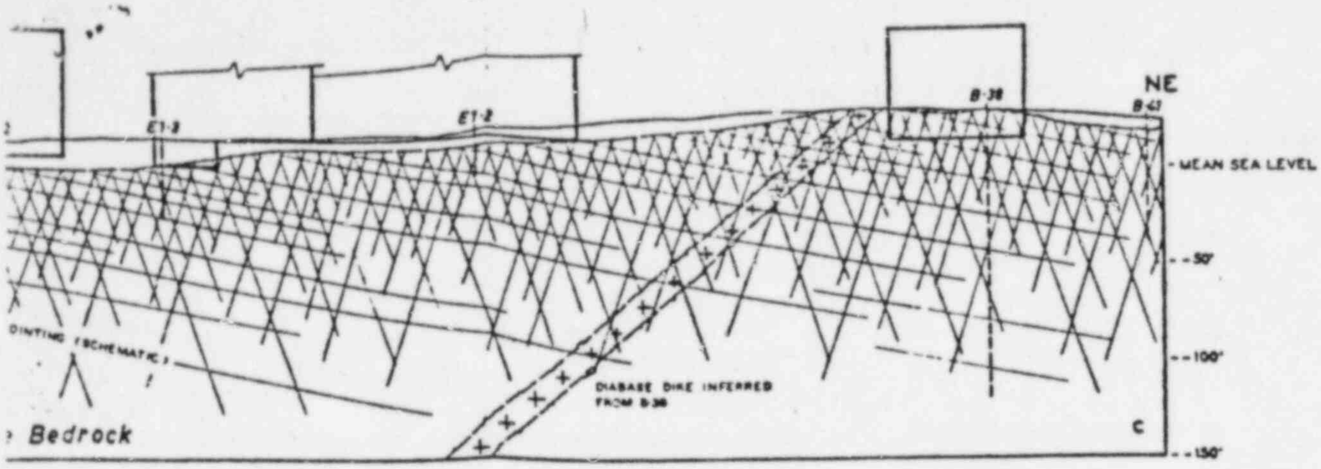
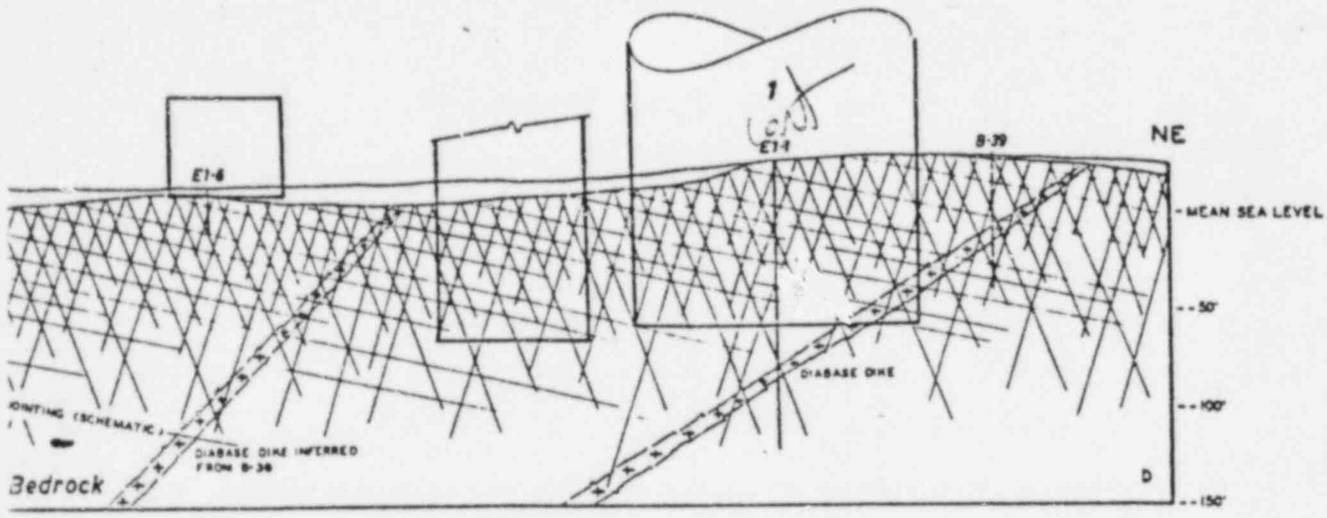
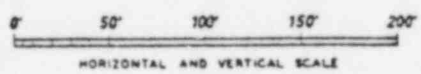
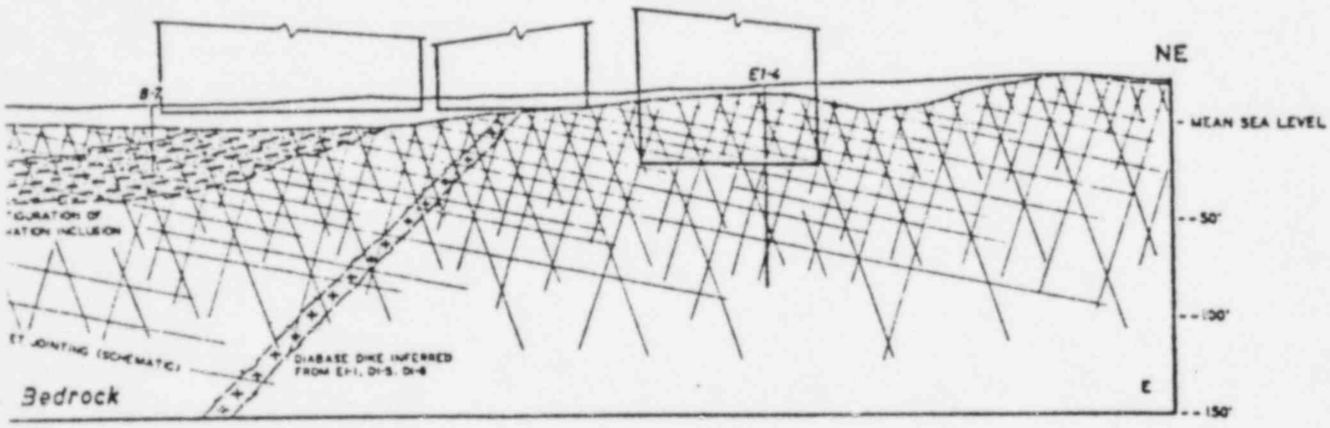


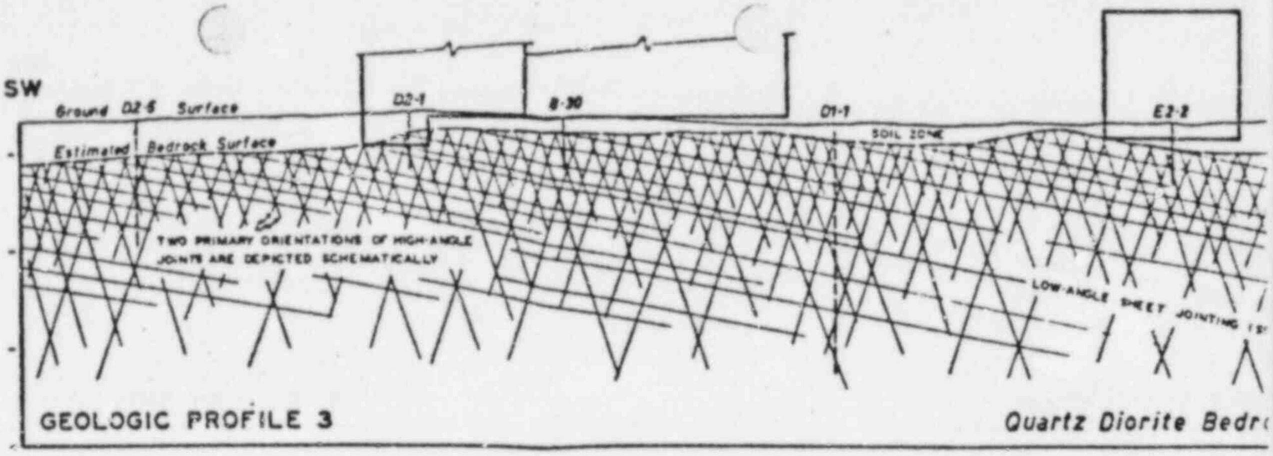


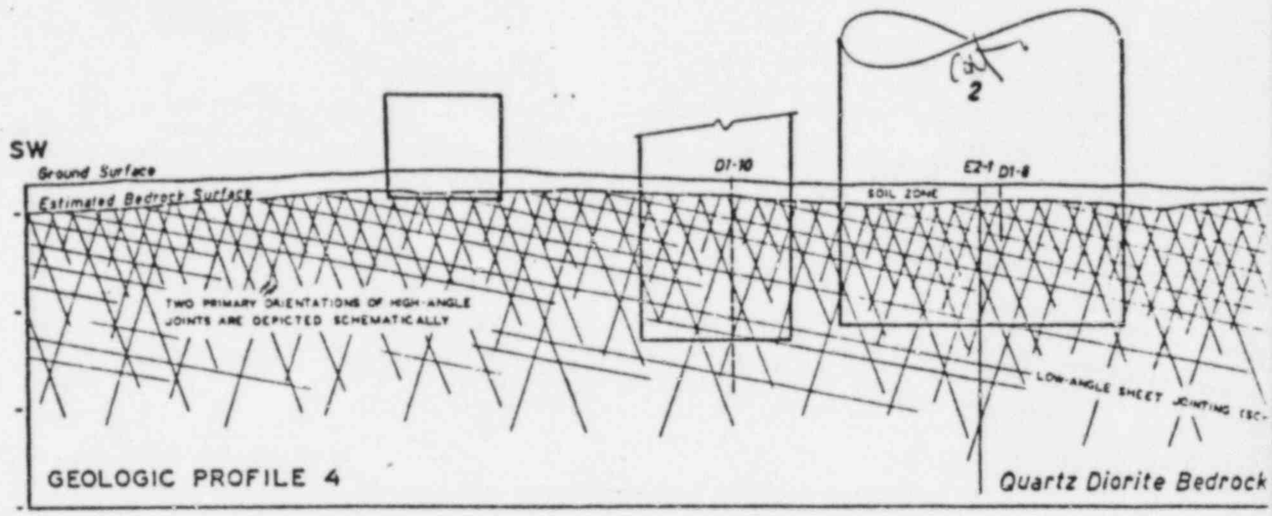
ROCK IS ESSENTIALLY FRESH IMMEDIATELY BELOW SOILS HORIZON. H SOME RUSTY COATINGS AND LOCAL MINOR WEATHERING EFFECTS MODERATE DEPTHS.





