A GEOGRAPHIC STUDY OF THE DELAWARE AND RARITAN CANAL AND THE ADJOINING LANDS

By

Sonia S. Kiriluk

AN ABSTRACT

Submitted to the College of Science and Arts
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AN ABSTRACT

The Delaware and Raritan Canal of Central New Jersey was built in the first half of the 19th Century, during an era when water transportation was the most economical means. But, unlike other canals of this period, the Delaware and Raritan was plagued by public skepticism, sectional rivalry and lack of co-operation. After three unsuccessful attempts, which began in 1804, the Canal was finally completed in 1834.

The Canal united the tidewaters of the Delaware and Raritan Rivers, and facilitated the flow of trade between Philadelphia and New York City. However, throughout its operation the Canal served primarily as a freight route; coal from Pennsylvania fields was the principal commodity carried. The Canal exerted its strongest influence on the terminal cities of Trenton and New Brunswick. Particularly in Trenton it was a great stimulus to industrial growth. Other than providing an outlet for produce from the hinterland, the Canal had little influence on the agricultural lands through which it passed. The Canal's peak operational years were reached during the Civil War. By 1870 tonnage on the Canal began to decline rapidly, due primarily to increased use of railways. In 1871 the

Canal was leased to the Pennsylvania Railroad, whose sole purpose was to obtain a right of way. By the turn of the century, the Delaware and Raritan Canal was operating at a loss, and in 1933 it was closed to navigation. In 1934 the waterway was turned over to the State of New Jersey.

Until 1944 the Canal lay unused. An ever increasing need for fresh water caused the State to regard the Canal as a source of water supply for agriculture and industry. At present 21 concerns utilize canal water; the largest consumers are industrial establishments, followed by irrigation, public water systems, and research projects. In addition to the water source function, the Canal is also utilized for recreational purposes.

The Delaware and Raritan Canal traverses four regions which were delimited for the purpose of this study. The Delaware and Millstone Valley Regions are predominantly agricultural, the Raritan Valley and Trenton Regions are primarily urban and industrial. Although each region is undergoing change in land use patterns, the most rapid rate of change is occurring in the Raritan Valley and Trenton Regions. In these two regions industry and urbanization are taking over idle and agricultural land. In the agricultural areas, the change is toward larger farm holdings, and an increase in rural residences.

Industry and urbanization will continue to increase in all regions except in the Delaware Valley Region, here the transition will be mainly toward "gentleman" farming, and rural dwellings. The Delaware and Raritan Canal possessing a new function, that of water supply, will be an important factor in the expansion and development of the territory through which it passes.

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Sonia S. Kiriluk

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INTRODUCTION

At the beginning of the 19th century, a canal building fever spread through the Eastern United States. Undoubtedly, a great incentive for the building of canals was the need for transportation lines between the expanding frontier to the west, and the east coast. The natural resources and agricultural products of the west, which were already produced in surplus quantities, required an economical means of transportation to the markets on the coast. The inhabitants of European descent were accustomed to the widespread use of waterways, and the importance they played in the economy of many countries on that continent. Passable roads were few, and railroads were little more than ideas. Canals such as the Delaware and Raritan appeared to be the answer to the transportation problem.

The Delaware and Raritan provided a direct route between two large population concentrations, that of the New York City metropolitan area, and the Philadelphia metropolitan area. The canal was built for the purpose of tapping the flow of trade between these cities. It not only facilitated the growth of the two urban centers, but also contributed to the economic development of the territory through which it passes. The Canal traverses the narrowest

part of Central New Jersey, linking the tidewaters of the Delaware with those of the Raritan.

Physiographically most of the area served by the canal lies within the Piedmont Region, here characterized by a rolling and rather rugged topography.[1] Stream valleys, draining to the Delaware River and the Atlantic Ocean, were utilized in the construction of the canal. The steeper slopes, ridges, swampy areas and most stream banks are covered, generally with deciduous vegetation. The native forest was removed from the more level land two centuries ago for agriculture. The reddish brown soils, derived from red shale parent material, are fairly productive when fertilizers and proper farming methods are employed. The area through which the canal passes has been throughout its history predominantly an agricultural region.

The Delaware and Raritan Canal was constructed in 1834, after a series of unsuccessful attempts that began in 1804. The reasons for the delays cannot be attributed to any one factor, but the lack of organization and public support were contributing problems. The construction of the canal was due primarily to the efforts of a small group of New Jersey business men from New Brunswick and Princeton, rather than a popular state wide movement, or governmental desire for such a waterway.

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[1]Nevin M. Fenneman, Physiography of Eastern United States, (New York: McGraw-Hill Book Co., 1938).

Commerce on the canal was slow in starting, and did not show a favorable increase for more than ten years. Throughout its existence the Delaware and Raritan Canal served primarily as a freight line. Coal from the Eastern Pennsylvania fields was the principal commodity carried. The operational peak was reached during the Civil War, when supplies and heavy materials were shipped south to the front lines. After 1866 the traffic declined steadily and by the turn of the century, the canal was operating at a loss. In 1933 the canal was not re-opened for navigation, marking the end of a colorful era. Competition from parallel rail lines plagued the canal throughout its existence, and finally forced its abandonment. During the century of its operation the canal served as a focus for industrial location, particularly influencing the development of the city of Trenton.

Along the banks of the Delaware and Raritan Canal the reminders of past activity are slowly disappearing. The towpaths are now either completely obliterated or overgrown with trees and underbrush. The movable bridges have been replaced by permanent structures, the wooden locks are now concrete flood control gates. The call of the bargeman, the crack of the mule driver's whip, and the lock-tender's greetings as the barges passed by, are now but echoes from the pages of history.

In the past the presence of the canal has given rise

to certain uses of land, and changes in economy. Today it passes through two regions that are rapidly undergoing major land use changes. The Trenton and Raritan Valley areas are heavily industrialized and centers of expanding population. Between these areas, in the Delaware and Millstone Valleys, agriculture is still important, and land use changes slowly.

The purpose of this study is to present a geographic description and interpretation of the Delaware and Raritan Canal, and the regions traversed by it. Sections of this study include the physical setting of the canal and its history. Emphasis will be placed upon the relation between the canal, and the past and present land use of the area. The canal's role in the future of the region is perhaps speculative, but nevertheless, a necessary portion of this study.

The data for this study was compiled through library and field research in the area under consideration. Field work was carried on during the summer of 1958, and rechecked in December of the same year. Information was also obtained by study of pertinent aerial photographs and field checking of them, and through interviews. Additional information and material was received from agencies concerned with special problems in the region. Photographs were taken along the canal to illustrate the text.

CHAPTER I

DEVELOPMENT OF THE DELAWARE AND RARITAN CANAL

> "On April 18, 1676 William Penn, Gawen Lowrie, Edward Bylinge, Nicholas and Edward Warner gave authority to James Wase, Richard Hartshorne and Richard Guy or any two of them, to secure information of one Augustine Heermans, an able surveyor, 'to go up the Delaware River as far as Newcastle or farther, as far as vessels of 100 tons could go, as we intend to have a way cut across country to Sandy Hook'"[1]

The idea of a canal to unite the waters of the Delaware and Raritan Rivers, was conceived approximately a century and a half before it actually became a reality. The first attempt to improve waterways between the Delaware and Raritan Rivers was in 1796. During that year the Assunpink Creek Navigation Company was incorporated for the purpose of improving the stream, thus enabling farmers in the vicinity of Trenton to transport their produce to market with greater convenience. Some historians classify the Assunpink Creek Navigation Company as an ancestor of the Delaware and Raritan Canal.

As the region prospered, the necessity for internal

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[1]William H. Benedict, New Brunswick in History, (New Brunswick: published by the author, 1925), p. 212. This is the earliest known reference to a canal route in Central New Jersey.

improvements became increasingly apparent. At the turn of the 19th Century a group of New Jersey businessmen and prominent citizens, realizing the potentialities of the region, proceeded with plans to build a canal to unite the tidewaters of the Delaware and Raritan Rivers. These men recognized that the construction of a canal through central New Jersey would tap the trade which flowed between the growing commercial centers of New York City and Philadelphia. At that time produce and cargo had to be hauled by sea around New Jersey. A canal would cut the time and distance more than half.

In 1804 the New Jersey Navigation Company was chartered to construct such a canal. No surveys of the proposed route had preceeded the incorporation, therefore, estimates of the cost were impossible. A very general survey of the proposed route under the direction of the company resulted in the recommendation of two plans, (1) to make use of riverbeds, and (2) to construct the canal along the banks of the Millstone and Raritan Rivers. The general survey was the extent of the accomplishments of the first company. It was the intention of this company to complete the canal by 1816.[2] Generally the provisions of the charter were quite broad, for nowhere did it mention a feeder canal or any other means of water supply. It appears

[2]Henry Meyer Balthasar, History of Transportation in the U.S. Before 1860, (Carnegie Institute of Washington, 1948), p. 227.

that the planners considered the streams along the way as being adequate in supplying the necessary amount of water. This showed on the part of the people concerned, the lack of experience in such matters, both in executive and planning departments. No action was taken on the canal again until after the War of 1812.

The canal company of 1804 was the first of three unsuccessful attempts, and it was finally the fourth company that constructed the canal. It appears that the primary reason for the failures involved sectional feelings between northern, central and southern New Jersey. It was argued that only the central portion of New Jersey would benefit from the canal. Therefore, why should the other sections contribute money to something which would be of no use to them? During the 1820's, as trade increased and the success of other canals became apparent, public opinion began to favor the construction of a canal.

In 1808, Secretary of the Treasury Albert Gallatin, after considerable study sent to Congress a report proposing the construction of four canals by the Federal Government, one of which was the Delaware and Raritan. Unfortunately, the House blocked all legislation promoting such a plan, and New Jersey's hopes for Federal aid in the canal project were stifled.[3]

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[3]Crawford C. Madeira Jr., The Delaware and Raritan Canal, (East Orange, N.J.: The Easterwood Press, 1941), pp. 9-11.

The War of 1812 made the United States realize the necessity for better and more efficient transportation lines. Internal improvements began with zeal in 1816, but they were undertakings of the individual states.

The New Jersey legislature passed an act in 1816, appointing commissioners to ascertain "the most eligible route for and the probable expense of a canal to connect the tidewaters of the Delaware with those of the Raritan".[4] No action was taken, and several years passed before the canal was again considered.

The New Jersey Delaware and Raritan Canal Company was incorporated in 1820. This company also failed to raise the necessary capital. However, by 1822, the people of New Jersey had sufficient evidence that a canal would be profitable. The Erie Canal and the Pennsylvania canals were all operating very successfully. Another factor which helped to change the unfavorable public opinion was that the expanding city of New York required an increasing amount of coal. Most of the city's supply came from Pennsylvania fields, but had to be shipped from Philadelphia by ocean vessel around New Jersey.

Legislative discussions on the canal were begun in 1823, but a company charter was not granted until 1824. This company also ran into difficulties and was finally dissolved. However, during the period of its existence

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[4] Ibid., p.11.

the route of the canal was chosen. The alternatives were the direct overland route, and the route along the Millstone River. The Millstone or northern route was much longer than the direct, but the elevation of land to be overcome was about twenty-five feet less. Also, along the Millstone River were located nine or ten of the best grist mills in the state, two cotton factories, and a paper mill. Advocates of the Millstone route bestirred themselves to convince the company commissioners of its superiority. New Brunswickers were particularly anxious that the Millstone route be adopted, for then their city would be the logical terminus of the canal. After surveys were made of both routes, the Millstone was chosen as the more feasible of the two.[5] Undoubtedly this route was chosen because fewer locks would have to be built, and there was established economic activity, which would benefit from the canal. The company had difficulty with the Commonwealth of Pennsylvania in receiving agreement to use the Delaware water to supply the canal. However, in 1828, the Pennsylvania Legislature passed a bill permitting the Delaware and Raritan Canal Company to use the waters of the Delaware River.

In 1829 a bill impowering the state to build the canal

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[5]Robert T. Thompson, Colonel James Neilson, (New Brunswick, New Jersey: Rutgers University Press, 1940), p. 172.

was defeated in the legislature on the basis of a public referendum. But on February 4, 1830 the legislature granted a charter to incorporate the fourth and final company, which did complete the canal. Unfortunately at the same time the legislature granted a charter to the Camden and Amboy Railroad and Transportation Company to build a railroad paralleling the canal's route.

The provisions of the canal charter stated that the capital stock was to be $1,000,000 with the privilege of increasing the amount by $500,000. It also required that the width of the canal be not less than fifty feet and the depth five feet. An act passed in 1831 increased the minimum width to seventy-five feet, and the depth to seven feet. The company was impowered to supply the canal with water from the Delaware River by constructing a feeder in the form of a navigable canal, not less than thirty feet wide and three feet deep. The charter provided for a set payment to the state for each passenger and ton of merchandise.[6]

Shortly after the charters for the canal and railroad companies were granted, disputes between the two arose. On February 3, 1831 the New Jersey legislature passed a supplement to the charter of the Delaware and Raritan Canal Company which afforded some protection

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6History of Trenton 1679-1929, (Published in 2 vol. under auspices of the Trenton Historical Society, Princeton: Princeton University Press, 1929), pp. 281-282.

against railroad competition on the canal right of way. No railroad was to be built nearer than five miles to the canal before 1838. If after this date the legislature did approve the construction of a railroad within the five mile limit, then the canal company was to have the option of building and operating it. While the act failed to grant the company positive power to build such a railroad, it did prohibit the laying of rails by any other corporation within the limits.[7]

With permission from the legislature, the two disputing companies agreed on a compromise to consolidate their stock. Although the Delaware and Raritan Canal, and Camden and Amboy Railroad companies retained their separate organizations, after 1831 they were commonly referred to as the Joint Companies.[8]

The construction of the canal was begun in 1832. The work was done almost entirely by immigrant Irish laborers, and was marked by epidemics of cholera, which took many lives.

