DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
THE APPALACHIAN REGIONAL COMMISSION

MISCELLANEOUS FIELD STUDIES
MAP MF-685 D
(SHEET 1 OF 2)

INTRODUCTION

The purpose of this map is to define zones in Allegheny County where landsliding, flooding, undermining, or more than one of these three processes can pose problems in uses of the land. It was prepared by combining data from maps and reports listed in the following sections of the text.

It is emphasized that the map is intended only to provide a warning that certain processes *can affect* the identified zones. This does not mean that landsliding, flooding, or undermining necessarily *will affect* all the identified zones to a seriously damaging extent in the foreseeable future. Moreover, the boundaries of zones are approximate, and the scale of the map makes it probable that zones identified as prone to flooding, for example, contain undelineated smaller zones free of flood hazard. Conversely, some relatively small flood-prone areas undoubtedly have not been defined elsewhere on the map.

This map thus is a guide to potential limitations on land use, but it is no substitute for detailed site investigations and assessment of hazards by competent technical personnel.

COMPARISON OF EFFECTS OF LANDSLIDING, FLOODING, AND UNDERMINING

Although landsliding, flooding, and undermining all can affect land use, they differ greatly in many respects.

Flooding in stream valleys and landsliding are natural processes that were important contributors toward shaping the landscape long before man appeared in the area. Both, though, can be and have been influenced by man, either purposefully, in attempts to limit or control events, or inadvertently, usually to his long-term detriment.

Landsliding is downslope movement by force of gravity of natural rock and soil, as well as materials placed on slopes, such as fills. Most landslides in Allegheny County in recent years result from excavation, loading, or other modification of slopes by man.

Damaging floods are of moderate frequency in Allegheny County. The most recent major event was the tropical storm "Agnes" flood of June, 1972, and more localized flooding caused appreciable damage along some tributary streams as recently as the summer of 1974.

For the purpose of this map, undermining is restricted to mean underground mining of extensive coal beds that has been an important activity in Allegheny County for more than two centuries. Surface subsidence over mined-out coal beds, "mine subsidence," is the chief threat to land use that results from undermining.

Areas potentially affected and degree of potential social disruption.--About 110 square miles, or 15 percent of the county, have a significant degree of susceptibility to landsliding; about 70 square miles, or less than 10 percent, are identified as prone to flooding; and about 250 square miles, or 35 percent of the county, have been undermined.

Floods on main stem rivers affect areas measurable in square miles and disrupt the lives of many people, though relatively few seriously or for long periods of time. Individual landsliding and mine subsidence events usually affect much smaller areas (less than an acre is common) and disrupt the lives of few people, although this disruption commonly is serious and may have long-term effects.

Predictability.--Flooding is the only one of the three processes that is essentially guaranteed to take place at some time, perhaps in the distant future, in virtually all of the zones so identified on the map. On the main stem rivers floods are periodic events with recurrence intervals for various stages fairly well established on the basis of historical records, but subject to modification as the result of flood-protection measures and encroachment. Zones shown along tributary streams certainly are flood prone, but whether extreme flooding on any given stream recurs on the average every decade or every century is not predictable. In contrast, there is little likelihood that landsliding or undermining ever will affect more than a small percentage of the identified zones, but just which small percentage will be affected is unknown. However, some landsliding is predictable in the sense that susceptible slopes almost assuredly will develope landslide problems if extensively modified by man. Although mine subsidence is known to be more frequent in undermined areas with certain characteristics, these areas of higher incidence are large, and accurate locations of future damaging subsidence events within them cannot now be predicted.

Persistence and rates of occurrence.--On the countywide basis, landsliding is the most persistent process, for it probably is safe to say at any time that damaging landsliding is taking place somewhere in the county. Damaging subsidence events are sporadic and relatively few, and floods of serious magnitude on the average occur only every few years.

Some landsliding is very rapid, but most landslide events in Allegheny County are of many minutes, hours, or days duration and some major events may take years from beginning to end. Damaging subsidence events are very rapid, and serious flash floods of brief duration may happen in tributary stream valleys. On the main stem rivers there commonly are some hours of warning of serious flooding, but the flooding may persist for days.

Damage costs and human risk.--The long-term average annual countywide costs of damages from flooding may be several million dollars, from landsliding well over a million dollars, and from mine subsidence appreciably less than a million dollars. However, the costs to the individual homeowner involved in a common degree of subsidence event probably are larger than the costs to an owner involved in a common landsliding event, and in turn his costs probably are larger than those of the average owner involved in a flooding event.

