ALDER RUN

MINE DRAINAGE POLLUTION

ABATEMENT PROJECT

OPERATION SCARLIFT

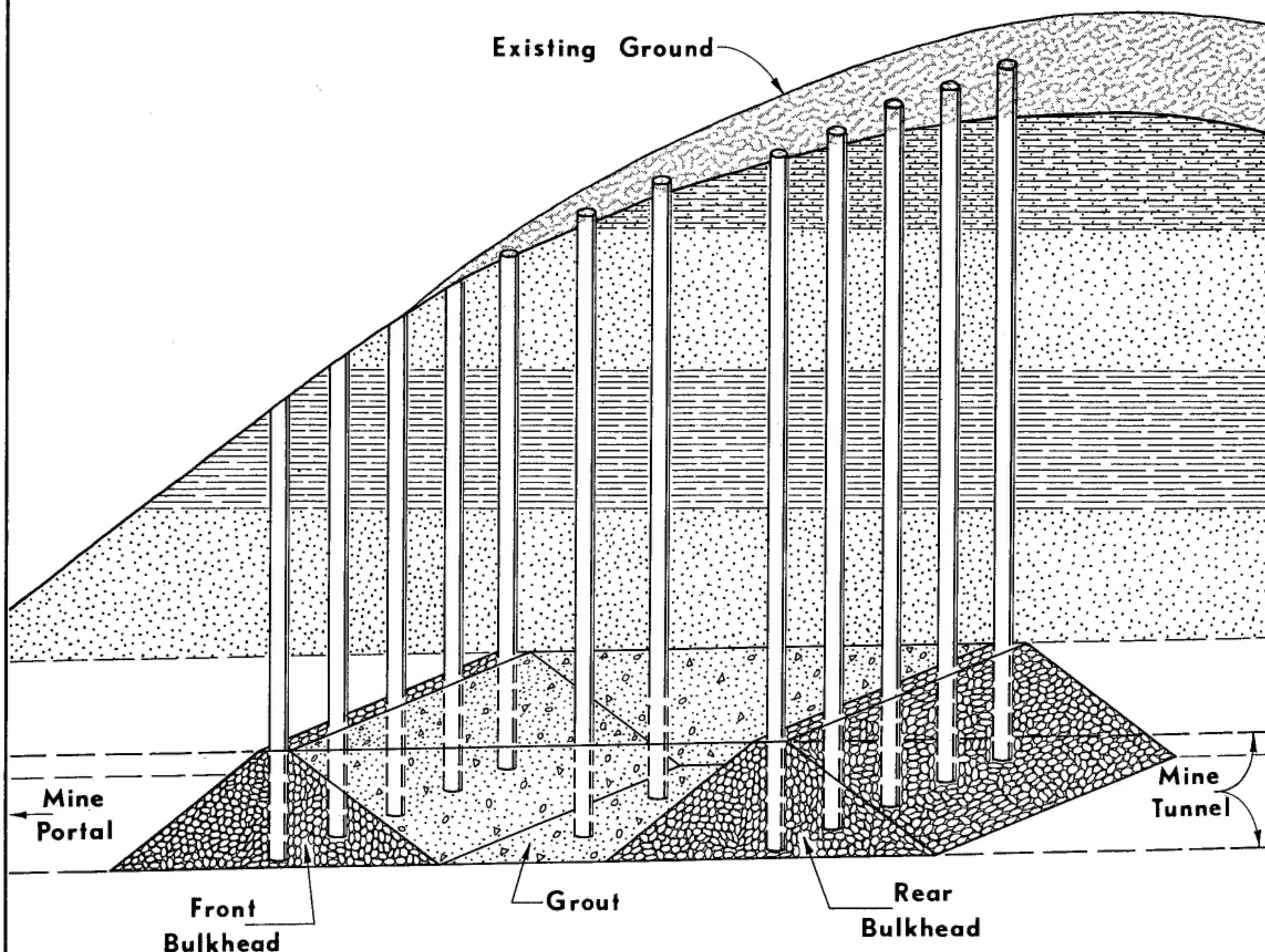
COMMONWEALTH OF PENNSYLVANIA

RAYMOND P. SHAFER, GOVERNOR

DEPARTMENT OF MINES AND MINERAL INDUSTRIES

H. B. CHARMBURY, SECRETARY

THE ABATEMENT PLAN



TYPICAL DEEP MINE SEAL

No Scale

ABATEMENT PLAN

ABATEMENT MEASURES

The fifty-eight (58) areas designated as significant pollution sources are shown on the Mine Development map in back of this report. Each area has been individually evaluated to ascertain the most feasible method of pollution reduction or abatement. In order to facilitate tabulation of the pollution sources and recommended abatement measures, the abatement measures are described in detail here:

(1) Mine sealing - the construction of a barrier within a mine portal, sometimes extended into the adjacent strata by means of a grout curtain. This barrier is usually intended to impede the movement of water from the mine, so the ground water level will rise to an elevation sufficient to permanently inundate the sulfuritic strata associated with the coal seam . The sealing method shown opposite was successfully used in Moraine State Park in Butler County. Other methods of sealing deep mines have been employed with limited success. The type of seal utilized will be determined individually for each situation encountered.

(2) Surface mine restoration - the draining, backfilling, grading

TYPICAL GRADING PLAN

No Scale

and revegetating of excavations resulting from surface coal mining, usually to the original ground contour or to a terrace configuration (see sketch opposite) . Such restoration often involves the placing of sulfuritic materials in the pit prior to backfilling. In those pits which will be permanently inundated by restoration of the water table, the sulfuritic material will be placed on the bottom of the cut. Where the water table will fluctuate above and below the level of the pit floor, the material will be layered above the elevation of the coal seam.

(3) Removal of refuse piles-the removal of accumulations of sul - furitic or acid forming materials which were waste products from coal processing operations, or separated from marketable coal during surface mining. These materials are usually buried in surface mines prior to backfilling and grading of the mines.

(4) Stream diversion - the movement of the established course of a stream to eliminate pollution of the stream by eliminating contact with sulfuritic materials associated with refuse piles or deep or strip mines.

(5) Complete stripping out of deep mines which cannot be successfully sealed. The cost of this method is at least partially defrayed by the value of the coal stripped.

(6) Treatment of mine drainage at sources of pollution or in the stream is sometimes feasible. In-stream treatment may or may not involve settling of precipitates of neutralization. The desirability of treatment is largely dependent upon the public need for the water resource. In view of the palliative nature of mine drainage treatment, it should not be undertaken unless all other measures have failed, or have been ineffective.

GRASSFLAT MINES COMPLEX

The Grassflat Mines complex is a large system of abandoned mine workings which is responsible for the vast majority of the pollution loads to Moravian, Grassflat and Sulfur Runs (tributaries of Moshannon Creek) and for 56% of the pollution load to Alder Run. The specific sources to Alder Run are described in the following section and abatement measures and costs are indicated.

It is proposed the openings to the mine situated on the Alder Run watershed be closed with watertight seals and whatever amount of grout curtain is necessary to abate the outflow from the mine to Alder Run.

.These seals will raise the water level in the western portion of this complex until sufficient elevation is reached to allow the water to flow down dip. The flow will be toward the Moravian Run, Grassflat Run, and Sulfur Run discharge points, on the Moshannon Creek watershed. It is estimated the maximum head of water which will be developed on any of the proposed seals is ten feet.

Although this proposal gives the initial impression of simply transferring a pollution problem from one watershed to another, such is not the case . Any abatement plan which is eventually conceived for Moshannon Creek will undoubtedly involve sealing of all the Grassflat Mines' portals (perhaps to divert all drainage to one portal for treatment if complete sealing proves impractical). Therefore, sealing of the Browns Run portals is very much in order.

These seals will accomplish two things:

(1) They will prevent the discharge of almost 70% of the acid load to Alder Run and also to that portion of the West Branch Susquehanna River between Alder Run and Moshannon Creek, a distance of eight miles. As indicated in the section on "Stream Quality", this portion of the West Branch is showing signs of improvement.

(2) The rising water level in the western portion of the mine resulting from the seals will inundate some mine workings. This will reduce the "make" of acid in these workings. The quality of water diverted to the Moshannon Creek watershed should ultimately be better than presently discharged to Moshannon Creek through these portals.

It is recognized the technology of mine sealing is not yet perfect, particularly in regard to determining the integrity of barriers adjacent to mine portals proposed for sealing. Core borings were taken near and in the portals which indicate that some grout curtain construction should be necessary to achieve an acceptable degree of imperviousness. The only feasible way to ascertain if grout curtain in addition to that proposed will be necessary is by actual construction of the seals to observe leakage at other locations. A satisfactory pollution abatement level by mine sealing would be 95% of the present pollution load.

