LAND ORIENTED REFERENCE DATA SYSTEM

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DIVISION OF WATER RESOURCES
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NEW JERSEY

LAND ORIENTED REFERENCE DATA SYSTEM

(LORDS)

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This bulletin was produced under my general direction with a great deal of help from George J. Halasi-Kun, Topographic Engineer, who worked out most of the details, held the discussions with the various computer program offices at the universities, and directly supervised those who were preparing the basic material for microfilming and computer printouts.

The Department of Community Affairs made it possible to hire Assistant Geologist, Glennda Tucker, for most of one year. She produced many of the maps assisted by Frank Viscomi, Draftsman, and originated a number of concepts to make the system more compatible with other similar programs. Her husband's transfer to Massachusetts nine months after the project was begun crippled operations until it was possible to hire Shirley Albright as a replacement. Upon Mrs. Albright's departure for a permanent position with the State Museum, we secured the services of Geologist Trainee, William Thomann, and at about the same time, David Harper, Assistant Geologist. Mr. Thomann and Mr. Viscomi have completed the Atlas Sheet Map Series, have updated some of the material first produced, and in general have handled the preparation of all Block Maps and some of the supplemental map material.

David Harper completed the onerous task of compiling the Atlas Sheet and Block Descriptions. These were modified several times in order to make them more useful and include more information.

The above staff has from time to time sought and received the cooperation of others in the Division of Water Resources, in other agencies of the Department of Environmental Protection, and with our colleagues in the Department of Community Affairs. Particular thanks is due to Roger Hoeh, Richard A. Ginman and Richard Binetsky, not only for the above mentioned funding of Mrs. Tucker's position, but particularly for their valued critical comments and advice as the program underwent various changes, which we hope are improvements, making it more useful.

Of all those who contributed to the LORDS Program, the MTST operator, Mrs. Edna Conroy, has had the most consistently onerous task of typing, transferring, retyping, and correcting the tapes for the Atlas Sheet and Block Descriptions. She has continuously made suggestions to improve the material or make it easier to recover and has cheerfully performed the many hours of typing involved.

All of those mentioned above have contributed to this program with cheerfulness and enthusiasm. Many valuable suggestions remain to be put into effect.

Kemble Widmer

Kemble Widmer, State Geologist

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Realization a few years ago that the earth was a space ship with finite resources started a surge of interest in what may loosely be called "environment" and "ecology." The factors and interrelationships of these two disciplines, while known and studied for years by a few, now became matters of general interest. Two deficiencies soon became apparent; there was a singular lack of specific data, particularly for the smaller areas and information sources available lacked the flexibility needed for quick recovery of information, rapid update of facts, and changing emphasis of use.

The problem is particularly acute in that part of the earth known as New Jersey. With an average population density of 1,008 people per square mile only 19% is urban, nearly 45% of the state is forested, 9% is lakes, and 27% is suburban or agricultural, with a per acre dollar value for crops produced which for years has ranked either first or second in the nation. On the one hand, one municipality has over 10,000 people per square mile while another has less than four people per square mile. In rural New Jersey, 16 townships encompassing over 1,000 square miles, nearly 1/7 of the land surface of the state, has a population density of less than 100 people per square mile. Half of these townships have population densities of less than 50 people per square mile. There is an intense competition for land use of whatever kind whether for open space or urban, suburban or agriculture. Whether the open spaces shall be preserved or suburbs built has become an increasingly difficult decision for local officials.

The various national environmental protection laws have accentuated the need for factual data that is not only available but also relevant, adequate, and current. To meet this need, various public and private, national and state organizations have turned to the data bank and computer program as a possible means of providing the vast amounts of factual data required for the wide variety of land use and environmental decisions which must be made.

Before discussing the development of the New Jersey Land Oriented Reference Data System, hereafter referred to as LORDS, four relationships with respect to the development of land use and environmental problems should be emphasized. First, people attract people; second, geology, topography and climate determine where people will settle and what, in a general way, they may do; thirdly, the activity of people in the physical environment determines the character of the biosphere or the ecological conditions, and finally, many little wrong or adverse decisions may result in undesirable environmental, ecological, or socio-economic conditions beyond recovery.

Regional plans have been in existence for over fifty years to provide factual data about land use and socio-economic conditions upon which sound long range decisions for land use and development could be based. The gathering of the data, the preparation of maps, the publication of statistics and the preparation of reports are all time consuming and, worst of all, once set in type cannot be easily changed. It is thought that the computer program and the related papers, tapes and machines would eliminate this difficulty if adequate programs could be developed. It would seem, however, that it would be most useful to the citizens of New Jersey to have a bit of both; maps and publications to give regional relationships even though fixed in time and a flexible system of specific data recoverable for a small area and capable of easy update and revision. It is believed that LORDS with all its parts meets this requirement.

The Bureau of Geology and Topography has been collecting, compiling, and evaluating data on the physical features and resources of New Jersey continuously since 1863. New Jersey, as a result, is the most completely mapped state in the nation, has an unusually large mass of geologic data, and a well developed geodetic system of precise locations and elevations. A special effort has been made in the past twenty years to compile and analyze data on water resources and publish or otherwise make this material available to the using public. Water well information, 90,000 well records, was and is the resource material most frequently in demand. The availability of water, more than any other single physical environmental factor, determines the type of land use in any area.

Several conferences and discussions in the latter part of 1971 led to a cooperative effort, because of mutual interests, with the Department of Community Affairs, Division of State and Regional Planning, Bureau of State Wide Planning, in assembling data for their Land Oriented Information System known as LOIS. Data for LOIS is recovered from many sources and many files. Real estate values, detailed land use and similar data are assembled from tax maps and information maintained locally and by the appropriate County Boards of Taxation, assisted by the Bureau of Local Property Tax, Division of Taxation, Department of Treasury. This information is computerized by the Bureau of State Wide Planning, using the State Plane Coordinate System for the location of the center point or centroid of each tax parcel. The Plane Coordinate System is a legally accepted system for designating property corners with x and y values in feet.

That part of the LOIS system worked on by the Bureau of Geology covering physical parameters of the environment such as geology, topography, drainage basins, water, and other resources and the geography of the State, with emphasis on specific land use types, such as historic sites or sanitary landfills, is based on the long-standing Rectangular Coordinate System. The Bureau of Statewide Planning experimented with the Rectangular Coordinate System to see if conversion from x and y coordinates to the appropriate block number under the Rectangular Coordinate System or vice versa could be easily done on the computer. A computer program was developed and the two systems of data presentation are thus compatible.

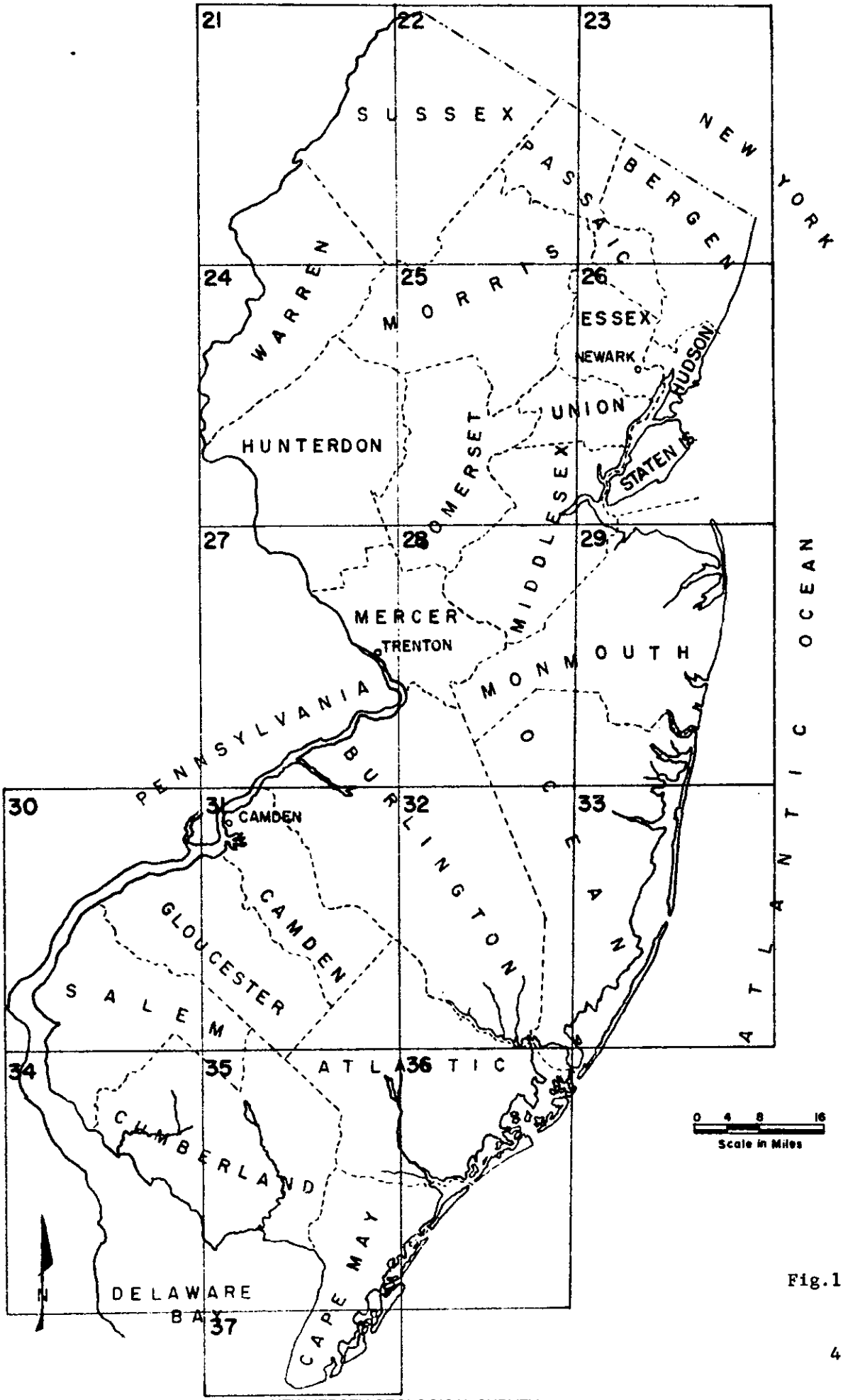
It should be explained that LOIS differs from LORDS in that it is more concerned with the socio-economic data, is primarily for the planning function, and is a true computer program with the capability of using many data sources. LORDS on the other hand is a geographic information system dependent upon the use of the New Jersey State Topographic Atlas Sheets. Instead of a computer, information is recovered from microfilms or automatic typewriter (MT/ST) print-outs. All that has been done in preparing data for maps or summaries in the LORDS programs must be done before the information can be put into a computer program.

Before proceeding with the discussion of how to use the data programs, an understanding of the two New Jersey systems and coordinate systems in general is needed. There is a UTM Grid or Universal Transverse Mercator Grid used by the Army and other international agencies to determine spot locations anywhere in the world. In New Jersey, for example, this is the coordinate system used by Civil Defense because it is the only system which applies to the whole United States. The UTM 1000 meter grid appears on some maps referred to in the LORDS program.

Most states also have their own plane coordinate system. These values in feet relate to some specific starting or reference point of latitude and longitude. In New Jersey the system has its origin at a point ESE of Cape May at 74° 40' West longitude and 38° 50' North latitude with $\underline{x}$ = 1,000,000 and $\underline{y}$ = 0. Values for this coordinate system are shown on the Federal U.S.G.S. 7.5' Quadrangle Maps for New Jersey. In the case of Pennsylvania, there are three grid systems because the state has its greatest length east-west and it is inconvenient to go too far from the origin in any one direction. Some Federal survey maps, particularly those covering areas in two states, may have both states' coordinate system indicators and the 1000 meter UTM grid along their margins.

In the 1890's the survey network was not complete enough for New Jersey to permit this type of coordinate system. Yet there was a need for the precise geographic location of mineral occurrences, wells and other resource data. With the introduction of the edge-matched Atlas Sheets it was possible to develop a reference system which is now known as the Rectangular Coordinate System. The 17 State Atlas Sheets (see Figure 1) are the base for the system, with the map number being the first two digits of a seven digit number. There is a uniform rectangular grid for each Atlas Sheet (see Figure 2) consisting of 25 blocks, most of which are 6 minutes of latitude by 6 minutes of longitude. Each full block (designated by the third and fourth digits) covers an area of approximately 34 square miles. Only 251 block maps are required to cover the entire state. Each block is divided into 9 rectangles of 2 minutes of latitude and longitude (the 5th digit with an area of less than 4 square miles) which can then be again divided in a similar manner into 9 squares (6th digit); and finally into 9 units (7th digit), each of which covers about 30 acres.

In order to completely dispose of the problem of geographic location and compatibility of coordinates it was decided to give, in the lower left hand corner of each Block map, the values for latitude and longitude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SUSSEX
NEW YORK
PASSAIC
BERGEN
WARREN
MORRIS
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ESSEX
NEWARK
HUDSON
HUNTERDON
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UNION
STATEN IS.
MIDDLESEX
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MERCER
TRENTON
MONMOUTH
ATLANTIC OCEAN
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BURLINGTON
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CAMDEN
GLOUCESTER
CAMDEN
SALEM
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CUMBERLAND
CAPE MAY
DELAWARE BAY
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0 4 8 16
Scale in Miles

Fig.1

and x and y in the New Jersey Plane Coordinate system. This, in effect, makes it possible to visually determine approximate latitude and longitude within a half degree or to secure the x and y coordinate values by measuring from the lower left hand corner of the map to the point desired. New Jersey Atlas Sheets are at a scale of exactly 1" to the mile (1:63360). Thus, whatever type of scale is used the fractions of an inch represent similar fractions of a mile. It should be pointed out that the thinnest line on the Atlas Sheet has a width on the ground of about 25'.

At the same time the problem of compatibility with other systems was being investigated staff was checking several university computer centers to determine the requirements for a computer program. New Jersey was found to have too small an area to efficiently use a computer program. The investigation also revealed that by using microfilm reader-printer and the MT/ST based on the first four digits of the Rectangular Coordinate System it would be possible to recover information faster than it could be recovered from a computer. It would also be easier to revise specific maps or block descriptions since there are only 251 blocks in the 17 atlas sheets. The time required to make visual identification and manually pull the material from the file is, because of the small number of tapes or microfilm jackets, less than it would take to recover or plot maps in a computer program. It is important to note that all of the operations performed to establish the LORDS system would be required before putting the data on the computer.

As the system developed using the Rectangular Coordinate System based on the Atlas Sheet it logically divided into four types of material:

(a) Supplemental Material - The printed maps, and reports and other items such as the State Geologic Map, the Drainage Basin Overlay or Atlas Sheet Geologic Overlays available from Publication Sales of the Bureau of Geology.

(b) Atlas Sheet Descriptions - General information about the Atlas Sheet area given as a descriptive tabulation with a uniform format in this Bulletin #74.

(c) Block Descriptions - Material including some of the items from the Atlas Sheet descriptions, but giving more specific data which applies within the 34-square-mile area of the block.

(d) Block Maps - At present the series, which may be expanded to a number of multi-parameter maps as data becomes available, consists of four maps:

(1) Population
(2) Water Resources
(3) Drainage Basins
(4) Geology

See Appendix B, pages 136-142, for Block Description and Block Maps for 25-33 in Fig. 2.

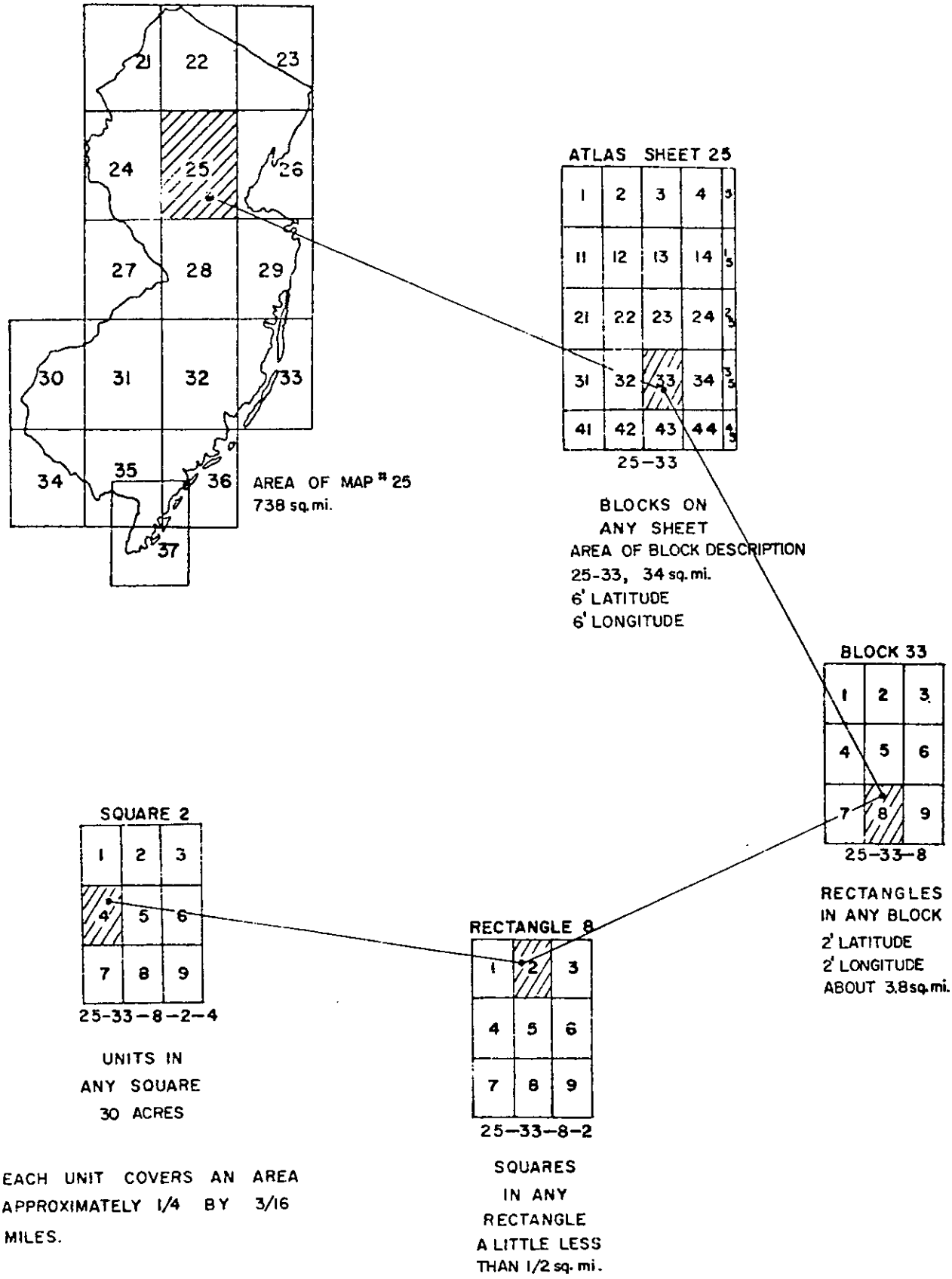


DIAGRAM SHOWING USE OF NEW JERSEY RECTANGULAR COORDINATE SYSTEM. TO LOCATE A FACILITY AT 25-33-8-2-4

Fig. 2

It is possible to revise or enlarge the amount of material provided for the Atlas Sheet Descriptions or Block Descriptions by transferring the existing tape information and the additions or corrections to a new tape. Map changes for each block can readily be accomplished by changing the microfilm in the appropriate Atlas Sheet microfilm jacket. Given the 4-digit block reference of the system, maps and descriptions can normally be recovered within minutes.

There are many ways in which regional plans or relationships may be treated. They may be studied and information compiled on the basis of state, county, drainage basin, physiographic province, market or economic center or by a group of municipalities. For New Jersey data about geographic, resource or physical conditions may be required with respect to the Delaware or Upper Passaic River Basin, the New York Regional Plan, or the Delaware Valley Regional Planning Commission.

New Jersey has maps available on three scales: State Maps at 1:250,000 or about four miles to the inch, the State Atlas Sheets (see Figure 1) at 1:63360 or one mile to the inch, and the 7.5' U.S.G.S. topographic quadrangle maps at 1:2400 or about 2-1/2" to the mile.

The U.S. Geological Survey has produced a Satellite Infrared Map of New Jersey on a scale of 1:500,000. At this time, August 1974, New Jersey is the only state to have such a map. It strikingly reveals the physiographic provinces and is interesting in other ways. A physiographic province is defined as a region which has had the same general geologic history and is underlain by the same types of rocks. Physiographic provinces thus generally extend across state boundaries. For New Jersey the physiographic provinces are shown in Figure 3.

Atlas Sheet #40 State Geologic Map (1:250,000) at a scale of about 4 miles to the inch has a projection which does not match the New York or Pennsylvania geologic maps. The three geologic maps can, however, be put together to give a regional picture and that part of the Triassic basin which extends northeastward to the Hudson in New York State is shown on the New Jersey geologic map. This map has tick marks at appropriate locations around its border so that it can be ruled off to show the area covered by the State Atlas Sheets. It should be noted, however, that there are 16 geologic overlays of the State Atlas Sheets which show the geology at a mile to the inch. This geology is also shown on the geologic block map. Reference should also be made to the available Geology in Brief series which, in addition to a black and white map usually at the scale of the Atlas Sheet, have a geologic cross-section and descriptive materials. The Tercentenary Volume 19, The Geology and Geography of New Jersey, is a useful adjunct to the above mentioned.

Atlas Sheet #39, the County and Municipality Map, also at the 1:250,000 scale, may be useful with respect to regional studies based on counties or on several municipalities. This map is also available with an overprint Atlas Sheet 39A showing the area covered by the State Atlas Sheets 21 to 37 and the Federal 7.5' Quadrangle topographic maps. This information, of course, is available in the material which follows within this Bulletin

except that the specific relationship between an Atlas Sheet Block and the Federal Quadrangle map are not shown graphically. Each Block Description lists the Federal Quadrangles that are needed to cover the same area as the block. Regrettably, only 2 of the 251 blocks used in this system coincide with Atlas Blocks on two of their borders. Using 39A and material in this Bulletin or an Atlas Sheet Block template (which is available from the Bureau) the relationship between blocks and quadrangle maps can be determined.

It should also be noted that the municipalities are given on the Atlas Sheet description, the index, and in the Block Descriptions. There also is a Municipality Population Block Map.

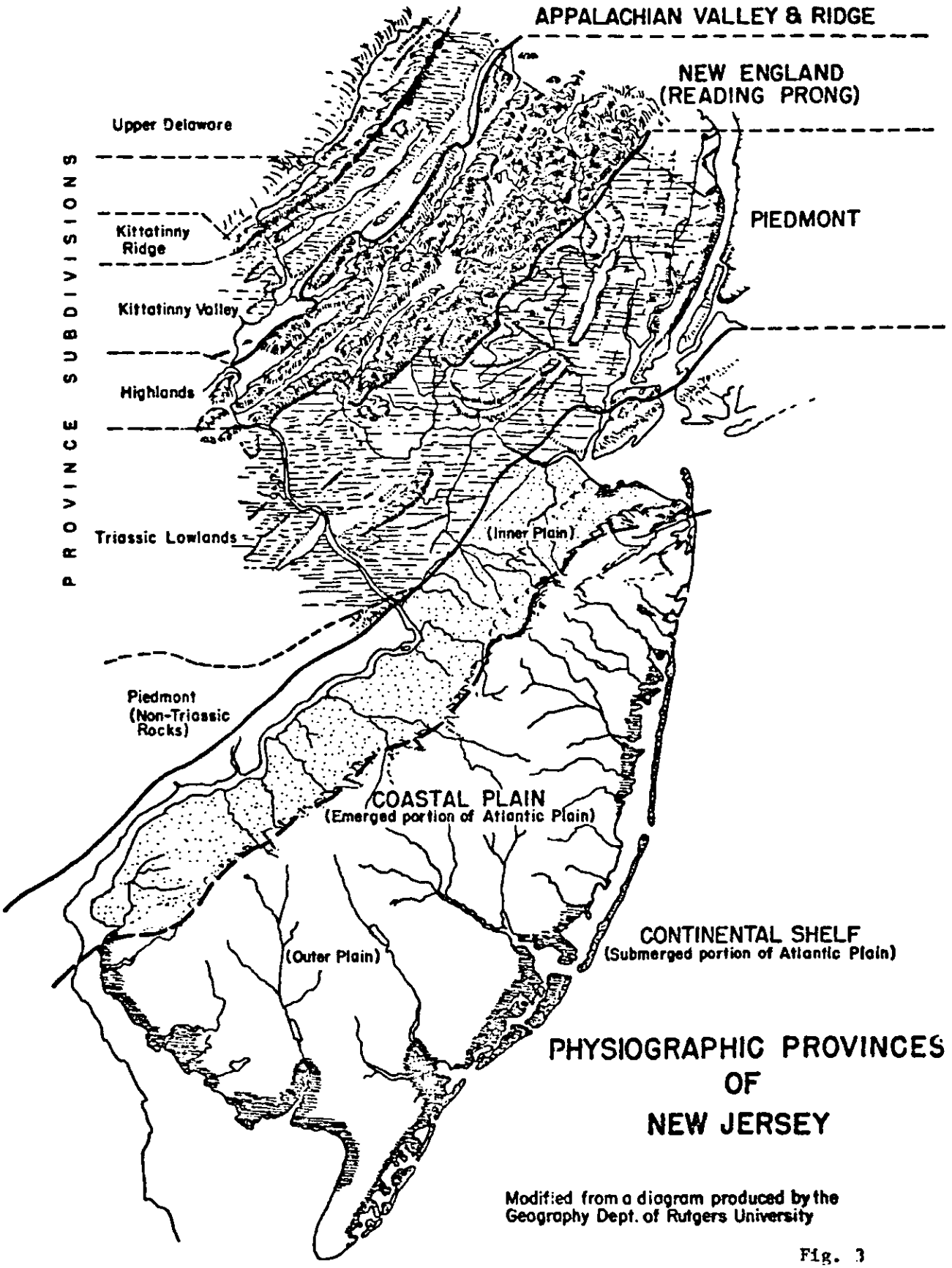
There is available a drainage basin overlay for either Atlas Sheet 39 or Atlas Sheet 40. This gives rainfall, stream gauging and water quality stations and area information for all the 1st, 2nd, and 3rd order streams in New Jersey. The information on this overlay, as well as the information which would be gained by putting the overlay on the above-mentioned maps, is available as a print-out for all or any specific drainage basins shown on the map.

Attention is also called to the Federal 1:250,000 topographic maps with a 100' contour interval. Most of New Jersey is covered by the Scranton, Philadelphia, and Wilmington sheets. The southern tip of Cape May requires the Salisbury, Md., sheet. The New Jersey border on the Hudson north of West New York requires a New York City and Hartford, Conn., sheet, although the latter will only show a small part of the Palisades Interstate Park.

There are other items of supplemental material on the price list available from the Bureau of Geology and, in many instances, these are mentioned in the Atlas Sheet descriptions.

In this Bulletin, for each Atlas Sheet area, there is an Index Map ruled off into blocks in accordance with the next breakdown of the Rectangular Coordinate System (see Figure 2). Each of these Atlas Sheet Indexes show the municipal boundaries and from it can be determined the blocks necessary to cover the information for a particular municipal subdivision or one of its parts. Following each Atlas Sheet Index are a series of descriptive pages with a uniform format giving references or factual data which APPLY TO THE ENTIRE ATLAS SHEET AREA INDICATED. A number of the reference maps or reports are based on the county or, occasionally, upon the watershed. In some instances, to get complete information, you will have to use one or more adjacent Atlas Sheets (see Figure 1).

The Block Descriptions in part repeat information given on the Atlas Sheet descriptions, but items such as rainfall, climate, and geology are given more precisely as they apply to the area covered by the block. It should be noted that the lakes given on the Atlas Sheet descriptions are larger than 20 acres, while on the Block Descriptions the lakes and ponds have areas from 5 to 20 acres. Also, the Block Description and the geologic block map must be used together for water well information. It is assumed that the user will use the Block Description and one or more of the block maps in making a study of a specific site.



PHYSIOGRAPHIC PROVINCES OF NEW JERSEY

Modified from a diagram produced by the Geography Dept. of Rutgers University

Fig. 3

The Population Block Map at present shows only the municipal boundaries, the average population density for the municipality, and the percentage of the municipality in the block being considered. It is proposed to rectify this at a later date to show where the people are in the municipality. It has not yet been determined whether this will be done with respect to a generalized land use symbol or whether it will be by showing major highways and market centers.

The Water Resources Block Maps show service areas for water and sewage, or areas served by both. Also indicated are the major trunk sewers and the major water mains. The location of sewage treatment plants are shown by a circle. The capacity is indicated below the block, coded to the 7th digit location number. The area of sanitary landfills is shown in black. It remains to be determined as to whether dumps that are no longer used will be retained as part of the system. At a later date, surface water intake points will probably be added. Because of clutter on this map, the major water wells have been placed on the geologic map.

The Drainage Basin Block Map shows the actual streams as shown on the Atlas Sheets or the so-called County Stream Maps. The drainage divides, as shown on the Drainage Basin Map of New Jersey Overlay, are also indicated. Wide floodplain or flood prone areas, stream flow information, points of diversion, and points of potential pollution may be indicated on these maps in the future.

The Geologic Block Map has been assembled from the most recent data and may, from time to time, be modified to give additional information. Industrial, public supply and other wells are shown which may have logs from which geologic cross-sections may be constructed. Anyone wishing to construct a geologic cross-section will probably have to secure well log information from the Bureau. Data about the wells shown on the Geologic Block Map is contained in the Block Description. From these the depth to bedrock in Northern New Jersey may be estimated (5' to 10' less than the depth of the casing indicated). Local ordinances, however, may require 30' to 50' of casing under all circumstances. This information, must, therefore, be used with care. Reference is also made to the Geologic Quadrangle maps, if any, referred to in this Bulletin in the appropriate Atlas Sheet description. For Coastal Plain New Jersey there are well report bulletins such as Deep Wells of the Coastal Plain which may be used in conjunction with geologic maps. Finally, mile to the inch geology similar to that on the Geologic Block Maps is available as the above-mentioned geologic overlays for State Atlas sheets.

The Archeological Block Map is not yet available, but the State Archeological Society has available information and is in the course of preparing maps showing archeological and historical sites, including for the former, sites which have not yet been published. A method of flagging the block map so that such an unpublished archeological site will not be endangered by construction has been developed. It may be that this map will include other items connected with the general interest in our heritage and history. Inquiries may be made to the Bureau of Geology, the State Archeologist, New Jersey State Museum or Archeology Department - Seton Hall University.

The Land Use Block Map was investigated and will be undertaken during the late summer of 1974. This map will utilize A Land Classification System for Use with Remote-Sensor Data, Geological Survey Circular 671, U.S.G.S. It will probably be compatible with the Carrets or Central Atlantic Regional Resource Test Site, which includes parts of southern New Jersey. In the interim, land use information required for a specific township may be worked out either from the aerial photo quads sold by the Bureau of Geology and Topography, 1972 coverage, or from aerial photography with 1974 coverage from Aero Service Corp. in Philadelphia. The air photo quads are aerial photographs that have been rectified to cover the same area covered by U.S.G.S. 7.5' Topographic Quadrangle Maps. Each is carried under the name of the map for which it is equivalent. The Aero Service photographs will have to be ordered directly from the company. The Bureau of Geology and Topography has an air photo index which indicates all major areas covered by aerial photography prior to 1972. The Bureau does not have the master photographs nor can it supply copies of the prints, but these can usually be secured from the firm which made the original survey.

The subjects to be included in other block maps are being investigated, tried, or discussed. If anyone has a particular need, it is suggested that they check with the Bureau to see whether a map has been prepared or the status, if any, of block map investigations which may apply.

The question will undoubtedly be raised as to why the U.S.G.S. 7.5' Topographic Quadrangle was not used as the basis for LORDS. This was considered. Some recent investigations, particularly those under Federal sponsorship, are based on these quadrangle maps. Coverage for New Jersey is complete but it was found that most of the files containing the basic data for various environmental factors in LORDS had been compiled using the rectangular coordinate system. Sufficient manpower to convert these files from the rectangular coordinate system to the U.S.G.S. quads did not exist.

The 7.5' quads are not a convenient size for regional discussion and are not adaptable to the 8-1/2x11 page size in that only one ninth of each quad can be printed per page. The multiplication of maps (173 x 9) and references was undesirable for coverage area, reference, and storage of the raw material. The Bureau possesses mile to the inch mylar copies of many of the U.S.G.S. quads for New Jersey. It is anticipated that this program will be expanded until it is complete. A comparison of the Atlas Sheet and 6' block at a mile to the inch and the 7.5' quad is, at best, somewhat difficult and usually not too helpful.

It should be noted that the age of the U.S.G.S. 7.5' quads, even though some 88 have been updated since 1970 with a purple overprint for many quads, range from 1945 to 1966. It should also be noted that except for the flat Coastal Plain and the flat tops of some of the mountainous areas in the Highlands, the original topography as shown on the State Atlas Sheets is, on many occasions, more reliable than the topography based on aerial photographs which is found on U.S.G.S. 7.5' quads. The contour interval and topography of both the State Atlas Sheets and the U.S.G.S. 7.5' quads is not suitable for any specific facility except for preliminary planning.

Topographic maps show relief and slope by means of contours. A contour is a line on a map, every point of which has the same elevation above sea level. The closer they are spaced, the steeper the slope. In New Jersey the State Atlas sheets have a contour interval of 10' for elevations under 200' and a 20' interval for elevations above 200'. The contour intervals of the U.S.G.S. quads should be checked for each specific sheet.

There is a knack to reading contour. The contours do not indicate specifically the slope or percentage of grade, which is what some users want. Two templates - one for State Atlas sheets and one for the Federal Quadrangle - have been prepared and are at the end of this Bulletin. By putting the edge of a sheet perpendicular to the contour lines for that part of the map for which you wish to know the slope you can get a reading from the template of the degree or per cent of slope. Care should be taken to use the proper contour interval on the proper template and to keep the template perpendicular to the contour.

Another aspect of land use in environmental analysis which is frequently confused is "soil." Basically, there are two kinds; the engineering soil, which is all of the unconsolidated material of whatever nature down to bedrock, and the agricultural soils, which are the first 3' or so below the surface.

The proper Rutgers Engineering Soil Survey is given in this Bulletin and various other parts of LORDS. To use a county Engineering Soils Bulletin one should have the first and/or last Bulletin of this series.

The agricultural soils are slightly more complicated. References are made to the so-called Linwood Lee Soil Survey of New Jersey which was completed in the period of 1900-1910 (Bulletins of the New Jersey Geological Survey). These surveys may be found in libraries but are otherwise hard to get at. Many of the maps are quite brittle and all are the old-fashioned type of soil survey concerned primarily with only the first 3' and the fertility of the soils. The texts, however, have climatological and ecological information which is frequently hard to find elsewhere. Some of this data has been included in the Atlas Sheets and Block Descriptions. There was complete coverage of the State.

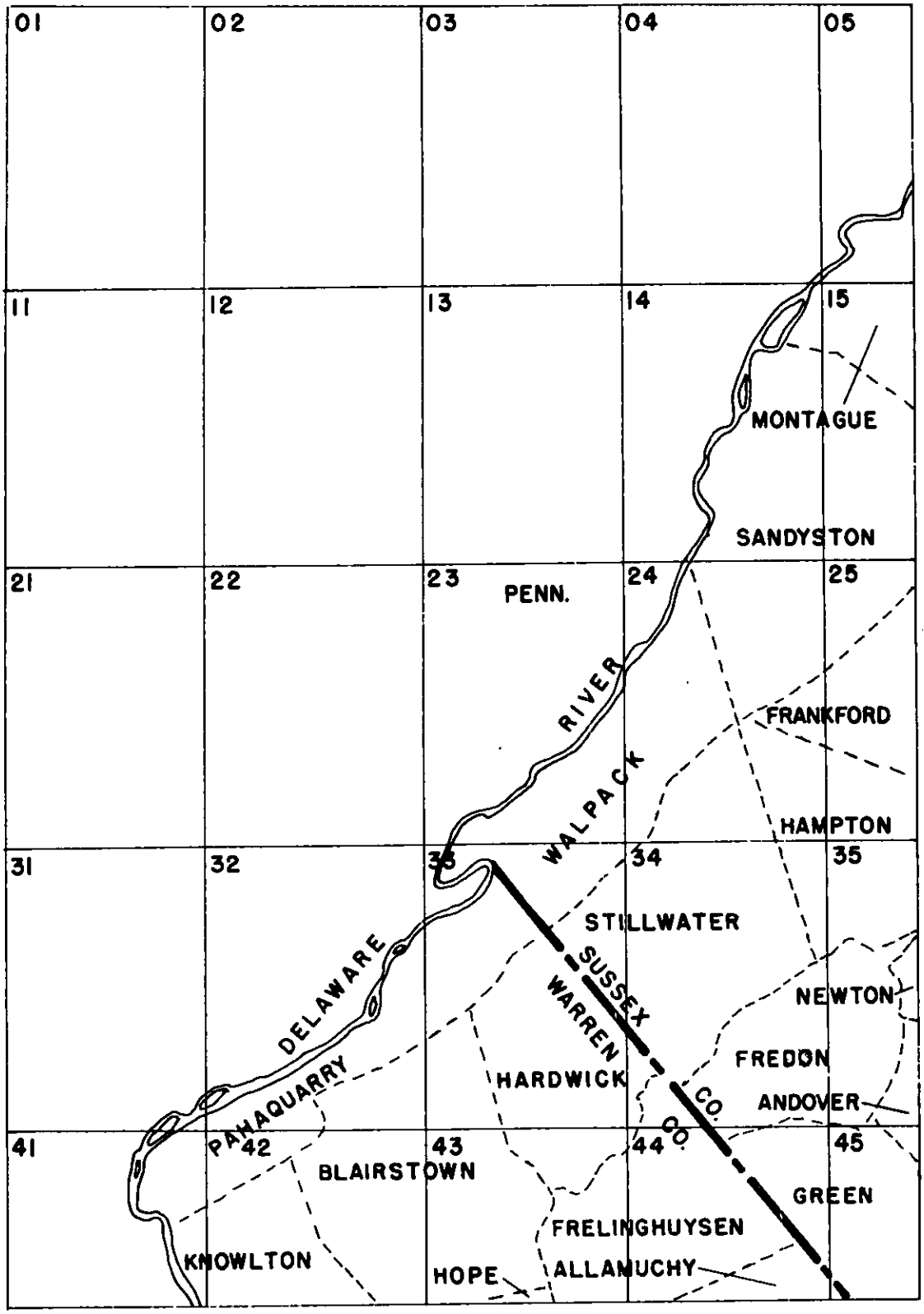
The modern soil survey concerns itself with slope, water table, and other characteristics of the soil material. The classification and naming of the agricultural soils is less complex than the original New Jersey Soil Survey. For the very latest information consult your County Agricultural Agent or the U.S. Soil Conservation Service.

