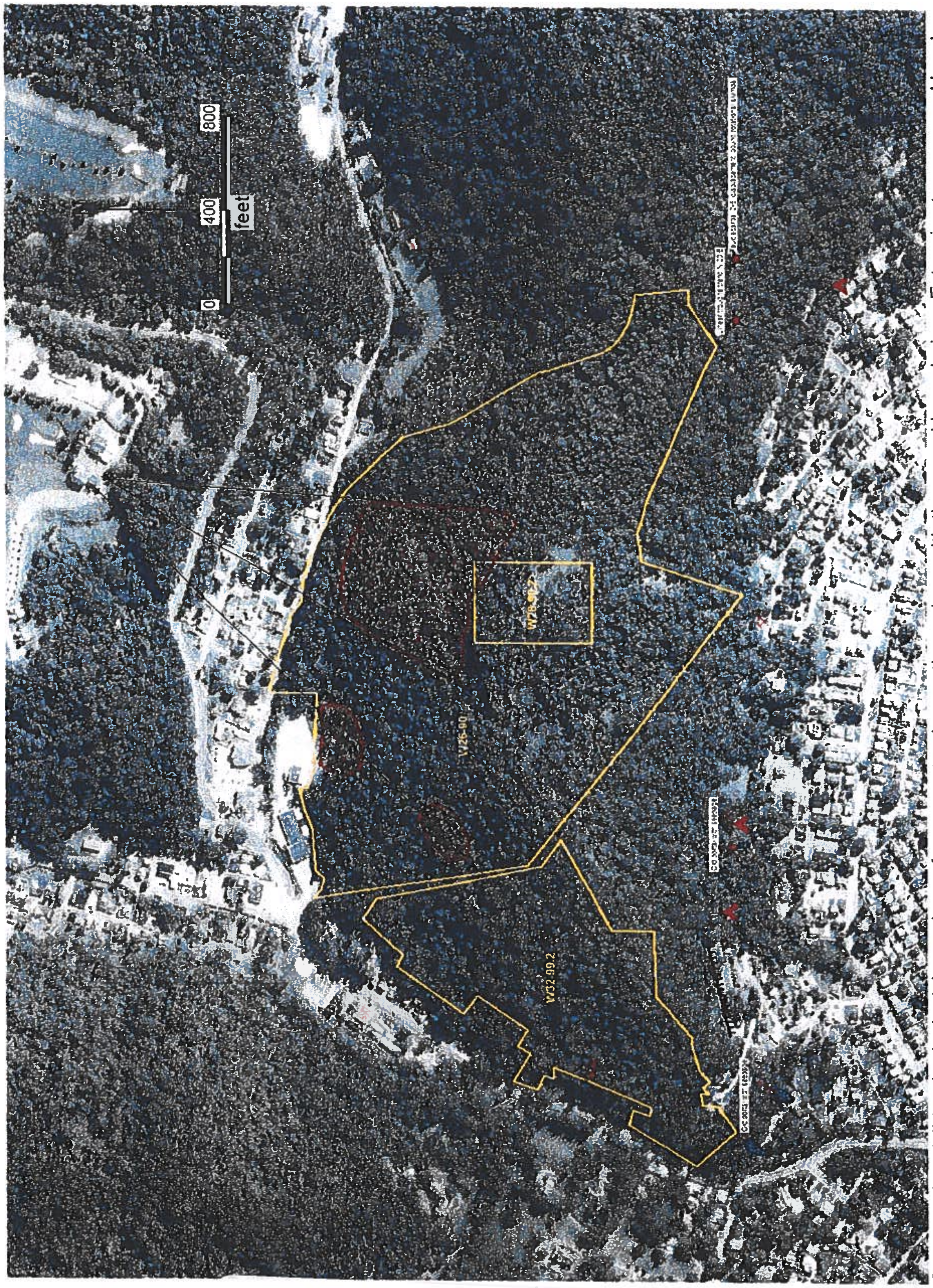



Figure 4. Landslides (red stipple) are shown from remote observations along with the parcel boundaries. Extensive tree removal has been performed since this aerial photo was taken in 2009.

Figure 5. Large earthflow truncates horizontal terraces for nearly the fully height of the north ridge slope.

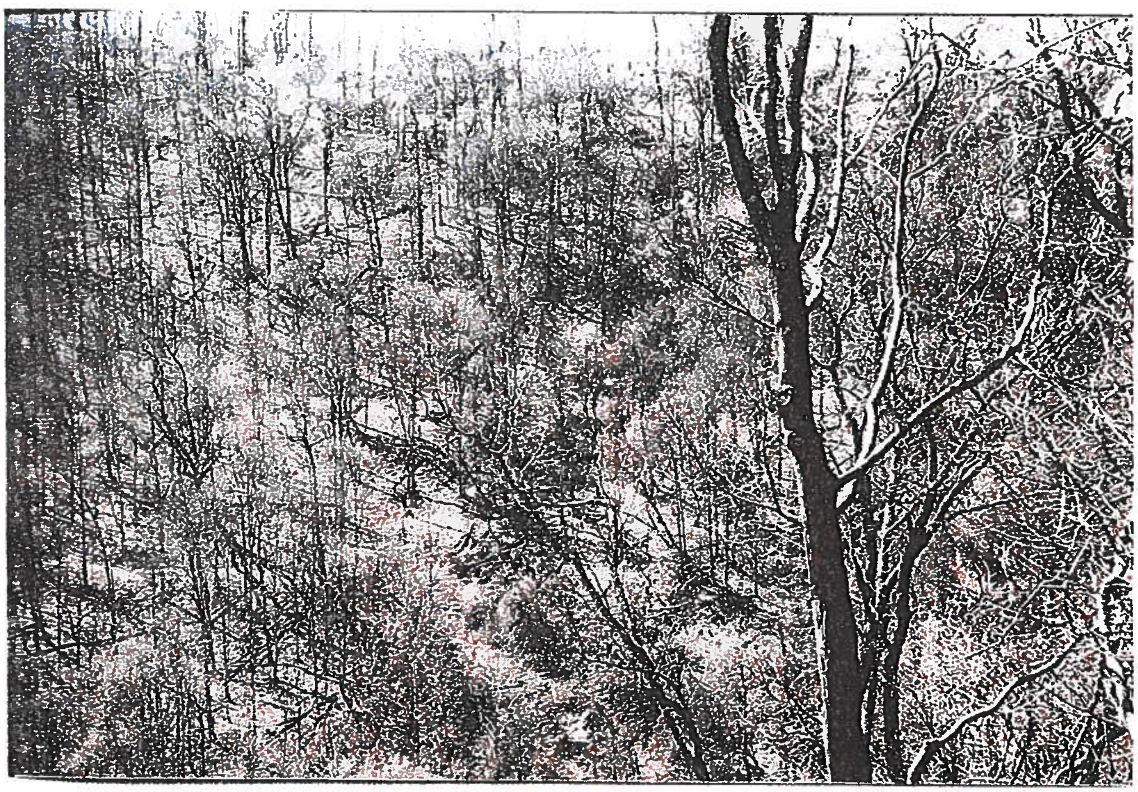


Figure 6. The eastern edge of the earthflow in Figure 5 truncates two former logging terraces, recognized as light-colored, horizontal surfaces.

Figure 7. The toe of a small earthflow truncated the top logging terrace beneath an area of denudation.

Figure 8. Jumbled rocks and mud (light brown patch) occur on the nose above the C-3 Church.

## Conclusions

In light of the foregoing discussion, it should be recognized that the ridge bounded by Woodsdale, Waddles Run, and State Route 88 is inherently unstable because of its steep slopes with thick, unconsolidated regolith accumulation resulting from previous years of clear-cutting, and that this inherent instability was recognized by the West Virginia Geological and Economic Survey in 1976 as part of their state-wide landslide mapping effort. Mass wasting is already ongoing on the ridge slopes, but existing vegetation at least inhibits the occurrence of rapid failures. The initiation of large earthflows believed to have occurred in response to heavy rains associated with Hurricane Ivan should be an indication of the meta-stable nature of slopes on this ridge. Any disturbance of the ridge that would involve removal of trees (thereby decreasing friction and allowing increased water saturation), or undercutting slopes (thereby removing the supporting buttress of overlying material) would have adverse consequences for homes located down-slope. Likely consequences could include damage from high volumes of water that would not have sufficient residence time to soak into the soil and therefore be transported rapidly to the base of the slope (sheet flow), the occurrence of mass wasting events such as slumps and earthflows, and eventually the undercutting of strong sandstone layers to allow down-slope movement of large, rolling blocks of rock. Similarly, earth moving activities could have the same effect, with the potential for dislodged rocks to roll unchecked down the steep slopes into neighborhoods below.

The West Virginia Geological and Economic Survey's Homeowner's Guide to Geologic Hazards states that homeowners who buy property within city limits have an assumption of protection from damage by zoning codes and building codes. The 1976 WVGES study reported that when property owners who experienced damage from landslides were interviewed, by a ratio of 2:1 they reported that under no circumstances would they move onto land that had a history of landslides, even if they were assured that the cause had been eliminated.

## References

Lessing, P., Kulander, b.R., Wilson, B.D., Dean, S.L., and Woodring, S.M., 1976, West Virginia Landslides and Slide-Prone Areas. Environmental Geology Bulletin No. 15, West Virginia Geological and Economic Survey, 64 p.

Previous Mining and Mine Subsidence Potential

**Background**

The ridge bounded by the Woodsdale neighborhood, Waddles Run, and State Route 88 is dominated by land parcels W26-90 and W32-99.2 (Figure 1). The ridge between State Route 88 and Boggs Hill Road, an extension of Edgington Lane, has been completely undermined by three main entities. These include the Pittsburgh-Wheeling Coal Co., the Peter Storch & Sons Coal Co. (known by 1919 as the Edgewood Fuel Co.'s Edgewood Mine, and finally prior to 1937 as the Clean Coal Co.'s Storch Mine), and the Hutchinson Coal Co. Parcel W26-90 is underlain by workings in the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine, and Parcel W32-99.2 is underlain by workings of the Hutchinson Coal Co. The Pittsburgh-Wheeling Coal Co.'s Edgewood Mine, which recorded production of 31,526 long tons of coal in 1907 and operated through the 1920s until closing around 1930, had a portal at the end of Orchard Lane (Figure 2). The Pittsburgh Seam outcrops at an elevation of approximately 800 feet above sea level, corresponding to the approximate break in slope from the valley to steeper portions of the ridge. It will be noted that many streets dead-end at the Pittsburgh Seam outcrop, and likely represent former access roads to small mines extracting low volumes of coal at relatively shallow depths (Figure 3). The remnants of caved-in adits are still visible at the ends of Springhaven Road and Woodlawn Court. Maximum depth to the mines is approximately 300 feet from the top of the ridge, but decreases down-slope symmetrically from the spine of the ridge.

There are no known production records for mining in the Hutchinson reserve. Despite the state of West Virginia recognizing the small Storch Mine in 1905 (producing 5,357 long tons of coal for use by local trades and tenants, and employing five miners), there was no recognition of mining activity in the Hutchinson reserve at the opposite end of the ridge from the earliest 1900s through the 1920s, when mines in the area had become larger and routinely produced tens of thousands of tons of coal per year. By 1907, which seemed to represent a sudden increase in coal mining in the Woodsdale area with production recorded from four new mines, including the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine, the Echo Coal Co.'s View Street Mine, the Edgington Coal Co.'s Edgington Mine, and the Edgewood Fuel Co.'s Edgewood Mine, there was still no record of the Hutchinson Coal Co. by the state of West Virginia's Department of Mines. It is therefore likely that workings in the Hutchinson reserves were of limited extent with small-scale production, and either operated prior to the issuance of the Annual Report of the West Virginia Department of Mines, begun in the 1880s, or did not maintain enough of a workforce or production output to warrant inspection. A map of underground coal mine outlines obtained from the West Virginia Geologic and Economic Survey indicates that no map of any mining in the Hutchinson reserve exists, although a Great Depression-era Works Projects Administration survey identified the presence of four drift mouths in the hillside (Figure 2). The location of those portals was not specified. Bright orange precipitates that stain the cliff face above the creek adjacent to State Route 88 on the west side of the ridge (located at approximately -80.69115° E/40.08698° N) are an indication of drainage from old mine workings beneath the ridge.

The map of the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine (portal located at -80.68440° E/40.08334° N) obtained from the West Virginia Geologic and Economic Survey indicates that the entirety of the ridge between Greggsville and Woodsdale was "worked out" with no indication of the sizes of any pillars or barriers that may have been left intact to support the weight of the ridge (Figure 4). However, the mine map provides an indication of the mining pattern in workings portrayed to the east, which are likely to have been similar to those in the western half of the mine. In this pattern of mining, the Pittsburgh Seam was accessed by a 2-entry submain used for track haulage. The two track entries are separated by a string of solid coal pillars measuring 65 feet long by 25 feet wide, each separated by a crosscut. Flanking the track entries to the left and right, 250-foot wide panels of essentially unlimited length were driven to the property boundaries. The panels are characterized by long, slender pillars of coal, also referred to as "fenders," that are all that remained of extracting coal from each "room." Each 130-foot long "room" is up to 25 feet wide, separated from the next room by a thin pillar 10 feet in width. The mouth of each room is flanked by a small coal pillar that was left in place to protect the track entries from stress. Together with the large pillar separating the two track entries, the two flanking pillars constitute what is known as a "composite barrier." This composite barrier system is expected to have very high stability, and was intended to resist crushing out in order to protect the track entries from the weight of overlying rock, thereby allowing continued mine access even if the flanking worked-out panels experienced collapse.