As previously mentioned, the Grassflat Mine is the major polluter of Moshannon Creek and several tributaries. The FWQA report on the Susquehanna River indicates this complex contributes 61% of the total pollution load of Moshannon Creek, which, in turn, is the largest polluting stream tributary to the West Branch. It seems appropriate that this area be extensively studied to develop and implement abatement procedures. The portion of the mine complex tributary to Sulphur Run has already been evaluated in detail by Gannett, Fleming, Corddry and Carpenter for the FWQA . This was accomplished during 1966-67, prior to development of the Moraine State Park sealing and grouting techniques. These techniques appear to be pertinent to an evaluation of the complex, and such evaluation of the entire complex is recommended.

TEST BORING PROGRAM

The test-boring program was undertaken to determine if it is feasible to install water-tight seals in those drifts draining the Grassflat and Ogle #9 deep mine systems. This information was obtained by using two borings at each site -- one to exactly locate the drift and pressure test the roof rock, and the other to pressure test the adjacent outcrop barrier for possible fracturing. The plan on the opposite page shows the location of the various test boring sites.

The results of this program have indicated double bulkhead seals can feasibly be installed at sites 1, 2, 3, 4, 17, 18, 22, 26, 27, 29, 31, 34, and 36. Grouting will have to be extended along the outcrop barrier associated with sites 3 and 4. Test borings at sites 17, 18, 26, 34, and 36 have indicated that grouting may have to be extended for a short distance from the sealed area, but not extensively.

The test boring results have been used to confirm the elevation and dip of the coal seams at each location, as well as the regional pattern of mine water movement. Of course, these test boring results will also be of value during actual design and construction of the mine seals.

The pages following the test boring location plan detail the specific findings for each core boring taken. The coal seam intercepted by these test borings is the Lower Kittanning.

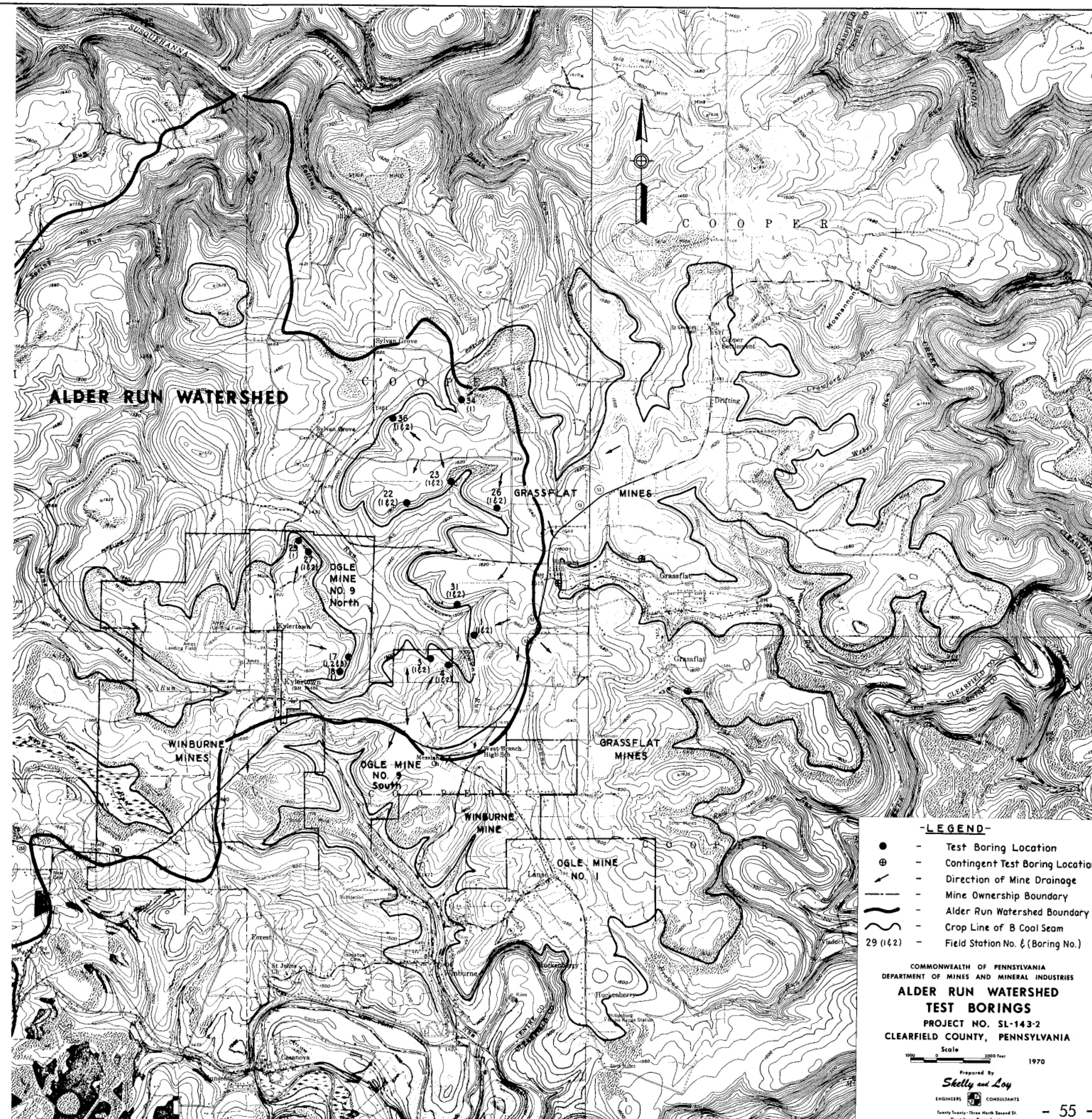
SCHEDULE OF DRILLING

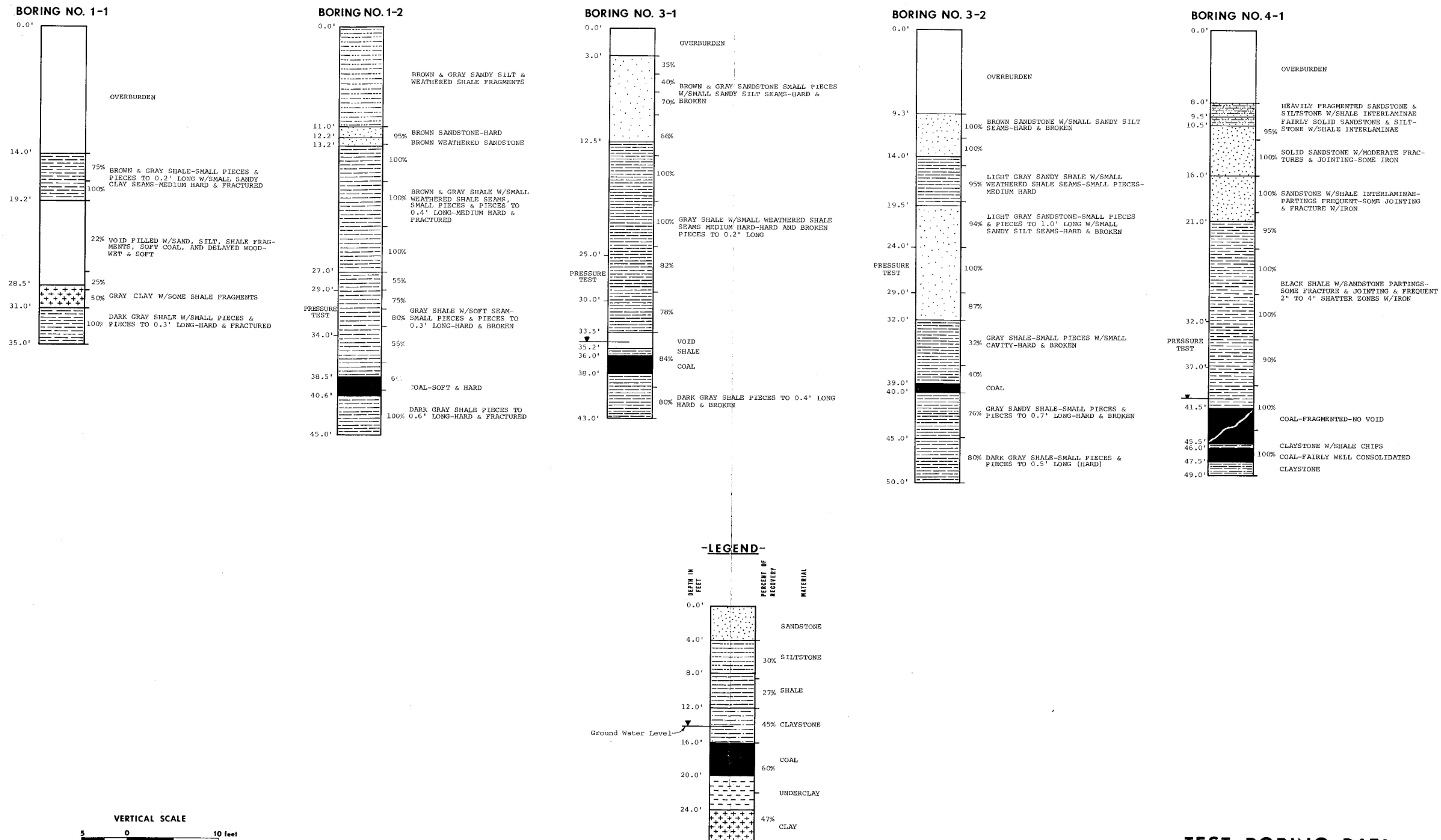
FIELD STATION NO.	ESTIMATED OVERBURDEN	ESTIMATED ROCK CORE
1	20'	60'
2	20'	60'
3	20'	60'
4	20'	60'
17	30'	120'
22	20'	80'
23	30'	120'
26	20'	110'
27	20'	80'
29	20'	80'
31	20'	60'
34	20'	70'
36	20'	80'