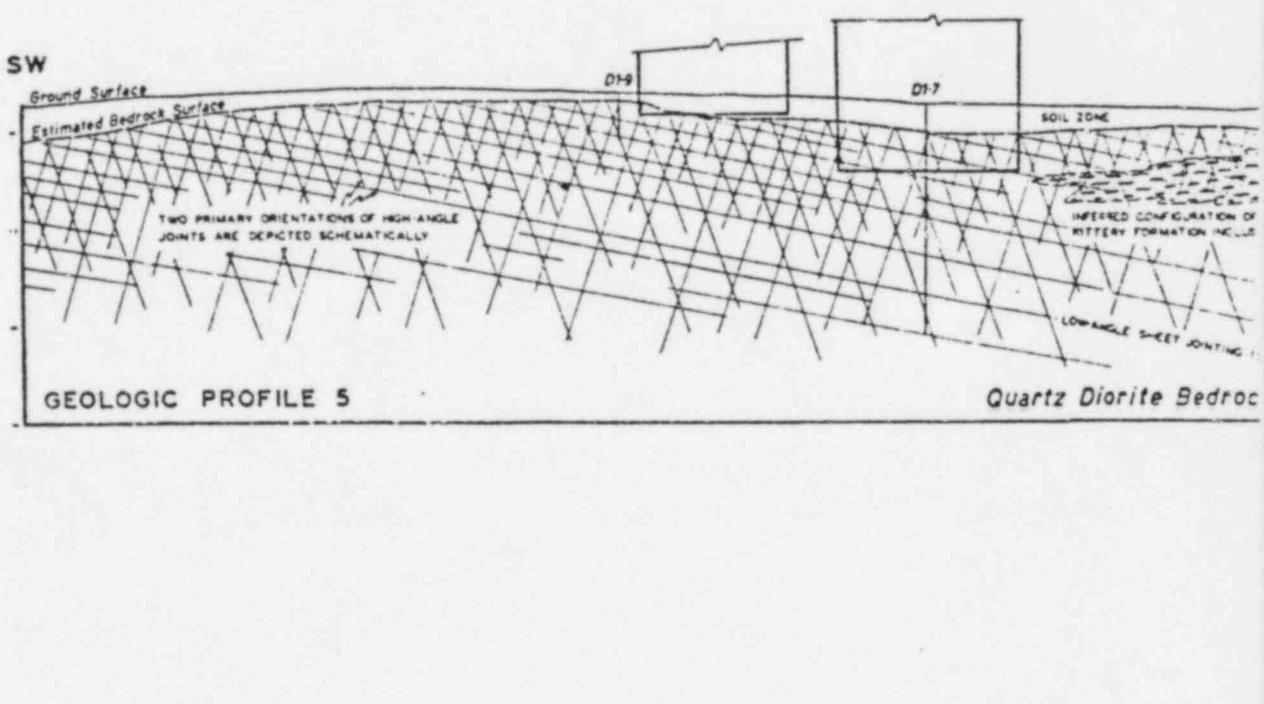
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION Preliminary Safety Analysis Report	GEOLOGIC PROFILE 3, 4 AND 5
	FIG. 2.5-10c, d, e





NOTE 1: SOIL ZONE IS CHARACTERIZED BY OUTWASH SANDS LOCALLY ENCLOSING MARINE CLAY-SILT BEDS, OVERLYING GLACIAL TILL.

NOTE 2 BEDROCK IS EST
WITH SOME RUS
TO MODERATE D



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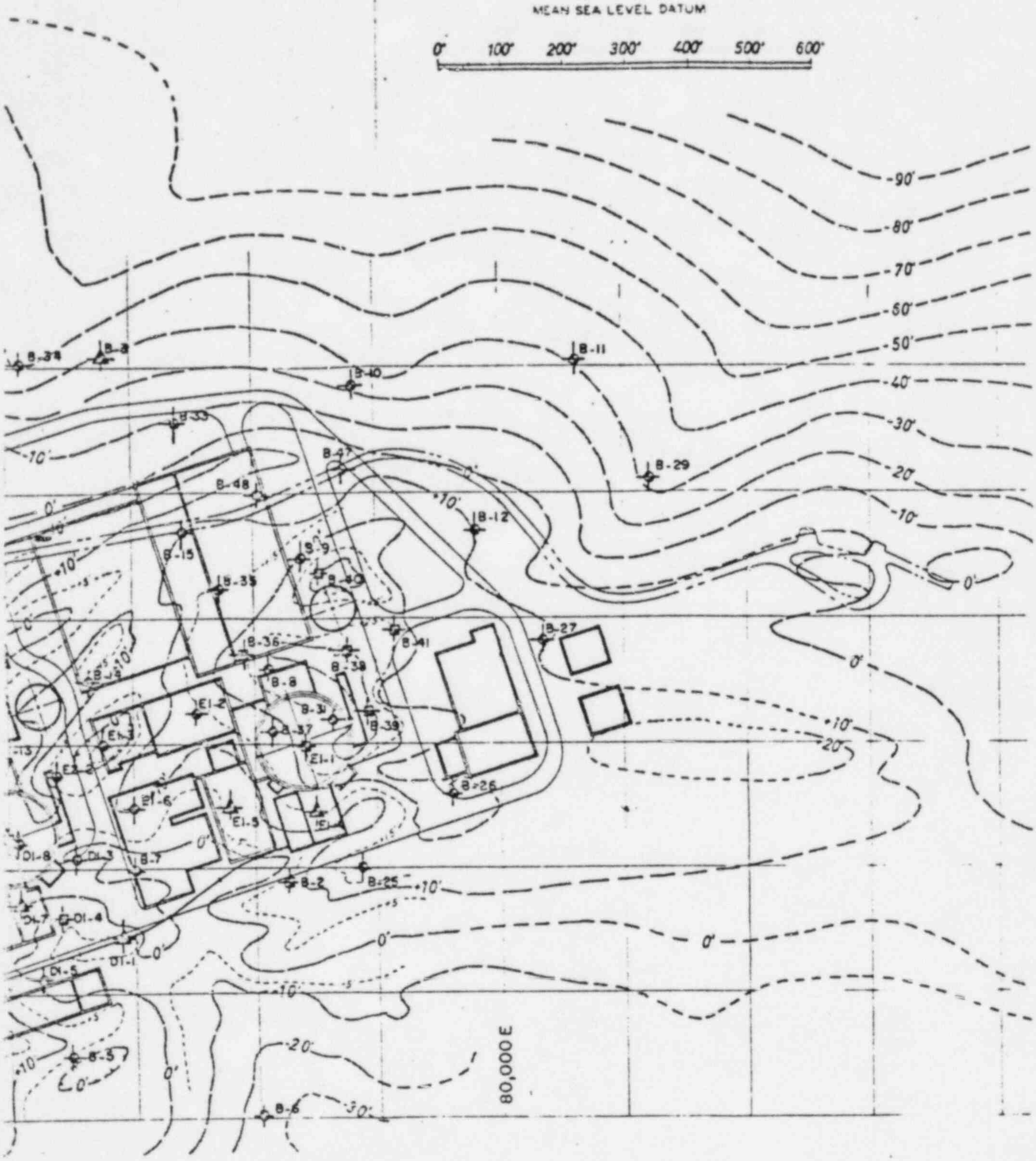
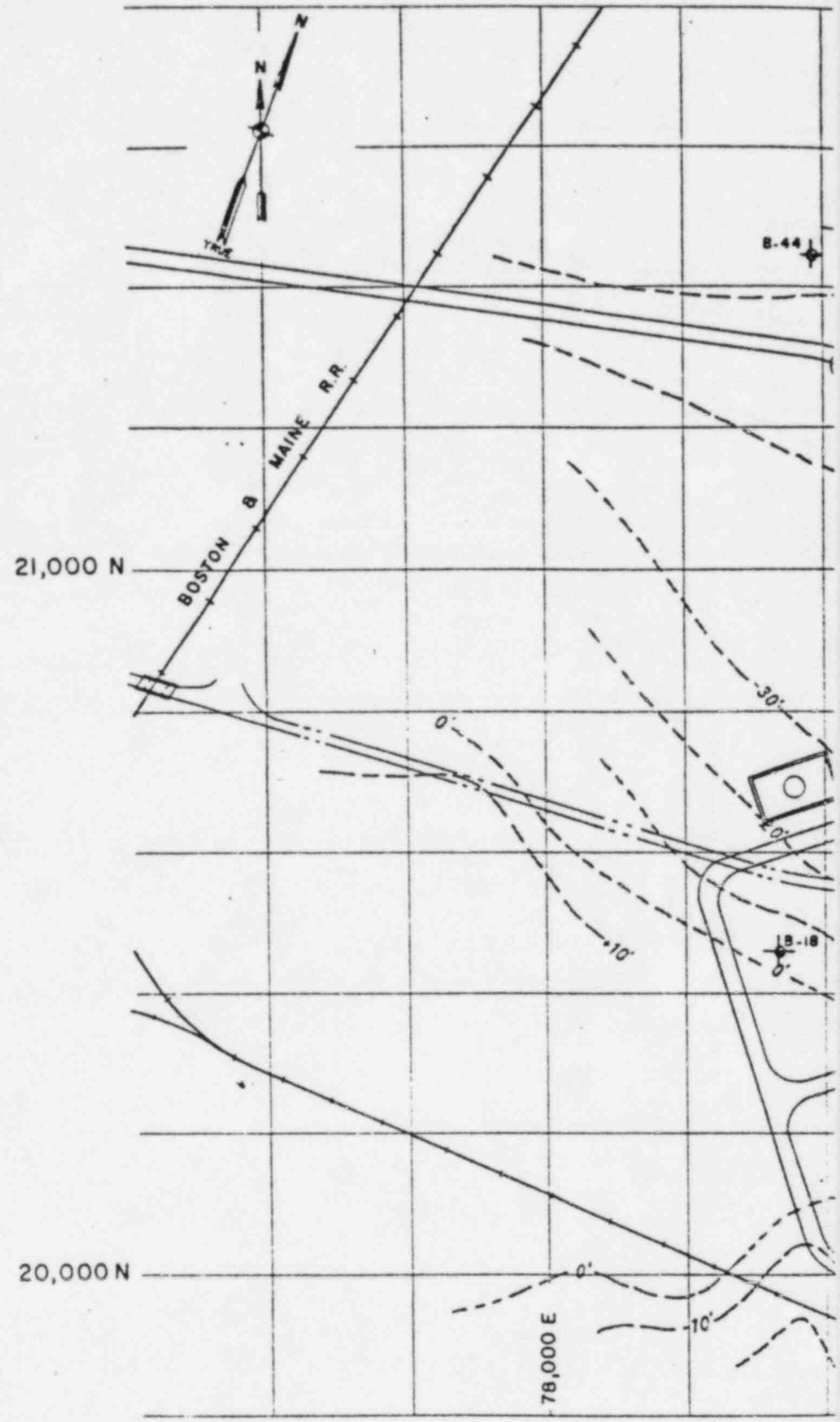
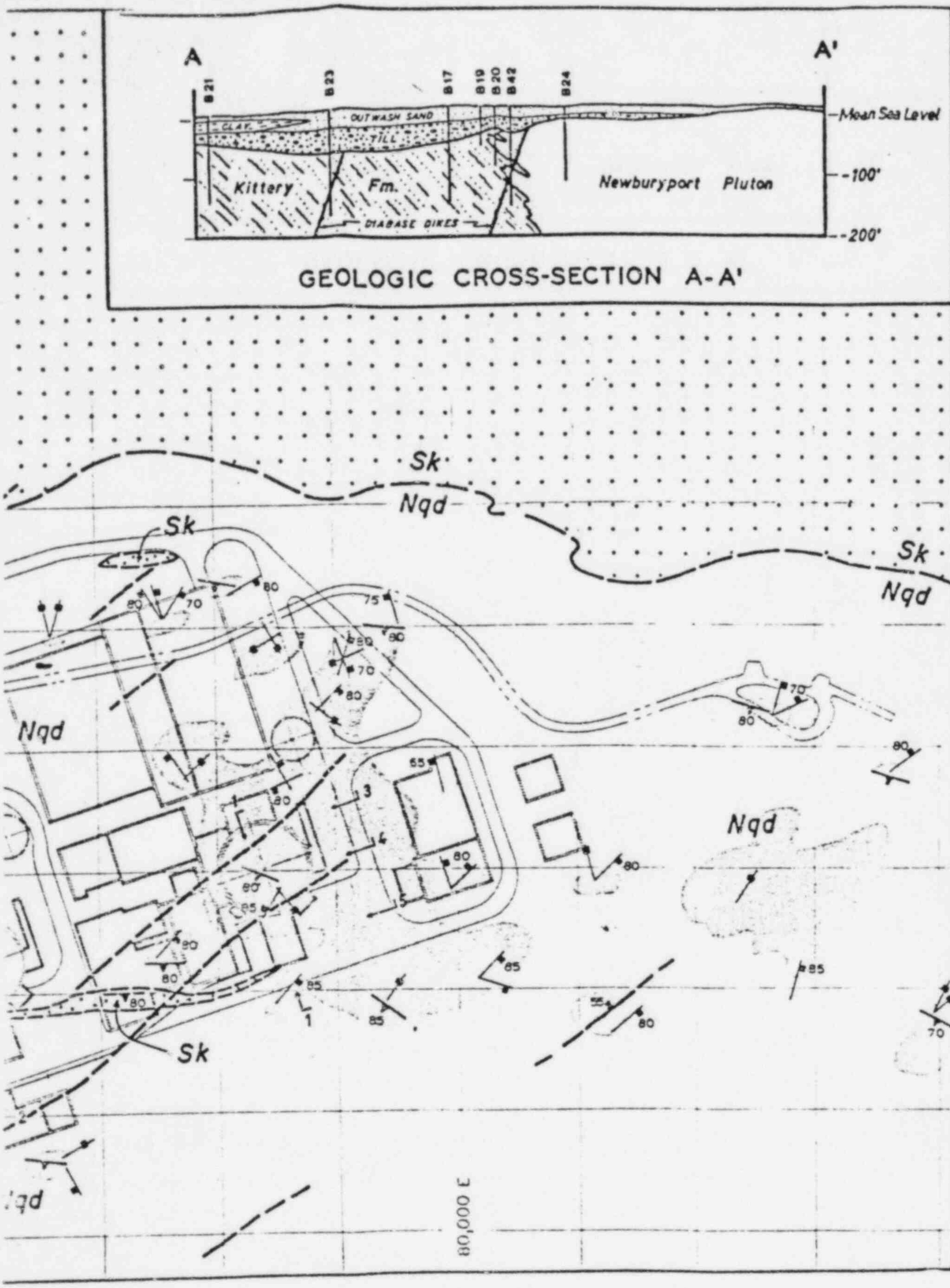