In 1834 the Delaware River dam, the feeder canal and the section of the main canal between Trenton and New Brunswick, were completed. The section between Trenton and Bordentown, where the canal joins the river was not completed until 1838.[9]

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[7] Thompson, op. cit., pp. 191-192.
[8] Ibid, p. 192.
[9] History of Trenton 1679-1929, op. cit., p. 282.

The Feeder Canal from Trenton to Bull's Island on the Delaware River measured twenty-two miles in length. The Main Canal is about eighty feet wide at the surface, fifty feet at the bottom and nine feet deep. The Main Canal had fourteen locks, seven of which were between Trenton and Bordentown, each lock had a fall of approximately eight feet. The cost of the canal was $2,850,000, most of which was furnished by Princeton stockholders.

In 1854 an outlet lock from the Feeder was built at Lambertville, thus allowing an exchange of traffic with the Delaware Division Canal, on the Pennsylvania side, which had a similar outlet lock south of New Hope. This proved a much shorter route than going down the river to Bordentown and Bristol.[10]

The Delaware and Raritan Canal was used primarily for shipping freight. Passengers utilized the railroad which was speedier and more convenient. For a short period of time the canal did provide passenger service, and those who patronized it took the canal principally for the scenic ride.

Coal proved to be the greatest single source of revenue for the canal and shipments so increased that it overshadowed all other traffic. Anthracite constituted over half the total tonnage carried by the canal. Strategically located between the anthracite fields of eastern

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[10]Ibid, p. 283.

Pennsylvania and the markets of New York and New England, the canal bore a steady stream of barges. The market along the canal, especially Trenton, was also important. The industry in this city was expanding rapidly, and consumed large quantities of coal. Eventually the eastbound tonnage became ten times as great as the westbound.[11]

A great quantity of coal carried by the Delaware and Raritan Canal was mined in the Schuylkill field of Pennsylvania, which lies between Mauch Chunk on the Lehigh River, and Dauphin on the Susquehanna River. The coal from this region was shipped out on the Schuylkill or "Navigation Canal". Both the canal and the Philadelphia and Reading Railroad supplied business for the Delaware and Raritan Canal.

The heyday of the canal occurred between 1850 and 1875. The maximum traffic on the canal was reached during the Civil War. Two factors contributed to the rapid increase in canal shipments. First, the industrialization of the United States that was splitting the North from the South proceeded at an ever increasing pace at this time, requiring more transportation facilities between New York and Philadelphia. Secondly, the Joint Companies, having established themselves, were now due to receive the full

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[11] Wheaton J. Lane, From Indian Trail to Iron Horse, (Princeton, New Jersey: Princeton University Press, 1939), p. 263.

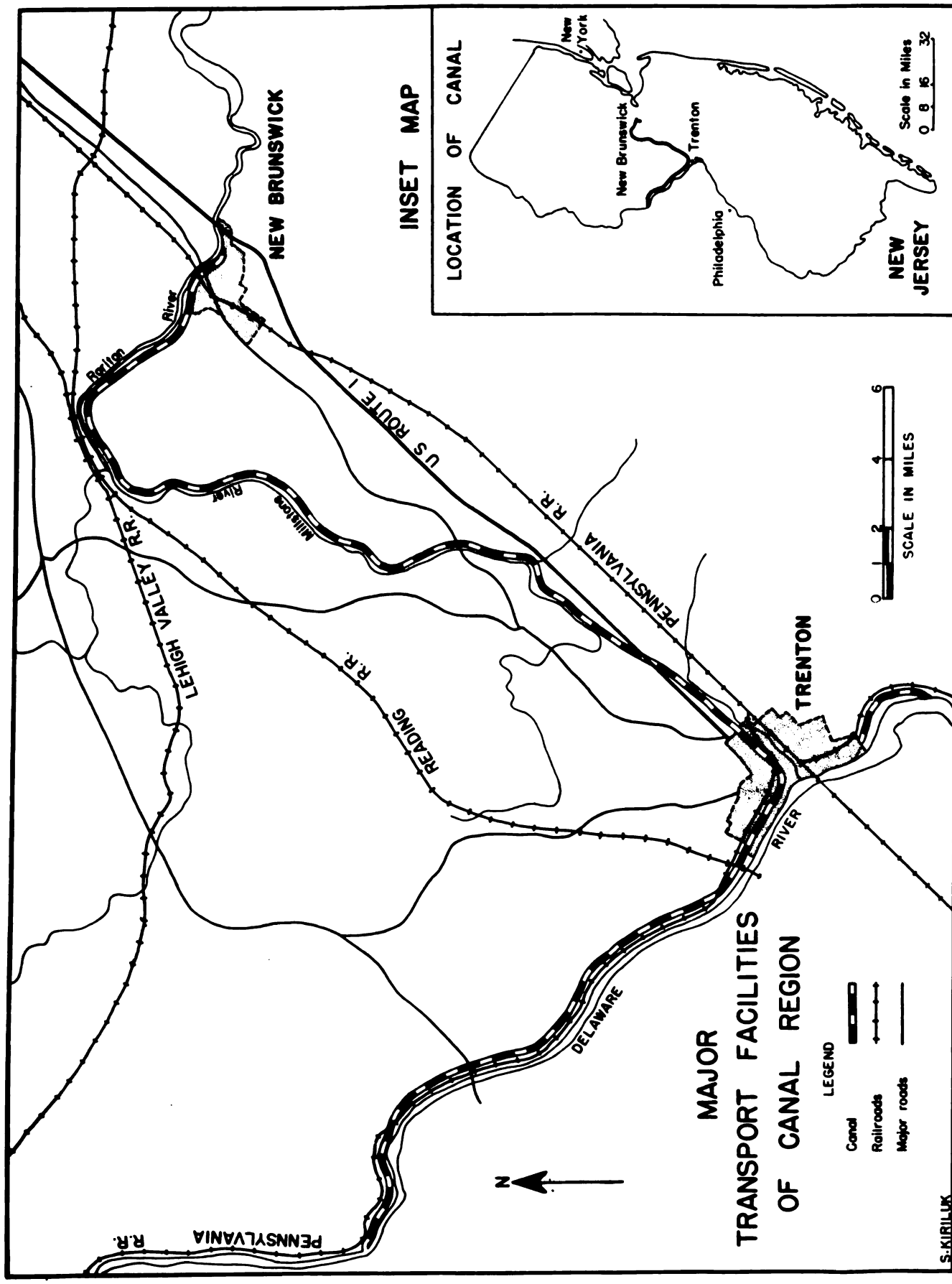

Figure 1. Major Transport Facilities of the Canal Region.

confidence of all Northern, Southern and Eastern merchants.[12]

The Joint Companies combined in 1867 with another railroad to form the United New Jersey Railroad and Canal Company. Shortly thereafter, in 1871 the property and the entire company was leased with legislative sanction to the Pennsylvania Railroad Company for 999 years.

The Pennsylvania Railroad was primarily interested in establishing rail connection with New York City, and terminals on the waterfront. Inevitably the canal was regarded as of secondary importance, and the future of the waterway came to depend upon the larger aspects of railroad policy.[13] Therefore traffic and income on the canal steadily declined, and by 1900 it was operating at a loss. In 1913 traffic was abandoned on the Feeder Canal and in 1933 the Main Canal was not opened for navigation. The Pennsylvania Railroad made a formal offer to relinquish its rights in the canal and transferred them to the State of New Jersey in 1934. In 1936 the Trenton portion of the Main Canal was deeded to the city and was filled in as a WPA project, which provided work during the depression.

The canal lay unused until 1944, when the New Jersey Department of Conservation and Economic Development launched a program to redevelop the canal, and make it a

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[12] Crawford C. Madeira Jr., The Delaware and Raritan Canal, (East Orange, New Jersey: The Easterwood Press, 1941), p. 49.

[13] Lane, op. cit., pp. 276-277.

source of water supply. With supplies of fresh water becoming an ever increasing concern in New Jersey, the canal is again regaining its importance. At present twenty-one establishments draw water from the canal. These consumers pay a sliding scale rate to the state government for this privilege. The canal currently delivers seventy-five million gallons per day. The consumers consist largely of industries, although the water is also utilized for irrigation, public water systems and research projects.

The canal played a prominent role in the development of Trenton. Although the city did not become a transhipment point, the industrial development that began in 1834 proved of greater value. Trenton, located on a major commercial route, and possessing cheap water power for factories, was attractive to industry. Coal, lumber and iron ore could be shipped to the city by waterways. After the completion of the Delaware and Raritan Canal, the Roebling Company was established, and began its world famous production of steel wire cables. Peter Cooper and Abram Hewitt from New York, formed the Trenton Iron Works, which at the time possessed the country's largest rolling mills. After the 1850's production of ceramics and china became increasingly important. Industrial development in Trenton would have grown without the canal, but the waterway stimulated an early start by providing cheap transport.[14]

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[14] Ibid, pp. 274-275.

New Brunswick, before the canal, was a shipping point for agricultural produce from the interior of the state. With the completion of the canal, the city lost this function, for the products were loaded on barges along the canal route, and went directly to the New York market. New Brunswick did not benefit to any great extent from the trade that passed her wharves, however, the transportation facilities offered by the canal and the railroad soon attracted industry. America's first wall-paper factory was located here, and was operated by water from the canal. The city also became an early center for the manufacture of rubber goods.[15]

The canal did not stimulate local agriculture to any great extent. The farmers could ship produce to communities at low rates, and in return could buy more manufactured articles. Because the canal was short, the number of farmers directly benefiting from the canal was limited.

During its existence the Delaware and Raritan Canal was an important commercial route. Although one of the shortest American canals, there were some years in which it surpassed in tonnage such a great waterway as the Erie.[16] As with many American canals, competition with the railroads proved overwhelming, and was the major cause of the decline of the Delaware and Raritan Canal.

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[15] Ibid, p. 274.
[16] Ibid, p. 276.

CHAPTER 2

PHYSICAL SETTING OF THE DELAWARE AND RARITAN CANAL

PHYSIOGRAPHY

As with the construction of any canal, the route of the Delaware and Raritan was largely determined by the nature of the terrain. For a better understanding of this canal and the region it serves, an examination of the physiography of Central New Jersey is necessary.

Geographers generally divide the state into two very broad physiographic provinces. The northern half, or the Appalachian Province, is generally underlain by solid rocks. In places the bedrock consists of old crystalline materials, such as those which make up the Northern Highlands. This province has been directly and indirectly influenced by glaciation. Twice, continental ice sheets have covered the northern portions, and there is evidence of a third glacial advance. The terminal moraine of the last glacier, the Wisconsin, traverses the state from Perth Amboy on the Atlantic Coast, to Belvidere on the Delaware River. The topography of the north is rolling and in parts rough. The southern portion of the state consists of the Coastal Plain. Geologically, this area is relatively recent, of Cretaceous and Quaternary times. The bedrock is composed