**Analysis of Pillar Stability**

An evaluation of coal pillar stability using the Analysis of Retreat Mining Pillar Stability (ARMPS) software, written by the National Institute of Occupational Safety and Health (NIOSH) indicates that the composite barrier system left in place to protect the track entries is characterized by a very high Pillar Stability Factor of 9.65 (Appendix 1). For comparison, a value of 1.5 is considered adequate to ensure pillar stability during mining operations and a value of 2.0 is considered adequate to ensure the stability of barrier pillars during mining operations. The very thin, long pillars in the flanking panels have very low stability, characterized by an ARMPS Pillar Stability Factor of only 1.09 (Appendix 2). This value is substantially lower than the recommended value of 1.5 that represents the industry standard for ensuring adequate pillar stability. Another important property in terms of pillar stability is represented by the width-to-height ratio, an indication that pillars with a relatively tall, slender profile are weaker than those that are relatively squat. Research by NIOSH and the former U.S. Bureau of Mines indicates that a phenomenon known as massive pillar collapse, representing the sudden, domino-style failure of large areas in a mine, are likely when the ARMPS Pillar Stability Factor is less than 1.5, the width-to-height ratio of individual pillars is less than 4.0, and the minimum dimension of panels is 300 feet. For comparison, massive pillar collapse is the failure mechanism that resulted in the deaths of six miners in 2007 at the Genwal Resources, Inc. Crandall Canyon Mine in Utah. The thin, tall pillars in the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine not only have low Pillar Stability Factors, but also are characterized by width-to-height ratios of only 1.8. A mining height of 5.5 feet was used in the analysis, based on reports of conditions recorded by inspectors for the Annual Report of the West Virginia Department of Mines. Although modern mines in the Pittsburgh Seam are regularly developed with heights exceeding seven feet to accommodate the passage of longwall equipment, miners of the 1920s strove to restrict mining to the coal seam itself in order to avoid the unprofitable handling of worthless rock and to maintain a stable, undisturbed roof horizon. The 250-foot width of production panels also approaches the minimum 300-foot width criteria of panels at risk of experiencing domino-style collapse. Thus, the thin pillars in the production panels are likely to be at considerable risk for failure, if they have not already failed in the 90 years since mining.

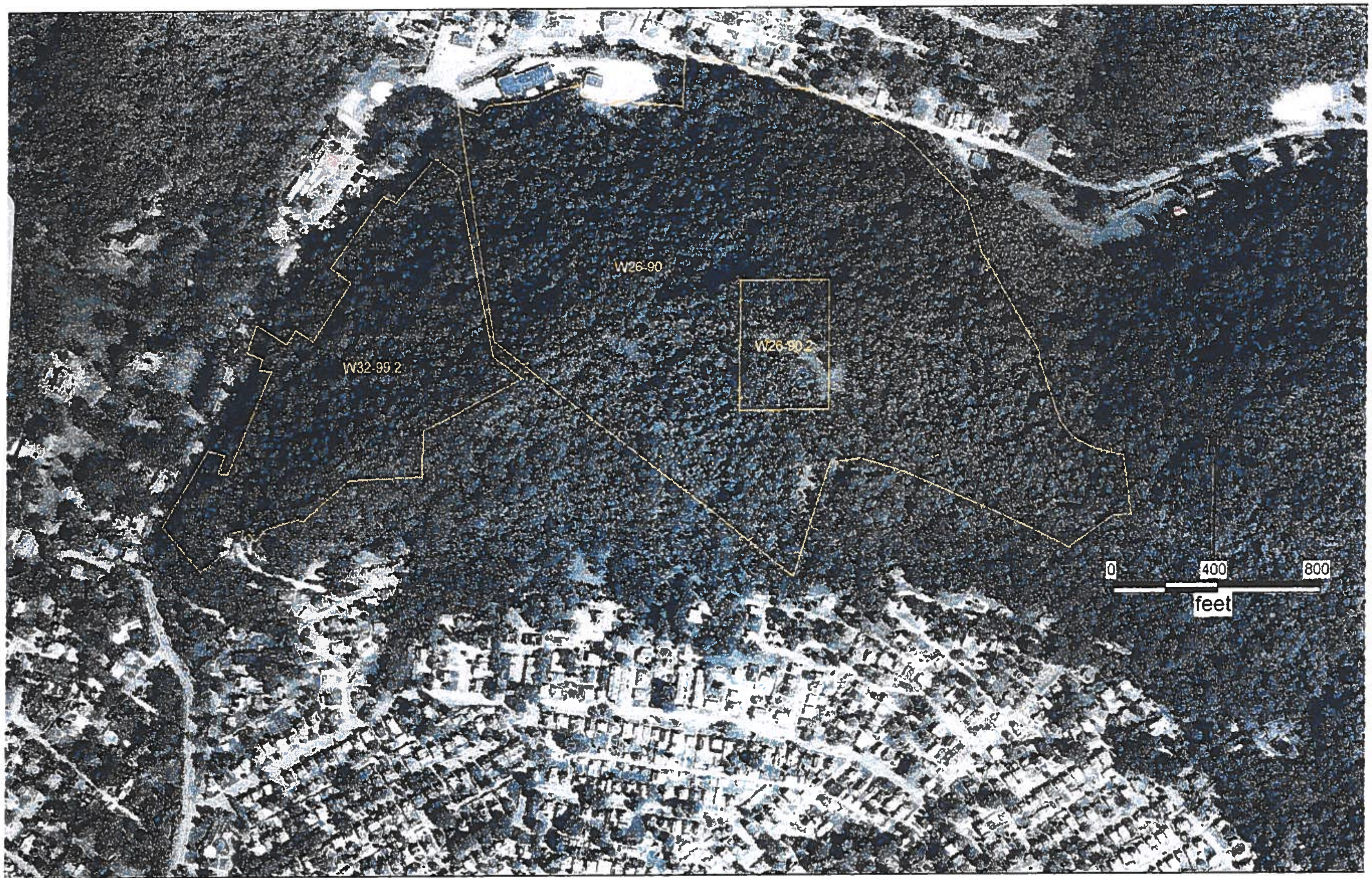



Figure 1. Property boundaries of parcels W32-99.2 and W26-90 are shown in relation to the ridge bounded by Woodsdale, Waddles Run, and State Route 88.

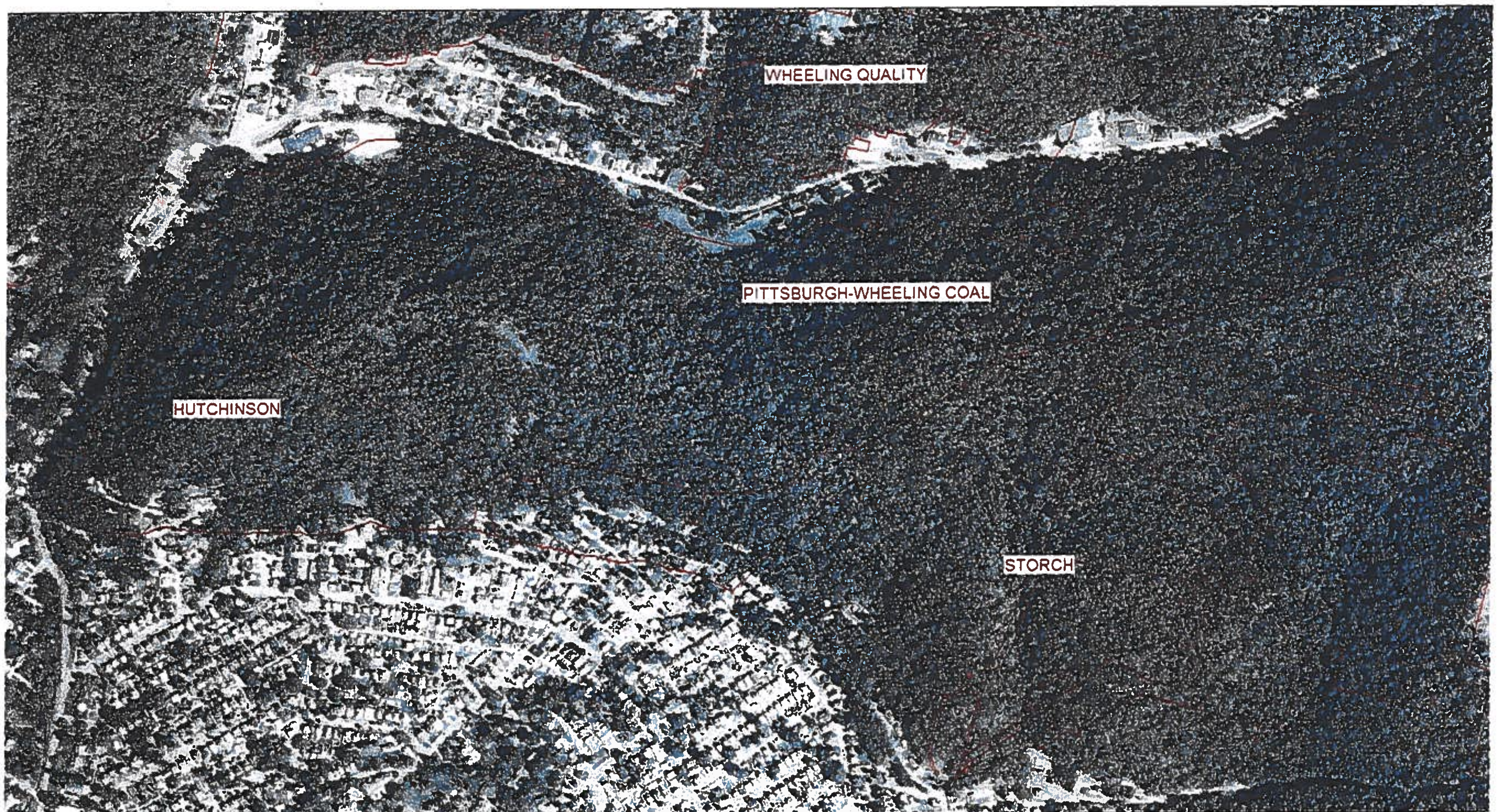



Figure 2. The outlines of underground coal mines are shown superimposed on a 1-meter resolution air photo of the Woodsdale area. The ridge between Woodsdale and Waddles Run was extensively undermined by the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine, the Storch Mine, and by the Hutchinson Coal Co.

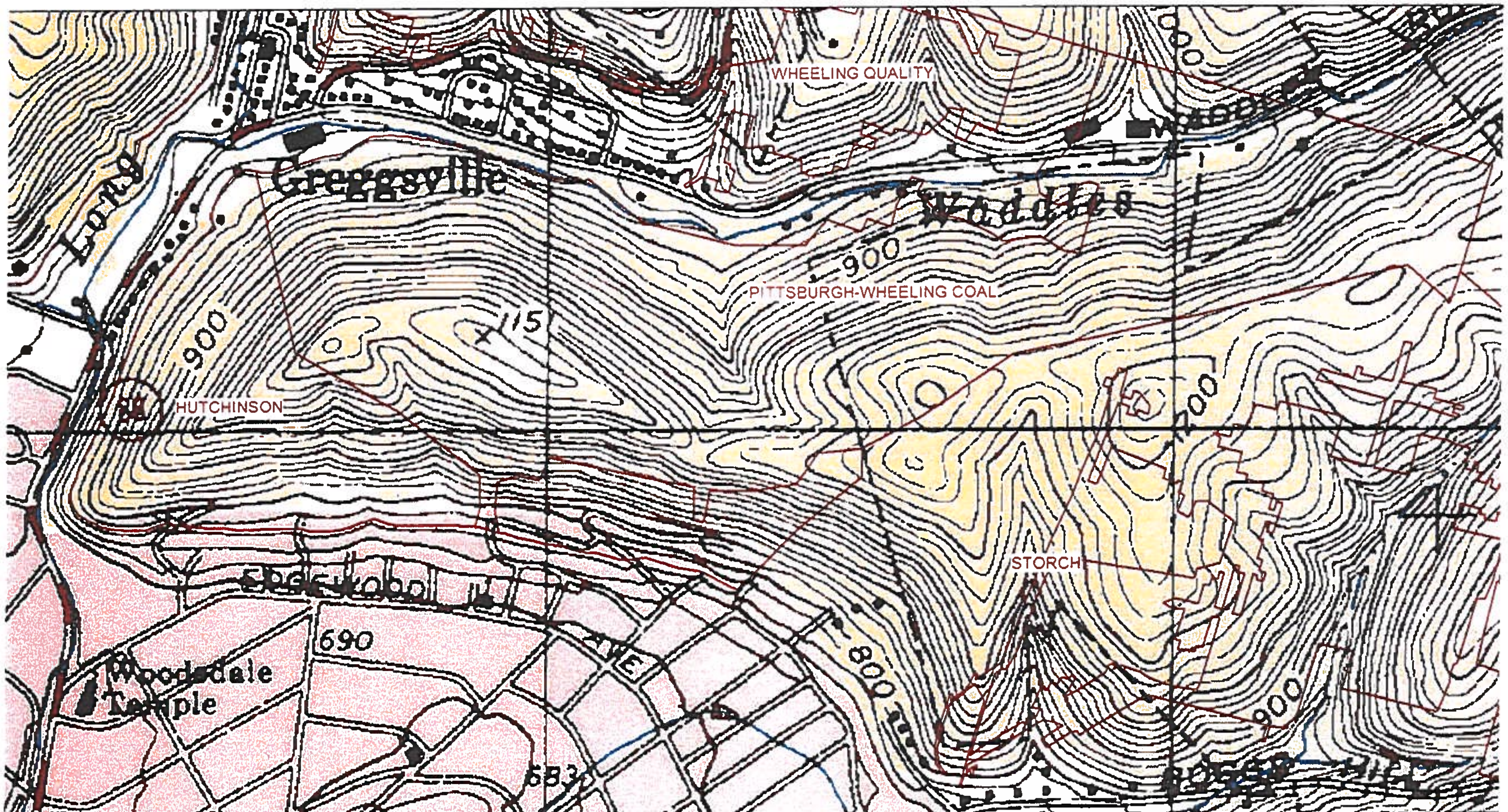



Figure 3. The outlines of underground coal mines (in red) are superimposed on a topographic map that shows the location of the ridge bounded by the Woodsdale neighborhood, Waddles Run, and State Route 88. The ridge was extensively undermined by the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine, the Storch Mine, and by the Hutchinson Coal Co. Contours are spaced 20 feet apart vertically, indicating the narrow, steep nature of the ridge.