Average Test Boring Depth:

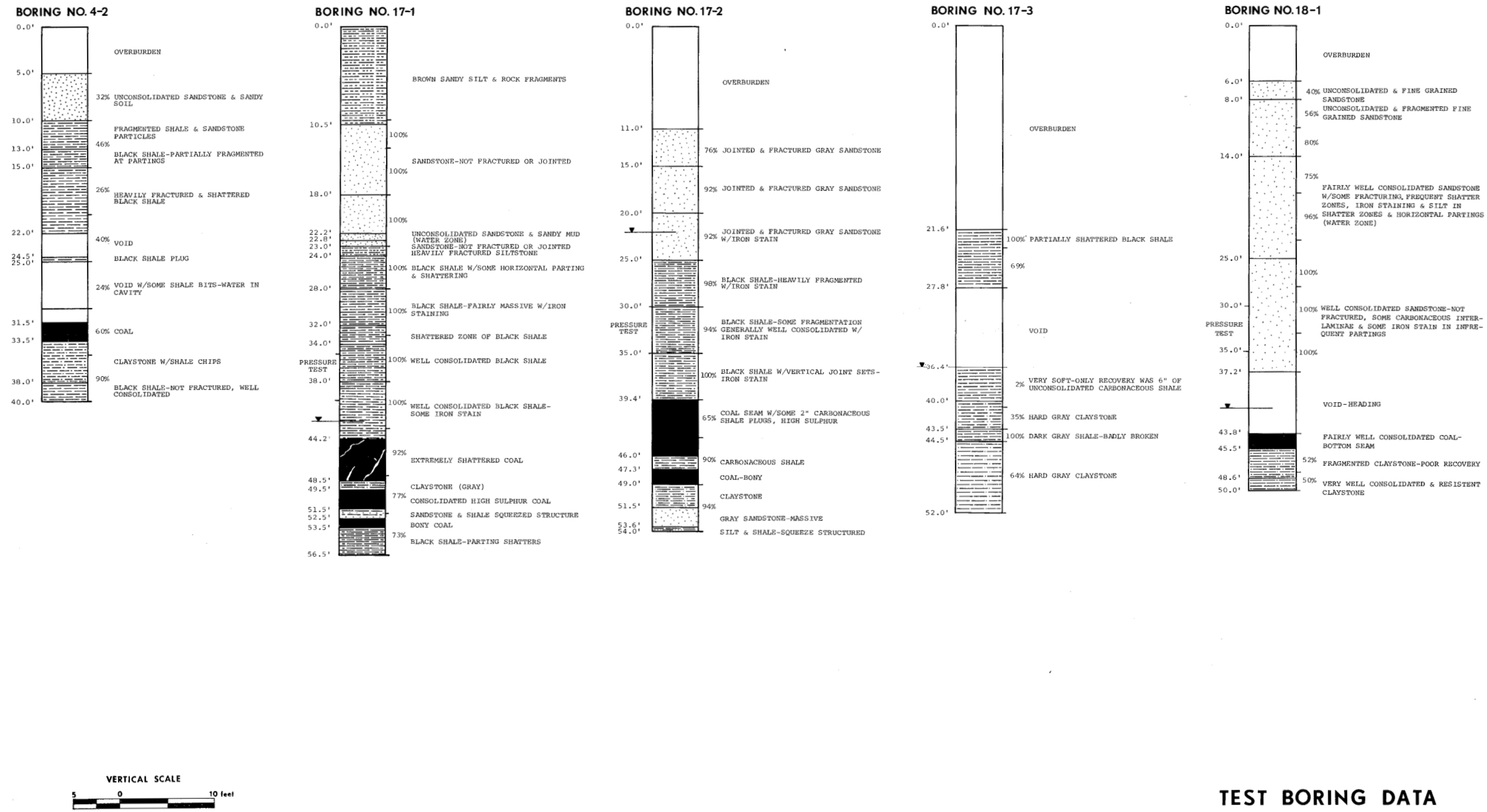
Overburden = 10'
Coring = 35'
Total 45'

Note: If the Contingent Test Borings are to be drilled, the Engineer will locate the Borings in the Field.





TEST BORING DATA



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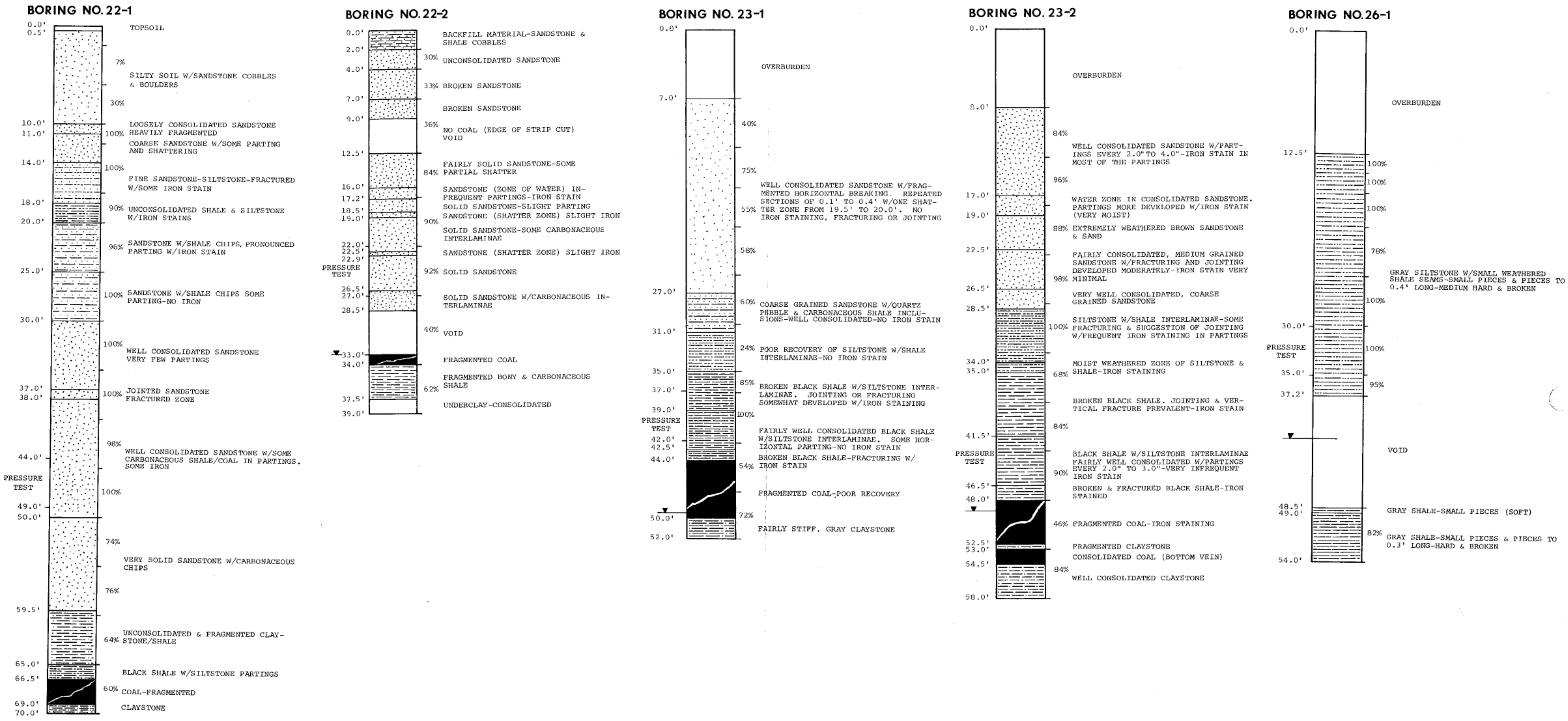