All three processes thus are costly in terms of property, but they share one thing in common: by comparison with the magnitude of damage costs, all result in relatively few deaths or serious injuries.

Summary.--From the point of view of the individual owner of land in a zone that can be affected, the odds against damaging mine subsidence are very high, but if subsidence does occur the odds also are high that damages will be serious. The odds against serious landsliding are high, provided care is exercised, but if landsliding does ensue, the odds are that at least moderate costs will be involved. In contrast, one is essentially assured that flood-prone zones will sometime be flooded, but the odds are that the average homeowner in a flood-prone zone will not suffer great financial loss, partly because of his awareness of the probability of flooding owing to frequency of occurrence.

Many risks are, inherently, a feature of daily life. Over-concern stifles existence but prudence demands an appropriate level of concern. Hence, the map serves the purpose of providing an awareness of potential hazard that will lead to adequate evaluation and preparedness.

INFLUENCE OF LANDSLIDING, FLOODING, AND UNDERMINING ON PAST DEVELOPMENT

Figure 1 shows the extent of the main contiguous urbanized area in Allegheny County, and the topographic base of the principal map reveals patterns of past development through its delineation of roads, buildings, and other features. These indicate that the threat of flooding and undermining, and to some extent landsliding, has not greatly influenced selection of areas for development. In fact, in the western part of the county are many areas largely free of significant threat from these processes, yet they are less densely developed than are areas in the southern and eastern parts where at least one of the processes can affect land use.

HOW TO USE THE MAP

Zones on the map are symbolized 3, where all three processes can affect land use (a very small part of the total area); symbolized 2, where two of the three processes can affect land use; symbolized 1, where only one process can affect land use; and symbolized Ø, where land use largely is unaffected by any of the processes.

Letter suffixes to the number symbols identify which processes are of concern, as stated in the accompanying texts and the map explanation.

The map can be used in two ways: to find potential land-use limitations at a given site or to locate areas where potential limitations from the subject processes are present or absent.

If, for example, a certain use is projected for a given area, the map user locates that site on the map by reference to the map's topographic base, identifies the map symbol or symbols for the zones that coincide with the site, and refers to the map explanation. If in this example, the site is symbolized 2ap, then the user learns that landsliding and flooding can affect land use and that the area may be undermined in the future. With the potential threat or threats identified, the next step recommended to the map user is to seek more information from the pertinent maps and reports that are listed.

Examples of the second use of the map include: map users who seek to avoid effects of the three processes should search the map for zones symbolized Ø; and map users to whom the possible effects of, for example, present undermining are most critical should search the map for zones symbolized 1c, 2b, 2c, and 3 and then proceed accordingly. A simple way of emphasizing critical zones is to fill them in using colored pencils.

LANDSLIDING

Map symbols.--Zones symbolized 1a, 1ap, 2a, 2ap, 2b and 3 on the map have a significant degree of susceptibility to landsliding.

Sources of more detailed information.--The present map treats susceptibility to landsliding as either present or absent, but there are degrees of susceptibility and a variety of landslide types. For detailed treatment of this process and its warning signs, the reader is referred to:

Map of susceptibility to landsliding, Allegheny County, Pennsylvania, by J. S. Pomeroy and W. E. Davies, 1975. U.S. Geol. Survey Misc. Field Studies Map MF-685 B. $1.00.

and

Landsliding in Allegheny County, Pennsylvania, by R. P. Briggs, J. S. Pomeroy, and W. E. Davies, 1975. U.S. Geol. Survey Circ. 728. Free on application.

They may be acquired from:

Distribution Section
U.S. Geological Survey
1200 South Eads Street
Arlington, Virginia 22202

In addition, they may be inspected at:

Department of Planning & Development
County of Allegheny
Allegheny Building, Room 1500
429 Forbes Avenue, Pittsburgh

FLOODING

Map symbols.--Zones symbolized 1b, 1bp, 2a, 2ap, 2c, and 3 are prone to occasional flooding. To avoid cluttering the map with unnecessary lines, zones 1b and 1bp also include river and stream channels.

Sources of more detailed information.--All zones that can be affected by flooding will be flooded at some time, with perhaps many years between significantly damaging events. Only for the main stem rivers and a few principal tributaries, however, are recurrence intervals and flood stages defined with reasonable accuracy. The reader is referred to the following reports for this information.

Flood plain information, Ohio, Allegheny, Monongahela, and Youghiogheny Rivers, Allegheny County, Pennsylvania, by U.S. Army Corps of Engineers, Pittsburgh District.
Flood plain information, Peters Creek, Jefferson Borough, Allegheny County, Pennsylvania, by U.S. Army Corps of Engineers, Pittsburgh District.

