DEPARTMENT OF ENVIRONMENTAL RESOURCES
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MINE DRAINAGE ABATEMENT SURVEY

MOON RUN WATERSHED

CONTRACT SL 162-1

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INTRODUCTION

This report was prepared under the authority of the *Land and Water Conservation and Reclamation Act,* "Act 443", for Pennsylvania Department of Environmental Resources, Bureau of Resources Programming, under Service Contract No. SL 162-1.

The purpose of this study was to determine the extent of mine acid drainage pollution in the Moon Run Watershed and to recommend necessary measures for pollution abatement. This was accomplished by the following procedure:

An initial investigation entailing geologic reconnaissance and a coal search to determine the extent of mining operations, both strip and tunnel, which influence the surface and subsurface water entering Moon Run.

Field studies included hydraulic and hydrologic analyses, determination of the extent and condition of past surface and subsurface mining, location of surface subsidence areas, and the identification of specific discharges of mine-acid drainage. This phase incorporated a 13 month sampling and flow measurement program to evaluate run-off and mine-water discharges on a long-term basis. Test borings were to be conducted, if necessary, during this phase of the study to determine the feasibility of sealing underground mine workings and to establish the limits of mine waste deposits. However, due to the findings of the study and the nature of the Moon Run Watershed pollution problem, no test borings were performed.

The determinations of the above studies are the basis of recommendations for pollution abatement measures for each identifiable source of mine-acid pollution. These remedial measures are presented with a cost/ benefit and feasibility analysis to establish a priority ranking system.

BASIN DESCRIPTION

LOCATION

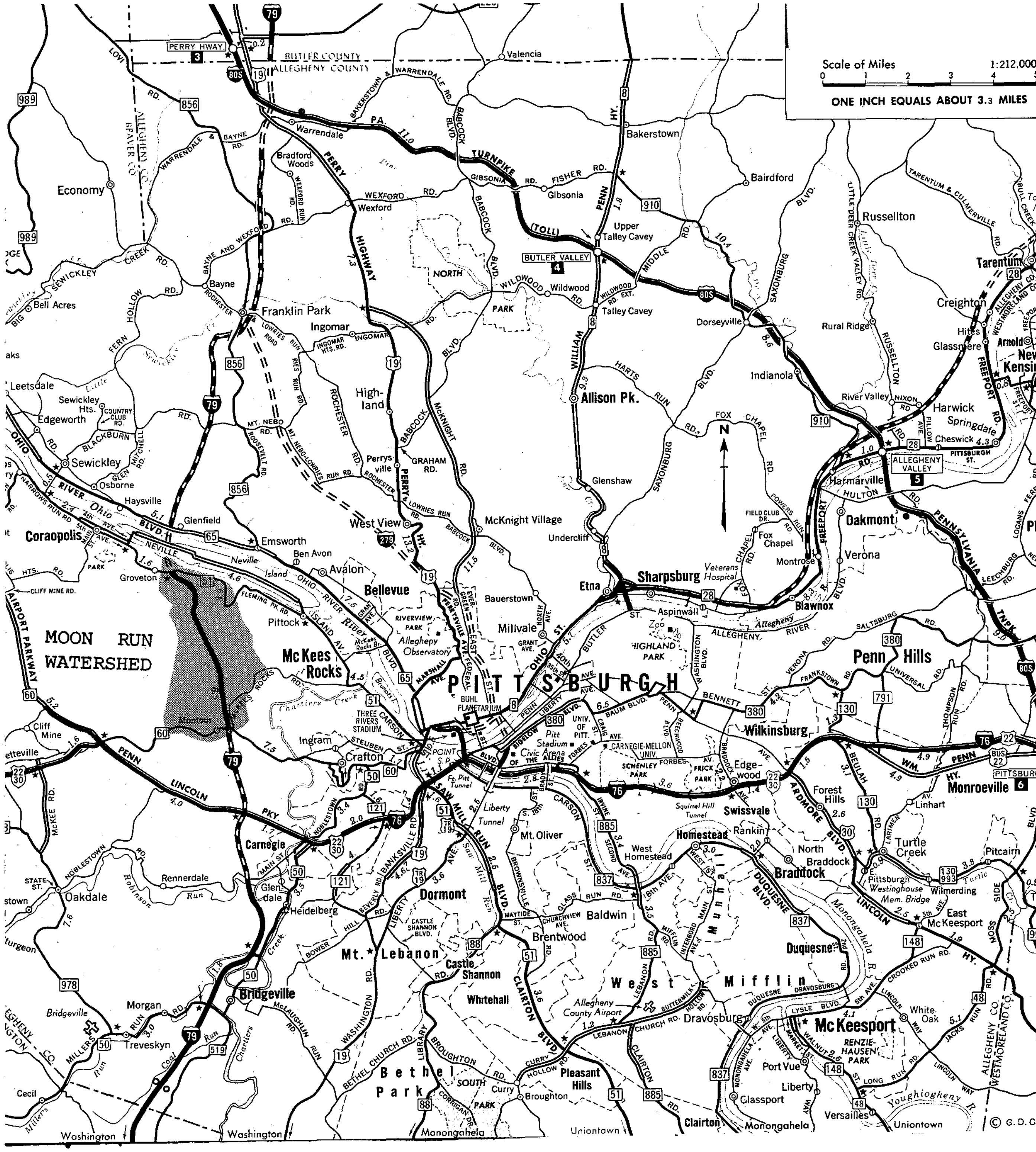
The Moon Run Watershed is situated approximately six miles west of the City of Pittsburgh in Allegheny County, Pennsylvania, and includes portions of Kennedy and Robinson Townships. The basin is irregularly shaped with a maximum length of approximately four miles and a maximum width of two miles. It encompasses approximately 5.5 square miles in area and includes over 21 miles of streams.

The source of Moon Run is in Robinson Township three miles south of Neville Island where three small swales join at approximately United States Geological Survey (USGS) elev. 1100 feet. Moon Run flows southeast for nearly one mile then northward for approximately four miles where it enters the back channel of the Ohio River at elev. 692 opposite Neville Island, approximately 8.7 miles downstream from the confluence of the Monongahela and Allegheny Rivers. Several unnamed tributaries contribute sizable flows to Moon Run.

The Moon Run Watershed has recently been altered to facilitate construction of Interstate Route 79 and the Robinson Township Sanitary Sewer System. Both of these projects essentially follow Moon Run and have required changes in the stream channel to facilitate construction operations. These construction operations delayed the initial installation of stream measuring devices and affected the stream flow numerous times.

TOPOGRAPHY AND GEOLOGY

The Moon Run Watershed is located in the Appalachian Plateaus Province which is characterized by almost flat-lying superficial rock strata. The regional structure in the Allegheny County section of the Plateau is a trough-like basin termed the "Pittsburgh-Huntington Basin". The axis of this basin, just southeast of the study area, runs northeast-southwest with all rock strata gently dipping toward this axis. Three minor geological



ENGINEERING MECHANICS, INC.
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LOCATION PLAN

SL 162-1

PITTSBURGH & VICINITY MAP
ESSO OIL COMPANY, 1972

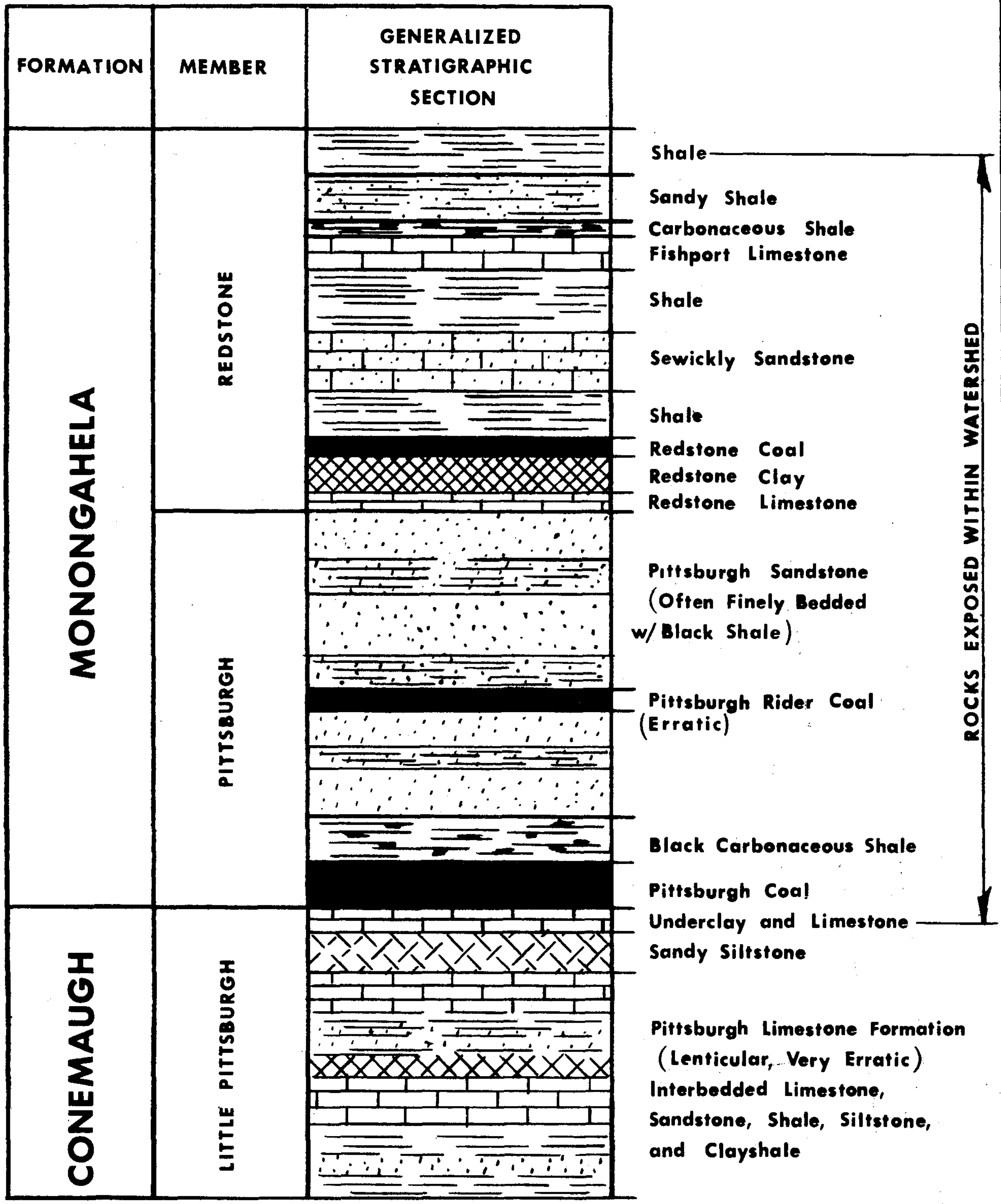
structures are also located within the limits of the watershed. An unnamed syncline which runs in a southeast direction through the center of the watershed is paralleled on both sides by anticlines which appear to be branches of the Wildwood Anticline. A geologic. structure map of this area is appended. Bedrock consists of sedimentary beds of shale, sandstone, limestone, indurated clay, and coal. The outcropping beds belong to the Carboniferous System and are part of the Monongahela Formation in the south, and the Conemaugh Formation in the north portion of the watershed. The regional dip of this rock is gently to the southeast.