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION	ESTIMATED TOPOGRAPHY OF THE BEDROCK SURFACE


B-21
40'
50'
60'
B-46
B-23
B-45
70'
B-44
60'
50'
B-19
B-20
B-42
40'
30'
20'
B-24
B-34
N
BOSTON & MAINE R.R.
-10'
10'
20'
0'
30'
B-16
B-32
10'
B-28
0'
-10'
B-18
B-1
D2-3
B-13
D2-7
B-30
D2-4
E2-1
D2-5
D1-10
D1-12
78,000 E
79,000 E
-10'
10'

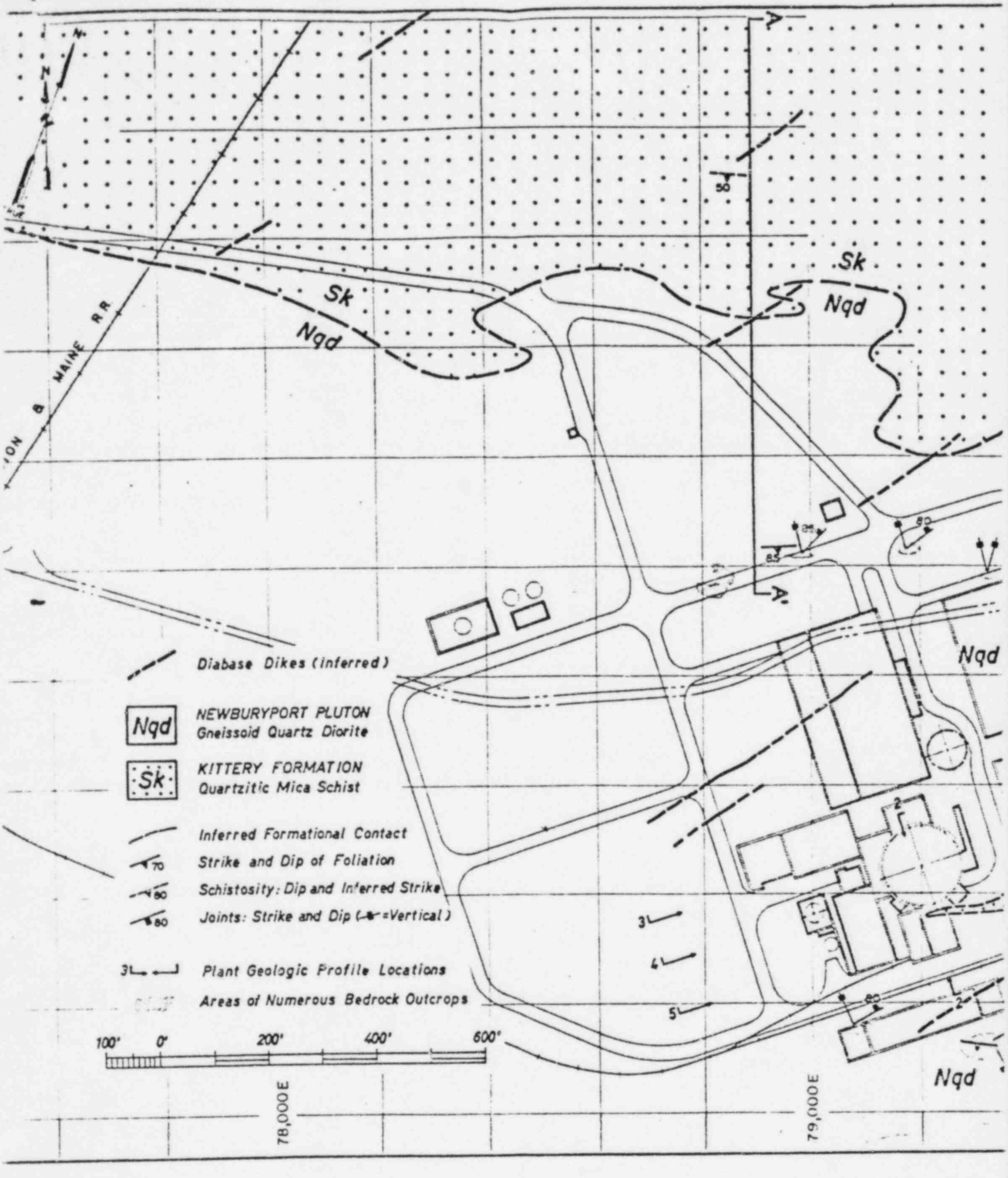


N
N
BOSTON & MAINE R.R.
21,000 N
20,000 N
78,000 E
B-44
B-18
0'
10'
20'
30'