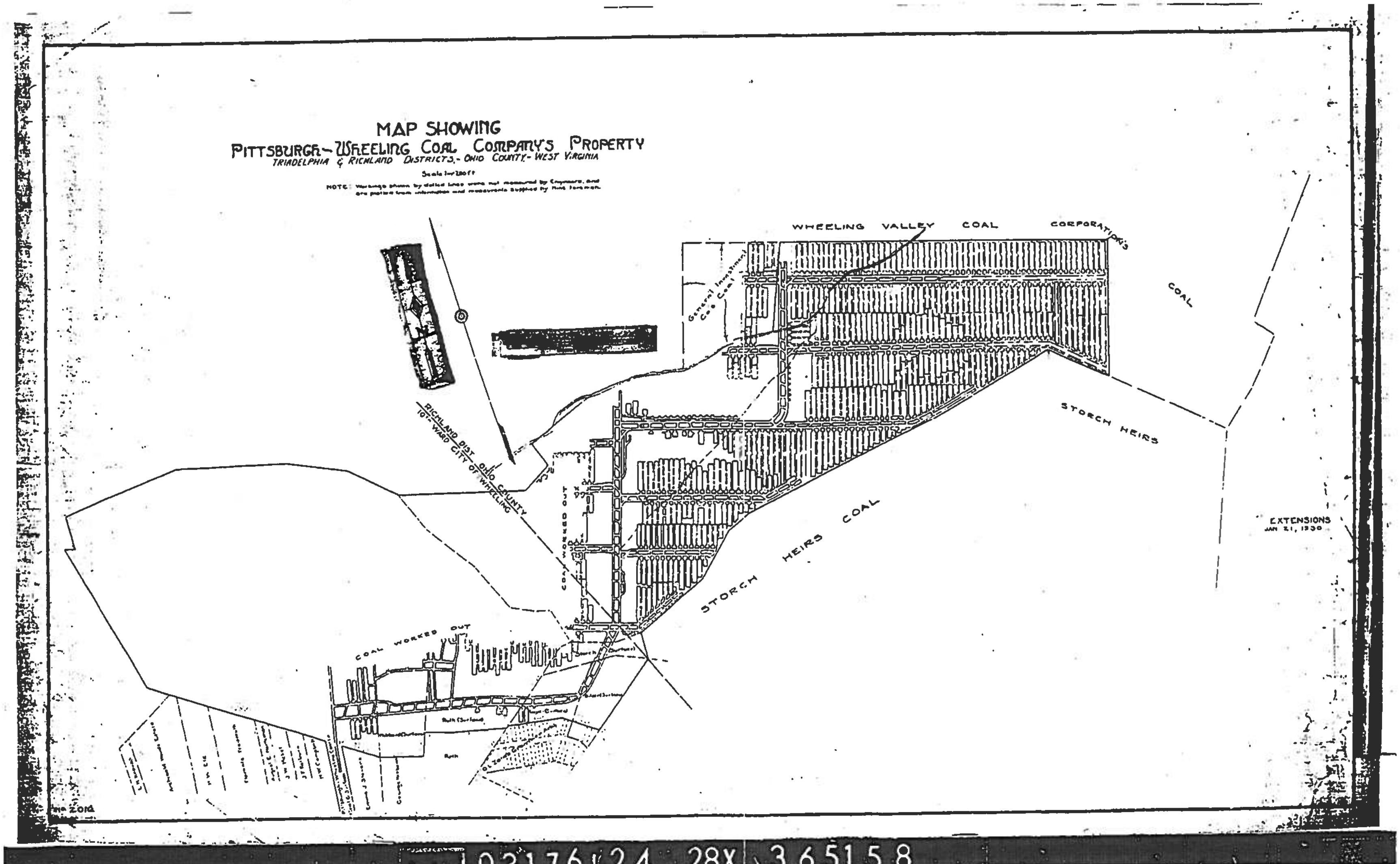



Figure 4. The Pittsburgh-Wheeling Coal Co.'s Edgewood Mine, which recorded production of 31,526 long tons in 1907 and operated through the 1920s until about 1930, underlies the ridge between Woodsdale and Greggsville. The large, blank area to the left of the map indicates only that the coal has been "worked out" and there is no indication of the size of any pillars that may have been left to support the weight of overlying rock.

**Finite Element Analysis**
To better understand the relation between the surface topography of the ridge bounded by Woodsdale and Waddles Run, and the underlying mine workings, a copy of the map of the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine obtained from the West Virginia Geologic and Economic Survey was geo-referenced in a Geographic Information System and superimposed on a Digital Raster Graphic of the U.S. Geological Survey's Wheeling 7 ½' topographic quadrangle (Figure 5). As a check on the accuracy of the geo-referencing, the map was displayed with the digitized boundaries of coal mines obtained from the West Virginia Geologic and Economic Survey's Interactive Coalbed Mapping Project.

With the mine map correctly scaled and located in relation to the topographic surface, it was possible to construct a cross-section showing the mine workings and land surface, and evaluate whether pillar failure might propagate to the surface and result in subsidence. A rule of thumb in longwall mining is that if the extraction panel's width is equal to or less than the depth to the surface, subsidence is likely. The fact that the 250-foot width of panels is generally greater than the depth from the surface to the mine is an indication that surface subsidence is likely. This assumes the presence of relatively continuous strata that can form a bridge between the barriers, analogous to a bridge span over a river when abutments are placed on either bank. Even with such continuous strata, the commonly accepted 21° angle of draw at gob-solid boundaries defines a subsidence trough along which subsidence occurs. It must be recognized, however, that a ridge has no such supporting abutments, and that the entire weight of the ridge would rest upon any intact pillars in the underlying coal mine without benefit of any bridging.

A series of Finite Element Models were constructed for a cross section through the ridge so that the possibility of subsidence could be further assessed. Finite Element Models calculate the displacements between nodes in a digital mesh that is superimposed on an area of interest. Strength properties are entered for rocks and geologic structures, and the computer applies loads, in this case the force of gravity, and calculates the reaction of the system. The model was constructed with the assumption that coal, shale, and sandstone were the only materials present. The thicknesses of shale and sandstone were obtained by direct measurement while traversing up the south side of the ridge. The thickness of coal in the Pittsburgh Seam was obtained from reports of conditions by state mine inspectors that visited the Edgewood Mine and Storch Mine, which are included in the Annual Report of the West Virginia Department of Mines for various years from 1907 through 1922. The topographic profile was obtained by measuring on the topographic map. Thus, a cross section was constructed that incorporates strata thicknesses that comprise the ridge, and the topographic profile between Edgwood Street and Waddles Run (Figure 6).

In order to allow the Finite Element Model to calculate displacement and potential failure, three stages were used to represent pre-mining conditions, followed by the excavation of the 2-entry track haulageways, and finally removal of the coal in the production panels (Figures 7 and 8). The very low ARMPS Pillar Stability Factors for the coal fenders in the production panels indicate that failure is very likely. Complete extraction was therefore assumed for purposes of modeling. If the thin fenders have not already failed, then collapse would now be dramatic. Figure 9 represents the distribution of "Strength Factors" in the calculated mesh displacements for the pre-mining situation shown in Figure 6. At this stage, no coal has yet been extracted, and the model predicts only surface slope movement under the force of gravity at the unconstrained surface of the earth. The models incorporate a feature known as "ubiquitous joints," meaning that joints are assumed to exist everywhere in the rock mass. Based on observations of strata on the ridge, the incorporation of ubiquitous joints is justified because vertical joints were measured in sandstone members. The presence of vertical joints is significant because they dismember the continuity of the strata and reduce or eliminate bridging capability. Figure 10 represents the distribution of Strength Factors for the mining situation shown in Figure 7 in which excavation of the 2-entry track haulageways has been completed. The excavation of these narrow tunnels has virtually no effect on the overlying rock mass because the strata, even when cut by joints, are expected to easily span the narrow openings. Figure 11 represents the distribution of Strength Factors after extraction of coal from the production panels flanking the 2-entry track haulageways. With no stable coal pillars to support the weight of the ridge, joint-bounded blocks are predicted to fail above the 250-foot wide mine voids, with zones of failure reaching the surface. Figure 12 further demonstrates the tendency toward subsidence with the pattern of stress vectors, which all point downward into the voids created by coal extraction in the panels. Finally, Figure 13 supports the interpretation of failure that was indicated by the distribution of low Strength Factors and stress vectors, predicting negative or downward displacement, in other words subsidence, of the top of the ridge above the mine voids.

Although the pillar stability analysis and Finite Element Model analyses give insight into the potential for massive pillar collapse and large-scale ground subsidence, areas on the south side of the ridge indicate that small-scale subsidence has already occurred and is therefore likely to occur under similar depths in other areas of the ridge. An area of the southern slope was visited in which linear, trough-like depressions were oriented along a compass bearing of N 20° E where depth to the Pittsburgh Seam is approximately 200 feet. The features were plotted on the map using the coordinates obtained with a GPS, and found to occur above the old production panels in the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine (Figures 14 and 15). The map indicates that the wide rooms mined in the production panels are oriented along a bearing of N 20° E, suggesting a causal relationship of subsidence between the trough-like structures on the surface. Rotational slumps bounded by fault scarps also occurred at the margin of a former production panel at another location, suggesting that mine subsidence may have influenced the formation of soil creep (slips). Thus, subsidence has been demonstrated to occur at depths of 200 feet at locations on the ridge, which supports the results of modeling.

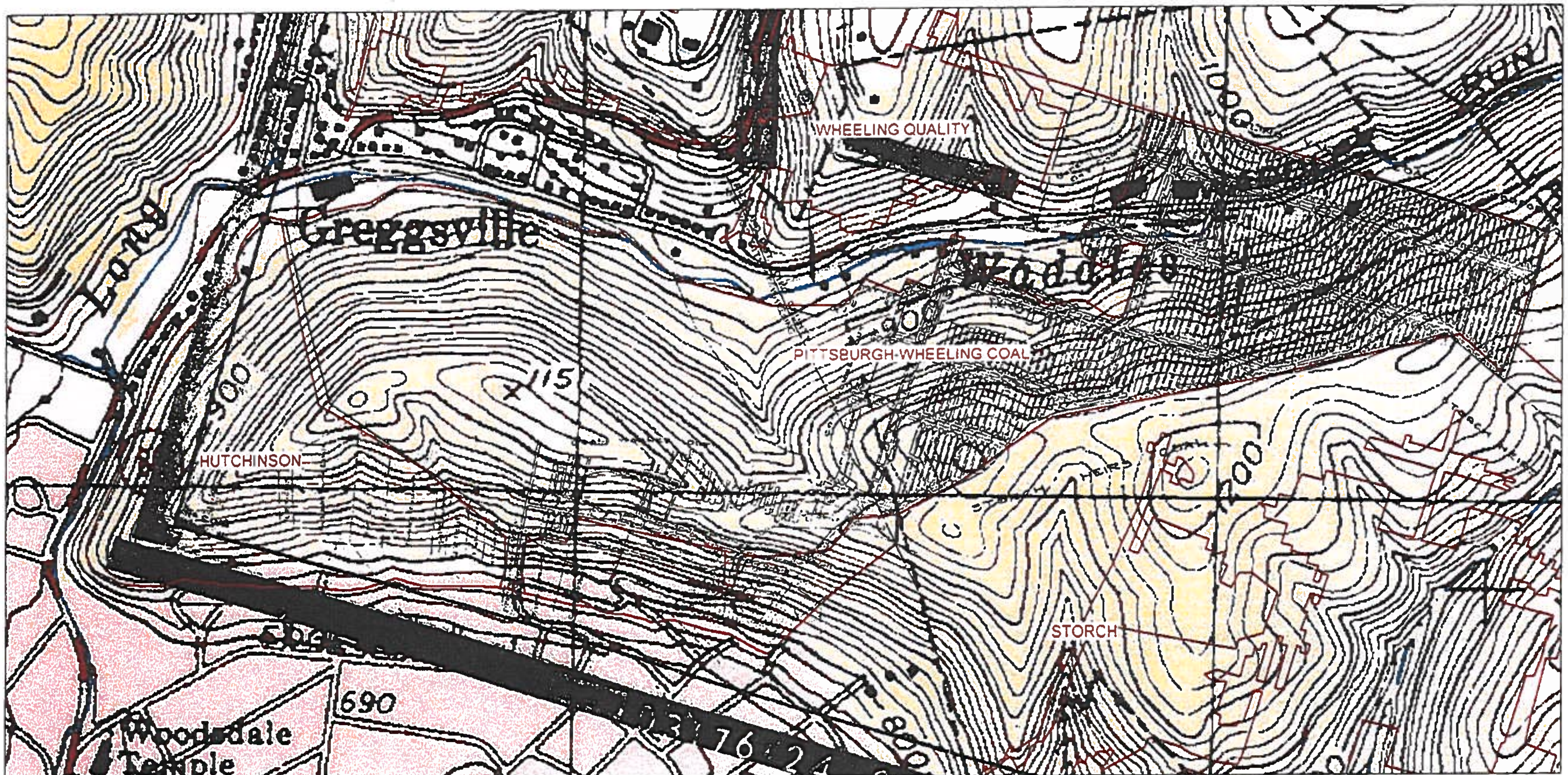



Figure 5. Map of the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine, which operated 1907-1930 and underlies the ridge between Woodsdale and Waddles Run. The large, blank area to the left of the map underlying the hill indicates extensive coal removal with no existing map, but is likely of the same pattern as that found to the east.