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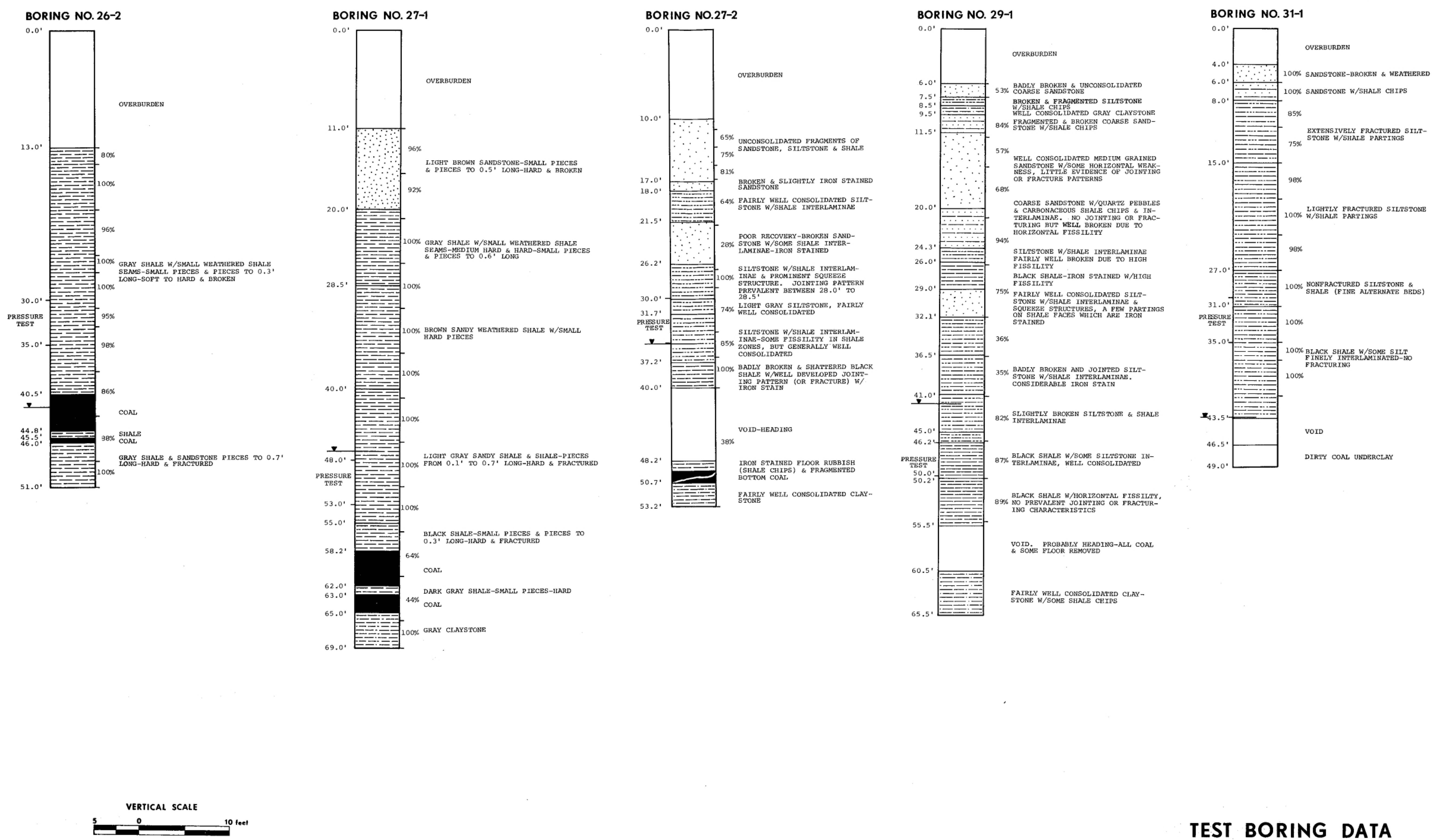

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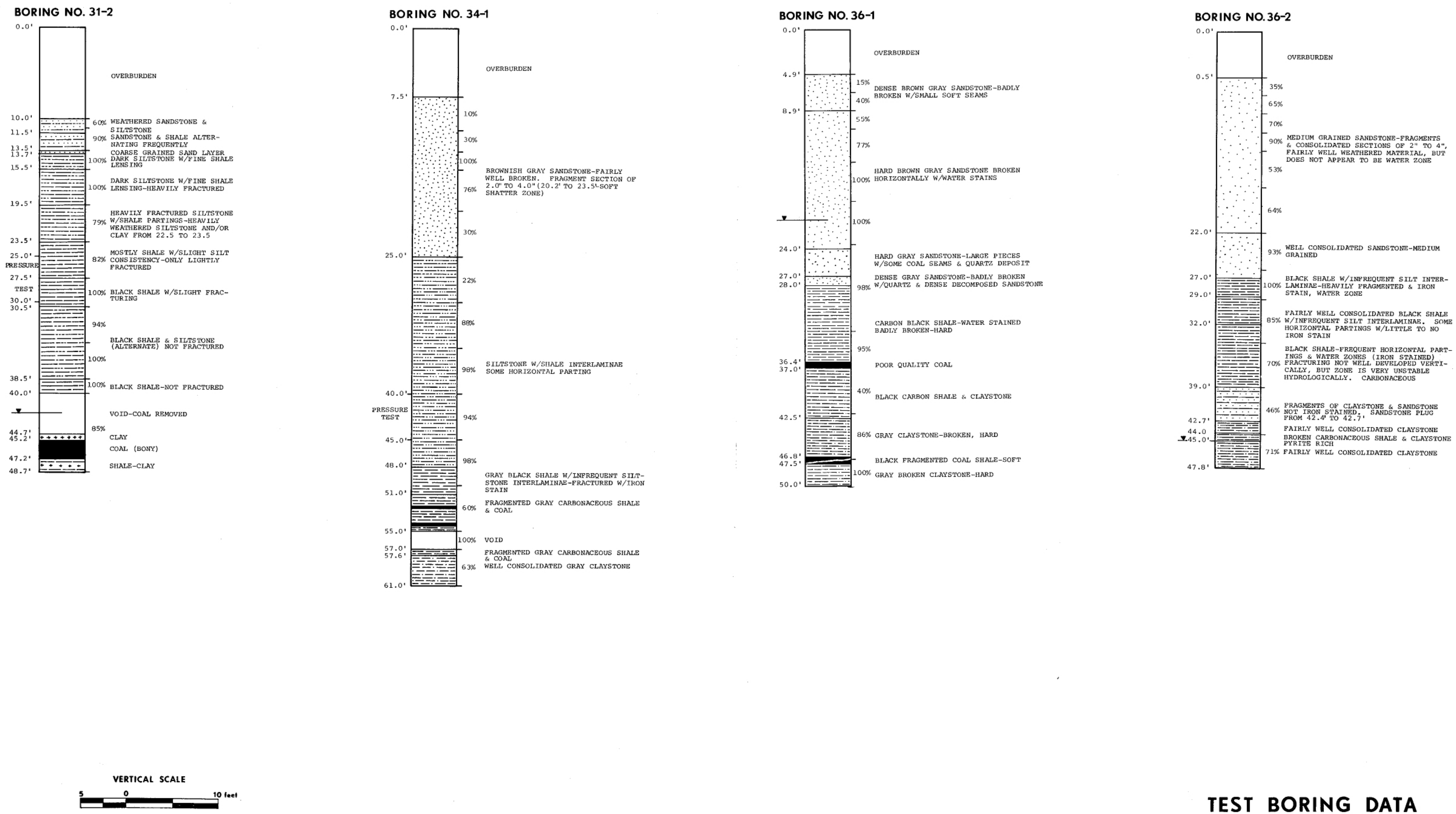


TEST BORING DATA

SOURCE DESCRIPTIONS, ABATEMENT MEASURES AND COSTS

Following are descriptions of each pollution area, its pollution load, the proposed method of abatement, and the estimated cost of abatement.

The ultimate pollution discharge points are indicated under "Source Description" and these are the points where major attention should be devoted to abate pollution. The deep mine discharge points are principally the result of interception of the ground water table although, in the areas noted, some contributions are made to the deep mine workings during periods of heavy precipitation by such ancillary sources as open surface mine pits and, to a much lesser extent, subsidence areas.

In some instances an estimated acid load in pounds per day is not listed for a particular pollution source; this is due to laminar flow or other difficult field conditions which prevented an accurate estimation of flow.

The cost estimates computed were based on five different judgemental criteria:

(1) Recent bid experiences by the Pennsylvania Department of Mines and Mineral Industries for similar types of projects and abatement measures.

(2) Cost estimates and actual construction costs for the Moraine State Park and Elkins, West Virginia projects, as reported by

Gwin Engineers and the Federal Water Quality Administration (FWQA), respectively.