Environmental and ecological studies should also be concerned with what is growing on the soil. In this connection, two books: Agriculture in New Jersey by Hubert G. Schmidt and Vegetation of New Jersey by Beryl Robichaud and Murray F. Buell, published by Rutgers University Press in 1973, should prove helpful.

An Appendix at the back of this Bulletin is a gazeteer of New Jersey townships showing the required four digit locator code - Atlas Sheet and Block numbers - to secure complete coverage for maps in LORDS.

It is believed that the work completed so far indicates that LORDS is compatible with other land use data systems, makes the maximum use of available files in various state agencies, is flexible enough to permit retrieval from many different points of view, and is capable of quick and easy expansion whenever the need arises. Comments, criticism, and suggestions will be welcomed as the system coverage is expanded.

ATLAS SHEET *21



ATLAS SHEET #21 6/74

Counties on Map: Sussex, Warren.

U.S.G.S. 7.5' Quads Covered: Blairstown, Bushkill, Culvers Gap, Flatbrookville, Lake Maskenozha, Newton West, Portland, Stroudsburg, Tranquility, Milford.

County in Brief Series: Sussex, Warren.

Soil Conservation Service Reports: Sussex, Warren (all on open file in county seats).

Engineering Soil Surveys of New Jersey: Report #11 Sussex; Report #13 Warren.

Water Resource Data Sources:

1. Sussex County Master Plan and Summary, Sussex County Board of Chosen Freeholders, Newton, N.J., 1970.
2. Sewage Feasibility Study for Sussex County, N.J., Sussex County Board of Chosen Freeholders, Newton, N.J., 1967.
3. Feasibility Report on Regional Sewerage Facilities, Warren County, N.J., Warren County Board of Chosen Freeholders, Belvidere, N.J., 1968.
4. Feasibility Study for Potable Water Facilities, Warren County, N.J., Warren County Board of Chosen Freeholders, Belvidere, N.J., 1969.
5. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Department, Newark, N.J.

Special Reports:

1. Bulletin #73, "Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area," Miller, J.; 1974.
2. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J.; 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Area within each category is given with block descriptions.

Population Data Sources: New Jersey County and Municipality Work Sheets, Pt. 1 (1971), New Jersey Department of Community Affairs

Geologic Overlay: Available in 1974.

Physiographic Provinces: Appalachian Valley and Ridge Province - Kittatinny Ridge, Kittatinny Valley; Reading Prong of the New England Physiographic Province - New Jersey Highlands.

Geology:

Major geomorphic patterns trend northeast-southwest.

Most of area is within the Appalachian Ridge and Valley Province the formations of which have undergone folding and differential erosion. Kittatinny Mountains are rugged, comparatively level-topped ridges made up of quartzite conglomerate and sandstone. Elevation ranges from 1600-1800'. Kittatinny Valley has two levels. Areas underlain by shale have been more resistant to weathering and erosion and are generally 200-400' higher than those parts of the valley underlain by limestone. Elevations in the valley range from 400-900'.

A small portion of the area is within the Highlands Province, an area of Precambrian gneissic rocks. Elevations about 1000'.

Entirely glaciated during Wisconsin advance. Topographic features and drainage affected by glaciation.

Economic deposits include sand and gravel, cement rock, and slate.

Climate:

Average annual precipitation:

Normal year:	43" in northeast to 46" in southwest
Wet year:	57" in northeast to 64" in southwest
Dry year:	34" in northeast to 29" in southwest

Mean temperature:	Winter months:	28°F
	Summer months:	72°F

January coldest month; July warmest month.

Average duration of growing season: 220 days. Last killing frost: 4/30; first killing frost: 9/13.

Northwesterly winds prevail during winter months; southwesterly winds prevail during summer months.

Drainage Basins:

Delaware Basin (Vancampens Brook, Shimmers Brook, Flat Brook, Paulins Kill, Delawanna Creek, Pequest River, and Musconetcong River)

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Sussex County:			
Brighton Lake, Green	---	20	---
Culvers Lake, Frankford	---	692	---
Fairview Lake, Stillwater	---	75	---
Harding Lake, Walpack	---	40	---
Hunts Pond, Fredon	---	30	---
Kittatinny Lake, Sandyston	---	73	---
Lake Ashroe, Sandyston	---	20	---
Lake Kemah, Hampton	---	109	---
Lake Owassa, Frankford	---	265	---
Little Swartswood Lake, Hampton	---	75	---
Muckshaw, Fredon	---	30	---
Paulins Kill Lake, Hampton	---	157	---
Quick Pond, Stillwater	---	43	---
Swartswood Lake, Stillwater	16.3	494	---
Tranquility Lake, Green	---	25	---
Warren County:			
Bass Lake, Hardwick	---	34	---
Catfish Pond, Pahaquarry	---	31	---
Cedar Lake, Blairstown	---	29	---
Silver Lake, Hope	---	59	---
Sunfish Pond, Pahaquarry	---	41	---
Upper Reservoir, Blairstown	---	164	---
White Pond, Hardwick	---	67	---

Sources:

1. The New Jersey Almanac and Travel Guide (1966-67), 2nd edition.
2. Geological Survey of New Jersey, Vol. III, Water Supply, 1894.
3. Lakes and Ponds Inventory, Division of Parks, Forestry and Recreation, March, 1970.

Water Companies Listed in:

1. Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area, N.J.G.S. Bull.#73, J. Miller, 1974.
2. Feasibility Study for Potable Water Facilities, Warren County, N.J., Warren County Board of Chosen Freeholders, Belvidere, N.J., 1969. pg. 87-104, Table 20.

Ground Water:

Ground water occupies pore space of unconsolidated formations and pore space, joints, faults, and solution cavities of consolidated rock. Recovery is mostly from consolidated rock.

Recovery Rates from Rock Types (gpd/sq.mi.):

1. Normal year 150,000, dry year less than 100,000
   a) Gabbro
   b) Martinsburg, Green Pond, Esopus, Skunnemunk Fms.
2. Normal year 200,000; dry year 120,000
   a) Unweathered gabbro, granite, Byram, Losee, and Pochuck Gneisses (specifically biotite gneiss, amphibolite, microcline gneiss, sillimanite gneiss, pyroxene granite, skarn and syenite)
   b) Hardyston, Longwood, High Falls, Kanouse, Bellvale and Pequanac Fms.
3. Normal year 250,000, dry year 170,000
   a) Granite, Byram, Losee, and Pochuck gneisses, (specifically alaskite, hornblende granite, hypersthene-quartz-andesine gneiss, quartz-oligoclase gneiss, granodiorite gneiss, pyroxene gneiss)
   b) Franklin Limestone
   c) Dolomitic Kittatinny (specifically Allentown and Epler Fms.), Decker, Bossardville, Martinsburg, Rondout, Poxono Island, Marcellus, New Scotland, Stormville and Port Ewen Fms.
4. Normal year 300,000; dry year 200,000
   a) Weathered precambrian rocks (granite, Byram, Losee, and Pochuck gneisses (specifically biotite gneiss, amphibolite, sillimanite gneiss, pyroxene granite, skarn and graphite schist)
   b) Jacksonburg, Oriskany, Becraft, Coeymans, Kittatinny (Lower Allentown, Rickenback), Tuff.
5. Normal year 350,000; dry year 225,000
   a) Kittatinny Limestone (specifically Leithsville Fm. in Hunterdon and Warren Counties)

Recommended Minimum Lot Sizes for Well and Septic Tank in acres:

Precambrian Gneiss	3.0-4.0*
Marcellus Shale, Onondaga Limestone	3.0-4.5
Esopus Grit	3.0-4.5
Oriskany & Becraft Limestone	3.0-4.5
New Scotland, Stormville, and Coeymans Formation	3.0-4.5
Manlius Shale, Rondout, Decker, Bossardville, Poxono Island	3.0-4.5
High Falls Formation	1.5-2.0
Shawangunk Conglomerate	3.0-4.0*
Martinsburg Shale	3.0-4.5
Kittatinny Limestone	1.5-3.0
Stratified Drift	1.0-1.5

*In certain areas of non-fractured rocks even 3-4 acres may be too small a minimum lot size.

Runoff of streams with drainage area less than 100 sq.mi. (Formations same as in Recovery Rates from Rock Types, identified with the same numbers)

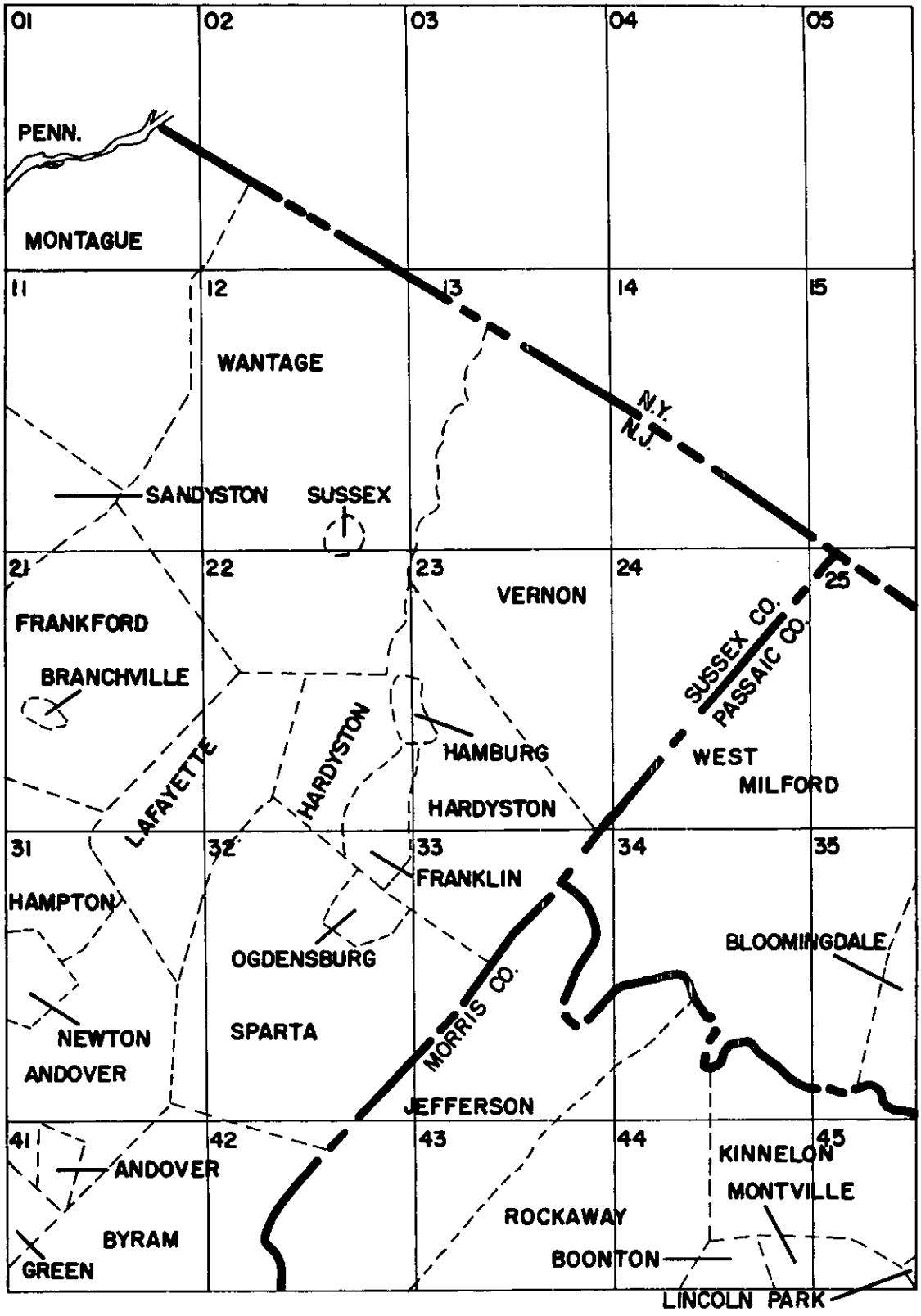
Formation	Peak (cu.ft./sec/sq.mi.)	Drought (gal./min/sq.mi.)
1	1300	1.0
2	1100	Less than 2.6
3	950	3.8
4	800	5.0
5	500	20.0

Historic Sites: None

State Owned Land:

Swartswood State Park (21 - 34)
Stokes State Forest (21 - 24, 25, 15)
Worthington Tract (21-41, 31, 32)
Hainesville Fish and Game Area (21 - 15)
Flatbrook Fish and Game Area (21 - 24, 14)
Roy Fish and Game Area (21 - 24)
Walpack Fish and Game Area (21 - 23)
Whittingham Fish and Game Area (21 - 44, 45, 34, 35)

ATLAS SHEET 22



ATLAS SHEET #22 6/74

Counties on Map: Sussex, Morris, Passaic.

U.S.G.S. 7 1/2' Quads Covered: Boonton, Branchville, Culvers Gap, Dover, Franklin, Greenwood Lake, Hamburg, Milford, Newfoundland, Newton East, Newton West, Pine Island, Pompton Plains, Port Jervis South, Stanhope, Tranquility, Unionville, Wanaque, Wawayanda.

County in Brief Series: Sussex, Morris.

Soil Conservation Service Reports: Sussex, Morris, Passaic (all on open file in county seats)

Engineering Soil Surveys of New Jersey: Report #11 Sussex, Report #9 Morris, Report #3 Passaic.

Water Resource Data Sources:

1. Morris County Master Plan (1970)
   a) Water supply element
   b) Sanitary sewerage facilities element
   Morris County Planning Board, Court House, Morristown, N.J.
2. Sewage Feasibility Study for Sussex County, N.J. (1967)
   Sussex County Board of Chosen Freeholders, Newton, N.J.
3. Passaic County Sewerage Study and Water Study, Passaic County Board of Chosen Freeholders, Paterson, N.J.
4. Fire Insurance Maps, Fire Insurance Rating Organization of N.J., Engineering Department, Newark, N.J.

Special Reports:

1. Division of Water Resources, Special Report #25, "Availability of Ground Water in Morris County, N.J.," Gill, Harold E., Vecchioli, J.; 1965.
2. Water Resources Circular #23, Statistical Summaries of New Jersey Streamflow Records, 1970.
3. Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area, N.J.G.S. Bull.#73, J. Miller, 1974.
4. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Source: N. J. County and Municipality Work Sheets, Pt.1 (1971), N.J. Department of Community Affairs.

Geologic Quadrangle Maps: Geology of Franklin and Part of the Hamburg Quadrangles, N.J.; U.S.G.S. Map I-346; 1961; A. F. Buddington and D. R. Baker.

Geologic Overlay: Overlay is available for Atlas Sheet 22 showing the geology of the Atlas Sheet area. This information is the same as that shown on any particular Atlas Sheet 22 coordinate block.

Physiographic Provinces: Appalachian Valley and Ridge Province, Reading Prong of the New England Physiographic Province - The New Jersey Highlands.

Geology

Located in Highlands Physiographic Province.
Made up of plateaus of crystalline, igneous, and metamorphic rocks, separated by deep narrow valleys underlain by less resistant limestone and shales.

Most of the area underlain by coarse-grained resistant Precambrian gneisses, originally sediments metamorphosed due to extreme heat and pressures associated with burial, folding and faulting, and igneous intrusion.

Northwestern portion of block is underlain by Cambrian, Ordovician, Silurian, and Devonian sediments. These sandstones, shales, and conglomerates were deposited during periodic transgressions by warm shallow seas. Folding and faulting partly due to Taconic Disturbance in late Ordovician.

Entire area glaciated and north of Wisconsin terminal moraine.

General elevations: ridges 900 to 1400'; valleys 350 to 1000'. Slopes and valley sides steep and rough.

Economically valuable deposits include: sand and gravel, granite gneiss, quartzite conglomerate, clay, and magnetite.

Climate:

Average annual precipitation:

Normal year:	43" in northwest to 50" in southeast
Wet year:	57" in northwest to 73" in southeast
Dry year:	34" in northwest to 38" in southeast

Mean temperature:

Winter Months:	25°F to 29°F
Summer Months:	70°F to 72°F

January coldest month; July warmest month.

Average duration of growing season: 224 days. Last killing frost: 4/1; first killing frost: 11/10.

Winter months - northwesterly winds prevail; summer months - southwesterly winds prevail.

Drainage Basins:

Delaware River (Shimmers Brook, Flat Brook, Paulins Kill, Pequest and Musconetcong Rivers)

Passaic River (Wanaque, Pequannock, Rockaway and Pompton Rivers)

Wallkill River (Pochuck, Papakating, and Wallkill Rivers)

Principal Lakes and Reservoirs (over 20 acres surface area):

	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Boonton	119	780	7.6
Canistear	5.6	350	2.4
Charlottesburg	56.2	375	2.9
Clinton	10.2	423	3.5
Echo Lake	4.4	282	1.9
Green Pond	1.7	460	---
Greenwood Lake	27.1	1920	10.6
Lake Hopatcong	25.6	2443	15.6
Morris Pond	1.5	136	---
Oak Ridge	27.3	415	3.8
Splitrock Pond	5.0	566	3.3

Sources:

1. Geological Survey of New Jersey, Vol. III, Water Supply, 1894.
2. "Reservoir Site Capacity Is Running Out in New Jersey," Rutgers Public Policy Forum, New Jersey Water Resources, Donald J. Kroeck, 1966.
3. "Lakes and Ponds Inventory," Division of Parks and Forestry, Comprehensive Recreation Planning Section, 1970.

Water Companies Are Listed in:

1. Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area, N.J.G.S. Bull.#73, J. Miller, 1974.
2. Morris County Master Plan, Water Supply Element, Pg. 7 and Plate 1.
3. Passaic County Water Study, Pgs. 53 and 134.

Ground Water:

Recovery is from pore space within unconsolidated deposits and from pore space, joints, faults, and solution openings within consolidated rocks. Most ground water in this region is recovered from consolidated rocks.

Recovery Rates from Rock Types (gpd/sq.mi.):

1. Normal year 150,000, dry year less than 100,000
   a) Gabbro
   b) Martinsburg, Green Pond, Esopus, Skunnemunk Fms.
2. Normal year 200,000; dry year 120,000
   a) Unweathered gabbro, granite, Byram, Losee, and Pochuck Gneisses (specifically biotite gneiss, amphibolite, microcline gneiss, sillimanite gneiss, pyroxene granite, skarn and syenite)
   b) Hardyston, Longwood, High Falls, Kanouse, Bellvale, and Pequanac Fms.
3. Normal year 250,000; dry year 170,000
   a) Granite, Byram, Losee, and Pochuck gneisses (specifically alaskite, hornblende granite, hypersthene-quartz-andesine gneiss, quartz-oligoclase gneiss, granodiorite gneiss, pyroxene gneiss)
   b) Franklin Limestone
   c) Dolomitic Kittatinny (specifically Allentown and Epler Fms.), Decker, Bossardville, Martinsburg, Rondout, Poxono Island, Marcellus, New Scotland, Stormville and Port Ewen Fms.
4. Normal year 300,000; dry year 200,000
   a) Weathered Precambrian rocks (granite, Byram, Losee, and Pochuck gneisses (specifically biotite gneiss, amphibolite, sillimanite gneiss, pyroxene granite, skarn and graphite schist)
   b) Jacksonburg, Oriskany, Becraft, Coeymans, Kittatinny (Lower Allentown, Rickenback), Tuff

Recommended Lot Size for Well and Septic Tank in acres:

Precambrian Crystallines & Schists	3.0-4.0*
Poxono Island Shale	3.0-4.5
High Falls Formation	1.5-2.0
Shawangunk Formation	3.0-4.0*
Stratified Drift	1.0-1.5
Kittatinny Limestone	1.5-3.0
Martinsburg Shale	3.0-4.5
Oriskany Limestone	3.0-4.5

*In certain areas of non-fractured rock, even 3-4 acres may be too small a minimum lot size.

Runoff of streams with drainage area less than 100 sq.mi. (Formations same as in Recovery Rates from Rock Types, identified with the same numbers)

Formation	Peak (cu.ft./sec/sq.mi.)	Drought (gal./min/sq.mi.)
1	1300	1.0
2	1100	Less than 2.6
3	950	3.8
4	800	5.0

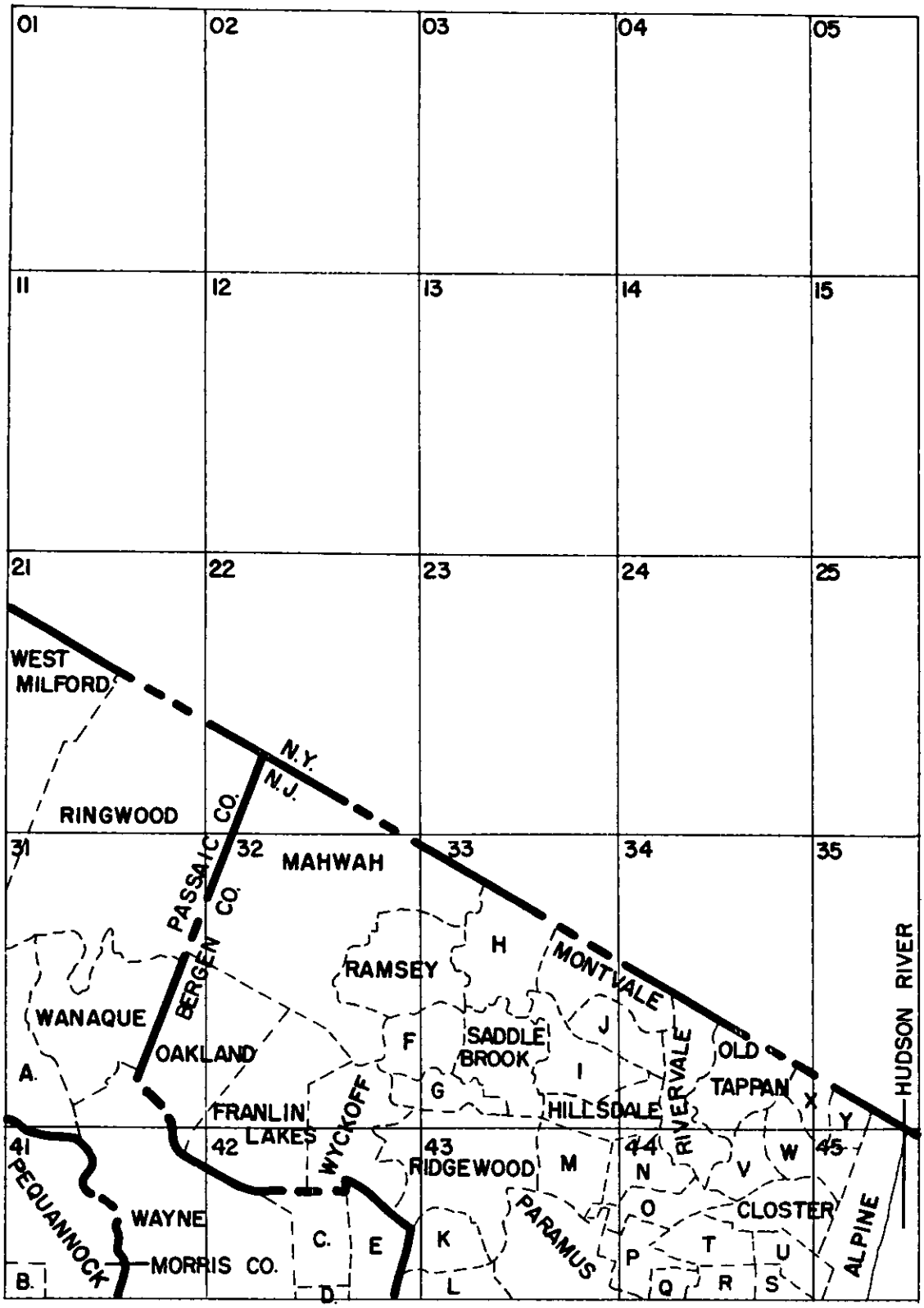
Historic Sites:

Sussex County:
Henry W. Merriam House, 131 Main St., Newton

State Owned Land:

Norvin Green State Forest (22 - 34, 35)
High Point State Park, along and north of Kittatinny Ridge (22-01,02,11)

ATLAS SHEET 23



A. BLOOMINGDALE
B. LINCOLN PARK
C. NORTH HALEDON
D. HALEDON
E. HAWTHORNE
F. ALLENDALE
G. WALDWICK
H. UPPER SADDLE RIVER
I. WOODCLIFF LAKE
J. PARK RIDGE
K. GLEN ROCK
L. FAIRLAWN
M. WASHINGTON
N. WESTWOOD
O. EMERSON
P. ORADELL
Q. NEW MILFORD
R. DUMONT
S. CRESSKILL
T. HAWORTH
U. DEMAREST
V. HARRINGTON PARK
W. NORWOOD
X. NORTHVALE
Y. ROCKLEIGH

ATLAS SHEET #23 6/74

Counties on Map: Bergen, Morris, Passaic.

U.S.G.S. 7.5' Quads Covered: Greenwood Lake, Hackensack, Nyack, Park Ridge, Paterson, Pompton Plains, Ramsey, Wanaque, Yonkers, Sloatsburg.

County in Brief Series: Morris

Soil Conservation Service Reports: Bergen, Morris, Passaic (all on open file in county seats)

Engineering Soil Surveys of New Jersey: Report #3 Passaic; Report #4 Bergen and Hudson; Report #9 Morris.

Water Resource Data Sources:

1. Morris County Master Plan (1970), Morris County Planning Board, Court House, Morristown, N.J.
   a) Water Supply Element
   b) Sanitary Sewerage Facilities Element
2. Bergen County Comprehensive Plan (1970); Bergen County Planning Board, Hackensack, N.J.
   a) Report #13 - Water Facilities
   b) Report #12 - Sewer Facilities
3. Passaic County Master Plan (1968); Passaic County Board of Freeholders, Paterson, N.J.
   a) Passaic County Water Study
   b) Passaic County Sewerage Study
4. Passaic River Basin Water Resources Development Information Bulletin (1968), U. S. Army Engineer District, New York, Corps of Engineers and Department of Conservation and Economic Development, State of New Jersey.
5. Water Resources Resume, Geologic Report Series #10, N.J.G.S., Department of Conservation and Economic Development, 1968.
6. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Department, Newark, N.J.

Special Reports:

1. Division of Water Resources, Special Report #25, "Availability of Ground Water in Morris County, N.J.;" Gill, Harold E., Vecchioli, J.; 1965.
2. Water Resources Circular #23, "Statistical Summaries of New Jersey Streamflow Records," 1970.
3. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:
Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Source: N.J. County and Municipality Work Sheets, Pt.1 (1971), N.J. Department of Community Affairs.

Geologic Overlay: Available in 1974.

Physiographic Provinces: Reading Prong of the New England Physiographic Province - The New Jersey Highlands; Piedmont - Triassic Lowlands.

Geology:
Both Highlands and Lowlands have poor water bearing strata.

Entire area affected by Pleistocene glaciation.

Highland belt is within Reading Prong of New England Physiographic Province. It is a relatively level plateau of Precambrian igneous and metamorphic rocks. Elevations range from 1000 to 1200'.

Border between Highlands and Piedmont marked by nearly straight fault-line valley.

Most of area in Piedmont. Characterized by gently rolling hills, wide valleys, isolated "peaks." Elevation ranges from sea level to 900'. Triassic Brunswick Formation predominates. Diabase and basalt date from the late Triassic Palisades Disturbance.

Economic deposits include: diabase and basalt used for concrete, road metal, and railroad ballast; Stockton sandstone (brownstone) used in building construction.

Climate:
Average annual precipitation:

Normal year:	49" in northwest to 45" in southeast
Wet year:	65" in northwest to 53" in southeast
Dry year:	35" in northwest to 41" centrally to 38" in southeast

Mean temperature: Winter months: 27.4°F
Summer months: 67.7°F

January coldest month; July warmest month.

Average duration of growing season: 142 days. Last killing frost: 5/7; first killing frost: 9/26.

Northwesterly winds prevail during winter months; southwesterly winds prevail during summer months.

Drainage Basins:

Passaic Basin (Ramapo, Wanaque, Pompton, Upper Passaic, Lower Passaic, Saddle Rivers)

Hackensack Basin (Pascack Creek, Hackensack River)

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Bergen County:			
Franklin Lake, Franklin Lakes	-	87	-
Franklin Pond, Franklin Lakes	-	76	-
Haledon Reservoir, Franklin	-	30	-
Lake Tappan Reservoir, Rivervale, Old Tappan	-	550	-
Oradell Reservoir, Haworth	115	620	2.8
Ramapo Lake, Oakland	-	50	-
Riverdale Reservoir, Rivervale	-	1255	-
Schlegel Lake, Washington	-	27	-
Washington Lake, Washington	-	25	-
Woodcliff Lake, Woodcliff Lake	20	170	0.8
Morris County:			
Unnamed Pond, Pequannock	-	25	-
Passaic County:			
Cupsaw Lake, Ringwood	-	67	-
Erskine Lake, Ringwood	-	115	-
Greenwood Lake, West Milford	-	1920	-
Glen Wild Lake, Bloomingdale	-	103	-
Lake Inez, Wanaque	-	49	-
Lake Iosco, Bloomingdale	-	69	-
Packanack Lake, Wayne	-	84	-
Pines Lake, Wayne	-	147	-
Point View Reservoir, Wayne	-	513	-
Pompton Lake, Pompton Lakes	160	204	-
Ramapo Lake, Wanaque	-	50	-
Sheppard Pond, Ringwood	-	74	-
Skyline Lakes, Ringwood	-	31	-
Wanaque Reservoir, Wanaque	90.4	2310	30

Sources:

1. N.J. Geol. Survey Vol. 3, "Report on Water Supply," Vermeule, C.C., 1894.
2. N.J. Dept. of Conservation and Economic Development, Comprehensive Recreation Planning Section, "Lakes and Ponds Inventory," 1970.

Water Companies Are Listed in:

1. Water Resources Resume, Geologic Report Series #10, 1966, New Jersey Geological Survey, Department of Conservation and Economic Development, pp. 12-15, Figure 3.
2. Passaic County Master Program - Water Study, 1969, Passaic County Board of Freeholders, Paterson, N.J., pp. 99-174.
3. Bergen County Comprehensive Plan - Water Facilities Final Report #13, 1970, Bergen County Planning Board, Hackensack, N.J., pp. 84-129, Table 6.
4. Morris County Master Plan - Water Supply Element, 1969-70, Morris County Planning Board, Morristown, N.J., pg. 7, Plate 1.

Ground Water:

Major sources are the Brunswick Formation and unconsolidated river valley deposits. Precipitation infiltrates through overburden and is stored in fractures, interstices, and voids.

Recovery Rates from Rock Types (gpd/sq.mi.):

1. Normal year 150,000, dry year less than 100,000
   a) Gabbro
   b) Triassic conglomerate, silty Brunswick of Saddle River Valley
2. Normal year 200,000; dry year 120,000
   a) Unweathered gabbro, granite, Byram, Losee, and Pochuck Gneisses (specifically biotite gneiss, amphibolite, microcline gneiss, sillimanite gneiss, pyroxene granite, skarn and syenite)
   b) Hardyston, Longwood, High Falls, Kanouse, Bellvale, and Pequanac Fms.
   c) Diabase dikes (where of hydrologic significance)
3. Normal year 250,000, dry year 170,000
   a) Granite, Byram, Losee, and Pochuck gneisses (specifically alaskite, hornblende granite, hypersthene-quartz-andesine gneiss, quartz-oligoclase gneiss, granodiorite gneiss, pyroxene gneiss)
   b) Franklin Limestone
   c) Triassic igneous rocks (diabase, basalt, volcanic breccia)
   d) Stockton Fm.
4. Normal year 300,000, dry year 200,000
   a) Weathered Precambrian rocks (granite, Byram, Losee, and Pochuck gneisses (specifically biotite gneiss, amphibolite, sillimanite gneiss, pyroxene granite, skarn and graphite schist)
5. Normal year 350,000, dry year 225,000
   a) Brunswick Fm.

Recommended Minimum Lot Sizes for Well and Septic Tank in acres:

Precambrian Crystalline Rocks	3.0-4.0*
Triassic basalt flows	2.0-2.5
Brunswick Formation	1.0-1.5
Wisconsin Stratified Drift	1.0-1.5
Triassic Diabase	2.5-3.0
Stockton Formation	1.5

*In certain areas of non-fractured rocks even 3-4 acres may be too small a minimum lot size.

Runoff of streams with drainage area less than 100 sq.mi. (Formations same as in Recovery Rates from Rock Types identified with the same numbers)

Formation	Peak (cu.ft./sec/sq.mi.)	Drought (gal./min/sq.mi.)
1	1300	1.0
2	1100	Less than 2.6
3	950	3.8
4	800	5.0
5	500	20.0

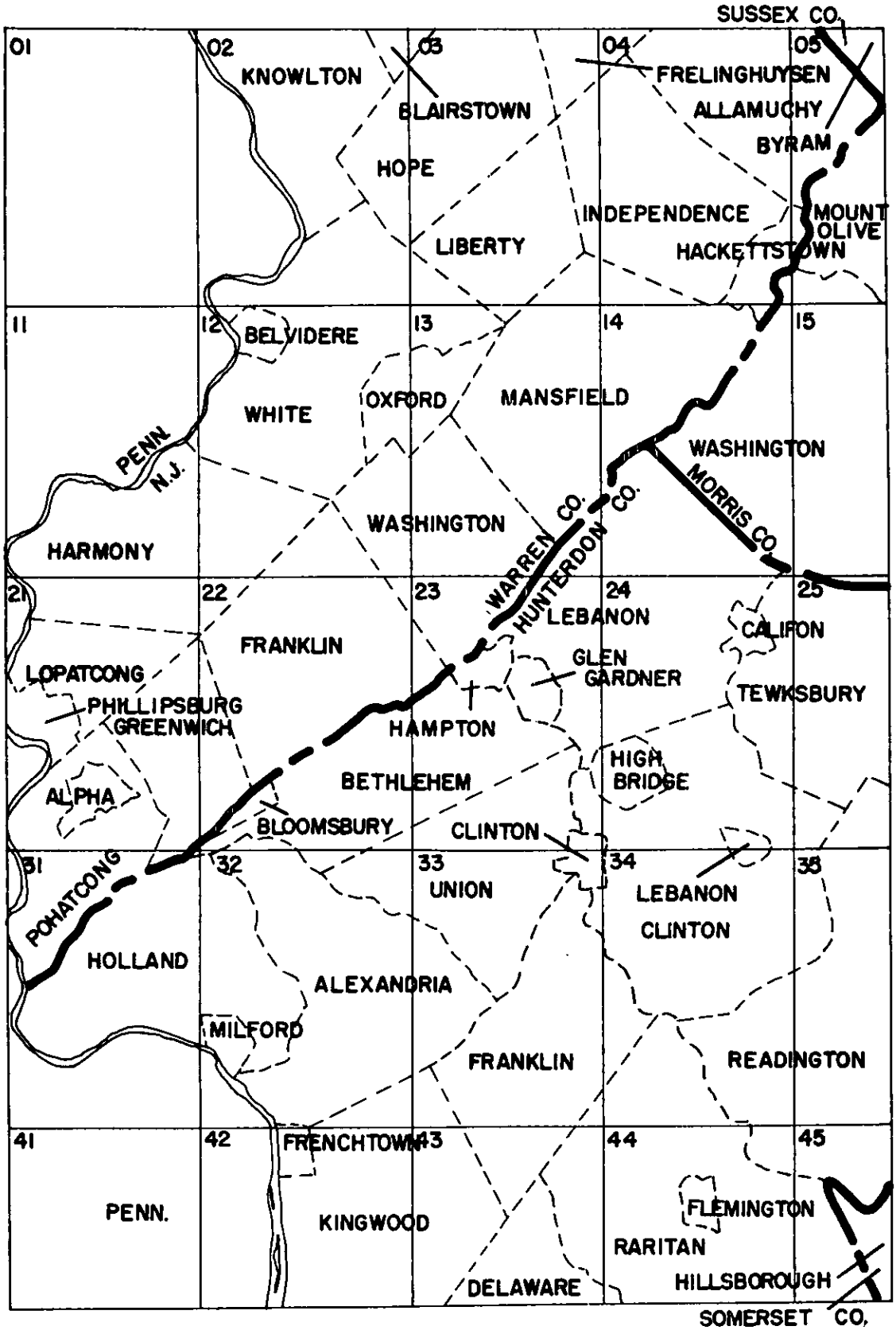
Historic Sites:

Bergen County:
The Hermitage, 335 North Franklin Turnpike, Ho-Ho-Kus
Palisades Interstate Park, west bank of the Hudson River
Wortendyke Barn, Park Ridge
Seven Chimneys, 25 Chimney Ridge Road, Westwood
Van Horn House, 398 Ramapo Valley Road, Mahwah
Terhune/Gardner/Lindenmeyer House, Paramus
Passaic County:
Ringwood Manor, Ringwood State Park, Hewitt vicinity

State Owned Land:

Ringwood Manor State Park (23 - 21)
Ramapo State College (23 - 32)
Alpina Tract (23 - 45)
Norvin Green State Park (23 - 31)

ATLAS SHEET # 24



ATLAS SHEET #24 6/74

Counties on Map: Hunterdon, Morris, Somerset, Sussex, Warren.

U.S.G.S. 7.5' Quads Covered: Bangor, Bedminster (Pa.), Belvidere, Blairstown, Bloomsbury, Califon, Easton, Flemington, Frenchtown, Hackettstown, High Bridge, Hopewell, Lumberville, Pittstown, Portland, Riegelsville, Stockton, Stroudsburg, Tranquility, Washington.

County in Brief Series: Hunterdon, Morris, Sussex, Warren.

Soil Conservation Service Reports: Hunterdon, Morris, Somerset, Sussex, Warren (all on open file in county seats)

Engineering Soil Surveys of New Jersey: Report #6 - Hunterdon; Report #7 - Somerset; Report #9 - Morris; Report #11 - Sussex; Report #13 - Warren.