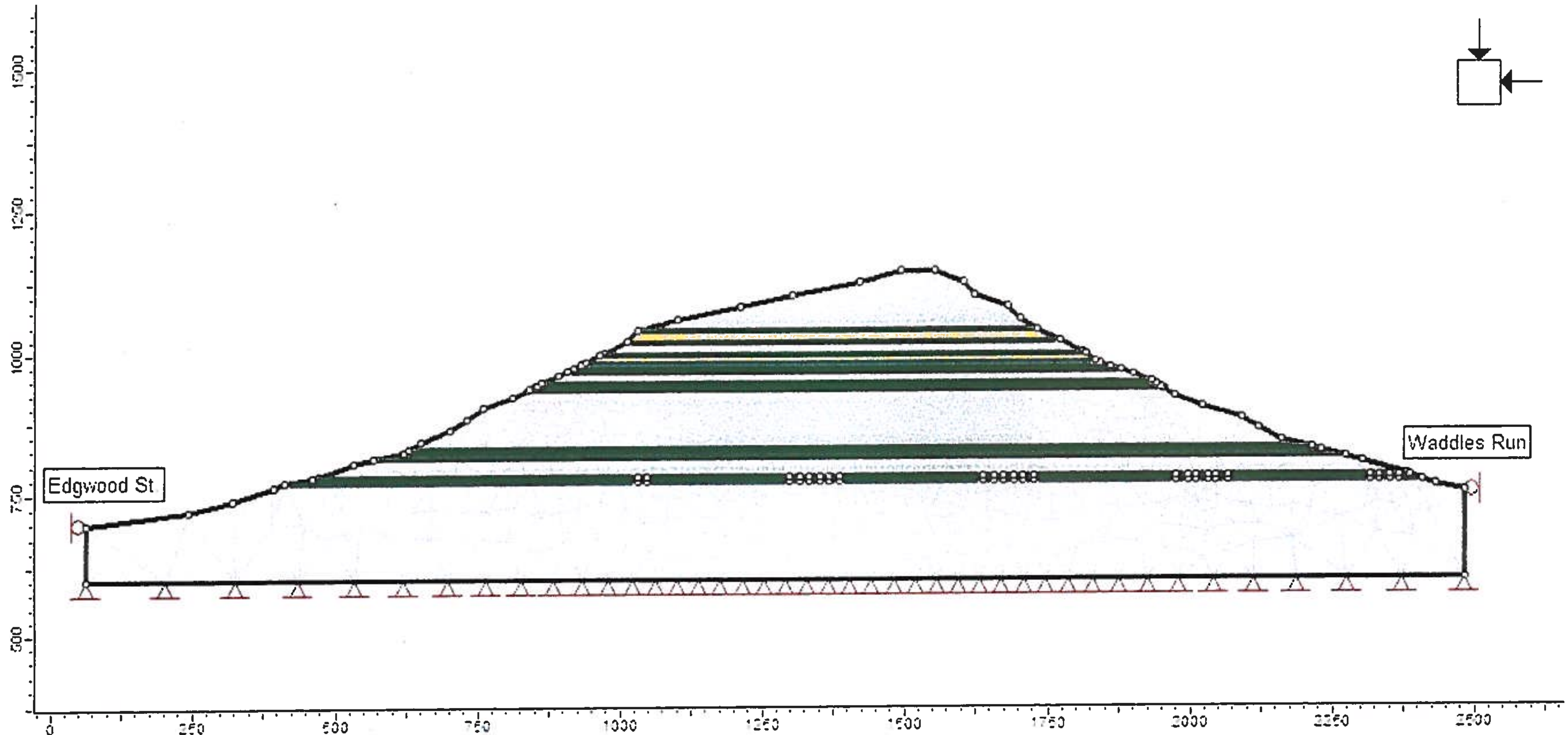



Figure 6. Cross section through the ridge bounded by Edgwood Street and Waddles Run, incorporating measured thicknesses of shale and sandstone with Finite Element Model mesh in place at a time prior to mining. Vertical scale is in feet above sea level; horizontal scale is in feet beginning from Edgwood Street.

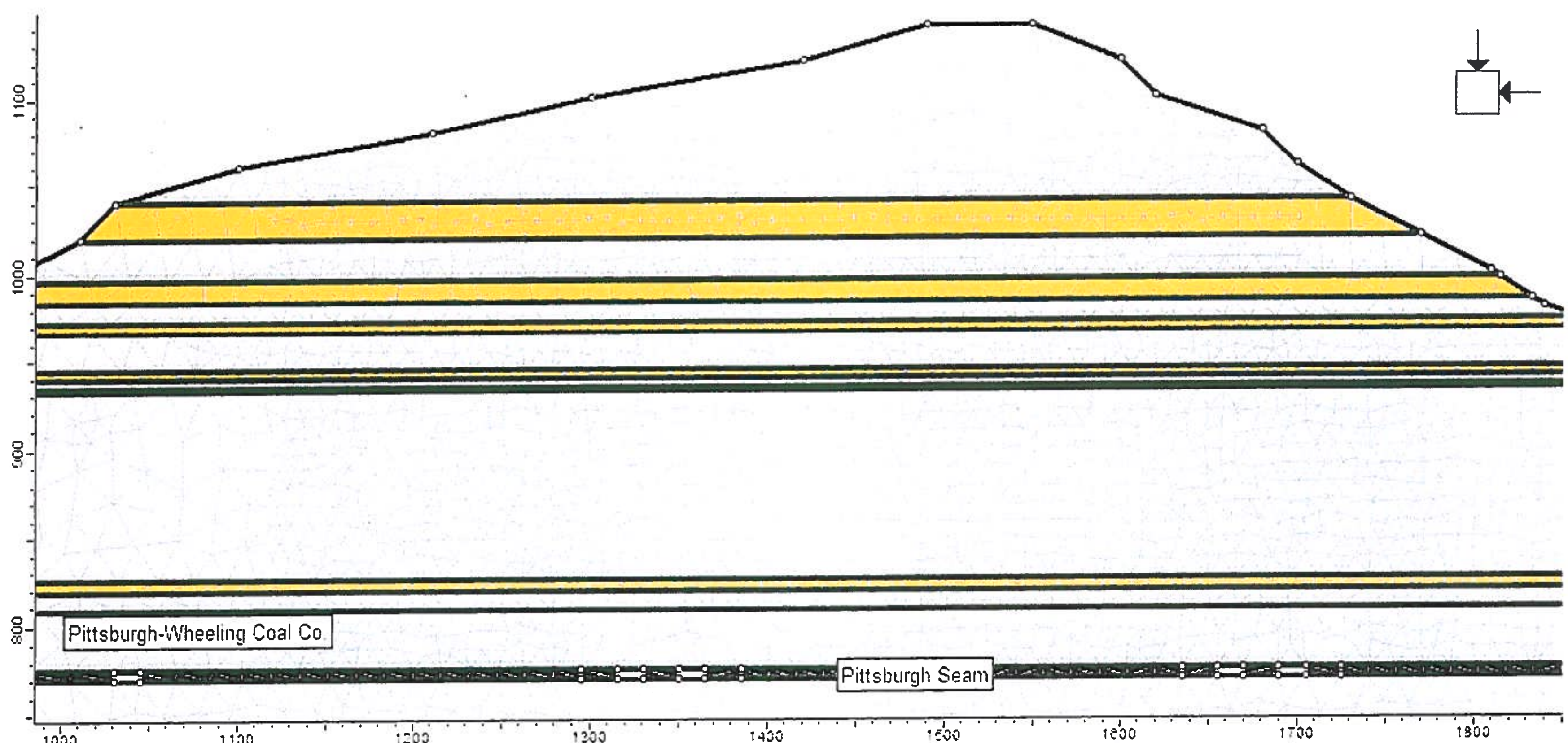



Figure 7. Cross section through the ridge bounded by Edgwood Street and Waddles Run, incorporating measured thicknesses of shale and sandstone with Finite Element Model mesh in place at a time after development of the 2-entry track haulageways, which will provide access to production panels.

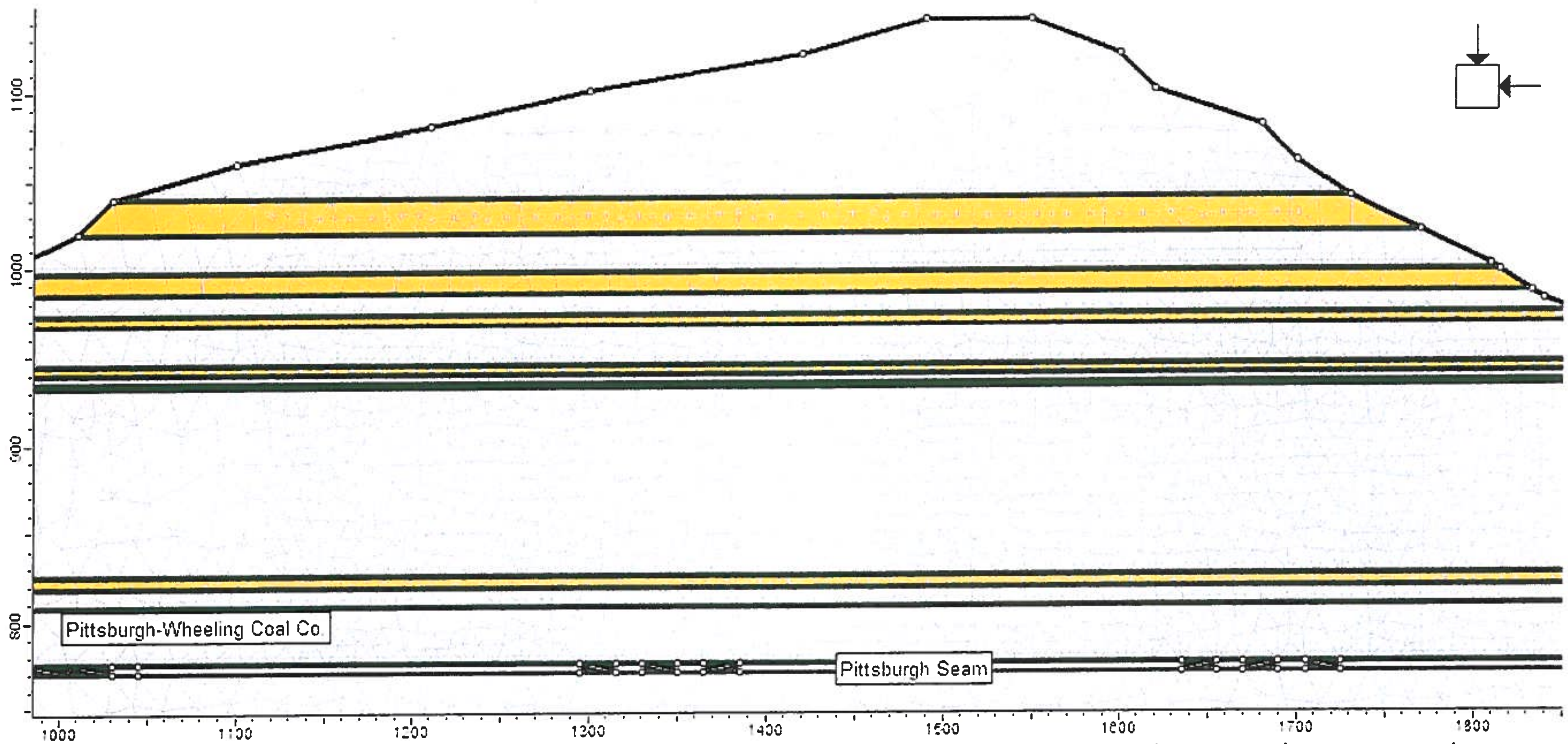



Figure 8. Cross section through the ridge bounded by Edgwood Street and Waddles Run, incorporating measured thicknesses of shale and sandstone with Finite Element Model mesh in place at a time after extraction of coal from production panels that flank the 2-entry track haulageways.

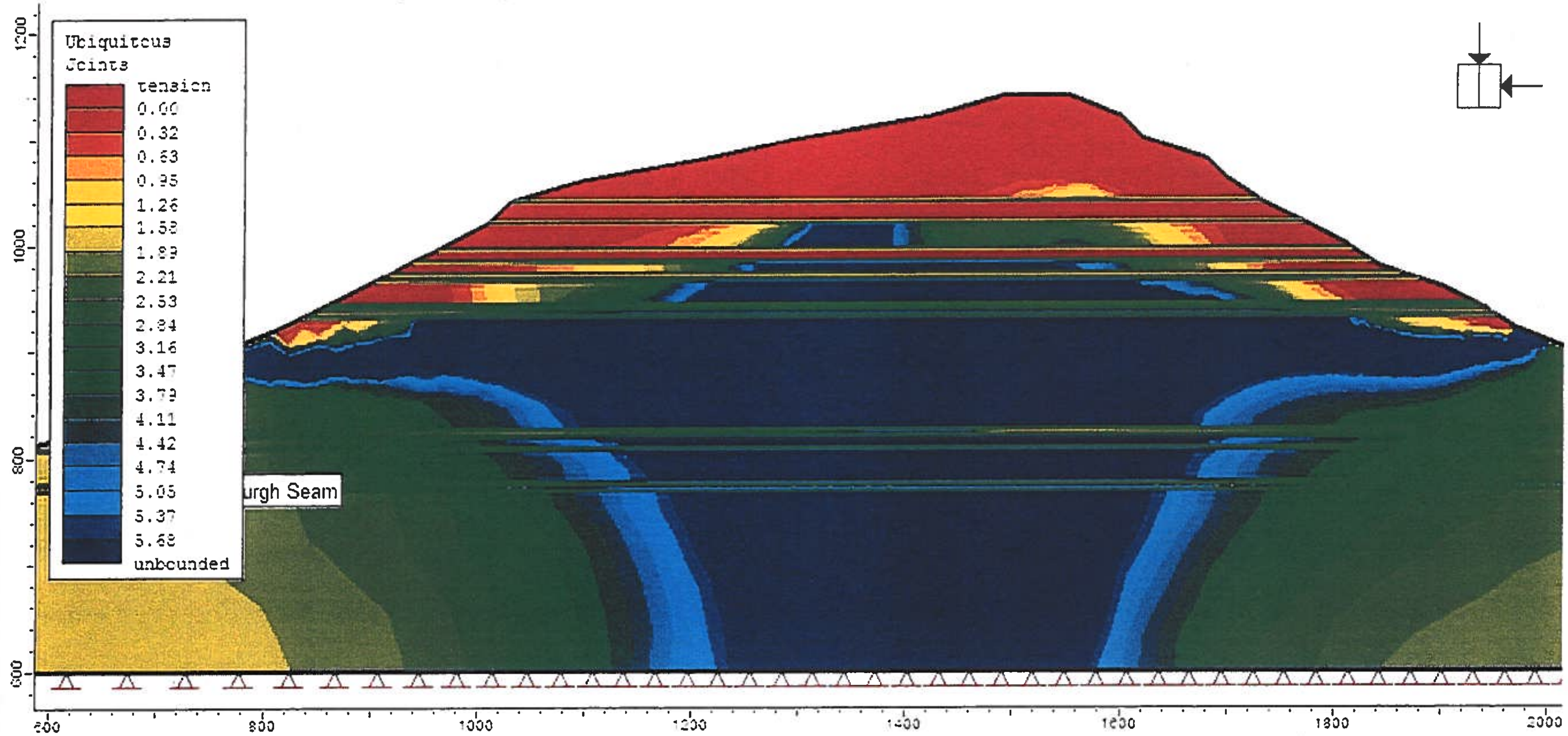



Figure 9. The distribution of values of "Strength Factor," an indication of failure for values less than 1, for pre-mining conditions assuming the presence of vertical joints in the rock mass. No failure is indicated underground, and only surface failure due to lack of constraint at the Earth's surface is indicated on the ridge slopes.