Information about the availability of these reports and information on flood hazards at other locations in Allegheny County can be obtained from the following office which also has comprehensive information on flood-proofing measures.

Flood-plain Management Section
U.S. Army Corps of Engineers, Pittsburgh District
Federal Office Building
1000 Liberty Avenue, Pittsburgh, Penn. 15222

Flood-prone zones on most tributary streams are shown in relative detail on maps prepared for the Federal Insurance Administration by the U.S. Geological Survey. A "map of flood-prone areas" has been prepared for most of the 7 1/2' quadrangles shown on figure 2. Copies of these maps may be acquired free on application to:

U.S. Geological Survey
Water Resources Division, Pennsylvania District
P.O. Box 1107
Harrisburg, Pennsylvania 17108

UNDERMINING AND RELATED SURFACE SUBSIDENCE

Map symbols.--Zones symbolized 1c, 2b, 2c, and 3 were undermined as of June 30, 1974. Zones that may be undermined after June 30, 1974 and in the foreseeable future are symbolized with the suffix "p," meaning potential undermining; they are Øp, 1ap, 1bp, and 2ap. They were defined on the basis of the relatively sparse information available on the distribution of coal beds of potentially mineable thicknesses, so they must be considered approximations only. However, it is reasonable to speculate that many large "p" zones adjacent to zones actually undermined will themselves be undermined in a few years or decades. Not so well based is speculation on ultimate undermining of more distant "p" zones and some small "p" zones surrounded by zones actually undermined. Far in the future some zones not labeled "p" also may be undermined.

Sources of more detailed information.--Underground mining is an active process, so some zones identified on the map as undermined will be enlarged with time. Moreover, certain structures in place on April 27, 1966 are protected against subsidence damage from mining after that date by State legislation and regulations, which also require that owners of structures not legally protected be given the option of purchasing protection. Such protection takes the form of a requirement that adequate coal be left in the ground to prevent or limit subsidence. Detailed information on these protective regulations, on much past mining, and on the status of active mining under specific sites is available from:

Division of Mine Subsidence Regulation
Pennsylvania Department of Environmental Resources
Donaldsons Crossroads (Pennsylvania Highway 19S, Washington Road)
McMurray, Pennsylvania 15317

Additional information on mining and subsidence is shown on the following maps:

Map showing depths to the Pittsburgh coal bed, mining activity, and related surface subsidence, Allegheny, Washington, and Westmoreland Counties, Pennsylvania, by Kent O. Bushnell. 1975. U.S. Geol. Survey Misc. Field Studies Map MF-693 A. $0.50.

Map showing depths to the Upper Freeport coal bed, mining activity, and related surface subsidence, and the Redstone coal bed mines, Allegheny, Washington, and Westmoreland Counties, Pennsylvania, by Kent O. Bushnell and John R. Peak. 1975. U.S. Geol. Survey Misc. Field Studies Map MF-693 B. $0.50.

Map showing areas that correlate with subsidence events due to underground mining of the Pittsburgh and Upper Freeport coal beds, Allegheny, Washington, and Westmoreland Counties, Pennsylvania, by Kent O. Bushnell. 1975. U.S. Geol. Survey Misc. Field Studies Map MF-693 C. $0.50.

These maps may be purchased at the prices indicated from:

Distribution Section
U.S. Geological Survey
1200 South Eads Street
Arlington, Virginia 22202

They may be inspected at:

Department of Planning and Development
County of Allegheny
Allegheny Building, Room 1500
429 Forbes Avenue, Pittsburgh

Surface, or strip, mining of previously undermined land is a current activity, chiefly in the southwestern part of the county. One effect of such mining at some places is the complete removal of undermined zones by excavation. Information on strip mining and mine reclamation activity is available from:

Bureau of Surface Mine Reclamation
Pennsylvania Department of Environmental Resources
200 North 3d Street
Harrisburg, Pennsylvania 17120

INSURANCE AGAINST LANDSLIDING, FLOODING, AND MINE SUBSIDENCE

The Commonwealth of Pennsylvania offers insurance against mine-subsidence damage to structures. Information on this service is available from:

Division of Mine Subsidence Insurance
Pennsylvania Department of Environmental Resources
Kossman Building
Forbes Avenue and Stanwix Street, Pittsburgh, Penn. 15222

Currently, the Federal Insurance Administration, U.S. Department of Housing and Urban Development, administers a program through which many commercial insurers offer insurance against flood damage to residents of municipalities that have met certain requirements. This is a relatively new program, but many communities had established eligibility to participate by early 1975, and many other municipalities were in the application process. Information on the Federal flood insurance program in Allegheny County is available from:

Department of Planning and Development
County of Allegheny
Allegheny Building, Room 1500
429 Forbes Avenue, Pittsburgh, Penn. 15219

The Federal flood insurance program also offers protection against damages from mudflows, a form of landsliding, that are related directly to a flooding event. With this one exception, in early 1975 there was no insurance against damage from landsliding available for Allegheny County.

