

The Effects of Subsidence Resulting from Underground Bituminous Coal Mining in Pennsylvania, 2013-2018

**Bituminous Mine Subsidence and Land Conservation Act
Act 54 Amendments
5th Five-Year Report**

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Research was conducted by the University of Pittsburgh for the Pennsylvania Department of Environmental Protection

Cover photos: Top row: impact of heave on Whitethorn Run over Bailey Mine and stream after heave cut was completed (PADEP file photos); Middle row: impact of fracture reducing flow in an unnamed tributary (NoF-4.9R) over Bailey Mine and result after sealing the fracture (PADEP file photos); Bottom row, left: Mitigation for gas line over Enlow Fork Mine (photo credit: Patrick Shirey); Bottom row, right: Mitigation trench dug around house over Contura Mine (photo credit: Patrick Shirey)



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Dear Mr. Shuler,

This letter accompanies the University’s 5th Act 54 assessment period report entitled “The Effects of Subsidence Resulting from Underground Bituminous Coal Mining, 2013 to 2018”. This report is the culmination of work by 19 researchers at the University of Pittsburgh and the Carnegie Museum of Natural History over a two-year period.

Thank you for the opportunity to work with you in providing this information to the citizens of the Commonwealth of Pennsylvania.

Sincerely,

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ACRONYMS AND ABBREVIATIONS

Units of measurement

%	percent
cfs	cubic feet per second
ft	feet
ft ³	cubic feet
GB	gigabytes
gpm	gallons per minute
in	inches
lbs	pounds
m	meters
MA	million years ago
mi	miles
µmho/cm	microohms per centimeter

General

Act 54	1994 amendments to BMSLCA
ArcGIS	geographic information systems software produced by ESRI
AutoCAD	design software produced by Autodesk
BAMR	Bureau of Abandoned Mine Reclamation
BMSLCA	Bituminous Mine Subsidence and Land Conservation Act
BUMIS	Bituminous Underground Mining Information System
CAD	computer-aided design
CDMO	California District Mining Office
CMAP	Coal Mining Activity Permit
CMNH	Carnegie Museum of Natural History
DEM	digital elevation model
EIA	United States Energy Information Administration
EPA	United States Environmental Protection Agency
ERRI	Environmental Resources Research Institute
ESRI	Environmental Systems Research Institute
GIS	geographic information system

HMR	Hydrologic Monitoring Report
LiDAR	Light Detection and Ranging
LLC	limited liability corporation
MrSID	multi-resolution seamless image database
MSHA	Mine Safety and Health Administration
NAD 1983	North American Datum of 1983
ND	no data
NHD	National Hydrography Dataset
NWIS	National Water Information System
OCR	optical character recognition
op	overburden pressure
PA	Pennsylvania
PADEP	Pennsylvania Department of Environmental Protection
PAEHB	Pennsylvania Environmental Hearing Board
PAFBC	Pennsylvania Fish & Boat Commission
PASDA	Pennsylvania Spatial Data Access
PennDOT	Pennsylvania Department of Transportation
PEM	Palustrine emergent
PFO	Palustrine forested
POW	Palustrine open water
PSS	Palustrine scrub/shrub
PSU	Pennsylvania State University
PUB	Palustrine unconsolidated bottom
QA/QC	quality assurance/quality control
Re	extraction ratio
RPZ	rebuttable presumption zone
SA	structure analysis
SD	standard deviation
SF	safety factor
SC	specific conductance
SID	seamless image database
SMCRA	Surface Mining Control and Reclamation Act of 1977
Sp	strength of coal pillar
SRE	Stream Recovery Evaluation
SSA	Surface Subsidence Agent
TBS	Total Biological Score
TGD	Technical Guidance Document
TGD 363-0300-001	Technical Guidance Document 363-0300-001, “Design Criteria – Wetland Replacement and Monitoring”
TGD 391-0300-002	Technical Guidance Document 391-0300-002, “Water Quality Antidegradation Implementation Guidance”
TGD 563-2000-655	Technical Guidance Document 563-2000-655, “Surface Water Protection – Underground Bituminous Coal Mining Operations”
TDS	Total Dissolved Solids
TIF	tagged-image format
UNT	Unnamed tributary

USGS	United State Geological Survey
UTM	Universal Transverse Mercator coordinate system
VPN	Virtual private network
WRDS	Water Resources Data System

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- Tunnel Ridge, LLC
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