Water Resource Data Sources:

1. Morris County Master Plan (1970), Morris County Planning Board, Court House, Morristown, N.J.
   a) Water Supply Element
   b) Sanitary Sewerage Facilities Element
2. Sewerage Feasibility Study for Sussex County, New Jersey (1967), Sussex Board of Chosen Freeholders, Newton, N.J.
3. A Master Sewage Plan for the Upper Raritan and Delaware Watersheds within Hunterdon, Morris, and Somerset Counties, New Jersey (1970), Board of Chosen Freeholders, Hunterdon, Morris, and Somerset Counties and the Department of Environmental Protection, N.J.
4. Hunterdon County Master Plan (1967), Report #4 - Ground and Surface Water, Hunterdon County Planning Board, Flemington, N.J.
5. Sewerage Systems Report: Somerset County, New Jersey (1972), Somerset County Planning Board, Somerville, N.J.
6. Sussex County Master Plan and Summary (1970), Board of Chosen Freeholders and Planning Board, Sussex County, N.J.
7. Warren County Master Plan (1968-69), Warren County Board of Chosen Freeholders, Belvidere, N.J.
   a) Feasibility Study for Potable Water Facilities
   b) Feasibility Report on Regional Sewerage Facilities
8. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Department, Newark, N.J.

Special Reports:

1. Bulletin #47, "Continuity of the Hardyston Formation in the Vicinity of Phillipsburg, New Jersey;" Ludlum, John C.; 1940.
2. Bulletin #60, "Geology and Mineralogy of the Manganese Deposits at Clinton Point, New Jersey;" (Short Geologic Papers); Thurston, William R.; 1951.

3. The Geology of Spruce Run Valley (Pamphlet); Widmer, Kemble.
4. Division of Water Resources, Special Report #24, "Geology and Ground Water Resources of Hunterdon County, N.J.;" Kasabach, Haig; 1966.
5. Division of Water Resources, Special Report #25, "Availability of Ground Water in Morris County, N.J.;" Gill, Harold E.; Vecchioli, John; 1965.
6. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J.; 1973.

Water Quality Standards:
Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Sources: N.J. County and Municipality Work Sheets, Pt. 1 (1971), New Jersey Department of Community Affairs.

Geologic Quadrangle Maps:
Geology of the Frenchtown Quadrangle, New Jersey-Pennsylvania; U.S.G.S. Map - 133; Drake, Jr., Avery A.; McLaughlin, Dean B.; Davis, Robert E.; 1961.

Geology of the Bloomsbury Quadrangle, New Jersey; U.S.G.S. Map - 595; Drake, Jr., Avery A.; 1967.

Geology of Riegelsville Quadrangle, New Jersey-Pennsylvania; U.S.G.S. Map - 593; Drake, Jr., Avery A.; et al; 1967.

Geologic Map and Sections of Parts of the Portland and Belvidere Quadrangles, New Jersey-Pennsylvania; Avery A. Drake, Jr.; U.S.G.S.Map-I 552; Jack B. Epstein; John M. Aaron.

Geology of the Easton Quadrangle, New Jersey-Pennsylvania; U.S.G.S. Map - 594; Drake, Jr., Avery A.; 1967.

Geologic Map of the Bangor Quadrangle, Pennsylvania-New Jersey; U.S.G.S. Map - 665; Robert E. Davis; Avery A. Drake, Jr. and Jack B. Epstein; 1967.

Geologic Overlay: Not available.

Physiographic Provinces: Appalachian Valley and Ridge Province - Kittatinny Valley; Reading Prong of New England Physiographic Province - New Jersey Highlands; Piedmont - Triassic Lowlands.

Geology:

Most of atlas sheet is in Highlands Physiographic Province, a plateau underlain by Precambrian igneous and metamorphic rocks and small areas of Paleozoic sedimentary rocks. All units have been extensively folded and faulted.

The southern third of the atlas sheet lies within the Triassic Lowlands. Gently folded, Triassic shales, sandstones, and argillites generally dip northwestward and are intruded by diabase. A major fault separates the Highlands and Piedmont. Triassic conglomerates along this border demonstrate uplift northwest of this fault during the Triassic.

Wisconsinan terminal moraine extends from Buttzville to Budd Lake, marking the southern limit of glacial advance.

Economically valuable deposits include: sand and gravel, marble, peat, brownstone, manganese (Clinton), traprock, and granite gneiss.

Climate:

Average annual precipitation:
Normal year: 44" in northwest to 48" centrally to 44" in southwest
Wet year: 63" in northwest to 53" in southwest
Dry year: 31" in northwest to 36" in southwest

Mean temperature: Winter months: 28.6°F
Summer months: 70.8°F

January coldest month; July warmest month.

Average Duration of Growing Season:
North: 163 days. Last killing frost: 5/3; first killing frost: 10/13
South: 187 days. Last killing frost: 4/23; first killing frost: 10/27

Winter months-northwesterly winds prevail; summer months-southwesterly winds prevail.

Drainage Basins:

Raritan River (North Branch, South Branch)

Delaware River Basin (Vancampen's Brook, Lockatong Creek, Musconetcong River, Paulins Kill River, Pequest River, Lopatcong Creek, Delawanna Creek, and Pohatcong Creek)

Principal Lakes and Reservoirs (over 20 acres surface area):

	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Silver Lake	3.3	35	---
Allamuchy Pond	1.8	56	---
Mountain Lake	1.0	70	---
Round Valley Reservoir	-	2350	---
Spruce Run Reservoir	-	1275	---

Sources:

1. Geological Society of New Jersey, Final Report of the State Geologist, Vol. III, Water Supply, 1894.
2. Unpublished Listing, New Jersey Dept. of Water Resources, Bureau of Geology and Topography.

Water Companies Are Listed in:

1. Morris County Master Plan - Water Supply Element, 1969-70, Morris County Planning Board, Morristown, N.J., pg. 7, Plate 1.
2. Feasibility Study for Potable Water Facilities, Warren County, N.J., Warren County Board of Chosen Freeholders, Belvidere, N.J., 1969, pp. 87-104, Table 20.
3. N.J.Geol.Surv.Bull.#73, "Geology and Ground Water Resources of Sussex County and the Warren County Portion of the Tocks Island Impact Area," Miller, J., 1974.
4. Hunterdon County Master Plan, Ground and Surface Water, 1967, pg. 88, 94, Table 15 (pg. 98).
5. Routine Inspection Reports for Public Water Supply - Somerset County, 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.

Ground Water:

Ground water is recovered mostly from quaternary deposits along the banks of the Delaware River and its tributaries, from terminal moraines, and from weathered igneous rocks.

Recovery Rates from Rock Types (gpd/sq.mi.)

1. Normal year 50-74,000, dry year 34-50,000
   a) Kittatinny Fm. in Buckhorn, Lopatcong, and Lower Pohatcong Valleys
2. Normal year 150,000, dry year less than 100,000
   a) gabbro, Manhattan Schist
   b) Martinsburg, Green Pond, Esopus, Skunnemunk Fms.
   c) Triassic conglomerate, Lockatong Fm.
3. Normal year 200,000, dry year 120,000
   a) Unweathered gabbro, granite, Byram, Losee, and Pochuck Gneisses (specifically biotite gneiss, amphibolite, microcline gneiss, sillimanite gneiss, pyroxene granite, skarn and syenite)
   b) Hardyston, Longwood, High Falls, Kanouse, Bellvale, and Pequanac Fms.
   c) Diabase dikes (where of hydrologic significance)
4. Normal year 250,000, dry year 170,000
   a) Granite, Byram, Losee, and Pochuck gneisses (specifically alaskite hornblende granite, hypersthene-quartz-andesine gneiss, quartz-oligoclase gneiss, granodiorite gneiss, pyroxene gneiss)
   b) Franklin Limestone
   c) Dolomitic Kittatinny (specifically Allentown and Epler Fms.), Decker, Bossardville, Martinsburg, Rondout, Poxono Island, Marcellus, New Scotland, Stormville and Port Ewen Fms.
   d) Stockton Fm.
   e) Triassic igneous rocks (diabase, basalt, volcanic breccia)

5. Normal year 300,000, dry year 200,000
   a) Weathered Precambrian rocks (granite, Byram, Losee, and Pochuck gneisses (specifically biotite gneiss, amphibolite, sillimanite gneiss, pyroxene granite, skarn and graphite schist)
   b) Jacksonburg, Oriskany, Becraft, Coeymans, Kittatinny (Lower Allentown, Rickenback), Tuff
6. Normal year 350,000, dry year 225,000
   a) Kittatinny Limestone (specifically Leithsville Fm. in Hunterdon and Warren Counties)
   b) Brunswick Fm.
   c) Pre-Wisconsinan glacial deposits

Recommended Minimum Lot Size for Well and Septic Tank in acres:

Precambrian gneiss	3.0-4.0*
Franklin Limestone	1.5-3.0
Kittatinny Limestone	1.5-3.0
Martinsburg Shale	3.0-4.5
Hardyston Sandstone	1.5-3.0
Jacksonburg Limestone	1.5-3.0
Brunswick Formation	1.0-1.5
Lockatong Formation	2.0-2.5
Stockton Formation	1.5
Triassic Diabase	2.5-3.0
Quaternary Stratified and Unstratified Drift	1.0-1.5

*In certain areas of non-fractured rocks, even 3-4 acres may be too small a minimum lot size.

Runoff of streams with drainage area less than 100 sq.mi. (Formations same as in Recovery Rates from Rock Types, identified with the same numbers)

Formation	Peak (cu.ft./sec/sq.mi.)	Drought (gal/min/sq.mi.)
1	2000	Less than .8
2	1300	1.0
3	1100	Less than 2.6
4	950	3.8
5	800	5.0
6	500	20.0

Historic Sites:

Hunterdon County:

Bray Hoffman House, Bray's Hill Road, Annadale

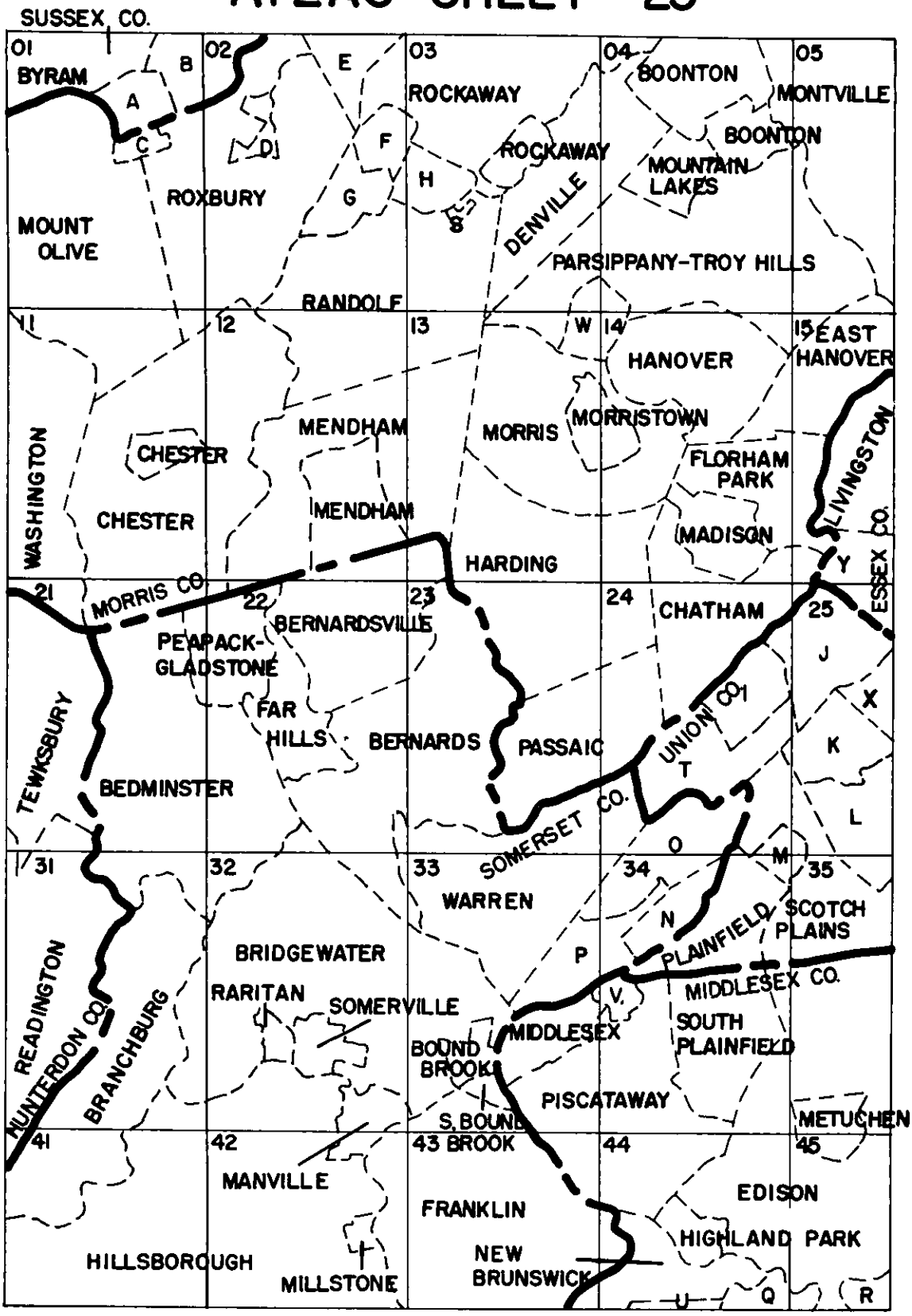
Warren County:

Oxford, Oxford Furnace, Washington Avenue, Cinder Street

State Owned Land:

Osmun Forest Natural Area (24 - 02)
Bursch Sugar Maple Natural Area (24 - 02)
Jenny Jump State Forest (24 - 02, 03, 04)
Stephens State Park (24 - 04, 05)
Voorhees State Park (24 - 23, 24)
Finesville State Park (24 - 31)
Hackettstown Hatchery (24 - 04)
Rockport Farm (24 - 13, 14)
Pequest Fish and Game Area (24 - 03, 13)
Lockwood Gorge Fish and Game Area (24 - 24)
Clinton Fish and Game Area (24 - 23)

ATLAS SHEET # 25



A. STANHOPE
B. HOPATCONG
C. NETCONG
D MOUNT ARLINGTON
E. JEFFERSON
F. WHARTON
G. MINE HILL
H. DOVER
I. NEW PROVIDENCE
J. SUMMIT
K. MOUNTAINSIDE
L. WESTFIELD
M. FANWOOD
N. NORTH PLAINFIELD
O. WATCHUNG
P. GREEN BROOK
Q. EAST BRUNSWICK
R SAYREVILLE
S. VICTORY GARDENS
T. BERKELEY HEIGHTS
U. NORTH BRUNSWICK
V. DUNELLEN
W. MORRIS PLAINS
X. SPRINGFIELD
Y. MILLBURN

ATLAS SHEET #25 6/74

Counties on Map: Essex, Hunterdon, Middlesex, Morris, Somerset, Sussex, Union.

U.S.G.S. 7.5' Quads. Covered: Bernardsville, Boonton, Bound Brook, Caldwell, Califon, Chatham, Chester, Dover, Flemington, Gladstone, Hackettstown, Hopewell, Mendham, Monmouth Junction, Morristown, New Brunswick, Perth Amboy, Pompton Plains, Plainfield, Raritan, Rocky Hill, Roselle, South Amboy, Stanhope, Tranquility.

County in Brief Series: Hunterdon, Morris, Sussex.

Soil Conservation Service Reports: Essex, Hunterdon, Middlesex, Morris, Somerset, Sussex, Union (all on open file in county seats).

Engineering Soil Surveys of New Jersey:
Report #2 - Essex; Report #5 - Union; Report #6 - Hunterdon; Report #7 - Somerset; Report #9 - Morris; Report #10 - Middlesex; Report #11 - Sussex.

Water Resource Data Sources:

1. Morris County Master Plan (1970), Morris County Planning Board, Court House, Morristown, N.J.
   a) water supply element
   b) sanitary sewage facilities element
2. Sewage Feasibility Study for Sussex County, N.J. (1967), Sussex County Board of Chosen Freeholders, Newton, N.J.
3. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Dept., Newark, N.J.
4. Hunterdon County Master Plan (1967), Report #4-Ground and Surface Water, Hunterdon County Planning Board, Flemington, N.J.
5. Catalog of Information on Water Data - Water Resources Region 02 (Middle Atlantic), (1972), U. S. Dept. of Interior, Office of Water Data Coordination.
   a) stream flow and stage
   b) quality of surface water
   c) quality of ground water
6. A Master Sewage Plan for the Upper Raritan and Delaware Watersheds within Hunterdon, Morris, and Somerset Counties, N.J.(1970); Boards of Chosen Freeholders, Hunterdon, Morris, and Somerset Counties and the Dept. of Environmental Protection, N.J.
7. Union County Master Plan Program, (1967), Union County Planning Board, Courthouse, Elizabeth, N.J.
   a) physical characteristics
   b) sewer and water plan
8. Sewerage Systems Report: Somerset County, N.J. (1972), Somerset County Planning Board, Somerville, N.J.
9. Sussex County Master Plan and Summary, (1970), Board of Chosen Freeholders and Planning Board, Sussex County, N. J.

10. Middlesex County Comprehensive Master Plan, (1972).
    a) Comprehensive Sewerage Plan - Phase 1
    b) Comprehensive Water Plan - Phase 1
    c) Appendix: Comprehensive Water Plan - Phase 1
    d) Appendix: Comprehensive Sewerage Plan - Phase 1
    e) Comprehensive Water Plan - Phases 2 and 3
    f) Comprehensive Sewerage Plan - Phases 2 and 3
    g) Recommended Water and Sewer Systems: Plans and Programs
    h) Storm Drainage Plan and Program

Information covering Essex County and eastern Union County is given with Atlas Sheet #26.

Special Reports:

1. Division of Water Resources, Special Report #24, "Geology and Ground Water Resources of Hunterdon County, N.J.;" Kasabach, Haig; 1966.
2. Division of Water Resources, Special Report #25, "Availability of Ground Water in Morris County, N.J.;" Gill, Harold E; Vecchioli, J.; 1965.
3. Division of Water Resources, Special Report #28, "Ground Water Resources of Essex County, N.J.;" Nichols, William D.; 1968.
4. Bulletin #24, "Soil Survey of the Bernardsville Area, N.J.;" Patrick, Austin L.; 1923.
5. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Source:

N. J. County & Municipality Work Sheets, Pt.1 (1971); N.J. Dept. of Community Affairs.

U.S.G.S. Geologic Quadrangle Maps:

Bedrock Topography of Eastern Morris and Western Essex Counties, N.J.; Nichols, William D.

Geologic Overlay: Available in 1974.

Physiographic Province:

Reading Prong of the New England Physiographic Province (New Jersey Highlands); Piedmont - Triassic Lowlands.

Geology:

Northern portion of the Atlas Sheet is in the Highlands Physiographic Province. Plateau underlain by Precambrian igneous (granites and gabbros) and metamorphic (primarily gneissic) rocks. All units have been extensively faulted. The Highlands also include some folded and faulted Paleozoic rocks.

The remainder of the Atlas Sheet lies within the Triassic Lowlands. Triassic shales, sandstones, and basalt flows dip northwestward beneath this area of the Piedmont. Major zones of faulting are present, particularly along the border between the Highlands and Piedmont. This border is characterized by a nearly straight trending fault-line valley.

Wisconsinan terminal moraine extends across the middle of the map area from west to east marking southern limit of glacial advance. Glacial Lake Passaic covered eastern portion of Morris County.

In the Highland Physiographic Province elevations of greater than 1,000' are common on the ridges; a few hills are greater than 1,300'. General elevations in the Piedmont are between 200 and 400'.

Economic deposits include: sand, gravel, granite gneiss and basalt for construction materials, clay and magnetite iron ore.

Climate:

Average annual precipitation:
Normal Year: 50" in north to 45" in south
Wet Year: 70" in north to 50" in south
Dry Year: 43" in north to 33" in south

Mean Temperature: Winter Months: 29°F
Summer Months: 73°F

January coldest month: July warmest month.

Considerable variation in length of growing season
Average duration of growing seasons:
Northern Section: 225 days. Last killing frost: 5/4; first killing frost: 10/7
Southern Section: 230 days. Last killing frost: 4/19; first killing frost: 10/7

Prevailing winds in winter months - northwesterly; in summer months - southwesterly.

Drainage Basins:

Delaware (Musconetcong River)
Passaic (Rockaway, Whippany and Upper Passaic Rivers)
Raritan Basin (Lower Raritan, North Branch, South Branch, Millstone, Lawrence Brook, and South River)
Arthur Kill (Rahway River)

Principal Lakes and Reservoirs (over 20 acres surface area):

	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Bergen County: None			
Essex County: None			
Middlesex County:			
Westons Mill Pond	-	92	-
Morris County:			
Boonton Reservoir, Parsippany-Troy Hills	119.0	780	7.6
Lake Parsippany, Parsippany-Troy Hills	1.2	158	
Budd Lake, Mt. Olive	4.5	475	-
Cedar Lake, Denville	-	86	-
Indian Lake, Denville	2.7	90	-
Lake Estling, Denville	-	70	-
Lake Hopatcong,Mt.Arlington	25.6	2440	8.1
Lake Musconetcong, Roxbury	-	329	-
Lake Valhalla, Montville	-	64	-
Mount Hope Lake, Rockaway	-	193	-
Mountain Lake, Mountain Lakes	1.0	120	-
Rainbow Lakes, Parsippany-Troy Hills	-	33	-
Shongum Lake, Randolph	-	67	-
White Meadow Lake, Rockaway	2.7	152	-
Somerset County:			
Bound Brook Reservoir, Bridgewater	-	67.2	-
Osborn Pond, Bernards	-	100	-
Ravine Lake, Gladstone	-	37	-
Union County:			
Lake Surprise, Summit	-	25	-

Reference:

Lakes and Ponds Inventory, N.J. Department of Conservation and Economic Development, 1970.

Water Companies Are Listed in:

1. Morris County Master Plan, Water Supply Element, pg. 7, Plate 1
2. Middlesex County Comprehensive Master Plan, Comprehensive Water Plan-Phase One, Pg. 27
3. Hunterdon County Master Plan, Ground and Surface Water, p. 88, 94, Table 15 (p. 98)
4. Union County Master Plan, Summary of Sewer and Water Plan, Exhibit W-2 (p. 28)
5. Routine Inspection Reports for Public Water Supply - Essex County, 1972-73, N.J. Dept. of Environmental Protection, Division of Water Resources, Bureau of Potable Water (unpublished)

Ground Water:

Recovery comes mostly from unconsolidated Pleistocene deposits and from fractures in bedrock.

Recovery Rates from Rock Types (gpd/sq.mi.):

1. Normal year 150,000, dry year less than 100,000
   a) Gabbro
   b) Martinsburg
   c) Triassic conglomerate, Lockatong
2. Normal year 200,000, dry year 120,000
   a) Unweathered gabbro, granite, Byram, Losee, and Pochuck Gneisses (specifically biotite gneiss, amphibolite, microcline gneiss, sillimanite gneiss, pyroxene granite, skarn and syenite)
   b) Diabase dikes (where of hydrologic significance)
3. Normal year 250,000, dry year 170,000
   a) Granite, Byram, Losee, and Pochuck gneisses (specifically alaskite, hornblende granite, hypersthene-quartz-andesine gneiss, quartz-oligoclase gneiss, granodiorite gneiss, pyroxene gneiss)
   b) Silty facies of Brunswick (Essex and Union Counties)
   c) Triassic igneous rocks (diabase, basalt, volcanic breccia)
4. Normal year 300,000, dry year 200,000
   a) Weathered Precambrian rocks (granite, Byram, Losee, and Pochuck gneisses (specifically biotite gneiss, amphiobolite, sillimanite gneiss, pyroxene granite, skarn and graphite schist)
5. Normal year 350,000, dry year 225,000
   a) Brunswick Fm.
   b) Pre-Wisconsinan glacial deposits

Recommended Lot Size for Well and Septic Tank in acres:

Precambrian Crystallines and Schists	3.0-4.0*
Brunswick Formation	1.0-1.5
Basalt Flows	2.0-2.5
Hardyston Sandstone	1.5-3.0
Kittatinny Limestone	1.5-3.0
Green Pond Conglomerate	3.0-4.0*
Martinsburg Shale	3.0-4.5
Stratified and Unstratified Drift	1.0-1.5

*In certain areas of non-fractured rocks, even 3-4 acres may be too small a minimum lot size.

Runoff of streams with drainage area less than 100 sq.mi. (Formations same as in Recovery Rates from Rock Types, identified with the same numbers)

Formation	Peak (cu.ft./sec/sq.mi.)	Drought (gal/min/sq.mi.)
1	1300	1.0
2	1100	Less than 2.6
3	950	3.8
4	800	5.0
5	500	20.0

Historic Sites:

Middlesex County:
- Ivy Hall, 1225 River Road, Piscataway
- Efraim Fitz Randolph House, Piscataway
- Metlar House, Piscataway

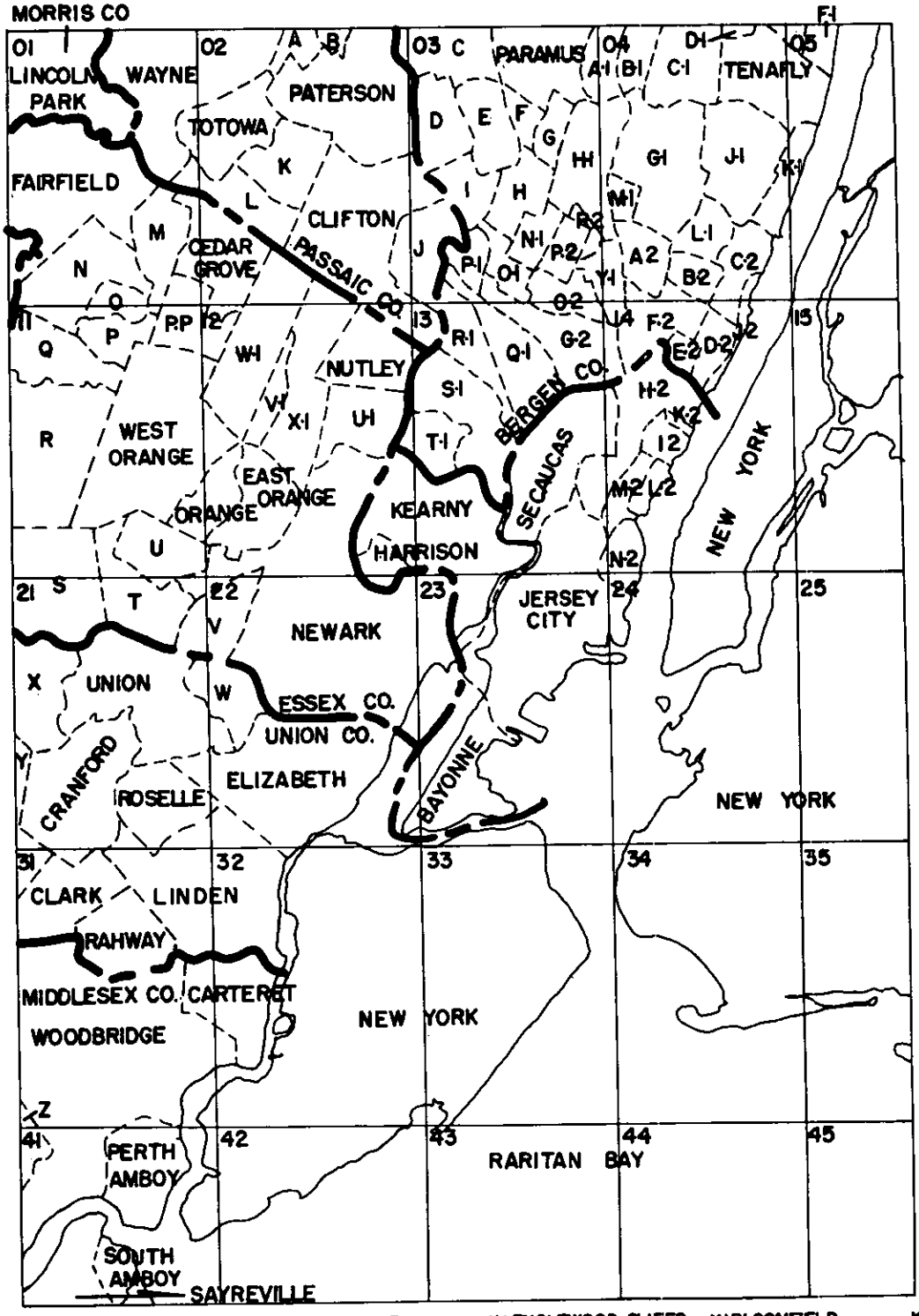
Morris County:
- Morristown National Historical Park, Morristown
- Thomas Nast House, Villa Fontana, MacCullough Ave.& Mullica Rd.,Morristown
- Speedwell Village, 333 Speedwell Ave., Morristown
- George Vail House, Speedwell Ave., Morristown
- Acorn Hall, 68 Morris St., Morristown
- Woman's Club of Morristown, Morristown
- Doremus House, Towaco

Somerset County:
- Frelinghuysen House, Raritan
- Old Dutch Parsonage, Somerville
- The Wallace House, Somerville

Union County:
- Cory House, 614 Mountain Ave., Westfield
- Baptist Parsonage, Park Ave. & Grand St., Scotch Plains

State Owned Land:
- Lake Musconetcong State Park (25-01)
- Hopatcong State Park (25-02)
- Hacklebarney State Park (25-11)
- Washington Rock State Park (25-33)
- Berkshire Valley (25-02)
- Black River (25-12)

ATLAS SHEET # 26



A. HALEDON
B. PROSPECT PARK
C. FAIR LAWN
D. EAST PATERSON
E. SADDLE BROOK
F. ROCHELLE PARK
G. MAYWOOD
H. LODI
I. GARFIELD
J. PASSAIC
K. WEST PATERSON

L. LITTLE FALLS
M. NORTH CALDWELL
N. WEST CALDWELL
O. CALDWELL
P. ESSEX FALLS
PP. VERONA
Q. ROSELAND
R. LIVINGSTON
S. MILLBURN
T. MAPLEWOOD
U. SOUTH ORANGE
V. IRVINGTON

W. HILLSIDE
X. SPRINGFIELD
Y. WESTFIELD
Z. EDISON

A-1 RIVER EDGE
B-1 NEW MILFORD
C-1 BERGENFIELD
D-1 CRESSKILL
F-1 ALPINE
G-1 TEANECK
H-1 HACKENSACK
J-1 ENGLEWOOD

K-1 ENGLEWOOD CLIFFS
L-1 LEONIA
M-1 BOGATA
N-1 HASBROUCK
O-1 WOOD RIDGE
P-1 WALLINGTON
R-1 RUTHERFORD
S-1 LYNDHURST
T-1 NORTH ARLINGTON
U-1 BELLEVILLE
V-1 GLEN RIDGE
W-1 MONTCLAIR

X-1 BLOOMFIELD
Y-1 LITTLE FERRY

A-2 RIDGFIELD PARK
B-2 PALISADES PARK
C-2 FORT LEE
D-2 CLIFFSIDE PARK
E-2 FAIRVIEW
F-2 RIDGEFIELD
G-2 CARLSTADT
H-2 NORTH BERGEN
J-2 EDGEWATER

K-2 WEST NEW YORK
L-2 WEEHAWKIN
M-2 UNION CITY
N-2 HOBOKEN
O-2 MOONACHIE
P-2 TETERBORO
R-2 SOUTH HACKENSACK

4. Division of Water Resource, Special Report #27; "Geology and Ground Water Resources of the Rahway Area, New Jersey;" Andersen, Henry R.; 1968.
5. Division of Water Resources, Special Report #28, "Ground Water Resources of Essex County, New Jersey;" Nichols, William D.; 1968.
6. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J.; 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Sources:

N. J. County and Municipality Work Sheets, Pt. 1 (1971), N. J. Dept. of Community Affairs.

Geologic Quadrangle Maps:

Bedrock Topography of Eastern Morris and Western Essex Counties, N.J.; William D. Nichols.

Geologic Overlay:

Overlay is available for Atlas Sheet 26, showing the geology of the Atlas Sheet area. This information is the same as that shown on any particular Atlas Sheet #26 coordinate block.

Physiographic Provinces:

Piedmont - Triassic Lowlands; Coastal Plain - Inner Plain.

Geology:

Piedmont is rolling plain - elevation 0 - 665' above sea level. Underlain by the upper Triassic Newark Group (volcanic and igneous intrusive rocks, argillite, grey feldspathic sandstone, red sandstone and shale, and conglomerate). Fossils and red color of sediments indicate terrestrial and lacustrine environments of deposition. Sediments originally deposited in a linear basin formed by northwestward tilting of a fault block of Paleozoic and Precambrian rocks. Most of eastern contact between Triassic and older formations is concealed by Coastal Plain sediments or Hudson River. Ramapo Fault forms northwestern margin.

Palisades Disturbance of the late Triassic characterized by magmatism and faulting. Lava flows cooled to form the Watchung Basalts. Intrusion of magma between sedimentary beds formed the Palisades Sill.

Hackensack Meadows are the result of glacial erosion and disruption of drainage. Glacial moraine and outwash up to 250' thick blocks preglacial valleys. Varved silt and clay overlying glacial deposits was deposited in ice age Lake Hackensack.

ATLAS SHEET #26 7/74

Counties on Map: Bergen, Essex, Hudson, Morris, Passaic, Union.

U.S.G.S. 7.5' Quads Covered: Arthur Kill, Central Park, Caldwell, Elizabeth, Hackensack, Keyport, Orange, Paterson, Perth Amboy, Pompton Plains, Roselle, Sandy Hook, South Amboy, The Narrows, Weehawken, Yonkers, Jersey City

County in Brief Series: Morris

Soil Conservation Service Reports: Bergen, Essex, Hudson, Morris, Passaic, Union (all on open file in County Seats)

Engineering Soil Surveys of New Jersey: Report #2 - Essex; Report #3 - Passaic; Report #4 - Bergen and Hudson; Report #5 - Union; Report #9 - Morris.

Water Resource Data Sources:

1. Morris County Master Plan (1970), Morris County Planning Board, Court House, Morristown, New Jersey.
   a) Water Supply Element
   b) Sanitary Sewerage Facilities Element
2. Passaic County Sewerage Study and Water Study (1969), Passaic County Board of Chosen Freeholders, Paterson, New Jersey.
3. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Department, Newark, N.J.
4. Union County Master Plan Program (1967), Sewer and Water Plan, Union County Planning Board, Courthouse, Elizabeth, N.J.
5. Bergen County Comprehensive Plan (1970), Bergen County Planning Board, Hackensack, N.J.
   a) Report #13 - Water Facilities
   b) Report #12 - Sewer Facilities
6. Passaic River Basin Water Resources Development Information Bulletin (1968), U. S. Army Engineer District, New York, Corps of Engineers and Department of Conservation and Economic Development, N.J.
7. Hudson County Master Plan on Land Use - Sewerage and Water (1963), Hudson County Dept. of Planning and Economic Development, Jersey City, N.J.

Special Reports:

1. Geologic Report Series #1 - Bedrock Map of the Hackensack Meadows; N.J.G.S.; Daniel G. Parillo.
2. Division of Water Resources, Special Report #10," Preliminary Report on the Geology and Ground Water Supply of Newark, N.J.;" Herpers, H.; Barksdale, H.G.; 1951.
3. Division of Water Resources, Special Report #25, "Availability of Ground Water in Morris County, New Jersey;" Gill, Harold E.; Vecchioli, John; 1965.

Inner Coastal Plain underlain by nearly flat-lying beds of unconsolidated sand, clay and marl. Inner Plain characterized by clayey soils. Outer Plain by sandy soils. Coastal plain sediments deposited during Cretaceous and Cenozoic advances of the sea.

Economic mineral deposits include trap-rock, sand and gravel, brick clay, and building stone.

Climate:

Average annual precipitation:
Normal Year: 49" in north to 41" in southeast
Wet Year: 63" in northwest to 41" in southeast
Dry Year: 40" in north to 34" in south

Mean temperature: Winter Months: 31.3°F
Summer Months: 73.1°F

January coldest month; July warmest month

Average Duration of Growing Season: 189 days. Last killing frost: 4/18; first killing frost: 10/24

Winter months northwesterly winds prevail; summer months southwesterly winds prevail.

Drainage Basins:

Passaic River Drainage Basin: drained by portions of Pompton, Lower Passaic, Upper Passaic, and Saddle Rivers.

Raritan River Drainage Basin: drained by portions of the Lower Raritan River.

Hackensack River Drainage Basin: drained by portions of the Hackensack River.

Arthur Kill Drainage Basin: drained by portions of the Rahway River and by all of Elizabeth Channel, Moses Creek, Elizabeth River, and Woodbridge River.

Atlantic Coastal Drainage Basin: drained by portions of Matawan Creek

Principal Lakes and Reservoirs (over 20 acres surface area):

	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Orange Reservoir	4.80	64	---

Sources:

1. Geological Survey of New Jersey, Final Report of the State Geologist, Vol. III, Water Supply, 1894.

Water Companies Are Listed in:

1. Morris County Master Plan - Water Supply Element, 1969-70, Morris County Planning Board, Morristown, N.J., pg.7, Plate 1.
2. Bergen County Comprehensive Plan - Water Facilities Final Report #13, 1970, Bergen County Planning Board, Hackensack, N.J., pp. 84-129, Table 6.
3. Passaic County Master Program - Water Study, 1969, Passaic County Board of Freeholders, Paterson, N.J., pp.99-174.
4. Union County Master Plan, Summary of Sewer and Water Plans, Exhibit W-2 (pg.28), 1967, Union County Planning Board, Elizabeth, N.J.
5. Routine Inspection Reports for Essex County, 1972-73, Public Water Supply, N.J. Dept. of Environmental Protection, Bureau of Potable Water.
6. Hudson County Master Plan on Land Use - Sewerage and Water, 1963, Hudson County Dept. of Planning and Economic Development, Jersey City, N.J., pp. 25-31, Plate 13.

Ground Water:

Ground water is recovered mostly from the Triassic Brunswick Formation and from the Quaternary stratified drift along river channels.

Recovery Rates from Rock Types in gpd/sq.mi.:

1. Paleozoic Metamorphics - serpentine, mica schist, gneiss.
   Normal year less than 100,000; dry year 000,000
2. Triassic sediments - hematitic sandstones, shales, conglomerate beds, arkose.
   Normal year 500,000; dry year 350,000
3. Triassic Diabase
   Normal year 250,000-380,000; dry year 170,000-200,000.
4. Triassic Basalt Flows
   Normal year 250,000-300,000; dry year 170,000-250,000.
5. Cretaceous sediments - lignitic sand and clay, glauconitic sediments
   Normal year 700,000; dry year 000,000
6. Quaternary unconsolidated sediment - clay, silt, sand, gravel, boulders
   Normal year 650,000; dry year 450,000.