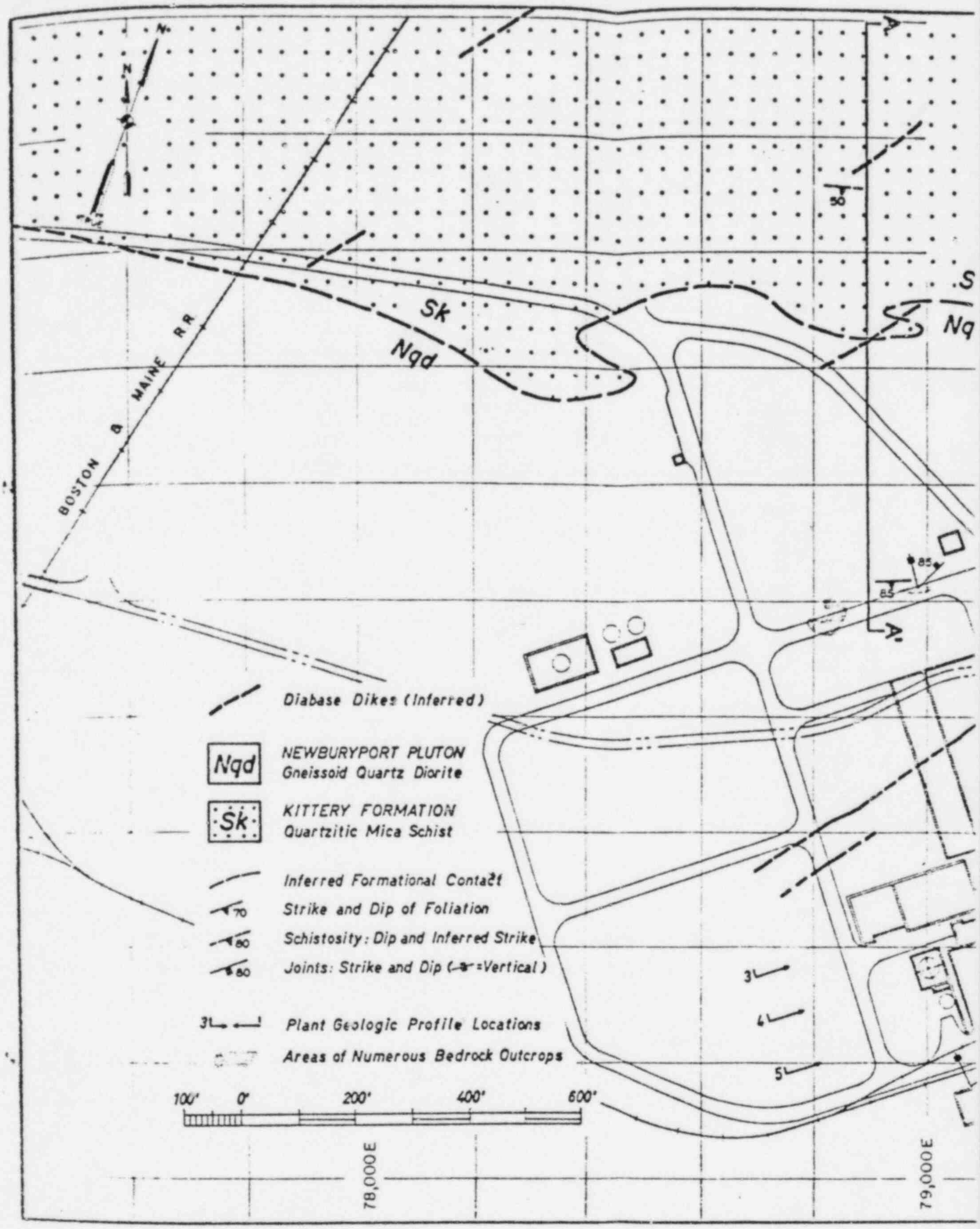


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION

GEOLOGIC MAP
FOR THE AREA OF THE
STATION SITE

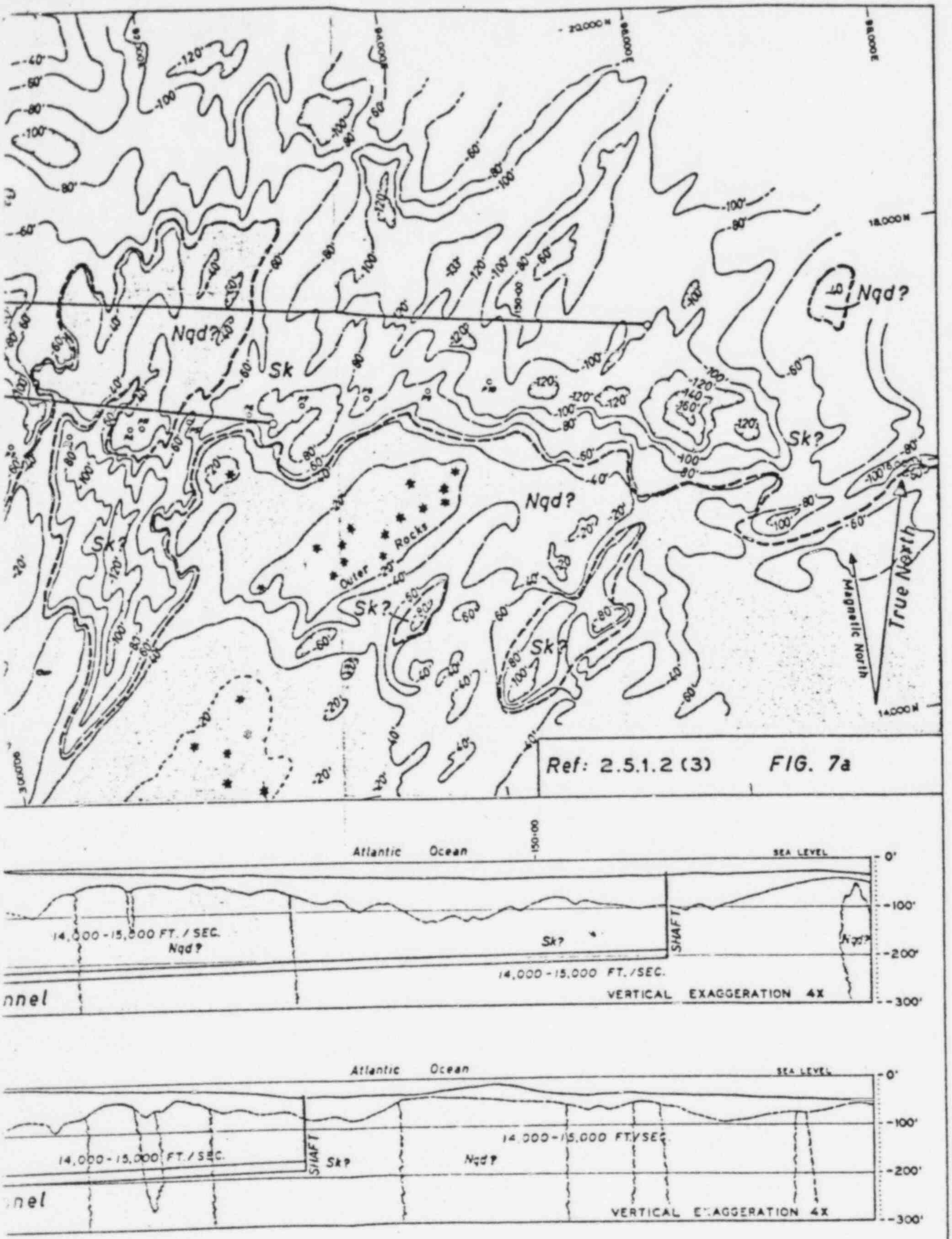


A
A'
50
Sk
Nqd
BOSTON & MAINE RR
85
80
Diabase Dikes (inferred)
Nqd
NEWBURYPORT PLUTON
Gneissoid Quartz Diorite
Sk
KITTERY FORMATION
Quartzitic Mica Schist
Inferred Formational Contact
70
Strike and Dip of Foliation
80
Schistosity: Dip and Inferred Strike
80
Joints: Strike and Dip (= Vertical)
3
Plant Geologic Profile Locations
Areas of Numerous Bedrock Outcrops
100'
0'
200'
400'
600'
3
4
5
2
78,000E
79,000E



Diabase Dikes (Inferred)
Nqd
NEWBURYPORT PLUTON
Gneissoid Quartz Diorite
Sk
KITTERY FORMATION
Quartzitic Mica Schist
Inferred Formational Contact
Strike and Dip of Foliation
Schistosity: Dip and Inferred Strike
Joints: Strike and Dip (=Vertical)
Plant Geologic Profile Locations
Areas of Numerous Bedrock Outcrops
100' 0' 200' 400' 600'
BOSTON & MAINE RR
Sk
Nqd
A
A'
50
85
3
4
5
78,000E
79,000E

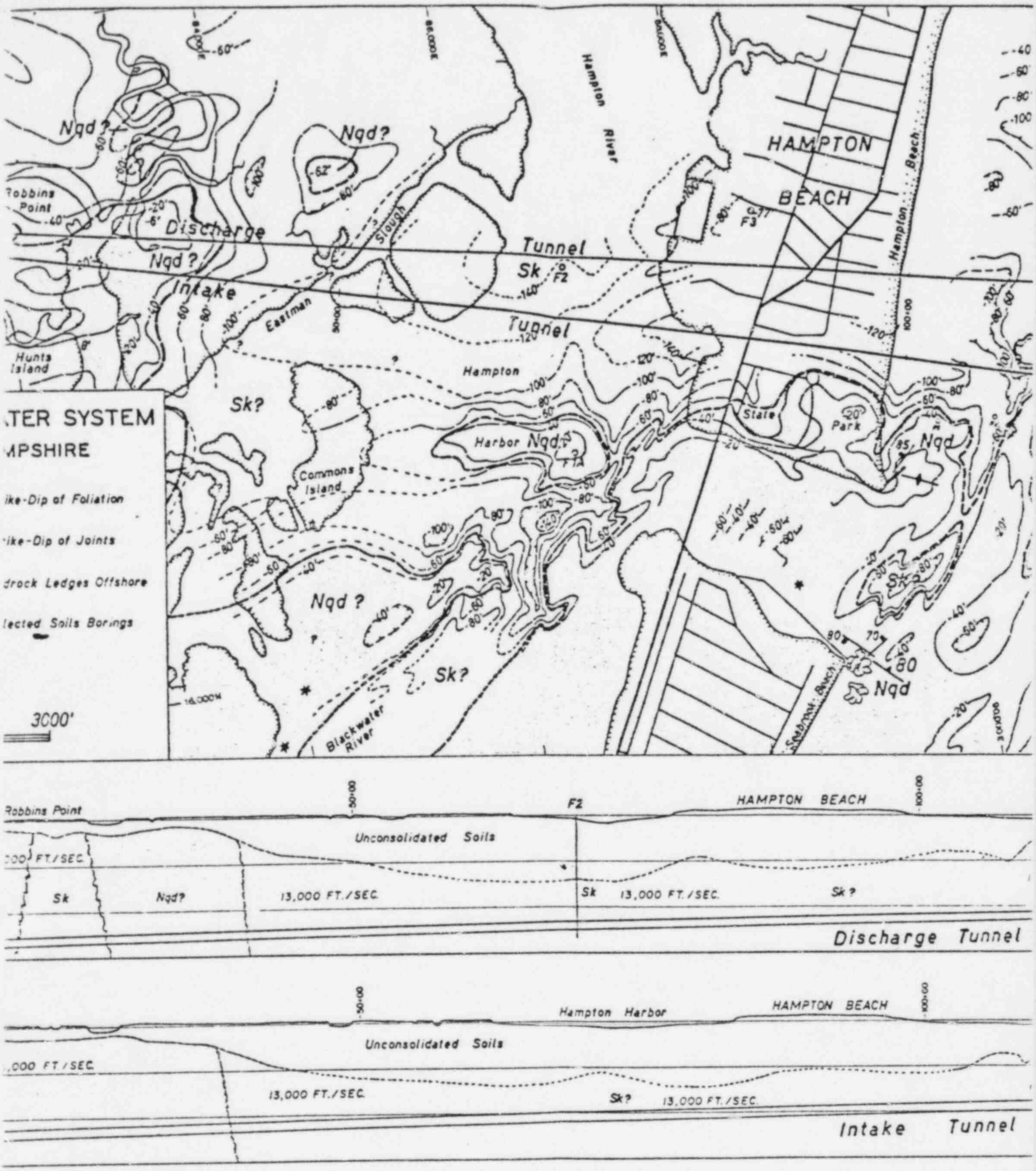
June 1973



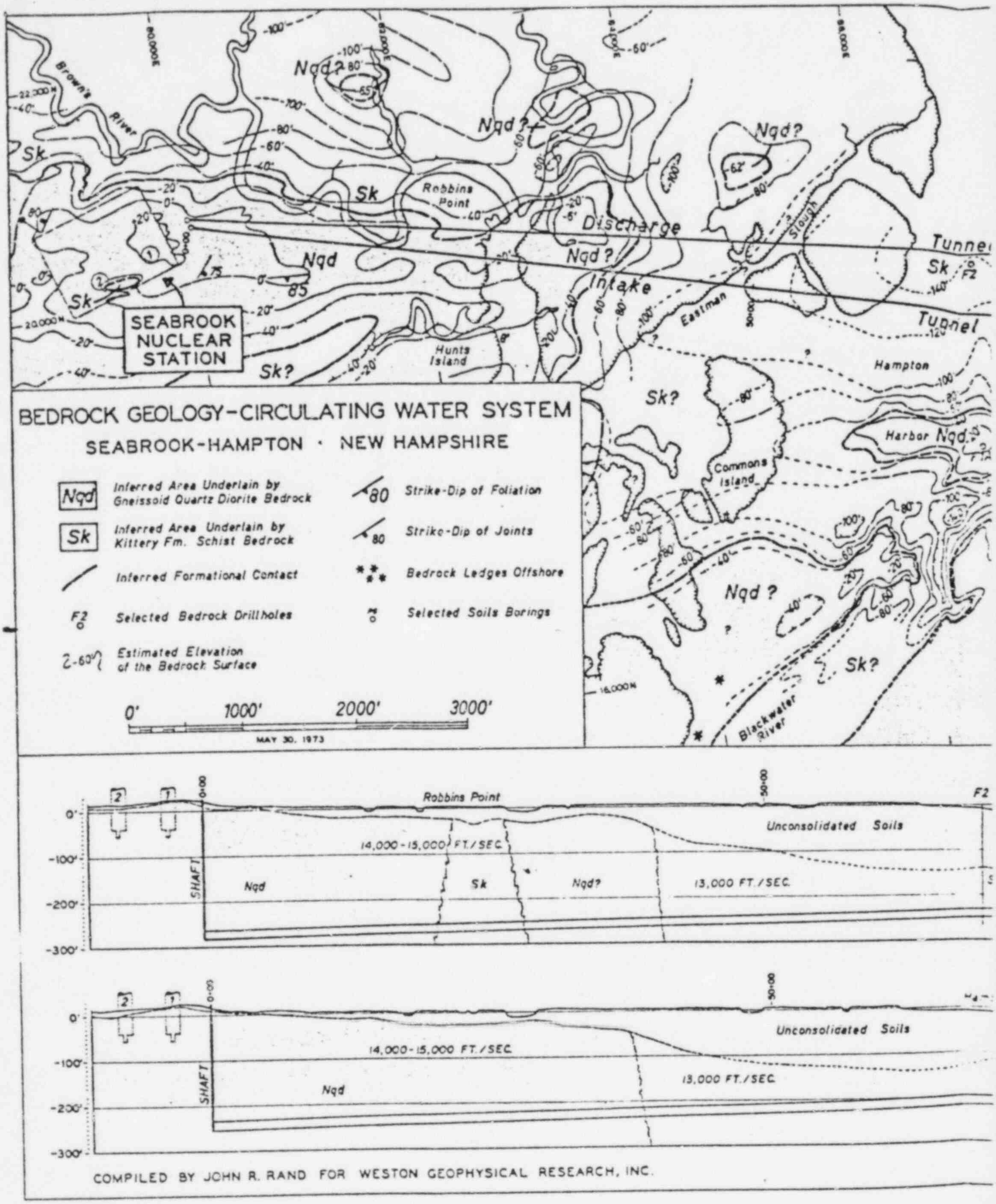
Ref: 2.5.1.2 (3) FIG. 7a

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION

BEDROCK GEOLOGY
CIRCULATING WATER SYSTEM



GEOPHYSICAL RESEARCH, INC.


BEDROCK GEOLOGY-CIRCULATING WATER SYSTEM
SEABROOK-HAMPTON · NEW HAMPSHIRE
Nqd Inferred Area Underlain by Gneissoid Quartz Diorite Bedrock
Sk Inferred Area Underlain by Kittery Fm. Schist Bedrock
Inferred Formational Contact
F2 Selected Bedrock Drillholes
Estimated Elevation of the Bedrock Surface
80 Strike-Dip of Foliation
80 Strike-Dip of Joints
Bedrock Ledges Offshore
Selected Soils Borings
0' 1000' 2000' 3000'
MAY 30, 1973
SEABROOK NUCLEAR STATION
Brown's River
Robbins Point
Discharge
Intake
Tunnel
Tunnel
Eastman
Slough
Hunts Island
Hampton
Harbor
Commons Island
Blackwater River
Robbins Point
Unconsolidated Soils
14,000-15,000 FT./SEC.
13,000 FT./SEC.
SHAFT
Nqd
Sk
Nqd?
Unconsolidated Soils
14,000-15,000 FT./SEC.
13,000 FT./SEC.
SHAFT
Nqd
COMPILED BY JOHN R. RAND FOR WESTON GEOPHYSICAL RESEARCH, INC.

j. Site Groundwater Conditions

The groundwater table approximates the configuration of the surface topography and frequently occurs within 10 feet of the ground surface in the upper elevations at the site, and at or very close to ground surface at lower elevations. Some low elevation drill holes flowed groundwater over the collar of the holes.

