AERIAL INFRARED SURVEY OF PORTIONS OF THE MONONGAHELA, OHIO, AND ALLEGHENY RIVERS; PITTSBURGH, PENNSYLVANIA VICINITY

JUNE 1973

PROJECT NO. N89.6

Prepared for

SURVEILLANCE AND ANALYSIS DIVISION

EPA - REGION III

Prepared by

ALBERT E. PRESSMAN

MONITORING OPERATIONS DIVISION

EPA - NERC-LAS VEGAS

In furnishing the Surveillance and Analysis Division - Region III with the data and the interpretation from NERC-Las Vegas services, it must be understood that the results stated and conclusions drawn represent NERC-Las Vegas' best judgment. Any action that the Surveillance and Analysis Division - Region III takes based on the data and reports will be the Surveillance and Analysis Division's - Region III own responsibility.

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B	QUADRANGLE MAPS; DISCHARGES SHOWN; 11 MAPS

SECTION I

INTRODUCTION

National Environmental Research Center (NERC) - Las Vegas under Project N89.6 conducted an aerial remote sensing survey for the Surveillance and Analysis Division - Region III. The work was initiated by a memorandum from Mr. J. Gary Gardner to Mr. L. Dunn on March 21, 1972, requesting..."IR coverage of portions of four major rivers to support enforcement activities and to provide information on waste discharge locations for possible surveillance investigations." Based on this and other communication, aerial infrared and other data were collected on August 25, 1972, over portions of the Monongahela, Ohio, and Allegheny Rivers in the Pittsburgh, Pennsylvania, vicinity.

The objective of this survey was to locate and provide information on waste discharges into the rivers covered. Results of this effort are presented in Section II of this report.

Section III describes the data collection operations; details of the data processing and analysis are covered in Section IV. Comments and recommendations regarding utility of this information are found in Section V. Appendix A lists the personnel, major items of equipment and functions involved in the conduct of this survey; and Appendix B is a set of eleven U.S.G.S. Quadrangle Maps (7-1/2 minute series) on which the discharge information has been plotted.

SECTION II

RESULT SUMMARY

Thirty-six discharges evidenced by their warmer surface temperature were located and mapped along the 150 linear mile (approx) section of river flown. The locations of the discharge points have been plotted on maps and listed to the nearest second. Total surface area of the mixing zones, furthest extent of the thermal influence (downstream), time of data recording and other related information have been mapped and tabulated. Area of thermal influence ranged from 40,000 to 1,360,000 sq. ft. Downstream extents varied between 400 and 3400 ft. from the discharge points. Where two thermal levels within a single mixing zone were observed, these have been mapped and noted. In several locations notations are made of mixing zones spanning the river between both shores. Occasionally, discharges could not be mapped with sufficient confidence and these are appropriately noted.

SECTION III

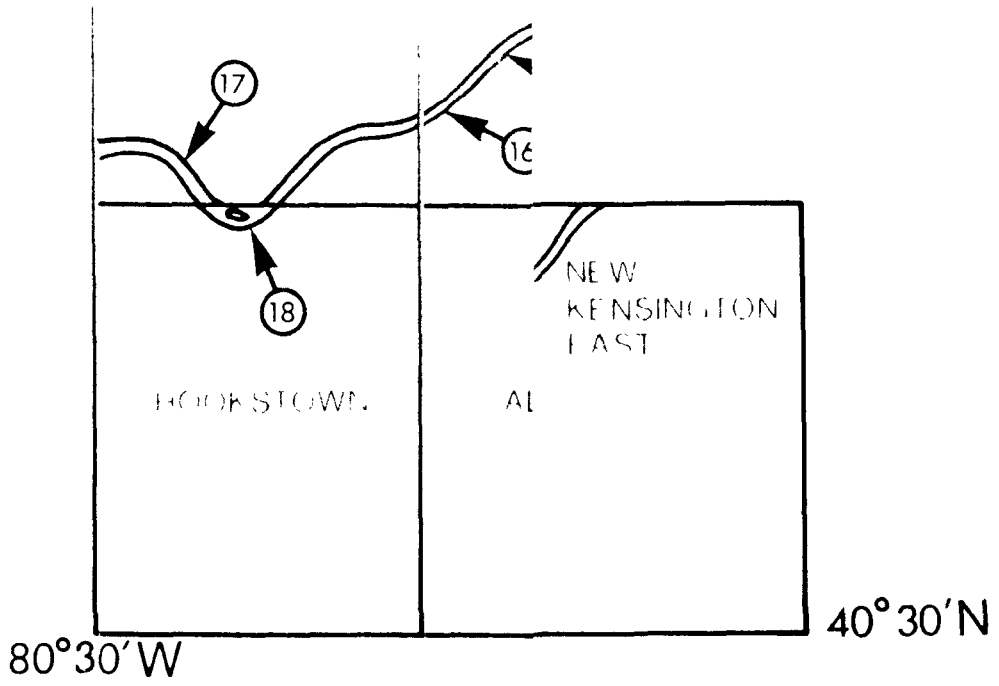
DATA COLLECTION

Airborne remote sensor data for this project were collected on August 25, 1972; 1158-1358 EDT. Approximately 150 linear miles of river segments were flown (figure 1). Thermal infrared (8-14 micron wavelength) imagery obtained with a HRB-Singer AN/AAS-14A optical/mechanical scanner was the primary data resulting from this effort. The aircraft altitude varied between 4000-8700 ft. above terrain. Ground coverage obtained by this scanner, of interpretive value, is a ground swath along the flight path approximately 80^{o} wide, i.e., 6700-14,600 ft. for this project.

Figures 2 through 6 are examples of imagery resulting from this survey. To produce these images, strip film is exposed, line by line, by light, the intensity of which is controlled by the output of an infrared sensitive detector. This detector is mercury-cadmium-telluride which is cooled to a temperature of 77^{o}K during operation to provide high temperature sensitivity. In normal operations, this scanner records temperature variations of the terrain surface on the order of several tenths of a degree centigrade.

Quality of the resultant imagery is affected by primarily; 1) condition of scanner, 2) operation of the scanner, 3) flight procedures, and 4) weather conditions. These variables are controllable or can be scheduled around.

Quality of infrared data collected for this project is considered fair to poor. It does, however, contain information believed to be of value to the Surveillance and Analysis Division - Region III and has therefore been analyzed and reported.