Recommended Minimum Lot Sizes for Well and Septic Tank in acres:

Brunswick Formation	1.0-1.5
Stockton Formation	1.5
Basalt Flows	2.0-2.5
Diabase	2.5-3.0
Magothy & Raritan Fm. (clay)	To be investigated individually
Quaternary Stratified & Unstratified Drift	1.0-1.5

Runoff of smaller streams with drainage area less than 100 sq. miles:

	Peak in cu.ft./sec/sq.mi.	Drought in gal/min/sq.mi.
Triassic Sediments:		
Brunswick Formation	500	20.0
Stockton Formation	1100	less than 2.6
Triassic Basalt	950	3.8
Triassic Diabase	950	3.8
Paleozoic Metamorphics:		
Manhattan Schist	1300	1.0
Serpentine	1300	1.0
Cretaceous Sediments:		
Magothy & Raritan Fm.	160	0-66
Quaternary Deposits	160-350	0-66

Historic Sites:

Bergen County:
- Palisades Interstate Park, west bank of the Hudson River.
- Steuben House, New Bridge Road, River Edge.

Essex County:
- Montclair Railroad Terminal, Montclair.
- Israel Crane House, Montclair.
- Sydenham House, Old Road to Bloomfield, Newark.
- Edison National Historic Site, Main Street, West Orange.
- Kruegar Mansion, 601 High Street (Scott Civic Center), Newark.
- Penn Station, Raymond Plaza West, Newark.
- First Baptist Peddie Memorial Church, Broad & Fulton Streets, Newark.
- St. James A. M. E., High and Court Streets, Newark.
- St. Stephan's Church, Ferry Street & Wilson, Newark.
- St. James' Church, Lafayette and Jefferson Streets, Newark.
- St. Mary's Church, High and William Streets, Newark.
- Queen of Angels Church, Belmont Avenue, Newark.
- Cathedral Evangelica Reformada, Lincoln Park & Halsey Streets, Newark.
- St. Barnabas, West Market Street, Newark.
- New Point Baptist Church, 17 East Kinney Street, Newark.
- South Park Presbyterian Church, Broad Street & Lincoln Park, Newark.
- St. Columba's Church, Pennsylvania & Brunswick Streets, Newark.
- Pan American C. M. A. Church, 76 Prospect Street, Newark.
- First United Methodist Church, 227 Market Street, Newark.
- House of Prayer Episcopal Church & Rectory, Broad & State Streets, Newark.
- Grace Church, Newark.
- North Reformed Church, Newark.
- St. John's Church, Newark.
- St. Patrick's Procathedral, Newark.
- The Old First Presbyterian Church, Newark.
- Trinity Episcopal Church, Newark.

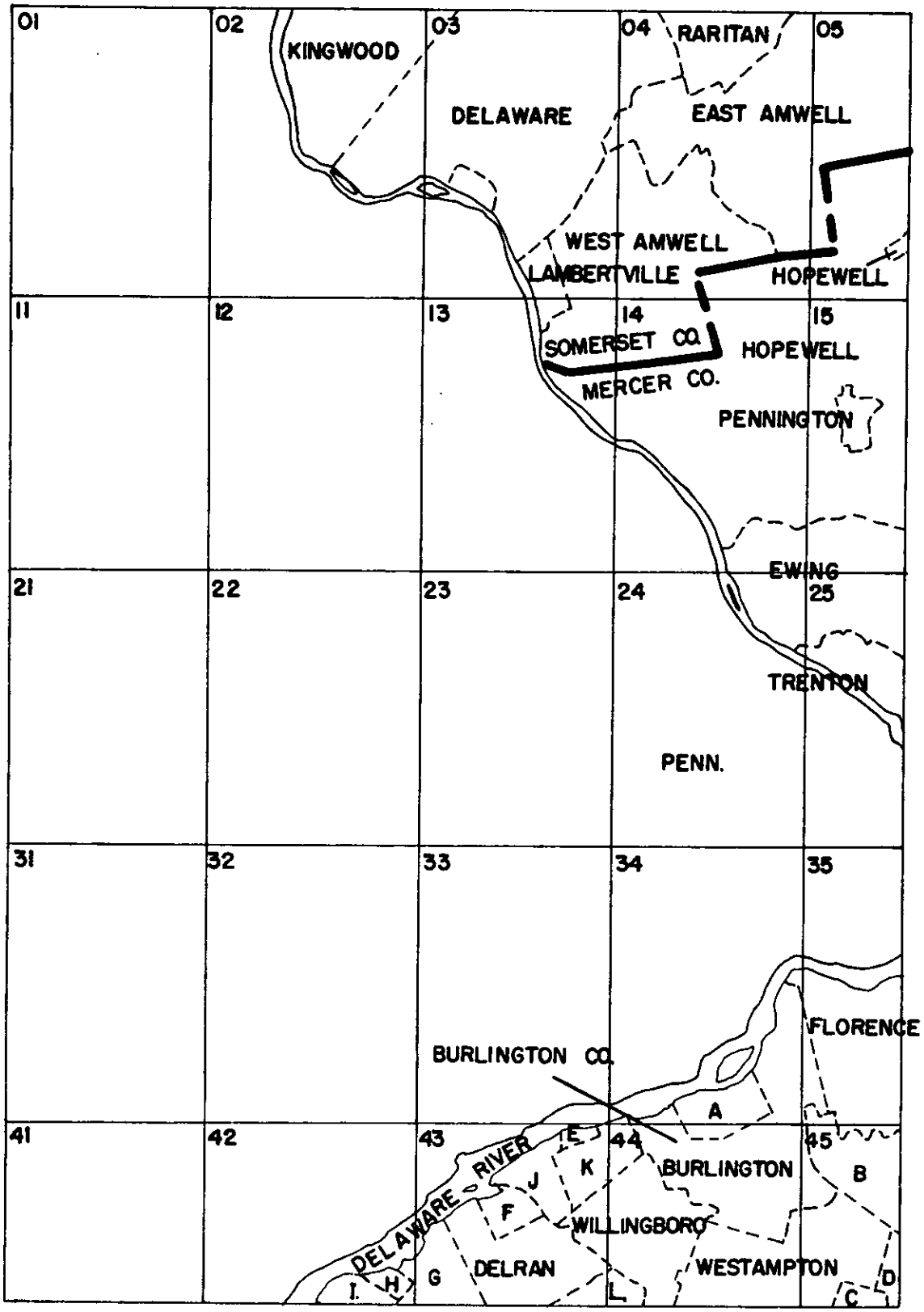
Hudson County:
- Hudson County Courthouse, Newark Avenue, Jersey City
- Statue of Liberty National Monument.

Middlesex County:
- Proprietary House, 149 Kearney Avenue, Perth Amboy.

Passaic County:
Westside Park/Van Houten House, Paterson.
Great Falls of Paterson and Society of Useful Manufactures, Historic District, Paterson
Dey Mansion, 199 Totowa Street, Wayne.
Van Duyne House, 636 Fairfield Rd., Wayne
Uriah Hopper House/Wayne Museum/Van Riper-Hopper House, 533 Berdan Ave., Wayne.
Colfax House, Wayne.
Union County:
Boxwood Hall/Boudinot Mansion, 1073 East Jerry St., Elizabeth.
First Presbyterian Congregation of Connecticut Farms, Stuyvesant Ave., Union.

State Owned Land:
Great Piece Meadows State Park (26 - 01)
Liberty State Park (26 - 23)

ATLAS SHEET # 27



A. BURLINGTON
B. SPRINGFIELD
C. MOUNT HOLLY
D. EASTAMPTON
E. BEVERLY
F. RIVERSIDE
G. CINNAMINSON
H. RIVERTON
I. PALMYRA
J. DELANCO
K. EDGEWATER PARK
L. MOORESTOWN

ATLAS SHEET #27 7/74

Counties on Map: Burlington, Hunterdon, Mercer

U.S.G.S. 7.5' Quads Covered: Beverly, Bristol, Frankford, Hopewell, Lambertville, Lumberville, Pennington, Stockton, Trenton West

County in Brief Series: Hunterdon, Mercer

Soil Conservation Service Reports: Burlington, Hunterdon, Mercer (all on open file in county seats)

Engineering Soil Surveys of New Jersey: Report #6 - Hunterdon County, Report #20 - Burlington County, Report #12 - Mercer County

Water Resource Data Sources:

1. Hunterdon County Master Plan (1967), Report #4 - Ground and Surface Water, Hunterdon County Planning Board, Flemington, N.J.
2. Mercer County Comprehensive Planning Program (1969)
   a) Storm Water Runoff and Drainage Facilities
   b) Analysis of Water Supply and Sewerage Facilities
   Mercer County Planning Board, Trenton, N. J.
3. Water Facilities Study for Burlington County (1970), Burlington County Board of Chosen Freeholders and Planning Board, Mount Holly, N.J., U.S. Department of Agriculture.
4. A Master Sewerage Plan for Burlington County, N.J. (1969), Burlington County Board of Chosen Freeholders and Planning Board, Mount Holly, N.J., New Jersey Department of Health.

Special Reports:

1. Geologic Report Series #7, "Geology of the Ground Water Resources of Mercer County, N.J.," Widmer, K., 1965.
2. Division of Water Resources, Special Report #19, "Geology and Ground Water Resources of Mercer County," Vecchioli, J.; Palmer, M., 1962.
3. Division of Water Resources, Special Report #24, "Geology and Ground Water Resources of Hunterdon County, N.J.," Kasabach, H., 1966.
4. Division of Water Resources, Special Report #26, "Geology and Ground Water Resources of Burlington County, N.J.," Rush, F.E., 1968.
5. Division of Water Resources, Circular #7, "Records of Wells and Ground Water Quality in Burlington County, N.J.," Rush, E.F., 1962.
6. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in N.J.," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Source: N. J. County and Municipality Work Sheets, Pt. 1 (1971), New Jersey Department of Community Affairs.

Geologic Quadrangle Maps: Pre-Quaternary Geology of the Bristol Quadrangle, New Jersey-Pennsylvania; U.S.G.S. Map 342; Owens, J.P., Minard, J.P., 1964.

Geologic Overlay: Overlay is available for Atlas Sheet #27 showing the geology of the atlas sheet area. This is the same information as is shown on any particular Atlas Sheet #27 coordinate block.

Physiographic Provinces: Piedmont, Inner subdivision of Atlantic Coastal Plain.

Geology:

The Piedmont Province includes terrains of highly metamorphosed Precambrian and early Paleozoic rocks and of non-metamorphosed Upper Triassic volcanic, intrusive igneous, and consolidated sedimentary rocks. In the New Jersey Piedmont, the Triassic greatly predominates, older rocks being exposed only in a small, triangular area including Trenton and widening southwestward toward Philadelphia. Triassic sedimentary rocks, consisting of argillite, gray, feldspathic sandstone, and red sandstone, shale, and conglomerate occupy a linear fault basin formed during the early stages of the separation of the North American and European continents. The western limit of this basin is clearly marked by the presence of Triassic conglomerates with pebbles derived from an adjacent uplifted block. The eastern limit, without conglomerates, its position determined by post-Triassic erosion, and covered along most of its length by Coastal Plain sediments, is less well known.

The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing New Jersey between Wilmington, Delaware, and Staten Island, N.Y., to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominantly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments. Atlas Sheet #27, underlain by the Wenonah and older formations, lies entirely to the northwest of this cuesta.

Quaternary alluvial and shoreline deposits include the Pensauken sands and gravels on higher terraces and the Cape May sands, gravels, and clays in lower areas.

Elevation ranges from sea level at tidal marshes along the Delaware to a maximum of 560' on northeast - southwest trending ridges developed from the Lockatong argillite.

Economically valuable deposits include sand, gravel, traprock, and brownstone.

Climate:

Average annual precipitation:
Normal year: 45"
Wet year: 55" in north to 60" centrally to 49" in south
Dry year: 35"

Mean temperatures: Winter months 31°F
Summer months 75°F

January coldest month; July warmest month

Average duration of growing season increases from north to south
North: about 236 days. Last killing frost: 4/23; first killing frost: 10/27
South: about 250 days. Last killing frost: 4/16; first killing frost: 10/28

Northwesterly winds prevail during winter months; southwesterly winds prevail during summer months.

Drainage Basins:

Most of this area lies within the Delaware River Basin and is drained by Mill Creek, Rancocas Creek, Pompeston Creek, Pennsauken Creek, Assicunk Creek, Crafts Creek, Assunpink Creek, and Locatong Creek. A small area to the northeast lies within the Raritan basin and is drained by the Millstone River and the south branch of the Raritan River.

Principal Lakes and Reservoirs (over 20 acres surface area):

	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Burlington County:			
Olympia Lakes, Willingboro	1	92	—

Water Companies Are Listed in:

1. Hunterdon County Master Plan, Ground and Surface Water, pp. 88, 94, Table 15 (p. 98), 1967.
2. Water Facilities Study - Burlington County, N.J., 1970, Exhibit 38 (pp. 30 - 34).
3. Mercer County Comprehensive Planning Program: Analysis of Water Supply and Sewerage Facilities of Mercer County, 1969, Map 1 (p.7), Table 4 (p.17), Table 5 (p.18), pp. 19-26.
4. Routine Inspection Reports for Public Water Supply - Burlington County, 1972-73, New Jersey Department of Environmental Protection, Bureau of Potable Water.
5. Routine Inspection Reports for Public Water Supply - Hunterdon County, 1972-73, New Jersey Department of Environmental Protection, Bureau of Potable Water.
6. Routine Inspection Reports for Public Water Supply - Mercer County, 1972-73, New Jersey Department of Environmental Protection, Bureau of Potable Water.

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant along coastal and estuarine shores, heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water contamination.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper lying formations.

Among Piedmont rocks the Brunswick Formation is a reliable source of ground water through most of its extent, but is argillaceous and a poor aquifer in the southern part of Hunterdon and northern part of Mercer Counties. Moderate amounts of ground water are drawn from the Stockton Formation and from fractures and solution openings in diabase and the Lockatong Formation.

Formations and approximate depths to commonly tapped aquifers are indicated on descriptions of individual atlas sheet blocks.

Recovery Rates from Formations in gpd/sq.mi.*:

Formation or Rock Type	Dry Year	Wet Year
Wissahickon Gneiss	120,000	200,000
Gabbro	120,000	200,000
Hardyston Sandstone	120,000	200,000
Stockton Formation	175 - 200,000	250 - 300,000
Lockatong Formation	100,000	150,000
Brunswick Formation	350,000	500,000
Silty Areas of Brunswick Fm.	-	-
Diabase	120,000	200,000
Magothy & Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mt. Laurel & Wenonah Sands	500,000	750,000
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Recommended Minimum Lot Size for Well and Septic Tank in acres:

Gneiss or Gabbro	3.0-4.0*
Hardyston Sandstone	1.5-3.0
Brunswick Formation	1.0-1.5
Lockatong Formation	2.0-2.5
Stockton Formation	1.5
Diabase	2.5-3.0

*In certain areas of dense, crystalline rock even 3-4 acres may be too small a minimum lot size.

Runoff of Smaller Streams with drainage area less than 100 square miles:

	Peak in cu.ft./sec/sq.mi.	Drought* in gal./min/sq.mi.
Gneiss or Gabbro	1100	less than 2.6
Hardyston Sandstone	1100	less than 2.6
Stockton Formation	1100	less than 2.6
Lockatong Formation	1300	1.0
Brunswick Formation	500	20.0
Silty areas of Brunswick Fm.	1300	1.0
Diabase	950	3.8
Magothy and Raritan Formation	160	0 - 66
Merchantville Clay**	1100	less than 2.6
Woodbury Clay**	1300	1.0
Englishtown Sand	400	0 - 66
Marshalltown Formation**	1300	1.0
Mt. Laurel & Wenonah Fms.	400	0 - 66
Pensauken Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For Coastal Plain Formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

**Runoff from Mesozoic and Tertiary clays can attain a peak of 2000 cu.ft./sec./sq.mi.

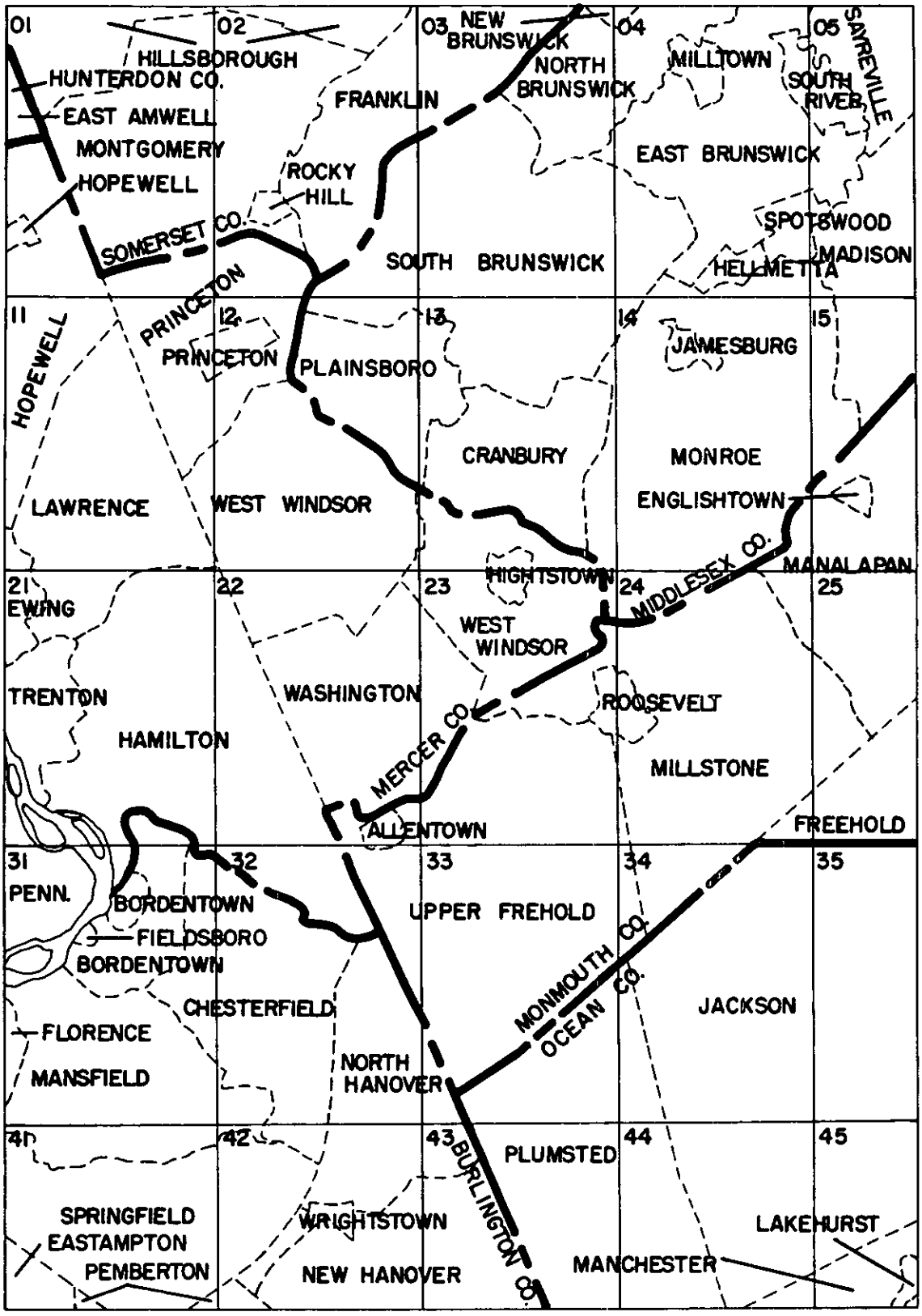
Historic Sites:

Burlington County:
St. Mary's Church, Burlington
Mount Holly District, Mount Holly
Hunterdon County:
James W. Marshall House, Lambertville
Mercer County:
Hunt/Hoch House, Pennington
John D. Hunt House, Pennington
John Welling, Pennington
Douglass House, Trenton
Mercer Street Friends' Center, Trenton
William Trent House, Trenton
Old Barracks, Trenton
McCall House, Trenton
Watson House, Trenton
Washington Crossing State Park
Temple Ryan Farm House, Hopewell

State Owned Land:

Delaware and Raritan Canal and Feeder (Division of Water Resources), 27 - 1, 2, 3, 14, 24, 25
Rancocas (Parks and Forestry), 27 - 43, 44
Hawk Island (Parks and Forestry), 27 - 43
Bulls Island (Parks and Forestry), 27 - 02
Amwell Lake (Fish, Game, and Shellfisheries), 27 - 04
Baldwin Lake (Fish, Game, and Shellfisheries), 27 - 14, 15
Washington Crossing State Park, 27 - 14

ATLAS SHEET 28



ATLAS SHEET #28 4/74

Counties on Map: Somerset, Middlesex, Monmouth, Ocean, Burlington, Mercer Hunterdon.

U.S.G.S. 7.5' Quads Covered: Hopewell, Rocky Hill, Monmouth Junction, New Brunswick, South River, Freehold, Jamesburg, Hightstown, Princeton, Pennington, Trenton West, Trenton East, Allentown, Roosevelt, Adelphia, Lakehurst, Cassville, New Egypt, Columbus, Bristol.

County in Brief Series: Hunterdon, Mercer.

Soil Conservation Service Reports: Somerset, Middlesex, Monmouth, Ocean, Burlington, Mercer, Hunterdon (all on open file in county seats).

Engineering Soil Surveys of New Jersey: Report #6 - Hunterdon, Report #7 - Somerset, Report #8 - Ocean, Report #10 - Middlesex, Report #19 - Monmouth, Report #20 - Burlington.

Water Resource Data Sources:

1. Middlesex County Comprehensive Master Plan (1972)
   a) Comprehensive Sewerage Plan - Phase I.
   b) Comprehensive Water Plan - Phase I.
   c) Appendix: Comprehensive Water Plan - Phase I.
   d) Appendix: Comprehensive Sewerage Plan - Phase I.
   e) Comprehensive Water Plan - Phases 2 & 3.
   f) Comprehensive Sewerage Plan - Phases 2 & 3.
   g) Recommended Water and Sewer Systems & Plans and Programs.
   h) Storm Drainage Plan and Program.
   Middlesex County Planning Board, New Brunswick, N.J.
2. Hunterdon County Master Plan (1967), Report #4 - Ground and Surface Water, Hunterdon County Planning Board, Flemington, N.J.
3. Mercer County Comprehensive Planning Program (1969).
   a) Storm Water Runoff and Drainage Facilities.
   b) Analysis of Water Supply and Sewerage Facilities.
   Mercer County Planning Board, Trenton, N.J.
4. Water Facilities Study for Burlington County (1970), Burlington County Board of Chosen Freeholders and Planning Board, Mount Holly, N.J.
5. A Master Sewerage Plan for Burlington County, N.J. (1969), Burlington County Board of Chosen Freeholders, N.J., N.J. Department of Health.
6. Sewerage Systems Report: Somerset County, N.J. (1972), Somerset County Planning Board, Somerville, N.J.
7. Monmouth County General Development Plan (1969-1985), Monmouth County Planning Board, Freehold, N.J. (1969).
8. Ocean County Functional Planning for Waste Water Management (1972), Ocean County Planning Board, Toms River, N.J.
9. Ocean County Master Plan for Water Resources Management (1969), Ocean County Board of Chosen Freeholders, Toms River, N.J.

Special Reports:

1. Geologic Report Series #7, "Geology of the Ground Water Resources of Mercer County, New Jersey," Widmer, K. N.J.G.S., 1965.
2. Division of Water Resources. Special Report #17, "Salt Water Encroachment into Aquifers of the Raritan Formation in the Sayreville Area, Middlesex County," Appel, C.A., 1962.
3. Division of Water Resources, Special Report #19, "Geology & Ground Water Resources of Mercer County," Vecchioli, J., Palmer, M., 1962.
4. Division of Water Resources, Special Report #23, "Geology and Ground Water Resources of Monmouth County, New Jersey," Jablonski, L.R.R., 1968.
5. Division of Water Resources, Special Report #24, "Geology and Ground Water Resources of Hunterdon County, New Jersey," Kasabach, H., 1966.
6. Division of Water Resources, Special Report #26, "Geology and Ground Water Resources of Burlington County, New Jersey," Rush, F.E., 1968.
7. Division of Water Resources, Special Report #29, "Geology and Ground Water Resources of Ocean County, New Jersey," Anderson, H.R., Appel, Chas. R., 1969.
8. Division of Water Resources, Circular #7, "Records of Wells and Ground Water Quality in Burlington County, New Jersey," Rush, E.F., 1962.
9. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Sources: New Jersey County and Municipality Work Sheets. Part I (1971), New Jersey Department of Community Affairs.

Geologic Quadrangle Maps:

Pre-Quaternary Geology of the Bristol Quadrangle, New Jersey-Pennsylvania U.S.G.S. Map 342; James P. Owens, James P. Minard, 1964.

Pre-Quaternary Geology of the Columbus Quadrangle, New Jersey U.S.G.S. Map 160; James P. Owens, James P. Minard, 1962.

Pre-Quaternary Geology of the Trenton East Quadrangle, New Jersey-Pennsylvania U.S.G.S. Map 341; James P. Owens, James P. Minard, 1964.

Pre-Quaternary Geology of the New Egypt Quadrangle, New Jersey U.S.G.S. Map 161; James P. Owens, James P. Minard; 1962.

Geology of the Roosevelt Quadrangle, New Jersey U.S.G.S. Map 340; James P. Minard, 1967.

Geologic Overlay: Overlay is available for Atlas Sheet #28 showing the geology of the Atlas Sheet area. This information is the same as that shown on any particular Atlas Sheet #28 coordinate block.

Physiographic Provinces: Piedmont, Inner and Outer subdivisions of Atlantic Coastal Plain.

Geology:

The Piedmont Province includes terrains of highly metamorphosed Precambrian and early Paleozoic rocks and of non-metamorphosed Upper Triassic volcanic, intrusive igneous, and consolidated sedimentary rocks. In the New Jersey Piedmont, the Triassic greatly predominates, older rocks being exposed only in a small, triangular area including Trenton and widening southwestward toward Philadelphia. Triassic sedimentary rocks, consisting of argillite, gray, feldspathic sandstone, and red sandstone, shale and conglomerate occupy a linear fault basin formed during the early stages of the separation of the North American and European continents. The eastern limit of this basin is determined by post-Triassic erosion, and covered among most of its length by Coastal Plain sediments.

The Atlantic Coastal Plain is developed from a wedge of southeastward dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing New Jersey between Wilmington, Delaware, and Staten Island, New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominantly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments.

Quaternary alluvial and shoreline deposits include the Pensauken and Bridgeton sands and gravels on higher terraces and the Cape May sands, gravels, and clays in lower areas.

Elevations range from sea level at tidal marshes bordering the Delaware and South Rivers to over 500' on northeast - southwest trending diabase ridges northwest of Princeton.

Economically valuable deposits include sand, gravel, and traprock.

Climate:

Average annual precipitation:
Normal year: 45" in north to 42" centrally to 48" in south
Dry year: 35"
Wet year: 53"

Mean Temperature: Winter Months: 32°F
Summer months: 74°F

January coldest month; July warmest month.

Average duration of growing season: 242 days. Last killing frost: April 16; first killing frost: October 28.

Northwesterly winds prevail during winter months; southwesterly winds prevail during summer months.

Drainage Basins:

Atlas Sheet #28 lies within the Delaware River, Raritan River, and Atlantic Ocean drainage basins. The Delaware Basin area is drained by Assunpink Creek, Blacks Creek, Crafts Creek, Crosswicks Creek, Duck Creek, Lockatong Creek group, and the North Branch of the Rancocas River. The Raritan Basin area is drained by the Millstone River, the South River, Lawrence Brook, and the South Branch of the Raritan River. The Atlantic drainage area is drained by the Metedeconk, Toms, and Manasquan Rivers.

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Burlington County:			
Crystal Lake, Mansfield and Bordentown	6.3	25	---
Mercer County:			
Carnegie Lake, West Windsor and Plainsboro	440	175	---
Gropps Lake, Hamilton	8	40	---
Grovers Mill Pond, West Windsor	11.5	30	---
Rowan Lake, Hamilton		28	---
Middlesex County:			
Carnegie Lake, Plainsboro and West Windsor	440	175	---
Davidson's Mill Pond, South Brunswick	16	24	---
DeVoe Lake, South Brunswick	50	30	---
Duhernal Lake, Madison	110	92	---
Farrington Lake, East Brunswick	34	290	---
Helmetta Pond, Helmetta		40	---
Lake Manalapan, Monroe	36	40	---
Mirror Lake, East Brunswick		25	---
Plainsboro Pond, Plainsboro	19	23	---
Spotswood Lake, Spotswood		58	---
Weston's Mill Pond, East Brunswick		92	---

Name, Municipality	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Monmouth County:			
Conines Millpond, Allentown	17.5	27	---
Millhurst Mills Pond, Millhurst Mills	9	22	---
Red Valley Lake Upper Freehold	4	20	---
Unnamed Pond, Imlaystown	9	40	---
Ocean County:			
Lahaway Lake	233	50	---
Brindle Lake, Plumstead	26	110	---
Colliers Mills Lake, Colliers Mills	3.1	34	---
Oakford Lake, Plumstead	44	25	---
Unnamed Pond, Cassville	5.5	30	---
Somerset County: None			

Water Companies Are Listed in:

1. Hunterdon County Master Plan, Ground and Surface Water, Pg. 88, 94, Table 15 (pg. 98), 1967.
2. Routine Inspection Reports for Public Water Supply - Somerset County 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.
3. Middlesex County Comprehensive Master Plan, Comprehensive Water Plan Phase One, pg. 27, 1972.
4. Routine Inspection Reports for Public Water Supply - Monmouth County, 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.
5. Master Plan for Water Resources Management, Ocean County, New Jersey, 1968. Table 3 - Sheets 1-3.
6. Water Facilities Study: Burlington County, New Jersey, 1970, Exhibit 38 (pp.30-34).
7. Mercer County Comprehensive Planning Program: Analysis of Water Supply and Sewerage Facilities of Mercer County, 1969, Map 1 (pg.7), Tables 4 & 5 (pp.17-18), pp.19-26.
8. Routine Inspection Reports for Public Water Supply - Hunterdon County, 1972-73, N.J. Department of Environmental Protection, Division of Water Resources, Bureau of Potable Water.
9. Routine Inspection Reports for Public Water Supply - Middlesex County, 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.
10. Routine Inspection Reports for Public Water Supply - Ocean County, 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.
11. Routine Inspection Reports for Public Water Supply - Burlington County, 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.
12. Routine Inspection Reports for Public Water Supply - Mercer County, 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water intrusion.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper laying formations.

Among Piedmont rocks the Brunswick Formation is a reliable source of ground water through most of its extent, but is argillaceous and a poor aquifer in the southern part of Hunterdon and northern part of Mercer Counties. Moderate amounts of ground water are drawn from the Stockton Formation and from fractures and solution openings in diabase and the Lockatong Formation.

Formations and approximate depths to commonly tapped aquifers are indicated on descriptions of individual atlas sheet blocks.

Recovery Rates from Formations (gallons per day per square mile)*:

Formation or Rock Type	Dry Year	Wet Year
Wissahickon Gneiss	200,000	300,000
Gabbro	120,000	200,000
Hardyston Sandstone	120,000	200,000
Stockton Formation	175 - 200,000	250 - 300,000
Lockatong Formation	100,000	150,000
Brunswick Formation	350,000	500,000
Silty Areas of Brunswick Fm.	175 - 200,000	250 - 300,000
Diabase	120,000	200,000
Magothy and Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mount Laurel & Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Red Bank and Tinton Sands	170 - 250,000	265 - 375,000
Hornerstown Marl	170 - 250,000	-
Vincentown Sand	500,000	750,000
Manasquan Marl	170 - 250,000	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Beacon Hill Gravel	500,000	750,000
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Recommended Minimum Lot Size for Well and Septic Tank in acres:

Underlying Bedrock	
Gneiss or Gabbro	3.0-4.0*
Hardyston Sandstone	1.5-3.0
Brunswick Formation	1.0-1.5
Lockatong Formation	2.0-2.5
Stockton Formation	1.5
Diabase	2.5-3.0

*In certain areas of dense, crystalline rocks, even 3-4 acres may be too small a minimum lot size.

Runoff of Smaller Streams with drainage area less than 100 sq. miles:

Underlying Bedrock	Peak in (cu.ft./sec/sq.mi.)	Drought* in (gal./min./sq.mi.)
Gneiss or Gabbro	800-1100	less than 5.0
Hardyston Sandstone	1100	less than 2.6
Stockton Formation	950	3.8
Lockatong Formation	1300	less than 1.0
Brunswick Formation	500	20
Silty areas of Brunswick Fm.	1300	0.8
Diabase	950	3.8
Magothy & Raritan Formation	160	0-66
Merchantville Clay**	1100	less than 2.6
Woodbury Clay**	1300	less than 1.0
Englishtown Sand	400	0-66
Marshalltown Formation**	1300	less than 1.0
Mt.Laurel & Wenonah Fms.	400	0-66
Navesink Marl**	1100	less than 2.6
Red Bank & Tinton Sands	950	3.8
Hornerstown Marl**	950	3.8
Vincentown Sand	400	0-66
Manasquan Marl**	950	3.8
Kirkwood Sand	350	0-66
Cohansey Sand	160	0-66
Beacon Hill Gravel	400	0-66
Bridgeton Formation	350	0-66
Pensauken Formation	350	0-66
Cape May Formation	100	0-66

*For Coastal Plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

**Runoff from Mesozoic and Tertiary clays can attain a peak of 2000 cu.ft./sec./sq.mi.

Historic Sites:

Burlington County:
- Hopkinson House, Park & Farnsworth Avenue, Bordentown
- Arney's Mount Meeting House, Juliustown & Pemberton Rds., Arney's Mount

Mercer County:
- Temple Ryan Farm House, 2306 Pennington Rd., Hopewell
- Grover Cleveland Home, Westland, 15 Hodge Road, Princeton
- Joseph Henry House, Princeton University Campus, Princeton
- Princeton Battlefield, Princeton Battlefield State Park, Princeton
- Morven, Stockton St., Princeton
- Nassau Hall, Princeton University Campus, Princeton
- John White Homestead, Cold Soil Road, Lawrenceville
- Bow Hill - Oaklyn House, Jermiah Avenue, Hamilton Township
- Hutchinson House, Hutchinson-Mill Pond Road, Washington Township
- Lawrence Historic District, Lawrenceville
- Anderson-Capner, Lawrenceville

Middlesex County:
- Old Cranbury School, 23 North Main Street, Cranbury

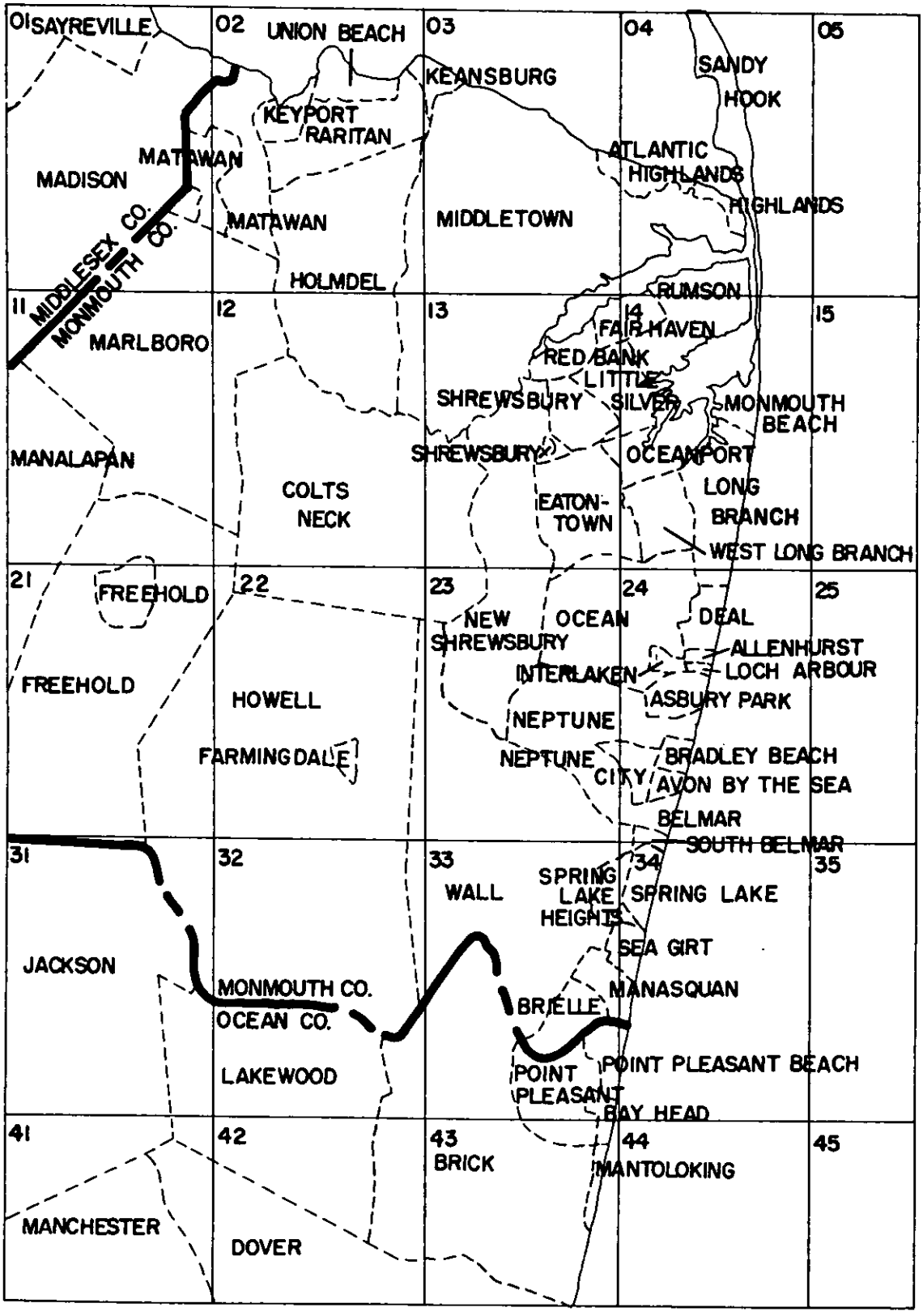
Monmouth County:
- Captain John Anderson House, Manalapan Township
- Village Inn, Main and Water Streets, Englishtown

Somerset County:
- Rockingham, Route 518, Rocky Hill

State Owned Lands:

Princeton Battlefield State Park (28-11)
Pigeon Swamp State Park (28-03)
Duck Island State Park (28-21)
Jackson State Forest (28-34)
Cook Natural Area (28-02)
Old Airport Property (28-11)
Van Nest Refuge Fish and Game Area (28-11,12,21,22)
Assunpink Fish and Game Area (28-23,24)
Imlaystown Lake Fish and Game Area (28-23,33)
Prospertown Lake Fish and Game Area (28-33,34)
Collier's Mills Fish and Game Area (28-34,44,45)
Manchester Fish and Game Area (28-44)
Turkey Swamp State Fish and Game Preserve (28-25)
Delaware and Raritan Canal and Feeder (28-2,11,12,21)

ATLAS SHEET #29



ATLAS SHEET #29 4/74

Counties on Map: Middlesex, Monmouth, Ocean.