The coal of major importance in this area is the Pittsburgh Coal seam which is the basal member of the Monongahela Formation (see stratigraphic section, pg. 5). This coal seam is high in pyritic minerals which when exposed to air and water create sulfuric acid. The base of the Pittsburgh Coal seam falls from elev 1180 near the Ohio River to elev 1080 near the southern portion of the watershed on an average grade of less than one per cent. The main coal seam is approximately 10 ft to 13 ft thick and for about 10 ft above it two alternating bands of black carbonaceous shale and bony coal can be found. The coal has been completely eroded away in the northern third of the watershed and only remnants of the seam remain on the high hills in the center third of the watershed. The coal eventually drops to where it outcrops just above the valley floor in the southern third of the watershed.

CLIMATOLOGY

The United States Weather Bureau has a weather station at Greater Pittsburgh International Airport a distance of seven miles from the Moon Run Watershed. The climate of the area is characterized by moderate variations in temperature with relatively consistent monthly and annual precipitation.

During the December, 1971-December, 1972, study period, the temperature in the area averaged 49.2°F. Temperature extremes ranged from -10°F to 91°F.



REFERENCE:

MINING PHYSIOGRAPHIC STUDY
ALLEGHENY COUNTY, PENNSYLVANIA
A.C. ACKENHEIL & ASSOCIATES, INC.
NOVEMBER 4, 1968

ENGINEERING MECHANICS, INC.
CONSULTING ENGINEERS PITTSBURGH, PA.

STRATIGRAPHIC SECTION
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The total precipitation for this study period was 43.31 in. with a monthly average of 3.33 inch. The average yearly rainfall in this area is 38.72 in., which makes the rainfall for the period of study 11.85 per cent above normal. This rainfall data is plotted with the 10-year mean average on the graph included in the Appendix.

MINING OPERATIONS

The Pittsburgh Coal seam is the only commercially minable coal exposed within the Moon Run Basin. The combination of nearly flat-lying coal bed and hill-valley topography has resulted in numerous coal outcrops in the valley walls. The coal seam was mined by drift entries directly into the hillside and contour strip mining which extracted the coal from outcrops along the valley walls. Available mine records indicate that most of the coal within the basin was mined as part of the Pittsburgh Consolidation Coal Company's Moon Run Mine and Fairhaven Coal Company's McKees Rocks Mine. The records show mining as early as 1897 and continuing thru 1942 utilizing the room-and-pillar method. The U. S. Bureau of Mines W.P.A. map, Carnegie Sheet No. 2, is included in the Appendix. The isolated coal capping the hills in the center portion of the basin was not mined on a large commercial basis but apparently was mined for local domestic use. Mining records are not available for these areas.

The numerous coal outcrops within the Moon Run Basin have been extensively strip mined and few have been regraded. The resulting ground water drainage is toward the highwall and into the deep mine workings which have been intercepted at numerous locations. This drainage is the major source of water entering the deep mines. This oxygen-rich water oxidizes the pyrite within the remaining coal pillars and carbonaceous shales producing sulfuric acid. The mine acid then seeps from the deep mines where the coal outcrops into a valley.

Extensive mine refuse piles, situated on both sides of Moon Run at its southerly limit, are additional sources of mine-acid pollution. This mine waste, in the vicinity of PSA-1, apparently resulted from deep mining operations south of the study area. The remains of a main entry and tipple can also be found in this area. The materials in the refuse piles, when exposed to the atmosphere, oxidize and produce sulfate minerals. Rainfall dissolves these minerals and carries them into the stream in the form of acid and other impurities.

There are presently no active coal mining operations within the Moon Run Watershed.

METHOD OF STUDY

Initially, a geologic survey and a coal mining evaluation were conducted to delineate areas of potential seepage. The approximate locations of coal outcrops were superimposed on topographic maps of the area. During September and October, 1971, a field reconnaissance of the coal outcrops was conducted to delineate strip mine areas and to locate and sample groundwater seepage points. Fifty-eight potential pollution sources were identified. V-notch weirs were installed at 12 select locations to measure stream flow.

The initial samples from the seeps and stream-monitoring locations were analyzed by Microbac Laboratories, Inc. to determine their pH, acidity, alkalinity, total iron, sulfate, and ferrous iron contents. After eliminating the seeps with pH values near seven, a remainder of 15 seepage points and 12 stream stations were monitored monthly during December, 1971, thru December, 1972, or for one hydrologic year. The resulting flow measurements and laboratory analyses are summarized in the Appendix.

A subsequent field reconnaissance during March, 1975, prompted additional study of newly discovered potential pollution sources within the previously defined areas. Samples were collected and stream-flow measured at two discharge points and three stream locations to re-evaluate the relative contribution of these sources to the overall pollution load of Moon Run. These additional five sampling stations were monitored during September thru December, 1975, and the samples analyzed by Green International, Incorporated. The resulting flow measurements and laboratory analyses are also summarized in the Appendix.

The data collected during the above portions of the study were thoroughly analyzed and correlated to delineate areas contributing the largest quantities of mine-acid drainage pollution. These areas were evaluated to determine potential remedial measures to alleviate this pollution.

STUDY RESULTS

STREAM QUALITY

Water quality sampling and flow measurements were conducted at select locations along the main channel and unnamed tributaries of Moon Run during the 13 month hydrologic analysis. The locations of these 27 sampling stations are shown on the attached *mine Development and Pollution Source Area* map. The results of the sampling program are tabulated in the Appendix.

The results of these sample analyses indicate that the upper one-third of Moon Run and its southern tributaries exhibit an average pH of 4.5 with relatively high concentrations of acidity and total iron. The only exception to this high acidity was indicated at Weir 3, upstream from a small man-made lake, where the pH averaged 6.8 and the water had a net alkalinity. This was essentially the only appreciable amount of alkalinity measured in the southern one-third of the watershed. It is felt that this was due to natural dilution of very small mine drainage flows. It should also be noted that the pH of the water sampled in the various ground seeps in this area was generally in a range of 3 to 4, again with essentially no concentration of alkalinity.

The average total acid load in Moon Run at Station 7 is estimated to be 1863 lb of acid per day. However, it should be noted that the actual monthly sampling results varied from an acid load of 25 lb/day to over 7200 lb/ day due to corresponding variations in the water flow and concentrations in Moon Run. Also, the analysis is based on 13 grab samples collected during the sampling year. Normally, a sampling run was completed within one day so that all points were measured under the same weather conditions. However, as noted earlier, construction projects within the Moon Run Watershed affected the stream flow at numerous times and, on occasion, caused disturbance of the weirs used for flow measurements. One other condition not accounted for by the sampling program is the potential *slugging* effects of deep mine pools released by heavy rainfall or other conditions that may affect total acid loadings. Overall, the average values reported tend to nullify some of the variables encountered in the measuring program and therefore provide the best indication of actual mine-acid drainage pollution conditions.

MOON RUN POLLUTION SOURCE AREAS

The twelve pollution source areas identified by the sampling program are shown on the attached *Mine Development and Pollution Source Area* map. In some areas, most notably PSA-1 through PSA-5, the acid load was not measured by just one sampling station; the acid pollution in these areas was generally not confined to a single discharge point. Therefore, the percentage contribution attributed to these areas had to be estimated based on the results and field observations. The following are descriptions of each pollution area with recommendations for remedial measures based on the acid load contributed by the source area and the estimated pollution reduction to be expected. The estimated cost for the proposed method of abatement and a subsequent cost/benefit ratio is included. The study results and recommended abatement measures are summarized in the table beginning on Page 21.

POLLUTION SOURCE AREA 1

PSA-1 is an extensive area of deep mine refuse material adjoining Moon Run in Robinson Township approximately 3000 ft northwest of the intersection of Interstate 79 and Pennsylvania Route 60. PSA-1 consists of a series of coneshaped partially burned spoil piles varying from elev 1050 to elev 1140 along the north bank of Moon Run; these piles have a maximum depth of approximately 60 feet. This pollution source area also includes a level section along the south side of Moon Run between the stream and the Robinson Township Sportsman's Club as well as the roadway base for several of the streets in this vicinity. It appears that the refuse material, covering a total area of approximately 30 acres, originated from the former operations of Pittsburgh Coal Company's Moon Run Mine. Remnants of old entries and a tipple are evident.

The acid discharge from this area is both surface and subsurface run-off which removes the sulfate minerals formed by oxidation of the coal mine waste, and drainage from at least one abandoned deep mine entry located north of the cone-shaped spoil piles at the northwest limit of PSA-1.

The total acid production of PSA-1 as monitored during 1972 is estimated at 447 lb per day - 24 per cent of the total Moon Run pollution load. Since this source of mine-acid drainage is both upstream and downstream of Weir 4, its total acid contribution cannot be isolated by one measuring station. The 1975 sampling indicates that the deep mine discharge (Station B) located in this area contributes approximately 100 lbs/day total acid load, while the refuse piles were actually contributing a net alkaline load. It is possible that occasionally the pollution from the refuse is due to slugging, during and immediately following heavy precipitation.

Most of the waste material is essentially barren and totally exposed to the atmosphere. This exposure promotes the maximum oxidation of the sulfate materials as discussed above. Accelerated run-off from the barren ground dissolves these minerals and carries them into the stream in the form of acid and impurities. Therefore, the waste materials should be regraded to simulate as nearly as possible the original contours of the valley ground surface. Wherever practical, the waste materials should be buried, such as in the adjoining strip mine designated as Pollution Source Area 3. After regrading, the mine spoils should be covered with a minimum of one foot of suitable soil cover and then re-vegetated. Regrading and re-vegetation of the spoil piles will develop an oxygen transport barrier and increase the physical stability of the spoil piles. In addition, the channel of Moon Run should be regraded to remove mine waste that has been washed into the stream bed. This improvement would enhance the flow characteristics of the stream as a side effect.

In addition, a watertight deep mine grout seal should be provided for the deep mine portal discharging acid mine waters. A seal of this nature would require a subsurface investigation to accurately locate the abandoned mine entry and determine the extent and feasibility of the required sealing program.

It is estimated that approximately 1,000,000 cu yd of mine waste material have been deposited in this area. Regrading operations will involve the handling of some 300,000 cu yd of this mine waste. Costs for the regrading and re-vegetation project are estimated at $265,000: $5,000 for site preparation;

$225,000 for regrading; $25,000 for suitable soil cover; and $10,000 for proper re-vegetation. It is estimated that the deep mine seal would cost approximately $30,000 to construct raising the total cost of abatement measures for PSA-1 to $295,000. These abatement measures should produce a 70 per cent reduction in the total acid load originating from PSA-1, or a net acid load reduction of approximately 313 lb/day. The resulting cost/benefit ratio would be $943/pound.

POLLUTION SOURCE AREA 2

This pollution source is located near the intersection of Moon Run and School Street in Robinson Township and includes Sampling Stations 13 and 14. Both of these sampling points are small streams which collect seepage from the general area. Sampling Station 13 had pH values from 2.0 to 5.2 - Sampling Station 14 had pH values from 2.6 to 5.6. During the initial study period a concentrated source of pollution could not be delineated, but numerous seepage zones were found. Findings of the recent study indicate that a major source of mine-acid drainage is the deep mine slope heading extending north to south from PSA-3 to PSA-2. Station C, monitored from September-December, 1975, showed an acid load from this slope heading of approximately 180 lbs/day. Based upon the coal contours, it appears that the groundwater recharge source for this discharge is the strip mine **in** PSA-3. Additional acid discharges originate as surface run-off which removes sulfate materials from the conical mine refuse piles located within this general pollution source area.