AERIAL INI
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SURVEILLAI
ANALYSIS
EPA - RE
BY MONITORING OPEI
NERC-LAS

DATA COLLECTED AUGUS
[illegible] TO 1358 EDT

DISCHARGE LOCATION
SEE REPORT FOR
NUMBER
REFERENCE

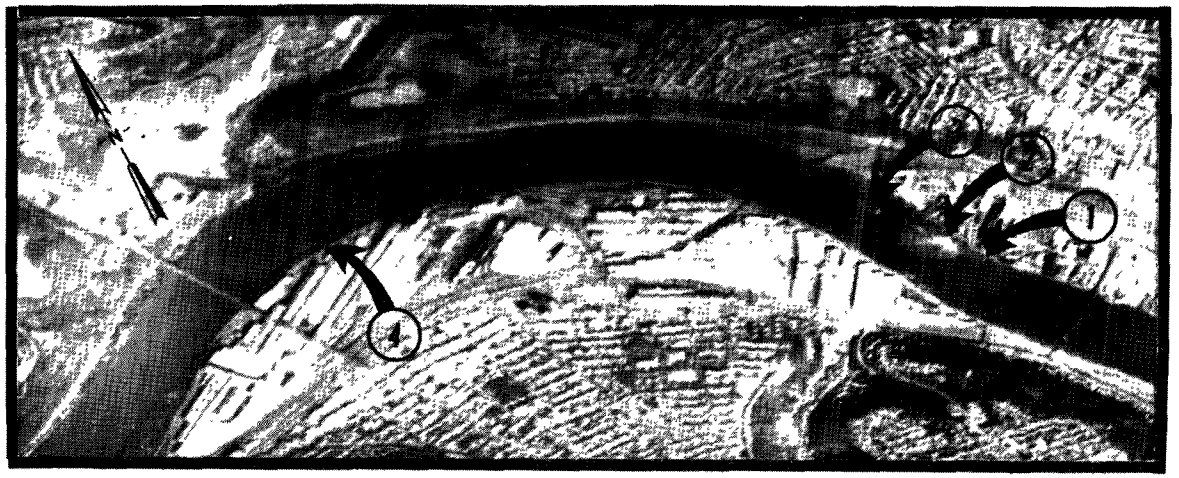
5

FIGURE 1 INDEX MAP

SECTION IV

DATA PROCESSING AND ANALYSIS

Data processing for this project consisted totally of film negative and positive development and duplication at a reconnaissance-type photographic laboratory at NERC-Las Vegas. Detailed examination of the infrared imagery for water discharge information was performed with the use of paper positive images and film positives backlighted by a simple photo interpretation light table. Interpreted discharge points and mixing zone outlines were delineated on film positive images then transferred to paper positives (figures 2 through 6) and Quadrangle Maps (Appendix B). Film and paper positives used and presented herein were photographically scaled to 1:24,000 (1 in = 2,000 ft.) to facilitate transfer of the discharge information to the maps and to minimize confusion to the reader due to scale variations in the original data. Scale variations were introduced into the data by altitude changes (above terrain) during the survey, by distortions inherent to this type of scanner recorder and by sinuous flight lines which attempted, on occasion, to follow the river courses. The combination of these three resulted in a distorted, scale varying image which presented serious difficulty in attempting to position the interpreted discharge points and aerial discharge outline to the maps. Although care was taken, it is estimated that, on occasion, the discharge points presented on the maps will be over 1,000 ft. removed from their true position, and discharge boundaries may be even more poorly located on the maps. Table 1, Discharge Data, is a tabulation of all pertinent discharge information resulting from this survey.



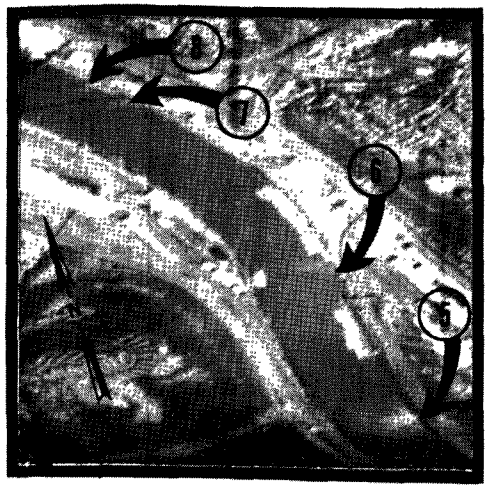
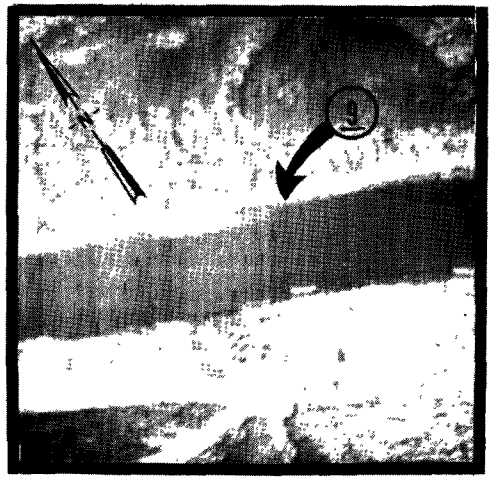
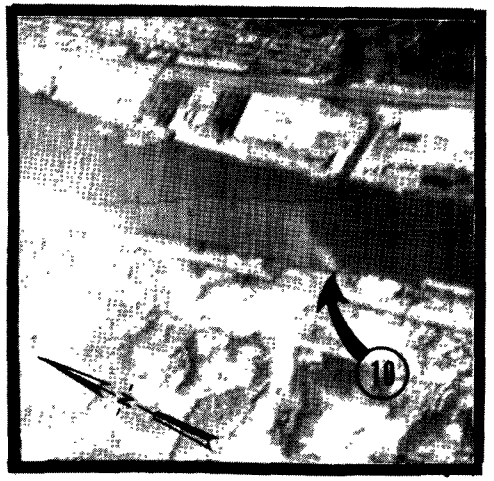
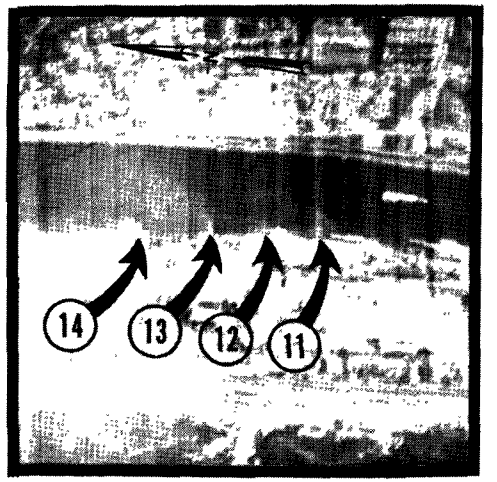


Figure 2
Infrared imagery displaying relative surface water temperature in shades of gray (white is hot). Arrow delineates interpreted point of discharge of warmer water. Scale 1:24,000 (1 inch = 2000 ft) approximately; date 25 August 1972; time 1158 to 1358 hours EDT, see Table I for coordinates and closer times.

NERC-LV







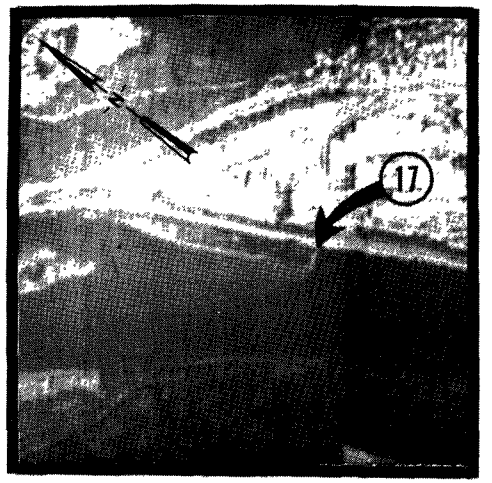
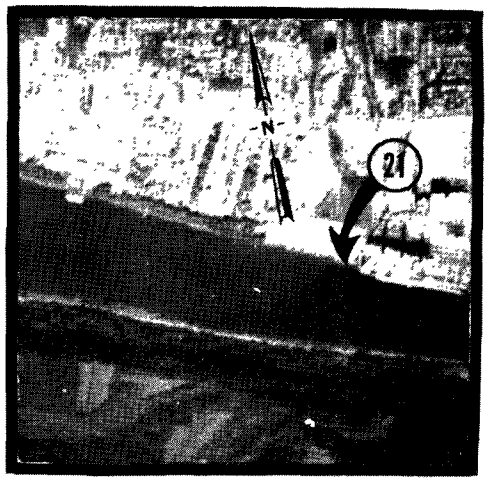
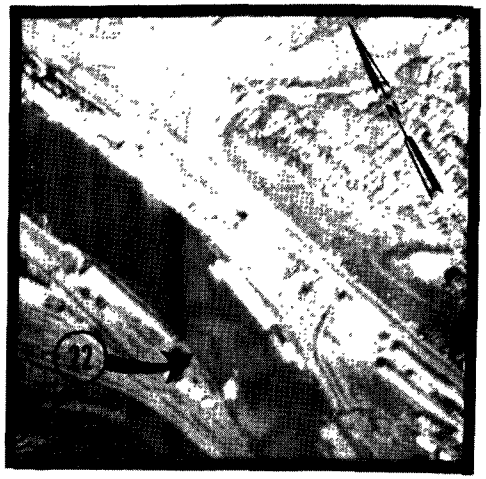