U.S.G.S. 7.5' Quads Covered: South Amboy, Keyport, Sandy Hook, Freehold, Adelphia, Farmingdale, Asbury Park, Point Pleasant, Lakewood, Lakehurst, Marlboro, Long Branch.

County in Brief Series: None.

Soil Conservation Reports: Middlesex, Monmouth, Ocean (all on open file in county seats).

Engineering Soil Surveys of New Jersey: Report #8 - Ocean, Report #10 - Middlesex, Report #19 - Monmouth.

Water Resource Data Sources:

1. Middlesex County Comprehensive Master Plan (1972)
   a) Comprehensive Sewerage Plan - Phase I
   b) Comprehensive Water Plan - Phase I
   c) Appendix: Comprehensive Water Plan - Phase I
   d) Appendix: Comprehensive Sewerage Plan - Phase I
   e) Comprehensive Water Plan - Phases 2 and 3
   f) Comprehensive Sewerage Plan - Phases 2 and 3
   g) Recommended Water and Sewer Systems: Plans and Programs
   h) Storm Drainage Plan and Program
   Middlesex County Planning Board, New Brunswick, N.J.
2. Monmouth County General Development Plan (1969-1985), Monmouth County Planning Board, Freehold, N.J. (1969).
3. Ocean County Functional Planning for Waste Water Management (1972), Ocean County Planning Board, Toms River, N.J.
4. Ocean County Master Plan for Water Resources Management (1969), Ocean County Board of Chosen Freeholders, Toms River, N.J.

Special Reports:

1. Bulletin #25, "Soil Survey of the Chatsworth Area, New Jersey," Austin L. Patrick, E.B. Deeter, C.C. Engle, Wm. Seltzer, and L.L. Lee; 1923.
2. Division of Water Resources, Special Report #17, "Salt Water Encroachment into Aquifers of the Raritan Formation in the Sayreville Area, Middlesex Count," Appel, C.A., 1962.
3. Division of Water Resources, Special Report #22, "Chloride Concentrations of Water from Wells in the Atlantic Coastal Plain of New Jersey, 1923-1961," Seaber, Paul R.; 1963.
4. Division of Water Resources, Special Report #23, "Geology and Ground Water Resources of Monmouth County, New Jersey," Jablonski, L.A.A., 1968.

5. Division of Water Resources, Special Report #29, "Geology and Ground Water Resources of Ocean County, New Jersey," Anderson, H.R.; Appel, Charles A.; 1969.
6. Bureau of Geology and Topography, Pamphlet, "Titanium Sands of Southern New Jersey," Markewicz, F.J.; Parillo, D.G.; Johnson, M.E.
7. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun,G.J.; 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Sources:

New Jersey and Municipality Work Sheets, Part I (1971), N. J. Department of Community Affairs.

Geologic Quadrangle Maps: None

Geologic Overlay: Overlay is available for Atlas Sheet #29 showing the geology of the atlas sheet area. This information is the same as that shown on any particular Atlas Sheet #29 coordinate block.

Physiographic Provinces: Atlantic Coastal Plan - Inner Plain, Outer Plain

Geology:

The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing New Jersey between Wilmington, Delaware, and Staten Island, New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominantly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments.

Topographically the area consists of low, rolling hills inland. Along the Atlantic Coast, barrier island and lagoon morphology, drowned valley type estuaries, and Sandy Hook Spit are prominent features. The more protected Raritan Bay shore is more irregular in outline and lacks barrier islands. Low bluffs and extensive salt marshes extend to the shoreline or are protected from wave action by a narrow beach.

Elevations range from sea level to 373' on Beacon Hill.

Economically valuable deposits include sand, gravel, and ilmenite.

Climate:

Average annual precipitation:
Normal year: 42" in north to 48" in south
Wet year: 52" in north to 57" centrally to 54" in south
Dry year: 34" in north to 37" in south

Mean Temperature: Winter months 32°F
Summer months 75°F

January coldest month; July warmest month.

Average duration of growing season varies from north to south: 250 days. Last killing frost: April 16; first killing frost: October 28.

Northwesterly winds prevail during winter months; southwesterly winds prevail during summer months.

Drainage Basins:

Atlantic Coastal Plain Drainage Basin: drained by Shark River, Whale Pond Brook, Wreck Pond Brook, Toms River, Kettle Creek, Metedeconk River, Manasquan River, Shrewsbury River, and Navesink River.

Raritan River Drainage Basin: drained by portions of South River.

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Drainage Area sq.mi.)	Surface Area (acres)	Volume (B.G.)
Middlesex County:			
Tennent Pond, Madison	1.6	41	---
Hooks Creek Pond, Cheesequake State Park	0.5	40	---
Monmouth County:			
Lake Lefferts, Matawan	6	69	---
Lake Matawan, Matawan	1	24	---
Natco Lake, Union Beach	0.5	43	---
Swimming River Reservoir, Middletown	50	102	---
Shadow Lake, Middletown	1.5	89	---
Wreck Pond, Spring Lake	11.5	20	---
Glendola Reservoir	-	124	---
Spring Lake, Spring Lake	0.5	23	---
Deal Lake, Asbury Park	6.5	144	---
Ocean County:			
Jackson's Mills Lakes, Jackson's Mills	14	20	---
Bennets Pond, Jackson	19	34	---
Pine Lake, Manchester	62	87	---
Lake Carsaljo, Lakewood	25	67	---
Irisado Lake, Lakewood	5.5	25	---
Horicon Lake, Lakewood	18	52	---
Lake of the Lilies, Pt.Pleasant Beach	1	100	---

Water Companies Are Listed in:

1. Middlesex County Comprehensive Master Plan, Comprehensive Water Plan Phase One, pg. 27, 1972.
2. Routine Inspection Reports for Public Water Supply - Monmouth County, 1972-73, N.J. Department of Environmental Protection Bureau of Potable Water.
3. Master Plan for Water Resources Management, Ocean County, N.J., 1969, Table 3 - Sheets 1-3.
4. Routine Inspection Reports for Public Water Supply - Middlesex County, 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.
5. Routine Inspection Reports for Public Water Supply - Ocean County, 1972-73, N.J. Department of Environmental Protection, Bureau of Potable Water.

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water intrusion.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper laying formations.

Formations and approximate depths of commonly tapped aquifers are indicated on descriptions of individual atlas sheet blocks.

Recovery Rates from Formations in gpd/sq.mi.*:

Formation or Rock Type	Dry Year	Wet Year
Magothy and Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mt. Laurel & Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Red Bank and Tinton Sands	170-250,000	265-375,000
Hornerstown Marl	170-250,000	-
Vincentown Sand	500,000	750,000
Manasquan Marl	170-250,000	-
Shark River Marl	170-250,000	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Beacon Hill Gravel	500,000	750,000
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Runoff of Smaller Streams with drainage area less than 100 square miles:

Underlying Bedrock	Peak in cu.ft./sec/sq.mi.	Drought* in gal/min/sq.mi.
Magothy & Raritan Fm.	160	0 - 66
Merchantville Clay**	1100	less than 2.6
Woodbury Clay**	1300	1.0
Englishtown Sand	400	0 - 66
Marshalltown Formation**	1300	1.0
Mt. Laurel & Wenonah Fms.	400	0 - 66
Navesink Marl**	1100	less than 2.6
Red Bank and Tinton Sands	950	3.8
Hornerstown Marl**	950	3.8
Vincentown Sand	400	0 - 66
Manasquan Marl**	950	3.8
Shark River Marl**	950	3.8
Kirkwood Sand	350	0 - 66
Cohansey Sand	160	0 - 66
Beacon Hill Gravel	400	0 - 66
Bridgeton Formation	350	0 - 66
Pensauken Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For Coastal Plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

**Runoff from Mesozoic and Tertiary clays can attain a peak of 2000 cu.ft./sec./sq.mi.

Historic Sites:

Monmouth County:
- The Old Mill at Tinton Falls, New Shrewsbury
- Deserted Village, Allair State Park
- Monmouth Battlefield, Route 522, Freehold Vicinity
- Sandy Hook Lighthouse, Sandy Hook
- Twin Lights (Navesink Lighthouse), south of Route 36, Highlands
- Christ Episcopal Church, 92 Kings Highway, Middletown
- Burrowes Mansion, 94 Main Street, Matawan
- North American Phalanx, Colt's Neck Township

Ocean County:
- Hangar Number 1, Lakehurst Naval Air Station, Lakehurst Vicinity
- Veterans of All Wars Historic Site, Manchester

State Owned Lands:

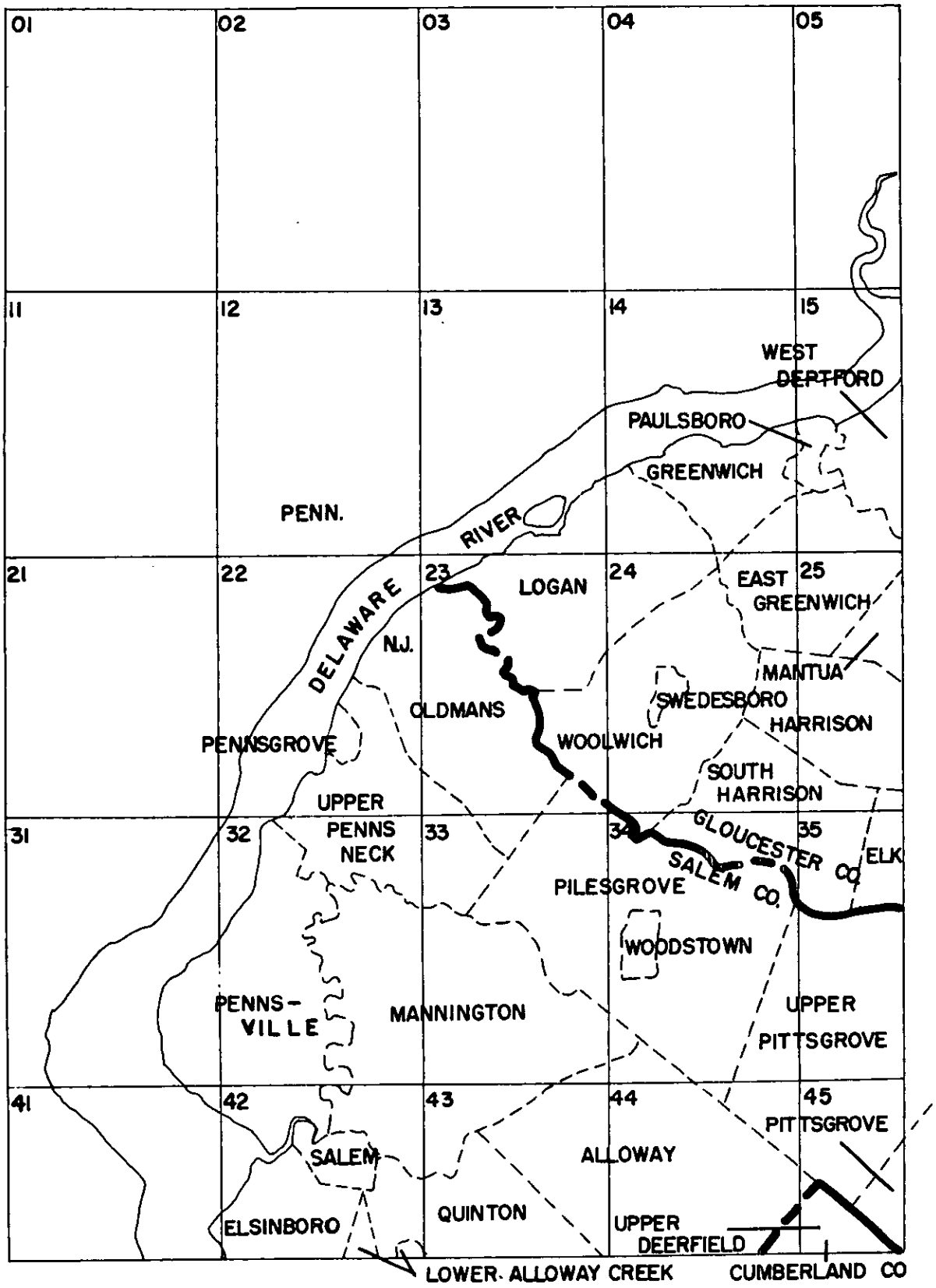
Cheesequake State Park (29-01)
Sandy Hook State Park (29-04)
Monmouth Battlefield State Park (29-11,21)
Allaire State Park (29-32,33)
Swimming River Natural Area (29-13)
Swan Point Natural Area (29-43)
Turkey Swamp Fish & Game Preserve (29-21)
Butterfly Pond Fish and Game Preserve (29-31)
State Quail Farm (29-31)
Manasquan Reservoir (29-21)

Wetlands Map Coverage:

Paper Wetlands Map or Plastic Wetlands Map,
Property Line Map,
Ownership List
with the following identification numbers:

Wetlands Map Index #16-9:
588-2106, 588-2112, 581-2100, 581-2106, 581-2112
Wetlands Map Index #16-10:
588-2118, 588-2130, 588-2136, 588-2142, 581-2118, 581-2124,
588-2130, 581-2136, 588-2142, 588-2148, 581-2154, 574-2118,
574-2124, 574-2154
Wetlands Map Index #16-11:
581-2160, 581-2166, 574-2160, 574-2166, 560-2184, 560-2190
Wetlands Map Index #15-10:
546-2154, 539-2154
Wetlands Map Index #15-11:
533-2160, 533-2184, 533-2190, 546-2160, 546-2184, 546-2190
Wetlands Map Index #14-11:
497-2172, 490-2166
Wetlands Map Index #13-10:
469-2154
Wetlands Map Index #13-11:
462-2172
Wetlands Map Index #12-10:
448-2148, 441-2148, 434-2148, 434-2154, 427-2148, 427-2154,
420-2142, 420-2148, 420-2154
Wetlands Map Index #12-11:
448-2160, 441-2160, 441-2166, 434-2160, 434-2166, 427-2160, 420-2160
Wetlands Map Index #11-10:
413-2148, 413-2154, 406-2124, 399-2142, 399-2154
Wetlands Map Index #11-11:
413-2160, 406-2160, 399-2160

ATLAS SHEET 30



ATLAS SHEET #30 4/74

Counties on Map: Gloucester, Salem, Cumberland.

U.S.G.S. 7.5 Quads. Covered: Bridgeport, Woodbury, Wilmington South, Penns Grove, Woodstown, Pitman West, Delaware City, Salem, Alloway, Elmer, Marcus Hook.

County in Brief Series: Not Available.

Soil Conservation Reports: Gloucester, Salem, Cumberland (all on open file in County Seats).

Engineering Soil Surveys of New Jersey: Report #16 - Gloucester; Report #14 - Salem; Report #21 - Cumberland.

Water Resource Data Sources:

1. a) Sewer and Water, Resources Inventory and Problem Analysis, Salem County, (1969), Salem County Planning Board Staff, Court House, Salem, N.J.
   b) Stage II Salem County Sewer and Water Plan, (May 1970), Salem County Planning Board Staff, Court House, Salem, N.J.
   c) Rural Sewerage Feasibility Salem County, N.J. (May 1972), Salem County Planning Board, Court House, Salem, N.J.
2. Fire Insurance Maps, Fire Insurance Rating Organization of N.J., Engineering Department, Newark, N.J.

Special Reports:

1. Division of Water Resources, Special Report #34, "Ground Water Resources of Cumberland Co.," Rooney, James G.
2. Division of Water Resources, Special Report #30, "Water Resources and Geology of Gloucester County, N.J.," Hardt, William F., Hilton, George S.; 1969.
3. Division of Water Resources, Special Report #33, "Geology and Ground Water Resources of Salem County, N.J.;" Rosenav, J.C.; Lang, S.M.; Hilton, G.S.; Rooney, J.G.
4. Water Resources Circular #9, "Public Water Supplies in Gloucester County, N.J.;" Hardt, William F.; 1963.
5. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in N. J.," Halasi-Kun, G.J.; 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Source: N.J. County and Municipality Work Sheets, Pt. 1 (1971), N.J. Department of Community Affairs.

Geologic Quadrangle Maps: Geologic Map of the Woodstown Quadrangle, Gloucester and Salem Counties, N.J.; James P. Minard.

Geologic Overlay: Overlay is available for Atlas Sheet #30, showing the geology of the Atlas Sheet area. This information is the same as that shown on any particular Atlas Sheet #30 coordinate block.

Physiographic Provinces: Coastal Plain, Inner Plain - Outer Plain

Geology:

The Atlantic Coastal Plain consists of a wedge of Cretaceous, Tertiary, and Quaternary unconsolidated deposits which are underlain by crystalline metamorphic and igneous rocks of early Paleozoic or Precambrian age. Beds of clay, silt, sand and gravel were deposited as the ancient shoreline transgressed across the gently sloping continental margin.

The Pre-Quaternary deposits strike generally in a northeast-southwest direction and dip gently to the southeast. Consolidated formations of Precambrian or early Paleozoic age are intersected by wells drilled at or near the Delaware River and occur at progressively greater depths toward the southeast. The oldest formations outcrop along the Delaware River and progressively younger formations outcrop as one proceeds in a southeast direction.

Elevation ranges from sea level at the tidal marsh bordering the Delaware River to 160+ altitudes further inland. Low, gently rolling slopes gradually rise inland.

Economically valuable deposits include: sand, gravel, clay and glass sand.

Climate:

Average annual precipitation:

Normal year:	45" in southeast to 44" in northeast
Wet year:	46" in southeast to 49" in northeast
Dry year:	27" in southeast to 33" in northeast

Mean temperature: Winter months: 34°F
Summer months: 76°F

January coldest month; July warmest month.

Average duration of growing season: 250 days. Last killing frost: April 1; first killing frost: October 19.

Winter months northwesterly winds prevail; summer months southwesterly winds prevail.

Drainage Basins:

Delaware River Drainage Basin: drained by Woodbury Creek, Mantua Creek, Rapaupo Creek, Maple Swamp, Raccoon Creek, Alloways, Cohansey Creek, and Maurice River.

Principal Lakes and Reservoirs (over 20 acres surface area):

	Drainage Area (sq.mi.)	Surface Area (acres)	Volume (B.G.)
Laytons Lake	5.6	35.8	---
Elkinton Mill Pond	3.0	31.5	---
Alloway Lake	21.9	122.0	---

Sources:

1. U.S.G.S. Quadrangle Maps.
2. Geological Survey of New Jersey, Vol. III, Water Supply, 1894.
3. Lakes and Ponds Inventory, N.J. Division of Parks and Forestry, Comprehensive Recreation Planning Section, 1970.

Water Companies Are Listed in:

1. Sewer and Water - Resources Inventory and Problem Analysis; Salem County Planning Board; p.55-77.
2. Routine Inspection Reports for Public Water Supply - Gloucester County 1972-73; N.J. Department of Environmental Protection, Bureau of Potable Water.
3. Routine Inspection Reports for Public Water Supply - Salem County 1972-73; N.J. Department of Environmental Protection, Bureau of Potable Water.
4. Rural Sewage Feasibility, Salem County, N.J. (1972); p.71-79.

Ground Water:

Ground water is recovered from Magothy and Raritan, Cohansey, Kirkwood, Pensauken, and Bridgeton Formations. Less is recovered from Englishtown Sand and Mount Laurel. There is no recovery from Mesozoic and Tertiary clay and marl.

Runoff of smaller streams with drainage area less than 100 square miles:

	Peak in cu.ft./sec/sq.mi.	Drought* in gal/min/sq.mi.
Magothy and Raritan Fm.	160	0-66
Merchantville Clay*	1100	near 0
Woodbury Clay*	1300	near 0
Englishtown Sand	400	0-66
Mount Laurel & Wenonah Sands	400	0-66
Hornerstown Marl*	950	3.8
Vincentown Sand	400	0-66
Kirkwood Sand	350	0-66
Cohansey Sand	160	0-66
Cape May Formation	100	0-66
Pensauken Formation	350	0-66
Bridgeton Formation	350	0-66
Stratified Drift	160	0-66

*Mesozoic and Tertiary Clay can be up to 2,000 in peak and near 0 in lowest runoff.

Note: For Coastal Plain formations the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exporure. In addition, lower values are to be expected where a permeable horizon is underlain by an aquifer and higher values on clayey areas of a formation.

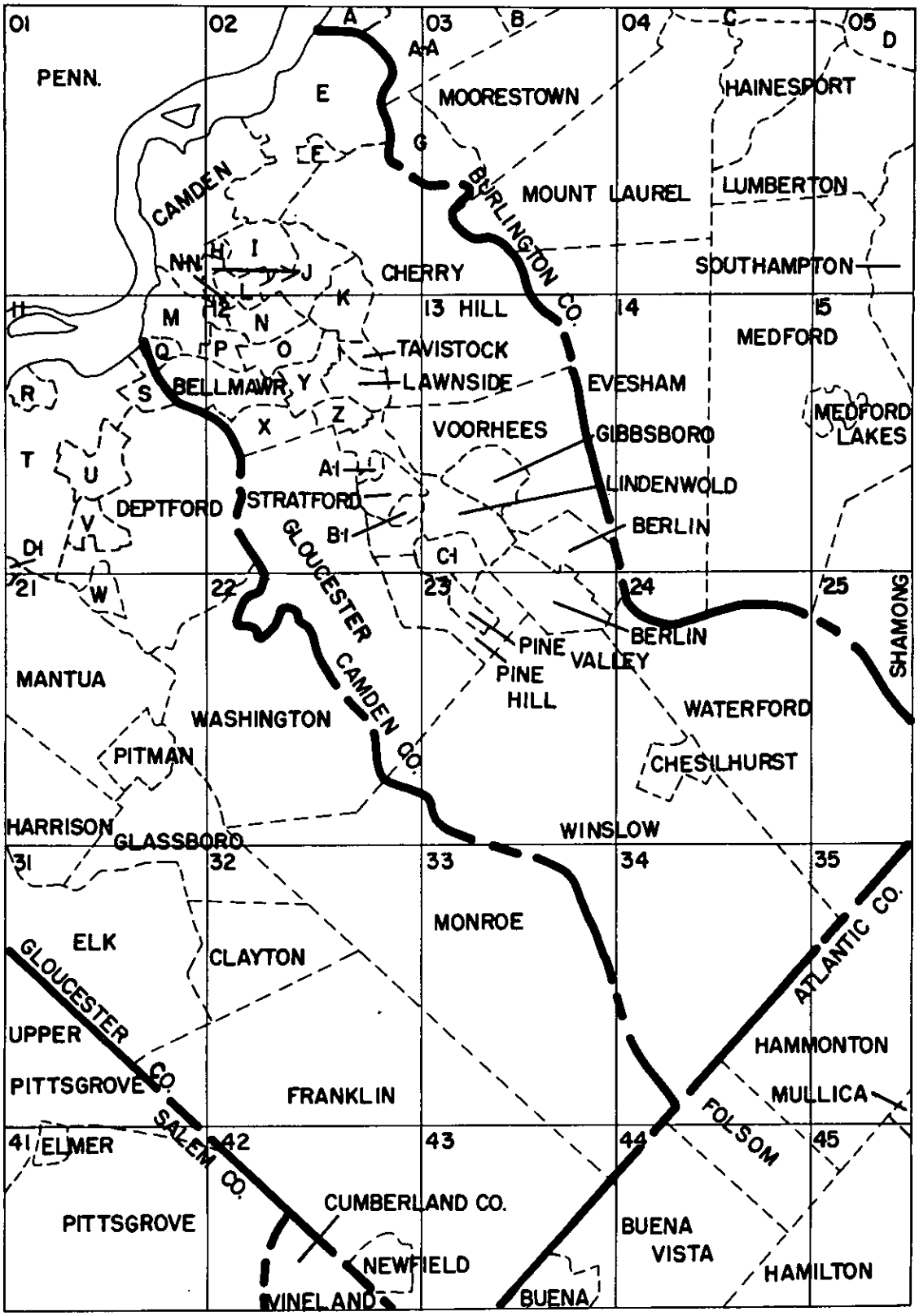
Historic Sites:

Salem County:
Finn's Point National Cemetery
The Hancock House
Gloucester County:
Red Bank Battlefield, National Park, Hessian Avenue

State Owned Land:

Fort Mott (30 - 31)
Salem Armory (30 - 42)
Deepwater Maintenance Yard (30 - 31)
Salem (30 - 42)
Logan Pond (30 - 14, 15)
Harrisonville Lake (30 - 34, 35)
Bridgeport Maintenance Yard (30 - 31)

ATLAS SHEET # 31



A. PALMYRA
A-A CINNAMINSON
B. DELRAN
C. WESTAMPTON
D. MT. HOLLY
E. PENNSAUKEN
F. MERCHANTVILLE
G. MAPLE SHADE
H. WOOD LYNNE
I. COLLINGSWOOD
J. HADDON
K. HADDONFIELD
L. OAKLYN
M. GLOUCESTER
N. AUDUBON
NN AUDUBON PARK
O. HADDON HEIGHTS
P. MT. EPHRAIM
Q. BROOKLAWN
R. NATIONAL PARK
S. WESTVILLE
T. WEST DEPTFORD
U. WOODBURY
V. WOODBURY HGTS.
W. WENONAH
X. RUNNEMEDE
Y. BARRINGTON
Z. MAGNOLIA
A-1 HI NELLA
B-1 LAUREL SPRINGS
C-1 CLEMENTON
D-1 EAST GREENWICH

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Counties on Map: Atlantic, Burlington, Camden, Cumberland, Gloucester, Salem

U.S.G.S. 7.5' Quads Covered: Buena, Camden, Clementon, Elmer, Medford Lakes, Moorestown, Mount Holly, Newfield, Newtonville, Philadelphia, Pitman East, Pitman West, Runnemede, Williamstown, Woodbury

County in Brief Series: Not available.

Soil Conservation Service Reports: Atlantic, Burlington, Camden, Cumberland, Gloucester, Salem (all on open file in county seats)

Engineering Soil Surveys of New Jersey: Report #14, Salem County; Report #16, Gloucester County; Report #17, Camden County; Report #18, Atlantic County; Report #20, Burlington County: Report #21, Cumberland County.

Water Resource Data Sources:

1. Water and Sewer Studies: A Master Plan Report. Atlantic County Planning Board, Atlantic City, 1969.
2. Comprehensive Water Facilities Plan and Water System Plan. Atlantic County Board of Chosen Freeholders Planning Board, Atlantic City, 1971.
3. Water Facilities Study, Burlington County, N.J., Burlington County Planning Board, Mount Holly, 1969.
4. A Master Sewerage Plan for Burlington County, N.J., Burlington County Planning Board, Mount Holly, 1969.
5. Ocean County Functional Planning for Waste Water Management. Ocean County Planning Board, Toms River, 1972.
6. Master Plan for Water Resources Management, Ocean County. Ocean County Planning Board, Toms River, 1969.
7. Salem County Sewer and Water Plan - Part 1, Salem County Planning Board Staff, Salem, N.J., 1969.
8. Salem County Sewer and Water Plan - Stage II, Salem County Planning Board Staff, Salem, N.J., 1971.
9. Rural Sewerage Feasibility Study for Salem County, N.J. Salem County Planning Board Staff, Salem, N.J., 1972.
10. Rural Water Plan, Cumberland County, N.J. Cumberland County Planning Board, Bridgeton, N.J., 1969.
11. Urban Water Plan, Cumberland County, N.J. Cumberland County Planning Board, Bridgeton, 1971.
12. Flood Plain Information, Pompeston Creek, Burlington County, N.J. Burlington County Planning Board, Mount Holly, N.J., 1971.
13. Flood Plain Information, Pennsauken Creek and South Branch, Burlington and Cumberland Counties, N.J. Burlington County Planning Board, Mount Holly, 1969.

14. Flood Plan Information Report on Rancocas Creek, Burlington County, N.J. Burlington County Planning Board, Mount Holly, 1967.
15. Water Resource Supply Primer, Camden County, N.J. Camden County Planning Department, Pennsauken, 1972.
16. Comprehensive Plan, Camden County, N. J. Camden County Planning Department, Pennsauken, N.J., 1972.
17. Land Use Plan, Comprehensive Planning Program, Camden County, N.J. Camden County Planning Department, Pennsauken, N.J., 1972.
18. Fire Insurance Maps, Fire Insurance Rating Organization of N.J., Newark.

Special Reports:

1. Division of Water Resources, Special Report #13, "Ground Water Resources in the Tri-State Region Adjacent to the Lower Delaware River," Barksdale, H.C., Greenman, D.W., Lang, S.W., Hilton, G.S., Outlaw, D.E.; 1958.
2. Division of Water Resources, Special Report #26, "Geology and Ground Water of Burlington County, New Jersey," Anderson, H.R., 1958.
3. Division of Water Resources, Special Report #30, "Water Resources and Geology of Gloucester County, New Jersey," Hardt, W.F., Hilton, G.S., 1969.
4. Division of Water Resources, Special Report #33, "Geology and Ground Water Resources of Salem County, New Jersey," Roseneau, J.C., Lang, S.M., Hilton, G.S., Rooney, J.S.; 1969.
5. Division of Water Resources, Special Report #34, "Ground Water Resources of Cumberland County, New Jersey," Rooney, J.G.; 1971.
6. Water Resources Circular #7, "Records of Wells and Ground Water Quality in Burlington County, New Jersey," Rush, E.F., 1962.
7. Water Resources Circular #9, "Public Water Supplies in Gloucester County, New Jersey" Hardt, W.F., 1963.
8. Water Resources Circular #19, "Iron in Ground Water of the Magothy and Raritan Formations in Camden and Burlington Counties, New Jersey," Langmuir, D., 1969.
9. New Jersey Geologic Report Series #11, " Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Source: N.J. County and Municipality Work Sheets, Pt. 1, N.J. Department of Community Affairs, Trenton.

Geologic Quadrangle Maps: "Pre-Quaternary Geology of the Mount Holly Quadrangle, New Jersey," U.S.G.S. Map G.Q. 272, Minard, J.P., Owens, J.P., Nichols, T.C.; 1964.

Geologic Overlay: Overlay is available for Atlas Sheet #31 showing the geology of the atlas sheet area. This information is the same as that shown on any particular Atlas Sheet #31 coordinate block.

Physiographic Province: Inner and Outer subdivisions of Atlantic Coastal Plain.

Geology:

The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing New Jersey between Wilmington, Delaware, and Staten Island, New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominantly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments.

Quaternary alluvial and shoreline deposits include the Pensauken and Bridgeton sands and gravels on higher terraces and the Cape May sands, gravels, and clays in lower areas.

Elevations range from sea level on tidal marshes at the Delaware River to a maximum of 220' on hills inland. Topographically the area is predominantly a low altitude plateau. Maturely dissected topography of low, rolling hills is found in the northeastern quadrant of the atlas sheet near the Delaware River.

Economically valuable deposits include sand, gravel, greensand marl, and clay.

Climate:

Average annual precipitation:

Normal year:	43" at Camden to 48" in the southeast part of area	
Wet Year:	48" at Camden to 58" in southeast	
Dry year:	35" at Camden to 37" in southeast	

Mean temperature:	Winter months:	33°F
	Summer months:	76°F

February coldest month; July warmest month.

Average duration of growing season: About 250 days. Last killing frost: April 1; first killing frost: October 19.

Prevailing winds:	Winter months:	northeasterly
	Summer months:	southwesterly

Drainage Basins:

Atlas Sheet #31 drains to the Delaware River through Mantua Creek, Woodbury Creek, Big Timber Creek, Newton Creek, Coopers Creek, Baldwin Run, Pennsauken Creek, and Rancocas River; to Delaware Bay through the Maurice River; and to the Atlantic Ocean through the Mullica and Great Egg Harbor Rivers.

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Surface Area (acres)	Drainage Area (sq.mi.)	Volume (B.G.)
Atlantic County:			
Collings Lakes (5), Folsom and Buena Vista	170	26	
Hammonton Lake, Hammonton	40	4	
Cushmans Lake, Buena Vista	26		
Unnamed Impoundment, Buena Vista	33		
Unnamed Reservoir, Hammonton	21		
Burlington County:			
Aetna Lakes, Medford Lakes	69	7	
Birchwood Lake, Medford	50		
Braddocks Mill Lake, Medford	30	4	
Centennial Lakes, Medford	60	10	
Marlton Lake, Evesham	75	1	
Kennelsworth Lakes (4), Evesham	23	1.5	
Mishe-Mokwa, Medford Lakes	45	1	
Oliphants Lake, Medford	100		
Taunton Lake, Medford	40	13	
Unnamed Impoundment, Washington	75		
Unnamed Reservoirs (4), Washington	105		
Camden County:			
Atco Lake, Waterford	22	3.5	
Clementon Lake, Clementon	25	2.5	
Grenlock Lake, Gloucester	75	15	
Kirkwood Lake, Voorhees	22	4.5	
New Brooklyn Lake, Winslow	40	23	
Newton Lake, Haddon	198	11	
Unnamed Gravel Pit, Pennsauken	21		
Unnamed Gravel Pit, Winslow	21		
Unnamed Impoundment, Delaware	22		
Gloucester County:			
Alcyon Lake, Pitman	30	5	
Almonesson Lake, Deptford	40	1.5	
Bells Lake, Washington	33	3.0	
Cedar Lake, Franklin	22	3.0	
Diamond Lake, Monroe	27	13	
Garrison Lake, Elk	37	7	
Iona Lake, Franklin	60	26	
Collings Lakes (5), Monroe	170	26	
Malaga Lake, Franklin	105	29	
Pickington Lake, Deptford	20		
Sacajawea Lake, Franklin	25		
Silver Lake, Clayton	57	7	
Sunset Lakes, Monroe	20	3.5	
Timber Lakes, Monroe	30	6	
Victory Lakes, Monroe	25	4	
Wilson Lake, Clayton	58	9	
Woodbury Lakes, Woodbury	45	6	

Salem County:		
Elmer Lake or Keans Lake, Pittsgrove	36	12
Harrisonville Lake, Pittsgrove	40	
Lake Algonquin, Pittsgrove	20	
Palatine Lake, Pittsgrove	100	25
Willow Grove Lake, Pittsgrove	120	80

Water Companies Are Listed in:

1. Routine Inspection Reports for Public Water Supply - Gloucester County 1972-1973; N. J. Department of Environmental Protection, Bureau of Potable Water.
2. Routine Inspection Reports for Public Water Supply - Salem County 1972-73; N. J. Department of Environmental Protection, Bureau of Potable Water.
3. Routine Inspection Reports for Public Water Supply - Atlantic County 1972-73; N. J. Department of Environmental Protection, Bureau of Potable Water.
4. Routine Inspection Reports for Public Water Supply - Burlington County 1972-1973; N. J. Department of Environmental Protection, Bureau of Potable Water.
5. Routine Inspection Reports for Public Water Supply - Camden County 1972-73; N. J. Department of Environmental Protection, Bureau of Potable Water.
6. Routine Inspection Reports for Public Water Supply - Cumberland County 1972-73; N. J. Department of Environmental Protection, Bureau of Potable Water.
7. Comprehensive Water Facilities Plan and Water System Plan, Atlantic County Board of Chosen Freeholders Planning Board, Atlantic City, 1971, p.81-87.
8. Water Facilities Study, Burlington County, New Jersey, Burlington County Planning Board, Mount Holly, 1969, p.29-34.
9. Water Resources Supply and Primer, Camden County Planning Department, Pennsauken, 1972, p.16-17.
10. Urban Water Plan, Cumberland County, New Jersey, Cumberland County Planning Board, Bridgeton, 1971, p.40-44.
11. Sewer and Water Resources Inventory and Problem Analysis, Salem County, 1969, p.53-62.

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water contamination.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper lying formations.

Formations and approximate depths of commonly tapped aquifers are indicated on descriptions of individual atlas sheet blocks.