Units of measurement

Customary (English) units of measurement are used for present purposes in preference to International System (SI or metric) units. Some conversion factors are given below:

Multiply	By	To obtain
millimetres	0.03937	inches
inches	25.4	millimetres
inches	2.54	centimetres
feet	30.48	centimetres
feet	0.3048	metres
miles	1.609	kilometres
feet per mile	0.189	metres per kilometres

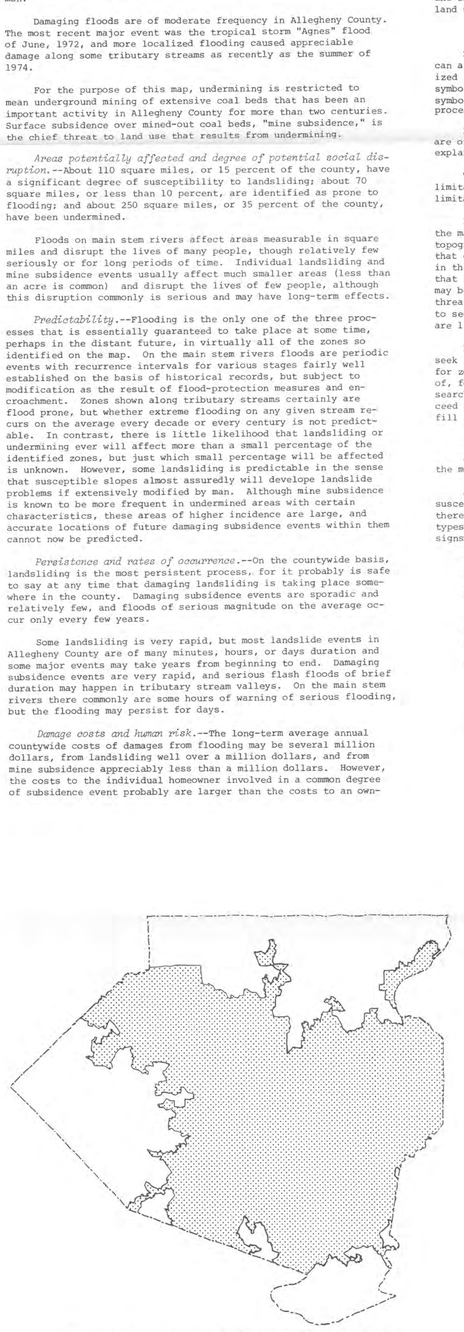


Figure 1.--Main contiguous urbanized area, Allegheny County, Pennsylvania (simplified from index sheet of 1970 census of housing, block statistics, Pittsburgh, Pennsylvania, urbanized area, by the U.S. Department of Commerce, Bureau of Census, 1971).

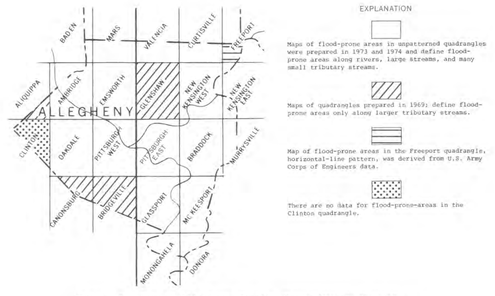


Figure 2.--Map of Allegheny County, Pennsylvania, showing locations of 7 1/2-minute quadrangles and sources of data for flood-prone areas.

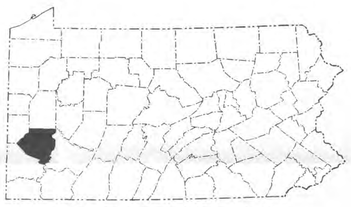
EXPLANATION

Maps of flood-prone areas in unpatterned quadrangles were prepared in 1973 and 1974 and define flood-prone areas along rivers, large streams, and many small tributary streams.