Figure 3
Infrared imagery displaying relative surface water temperature in shades of gray (white is hot). Arrow delineates interpreted point of discharge of warmer water. Scale 1:24,000 (1 inch = 2000 ft) approximately; date 25 August 1972; time 1158 to 1358 hours EDT, see Table I for coordinates and closer times.





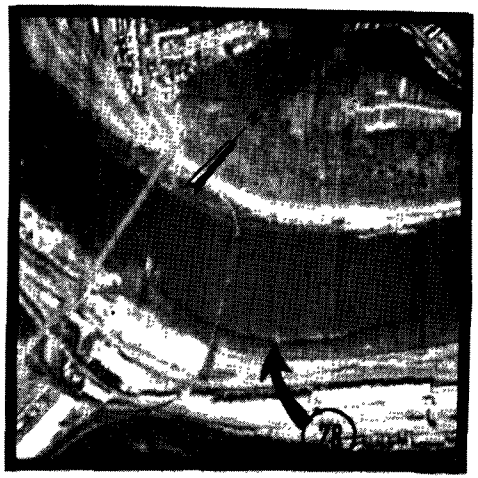
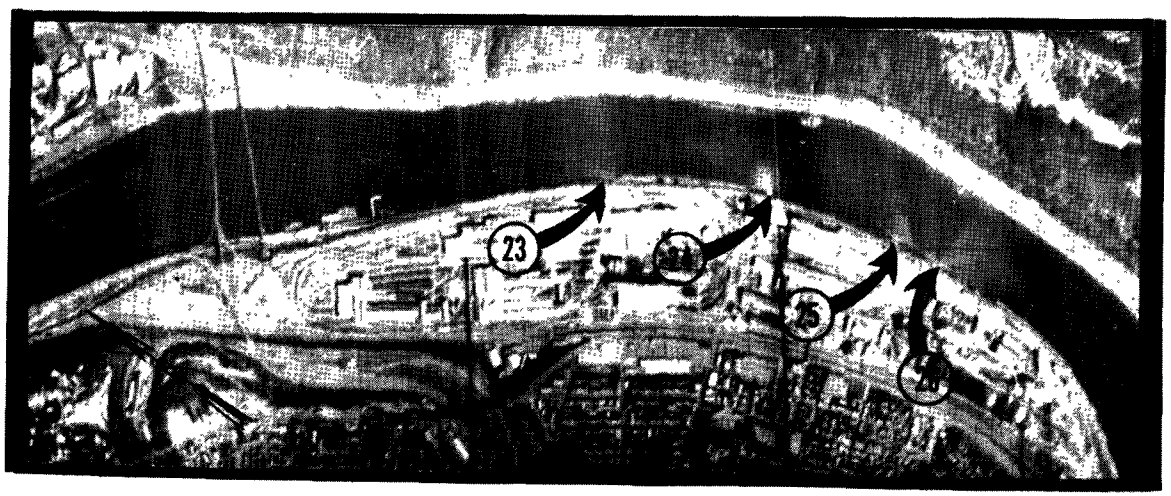
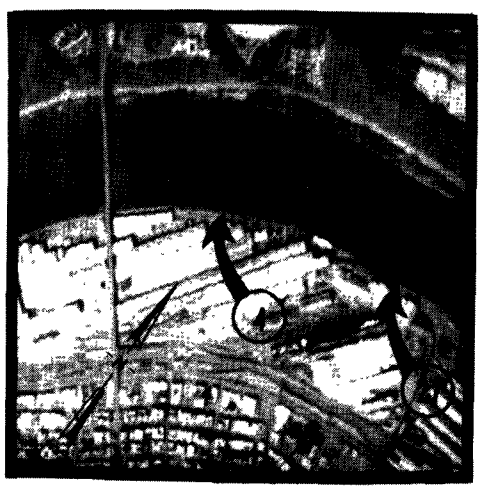


Figure 4
Infrared imagery displaying relative surface water temperature in shades of gray (white is hot). Arrow delineates interpreted point of discharge of warmer water. Scale 1:24,000 (1 inch = 2000 ft) approximately; date 25 August 1972; time 1158 to 1358 hours EDT, see Table I for coordinates and closer times.





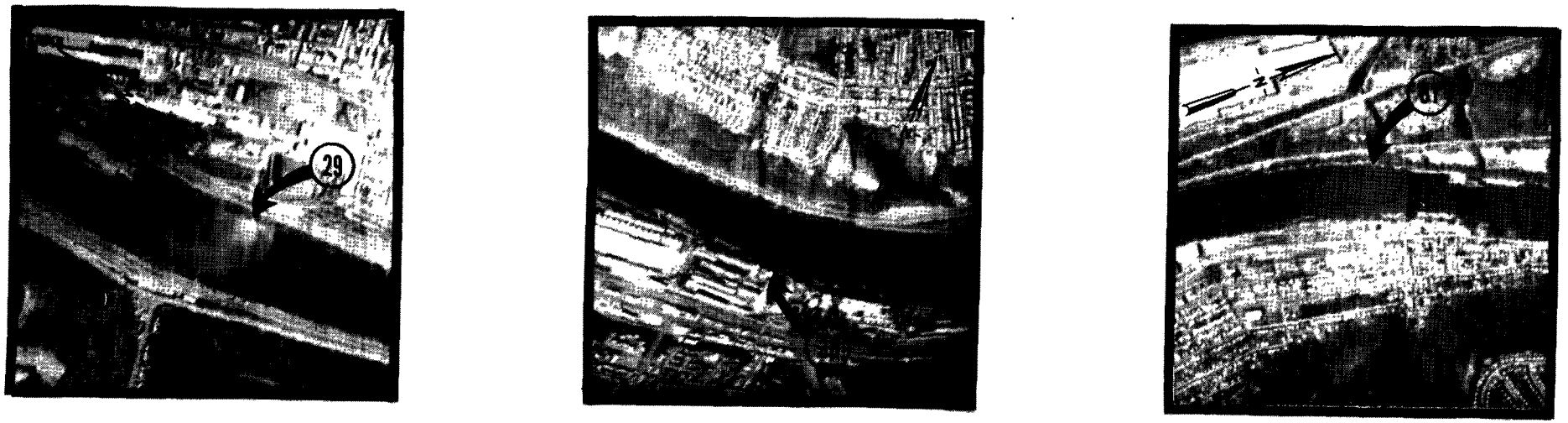


Figure 5
Infrared imagery displaying relative surface water temperature in shades of gray (white is hot). Arrow delineates interpreted point of discharge of warmer water. Scale 1:24,000 (1 inch = 2000 ft) approximately; date 25 August 1972; time 1158 to 1358 hours EDT, see Table I for coordinates and closer times.