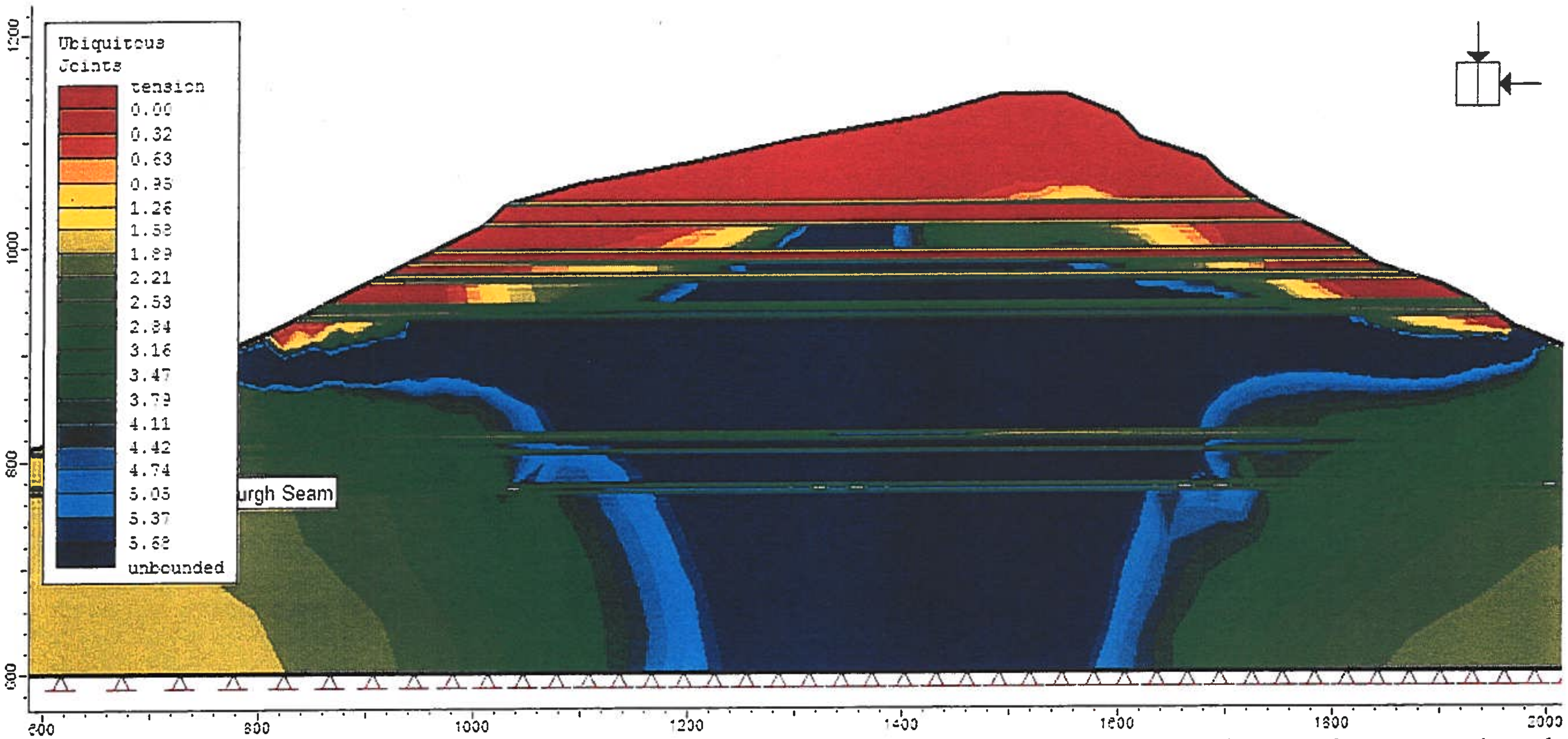



Figure 10. The distribution of values of "Strength Factor," an indication of failure for values less than 1, after excavation of the 2-entry track haulageways assuming the presence of vertical joints in the rock mass. When compared to the pre-mining condition in Figure 9, this limited excavation has virtually no effect on the overlying rock mass.

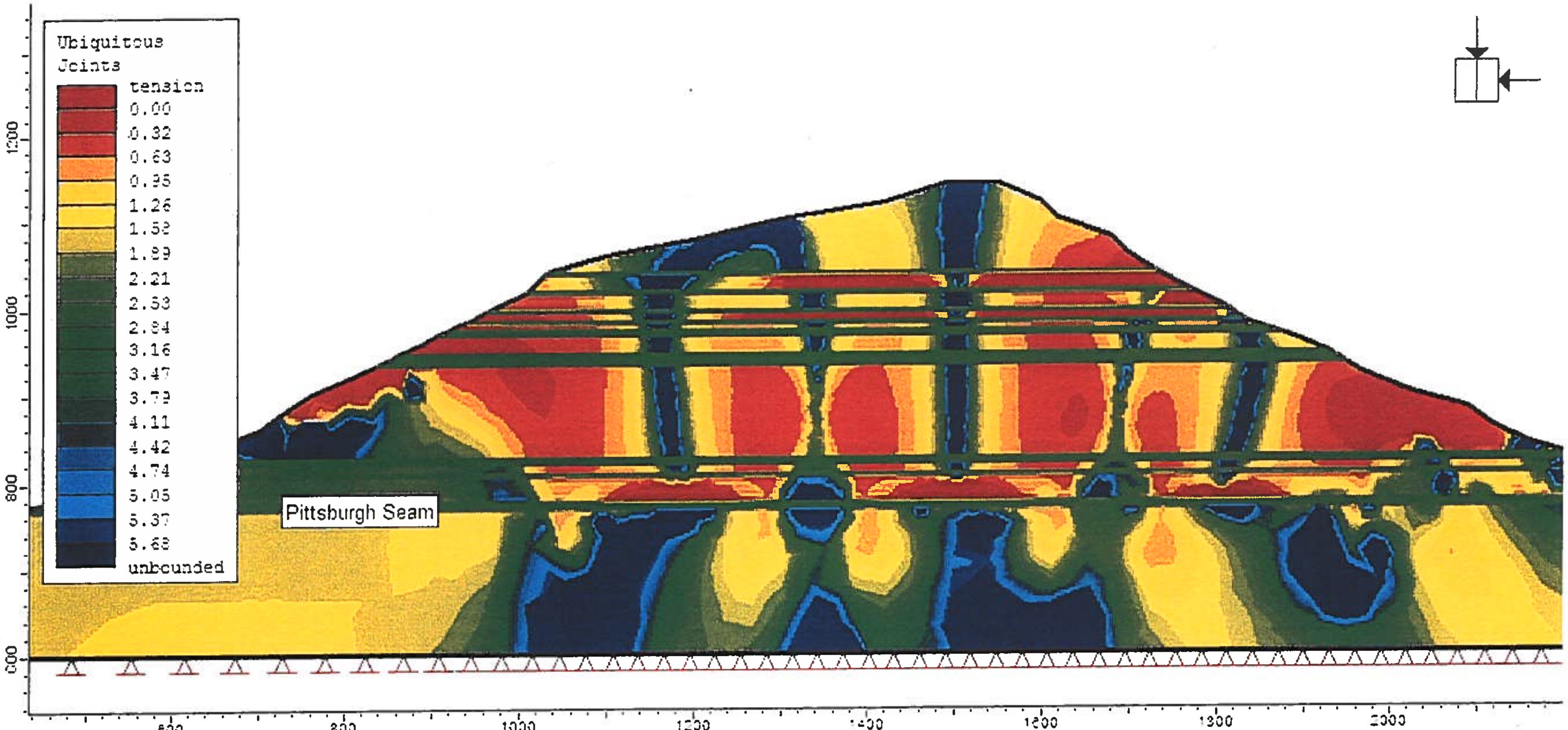



Figure 11. The distribution of values of "Strength Factor," an indication of failure for values less than 1, following extraction of coal from the production panels flanking the 2-entry haulageways and assuming the presence of vertical joints in the rock mass. Zones of failure along vertical joint zones, indicated by "hot" colors, extend to the surface as an indication of shear failure through the overburden and settling of joint-bounded blocks into the underlying mine voids.

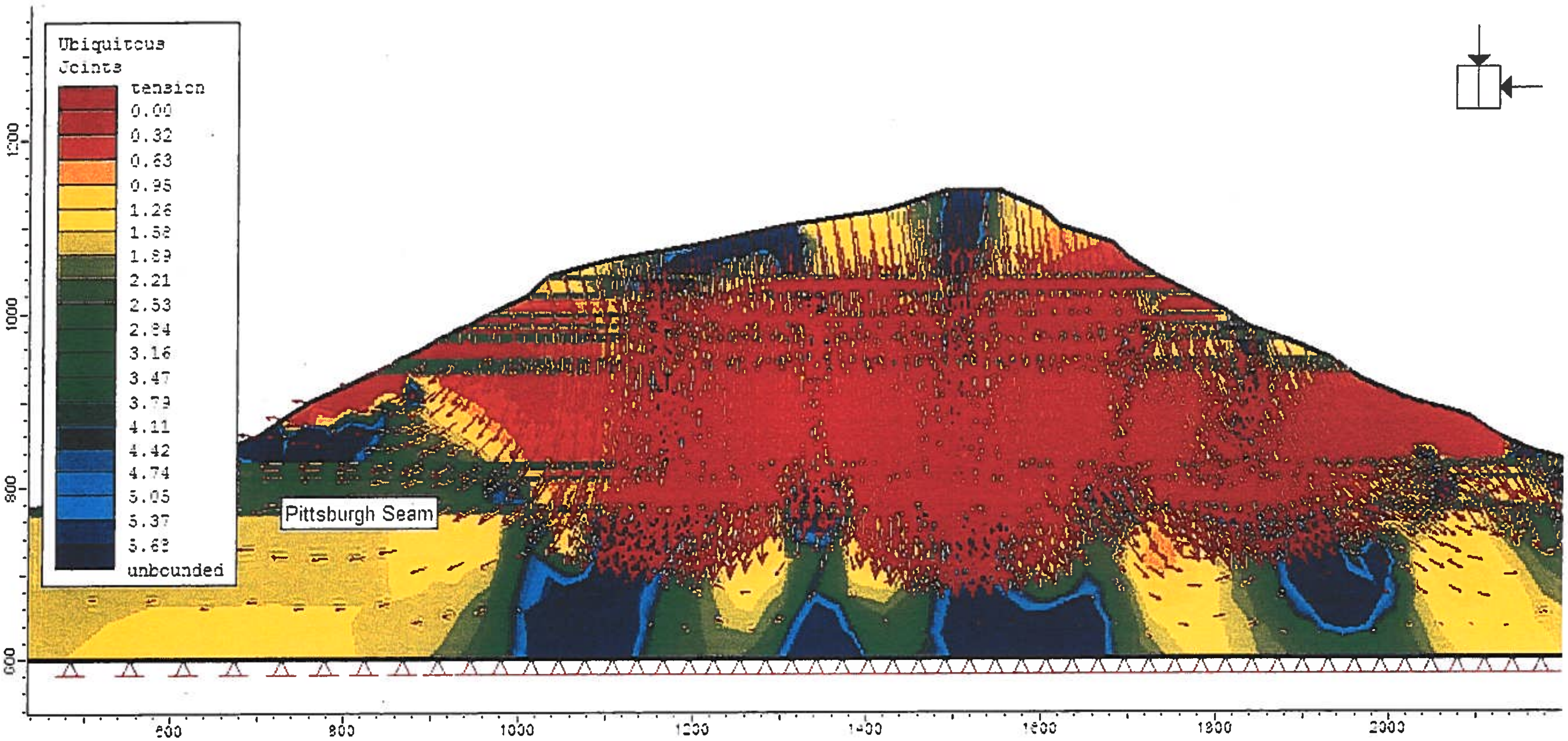



Figure 12. The distribution of values of "Strength Factor," an indication of failure for values less than 1, following extraction of coal from the production panels flanking the 2-entry haulageways. Stress vectors (downward-pointing arrows) indicate the overwhelming tendency for subsidence into the underlying voids.

