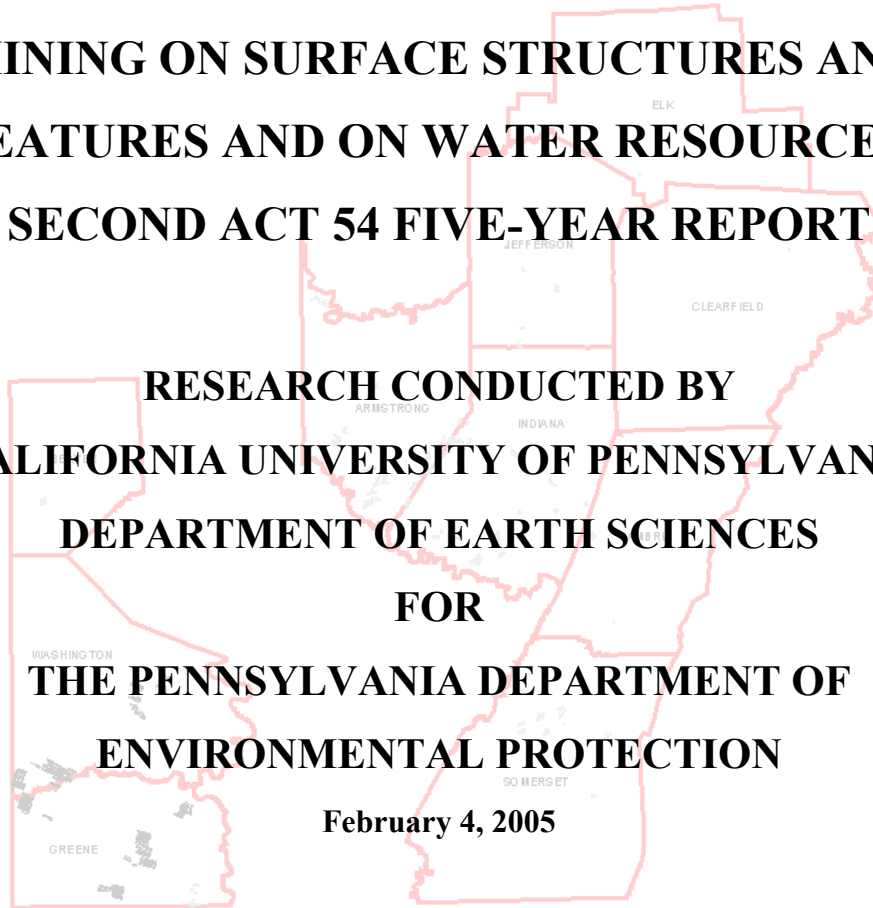


**THE EFFECTS OF SUBSIDENCE RESULTING
FROM UNDERGROUND BITUMINOUS COAL
MINING ON SURFACE STRUCTURES AND
FEATURES AND ON WATER RESOURCES:
SECOND ACT 54 FIVE-YEAR REPORT**

**RESEARCH CONDUCTED BY
CALIFORNIA UNIVERSITY OF PENNSYLVANIA
DEPARTMENT OF EARTH SCIENCES
FOR
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ENVIRONMENTAL PROTECTION**

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Section II: SCOPE OF THE STUDY

II.A. Overview

This section frames the scope of this report. It does not enumerate all the details of the original MOU. The following section (III Limitations) refines the scope.

The full scope of the study is defined by the MOU under which it was written and by the requirements of Act 54. The goal at the outset of this study was to report on all effects of underground bituminous coal mining on the water sources, structures, streams, wetlands, land surface, and infrastructure. Within the context of available data on these effects, the University attempts here to present a useful, holistic analysis of the influence of underground bituminous coal mining on the surface.

II.B. Temporal Delineation of the Study

This study commenced on March 22, 2004, and resulted in an initial draft dated August 28, 2004. The original intent of the PA DEP and the University was to collect all the data necessary for the report in an initial 160-day study period. The time for the report was lengthened as circumstances dictated. Such circumstances included the wait for organizations and agencies to respond to inquiries about subsidence impacts and the discovery of new sources of data that contradicted or enhanced the data from previously tapped sources.

II.C. Impacts on Ground Water

The report provides an analysis of the number of water supplies reportedly impacted during the assessment period, with results organized by mining method and water supply type (springs, wells).