Based on the 1972 sampling, PSA-2 is contributing approximately eight per-cent of the total Moon Run mine-acid load. The 1975 sampling indicates a total acid contribution from this tributary (Station D) of approximately 400 lbs/day or 21 per cent of the total acid load monitored at Weir 7. The seepage is situated in residential areas where extensive regrading or other abatement measures would prove costly. It is therefore recommended that only the exposed mine waste piles at the eastern limit of PSA-2 be regraded, blanketed by a minimum of one foot of suitable soil, and re-vegetated. The regrading is estimated to involve 5000 cu yd of the 8000 cu yd of mine waste material present in this area. Costs for abatement measures are estimated at $3,000 for site preparation, $3,750 for regrading, $3,000 for soil cover, and $1,500 for re vegetation - a total cost of $11,250. It appears that the discharge from the deep mine just north of Moon Run Road (Station C) can be greatly reduced, or totally eliminated, by abatement measures at PSA -3. It is anticipated that the total pollution load of Moon Run due to PSA -2 can be reduced by two per cent, at a cost of $304/lb, through reclamation of the exposed refuse piles.

POLLUTION SOURCE AREA 3

PSA-3 is an unreclaimed strip mine covering approximately 15.5 acres on the north slope of a ridge between Moon Run Road and Moon Run, stretching essentially from PSA-2 to the headwaters of Moon Run. During stripping opera tions the overburden materials were disposed of in a series of ridges essentially paralleling the highwall. Subsequently, this strip mine has become extensively overgrown with tree and brush cover. The area between the outer ridge and the remaining highwall collects surface run-off and channels it into the deep mine workings. intercepted by the stripping operations.

The only drainage evident in this area is in the vicinity of Sampling Station 68 located at the extreme western end of the strip mine. The efflue nt at this station is extremely variable, with pH values from 3.0 to 7.1. The change from acidic to alkaline effluent is evidently the result of an intermixing of surface waters. It appears that this area is the major source of the ground - water recharge to the deep mine discharge (Station C) in PSA -2.

PSA-3 was not directly measured by any single stream sampling station; instead, it contributed portions of the acidity measured by Weirs 1, 12,2, and 4. Analysis indicates that the mine-acid load due to PSA-3 is approximately 25 per cent of the total average daily acid pollution in Moon Run., It appears that this pollution is due mostly to its contribution to the discharge in PSA -2 and to ponding and subsequent seepage of surface waters through the spoil materi al. To effect any reduction in this acid load, it will be necessary to enhance the natural drainage of this hillside and to eliminate diversion of surface waters into the intercepted deep mine workings. This will entail regrading approximately 35,000 cu yd of material. Prior to regrading of the existing on-site materials, porous material near the highwall should be removed and clay of suitable consistency should be placed against the face of the excavated coal seam for its entire exposed length. The clay should prevent small seeps and eventually seal the coal seam from air while acting as a dam, thereby preventing surface waters from entering the deep mine workings. This clay blanket, compacted mechanically, should extend the entire length of the highwall. The area immediately adjacent to the highwall cut should then be regraded, incorporating, where possible, the mine waste materials from the adjoining PSA-I and PSA-2. The entire disturbed area should be fertilized and re-vegetated. In effecting these remedial measures, only the uppermost barren ridges of the cast-off strip mine spoils should be included, thus minimizing disturbance of the naturally re-vegetated hillside at lower elevations. The cost for this project is estimated at $58,500 - $15,500 for site preparation, $26,250 for regrading, $9,000 for the clay seal and suitable soil cover, and $7,750 for re-vegetation. These measures would reduce the total watershed acid pollution by 336 lb/day, with a resulting cost/benefit ratio of $174/pound.

If the above remedial measures are conducted, it should not be necessary to construct a watertight deep mine grout seal at PSA-2 near the eastern limit of PSA-3 as this flow should be greatly reduced.

POLLUTION SOURCE AREA 4

This pollution source adjoins Aiken Road on the north near its intersection with Beaver Grade Road in Robinship Township. In this area, the Pittsburgh Coal seam varies from elev 1100 ft to 1110 ft and outcrops slightly above road level. As the coal seam rises to the northwest, drainage from deep mine workings in this area emanates at the ground surface, dispersing widely as undefined seepage zones adjacent to Aiken Road. The water quality was measured by Sampling Stations 35 and 38 north of the road, and by Sampling Stations 31 and 34 just south of the road. Weir 1 measured flow quantities on the south side of the roadway consisting of this discharge plus the discharge from PSA-12; Weir 12 measured the flow from Weir 1 plus the north side of Aiken Road. The acid load at Weir 1 varied from zero to 168 lb/day with an average of approximately 55 lb/day; at Weir 12 it varied from 30 lb/day to 1050 lb/day with an average of 224 lb/day. The water quality measured by the sampling stations, as summarized in the Appendix, exhibited high concentrations of acidity with pH values in the range of 3.0 to 3.5.

The mining records and site reconnaissance indicate that this seepage may be emanating from an abandoned mine portal. The potential abatement method for this area would consist of a subsurface seal with grouting of the adjoining rock to provide an impervious barrier. Such a watertight seal would decrease the estimated contribution of 150 lb of acid per day by approximately 40 per cent, or 60 lb of acid per day. This would result in a cost/benefit ratio of $333/lb, based on an estimated mine seal construction cost of $20,000.

The coal at PSA-4 is located in a peninsular block which outcrops on three sides. The northern and eastern sides were reportedly strip mined and regraded. These areas apparently are not contributing any, substantial amount of mine-acid. Watertight sealing of the deep mine portal discharging acid mine water along Aiken Road may not be feasible, since it may only temporarily prevent acid discharges from the deep mines workings. The groundwater discharge could eventually break out in other locations due to a lack of isolation between the deep mine workings and the strip mines. Furthermore, this area has been extensively developed and condominium-type housing units are being constructed.

Due to development of the site, surface reconnaissance does not permit actual determination of the portal location. Therefore, a subsurface investigation utilizing test borings would be necessary to locate the abandoned mine shaft and to determine the extent - and feasibility - of the grout barrier required for sealing. The above costs for seal construction could vary considerably depending on conditions encountered in the rock overburden and mine portal. Also, the housing constructed at the site would limit the area and scope of the investigation, and hinder grout seal construction. Hence, it appears that remedial measures would not be feasible at PSA-4, regardless of the costs involved.

The valley immediately north of PSA-4 was monitored by Sampling Stations 36 and 46 and Weir 3. The valley's coal outcrops were reportedly strip mined and regraded. The acid loads varied from zero to 67 lb/ day at Weir 3 with an average of 23 lb/day - less than two per cent of the total acid pollution load. The pH values at this location varied from 5.9 to 7.8, essentially a normal solution. It should also be noted that Weir 3 is located upstream from a small lake which supports fish and other water life.

POLLUTION SOURCE AREA 5

This pollution source, monitored utilizing Sampling Stations 40 and 42, consists of a narrow valley surrounded on the east, north, and west by deep mined coal. Numerous subsidence depressions are evident throughout the area. Sampling Station 42 monitored the discharges from a 4-in.-dia clay pipe which is apparently connected to the deep mine workings at the crop line. This sampling station displayed pH values varying from 2.5 to 6.4. Sampling Station 40 is in the vicinity of a 2-1/2-in.-dia steel pipe that apparently is also connected to deep mine workings. The pH readings for this station varied from 2.2 to 4.1. The drainage is highly acidic; however, the volume of flow from these stations is small.

It is estimated that this entire area contributes only five per-cent of the total daily acid load of, Moon Run. The only recommended pollution abatement measure consists of regrading the area in the vicinity of the coal outcrop where subsidence has occurred. This should be done utilizing a clay-type soil to obtain a surface seal to reduce infiltration of surface waters into the deep mine workings. Additional. surface seals would be required over an extensive area to block the seepage entirely. The remedial measures would involve approximately ten acres at an estimated cost of $30,000. A net acid reduction of approximately 60 lb would yield a cost/benefit ratio of $500/ pound.

POLLUTION SOURCE AREA 6

This source area is located south of Clever Road immediately west of Montour High School in Robinson Township. It was monitored by Weir 8, located near the Clever Road underpass beneath Interstate Route 79. Weir 8 displayed acid loads from 16 lb/day to in excess of 1850 lb/day with an average of 307 lb/day. The mine-acid drainage originates in the vicinity of the school from coal outcrops exposed during the site grading for the athletic field facilities. The acid emanates from a 12-in.-dia drain located in a headwall common with two additional drains. Due to the extensive area of the coal outcrop about the perimeter of the athletic field, it does not appear economically feasible to attempt to seal this area. In addition, extensive areas of carbonaceous shale above the coal outcrop have been exposed to weathering and are producing sulfate materials.

The abatement measure recommended for this seep is a treatment facility located near the original position of Weir 8. It is estimated that such a facility would cost approximately $35,000 to construct - but would require yearly operating expenditures of at least half that amount. The facility should be designed to effectively neutralize the entire discharge. Based on a one year operating period, plus construction costs, the cost/benefit ratio would be $171/lb with a net reduction of 307 lb/acid per day.

POLLUTION SOURCE AREA 7

This source is a small stream which develops from a series of springs along a sandstone outcrop located south of Clever Road near the underpass for Interstate Route 79 in Robinson Township. The stream enters Moon Run near the culvert headwall which carries Moon Run beneath the township road. The quality of the water was monitored by Sampling Station 25 which gave pH values varying from 2.8 to 5.5. The springs are located at approximately elev

1020, some 100 ft below the Pittsburgh Coal seam which occurs at approximately elev 1120. Apparently the acid is originating at a small strip mined area above elev 1120 and is migrating through the fractured sandstone bedrock.

The total mine-acid pollution load of this area is estimated to be only one per cent of the total Moon Run pollution. Therefore, due to the indefinite nature of the actual source and the limited amount of acid produced, no remedial measures are proposed for PSA-7.

POLLUTION SOURCE AREA 8

PSA-8 is located in Robinson Township in a small swale immediately south of Aiken Road near its eastern end, approximately 1000 ft west of Moon Run. It consists of a large indistinct seepage zone apparently originating where the Pittsburgh Coal seam crosses the swale. Weir 5, which monitored the flow from this source, exhibited pH values varying from 4.3 to 7.5. The acid load varied from zero to a maximum of approximately 148 lb/day. The average discharge was 25 lb/day - less than two per cent of the total acid load measured.

A subsurface pressure grout curtain or fly ash barrier would be required to seal this minor source of seepage. It is estimated that such a seal would cost $20,000 to construct, but would only prove to be 50 per cent effective. This is due to the density of residential housing within the immediate area of the swale - these homes would hinder effective grouting of the coal seam. Due to the high cost and reduced effectiveness, the cost/ benefit ratio for the recommended abatement measure would be $1666/lb. The measures would prove difficult to effect, and they would produce minimal results.

POLLUTION SOURCE AREA 9

This mine-acid pollution originates from the coal outcrop exposed during the construction of Interstate Route 79. The area is located in Kennedy Township immediately east of the northbound lane and was monitored by Sampling Station 20. The pH values for Sampling Station 20 were relatively consistent, varying from 2.2 to 3.9.

Generally, the subsurface drainage through the deep mine workings is to the southeast; however, in this particular area there is a change in the dip of the coal and the coal falls to the southwest. The highway cut intercepted the seepage along the base of the coal seam and the seepage is now collected in an open drain flowing. north to Sampling Station 20.

Since this pollution source area is within the right-of-way of Interstate Route 79, Pennsylvania Department of Transportation District 11-0 should be notified of this mine-acid pollution problem. In those areas where the coal outcrop has been exposed, a clay seal should be compacted along the entire cut slope to prevent small seeps and to effectively seal the coal seam from the air. It is possible that these or other measures were undertaken by the Department of Transportation, but have proven to be ineffective. The total acid production of PSA-9 is estimated at 30 lb/acid per day, only two per cent of the total Moon Run pollution load.

POLLUTION SOURCE AREAS 10 AND 11

These pollution sources consist of two separate unreclaimed strip mine areas in Kennedy Township. The source of pollution appears to be surface and subsurface run-off from the waste piles which removes the sulfate minerals formed by weathering of the exposed mine waste. Weir 6 monitored the flow from both sources. The pH values at this weir varied from 3.1 to 7.2. The acid load varied between 7 lb/day and 287 lb/day with an average of 113 lb/day - six per cent of the total measured pollution load in Moon Run.