(3) Incremental costs developed by Cyrus Wm. Rice and Company and reported by the Appalachian Regional Commission.

(4) Incremental cost estimates based on a study of five project locations and reported by Gannett, Fleming, Corddry and Carpenter, Inc.

(5) All of the above modified by judgement and past experience of the principals of this firm. Cost estimates of all projects were updated by the Engineering News Record Construction Cost Index.

SOURCE DESCRIPTIONS

ABATEMENT MEASURES AND COSTS

Source Number	Source Description	Recommended Abatement Measures	Cost
100	Continuous gravity discharge from pipe in Grassflat Mine air seal. Acid load = 300 #/day.	Construction of water-tight seal without grout curtain.	$ 13,000
101	Continuous gravity discharge from drift portal in Grassflat Mine. Acid load = 600 #/day. Also refuse pile with leaching discharge (0.64 Acres).	Watertight seal in portal, some grout curtain and removal and burial of refuse.	18,000
102	Continuous gravity discharge from pipe in air seal in portal of Peale, Peacock and Kerr's Ogle #9 mine. Acid load - 1,000 #/day. Also leaching refuse pile (0.26 Acres).	Watertight seal in portal, extensive grout curtain and removal and burial of refuse.	21,000
103	Continuous gravity discharge from pipe in air seal in portal of Peale, Peacock and Kerr's Ogle #9 mine. Acid load = 400 #/day.	Watertight seal in portal and grout curtain.	18,000
104	Acid water (44 mg/L) inpounded in strip mine pit. Acts as significant catchment basin with drainage of acid water to deep mines and ground water with ultimate discharge to Browns Run (7.81 Acres).	Drain pit; bury refuse from 101 and 102; regrade to approximate contour; and revegetate.	20,000
105	Continuous gravity discharge from pipe from air seal in portal of Grassflat Mine. Acid load 1200 #/day.	Watertight seal in portal without grout curtain.	13,000
106	Acid water pumped from active strip mine of River Hill Coal Company. Acid load 50 #/day.	Abatement by operator under Clean Stream & Land Reclamation Laws.	None

Source Number	Source Description	Recommended Abatement Measures	Cost
107	Runoff from regraded strip mine areas impounded and polluted by tipple refuse. Load not determinable but accumulated water contained 450 mg/L acid; pH = 1.9.	Refuse material should be removed and buried in strip pit (0.52 Acres).	$ 2,000
108	Continuous gravity discharge from portal of Peale, Peacock and Kerr's Ogle #9 mine. Acid load = 1500 #/day. Also refuse pile is leaching acid water (1.38 Acres).	Watertight seal in portal and removal and burial of refuse material.	18,000
109	Continuous gravity discharge from an apparent drift opening to the Ogle #9 mine. Acid load = 800 #/day.	Watertight seal in portal and grout curtain.	17,000
110	Small intermittent gravity discharge from main heading in Ogle #9 mine. Refuse from past operation extends 300 feet downstream thereby creating a serious pollution source (1.03 Acres).	Watertight seal in portal, grout curtain; and removal and burial of the refuse material (includes Quick Start Project No. 5).	20,000
111	Continuous gravity discharge from open drift (or air seal) in Grassflat Mine. Acid load = 1500 #/day.	Watertight seal in portal, small amount of grout curtain.	12,000
112	Continuous gravity discharge from main heading of Grassflat Mine. Very large refuse piles are associated with the former tipple operation. Acid load = 300 #/day (2.34 Acres).	Watertight seal in portal; grout curtain and removal and burial of refuse material.	21,000
113	Inadequately restored strip pits from former surface mine operation have seepages which are impounded by refuse piles in No. 112. Seepages have pH of 2.5 (7.39 Acres).	Use these pits for refuse burial from #112; backfill, grade and revegetate.	15,000

Source Number	Source Description	Recommended Abatement Measures	Cost
114	Continuous gravity discharge from drift opening to Grassflat Mine. Acid load = 700 #/day.	Watertight seal in portal and grout curtain.	$ 19,000
115	Continuous gravity discharge from drift opening to Grassflat Mine, probably through air seal pipe. Acid load = 1500 #/day. Also refuse pile in area with acid seepages.	Watertight seal in portal; grout curtain and removal and burial of refuse material (0.39 Acres).	18,000
116	Small, intermittent discharge from partially reclaimed surface mine which may have broken through to the Grassflat mine workings (5.85 Acres).	Backfill, grade and revegetate.	12,000
117	Continuous gravity discharge from drift openings to the Grassflat Mine. Acid load 450 #/day. Also, adjacent surface mine strip pit is unsatisfactorily backfilled and seeping acid water.	Watertight seal in mine portal, grout curtain and backfill, grade and revegetate strip pit (Acreage under 116).	21,000
118	Refuse material near a tributary of Browns Run is polluting the tributary. Formerly associated with operations of the Grassflat Mine.	Removal and burial of the refuse material (6.06 Acres).	8,000
119	An abandoned spring has a small continuous discharge; pH = 2.7, acidity = 23 #/day. Probably due to ground water flowing along coal-clay interface.	Seal the spring where water enters the spring excavation.	1,000
120	Continuous gravity discharge from drift into Ogle #9 mine. Acid load = 500 #/day.	Watertight seal in portal. No grout curtain.	12,000

Source Number	Source Description	Recommended Abatement Measures	Cost
121	Continuous gravity discharge from drift to Ogle #9 mine. Acid load = 160 #/day.	Watertight seal in portal and grout curtain.	$ 18,000
122	Small intermittent discharge from regraded surface mine on Clarion coal seam. Acid load indeterminable due to laminar flow; pH 2.3; acidity 80 mg/L.	This small discharge does not warrant disturbing the regraded area.	None
123	Discharge principally from active surface mine of Bailey Coal Company. Acid load = 277 #/day.	Abatement by operator under Clean Streams & Land Reclamation Law.	None
124-125	Small intermittent gravity discharge from deep mine area, subsequently surface mined. Water is collected in strip pits and travels through deep mine workings until discharged.	See 126 - 127	Cost Included With 126-127
126-127	Continuous gravity discharges from drift openings in a small deep mine "island", which was subsequently surface mined, but deep mine workings are still present to act as a conduit of water collected in the strip pits. Acid load = 250 #/day (30.00 Acres).	Completely strip out the deep mine workings, regrade and revegetate the entire area. Some financial return should result from stripping of the remaining coal.	54,000
128-129	Continuous small ground water seepage, high in acid. The source or cause of the discharge was not determinable.	None	None
130	Surface mining has created a pollution load in this headwater stream of 200 #/day acid.	Backfill, regrade and vegetate the strip pits.	Included With 131

Source Number	Source Description	Recommended Abatement Measures	Cost
131	Another small stream originating in same disturbed area as No. 130 is polluted by stripping and refuse piles in area. Acid load = 64 #/day.	Removal and burial of refuse and backfilling, regrading and revegetation of strip mine (26.21 Ac.)	$ 42,000
132	Continuous gravity discharge from water impounded in surface mine strip pit, possibly some contribution from deep mine workings and refuse piles. Acid load = 1,019 #/day (33.22 Acres).	Strip out remaining deep mine workings; pump out impounded water; bury refuse material and backfill, grade and revegetate. (Quick Start Project No. 2).	60,000
133-139	These stations indicate points at which AMD discharges were analyzed along an approximate one mile stream length, paralleling Mons Run. The discharges appear to emanate from unrestored strip pits through breached or fractured outcrop barriers. Acid load = 1300 #/day. Refuse piles are also pollution contributors. The analyses were as follows:	Repair breaches in outcrop barriers; bury refuse material; backfill, grade and revegetate strip pits; construct water diversion ditches; utilize exploratory excavation to locate any old deep mine workings.	55,000

	pH	Acid	Iron	Sulfate
133	2.8	900	2.6	2200
134	3.7	188	4.0	1300
135	3.2	1010	1.52	3650
136	3.0	-	-	-
137	2.9	500	27.5	900
138	3.0	-	-	-
139	3.1	800	2.4	1700

The Clair McGovern Coal Company is presently surface mining the western edge of this area (30.70 Acres).