The report also provides an analysis of the distances at which underground mining affected water supplies, with results organized by mining method and water supply type. The analysis includes a comparison between the observed distances at which impacts

occurred and distances calculated for a presumptive zone of influence on dewatering (the distance wherein an operator is presumed by law to be liable for water supply impacts).

The report provides a regional analysis of the ability of shallow aquifers to support rural domestic and agricultural water supplies in areas undermined during the assessment period. The analysis distinguishes among areas undermined by longwall mining, room-and-pillar mining, and room-and-pillar-retreat mining. The report provides, within the context of the reported number and locations of springs, an analysis of the extent to which springs were affected by longwall mining.

II.D. Impacts on Structures

The report provides (from such information as was available during the study period) an analysis of the impacts of underground mining that caused structure damage with results organized by mining method. The first draft included an analysis of structure problems with respect to their “distance to mining.” This second draft does not include such an analysis: not all structures have a recorded distance to mining, and structures overlying a mine are given a distance of zero. The report does, however, provide maps of longwall mines that relate mining boundaries to structures with reported problems and structures with actual, investigated claims.

The report provides a magnitude or severity scale of damage sustained by a number of structures during the assessment period. The scale is qualitative because no complete set of records exists for costs associated with structural damage; and no architecturally precise descriptions of structure damage were available for numerous structures.

II.E. Impacts on Streams

The report presents a description of the length of streams undermined during the assessment period, with results organized by mining method. The report also presents information on the effects of underground mining on undermined stream segments with respect to their use classification (e.g., high quality cold water fishes, cold water fishes, high quality warm water fishes, warm water fishes, etc.), stream order, and flow

classification (intermittent or perennial). The report also presents an updated description of the condition of 15 streams identified as affected by mining in the Department's supplement to the 1999 report.

II.F. Impacts on Wetlands

The report provides an analysis of the number of National Wetlands Inventory wetlands that were undermined by longwall mines during the assessment period, with results organized by type of wetland (e.g., vernal, emergent, palustrine, etc.). Second, the report presents an analysis of the number of wetlands that changed during the assessment period as a result of underground longwall mining. Third, the report offers an analysis of the number of wetlands that were changed as a result of mine subsidence over longwall mines during the assessment period.

II.G. Impacts on the Land Surface

The report provides a count of the number of land impacts incurred as the result of mine subsidence. Such impacts include cracks in the surface soil and rocks and compression bumps.

II.H. Impacts on Infrastructure

Underground mining affects infrastructure. Therefore, this report includes information on roads, pipelines, power lines that were undermined, insofar as such information was available during the study period. The scope also includes impacts to sewer lines and railroad tracks.

II.I. Impacts on the Economy of Pennsylvania

This report includes a summary of an economic analysis made by another research group that investigated the impact of underground mining on the real estate values of Washington and Greene counties. The initial scope was intended to include a further economic analysis based on information about the costs of damages to structures, water sources, and infrastructure. Inconsistent and incomplete data on such costs forced the University and the PA DEP to alter the scope.

II.J. Review of Commissioned Reports Germane to This Study

One charge of the MOU was the review of four studies commissioned during the assessment period. The studies were an outgrowth of the 1998 Audubon Report, *An Investigation of High Extraction Mining and Related Valley fill Practices in Southwestern Pennsylvania* that was released prior to the Department's first five-year Act 54 report. The Audubon Report suggested that mining affected land productivity, property values, the local economy, and the tax base of undermined communities. The four commissioned studies address, in part, these suggested effects. These reviews of these studies are contained in their own section of the report. The authors of these reports are responsible for their findings and recommendations. No participants in this Act 54 report were associated with the four studies.

The four studies are:

Remote Sensing of Forestland Above Longwall Mines, by D'Appolonia of Monroeville, Pa.

Study of the Effects of Longwall Mining on Streams, Wetlands and Riparian Areas, by Earth Sciences Consultants, Inc. of Export, Pa.

Effects of Longwall Mining of Real Property Value and the Tax Base of Greene and Washington Counties, Pennsylvania, by Resource Technologies Corporation of State College, Pa.

Effects of Undermining Interstate Route 70 South Strabane Township, Washington County, by GeoTDR of Westerville, Oh.