PSA-10 entails approximately 9 acres while PSA-11 covers approximately 22 acres. At the start of this study PSA-1l was an undeveloped hilltop strip mine area; during the past year the area has been highly developed with residential-type housing. Therefore, regrading of remaining acid-forming materials will not be practical. The recommended abatement measure for the combined acid mine drainage from these two areas is an in-stream treatment plant having the capability of treating both acid pollution and high iron content. It is estimated that this plant will cost $35,000 to construct and will require at least half that amount for its yearly operating expense. Based on a one year operating period the cost/benefit ratio becomes $465/lb with a six per cent reduction in the Moon Run acid pollution load.

It appears that there are several minor sources of pollution which are presently collected with subsurface drains and conducted to the storm drains. The actual locations of these sources cannot be ascertained from this investigation, but their acid load contribution is *very* small.

POLLUTION SOURCE AREA 12

PSA-12 is a two-acre pile of deep mine refuse that has been placed directly in the Moon Run channel near its headwaters above Weir 1. This mine spoil pile appears to have come from the deep mine workings defined in PSA-4. The stream bed is actually an erosion channel within the coal waste. It is estimated that four per cent of the total pollution load surveyed in this study is from this area.

The recommended pollution abatement measure for PSA-12 entails regrading and burial of the mine spoil, cleaning of the Moon Run channel, and fertilizing and revegetating the regraded area. It is estimated that 12,000 cu yd of mine waste material is present in this area and regrading operations would involve all of this material. The cost for abatement measures are estimated at $1,000 for site preparation, $9,000 for regrading, $6,400 for soil cover, and $1,000 for re-vegetation - a total cost of $17,400. These recommended measures should abate two per cent of the total acid load and result in a $435/lb cost/benefit ratio.

POLLUTION SOURCE SUMMARY

POLLUTION SOURCE AREA	SOURCE DESCRIPTION	RECOMMENDATIONS	COST
1	Extensive deep mine spoil piles from Moon Run Mine. Seepage from deep mine.	Recontour and bury refuse, fertilize, and seed to vegetate area. Clean-up and relocate stream bed. Deep mine grout seal.	$295,000
2	Seepage from deep mines and conical bony pile, adjacent to residential area.	Remove and bury bony pile, fertilize and revegetate area.	$ 11,250
3	Abandoned 15.5 acre strip mine that is ponding water which drains to intercepted deep mine workings.	Seal coal seam with clay-like soil, recontour, and revegetate.	$ 58,500
4	Large seepage zones emanating from deep mine workings. High acid and sulfate concentrations; very high iron concentrations.	Inundate deep mine workings with grout seals.	$ 20,000
5	Acid discharges from pipes originating in deep mines. Subsidence depressions channel run-off to mines.	Surface seal sinkholes with clay-like soil. Revegetate to create oxygen barrier.	$ 30,000
6	Acid discharge from Pittsburgh Coal seam intercepted in cut for Athletic Fields, Montour High School.	Treatment plant.	$ 52,500*
7	Seepage from abandoned strip mine highwall.	No abatement recommended.	---
8	Seepage from buried coal outcrop in residential area.	Grout curtain seal.	$ 20,000

* Involves yearly operating costs

POLLUTION SOURCE SUMMARY (cont'd)

POLLUTION SOURCE AREA	SOURCE DESCRIPTION	RECOMMENDATIONS	COST
9	Coal seam intercepted in highway cut for I-79; PennDOT right-of-way	Compacted clay blanket along coal seam.	---
10,11	Abandoned strip mine spoil piles in residential areas.	Treatment plant.	$ 52,500*
12	2-acre deep mine spoil pile placed in the headwater of Moon Run.	Regrade and bury bony waste, fertilize and re-vegetate area; improve stream bed.	$ 17,400

* Involves yearly operating costs

PRIORITIES OF ABATEMENT PROJECTS

The major sources of pollution within the Moon Run Watershed are deep mine waste piles, strip mines areas, and deep mine discharges. The strip mine and refuse pile sources are the most difficult to measure since they contribute acid by surface run-off and subsurface drainage into deep mine workings. The recommended highest priority project for the Moon Run Watershed is to implement remedial measures set forth for Pollution Source Area 3. This project will result in a major reduction in the acid load within Moon Run at alow cost/ benefit ratio. PSA-3 is collecting large quantities of surface run-off and channelling it into the deep mine workings, which discharge at a mine portal in PSA-2. Based on the coal contours, part of the water flows from the Moon Run Watershed into Chartiers Watershed.. Even though this recommended project involve clearing and grubbing some natural vegetative cover, it is considered the highest priority project since it will greatly reduce inflow into the deep mine workings.

The next highest priority project entails the remedial measures set forth for Pollution Source Area 1. This project would result **in** major reduction of the acid load within Moon Run at an acceptable cost/benefit ratio. Due to the barren nature of the ground surface in this area, there is little natural renovation occurring. Since this pollution source area is also located near the headwaters of Moon Run, remedial measures effected in this area will have a maximum benefit along the entire length of the stream channel. However, deep mine workings north of PSA-1 are extensive and completion of the recommended remedial measures could result in the creation of additional deep mine discharge locations.

Pollution Source Area 2 is similarly dominated by a barren waste pile. However, due to the limited acreage and the residential area involved, the recommended abatement measures for PSA-2 will result in only minor reductions in the acid load within Moon Run. It also appears that the pollution due to PSA-2 can be greatly reduced by abatement measures at Pollution Source Area 3.

Recommended abatement measures for PSA-12 involve the regrading and burial of mine spoil. These measures are similar to those recommended for PSA-1; however, because the acid contribution from this area is a minor percentage of the total, it has been assigned a lower priority. PSA-5 is of a similar nature since it is estimated to contribute only five per cent of the total acid load.

Pollution Source Areas 6, 10, and 11 do not lend themselves to seals or other methods of reducing the amount of mine-acid that is formed. These sources would require in-stream treatment of the effluent to reduce their acid loads. As these sources exhibit high concentrations of iron and sulfate, it may be impractical to locate the required plant within the source areas. Furthermore, such treatment plants would entail yearly maintenance and operating expenses, and possibly plant operating personnel.

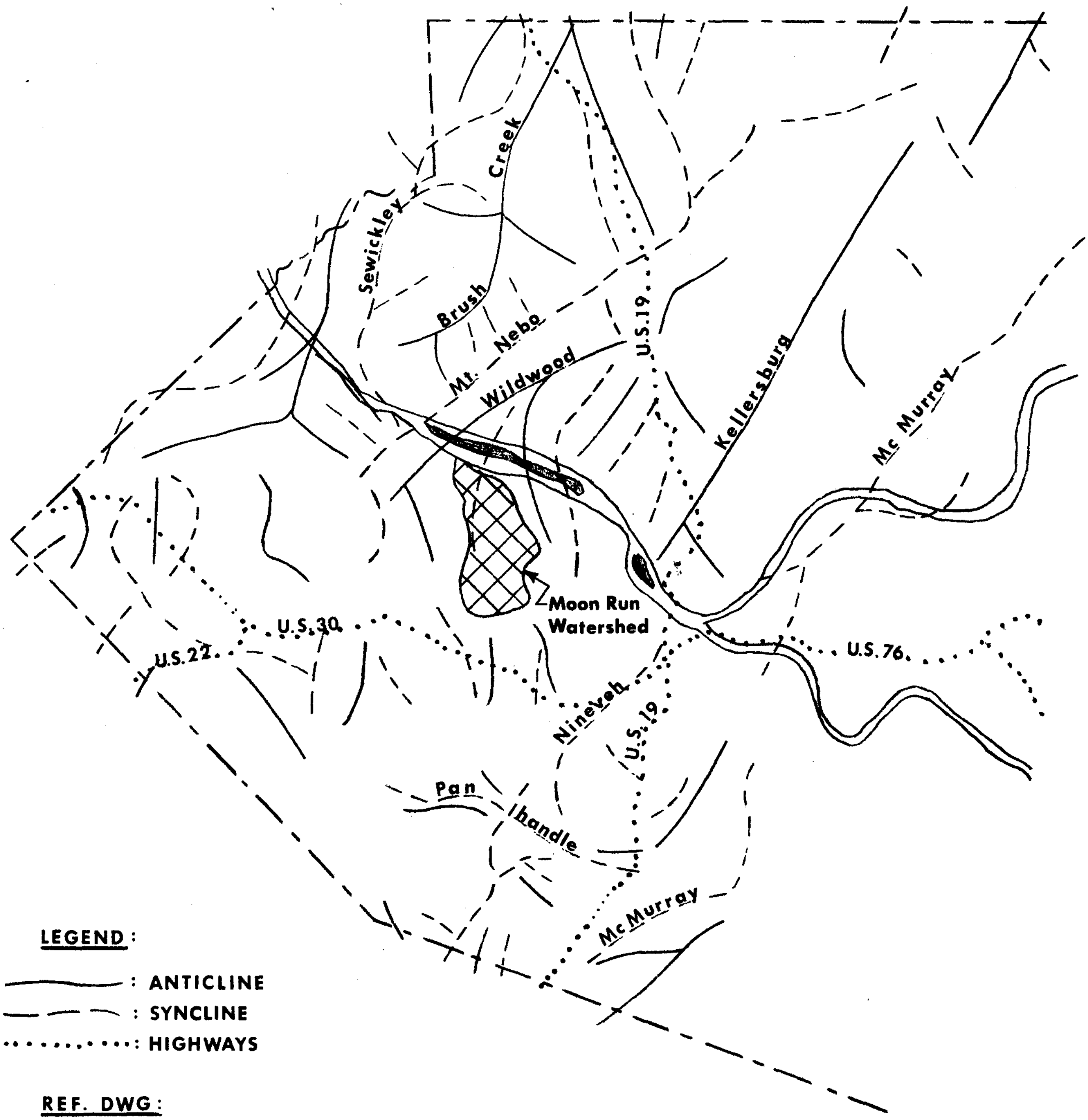
Abatement measures proposed for Pollution Source Area -4 will require the construction of a seepage barrier. Additional subsurface investigations are needed to accurately assess the feasibility of such a deep mine seal. Due to the unpredictable effectiveness of such sealing operations, which generally entail a large initial investment with little or no maintenance, and the high-density housing development which has been constructed at this site, this project was assigned the lowest priority rating despite its very attractive anticipated cost/benefit ratio. Abatement measures for Pollution Source Area 8 would also be hindered by similar conditions, thus resulting in the highest cost/benefit ratio.

The table on Page 25, *Priorities of Abatement Projects,* summarizes the acid pollution loads in Moon Run during the study period Dec., 1972, through Dec., 1973, as revised to reflect recent studies in the Pollution Source Areas, with the estimated abatement to be expected for each of the recommended pollution source area projects. Costs for the abatement measures presented in this report are based on the construction work and materials required and do not include costs for engineering plans and services.