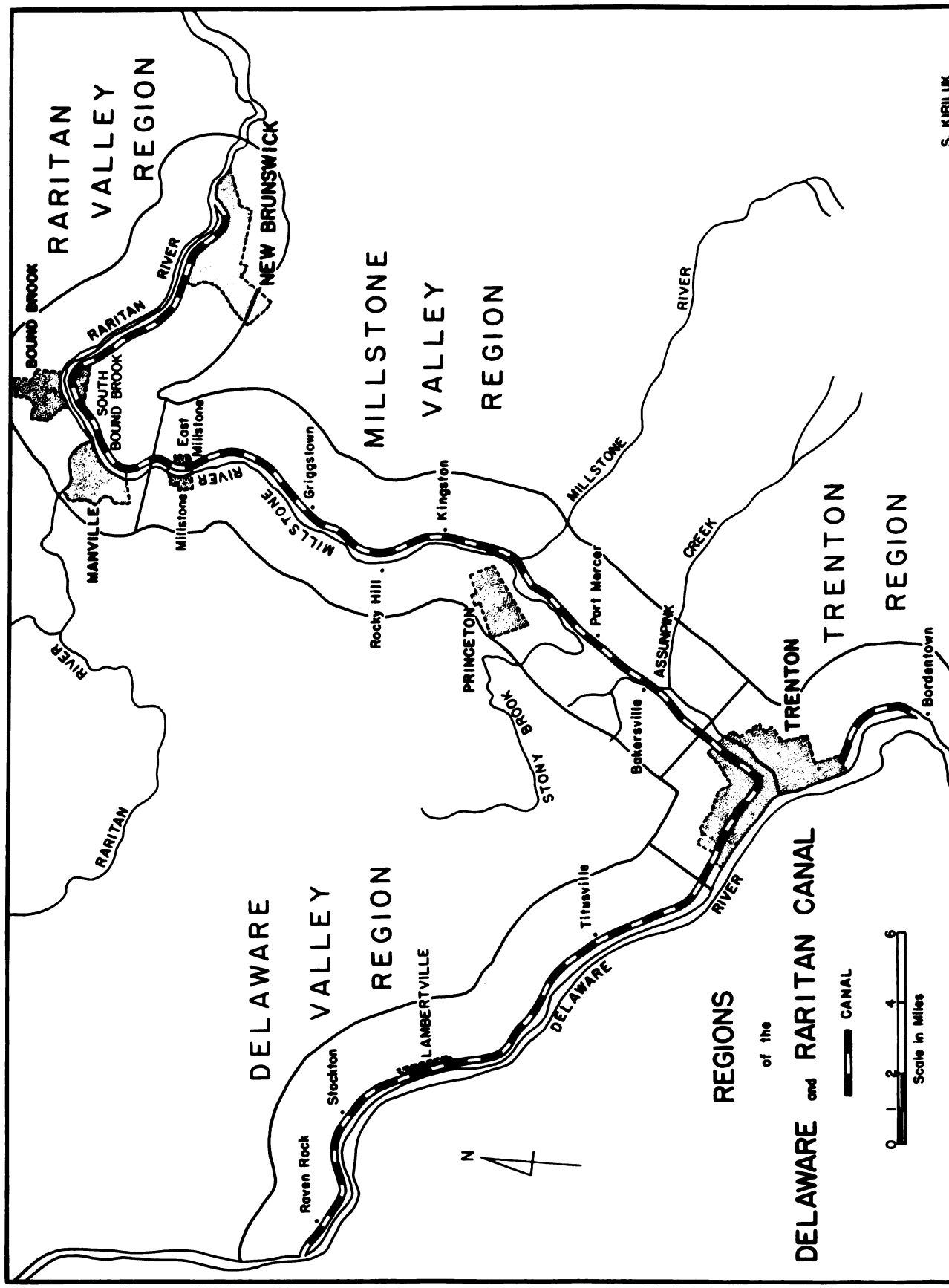

Figure 2. Regions of the Delaware and Raritan Canal.

of unconsolidated material, sediments deposited by streams, ocean and wind. The entire area slopes gently toward the sea, and the elevation range is small. Several cuestas break the monotony of the region. The highest points are approximately 100 feet above sea level in the northwestern sections of this province.

These two broad provinces are in turn subdivided to form more concise regions, and which are physiographically homogeneous. The Appalachian Province is divided into the following regions; the Appalachian Valley, Appalachian Highlands, and the Piedmont. The Coastal Plain Province consists of the Inner and the Outer Coastal Plains.

The Delaware and Raritan Canal Region lies primarily within the Piedmont of Central New Jersey. This is also the narrowest section, and sometimes referred to as the "waist" of the State. The canal region is almost triangular in shape, with the widest part, or the base of the triangle toward the west. Bounding the region on the west is the Delaware River, on the south, approximately the boundary between the Piedmont and the Coastal Plain. On the north it is bounded by a line beginning at New Brunswick, thence to Bound Brook along the Raritan River, and west across the state to the Delaware River.

The canal route begins at Raven Rock in the upper part of the Piedmont. Before it reaches Trenton the canal passes through a transition zone, which is considered the

boundary between the Piedmont and the Coastal Plain. Between Trenton and Port Mercer, the canal traverses the northern portions of the Coastal Plain. From Port Mercer to the terminal point in New Brunswick, the canal again is located in the Piedmont Region. The segment of the canal between Trenton and the southern terminal point at Bordentown, traverses a river terrace, undoubtedly formed by the Delaware River and the Assunpink Creek.

In general, the canal region presents a rolling or hilly surface, with trap rock ridges and the Hunterdon Plateau Escarpment being the most conspicuous features of the landscape. Where it joins the Coastal Plain toward the south, the region is less rolling, and becomes only slightly undulating. The average elevations for the region are 100-200 feet, however, the ridges and areas in the region's northwestern sections, reach 400 feet or more. The topography is the result of peneplanation, and some geologists refer to the area as a plain.

What is now the Piedmont, was during the Triassic time an intermontaine valley, with high mountains to the northwest and a lower range to the southeast. The streams coming down from the mountains brought huge quantities of sediment and deposited it on the valley floor.[1]

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[1] Geology of New Jersey, Lectures by Henry B. Kummel, Rutgers University, New Brunswick, New Jersey, notes taken and compiled by Anne Burgess.

The present igneous intrusions of Central New Jersey were formed during the latter part of the Triassic period. These intrusions were buried by sediments, still under deposition tectonic forces tilted the beds, producing block mountains. Sometime during the Jurassic Period the block mountains were eroded and leveled to a peneplain. Subsequent erosion of the uplifted peneplain removed the soft shales, leaving the hard trap belts to form the ridges which characterize the present topography.[2] The rivers and the tributaries of this region are well entrenched, in some areas with steep valley slopes. Most significant are the Delaware, Millstone and Raritan Rivers. The valleys of these rivers are also the route of the Delaware and Raritan Canal. This region contains some interesting land types, which will be discussed as they are found along the canal route, beginning with the Feeder Canal at Raven Rock.

The Feeder Canal begins in rugged terrain, just south of a gap made by the Delaware River through a trap rock ridge. In this area, the escarpment of the Hunterdon Plateau is bisected by the river, producing very steep valley slopes. The river has a fairly wide flood plain opposite the escarpment slopes, however, the width fluctuates from place to place along the route.

South of the escarpment is an area of coarse sandstone. The topography is rolling, but becomes quite steep

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[2] Ibid.

along the main streams. Along the Delaware River in this section there are terrace deposits. Another small trap rock ridge is found along the river, south of the town of Stockton.

The next land type section is the most extensive in the canal region, and is labeled as the Flemington-Pennington-New Brunswick section. This section is too complex to be divided into any distinct units, thus, it is considered as one area. It is underlain mainly by shales and sandy shales, with red colors being most common. The terrain is rolling, but stream tributaries in some areas are characterized by deep valleys. In general however, the main streams have wide flood plains. Terraces composed of silt, and or gravel are found in some places fifty to one hundred feet above the present stream level. Drainage in this section ranges from well drained to poorly drained.

South of Lambertville the canal traverses a section which consists of an extensive trap rock ridge. Encompassed by the ridge is an area classified as the Delaware Bluffs. Because of its elevation, this ridge forms a distinct feature in the landscape of the canal region.

From the ridge section to the northern parts of Trenton, the canal again traverses the red shale area. The topography is undulating with broad and gently rolling slopes, and southward becomes progressively flatter. However, the larger streams have deep V-shaped valleys. The

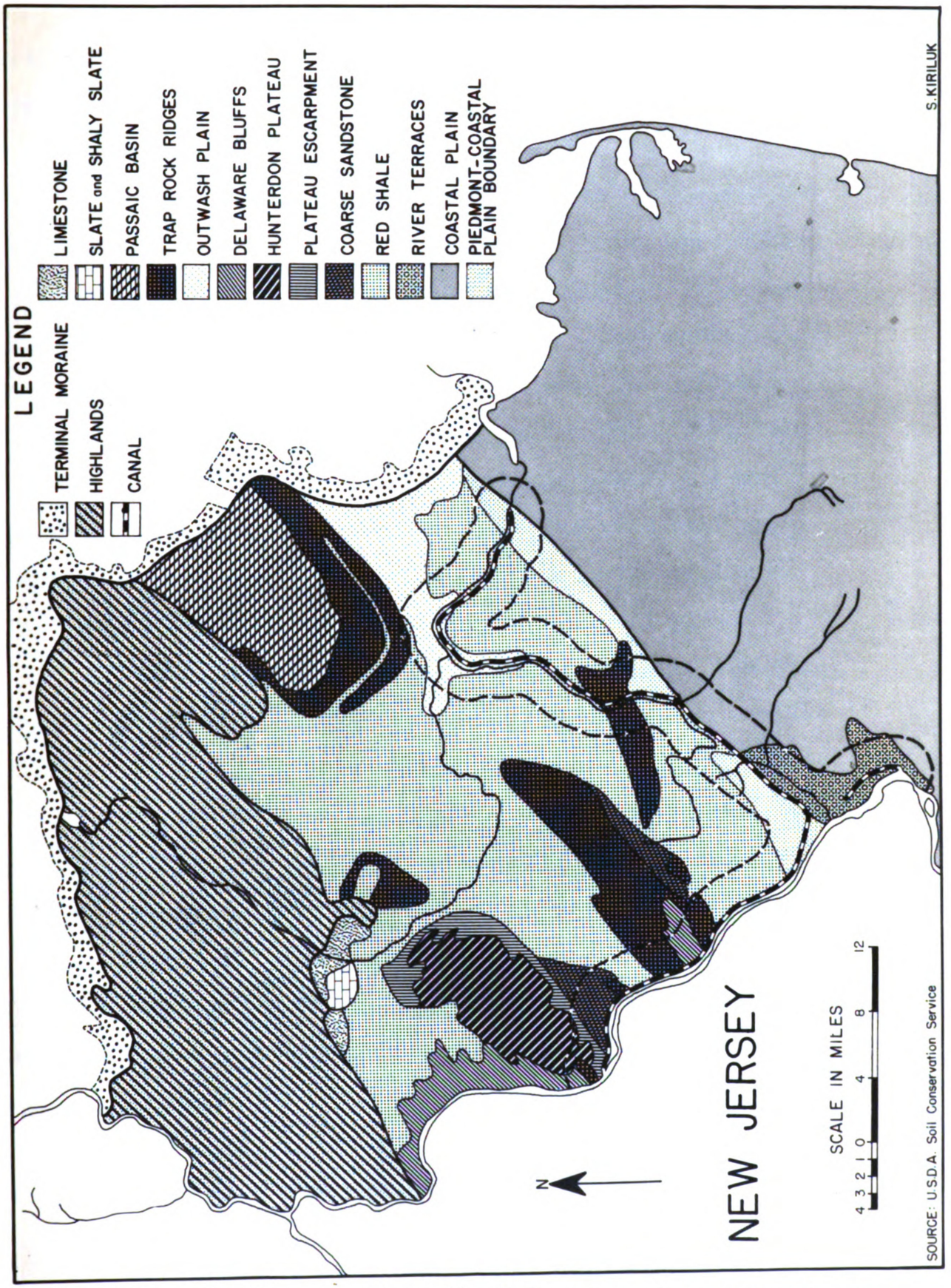

Figure 3. Land Types along the Delaware and Raritan Canal based upon underlying rocks and soil types.

soil materials vary from sands to clays. Drainage is generally good, however, there are extensive areas that are poorly drained.

The section of the main canal between Bordentown and Port Mercer, passes over river terraces, which were formed by the Delaware River and the Assunpink Creek. This area has generally low elevations, with only slight undulations in the forms of dune-like mounds. A great part of this area is swampy. Through this section the canal parallels the Assunpink Creek, here a sluggish and swampy stream. In Trenton though, the creek narrows, and runs over small rapids before joining the Delaware River. The rapids at Trenton coincide with the location of the Fall Line.

Northeast of Trenton, for a short distance, the canal passes through the gravel sections of the Northern Coastal Plain. The topography is gently undulating, and in places is covered with light brown sands. The drainage in this area is rather poor. Here the canal enters the Stony Brook Valley, which joins the Millstone Valley at Princeton. From Princeton the canal parallels the Millstone to its junction with the Raritan River at Manville. The Millstone River is a fairly large stream, and is characterized by a wide flood plain. In the upper sections it tends to be rather sluggish, for the headwaters of the Millstone lie in the Coastal Plain.

At Princeton the canal re-enters the red shale section,

and again the terrain becomes increasingly rolling. The Millstone River has cut a deep gap through the Rocky Hill trap rock ridge, forming a natural route for the canal. Beyond Rocky Hill the canal again traverses the red shale area to Millstone. From Millstone to South Bound Brook the canal traverses a narrow outwash plain. At Manville the Millstone River joins the Raritan, and from there the canal parallels the latter to the terminal point at New Brunswick. In general the topography is gently rolling and in some areas rather flat. The canal ends at the head of navigation on the Raritan River, at the base of steep cliffs, composed of red shale. The Raritan River is the largest within the boundaries of New Jersey. A dendritic stream, it drains most of the central part of the state, rising in the highlands of Northern New Jersey, and emptying into the Atlantic Ocean.

Mineral resources in this region are negligible. In the early eighteen hundreds some copper was mined near Flemington, Rocky Hill and Griggstown. Presently, only trap rock is quarried.

CLIMATE

New Jersey has a continental climate, as a result of the predominance of winds from the interior of North America. The Appalachian Mountains to the west prove to be an important influence, as they protect New Jersey from the many outbreaks of arctic air, that sweep southeast-

ward across the central United States and Canada during the winter. The coldest weather is experienced when the high pressure systems develop over eastern Canada, allowing a north-south flow of air into this area, unobstructed by the Appalachian Mountains. The predominant winds during the summer are from the west and southwest. These air masses originate over the Gulf of Mexico becoming increasingly warmer, as they move over land. They bring the hot humid summer weather so often associated with New Jersey.[3]

New Jersey lies south of the North American storm track, which runs from the prairies of southern Canada over the Great Lakes into the New England states and toward Newfoundland. Frequent precipitation and rapid changes in weather are usually experienced by areas lying in such storm paths, while regions further south have longer periods of settled weather. New Jersey is close enough to have considerable variation, particularly in the northern portions.[4]

Although the state is small in area, there is a climatic difference between the northern and southern parts. The ocean possesses a greater role in influencing the climate of the southern and coastal portions of New Jersey,

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[3]U.S. Department of Commerce, Weather Bureau, Local Climatological Data, Trenton, New Jersey, 1957.

