

## DEVELOPER AVOIDS SUBSTANTIAL RISK OF SUBSIDENCE DAMAGE

Assessments of the potential for damage from subsidence and how it can be mitigated play key roles in important economic land development decisions. Given such decisions can result in expenditures on the order of \$1 million to \$15 million, one should be well informed on all such aspects by an expert.

Consequently, MEA was asked by a developer to investigate the effects of old coal workings which existed below a Midwest site. These old works were at a depth of about 210 ft. and were developed during the 1900 to 1925 time period, or almost a hundred years ago.

The method used to recover the coal is called room-and-pillar extraction. Here, the coal is extracted by excavating intersecting tunnels (also known as rooms or entries) while pillars of the remaining coal are left to support the overburden (Figure 1). A historical map showing the rooms and pillars left beneath the site is shown in Figure 2.

One of the important questions which needed to be answered during the investigation was how stable the mine structure was after almost a century. This would determine the risk of subsidence and in turn the damage potential. To assess the existing state of this old underground mine, a number of exploratory borings were drilled through the old works to determine the ultimate strength of the rocks which made up the mine structure.

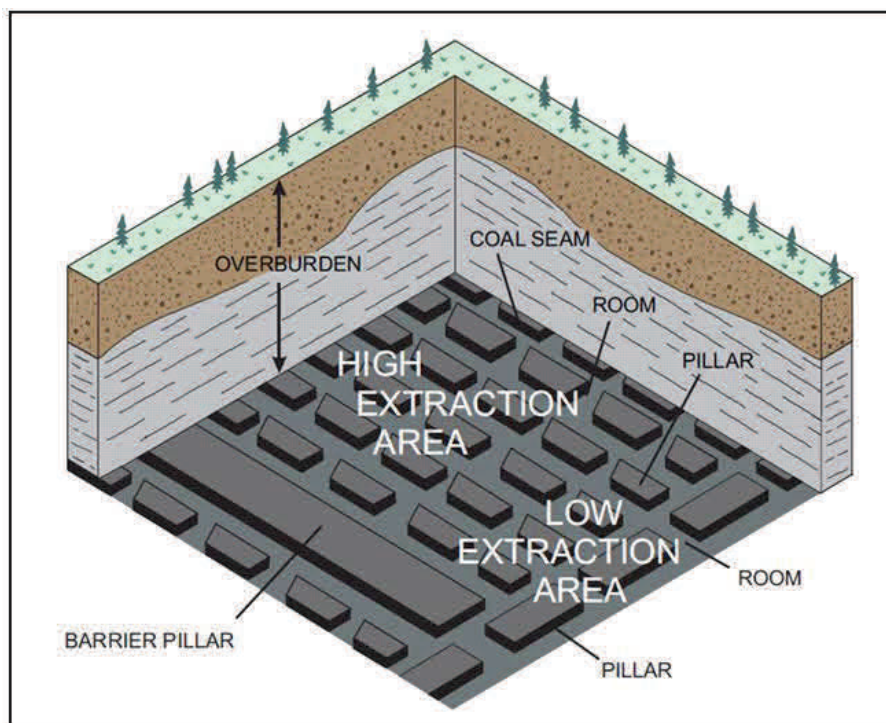


FIGURE 1: ISOMETRIC VIEW OF ROOM-AND-PILLAR MINES

Also, existing conditions of mine voids were inspected with the use of a borehole camera. One of the features which could be seen with the camera was pooled groundwater present in the old works (Figure 3).

From all the information collected, including the subsidence activity in the area and advanced engineering analyses of the stability of these old works it was determined that there was a high risk of future subsidence, and that it was possible that very severe damage could result. What was determined was that the coal pillars did not have firm bearing and would eventually sink into the water softened mine floor.