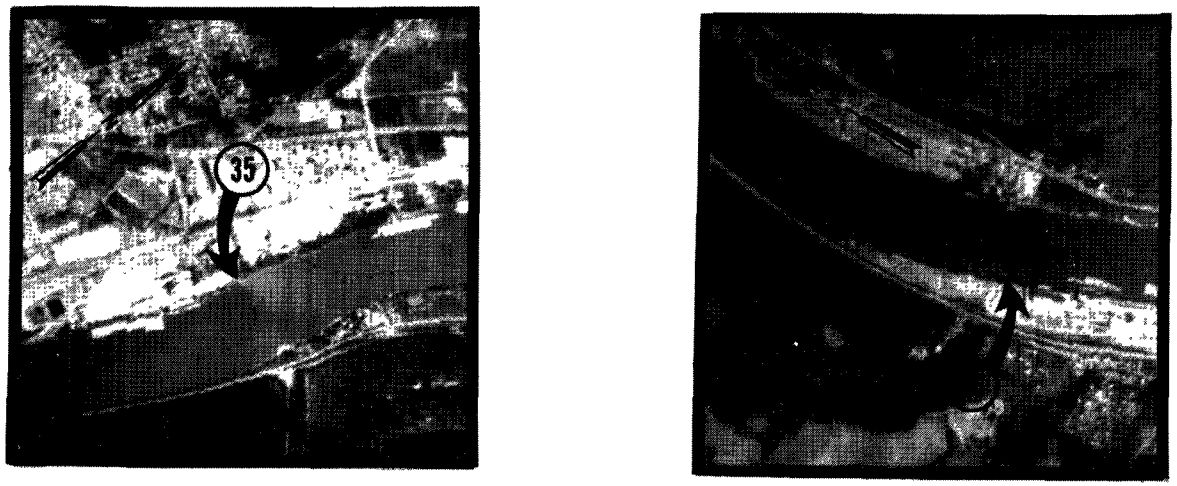


Figure 6
Infrared imagery displaying relative surface water temperature in shades of gray (white is hot). Arrow delineates interpreted point of discharge of warmer water. Scale 1:24,000 (1 inch = 2000 ft) approximately; date 25 August 1972; time 1158 to 1358 hours EDT, see Table I for coordinates and closer times.

Although it was not possible to determine the absolute surface water temperature of the mixing zones or receiving water, an attempt was made to indicate relative discharge temperatures. The discharges interpreted as being warmer are noted "two thermal levels" under Remarks. Both thermal levels of these mixing zones are delineated on the quadrangle maps.

Infrared images of each thermal discharge are shown as figures 2 through 6. These were included in the report to assist in any possible follow-up ground investigation where accurate positioning may be required. (Distortions and inaccuracies associated with the data and subsequent map transfers have been discussed above.) Each discharge is key numbered to the maps and tabulated data are in Table 1.

Close examination of these infrared images should reveal warmer water areas (lighter toned) sourcing at the tip of each arrow. Although the "originals" of the imagery were slightly better quality than the report copies, the reader should be able to realize the relative confidence to place in the actual presence of each discharge. (This is the "raw" data.) Compare for example discharge #9 (Figure 2) which carries the notation in Table 1 "Questionable if discharge is actually present" with #29 which presents little detection or mapping problem. Again, it is stressed that data collected for this project was of marginal quality, not representative of unclassified state-of-the-art infrared scanning for thermal mapping purposes, and finally, not representative of future results to be produced by NERC-LV.

TABLE 1 DISCHARGE DATA August 25, 1972

Discharge #	River	Quadrangle Map	Location N-Lat	Location W-Long	Area of Thermal Influence (ft^2) (approx)	Furthest Extent of Influence (ft) (approx)	Time (EDT)	Remarks
1	Monongahela	Pittsburgh E., Pa.	40°24'38"	79°53'20"	300,000	600	1146	
2	Monongahela	Pittsburgh E., Pa.	40°24'41"	79°53'24"	360,000	600	1146	Two thermal levels
3	Monongahela	Pittsburgh E., Pa.	40°24'45"	79°53'32"	240,000	600	1149	
4	Monongahela	Pittsburgh E., Pa.	40°24'41"	79°54'54"	480,000	800	1153	
5	Monongahela	Pittsburgh E., Pa.	40°24'45"	79°57'6"	160,000	800	1158	
6	Monongahela	Pittsburgh E., Pa.	40°25'3"	79°57'6"	100,000	700	1158	
7	Monongahela	Pittsburgh E., Pa.	40°25'36"	79°57'26"	320,000	900	1158	
8	Monongahela	Pittsburgh E., Pa.	40°25'39"	79°57'30"	NA	NA	1158	Included in #7
9	Ohio	Ambridge, Pa.	40°31'54"	80°10'08"	120,000	800	1201	Questionable(1)
10	Ohio	Ambridge, Pa.	40°34'15"	80°14'00"	720,000	1800	1205	Two thermal levels
11	Ohio	Baden, Pa.	40°37'45"	80°14'08"	360,000	1200	1206	Location question(2)
12	Ohio	Baden, Pa.	40°37'48"	80°14'08"	80,000	400	1206	Location question(2)
13	Ohio	Baden, Pa.	40°37'56"	80°14'08"	1,360,000	3400	1207	Two thermal levels
14	Ohio	Baden, Pa.	40°38'02"	80°14'12"	180,000	900	1207	Two thermal levels
15	Ohio	Beaver, Pa.	40°40'22"	80°20'20"	720,000	1800	1213	
16	Ohio	Beaver, Pa.	40°39'30"	80°21'26"	400,000	2000	1215	
17	Ohio	Midland, Pa.	40°38'19"	80°28'05"	1,200,000	2000	1216	Two thermal levels
18	Ohio	Hookstown, Pa.	40°37'13"	80°26'20"	480,000	1200	1216	(1);Two thermal levels
19	Ohio	Beaver, Pa.	40°41'10"	80°15'45"	720,000	1200	1210	(1)
20	Allegheny	New Kensington W., Pa.	40°32'42"	79°46'02"		1600	1306	(2)
21	Allegheny	New Kensington W., Pa.	40°32'13"	79°47'36"		1700	1306	(2); "spans" river(3)
22	Monongahela	Pittsburgh E., Pa.	40°25'9"	80°57'21"	960,000	1600	1320	(2); "spans" river(3)
23	Monongahela	Braddock, Pa.	40°22'43"	79°50'37"	600,000	800	1311	
24	Monongahela	Braddock, Pa.	40°22'29"	79°50'24"	600,000	1200	1311	Two thermal levels
25	Monongahela	McKeesport, Pa.	40°22'15"	79°50'24"	720,000	1200	1310	(2)
26	Monongahela	McKeesport, Pa.	40°22'10"	79°50'23"	640,000	800	1309	
27	Monongahela	Pittsburgh E., Pa.	40°24'51"	79°54'29"	40,000	400	1321	
28	Monongahela	Pittsburgh E., Pa.	40°23'54"	79°55'42"	140,000	1400	1321	(1)
29	Monongahela	Pittsburgh E., Pa.	40°24'30"	79°57'05"	1,400,000	1800	1325	Two thermal levels
30	Monongahela	McKeesport, Pa.	40°21'18"	79°51'13"	160,000	400	1332	
31	Monongahela	Glassport, Pa.	40°20'15"	79°53'42"	120,000	600	1337	
32	Monongahela	McKeesport, Pa.	40°17'42"	79°52'06"	40,000	400	1338	
33	Monongahela	Glassport, Pa.	40°18'34"	79°52'54"	240,000	600	1337	
34	Monongahela	McKeesport, Pa.	40°17'18"	79°52'25"	400,000	800	1341	Two thermal levels
35	Monongahela	Glassport, Pa.	40°15'10"	79°55'00"	480,000	1200	1343	
36	Monongahela	Monongahela, Pa.	40°13'21"	79°58'16"	720,000	1600	1352	

(1) Questionable if discharge is actually present.