[4]Department of Conservation and Economic Development, The Climate of New Jersey, Rutgers University, New Brunswick, New Jersey, 1958, p. 56.

while the northern half is well within the zone of continental influence.

The central part of the state, the region considered in this study,is generally characterized by a continental climate, however, the marine influence is not completely absent. The moderating influences of both the Appalachian Mountains, and the ocean are reflected in the average temperatures. For the canal region the average annual temperature is 51.8°F, while for January and July it is 30° and 75° respectively. During the winter the temperature occasionally falls below zero, and during the summer may reach 100° or more. The highest extreme for the state was recorded in the central region, 108°F. at Flemington. During July and August the temperature is generally in the 80's, and is usually accompanied by high humidity. Heat waves, subtropical in nature, occur throughout the summer bringing discomfort to man and beast.

The growing season averages 240 days in central New Jersey, and the number of days without killing frost is 178. The frostless period from April through October is favorable for agriculture.

Precipitation in the central region is moderate and well distributed throughout the year. The average annual rainfall is 45 inches with a slight summer maximum. Summer droughts are usually of short duration. During the warm period most of the precipitation is produced by showers and

thunderstorms, whereas in the cool season it is associated with more widespread storms.[5] Thunderstorm frequency is very high in this area, numbering from 30 to 35 per year. Precipitation from the "northeasters" often lasts for one or two days. The northeasters also account for most of the snowfall of this region. During autumn or late summer, storms of tropical origin may occur, which bring the heaviest and most extended rains.[6] These storms and heavy summer rains cause severe erosion on unprotected soils.

The use of the Delaware and Raritan Canal during its navigable days was limited to the ice free season. The canal was open from April first to the middle of December, or approximately 250 days. Seasonality does not affect the canal's present function of supplying water for industrial and potable purposes.

SOILS AND VEGETATION

The soils of this region are primarily composed of sands and disintegrated shales, derived from sandstone and red, or Brunswick shale bedrock. The silt and clay content of the soil varies from place to place. In general however, there are sufficient amounts of clay or silt to produce good moisture retention. It may also result in

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[5] U.S. Department of Commerce, Weather Bureau, Local Climatological Data, Trenton, New Jersey, 1957.

[6] Ibid.

less absorption, greater runoff and more erosion.[7]

Predominant sandiness occurs in the coarse sandstone sections of this region, although loamy soils are not uncommon. Harshness characterizes these sandy soils, and the preponderant red color is varied with the brown. The soils are fairly deep and well drained. However, because the sandstone bedrock is soft, many rock fragments are found in this soil. The river terrace at Washington's Crossing is composed of sands and gravels. From Princeton to the town of Millstone, the Millstone River flows over a bed formed of the same type of sands. The river from the town of Millstone, to its junction with the Raritan River flows over a glacial outwash plain, which also consists of sands and gravels.

The red shale section has silty soils, minor shaly ribs where rock strata protrude near to the surface, and shaly steeper slopes. On the shaly portions the soil is rather thin, in places may not even be a plow depth. The silty soils are generally deeper. Soils consisting of plastic clays occur in many swales or low spots, which impound pools of water during rainy periods. This proves harmful to crops planted in such areas.[8]

Near Princeton and other scattered locations, brown

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[7]N.J. Agricultural Experiment Station, Our New Jersey Land, New Brunswick, New Jersey, Rutgers University, Bulletin 775, Jan., 1955, p.8.

[8]Ibid, p. 30.

silty soils overlie the red shale, sandstone and argillite bedrock. The thickness of these soils varies from a few inches to six feet, and the drainage is generally good.

The soils of this region are fairly productive, if proper farming methods are employed. These soils require fertilizers to maintain productivity, and good conservation practices to check erosion. Common crops in this region consist of wheat, hay, corn, oats, barley and soybeans. Sorghums are becoming common as a silage crop.

The vegetation of this region primarily consists of deciduous hardwoods. Maple, linden, ash, walnut, hickory, butternut, white oak, ironwood, poplar and willow are examples of the variety found here. Evergreens grow well when planted, but the only one that grows naturally in this region is the cedar tree.

The original forest has long since disappeared, to make way for agriculture. The forest found here today is a poor second growth. The trees generally average about a foot and a half in diameter, some may reach two or more feet. The woods usually lack thick undergrowth. The ridges, steep slopes, and areas which were found unsuitable for agriculture are mantled by woods. However, man is again encroaching on the forest, as the need for space to construct homes and factories increases.

CHAPTER 3

LAND USE ADJOINING THE DELAWARE AND RARITAN CANAL

The narrow central portion of the State of New Jersey, from the earliest colonial times to the present, has been a focal point for transportation lines. Through this area pass major railroads, highways and the canal. They link not only the metropolitan areas of New York and Philadelphia, but New England and the South as well. Although the Delaware and Raritan Canal is no longer used for transport, the railroads and highways of this area are among the most heavily used in the eastern United States.

In this study the Delaware and Raritan Canal and the adjoining lands are divided into four regions; (see Fig. 2) the principal criteria for delimitation is that of the major use of land. Two regions are predominantly agricultural, the other two are primarily urban and industrial. The Delaware Valley Region includes most of the Feeder Canal and embraces an agricultural area. It is characterized by small towns, rural residences, poultry and dairy farming. The Trenton Industrial Complex is the second region, encompassing the city of Trenton and its surrounding suburban communities. The Millstone Valley Region is another predominantly agricultural area, although industrial and residential areas are

increasing rather rapidly. This is particularly true of the section between Princeton and the northeastern suburbs of Trenton, an area which is in a state of transition. The Raritan Valley Region comprises the second urban and industrial area. Even though agriculture is found in the southern portions of the region, in general it is greatly overshadowed by industry and urbanization. This region is the southern portion of the heavily populated northeastern part of New Jersey.

DELAWARE VALLEY REGION

The Feeder Canal begins at Bull's Island, north of the little hamlet of Raven Rock, and parallels the Delaware River to Trenton, where it joins the main canal. Its purpose was to supply the main canal with sufficient water to maintain a constant level. The Feeder begins at an elevation of 69.9 feet above sea level and drops to 56.3 feet at Trenton. Only two locks were required to make the descent.

The terrain along the route of the canal, except for the southern portions of this region, is quite rugged and most of the land is heavily wooded. This is especially true of the high ridges, steep slopes and areas that are generally unsuitable for agriculture.

To the north of Bull's Island stands a trap rock ridge, which has been bisected by the Delaware River forming a gap. Contiguous south of the ridge is the Hunterdon Plateau Escarpment descending abruptly to the narrow river

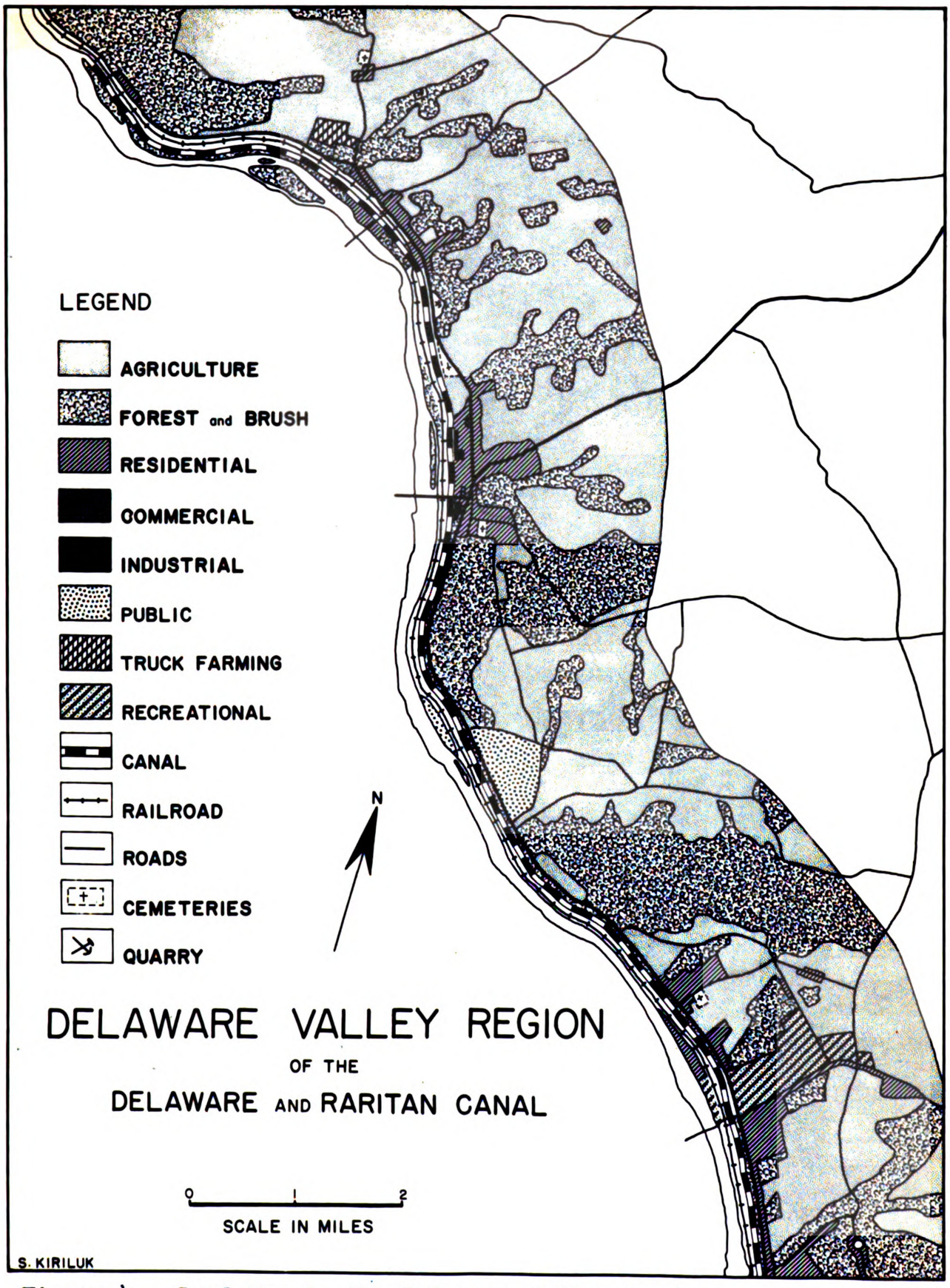

Figure 4. Land Use in the Delaware Valley Region of the Delaware and Raritan Canal.

lowlands. The same ruggedness continues on the Pennsylvania side, for the Delaware River at this point is well entrenched. In these surroundings lies the northwestern terminus of the Delaware and Raritan Canal. To the observer on the opposite side of the river, the canal inlet may appear as a mouth of a tributary stream, except that the flow is reversed. The banks are covered with thick vegetation, and save for the regular shoreline there is no other evidence that the channel is man made. The wing dam which was built to help divert water into the canal is located a few hundred feet downstream and is still in good condition (Fig. 6). Approximately a quarter mile south of the canal inlet, at the base of the escarpment cliffs, nestles the tiny hamlet of Raven Rock. The older portion of the settlement consists of homes that cling to the rugged backdrop of the escarpment. Of more recent construction are the homes on Bull's Island, which are also a part of this settlement. The unpaved road which passes through Raven Rock is currently being replaced by a paved highway. When this road is completed, it will form a part of the Delaware River Drive from Trenton to Frenchtown, a town nine miles north of Raven Rock. A footbridge built on piers spans the river uniting Raven Rock with the small town of Lumberville in Pennsylvania. At one time a wooden covered bridge was located here. When it was removed the community did not have sufficient funds to construct a motor bridge, and thus the

Figure 5. The inlet to the Feeder Canal, north of Raven Rock.

Figure 6. View of the Delaware River, looking north from the footbridge at Raven Rock. The Wing Dam is in the background.

footbridge was built. It is used primarily by tourists and patrons of the hotel and restaurant located by the bridge in Lumberville, to view the picturesque surroundings.

To the east of the river and the canal, the escarpment of the Hunterdon Plateau is disected and characterized by steep slopes. The escarpment and the plateau are not especially suited for cultivation because of the poor soil and imperfect drainage conditions. Although some small grains and hay are grown, much of the land on the plateau and escarpment is either idle or wooded. The main activity in this area is poultry raising, primarily for egg production. This is evidenced by long two story chicken houses which are a common sight.

South of Raven Rock the canal's banks are wooded and it's route parallels the river. Although the flood plain in this area is fairly wide, few parts are cultivated. Much land is idle or is used for rural dwellings.