Recovery Rates from Formations in gpd/sq.mi.*

Formation or Rock Type	Dry Year	Wet Year
Magothy and Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mount Laurel & Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Hornerstown Marl	-	-
Vincentown Sand	500,000	750,000
Manasquan Marl	-	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Tertiary Clays of Salem Co.	-	-
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Runoff of Smaller Streams with drainage area less than 100 square miles:

Underlying Bedrock	Peak in cu.ft./sec/sq.mi.	Drought* in gal./min/sq.mi.
Magothy & Raritan Fm.	160	0 - 66
Merchantville Clay**	1100	less than 2.6
Woodbury Clay**	1300	1.0
Englishtown Sand	400	0 - 66
Marshalltown Formation**	1300	1.0
Mt.Laurel & Wenonah Fms.	400	0 - 66
Navesink Marl**	1100	less than 2.6
Hornerstown Marl**	950	3.8
Vincentown Sand	400	0 - 66
Manasquan Marl**	950	3.8
Kirkwood Sand	350	0 - 66
Cohansey Sand	160	0 - 66
Tertiary Clays of Salem Co.	1300	0.8
Bridgeton Formation	350	0 - 66
Pensauken Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For Coastal Plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

**Runoff from Mesozoic and Tertiary clays can attain a peak of 2000 cu.ft./sec/sq.mi.

Historic Sites:

Burlington County:
- John Woolman Memorial, Mount Holly
- Mount Holly District, Mount Holly
- Kirby's Mill, Medford
- Burlington County Jail, Mount Holly
- The Old School House, Mount Holly

Camden County:
- Indian King Tavern, Haddonfield
- Walt Whitman House, Camden
- Benjamin Cooper House, Camden
- Joseph Cooper House, Camden
- Pomona Hall, Camden
- Taylor House, Camden
- Newton Friends Meeting House, Camden
- Charles S. Boyer Memorial Hall, Camden
- Haddon Fortnightly, Haddonfield
- Griffith Morgan House, Pennsauken
- 1743 Samuel Cole House, Cherry Hill
- Whitman-Stafford House, Lindenwold

Gloucester County:
- Barnsboro Hotel, Barnsboro
- Woodbury Friends Meeting House, Woodbury
- James Whitall House, National Park
- Red Bank Battlefield Park, National Park
- Holly Bush, Glassboro
- St. Thomas Episcopal Church, Glassboro
- Benjamin Clark House, Deptford

State Owned Land:

Burlington County:
- Mount Laurel State Park 31 - 04
- Wharton Tract 31 - 14,15,24,25
- Rancocas State Park 31 - 04,05
- Medford Public Shooting Grounds 31 - 04

Atlantic County:
- Wharton Tract 31 - 34, 35
- Hammonton Lake 31 - 34, 35

Camden County:
- Wharton Tract 31 - 24,25,24
- Rowands Pond 31 - 33
- Winslow Fish and Wildlife Management Area 31 - 23,33,34

Gloucester County:
- Inskip 31 - 33
- Glassboro Public Hunting and Fishing Grounds 31 - 32
- Glassboro State College 31 - 21

Salem County:
- Greenwood Pond 31 - 41

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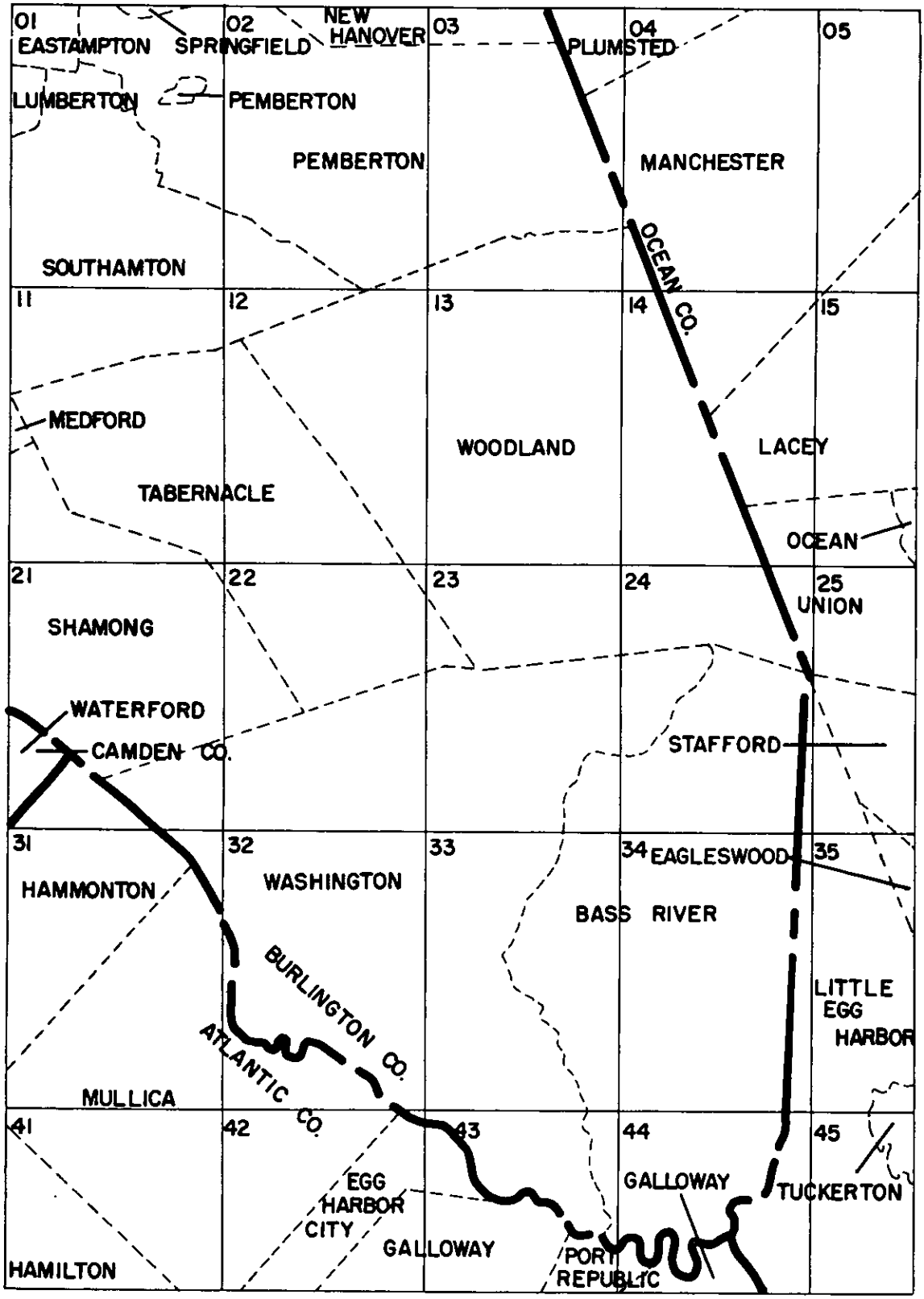


ATLAS SHEET #32 4/74

Counties on Map: Atlantic, Burlington, Ocean, Camden.

U.S.G.S. 7.5' Quads. Covered: Atsion, Brookville, Browns Mills, Chatsworth, Hammonton, Indian Mills, Keswick Grove, Medford Lakes, Mt.Holly, New Gretna, Newtonville, Oswego Lake, Pemberton, Tuckerton, West Creek, Whiting, Woodmansie.

County in Brief Series: Not available.

Soil Conservation Service Reports: Atlantic, Burlington, Ocean, Camden. (All on open file in county seats.)

Engineering Soil Surveys of New Jersey: Report #18 - Atlantic County; Report #20 - Burlington County; Report #8 - Ocean County; Report #17 - Camden County.

Water Resource Data Sources:

1. Water and Sewer Studies: A Master Plan Report. Atlantic County Planning Board, Atlantic City, N.J., 1969.
2. Comprehensive Water Facilities Plan and Water System Plan. Atlantic County Board of Chosen Freeholders Planning Board, Atlantic City, 1971.
3. Water Facilities Study, Burlington County, N. J. Burlington County Planning Board, Mount Holly, 1969.
4. A Master Sewerage Plan for Burlington County, N. J. Mount Holly, 1969.
5. Ocean County Functional Planning for Waste Water Management. Ocean County Planning Board, Toms River, N. J., 1972.
6. Ocean County Master Plan for Water Resources Management. Ocean County Board of Chosen Freeholders, Toms River, 1969.
7. Water Resource Supply Primer. Camden County Planning Department, Pennsauken, N.J., 1972.
8. Comprehensive Plan, Camden County, N. J. Camden County Planning Department, Pennsauken, N.J., 1972.
9. Land Use Plan, Comprehensive Planning Program, Camden County, N.J. Camden County Planning Department, Pennsauken, N.J., 1972.
10. Fire Insurance Maps, Fire Insurance Rating Organization of N. J., Engineering Department, Newark, N. J.

Special Reports:

1. New Jersey Geologic Survey Bulletin #25 "Soil Survey of the Chatsworth Area, New Jersey," Austin, L.P., Deeter, C.C., Engle, Wm. F., and Lee, L.L., 1923.
2. New Jersey Geologic Report Series #3, "Deep Wells of the New Jersey Coastal Plain," Kasabach, H. and Scudder, R., 1969.
3. New Jersey Geologic Survey Pamphlet "Titanium Sands of Southern New Jersey," Markewicz, F.J., Parillo, D.G., Johnson, M.E., 1958.
4. Division of Water Policy and Supply, Water Resources Circular #22, "A Hydrologic Analysis of the New Jersey Pine Barrens Region," Rhodehamel, E.C., 1970.

5. New Jersey Geologic Survey Miscellaneous Publication, "Of Batsto and Bog Iron," Boucher, J.E., Batsto Citizens Advisory Committee, 1964.
6. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, N. J. Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Source:

New Jersey County and Municipality Work Sheets, Pt. 1 (1971), N. J. Department of Community Affairs, Trenton, N. J.

Geologic Quadrangle Maps:

1. Pre-Quaternary Geology of the Browns Mills Quadrangle, N. J. Minard, J.P. and Owens, J.P.
2. Geologic Map of the Pemberton Quadrangle, N. J. Owens, J.P. and Minard, J.P.

Geologic Overlay:

Overlay is available for Atlas Sheet #32 showing the geology of the atlas sheet area. This information is the same as that shown on any particular Atlas Sheet #32 coordinate block.

Physiographic Province:

Outer Plain subdivision of Atlantic Coastal Plain Province.

Geology:

The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing N.J. between Wilmington, Delaware, and Staten Island, New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominantly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments. Atlas Sheet #32, lying almost entirely to the southeast of this cuesta, includes only a small area of Cretaceous terrain.

Quaternary alluvial and shoreline deposits include the Pennsauken and Bridgeton sands and gravels on higher terraces and the Cape May sands, gravels, and clays in lower areas.

Physiographically the area consists of a low, sandy plain extending northwestward from the Great Bay. A few low hills are found to the northeast.

Elevations range from sea level at tidal marshes on the Great Bay and Mullica River to just over 200' on hills to the northeast.

Economically valuable deposits include sand and gravel. Historically, bog iron and peat have been of importance.

Climate:

Average annual precipitation:
Normal year: 44" in the northwest to 49" in the northeast
Wet year: 54" in the northwest to 58" in the south
Dry year: 37" in the northwest to 35" in the south

Mean temperature: Winter months: 33°F
Summer months: 75°F

January coldest month; July warmest month.

Average duration of growing season: 245 days. Last killing frost: April 30; first killing frost: October 19.

Drainage Basins:

Most of the area of Atlas Sheet #32 drains to the Great Bay through the Mullica River. To the northwest, drainage is to the Delaware River through Rancocas Creek. Along the eastern margin, drainage is to Barnegat Bay through Toms River and a number of creeks (Cedar Creek, Forked River, Oyster Creek, Mill Creek, Westecunk Creek, etc.)

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Surface Area (acres)	Drainage Area (sq.mi.)	Volume (B.G.)
Atlantic County:			
Makepeace Lake, Hamilton	184	9	
Nescochague Lake, Mullica	42	17	
Pleasant Mills Pond, Mullica	60	7	
Egg Harbor Lake, Egg Harbor City	30		
Burlington County:			
Atsion Lake, Shamong	93	27	
Chatsworth Lake, Woodland	36	9	
Country Lake, Pemberton	38		
Lake Absegami, Bass River	68	4	
Lebanon Lake, Woodland	88		
Mirror Lake, Pemberton	250	26	
Hanover Lake, Pemberton	40	11	

Presidential Lakes, Pemberton	30	
Unnamed Impoundment, Pemberton	40	
Unnamed Pond, Pemberton	38	
Unnamed Reservoirs (7), Bass River	113	
Vincentown Mill Pond, Southampton	22	52
Woodland Lakes, Woodland	40	
Harrisville Pond, Washington	40	62
Oswego Lake, Washington	90	54
Batsto Lake, Batsto	60	65
Indian Mills Lake, Shamong	30	5
Ocean County:		
Keswick Lake, Manchester	75	2.5
Pohatcong Lake, Tuckerton	28	10

Water Companies Are Listed in:

1. Routine Inspection Reports for Public Water Supply - Atlantic County, 1972-73. N. J. Department of Environmental Protection, Bureau of Potable Water.
2. Routine Inspection Reports for Public Water Supply - Burlington County, 1972-73. N. J. Department of Environmental Protection, Bureau of Potable Water.
3. Routine Inspection Reports for Public Water Supply - Ocean County, 1972-73. N. J. Department of Environmental Protection, Bureau of Potable Water.
4. Comprehensive Water Facilities Plan and Water System Plan, Atlantic County. Atlantic County Board of Chosen Freeholders, Atlantic City, 1971. pp.81-87.
5. Water Facilities Study, Burlington County, N. J. Burlington County Planning Board, Mount Holly, 1969. pp.29-34.
6. Master Plan for Water Resources Management, Ocean County. Ocean County Board of Chosen Freeholders, Toms River, 1969. Table III, Sheets 1 and 2.

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water contamination.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper lying formations.

Formations and approximate depths of commonly tapped aquifers are indicated on individual atlas sheet block descriptions.

Recovery Rates from Formations in gpd/sq.mi.*:

Formation or Rock Type	Dry Year	Wet Year
Magothy and Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mt. Laurel & Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Hornerstown Marl	-	-
Vincentown Sand	500,000	750,000
Manasquan Marl	-	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Beacon Hill Gravel	500,000	750,000
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Runoff of Smaller Streams with drainage area less than 100 square miles:

Underlying Bedrock	Peak in cu.ft./sec/sq.mi.	Drought* in gal./min/sq.mi.
Mt. Laurel and Wenonah Fms.	400	0 - 66
Navesink Marl**	1100	less than 2.6
Hornerstown Marl**	950	3.8
Vincentown Sand	400	0 - 66
Manasquan Marl**	950	3.8
Kirkwood Sand	350	0 - 66
Cohansey Sand	160	0 - 66
Beacon Hill Gravel	400	0 - 66
Bridgeton Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For Coastal Plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

**Runoff from Mesozoic and Tertiary clays can attain a peak of 2000 cu.ft./sec./sq.mi.

Historic Sites:

Burlington County:
Atsion, Atsion, Rt. 206
Batsto Village, Batsto

State Owned Land:

Atlantic County:
- Wharton Tract
- Port Republic Fish and Wildlife Management Area

Burlington County:
- Wharton Tract
- Bass River State Forest
- Lebanon State Forest
- Penn State Forest
- Swan Bay Fish and Wildlife Management Area
- Carranza Memorial
- New Lisbon State Colony

Camden County:
- Wharton Tract

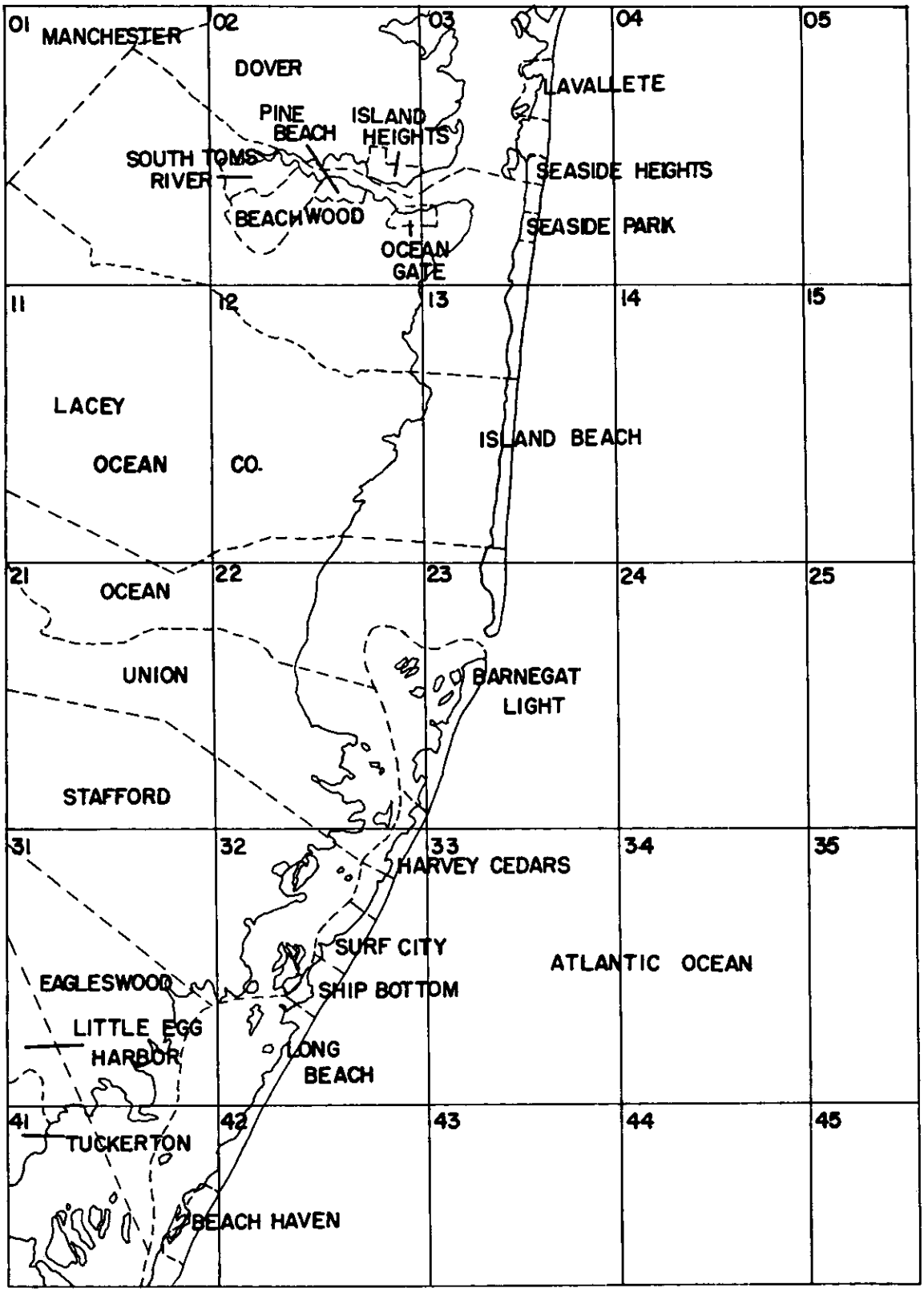
Ocean County:
- Wharton Tract
- Lebanon State Forest
- Bass River State Forest
- Greenwood Forest Fish and Wildlife Management Area
- Manchester Fish and Wildlife Management Area
- Pasadena Fish and Wildlife Management Area
- Whitings Fish and Wildlife Management Area

Wetlands Map Coverage:

Paper Wetlands Map or Plastic Wetlands Map,
Property Line Map,
Ownership List
with the following identification numbers:

Wetlands of Tuckerton Test Site consisting of 17 Wetlands Maps

ATLAS SHEET # 33



ATLAS SHEET #33 4/74

Counties on Map: Ocean, Atlantic.

U.S.G.S. 7.5' Quads Covered: Keswick Grove, Toms River, Seaside Park, Brookville, Forked River, Barnegat Light, West Creek, Ship Bottom, Long Beach, Tuckerton, Beach Haven, Brigantine Inlet.

County in Brief Series: None available.

Soil Conservation Service Reports: Ocean, Atlantic (all on open file in county seats)

Engineering Soil Surveys of New Jersey: Report #18 - Atlantic County; Report #8 - Ocean County.

Water Resource Data Sources:

1. Water and Sewer Studies: a Master Plan Report. Atlantic County Planning Board, Atlantic City, N. J., 1969.
2. Comprehensive Water Facilities Plan and Water System Plan. Atlantic County Board of Chosen Freeholders Planning Board, Atlantic City, 1971.
3. Master Plan for Water Resources Management, Ocean County. Ocean County Board of Chosen Freeholders, Toms River, 1969.
4. Ocean County Functional Planning for Waste Water Management. Ocean County Planning Board, Toms River, N. J., 1972.

Special Reports:

1. Division of Water Resources Special Report #29, "Geology and Ground Water Resources of Ocean County, N. J.," Anderson, H.R., Appel,C.A., 1969.
2. Division of Water Resources Special Report #6, "Supplementary Report on the Ground Water Supplies of the Atlantic City Region," Barksdale, H.C., Sundstrom, R.W., Brunstein, M.S., 1936.
3. Division of Water Resources Special Report #22, "Chloride Concentrations of Water from Wells in the Atlantic Coastal Plain of New Jersey 1923-1961," Seaber, P.R., 1963.
4. Division of Water Resources Circular #22, "A Hydrologic Analysis of the New Jersey Pine Barrens Region," Rhodehamel, E.C., 1970.
5. Division of Water Resources Bureau of Geology and Topography, Geologic Report Series #3, "Deep Wells of the New Jersey Coastal Plain," Kasabach, H., Scudder, R.
6. Division of Water Resources, Bureau of Geology and Topography Pamphlet, ""Titanium Sands of Southern New Jersey," Markewicz, F.J., Parillo, D.G., Johnson, M.E.

7. New Jersey Department of Conservation and Economic Development, Bulletin 55, Geologic Series, "The Peats of New Jersey and Their Utilization, Parts A and B," Waksman, S.A., 1942.
8. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:
Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, N. J. Department of Environmental Protection, Trenton, 1971. Areas and classifications are given in block descriptions.

Population Data Sources:
New Jersey County and Municipality Work Sheets, Pt. 1, (1971); N. J. Department of Community Affairs, Trenton.

Geologic Quadrangle Maps: None available.

Geologic Overlay: Overlay is available for Atlas Sheet #33 showing the geology of the atlas sheet area. This information is the same as that shown on any particular Atlas Sheet #33 coordinate block.

Physiographic Province: Outer subdivision of Atlantic Coastal Plain.

Geology:
The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing N.J.between Wilmington, Delaware, and Staten Island, New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal formations, predominatly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments. Atlas Sheet #33 lies entirely to the southeast of this cuesta. Surface formations range in age from Miocene or Pliocene (the Cohansey Sand) to Holocene. Quaternary alluvial and shoreline deposits include the Bridgeton sands and gravels on higher terraces and the Cape May sands, gravels, and clays in lower areas.

Physiographically the area consists of barrier island and lagoon morphology along the coast and a low, sandy plain inland.

Elevations range from sea level to 186'.

Economically valuable materials include sand and gravel.

Climate:

Average Annual Precipitation:
Normal year: 48" in north to 43" in south
Wet year: 50" in north to 55" in south
Dry year: 35" in north to 33" in south

Mean temperature: Winter months: 34°F
Summer months: 74°F

February coldest month; July warmest month.

Average duration of growing season:
Inland: 245 days. Last killing frost: April 27; first killing frost: October 16.
Coastal: 245 days. Last killing frost: April 20; first killing frost: October 20.
Prevailing winds: Winter months: northwesterly
Summer months: southeasterly

Drainage Basins:

Drainage is entirely to Barnegat Bay through Toms River, Forked River, and a number of creeks (Kettle Creek, Sloop Creek, Cedar Creek, Doughty Creek, etc.)

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Surface Area (acres)	Drainage Area (sq.mi.)	Volume (B.G.)
Ocean County:			
Bamber Lake, Lacey	51	20	
Deer Head Lake, Lacey	32	14	
Dover Forge Pond, Berkeley and Lacey	25		
Lake Barnegat, Lacey	69	15	
Manahawken Lake, Lacey	55	19	
Unnamed Impoundment, Berkeley	37		

Water Companies Are Listed in:

1. Master Plan for Water Resources Management, Ocean County. Ocean County Board of Chosen Freeholders Planning Board, Toms River, N.J., 1969. p.30, Table III, sheets 1-3.
2. Comprehensive Water Facilities Plan and Water System Plan. Atlantic County Board of Chosen Freeholders Planning Board, Atlantic City, N.J., 1971. pp. 81-84.
3. Routine Inspection Reports for Public Water Supply - Atlantic County, 1972-1973. N.J. Department of Environmental Protection, Bureau of Potable Water.
4. Routine Inspection Reports for Public Water Supply - Ocean County, 1972-1973. N.J. Department of Environmental Progection, Bureau of Potable Water.

Ground Water:

Ground water in the coastal plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water contamination.

Well yield values for coastal plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper lying formations.

Formations and approximate depths of commonly tapped aquifers are indicated on individual atlas sheet block descriptions.

Recovery Rates from Formations in gpd/sq.mi.*:

Formation or Rock Type	Dry Year	Wet Year
Magothy and Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mt. Laurel and Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Red Bank and Tinton Sands		
Hornerstown Marl	-	-
Vincentown Sand	500,000	750,000
Manasquan Marl	-	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Runoff of Smaller Streams with drainage area less than 100 square miles:

Underlying Bedrock	Peak in cu.ft./sec/sq.mi.	Drought* in gal./min/sq.mi.
Cohansey Sand	160	0 - 66
Bridgeton Formation	350	0 - 66
Pensauken Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For coastal plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

Historic Sites:

Ocean County:
Barnegat Lighthouse, Long Beach Island
Manahawkin Baptist Church, Manahawkin

Atlantic County: None

State Owned Land:

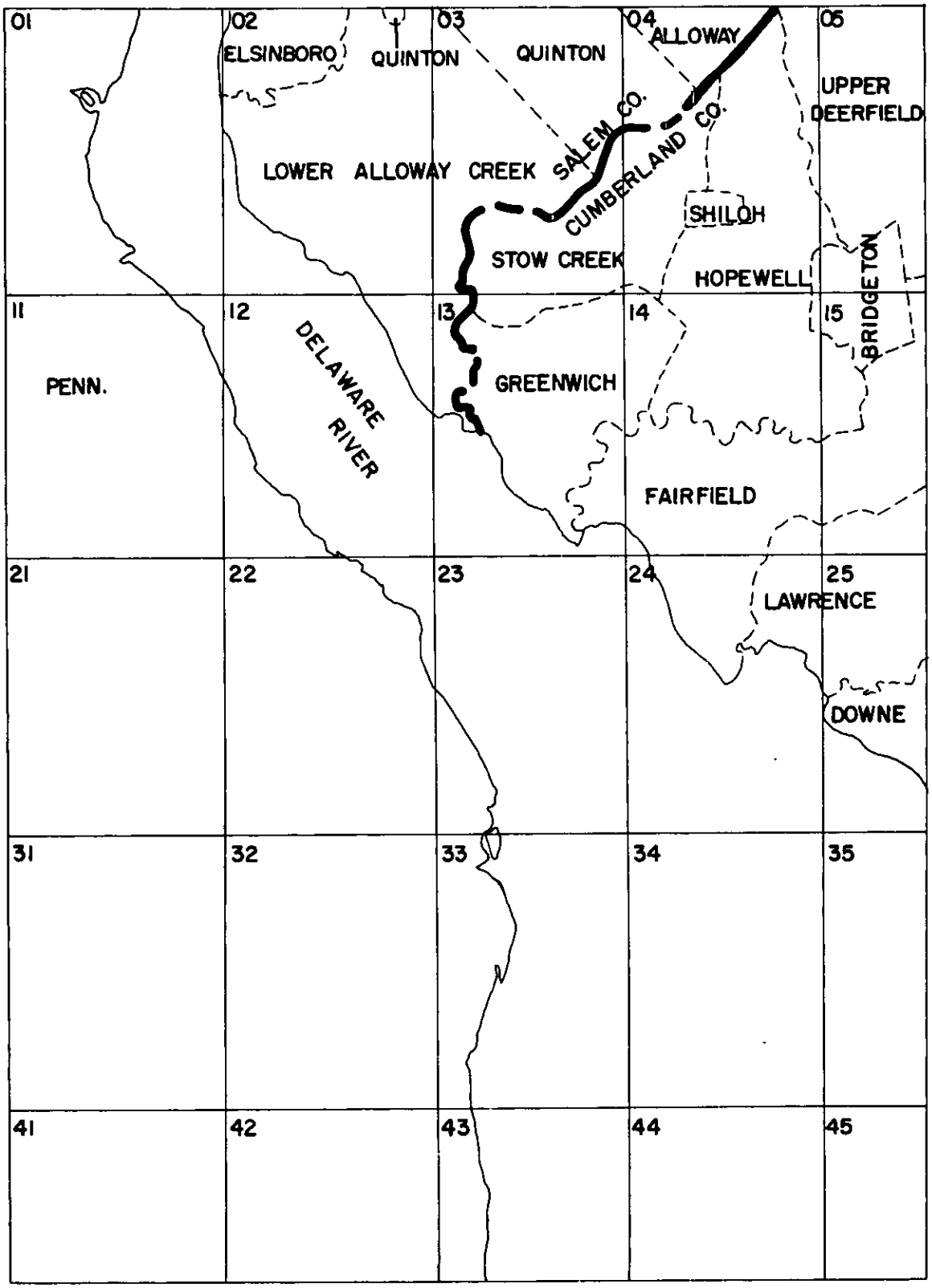
Ocean County:
Barnegat Light (Div. of Parks and Forestry, Bureau of Parks), 33-23
Island Beach State Park, 33-03,13,33
Double Trouble State Park, 33-01,02,11,12
Forked River Farm (Div. of Fish, Game, and Shellfisheries), 33-12
Manahawkin Fish and Wildlife Management Area, 33-31,32
Stafford Forge Fish and Wildlife Management Area, 33-31
Great Bay Natural Area, 33-41
Forked River Marina, 33-12

Atlantic County: None

Wetlands Map Coverage:
Paper Wetlands Map or Plastic Wetlands Map,
Property Line Map,
Ownership List
with the following identification numbers:

Wetlands Map Index #11-10:
399-2142, 399-2154, 392-2142, 392-2148, 392-2154, 385-2142, 385-2148
Wetlands Map Index #11-11:
399-2160, 385-2160
Wetlands Map Index #10-10:
378-2142, 378-2148, 371-2136, 371-2142, 371-2148, 364-2136, 364-2142,
350-2130, 350-2136, 350-2198, 350-2154
Wetlands Map Index #10-11:
378-2160, 371-2160, 364-2160, 357-2160, 350-2160
Wetlands Map Index #9-10:
343-2148, 343-2154, 343-2160, 336-2124, 336-2130, 336-2142, 336-2148,
336-2154, 329-2130, 329-2136, 329-2142, 329-2148, 322-2124, 322-2130,
322-2136, 322-2148, 315-2124, 315-2130, 315-2136, 315-2142
Wetlands Map Index #8-9:
301-2112, 294-2106, 294-2112, 287-2100, 287-2106, 287-2112, 280-2094,
280-2100, 280-2106, 280-2112
Wetlands Map Index #8-10:
308-2124, 308-2130, 308-2136, 301-2118, 301-2124, 301-2130, 294-2118,
294-2124, 294-2130, 287-2124, 287-2130
Wetlands Map Index #7-9:
273-2094, 273-2100, 266-2094, 266-2100, 266-2106, 259-2100, 259-2106,
259-2112, 252-2106
Wetlands Map Index #7-10:
273-2118, 266-2118
Wetlands of Tuckerton Test Site consisting of 17 wetlands maps

ATLAS SHEET 34



ATLAS SHEET #34 7/74

Counties on Map: Cumberland, Salem.

U.S.G.S. 7.5' Quads Covered: Ben Davis Point, Bombay Hook, Bridgeton, Canton, Delaware City, Elmer, Salem, Shiloh, Smyrna, Taylors Bridge.

County in Brief Series: Not available.

Soil Conservation Service Reports: Cumberland, Salem (all on open file in county seats)

Engineering Soil Surveys of New Jersey:
Report #21 - Cumberland County; Report #14 - Salem County.

Water Resource Data Sources:

1. Salem County Sewer and Water Plan - Part 1 (1969), Salem County Planning Board Staff, Salem, N.J.
2. Salem County Sewer and Water Plan - Stage II (1970), Salem County Planning Board Staff, Salem, N.J.
3. Rural Sewerage Feasibility Study for Salem County (1972), Salem County Planning Board, Salem, N. J.
4. Rural Water Plan, Cumberland County, N.J., (1969), Cumberland County Planning Board, Bridgeton.
5. Urban Water Plan, Cumberland County, N.J., (1971), Cumberland County Planning Board, Bridgeton.
6. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Department, Newark, N.J.

Special Reports:

1. Division of Water Resources Special Report #13, "Ground Water Resources in the Tri-State Region Adjacent to the Lower Delaware River," Barksdale, H.C., Greeman, D.W., Lang, S.M., Hilton, G.S., Outlaw, D.E.; 1958.
2. Division of Water Resources Special Report #33, "Geology and Ground Water Resources of Salem County, N.J.," Rosenau, J.C., Lang, S.M., Hilton, G.S., Rooney, J.G.; 1969.
3. Division of Water Resources special Report #34, "Ground Water Resources of Cumberland County, N.J.," Rooney, J.G., 1971.
4. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:
Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, N. J. Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Source:
N.J. County and Municipality Work Sheets, Pt. 1 (1971), N.J. Department of Community Affairs, Trenton, N.J.

Geologic Quadrangle Maps: None available.

Geologic Overlay:
Overlay is available for Atlas Sheet #34 showing the geology of the atlas sheet area. This information is the same as that shown on any particular Atlas Sheet #34 coordinate block.

Physiographic Province: Outer Plain of Atlantic Coastal Plan Province.

Geology:
The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing N.J. between Wilmington, Delaware, and Staten Island, New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominantly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments. Atlas Sheet #34 lies entirely to the southeast of this cuesta.

Quaternary alluvial and shoreline deposits include the Bridgeton sands and gravels on higher terraces and the Cape May sands, gravels and clays in lower areas.

Physiographically, Atlas Sheet #34 consists of salt marsh along the Delaware and a low altitude plateau inland.

Elevations range from sea level along the Delaware to over 130' inland.

Economically valuable deposits include sand and gravel.

Climate:

Average annual precipitation:
Normal year: 42" in south to 43" in north
Dry year: 27"
Wet year: 53" in south to 45" in north

Mean temperatures: Winter months: 35°F
Summer months: 75°F

January-February coldest months; July warmest month.

Average duration of growing season: 252 days. Last killing frost: 4/16; first killing frost: 10/24.

Prevailing winds:
Winter months: northwesterly
Summer months: southwesterly

Drainage Basins:

Atlas Sheet #34 drains to the Delaware River and Bay through the Cohansey River and a number of creeks (Alloway Creek, Hope Creek, Mad Horse Creek, Stow Creek, Back Creek, Nantuxent Creek, Cedar Creek, etc.).

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Surface Area (acres)	Drainage Area (sq.mi.)	Volume (B.G.)
Cumberland County:			
Cedarville Lake, Lawrence	20	7	
Clarks Pond, Fairfield	43	13	
East Lake, Bridgeton	22	6	
Mary-Elmer Lake, Hopewell	22	7	
Seeley Lake, Upper Deerfield and Hopewell	25	6	
Sheppards Millpond, Greenwich	52	1	
Sunset Lake, Upper Deerfield	88	46	
Unnamed Impoundment, Fairfield	41		
Unnamed Impoundment, Stowe Creek	41		
Salem County:			
Larkspur Lake, Lower Alloways Creek	30		

Water Companies Are Listed in:

1. Routine Inspection Reports for Public Water Supply - Cumberland County 1972-73; N.J. Department of Environmental Protection, Bureau of Potable Water.
2. Routine Inspection Reports for Public Water Supply - Salem County 1972-73; N.J. Department of Environmental Protection, Bureau of Potable Water.
3. Urban Water Plan, Cumberland County, N. J. Cumberland County Planning Board, Bridgeton, 1971. pp.40-44.
4. Salem County Sewer and Water Plan - Part 1 (Sewer and Water Resources Inventory and Problem Analysis), Salem County Planning Board, Salem, N.J., 1969. pp.53-62.

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water contamination.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper lying formations.

Formations and approximate depths of commonly tapped aquifers are indicated on individual atlas sheet block descriptions.

Recovery Rates from Formations in gpd/sq.mi.*:

Formation or Rock Type	Dry Year	Wet Year
Magothy & Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mt. Laurel & Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Hornerstown Marl	-	-
Vincentown Sand	500,000	750,000
Manasquan Marl	-	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Tertiary Clays of Salem Co.	-	-
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Runoff of Smaller Streams with drainage area less than 100 square miles:

Underlying Bedrock	Peak in cu.ft./sec/sq.mi.	Drought* in gal./min/sq.mi.
Vincentown Sand	400	0 - 66
Kirkwood Sand	350	0 - 66
Cohansey Sand	160	0 - 66
Tertiary Clays of Salem Co.**	1300	0.8
Bridgeton Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For Coastal Plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the shoutheastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

**Runoff from Mesozoic and Tertiary clays can attain a peak of 2000 cu.ft./sec/sq.mi.

Historic Sites:

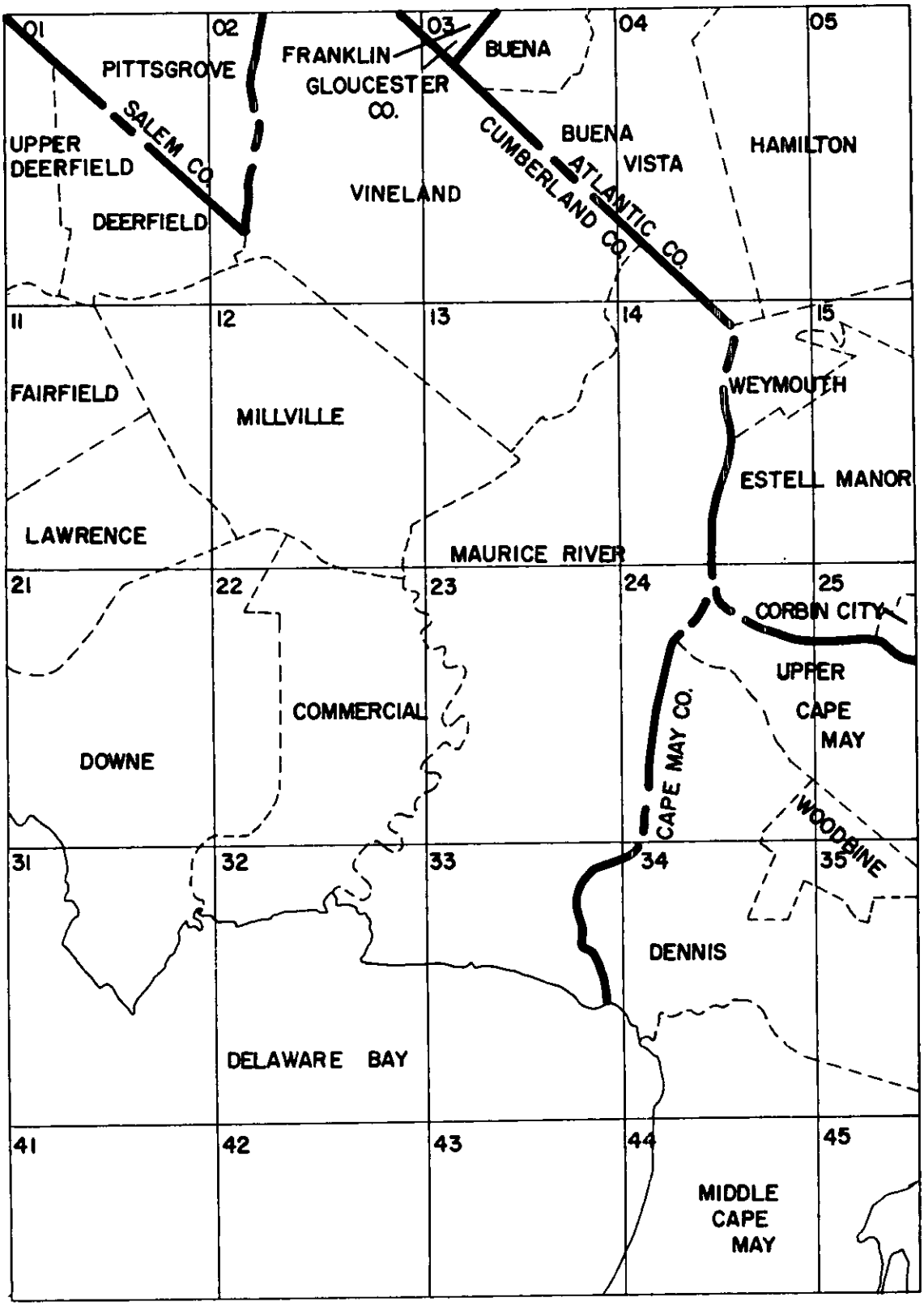
Cumberland County:
Potter's Tavern, Bridgeton
Historic District, Greenwich
Salem:
The Hancock House, Hancock's Bridge

State Owned Land:

Salem County:
Mad Horse Creek Fish and Wildlife Management Area, 34-02,03,12,13
Maskeels Mill Pond (Div. of Fish, Game and Shellfisheries), 34-03
Hancock House, Lower Alloways Creek (historic site), 34-02

Cumberland County:
Osborne Tract (Div. of Fish, Game, and Shellfisheries), 34-13
Clarks Pond (Div. of Fish, Game, and Shellfisheries), 34-15
Dix Fish and Wildlife Management Area, 34-14
Nantuxent Fish and Wildlife Management Area, 34-25
Cohansey River Natural Area, 34-13,14

ATLAS SHEET # 35



ATLAS SHEET #35 7/74

Counties on Map: Atlantic, Cape May, Cumberland, Salem, Gloucester.