PRIORITIES OF ABATEMENT PROJECTS

POLLUTION SOURCE AREA	PRIORITY NUMBER	ESTIMATED DAILY ACID LOAD CONTRIBUTION (%)	ESTIMATED DAILY ACID LOAD CONTRIBUTION (lb/day)	ESTIMATED ABATEMENT OF ACID LOAD (%)	ESTIMATED ABATEMENT OF ACID LOAD (lb/day)	COST OF ABATEMENT MEASURE ($)	COST/BENEFIT RATIO ($/lb)
1	2	24	447	17	313	295,000	943
2	3	8	149	2	37	11,250	304
3	1	25	463	18	336	58,500	174
4	9	8	150	3	60	20,000	333
5	5	5	90	3	60	30,000	500
6	6	16	307	16	307	52,500	171
7	-	1	19	0	0	---	-
8	8	1	25	1	12	20,000	1666
9	-	2	30	0	0	---	-
10,11	7	6	113	6	113	52,500	465
12	4	4	70	2	40	17,400	435
TOTALS		100	1863	68	1278	557,150	

APPENDIX



LEGEND:

- ——————: ANTICLINE
- — — — —: SYNCLINE
- • • • • • • • •: HIGHWAYS

REF. DWG:

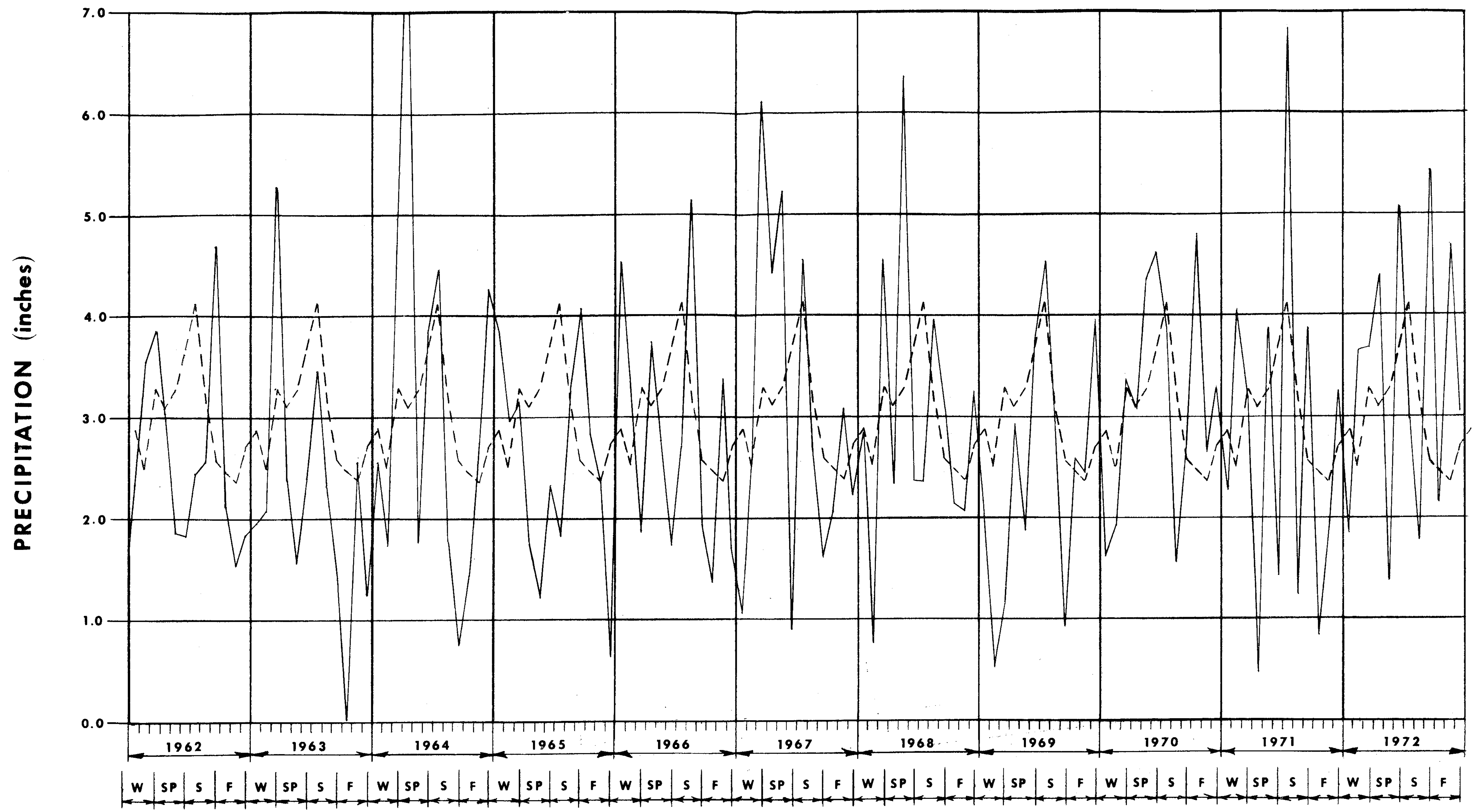
GENERAL GEOLOGY REPORT G 59
GEOLOGY of the PITTSBURGH AREA
PENNSYLVANIA GEOLOGICAL SURVEY
FOURTH SERIES
HARRISBURG 1970

SCALE

0 5 10 Miles

ENGINEERING MECHANICS, INC.
CONSULTING ENGINEERS PITTSBURGH, PA.

GEOLOGIC STRUCTURE MAP
SL 162 - 1



LEGEND:

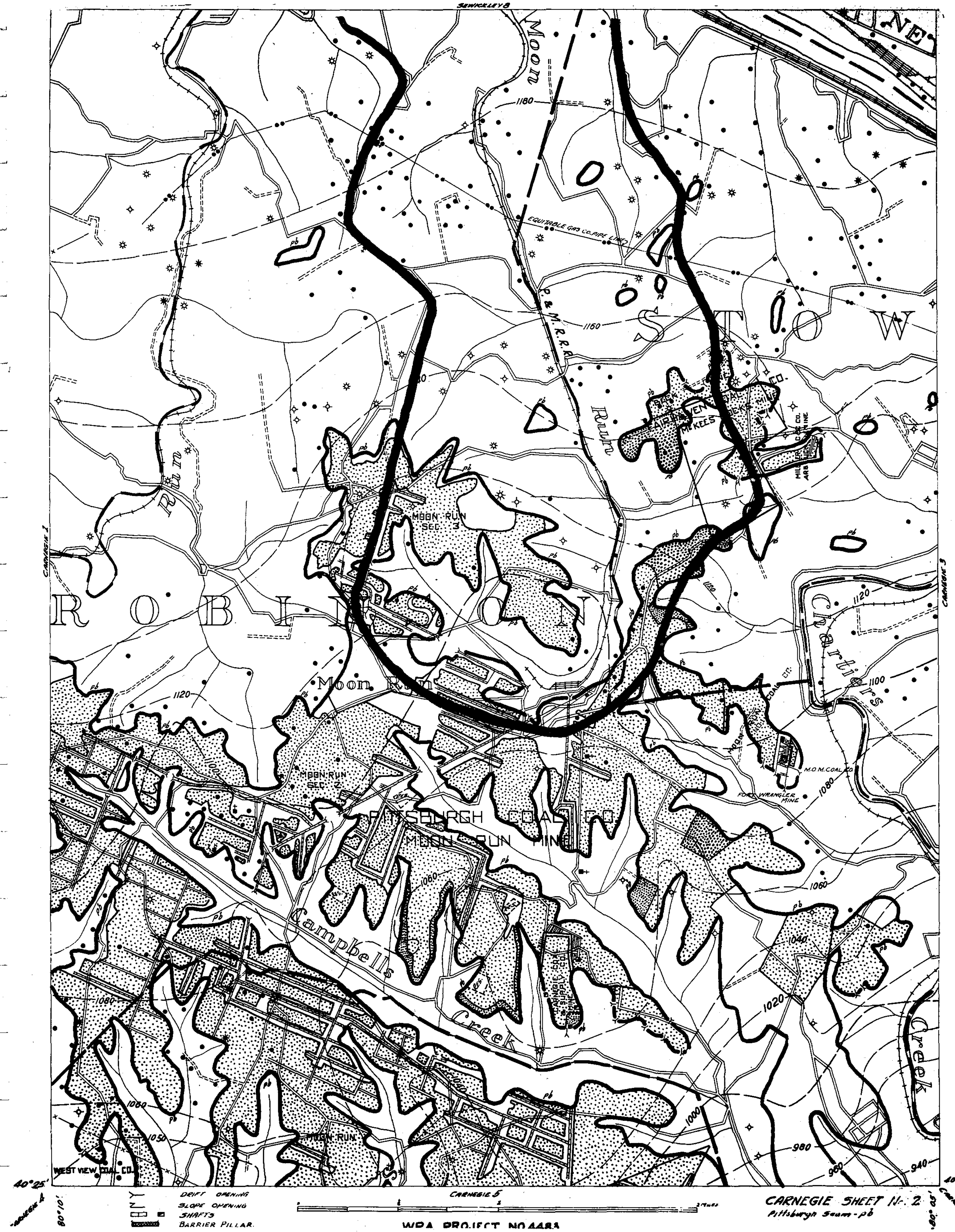
- - - - : AVERAGE PRECIPITATION
——— : RECORDED PRECIPITATION

NOTE:

DATA TAKEN FROM
U S. DEPARTMENT OF COMMERCE
LOCAL CLIMATOLOGICAL DATA

ENGINEERING MECHANICS, INC.
CONSULTING ENGINEERS PITTSBURGH, PA.

RAINFALL DATA GRAPH
SL 162-1



SEWICKLEY 8
Moon
Run
Moon Run
1180
1160
1120
1100
1080
1060
1040
1020
1000
980
960
940
EQUITABLE GAS CO. PIPE LINE
P.&M. R.R.
S T O W
R O B I N S O N
MOON RUN SEC. 3
MOON RUN SEC. 2
PITTSBURGH COAL CO
MOON RUN MINE
Campbells
Creek
Chartiers
M.O.M. COAL CO.
FORT WRANGLER MINE
MOON RUN
WEST VIEW COAL CO.
CARNEGIE 1
CARNEGIE 5
40°25'
80°10'
80°05'
DRIFT OPENING
SLOPE OPENING
SHAFTS
BARRIER PILLAR
CARNEGIE SHEET No. 2
Pittsburgh Seam - pb
WPA PROJECT NO 4483

WEIR NO. 1

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.082	36.8	4.0	112	49.6	0.0	0.0	1.0	0.5	460	203.7
JAN. 31, 72	0.047	21.2	4.1	146	37.2	0.0	0.0	0.4	0.1	470	119.9
FEB. 28, 72	0.129	57.9	3.3	242	168.4	0.0	0.0	1.1	0.8	430	299.2
MAR. 29, 72	0.151	67.8	4.0	119	96.9	0.0	0.0	0.4	0.3	680	553.8
APR. 26, 72	0.231	103.7	3.8	120	149.5	0.0	0.0	0.6	0.8	720	897.1
MAY 19, 72	0.129	57.9	3.8	98	68.2	0.0	0.0	0.8	0.5	470	327.0
JUN. 28, 72	0.053	24.0	4.3	106	30.5	0.0	0.0	0.9	0.2	330	95.0
JUL. 29, 72	0.082	36.8	4.0	152	67.3	0.0	0.0	1.6	0.7	315	139.5
AUG. 25, 72	0.027	12.3	3.8	157	23.1	0.0	0.0	31.5	4.6	410	60.4
SEP. 26, 72	0.047	21.2	4.3	84	21.4	0.0	0.0	8.0	2.0	420	107.1
OCT. 30, 72	0.008	3.8	3.9	70	3.2	0.0	0.0	0.5	0.0	345	15.8
NOV. 30, 72	0.008	3.8	4.3	70	3.2	0.0	0.0	0.5	0.0	255	11.7
DEC. 22, 72	0.060	26.9	6.5	0	0.0	49.0	15.8	4.9	1.6	280	90.4
AVERAGE	0.081	36.5		113	55.2	3.8	1.2	4.0	1.0	430	224.7