At the southern tip of the flood plain approximately an eighth of a mile north of the Boro of Stockton, are the Worchester Orchards. They lie on the slopes overlooking the river and the canal. This is one of several commercial orchards in the region, growing apples and peaches for local markets. The region and the surrounding areas were at one time famous for their apples and apple cider, but fruit growing in the area is no longer important.

Stockton is a small community built on a flood plain

of the Delaware River about three and a half miles south of the mouth of the Feeder Canal. The town serves as a minor retailing center for the surrounding area. The flat plain is occupied by the canal, the railroad, commercial center and residential dwellings which parallel the roads. Other dwellings cling to the slopes which rise from the plain. The southern portion of this flood plain is characterized by garden plots, while at the northern end there is a lumber and feed mill. The stone from the Stockton Brown Stone Quarry was utilized in the construction of many Pennsylvania Railroad bridges in New Jersey and Eastern Pennsylvania. It was also used for fashionable brown stone fronts and ecclesiastical edifices of large eastern cities. During the canal era Stockton served as a transhipment point for agricultural products of this area. And in turn the canal was used to bring in supplies, such as fertilizers, lime, coal and manufactured goods. In this it did not differ from other small towns along the canal, which served an agricultural hinterland. As was the case in other small canal towns, Stockton was a center of dynamic activity during the peak of the canal era. Each settlement had at least one barge basin and a number of small industries, which usually included lumber mills, grist mills and woodcrafts of various types. Stockton had two wood working shops, a canning establishment and a spokeworks. However, the industries in the majority of these small towns had disappeared even be-

fore the closing of the canal. Today these towns are primarily quaint residential settlements with a commercial establishment or two.

South of Stockton the predominant relief feature is another trap rock ridge, which is being excavated by a quarrying company. The quarry utilizes water from the canal in the washing and sorting process.

South of the ridge, the canal enters a shaly area dominated by red colored rocks and soils. The rolling terrain is characterized by deep stream valleys, whose steeper slopes are wooded. Where the slopes are less steep the valleys are utilized as pastureland. Where cultivation is possible wheat, hay and corn are the primary crops; oats, barley and soybeans are of secondary importance. On these shaly soils dairying is much more important than poultry, although some farms engage in both of these activities. Along the canal are cultivated fields, and to the east of it well kept homesteads. Many of the colonial homesteads in this area, with their spacious structures were once parts of large estates or landholdings. In time land from these estates was sold to form smaller units. Today the farmsteads and associated land of these colonial estates are usually owned by gentlemen farmers and kept in excellent condition.

The city of Lambertville, about seven miles from the canal inlet, is located on a flat, rather narrow plain be-

tween the river and the rugged slopes to the east. Several streams descend from the higher elevations, crossing through the city and flowing into the Delaware River. This city was founded before the Revolutionary War, and was then known as Coryell's Ferry. It was the site of a ferry crossing for the Old York Road, which at the time was one of the main stagecoach lines between Philadelphia and New York, and presently is the route of a U.S. highway. The settlement remained quite small until the construction of the canal. Twelve years after the completion of the canal, Lambertville began to flourish as an industrial town. One of the earliest industries was the Lambertville Iron Works established in 1840 on the canal banks in the southern portion of the city. Many industries were established during the 1860's and the decades following. They included a pottery, two rubber mills, a brass and iron foundry, paper mills, a brewery, a silver plating plant, a linen factory and flour mills. All of these industries were situated adjacent to, or in close proximity to the canal, and utilized it for power, water and transportation. The town was also a transhipment point for agricultural products which were sent on the canal. As canal usage diminished and industry in Trenton expanded, Lambertville's industrial position declined. The present industries of the city include a lace works, a leather products company, a company producing ceramic parts for the textile industry, and a few branch distributing concerns.

Figure 7. The Delaware Valley. On the right is a trap rock ridge south of Lambertville.

Figure 8. The Delaware Valley south. The exposed cliffs of Baldpate Mountain are hidden in the vegetation on the far right bank.

The railroad which parallels the Feeder Canal was opened to Lambertville in 1851, and became a subsidiary of the Camden and Amboy Railroad. At present the city utilizes the canal as a source of water supply during drought periods.

A dam was constructed across the river between Lambertville and New Hope by the Commonwealth of Pennsylvania. The dam supplied the Delaware Division Canal and provided water power for a paper mill located on the Pennsylvania side. The Delaware Division Canal was constructed by the Commonwealth of Pennsylvania in 1827 from Easton south to Bristol, which is opposite Bordentown, New Jersey, and the outlet to the Delaware and Raritan Canal. The Division Canal was a principal transport route for Lehigh Valley coal. Outlet locks were built south of Lambertville and New Hope, on the respective canals. Many of the barges destined for New York left the Pennsylvania canal, and by means of a cable strung across the Delaware River, were towed into the Feeder Canal.

South of Lambertville lies the largest trap rock ridge in the canal region (Fig. 7). The ridge extends into Pennsylvania and is bisected by the Delaware River forming a gap, with accompanying rapids and steep slopes, It is a wooded area, underlain by igneous intrusions, and littered with boulders of diabase. Very little agriculture is carried on, but there are favorable sites for rural residences. A quarry operation located along the canal has excavated part

of the trap rock ridge. The wide flood plain at this point is owned by Mercer County and is intensively cultivated. Surrounded by this igneous intrusion is an area of sandstone and shale, which is characterized by more gentle relief. Agriculture is the dominant activity, except on the steeper slopes. South of the sandstone area is Baldpate Mountain, (Fig. 8) the southern edge of the ridge section. An unsuccessful attempt to excavate for trap rock, has left sheer rock cliffs exposed facing the canal and the river.

South of Baldpate Mountain the canal enters a rolling agricultural area as it approaches the settlement of Titusville. This town, three miles south of Lambertville,is a small town which does not differ from other small settlements along the canal route. It thrived during the canal era, but today is primarily a residential community. It has spread up the slopes to the east of the canal, encompassing a farm which stubbornly resists urban settlement. Immediately south of Titusville, along the route of the canal is Washington's Crossing State Park. George Washington's crossing of the Delaware River with his army on Christmas Eve, 1776 is commemorated by this park.

From the State Park to the suburbs of Trenton the land adjoining the canal and river is occupied by above average residences. Some homes are old mansions, some colonial homes, others are spacious modern dwellings. Most are situated on high bluffs commanding a scenic view

Figure 9. Concrete flood control gate at Raven Rock.

Figure 10. A substantial residence overlooking the canal and the Delaware River south of Washington's Crossing.

of the canal and river. Most of these homes are owned by persons employed in Trenton. To the east of the canal, beyond the residential strip, the land is utilized for agriculture, although rural residences are springing up along the roads. The gently rolling terrain along the canal, and the area's proximity to Trenton is conducive to residential development. Though the region has been primarily agricultural, there is a definite trend towards suburbanization.

TRENTON REGION

The city of Trenton lies on the east bank of the Delaware River at the junction of the Piedmont and Coastal Plain Physiographic Provinces. In addition to its function as a port city, it is served by major highway and rail routes of the Middle Atlantic coastal area. The position of the city, at the head of navigation on the Delaware River, has been a causal factor in the location of the routes which converge there. Within a seventy-five mile radius of Trenton lives a tenth of the United States population. In this circle are included New York City, sixty miles from Trenton, and Philadelphia, thirty miles from the city.

The city, like a giant octopus, spreads eastward from the river in a semi-circular fashion, with tentacles of urbanization along major roads. The city has a population of 128,000, not including the surrounding suburbs, which

are rapidly growing outward from the city. The nucleus and oldest part of the city located near the waterfront contains the state administrative buildings, hotels, and financial and commercial establishments. To the east of the central business district lies the main canal route and the Pennsylvania Railroad, together with the majority of Trenton's industries. A small industrial district lies along the river in the southern portion of the city nucleus. To the north of the center of the city lies the route of the Feeder Canal and its junction with the Main Canal. If observed from the air the canal system in the city would resemble a giant Y shaped pattern. The left branch of the Y is the Feeder Canal and the right branch and the stem, the Main Canal.

Trenton was founded in 1679 by an English Quaker, Mahlon Stacy, who acquired land and constructed a grist mill on the Assunpink Creek. Some years later Stacy's estate and mill were bought by William Trent, a Philadelphia merchant, who named the settlement Trent's Town. The natural navigable river channel to Trent's Town soon made it a convenient shipping point for its rich agricultural hinterland. The village also became a commercial center for the region, and a resting place for travelers on the King's Highway, between Philadelphia and New York.

The rapid industrial development of Trenton began with the completion of the Delaware and Raritan Canal in

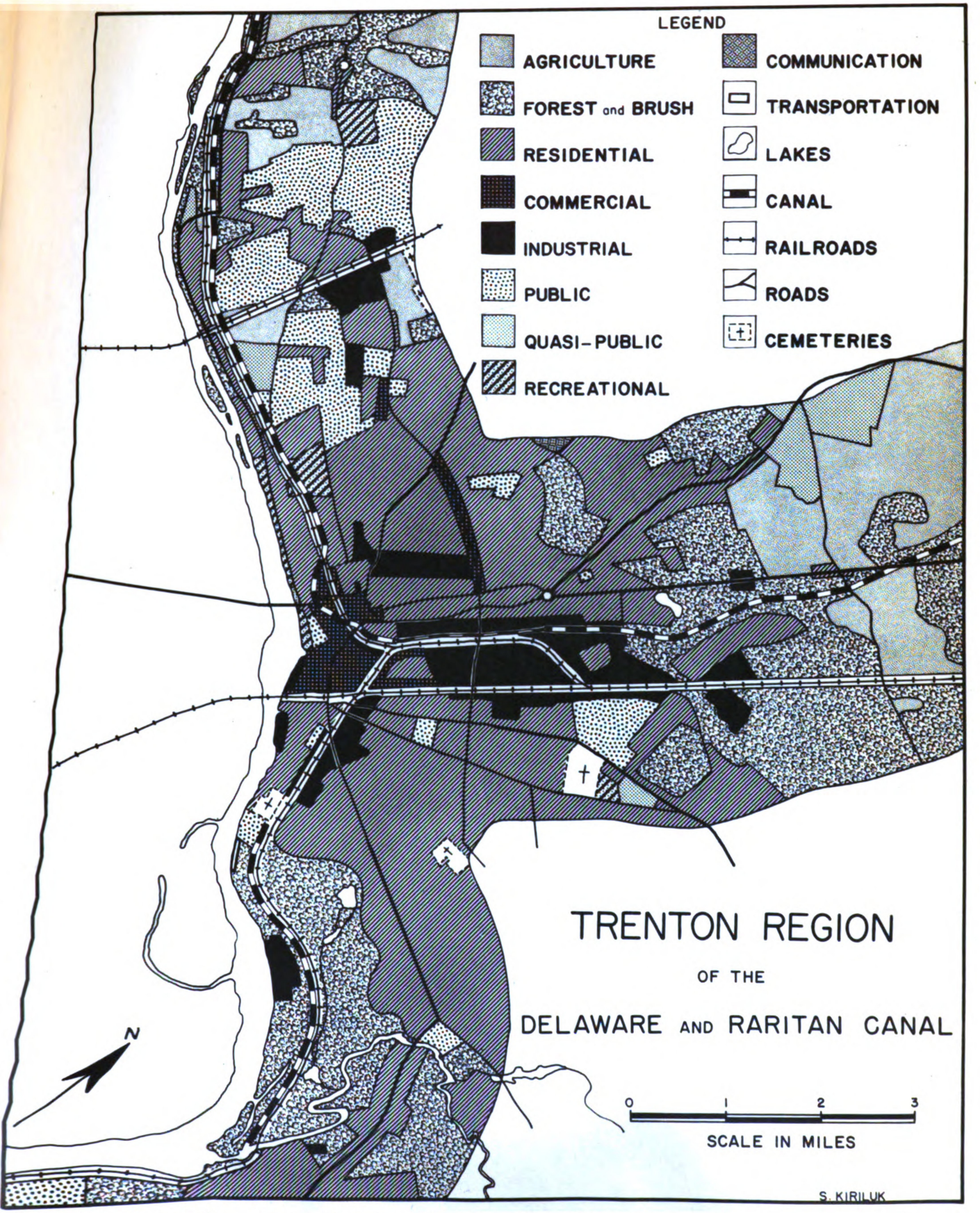

Figure 11. Land Use in the Trenton Region of the Delaware and Raritan Canal.

1834, and the Camden and Amboy Railroad at approximately the same time. Industry in the city lined both banks of the canal. The larger industries such as the Roebling Company, which came to Trenton in 1848, had private basins for canal barges. Early industry in Trenton included pottery making, and the manufacture of various rubber products.[1] Rubber products, metal working and pottery still remain the most important industries in the city today. According to the 1954 United States Manufacturing Census, Trenton had 334 industrial establishments. In the surrounding suburbs, are more than 150 industrial establishments.

The Feeder Canal route through Trenton

The Feeder Canal approaches the city of Trenton passing through the suburban areas of Ewing Township. The housing along the canal is composed of substantial dwellings. Where the canal swings away from the river the land between the waterways will be occupied by a new highway. Approximately an eighth of a mile south of the point where the canal leaves the river, the lands along the canal support some agriculture. Those along the river are occupied by the Villa Victoria, a private school for girls. South of the school residential areas resume. The area is flat and is occupied by homes that are generally above average. Land to the east of the canal is wooded, with scattered

[1]For a period after the Civil War, Trenton was considered the country's center of rubber manufacturing.