No major groundwater aquifers occur at the site. Groundwater is held in the bedrock in the narrow planar spaces between joint and foliation surfaces; the bedrock materials have low measured permeability. Water levels in borings which were drilled along the edge of the tidal marsh enclosing the site did not fluctuate markedly with daily tidal sea-level variations. Cross-reference Subsection 2.4.13.

k. Results of Geophysical Surveys

The purpose of the reconnaissance seismic survey was to determine depths to bedrock and depths of major seismic overburden discontinuities.

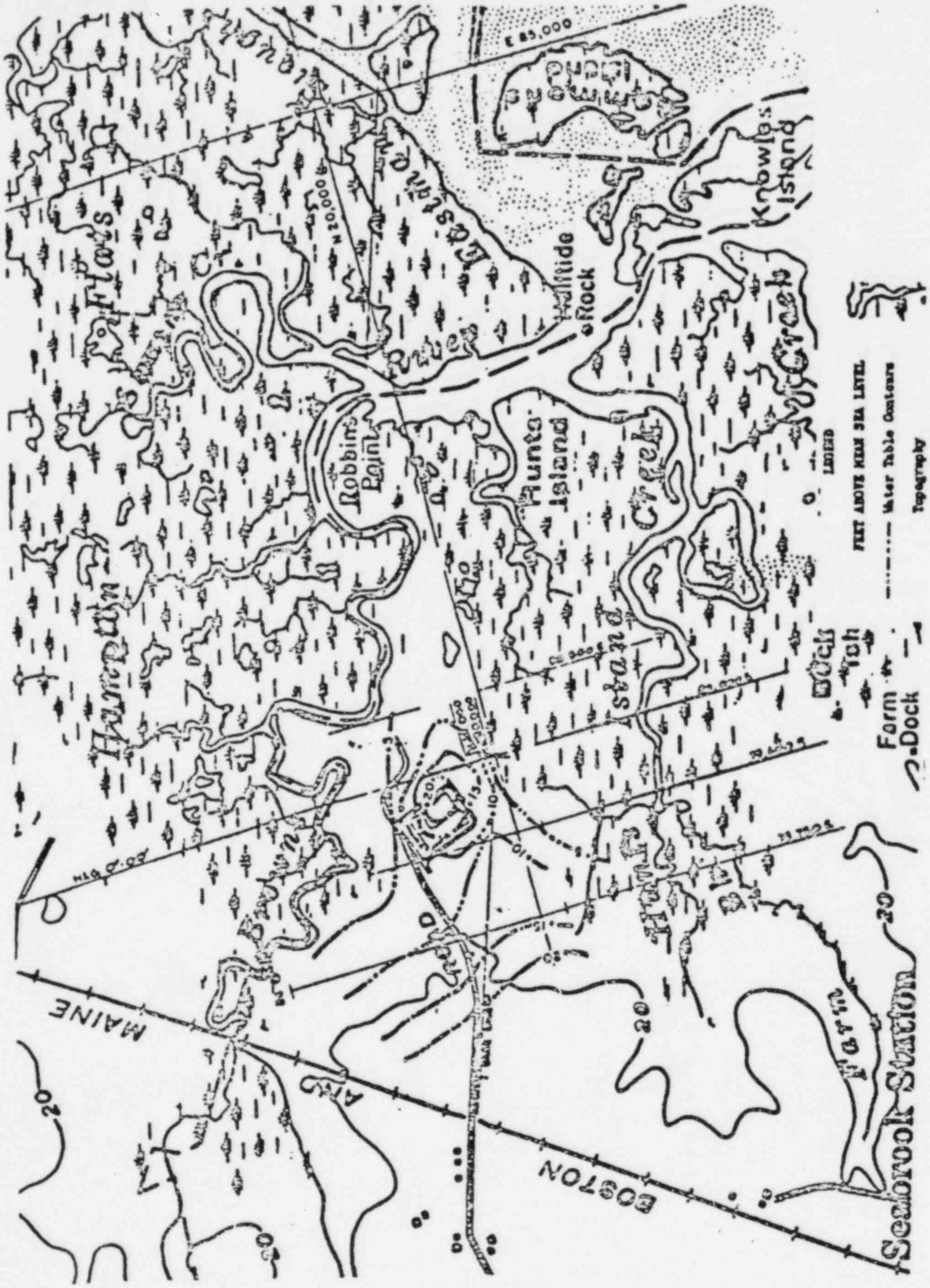
(1) Plant Site Area

The plan of the seismic lines of investigation in the plant site area is shown in Figure 2E-1 of Appendix 2E. In addition to the previously stated purpose, Line 20,000N was extended west to provide supplimentary data for the ground-water hydrology study. Other lines were extended north for the purpose of exploring the contact zone between the Newburyport quartz diorite in the site area and the Merrimack formation to the north of the site.

The results of refraction surveys in the plant site area are shown on Figure 2E-2 (Sheets 1, 2 and 3) of Appendix 2E. In general, the seismic survey showed that hard rock was shallow in the vicinity of the selected plant location, with dense till along the north side of the site and less dense till and possible other overburden materials west of the plant location. There is good correlation between seismic and boring data.

The bedrock velocities measured by surface refraction techniques ranged between 13,000 and 16,000 ft./sec.; this is indicative of sound bedrock conditions.

Overburden materials can be tentatively identified by their respective seismic velocities. Velocities for the overburden materials ranged from 2,000 ft./sec. for loose, unconsolidated overburden materials to 6,500 to 6,800 ft./sec. for dense glacial till. In general, overburden materials with velocities in excess of 5,500 ft./sec. and in excess of 3,000 ft./sec. for



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION

WATER TABLE CONTOURS

2.4-19

TOPOGRAPIC DATUM IS MEAN SEA LEVEL
BATHYMETRIC SOUNDINGS IN FEET-DATUM IS MEAN LOW WATER
THE MEAN RANGE OF TIDE IS APPROXIMATLY 8.3 FEET

REFERENCE: USGS HAMPTON, N.H. 7.5' QUADRANGLE
USGS NEWBURYPORT EAST, MASS.-N.H. 7.5' QUADRANGLE
USGS NEWBERYPORT WEST, MASS.-N.H. 7.5' QUADRANGLE
USGS EXETER, N.H.-MASS. 7.5' QUADRANGLE

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION Preliminary Safety Analysis Report	SITE VICINITY MAP
	FIG. 2.4-14

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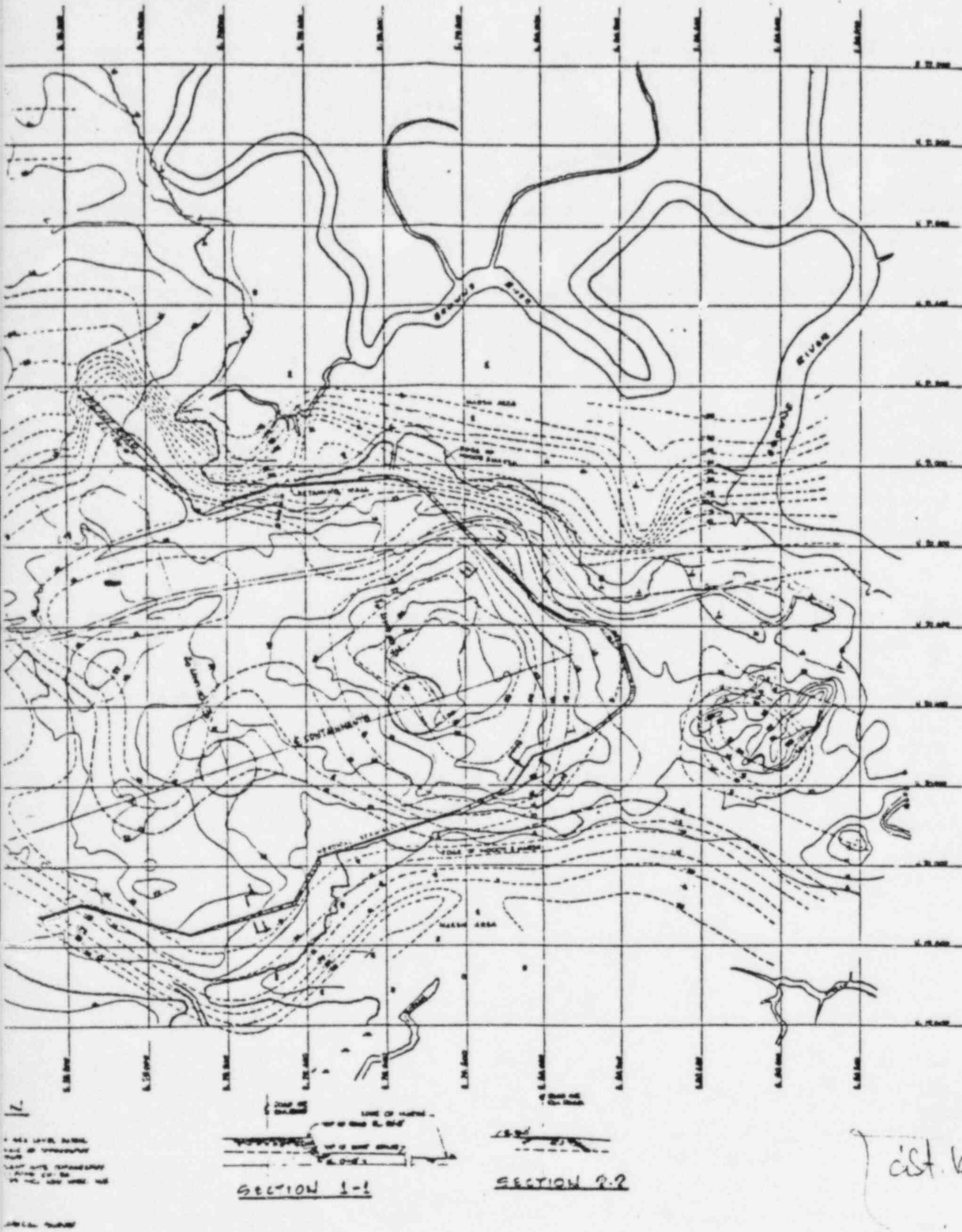
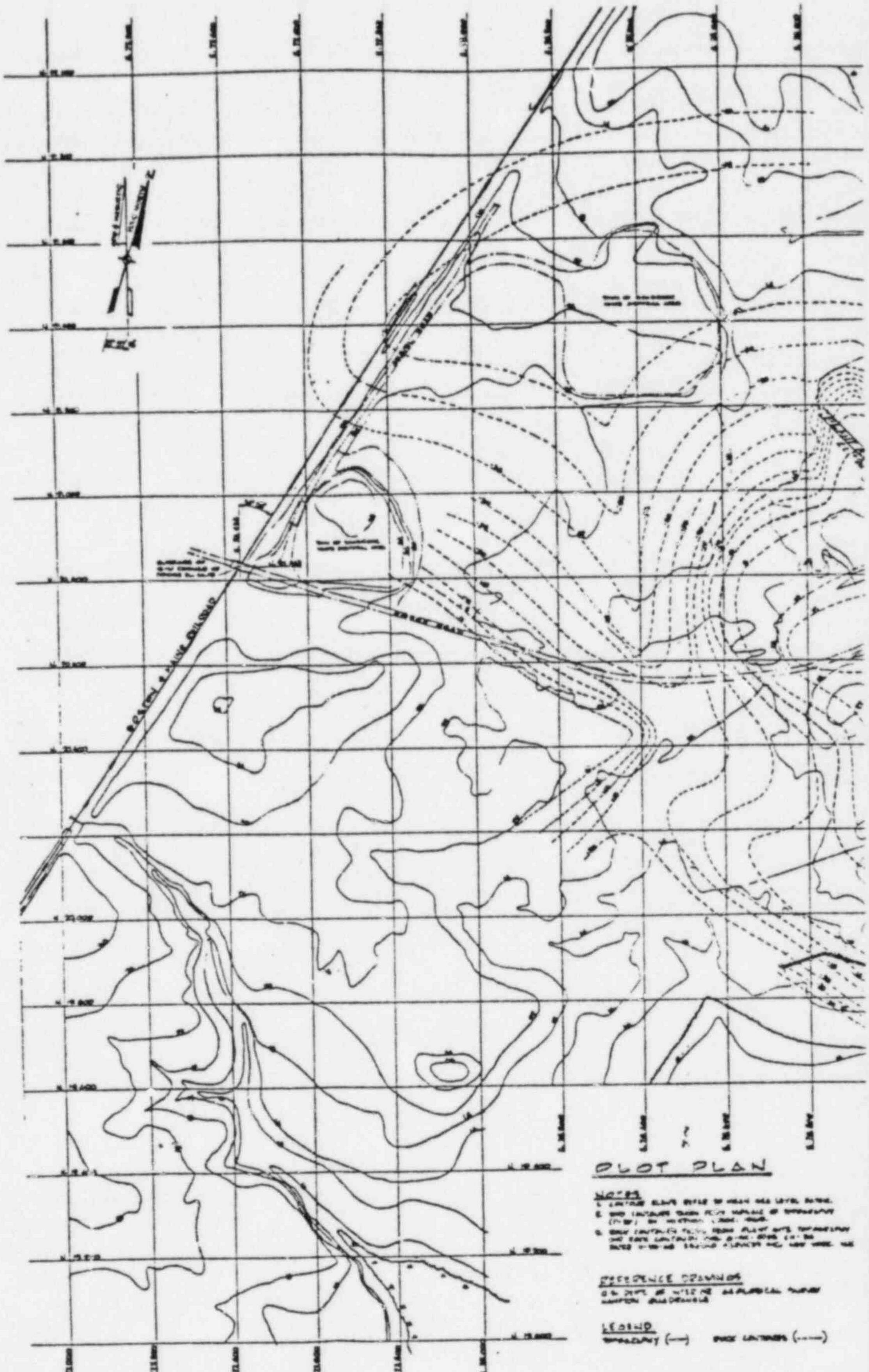