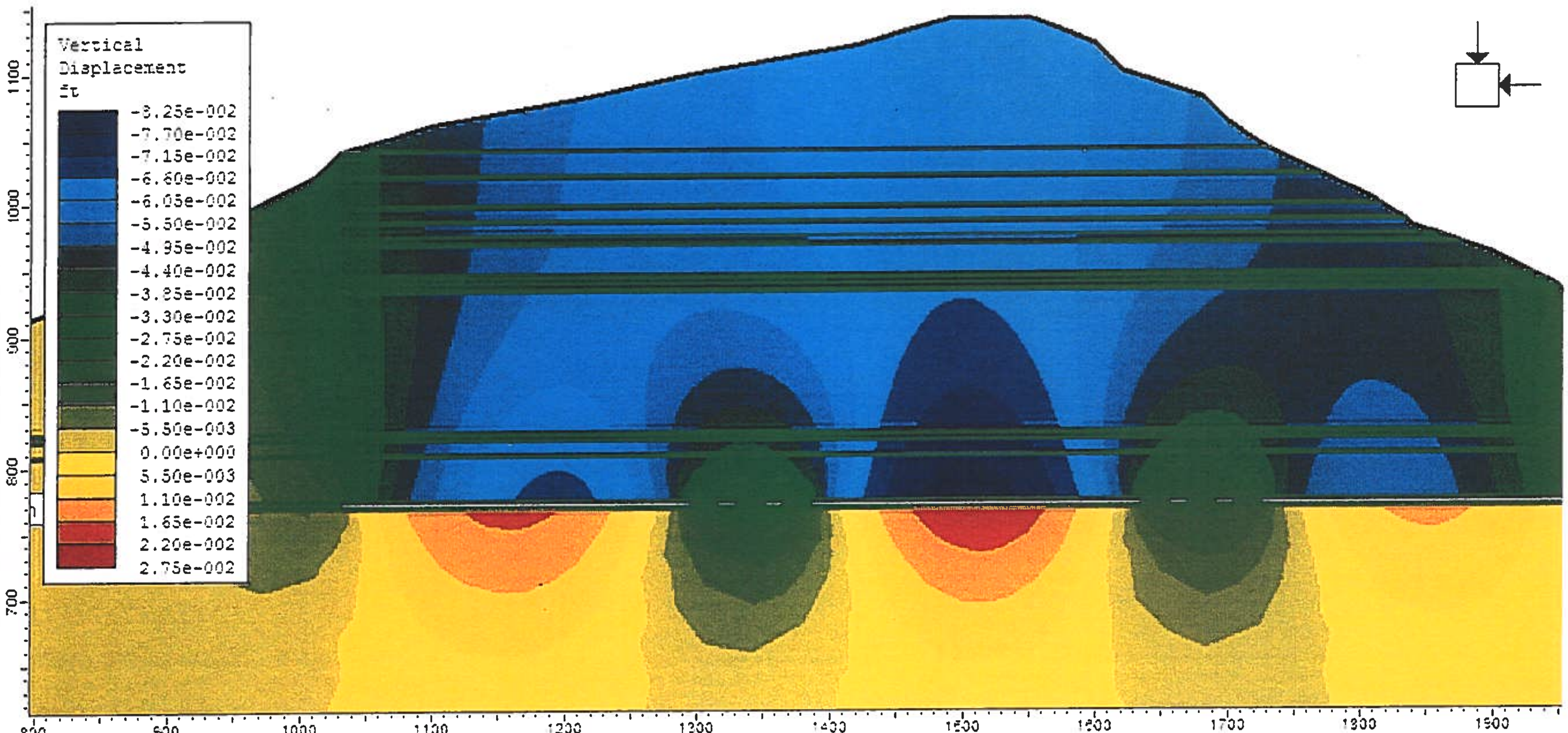



Figure 13. The distribution of values of Vertical Displacement after mining the production panels and creating 250-foot wide voids separated by the composite barriers protecting the 2-entry haulageways. The "cool" colors represent negative, in other words downward, displacement, indicating that the spine of the ridge is predicted to subside into underlying voids.

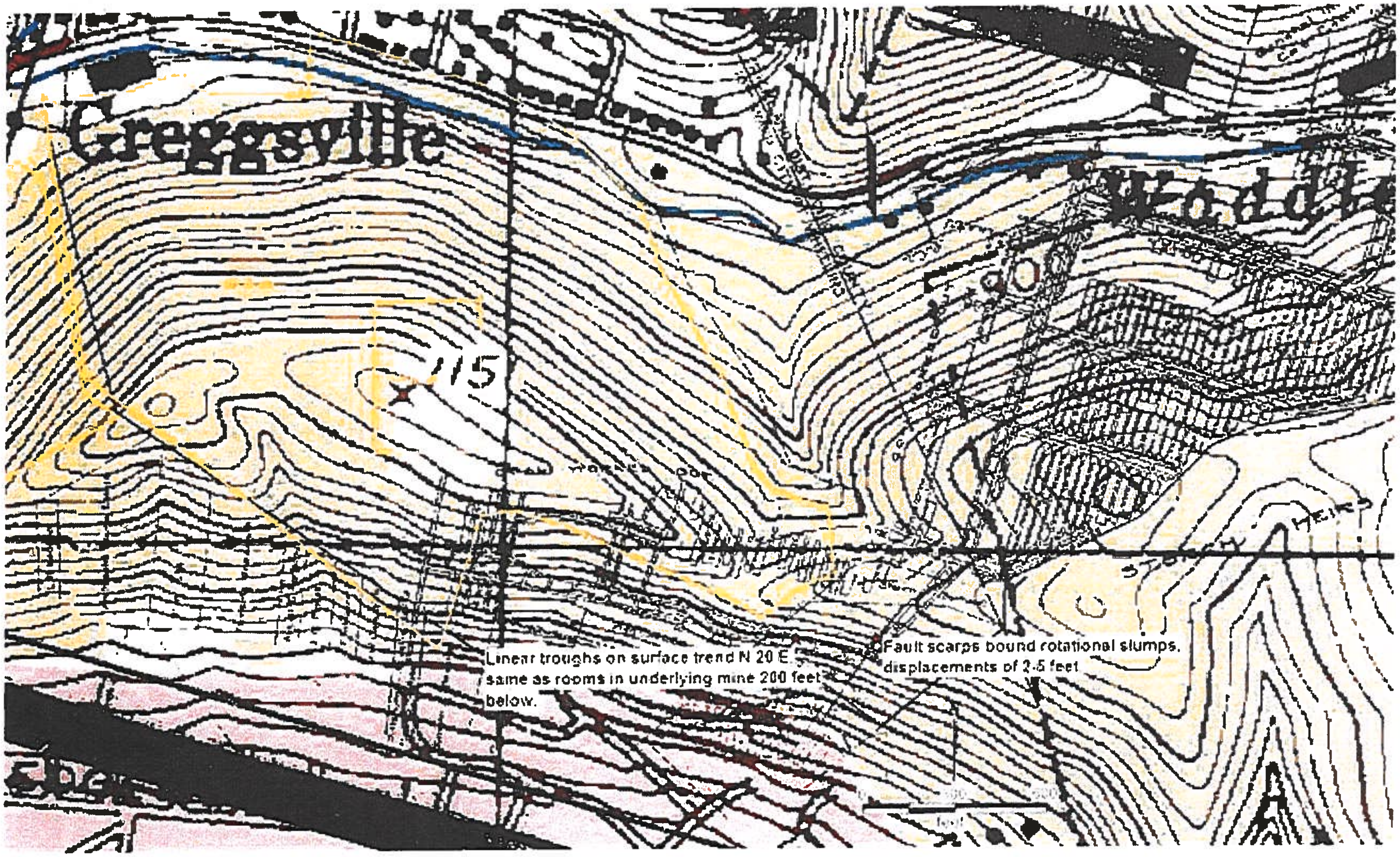



Figure 14. The outline of parcels W32-99.2 and W26-90 are superimposed on a map of the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine, showing in relation to a topographic map for orientation. Text on the map describes mine subsidence-related features located with a GPS on the south side of the ridge, corresponding to the margin of the underlying mine.

Linear trough observed on the ridge slope 200 feet above the Pittsburgh-Wheeling mine trends N 20 E, the same orientation as rooms and fenders in the production panels.

Figure 15. A linear trough, trending from the photo's left across the center of the field of view, is oriented with its long axis along a bearing of N 20° E, which is parallel to the long axis of rooms mined in the underlying Pittsburgh-Wheeling Coal Co.'s Edgewood Mine.

For further evaluation, Figure 16 represents the profile of the ridge bounded by Woodsdale on the south and Waddles Run on the north after proposed excavation to develop a flat pad to accept construction development. The original profile has been reduced by removal of the hilltop to the elevation of the property boundary of Parcel W26-90, from which point the final highwall steps down toward the north. Figure 17 presents the distribution of Strength Factor determined by finite element analysis for the remaining strata between the Pittsburgh Seam and the construction pad elevation. The prediction of failed elements in shear and tension, as well as Strength Factor values less than 1 (red and orange) is an indication that, if mine openings in the Wheeling Pittsburgh Coal Co.'s Edgwood Mine are still intact, subsidence into those openings can be considered likely. The distribution of red color, indicating potential for failure, indicates subsidence into panels previously described as having thin coal fenders, with tensile failures likely above the robust, intact pillars flanking former haulageways.

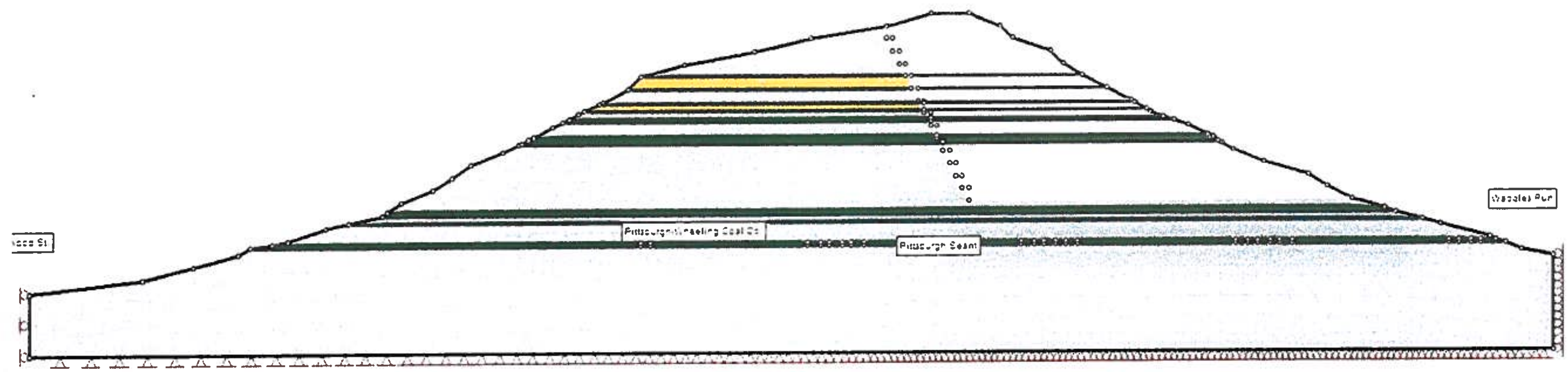



Figure 16. Cross section profile along the longitudinal axis of the ridge, with Woodsdale on left and Waddles Run on right, showing approximate extent of proposed excavation (white space) in relation to original profile (purple line).

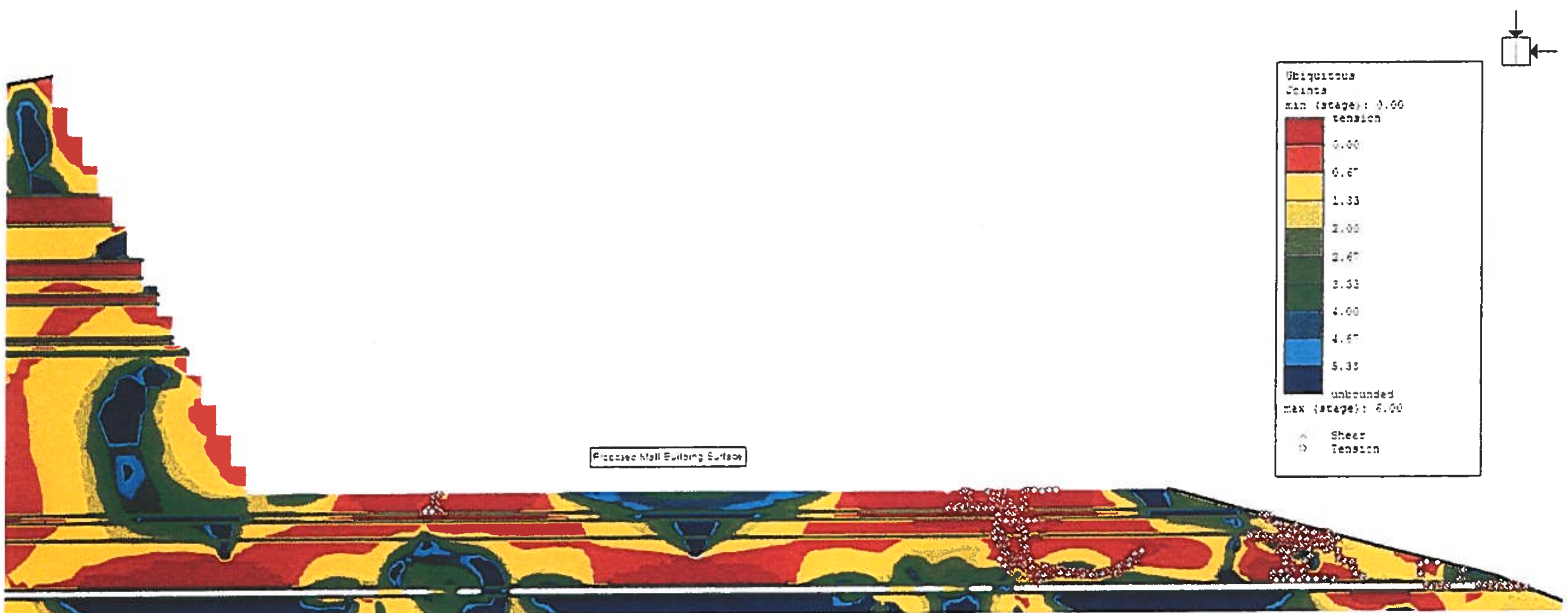



Figure 17. Distribution of Strength Factor for remaining strata above assumed mine voids in Pittsburgh Seam, suggesting potential for shear and tensile failure.