Source Number	Source Description	Recommended Abatement Measures	Cost
140	Small intermittent gravity discharges from stripped out deep mine. Water collected by the unrestored strip pit percolates to natural aquifers, thence to the surface. Also, a refuse pile is present. This discharge probably increases considerably during wet periods (11.43 Acres).	Bury refuse material in strip pit; retard water flow by rolling in clay layer; backfill, regrade and revegetate.	$ 23,000
141-142	Gravity discharges and apparent pollution via ground water movement from area extensively deep and surface mined. Refuse piles are present in swampy area formed by retarded flow of Flat Run. Also, a large strip pit impoundment overflows to the stream. Acid load = 332 #/day (38.93 Acres).	Bury refuse in strip pits; dewater pits; roll in clay layer to repair breaches; backfill, regrade and revegetate strip pits; clean out stream channel to enhance flow. (Quick Start No. 4).	76,000
143	Small intermittent discharge from former deep mine which has been completely stripped out. Refuse piles from the former deep mine operation add to the pollution. The strip pit impounds surface runoff.	Bury refuse material in strip pit; roll in clay layer, backfill, regrade and revegetate strip pits (20.27 Acres).	37,000
144	Intermittent gravity discharge from area formerly deep mined and subsequently stripped out. Water impounded in the pits seeps through the fractured outcrop barrier. Also, refuse material from the former deep mine operation contributes to the pollution (55.19 Acres).	Bury refuse material in the strips, dewater the pits, roll with clay layer, backfill, regrade and revegetate.	83,000

Source Number	Source Description	Recommended Abatement Measures	Cost
145-147	Small continuous gravity discharges from the Bumbarger Drifts which penetrate the low wall of a subsequent surface mine strip pit. Water from surface and subsurface sources is entrapped in the open strip pit and directed toward the low wall breaches (the drifts) and discharges upstream of a popular swimming site on the Frank Albert farm. (Site No. 147) Refuse piles also add to the pollution load.	Plug the low wall breaches with earth and rolled clay; bury the refuse material; backfill, regrade and revegetate the strip pits (41.12 Acres).	$ 74,000
148	Intermittent gravity seepage from a small area formerly deep mined by Commercial Collieries and subsequently strip mined. Although the deep mine may be connected to the Morrisdale Mine to the east, the dip of the coal would preclude any significant flow from the deep mine. Acid load = 75 #/day.	Backfill, regrade and revegetate the strip pits (6.75 Acres).	14,000
149	Continuous gravity discharge from abandoned surface mine strip pits containing a large impoundment. Also, refuse piles contribute to the pollution load. Acid load = 300 #/day (20.55 Acres).	Dewater strip pit; bury refuse material; backfill, regrade and revegetate strip site (Quick Start Project No. 3).	37,000
150	This small tributary of Alder Run, gauged by sampling station No. 1 contributes about 164 #/day of acid. The stream follows the course of the bottom of an unrestored strip pit thereby becoming polluted. The course is impounded at several locations in the pit (143.25 Acres).	Backfill and regrade the strip pits to remove opportunity for contact between stream and acid forming materials and eliminate impoundments.	215,000

Source Number	Source Description	Recommended Abatement Measures	Cost
151	Small intermittent discharge from a strip pit which was partially reclaimed. The receiving tributary was gauged by Sampling Station No. 2. This tributary is also affected by the same stripping mentioned in No. 150 Acid load = 20 #/day (50.51 Acres).	This problem can be remedied by backfilling, regrading and revegetation of strip pits along with the reclamation work on No. 150.	$ 76,000
152	Continuous gravity discharges from series of impoundments formed by interception of a tributary of Alder Run by a former surface mine operation. Acid load = 400 #/day.	Backfill and regrade the strip pits and form channel through the restored area for the tributary to flow unimpeded (92.13 Acres).	138,000
153	A natural low area in the stream gradient has resulted in an impoundment of acid water and precipitates, plus silt and other solids. The tipple and refuse area as well as haul roads built of refuse which served the former Commercial Collieries add considerably to the pollution load.	The refuse material must be removed to the highest degree possible and the stream channel improved to eliminate the contact time between the stream and remaining refuse (44.58 Acres).	89,000
154	A large refuse pile impounds a tributary of Alder Run which forces the stream to flow through the refuse, creating an acid load of 200 #/day.	The refuse pile must be removed and buried and the stream channel reestablished away from any possible residue from the pile.	Included With 153
155	Continuous gravity discharge from water impounded in a strip pit which very likely also affects Kettle Spring Run. The pollution load to the two streams totals more than 1,050 #/day of acid (35.38 Acres).	Dewater the pits, backfill, regrade and revegetate.	54,000

Source Number	Source Description	Recommended Abatement Measures	Cost
156	The tributary measured by sampling station number 6 flows into an unrestored strip pit. The quality of this water is marginal and should be diverted to Alder Run (26.54 Acres).	Divert this tributary to the Quick Start No. 1 diversion channel; backfill, regrade and revegetate the open strip pit.	$ 31,000
157	A road is made of bony and other coal waste products which pollute surface waters contacting the roadway. This adversely affects Mons Run (2.94 Acres).	Remove the worst areas of acid-forming materials and replace with crushed limestone. Also, place limestone over entire road surface and sides.	20,000
158	The headwaters of Alder Run are entering old mine workings of the Morrisdale Coal Company and probably emerging from interconnected deep mines into Hawk Run. The diverted flow averages about 120 gallons per minute but is several times higher than that during high flow periods. It degrades in quality during the passage through these deep mines.	"Quick Start" Project No. 1 is underway, which will return these headwaters to the Alder Run watershed.	117,000
		TOTAL	$1,612,000

Property Owners

The owners of property affected by the preceding reclamation measures follow:

Source	Property Owners
100	Carl Pearce
101	Jones & Peterson; Victor &Arthur Rydberg
103	Victor &Arthur Rydberg
104	Jones & Peterson
105	Timothy Woodside; Carl Pearce
Active Mine	River Hill Coal Company
107	F. Brown; River Hill Coal Company; C. A. Rydberg; Herb Roos
108	Carl J. & Nellie Pearce; Anton F. Erickson; Arthur Rydberg
109	Anton F. Erickson; Arthur Rydberg; Carl J. & Nellie Pearce
110	Arthur Rydberg
111	River Hill Coal Company
112	W . R. Johnson; J. F. Hudish; C. B.C. Corp.
113	W. R. Johnson
114	J. F. Hudish; Joseph Laskovan
115	River Hill Coal Company
116	Donald Harper; River Hill Coal Co.

117	Donald Harper; River Hill Coal Co.
118	River Hill Coal Co.
119	Edward Veres; William and Margaret Steele; Allen B. Roos
120	Walter L. Hollenback; Victor Rydberg
121	Victor Rydberg
Active Mine	Robert Bailey, Heirs; Norma Bailey, Est.
Active Mine	River Hill Coal Co.; Victor Rydberg
124	County National Bank and Trust Co.
125	County National Bank and Trust Co.
126	County National Bank and Trust Co.; Peterson Bros.; Elizabeth Murphy, Est.
127	County National Bank and Trust Co.; Peterson Bros.; Steve Belong, Sr.
128	Walter Jones, Jr.; County National Bank and Trust Company
129	County -National Bank and Trust Co.
130	County National Bank and Trust Co.
131	Hubler & Rowland; B. D. Schoonover; County National Bank and Trust Co.
132	County National Bank and Trust Co.
133	Hubler and Rowland
134	Hubler and Rowland; M. Mons, Est.; B. D. Schoonover

135	Hubler & Rowland; Roscoe Orwick; Willa Sharp; M. Mons, Est.
136	Willa Sharp; M. Mons, Est.
137	LeRoy Thompson, Etal .
138	LeRoy Thompson, Etal.; James Taylor
139	Willa Sharp
140	Ernest Schoening
141	County National Bank and Trust Co.; Roscoe & Frances Orwick; Ernest Coble
142	Ernest Coble; Berlin Hubler; County National Bank and Trust Co.; Roscoe Orwick
143	County National Bank and Trust Co.; Berlin Hubler; Cecil Coble
144	Dwight & Max Forcey, Etal.; H. Bumbarger
145	M. & L. Hubler
146	Frank Albert
147	Frank Albert
148	Frank Albert; B. C. Hubler; Commercial Collieries Company
149	Commercial Collieries Company; Frank Albert
150	Frank Albert; Kristianson & Johnson; L. Thompson; Norman & Bernice Schimmel; Robert Bailey; J. Emeigh, Heirs
151	Albert Sanderson; Commercial Collieries Co.

151	Albert Sanderson; Commercial Collieries Co.
152	B. Rothrock; Commercial Collieries Co.; B & M Turner; Frank Albert; Catherine Shugarts, Heirs
153	Clifford & Florence Smeal; B. C. Hubler Commercial Collieries Co.
154	Commercial Collieries Co.
155	Richard Evans
156	Frank Albert
157	Road - apparently by Graham Township; adjacent property by Willa Sharp; James Taylor; LeRoy Thompson, Et al ; Mrs. R. Hubler
158	Robert Bailey; Frank Albert; John Hill, Sr. & Heirs

Cost of Complete Land Reclamation

The abatement measures listed on the preceding pages involving strip mine reclamation work include only sufficient restoration to abate most of the pollution. The following table indicates the amount of restoration recommended, as compared to the amount of disturbed area .