(2) Thermal area evident; exact discharge location in question.

(3) Warmer effluent extends from one river bank to other.

SECTION V

COMMENTS AND RECOMMENDATIONS

1. Aerial infrared surveying can readily detect and delineate the presence and surface extent of discharges into rivers by displaying on permanent film record a map-like presentation of surface temperature.

2. This technique can be applied day or night but is limited in inclement weather conditions.

3. Documentation of this type can be obtained in a confidential manner.

4. Absolute water surface temperature to $1^{\circ}F$ accuracies in contour map presentation is attainable by this method.

5. Large areas can be screened rapidly via infrared surveillance.

6. The equipment and techniques utilized are quite sophisticated, and good quality data are not obtained easily. Attaining and maintaining operational status is difficult and costly.

It is recommended that personnel from Region III, Surveillance and Analysis, share available or newly acquired information related to these interpreted discharges with NERC-LV. A short field check to selected sites, made jointly, would be helpful toward improving future similar efforts.

Any recommendations by Regional personnel geared to improving these aerial reconnaissance surveys are solicited and necessary for development of a viable technique.

APPENDIX A

PROJECT PERSONNEL AND EQUIPMENT (#N89.6)

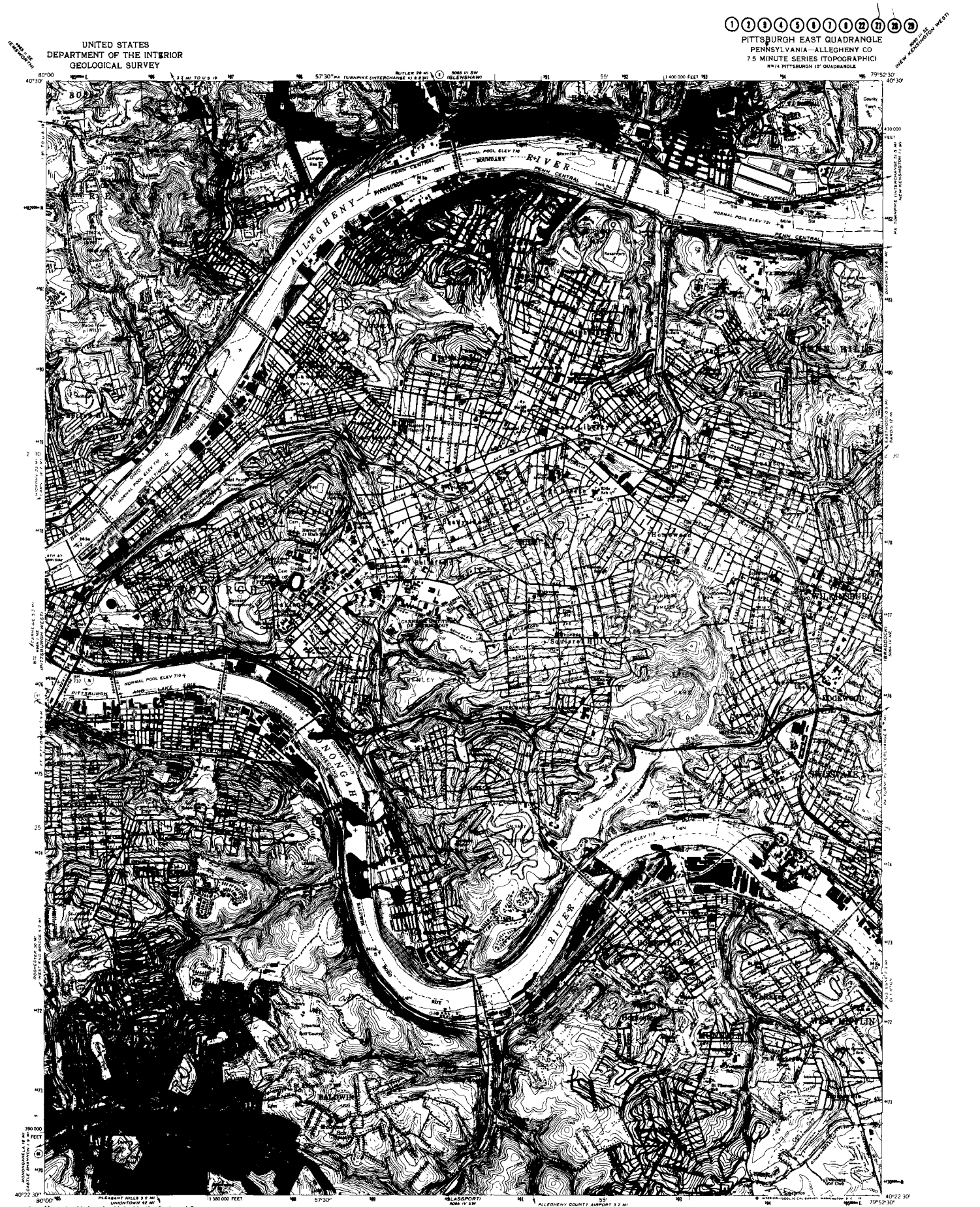
Name	Function
R. Landers	Mission Manager
M. Smith	Pilot
J. Schmidt	IR Scanner Engineer
C. Lake, W. Fowler	Film Processing, Printing
B. Spavin, W. Fowler	Graphics
G. Niles	Data Compilation
A. Pressman	Data Analysis, Report

Grumman Mohawk OV-1C	Aircraft
HRB Singer AN/AAS-14A	Infrared Scanner
Kodak Versamat 11C-M	Roll Film Processor
LogEtronic SP10/70-B	Roll Paper Printer
Miller-Holzworth EN88A	Image Scale Adjustment