dist. betw cont centers = 500 ft

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION Preliminary Safety Analysis Report	TOPOGRAPHIC MAP OF SITE
	FIG. 2.4-1



PLOT PLAN
NOTES
REFERENCE DRAWINGS
LEGEND

TABLE 2.4-16

SUMMARY OF FIELD PERMEABILITY FOR GLACIAL AND BEDROCK MATERIALS IN THE SEABROOK AREA

Type of Material	Number of Samples	Permeability in gpd/sq. ft. Range	Mean
Outwash	6	17 - 130	50
Marine (silty phase)	2	0.3 - 0.6	0.4
Till	21	0.3 - 25	5
Bedrock	9	1 - 51*	4

*Large fracture, not used in Mean

Reference: Groundwater Hydrology for the Proposed Seabrook Nuclear Station, by Weston Geophysical Research, Inc., 1969.

Many places immediately underlain by till also serve as recharge areas, but here the rate of recharge is comparatively small. Not only is the till less permeable than the outwash and the ice-contact deposits, but it commonly forms hills whose slopes shed water rapidly. Furthermore, because till generally is thin, it may at some places become so fully saturated during prolonged periods of wet weather that potential recharge is rejected.

The site is primarily underlain by well compacted till up to 62 feet thick and, therefore, it is not an important recharge area (Ref. 19).

2.4.13.3 Accident Effects

There is no evidence to indicate that accidental liquid discharge at the reactor site could contaminate any existing well supplies in the area, since groundwater is moving toward neighboring tidewater bodies and away from population inland areas. Moreover, public supply wells are located in areas beyond reasonable limits of groundwater travel from the site area. Liquid waste discharge on the site could conceivably reach nearby tidewater bodies. However, since groundwater is moving at less than 100 feet per year, such liquid wastes would be well diluted before discharging into the tidewater. Furthermore, a part of such wastes would be absorbed on clay or silt particles in the till and marine deposits.

It is unlikely that any wells will be located east of the site in the future, because the groundwater underlying the marsh is brackish. Also, the Seabrook municipal water system is well developed and serves nearly 100 percent of the town's residents. Any future users will be served by this system which draws its water from wells far to the west of the site (Figure 2.4-20). These are Seabrook well numbers 1, 2, 4, 27 and 28 on Figure 2.4-20. The Hampton Beach area is served by the town of Hampton municipal water system, which draws water from wells far to the north of the site at locations, numbers 3 and 7, in the town of Hampton. The nearest public wells to the site in the town of Salisbury are far to the south at locations numbers 5, 6 and 7 on the same map.

2.4.13.4 Monitoring or Safeguard Requirements

The potential for groundwater contamination by the Seabrook Station is extremely low. The plant design and safeguards systems make this an unlikely occurrence.

The natural movement of groundwater in the site area is away from the public and private wells in the region. Moreover, the movement of groundwater in the site area is less than 100 feet per year, making all wells in the region beyond the reasonable limit of groundwater travel from the site area. Liquid waste discharge on the site could conceivably reach nearby tide water bodies. However, since groundwater is moving at less than 1/3 foot per day, such liquid wastes would be well diluted before discharging into the tide water. Furthermore, a part of such wastes would be absorbed on clay or silt particles in the till and marine deposits.

b. Flow Directions and Gradients

In southeastern New Hampshire, groundwater generally moves from the interstream areas, where much of the recharge takes place, toward nearby streams or other bodies of surface water into which some of the groundwater is discharged. During warm weather, some groundwater also is discharged directly to the atmosphere by evaporation and transpiration in areas such as swamps or marshes where the water table is at or near the surface. Under the hydraulic gradients that exist in nature, the rate of groundwater movement is very slow. In the aquifers of the report area, groundwater moves at rates that range from a few inches per year to a few feet per day.

Groundwater movement in the site area is toward adjoining tidal areas, and essentially normal to the water table contours shown on Figure 2.4-19. Local modifications in flow lines are the results of variations in permeability of water bearing materials and of topography. Rates of groundwater movement at the site do not exceed 100 feet per year (Ref. 19). This is based on a water table gradient of 0.06 feet per foot, as observed during high water table conditions, and an average permeability of 5 and 4 Meinzer units (gallons per day per square foot at prevailing groundwater temperatures) for the till and bedrock, respectively. The low permeability of the till and bedrock is substantiated by the lack or relatively small response in water levels to tidal fluctuations, as observed in several borings located along the edge of the tidal marshes. Table 2.4-16 lists the range and mean values of field permeabilities of glacial and bedrock materials. These were determined by falling head and packer tests made in the test borings on the site area. The listed values for the outwash material are representative for the finer sands more commonly found to the west of the site, whereas, the coarser outwash and beach sands to the east (Figure 2.4-17) appear to be much more permeable, and values of 1,000 gpd per square foot or more are probably not uncommon.

c. Recharge area within the Influence of the Site

Under natural conditions, nearly all recharge to aquifers in southeastern New Hampshire is accomplished by the infiltration of precipitation within the area. The principal recharge areas are the places immediately underlain by ice-contact deposits and by outwash and shore deposits. These deposits are sufficiently permeable to absorb water readily. They commonly form terraces and plains whose flat surfaces retard surface runoff and, thereby, afford ample opportunity for infiltration. They, generally, also provide sufficient storage space to accommodate the additional water.

(4) Town of Salisbury, Massachusetts, Water Supply System

The town of Salisbury at present is served by the privately owned Salisbury Water Supply Company which draws its supply from 5 wells in the northwestern corner of Salisbury (Figure 2.4-20). The five wells draw from 400 gpm to 700 gpm to supply the towns residential and industrial users. A 200,000 gallon elevated storage tank is also in use.

(5) Projected Future Use

The demand for water in this region is expected to grow at an accelerating rate over the projection period (1980-2020). This increase in water can be attributed to the shifting industrial trends and increasing suburbanization of New Hampshire. More supply wells and inter-municipal distribution systems are anticipated to satisfy the region's increased demand for water.

Table 2.4-15 presents the water use projections through the year 2020 for towns in Rockingham county and Salisbury, Massachusetts, thru 1990. It is expected, that both surface and groundwater sources will be developed to provide the required supply. Specific data for the town of Seabrook are included in Table 2.4-16.

(6) Groundwater Levels

The pattern of water-level fluctuations in the region is irregular, reflecting variations in precipitation and temperature. This is illustrated in Figure 2.4-22 which correlates the hydrographs of selected wells in southeastern New Hampshire with monthly precipitation records (Ref. 26).

The water table in the site area is mostly in till or bedrock at depths no greater than 17 feet, and usually less than 10 feet below the ground surface. In the outwash deposits west of the site (Figure 2.4-17), it occurs mostly within 5 feet of the surface. Some partially confined groundwater is found at depth in bedrock fractures. Evidence of this found along the edge of tidal marshes where fresh groundwater with a chloride content ranging from 38 to 144 ppm was encountered in bedrock borings under sufficient hydrostatic head to cause flowing conditions (Ref. 19).

Seabrook, are supplied by the town's municipal water system (Ref. 19). The Salisbury Water Company uses five wells to supply water to most homes and industries in Salisbury, Massachusetts.

Other wells supplying mostly domestic and farm needs are scattered throughout the area, including the towns of Hampton Falls and Kensington, which are both without public water supply systems. In the site vicinity a few private wells supply homes. All of these are less than 15 feet deep, and tap the shallow outwash deposits to the west and southwest of the site area (Ref. 19).

(2) Tabulation of Existing Users

Figure 2.4-20 shows the location of all known active wells in the region (Ref. 23). Data for each of these wells and for many test borings is presented in Table 2.4-12 and Table 2.4-13. The information provided in these tabulations includes names of owners, location, year completed, depth, diameter, type, geologic characteristics, water level and type of use.

(3) Town of Seabrook Municipal Water System

The town of Seabrook is served by its own municipal water works system, whose source is groundwater wells. The basic system, first put into use in 1956 with two wells, now consists of five active high yield groundwater wells, each with a pump and pump house. Present storage capacity is provided by a 720,000 gallon storage standpipe, with a 1,000,000 gallon tank scheduled for construction in the next few years.

The system, with approximately twenty miles of 6, 8, 10 and 12-inch diameter distribution pipe, is outstanding in size and service in comparison to the small population of the town and to the water systems of adjacent towns.

The quality of the groundwater drawn in Seabrook is of good quality, as it generally is throughout the whole southeastern New Hampshire region (Table 2.4-14).

The water consumption rate in Seabrook has been steadily increasing over the past decade. Figure 2.4-21 plots this annual trend which now shows an average increase of about 70,000,000 gallons per year (Ref. 7, 8).

West of the site, thin outwash deposits overlie either till or marine silts and clays. To the east, toward Hampton Beach, medium to fine sands, 50 feet or more in thickness, occur just below ground level or recent marsh deposits (Figure 2.4-18). The sands, which appear permeable, are essentially saturated with salt water. They probably are outwash or older shore deposits with beach sands overlying them in the Hampton Beach area.

In the site area, the water table is found at depths no greater than 17 feet, and generally less than 10 feet. West of the site area in the sandy outwash material it is usually within 5 feet of the ground surface.

Predominant groundwater movement is toward the tidal areas, however, local flow lines are modified by variations in permeability of water bearing materials and by topography. A plot of available water table levels in the plant area is shown on Figure 2.4-19. Rate of groundwater movement is expected to range from a few feet to several tens of feet per year. Based on available information, the average permeability of both the till and bedrock is less than 10 gpd per ft^2 (gallons per day per square foot). Permeability of the marine deposits is less than 1 gpd per ft^2.

c. Utilization of Groundwater by the Plant

Groundwater used by the plant will be supplied by the town of Seabrook. The present Seabrook water supply system is supplied by 5 wells (Figure 2.4-20). A sixth well will be added to supply the plant's needs, which are not expected to exceed 350 gpm during startup and considerably less during normal operation. Presently, no wells are planned for the site.

The groundwater will be utilized in the plant makeup water system which will have a makeup water storage tank. It will also be used for fire protection.