Figure 12. The Feeder Canal at the northern city limits of Trenton.

Figure 13. A textile mill adjoining the Feeder Canal at Artesian Street. In the past the mill was served by the Feeder Canal.

residences. South of the wooded area are state owned farmlands, and the route of the Reading Railroad. To the west of the canal, along the river, are a few commercial establishments and a tree nursery. As the canal enters the city of Trenton, a residential area lies to the west and the Trenton Country Club and golf course lie to the east, (Fig. 12). The Country Club draws water from the canal for use on the golf course. South of the country club, within the city limits of Trenton, the canal passes state owned land. The waterway then winds past the beautiful residential district of Hiltonia, which includes the homes of many of Trenton's professional and business people. To the west residential areas continue, with the beginning of high-rent apartments which parallel the canal for several city blocks. South of Hiltonia the canal passes by Cadwalder Park, and the recreational area of a junior high school. South of the park is a residential area with many duplex houses. Overall, the dwellings are in very good condition. The first industry along the canal within Trenton is located at Artesian Street. It is an old textile mill, (Fig. 13) which undoubtedly utilized the services of the canal in the past. The Feeder Canal continues through several blocks of an older residential section which gives way to a zone of commerce and light industry (see Figures 14 and 15), that extends to the junction with the Main Canal at the end of Holland Street. The commerce consists of warehouses, auto

Figure 14. The Feeder Canal passing through the Northwestern commercial district.

Figure 15. The Feeder Canal paralleling Holland Street and a light industrial area, near the junction with the Main Canal.

sales and service lots, and supply concerns. The industrial establishments in this section include machine shops, a beverage bottling establishment, a small porcelain plant and a block and supply concern. At the eastern end of Holland Street the Feeder Canal turns north and becomes the Main Canal.

Main Canal between Holland Street, Trenton and Bordentown.

Today the northern half of the Main Canal route within the city is occupied by a four lane highway, constructed eight years ago. Several city blocks south from Holland Street and the Feeder Canal, the former route of the Main Canal is bordered primarily by residential and commercial areas. Further south the route passes administrative and government buildings, including the post-office, city hall and the armory. From here the four lane highway swings west across the river and into Pennsylvania. The canal route south of this point is filled in, but presently unoccupied. In this area is a heavy industrial district. On the east for several blocks the canal route is paralleled by the buildings of the Roebling Corporation, and on the west by U. S. Steel. Away from the canal route beyond the industries, residential areas occupy the land. South of Roebling and U.S. Steel, the canal route passes the State Prison and coal yards. Further south industrial establishments resume, beginning with the Columbian Carbon Company, a large chemical plant. South of the chemical

Figure 16. Route of the Main Canal viewed from the Roebling plant to the north.

Figure 17. The Roebling plant facing the filled bed of the Main Canal which lies to the left of the railroad.

Figure 18. The Columbian Carbon Co. along the eastern side of the canal route, south of the Roebling Corp.

Figure 19. The filled bed of the Canal in Trenton's southern industrial district.

plant, along the canal route are, the Home Rubber Company, Lamberton Ceramics, Stokely Foods Incorporated, Trenton Potteries and Atlantic Mills, which is a shopping center. The food and pottery plants mark the southern city limits of Trenton. Except for several Roebling warehouses, the filled canal enters a wooded area. Approximately a quarter of a mile south of Trenton the waterway resumes and continues to its terminal at Bordentown. This section is abandoned, and except for the railroad which parallels it, the canal would be completely obscured by thick vegetation. The area between Trenton and Bordentown is quite flat and marshy. The outlet of the canal at Bordentown resembles the mouth of a tributary, and there is little evidence that the waterway is man made.

Main Canal north from Holland Street

From Holland Street, the junction with the Feeder Canal, north to the northern city limits the canal is flumed. The water is carried underground via a large duct, but north of the city it again flows on the surface. The canal route is taken over by the highway which carries transit traffic through the city from U.S. Route 1 into Pennsylvania. The route in this section is lined by industry, which is the industrial heart of Trenton, located between the Delaware and Raritan Canal and the Pennsylvania Railroad, three quarters of a mile to the east. The industrial area along the canal was very important during the canal era, as

Figure 20. Beginning of flumed section of the canal at Holland Street, Mercer County Highway Dept. fuel tanks in the background.

Figure 21. View northeast from eastern end of Holland Street, and beginning of Trenton's main industrial area.

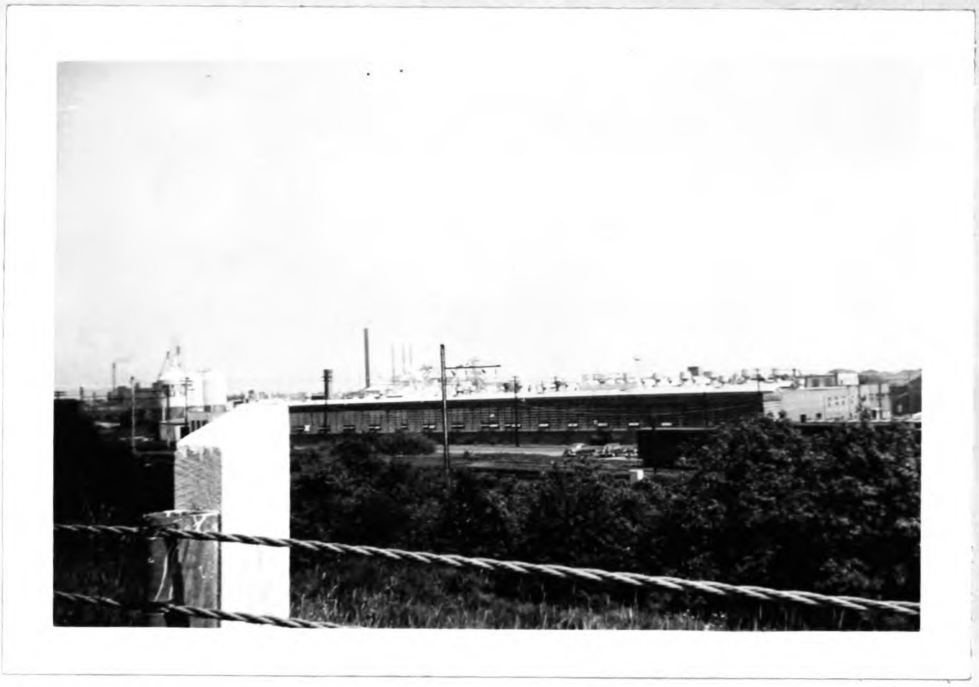

Figure 22. Wenczel Ceramic Tile Co., and Trenton's industrial heart to the east of the canal route, north of Holland Street.

Figure 23. National Ceramic Co. on the western side of the canal route, north of Holland Street.

evidenced by the old structures, particularly on the northwestern side. Those that were located on the southeastern side have been torn down to make room for a branch railroad yard for the Pennsylvania Railroad.

Traveling northeast on the canal route, an observer may surmise that he is entering a heavy industrial area by the maze of water towers and chimneys, particularly to the southeast. Along the northeastern side of the canal route north of Holland Street are the buildings and fuel tanks of the Mercer County Highway Dept. (Fig. 20). Further along the route are located the National Ceramic Co. (Fig. 23), metal scrap yards, suppliers of building material, and warehouses. Some of these warehouses were once manufacturing plants. The oldest industry on the northwestern side of the canal is Stangl Pottery (Fig. 25), which established its present site in 1830. Although it was built prior to the canal, its location was influenced by the proposed route of the waterway. The immediate area to the northwest of the canal route also includes many small shops and a number of distributing concerns.

Paralleling the southeastern side of the canal route is a railroad yard and side branch of the Pennsylvania Railroad. Whereas the northwestern side of the canal is characterized by small older sturctures, the southeastern side beyond the railroad yard is dominated by large sprawling industries. Such firms as Hamilton Rubber Company, Wenczel

Figure 24. The Trenton Paper Corporation northwest of the former canal route.

Figure 25. The Stangl Pottery Co. on the northwestern side of the canal. The highway in the foreground occupies the old canal route.

Ceramic Tile Company, American Smelting and Refining, Trenton Potteries, Termoid Textiles and Goodall Rubber are located here.

At the city limits the highway swings northwest from the canal route to join U.S. Route 1. The canal leaves the flume and passes through idle land which may be an area for future industrial expansion. Southeast of the canal on higher land, are industrial and residential areas. The canal crosses Whitehead Road and enters a marshy wooded area, and another region.

Except for the northern and southern portions, the canal throughout this region is largely paralleled by industry. Many of these industries may attribute their growth and development to the canal, which, during its operational years provided them with raw materials and a means of transportation for the finished products. The railroads which parallel the canal route, now serve the industries that were once served by the waterway. The only remnant of the Main Canal in Trenton is an empty right of way in the southern portion of the city, for the northern part of the right of way is occupied by a highway. Although only a small portion of the Delaware and Raritan Canal is visible in Trenton, it's influence on the development of the city can be readily observed. The pattern of Trenton's industrial land use (see Fig. 11), reflects the impact of the Delaware and Raritan Canal on the city. No other city or region on

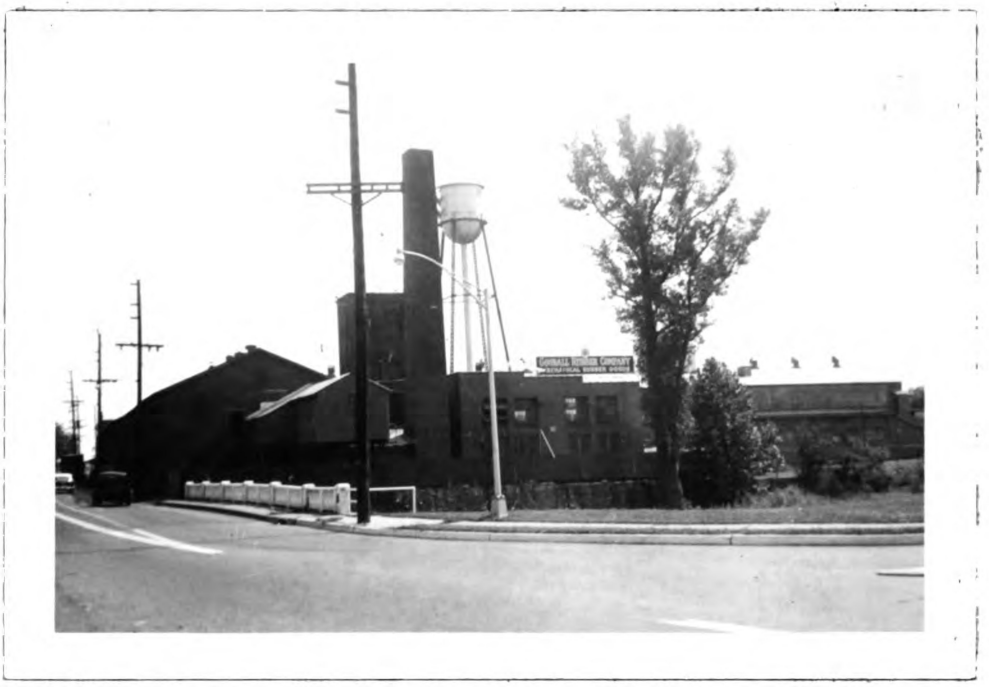

Figure 26. The Goodall Rubber Company at Whitehead Road in the north end of the Trenton Region.

Figure 27. Trenton Potteries on the eastern side of the canal route at the southern end of Trenton.

the canal route has a land use pattern which may be so readily attributed to the waterway.

MILLSTONE VALLEY REGION

From Trenton to Manville, a distance of approximately twenty-five miles, the canal passes through a region dominated by the Millstone River Valley. Although the canal follows the Assunpink Creek to Bakersville, and the Stony Brook to Princeton, the Millstone Valley was the major factor in the location of the canal. This region is also the route of the major rail and motor transportation lines between New York and Philadelphia. It is not surprising then, that the area adjoining the Main Canal is in a greater state of transition than the area adjoining the Feeder Canal.

Northeast of Trenton the canal follows the Assunpink Creek Valley, a broad, flat stream valley which is quite swampy and over grown with thick vegetation. On either side of the canal the lands of higher elevations are occupied by suburban developments and light industrial establishments. Approximately a quarter of a mile west of the canal lies U.S. Route 1, a four lane highway. At Bakersville the highway crosses the canal, and from that point lies to the east of the canal. The most marked changes of land use in the region are found along U.S. Route 1, a change from agriculture and woodland to commerce, industry and homes. The Pennsylvania Railroad, another important transport route lies east of the canal.