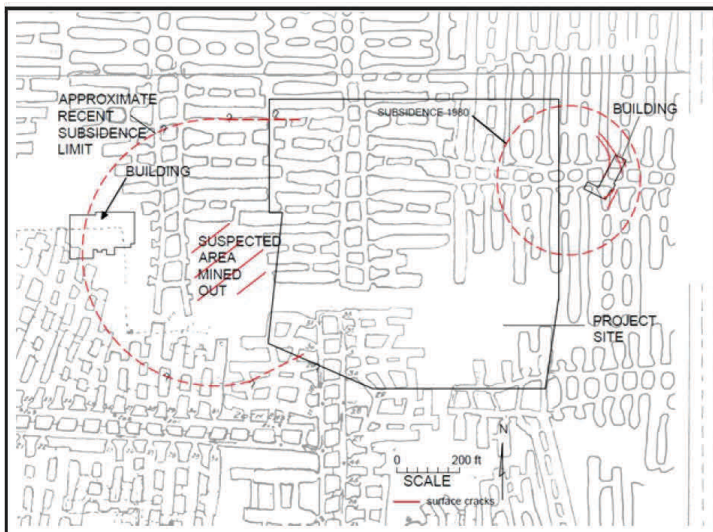


FIGURE 2: HISTORICAL MINE MAP SHOWING ROOMS AND PILLARS WITH LOCATIONS OF SITE AND SURFACE SUBSIDENCE

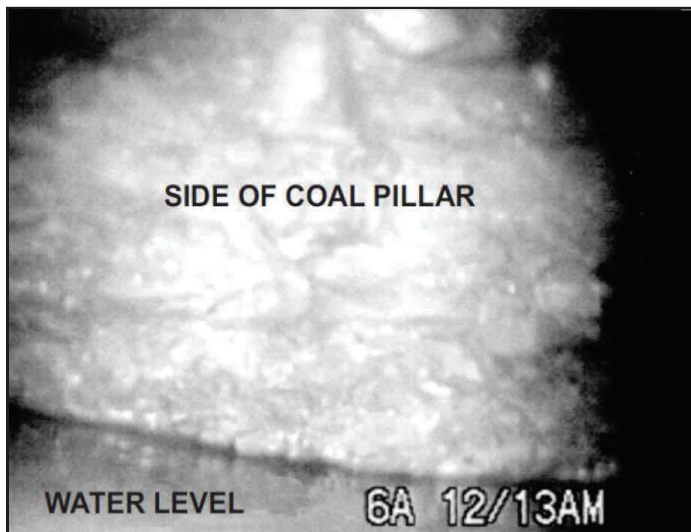


FIGURE 3: BOREHOLE CAMERA SHOT IN ABANDONED MINE AT A DEPTH OF 211 FT. SHOWING POOLED WATER AGAINST COAL PILLAR

Also based on our in-house files, it was known that about a quarter of a century ago there was a subsidence event which formed on the east side of the property. Because of this subsidence, a structure was damaged and had to be abandoned and razed (see Figure 2). As a result of the assessed risk, the developer decided to abandon the site due to the related potential liabilities it presented.

Four years after our investigation, a fairly significant subsidence event resulted in substantial damage to another structure just west of the site (see Figure 2). Although no data is available on the former store site, it is likely that this subsidence extended into it. This would have resulted in substantial damage if the store had been built, unless the mine had been stabilized.

## SUMMARY

A developer was interested in a site which was underlain with an old underground coal mine. Consequently, the developer required an expert assessment of the risk and potential of subsidence damage and alternative damage mitigation measures. After a thorough investigation of the site conditions, MEA concluded that the site was a high subsidence risk. The site was subsequently abandoned given the subsidence related liabilities. Four years after MEA's investigation, a significant subsidence resulted and caused substantial damage to a neighboring building and would have likely caused a significant damage to the store if it had been built.

### Other Engineering UPDATES of Interest:

#### UPDATE 14: Establishing Mine Subsidence Risk

#### UPDATE 4: Improvement of Mine Support Saves Pipeline from Subsidence Event

#### UPDATE 33: Investigation of Excessive Fill Shrinkage from Embankment Construction

**ABOUT MEA:** Marino Engineering Associates, Inc. focuses on engineering research, practice and expert evaluations and is licensed in 24 states in the U.S. Our projects primarily have an emphasis on Geotechnical Engineering, however, we also have significant experience in projects involving transportation, subsidence engineering, laboratory testing, training, and geophysical exploration. Gennaro G. Marino, Ph.D., P.E., D.GE is president and principal engineer of Marino Engineering Associates, Inc., and has been a licensed professional engineer since 1984. To obtain additional information on MEA, one can also visit our website at [www.meacorporation.com](http://www.meacorporation.com).

**FOR MORE INFORMATION:** There is a significant amount of additional information that is available on the above subject. For more information, please contact Dr. Marino at the address listed below.