U.S.G.S. 7.5' Quads Covered: Bridgeton, Buena, Cedarville, Dividing Creek, Dorothy, Elmer, Five Points, Fortesque, Heislerville, Millville, Newfield, Newtonville, Port Elizabeth, Port Norris, Rio Grande, Stone Harbor, Tuckahoe, Woodbine.

County in Brief Series: Not available.

Soil Conservation Service Reports: Atlantic, Cape May, Cumberland (all on open file in county seats)

Engineering Soil Surveys of New Jersey: Report #15 - Cape May County, Report #18 - Atlantic County, Report #21 - Cumberland County

Water Resource Data Sources:

1. Comprehensive Plan for Cape May County - Water Resources Study. Cape May Planning Board, Cape May Court House, N. J., 1962.
2. Water and Sewer Studies: A Master Plan Report. Atlantic County Planning Board, Atlantic City, 1969.
3. Comprehensive Water Facilities Plan and Water System Plan. Atlantic County Board of Chosen Freeholders Planning Board, Atlantic City, 1971.
4. Rural Water Plan, Cumberland County, N. J. Cumberland County Planning Board, Bridgeton, 1969.
5. Urban Water Plan, Cumberland County, N. J. Cumberland County Planning Board, Bridgeton, 1971.
6. Salem County Sewer and Water Plan - Stage II (1970), Salem County Planning Board Staff, Salem, N. J.
7. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Department, Newark.

Special Reports:

1. Division of Water Resources Special Report #18, "Ground Water Resources of Cape May County, N. J. - Salt Water Invasion of Principal Aquifers," Gill, H.E., 1962.
2. Division of Water Resources Special Report #34, "Ground Water Resources of Cumberland County," Rooney, J.G., 1971.
3. Division of Water Resources Special Report #6, "Supplementary Report on the Ground Water Supplies of the Atlantic City Region," Barksdale, H.C., Sundstrom, R.W., Brunstein, M.S., 1936.
4. Division of Water Resources Special Report #22, "Chloride Concentrations of Water from Wells in the Atlantic Coastal Plain of New Jersey, 1923 - 1961" Seaber, P.R., 1963.
5. Division of Water Resources Circular #8, "Factual Report Summarizing Records of Well, Well Logs, and Summary of Stratigraphy of Cape May County, New Jersey," Gill, H., 1962.

6. Division of Water Resources Circular #22, "Hydrologic Analysis of the N.J. Pine Barrens Region," Rhodehamel, E.C., 1970.
7. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, N. J. Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Sources:

New Jersey County and Municipality Work Sheets, Pt. 1 (1971), N. J. Department of Community Affairs, Trenton, N. J.

Geologic Quadrangle Maps: None available.

Geologic Overlay:

Overlay is available for Atlas Sheet #35 showing the geology of the atlas sheet area. This information is the same as that shown on any particular Atlas Sheet #35 coordinate block.

Physiographic Province:

Outer plain subdivision of Atlantic Coastal Plain Province.

Geology:

The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing N.J. between Wilmington, Delaware, and S. I., New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominatly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments. Atlas Sheet #35 lies entirely to the southeast of this cuesta, being developed primarily on the Miocene or Pliocene Cohansey sand.

Quaternary alluvial and shoreline deposits include the Bridgeton sands and gravels on higher terraces and the Cape May sands, gravels, and clays in lower areas.

Physiographically, Atlas Sheet #35 consists of a low, sandy plain to the south and east and a low altitude plateau to the northwest. Barrier beach and lagoon morphology is found along the Atlantic Coast. Along the more protected shore of Delaware Bay, extensive salt marsh continues to open water or is protected from wave action by a narrow beach.

Elevation ranges from sea level to 142'.

Economically valuable deposits include sand and gravel.

Climate:

Average annual precipitation:
Normal year: 40" in south to 44" in north
Wet year: 62" in south to 48" in north
Dry year: 26" in south to 32" in north

Mean temperature: Winter months: 34°F
Summer months: 75°F

February coldest month; July warmest month.

Average duration of growing season:
Inland: 250 days. Last killing frost: 5/5; first killing frost: 10/9

Along coast: 250 days. Last killing frost: 4/4; first killing frost: 11/15

Drainage Basins:

Drainage is divided between Delaware Bay and the Atlantic Ocean. The Maurice River, Cohansey Creek, and a number of smaller creeks (Dennis Creek, Bidwells Ditch, West Creek, Dividing Creek, Oranaoken Creek, etc.) run to Delaware Bay. The Great Egg Harbor and Tuckahoe Rivers and a number of creeks (Crooked Creek, Cedar Swamp Creek, etc.) run to the Atlantic Ocean.

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Surface Area (acres)	Drainage Area (sq.mi.)	Volume (B.G.)
Atlantic County:			
Cedar Lake, Buena Vista	20		
Florence Lake, Estell Manor	35		
Pancoast Mill Pond, Buena Vista	50	3	

Cape May County:		
Cape May County Park, Middle Township	75	
Dennisville Lake, Dennis	35	
East Creek Pond, Dennis	62	8
Johnson Pond, Dennis	50	5
Lake Nummi, Dennis	26	3
Ludlams Pond, Dennis	53	2
Pickle Factory Pond, Maurice River Twp. and Dennis	59	10
Cumberland County:		
Bostwick Lake, Upper Deerfield	62	
Cedar Lake, Lawrence	23	
Cedarville Lake, Lawrence	20	7
Crystal Sand Wash, Vineland	31	
Hands Millpond, Maurice River	22	8
Laurel Lake, Commercial	145	18
Lummis Lake, Lawrence	22	4
Manantico Lake, Vineland	62	21
Pickle Factory Pond, Maurice River	59	10
Shaws Mill Pond, Lawrence	29	3
Union Lake, Millville	920	220
Unnamed Gravel Pits, Maurice River	20,35,27,20	
Unnamed Impoundment, Millville	58	
Unnamed Impoundment, Vineland	20	
Unnamed Sand Pits, Commercial	21, 25	
Unnamed Sand Pits, Downe	22, 24, 37	
Salem County:		
Centerton Pond, Pittsgrove	30	10
Parvin Lake, Pittsgrove	95	42
Rainbow Lake, Pittsgrove	40	50

Water Companies Are Listed in:

1. Urban Water Plan, Cumberland County, New Jersey. Cumberland County Planning Board, Bridgeton, 1971, pp. 40-44.
2. Comprehensive Water Facilities Plan and Water System Plan, Atlantic County. Atlantic County Board of Chosen Freeholders, Atlantic City, 1971, pp. 81-87.
3. Routine Inspection Reports for Public Water Supply, Cape May County, 1972-73. New Jersey Department of Environmental Protection, Bureau of Potable Water.
4. Routine Inspection Reports for Public Water Supply, Atlantic County, 1972-73. New Jersey Department of Environmental Protection, Bureau of Potable Water.
5. Routine Inspection Reports for Public Water Supply, Cumberland County, 1972-73. New Jersey Department of Environmental Protection, Bureau of Potable Water.

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water contamination.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper lying formations.

Formations and approximate depths of commonly tapped aquifers are indicated on individual atlas sheet block descriptions.

Recovery Rates from Formations in gpd/sq.mi.*:

Formation or Rock Type	Dry Year	Wet Year
Magothy & Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mt. Laurel and Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Hornerstown Marl	-	-
Vincentown Sand	500,000	750,000
Manasquan Marl	-	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Tertiary Clays of Salem Co.	-	-
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Runoff of Smaller Streams with drainage area less than 100 sq.mi.:

Underlying Bedrock	Peak in cu.ft./sec/sq.mi.	Drought* in gal./min/sq.mi.
Cohansey Sand	160	0 - 66
Tertiary Clays of Salem Co.**	1300	0.3
Bridgeton Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For Coastal Plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

**Runoff from Mesozoic and Tertiary clays can attain a peak of 2000 cu.ft./sec/sq.mi.

Historic Sites: None

State Owned Lands:

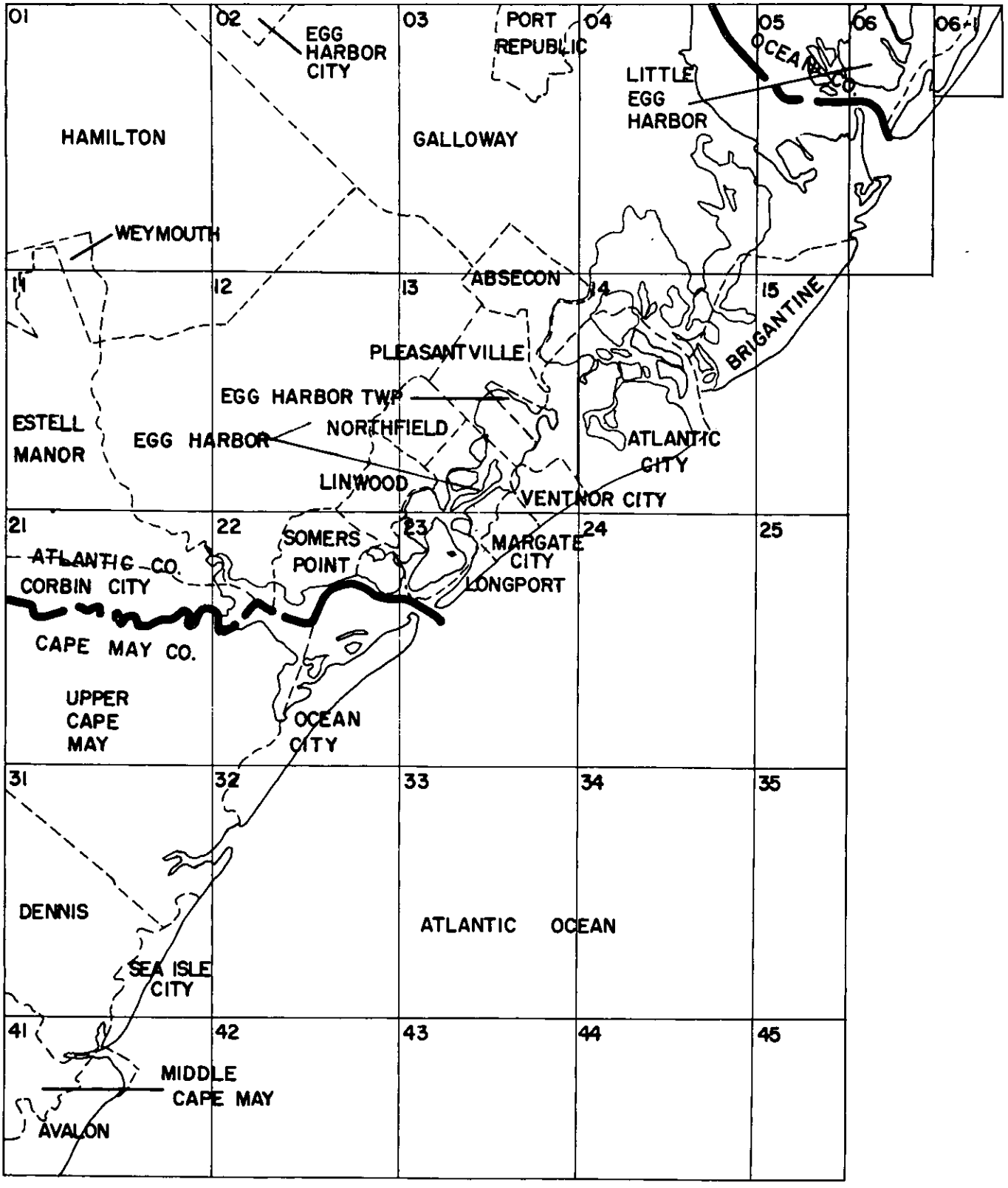
Cape May County:
Belleplain State Forest, 35-23,24,33,34
Peaslee Fish and Wildlife Management Area, 35-13,14,23,24
Dennis Creek Fish and Wildlife Management Area, 35-33,34,43,44
Great Sound Natural Area, 35-44,45
Beaver Swamp Fish and Wildlife Management Area, 35-34,35,44
Cape May Wetlands, 35-35,44,45

Cumberland County:
Belleplain State Forest, 35-23,24,33,34
Millville Fish and Wildlife Management Area, 35-11,12,21,22
Egg Island Fish and Wildlife Management Area, 35-31
Heislerville Fish and Wildlife Management Area, 35-32
Peaslee Fish and Wildlife Management Area, 35-13,14,23,24
Turkey Point (Berry Town) (Div.of Fish,Game, and Shellfisheries), 35-31,32
Menantico Pond (Div. of Fish, Game, and Shellfisheries), 35-12
Corson Tract (Div. of Fish, Game, and Shellfisheries), 35-33
Fortesque Fish and Wildlife Management Area, 35-21,31
Clarks Pond (Div. of Fish, Game, and Shellfisheries), 34-15
Cedarville Ponds (Div. of Fish, Game, and Shellfisheries), 35-21
Fortesque State Marina, 35-21

Salem County:
Parvin State Park, 35-01

Gloucester County: None

ATLAS SHEET #36



ATLAS SHEET #36 3/14/74

Counties on Map: Atlantic, Cape May, Ocean

U.S.G.S. 7.5' Quads Covered: Atlantic City, Brigantine Inlet, Marmora, Mays Inlet, New Gretna, Newtonville, Ocean City, Oceanville, Pleasantville, Sea Isle City, Stone Harbor, Tuckerton

County in Brief Series: None available

Soil Conservation Service Reports: Atlantic County, Cape May County, Ocean County (all on open file in county seats)

Engineering Soil Surveys of New Jersey: Report #8 - Ocean County; Report #15 - Cape May County; Report #18 - Atlantic County

Water Resources Data Sources:

1. Water and Sewer Studies: A Master Plan Report. Atlantic County Planning Board, Atlantic City, 1969.
2. Comprehensive Water Facilities Plan and Water System Plan. Atlantic County Board of Chosen Freeholders Planning Board, Atlantic City, 1971.
3. Ocean County Functional Planning for Waste Water Management, Ocean County Planning Board, Toms, River, 1969.
4. Ocean County Master Plan for Water Resources Management, Ocean County Board of Chosen Freeholders, Toms River, New Jersey, 1969.
5. Comprehensive Plan for Cape May County - Water Resources Study. Cape May Planning Board, Cape May Court House, New Jersey, 1962.
6. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Department, Newark, New Jersey.

Special Reports:

1. Division of Water Resources Special Report #29, "Geology and Ground Water Resources of Ocean County, New Jersey," Anderson, H.R., Appel, C.A., 1969.
2. Division of Water Resources Special Report #18, "Ground Water Resources of Cape May County, New Jersey - Salt Water Invasion of Principal Aquifers," Gill, H.E., 1962.
3. Division of Water Resources Special Report #6, "Supplementary Report on the Ground Water Supplies of the Atlantic City Region," Barksdale, H.C., Sundstrom, R.W., Brunstein, M.S., 1936.
4. Division of Water Resources Special Report #22, "Chloride Concentrations of Water from Wells in the Atlantic Coastal Plain of New Jersey, 1923-1961," Seaber, P.R., 1963.
5. Division of Water Resources Water Resource Circular #8, "Factual Report Summarizing Records of Well, Well Logs, and Summary of Stratigraphy of Cape May County, New Jersey," Gill, H.E., 1962.

6. Division of Water Resources Water Resource Circular #22, "A Hydrologic Analysis of the New Jersey Pine Barrens Region," Rhodehamel, E.C., 1970.
7. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Hydrologic Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block description.

Population Data Source:

New Jersey County and Municipality Work Sheets, Part 1, 1971. N. J. Department of Community Affairs, Trenton, New Jersey.

Geologic Quadrangle Maps: None available.

Geologic Overlay:

Overlay is available for Atlas Sheet #36 showing the geology of the atlas sheet area. This information is the same as that shown on any particular Atlas Sheet #36 coordinate block.

Physiographic Province: Outer Plain subdivision of Coastal Plain Province.

Geology:

The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing N.J. between Wilmington, Del., and Staten Island, New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominantly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments. Atlas Sheet #36 lies entirely to the southeast of this cuesta, being developed primarily on the Miocene or Pliocene Cohansey sand.

Quaternary alluvial and shoreline deposits include the Bridgeton sands and gravels on higher terraces and the Cape May sands, gravels, and clays in lower areas.

Physiographically the area consists of barrier and lagoon configurations along the coast, salt marsh in the Great Bay - Mullica River and Great Egg Harbor estuaries, and a low, sandy plain inland.

Elevations range from sea level to 87'.

Economically valuable deposits include sand and gravel.

Climate:

Average annual precipitation:
Normal year: 39" in south to 46" in north
Dry year: 27" in south to 32" in north
Wet year: 61" in south to 56" in north

Mean temperature: Winter months: 35°F
Summer months: 72°F

February coldest month; July warmest month

Average duration of growing season:
Along coast, 183 days. Last killing frost: 4/20; first killing frost: 10/20

Inland, 250 days. Last killing frost: 4/24; first killing frost: 10/13

Drainage Basins:

Inland drainage is to the Great Egg Harbor or Mullica River. Along the coast, drainage is directly to coastal lagoons through a number of creeks (Mill Creek, Dougherty Creek, Absecon Creek, Patcong Creek, etc.).

Principal Lakes and Reservoirs (over 20 acres surface area):

Name, Municipality	Surface Area (acres)	Drainage Area (sq.mi.)	Volume (B.G.)
Atlantic County:			
Atlantic City Reservoir, Egg Harbor	126	18	
Bargaintown Ridge Lake, Linwood and Egg Harbor	60		
Big Goose Pond, Hamilton	34		
Birch Park Grove Ponds (25), Northfield	250	2	
Harding Lakes (3), Hamilton	27	11	
Lake Lenape, Hamilton	350	200	
Lily Lake, Gallaway	24	3	
Patcong Lake, Egg Harbor	40	12	
Port Republic Lake, Port Republic	50	26	
Saw Mill Pond, Port Republic	37		
Stephen Lake, Estell Manor	27	13	

Cape May County:	
Tuckahoe Impoundments, Upper Twp.	225
Tuckahoe-Menantico Sand Wash (5 ponds), Upper Twp.	30

Water Companies Are Listed in:

1. Comprehensive Water Facilities Plan and Water System Plan, Atlantic County. Atlantic County Board of Chosen Freeholders, Atlantic City, 1971, pp.81-87.
2. Master Plan for Water Resources Management, Ocean County. Ocean County Board of Chosen Freeholders, Toms River, 1969. Table III, Sheets 1 and 2.
3. Routine Inspection Reports for Public Water Supply, Cape May County, 1972-73. N. J. Department of Environmental Protection, Bureau of Potable Water.
4. Routine Inspection Reports for Public Water Supplies, Atlantic County, 1972-73. N. J. Department of Environmental Protection, Bureau of Potable Water.
5. Routine Inspection Reports for Public Water Supplies, Ocean County, 1972-73. N. J. Department of Environmental Protection, Bureau of of Potable Water.

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water contamination.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper lying formations.

Formations and approximate depths of commonly tapped aquifers are indicated on individual atlas sheet block descriptions.

Recovery Rates from Formations in gpd/sq.mi.*:

Formation or Rock Type	Dry Year	Wet Year
Magothy & Raritan Formation	700,000	1,000,000
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mt. Laurel & Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Hornerstown Marl	-	-
Vincentown Sand	500,000	750,000
Manasquan Marl	-	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Beacon Hill Gravel	500,000	750,000
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Runoff of Smaller Streams with drainage area less than 100 square miles:

Underlying Bedrock	Peak in cu.ft./sec/sq.mi.	Drought* in gal/min/sq.mi.
Cohansey Sand	160	0 - 66
Bridgeton Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For Coastal Plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

Historic Sites:

Atlantic County:
- Absecon Lighthouse, Atlantic City
- "Lucy the Elephant," Margate City
- Traymore Hotel, Atlantic City (demolished)
- Somers Mansion, Somers Point

Cape May County:
- Historic District, Cape May

State Owned Land:

Atlantic County:

Tuckahoe - Corbin City Fish and Wildlife Management Area, 36-11,21,22
Absecon Wetlands, 36-04,05,14,15
Atlantic City State Marina, 36-14
Absecon Lighthouse (Historic Site), 36-14
Somers Mansion (Historic Site), 36-22

Cape May County:

Corson's Inlet (Div.of Parks and Forestry, Bureau of Parks), 36-32
Tuckahoe-Corbin City Fish and Wildlife Management Area, 36-11,21,22
Cape May Wetlands, 36-21,22,31,32,41

Wetlands Map Coverage:

Paper Wetlands Map or Plastic Wetlands Map,
Property Line Map
Ownership List

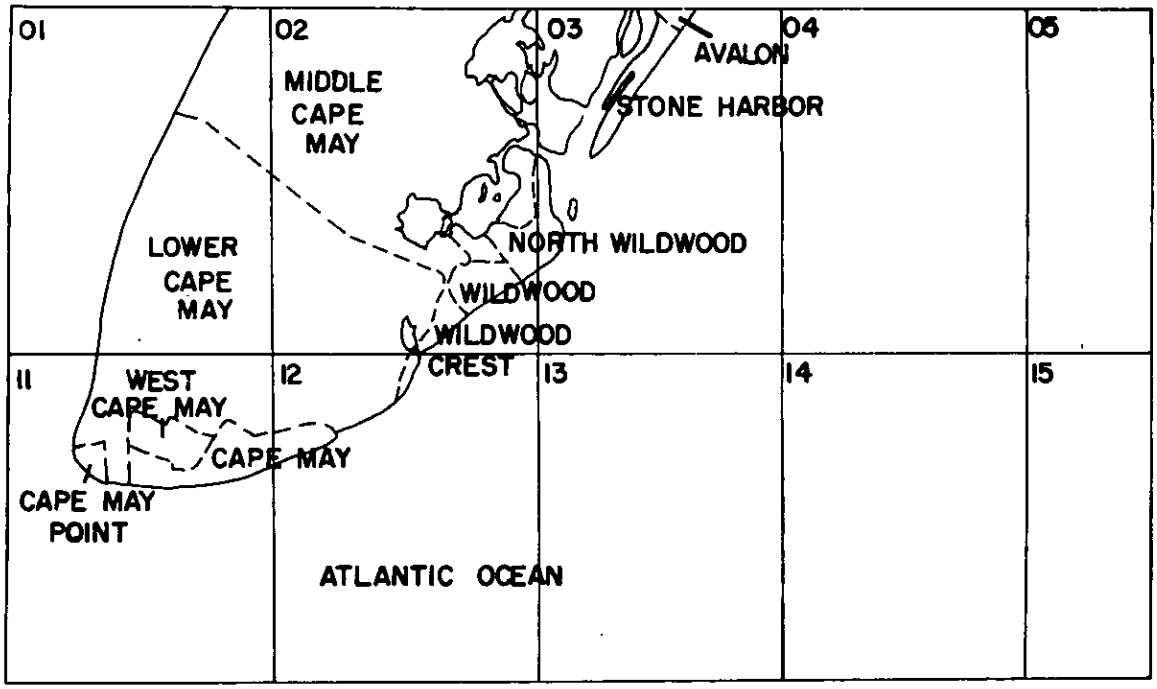
with the following identification numbers:

Wetlands Map Index #7-9:

252-2106, 245-2088

Wetlands of Tuckerton Test Site consisting of 17 wetlands maps

ATLAS SHEET 37



ATLAS SHEET #37 5/74

Counties on Map: Cape May

U.S.G.S. 7.5' Quads Covered: Avalon, Cape May, Rio Grande, Stone Harbor, Wildwood

County in Brief Series: Not available

Soil Conservation Service Reports: Cape May (on open file in county seat)

Engineering Soil Surveys of New Jersey: Report #15 - Cape May County

Water Resources Data Sources:

1. Comprehensive Plan for Cape May County - Water Resources Study. Cape May Planning Board, Cape May Court House, New Jersey, 1962.
2. Fire Insurance Maps, Fire Insurance Rating Organization of New Jersey, Engineering Department, Newark.

Special Reports:

1. Division of Water Resources Special Report #18, "Ground Water Resources of Cape May County, New Jersey - Salt Water Invasion of Principal Aquifers," Gill, H.E., 1962.
2. Division of Water Resources Special Report #22, "Chloride Concentrations of Water from Wells in the Atlantic Coastal Plain of New Jersey, 1923 - 1961," Seaber, 1963.
3. Division of Water Resources Circular #8, "Factual Report Summarizing the Records of Wells, Well Logs, and Summary of Stratigraphy of Cape May County, New Jersey," Gill, H.E., 1962.
4. New Jersey Geologic Report Series #11, "Computation of Extreme Flow and Ground Water Capacity with Inadequate Data in New Jersey," Halasi-Kun, G.J., 1973.

Water Quality Standards:

Surface water standards established as authorized under the Federal Water Quality Act of 1965. The standards are described in Rules and Regulations Establishing Surface Water Quality Criteria, New Jersey Department of Environmental Protection, Trenton, 1971. Areas and categories are given in block descriptions.

Population Data Sources: New Jersey County and Municipality Work Sheets, Pt. 1 (1971), N. J. Department of Community Affairs, Trenton, N. J.

Geologic Quadrangle Maps: None available.

Geologic Overlay:

Overlay is available for Atlas Sheet #37 showing the geology of the atlas sheet area. This information is the same as that shown on any particular Atlas Sheet #37 coordinate block.

Physiographic Province: Outer Plain subdivision of Atlantic Coastal Plain Province.

Geology:

The Atlantic Coastal Plain is developed from a wedge of southeastward-dipping, unconsolidated sediments thickening from its northwestern margin, a line crossing N.J. between Wilmington, Del., and Staten Island, New York, to about 4000' beneath the southeastern part of the state. New Jersey Coastal Plain formations, predominantly sands, clays, and marls, were deposited above older, mostly Paleozoic and Precambrian crystalline rocks during Upper Cretaceous and Cenozoic advances of the sea. The oldest Coastal Plain formations are exposed along the northwestern margin of the province, progressively younger formations being encountered to the southeast. A low cuesta extending from Salem to Atlantic Highlands separates the Inner Coastal Plain, underlain by Cretaceous formations, from the Outer Coastal Plain, dominated by Cenozoic sediments. Atlas Sheet #37 lies entirely to the southeast of this cuesta, being developed primarily on the Cape May Formation of Pleistocene and Holocene age.

Quaternary alluvial and shoreline deposits include the Bridgeton sands and gravels on higher terraces and the Cape May sands, gravels, and clays in lower areas.

Physiographically Atlas Sheet #37 consists of a low, sandy plain. Barrier island and lagoon morphology is found along the Atlantic Coast. Along the more protected shore of Delaware Bay extensive salt marsh continues to open water or is protected from wave action by a narrow beach.

Elevation ranges from sea level to 67'.

Economically valuable deposits include sand and gravel.

Climate:

Average Annual Precipitation:

Normal year:	38"
Dry year:	26"
Wet year:	60"

Mean Temperature: Winter months: 34°F
Summer months: 74°F

February coldest month; July warmest month.

Average duration of growing season:

Inland: 255 days. Last killing frost: May 5; first killing frost: October 9

Along coast: 255 days. Last killing frost: April 4; first killing frost: November 15.

Drainage Basins:

Drainage is to Delaware Bay or the Atlantic Ocean through a number of creeks (Fishing Creek, Dias Creek, Bidwells Ditch, Dennis Creek, West Creek, Riggins Ditch, Mill Creek, Deep Creek, Crooked Creek, Cape Island Creek, etc.).

Ground Water:

Ground water in the Coastal Plain is obtained from seaward-sloping aquifers of Cretaceous and Cenozoic age. Although ground water is generally abundant, along coastal and estuarine shores heavy pumping of deeper aquifers or even moderate pumping of near surface aquifers may lead to salt water contamination.

Well yield values for Coastal Plain formations given below are valid for both water table and enclosed portions of an aquifer. In some areas where water table supplies are insufficient, additional supplies have at times been obtained by drilling additional wells to deeper lying formations.

Formations and approximate depths of commonly tapped aquifers are indicated on individual atlas sheet block descriptions.

Recovery Rates from Formations in gpd/sq.mi.*:

Formation or Rock Type	Dry Year	Wet Year
Merchantville Clay	120,000	200,000
Woodbury Clay	100,000	150,000
Englishtown Sand	500,000	750,000
Marshalltown Formation	100,000	150,000
Mt. Laurel & Wenonah Sands	500,000	750,000
Navesink Marl	120,000	200,000
Hornerstown Marl	-	-
Vincentown Sand	500,000	750,000
Manasquan Marl	-	-
Kirkwood Sand	600,000	900,000
Cohansey Sand	700,000	1,000,000
Beacon Hill Gravel	500,000	750,000
Tertiary Clays of Salem Co.	-	-
Cape May Formation	up to 850,000	up to 1,300,000

*Depending on local conditions individual wells may deviate considerably from these values.

Runoff of Smaller Streams with drainage area less than 100 square miles:

	Peak in cu.ft./sec/sq.mi.	Drought* in gal./min/sq.mi.
Cohansey Sand	160	0 - 66
Bridgeton Formation	350	0 - 66
Cape May Formation	100	0 - 66

*For Coastal Plain formations, the lower lowest flow value is more likely towards the northwestern limits of a formation while the higher value is to be expected along the southeastern limits of its exposure. In addition, lower values are to be expected where a permeable horizon is underlain by an unsaturated aquifer and higher values on clayey areas of a formation.

Historic Sites:

Cape May County:
Historic District, Cape May

State Owned Land:

Cape May County:
Belleplain State Forest, 37-01,02,11,12
Tuckahoe - Corbin City Fish and Wildlife Management Area, 37-03,04
Dennis Creek Fish and Wildlife Management Area, 37-12,22
Beaver Swamp Fish and Wildlife Management Area, 37-12,13,22,23
Cape May Wetlands, 37-04,05,13,14,22,23,32,33
Cape May Point (Div. of Parks and Forestry, Bur.of Parks), 37-31,41
Great Sound (Div. of Parks and Forestry, Bur. of Parks), 37-23
Hereford Inlet Coast Guard Station (Bur. of Marine Enforcement), 37-33
Natural Lands Trust, Inc. (Dept. of Env. Protec.,Miscellaneous Area), 37-14

County	Abbreviations	Atlas Sheets
Atlantic	A	31,32,35,36
Bergen	Be	23,26
Burlington	Bu	27,28,31,32
Camden	Cam	31,32
Cape May	C.M.	35,36,37
Cumberland	Cu	30,31,34,35
Essex	E	25,26
Gloucester	G	30,31,35
Hudson	Hd	26
Hunterdon	Hn	24,25,27
Mercer	Me	27,28
Middlesex	Mi	25,26,28,29
Monmouth	Mn	26,28,29
Morris	Mr	22,23,24,25,26
Ocean	O	28,29,32,33,36
Passaic	P	22,23,26
Salem	Sa	30,31,34,35
Somerset	So	24,25,27,28
Sussex	Su	21,22,24,25
Union	U	25,26
Warren	W	21,24

TOWNSHIPS BY COUNTIES

ATLANTIC

Buena Vista.....31-43 31-44 35-03
35-04 35-14

Egg Harbor.....36-02 36-03 36-11
36-12 36-13 36-21
36-22

Galloway.....32-42 32-43 32-44
36-02 36-03 36-04
36-05 36-14

Hamilton.....31-44 31-45 32-41
35-04 35-05 35-14
36-01 36-02 36-11
36-12

Mullica.....31-35 31-45 32-31
32-32 32-41 32-42
36-01

Weymouth.....35-05 35-14 35-15
36-01 36-11

BERGEN

Lyndhurst.....26-13

Mahwah.....23-22 23-31 23-32

Ridgefield Park..26-04

Ridgewood.....23-42 23-43

River Vale.....23-34 23-44

Rochelle Park....26-03

Saddle Brook.....23-33 26-03
(Saddle River Twp.Prior to 1955)

Saddle River.....23-33 26-03
(Saddle Brook Twp.After 1955)

South Hackensack.26-03

Teaneck.....26-03 26-04

Washington.....23-33 23-43

Wyckoff.....23-32 23-33

BURLINGTON

Bass River.....32-23 32-24 32-33
32-34 32-43 32-44

Bordentown.....28-21 28-31

Burlington.....27-34 27-44

Chesterfield.....28-31 28-32 28-42

Cinnaminson.....27-43 31-02 31-03

Delanco.....27-43

Delran.....31-03

Eastampton.....27-45 28-41 31-05
32-01

Edgewater Park...27-43

Evesham.....31-03 31-04 31-13
31-14 31-23 31-24

Florence.....27-34 27-35 28-31

Hainesport.....31-04

Lumberton.....31-04 31-05 32-01

Mansfield.....28-31 28-32 28-41

Maple Shade.....31-02 31-03

Medford.....31-04 31-05 31-41
31-15 31-24

Moorestown.....31-02 31-03 31-04

Mount Holly.....31-04 31-05

Mount Laurel.....31-03 31-04

New Hanover.....28-32 28-33 28-42
28-43

Pemberton.....28-41 28-42 32-01
32-02 32-03

Riverside.....27-43

Shamong.....31-14 31-15 31-24
31-25 32-11 32-21
32-22

BURLINGTON COUNTY CONT'D.

Southampton.....31-05 31-15 32-01
32-02 32-11 32-12

Springfield.....27-45 28-41 28-42

Tabernacle.....32-11 32-12 32-22

Washington.....31-05 32-01 32-11
32-21 32-22 32-23
32-24 32-31 32-32
32-33 32-43

Westampton.....27-44 27-45

Willingboro.....27-43 27-44

Woodland.....32-02 32-03 32-04
32-12 32-13 32-14
32-22 32-23 32-24

CAMDEN

Berlin.....31-13 31-23

Cherry Hill.....31-02 31-03 31-13
(Delaware Twp.Prior to 1961)

Delaware.....31-02 31-03 31-13
(Cherry Hill after 1961)

Gloucester.....31-11 31-12 31-22

Haddon.....31-02 31-12

Pennsauken.....31-02

Voorhees.....31-12 31-13

Waterford.....31-23 31-24 31-25
31-34 31-35 32-21

Winslow.....31-22 31-23 31-24
31-33 31-34

CAPE MAY

Dennis.....35-24 35-33 35-34
35-35 36-31 36-41

Middle.....35-34 35-35 35-43
35-44 35-45 36-41
37-01

Upper.....35-21 35-24 35-25
35-35 36-21 36-22
36-31 36-32

CUMBERLAND

Commercial.....35-12 35-21 35-22
35-23 35-31 35-32

Deerfield.....35-01 35-02 35-11

Downe.....34-24 34-25 34-11
35-12 35-21 35-22
35-31

Fairfield.....34-13 34-14 34-15
34-24 35-01 35-11

Greenwich.....34-13 34-14

Hopewell.....34-04 34-14 34-15

Landis.....Known as City of
Vineland; Twp.no longer in existence.

Lawrence.....34-14 34-15 34-24
34-25 35-11 35-12
35-21

Maurice River....35-03 35-04 35-12
35-13 35-14 35-22
35-23 35-24 35-32
35-33

Stow Creek.....34-03 34-04 34-13
34-14

Upper Deerfield..30-44 30-45 34-04
34-05 35-01

ESSEX

Caldwell.....26-01 26-11
(Became Fairfield Twp.in 1963)

Cedar Grove.....26-01 26-02

Fairfield Twp....26-01 26-11
(Became Fairfield Boro in 1964)

Livingston.....25-14 25-15 26-11

Maplewood.....26-11 26-21

ESSEX COUNTY CONT'D.

Millburn.....25-14 25-15 25-25
26-21

GLOUCESTER

Deptford.....31-11 31-12 31-21
31-22

East Greenwich...30-14 30-15 30-24
30-25 31-11 31-21

Elk.....30-25 30-35 31-31

Franklin.....31-31 31-32 31-33
31-42 31-43 35-02
35-03

Greenwich.....30-14 30-24

Harrison.....30-24 30-25 31-21
31-31

Logan.....30-13 30-14 30-23
30-24

Mantua.....31-21

Monroe.....31-22 31-23 31-32
31-33 31-34 31-43
31-44

South Harrison...30-24 30-34 30-35

Washington.....31-21 31-22

West Deptford....30-15 31-11 31-21

Woolwich.....30-23 30-24 30-34

HUDSON

North Bergen.....26-13 26-14

Weehawken.....26-14

HUNTERDON

Alexandria.....24-21 24-22 24-32
24-33

Bethlehem.....24-21 24-22 24-23
24-32

Clinton.....24-24 24-34 24-35

Delaware.....24-43 24-44 27-02
27-03

East Amwell.....24-44 24-45 27-04
27-05 28-01

Holland.....24-21 24-22 24-31
24-32

Kingwood.....24-32 24-33 24-42
24-43 27-02

Lebanon.....24-13 24-14 24-23
24-24

Raritan.....24-33 24-34 24-43
24-44 24-45 27-04

Readington.....22-44 24-24 24-25
24-34 24-35 24-45
25-21 25-31 25-41

Tewksbury.....24-14 24-15 24-24
24-25 25-11 25-21
25-31

Union.....24-22 24-23 24-32
24-33

West Amwell.....27-03 27-04 27-13
27-14

MERCER

East Windsor.....28-12 28-13 28-22
28-23

Ewing.....27-14 27-15 27-24
27-25 28-11 28-21

Hamilton.....28-11 28-21 28-22
28-31 28-32

MERCER COUNTY CONT'D.