2.4.13.2 Sources

a. Groundwater Use

(1) Present Regional Use

Most water supplied in the area are dependent on groundwater sources. Public supplies in the towns of Seabrook and Salisbury are taken from wells which tap aquifers in ice contact deposits. These wells yield from about 300 to 700 gpm, and range from 22 to 54 feet deep (Ref. 19). The town of Seabrook at the present uses five wells for its public water supply, and all of these are located at least two miles from the site. Most homes, as well as commercial and industrial users in

Changes in groundwater storage are reflected by fluctuations in groundwater levels; these levels rise when recharge exceeds discharge and decline when discharge exceeds recharge.

In general, the greater the permeability of a deposit, the smaller the water-level fluctuations. In till, for example, fluctuations ranging from 10 to 20 feet are not unusual, especially in wells located on hills or slopes. During periods of recharge, the low permeability of the till prevents rapid lateral percolation of groundwater to areas of discharge, and the water level rises considerably. However, during periods of little recharge, the groundwater continues to drain and discharge slowly; thus, the water level declines. In contrast, fluctuations of only a few feet are common in wells in ice-contact deposits. These deposits are sufficiently permeable to transmit groundwater laterally at rates approximating those of recharge, and large rises in water levels ordinarily do not occur (Ref. 22).

b. Local Aquifers, Formations, Sources, and Sinks

No major aquifers underlie the site or its vicinity. Locally, the most productive aquifers are in the outwash deposits which are widely distributed just west and southwest of the site (Figure 2.4-17). The outwash, however, is made up mostly of predominantly fine silty sand of low permeability. In the site area, it is up to 35 feet thick and, generally, overlies marine sediments.

Local occurrences of coarser grained glacial and/or recent deposits are evident both to the northwest and under the tidal marshes east of the site (Figure 2.4-18). These deposits, however, contain either brackish or salty water, or would be subject to salt water intrusion under pumping conditions because of their proximity to salt water bodies.

On the site property, bedrock occurs at or near the surface, becoming deeper under the tidal marshes to the south and north where it is as much as 70 feet or more below sea level. On the site, the bedrock forms an irregularly buried ridge trending in an approximately easterly direction. It is overlain by a sandy textured, but well compacted, till up to 62 feet thick. A sequence of marine and recent marsh deposits normally rests on the till along or just north of the Browns River near the northern site boundary and also in adjoining areas to the south (Figure 2.4-17).

They commonly form terraces and plains whose flat surfaces retard surface runoff, and thereby afford ample storage space to accommodate the additional water (Ref. 22).

Many places immediately underlain by till also serve as recharge areas, but here the rate of recharge is comparatively small. Not only is the till less permeable than the outwash and the ice-contact deposits, but it commonly forms hills whose slopes shed water rapidly.

Recharge occurs intermittently, and usually follows a seasonal pattern. During the growing season, most of the precipitation that enters the soil is retained there to satisfy soil-moisture requirements, and recharge therefore is small. During the rest of the year when plants are dormant, the soil-moisture requirement usually is small, and recharge is great whenever there is much rain or snowmelt. The peak usually accompanies snowmelt during the spring season.

Groundwater is discharged naturally through springs by seepage to streams and other bodies of surface water, and by evapotranspiration. It is discharged artifically through wells and arttificial drains. Discharge to streams, called groundwater runoff, usually is greatest soon after periods of dry weather and sustains the flow of the streams when there is little or no surface runoff. Discharge by evapotranspiration is greatest during the growing season.

Under natural conditions, the principal discharge areas in the Seacoast Region are stream channels, the swamps, and the coastline. The water table normally slopes toward the streams, and groundwater enters them wherever they flow on permeable material. Groundwater is discharged in swamps and other low areas by seepage whenever the water table is high enough to intersect the land surface, and by evaporation and transpiration at times when the water table is only a short distance below the land surface. Along the coastline, some of the groundwater evaporates and some of it seeps directly into the ocean.

Changes in groundwater storage take place as a result of changes in the ratio between recharge and discharge. In general, periods when recharge is greater than natural discharge occur in late fall, winter, and early spring while evapotranspiration is ineffective. During late spring, summer, and early fall, however, when most of the rainfall that infiltrates into the soil is evaporated or transpired by plants and does not reach the zone of saturation, recharge and natural discharge continue, though at a reduced rate, and the amount of groundwater in storage declines.

few gpm to a well in this area (Ref. 20). Groundwater development from permeable beach sands in the Hampton and Seabrook Beach areas is limited by a thin freshwater lens, in many place only a few feet thick, which is floating on saline water. Recharge to the lens is from infiltrating precipitation which originates in the beach areas. These till deposits are not considered an important source of water for the region.

Impermeable marine deposits largely consisting of silt and clay are widely distributed in the area. They are not a source of well supplies but locally confine groundwater in ice contact deposits, till or bedrock (Ref. 19).

Bedrock which underlies the unconsolidated materials is composed of the Newburyport quartz diorite and the metamorphosed sediments of the Merrimack group. There is no apparent difference in the water bearing properties of the different types of rock and they are not an important water source. Most bedrock wells yield less than 10 gpm from depths up to 300 feet (Ref. 21).

Swamp deposits almost wholly occupy the tidal marshes and contain brackish or salty water. These deposits are impermeable and are not sources of well supplies.

(2) Sources and Sinks

The groundwater body in the area occurs under water table conditions, except in some places where it is confined by marine sediments. It is principally sustained by infiltrating precipitation which in the region averages about 43 inches per year. The infiltration capacities of soils in the area vary considerably and, where the soil is composed of marine clays, groundwater recharge is greatly retarded.

The regional water table approximates the configuration of the topography, and frequently occurs within 10 feet of the ground surface. Groundwater movement is limited to drainage areas where streams intersect the water table and in areas where streams are tributary to tidewater. Because these drainages are relatively small, groundwater flow paths from points of recharge to discharge generally do not exceed one mile (Ref. 19).

Recharge to aquifers in the region is accomplished by the infiltration of precipitation. The places immediately underlaid by ice-contact deposits and by outwash and shore deposits (see Figure 2.4-17) are the principal recharge areas. These deposits are sufficiently permeable to absorb water readily.

Mean annual precipitation is about 43 in. and annual loss to evaporation from water bodies is approximately 25 inches. Seepage into the groundwater body is extremely variable owing to the variations in the permeability of the surficial deposits.

The hydrologic boundaries of the site are Hampton Harbor, the local drainage courses and impervious subsurface materials.

2.4.13.1 Description and On-Site Use

a. Regional Aquifers, Formations, Sources and Sinks

The study area comprises the drainage basins of Hampton River, Browns River, Blackwater River and Hampton Harbor. It includes the towns of Hampton, Hampton Falls, Kensington and Seabrook in New Hampshire and Salisbury, Massachusetts. Throughout the area, groundwater is found in the bedrock and in overlying glacial and recent deposits. The seaward limit of the fresh groundwater body does not extend greatly beyond the tidewater margins of Hampton Harbor. Infiltration of precipitation is retarded in places by the impermeable marine sediments which overlie much of the area. The shallow unconsolidated surficial deposits overlying bedrock are the principal aquifers in the area. These are composed of beach deposits, swamp deposits and glacial drift. The latter includes: till, ice contact, marine and outwash deposits. Groundwater in the underlying bedrock is limited to fractures which become less frequent at increasing depths. The effective depth for fractures to transmit water is about 300 feet.

(1) Aquifers and Formations

The largest quantities of groundwater are obtained from course-grained sediments in the ice contact deposits which consist primarily of stratified sand and gravel. These are the coarsest in texture of all the local deposits and average about 50 feet in thickness. As shown in Figure 2.4-17, their areal extent is small, except in the vicinity of Hampton and Salisbury. These deposits are a source of public water supply for the towns of Seabrook, Salisbury and Hampton.

Lesser amounts of groundwater, adequate for meeting the needs of homes, farms and small industries are available from the outwash deposits. Well yields from them generally do not exceed 100 gpm (Ref. 19). In the study area, the outwash is mostly made up of fine sand, commonly less than 25 feet thick, and is a source for small domestic supplies.

Some small wells are also developed in the till and in beach sands. The till which is an assorted mixture of rock particles in a matrix of clay and silt, generally yields only a

2.4.13 Groundwater

The Seabrook Station is located in what is termed by Meizner (Ref. 18) as the Northeastern Drift Province. Principal groundwater supplies in the area come from glacial drift. The average annual temperature in the area is 50° F.

The Blackwater River terminates in a 4-mile long tidal inlet which extends two miles southward from Hampton Harbor to the Massachusetts state line. In addition, Browns River, Hunts Island Creek and Mill Creek flow into the confluence from the west. Although there is a discernible watershed, it is small and the attendant fresh water runoff is not particularly significant. Thus, the several streams and their branches primarily serve a tidal stream directing the semidiurnal inward and outward flow of saline water.

Estimates of the areal extent of the salt marsh and Hampton harbor are found in several sources. The variance in the estimation is high, probably reflecting the difference in interpretation of what constitutes marshland and harbor. Whether or not planimetry was used on Geological Survey maps, Coast and Geodetic Survey charts or aerial photographs may also cause differences in values of areal extent.

The New England River Basins Commission (1971) estimates the total acreage of marsh and open water as 5700 acres of which some 4990 acres are tidal marshes. They state further that there are several hundred acres of intertidal flats fringing the mouths of the tidal streams and the harbor.

Normandeau Associates, Inc. (1971) estimates the tidal marsh area to be approximately 3800 acres as obtained from planimetry of a U.S.G.S. Topographical map.

The Corps of Engineers (1972) estimates the tidal marsh to be about 8 square miles (5120 acres) in extent.

The New England - New York Interagency Committee (1955) estimates the open water harbor area at high tide to be 300 acres in extent.

The New Hampshire Fish and Game Department (1964) estimates the salt marsh to be 2784 acres in extent, although a check of their figures indicates 3085 acres of tidal marsh and 23 acres of dunes and flats.

Finally, Ebasco Services, Inc. (1969) estimates the water surface area in the estuary arms at mean low water to be 24 million square feet (550.9 acres). This result was arrived at by planimetry of aerial photographs.

The plant site is located between the Browns River and Hunts Island Creek, both of which are less than 3 river miles long. These two rivers are mainly contributed to by the estuarine tide from Hampton Harbor and carry very little surface runoff.

Tables 2.4-12 and 2.4-13 include data on wells in the area as well as the owners. Since these wells are located upstream of the site, the plant will have no adverse effect upon the water supply in the area. Figure 2.4-2 is a topographical map depicting the major hydrological features of the region.

Piscataqua River) and the southern end of Seabrook Beach at the Massachusetts state line, 16 miles to the south. It is with the Seabrook area, particularly Hampton Harbor, that this report is primarily concerned.

Geographically, Hampton Harbor is located about 13 miles south of Portsmouth Harbor, 8 miles south of Rye Harbor, 1.5 miles north of the Massachusetts state line and 5 miles north of Newburyport Harbor, at the mouth of the Merrimack River.

Hampton Harbor itself is a shallow lagoon of about 596.8 acres behind two barrier beaches: Hampton Beach to the north of the harbor entrance, and Seabrook Beach to the south of the harbor entrance. The harbor is roughly 1.2 miles wide by 1.5 miles long. It is situated at the confluence of several rivers. These are shallow tidal streams emptying into Hampton Harbor from the Blackwater River, Hampton Falls River and Taylor River drainage basins.

The mean tidal range of Hampton Harbor itself is about 8.6 feet, varying from 4 feet below to 4.6 feet above MSL. Since the harbor is very shallow, only 5-6 feet of water remains in the deeper channels at low tide and only 2-3 feet of water covers most of the area. The volume in the intertidal zone or the tidal prism of Hampton Harbor is 224 million cubic feet.

Within the entire Hampton Harbor estuary, the volume in the tidal prism (between MLW and MHW) is approximately 470 million cubic feet. The maximum average tidal velocity through the harbor entrance is about 1.7 fps.