ALL CONCENTRATIONS IN PPM

WEIR NO. 2

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.108	48.7	4.4	82	48.0	0.0	0.0	7.2	4.2	490	287.0
JAN. 31, 72	0.140	62.8	4.4	100	75.5	0.0	0.0	1.3	0.9	350	264.3
FEB. 28, 72	0.202	90.7	4.2	80	87.2	0.0	0.0	0.5	0.6	315	343.2
MAR. 29, 72	0.937	420.5	3.1	286	1445.4	0.0	0.0	1.7	8.9	660	3335.5
APR. 26, 72	1.008	452.4	3.4	244	1326.6	0.0	0.0	4.5	24.5	690	3751.3
MAY. 19, 72	0.202	90.6	3.0	215	234.3	0.0	0.0	20.6	22.4	700	762.6
JUN. 28, 72	+	+	3.8	151	+	0.0	0.0	10.3	+	470	+
JUL. 29, 72	0.189	84.8	3.8	240	244.6	0.0	0.0	21.3	21.7	800	815.5
AUG. 25, 72	0.129	57.9	3.4	208	144.7	0.0	0.0	16.3	11.3	430	299.2
SEP. 26, 72	0.109	48.7	4.5	108	63.3	0.0	0.0	0.5	0.3	430	251.9
OCT. 30, 72	0.118	53.2	4.3	80	51.1	0.0	0.0	5.9	3.8	360	230.1
NOV. 30, 72	0.151	67.8	4.3	80	65.2	0.0	0.0	7.5	6.1	330	268.7
DEC. 22, 72	0.099	44.6	4.1	180	36.4	0.0	0.0	9.3	5.0	260	139.3
AVERAGE	0.282	126.8		158	318.5	0.0	0.0	8.6	9.1	483	895.7

\+ WASH OUT

ALL CONCENTRATIONS IN PPM

WEIR NO. 3

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.189	84.8	7.0	7	7.1	51.0	51.9	0.9	0.9	310	315.9
JAN. 31, 72	0.189	84.8	6.7	34	34.7	64.0	65.2	2.0	2.1	340	346.6
FEB. 28, 72	0.216	96.9	6.1	38	44.3	47.0	54.7	0.6	0.7	235	273.8
MAR. 29, 72	1.238	555.6	7.6	7	46.7	65.0	434.0	0.4	2.4	270	1802.8
APR. 26, 72	0.411	184.5	6.9	30	66.5	66.0	146.3	0.2	0.5	880	1950.7
MAY. 19, 72	0.216	96.9	7.5	7	8.1	75.0	87.4	1.3	1.5	440	512.6
JUN. 28, 72	0.246	110.4	7.8	4	5.3	60.0	79.6	1.2	1.6	170	225.7
JUL. 29, 72	0.118	53.2	6.9	36	23.0	73.0	46.7	1.7	1.1	400	255.7
AUG. 25, 72	0.042	18.7	6.6	35	7.8	65.0	14.6	0.2	0.0	420	94.4
SEP. 26, 72	0.090	40.6	5.9	100	48.8	50.0	24.4	0.6	0.3	430	209.7
OCT. 30, 72	0.027	12.2	6.7	0	0.0	73.0	10.7	0.4	0.0	600	88.3
NOV. 30, 72	0.013	6.0	6.1	0	0.0	73.0	5.3	2.9	0.2	210	15.2
DEC. 22, 72	0.047	21.2	5.9	0	0.0	86.0	21.9	0.5	0.2	252	64.3
AVERAGE	0.234	105.1		23	22.5	65.2	80.2	1.0	0.9	381	473.5

ALL CONCENTRATIONS IN PPM

WEIR NO. 4

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.246	110.4	4.1	110	145.9	0.0	0.0	0.9	1.2	700	928.8
JAN. 31, 72	0.390	175.0	4.1	144	302.9	0.0	0.0	1.1	2.4	940	1977.2
FEB. 28, 72	0.937	420.5	3.4	127	641.8	0.0	0.0	1.4	7.5	480	2425.8
MAR. 29, 72	0.629	282.3	2.9	462	1567.3	0.0	0.0	21.3	72.3	970	3290.7
APR. 26, 72	1.279	574.0	3.3	398	2745.5	0.0	0.0	11.1	76.6	860	5932.5
MAY. 19, 72	0.478	214.5	2.7	379	977.1	0.0	0.0	30.6	78.9	1040	2681.2
JUN. 28, 72	1.408	631.9	3.7	262	1989.7	0.0	0.0	23.3	176.9	1130	8581.3
JUL. 29, 72	0.189	84.8	3.8	340	346.6	0.0	0.0	22.5	22.9	1330	1355.7
AUG. 25, 72	0.099	44.4	3.3	390	208.3	0.0	0.0	16.3	8.7	880	469.9
SEP. 26, 72	0.119	53.4	5.7	78	50.1	17.0	10.9	9.0	5.8	960	616.1
OCT. 30, 72	0.090	40.4	3.7	200	97.1	0.0	0.0	10.3	5.0	420	203.9
NOV. 30, 72	0.140	62.8	3.7	230	173.7	0.0	0.0	14.0	4.5	360	116.5
DEC. 22, 72	0.129	57.9	3.7	110	76.5	0.0	0.0	18.8	13.1	320	222.7
AVERAGE	0.471	220.2		248	717.1	1.3	0.9	13.9	36.6	799	2215.6

ALL CONCENTRATIONS IN PPM

WEIR NO. 5

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.013	6.0	7.5	18	1.3	120.0	8.7	1.9	0.1	470	33.9
JAN. 31, 72	0.011	4.8	7.5	12	0.7	157.0	9.1	0.7	0.0	370	21.5
FEB. 28, 72	0.129	57.9	6.7	40	27.8	92.0	64.0	0.3	0.2	270	187.9
MAR. 29, 72	0.129	57.9	4.3	150	104.4	0.0	0.0	2.8	1.9	860	598.3
APR. 26, 72	0.163	73.1	4.3	168	147.7	0.0	0.0	0.6	0.5	740	650.6
MAY. 19, 72	0.041	18.7	5.0	64	14.4	2.0	0.4	4.8	1.1	900	202.4
JUN. 28, 72	0.036	16.4	5.0	88	17.3	5.0	9.8	1.2	0.2	780	153.5
JUL. 29, 72	0.011	4.8	5.6	87	5.1	13.0	0.7	7.4	0.4	1000	58.2
AUG. 25, 72	0.008	3.8	7.2	24	1.1	152.0	6.9	2.4	0.1	470	21.5
SEP. 26, 72	0.008	3.8	6.8	69	3.2	201.0	9.2	2.3	0.1	490	22.4
OCT. 30, 72	0.008	3.8	7.0	0	0.0	145.0	6.6	27.8	1.3	490	22.4
NOV. 30, 72	0.008	3.8	6.0	0	0.0	108.0	4.9	2.5	0.1	306	14.0
DEC. 22, 72	0.006	2.7	5.6	0	0.0	40.0	1.3	0.5	0.2	336	10.9
AVERAGE	0.043	19.8		55	24.9	79.6	9.4	4.2	0.5	576	153.7

ALL CONCENTRATIONS IN PPM

WEIR NO. 6

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.201	90.2	7.0	7	7.4	59.0	64.0	1.4	1.6	300	325.2
JAN. 31, 72	0.201	90.2	7.2	9	9.7	103.0	111.7	1.5	1.6	520	563.7
FEB. 28, 72	0.253	113.5	5.7	29	39.6	23.0	31.4	0.2	0.3	260	354.8
MAR. 29, 72	0.215	96.5	4.0	248	287.6	0.0	0.0	1.7	1.9	1130	1310.4
APR. 26, 72	0.215	96.5	4.2	218	252.8	0.0	0.0	23.0	26.7	840	974.1
MAY. 19, 72	0.215	96.5	4.0	230	266.7	0.0	0.0	17.0	19.7	1660	1924.9
JUN. 28, 72	0.215	96.5	5.0	85	98.6	7.0	8.1	8.3	9.6	810	939.3
JUL. 29, 72	0.129	57.9	4.7	138	96.0	80.0	55.7	7.9	5.5	1010	702.8
AUG. 25, 72	0.086	38.6	4.7	61	28.3	1.0	0.4	6.6	3.1	560	259.7
SEP. 26, 72	0.086	38.6	4.0	366	169.7	0.0	0.0	5.8	2.7	1180	547.3
OCT. 30, 72	0.078	35.0	3.1	410	172.5	0.0	0.0	39.5	16.6	970	408.1
NOV. 30, 72	0.194	87.1	5.8	14	14.6	46.0	48.1	2.9	3.1	336	351.6
DEC. 22, 72	0.215	96.5	5.3	19	22.0	20.0	23.2	4.5	5.2	394	456.9
AVERAGE	0.177	79.5	-	141	112.7	24.5	26.4	9.3	7.5	767	701.4

ALL CONCENTRATIONS IN PPM

WEIR NO. 7

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	1.082	485.6	5.2	25	145.9	2.0	11.7	4.2	24.3	740	4318.5
JAN. 31, 72	4.727	2121.6	5.1	37	943.3	3.0	76.5	3.3	83.1	680	17337.0
FEB. 28, 72	4.373	1962.7	4.5	55	1297.2	0.0	0.0	0.4	9.7	315	7429.7
MAR. 29, 72	3.793	1702.4	3.3	312	6382.8	0.0	0.0	3.3	67.5	740	15138.7
APR. 26, 72	4.373	1962.7	3.6	282	7201.1	0.0	0.0	3.9	91.6	780	19928.3
MAY. 19, 72	1.364	612.2	3.2	260	1912.8	0.0	0.0	8.3	61.1	1260	9269.5
JUN. 28, 72	4.727	2121.6	4.1	203	5175.4	0.0	0.0	13.1	334.0	1330	33908.1
JUL. 29, 72	0.262	117.6	4.3	208	293.9	0.0	0.0	12.0	17.0	1280	1808.7
AUG. 25, 72	0.163	73.2	4.4	139	122.2	0.0	0.0	8.5	7.5	580	509.9
SEP. 26, 72	1.238	555.7	5.0	88	587.6	17.0	113.5	2.3	15.1	850	5675.6
OCT. 30, 72	0.140	62.8	4.8	79	59.6	1.0	0.8	4.9	3.7	490	370.0
NOV. 30, 72	0.231	103.7	4.6	20	24.9	2.0	2.5	8.3	10.3	410	510.8
DEC. 22, 72	0.189	84.9	4.4	75	76.4	0.0	0.0	7.8	8.0	500	509.7
AVERAGE	2.051	920.5		137	1863.3	1.9	15.8	6.2	56.4	766	8978.0

ALL CONCENTRATIONS IN PPM

WEIR NO. 8

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.118	53.2	3.7	286	182.8	0.0	0.0	25.8	16.5	1360	869.2
JAN. 31, 72	0.109	48.7	3.5	286	167.5	0.0	0.0	4.1	2.4	820	480.3
FEB. 28, 72	0.714	320.5	3.3	133	512.2	0.0	0.0	1.0	3.8	260	1001.3
MAR. 29, 72	0.008	3.8	3.2	360	16.5	0.0	0.0	6.7	0.3	900	41.2
APR. 26, 72	0.870	390.5	3.3	396	1858.2	0.0	0.0	10.3	48.3	1040	4880.1
MAY. 19, 72	0.189	84.8	2.9	313	319.1	0.0	0.0	7.2	7.3	1200	1223.2
JUN. 28, 72	0.109	48.7	3.8	300	175.7	0.0	0.0	15.8	9.3	1010	591.6
JUL. 29, 72	0.231	103.7	4.2	286	356.3	0.0	0.0	15.3	19.1	1200	1495.1
AUG. 25, 72	0.140	62.8	3.5	247	186.5	0.0	0.0	6.9	5.2	530	400.2
SEP. 26, 72	0.042	18.7	4.2	264	59.4	0.0	0.0	1.2	0.3	680	152.9
OCT. 30, 72	0.053	24.0	3.6	60	17.3	0.0	0.0	3.0	0.9	520	149.8
NOV. 30, 72	0.053	24.0	3.4	330	95.0	0.0	0.0	5.9	1.7	400	115.2
DEC. 22, 72	0.047	21.2	3.6	190	48.5	0.0	0.0	8.0	2.0	390	99.5
AVERAGE	0.206	92.7		265	307.3	0.0	0.0	8.6	9.0	793	884.6