Hopewell.....27-14 27-15 28-01
28-11

Lawrence.....28-11 28-21

Princeton.....28-01 28-02 28-11
28-12

Washington.....28-22 28-23

West Windsor.....28-11 28-12 28-22

MIDDLESEX

Cranbury.....28-13

East Brunswick...25-44 28-03 28-04

Edison 25-34 25-35 25-44
(Raritan Twp. Prior to 1954)

Madison.....28-04 28-05 28-14
28-15 29-01 29-11

North Brunswick..25-43 25-44 28-03
28-04

Piscataway.....25-33 25-34 25-43
25-44

Plainsboro.....28-12 28-13

Raritan.....25-34 25-35 25-44
(Edison Twp. After 1954)

South Brunswick..28-02 28-03 28-04
28-12 28-13

Woodbridge.....25-35 26-31 26-32
26-41

MONMOUTH

Atlantic.....29-12 29-13 29-22
(Colts Neck Twp. After 1962)

Colts Neck Twp...29-12 29-13 29-22
(Atlantic Twp. Prior to 1962)

Freehold.....28-24 28-25 29-11
29-21

Hazlet.....29-02
(Raritan Twp. Prior to 1967)

Holmdel.....29-02 29-12

Howell.....29-21 29-22 29-31
29-32

Manalapan.....28-14 28-15 28-24
28-25 29-11 29-21

Marlboro.....29-11 29-12

Matawan.....29-01 29-02

Middletown.....29-02 29-03 29-12
29-13

Millstone.....28-14 28-23 28-24
28-25 28-34

Neptune.....29-23 29-24

Ocean.....29-13 29-14 29-23
29-24

Raritan.....29-02
(Hazlet Twp. After 1967)

Shrewsbury.....29-13

Upper Freehold...28-23 28-32 28-33

Wall.....29-22 29-23 29-24
29-32 29-33

MORRIS

Boonton.....22-44 25-04

Chatham.....25-14 25-24

Chester.....25-01 25-02 25-11
25-12 25-21

MORRIS COUNTY CONT'D

Denville.....25-03 25-04

East Hanover.....25-04 25-05 25-14
25-15

Hanover.....25-04 25-13 25-14

Harding.....25-13 25-14 25-23
25-24

Jefferson.....22-32 22-33 22-34
22-42 22-43 25-02

Mendham.....25-12 25-13

Mine Hill.....25-02

Montville.....22-34 22-44 25-03
25-05

Morris.....25-13 25-14

Mount Olive.....24-04 24-05 25-01
25-11

Parsippany-Troy Hills
25-03 25-04 25-05
25-13 25-14

Passaic.....25-23 25-24

Pequannock.....23-31 23-41

Randolph,.....25-02 25-03 25-12
25-13

Rockaway.....22-33 22-34 22-42
22-43 22-44 25-02
25-03 25-04

Roxbury.....25-01 25-02 25-11

Washington.....24-04 24-05 24-14
24-15 25-01 25-11
25-21

OCEAN

Berkeley.....33-01 33-02 33-03
33-12 33-13 33-23

Brick.....29-32 29-33 29-42
29-43

Dover.....29-41 29-42 29-43
33-01 33-02 33-03

Eagleswood.....32-35 33-31 33-32

Jackson.....28-24 28-25 28-34
28-35 28-44 28-45
29-21 29-31 29-41

Lacey.....32-05 32-14 32-15
33-01 33-11 33-12
33-13 33-21

Lakewood.....29-31 29-32 29-41
29-42

Little Egg Harbor
32-24 32-25 32-34
32-35 32-44 32-45
33-31 33-41 36-05

Long Beach.....33-22 33-23 33-31
33-32 33-41 33-42
36-01 36-05

Manchester.....28-44 28-45 29-41
32-03 32-04 32-05
32-14 33-01

Ocean.....33-11 33-12 33-21
33-22 33-23

Plumsted.....28-33 28-34 28-43
28-44 32-03 32-04

Stafford.....32-24 32-25 33-21
33-22 33-31 33-32

Union.....32-14 32-15 32-24
32-25 33-21 33-22

PASSAIC COUNTY

Little Falls.....26-01 26-02

Ringwood.....23-21 23-22 23-31
23-32

Wanaque.....23-31

Wayne.....23-41 23-42 26-01
26-02

West Milford.....22-14 22-23 22-24
22-25 22-33 22-34
22-35 23-21 23-31

SALEM

Alloway.....30-33 30-34 30-43
30-44 34-03 34-04

Elsinboro.....30-42 34-02

Lower Alloway Creek
30-42 34-01 34-02
34-03 34-12 34-13

Lower Penns Neck 30-31 30-32 30-42
(Pennsville Twp.
After 1965)

Mannington.....30-32 30-33 30-34
30-42 30-43

Oldmans.....30-22 30-23 30-33

Pennsville.....30-31 30-32 30-42
(Lower Penns Neck
Twp. Prior to 1965)

Pilesgrove.....30-23 30-33 30-34

Pittsgrove.....30-45 31-41 31-42
35-01 35-02

Quinton.....30-42 30-43 34-03
34-04

Upper Penns Neck..30-22 30-23 30-32
30-33

Upper Pittsgrove..30-34 30-35 30-44
30-45 31-31 31-41

SOMERSET

Bedminster.....25-21 25-22 25-31
25-32

Bernards.....25-13 25-22 25-23
25-32

Branchburg.....25-31 25-41

Bridgewater.....25-22 25-31 25-32
25-33

Franklin.....25-32 25-33 25-42
25-43 25-44 28-02
28-03

Green Brook.....25-33 25-34

Hillsborough.....24-45 25-31 25-32
25-41 25-42 28-02

Montgomery.....25-41 25-42 28-01
28-02

Warren.....25-22 25-23 25-32
25-33

SUSSEX

Andover.....21-35 21-45 22-31
22-41

Byram.....21-45 22-31 22-32
22-41 22-42 24-05
25-01

Frankford.....21-24 21-25 22-11
22-21 22-22

SUSSEX COUNTY CONT'D

Fredon.....21-34 21-35 21-44
22-31

Green.....21-34 21-35 21-44
21-45 22-41 24-05

Hampton.....21-24 21-25 21-34
21-35 22-21 22-31

Hardyston.....22-22 22-23 22-32
22-33

Lafayette.....22-21 22-22 22-31

Montague.....21-04 21-05 21-14
21-15 22-01 22-02
22-11

Sandyston.....21-14 21-24 21-25
22-11 22-21

Sparta.....22-22 22-31 22-32
22-33 22-42

Stillwater.....21-24 21-33 21-34

Vernon.....22-13 22-14 22-22
22-23 22-24

Walpack.....21-23 21-24 21-33

Wantage.....22-01 22-02 22-11
22-12 22-13 22-21
22-22

UNION

Berkeley Heights 21-35 22-31 25-24
(New Providence
Twp. Prior to
1951)

Clark.....25-35 26-21 26-31

Cranford.....26-21

Hillside.....26-21 26-22

New Providence...21-35 22-31 25-24
(Berkeley Heights
Twp. After 1951)

Scotch Plains....25-24 25-25 25-34
25-35

Springfield.....25-25 26-21 28-41

Union.....26-21

WARREN

Allamuchy.....21-44 24-04 24-05

Blairstown.....21-32 21-33 21-42
21-43 24-02 24-03

Franklin.....24-12 24-21 24-22

Frelinghuysen....21-34 21-43 21-44
24-03 24-04

Greenwich.....24-21 24-22

Hardwick.....21-33 21-34 21-43

Harmony.....24-11 24-12 24-21
24-22

Hope.....21-43 24-02 24-03

Independence.....24-03 24-04

Knowlton.....21-42 21-44 24-01
24-02

Liberty.....24-02 24-03 24-13

Lopatcong.....24-21

Mansfield.....24-03 24-04 24-13
24-14

Oxford.....24-12 24-13

WARREN COUNTY CONT'D

Pahaquarry.....21-31 21-32 21-33
21-41

Pohatcong.....24-21 24-31

Washington.....24-12 24-13 24-22
24-23

White.....24-02 24-03 24-11
24-12 24-13

Outline of Block Description

Block # 25-33

A. U.S.G.S. Quads

B. Drainage Basins

C. Environmental Monitoring Stations
   1. Meteorologgic Stations
   2. Stream Gauging Stations
   3. Water Quality Stations
   4. Others

D. Geologic Formations

E. Geographic Description
   1. Topography
   2. Climate
      a. Average annual precipitation
      b. Mean Temperature
      c. Average Duration of Growing Season
   3. Land Use
      a. Urban
      b. Agricultural Suburban
      c. Forest
      d. Industrial
      e. Mineral Resources
      f. Transportation

F. State Owned Land

G. Federally Owned Land

H. Historic Sites

I. Water Well Records

BLOCK #25-33

A. Bernardsville, Bound Brook, Chatham, Plainfield

B. Passaic-Upper Passaic, Raritan-Lower Raritan

C. 1. Bound Brook - Non-recording precipitation gauge

2. Map No.	Location	Period of Record
90	Raritan River at Manville	1903-1915, 1921-
100	Raritan River at Bound Brook	1904-1909,1936-1939 1942,1945-1961
102	Green Brook at Plainfield	1938-
103	Green Brook at Bound Brook	1964-

3.			
	90	Raritan River at Manville	1964-
	103	Green Brook at Bound Brook	1964-
	282	Raritan River at Bround Brook (Queens Bridge)	1964-
	284	Green Brook at Dunellen (Washington Ave.)	1964-
	285	Ambrose Brook at Middlesex, Raritan Ave.	1964-
	287	Bound Brook at Middlesex (Rt.28 Br.)	1964-

Water Quality Standards: (explained in Atlas Sheet description)
FW2 except where classified FW3

D. Brunswick Formation (Trb), Basalt Flows (Trbs)

E. 1. Physiographic Province: Piedmont
Subdivision: Triassic Lowlands
Major Topographic Features: Red Sandstone Plain, Watchung Ridges
Elevations (ft.above sea level): ridges 530, valleys 50
Relief (ft.): 479

2. a. Normal Year: 48"
Dry Year: 34"
Wet Year: 53"

b. January: 30°F
July: 74°F

c. 238 days. Last killing frost: 4/25; first killing frost: 10/15

3. Not available as of 5/74

F. State, County Owned Land and Major Semi-public Areas
Div. of Parks and Forestry - Washington Rock State Park
Div. of Water Resources - Delaware and Raritan Canal
Middlesex County - Johnson Park
Bound Brook Water Company - Private Watershed

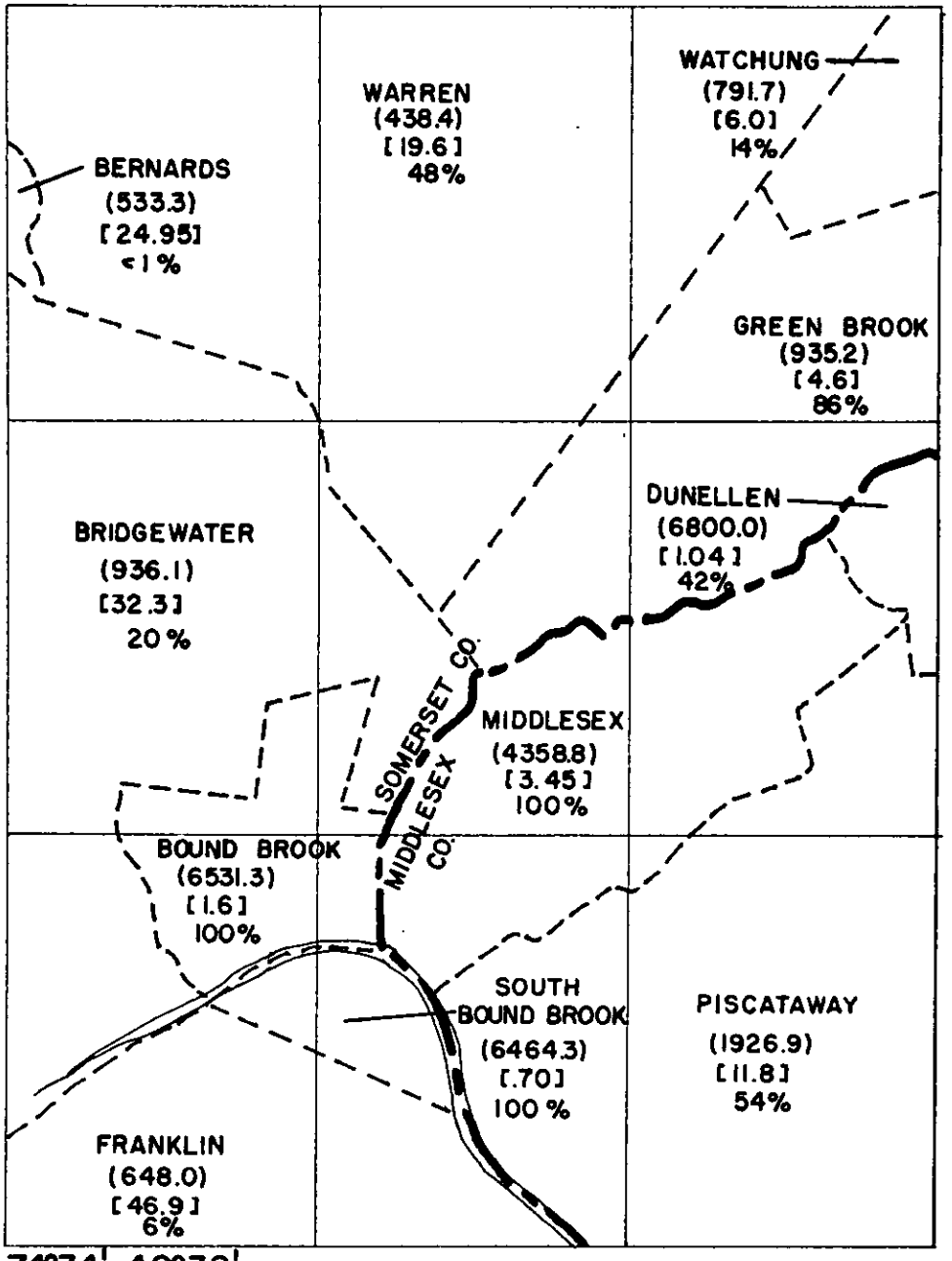
Appendix B

I. Water Well Records

Location	Owner	Year Drilled	Depth of Casing	Total Depth	g/m Yield	Formation
25-33-278	Warren Twp.Bd.of Ed.	1959	42	200	75	Trb
25-33-338	Twin Brooks Country Club	1965	32	210	100	"
25-33-386	Zappa Research Molding Co.	1971	63	220	100	"
25-33-305	Zappa Tool Corp.	1969	50	185	100	"
25-33-445	Houdaille Const.Mat.Inc.	1965	60	212	75	Trbs,Trb
25-33-472	Central Commercial Co.	1957	39	556	448	Trb
25-33-546	Knickerbocker Towy Co.	1973	40	213	150	"
25-33-559	George Osterman (Car Wash)	1965	32	145	120	"
25-33-565	Elizabethtown Water Co.	1965	51	430	350	"
25-33-565	"	1963	22	285	316	"
25-33-577	Central Jersey Operating Co.,Inc.	1963	52	340	157	"
25-33-682	Captive Plastics, Inc.	1971	38	240	100	"
25-33-714	American Cyanamid Co.	1959	47	402	510	"
25-33-714	"	1959	45	404	503	"
25-44-715	"	1959	46	403	183	"
25-33-756	Cemco Tool Co., Inc.	1968	60	175	75	"
25-33-757	Driver Harris Co.	1967	40	400	220	"
25-33-813	Elizabethtown Water Co.	1963	29	300	264	"
25-33-816	Tower Plastics Corp.	1973	52	200	100	"
25-33-835	Air Reduction Sales Co.	1954	34	404	292	"

POPULATION MAP

25-33



74°34' 40°32'

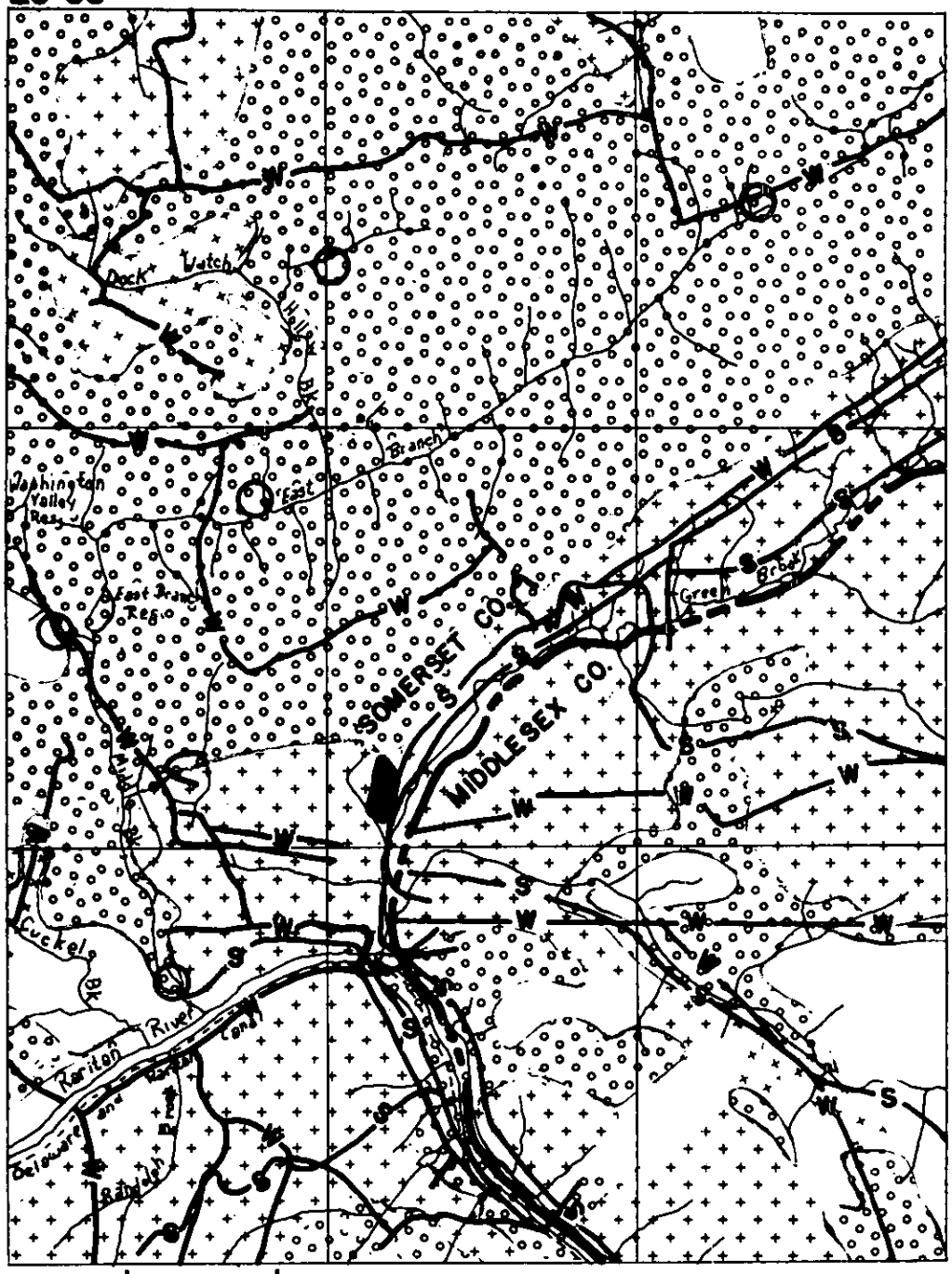
X = 2027797.17

Y = 619241.52

N J G S 11-73

WATER RESOURCE MAP

25-33



74° 34' 40° 32'

X = 2027797.17

Y = 619241.52

NJGS 11-73

■ SANITARY LANDFILL

2533575 SEVERIN

2533738 BOUND BROOK BORO

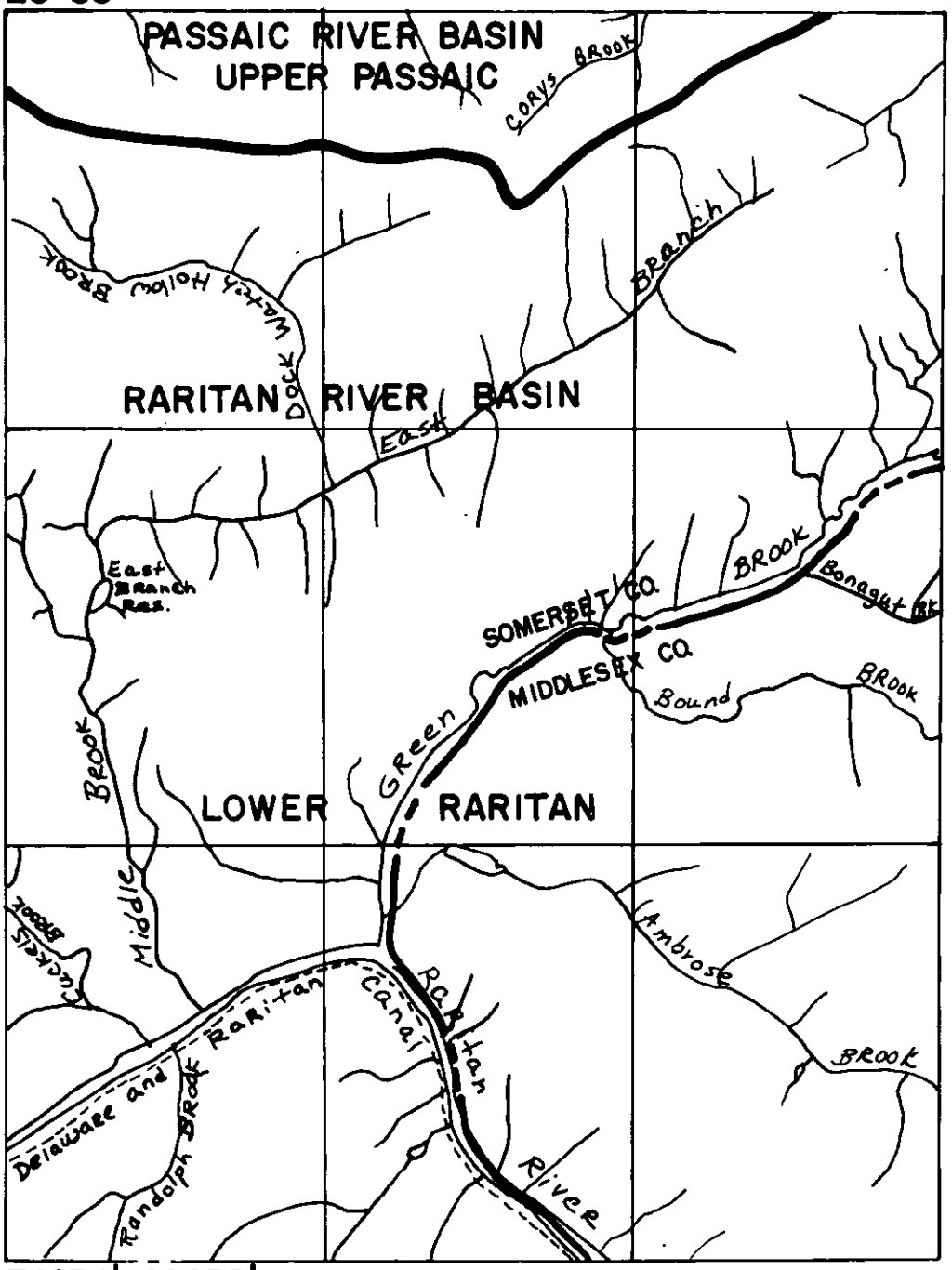
2533817 BOUND BROOK BORO

○ SEWAGE TREATMENT PLANTS

2533247	.042 mgd	DOMESTIC
2533354	.010 mgd	DOMESTIC
2533435	.01 mgd	DOMESTIC
2533445	.018 mgd	DOMESTIC
2533728		DOMESTIC

DRAINAGE BASIN MAP

25-33



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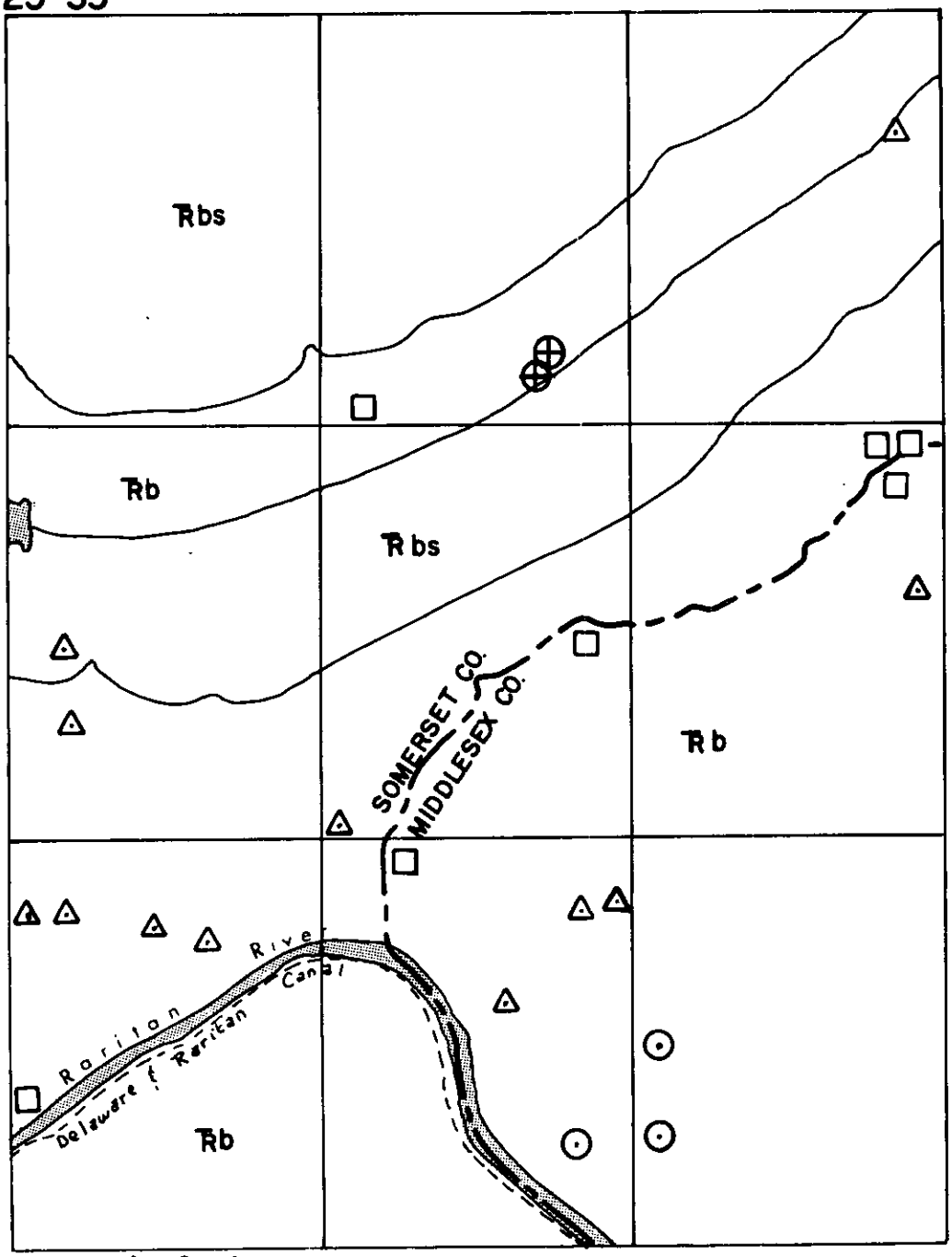
X = 2027797.17

Y = 619241.52

NJGS 11-73

GEOLOGIC MAP

25-33



74° 34' 40" 32'

X = 2027797.17

Y = 619241.52

NJGS 4-73

COMPREHENSIVE LEGEND FOR ALL GEOLOGIC MAPS (21-37)

△ INDUSTRIAL WELL YIELDING OVER 70 GALLONS PER MINUTE

□ PUBLIC SUPPLY WELL YIELDING OVER 70 GALLONS PER MINUTE

⊕ UNSUCCESSFUL ROCK WELL YIELDING LESS THAN 70 GALLONS PER MINUTE

⊙ UNSUCCESSFUL SAND WELL YIELDING LESS THAN 70 GALLONS PER MINUTE

[t] NO TEST – NO DATA ON YIELD

○ NEW JERSEY COASTAL PLAIN DEEP WELLS

——– – – FAULT (DASHED WHERE INFERRED)

—— – – CONTACT (DASHED WHERE INFERRED)

PHYSIOGRAPHIC PROVINCE BOUNDARY

QUATERNARY

Qf - RECENT FILL
Qm - TIDAL MARSH & SWAMP DEPOSITS
Qbs - BEACH SAND
Qg - GRAVELS
Qsd - STRATIFIED DRIFT (WISCONSIN)
Qrm - RECESSIONAL MORAINE (WISCONSIN)
Qtm - TERMINAL MORAINE OF WISCONSIN GLACIAL EPOCH
Qbt - BRIDGETON FORMATION
Qps - PENSAUKEN FORMATION
Qcm - CAPE MAY FORMATION

TERTIARY

Tbh - BEACON HILL GRAVEL
Tch - COHANSEY SAND
Tkw - KIRKWOOD SAND
Tsr - SHARK RIVER MARL
Tmq - MANASQUAN MARL
Tvt - VINCENTOWN SAND
Tht - HORNERSTOWN MARL

CRETACEOUS

Krs - SHREWSBURY MEMBER OF RED BANK SAND
Krsh - SANDYHOOK MEMBER OF RED BANK SAND
Krb - RED BANK
Krbt - RED BANK (TRANSITIONAL UNIT)
Krbg - RED BANK (GLAUCONITE SAND UNIT)
Kt - TINTON SAND
Kns - NAVESINK MARL
Kml - MOUNT LAUREL SAND
Kw - WENONAH SAND
Kmw - MOUNT LAUREL & WENONAH SAND (UNDIFFERENTIATED)
Kmt - MARSHALLTOWN FORMATION
Ket - ENGLISHTOWN SAND
Kwb - WOODBURY CLAY
Kmv - MERCHANTVILLE CLAY
Km - MAGOTHY FORMATION
Kr - RARITAN FORMATION
Kmr - MAGOTHY & RARITAN FORMATION

TRIASSIC

Trb - BRUNSWICK FORMATION
Trbo - BEDS SIMILAR TO LOCKATONG FORMATION
Trc - TRIASSIC BORDER CONGLOMERATE
Trl - TRIASSIC LOCKATONG FORMATION
Trs - STOCKTON FORMATION
Trbs - BASALT FLOWS
Trdb - TRIASSIC DIABASE

DEVONIAN

Dsk - SKUNNEMUNK CONGLOMERATE
Dbp - BELLVALE SANDSTONE & PEQUANAC SHALE
Dm - MARCELLUS FORMATION
Dkn - KANOUSE SANDSTONE
Don - ONONDAGA FORMATION

Dsch - SCHOHARIE FORMATION
Des - ESOPUS FORMATION
Dob - ORISKANY & BECRAFT LIMESTONE
Dg - GLENERIE FORMATION
Dpe - PORT EWEN FORMATION
Dmi - MINISINK FORMATION
Dns - NEW SCOTLAND FORMATION
Dkc - KALKBERG & COEYMANS FORMATION

SILURIAN

Sdm - MANLIUS FORMATION
Srdf - RONDOUT, DECKER FERRY FORMATION
Sb - BOSSARDVILLE FORMATION
Spi - POXONO ISLAND FORMATION
Shf - HIGH FALLS FORMATION
Sd - DECKER LIMESTONE & LONGWOOD SHALE
Ssg - SHAWANGUNK FORMATION
Sgp - GREEN POND CONGLOMERATE

POST-ORDOVICIAN

ns - NEPHELITE SYENITE
bb - BASIC VOLCANIC BRECIA
nf - BASIC DIKES
sp - SERPENTINE

ORDOVICIAN

Omb - MARTINSBURG FORMATION (SHALE)
Oms - MANHATTAN SCHIST
Ojb - JACKSONBURG FORMATION (LIMESTONE)

CAMBRO-ORDOVICIAN

Cok - KITTATINNY LIMESTONE (PRESENTLY UNDER REVISION-TO BE BROKEN DOWN INTO FIVE FORMATIONS)

CAMBRIAN

Ch - HARDYSTON SANDSTONE

PRE - CAMBRIAN

gh - HORNBLENDE GRANITE

am - AMPHIBOLITE

gnm - MICROCLINE GNEISS

go - ALASKITE

gs - SYENITE

gd - GRANODIORITE GNEISS

gns - PYROXENE SYENITE

ghb - HORNBLENDE & BIOTITE GNEISS

gpx - PYROXENE GNEISS

hqa - HYPERSTENE - QUARTZ - ANDESINE GNEISS

gs - SILLIMANITE GNEISS

qo - QUARTZ - OLIGOCLASE GNEISS

qob - QUARTZ - OLIGOCLASE - BIOTITE GNEISS

sk - MARLBE & SKARN

pqo - PYROXENE GNEISS; MAINLY QUARTZ - OLIGOCLASE - CLINOPYROXENE GNEISS

gnq - QUARTZ PLAGIOCLASE GNEISS

gb - GABBRO

bgn - BYRAM GNEISS

METAMORPHIC ROCKS OF UNKNOWN ORIGIN

Wgn - WISSAHICKON SCHIST

gn - AMPHIBOLITES & GNEISS

fnd - FORMATION NOT DETERMINED

LEGEND FOR ATLAS SHEET

COUNTY OR STATE BOUNDARY

MUNICIPAL BOUNDARY

( ) POPULATION DENSITY IN PERSONS PER SQUARE MILE

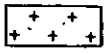
[ ] AREA IN SQUARE MILES

% PERCENT AREA OF MUNICIPALITY ON BLOCK

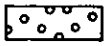
DRAINAGE BASIN BOUNDARY

RIVER BASIN BOUNDARY

HUDSON DRAINAGE BASIN NAME

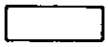


AREA SERVED BY PUBLIC WATER AND SEWAGE SEWAGE



AREA SERVED BY PUBLIC WATER SUPPLIES ONLY

AREA SERVED BY SEWAGE SERVICE ONLY



EXISTING PONDS, LAKES, AND RESERVOIRS

SANITARY LANDFILLS

SEWAGE TREATMENT PLANTS

—— S ——

MAJOR SEWAGE TRANSMISSION LINES

—— W ——

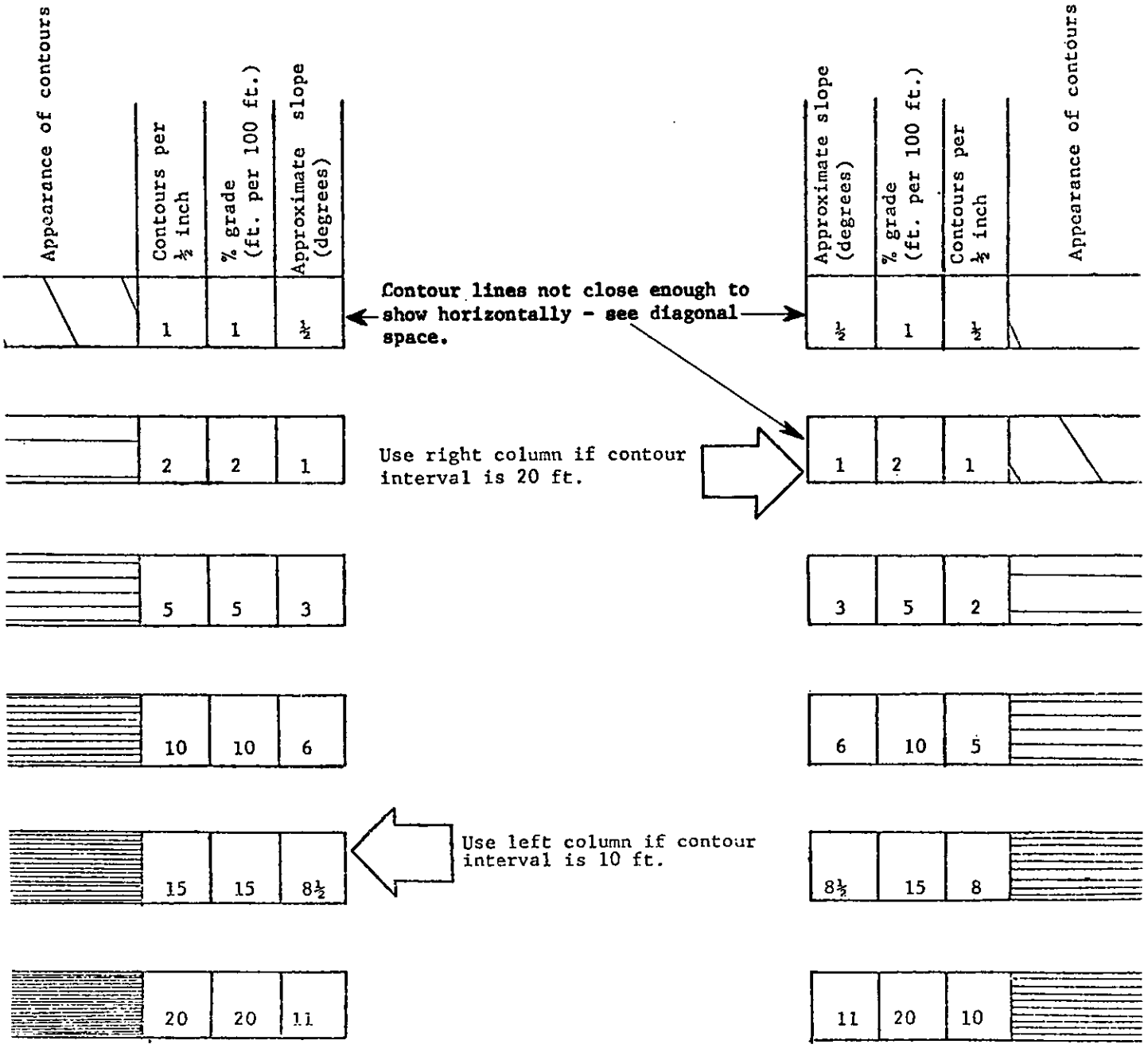
MAJOR WATER PIPELINES

ALL MAP COORDINATES ARE FOR THE LOWER LEFT HAND CORNER

SCALE 1 INCH = 1 MILE

Appendix B

SLOPE ESTIMATOR FOR U.S.G.S. 7½' QUADRANGLE MAPS
SCALE 1:24,000



SLOPE ESTIMATOR FOR STATE OF N.J. ATLAS SHEETS
SCALE 1:63360 (1 inch = 1 mile)