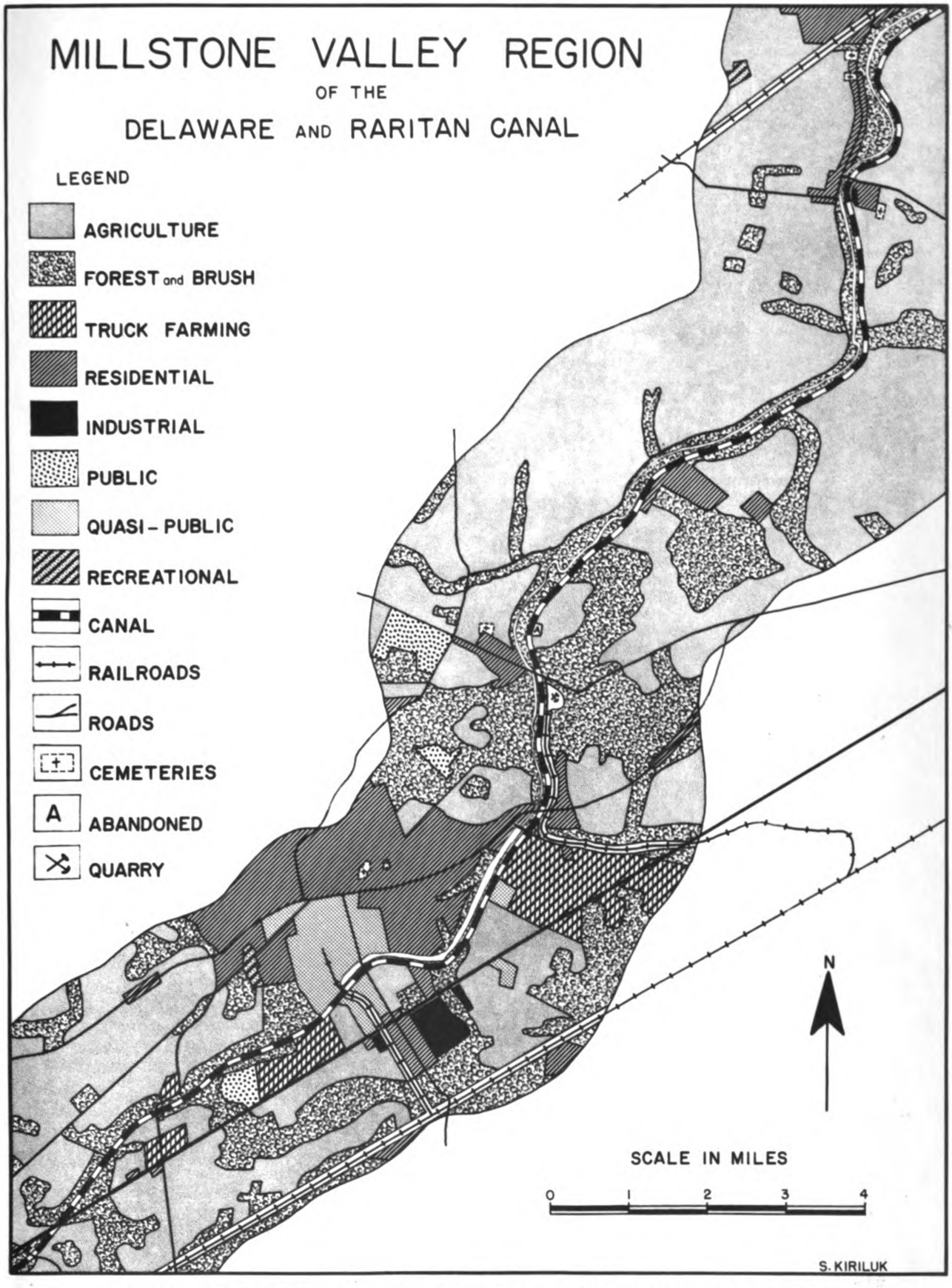

Figure 28. Land Use in the Millstone Valley Region of the Delaware and Raritan Canal.

Near Bakersville, three miles north of Trenton, the canal leaves the Assunpink Creek Valley and is routed north about two miles entering the Stony Brook Valley at Port Mercer. The area between Bakersville and Port Mercer is generally flat to gently rolling, with swampy areas along stream courses. Where the terrain is not swampy, agriculture is carried on.

North of Port Mercer, a small agricultural center, the canal follows the Stony Brook Valley to Princeton, passing through a swampy, heavily wooded area immediately adjacent to the Stony Brook Creek. Away from the stream valley the land is cultivated. On the northwestern side of the canal there are neat fields with equally well kept farmsteads. Closer to Princeton residences are more numerous. Southeast of the canal is a private airfield and a large commercial orchard. During dry periods this orchard is irrigated with water from the canal. Northeast of the orchard is the small community of Penn's Neck, directly opposite Princeton. This town has one industry, the American Cyanimide Company, located on U.S. Route 1, which passes through the town. Although it is situated three fourths of a mile distant, the American Cyanimide Company draws water from the canal. Between Penn's Neck and Princeton the lands are owned by Princeton University. The land is presently cultivated and may in the future be used for expansion of the campus. The university also has two research centers

Figure 29. Flood control gate and lock-keepers house at Kingston.

Figure 30. Walled canal banks near Princeton.

located along U.S. Route 1, northeast of Penn's Neck. They are the Princeton University Laboratory and the Princeton University Medical Research Center. Princeton University's most recent addition is the James Forrestal Research Center, a large scale nuclear energy research project, sponsored by the United States Atomic Energy Commission. The canal will supply this project daily, with one million gallons of water for cooling purposes.

The Boro of Princeton has a population of 12,300. It is a university town dominated by Princeton University and the Theological Seminary. In addition to the universities, there are many private and public schools within the Boro and the outlying districts. The Boro was founded in Pre-revolutionary times, evidenced by numerous colonial homes. Modern dwellings of recent construction encircle the town. Housing developments are located in the northeast fringes, and individual residences lie to the west and southwest. The town is situated on higher terrain overlooking Carnegie Lake, formed by the damming of the Millstone River south of Kingston. The lake is about three miles long, and approximately an eighth of a mile wide. The lands immediately adjacent to the lake and the canal are utilized as park and recreational areas.

The Walker-Gordon Farm, a large dairy operation, is located east of Princeton between Route 1 and the Pennsylvania Railroad. This holding is presently decreasing in

size, for portions are being sold as industrial sites, along the Millstone River. These sites are quite favorable for industrial development, because of their location between U.S. Route 1 and the Pennsylvania Railroad, as well as their proximity to a water supply, the Delaware and Raritan Canal.

East of Princeton the canal route closely parallels the Millstone River. Immediately to the east of the canal are farm lands and one of the many private schools in this area. Northeast of the school extending away from the canal are the fields of the Princeton Nursery, which depend upon the canal for irrigation water during dry periods. In addition to the nursery, a number of large farms in this region utilize canal water for irrigation.

The small community of Kingston, two and a half miles northeast of Princeton is situated on high banks overlooking the Millstone Valley. It is primarily a residential town.

Approaching Rocky Hill the valley narrows and the terrain on both sides of the canal becomes increasingly rugged. This area is generally wooded, with occasional areas of agriculture. Because of the rough terrain and the igneous bedrock, soils in this area are not very deep or fertile.

Through the gap in the Rocky Hill trap rock ridge the canal passes the Kingston Quarry, located on the east bank of the canal. A large portion of the ridge has been

Figure 31. A bridge spanning the canal north of Griggstown. The house at the right was used by the bridge tender when the canal was in operation.

excavated, leaving a crater in the landscape. During the early days of the canal the waterway served the quarry, but the function was soon taken over by the railroad which at present serves the quarry. The town of Rocky Hill is situated on the western slopes of the valley. It has been primarily a residential town until several years ago, when a plastics research and production plant was located here. There is little evidence of its importance and activity during the canal era. The barge basin that was located on the east side of the canal is today an empty lot, and the woolen, lumber and grist mills have disappeared, the land which they occupied is now idle.

Between Trenton and Rocky Hill there are no locks on the canal as it traverses a plateau-like area 56.3 feet above sea level. From Rocky Hill the canal descends to five feet above sea level at New Brunswick, requiring five locks to make the descent.

The area between Rocky Hill and East Millstone, a distance of about eight miles, may be considered the most rural section of the entire canal route. The lands along the eastern side of the canal to Griggstown are generally rugged and heavily wooded, supporting little agriculture. In contrast, the lands with shaly and sandy soils across the valley to the west of the canal are well cultivated, except for the steep slopes along stream courses. North from Rocky Hill the canal follows the base of the rugged

Figure 32. Canoeing on the Delaware and Raritan Canal, a popular recreational activity.

slopes, through an area that is covered with vegetation. On the east canal bank approximately a half mile north of Rocky Hill stand the ruins of the Atlantic Terra Cotta Company, which at one time produced ceramic emblems and shields. With the Millstone River to the west and the rugged slopes to the east, the canal continues through heavily wooded country, broken only by scattered dwellings and small farmsteads.

Griggstown, about seven miles north of Princeton, is in many respects, a typical eighteenth century settlement. During the canal era it was a busy trading point with a grist mill. Now it is a peaceful village with a corner general store. The settlement lies on the gentle valley slopes with recent development of housing east of the older section of the town.

Between Griggstown and East Millstone the land on both sides of the canal is cultivated. Dairying and poultry raising dominate the agricultural activities. The Millstone River lowlands, where not wooded, are used for pastureland or the cultivation of sod. The state owned lands along the canal in this section are used for recreation, providing opportunities for canoeing and picnicing in pleasant wooded surroundings, (Fig. 32). As yet, these opportunities are not heavily utilized, for facilities such as tables and fireplaces do not exist. However, the most promising areas for recreational land use along the canal, are those within

Figure 33. Ruins of the Atlantic Terra Cotta Company north of Rocky Hill.

Figure 34. The Somerset Rubber Reclaiming Company at East Millstone, as it appears from the canal bank.

this region and the Delaware Valley Region.

The town of East Millstone located on the east bank of the canal, and its counterpart Millstone across the river to the west, are settlements dating back to Pre-revolutionary times. Both towns experienced much greater activity during the canal era than they do today. East Millstone was an important canal shipping point, particularly for grain. The town had many trading establishments and stores. Adjacent to the canal still stands the old Inn, although quite dilapidated. Industry included grist mills, and even a distillery, which no doubt was established because of the flow of grain through the town. The distillery was situated in the southern portion of the town adjacent to the canal. The structures are now occupied by the Somerset Rubber Reclaiming Company, which utilizes canal water in its reclaiming process, (Fig. 34). Both towns today are primarily residential. Millstone is expanding along the roads which lead out of town, but East Millstone can expand only to the south and the southeast. On the north it is limited by Mettler's Farms, a large holding of 545 acres. The farm is devoted to raising pure-bred Hereford cattle, and extends about a mile north along the canal. To the east the town is bounded by the William L. Hutcheson Memorial Forest, a 136 acre plot owned by Rutgers University.[2]

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[2]This lot is one of the few remaining stands of virgin forests on the eastern seaboard.

Figure 35. The Canal as it appears throughout much of the route.

North of Millstone, to the west of the canal, rural residences line the main roads. Some of the land is cultivated, but large portions are idle and those areas along the river and canal are wooded, in many places marshy. Approaching Manville agriculture gives way to residential and commercial areas as well as industry.

The Millstone Valley, although predominately agricultural, is gradually undergoing a transition in land use, particularly along major transportation routes where industry, commercial and research establishments are springing up. Many of the livestock farms in this region must be classified as "gentlemen's farms", where agriculture is a hobby or a sideline. However, agriculture in this region will remain important for decades to come. It is probable that operations will be on a larger scale, with dairying dominant, and truck farming gaining in importance.

RARITAN VALLEY REGION

The Raritan Valley Region begins at Manville, where the Millstone River flows into the Raritan River, and ends at New Brunswick, the terminus of the canal, a distance of approximately ten miles. Although some agriculture is present in the southern portions of this region, it is predominately an urbanized and industrialized area. The region is the southern fringe of the heavily populated and industrialized northeastern New Jersey, and the outer limit