ALL CONCENTRATIONS IN PPM

WEIR NO. 9

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.099	44.6	7.6	4	2.1	94.0	50.3	0.2	0.1	176	94.3
JAN. 31, 72	0.129	57.9	7.6	5	3.5	97.0	67.5	0.5	0.4	172	119.7
FEB. 28, 72	0.189	84.8	7.0	22	22.4	74.0	75.4	0.3	0.3	136	138.6
MAR. 29, 72	0.246	110.4	8.5	0	0.0	83.0	13.2	0.2	0.3	210	278.6
APR. 26, 72	0.550	246.9	7.3	14	41.5	91.0	269.9	0.3	0.9	194	575.5
MAY. 19, 72	0.109	48.7	7.5	8	4.7	112.0	65.6	2.3	1.3	166	97.3
JUN. 28, 72	0.411	184.5	8.0	3	6.6	108.0	239.4	0.7	1.7	162	359.1
JUL. 29, 72	0.118	53.2	4.7	192	122.7	34.0	21.7	7.2	4.6	1130	722.2
AUG. 25, 72	0.067	30.0	7.4	15	5.4	125.0	45.0	0.5	0.2	240	86.5
SEP. 26, 72	0.074	33.3	7.7	6	2.4	174.0	69.6	0.5	0.2	1260	504.3
OCT. 30, 72	0.067	30.0	2.8	450	162.4	0.0	0.0	63.0	22.7	1760	634.0
NOV. 30, 72	0.032	14.2	4.0	124	21.2	0.0	0.0	5.5	0.9	310	53.0
DEC. 22, 72	0.037	16.4	6.0	0	0.0	102.0	20.1	0.3	0.1	162	31.9
AVERAGE	0.164	74.4		65	30.4	84.2	72.1	6.7	2.6	468	284.2

ALL CONCENTRATIONS IN PPM

WEIR NO. 10

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.074	33.3	7.6	5	2.0	87.0	34.8	0.3	0.1	148	59.2
JAN. 31, 72	0.047	21.2	7.7	3	0.8	82.0	20.9	0.3	0.1	101	25.7
FEB. 28, 72	0.411	184.5	6.8	11	24.4	61.0	135.2	0.2	0.4	78	172.9
MAR. 29, 72	0.433	194.3	7.3	8	19.4	77.0	179.8	0.1	0.3	120	280.3
APR. 26, 72	0.262	117.6	6.7	18	25.4	67.0	94.7	0.3	0.4	96	135.6
MAY. 19, 72	0.047	21.2	7.2	16	4.1	136.0	34.7	8.9	2.3	104	26.5
JUN. 28, 72	0.036	16.4	7.5	3	0.6	79.0	15.5	0.8	0.2	98	19.3
JUL. 29, 72	0.202	90.7	6.6	78	85.0	13.0	14.2	44.0	47.9	135	147.1
AUG. 25, 72	0.047	21.2	7.2	21	5.4	142.0	36.2	19.8	5.0	350	89.3
SEP. 26, 72	0.032	14.2	7.0	8	1.4	103.0	17.6	0.3	0.0	194	33.2
OCT. 30, 72	0.074	33.3	6.8	0	0.0	25.0	10.0	0.2	0.0	205	82.0
NOV. 30, 72	*	*	6.4	40	*	84.0	*	6.9	*	187	*
DEC. 22, 72	0.042	18.7	6.2	0	0.0	6.6	1.5	0.2	0.0	112	25.2
AVERAGE	0.142	63.9		16	14.0	74.0	49.6	6.3	4.7	148	91.4

* WEIR DAMAGE

ALL CONCENTRATIONS IN PPM

WEIR NO. 11

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.082	36.8	6.9	19	8.4	77.0	34.1	1.7	0.8	216	95.6
JAN. 31, 72	0.262	117.6	7.1	10	14.1	80.0	113.1	0.3	0.5	216	305.2
FEB. 28, 72	0.870	390.5	6.5	24	112.6	61.0	286.2	2.5	11.7	184	863.4
MAR. 29, 72	0.576	258.5	6.4	32	99.4	32.0	99.4	0.1	0.4	255	792.2
APR. 26, 72	1.238	555.7	6.4	16	106.8	46.0	307.2	0.1	0.9	236	1575.8
MAY. 19, 72	0.189	84.8	6.5	22	22.4	47.0	47.9	1.2	1.2	325	331.3
JUN. 28, 72	0.231	103.7	7.3	13	16.2	56.0	69.8	0.5	0.6	226	281.6
JUL. 29, 72	0.163	73.2	6.7	50	44.0	62.0	54.5	16.7	14.7	180	158.2
AUG. 25, 72	0.042	18.7	6.7	32	7.2	102.0	22.9	0.1	0.0	316	71.1
SEP. 26, 72	0.140	62.8	6.6	29	21.9	106.0	80.0	0.8	0.6	230	238.6
OCT. 30, 72	0.109	48.7	6.6	0	0.0	193.0	113.0	0.2	0.1	250	146.4
NOV. 30, 72	*	*	6.6	0	*	71.0	*	0.3	*	176	*
DEC. 22, 72	*	*	6.3	0	*	51.0	*	0.3	*	170	*
AVERAGE	0.355	159.2		19	41.2	75.7	111.6	1.9	2.9	229	441.8

*WEIR DAMAGE

ALL CONCENTRATIONS IN PPM

WEIR NO. 12

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
DEC. 14, 71	0.082	36.8	3.5	162	71.7	0.0	0.0	5.9	2.6	680	301.1
JAN. 31, 72	0.036	16.4	3.3	182	35.8	0.0	0.0	4.7	0.9	370	72.8
FEB. 28, 72	0.053	24.0	2.6	221	63.6	0.0	0.0	41.0	11.8	450	129.6
MAR. 29, 72	0.433	194.3	2.9	450	1050.9	0.0	0.0	9.6	22.4	1280	2989.4
APR. 26, 72	0.411	184.5	3.2	328	727.1	0.0	0.0	19.8	43.9	880	1950.8
MAY. 19, 72	0.118	53.2	2.8	306	195.6	0.0	0.0	13.5	8.6	1100	703.1
JUN. 28, 72	*	*	3.6	191	*	0.0	0.0	11.3	*	520	*
JUL. 29, 72	0.109	48.7	3.9	330	193.3	0.0	0.0	23.3	13.6	800	468.6
AUG. 25, 72	0.118	53.2	3.4	243	155.3	0.0	0.0	19.5	12.5	400	255.7
SEP. 26, 72	0.047	21.2	3.8	126	32.1	0.0	0.0	8.0	2.0	410	104.6
OCT. 30, 72	0.032	14.2	3.3	174	29.8	0.0	0.0	6.3	1.1	700	119.7
NOV. 30, 72	0.053	24.0	3.2	250	72.0	0.0	0.0	11.1	3.2	330	95.0
DEC. 22, 72	0.053	24.0	3.5	210	60.5	0.0	0.0	16.3	4.7	350	100.8
AVERAGE	0.129	57.9		244	224.0	0.0	0.0	14.6	10.6	636	607.6

* WEIR DAMAGE

ALL CONCENTRATIONS IN PPM

SAMPLING STATION NO. 13

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	2.8	1172	0.0	113.0	1830
1/31/72	2.6	1078	0.0	344.0	2900
2/28/72	2.0	1078	0.0	32.0	3300
3/29/72	2.6	930	0.0	131.0	1650
4/26/72	2.9	934	0.0	111.0	2060
5/19/72	2.5	3062	0.0	12.6	2400
6/28/72	3.2	1014	0.0	191.5	2400
7/29/72	3.8	1014	0.0	138.0	2400
8/25/72	2.9	1010	0.0	177.0	1080
9/26/72	3.1	1230	0.0	195.0	1260
10/30/72	2.5	1800	0.0	18.0	3250
11/30/72	2.8	1220	0.0	173.0	1260
12/22/72	5.2	24	17.0	17.2	395
AVERAGE:		1197	1.3	127.2	2014

SAMPLING STATION NO. 14

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	3.5	252	0.0	13.0	700
1/31/72	3.0	568	0.0	167.0	1080
2/28/72	3.4	313	0.0	27.3	830
3/29/72	2.7	922	0.0	170.0	3200
4/26/72	2.9	788	0.0	63.0	2000
5/19/72	2.6	1070	0.0	80.0	2460
6/28/72	4.8	312	2.0	129.0	1940
7/29/72	4.3	220	0.0	11.3	1050
8/25/72	4.9	90	3.0	30.0	450
9/26/72	4.9	78	10.0	20.0	450
10/30/72	5.6	18	27.0	15.3	350
11/30/72	4.3	110	0.0	22.5	630
12/22/72	5.6	22	20.0	11.8	440
AVERAGE:		366	4.8	58.5	1198

SAMPLING STATION NO. 20

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	3.0	748	0.0	113.0	2950
1/31/72	3.0	594	0.0	65.0	1800
2/28/72	2.2	816	0.0	122.0	2550
3/29/72	2.8	774	0.0	99.0	3100
4/26/72	3.8	628	0.0	26.5	1660
5/19/72	2.7	664	0.0	40.0	1560
6/28/72	3.3	730	0.0	74.4	2200
7/29/72	3.9	1340	0.0	72.0	1080
8/25/72	3.1	693	0.0	59.0	820
9/26/72	3.2	760	0.0	57.0	860
10/30/72	2.8	570	0.0	65.0	1230
11/30/72	3.0	1000	0.0	78.0	970
12/22/72	3.1	900	0.0	55.6	830
AVERAGE:		786	0.0	71.3	1662

SAMPLING STATION NO. 25

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	5.5	26	5.0	8.3	195
1/31/72	3.3	342	0.0	10.3	1130
2/28/72	3.7	95	0.0	1.1	460
3/29/72	2.8	566	0.0	55.0	3000
4/26/72	3.1	566	0.0	30.8	1580
5/19/72	3.1	286	0.0	41.8	1660
6/28/72	4.2	180	0.0	9.9	1000
7/29/72	4.2	242	0.0	11.3	830
8/25/72	4.5	155	0.0	7.5	740
9/26/72	4.1	84	0.0	12.0	1010
10/30/72	4.3	78	0.0	5.2	730
11/30/72	4.2	100	0.0	8.0	410
12/22/72	3.6	250	0.0	24.0	600
AVERAGE:		228	0.4	17.3	1027

SAMPLING STATION NO. 30

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	3.0	552	0.0	67.0	1600
1/31/72	3.0	416	0.0	118.0	1180
2/28/72	2.1	460	0.0	106.0	1100
3/29/72	2.7	716	0.0	69.0	3150
4/26/72	2.8	660	0.0	75.0	1560
5/19/72	3.0	280	0.0	51.6	2000
6/28/72	3.2	504	0.0	56.6	1200
7/29/72	3.8	522	0.0	72.0	930
8/25/72	6.5	162	280.0	41.8	1090
9/26/72	5.9	238	208.0	4.7	1680
10/30/72	6.5	0	257.0	8.0	1180
11/30/72	5.8	0	158.0	2.1	1480
12/22/72	3.8	160	0.0	17.7	750
AVERAGE:		359	69.5	53.0	1454