New water is added to and old water is lost from the Hampton estuary at an average rate of 9850 ft^3/sec. Expressed on a percentage basis, about 88 percent of the estuary volume leaves and returns on each ebb and flood tide cycle. At ebb slack tide the estuarine residual is approximately 12 percent that of the total volume of the basin. These figures indicate, then that the Hampton Harbor estuary exhibits a substantial tidal exchange rate under natural conditions.

The Hampton River is tidal for two miles to the northwestward, where it is fed largely by the Taylor and Hampton Falls Rivers. The Taylor River has a total length of 10 miles and a total fall of only 75 feet. This river has a safe yield of between 1 and 10 million gallons per day within a length of 1 mile above the Hampton Falls River. The Hampton Falls River has a total length of nearly 7 miles and a total fall of nearly 120 feet. The lower of two series of small falls has been developed by three small dams near the village of Hampton Falls, about two miles upstream from the mouth of the river. The impounded water bodies, Dodge Ponds, have a total surface area of roughly 20 acres.

A third tributary of the Hampton River is the 8-mile long Tide Mill Creek which drains the south-central part of North Hampton and the eastern part of Hampton. It flows southward through extensive marshes into the Hampton River about one mile north of Hampton Harbor.

2.4 HYDROLOGIC ENGINEERING

2.4.1 Hydrologic Description

2.4.1.1 Site and Facilities

Seabrook Station site is located in the northern part of Seabrook, New Hampshire, approximately one mile from the western shore of Hampton Harbor. Hampton Harbor is situated at the confluence of Hampton River, Browns River and Blackwater River, and is located on the coast of New Hampshire, about 1.5 miles north of the Massachusetts state line and 13 miles south of Portsmouth Harbor. The towns of Hampton, Hampton Falls, and Seabrook abut Hampton Harbor on the north, west, and south respectively. The villages of Hampton Beach, north of the harbor entrance, and Seabrook Beach, south of the entrance, border the navigable waters of the harbor.

The entrance to Hampton Harbor is crossed by highway Route 1A. New Hampshire 17
Route 286 crosses the Blackwater River about 2 miles south of the harbor entrance on a fixed bridge, and the Boston and Maine Railroad crosses Mill Creek, Browns River, and Hampton Falls River about 2 miles west of the harbor entrance on small bridges. The rivers are navigable up to these bridges.

The station site is situated on a point of land the terminus of which is called "The Rocks", located between the Browns River and Hunts Island Creek. Figure 2.4-1 is a topographic map of the site.

Adjoining the site is a broad, flat marsh zone in the north, east and south, identified as Hampton Flats, with an elevation of approximately +4 feet MSL.

The above mentioned tidal estuaries will accept the surface drainage of the plant site. There are no projected changes to the natural drainage features of the area surrounding the site.

The station structures are located at finished grade elevation of +20 feet MSL. Some of the existing ground elevations of the site beyond the plant limits and bordering on the salt marsh are below this elevation and could be exposed to flooding from wave runup produced by the hypothetical storm surge. These lower locations of the plant site adjoining the salt marsh (northeast, east, southeast and south sides) are protected by a riprap revetment or a seawall at the edges of the embankment. Figure 2.5-11 shows
the arrangement of the plant site, the protective revetment and sea walls. 17

2.4.1.2 Hydrosphere

The New Hampshire Coastal Area is a 47,000 acre, triangular-shaped drainage basin at the eastern end of Rockingham County in the extreme southeastern corner of New Hampshire. It includes all of the drainage entering the Atlantic Ocean between Odiornes Point in Rye (the south entrance point to the

Seabrook

Estuary

conf. fl -52 ft

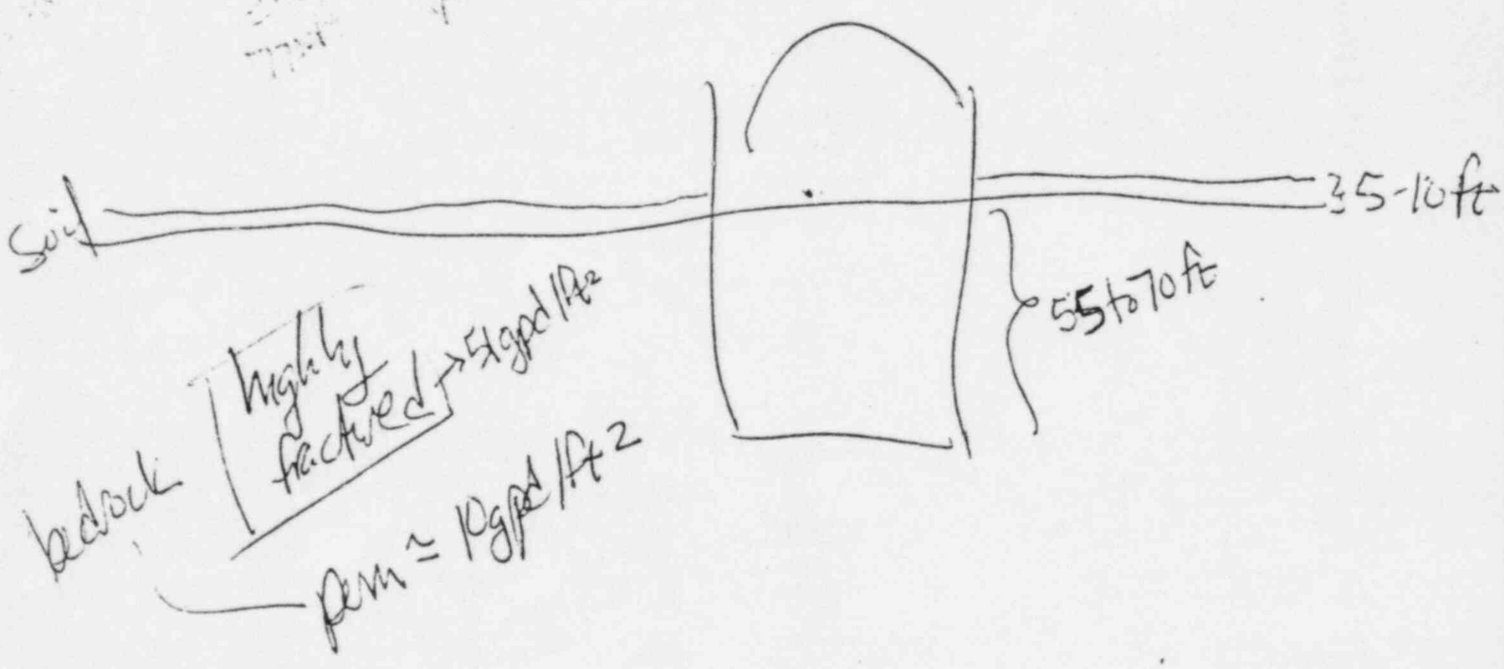
dist to H_2O

Seabrook

this X-sect does NOT persist all the way to the H_2O body;
~~X-sect to ocean provided~~

bedrock = Newburyport quartz diorite + metamorphosed sediments;
not an important H_2O source

fractures significant to at least 300 ft



THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF THE ATTORNEY GENERAL
JOHN W. MC CORMACK STATE OFFICE BUILDING
ONE ASHBURTON PLACE, BOSTON 02108

FRANCIS X. BELLOTTI
ATTORNEY GENERAL

November 8, 1982

CERTIFIED MAIL

Director, Office of Administration
Freedom of Information and
Privacy Department
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Re: Freedom of Information Act Request

Dear Sir:

Pursuant to the Freedom of Information Act, 5 U.S.C. §552, as amended, and 10 CFR Part 9, the Attorney General of the Commonwealth of Massachusetts requests the following documents concerning the release of radiation from the Pilgrim Nuclear Power Station in Plymouth, Massachusetts. As used herein, the term "documents" refers to the original and copy (but not both if identical in every respect) of any printed, written, recorded, transcribed, punched, taped, filmed, photographed or graphic matter in the possession of or subject to the control of the NRC or any Commissioner, employee, agent or attorney thereof, whether sent or received or neither, whether a draft or otherwise, however produced or reproduced, and both sides thereof, including but not limited to, any memorandum, correspondence, letter, affidavit, court paper, transcript, diary, report, study, telegram, table, telex message, record, chart, paper, work paper, graph, index, book, notebook, pamphlet, periodical, tape, data sheet, data processing card, note, notation, minute desk calendar, appointment book, sound recording, computer print-out or microfilm.

DOCUMENTS REQUESTED

1. All documents which relate in any way to the routine, planned, or accidental release of radiation from the Pilgrim Nuclear Power Station since startup, including all documents containing information as to the amount or type of radionuclides released on particular occasions, or dates of release.

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PDR/LPDR

2. All documents which describe the manner in which Boston Edison Company or government officials have monitored radiation releases from Pilgrim Station since its startup, including all documents describing the number, type and/or location of radiation monitoring equipment used by BECo or by any such officials.

3. All documents which describe the methodology or results of environmental sampling or analysis performed by BECo or by federal officials since the startup of Pilgrim I to assess the effects on the environment of radiation releases from the plant.

4. All documents relating in any way to the release of spent resins from Pilgrim Station which was discovered by BECo on or about June 11, 1982, including all documents which discuss the date or approximate date of the release, the cause[s] of the release or of BECo's failure to discover the release until June 11, 1982, the type and amount of radionuclides released, and all steps which have been or will be taken to prevent further releases of spent resins from the Pilgrim Plant.

In our opinion, it is appropriate in this case for the NCR to waive copying charges, pursuant to 5 U.S.C. §552(a)(4)(A) and 10 CFR §9.14a "because furnishing the information can be considered as primarily benefiting the general public" and this office is a state agency to whom furnishing the records without charge is an "appropriate courtesy."

We understand that, under the Freedom of Information Act, you must respond to this request within ten (10) working days and that your failure to respond within that period of time is considered to be a denial of the request. Thank you for your prompt consideration.

Very truly yours,

JoAnn Shotwell

JoAnn Shotwell
Assistant Attorney General
Environmental Protection Division
Public Protection Bureau
Tel: (617) 727-2265

JAS:jmc

THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF THE ATTORNEY GENERAL
JOHN W. MC CORMACK STATE OFFICE BUILDING
ONE ASHBURTON PLACE, BOSTON 02108

FRANCIS X. BELLOTTI
ATTORNEY GENERAL

January 5, 1983

FREEDOM OF INFORMATION ACT REQUEST
FOIA-83-21
Rec'd 1-10-83

J.M. Felton, Director
Division of Rules and Records
Office of Administration
Nuclear Regulatory Commission
Washington, D.C. 20555

Re: FOIA 82-557

Dear Mr. Felton:

We are in receipt of your response to our FOIA request of November 5, 1982. It appears, however, that certain documents responsive to that request have not been supplied. In response to an earlier FOIA request seeking documents related to the Pilgrim Nuclear Power Station in Plymouth, Massachusetts, your office forwarded to us a document entitled "Table D.1. Mean Number of Early Fatalities, Early Injuries and Latent Cancer Fatalities for 91 Sites, Conditional on SST 1, SST 2, or SST 3" and the computer printouts and other documents underlying that study which related to the Pilgrim site. Such underlying documentation for the Seabrook site is covered by paragraph (1) of our FOIA request and should be forwarded immediately.

Also supplied in response to our Pilgrim request were documents related to the liquid pathway situation at that site which, along with similar studies for all other sites and proposed sites in the country, formed the basis for NUREG/CR-1596: "The Consequences from Liquid Pathways After a Reactor Meltdown Accident." Again, such underlying documentation for the Seabrook site is responsive to our request (paragraph (11)) and we would ask that it be sent to us at the earliest possible date.

On another matter, we have received no response to our FOIA request dated November 8, 1982. I enclose a copy of that request for your convenience.

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PDR

We ask that you give these matters your immediate attention, since the deadline for responding to our requests passed some time ago.

Very truly yours,

Jo Ann Shotwell
Assistant Attorney General
Environmental Protection Division
One Ashburton Place
Boston, MA 02108

JAS/BT

Enc.