APPENDIX B

QUADRANGLE MAPS SHOWING DISCHARGES; 11 MAPS

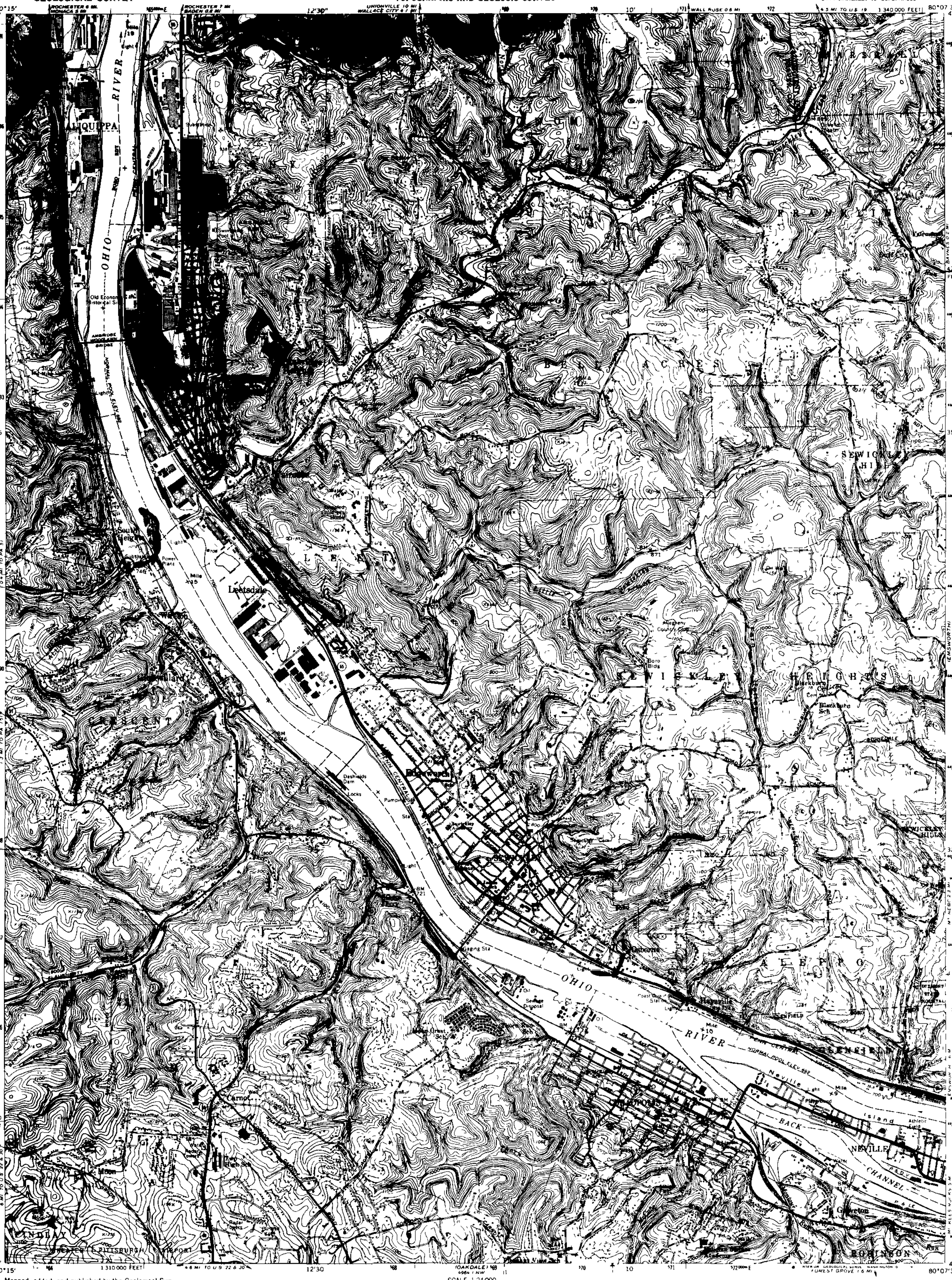
Discharge No.	Map
1, 2, 3, 4, 5, 6, 7, 8, 22, 27, 28, 29	Pittsburgh East, PA
9, 10	Ambridge, PA
11, 12, 13, 14	Baden, PA
15, 16, 19	Beaver, PA
17	Midland, PA
18	Hookstown, PA
20, 21	New Kensington West, PA
23, 24	Braddock, PA
25, 26, 30, 32, 34	McKeesport, PA
31, 33, 35	Glassport, PA
36	Monongahela, PA


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
PITTSBURGH EAST QUADRANGLE
PENNSYLVANIA—ALLEGHENY CO
7 5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 PITTSBURGH 15' QUADRANGLE
ALLEGHENY RIVER
MONONGAHELA RIVER
OHIO RIVER
PENN CENTRAL
PITTSBURGH
ALLEGHENY
MANCHESTER
NORTH SIDE
SOUTH SIDE
WILKINSBURG
EDGEWOOD
SWISSVALE
BRADDOCK
BALDWIN
WEST MIFFLIN
CARNEGIE
MCKEESPORT
ROBINSON TWP
MOON TWP
CRAFTON
NORMAL POOL ELEV 710
NORMAL POOL ELEV 720
NORMAL POOL ELEV 710+
SCALE 1:24 000
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
Mapped, edited, and published by the Geological Survey
Control by USGS USC&GS USCE and the City of Pittsburgh
Topography by planetable surveys 1925–1941, and 1948
Culture revised by photogrammetric methods from aerial photographs taken 1959 Field check 1960
Polyconic projection 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, south zone
1,000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue
Red tint indicates areas in which only landmark buildings are shown
Revisions shown in purple compiled from aerial photographs taken 1969 This information not field checked
Purple tint indicates extension of urban areas
ROAD CLASSIFICATION
Heavy duty
Medium duty
Light duty
Unimproved dirt
Interstate Route
U S Route
State Route
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON, D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
QUADRANGLE LOCATION
PITTSBURGH EAST, PA
NW/4 PITTSBURGH 15' QUADRANGLE
N4022 5—W7952 5/7 5
1960
PHOTOREVISED 1969
AMS 5064 IV NW—SERIES V831

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
TOPOGRAPHIC AND GEOLOGIC SURVEY

AMBRIDGE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 SEWICKLEY 15' QUADRANGLE



80°15' 40°37'30" — 12'30" — 10' — 80°07'30" 40°37'30"
40°30' 80°15' — 1 310 000 FEET — 12'30" — 10' — 40°30' 80°07'30"

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1952. Field check 1953. Revised 1960

Polyconic projection. 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Red tint indicates areas in which only landmark buildings are shown

Revisions shown in purple compiled from aerial photographs taken 1969. This information not field checked

Purple tint indicates extension of urban areas

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy duty	Light duty
Medium duty	Unimproved dirt

State Route

AMBRIDGE, PA.
SW/4 SEWICKLEY 15' QUADRANGLE
N4030—W8007.5/7.5

1960
PHOTOREVISED 1969
AMS 4965 II SW—SERIES V831

UNITED STATES
PARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
STATE PLANNING BOARD
TOPOGRAPHIC AND GEOLOGIC SURVEY

(11)(12)(13)(14)
BADEN QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 SEWICKLEY 15 QUADRANGLE

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1952 Field check 1953

Polyconic projection 1927 North American datum
10 000 foot grid based on Pennsylvania coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks zone 17
shown in blue

Revisions [illegible] in cooperation with
[illegible]

This publication [illegible]