Basin	Total Acres	Total Disturbed		Recommended Restoration	
		Acres	%	Acres	%
Flat Run	1,158	221	19	61	5.3
Mons Run	1,242	141	11	71	5.7
Browns Run	3,981	457	11	40	1.0
Alder Run	8,979	1,245	14	557	6.2
TOTALS	15,360	2,064	13.5	729	4.7

If in the future it becomes desirable to restore all of the acreage disturbed by surface mining, the estimated cost of this additional work is $2,400,000. The total cost for all work within the watershed would then become $4,012,000. One benefit which would occur from a total reclamation effort would be the complete elimination of the slugging effect that occurs to the West Branch after heavy precipitation.

Mine Drainage Treatment

Alder Run watershed has been so completely devastated by deep and surface mining that, in combination with the low natural alkalinity resources of the basin, all of the waters have been rendered acid, with the exception of the two small tributaries which are neutral (nearly equal titrations of alkalinity and acidity).

This lack of natural alkalinity forebodes only the limited success of reclamation measures, since alkalinity will not be available to overcome the inevitable residual pollution after reclamation. It appears, therefore, that reclamation measures will reduce the pollution load being carried by Alder Run and its tributaries and thereby considerably lessen the adverse impact of the stream on the West Branch. Without an input of alkalinity, however, the future is uncertain in regard to whether stream quality would improve to a level needed to support aquatic life. This situation suggests an evaluation of the potential of treatment on the watershed or, at least, the addition of an alkaline substance directly to the streams.

In order to artificially raise the pH in significant stretches of Alder Run and its tributaries, treatment facilities or in-stream liming devices would have to be constructed. These would be built at locations maximizing the length of potential fishing streams within the practical constraints imposed by such items as (1) quality of water at a treatment site; (2) the suitability of the stream for natural fish habitation and propagation; and (3) the access to the stream by the public.

Three general possibilities were considered:

(1) In-stream liming devices without provision for settling-of precipitates could be located at strategic locations in the headwaters of Alder Run, Flat Run, Mons Run and Browns Run. Such a consideration must recognize the high iron and aluminum levels in these streams would create considerable quantities of precipitates which are detrimental to aquatic life. Under these circumstances, normal ecology conducive to fish habitation would not ensue even in the desirable pH range. If, in the future, reclamation measures considerably reduced the concentration of these precipitative constituents and, if public pressure for complete restoration of Alder Run became evident, in-stream treatment could be further evaluated. Based on present acid levels in the streams, capital cost for four in-stream plants would be approximately $160,000 with annual operating fees nearly equal to the capital cost.

(2) Treatment facilities at the locations noted above could be constructed which are designed for settling of precipitates. Such plants would result in a good quality water at these headwater locations, but would not be technically practical unless downstream pollution sources were significantly reduced so they would not counteract the alkalinity from the treated waters.

The concentrations of precipitative constituents in the downstream sources must also be reduced. The total cost for four such plants would be approximately $1 million with annual operation costs of $200,000.

(3) A large treatment facility could be constructed at the confluence of Alder Run and Browns Run which would include precipitate removal. Such a facility, which would cost approximately $900,000, and have an annual operating cost of $150,000, would reclaim the lower three miles of Alder Run. Although the access to this portion of the stream is difficult due to very steep banks and poor roads, the Waterways Patrolman indicates that the public pressure for fishing waters would not make accessibility a serious factor. This facility would result in the elimination of an average contribution of 16,470 #/day acid to the West Branch and, with a residual of 20 mg/L alkalinity, would add about 655 #/day alkalinity to the West Branch.

PRIORITIES OF ABATEMENT PROJECTS

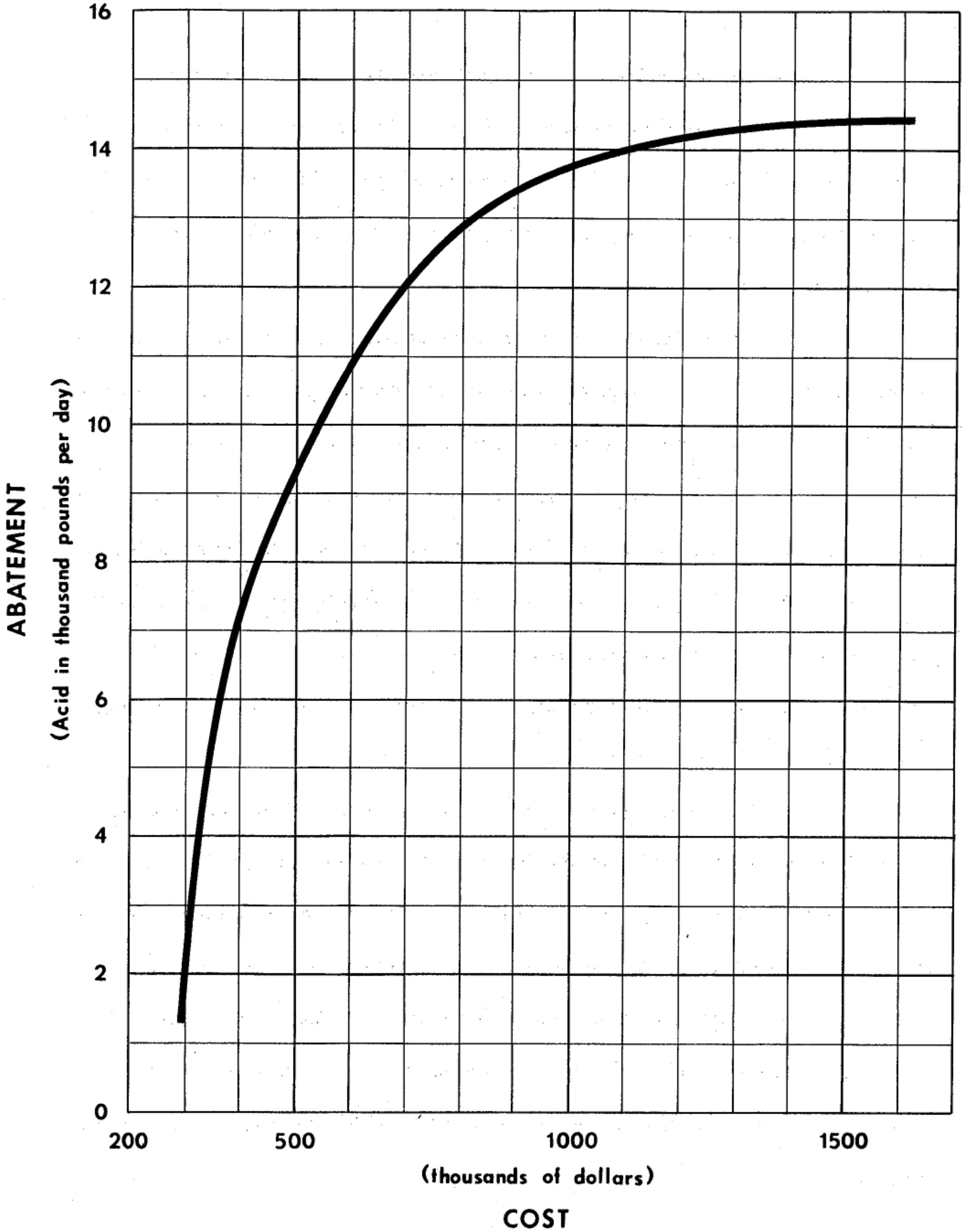
The establishment of pollution abatement priorities must be an integral part of any water resource study, particularly when extensive mine drainage pollution abatement is involved. Priorities are necessary, because public funds available for reclamation presently are limited and must be utilized in the most advantageous manner. Specific priority lists also assist the program agency in maintaining an accurate accounting system. This provides information relative to the extent that reclamation has proceeded and the amount of money necessary to achieve each new incremental level of pollution abatement. Such accounting will be invaluable in the future when more public funds become available for additional drainage pollution abatement.

One of the major factors used in forming project abatement priorities was the ratio of abatement costs to amount of pollution expected to be eliminated. The obvious weakness in using such parameters solely is that all pollution is not readily detectable. Correspondingly, some pollution enters the, waterways through ground water movement, including that which reaches deep mine workings and may travel considerable distances prior to discharge to surface streams. For example, at source number 158 on the watershed the entire stream flow disappears into the underground. Although a ratio of abatement cost per pound of acid cannot be rationally determined from these particular situations, recognition of the importance of correcting such conditions is prevalent among experts in mine drainage pollution abatement.

Another factor considered .was the probable effect of abatement measures and reclamation on the residents in the area; their use of the land near the streams and the over-all aesthetic factors. Accordingly, all things being equal from a pollution abatement standpoint, the land use and aesthetic considerations did influence the priority ranking of a project.