SAMPLING STATION NO. 31

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	4.8	64	4.0	6.0	1280
1/31/72	5.5	101	0.0	4.5	1280
2/28/72	5.4	173	94.0	3.6	880
3/29/72	3.0	508	0.0	10.6	2600
4/26/72	3.3	338	0.0	12.3	1660
5/19/72	2.6	620	0.0	90.0	2060
6/28/72	3.6	286	0.0	93.0	2100
7/29/72	3.8	252	0.0	17.0	880
8/25/72	4.4	141	0.0	31.5	820
9/26/72	5.1	135	0.0	6.7	830
10/30/72	4.5	108	0.0	6.1	850
11/30/72	4.0	220	0.0	118.0	880
12/22/72	6.3	0	213.0	11.1	1150
AVERAGE:		227	23.9	31.6	1328

SAMPLING STATION NO. 34

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	3.0	460	0.0	41.8	880
1/31/72	3.0	392	0.0	69.0	680
2/28/72	2.7	182	0.0	1.3	290
3/29/72	3.0	478	0.0	9.6	540
4/26/72	3.2	396	0.0	28.8	1260
5/19/72	3.4	386	0.0	19.2	1000
6/28/72	3.7	341	0.0	37.2	1080
7/29/72	3.7	382	0.0	31.5	660
8/25/72	3.2	438	0.0	53.0	530
9/26/72	3.4	480	0.0	247.0	810
10/30/72	3.0	190	0.0	39.5	970
11/30/72	3.4	310	0.0	29.5	580
12/22/72	3.3	350	0.0	24.0	590
AVERAGE:		368	0.0	48.6	759

SAMPLING STATION NO. 35

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	3.0	560	0.0	103.0	1280
1/31/72	2.8	476	0.0	120.0	1200
2/28/72	2.1	622	0.0	88.0	1180
3/29/72	2.6	912	0.0	176.0	5900
4/26/72	2.9	902	0.0	88.0	1870
5/19/72	2.5	716	0.0	54.6	1580
6/28/72	3.5	690	0.0	86.0	1280
7/29/72	3.7	658	0.0	93.0	1230
8/25/72	3.1	808	0.0	115.0	820
9/26/72	3.2	860	0.0	99.0	880
10/30/72	2.7	550	0.0	99.0	1360
11/30/72	3.0	600	0.0	50.0	790
12/22/72	3.0	900	0.0	55.0	730
AVERAGE:		712	0.0	94.4	1546

SAMPLING STATION NO. 36

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	4.1	129	0.0	11.3	640
1/31/72	4.2	167	0.0	1.1	720
2/28/72	3.6	149	0.0	0.6	300
3/29/72	2.8	454	0.0	90.0	2750
4/26/72	3.3	536	0.0	40.8	1280
5/19/72	2.7	490	0.0	89.4	1600
6/28/72	3.5	396	0.0	40.8	1150
7/29/72	3.1	508	0.0	65.6	1280
8/25/72	3.3	340	0.0	103.0	780
9/26/72	3.6	164	0.0	20.8	780
10/30/72	3.5	106	0.0	24.0	830
11/30/72	3.8	200	0.0	24.0	530
12/22/72	3.4	170	0.0	24.0	500
AVERAGE:		293	0.0	41.2	1011

SAMPLING STATION NO. 37

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	3.6	228	0.0	5.0	320
1/31/72	---	---	---	---	---
2/28/72	2.4	402	0.0	2.1	660
3/29/72	2.8	776	0.0	55.0	2800
4/26/72	3.2	776	0.0	18.6	2100
5/19/72	2.8	758	0.0	9.3	2000
6/28/72	3.3	656	0.0	40.8	1660
7/29/72	3.5	676	0.0	440.0	7900
8/25/72	---	---	---	---	---
9/26/72	3.4	640	0.0	33.8	1630
10/30/72	3.3	164	0.0	63.2	970
11/30/72	3.4	740	0.0	168.0	660
12/22/72	3.3	800	0.0	63.2	1000
AVERAGE:		601	0.0	81.7	1973

SAMPLING STATION NO. 38

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	3.0	402	0.0	41.8	860
1/31/72	3.0	504	0.0	27.0	780
2/28/72	2.2	512	0.0	24.6	800
3/29/72	3.0	438	0.0	230.0	850
4/26/72	3.4	380	0.0	19.2	1260
5/19/72	2.8	420	0.0	27.8	1280
6/28/72	3.3	432	0.0	32.8	1080
7/29/72	4.1	444	0.0	39.5	720
8/25/72	3.2	489	0.0	39.5	690
9/26/72	3.8	586	0.0	315.0	970
10/30/72	2.8	180	0.0	67.0	1080
11/30/72	3.1	470	0.0	27.8	590
12/22/72	3.3	400	0.0	28.8	390
AVERAGE:		435	0.0	70.8	873

SAMPLING STATION NO. 40

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	3.1	1074	0.0	316.0	2200
1/31/72	3.0	900	0.0	430.0	2100
2/28/72	2.2	1116	0.0	172.0	2700
3/29/72	2.7	956	0.0	246.0	5500
4/26/72	3.2	1006	0.0	126.0	1860
5/19/72	3.1	184	0.0	5.6	780
6/28/72	3.2	1134	0.0	197.5	2300
7/29/72	3.6	928	0.0	8.0	1360
8/25/72	3.0	976	0.0	153.0	1090
9/26/72	3.1	1220	0.0	125.0	900
10/30/72	2.8	940	0.0	247.0	1260
11/30/72	4.1	50	0.0	50.0	425
12/22/72	3.2	420	0.0	40.8	400
AVERAGE:		639	0.0	162.8	1760

<u>SAMPLING STATION NO. 42</u>

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	6.4	24	31.0	0.7	430
1/31/72	3.8	338	0.0	149.0	930
2/28/72	3.5	91	0.0	0.6	390
3/29/72	2.8	532	0.0	212.0	1950
4/26/72	4.0	106	0.0	1.3	820
5/19/72	2.5	1168	0.0	123.0	3100
6/28/72	3.3	630	0.0	72.0	2000
7/29/72	3.7	1158	0.0	138.0	2000
8/25/72	3.0	1058	0.0	149.0	1260
9/26/72	3.2	1290	0.0	700.0	3800
10/30/72	2.6	690	0.0	163.0	1630
11/30/72	3.0	1290	0.0	188.0	1050
12/22/72	3.0	1500	0.0	213.0	1530
AVERAGE:		760	2.4	162.3	1607

SAMPLING STATION NO. 46

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SULFATES (PPM)
12/14/71	6.2	10	10.0	0.3	38
1/31/72	6.5	185	124.0	8.2	440
2/28/72	6.1	71	22.0	1.3	193
3/29/72	2.8	536	0.0	83.0	1950
4/26/72	7.1	28	111.0	0.4	690
5/19/72	6.3	34	34.0	2.9	250
6/28/72	7.5	15	134.0	4.6	850
7/29/72	7.0	27	155.0	59.0	490
8/25/72	5.8	63	36.0	0.7	440
9/26/72	6.1	175	325.0	188.0	1500
10/30/72	6.6	0	75.0	0.3	750
11/30/72	6.2	30	78.0	3.5	290
12/22/72	6.9	0	82.0	0.5	226
AVERAGE:		90	91.2	27.1	624

SAMPLING STATION NO. 68

DATE	pH	ACIDITY (PPM)	ALKALINITY (PPM)	TOTAL IRON (PPM)	SUEFATES (PPM)
12/14/71	3.2	234	0.0	17.0	780
1/31/72	3.2	321	0.0	6.1	840
2/28/72	3.7	202	0.0	0.8	260
3/29/72	3.5	250	0.0	1.8	680
4/26/72	6.6	41	120.0	4.7	720
5/19/72	3.0	182	0.0	4.4	1080
6/28/72	7.1	12	61.0	0.6	98
7/29/72	6.4	68	168.0	38.3	860
8/25/72	6.8	83	248.0	2.4	530
9/26/72	5.7	52	18.0	0.6	410
10/30/72	6.8	0	221.0	28.8	1330
11/30/72	6.1	0	148.0	2.8	730
12/22/72	6.0	0	87.0	6.8	354
AVERAGE:		111	82.4	8.9	667

SAMPLING STATION A

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
SEPT. 12, 75	0.151	67.8	5.1	16	13.0	6	4.9	3.4	2.7	462	373.9
OCT. 20, 75	0.295	132.5	6.3	40	63.4	16	25.4	6.0	9.5	210	333.0
NOV. 20, 75	0.233	104.6	4.5	60	75.4	18	22.6	4.8	6.0	575	722.6
DEC. 08, 75	0.359	161.3	5.7	32	61.4	28	53.7	4.1	7.9	425	815.7
AVERAGE	0.260	116.6		37	53.3	17	26.7	4.6	6.5	418	561.3

SAMPLING STATION B

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
SEPT. 12, 75	0.025	11.2	2.8	1030	137.5	0.0	0.0	97.5	13.0	966	129.0
OCT. 20, 75	0.030	13.6	3.3	896	142.1	0.0	0.0	80.0	12.7	1100	174.4
NOV. 20, 75	0.018	8.2	2.9	840	68.0	0.0	0.0	80.0	6.5	4500	364.0
DEC. 08, 75	0.015	6.5	2.9	816	66.1	0.0	0.0	75.0	6.1	1575	127.5
AVERAGE	0.022	9.9		895.5	103.1	0.0	0.0	83.1	9.6	2035.3	198.7

SAMPLING STATION C

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
SEPT. 12, 75	0.043	19.3	2.7	1170	273.3	0.0	0.0	123.8	28.9	1218	284.6
OCT. 20, 75	0.061	27.3	2.9	824	268.2	0.0	0.0	81.0	26.4	1050	341.7
NOV. 20, 75	0.025	11.1	2.7	872	116.4	0.0	0.0	92.0	12.3	4750	634.2
DEC. 08, 75	0.015	6.9	2.7	896	72.5	0.0	0.0	90.5	7.3	1550	125.5
AVERAGE	0.036	16.2		940.5	182.6	0.0	0.0	96.8	18.7	2142	346.5

SAMPLING STATION D

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
SEPT. 12, 75	0.103	46.2	2.9	570	318.7	0.0	0.0	49.8	27.8	714	399.2
OCT. 20, 75	0.147	65.8	3.2	404	323.6	0.0	0.0	41.0	32.8	800	640.9
NOV. 20, 75	0.229	102.7	2.9	544	671.9	0.0	0.0	62.0	76.6	1175	1451.2
DEC. 08, 75	0.113	50.5	2.9	488	297.3	0.0	0.0	66.2	40.3	925	563.5
AVERAGE	0.148	66.3		501.5	402.9	0.0	0.0	54.8	44.4	903.5	763.7

SAMPLING STATION E

DATE	FLOW (c.f.s.)	FLOW (g.p.m.)	pH	ACIDITY (conc.)	ACIDITY (lbs/day)	ALKALINITY (conc.)	ALKALINITY (lbs/day)	TOTAL IRON (conc.)	TOTAL IRON (lbs/day)	SULFATES (conc.)	SULFATES (lbs/day)
SEPT. 12,75	0.436	195.7	4.3	108	254.2	4	9.4	4.0	9.4	756	1779.1
OCT. 20,75	0.851	381.9	4.4	104	477.3	4	18.4	5.7	26.2	650	2983.3
NOV. 20,75	0.556	249.6	3.7	124	371.5	0	0	5.3	15.9	975	2921.0
DEC. 08,75	0.642	288.0	4.6	80	277.1	8	27.7	5.9	20.4	600	2077.9
AVERAGE	0.621	278.8		104	345.0	4.0	13.9	5.2	18.0	745	2440.3