Public land survey corners and boundaries

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

1 MILE
1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

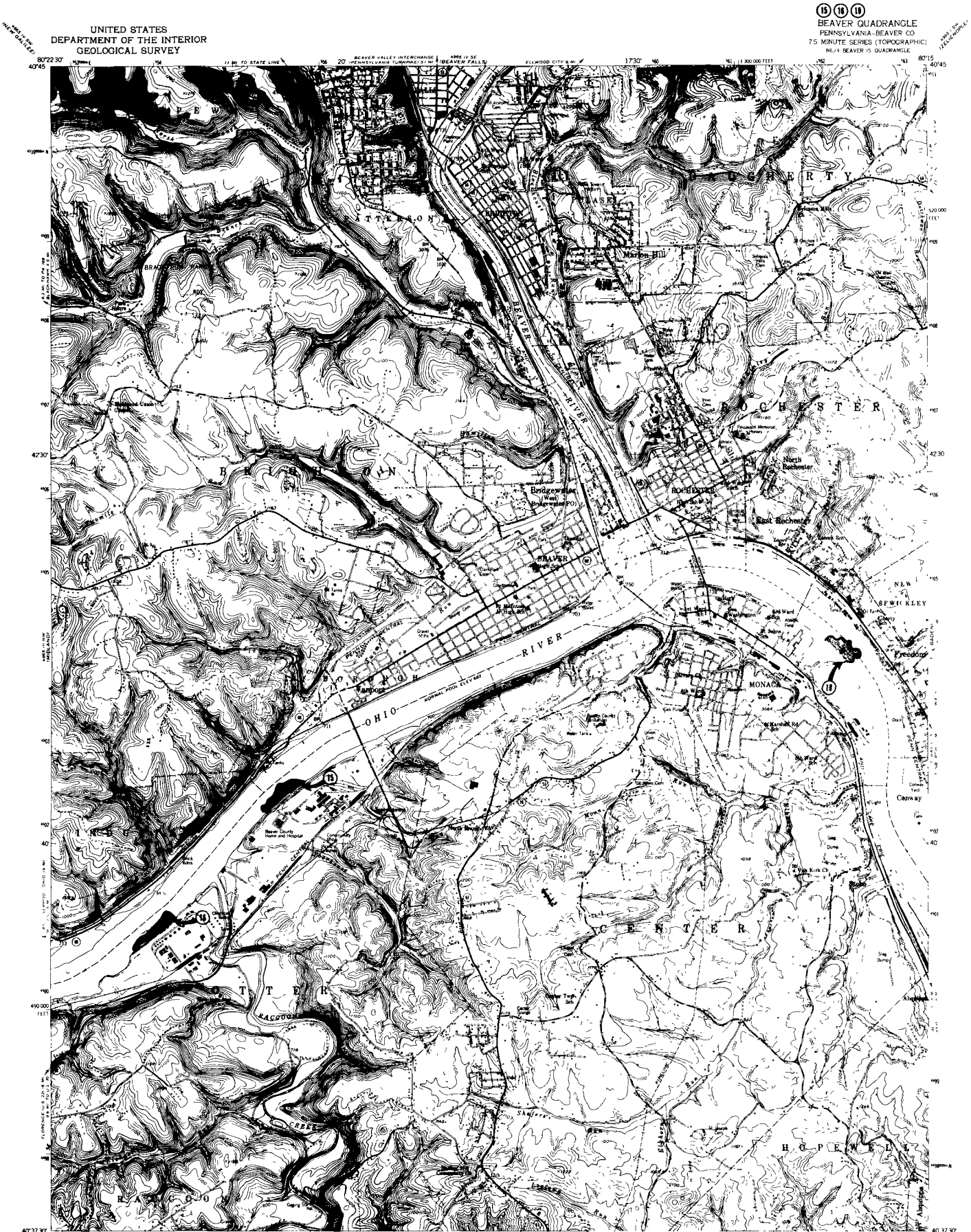
PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy duty — Light duty
Medium duty — Unimproved dirt
Interstate Route — State Route

BADEN PA
NW/4 SEWICKLEY 15 QUADRANGLE
N4037.5—W8007.5/7.5

1953
PHOTOREVISED 1969
AMS 4965 II NW—SERIES V831


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
15 16 19
BEAVER QUADRANGLE
PENNSYLVANIA-BEAVER CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 BEAVER 15 QUADRANGLE
80°22'30"
40°45
80°15
40°37'30"
40 37'30"
17'30"
1 300 000 FEET
1 260 000 FEET
490 000 FEET
520 000 FEET
BEAVER
RIVER
OHIO
RACCOON
CREEK
BRIDGEWATER
BOROUGH
ROCHESTER
BOROUGH
CENTER
HOPEWELL
Marion Hill
Bridgewater (West Bridgewater PO)
Rochester
North Rochester
East Rochester
NEW SEWICKLEY
Freedom
MONACA
Conway
Sampson
Beaver County Home and Hospital
Beaver County Jail
Beaver High Sch
Water Tank
Gas Plant
Cemetery
Dump
Quarry
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography from aerial photographs by multiplex methods
Aerial photographs taken 1952 Field check 1953
Polyconic projection 1927 North American datum
10 000-foot grid based on Pennsylvania coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks zone 17
shown in blue
Red tint indicates area in which only landmark buildings are shown
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1969
This information not field checked
Purple tint indicates extension of urban areas
UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24000
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
Heavy duty
Medium duty
Light duty
Unimproved dirt
State Route
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
BEAVER PA
NE/4 BEAVER 15 QUADRANGLE
N4037.5-W8015/7.5
1953
AMS 4965 III NE-SERIES V831


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
17
MIDLAND QUADRANGLE
PENNSYLVANIA-BEAVER CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 BEAVER 15 QUADRANGLE
SOUTH BEAVER
CHIPPEWA
BRIGHTON
OHIO
INDUSTRY
RACCOON
POTTER
Midland
Ohioview
Shippingport
Georgetown
Island
OHIO RIVER
PENN CENTRAL
Mapped, edited and published by the Geological Survey
Control by USGS and USC&GS
Topography from aerial photographs by multiplex methods
Aerial photographs taken 1952 Field check 1954
Polyconic projection 1927 North American datum
10 000 foot grid based on Pennsylvania coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks zone 17
shown in blue
Red tint indicates areas in which only landmark buildings are shown
SCALE 1:24000
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
Heavy duty
Medium duty
Light duty
Unimproved dirt
State Route
MIDLAND PA
NW/4 BEAVER 15 QUADRANGLE
N4037.5—W8022.5/7.5
1954
AMS 4965 III NW—SERIES V851
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
QUADRANGLE LOCATION


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
18
HOOKSTOWN QUADRANGLE
PENNSYLVANIA-BEAVER CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 BEAVER 15 QUADRANGLE
80°30'
80°22'30"
40°37'30"
40°30'
32'30"
27'30"
OHIO RIVER
Midland
Phillis Island
Shippingport
Hookstown
GREENE
RACCOON
HANOVER
RACCOON CREEK
STATE PARK
Wesleyan Ch
Hanbarlo
Kendall
Miller Sch
Mark
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography from aerial photographs by multiplex methods
Aerial photographs taken 1952 Field check 1954
Polyconic projection 1927 North American datum
10,000 foot grid based on Pennsylvania coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks zone 17 shown in blue
Revisions shown in purple compiled in cooperation with State of Pennsylvania agencies from aerial photographs taken 1969 This information not field checked
UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24000
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
ROAD CLASSIFICATION
Heavy duty
Light duty
Medium duty
Unimproved dirt
U S Route
State Route
HOOKSTOWN PA
SW/4 BEAVER 15 QUADRANGLE
N4030 W8022.5/7.5
1954
AMS 4965 III SW SERIES V851

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
TOPOGRAPHIC AND GEOLOGIC SURVEY

(20) (21)

NEW KENSINGTON WEST QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE 4 NEW KENSINGTON 15 QUADRANGLE

Mapped edited and published by the Geological Survey

Control by USGS USC&GS USCE and the City of Pittsburgh

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1952 Field check 1953 Revised 1960

Polyconic projection 1927 North American datum
10 000 foot grid based on Pennsylvania coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks
zone 17 shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs This information is unchecked

Red tint indicates areas in which only landmark buildings are shown

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
(MN 5½° 98 MILS; GN 0°46' 14 MILS)

SCALE 1:24 000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Revisions shown in purple compiled from aerial photographs taken 1969 This information not field checked

Purple tint indicates extension of urban areas

ROAD CLASSIFICATION

Heavy duty — Light duty
Medium duty — Unimproved dirt
Interstate Route State Route