**Conclusion**

The presence of stable barriers flanked by large areas of weak pillars is an indication that differential subsidence is likely beneath the ridge, if it has not already occurred. Differential subsidence is simply a more technical term for the commonly recognized concept of mine subsidence. Mine subsidence occurs above old mine voids, and at shallow depths might occur above individual entries or crosscuts (commonly referred to as "tunnels") but on a larger scale occur at boundaries between solid coal or barriers and areas of mine-out gob in which there is no longer support for the overlying strata (Appendix 3). If virtually all the coal had been extracted, the remaining weak pillars would likely have failed and it would be as though the coal seam and intervening mine voids had never existed. However, the presence of strong barriers flanking the weak pillars allows the continued possibility of mine subsidence, especially if the thin coal pillars suddenly collapse. In the case of the ridge bounded by Woodsdale and Waddles Run, the 250-foot width of panels is greater than the depth to the surface for much of the north side of the ridge, which makes it possible for mine subsidence to reach the ground surface. There is already evidence of mine subsidence on the south side of the ridge up to 200 feet above rooms in the Pittsburgh-Wheeling Coal Co.'s Edgewood Mine.

It should be recognized that simply because mining was performed approximately 90 years ago, there is no expectation that full convergence has already occurred. The foregoing analyses indicate only that pillars in production panels have very low stability and that collapse or failure is likely, but cannot predict when collapse will occur or even if it has occurred. However, if collapse has not already occurred, all indications are that it will. As presented in two articles from the Pittsburgh press, mines in the Mount Washington area of Pittsburgh have experienced mine subsidence and sinkhole development, with related damage to homes, since the 1950s (Appendices 4 and 5). Mine subsidence continues to the current time above the Pittsburgh Seam in this neighborhood, requiring the intervention of state-funded mitigation methods because of the vast scale and expense of measures to stabilize the ground. The only way to determine whether subsidence has not occurred, in other words that pillars are still intact and could fail in the future, would be through a program of core drilling and ground-penetrating radar to identify any existing mine voids.

## Appendix 1
## Stability of Composite Barriers in 2-Entry Track Haulageways

ARMPS module build: 6.1.04

Units: (ft) (psi) (tons)

[PROJECT TITLE]
Pittsburgh-Wheeling Coal Co. Mains

[PROJECT DESCRIPTION]

[DEVELOPMENT GEOMETRY PARAMETERS]
Entry Height.........................................5.5 (ft)
Depth of Cover.......................................300 (ft)
Crosscut Angle.......................................90 (deg)
Entry Width..........................................12 (ft)
Number of Entries....................................2
Crosscut Spacing.....................................75 (ft)
Center to Center Distance #1..........................35 (ft)

[DEFAULT PARAMETERS]
In Situ Coal Strength................................900 (psi)
Unit Weight of Overburden............................162 (pcf)
Breadth of AMZ.......................................87 (ft)
AMZ set automatically
Pressure Arch Factor.................................0.4
Pressure Arch Factor set automatically

[RETREAT MINING PARAMETERS]
Loading Condition.................DEVELOPMENT LOAD (NO NEARBY GOB)

[ARMPS STABILITY FACTORS]

Development.................................9.65

[WARNINGS]

The Pressure Arch loading model used in ARMPS v6 was derived from analysis of case history data from the Western and Central Appalachian coalfields in the US. The overburden rock in these two coalfields is relatively strong. No research has been conducted to test the applicability of the pressure arch loading model in other coalfields.
[DATA ABOUT THE ACTIVE MINING ZONE (AMZ)]

Panel Width............................35.0 (ft)
Depth to Panel Width Ratio.............8.6
AMZ Breadth............................87.0 (ft)
AMZ Area...............................3045.0 (ft)*(ft)
Extraction Ratio within AMZ............0.45
Tributary Area Load on AMZ.............7.40E+04 (tons)

DEVELOPMENT LOADINGS ON AMZ (tons)
Tributary Area*........................2.96E+04
TOTAL DEVELOPMENT......................2.96E+04
*Adjusted by Pressure Arch Factor

R-Factor for front abutment is the percent of the total front abutment load that is applied to the AMZ.

R-Factor for side abutment is the percent of the total side abutment load that is applied to the barrier pillar (the remainder is applied to the AMZ).

LTRANSBAR is the load transferred to the AMZ from the barrier pillar between the side and active gob if the barrier's SF is less than 1.5.

LTRANSREM is the load transferred to the AMZ from the remnant barrier between the side and active gob if the remnant's SF is less than 1.5.

[PILLAR PARAMETERS]

PILLAR ENTRY MINIMUM MAXIMUM CENTER DIMENSION
DIMENSION (ft) (ft) (ft) 1 35.00 23.00 63.00

PILLAR AREA STRENGTH LOAD-BEARING
CAPACITY (ft)*(ft) (psi) (tons) 1 1.45E+03 2361.04
2.46E+05

TOTAL LOAD-BEARING CAPACITY OF PILLARS WITHIN AMZ: 2.86E+05 (tons)
To view the distribution of Pillar Load Bearing Capacity select 'View Plots->Settings->Pillar Load Bearing Capacity'

[BARRIER PILLAR PARAMETERS]
***none***

[REMNANT PILLAR AND LEAVE PILLAR PARAMETERS]
***none***

## Appendix 2
## Stability of Remnant Pillars in Production Panels

ARMPS module build: 6.1.04

Units: (ft) (psi) (tons)

[PROJECT TITLE]
Pittsburgh-Wheeling Coal Co. Panels

[PROJECT DESCRIPTION]

[DEVELOPMENT GEOMETRY PARAMETERS]
Entry Height........................................5.5 (ft)
Depth of Cover.......................................300 (ft)
Crosscut Angle.......................................90 (deg)
Entry Width..........................................23 (ft)
Number of Entries....................................10
Crosscut Spacing.....................................150 (ft)
Center to Center Distance #1..........................33 (ft)
Center to Center Distance #2..........................33 (ft)
Center to Center Distance #3..........................33 (ft)
Center to Center Distance #4..........................33 (ft)
Center to Center Distance #5..........................33 (ft)
Center to Center Distance #6..........................33 (ft)
Center to Center Distance #7..........................33 (ft)
Center to Center Distance #8..........................33 (ft)
Center to Center Distance #9..........................33 (ft)

[DEFAULT PARAMETERS]
In Situ Coal Strength.................................900 (psi)
Unit Weight of Overburden.............................162 (pcf)
Breadth of AMZ.......................................87 (ft)
AMZ set automatically
Pressure Arch Factor.................................1
Pressure Arch Factor set automatically

[RETREAT MINING PARAMETERS]
Loading Condition.................DEVELOPMENT LOAD (NO NEARBY GOB)

[ARMPS STABILITY FACTORS]

Development................................1.09
[WARNINGS]

A. Analysis of the ARMPS case history data base suggests that the risk of pillar failure is increased when the ARMPS SF is less than 1.5. For more information, consult Help/Stability Factors.

Analysis of the ARMPS case history data base suggests that large groups of slender pillars, with width-to-height ratios of less than 4.0, may collapse suddenly. To minimize this potentially severe hazard, an ARMPS SF of at least 2.0 is recommended when such slender pillars are used. An alternative is to minimize the size of the area supported by slender pillars. For more information, consult Help/Stability Factors.

[DATA ABOUT THE ACTIVE MINING ZONE (AMZ)]

Panel Width............................297.0 (ft)
Depth to Panel Width Ratio.............1.0
AMZ Breadth............................87.0 (ft)
AMZ Area...............................25839.0 (ft)*(ft)
Extraction Ratio within AMZ............0.74
Tributary Area Load on AMZ.............6.28E+05 (tons)

DEVELOPMENT LOADINGS ON AMZ (tons)
Tributary Area*.........................6.28E+05
TOTAL DEVELOPMENT......................6.28E+05
*Adjusted by Pressure Arch Factor

R-Factor for front abutment is the percent of the total front abutment load that is applied to the AMZ.

R-Factor for side abutment is the percent of the total side abutment load that is applied to the barrier pillar (the remainder is applied to the AMZ).

LTRANSBAR is the load transferred to the AMZ from the barrier pillar between the side and active gob if the barrier's SF is less than 1.5.

LTRANSREM is the load transferred to the AMZ from the remnant barrier between the side and active gob if the remnant's SF is less than 1.5.

[PILLAR PARAMETERS]

| PILLAR DIMENSION | ENTRY (ft) | MINIMUM (ft) | MAXIMUM (ft) | CENTER | DIMENSION |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | 33.00 | 10.00 | 127.00 |
| 2 | 33.00 | 10.00 | 127.00 |
| 3 | 33.00 | 10.00 | 127.00 |
| 4 | 33.00 | 10.00 | 127.00 |
| 5 | 33.00 | 10.00 | 127.00 |
| 6 | 33.00 | 10.00 | 127.00 |
| 7 | 33.00 | 10.00 | 127.00 |
| 8 | 33.00 | 10.00 | 127.00 |
| 9 | 33.00 | 10.00 | 127.00 |

| PILLAR | AREA (ft)*(ft) | STRENGTH (psi) | LOAD-BEARING CAPACITY (tons) |
|---|---|---|---|
| 1 | 1.27E+03 | 1436.44 | 1.31E+05 |
| 2 | 1.27E+03 | 1436.44 | 1.31E+05 |
| 3 | 1.27E+03 | 1436.44 | 1.31E+05 |
| 4 | 1.27E+03 | 1436.44 | 1.31E+05 |
| 5 | 1.27E+03 | 1436.44 | 1.31E+05 |
| 6 | 1.27E+03 | 1436.44 | 1.31E+05 |
| 7 | 1.27E+03 | 1436.44 | 1.31E+05 |
| 8 | 1.27E+03 | 1436.44 | 1.31E+05 |
| 9 | 1.27E+03 | 1436.44 | 1.31E+05 |

TOTAL LOAD-BEARING CAPACITY OF PILLARS WITHIN AMZ: 6.86E+05 (tons)

To view the distribution of Pillar Load Bearing Capacity select 'View Plots->Settings->Pillar Load Bearing Capacity'

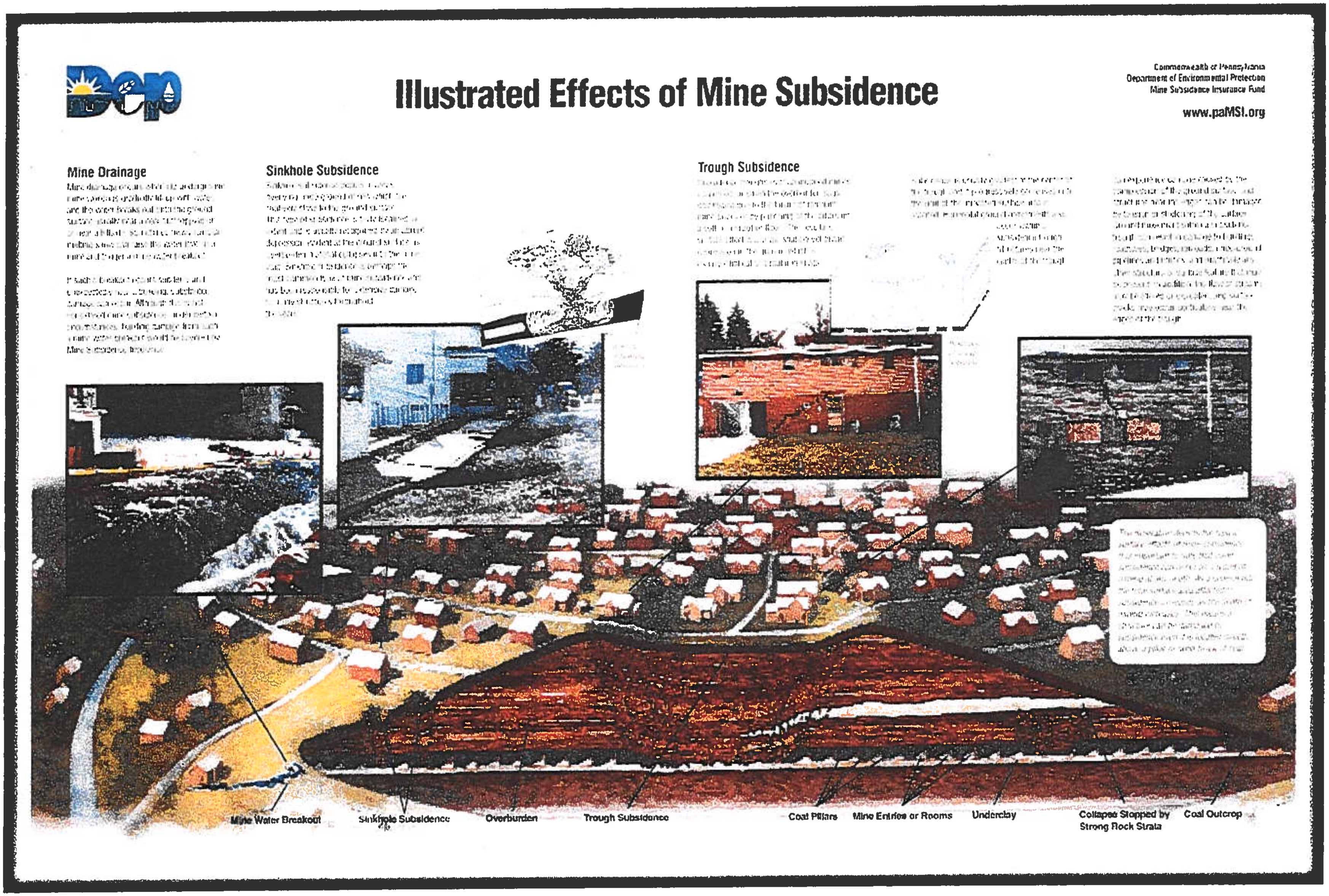
[BARRIER PILLAR PARAMETERS]

***none***

[REMNANT PILLAR AND LEAVE PILLAR PARAMETERS]

***none***

## Appendix 3


Illustrated Effects of Mine Subsidence
Commonwealth of Pennsylvania
Department of Environmental Protection
Mine Subsidence Insurance Fund
www.paMSI.org
Mine Drainage
Sinkhole Subsidence
Trough Subsidence
Mine Water Breakout
Sinkhole Subsidence
Overburden
Trough Subsidence
Coal Pillars
Mine Entries or Rooms
Underclay
Collapse Stopped by Strong Rock Strata
Coal Outcrop

## Appendix 4

**Pittsburgh Tribune Review**
**July 15, 2013**
**DEP determines mine subsidence caused Mt. Oliver homes' damage**

By Timothy Puko and Adam Smeltz

State regulators plan to fill an abandoned underground coal mine in Mt. Oliver Borough this month to stop homes from sliding off their foundations, a Department of Environmental Protection spokesman said on Monday. Department workers have identified a dozen damaged houses in the 100 block of Frederick Street since the ground began shifting last week, DEP spokesman John Poister said. Emergency responders initially blocked access on Friday to five houses that the borough has since condemned as unsafe. "It became a little more complex, but we're still moving as fast as we can," Poister said, calling the situation "not something you can leave alone, that's for sure." He said workers could see cracks Monday in the foundations and brick work of seven newly identified homes, some of which are near Walnut and Frederick streets. Damage at those houses was not serious enough to warrant evacuation.