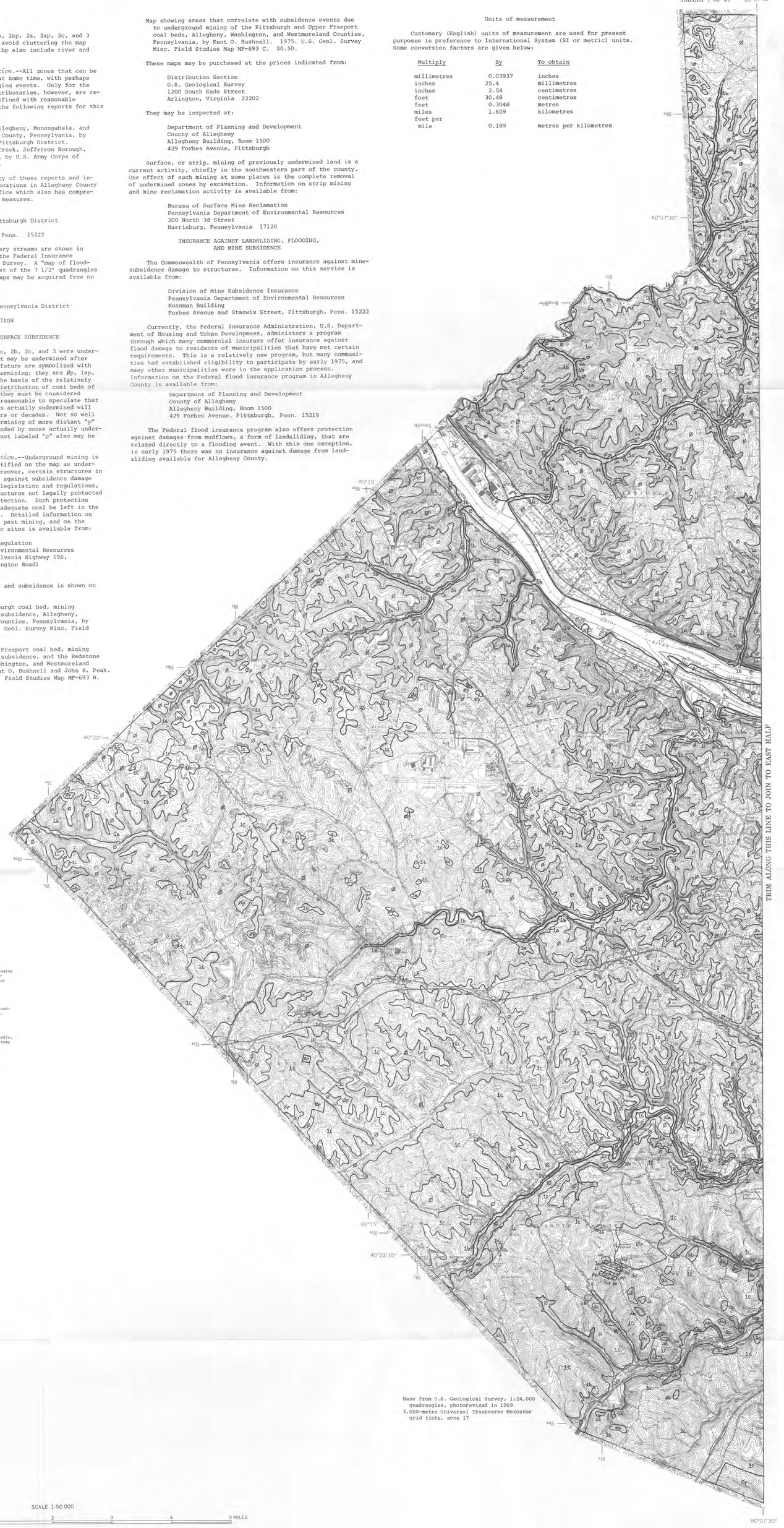
Maps of quadrangles prepared in 1969; define flood-prone areas only along larger tributary streams.

Map of flood-prone areas in the Freeport quadrangle, horizontal-line pattern, was derived from U.S. Army Corps of Engineers data.

There are no data for flood-prone areas in the Clinton quadrangle.



Pennsylvania county index map showing location of Allegheny County



Base from U.S. Geological Survey, 1:24,000 quadrangles, photorevised in 1969
5,000-metre Universal Transverse Mercator grid ticks, zone 17

SCALE 1:50 000
1 ½ 0 1 2 3 4 5 MILES
1 .5 0 1 2 3 4 5 KILOMETRES
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

MAP OF ZONES WHERE LAND USE CAN BE AFFECTED BY LANDSLIDING, FLOODING, AND UNDERMINING, ALLEGHENY COUNTY, PENNSYLVANIA

By
Reginald P. Briggs and William R. Kohl

1975

Interior--Geological Survey, Reston, Virginia--1975

For sale by U.S. Geological Survey,