NEW KENSINGTON WEST, PA
SE 4 NEW KENSINGTON 15 QUADRANGLE
N4030—W7945/7.5

1960
PHOTOREVISED 1969
AMS 5065 III SE—SERIES V831

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
TOPOGRAPHIC AND GEOLOGIC SURVEY

BRADDOCK QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 PITTSBURGH 15 QUADRANGLE

Mapped edited and published by the Geological Survey

Control by USGS USC&GS and the City of Pittsburgh

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1952 Revised by photogrammetric methods from aerial photographs taken 1959 Field check 1960

Polyconic projection 1927 North American datum
10 000 foot grid based on Pennsylvania coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks
zone 17 shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs This information is unchecked

Red tint indicates areas in which only landmark buildings are shown

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy Duty — Light Duty
Medium Duty - - - Unimproved
Interstate Route U.S. Route State Route

BRADDOCK, PA
NE 4 PITTSBURGH 15 QUADRANGLE
N4022.5—W7945/7.5

1960

AMS 5064 IV NE SERIES V831

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
TOPOGRAPHIC AND GEOLOGIC SURVEY

MC KEESPORT QUADRANGLE
PENNSYLVANIA
7 5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 PITTSBURGH 15 QUADRANGLE

Mapped, edited and published by the Geological Survey

Control by USGS, USC&GS and the City of Pittsburgh

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1952 Field check 1953 Revised 1960

Polyconic projection 1927 North American
10 000 foot grid based on Pennsylvania coordi south zone
1000 meter Universal Transverse Mercator grid zone 17 shown in blue

Fine red dashed lines indicate selected fence and hi t lines where generally visible on aerial photographs This information is unchecked

Red tint indicates areas in which only landmark buildings are shown

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Heavy duty	Light duty
Medium duty	Unimproved dirt
U S Route	State Route

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

MC KEESPORT, PA
SE 4 PITTSBURGH 15 QUADRANGLE
N 40° 15'—W 79° 45' 7 5

1960

AMS 5064 IV SE—SERIES V831

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
TOPOGRAPHIC AND GEOLOGIC SURVEY

31 33 35
GLASSPORT QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW 4 PITTSBURGH 15 QUADRANGLE

Mapped edited and published by the Geological Survey

Control by USGS USC&GS and City of Pittsburgh

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1952 Revised by photogrammetric methods from aerial photographs taken 1959 Field check 1960

Polyconic projection 1927 North American datum
10 000 foot grid based on Pennsylvania coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks
zone 17 shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs This information is unchecked

Red tint indicates areas in which only landmark buildings are shown

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy duty — Light duty
Medium duty — — — Unimproved dirt
State Route

PENNSYLVANIA
QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

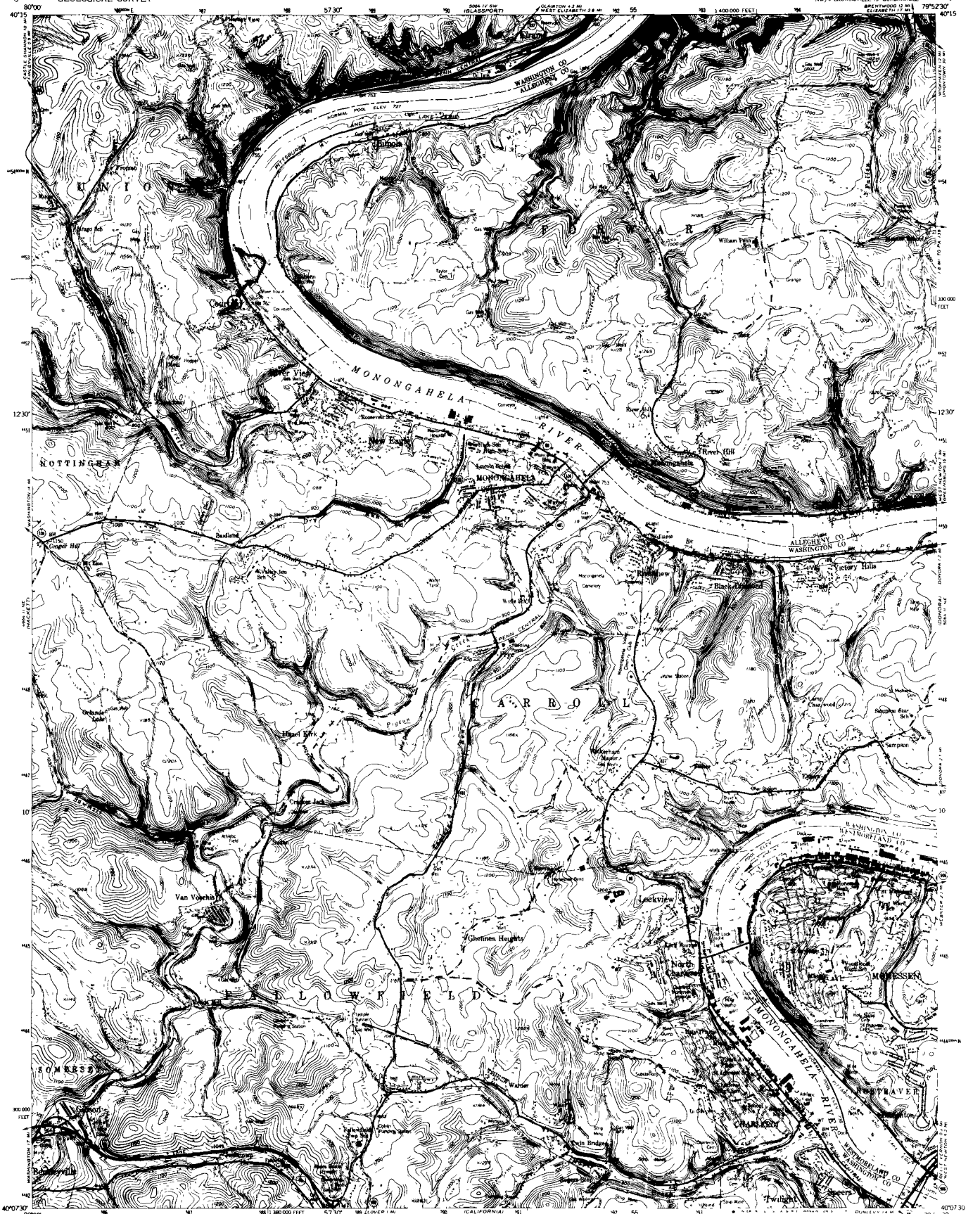
GLASSPORT, PA
SW 4 PITTSBURGH 15 QUADRANGLE
N4015 – W7952.5/7.5

1960

AMS 5064 IV SW–SERIES V831

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MONONGAHELA QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 BROWNSVILLE 15 QUADRANGLE



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1952 Field check 1954

Polyconic projection 1927 North American datum
10,000-foot grid based on Pennsylvania coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks zone 17
shown in blue

Red tint indicates areas in which only landmark buildings are shown

Broken contours in strip mine areas indicate mining
since photography

Revisions shown in purple compiled in cooperation with
State of Pennsylvania agencies from aerial photographs taken 1969
This information not field checked

Purple tint indicates extension of urban areas

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U S GEOLOGICAL SURVEY WASHINGTON D C 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy duty — Light
Medium duty — Unimp
U S Route — State R
Interstate Route

MONONGAHELA, PA
NW/4 BROWNSVILLE QUA
N4007.5—W7952.5/7.5

1954

AMS 5064 III NW—SERIES V851