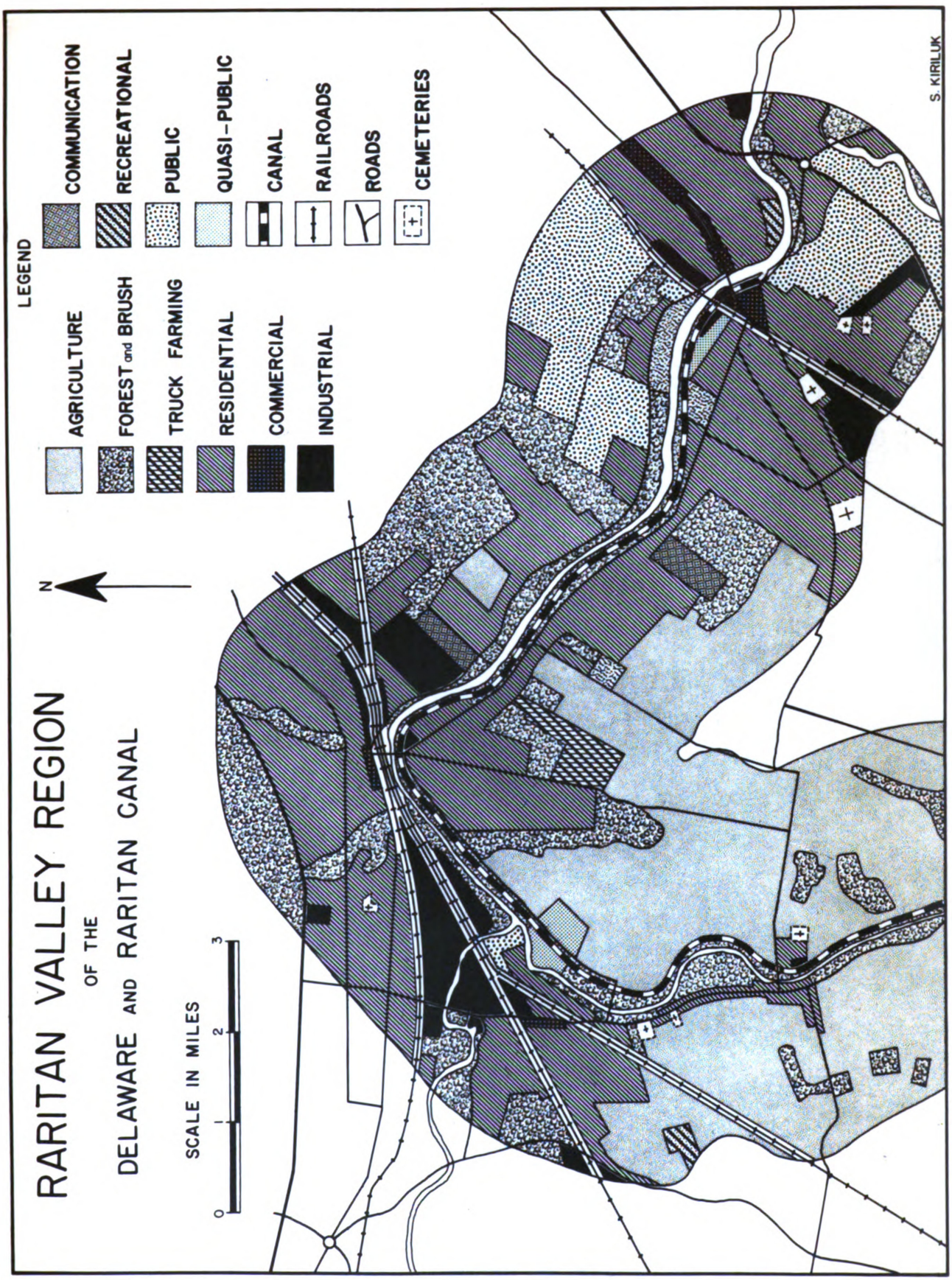

Figure 36. Land Use in the Raritan Valley Region of the Delaware and Raritan Canal.

of the New York metropolitan area.

Located at the junction of the Millstone and Raritan Rivers, the city of Manville has a population of 12,000 people. Although there are other industries in Manville, it is primarily centered around the Johns-Manville Asbestos Corporation. The corporation is situated on the south bank of the Raritan River, and utilizes the services of both the Lehigh Valley and Reading Railroads, whose routes pass immediately south of its site. Because it is confined by rivers to the north and east, Manville's rapidly increasing population is expanding to the south and to the west.

To the east of Manville between the Millstone River and the Delaware and Raritan Canal stands the Alma White College, the Pillar of Fire Seminary and Preparatory School. In addition to occupying the land between the river and canal, this institution owns land to the east of the canal, where a radio station is located.

North of the college some agriculture is present along the east side of the canal. Near the Boro of South Bound Brook housing developments are crowding out agricultural lands. Poultry raising is the dominant agricultural activity. Much of the land stands idle, and rural residences line the roadways. In general, housing developments and suburban expansion characterize the area.

Except in urban areas and where cultivated lands border the canal, the banks of the waterway are densely

wooded. Excluding the cities through which it passes, the canal in this region is almost obscured by the natural barrier of vegetation, which isolates it from the bustling activity of the surrounding landscape.

North of Manville, and to the northwest of the canal and river, is the American Cyanimide Company. This company is served by the Lehigh Valley, the Reading and the Central of New Jersey Railroads. Lands adjacent to the river are occupied by the waterworks and spoil pools of the American Cyanimide Company. The industrial establishments along the river and paralleling the railroads are predominantly chemical.

South Bound Brook lies within the bend of the Raritan River. It is primarily a residential town rapidly expanding south in the form of suburban developments. Through these developments and south of the boro will pass a new expressway, bisecting the loop of the river and the canal. The largest industry in South Bound Brook is the Ruberiod Company, located on the south bank of the canal. Across the Raritan River to the north of South Bound Brook, and oriented to the waterway lies the city of Bound Brook. The city's industry is mainly concentrated along the railroads, which parallel the river, and the commercial districts, immediately to the north of the industry. Bound Brook is an old town with many dwellings of eighteenth and nineteenth century architecture.

Figure 37. New dormitories of Rutgers University overlooking the canal in New Brunswick.

Figure 38. A leather manufacturing establishment along the canal in New Brunswick's waterfront district.

Between South Bound Brook and New Brunswick, a distance of about six miles, the areas on both sides of the canal and river are becoming increasingly suburbanized. South of the canal are housing developments and individual dwellings. A number of areas bordering the canal are wooded or idle, many are being cleared for construction, and the remaining will probably be utilized in the near future.

North of the canal and the Raritan River, to the east of Bound Brook is a large industrial firm, the Bake-a-Lite Company. Immediately to the east of Bake-a-Lite stand the buildings and towers of a radio broadcasting station. To the east of the radio station and facing the river are more residential areas.

One half mile west of New Brunswick on the south bank of the canal, stand the abandoned buildings and towers of a wireless radio station.[3] East of the station, adjacent to the canal, the lands are occupied by a residential district, which is contiguous with the city of New Brunswick. Across the Raritan River to the north of the canal is an extension of the Rutgers University Campus, the site of the university golf course and stadium. The area along the river is occupied by Johnson Park, which provides recreational facilities for the surrounding urban areas.

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[3]The station was closed during World War II, because it was used by Nazi sympathizers to send messages to enemy submarines in the Atlantic Ocean.

Figure 39. The Johnson & Johnson Co. situated on the south bank of the canal in New Brunswick.

Northeast of the park are additional university lands, and beyond is located Camp Kilmer, a United States Military Reservation. The camp occupies several hundred acres of land.

Entering the city limits of New Brunswick, the Delaware and Raritan Canal passes Buccleuch Park, the only public park of reasonable size within the city. East of the park the canal continues past the Rutgers University Campus and the Theological Seminary. On the high bank overlooking the canal and the river are three new dormitories for the university students, (Fig. 37). East of the dormitories, the canal enters New Brunswick's waterfront industrial district. The largest industry in this district, and the one contiguous with the campus, is the Johnson & Johnson Company. It is a pharmaceutical firm, and is also a consumer of canal water. Other industries in the district include leather (Fig. 38), textile, glass and clothing concerns. Additional consumers of canal water are the city of New Brunswick and Rutgers University. The university utilizes the water in their air conditioning system, and the city for drinking purposes.

From the end of the industrial district to the canal outlet locks, the land along the waterway has been cleared and landscaped to be utilized for recreational purposes. However, the city planners lack of foresight pertaining to land use is evidenced by the establishment

Figure 40. Barge tied in one of the outlet locks, used by a boating club in New Brunswick.

Figure 41. The outlet locks at New Brunswick. The Raritan River is in the background.

of a sewage disposal plant in the center of this area. New Brunswick has never considered the potentialities of its scenic waterfront until very recently. The slums which existed until several years ago have been replaced by apartment buildings. An area just within the locks section is planned for a yacht basin, which should further encourage recreational possibilities. The locks are in good condition, and are kept up. The old toll collectors building next to the canal, and the lock-keepers house still stand, although in urgent need of repair. These structures have not been removed, and may remain to represent an important historic land-mark, a symbol of the canal era. An old barge tied in one of the outlet locks, is used as a meeting place for a boating club (Fig. 40). The canal terminus also marks the head of navigation on the Raritan River. The channel presently is not utilized for commercial purposes. During the summer hundreds of yachts lay anchored in the river opposite the locks, (Fig. 41). Overshadowing the locks are nearly perpendicular red shale cliffs, upon which stands part of the Douglass College campus. A four lane highway parallels the canal from Route 27, and continues to the top of the cliffs, carrying traffic to U.S. Route 1 and the New Jersey Turnpike. Both Route 1 and the turnpike pass to the east of the city.

The city of New Brunswick, founded in 1684, was a resting stop on the King's Highway, as was Trenton. For

Figure 42. Toll collector's building at the outlet locks in New Brunswick.

Figure 43. View west from outlet locks, to the left proposed recreational area.

many years New Brunswick derived it's livelihood from agriculture, which came from a large and rich farming area. During that period it was a center for flour milling and trading. In 1771 the city became the site of Queen's College, later to become Rutgers University. The State Legislature in 1864 designated the Rutgers Scientific School as New Jersey's Land Grant College. Since then the present Rutgers University, the State College for Women, and the New Jersey State Agricultural Experimental Station have evolved, all of which play important roles in the city's life.

The building of the Delaware and Raritan Canal, stimulated trading and industrial development in the city. However, the rapid industrial expansion came with the railroads. Today there are over 130 industrial establishments in the New Brunswick area. Most of the industry is located along the railroads. The influence of the canal on land use has been very limited.

SUMMARY AND CONCLUSION

The Delaware and Raritan Canal was built during an era when waterways offered an inexpensive means of transportation, and railroads were in a developmental stage. The construction of the Canal, during the 1830's, was motivated by commercial interests in the central New Jersey area. The Main Canal, thirty three miles in length, connecting Trenton and New Brunswick, was completed in 1834. The Feeder Canal, intended for navigation as well as a source of water, extended northward from Trenton along the Delaware Valley for a distance of twenty-two miles. From its inception the Canal was intended as a connecting link between cities, rather than a waterway which would serve a large number of people and communities. In this respect the Delaware and Raritan differed from the Pennsylvania Canal System and the Erie Canal of New York. Furthermore, the Delaware and Raritan Canal was a freight route from the beginning. Coal shipping was the principal activity throughout its history. The Canal was plagued by railroad competition from the start, and following the peak operational years during the Civil War, the company was sold to the Pennsylvania Railroad. It is surprising that the railroad continued to operate the Canal for so many years, as revenues did not meet expenses

after 1900. The Canal was closed in 1933, and the following year was turned over to the State of New Jersey.

The Canal was in active use then, for almost a century. What effects did it have on the landscape during that time and to what extent are these effects still visible today? This has been the major theme of this study. In general the Canal had very little influence on the agricultural lands, and a profound influence on the industrial pattern of Trenton and to some extent New Brunswick. The contrast between the urban and rural landscape is sufficient to warrant recognition of four regions along the route of the Canal.

Of the four regions, the most rural is the Delaware Valley, even though the Millstone Valley Region is predominantly agricultural. In these two regions the Canal, bordered by brush and trees, passes through farm lands and forests that are not particularly affected by its presence. The other regions are characterized by urban and industrial landscapes. The Trenton Region is almost entirely urbanized with a heavy industrial core, in contrast the industrial areas of the Raritan Valley Region are scattered. The greatest influence of the Canal was on the Trenton Region, where it stimulated industrial growth, and was the major locational factor in determing the industrial land use of the city.

In Trenton, as well as the Raritan Valley Region,

railroad facilities were extended to the industrial sites shortly after the completion of the Canal. To some extent the Canal influenced the location of rail facilities in the Trenton and Raritan Valley Regions. The purchase of the Canal by the Pennsylvania Railroad, and the Canal's early consolidation with the Camden and Amboy Railroad indicate that the builders of the Delaware and Raritan had selected their route with care. Such local industry as did appear in small towns along the Canal all but disappeared with the decline of the waterway. The Canal exerted very little influence on the towns along its route other than the terminal cities. There are indications that the Canal may become an important source of industrial water and again become a factor in the industrial landscape of New Jersey.

Changes in land use are most marked in the Trenton and Raritan Valley Regions. For the most part these changes reflect a rapid growth of the suburban areas. New housing developments are springing up in these regions, bordering the Canal and eliminating the rural landscape. Industrial land use is increasing at a much slower rate. In the Millstone and Delaware Valley Regions there is a marked trend toward rural residences rather than development housing. These residences are scattered and primarily located along roadways adjacent to the Canal. Industry and urbanization will in all probability continue to expand in the Raritan and Trenton Regions. Although industry and rural residences

are slowly increasing in the Delaware and Millstone Valley Regions, agriculture will be the predominant land use in the foreseeable future.

The majority of State or public lands lie in the Raritan Valley and Trenton Regions, near the large cities of Trenton and New Brunswick. These lands are occupied primarily by schools, hospitals, military installations, and parks.

The use of the Canal for recreational purposes is limited at the present time. With careful management, sections in the Delaware and Millstone Valley Regions hold promising possibilities for future use as picnic grounds, and areas for swimming and canoeing.

The future function of the Delaware and Raritan Canal will be quite different from that originally intended. Built and utilized as a navigable waterway, the Canal currently, and in the future will serve primarily as a source of water supply. At present, industry is the largest consumer of canal water, followed by research establishments and agricultural irrigation. Expansion of industrial and research concerns in the Canal region would seem to assure continued use of the Canal.

The Canal was built for a purpose and it served that purpose well, until rail transport forced its abandonment. The Delaware and Raritan Canal has in the past

left its impact on the surrounding regions. In the future the impact may be of a different nature. As a source of water, the Canal may well be a major factor in the growth of its surrounding areas, and could become a source of livelihood and recreation for the citizens of Central New Jersey.

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