Some residents at first suspected a water line break as a cause for the upheaval, a point that several of them raised at a packed borough council meeting on Monday night. Poister said state environmental officials are so certain the damage is from mine subsidence that they're fast-tracking their response. "That's just honeycombed up in that area with mines," said Harry Cook, 71, of Jefferson Hills, who lived on Arlington Avenue as a child. He said a huge hole appeared in a field adjacent to Frederick Street in the early 1950s, sounding like a bomb when it opened up. "They dumped truckloads and truckloads — 24 hours a day for weeks — to fill that thing in," Cook said. Mt. Oliver residents interviewed on Monday couldn't remember anything that dramatic in recent years.

Poister said the DEP is studying maps and compiling a report so that an independent contractor might start filling the mine by July 29 with a mixture of sand, concrete and fly ash. Crews can inject the mixture at each affected address where homeowners give the go-ahead for the stabilization, DEP appraiser Darryl Audia said. State officials also need approval from the federal Office of Surface Mining to pay for the work, for which the department hopes to seek bids this week. Poister declined to speculate on the cost but said tax revenue from active coal mines elsewhere should cover that expense. Billie Michener, the borough council president, said the municipality will help the residents however it can.

"I wouldn't know what I would do. I wouldn't be able to sleep. My God," Michener said. Stephen Thomas, 34, who lived with his fiancée and children in a now-condemned house, has been staying in a hotel since they were evacuated Friday. He said his family still doesn't know when it can return to collect belongings. "I'm just taking it day by day," Thomas said. The displaced residents can return only when engineers confirm it's safe to go inside, said borough ordinance officer Steve Wilharm. He and Michener said that will happen as soon as possible, though they did not specify a date.

Meanwhile, the DEP is encouraging neighborhood residents to consider mine subsidence insurance that's available through the department. None of the five evacuated houses had the insurance, which means any building repairs will fall directly to homeowners. "It's a shame. I know a lot of the people, and they might be losing everything because they didn't have insurance," said Duke Winkowski, 71, a 40-year Mt. Oliver resident. He said he bought mine subsidence coverage several years ago when a dimple appeared in his driveway. Now his neighbors "are rushing and getting it," Winkowski said. Premiums for the insurance coverage run about $57 for $100,000 in coverage, according to the DEP website.

No one was living in two of the five Frederick Street houses evacuated Friday, according to borough firefighters. The American Red Cross has helped supply food and shelter to five adults and six children from the other three homes.

**Appendix 5**

**Pittsburgh Tribune Review**
**August 4, 2013**
**Mine subsidence in region a constant problem for DEP**

By Mary Ann Thomas

Shelva Corna wasn't too happy to spend part of her retirement on $30,000-plus in repairs for her Hyde Park basement that shifted in 2011 due to mine subsidence. More than any other part of the state, Southwestern Pennsylvania is honeycombed with abandoned coal mines.

And they can collapse at any time.

Recently, 10 homes in Mt. Oliver Borough, which is next to Pittsburgh's Mt. Washington neighborhood, sustained damage from mine subsidence. The state Department of Environmental Protection is starting work on a $1.35 million project there to fill in the mine voids. It is expected to take eight to 10 weeks. And in Hyde Park, the DEP is a few weeks away from completing a nearly $3.7 million, nine-month project that is injecting 48,000 tons of cement and fly ash grout into the underground mine voids beneath 69 homes in the borough.

Where will subsidence hit next?

Anywhere there are underground mines, which are most places in this corner of the state. "We feel there are communities where residents possibly aren't aware that there are homes built over mines — based on the number of mine subsidence policies we have there," said John Poister, DEP spokesman. The state is responsible for shoring up mine subsidence from abandoned underground coal mines. However, the state is not responsible for damage caused to private property.

Insurance suggested

Plum, Penn Hills, Mt. Lebanon, Upper St. Clair and Belle Vernon are among communities where DEP would like to see more homeowners with mine insurance. "As good as our guys are at doing this," Poister said, "they cannot predict where it's going to happen and when it's going to happen." After Corna paid to fix her Hyde Park home, she bought the subsidence insurance "just in case," she said. Corna said that she considered buying the insurance earlier when she heard of mine subsidence years ago in nearby West Leechburg, Leechburg and North Apollo. It's all too common for residents to not be prepared for mine subsidence: Only about 6 percent of the more than 1 million at-risk homeowners sitting on top of abandoned mines in the state — most of whom are in Southwestern Pennsylvania — have the insurance, according to Poister. Standard homeowner's policies don't cover damage caused by subsidence. The insurance is relatively cheap through the state program at $57 annually per $100,000 worth of coverage up to $500,000. DEP administers the program, which is funded by insurance premium payments and no taxpayer money, according to Poister. Trying to get the word out, DEP most recently sent 1,700 insurance brochures to homeowners within a 5-mile radius of Mt. Oliver, according to Poister. In the coming weeks, DEP will target Munhall, Pleasant Hills and West Mifflin with mailings.

Not going away

After more than two centuries of coal mining, the room-and-pillar mines have been deteriorating and will continue to do so. The rate of decay in mines is dependent on the location of the mines and type of surrounding rock, according to Paul Ziemkiewicz, director of the West Virginia University Water Research Institute. "In some cases, the mine roof is still intact even if the pillars are gone," he said. "Other times, you have a weak, shale rock, and those start falling down as soon as you pull out mining equipment." While the construction and condition of the mines differ, the depth of the mine is predictive of subsidence: The more shallow the mine — in the 50-foot deep range — the more likely that subsidence will make its way to the surface, Ziemkiewicz said. The deeper mines will often fill in when they collapse and subsidence will never make it to the surface, he said.

According to DEP, the incidences of mine subsidence are constant, not increasing nor decreasing. However, according to Ziemkiewicz and Poister, there could be more subsidence in years to come as the old coal mines continue to age and collapse underground. DEP pumps in cement and grout into the mines that threaten to collapse. Subsidence usually is discovered at one or several homes. The agency then drills holes throughout the area to assess the size and extent of the underground void caused by the mine collapse. Some type of an event usually triggers the agency to check subsidence damage in a particular area, according to Gene Trio, a longtime DEP mining engineer.

Filling the void

The DEP projects have been successful in preventing future subsidence, according to Poister. In the last two decades, there have been only four cases of subsidence reoccurrence out of 2,500 properties that DEP had to go in and fill in the underground mines, Trio said. "Although we have not eliminated the chance of subsidence from occurring in these areas," Trio said, "we greatly reduced the chance."

September 23, 2019

RECEIVED
SEP 26 2019
CITY OF WHEELING
ECD DEPARTMENT

Mr. Thomas Connelly
Assistant Director
Economic and Community Development
City of Wheeling
Wheeling, WV 26003

Dear Mr. Connelly:

My wife Catherine and I wish to express our opposition to the proposed plan of GC&P Development Corporation for a multi-use shopping, business, and residential facility on Bethany Pike. You have probably listened to many reasons for thinking the plan untimely, impersonal, and destructive already, but allow me to express our reasons succinctly:

1) The facility is not, as the proposal claims, "community friendly." It will be located on top of a hill, out of sight from the lives of the people living there, walled and water-tight (if this is possible), hardly accessible by walking, and removed from the daily comings and goings of the people who work in the city.

2) We already are blessed with adequate shopping areas outside the city limits. If the proposal had been located downtown, along the river or in city-center, we would have seriously considered it as being beneficial for all citizens; however, as it is, the plan adds nothing to the life of the community, seeking only to attract shoppers and businesses (again!) away from the vital part of Wheeling.

3) Furthermore, if a retail area is being established, will young people who are primarily shopping on-line frequent these establishments on a regular basis? Or (and this is a question) is this new development primarily to attract the wealthy and those of older ilk who can afford it?

4) There will be increased traffic congestion in an area that has always been "country." People who have their homes nearby, or farther up Oglebay Park Hill (Rt. 88) or GC & P Road will have more difficultly negotiating to and from work.

5) Environmental damage will be exacerbated. Already, trees thirty-years-old and more have been eliminated. The developers will be tearing down homes and more trees, increasing both noise and air pollution and probably water and soil pollution. They have promised to plant 750 more trees on the site, trees which will take years to mature and which are incapable of reviving the ones already destroyed.

Although we live three miles up from the proposed development project (at the intersection of GC&P Road and McColloch Drive) we realize the tremendous difficulties and inconveniences to the people of the Woodsdale/Edgewood area—and to the city itself—in building a complex such as this. Most of all, this development is unnecessary and detrimental to the common good of the city and the people as a whole. Riding roughshod over hillside land which was beautiful and good in itself, these developers and their associates ignore real progress and renewal simply for something which is "new."

Mr. Connelly, I ask you to continue—as you have done so far—to discern the ethical, environmental, and personal outcomes of this proposal and to work with city council in coming to a decision which respects both the true needs of the city and its people.

Thank you for listening.

Sincerely,

Louis A. Volpe

Louis A. Volpe

Catherine A. Volpe

Catherine A. Volpe

101 McColloch Drive
Wheeling WV 26003

**Tom Connelly**

**From:** Gig Meredith <gig.meredith@yahoo.com>
**Sent:** Tuesday, October 8, 2019 6:01 PM
**To:** Tom Connelly
**Subject:** Woodsdale Hill

I am a resident of Woodsdale in Wheeling. My address is 98 Edgwood Street. I am very concerned about the proposed development by GC & P.
I do not feel that a development that involves a major alteration to hillside of such magnitude is appropriate for this site.
My concerns include management of water runoff to a very large area that could damage homes and streets.
Also the noise, dirt & traffic for five years would be a nuisance to many residents.
I live where I currently can see runoff that comes down the hillside. Our parking lot suffers wash outs when there us more than 1/2 an inch of rain in one day.
I previously resided at Campbell Terrace. When there was the rain event a few years ago I watched in horror as water rushed down the hillside and spilled over the retaining wall toward the back of my townhouse.
I urge the city to protect the homeowners who would have property at risk with a development such as the proposal on the hillside.
Thank you for your consideration.
Frances Meredith

Sent from Yahoo Mail on Android

## Tom Connelly

**From:** Karen Kangisser <karenkangisser@yahoo.com>
**Sent:** Thursday, October 10, 2019 8:15 AM
**To:** Tom Connelly
**Subject:** GC&P Development Application

Hi Tom,

Woodsdale UNITED has a public meeting this evening so I was just checking to see if you have received any information that has been sent to the Planning Commissioners that you could share with me?

Also, I was wondering who I would contact so that I could read or get a copy of the GC&P's original application, supporting documentation and minutes of the Planning Commission meeting when GC&P Development first applied for a zoning change for "Woodsdale hill." I'm not sure exactly when in the spring of 2013 the meeting took place but could look for my old calendars if you think it would help.

Thanks so much for your help.
Karen

Karen Kangisser
2 Lorraine Terrace
Wheeling, WV 26003
304-551-5445
karenkangisser@yahoo.com

## Tom Connelly

**From:** Karen Kangisser <karenkangisser@yahoo.com>
**Sent:** Thursday, October 10, 2019 2:34 PM
**To:** Tom Connelly
**Subject:** GC&P Development Map 60

Tom,
For the Planning Commissioners-

Reviewing Applicant Map 60, titled BWQ SAMPLE Sites: Please explain what the sites are, what was collected at each site and provide the data and report(s) explaining the findings.

Thanks,
Karen Kangisser
karenkangisser@yahoo.com
304-551-5445

## Tom Connelly

**From:** Ed Jepson <edjepson@gmail.com>
**Sent:** Thursday, October 10, 2019 9:56 PM
**To:** Tom Connelly
**Subject:** Stop GC&P Development

Tom,
The city has a comprehensive development plan.
It took a lot of time, thought, effort and money to put it in place.
It tried to capture what is best for the city and it's citizens.
Please encourage the planning commission and council to not abandon it now.
Thank you,

--
Ed Jepson
2 Hazlett Court
Wheeling, WV 26003
edjepson@gmail.com

**Tom Connelly**


**From:** kcampanizz@aol.com
**Sent:** Thursday, October 10, 2019 10:38 PM
**To:** Tom Connelly
**Subject:** GCP project


Kathleen Campanizzi
19 Vista Ave.

I am already experiencing effects of the tree removal by the GCP proposal. The increased amount of water that gushes down Vista Ave has caused water to come in my basement. I recently spent several thousand dollars to try to remedy this problem. If I am experiencing additional water damage now, I can imagine what it will be like when the development begins in full force.

**Tom Connelly**

**From:** Kevin Frank <kevin.frank@covestro.com>
**Sent:** Friday, October 11, 2019 7:19 AM
**To:** Tom Connelly
**Subject:** Woodsdale hill

Hello Tom,

Please send my information to the planning commission.

I am against the project for several issues
- construction traffic
- road damage
- air pollution
- water run off
- damage to an historical neighborhood

I could go further but you get the message.

Thanks,
Kevin Frank
24 Hamilton Ave

Sent from Workspace ONE Boxer