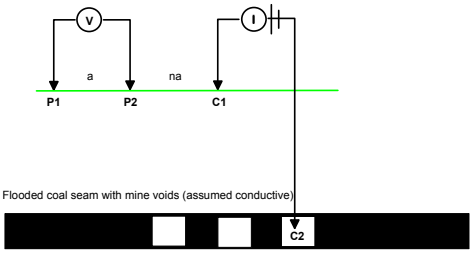
PROJECT PROFILE

GEOPHYSICAL CHARACTERIZATION OF ABANDONED COAL MINE WORKINGS

Geophysical techniques were employed at a proposed power plant site in southwest Indiana to supplement conventional subsurface exploration methods. Mine maps were reviewed and a drilling program was conducted. The results of the drilling program were evaluated along with information obtained though geophysical methods to assess subsurface conditions and to determine the extent of past surface and deep coal mining at the site.



Setup spacing for pole-dipole survey.

The study site was underlain by two coal seams - one at an approximate depth of 30 feet below the surface and a second one at a depth of about 90 feet. The shallower of the two seams had been partially surface mined, and the available mine map indicated the presence of some auger workings extending from the former highwall. The deeper of the two seams had been deep mined.

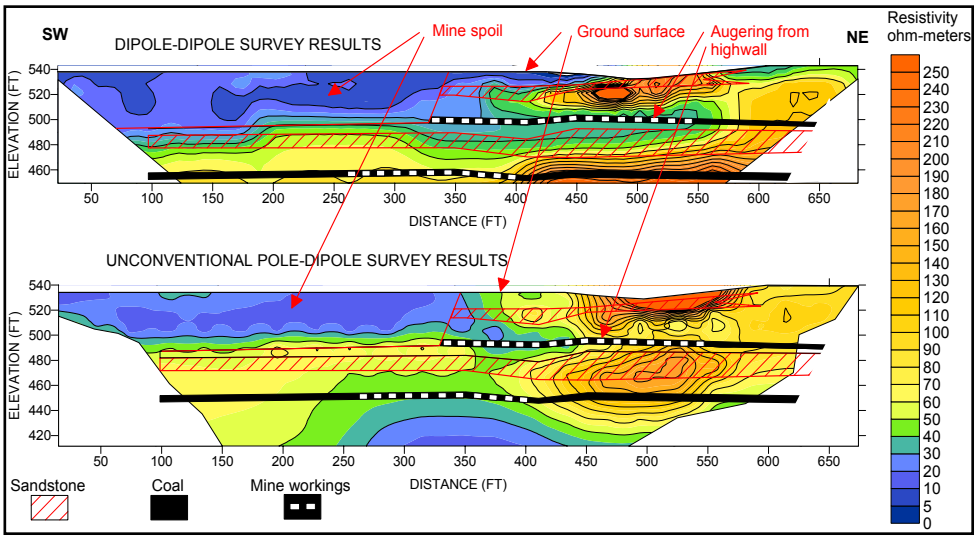
The DC resistivity technique was employed to determine the location of the abandoned mine workings. Testing was conducted along a 700-foot-long profile that traversed a main in the deeper seam, as well as a buried highwall associated with the shallow seam.

The geophysical survey was initiated using two configurations: conventional dipole-dipole and an innovative approach using a pole-dipole configuration. With the conventional dipole configuration, two electrodes separated by a constant spacing (referred to as the "a" spacing) were used to induce current into the ground. With this configuration, two additional electrodes also separated by the same distance are moved along the survey line at distances from the current electrodes that are multiples of the "a" spacing.

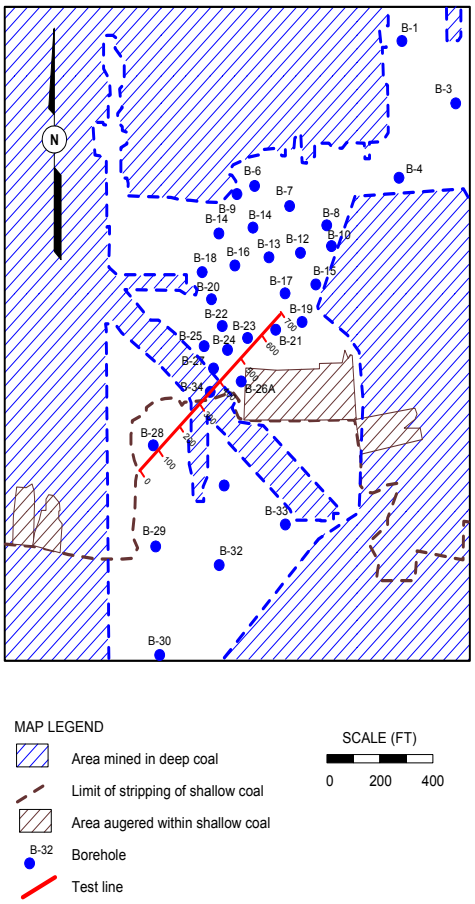
The pole-dipole DC resistivity survey uses three electrodes and normally has one current electrode placed far enough from the others that it can be considered to be at an "infinite" distance. The form of this configuration used along the test profile was unconventional in that the "infinite" current electrode was placed within the deep coal seam.

The field geophysical study led to two conclusions:

- The existing mine map did not accurately depict the extent of shallow augering from the former strip mine highwall. The resistivity results indicated that the augering in the shallow seam actually extended about 150 to 200 feet from the highwall along the test line.



Subsurface profiles showing the presence of coal seams and underground mine workings.



Plan view of site showing mined areas, boring locations, and the location of the geophysical test line.

- The existing mine map appeared to be a good representation of the location of the deep mine workings. The pole-dipole configuration survey results depicted the deep workings in a manner consistent with the mine map and the results obtained from the borings.

Conventional dipole-dipole surveying provided the best resolution of the shallow subsurface. The pole-dipole resistivity survey provided deeper penetration and thus was more effective for location of deep mine workings.

It was concluded that DC resistivity is an effective tool for locating subsurface mine workings and that deep coal workings can be imaged, even when complex conditions are present above the seam, as long as it is practical to electrify the coal seam with a current electrode.