A further consideration in establishing priorities is the relationship and interlocking of one abatement measure with another. An example of this is the need to seal all entryways to a mine or portion of a mine in order to meet the objective of the sealing program. Another example would be the removal of a refuse pile and burial of the material in a nearby strip pit. The complete restoration of the pit receiving the refuse should be an integral part of the over-all abatement project, even though the strip pit alone may not have received a high priority ranking. The graph on the next page shows the level of pollution abatement that can be achieved for each increment of expenditure within this watershed.

Several abatement projects involving extensive backfilling which presently do not have favorable cost/abatement ratios would be considerably enhanced by the resumption of surface mining in those areas. The Land Reclamation Board and the Department of Mines and Mineral Industries could consider negotiating with applicants for surface mine permits for correction of old pollution sources adjacent to proposed mining operations. The coordination of restoration requirements for new strip mines with nearby restoration needs could result 'in inexpensive reclamation of important areas of the watershed.



ABATEMENT COSTS vs. ACID REMOVED

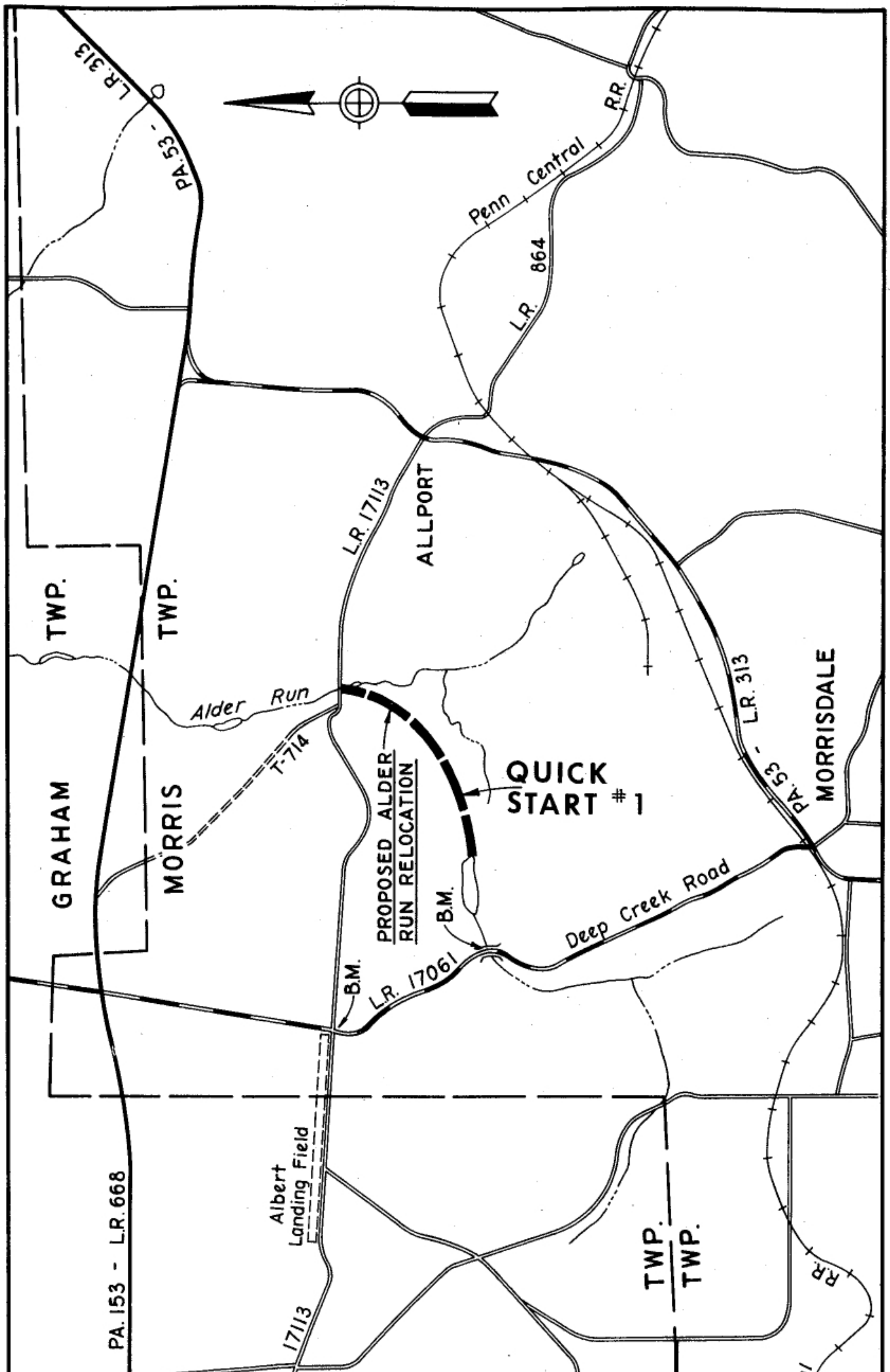
Five (5) "Quick Start" Projects have been initiated, the first of which is now in the construction phase. This first Quick Start project was part of this original contract. The remaining four projects were chosen as soon as the study established their importance in abating pollution on the watershed and feasibility of their implementation, and are currently in the design stage. These projects are described in detail later in the report. They are listed under Priority No. 1 in the following tabulation:

Recommended Priority	Project Cost	Accumulated Cost	Acid #/Day
Priority No. 1 - The five "Quick Start" Projects: Source numbers 158, 132, 149, 141-142, and part of 110. (95 Acres)	$ 292,000	$ 292,000	1,650
Priority No. 2 - Deep mine seals on Browns Run involving Source numbers 100, 101, 105, 111, 112, 113, 114, 115, 116, 117 and 118 (Grassflat Mine). (23 Acres)	170,000	462,000	6,550
Priority No. 3 - Deep mine seals on Browns Run involving Source numbers 102, 103, and 104 (Ogle #9 Mine). (9 Acres)	59,000	521,000	1,400
Priority No. 4 - Deep mine seals on Browns Run involving Source numbers 108, 109, 110, 120, and 121 (Ogle #9 Mine). (2 Acres)	83,000	604,000	2,960
Priority No. 5 - Strip mine reclamation along Mons Run - Source numbers 133 through 139. (31 Acres)	55,000	659,000	1,300
Priority No. 6 - Strip mine reclamation at headwaters above new diversion channel - Source number 148. (7 Acres)	14,000	673,000	75

Recommended Priority	Project Cost	Accumulated Cost	Acid #/Day
Priority No. 7 - Strip mine reclamation at head-waters above new diversion channel - Source number 152. (92 Acres)	$ 138,000	$ 811,000	400
Priority No. 8 - Refuse pile removal and stream clearance at headwaters above new diversion channel - Source numbers 153-154. (45 Acres)	89,000	900,000	200
Priority No. 9 - Strip mine reclamation at head-waters above new diversion channel - Source number 150. (144 Acres)	215,000	1,115,000	165
Priority No. 10 - Strip mine reclamation at head-waters above new diversion channel - Source number 151. (51 Acres)	76,000	1,191,000	20
Priority No. 11 - Stream diversion of tributary flow into deep mine workings via strip pits - Source number 156. (27 Acres)	31,000	1,222,000	*
Priority No. 12 - Strip out small "island" of deep mine works stripped on all sides - Source numbers 124 through 127. (30 Acres)	54,000	1,276,000	250
Priority No. 13 - Strip mine reclamation of strip-pings affecting two tributaries. Only pol-lution source to Kettle Spring Creek - Source number 155. (36 Acres)	54,000	1,330,000	1,050
Priority No. 14 - Strip mine reclamation of pollution sources above small tributary and bathing pond. Source numbers 145 to 147. (41 Acres)	74,000	1,404,000	*
Priority No. 15 - Replacement of road constructed of refuse - Source number 157. (3 Acres)	20,000	1,424,000	*
Priority No. 16 - Removal of tipple refuse - Source number 107. (1 Acre)	2,000	1,426,000	*

Recommended Priority	Project Cost	Accumulated Cost	Acid #/Day
Priority No. 17 - Strip mine reclamation of headwater streams originating in strip mine areas - Source numbers 130 - 131. (27 Acres)	$ 42,000	$1,468,000	265
Priority No. 18 - Strip mine reclamation to abate pollution from unrestored surface mine to Mons Run - Source number 140. (12 Acres)	23,000	1,491,000	*
Priority No. 19 - Strip mine reclamation to abate pollution from unrestored surface mine and refuse - Source number 143. (21 Acres)	37,000	1,528,000	*
Priority No. 20 - Strip mine reclamation to abate pollution to Alder Run from unrestored surface mine and refuse - Source number 144. (56 Acres)	83,000	1,611,000	*
Priority No. 21 - Seal spring to eliminate pollution from abandoned spring - Source number 119.	1,000	1,612,000	25

* Where an acid load in Pounds Per Day is not shown, an accurate estimation of the flow could not be made in the field.



LOCATION PLAN
QUICK START #1

Scale
1000 0 2000 Feet